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TWR-17542-10

SPACE SHUTTLE

Solid Rocket Motors
Morton Thiokol, Inc

RSRM-3 (360L003) FINAL REPORT
BALLISTICS/MASS PROPERTIES

5 May 1989

Prepared for:

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
GEORGE C. MARSHALL SPACE FLIGHT CENTER
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Space Booster Programs
Morton Thiokol Inc

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1.0 INTRODUCTION

This report contains the propulsion performance and reconstructed mass properties data from Morton Thiokol's RSRM-3 motors which were assigned to the STS-29 launch. The Morton Thiokol manufacturing designation for the motors were 360L003-A,B which are referred in this report as RSRM-3A and RSRM-3B, respectively. The launch occurred on 13 March 1989 at the Eastern Test Range (ETR). The data contained herein was input to the STS-29 Flight Evaluation Report.

The SRM propellant, TP-H1148, is a composite type solid propellant, formulated of polybutadiene acrylic acid acryonitrile terpolymer binder (PBAN), epoxy curing agent, ammonium perchlorate oxidizer and aluminum powder fuel. A small amount of burning rate catalyst (iron oxide) was added to achieve the desired propellant burn rate. The propellant evaluation and raw material information for the RSRM-3 is included in the discussion section of this report.

The propellant grain design consists of a forward segment with an eleven point star with a transition into a tapered circular perforated (CP) configuration, two center segments that result in a double tapered CP configuration and an aft segment with a triple taper CP configuration, and a cutout for the partially submerged nozzle (Figure 1.1).

The ballistic performance presented in this report was based on the OFI 12.5 sample per second pressure data for the steady state and tailoff portion of the pressure trace. The OFI data on the left motor was adjusted down by 0.2 percent to closer match the magnitude of the real time data. The ignition buildup and maximum headend pressure was assessed using the 320 samples per second DFI data. The DFI data magnitudes were below that of the OFI and real time data, therefore, the left and right motor DFI data was adjusted up by 0.4 and 0.6 percent respectively.

2.0 SUMMARY

The delivered propellant burn rates were close to predicted. The delivered burn rates were 0.367 in/sec at 625 psia and 60°F and 0.368 for the left and right motors respectively. This was 0.001 in/sec lower than predicted for the left motor and the same as predicted for the right motor. The average of the two motors was 0.0005 in/sec below the target rate of 0.368 in/sec at 625 psia and 60°F. The performance of the two motors were very close to the same as can be seen in Figure 2.2.

The performance of the pair of motors were compared to the following CEI Specification CPW1-3600 paragraphs for compliance: 3.2.1 Performance, 3.2.1.1 General Performance, 3.2.1.1.1 Ignition Characteristics, 3.2.1.1.1.1 Ignition Interval, 3.2.1.1.1.2 Pressure Rise Rate, 3.2.1.1.2 Motor Characteristics, 3.2.1.1.2.1 Nominal Thrust Time Curve, 3.2.1.1.2.2 Performance Tolerance and Limits, 3.2.1.1.2.3 Thrust Differential, 3.2.1.1.2.4 Impulse Gates. The performance from each motor as well as matched pair performance values were well within the CEI Specification requirements. The nominal thrust time curve and impulse gate information has been included. The historical average was well within the variation limits developed from the HPM Block prediction population at a burn rate of 0.368 in/sec at 625 psia and 60°F. The historical population values are the average performance data from QM-4, SRM-8A, SRM-8B, SRM-9A, SRM-10A, SRM-10B, SRM-11B through SRM-19B, SRM-24A, SRM-24B, ETM-1A, DM-8, DM-9, QM-6, QM-7, PVM-1, RSRM-1, RSRM-2, and RSRM-3. The motors used in the HPM Block prediction population were QM-4, SRM-8A, 8B, 9A, 10A, 10B, 11B, 13A, and 13B.

Post flight reconstructed Redesigned Solid Rocket Motor (RSRM) mass properties are within expected values for the lightweight (RSRML) configuration and meet the following CEI paragraphs:3.2.2.2, 3.2.2.2.1, 3.2.2.2.2, and 3.2.2.2.3.

3.0 DISCUSSION AND RESULTS

3.1 RSRM-3 PROPELLANT MATERIALS

Both of the third flight motors were cast with primarily one evaluation of propellant, E63. The left motor contained two mixes from evaluation E64V in the center aft segment and two in the aft segment. The right motor was cast all from evaluation E63. Table 3.1 shows the raw material lots and vendors for the evaluations used.

TABLE 3.1

RAW MATERIAL EVALUATION SUMMARY

TP-H1148 PROPELLANT EVALUATION E63

Ingredient	Stock-Lot	Vendor
HB Polymer	7227-0067	ASRC
ECA	7225-0075	Dow Chemical
Aluminum	7228-0064	ALCAN
Fe_2O_3	7226-0021	Charles Pfister
AP unground	7229-0071	PEPCON
AP ground	7229-0071	PEPCON

TP-H1148 PROPELLANT EVALUATION E64 (VERIFICATION)

Ingredient	Stock-Lot	Vendor
HB Polymer	7227-0068	ASRC
ECA	7225-0076	Dow Chemical
Aluminum	7228-0065	ALCAN
Fe_2O_3	7226-0021	Charles Pfister
AP unground	7229-0074	Kerr McGee
AP ground	7229-0074	Kerr McGee

3.2 RSRM PROPULSION PERFORMANCE ANALYSIS

All times shown in this section, unless noted otherwise are referenced to the RSRM ignition command time at 1989:072:14:57:00:017 (EDT).

As previously mentioned the OFI (12.5 s/s) data was used for the steady state and tailoff performance assessment. It compared well with the real time data although the left motor OFI data needed to be adjusted up 0.2 percent. The high sample rate DFI data (320 s/s) needed to be adjusted to match the magnitudes of the real time data. The DFI data for the left motor was adjusted up 0.4 percent and the right motor DFI data was adjusted up 0.6 percent. After the adjustments were made to the DFI data, it was used to assess the ignition characteristics and maximum headend pressure of each motor.

The ballistic performance was reconstructed using SCB04 steady state 1-D mass addition computer program, and SCA08 SRM modeling program. Both computer codes have been consistently used for predictions as well as reconstructions throughout the SRM program. Since thrust was not measured on the flight motors, average values of η_r's and C_m's, which are used for the pressure to thrust conversion, were taken from RSRM static test motors and applied to the measured headend pressure to determine the thrust values. The ignition characteristics of the motors were assessed using a 5-point running average smoothing method to reduce noise level in the raw pressure data.

3.3 RSRM DELIVERED PERFORMANCE

3.3.1 RSRM-3A/RSRM-3B Thrust and Pressure Comparison

The flight motor reconstructed thrust-time traces at the delivered temperature of 62°F are shown in figure 2.1. A comparison between the predicted thrust and reconstructed thrust for each motor can be seen in Figures 3.1, 3.2. Figure 2.2 shows the RSRM-3B igniter inside of the igniter lot acceptance specification.

The comparison of predicted and measured headend chamber pressure is shown in Figures 3.3, 3.4.

Figures 3.5 and 3.6 show how RSRM-3A and RSRM-3B compared with a nominal performance average for the RSRM at standard conditions of 0.368 burn rate and 60 degree F PMBT. From the figures, it is evident that the RSRM design will continue to influence the shape of the average thrust time trace near 50 seconds.

3.3.2 RSRM Predicted Impulse, ISP, Burn Rate, Event Times, Separation, and PMBT Comparison

The reconstructed RSRM propulsion performance is compared to the predicted performance in Table 3.2. The actual values are very close to the predicted data for both motors and well within specification limits.

Figure 3.7 shows the high sample rate data points used to evaluate the ignition characteristics. Figure 3.8 shows the DP/DT or pressure rise rate curve. The calculated pressure rise rate for RSRM-3A was 82.7 psia/10 ms while that of RSRM-3B was 89.9 psia/10 ms. Table 3.3 lists the ignition history of all SRMs that were instrumented for high sample rate pressure data.

A comparison of actual and predicted propellant burn rates to the target burn rate for the flight RSRMs at a PMBT of 60°F is shown in Figure 3.9. The predicted scale factor of 1.0175 for conversions from 5 inch CP burn rates to actual motor burn rate were based on an average scale factor from the HPM-RSRM population. The actual scale factors for left and right motors respectively were 1.0130 and 1.0177.

The predicted propellant mean bulk temperature (PMBT) for both motors was 62°F. This was based on predicted 2-D temperature gradients expected in the RSRMs. Table 3.4 shows the predicted gradient.

TABLE 3.2
RSRM PROPULSION PERFORMANCE

	(LEFT MOTOR 62 DEG) PREDICTED	ACTUAL	(RIGHT MOTOR 62 DEG) PREDICTED	ACTUAL
IMPULSE GATES *				
I-20 (10^6 lbf sec)	64.73	63.98	64.80	63.94
I-60 (10^6 lbf sec)	172.52	172.11	172.68	172.29
I-AT (10^6 lbf sec)	296.33	295.58	296.51	296.10
VACUUM ISP (lbf*sec/lbm)*	268.2	267.5	268.2	267.8
BURN RATE (in/sec)* (@ 60°F, 625 psia)	0.368	0.367	0.368	0.368
EVENT TIMES (sec)**				
IGNITION INTERVAL	0.232	0.241	0.232	0.241
WEB TIME	111.1	111.4	111.1	111.4
TIME OF 50 PSIA CUE	120.8	120.8	120.7	120.9
ACTION TIME	123.1	124.1	123.1	123.8
SEPARATION COMMAND (sec)	125.7	125.8	125.7	125.8
PMBT (deg F)	62.0	62.0	62.0	62.0
MAXIMUM IGNITION RISE RATE (psia/10 ms)	91.9	82.7	91.9	89.9
DECAY TIME (sec) (59.4 psia to 85 K)	2.9	4.0	2.8	3.5

	PREDICTED	ACTUAL
TAILOFF IMBALANCE IMPULSE DIFFERENTIAL (LBF-SEC)***	+47 K	+61 K

* IMPULSE, ISP, BURN RATE PARAMETERS ARE RECONSTRUCTED VALUES
** EVENT TIMES REFERENCED TO IGNITION COMMAND TIME
*** IMPULSE IMBALANCE = LEFT MOTOR - RIGHT MOTOR

TABLE 3.3

HISTORICAL THREE POINT AVERAGE
THRUST AND PRESSURE RISE RATE DATA

MOTOR	OCCURRENCE TIME	PRESSURE RISE RATE	OCCURRENCE TIME	THRUST RISE RATE	IGNITION INTERVAL
STATIC TEST		(PSI/10 ms)		(LBF/10 ms)	
DM-2	0.1480	85.30	0.1480	245380	0.2330
QM-1	0.1560	86.38	0.1560	246128	0.2362
QM-2	0.1640	93.58	0.1720	234950	0.2391
QM-3	0.1560	94.45	0.1520	245615	0.2287
QM-4	0.1505	91.96	0.2225	234438	0.2192
ETM-1A	0.1520	86.72	0.1560	230023	0.2279
FLIGHT MOTORS					
SRM-1A	0.1530	87.58			0.2373
SRM-1B	0.1500	91.57			0.2358
SRM-2A	0.1530	90.74			0.2348
SRM-2B	0.1660	90.27			0.2345
SRM-3A	0.1500	91.05			0.2308
SRM-3B	0.1500	89.68			0.2271
SRM-5A	0.1530	95.10			0.2361
SRM-5B	0.1660	84.43			0.2380
SRM-6A	0.1530	92.72			0.2342
SRM-6B	0.1470	88.22			0.2329
SRM-7A	0.1500	99.90			0.2282
SRM-7B	0.1500	99.32			0.2276
SRM-8A	0.1530	106.29			0.2224
SRM-8B	0.1500	91.06			0.2196
SRM-9A	0.1530	92.31			0.2303
SRM-10A	0.1530	92.89			0.2373
SRM-10B	0.1500	84.56			0.2342
SRM-13B	0.1410	98.85			0.2115
	NUMBER	24		6	24
	AVERAGE	91.87		236,357	0.2307
STANDARD DEVIATION		5.31		11,977	0.0069
% COEFFICIENT OF VARIATION		5.78		5.07	2.99
DM-8	0.1680	77.00	0.1670	234,001	0.2424
DM-9	0.1640	81.00	0.1720	275,525	0.2436
QM-6	0.1480	87.40	0.1520	211,476	0.2321
QM-7	0.1480	99.60	NA	NA	0.2230
PVM-1	0.1520	92.80	0.1520	294,664	0.2338
RSRM-1A	0.1501	99.00	NA	NA	0.2296
RSRM-1B	0.1596	80.50	NA	NA	0.2310
RSRM-2A	0.1584	87.30	NA	NA	0.2410
RSRM-2B	0.1521	100.2	NA	NA	0.2360
RSRM-3A	0.1560	82.70	NA	NA	0.2414
RSRM-3B	0.1529	89.90	NA	NA	0.2408

TABLE 3.4

PREDICTED PROPELLANT

TEMPERATURE GRADIENTS IN RSRM-3

WEB DIST(1)	DEGREE LOCATIONS							
	0	45	90	135	180	225	270	315
2.63	66.7	57.5	56.3	56.5	56.5	56.8	66.5	71.5
7.88	64.1	59.0	57.9	58.0	58.0	58.5	63.9	67.5
14.19	65.1	60.5	59.2	59.2	59.2	60.1	64.9	68.1
21.56	65.7	61.8	60.5	60.4	60.5	61.5	65.6	68.2
28.94	66.2	62.8	61.4	61.2	61.4	62.5	66.0	68.3
36.31	66.4	63.3	61.9	61.7	61.9	63.0	66.2	68.2

(1) MEASURED FROM CASE WALL TOWARD CENTER OF SEGMENT (INCHES)

3.3.3 RSRM-3 Pressure Distribution

Tables 3.5 and 3.6 show RSRM-3 reconstructed pressure distribution during ignition and steady state at a Propellant Mean Bulk Temperature (PMBT) of 62 degrees F. Figure 3.10 shows the location points referenced in the pressure distribution tables. The pressure distribution was reconstructed theoretically, since, no internal pressures are measured other than headend pressure. The pressures were reconstructed using Caveny-Kuo ignition transient program, SCB04 steady state 1-D mass addition, and SCA08 SRM modeling program.

