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A. Edward Scherer
Manager of
Nuclear Regulatory Affairs

June 6, 2000

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

Gentlemen:

Subject: **Docket Nos. 50-361 and 50-362**
Completion of Commitments for Generic Letter 95-07: Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves
San Onofre Nuclear Generating Station Units 2 and 3
(TAC Nos. M93515 and M93516)

References:

1. Letter from L.Raghavan (NRC) to Harold B. Ray (SCE), dated June 15, 1999, Subject: San Onofre Nuclear Generating Station (SONGS), Units 2 and 3 - Request for Additional Information - Generic Letter 95-07, "Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves," (TAC Nos. M93515 and M93516)

2. Letter from J. L. Rainsberry (SCE) to the Document Control Desk (NRC), dated July 21, 1999, Subject: Response to Request for Additional Information Regarding Generic Letter 95-07, Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves, San Onofre Nuclear Generating Station Units 2 and 3 (TAC Nos. M93515 and M93516)

3. Letter from A. E. Scherer (SCE) to the Document Control Desk (NRC), dated November 12,1999, Subject: Same as reference 2

Southern California Edison (SCE) has completed testing of a WKM gate valve and analysis of the testing to validate the thrust prediction methodology used in the SCE Generic Letter 95-07 pressure locking calculations. This testing and analysis were in response to the reference 1 NRC Request for Additional Information as committed to in references 2 and 3. Testing on an 8" WKM Model D2 double disc gate valve and the analysis of the test results, completed in March 2000, validate SCE's pressure-locking thrust prediction methodology for double disc gate valves. A description of the WKM valve test and the analysis results is provided in the enclosure to this letter.

P. O. Box 128
San Clemente, CA 92674-0128
949-368-7501
Fax 949-368-7575

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Also in response to the NRC request in reference 1, no additional actuator margin requirements, limitations associated with the use of the pressure-locking thrust prediction methodology, or diagnostic test equipment accuracy considerations are necessary for double disc gate valves. These three conclusions are based on the WKM valve test results and conservatisms in the analysis of the test results and valve actuator design discussed in Section III. of the enclosure.

If you have any questions or would like additional information, please let me or Mr. Jack Rainsberry (949/368-7420) know.

Sincerely,

Enclosure

cc: E. W. Merschoff, Regional Administrator, NRC Region IV
J. A. Sloan, NRC Senior Resident Inspector, San Onofre Units 1, 2, and 3
L. Raghavan, NRC Project Manager, San Onofre Units 2 and 3

State of California

County of San Diego

Subscribed and sworn to before me this 6th day of June 2000

By:
A. E. Scherer

Notary

MARIANE SANCHEZ
Commission # 1196482
Notary Public - California
San Diego County
My Comm. Expires Oct 14, 2002

RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION GENERIC LETTER 95-07: PRESSURE LOCKING AND THERMAL BINDING OF SAFETY-RELATED POWER-OPERATED GATE VALVES

I. INTRODUCTION

In response to the NRC's Request for Additional Information (RAI) dated June 15, 1999, San Onofre Nuclear Generating Station (SONGS) has performed pressure locking testing of an 8 inch, 1500 lb WKM gate valve to validate the thrust prediction methodology used by SONGS in their Generic Letter (GL) 95-07 pressure locking calculation (A-96-NM-MOV-PL/TB-003). This methodology is used for both WKM and Target Rock double disc gate valves identified in the GL 95-07 population. The test rig included a hydro pump that provided pressurized water to the upstream and bonnet areas of the test valve. Three separate pressure transducers were mounted to measure the upstream, bonnet, and downstream pressures throughout the valve stroke (refer to Figure 1 for a photo of the test rig). The MOVATS Universal Diagnostic System (UDS) was used to record valve stem thrust (via a stem-mounted strain gage) and pressure transducer outputs.

The test valve was an 8-inch WKM valve. All WKM gate valves in the GL 95-07 population and the test valve are double disc gate valves that consist of an upstream "segment" and a downstream "gate" where the stem is connected. A detailed description of the design and operation of a WKM gate is available in the EPRI Performance Prediction Program document (TR-3433-16). The pressure locking thrust prediction methodology used by SONGS is based on a double disc drag model similar to the methodology described in NUREG/CR-6611, "Results of Pressure Locking and Thermal Binding Tests of Gate Valves."

The WKM valve testing performed included a series of static (ST) tests and pressure locked (PL) tests with pressure applied from the bonnet. Copies of representative diagnostic test signatures for each test type with a description of key opening stroke events are provided in Figures 2-4. The objectives of the SONGS testing included:

1) Determining how pressure locking affects the key opening stroke events of double disc WKM gate valves.

2) Determining an applicable coefficient of friction (COF) for the sliding contact surfaces of the test valve.

3) Confirming that the methodology utilized in the SONGS GL 95-07 pressure locking calculation conservatively predicts the required thrust to overcome a pressure locked condition for a WKM gate valve.

II. TEST DATA ANALYSIS

The SONGS pressure locking prediction methodology assumes that the potential peak thrust required to overcome a true PL condition exists when both the gate and segment areas are in motion trying to overcome the contact force generated from the internal bonnet pressure acting against the combined gate and segment areas. This condition is referred to as double disc drag. Prior to the point of double disc drag (potential peak thrust), the valve goes through several points of interest. Figures 3 and 4 are samples of PL valve diagnostic test strokes obtained during the SONGS testing and have been annotated to provide details of the points of interest.

During the beginning portion of the open PL stroke, the stem decompression, stem/stem-nut thread transition, and the take-up of stem T-slot clearance can be seen. After these events occur, the tension load on the stem begins to rapidly increase to overcome the wedging forces that exist on the gate. Wedging forces are developed during the closing stroke of a WKM valve and include contact forces on both the gate back angle and the gate interface with the downstream valve seat. SONGS has found that an effective means of analyzing the effects of contact friction on valve unwedging is through the calculation of a factor referred to as the pullout ratio (Kpo). The value of Kpo is defined as the ratio of the peak unseating thrust divided by the total thrust from the previous closing stroke. The opening stem decompression thrust can be used in lieu of total closing thrust since they are equivalent.

As shown on Table 1, the calculated values of Kpo from static testing were found to be relatively constant at an average value of 0.41 or 0.46 with a two-sigma standard deviation. SONGS has noted similar static Kpo values during periodic static testing of WKM valves in the GL 89-10 program. During the PL tests, the average Kpo value was calculated to be 0.49 or 0.59 with a two-sigma standard deviation. Figure 5 provides a graphical representation for values of Kpo calculated for the ST and PL test strokes performed by SONGS on the WKM test valve. The higher value of Kpo indicates that the unwedging thrust required during PL conditions is greater than under static conditions. This condition was expected. During a PL condition, the bonnet pressure acts on the area of the gate, thereby increasing the opening thrust required to overcome the contact force between the gate and downstream seat. However, it is important to note that the increase in opening thrust is less than the value that would be predicted by the effects of pressure acting on the gate alone (given the known seat area and bonnet pressure). The lower than expected unwedging force under a PL condition is attributed to the fact that, while there is an increase in the contact force acting on the downstream seat, the same bonnet pressure is causing a decrease in the contact force between the gate and segment back angle. When the valve bonnet is pressurized, the pressure tries to separate the gate and segment. Since only the gate is in motion during the unwedging portion of the valve stroke, the increase in unwedging force is the net of increasing contact forces on the downstream seat and decreasing contact forces on the gate back angle.

Figure 5 shows the maximum measured value of Kpo was slightly less than 0.60 with the bonnet pressurized during the test to approximately 750 psi. The worst case bonnet pressure predicted in the SONGS GL 95-07 pressure locking calculation is approximately 700 psi (400 psi maximum SDC pressure + 250 psi maximum relief valve pressure + 50 psi relief valve tolerance). Given the measured values for Kpo during PL conditions, SONGS is confident that pressure locking of WKM valves within the GL 95-07 population will not significantly challenge the opening capability of the valve during the unwedging portion of the opening stroke. Furthermore, it was shown in this analysis that the region in which double disc drag is present represents the highest potential required thrust condition during a worst case PL opening valve stroke.

As seen on the attached PL diagnostic test traces (Figures 3 and 4), once the gate has unwedged, gate motion continues and single disc drag of the gate can be seen. The measured thrust at this point (referred to as "F1" on the test traces) is important because it allows a coefficient of friction (COF) to be calculated for the gate as it slides across the downstream seat with a steady bonnet pressure applied. Table 1 provides a summary of calculated COF values for the gate using thrust and bonnet pressure values measured at point F1. The average gate COF at point F1 (COFg1) was calculated to be 0.40 or 0.48 with a two-sigma standard deviation. As gate motion continues through the opening stroke, the cam of the lev-r-lock arm engages the segment and begins to lift the segment. At this point both the gate and segment are in motion. The thrust required at this point of the valve stroke (referred to as "F2" on the test traces) is the point at which double disc drag occurs as a result of pressure locking. Measuring the thrust at this point and subtracting from it the thrust measured at F1 leaves a net thrust required to overcome sliding friction between the segment and upstream seat. With the net thrust and pressure acting on the segment known, a COF value for the segment (COFs2) can be calculated. The average measured value for the segment COF was 0.34 or 0.48 with a two-sigma standard deviation. For comparative purposes, a resultant COF was calculated at point F2 using the double disc drag equation provided in Appendix B of NUREG/CR-6611. The resultant COF (COFgs2) calculated using the NUREG methodology was 0.38 or 0.43 with a two-sigma standard deviation. A graphical representation of the COF values calculated in Table 1 is provided on Figure 6.

The COF values of the test valve are within the design value of 0.5 used in the current pressure locking calculation at SONGS. The PL testing performed by SONGS was performed primarily for the purpose of confirming the validity of the double disc drag methodology. In addition, the suitability of the COF value used by SONGS is supported by EPRI stellite friction testing and the EPRI Performance Prediction Program for WKM valves. It should also be noted that the SONGS PL testing was performed at ambient temperatures of approximately 70 degrees Fahrenheit. EPRI testing has shown COF values typically decrease at higher temperatures, which would be the case if a PL condition were to occur at SONGS.

As the opening valve stroke continues, a flow path is eventually established past the segment with the upstream and bonnet pressures equalizing. Once the net delta pressure across the segment is eliminated, the disc drag across the segment is eliminated and the test traces return to a single disc drag condition as the pressure is now acting only on the gate. Shortly after, a flow path is then established across the gate and the differential pressure across the gate is eliminated along with any remaining disc drag.

A review of the test traces (Figures 3 and 4) during a PL condition is important to understanding the dynamic interaction of the WKM valve components. The analytical review of the PL diagnostic traces confirmed that the greatest potential for a PL condition to challenge the thrust capability of an actuator will occur when bonnet pressure is at a maximum and the valve is proceeding through the stroke region in which double disc drag is present. The thrust prediction methodology used for the SONGS pressure locking calculation (A-96-NM-MOV-PL/TB-003) was established assuming the double disc drag condition. The thrust prediction equation used in the NRC sponsored NUREG/CR-6611 is also based on the assumption of double disc drag and is basically equivalent to the SONGS equation, which is the following:

SONGS Methodology for Prediction of Required Opening Thrust Under PL Conditions

Equation 1:

$$FPLO = (COF \times Ast \times (Pb-Pu)) + (COF \times Ast \times (Pb-Pd)) - (Asml \times Pb) + Fpl + Wg$$

where:
- FPLO = Max Open Pressure Locking Force (lbs)
- COF = Disc to Seat Contact Friction
- Ast = Area of Seat (sq in)
- Pb = Max Bonnet Pressure (psi)
- Pu = Upstream Pressure (psi)
- Pd = Downstream Pressure (psi)
- Asml = Area of Stem (sq in)
- Fpl = Packing Load (lbs)
- Wg = Weight of Valve Disc (lbs)

III. RESPONSE TO NRC RAI ON SONGS PRESSURE LOCKING PREDICTION METHODOLOGY

SONGS was requested to describe and discuss the testing and analysis that validates the pressure locking thrust prediction methodology. SONGS believes the information provided in Sections I. and II. above validates the methodology used by SONGS. The NRC also requested that SONGS discuss "the recommended margin between actuator capability and the calculated thrust value when using your pressure-locking prediction methodology, any limitations associated with the use of your methodology, and any diagnostic test equipment accuracy requirements."

In the RAI, the NRC stated that a 40% margin is needed to account for valve degradation, diagnostic equipment accuracy, and the additional thrust required to open the test valve used as part of the NUREG/CR-6611 testing. The SONGS test results confirm that a 40% margin is overly conservative and not required to assure that an actuator is capable of overcoming a potential pressure locking condition. The NUREG claim that the double disc drag equation under-predicted the actual thrust by 5%-30% is attributed to the use of COF values calculated during hydrostatic testing rather than COF values determined during actual pressure locking tests. COF values calculated from opening thrust values measured during hydrostatic testing (i.e., pressure applied from upstream of the valve disc) may exceed actual COF values against the downstream valve seat since additional contact forces associated with un-wedging of the back angles of the valve may still be present. Test results show that the value of COF used in the SONGS pressure locking evaluation is conservative. This is supported by the fact that the margin between the predicted and measured PL thrust ranged from 10% to 30% (including diagnostic inaccuracies), as shown in Table 2.