TABLE 3.5

RSRM-3A MOTOR PRESSURE DISTRIBUTION SUMMARY AT 60 DEGREES F
IGNITION TRANSIENT: CAVENY KUO

TIME	HEADEND PRESSURE (489.9)	530.0	689.3	851.2	1012.1	1171.2	1332.1	1491.2	1577.5	1697.5	1816.7	NOZZLE STAGNATION PRESSURE
	X LOCATIONS (INCHES)											
0.000	21.7	21.7	21.6	21.6	21.6	21.8	21.5	21.6	21.4	21.5	21.5	21.8
0.002	20.7	20.5	20.2	20.1	20.1	20.3	20.0	20.1	20.0	20.0	20.1	20.4
0.004	19.7	19.4	19.0	18.9	18.9	19.1	18.9	19.0	18.8	18.8	18.9	19.1
0.006	19.1	18.9	18.5	18.4	18.3	18.5	18.3	18.4	18.2	18.2	18.3	18.5
0.008	18.6	18.4	17.9	17.8	17.7	17.9	17.7	17.8	17.6	17.6	17.7	17.9
0.010	18.4	18.3	17.9	17.6	17.5	17.7	17.5	17.6	17.4	17.5	17.5	17.7
0.012	18.3	18.2	17.8	17.5	17.3	17.5	17.3	17.4	17.2	17.3	17.3	17.5
0.014	18.4	18.4	18.0	17.6	17.4	17.6	17.4	17.5	17.3	17.4	17.4	17.6
0.016	18.6	18.5	18.2	17.7	17.5	17.7	17.5	17.6	17.4	17.5	17.5	17.7
0.018	19.0	18.9	18.6	18.1	17.8	18.0	17.8	17.9	17.7	17.7	17.8	18.0
0.030	22.9	22.7	22.4	21.8	21.5	21.7	21.4	21.5	21.2	21.3	21.4	21.7
0.032	23.6	23.4	23.0	22.4	22.1	22.2	21.9	22.0	21.8	21.9	21.9	22.2
0.034	24.4	24.2	23.7	22.9	22.5	22.6	22.3	22.4	22.2	22.3	22.3	22.6
0.036	25.2	25.0	24.4	23.5	23.0	23.1	22.8	22.8	22.6	22.7	22.8	23.1
0.038	26.1	25.8	25.1	24.0	23.4	23.4	23.0	23.1	22.9	23.0	23.1	23.4
0.040	26.9	26.6	25.9	24.6	23.8	23.8	23.4	23.5	23.3	23.4	23.4	23.7
0.042	27.7	27.4	26.7	25.1	24.2	24.1	23.7	23.7	23.5	23.6	23.7	24.0
0.044	28.5	28.2	27.7	25.9	24.7	24.4	24.0	24.1	23.9	24.0	24.0	24.3
0.046	29.2	29.0	28.8	26.7	25.2	24.8	24.3	24.4	24.1	24.2	24.3	24.6
0.048	29.9	29.9	29.9	27.7	25.8	25.2	24.6	24.7	24.5	24.5	24.6	24.9
0.050	30.6	30.6	31.1	28.8	26.4	25.7	25.0	25.0	24.8	24.8	24.9	25.2
0.052	31.2	31.4	32.3	30.1	27.3	26.2	25.5	25.4	25.2	25.2	25.3	25.5
0.054	31.8	32.1	33.4	31.4	28.3	26.9	26.0	25.9	25.7	25.7	25.8	26.0
0.056	32.4	32.9	34.6	32.9	29.6	27.6	26.5	26.4	26.2	26.2	26.3	26.5
0.058	33.0	33.5	35.7	34.4	31.1	28.5	27.1	27.0	26.6	26.7	26.7	27.0
0.060	33.5	34.2	36.8	35.8	32.8	29.6	27.7	27.5	27.1	27.2	27.2	27.5
0.062	33.9	35.0	37.9	37.2	34.7	30.9	28.5	28.2	27.8	27.9	27.9	28.2
0.064	34.3	35.6	38.5	38.1	36.3	32.0	29.1	28.6	28.2	28.2	28.2	28.5
0.066	34.7	36.2	38.9	38.6	37.6	33.2	29.5	28.8	28.3	28.3	28.3	28.6
0.068	35.0	36.8	39.3	39.0	38.6	34.5	30.0	29.0	28.4	28.4	28.4	28.7
0.070	35.3	37.1	39.5	39.3	39.2	35.9	30.5	29.0	28.4	28.4	28.3	28.6
0.072	35.6	37.4	39.6	39.4	39.4	37.3	31.1	29.1	28.4	28.2	28.2	28.5
0.074	35.8	37.5	39.7	39.5	39.5	38.6	32.0	29.1	28.3	28.1	28.0	28.3
0.076	36.0	37.6	39.7	39.6	39.5	39.5	33.1	29.3	28.2	27.9	27.8	28.1
0.078	36.1	37.6	39.7	39.7	39.7	40.1	34.3	29.5	28.3	27.8	27.6	27.9
0.080	36.2	37.7	39.8	39.8	39.9	40.5	35.8	30.1	28.4	27.8	27.5	27.8
0.082	36.4	36.7	38.4	38.3	38.5	39.2	35.7	29.3	27.2	26.2	26.0	26.2
0.084	36.5	33.9	34.2	34.1	34.4	35.1	32.7	26.1	23.5	22.1	21.7	22.0
0.086	36.6	32.6	32.3	31.9	32.2	32.9	31.1	25.0	21.8	19.9	19.3	19.6
0.088	36.7	32.3	31.8	30.8	31.0	31.6	30.2	25.1	21.3	18.7	18.0	18.2
0.090	36.8	32.5	30.8	29.2	29.0	29.6	28.2	24.5	20.4	17.0	15.8	16.0
0.092	36.9	32.5	30.4	28.1	27.5	27.7	26.5	23.9	19.9	15.6	14.0	14.2
0.094	37.0	32.6	29.9	27.6	26.4	26.1	24.8	23.2	19.5	14.6	12.4	12.6
0.096	37.1	32.7	29.2	27.3	25.8	24.7	23.2	22.2	19.1	13.8	11.0	11.1
0.098	37.3	33.0	28.4	26.9	25.6	23.7	21.7	21.0	18.5	13.2	9.9	10.0
0.100	37.5	33.1	28.1	26.2	25.3	23.0	20.3	19.5	17.6	12.6	8.9	9.0
0.102	37.8	33.4	27.4	25.1	24.4	22.2	18.9	17.6	15.8	11.6	7.9	8.0
0.104	38.1	33.8	25.6	23.7	22.6	20.9	17.2	15.0	13.3	9.9	6.7	6.8

TABLE 3.5 (CONTINUED)

RSRM-3A MOTOR PRESSURE DISTRIBUTION SUMMARY AT 60 DEGREES F
IGNITION TRANSIENT: CAVENY KUO

TIME	HEADEND PRESSURE (489.9)	530.0	689.3	851.2	1012.1	1171.2	1332.1	1491.2	1577.5	1697.5	1816.7	NOZZLE STAGNATION PRESSURE
	X LOCATIONS (INCHES)											
0.106	38.5	34.3	23.6	22.0	20.8	19.2	15.7	12.4	10.4	7.6	5.7	5.8
0.108	38.9	34.7	21.8	20.0	19.0	17.3	14.3	10.2	7.6	5.1	5.0	5.2
0.110	39.9	35.8	20.8	18.6	17.7	16.2	13.4	9.0	5.6	3.3	5.1	5.3
0.112	40.9	37.0	19.8	17.6	16.3	15.2	12.4	8.3	4.2	1.5	5.3	5.4
0.114	43.0	39.2	20.0	17.5	16.3	15.3	12.4	8.8	4.5	1.1	6.4	6.5
0.116	45.1	41.5	20.1	17.3	16.3	15.3	12.3	9.0	4.9	1.3	7.4	7.5
0.118	48.1	44.8	21.2	18.0	17.1	16.3	13.0	9.8	6.2	2.9	9.4	9.6
0.120	51.1	48.0	22.2	18.5	17.7	17.2	13.6	10.4	7.1	4.8	11.9	12.2
0.122	54.8	51.9	23.9	19.5	19.0	18.7	14.9	11.6	8.3	7.7	16.2	16.5
0.124	58.6	55.9	25.5	20.5	20.1	20.0	15.9	12.5	9.1	10.4	21.7	22.1
0.126	62.7	60.3	27.5	21.8	21.5	21.5	17.1	13.7	10.2	13.0	28.6	29.1
0.128	66.7	64.6	29.4	22.9	22.7	22.8	18.0	14.6	11.1	15.9	35.9	36.5
0.130	70.6	68.9	31.1	23.8	23.6	23.9	18.6	15.0	11.6	19.2	41.9	42.7
0.132	74.5	73.0	32.8	24.5	24.3	24.8	18.9	15.3	12.0	23.8	46.1	46.9
0.134	78.1	76.9	34.2	24.8	24.6	25.3	18.8	15.1	12.1	29.4	47.9	48.7
0.136	81.7	80.9	36.0	25.1	24.7	25.7	18.5	14.8	12.5	36.1	48.5	49.2
0.138	85.5	85.3	39.2	26.7	25.2	26.2	18.3	14.6	13.7	43.3	48.8	49.5
0.140	89.3	89.8	44.2	28.4	25.4	26.5	17.6	14.0	16.0	48.7	48.9	49.7
0.142	95.2	96.2	50.5	31.5	27.2	28.2	18.0	14.6	22.8	52.6	50.6	51.5
0.144	101.0	102.8	56.3	36.3	29.3	30.7	17.1	14.4	31.8	52.5	51.2	52.2
0.146	111.6	114.1	65.7	44.8	36.1	39.3	19.5	18.8	44.9	54.4	55.3	56.2
0.148	122.3	125.6	74.4	51.8	40.7	45.4	21.1	22.7	54.6	55.3	57.9	59.0
0.150	138.6	142.7	88.2	63.3	50.3	55.7	27.1	31.5	65.6	61.6	65.2	66.5
0.152	154.9	159.8	101.5	73.5	59.2	64.6	31.9	39.8	72.1	67.9	71.6	72.9
0.154	168.7	174.2	111.8	80.3	65.1	70.1	33.6	45.6	73.0	71.4	74.9	76.3
0.156	182.7	188.4	122.2	86.9	71.0	75.2	35.2	51.4	72.3	74.4	78.8	80.2
0.158	198.4	204.5	134.5	95.3	79.2	82.2	38.9	60.4	73.4	78.8	84.9	86.6
0.160	214.2	220.6	146.5	103.5	87.8	88.9	42.8	72.6	73.8	82.4	90.7	92.6
0.162	231.1	237.8	159.3	112.1	97.2	96.4	47.8	82.9	75.4	86.9	96.8	98.9
0.164	248.0	254.8	170.6	120.1	106.3	103.6	52.3	91.1	76.9	91.2	102.4	104.6
0.166	264.2	270.9	180.2	127.3	114.6	110.5	57.0	97.7	78.8	95.7	107.7	110.2
0.168	280.3	286.8	190.6	135.6	124.1	119.2	63.9	104.5	83.0	102.4	115.3	118.1
0.170	296.8	303.3	202.9	146.1	135.6	130.2	74.0	113.0	89.8	112.4	126.3	129.5
0.172	313.2	319.8	216.3	158.3	148.6	143.0	87.2	123.2	98.7	124.6	141.0	144.6
0.174	328.7	335.3	229.2	170.6	161.5	155.8	101.4	133.6	108.2	137.9	156.2	160.5
0.176	344.2	350.8	242.4	183.5	175.1	169.4	117.0	144.4	118.9	153.0	172.6	177.3
0.178	357.0	363.3	253.4	194.5	186.7	181.2	131.2	153.6	128.5	167.3	187.5	192.9
0.180	369.8	375.4	266.6	208.3	200.9	195.6	148.3	165.7	141.8	185.1	205.5	211.5
0.182	380.7	386.1	278.9	222.0	215.0	209.9	165.4	178.2	156.4	203.3	223.6	230.3
0.184	391.4	396.7	290.9	235.7	229.5	224.8	182.7	191.8	172.6	222.1	242.3	249.8
0.186	400.2	405.2	300.3	247.2	241.9	237.7	197.8	204.0	188.4	239.1	259.3	267.6
0.188	408.9	413.6	310.1	259.2	254.5	251.2	213.2	217.8	206.2	256.4	277.0	285.9
0.190	415.8	420.4	318.7	270.0	265.6	263.3	226.8	231.5	224.0	272.7	293.3	303.1
0.192	422.8	427.3	327.9	281.2	277.3	275.5	240.3	246.6	242.8	289.3	309.7	320.4
0.194	428.0	432.7	335.4	291.0	287.5	285.9	252.0	260.9	260.0	304.1	324.2	335.6
0.196	433.4	438.0	342.9	300.7	297.6	295.9	263.3	275.6	276.7	318.4	338.0	350.1
0.198	437.6	442.2	349.1	309.2	306.6	304.6	273.8	289.7	291.8	331.0	349.6	362.5
0.200	441.9	446.3	355.2	317.6	315.3	313.1	284.7	304.0	306.1	342.6	360.1	373.7

TABLE 3.5 (CONTINUED)