Overall, SONGS test results show that the double disc drag equation (Equation 1 above) will conservatively predict the thrust required to overcome the worst case pressure locking conditions that could occur to the WKM valves within the GL 95-07 population. The key to accurate prediction of required thrust is the use of an appropriate value of COF for the sliding friction between the valve seats and the gate and segment. As previously discussed, the resultant COFgs2 measured during PL testing had a value of 0.43 (including a two-sigma standard deviation).

To demonstrate the effect of assuming a conservative COF value, Table 2 summarizes the actual thrust measured at point F2 (adjusted for instrument inaccuracy) during PL testing and the predicted thrust using an assumed COF of 0.50. For the series of PL tests, the prediction margin observed was never less than 10% with an overall average of approximately 20%. A graphical representation of this comparison is provided in Figure 7.

Additional elements that contribute to the SONGS position that the pressure locking calculation methodology provides an acceptable level of conservatism include:

1) The assumption that the Marotta relief valve, which limits the internal bonnet pressure by providing an internal relief path through the valve segment, will relieve at a net differential pressure of 300 psi, which is 20% greater than the nominal setpoint relief pressure of 250 psi.

2) The conservative actuator output capability thrust used to establish margin between available thrust and predicted required thrust. The actuator thrust capability is calculated assuming rated motor start torque even though the existing control logic bypasses the open torque switch and permits actuator output torque up to the point of motor stall. Motor stall torque has been shown in industry tests to typically exceed rated torque by 10%. In addition, the stem factor value used to predict the conversion of actuator torque to thrust is typically greater than the actual in-situ stem factor that results in an under-prediction of available actuator output thrust.

3) The pressure locking calculation methodology assumes zero leakage from the valve bonnet, does not credit bonnet pressure drop due to the reduction in stem volume during travel, always assumes a water solid bonnet with no allowance for entrapped air, includes the weight of valve trim components in the required thrust although the weight of these components is already incorporated within the COF calculation, and uses a predicted packing load which exceeds actual packing loads measured during in-situ testing.

4) All of the WKM valves included in the population of GL 95-07 are within the shutdown cooling (SDC) system. When establishing the maximum pressure that could act on these valves, it was assumed that the pressure would be at the maximum design pressure prior to initiation of SDC (approximately 400 psi). It is unlikely that during a design basis event that the valves would be opened at the point of maximum system design basis pressure since SDC is manually initiated by operator action.

The cumulative effects of these items combined with the actual available margin of these valves are considered adequate bases to preclude defining a specific value for minimum required margin. Therefore, SONGS will continue using the current pressure locking calculation methodology, which has been shown to be conservative through testing, and does not intend to impose a minimum required margin threshold for any valve within the GL 95-07 population.

IV. CONCLUSIONS

All valves in the SONGS population identified as potentially susceptible to pressure locking are double disc style gate valves. The pressure locking testing performed on the WKM gate valve confirmed that the analytical methodology utilized in the SONGS pressure locking calculation A-96-NM-MOV-PL/TB-003 was representative of the actual required thrust to overcome a pressure locked condition for a double disc valve. Through the analysis of test data, SONGS has confirmed that the calculation methodology that predicts the force required to overcome pressure locking is valid and conservative. In addition, given the inherent conservatisms utilized in the prediction of pressure locking forces and the available actuator thrust available, SONGS has confidence that all valves considered susceptible to pressure locking have adequate margin to overcome the forces required to operate in the presence of a potential pressure locking condition.

FIGURE 1

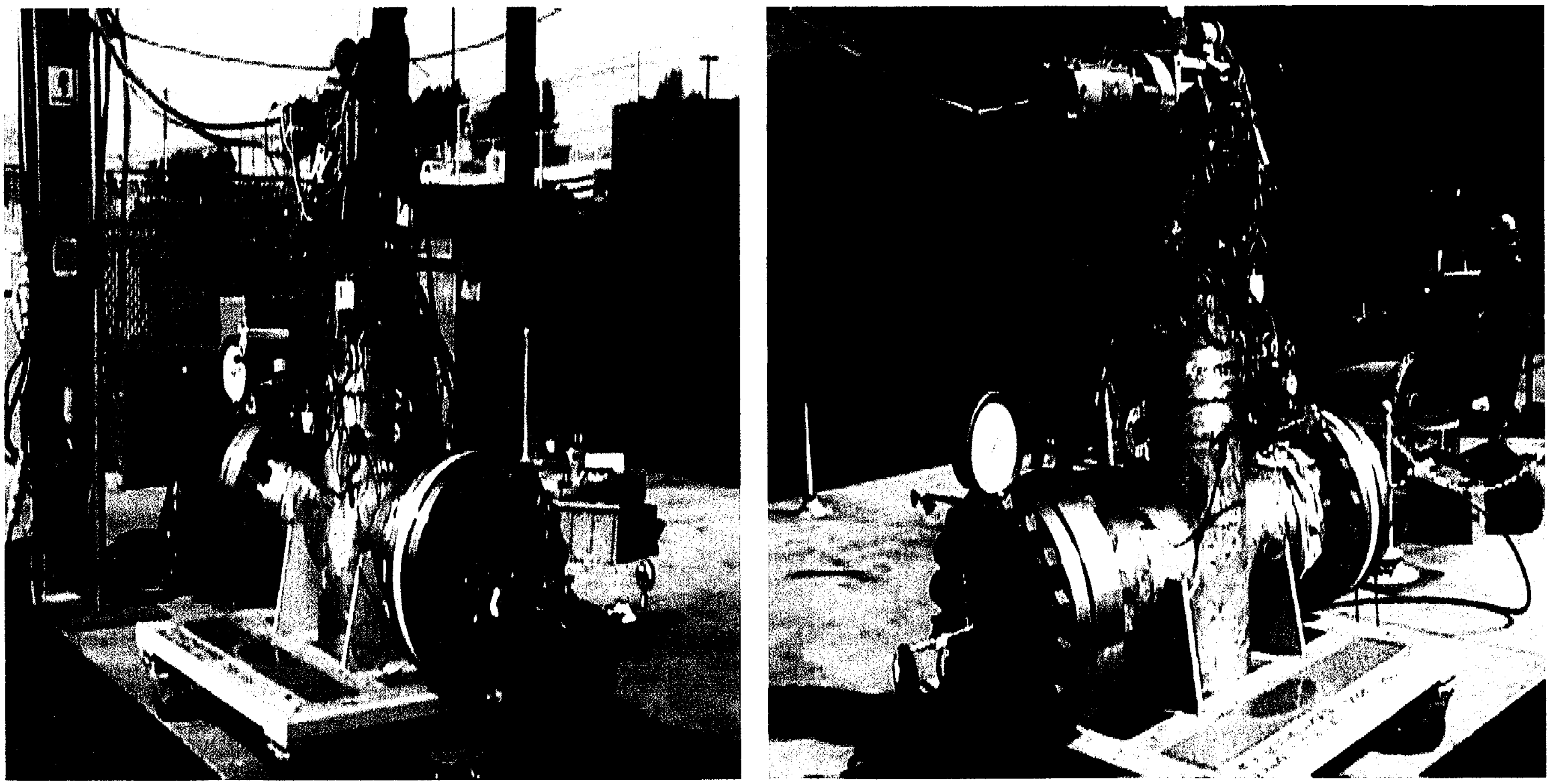
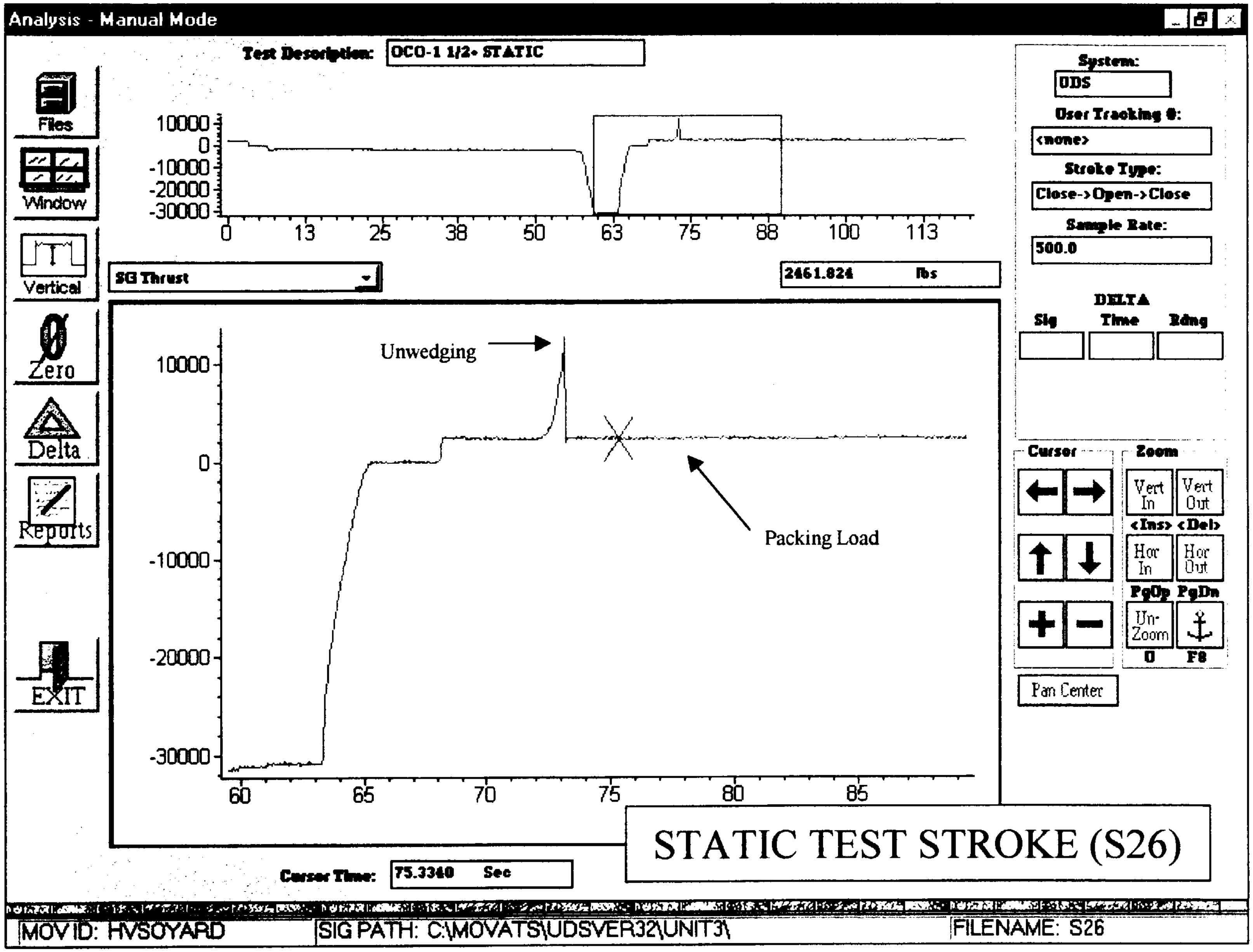
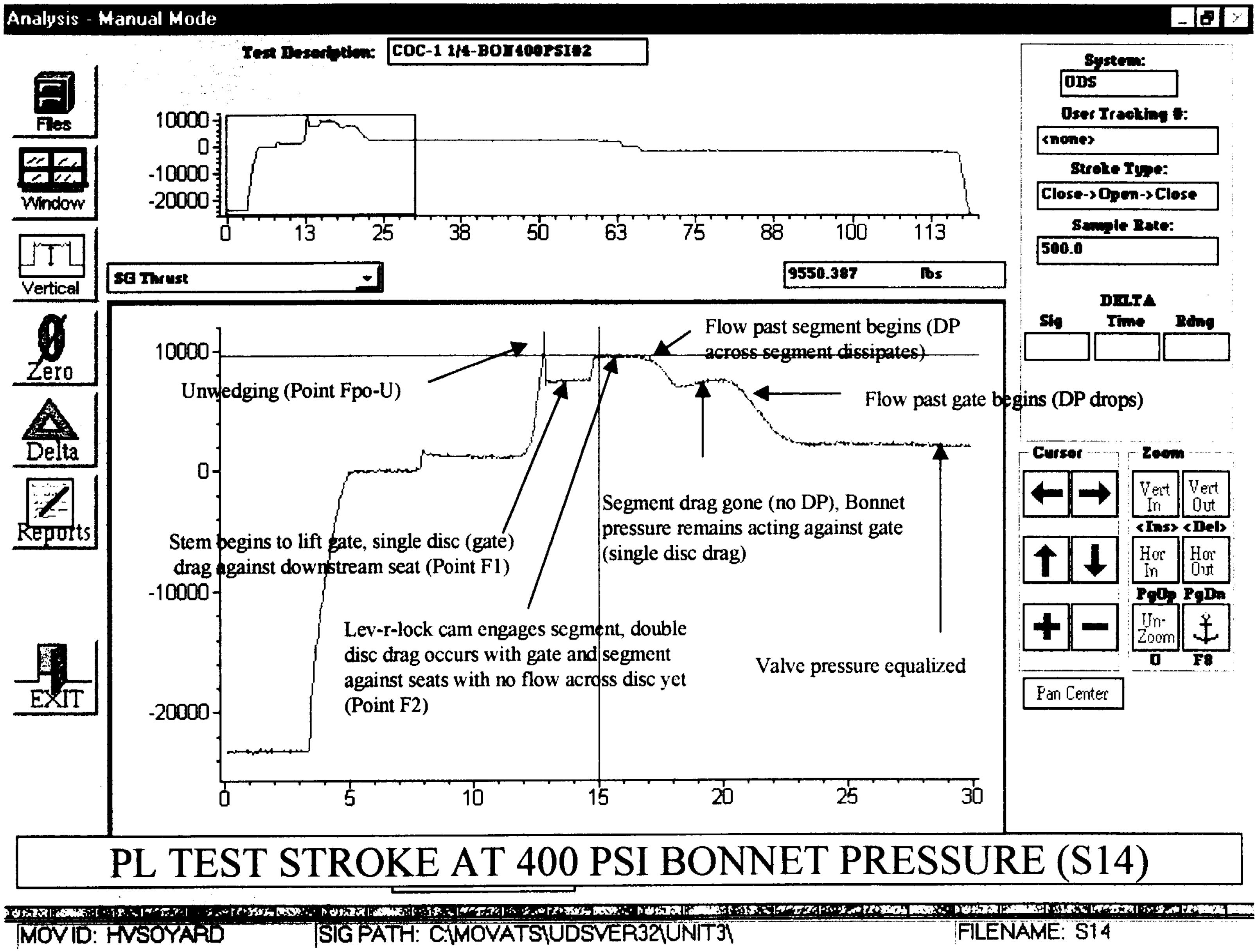