RSRM-3A MOTOR PRESSURE DISTRIBUTION SUMMARY AT 60 DEGREES F
IGNITION TRANSIENT: CAVENY KUO

TIME	HEADEND PRESSURE (489.9)	530.0	689.3	851.2	1012.1	1171.2	1332.1	1491.2	1577.5	1697.5	1816.7	NOZZLE STAGNATION PRESSURE
	X LOCATIONS (INCHES)											
0.202	445.3	449.8	360.7	325.5	323.4	320.9	295.7	317.9	319.3	352.9	369.0	383.1
0.204	448.8	453.3	366.5	333.4	331.5	328.8	307.9	331.6	331.8	362.4	377.2	392.0
0.206	452.2	456.5	372.2	341.2	339.2	336.9	320.9	344.6	343.1	370.8	384.7	400.0
0.208	455.5	459.8	377.9	348.9	346.8	345.2	334.5	356.5	353.2	378.2	391.5	407.3
0.210	459.1	463.4	383.9	356.6	354.5	354.4	348.7	367.1	362.3	385.2	397.8	414.2
0.212	462.7	467.0	389.8	364.0	362.1	364.2	362.7	376.2	369.8	391.5	403.5	420.4
0.214	466.9	471.0	396.3	371.9	370.6	375.4	376.6	384.7	377.3	398.0	409.5	426.9
0.216	471.1	474.9	403.1	380.0	380.0	387.5	389.3	392.4	384.4	404.5	415.4	433.2
0.218	476.3	479.9	410.7	389.2	390.9	400.9	401.2	400.5	392.0	411.6	421.9	440.2
0.220	481.5	484.9	418.1	398.5	402.8	414.3	411.5	407.7	399.0	418.3	428.1	446.8
0.222	487.6	490.9	426.4	408.9	416.3	427.9	421.3	415.4	406.7	425.6	434.9	454.0
0.224	493.8	496.8	434.8	419.9	430.2	440.3	430.0	422.8	414.0	432.5	441.4	461.0
0.226	500.9	503.8	444.5	432.8	445.1	452.4	439.0	430.9	422.2	440.2	448.7	468.7
0.228	508.0	510.9	454.6	446.4	459.6	463.0	447.6	438.9	429.9	447.6	455.7	476.2
0.230	515.7	518.5	465.4	460.9	473.4	473.0	456.2	446.9	437.9	455.1	462.9	483.8
0.232	523.4	526.2	476.4	474.9	485.1	481.5	464.0	454.2	445.2	462.0	469.5	490.8
0.234	531.4	534.1	487.8	488.3	495.2	489.0	471.2	461.0	451.8	468.4	475.7	497.3
0.236	539.4	541.9	499.2	499.9	503.3	495.5	477.5	466.8	457.6	473.8	481.0	502.9
0.238	547.1	549.5	509.9	509.5	509.5	500.7	482.8	471.4	462.2	478.3	485.2	507.5
0.240	554.9	557.0	519.4	517.1	514.7	505.1	487.0	475.2	465.9	481.9	488.8	511.4
0.242	562.3	564.1	527.5	522.9	518.7	508.6	490.3	478.0	468.8	484.6	491.4	514.3
0.244	569.5	571.2	534.9	527.8	522.5	511.9	493.3	480.6	471.4	487.1	493.8	517.0
0.246	576.4	577.7	540.9	531.7	525.7	514.5	495.8	482.7	473.6	489.2	495.8	519.2
0.248	583.1	584.3	546.7	535.9	529.1	517.4	498.6	485.1	475.9	491.5	498.0	521.7
0.250	589.4	590.3	552.1	540.4	532.9	520.6	501.5	487.8	478.7	494.1	500.4	524.4
0.252	595.7	596.5	557.9	545.5	537.2	524.4	505.0	491.0	481.9	497.2	503.4	527.6
0.254	601.5	602.5	562.7	549.9	541.2	527.7	507.9	493.6	484.6	499.8	505.9	530.3
0.256	607.2	608.3	567.5	554.4	545.2	531.1	511.0	496.4	487.4	502.3	508.3	532.9
0.258	612.6	613.8	572.4	558.9	549.3	534.7	514.2	499.2	490.1	505.0	510.9	535.7
0.260	618.1	619.2	577.4	563.4	553.5	538.5	517.7	502.3	493.1	507.8	513.8	538.7
0.262	623.1	624.3	582.3	567.7	557.3	541.9	520.9	505.0	495.8	510.4	516.2	541.4
0.264	628.3	629.4	586.9	571.8	560.9	545.1	523.7	507.6	498.4	512.9	518.6	544.0
0.266	633.2	634.2	590.9	575.5	564.3	547.9	526.3	510.0	500.6	514.9	520.8	546.4
0.268	638.1	639.0	594.9	579.1	567.6	550.7	528.8	512.3	502.9	517.2	523.1	549.0
0.270	642.8	643.7	598.6	582.5	570.8	553.5	531.2	514.4	505.0	519.5	525.5	551.6
0.272	647.5	648.4	602.5	585.9	574.1	556.5	533.9	516.7	507.3	522.0	528.3	554.6
0.274	652.1	653.0	606.4	589.4	577.3	559.5	536.6	519.2	509.7	524.7	531.2	557.8
0.276	656.7	657.5	610.5	593.2	580.7	562.6	539.5	521.8	512.3	527.8	534.4	561.2
0.278	661.2	661.9	614.3	596.9	584.1	565.7	542.3	524.6	515.2	531.0	537.6	564.8
0.280	665.5	666.3	618.1	600.5	587.7	568.8	545.2	527.5	518.2	534.6	541.2	568.7
0.282	669.8	670.6	621.9	604.0	591.1	572.0	548.1	530.3	521.4	538.1	544.9	572.7
0.284	674.1	674.8	625.6	607.6	594.5	575.2	551.1	533.4	524.6	541.9	548.9	577.0
0.286	678.3	678.9	629.1	610.9	597.9	578.3	554.1	536.5	528.0	545.7	552.9	581.3
0.288	682.4	683.1	632.8	614.4	601.1	581.5	557.3	539.9	531.6	549.7	557.2	585.8
0.290	686.5	687.2	636.3	617.6	604.2	584.5	560.3	543.1	535.0	553.7	561.2	590.2
0.292	690.5	691.3	639.5	620.6	607.1	587.3	563.1	546.2	538.5	557.5	565.2	594.5
0.294	694.4	695.3	642.5	623.2	609.6	589.7	565.8	549.1	541.6	561.3	568.9	598.6
0.296	698.3	699.3	645.6	625.8	612.1	592.3	568.3	552.0	544.8	564.9	572.8	602.7

TABLE 3.5 (CONTINUED)

RSRM-3A MOTOR PRESSURE DISTRIBUTION SUMMARY AT 60 DEGREES F
IGNITION TRANSIENT: CAVENY KUO

TIME	HEADEND PRESSURE (489.9)	530.0	689.3	851.2	1012.1	1171.2	1332.1	1491.2	1577.5	1697.5	1816.7	NOZZLE STAGNATION PRESSURE
	X LOCATIONS (INCHES)											
0.298	702.0	703.1	648.6	628.4	614.5	594.6	570.7	554.7	547.8	568.4	576.3	606.6
0.300	705.8	707.0	651.7	631.1	617.1	597.0	573.2	557.4	550.9	571.8	579.9	610.5
0.302	709.5	710.8	654.5	633.8	619.6	599.3	575.6	560.1	553.8	575.2	583.2	614.2
0.304	713.2	714.5	657.5	636.5	622.3	601.8	578.1	562.9	556.8	578.5	586.6	617.9
0.306	716.7	717.8	660.6	639.3	625.1	604.5	580.8	565.7	559.8	581.9	589.9	621.5
0.308	720.3	721.2	663.7	642.5	628.2	607.5	583.7	568.6	563.0	585.2	593.3	625.2
0.310	723.6	724.5	666.4	645.4	631.0	610.4	586.7	571.6	566.1	588.4	596.5	628.6
0.320	740.1	743.4	685.2	663.1	650.7	632.7	609.0	595.4	589.0	610.7	619.5	653.2
0.330	755.1	757.8	700.2	677.9	665.1	645.6	621.9	608.0	602.8	627.0	636.7	672.2
0.340	769.0	770.9	714.3	693.7	682.0	662.7	638.9	624.8	619.4	642.1	650.4	687.1
0.350	781.5	782.4	728.9	709.1	697.4	677.9	654.8	639.4	633.5	657.8	667.2	705.7
0.360	793.0	792.9	742.1	724.1	713.2	692.9	668.6	653.0	647.9	672.2	680.9	720.7
0.370	803.6	802.9	755.6	738.8	727.2	706.2	682.6	666.5	660.9	685.3	693.9	734.9
0.380	813.3	812.2	766.7	750.7	739.2	718.1	694.3	677.2	671.8	695.9	704.1	746.1
0.390	821.9	820.8	776.7	761.6	749.7	727.7	704.2	686.1	680.3	704.1	711.8	754.6
0.400	829.9	828.8	785.7	771.3	759.2	736.8	712.7	693.3	687.0	710.1	717.4	760.6
0.410	837.0	835.7	793.0	778.9	766.2	742.9	718.1	697.7	691.0	713.8	720.8	764.5
0.420	843.4	842.0	799.4	785.1	771.7	747.2	721.9	700.9	694.0	716.7	723.5	767.5
0.430	849.3	848.5	804.2	789.1	775.1	749.9	724.5	703.0	695.9	718.3	725.2	769.5
0.440	854.5	854.3	808.8	793.7	779.4	753.6	727.8	705.9	698.8	721.2	727.9	772.6
0.450	859.1	859.2	813.4	798.4	784.4	758.5	732.7	710.7	703.5	725.9	732.7	777.7
0.460	863.3	863.6	817.5	802.5	788.8	763.2	737.5	715.8	708.8	731.5	738.4	784.0
0.470	867.0	867.3	820.5	805.5	791.8	766.3	741.1	719.6	712.7	735.5	742.4	788.2
0.480	870.3	870.4	823.5	808.6	795.2	769.6	744.6	722.9	716.1	738.5	745.2	791.3
0.490	873.3	873.2	826.3	811.8	798.6	773.3	748.4	726.4	719.3	741.7	748.4	794.7
0.500	875.8	875.6	828.6	814.1	800.9	775.5	750.7	728.6	721.7	744.2	750.9	797.5
0.510	878.1	877.6	830.6	815.7	802.4	776.8	751.9	729.9	723.1	745.4	752.1	798.8
0.520	880.0	879.4	832.1	817.1	803.7	778.0	753.2	731.0	724.0	746.2	752.9	799.8
0.530	881.7	881.0	833.7	818.6	805.3	779.6	754.8	732.3	725.3	747.7	754.4	801.4
0.540	883.3	882.4	834.9	819.8	806.7	781.0	756.3	733.8	727.0	749.5	756.3	803.4
0.550	884.5	883.5	836.2	821.0	807.9	782.3	757.8	735.5	728.7	751.3	758.1	805.4
0.560	885.7	884.6	837.3	822.2	809.2	783.8	759.4	737.2	730.4	752.9	759.7	807.1
0.570	886.6	885.5	838.4	823.4	810.4	785.1	760.8	738.5	731.7	754.3	761.0	808.5
0.580	887.5	886.3	839.2	824.2	811.2	785.8	761.6	739.2	732.4	754.9	761.6	809.2
0.590	888.1	886.9	839.9	824.7	811.8	786.3	762.0	739.5	732.7	755.2	761.8	809.4
0.600	888.7	887.4	840.4	825.1	812.1	786.5	762.3	739.7	732.9	755.3	761.9	809.6

TABLE 3.5 (CONTINUED)

RSRM-3A MOTOR PRESSURE DISTRIBUTION SUMMARY AT 60 DEGREES F
STEADY STATE: SCB04, SCA08

TIME	HEADEND PRESSURE (489.9)	X LOCATIONS (INCHES) 530.0	689.3	851.2	1012.1	1171.2	1332.1	1491.2	1511.0	1577.5	1697.5	1816.7	NOZZLE STAGNATION PRESSURE
0.6	888.7	887.4	840.4	825.1	812.1	786.5	762.3	739.7	733.2	732.9	755.3	761.9	809.6
0.8	892.5	891.4	848.5	834.1	821.6	797.7	774.5	753.9	747.1	746.8	768.2	774.5	808.0
1.0	890.3	889.3	849.0	835.2	823.2	800.8	778.3	759.0	752.3	751.9	772.3	778.2	796.9
2.0	882.7	881.8	845.8	832.8	821.3	800.8	778.6	760.9	753.9	753.3	772.2	777.7	797.2
3.0	877.6	876.8	844.1	831.7	820.6	801.5	779.9	763.4	756.3	755.7	773.2	778.5	798.9
4.0	876.5	875.8	845.8	833.9	823.2	804.1	784.1	768.2	761.5	760.7	777.2	782.1	803.6
5.0	876.1	875.5	847.7	836.3	826.0	807.0	788.5	773.2	766.6	765.8	781.4	786.0	808.6
6.0	879.6	879.0	853.2	842.0	832.1	813.3	795.9	781.2	774.7	773.8	788.6	792.9	816.7
7.0	881.4	880.9	857.1	846.4	836.8	818.5	802.1	788.0	781.7	780.7	794.6	798.7	821.4
8.0	881.2	880.7	858.9	848.6	839.4	821.6	806.2	792.6	786.6	785.5	798.4	802.2	823.9
9.0	881.7	881.3	861.2	851.4	842.5	825.2	810.7	797.6	791.8	790.6	802.6	806.1	826.8
10.0	881.2	880.8	862.3	852.9	844.3	827.7	813.8	801.2	795.7	794.4	805.6	808.9	828.5
12.0	877.1	876.8	861.0	852.4	844.5	829.1	816.5	804.8	800.0	798.6	808.2	810.9	828.5
14.0	872.6	872.4	858.8	851.0	843.6	829.4	818.0	807.1	802.8	801.3	809.6	811.9	827.5
16.0	870.0	869.8	858.0	850.8	843.9	830.9	820.5	810.2	806.4	804.9	812.1	813.9	827.7
18.0	867.3	867.1	857.0	850.3	843.9	831.9	822.4	812.6	809.3	807.7	813.8	815.5	827.5
20.0	865.0	864.8	856.0	849.9	843.8	832.8	824.0	814.9	811.8	810.3	815.5	816.9	827.2
22.0	861.4	861.3	854.0	848.4	842.8	832.6	824.4	815.7	813.0	811.4	815.8	816.8	825.4
24.0	827.8	827.7	822.1	817.3	812.2	803.2	795.7	787.6	785.3	783.5	787.0	787.6	795.6
26.0	798.4	798.4	794.1	789.8	785.2	777.2	770.3	762.8	760.8	759.0	761.8	762.1	769.4
28.0	774.5	774.5	771.1	767.5	763.2	756.1	749.7	742.7	740.9	739.2	741.3	741.4	748.1
30.0	754.4	754.3	751.7	748.5	744.7	738.3	732.3	725.8	724.1	722.5	724.0	724.0	730.3
32.0	735.1	735.1	733.1	730.2	726.8	721.0	715.5	709.4	708.0	706.3	707.4	707.2	713.2
34.0	717.4	717.4	715.9	713.4	710.3	705.1	700.0	694.3	693.0	691.3	692.1	691.7	697.4
36.0	700.3	700.3	699.2	697.0	694.2	689.5	684.8	679.3	678.2	676.6	677.0	676.6	682.0
38.0	684.0	684.0	683.2	681.4	678.9	674.6	670.2	665.1	664.1	662.5	662.7	662.1	667.4
40.0	668.3	668.3	667.8	666.2	663.9	660.0	655.9	651.2	650.2	648.7	648.7	648.1	653.1
42.0	654.0	654.0	653.7	652.4	650.3	646.8	643.0	638.5	637.6	636.2	636.0	635.3	640.2
44.0	642.0	642.0	641.8	640.6	638.8	635.6	632.0	627.8	627.1	625.6	625.3	624.6	629.4
46.0	631.0	631.0	630.9	629.9	628.2	625.3	621.9	618.0	617.3	615.9	615.5	614.7	619.4
48.0	617.3	617.3	617.2	616.4	614.8	612.2	609.0	605.3	604.6	603.2	602.8	602.0	606.7
50.0	601.7	601.8	601.7	601.0	599.6	597.2	594.2	590.6	590.0	588.7	588.2	587.3	592.0
52.0	596.4	596.4	596.3	595.7	594.3	592.1	589.1	585.8	585.2	583.9	583.4	582.5	587.3
54.0	595.7	595.7	595.6	595.0	593.8	591.5	588.8	585.6	585.1	583.9	583.3	582.5	587.1
56.0	599.3	599.3	599.2	598.7	597.5	595.3	592.7	589.7	589.2	588.0	587.4	586.6	591.0
58.0	605.7	605.7	605.7	605.1	604.0	602.0	599.5	596.5	596.0	594.9	594.3	593.5	597.8
60.0	611.2	611.2	611.2	610.7	609.5	607.6	605.2	602.4	602.0	600.9	600.3	599.5	603.6
62.0	616.1	616.1	616.1	615.6	614.5	612.7	610.4	607.7	607.4	606.3	605.6	604.8	608.8
64.0	620.9	620.9	620.9	620.4	619.4	617.6	615.4	612.8	612.5	611.4	610.8	610.0	613.9
66.0	623.1	623.1	623.1	622.7	621.7	620.0	617.9	615.4	615.1	614.1	613.4	612.7	616.4
68.0	628.3	628.3	628.3	627.9	626.9	625.3	623.3	620.9	620.6	619.6	619.0	618.2	621.9
70.0	630.9	630.9	630.9	630.5	629.6	628.1	626.1	623.8	623.5	622.6	622.0	621.2	624.7
72.0	633.7	633.7	633.6	633.3	632.4	631.0	629.0	626.9	626.6	625.7	625.0	624.3	627.7
74.0	634.7	634.7	634.7	634.4	633.5	632.2	630.3	628.3	628.0	627.1	626.4	625.8	629.1
76.0	633.7	633.7	633.7	633.4	632.6	631.3	629.5	627.6	627.3	626.5	625.8	625.2	628.3
78.0	631.4	631.4	631.4	631.0	630.2	629.0	627.3	625.4	625.2	624.4	623.7	623.1	626.2
80.0	620.2	620.2	620.2	619.9	619.1	617.9	616.3	614.4	614.2	613.5	612.8	612.3	615.3
82.0	609.9	609.9	609.9	609.6	608.9	607.7	606.1	604.3	604.1	603.3	602.7	602.3	605.2

TABLE 3.5 (CONTINUED)

RSRM-3A MOTOR PRESSURE DISTRIBUTION SUMMARY AT 60 DEGREES F
STEADY STATE: SCB04, SCA08

TIME	---- X LOCATIONS (INCHES) ---- HEADEND PRESSURE (489.9)	530.0	689.3	851.2	1012.1	1171.2	1332.1	1491.2	1511.0	1577.5	1697.5	1816.7	NOZZLE STAGNATION PRESSURE
84.0	597.7	597.7	597.7	597.4	596.6	595.5	593.9	592.2	592.0	591.3	590.6	590.3	593.2
86.0	578.3	578.3	578.3	578.0	577.3	576.2	574.7	573.0	572.8	572.2	571.5	571.3	574.1
88.0	557.7	557.7	557.7	557.4	556.7	555.7	554.2	552.7	552.5	551.7	551.1	551.1	553.7
90.0	538.9	538.9	538.9	538.7	538.0	537.1	535.6	534.1	533.9	533.3	532.6	532.6	535.2
92.0	532.9	532.9	532.9	532.6	532.0	531.1	529.7	528.2	528.0	527.3	526.8	526.8	529.3
94.0	522.8	522.8	522.8	522.6	522.0	521.1	519.7	518.3	518.1	517.5	517.0	517.0	519.5
96.0	508.9	508.9	508.9	508.7	508.0	507.2	505.8	504.5	504.3	503.7	503.3	503.3	505.7
98.0	493.4	493.4	493.4	493.2	492.6	491.8	490.4	489.2	489.0	488.4	488.0	488.0	490.4
100.0	481.0	481.0	481.0	480.8	480.2	479.4	478.1	476.9	476.8	476.1	475.9	475.9	478.1
100.4	478.1	478.1	478.1	477.9	477.3	476.6	475.3	474.1	473.9	473.3	473.0	473.0	475.3
100.8	475.0	475.0	475.0	474.8	474.2	473.5	472.2	471.0	470.9	470.2	470.0	470.0	472.2
101.2	471.9	471.8	471.8	471.7	471.1	470.3	469.1	467.9	467.7	467.1	466.9	466.9	469.1
101.6	468.7	468.7	468.7	468.5	467.9	467.2	465.9	464.7	464.6	464.0	463.7	463.7	466.0
102.0	465.5	465.5	465.5	465.3	464.8	464.0	462.8	461.6	461.5	460.9	460.6	460.6	462.9
102.4	462.4	462.4	462.4	462.2	461.7	461.0	459.7	458.5	458.4	457.8	457.6	457.6	459.8
102.8	459.4	459.3	459.3	459.2	458.6	457.9	456.7	455.5	455.4	454.8	454.6	454.6	456.7
103.2	456.2	456.3	456.3	456.1	455.5	454.8	453.6	452.4	452.3	451.7	451.5	451.5	453.7
103.6	453.1	453.1	453.1	452.9	452.4	451.6	450.4	449.3	449.2	448.6	448.4	448.4	450.6
104.0	449.8	449.8	449.8	449.6	449.1	448.4	447.1	446.0	445.9	445.3	445.1	445.1	447.3
104.4	446.4	446.3	446.3	446.2	445.6	444.9	443.7	442.6	442.5	441.9	441.8	441.8	443.9
104.8	442.8	442.8	442.8	442.7	442.1	441.4	440.2	439.1	439.0	438.4	438.3	438.3	440.4
105.2	439.3	439.3	439.3	439.1	438.6	437.9	436.7	435.6	435.5	434.9	434.8	434.8	436.9
105.6	435.7	435.7	435.7	435.6	435.0	434.3	433.2	432.0	432.0	431.4	431.3	431.3	433.4
106.0	432.2	432.2	432.2	432.1	431.5	430.9	429.7	428.6	428.5	427.9	427.8	427.8	429.9
106.4	428.9	428.9	428.9	428.7	428.2	427.5	426.4	425.2	425.2	424.6	424.5	424.5	426.6
106.8	425.8	425.8	425.8	425.6	425.1	424.4	423.3	422.1	422.1	421.5	421.5	421.5	423.5
107.2	422.9	422.9	422.9	422.8	422.3	421.6	420.4	419.3	419.3	418.7	418.7	418.7	420.7
107.6	420.4	420.5	420.5	420.3	419.8	419.1	417.9	416.8	416.8	416.2	416.2	416.2	418.2
108.0	418.5	418.5	418.5	418.3	417.8	417.1	416.0	414.9	414.9	414.2	414.2	414.2	416.3
108.4	416.9	416.9	416.9	416.7	416.2	415.5	414.4	413.3	413.2	412.7	412.7	412.7	414.7
108.8	415.4	415.4	415.4	415.2	414.7	414.0	412.9	411.8	411.7	411.2	411.2	411.2	413.2
109.2	414.1	414.1	414.1	414.0	413.4	412.8	411.6	410.6	410.5	410.0	410.0	410.0	412.0
109.6	412.5	412.5	412.5	412.4	411.9	411.2	410.0	409.0	408.9	408.4	408.4	408.4	410.4
110.0	409.9	409.9	409.9	409.8	409.3	408.6	407.5	406.5	406.4	405.9	405.9	405.9	407.9
110.4	406.0	406.0	406.0	405.9	405.3	404.7	403.6	402.6	402.5	402.0	402.0	402.0	403.9
110.8	400.1	400.1	400.1	399.9	399.4	398.8	397.7	396.6	396.6	396.1	396.1	396.1	398.1
111.2	392.5	392.5	392.5	392.3	391.8	391.2	390.1	389.1	389.0	388.7	388.7	388.7	390.5
111.6	383.7	383.7	383.7	383.6	383.0	382.4	381.3	380.3	380.2	380.0	380.0	380.0	381.8
112.0	373.7	373.7	373.7	373.5	373.0	372.4	371.3	370.3	370.3	370.0	370.0	370.0	371.8
112.4	361.7	361.7	361.7	361.6	361.1	360.5	359.4	358.4	358.4	358.2	358.2	358.2	360.0
112.8	347.0	347.0	347.0	346.8	346.3	345.8	344.7	343.7	343.7	343.6	343.6	343.6	345.3
113.2	328.4	328.4	328.4	328.3	327.8	327.3	326.3	325.3	325.3	325.3	325.3	325.3	326.9
113.6	306.6	306.6	306.6	306.5	306.0	305.6	304.5	303.7	303.7	303.7	303.7	303.7	305.2
114.0	283.2	283.2	283.2	283.1	282.7	282.2	281.3	280.5	280.5	280.5	280.5	280.5	281.9
114.4	260.3	260.3	260.3	260.2	259.7	259.4	258.5	257.8	257.8	257.8	257.8	257.8	259.1
114.8	239.3	239.3	239.3	239.2	238.7	238.5	237.6	237.0	237.0	237.0	237.0	237.0	238.2
115.2	220.4	220.4	220.4	220.3	219.9	219.7	218.8	218.3	218.3	218.3	218.3	218.3	219.4
115.6	203.1	203.1	203.1	202.9	202.5	202.4	201.6	201.1	201.1	201.1	201.1	201.1	202.1

TABLE 3.5 (CONTINUED)

RSRM-3A MOTOR PRESSURE DISTRIBUTION SUMMARY AT 60 DEGREES F
STEADY STATE: SCB04, SCA08

TIME	HEADEND PRESSURE (489.9)	X LOCATIONS (INCHES) 530.0	689.3	851.2	1012.1	1171.2	1332.1	1491.2	1511.0	1577.5	1697.5	1816.7	NOZZLE STAGNATION PRESSURE
116.0	186.5	186.5	186.5	186.3	185.9	185.8	185.0	184.7	184.7	184.7	184.7	184.7	185.6
116.4	170.2	170.2	170.2	170.1	169.6	169.6	168.8	168.6	168.6	168.6	168.6	168.6	169.4
116.8	154.6	154.6	154.6	154.5	154.1	154.1	153.3	153.2	153.2	153.2	153.2	153.2	153.9
117.2	140.7	140.7	140.7	140.6	140.2	140.2	139.5	139.4	139.4	139.4	139.4	139.4	140.0
117.6	128.6	128.6	128.6	128.5	128.2	128.2	127.5	127.4	127.4	127.4	127.4	127.4	128.0
118.0	117.8	117.8	117.8	117.7	117.3	117.3	116.6	116.7	116.7	116.7	116.7	116.7	117.2
118.4	106.7	106.7	106.7	106.6	106.3	106.3	105.7	105.7	105.7	105.7	105.7	105.7	106.2
118.8	94.8	94.8	94.8	94.7	94.5	94.5	93.9	94.0	94.0	94.0	94.0	94.0	94.4
119.2	83.1	83.1	83.1	83.0	82.8	82.8	82.3	82.3	82.3	82.3	82.3	82.3	82.7
119.6	72.8	72.8	72.8	72.7	72.5	72.5	72.1	72.1	72.1	72.1	72.1	72.1	72.5
120.0	64.6	64.6	64.6	64.5	64.3	64.3	64.0	64.0	64.0	64.0	64.0	64.0	64.3