FIGURE 2



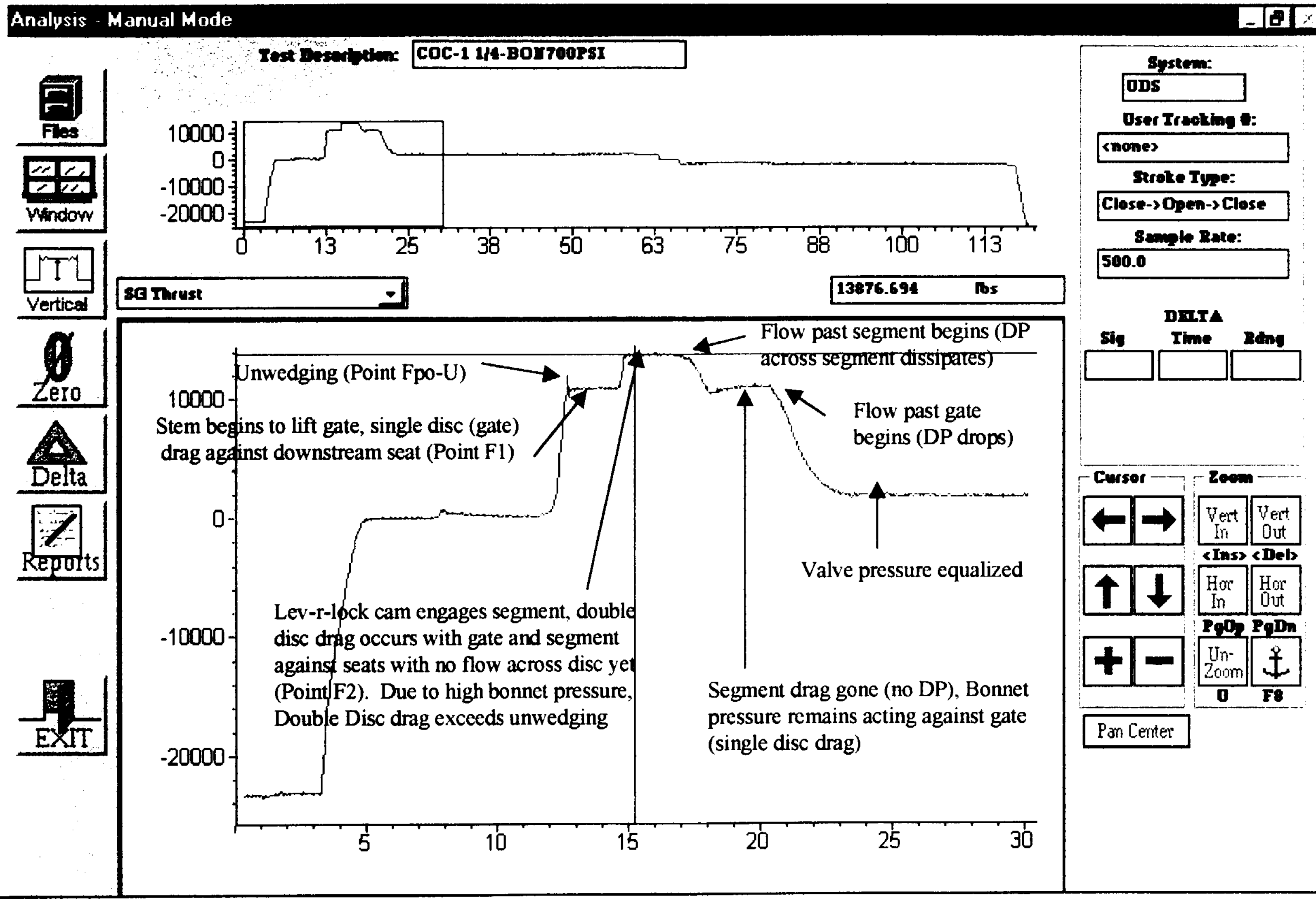
Analysis - Manual Mode
Test Description: OCO-1 1/2• STATIC
Files
Window
Vertical
Zero
Delta
Reports
EXIT
10000
0
-10000
-20000
-30000
0 13 25 38 50 63 75 88 100 113
SG Thrust
2461.824 lbs
Unwedging
Packing Load
-30000
60 65 70 75 80 85
STATIC TEST STROKE (S26)
Cursor Time: 75.3340 Sec
System: UDS
User Tracking #: <none>
Stroke Type: Close->Open->Close
Sample Rate: 500.0
DELTA
Sig Time Rdng
Cursor
Zoom
Vert In
Vert Out
<Ins> <Del>
Hor In
Hor Out
PgUp PgDn
Un-Zoom
0 F8
Pan Center
MOV ID: HVSOYARD
SIG PATH: C:\MOVATS\UDSVER32\UNIT3\
FILENAME: S26