TABLE 3.6

RSRM-3B MOTOR PRESSURE DISTRIBUTION SUMMARY AT 60 DEGREES F
IGNITION TRANSIENT: CAVENY KUO

TIME	HEADEND PRESSURE (489.9)	530.0	689.3	851.2	1012.1	1171.2	1332.1	1491.2	1577.5	1697.5	1816.7	NOZZLE STAGNATION PRESSURE
	X LOCATIONS (INCHES)											
0.000	16.5	16.6	16.5	16.5	16.5	16.6	16.4	16.5	16.4	16.4	16.4	16.6
0.002	18.4	18.2	18.0	18.0	18.0	18.1	17.9	18.0	17.9	17.8	17.9	18.1
0.004	20.4	20.2	19.8	19.8	19.8	19.9	19.7	19.8	19.5	19.6	19.7	19.9
0.006	20.8	20.6	20.1	20.1	20.1	20.2	20.0	20.1	19.8	19.9	20.0	20.2
0.008	21.2	21.0	20.5	20.4	20.4	20.5	20.3	20.4	20.2	20.2	20.3	20.5
0.010	20.6	20.5	20.0	19.8	19.8	19.9	19.7	19.8	19.6	19.7	19.7	19.9
0.012	20.1	20.0	19.6	19.3	19.2	19.3	19.1	19.2	19.0	19.1	19.1	19.3
0.014	19.2	19.1	18.8	18.4	18.3	18.4	18.2	18.3	18.1	18.2	18.2	18.4
0.016	18.4	18.3	17.9	17.5	17.4	17.5	17.3	17.3	17.2	17.2	17.3	17.5
0.018	17.6	17.5	17.2	16.7	16.5	16.6	16.4	16.5	16.4	16.4	16.4	16.6
0.030	17.6	17.5	17.2	16.6	16.4	16.4	16.2	16.3	16.2	16.2	16.2	16.4
0.032	17.8	17.6	17.3	16.6	16.3	16.4	16.1	16.2	16.1	16.1	16.2	16.4
0.034	19.0	18.8	18.3	17.6	17.2	17.2	17.0	17.1	17.0	17.0	17.0	17.2
0.036	20.2	19.9	19.5	18.6	18.1	18.1	17.8	17.9	17.8	17.8	17.8	18.0
0.038	21.8	21.5	20.9	19.8	19.3	19.2	18.9	19.0	18.8	18.9	18.9	19.1
0.040	23.4	23.1	22.5	21.2	20.5	20.3	20.0	20.1	19.9	20.0	20.1	20.3
0.042	25.3	25.0	24.4	22.9	21.8	21.7	21.4	21.5	21.2	21.4	21.4	21.6
0.044	27.2	26.9	26.5	24.6	23.4	23.1	22.8	22.8	22.6	22.6	22.8	23.0
0.046	29.1	28.9	28.7	26.6	25.1	24.7	24.3	24.3	24.1	24.1	24.3	24.5
0.048	31.1	31.0	31.0	28.7	26.8	26.3	25.7	25.9	25.6	25.7	25.7	26.0
0.050	32.9	32.9	33.3	31.0	28.7	27.9	27.2	27.4	27.0	27.1	27.2	27.5
0.052	34.7	34.8	35.7	33.5	30.7	29.6	28.8	28.9	28.6	28.7	28.7	29.0
0.054	36.2	36.5	37.8	35.8	32.7	31.3	30.3	30.3	30.0	30.1	30.1	30.4
0.056	37.8	38.2	39.9	38.3	34.9	33.0	31.8	31.6	31.4	31.4	31.5	31.8
0.058	38.9	39.5	41.7	40.3	36.9	34.5	33.0	32.8	32.4	32.5	32.6	32.9
0.060	40.0	40.7	43.3	42.3	39.2	36.1	34.1	33.9	33.5	33.6	33.7	34.0
0.062	40.6	41.6	44.6	43.8	41.2	37.5	35.1	34.8	34.4	34.4	34.5	34.8
0.064	41.2	42.5	45.4	44.8	43.0	38.8	35.8	35.3	34.9	34.9	34.9	35.3
0.066	41.2	42.8	45.5	45.1	44.1	39.7	36.0	35.2	34.8	34.8	34.8	35.2
0.068	41.3	43.0	45.5	45.2	44.9	40.8	36.2	35.1	34.6	34.6	34.5	34.9
0.070	40.9	42.7	45.1	44.8	44.8	41.5	36.0	34.5	33.9	33.9	33.9	34.2
0.072	40.5	42.3	44.6	44.3	44.4	42.3	36.0	33.9	33.2	33.1	33.1	33.4
0.074	39.8	41.5	43.7	43.5	43.5	42.6	35.9	33.0	32.2	32.0	32.0	32.3
0.076	39.0	40.6	42.8	42.7	42.6	42.6	36.0	32.2	31.3	31.0	30.9	31.2
0.078	38.1	39.6	41.8	41.7	41.7	42.2	36.3	31.5	30.3	29.8	29.7	30.0
0.080	37.3	38.7	40.8	40.8	40.9	41.5	36.8	31.0	29.5	28.8	28.5	28.8
0.082	36.4	36.7	38.4	38.4	38.5	39.2	35.7	29.3	27.2	26.3	25.9	26.2
0.084	35.5	33.0	33.3	33.2	33.5	34.2	31.7	25.2	22.6	21.2	20.7	20.9
0.086	34.9	30.9	30.7	30.3	30.6	31.2	29.5	23.4	20.2	18.3	17.6	17.8
0.088	34.3	29.9	29.4	28.4	28.6	29.2	27.8	22.8	19.0	16.4	15.5	15.7
0.090	34.1	29.8	28.0	26.4	26.3	26.8	25.6	21.8	17.7	14.2	13.1	13.2
0.092	33.9	29.5	27.3	25.2	24.5	24.7	23.5	20.9	16.9	12.6	11.0	11.1
0.094	34.2	29.8	27.1	24.8	23.6	23.2	22.0	20.4	16.7	11.8	9.6	9.7
0.096	34.5	30.2	26.6	24.7	23.1	22.0	20.6	19.6	16.5	11.2	8.4	8.5
0.098	35.5	31.1	26.6	25.0	23.6	21.8	19.9	19.1	16.7	11.4	8.0	8.1
0.100	36.4	32.1	27.0	25.1	24.1	21.8	19.3	18.4	16.5	11.6	7.8	7.9
0.102	38.0	33.6	27.5	25.4	24.5	22.3	19.0	17.7	16.0	11.8	8.0	8.1
0.104	39.6	35.4	27.1	25.3	24.0	22.3	18.6	16.4	14.7	11.3	8.1	8.2

TABLE 3.6 (CONTINUED)

RSRM-3B MOTOR PRESSURE DISTRIBUTION SUMMARY AT 60 DEGREES F
IGNITION TRANSIENT: CAVENY KUO

TIME	HEADEND PRESSURE (489.9)	530.0	689.3	851.2	1012.1	1171.2	1332.1	1491.2	1577.5	1697.5	1816.7	NOZZLE STAGNATION PRESSURE
	X LOCATIONS (INCHES)											
0.106	41.8	37.7	27.0	25.4	24.0	22.4	18.9	15.7	13.6	10.9	9.0	9.1
0.108	44.0	39.9	27.0	25.1	24.0	22.4	19.4	15.2	12.5	10.2	10.1	10.2
0.110	49.9	45.9	30.8	28.6	27.7	26.2	23.4	19.0	15.5	13.2	15.0	15.3
0.112	55.8	51.9	34.8	32.4	31.3	30.1	27.2	23.2	19.0	16.2	20.1	20.3
0.114	61.1	57.4	38.2	35.6	34.3	33.5	30.4	26.9	22.4	19.1	24.4	24.7
0.116	66.5	62.9	41.5	38.6	37.6	36.8	33.6	30.4	26.0	22.3	28.6	28.9
0.118	68.4	65.0	41.4	38.1	37.2	36.6	33.2	30.1	26.2	22.8	29.5	29.9
0.120	70.3	67.2	41.3	37.5	36.8	36.4	32.7	29.6	25.9	23.8	30.9	31.3
0.122	68.7	65.8	37.6	33.3	32.8	32.6	28.5	25.3	21.8	21.4	29.9	30.2
0.124	67.1	64.4	33.9	28.9	28.5	28.4	24.3	20.9	17.5	18.7	30.1	30.5
0.126	66.8	64.4	31.5	25.9	25.5	25.5	21.1	17.7	14.2	17.0	32.7	33.2
0.128	66.4	64.3	29.0	22.6	22.3	22.4	17.6	14.1	10.7	15.5	35.5	36.2
0.130	70.5	68.7	30.9	23.7	23.4	23.7	18.3	14.8	11.4	19.1	41.9	42.6
0.132	74.6	73.2	32.8	24.6	24.3	24.8	18.9	15.3	11.9	23.7	46.1	46.9
0.134	80.4	79.4	36.5	27.1	26.9	27.6	21.0	17.4	14.3	31.6	50.2	51.0
0.136	86.3	85.5	40.6	29.6	29.2	30.3	23.0	19.3	17.0	40.6	53.1	53.8
0.138	90.7	90.4	44.4	31.7	30.2	31.4	23.3	19.7	18.7	48.4	53.9	54.7
0.140	95.1	95.4	49.8	34.0	31.0	32.2	23.2	19.6	21.6	54.4	54.5	55.4
0.142	100.2	101.2	55.5	36.4	32.2	33.1	22.9	19.4	27.6	57.6	55.5	56.4
0.144	105.3	107.1	60.4	40.4	33.5	34.8	21.2	18.4	35.9	56.7	55.4	56.3
0.146	118.0	120.5	72.0	51.0	42.2	45.6	25.6	25.0	51.2	60.6	61.5	62.5
0.148	130.8	134.0	82.8	60.2	49.0	53.8	29.4	31.0	62.9	63.7	66.3	67.4
0.150	149.1	153.2	98.7	73.7	60.7	66.1	37.4	41.8	75.9	72.0	75.6	76.9
0.152	167.5	172.4	114.0	85.9	71.6	77.0	44.1	52.1	84.4	80.3	83.9	85.3
0.154	184.4	189.9	127.3	95.9	80.5	85.6	48.8	61.1	88.4	86.8	90.4	91.8
0.156	201.4	207.1	140.7	105.4	89.4	94.0	53.6	69.9	90.6	92.9	97.2	98.8
0.158	219.6	225.7	155.5	116.3	100.2	103.4	59.7	81.4	94.2	99.7	105.8	107.8
0.160	237.9	244.4	170.1	127.0	111.2	112.6	66.1	96.1	97.0	105.8	114.1	116.3
0.162	255.8	262.5	183.8	136.4	121.4	121.0	71.9	107.2	99.5	111.1	121.2	123.4
0.164	273.5	280.5	195.9	145.4	131.4	129.1	77.3	116.3	101.9	116.4	127.5	130.1
0.166	291.4	298.1	207.2	154.1	141.5	137.6	83.5	124.6	105.3	122.4	134.5	137.3
0.168	309.1	315.7	219.2	164.1	152.6	147.8	92.1	133.1	111.1	130.7	143.7	146.8
0.170	325.6	332.1	231.5	174.6	164.0	158.9	102.3	141.5	118.0	140.7	154.7	158.2
0.172	342.0	348.6	245.0	186.8	177.0	171.7	115.4	151.7	126.8	153.0	169.4	173.3
0.174	355.6	362.3	256.0	197.3	188.1	182.6	127.8	160.2	134.5	164.4	182.8	187.3
0.176	369.2	375.9	267.3	208.3	199.8	194.3	141.5	169.3	143.4	177.7	197.4	202.3
0.178	380.2	386.6	276.5	217.5	209.6	204.2	153.9	176.5	151.2	190.2	210.5	216.0
0.180	391.2	396.8	287.7	229.3	221.8	216.7	169.2	186.7	162.5	206.0	226.5	232.7
0.182	399.5	405.0	297.7	240.6	233.6	228.7	183.9	196.8	174.7	221.9	242.2	249.1
0.184	407.8	413.2	307.1	252.0	245.7	241.1	198.9	208.0	188.6	238.3	258.6	266.1
0.186	414.0	419.0	314.0	260.8	255.3	251.4	211.3	217.6	201.9	252.6	273.0	281.2
0.188	420.1	424.9	321.1	270.2	265.4	262.2	224.1	228.8	217.1	267.5	288.1	297.0
0.190	424.6	429.2	327.3	278.5	274.2	271.9	235.4	240.1	232.6	281.3	302.0	311.8
0.192	429.0	433.7	334.1	287.5	283.5	281.7	246.6	252.8	248.9	295.6	316.2	326.7
0.194	432.6	437.3	339.9	295.5	292.0	290.4	256.5	265.4	264.5	308.7	329.0	340.3
0.196	436.3	440.9	345.8	303.5	300.4	298.7	266.2	278.4	279.6	321.5	341.0	353.1
0.198	439.6	444.3	351.1	311.1	308.5	306.5	275.7	291.8	293.7	333.1	351.8	364.6
0.200	443.0	447.6	356.2	318.7	316.4	314.1	285.8	305.3	307.3	344.0	361.4	374.9

TABLE 3.6 (CONTINUED)

RSRM-3B MOTOR PRESSURE DISTRIBUTION SUMMARY AT 60 DEGREES F
IGNITION TRANSIENT: CAVENY KUO

TIME	HEADEND PRESSURE (489.9)	530.0	689.3	851.2	1012.1	1171.2	1332.1	1491.2	1577.5	1697.5	1816.7	NOZZLE STAGNATION PRESSURE
	X LOCATIONS (INCHES)											
0.202	446.5	451.0	361.8	326.5	324.5	322.0	297.0	319.2	320.5	354.3	370.4	384.5
0.204	450.1	454.5	367.7	334.6	332.6	330.0	309.1	333.0	333.1	363.8	378.8	393.4
0.206	454.1	458.6	374.0	343.1	341.0	338.8	322.8	346.6	345.2	372.9	386.9	402.1
0.208	458.2	462.5	380.5	351.5	349.4	347.9	337.2	359.2	356.0	381.1	394.3	410.1
0.210	462.7	467.1	387.6	360.2	358.1	358.1	352.6	371.0	366.1	389.1	401.7	418.0
0.212	467.4	471.7	394.4	368.7	366.7	369.0	367.6	381.0	374.8	396.4	408.6	425.3
0.214	472.7	476.8	402.1	377.7	376.4	381.2	382.5	390.7	383.2	404.1	415.6	432.9
0.216	478.0	481.9	409.9	387.0	386.8	394.5	396.3	399.5	391.4	411.7	422.6	440.3
0.218	484.0	487.7	418.4	396.9	398.6	408.8	409.1	408.4	399.8	419.6	429.9	448.1
0.220	490.0	493.4	426.6	407.0	411.3	422.9	420.2	416.5	407.7	427.1	436.9	455.5
0.222	496.3	499.6	435.2	417.7	425.0	436.7	430.2	424.4	415.6	434.6	443.9	463.0
0.224	502.8	505.9	443.9	428.9	439.2	449.4	439.2	432.1	423.2	441.8	450.7	470.2
0.226	509.6	512.6	453.2	441.6	453.9	461.3	448.0	440.0	431.0	449.2	457.8	477.6
0.228	516.4	519.3	463.0	454.8	468.1	471.7	456.3	447.5	438.6	456.3	464.5	484.8
0.230	523.3	526.3	473.1	468.6	481.1	480.9	464.1	454.9	445.8	463.1	470.9	491.7
0.232	530.4	533.2	483.4	482.0	492.2	488.6	471.3	461.4	452.3	469.2	476.9	497.9
0.234	537.4	540.1	494.0	494.5	501.3	495.3	477.6	467.3	458.1	474.7	482.0	503.5
0.236	544.5	547.1	504.4	505.2	508.5	500.8	483.0	472.3	462.9	479.4	486.5	508.3
0.238	551.5	553.9	514.3	514.0	514.0	505.2	487.4	476.1	466.8	482.9	489.9	512.1
0.240	558.4	560.7	523.0	520.8	518.3	508.8	490.9	479.1	469.7	485.8	492.7	515.2
0.242	565.2	567.2	530.7	526.1	521.9	511.8	493.6	481.3	472.1	488.0	494.8	517.6
0.244	572.1	573.8	537.5	530.5	525.2	514.6	496.1	483.4	474.3	490.0	496.8	519.8
0.246	578.7	580.2	543.4	534.2	528.1	517.1	498.4	485.3	476.2	491.8	498.4	521.7
0.248	585.3	586.5	549.0	538.2	531.3	519.8	501.0	487.5	478.4	494.0	500.5	524.0
0.250	591.6	592.6	554.6	542.9	535.2	523.1	504.0	490.3	481.2	496.7	503.1	526.8
0.252	598.0	599.0	560.4	548.1	539.8	527.0	507.7	493.7	484.6	500.0	506.2	530.2
0.254	604.2	605.3	565.6	552.8	544.0	530.6	511.0	496.7	487.6	502.8	508.9	533.2
0.256	610.3	611.4	570.7	557.6	548.4	534.4	514.3	499.8	490.6	505.7	511.7	536.2
0.258	616.2	617.3	576.0	562.5	552.9	538.4	518.0	503.0	493.8	508.8	514.8	539.4
0.260	622.0	623.3	581.5	567.6	557.5	542.6	521.9	506.5	497.3	512.1	518.0	542.9
0.262	627.6	628.8	586.8	572.2	561.8	546.5	525.5	509.8	500.4	515.1	520.9	546.0
0.264	633.2	634.3	591.9	576.8	565.9	550.1	529.0	512.9	503.5	518.1	523.8	549.1
0.266	638.5	639.6	596.4	581.1	569.7	553.4	531.9	515.6	506.1	520.6	526.5	552.0
0.268	643.9	644.9	600.7	585.1	573.4	556.6	534.8	518.4	508.8	523.3	529.2	554.9
0.270	648.9	650.0	604.9	588.7	577.0	559.7	537.6	520.9	511.4	525.9	532.0	557.9
0.272	654.0	655.0	609.2	592.6	580.6	563.1	540.6	523.5	514.0	528.7	535.1	561.3
0.274	658.9	659.8	613.3	596.4	584.1	566.3	543.6	526.2	516.7	531.8	538.2	564.7
0.276	663.7	664.6	617.6	600.4	587.8	569.7	546.8	529.2	519.6	535.2	541.7	568.5
0.278	668.4	669.2	621.7	604.2	591.5	573.0	549.9	532.1	522.6	538.5	545.2	572.2
0.280	673.0	673.8	625.7	608.1	595.2	576.4	552.9	535.2	525.9	542.2	548.9	576.3
0.282	677.4	678.2	629.4	611.7	598.7	579.7	555.9	538.2	529.1	545.9	552.8	580.4
0.284	681.7	682.5	633.3	615.3	602.2	583.0	559.0	541.4	532.5	549.8	556.9	584.8
0.286	685.9	686.7	637.0	618.8	605.6	586.1	562.0	544.4	535.8	553.7	560.9	589.2
0.288	690.1	690.9	640.7	622.2	608.9	589.3	565.2	547.8	539.5	557.7	565.2	593.7
0.290	694.1	695.0	644.1	625.4	611.9	592.3	568.3	551.1	542.9	561.7	569.2	598.1
0.292	698.1	699.0	647.1	628.3	614.7	595.0	571.0	554.1	546.3	565.5	573.1	602.3
0.294	702.0	702.9	650.2	630.9	617.2	597.5	573.5	557.0	549.4	569.1	576.9	606.4
0.296	705.8	706.8	653.2	633.5	619.7	599.9	576.0	559.8	552.5	572.6	580.5	610.4

TABLE 3.6 (CONTINUED)

RSRM-3B MOTOR PRESSURE DISTRIBUTION SUMMARY AT 60 DEGREES F
IGNITION TRANSIENT: CAVENY KUO

TIME	HEADEND PRESSURE (489.9)	530.0	689.3	851.2	1012.1	1171.2	1332.1	1491.2	1577.5	1697.5	1816.7	NOZZLE STAGNATION PRESSURE
	X LOCATIONS (INCHES)											
0.298	709.4	710.5	656.0	635.9	621.9	602.1	578.3	562.4	555.3	576.0	584.0	614.1
0.300	713.0	714.3	658.9	638.5	624.3	604.3	580.6	564.9	558.2	579.4	587.3	617.8
0.302	716.5	717.8	661.7	640.9	626.6	606.5	582.9	567.4	561.0	582.5	590.6	621.4
0.304	720.0	721.3	664.5	643.4	629.1	608.8	585.2	569.9	563.7	585.7	593.8	624.8
0.306	723.3	724.6	667.3	646.1	631.8	611.3	587.7	572.6	566.6	588.8	596.9	628.2
0.308	726.6	727.7	670.2	649.0	634.6	614.0	590.4	575.4	569.6	591.9	600.0	631.7
0.310	729.8	730.8	672.8	651.7	637.4	616.7	593.1	578.1	572.5	595.0	603.0	634.9
0.320	744.9	748.4	690.2	668.2	655.7	637.9	614.2	600.7	594.2	616.0	624.8	658.3
0.330	758.6	761.6	703.8	681.7	668.7	649.4	625.9	611.9	606.6	631.0	640.7	675.9
0.340	771.3	773.2	716.8	696.2	684.4	665.1	641.6	627.4	622.0	644.9	653.2	689.7
0.350	782.6	783.7	730.2	710.5	698.6	679.1	656.4	640.9	634.9	659.5	668.9	707.2
0.360	793.2	793.1	742.4	724.6	713.4	693.2	669.1	653.6	648.4	672.9	681.5	721.1
0.370	803.0	802.3	755.1	738.4	726.7	705.7	682.4	666.2	660.7	685.2	693.8	734.6
0.380	811.9	810.9	765.5	749.6	738.1	716.9	693.4	676.4	670.9	695.2	703.4	745.2
0.390	820.1	819.1	775.0	760.1	748.0	726.1	702.8	684.8	678.9	702.9	710.5	753.1
0.400	827.7	826.7	783.8	769.4	757.2	734.8	710.9	691.5	685.2	708.5	715.7	758.7
0.410	834.6	833.4	790.7	776.8	764.0	740.6	716.1	695.7	689.0	711.9	719.0	762.4
0.420	840.7	839.5	796.9	782.7	769.2	744.7	719.7	698.7	691.8	714.5	721.5	765.2
0.430	846.5	845.8	801.6	786.6	772.5	747.4	722.2	700.7	693.6	716.2	723.0	767.0
0.440	851.7	851.6	806.3	791.1	776.7	750.9	725.5	703.6	696.4	719.0	725.7	770.0
0.450	856.3	856.5	810.8	795.9	781.7	756.0	730.3	708.3	701.2	723.6	730.4	775.2
0.460	860.6	860.9	814.8	800.0	786.3	760.6	735.3	713.4	706.4	729.4	736.2	781.5
0.470	864.3	864.7	817.9	803.0	789.3	763.8	738.8	717.3	710.6	733.4	740.2	785.8
0.480	867.7	867.8	821.0	806.3	792.6	767.2	742.5	720.8	713.9	736.5	743.2	789.0
0.490	870.6	870.6	824.0	809.5	796.2	770.9	746.3	724.3	717.2	739.7	746.4	792.5
0.500	873.2	873.1	826.3	811.9	798.6	773.2	748.6	726.6	719.7	742.2	749.0	795.3
0.510	875.6	875.3	828.3	813.5	800.1	774.5	750.0	727.9	721.0	743.5	750.2	796.7
0.520	877.6	877.1	829.8	814.9	801.5	775.8	751.3	729.0	722.0	744.4	751.1	797.7
0.530	879.3	878.7	831.4	816.4	803.0	777.4	752.9	730.4	723.4	745.9	752.6	799.3
0.540	880.9	880.1	832.8	817.7	804.5	778.8	754.4	731.9	725.1	747.7	754.5	801.4
0.550	882.2	881.3	834.0	818.9	805.7	780.1	755.9	733.6	726.8	749.5	756.2	803.3
0.560	883.2	882.3	835.1	820.1	807.0	781.6	757.5	735.2	728.4	751.1	757.8	805.0
0.570	884.1	883.1	836.1	821.2	808.2	782.8	758.8	736.5	729.7	752.4	759.1	806.3
0.580	884.9	883.8	836.9	821.9	808.9	783.5	759.5	737.1	730.3	753.0	759.6	806.9
0.590	885.4	884.3	837.4	822.4	809.3	783.8	759.8	737.3	730.5	753.1	759.7	807.1
0.600	885.9	884.7	837.8	822.6	809.5	783.9	759.9	737.4	730.6	753.1	759.7	807.1

TABLE 3.6 (CONTINUED)

RSRM-3B MOTOR PRESSURE DISTRIBUTION SUMMARY AT 60 DEGREES F
STEADY STATE: SCB04, SCA08

TIME	HEADEND PRESSURE (489.9)	530.0	689.3	851.2	1012.1	1171.2	1332.1	1491.2	1511.0	1577.5	1697.5	1816.7	NOZZLE STAGNATION PRESSURE
	X LOCATIONS (INCHES)												
0.6	885.9	884.7	837.8	822.6	809.5	783.9	759.9	737.4	730.9	730.6	753.1	759.7	807.1
0.8	888.4	887.2	844.6	830.3	817.8	794.0	770.9	750.4	743.7	743.4	764.8	771.0	804.4
1.0	885.5	884.4	844.3	830.7	818.7	795.7	774.0	754.9	748.2	747.9	768.1	774.0	792.6
2.0	881.1	880.2	844.2	831.3	819.7	799.3	777.1	759.4	752.4	752.0	770.8	776.3	795.8
3.0	877.6	876.8	844.0	831.7	820.5	801.4	779.9	763.3	756.3	755.7	773.3	778.5	798.9
4.0	876.2	875.5	845.4	833.5	822.8	803.7	783.8	767.9	761.2	760.4	777.0	781.9	803.4
5.0	876.2	875.6	847.8	836.4	826.0	807.1	788.5	773.3	766.7	765.9	781.5	786.1	808.7
6.0	878.9	878.3	852.5	841.4	831.4	812.7	795.3	780.6	774.1	773.2	788.0	792.4	816.1
7.0	879.9	879.4	855.6	845.0	835.4	817.1	800.7	786.7	780.4	779.4	793.3	797.4	820.1
8.0	880.4	880.0	858.1	847.9	838.7	820.8	805.5	792.0	785.9	784.9	797.8	801.5	823.2
9.0	879.6	879.2	859.1	849.3	840.4	823.2	808.7	795.7	789.9	788.7	800.7	804.2	824.9
10.0	878.6	878.3	859.8	850.4	841.9	825.2	811.4	798.9	793.4	792.1	803.3	806.6	826.1
12.0	875.1	874.8	859.1	850.5	842.6	827.2	814.7	803.0	798.2	796.9	806.4	809.2	826.7
14.0	870.9	870.6	857.0	849.2	841.8	827.6	816.3	805.4	801.1	799.7	808.0	810.3	825.8
16.0	869.6	869.4	857.6	850.4	843.5	830.4	820.1	809.8	806.0	804.5	811.7	813.6	827.4
18.0	867.2	867.0	856.8	850.1	843.7	831.7	822.2	812.4	809.1	807.5	813.7	815.3	827.3
20.0	864.4	864.2	855.3	849.2	843.2	832.2	823.4	814.3	811.2	809.7	815.0	816.3	826.6
22.0	861.8	861.7	854.3	848.8	843.1	833.0	824.7	816.0	813.3	811.7	816.2	817.2	825.8
24.0	831.4	831.3	825.6	820.8	815.7	806.7	799.2	791.0	788.7	786.9	790.5	791.1	799.0
26.0	801.3	801.2	796.9	792.7	788.0	780.0	773.1	765.5	763.5	761.8	764.6	764.9	772.1
28.0	776.7	776.6	773.2	769.6	765.3	758.1	751.8	744.8	743.0	741.2	743.4	743.5	750.2
30.0	755.7	755.7	753.1	749.8	746.0	739.6	733.7	727.1	725.5	723.8	725.3	725.3	731.7
32.0	736.6	736.6	734.7	731.8	728.3	722.5	717.1	710.9	709.5	707.8	708.9	708.7	714.7
34.0	718.2	718.2	716.8	714.2	711.2	706.0	700.8	695.1	693.8	692.1	692.9	692.6	698.3
36.0	701.1	701.0	699.9	697.8	695.0	690.2	685.5	680.1	679.0	677.4	677.8	677.4	682.8
38.0	684.5	684.5	683.7	681.9	679.4	675.1	670.7	665.6	664.6	663.0	663.2	662.7	667.9
40.0	668.4	668.4	668.0	666.4	664.1	660.2	656.2	651.4	650.4	649.0	649.0	648.3	653.3
42.0	653.9	653.9	653.7	652.3	650.3	646.8	643.0	638.5	637.6	636.2	636.0	635.3	640.2
44.0	642.5	642.5	642.3	641.2	639.4	636.2	632.6	628.4	627.7	626.2	625.9	625.2	629.9
46.0	631.9	631.9	631.8	630.9	629.2	626.3	622.9	618.9	618.2	616.8	616.5	615.7	620.4
48.0	617.0	617.0	616.9	616.1	614.6	612.0	608.8	605.0	604.4	603.0	602.6	601.8	606.4
50.0	602.9	602.9	602.9	602.2	600.8	598.4	595.3	591.8	591.2	589.9	589.4	588.5	593.2
52.0	596.6	596.6	596.5	595.9	594.6	592.3	589.4	586.0	585.4	584.2	583.6	582.8	587.5
54.0	596.1	596.1	596.0	595.4	594.2	591.9	589.2	586.0	585.5	584.3	583.7	582.9	587.5
56.0	599.8	599.8	599.8	599.2	598.0	595.9	593.3	590.2	589.7	588.6	588.0	587.2	591.6
58.0	605.4	605.4	605.4	604.9	603.7	601.7	599.2	596.3	595.9	594.7	594.1	593.3	597.6
60.0	610.7	610.7	610.6	610.1	609.0	607.1	604.7	601.9	601.5	600.4	599.8	599.0	603.1
62.0	614.9	614.9	614.9	614.4	613.3	611.5	609.2	606.5	606.2	605.1	604.5	603.7	607.7
64.0	618.9	618.9	618.9	618.4	617.4	615.7	613.4	610.9	610.6	609.5	608.9	608.1	612.0
66.0	623.0	623.0	623.0	622.6	621.6	619.9	617.8	615.3	615.0	614.0	613.4	612.6	616.3
68.0	625.5	625.5	625.5	625.1	624.1	622.6	620.5	618.2	617.9	616.9	616.3	615.5	619.1
70.0	629.9	629.9	629.8	629.5	628.5	627.0	625.1	622.8	622.5	621.6	621.0	620.2	623.7
72.0	634.0	634.0	634.0	633.6	632.7	631.3	629.4	627.3	627.0	626.1	625.4	624.7	628.1
74.0	634.9	634.9	634.9	634.5	633.6	632.3	630.5	628.5	628.2	627.3	626.6	626.0	629.2
76.0	634.5	634.5	634.5	634.2	633.3	632.1	630.3	628.4	628.1	627.3	626.6	626.0	629.1
78.0	634.8	634.8	634.8	634.5	633.7	632.4	630.7	628.8	628.6	627.8	627.1	626.5	629.6
80.0	629.1	629.1	629.1	628.8	628.0	626.8	625.1	623.3	623.1	622.3	621.7	621.2	624.2
82.0	612.5	612.5	612.5	612.2	611.4	610.3	608.7	606.9	606.7	605.9	605.3	604.9	607.8