FIGURE 3



Analysis - Manual Mode
Test Description: COC-1 1/4-BON400PSI82
Files
Window
Vertical
Zero
Delta
Reports
EXIT
System: UDS
User Tracking #: <none>
Stroke Type: Close->Open->Close
Sample Rate: 500.0
SG Thrust
9550.387 lbs
DELTA
Sig
Time
Rdng
Cursor
Zoom
Vert In
Vert Out
<Ins> <Del>
Hor In
Hor Out
PgUp PgDn
Un-Zoom
0
F8
Pan Center
10000
0
-10000
-20000
0
13
25
38
50
63
75
88
100
113
5
10
15
20
25
30
Flow past segment begins (DP across segment dissipates)
Unwedging (Point Fpo-U)
Flow past gate begins (DP drops)
Segment drag gone (no DP), Bonnet pressure remains acting against gate (single disc drag)
Stem begins to lift gate, single disc (gate) drag against downstream seat (Point F1)
Lev-r-lock cam engages segment, double disc drag occurs with gate and segment against seats with no flow across disc yet (Point F2)
Valve pressure equalized
PL TEST STROKE AT 400 PSI BONNET PRESSURE (S14)
MOV ID: HVSOYARD
SIG PATH: C:\MOVATS\UDSVER32\UNIT3\
FILENAME: S14

FIGURE 4



PL TEST STROKE AT 700 PSI BONNET PRESSURE (S20)

FIGURE 5
Pressure Locking Pullout Ratio (Kpo)