TABLE 3.6 (CONTINUED)

RSRM-3B MOTOR PRESSURE DISTRIBUTION SUMMARY AT 60 DEGREES F
STEADY STATE: SCB04, SCA08

TIME	HEADEND PRESSURE (489.9)	530.0	689.3	851.2	1012.1	1171.2	1332.1	1491.2	1511.0	1577.5	1697.5	1816.7	NOZZLE STAGNATION PRESSURE
	X LOCATIONS (INCHES)												
84.0	600.6	600.6	600.6	600.3	599.6	598.5	596.9	595.1	594.9	594.2	593.5	593.3	596.1
86.0	584.1	584.1	584.1	583.8	583.1	582.0	580.4	578.8	578.6	577.9	577.2	577.0	579.8
88.0	568.0	568.0	568.0	567.8	567.1	566.0	564.5	562.9	562.7	562.0	561.4	561.3	564.1
90.0	545.6	545.6	545.6	545.4	544.7	543.8	542.3	540.8	540.6	539.9	539.3	539.3	541.9
92.0	533.9	533.9	533.9	533.7	533.0	532.1	530.7	529.2	529.1	528.4	527.8	527.8	530.4
94.0	527.5	527.5	527.5	527.2	526.6	525.7	524.3	522.9	522.7	522.0	521.6	521.6	524.1
96.0	513.1	513.1	513.1	512.9	512.3	511.4	510.1	508.7	508.5	507.9	507.5	507.5	509.9
98.0	493.9	493.8	493.8	493.6	493.0	492.3	490.9	489.7	489.5	488.9	488.5	488.5	490.9
100.0	482.2	482.2	482.2	482.0	481.4	480.6	479.3	478.1	478.0	477.3	477.0	477.0	479.3
100.4	479.5	479.5	479.5	479.3	478.7	478.0	476.7	475.5	475.3	474.7	474.4	474.4	476.7
100.8	476.7	476.7	476.7	476.5	475.9	475.2	473.9	472.7	472.5	471.9	471.7	471.7	473.9
101.2	473.6	473.6	473.6	473.4	472.9	472.1	470.8	469.7	469.5	468.9	468.7	468.7	470.9
101.6	470.4	470.4	470.4	470.2	469.6	468.9	467.6	466.4	466.3	465.7	465.4	465.4	467.7
102.0	467.0	467.0	467.0	466.8	466.2	465.5	464.2	463.1	462.9	462.3	462.1	462.1	464.3
102.4	463.7	463.7	463.7	463.5	463.0	462.2	461.0	459.8	459.7	459.1	458.9	458.9	461.1
102.8	460.7	460.7	460.7	460.5	459.9	459.2	458.0	456.8	456.7	456.1	455.9	455.9	458.1
103.2	457.9	457.8	457.8	457.7	457.1	456.4	455.2	454.0	453.9	453.3	453.1	453.1	455.3
103.6	455.1	455.1	455.1	454.9	454.3	453.6	452.4	451.2	451.2	450.5	450.4	450.4	452.5
104.0	452.1	452.1	452.1	451.9	451.4	450.7	449.4	448.3	448.2	447.6	447.4	447.4	449.6
104.4	448.7	448.7	448.7	448.5	447.9	447.2	446.0	444.9	444.8	444.2	444.1	444.1	446.2
104.8	444.7	444.7	444.7	444.6	444.0	443.3	442.1	441.0	440.9	440.3	440.2	440.2	442.3
105.2	440.3	440.3	440.3	440.2	439.6	438.9	437.7	436.6	436.6	436.0	435.9	435.9	437.9
105.6	435.8	435.8	435.8	435.7	435.1	434.4	433.2	432.1	432.1	431.4	431.4	431.4	433.5
106.0	431.5	431.5	431.5	431.3	430.8	430.1	428.9	427.8	427.8	427.2	427.1	427.1	429.2
106.4	427.4	427.5	427.5	427.3	426.8	426.1	424.9	423.8	423.8	423.2	423.1	423.1	425.2
106.8	423.7	423.7	423.7	423.5	423.0	422.3	421.1	420.0	420.0	419.4	419.4	419.4	421.4
107.2	420.4	420.4	420.4	420.2	419.7	419.0	417.9	416.8	416.8	416.1	416.1	416.1	418.2
107.6	418.0	418.0	418.0	417.8	417.3	416.6	415.4	414.3	414.3	413.7	413.7	413.7	415.8
108.0	416.5	416.5	416.5	416.3	415.8	415.2	414.0	412.9	412.8	412.3	412.3	412.3	414.3
108.4	415.7	415.7	415.7	415.6	415.0	414.4	413.2	412.1	412.1	411.6	411.6	411.6	413.6
108.8	414.9	414.9	414.9	414.8	414.3	413.6	412.5	411.4	411.3	410.8	410.8	410.8	412.8
109.2	413.9	413.9	413.9	413.8	413.3	412.6	411.5	410.4	410.3	409.8	409.8	409.8	411.8
109.6	411.8	411.8	411.8	411.6	411.1	410.5	409.3	408.3	408.2	407.7	407.7	407.7	409.7
110.0	408.0	408.0	408.0	407.8	407.3	406.7	405.5	404.5	404.4	404.0	404.0	404.0	405.9
110.4	402.1	402.1	402.1	402.0	401.5	400.8	399.7	398.7	398.6	398.2	398.2	398.2	400.1
110.8	394.3	394.3	394.3	394.2	393.6	393.0	391.9	390.8	390.8	390.5	390.5	390.5	392.4
111.2	384.9	384.9	384.9	384.7	384.2	383.6	382.4	381.4	381.4	381.1	381.1	381.1	382.9
111.6	374.2	374.2	374.2	374.1	373.6	372.9	371.8	370.8	370.8	370.6	370.6	370.6	372.4
112.0	362.7	362.7	362.7	362.6	362.1	361.4	360.3	359.3	359.3	359.2	359.2	359.2	360.9
112.4	350.2	350.2	350.2	350.1	349.6	349.0	347.9	346.9	346.9	346.9	346.9	346.9	348.6
112.8	336.6	336.6	336.6	336.5	336.0	335.4	334.4	333.4	333.4	333.4	333.4	333.4	335.0
113.2	321.1	321.1	321.1	320.9	320.5	320.0	318.9	318.0	318.0	318.0	318.0	318.0	319.5
113.6	303.3	303.3	303.3	303.2	302.7	302.3	301.2	300.5	300.5	300.5	300.5	300.5	301.9
114.0	283.3	283.4	283.3	283.2	282.7	282.4	281.4	280.7	280.7	280.7	280.7	280.7	282.0
114.4	261.8	261.8	261.8	261.7	261.2	261.0	259.9	259.4	259.4	259.4	259.4	259.4	260.6
114.8	240.3	240.4	240.4	240.2	239.7	239.5	238.6	238.1	238.1	238.1	238.1	238.1	239.2
115.2	220.8	220.8	220.8	220.6	220.1	220.0	219.1	218.7	218.7	218.7	218.7	218.7	219.7
115.6	203.7	203.7	203.7	203.6	203.0	203.0	202.0	201.8	201.8	201.8	201.8	201.8	202.8

TABLE 3.6 (CONTINUED)

RSRM-3B MOTOR PRESSURE DISTRIBUTION SUMMARY AT 60 DEGREES F
STEADY STATE: SCB04, SCA08

TIME	HEADEND PRESSURE (489.9)	X LOCATIONS (INCHES) 530.0	689.3	851.2	1012.1	1171.2	1332.1	1491.2	1511.0	1577.5	1697.5	1816.7	NOZZLE STAGNATION PRESSURE
116.0	188.2	188.2	188.2	188.1	187.5	187.5	186.6	186.5	186.5	186.5	186.5	186.5	187.3
116.4	172.7	172.7	172.7	172.5	172.1	172.0	171.1	171.1	171.1	171.1	171.1	171.1	171.9
116.8	156.4	156.4	156.4	156.3	155.9	155.9	155.0	155.0	155.0	155.0	155.0	155.0	155.7
117.2	140.5	140.5	140.5	140.4	140.0	140.0	139.2	139.2	139.2	139.2	139.2	139.2	139.9
117.6	126.6	126.6	126.6	126.5	126.2	126.1	125.4	125.4	125.4	125.4	125.4	125.4	126.0
118.0	114.8	114.8	114.8	114.6	114.3	114.3	113.7	113.7	113.7	113.7	113.7	113.7	114.2
118.4	104.1	104.1	104.1	104.0	103.7	103.7	103.1	103.1	103.1	103.1	103.1	103.1	103.6
118.8	93.9	93.9	93.9	93.8	93.5	93.5	93.0	93.0	93.0	93.0	93.0	93.0	93.5
119.2	84.3	84.3	84.3	84.2	84.0	84.0	83.5	83.5	83.5	83.5	83.5	83.5	83.9
119.6	75.7	75.7	75.7	75.5	75.4	75.4	74.9	75.0	75.0	75.0	75.0	75.0	75.3
120.0	68.2	68.2	68.2	68.0	67.9	67.9	67.5	67.5	67.5	67.5	67.5	67.5	67.9

3.3.4 RSRM-3 Pressure Oscillations

Both boosters used on STS-29 were instrumented with a special channel for measuring chamber pressure oscillations. The measurement was accomplished by electrically A-C coupling the data acquired from the OPTs. This gage is identical to the P001 gage used in static test, and in fact is very similar to the A-C coupled gage used on static test motors, P016. The P016 gage is also an A-C coupled mean pressure gage, is the same make as the OPTs, uses the same operating principles as the OPT, and externally appears identical to the OPTs. Though they are not exactly the same gage, they are extremely similar. Bit resolution and sample rate were adequate for measuring the low level 1-L and 2-L mode pressure oscillations anticipated in the combustion chambers of the boosters. The measurement system used on STS-29 should be comparable to that used during static testing.

Data acquired from the A-C coupled OPTs are displayed in a waterfall plot format in Figures 3.11 (left booster) and 3.12 (right booster). The first longitudinal (1-L) and second longitudinal (2-L) acoustic modes of the combustion cavity can be observed at about 15 and 30 Hz, respectively. Maximum oscillation amplitudes for the left motor were 0.31 psi 0-to-peak at 15.5 Hz and 86 seconds (1-L mode) and 0.44 psi at 28 Hz and 89 seconds (2-L mode). The right motor experienced a maximum 1-L mode amplitude of 0.38 psi 0-to-peak at 15.5 Hz and 85 seconds. The maximum 2-L mode amplitude for the right motor was 0.54 psi 0-to-peak at 29.5 Hz and 83 seconds. Figures 3.13 through 3.16 describe running, instantaneous, peak-to-peak oscillations amplitudes in the 1-L and 2-L modes for the left and right motors, respectively, during the last half of operation. This type of analysis is more representative of instantaneous oscillations than are the time averaged oscillations presented in a waterfall plot. Figure 3.13 shows maximum peak-to-peak 1-L mode oscillations of 1.26 psi for the left motor. The corresponding number for the right motor is 1.24 psi.

Several observations about the two STS-29 solid rocket boosters can be made:

Both motors have strikingly similar acoustic signatures.

The STS-29 waterfall plots are very similar to those from STS-27 and STS-26, though 2-L mode activity is somewhat less.

The general appearance of the STS_29 waterfall plots more closely resembles HPM behavior than recent RSRM static test behavior.

Oscillation amplitudes for RSRM flight motors continue to be significantly lower than for RSRM static test motors.

When using waterfall plots to compare oscillation amplitudes, it is important to remember that this format uses an averaging method of analysis. This presents no difficulty for steady state signals but has an attenuating effect on transient signals. Since most of the data obtained from a solid rocket motor are transient, any oscillation magnitudes referred to as maxima are, in fact, not true but averaged values over a given time slice. These numbers are, nonetheless, very useful for comparison. Table 3.7 shows such a comparison for the STS-29, STS-27, STS-26 motors and recent static test motors. DM-6 and DM-7 were Filament Wound Case (FWC) motors.

In conclusion, both STS-29 motors exhibited chamber pressure oscillations similar to previous RSRM flight motors and previous HPM designs. The high amplitude 1-L mode oscillations experienced late in operation in the RSRM static test motors was not present in any of the 6 RSRM flight motors used to date.