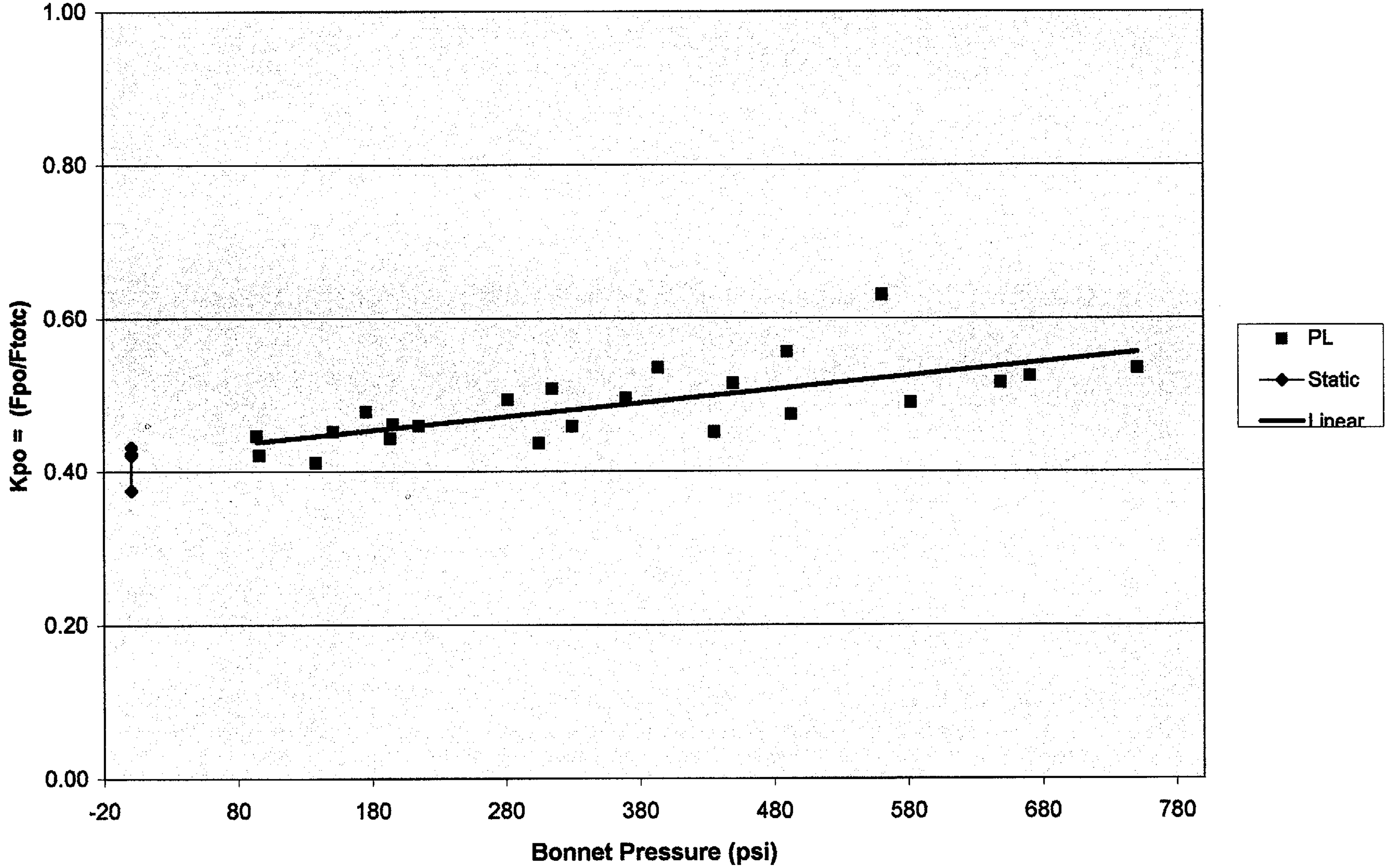


FIGURE 6
Valve COF Analysis

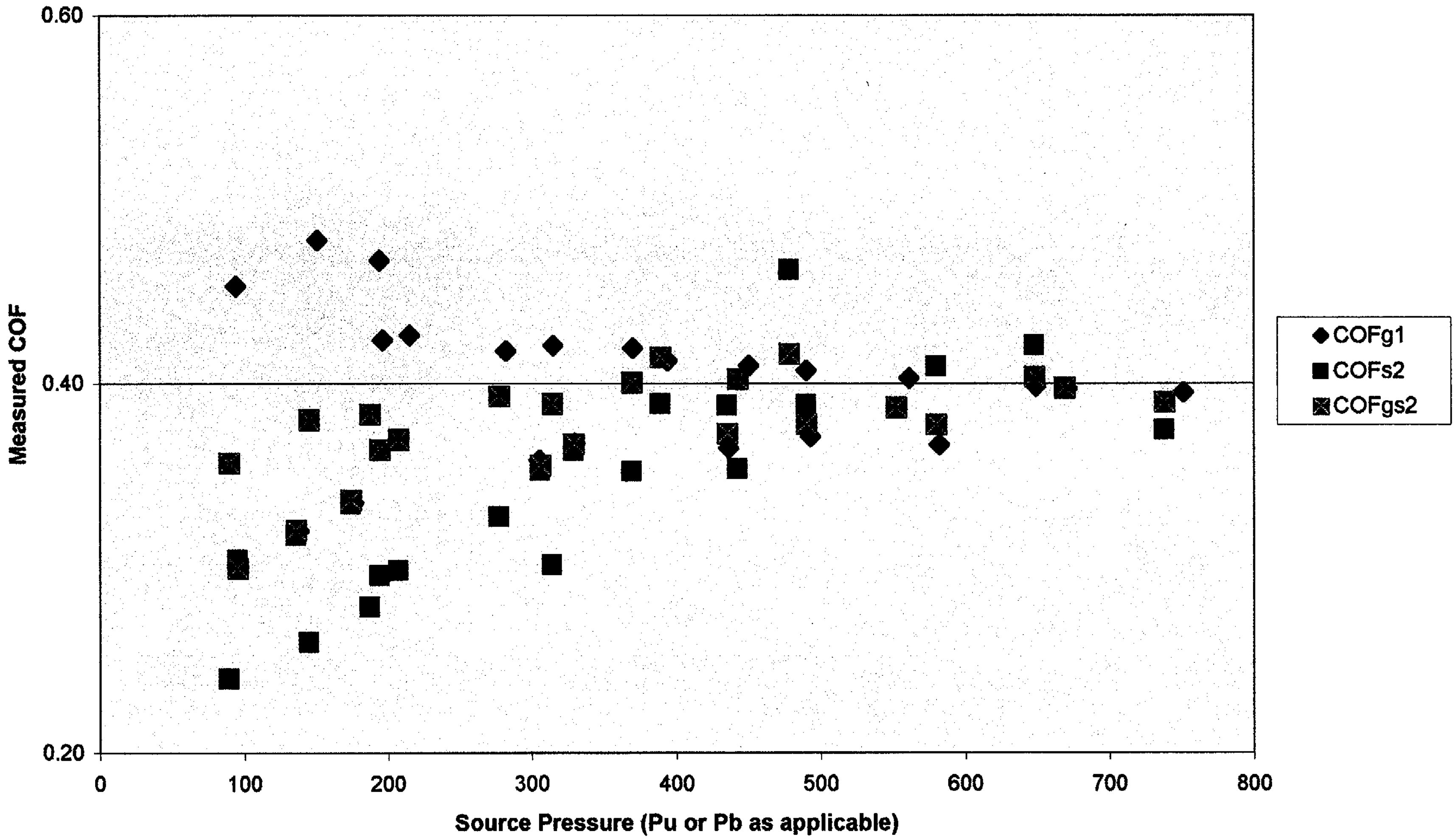


FIGURE 7
Actual vs. Predicted PL Thrust Comparison

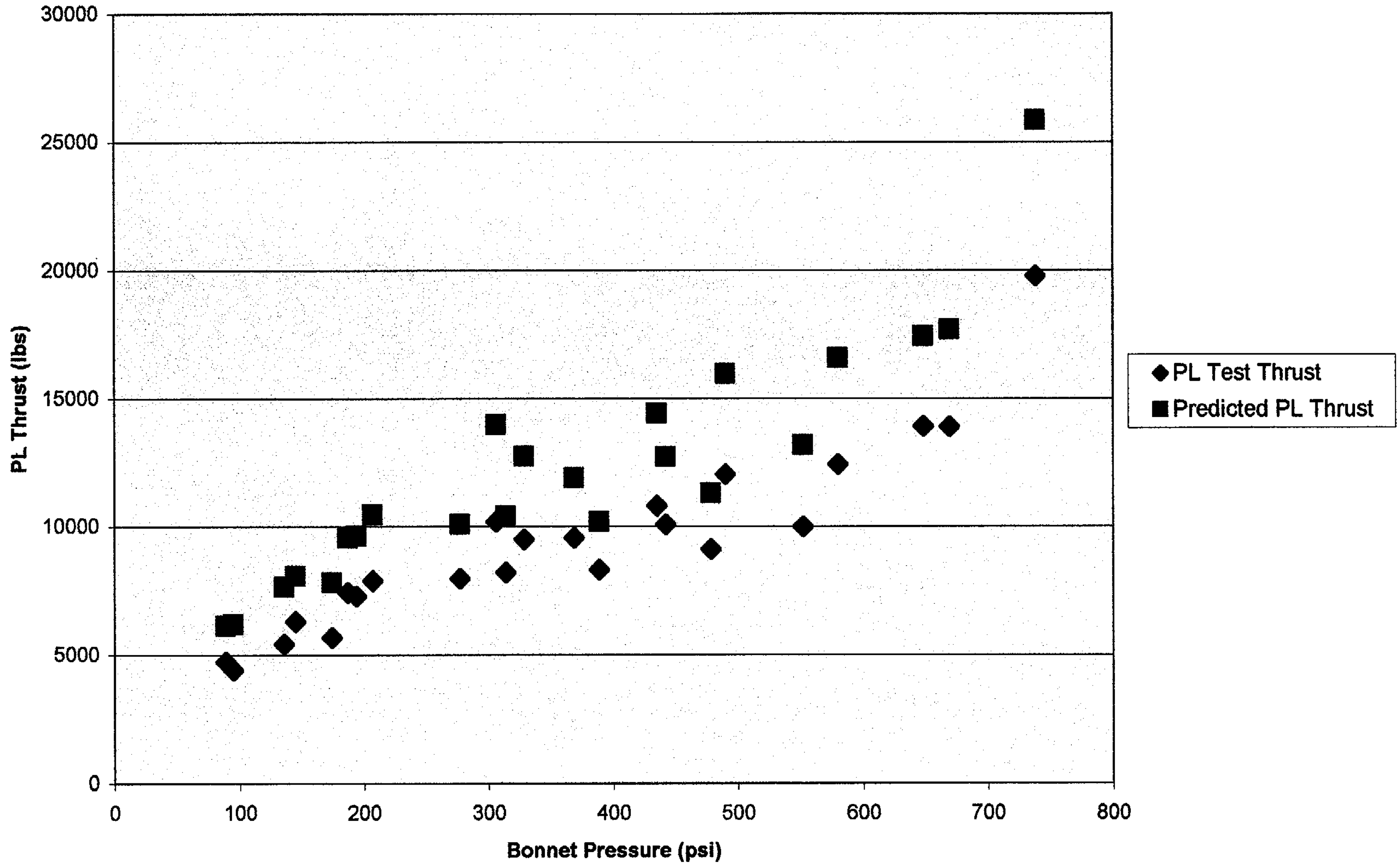


TABLE 1

TABLE 1: BONNET PRESSURE LOCK & STATIC TEST DATA EVALUATION																					
File #	Test Type	Initial Stem Decompress (Ftotc)	Initial Unwedge (Fpo-U)	Static Unwedge Ratio (Kpo-s)	Static Packing Load (Fpl-s)	Pressure Locked Unwedge Ratio (Kpo-pl)	Net Pullout Force above Static (Net Fpo-pl)	Max Open Throttling Thrust at Pt1 (F1)	Max Open Throttling Thrust at Pt2 (F2)	Pressure Locked Average Opening Running Thrust Faro-pl	Upstrm Press at Pt1 Pu1	Upstrm Press at Pt2 Pu2	Bonnet Press at Pt1 Pb1	Bonnet Press at Pt2 Pb2	Downstrm Press at Pt1 Pd1	Downstrm Press at Pt2 Pd2	Throttling Point Time at Pt1	Throttling Point Time at Pt2	Gate COF at Pt1 COFg1	Segment COF at Pt2 COFs2	Cumulative COF at Max Throttling Thrust (Pt2) COFgs2
S30	S	24143	10162	0.42	2493								1								
S26	S	30846	13319	0.43	2461								1								
S42	S	29427	12457	0.42	2273								1								
S50	S	29688	11126	0.37	2387								1								
S60	S	30870	12453	0.40	2335																
			AVG	**0.41**	**2390**																
			SD	**0.02**	**90**																
			AVG + 1SD	**0.43**	**2480**																
S39	PL	23406	10436			0.45	10436	3882	4734	2356	8	0	94	89	0	0	13.5	14.8	0.45	0.24	0.36
S51	PL	29447	12389			0.42	12389	3292	4396	2230	4	4	96	95	3	1	13.5	16.4	0.30	0.30	0.30
S52	PL	29605	12179			0.41	12179	3807	5416	2198	9	9	138	136	0	0	13.5	16	0.32	0.32	0.32
S40	PL	23610	10658			0.45	10658	4882	6302	2346	8	8	151	145	0	0	13.5	15	0.48	0.26	0.38
S53	PL	29132	13914			0.48	13914	4280	5669	2166	69	70	176	174	0	0	13.5	15.5	0.34	0.33	0.34
S41	PL	23628	10457			0.44	10457	5481	7427	2314	12	12	194	187	0	0	13.5	15.1	0.47	0.28	0.38
S10	PL	23625	10897			0.46	10897	5175	7289	2240	15	15	196	194	0	0	13.5	15.2	0.42	0.30	0.36
S9	PL	23255	10676			0.46	10676	5459	7878	2230	4	4	215	207	0	0	13.5	15.1	0.43	0.30	0.37
S11	PL	23373	11528			0.49	11528	6290	7963	2146	147	149	282	277	0	0	13.5	15	0.42	0.33	0.39
S55	PL	28975	12642			0.44	12642	5879	10181	2145	0	0	305	306	0	1	13.5	15.4	0.36	0.35	0.36
S12	PL	22868	11613			0.51	11613	6774	8194	2125	191	196	315	314	0	0	13.5	15	0.42	0.30	0.39
S56	PL	28934	13263			0.46	13263	6279	9498	2156	105	107	330	329	0	1	13.4	15.4	0.37	0.36	0.37
S14	PL	23266	11517			0.50	11517	7499	9550	2146	218	223	370	369	0	0	13.5	15	0.42	0.35	0.40
S15	PL	23510	12571			0.53	12571	7721	8310	2146	332	351	394	389	0	0	13.5	15	0.41	0.39	0.41
S58	PL	30398	13695			0.45	13695	7436	10792	1988	212	218	436	435	1	1	13.3	15.5	0.36	0.39	0.37
S16	PL	23027	11845			0.51	11845	8415	10078	2146	315	324	450	442	0	0	13.5	15	0.41	0.35	0.40
S17	PL	23301	12939			0.56	12939	8889	9110	2146	436	466	490	478	0	0	13.5	15	0.41	0.46	0.42
S59	PL	29882	14157			0.47	14157	8225	12022	2009	240	245	493	490	0	0	13.4	15.5	0.37	0.39	0.38
S18	PL	22507	14177			0.63	14177	9728	9991	2146	505	505	561	552	0	0	13	16	0.40	0.14	0.39
S62	PL	28112	13756			0.49	13756	9129	12410	2061	373	379	582	580	2	1	13.4	16.5	0.37	0.41	0.38
S19	PL	23153	11918			0.51	11918	10751	13886	2093	454	461	649	648	0	0	13.5	16	0.40	0.42	0.40
S20	PL	23103	12099			0.52	12099	10994	13877	1925	480	487	671	669	0	0	13.7	15.3	0.40	0.40	0.40
S21	PL	22722	12139			0.53	12139	11950	19755	1893	218	216	751	738	0	0	13	17	0.40	0.38	0.39
			AVG			**0.49**												**AVG**	**0.40**	**0.34**	**0.38**
			Sdev			**0.05**												**Sdev**	**0.04**	**0.07**	**0.03**
			AVG + 1SD			**0.54**												**AVG + 1SD**	**0.44**	**0.41**	**0.41**

TABLE 2

TABLE 2: STEM THRUST PREDICTION COMPARISON WITH BONNET PRESSURE LOCKED												
File #	Date	Test Type	Upstrm Press at Pt1 (Pu1)	Upstrm Press at Pt2 (Pu2)	Bonnet Press at Pt1 (Pb1)	Bonnet Press at Pt2 (Pb2)	Downstrm Press at Pt1 (Pd1)	Downstrm Press at Pt2 (Pd2)	Max Open Throttling Thrust at Pt2 (F2)	SONGS PL Thrust Prediction	SONGS Prediction Margin
S39	10-Feb	PL	8	0	94	89	0	0	4734	6149	30%
S51	15-Feb	PL	4	4	96	95	3	1	4396	6190	41%
S52	15-Feb	PL	9	9	138	136	0	0	5416	7636	41%
S40	10-Feb	PL	8	8	151	145	0	0	6302	8066	28%
S53	15-Feb	PL	69	70	176	174	0	0	5669	7815	38%
S41	10-Feb	PL	12	12	194	187	0	0	7427	9549	29%
S10	11-Feb	PL	15	15	196	194	0	0	7289	9646	32%
S9	11-Feb	PL	4	4	215	207	0	0	7878	10463	33%
S11	11-Feb	PL	147	149	282	277	0	0	7963	10083	27%
S55	15-Feb	PL	0	0	305	306	0	1	10181	13979	37%
S12	11-Feb	PL	191	196	315	314	0	0	8194	10425	27%
S56	15-Feb	PL	105	107	330	329	0	1	9498	12731	34%
S14	11-Feb	PL	218	223	370	369	0	0	9550	11907	25%
S15	11-Feb	PL	332	351	394	389	0	0	8310	10170	22%
S58	15-Feb	PL	212	218	436	435	1	1	10792	14411	34%
S16	11-Feb	PL	315	324	450	442	0	0	10078	12715	26%
S17	11-Feb	PL	436	466	490	478	0	0	9110	11286	24%
S59	15-Feb	PL	240	245	493	490	0	0	12022	15953	33%
S18	11-Feb	PL	505	505	561	552	0	0	9991	13166	32%
S62	15-Feb	PL	373	379	582	580	2	1	12410	16547	33%
S19	11-Feb	PL	454	461	649	648	0	0	13886	17410	25%
S20	11-Feb	PL	480	487	671	669	0	0	13877	17683	27%
S21	11-Feb	PL	218	216	751	738	0	0	19755	25839	31%