TABLE 3.7
Maximum Pressure Oscillation Amplitude Comparison

Motor	Source of Measurement	Mode	Time of Measurement	Frequency (Hz)	Max Pressure (psi 0-to-peak)
STS-29 (left)	Waterfall AC OPT	1-L	86	15.5	0.31
		2-L	89	28.0	0.44
STS-29 (right)	Waterfall AC OPT	1-L	85	15.5	0.38
		2-L	83	29.5	0.54
TEM-02	Waterfall	1-L	78	16.0	0.40
		2-L	100	29.5	0.59
QM-8	Waterfall	1-L	104	14.5	1.11
		2-L	55	27.5	0.45
TEM-01	Waterfall	1-L	79	15.5	0.53
		2-L	95	29.5	1.07
STS-27 (left)	Waterfall AC OPT	1-L	82	15.5	0.37
		2-L	82	29.5	0.60
STS-27 (right)	Waterfall AC OPT	1-L	82	15.5	0.57
		2-L	83	29.5	0.72
STS-26 (left)	Waterfall AC OPT	1-L	79	16.0	0.70
		2-L	95	29.5	0.87
STS-26 (right)	Waterfall AC OPT	1-L	83	15.0	0.54
		2-L	94	30.0	0.47
PVM-1	Waterfall	1-L	99	14.5	1.76
		2-L	79	29.5	1.05
QM-7	Waterfall P000001	1-L	93	14.5	1.40
		2-L	79	29.5	0.95
QM-6	Waterfall	1-L	107	14.5	1.50
		2-L	83	29.5	0.65

Source of Motor	Measurement	Mode	Time of Measurement	Frequency (Hz)	Max Pressure (psi 0-to-peak)
DM-9	Waterfall	1-L	107	14.5	1.15
		2-L	96	30.0	0.88
DM-8	Waterfall	1-L	78	16.0	0.83
		2-L	97	29.5	0.85
ETM-1A	Waterfall	1-L	83	15.5	0.47
		2-L	100	29.5	0.55
DM-7	Waterfall	1-L	77	15.5	1.29
		2-L	93, 96	29.5	0.86
DM-6	Waterfall	1-L	76	15.5	0.51
		2-L	86	29	0.78
QM-4	Waterfall	1-L	93	14	0.41
		2-L	83	29	0.35

3.4 CEI SPECIFICATION PERFORMANCE REQUIREMENTS

3.4.1 Performance Tolerances

The parameter variations of the total population of RSRMs about a nominal value are constrained by the requirements defined in the CEI Specification paragraph 3.2.1.1.2.2, Table II. A comparison of the RSRM-3A and RSRM-3B calculated and reconstructed parameters at PMBT of 60°F with respect to the nominal values and the CEI Specification maximum 3 sigma requirements is shown on the following two tables.

TABLE 3.8

COMPARISON OF RSRM-3A VARIATIONS
AT PMBT = 60°F ABOUT THE NOMINAL TO THE
CEI SPECIFICATION REQUIREMENTS

PARAMETER (1)	CEI MAX 3 SIGMA VARIATION%	NOMINAL VALUE(2)	RSRM-3A VALUE(3)	RSRM-3A DELTA%(4)
WEB TIME	±5.0	111.7	111.4	-0.27
ACTION TIME	±6.5	123.4	124.1	0.57
WEB TIME AVG PRESSURE	±5.3	660.8	659.8	-0.15
MAX PRESSURE	±6.5	918.4	895.0	-2.55
MAX SEA LEVEL THRUST	±6.2	3.06	3.04	-0.65
WEB TIME AVG VAC THRUST	±5.3	2.59	2.58	-0.39
VAC DEL SPECIFIC IMPULSE	±0.7	267.1	267.5	0.15
WEB TIME VAC TOTAL IMPULSE	±1.0	288.9	287.8	-0.38
ACTION TIME TOTAL IMPULSE	±1.0	296.3	295.4	-0.30

PRESSURE VALUES IN PSIA, THRUST VALUES IN MLBF,
IMPULSE VALUES IN MLBF-SEC

(1) CEI PARAGRAPH 3.2.1.1.2.2, TABLE II

(2) QM-4 STATIC TEST AND SRM-8A AND B, SRM-9A, SRM-10A, SRM-10B, SRM-11A, SRM-13A AND SRM-13B FLIGHT AVERAGE AT STANDARD CONDITIONS.

(3) RSRM-3A AT PMBT = 60°F

(4) DELTA = ((RSRM-3A - NOMINAL)/NOMINAL)*100

TABLE 3.9

COMPARISON OF RSRM-3B VARIATIONS
AT PMBT = 60°F ABOUT THE NOMINAL TO THE
CEI SPECIFICATION REQUIREMENTS

PARAMETER	CEI MAX 3 SIGMA VARIATION % (1)	NOMINAL VALUE(2)	RSRM-3B VALUE(3)	RSRM-3B DELTA%(4)
WEB TIME	±5.0	111.7	111.4	-0.27
ACTION TIME	±6.5	123.4	123.8	0.32
WEB TIME AVG PRESSURE	±5.3	660.8	660.8	0.00
MAX PRESSURE	±6.5	918.4	890.0	-3.09
MAX SEA LEVEL THRUST	±6.2	3.06	3.05	-0.33
WEB TIME AVG VAC THRUST	±5.3	2.59	2.59	0.00
VAC DEL SPECIFIC IMPULSE	±0.7	267.1	267.8	0.26
WEB TIME VAC TOTAL IMPULSE	±1.0	288.9	288.2	-0.24
ACTION TIME TOTAL IMPULSE	±1.0	296.3	295.9	-0.13

PRESSURE VALUES IN PSIA, THRUST VALUES IN MLBF,
IMPULSE VALUES IN MLBF-SEC

(1) CEI PARAGRAPH 3.2.1.1.1, TABLE II

(2) QM-4 STATIC TEST AND SRM-8A AND B, SRM-9A, SRM-10A, SRM-10B, SRM-11A, SRM-13A AND SRM-13B FLIGHT AVERAGE AT STANDARD CONDITIONS.

(3) RSRM-3B AT PMBT = 60 F

(4) DELTA = ((RSRM-3B - NOMINAL)/NOMINAL)*100

3.4.2 RSRM Nominal Thrust-Time Performance

The nominal RSRM-HPM performance is defined as the average performance of the HPM and RSRM static test and flight motor series at standard conditions. The standard conditions consist of the propellant burn rate of 0.368 in/sec at 625 psia and a PMBT of 60°F. The flight motor reconstructed thrust-time traces are normalized to standard conditions and averaged with past flight and static test data at standard conditions to form the RSRM-HPM population nominal thrust-time trace. This nominal RSRM-HPM performance will be continually updated during the

Shuttle program. It is the current estimate of the total population nominal. The nominal performance for the thrust time trace and impulse gate requirements is based on the performance of QM-4, SRM-8A, SRM-8B, SRM-9A, SRM-10A, SRM-10B, SRM-11B through SRM-19B, SRM-24A, SRM-24B, ETM-1A, DM-8, DM-9, QM-6, QM-7, PVM-1, RSRM-1, RSRM-2, and RSRM-3. The delivered RSRM-HPM population nominal performance is compared to the CEI Specification paragraph 3.2.1.1.2.1, Table I requirements on Figure 3.17.

3.4.3 Impulse at Standard Conditions VS Requirement Gates

The vacuum impulse at standard conditions at each of the gates is compared to the CEI Specification paragraph 3.2.1.1.2.4 requirements on the following table. The population making up the standard nominal for the impulse requirements are the same as those in the nominal thrust time trace (Figure 3.17).

TABLE 3.10

RSRM-HPM POPULATION
IMPULSE GATES

IMPULSE	REQUIREMENT (1)	STANDARD NOMINAL (2)
Impulse at 20 sec (10**6 LBF-SEC)	63.1 (MIN)	64.5
Impulse at 60 sec (10**6 LBF-SEC)	172.9 178.1(+3%) 171.2(-1%)	172.5
Impulse at ACTION TIME (10**6 LBF-SEC)	293.8 (MIN)	296.3

(1) CEI PARAGRAPH 3.2.1.1.2.4

(2) NORMALIZED TO STANDARD CONDITIONS-BURN RATE OF 0.368 IN/SEC. POPULATION IS SAME AS USED TO COMPARE NOMINAL THRUST TRACE, Figure 3.17.

3.4.4 Matched Pair Thrust Differential

The maximum thrust imbalance assessment is shown on the following table. Figure 3.18 through Figure 3.21 shows the thrust differential during ignition, steady state, and tailoff. All the thrust differential values were near the nominal values experienced by previous flight SRMs and were well within the CEI Specification paragraph 3.2.1.1.2.3, Table III limits. The thrust values used for the assessment were reconstructed at the delivered conditions of each motor.

TABLE 3.11

RSRM-3 THRUST IMBALANCE SUMMARY

	SPEC	IMBALANCE	TIME
IGNITION (0 SEC TO 1.0 SEC, LBF)	300K	-88.8K	0.094
STEADY STATE (1.0 SEC TO FIRST WEB TIME MINUS 4.5 SEC, LBF)	85K	-39.0K	90.0
TRANSITION (FIRST WEB TIME MINUS 4.5 SEC TO FIRST WEB TIME, LBF)	85K-268K linear	+30.8K	111.0
TAILOFF (FIRST WEB TIME TO LAST ACTION TIME, LBF)	710K	+46.1K	112.0

IMBALANCE = LEFT SRM - RIGHT SRM

3.4.5 Matched Pair Performance Requirements

The CEI Specification requires that the performance of a matched pair of motors on a flight set have similar performance according to table 3.12. The RSRMs for STS-27 were well within the matched pair specification requirements.

TABLE 3.12

MATCHED PAIR PERFORMANCE LIMITS

PARAMETER	CEI SPECIFICATION MAX DIFFERENCE(%)(1)	DELIVERED % DIFFERENCE(2)
WEB TIME	±2.0	0.00
ACTION TIME	±3.0	-0.24
WEB TIME AVG PRESSURE	±2.0	0.15
MAX PRESSURE	N/A	-0.56
MAX SEA LEVEL THRUST	N/A	0.33
WEB TIME AVG VAC THRUST	±2.0	0.39
VAC DEL SPECIFIC IMPULSE	±1.0	0.11
WEB TIME VAC TOTAL IMPULSE	±1.4	0.14
ACTION TIME TOTAL IMPULSE	±1.4	0.17

PRESSURE VALUES IN PSIA, THRUST VALUES IN MLBF,
IMPULSE VALUES IN MLBF-SEC

(1) CEI SPECIFICATION PARAGRAPH 3.2.1.1.2.2, TABLE II

(2) DIFFERENCE = ((RSRM-3B - RSRM-3A)/RSRM-3 AVERAGE)*100
DATA AT PMBT OF 60 DEG F

3.4.6 Ignition Characteristics

The ignition characteristics of both motors are shown in Table 3.13 compared with the limits from CEI Specification paragraphs 3.2.1.1.1.1 and 3.2.1.1.1.2. All the values were well within the limits.

TABLE 3.13

RSRM-3 Ignition Characteristics

Parameter	CEI Requirement	RSRM-3A	RSRM-3B
Ignition Interval	202-262 ms	241 ms	241 ms
Pressure Rise Rate	115.9 psi/10 ms	82.7	89.9

3.5 RECONSTRUCTED MASS PROPERTIES

The Morton Thiokol manufacturing designation, 360L003, along with STS-29 have been used, by Mass Properties, to identify the RSRMs used on this flight. The left and right hand RSRMs for the flight will be designated as A and B.

Tables 3.14 and 3.15 provide STS-29A and STS-29B reconstructed sequential mass properties, respectively.

Table 3.16 and 3.17 compares RSRML predicted sequential weight and center of gravity (cg) data against post flight reconstructed data. A 1,518 lbm slag weight was used for both prefire and postfire sequential predictions. Actual STS-29 mass properties may be obtained from Mass Properties History Log Space Shuttle 360L003-LH (TWR-17338), dated 25 October 1988, and 360L003-RH (TWR-17339), dated 25 October 1988. Post flight reconstructed data reflects Ballistics mass flow data from the 320 sample per second measured pressure traces. Tables 3.18 and 3.19 present CEI requirements, predicted, and actual weight comparisons. The actual weights are in close agreement with predicted values. Mass Properties data for both RSRMs comply with CEI requirements.

TABLE 3.14

SEQUENTIAL MASS PROPERTIES
STS-29 LEFT HAND

EVENTS/TIMES	WEIGHT (LBS)	CENTER OF GRAVITY LONG.	LAT.	VERT.	MOMENT OF INERTIA PITCH	ROLL	YAW
PRE-LAUNCH TIME = 0.00	1255040.6	1171.588	0.072	0.008	42391.866	878.095	42392.895
LIFT-OFF TIME = 0.24	1254345.7	1171.724	0.072	0.008	42348.459	876.758	42349.488
INTERMEDIATE BURN TIME = 20.00	1016525.6	1207.942	0.089	0.010	30830.782	761.675	30831.809
INTERMEDIATE BURN TIME = 40.00	796537.3	1231.709	0.112	0.013	21792.256	627.629	21793.278
MAX "Q" TIME = 54.00	666485.7	1229.527	0.134	0.015	18079.433	550.529	18080.447
INTERMEDIATE BURN TIME = 60.00	611980.3	12P7.097	0.145	0.017	16688.611	515.470	16689.622
INTERMEDIATE BURN TIME = 80.00	420936.3	1215.124	0.209	0.024	12011.826	381.793	12012.826
MAX "G" TIME = 87.00	356591.9	1213.719	0.247	0.029	10609.358	331.180	10610.352
INTERMEDIATE BURN TIME = 100.00	251397.2	1225.183	0.348	0.041	8605.563	242.987	8606.549
WEB BURN TIME = 111.44	174250.5	1266.459	0.499	0.059	7272.103	173.124	7273.080
END OF ACTION TIME TIME = 124.08	144582.6	1313.361	0.600	0.071	6568.299	146.845	6569.271
SEPARATION TIME = 125.83	144008.7	1314.840	0.603	0.070	6542.600	146.436	6543.575
NOZZLE JETTISONED TIME = 195.83	141429.0	1305.149	0.604	0.070	6323.230	141.664	6324.185
MAX REENTRY "Q" TIME = 320.83	141211.1	1305.045	0.605	0.070	6311.820	141.471	6312.776
NOSE P DEPLOYMENT TIME = 350.83	141158.8	1305.022	0.605	0.070	6309.031	141.425	6309.987
DROGUE CHUTE DEPLOYMENT TIME = 351.43	141157.8	1305.022	0.605	0.070	6308.976	141.424	6309.931
FRUSTUM RELEASE TIME = 372.53	141121.0	1305.006	0.605	0.070	6307.001	141.391	6307.957
MAIN CHUTE LINE STRETCH TIME = 373.83	141118.7	1305.005	0.605	0.070	6306.880	141.389	6307.835
MAIN CHUTE 1ST DISREEFING TIME = 383.93	141101.1	1304.998	0.605	0.070	6305.930	141.374	6306.885
MAIN CHUTE 2ND DISREEFING TIME = 389.83	141090.8	1304.994	0.605	0.070	6305.376	141.365	6306.331
SPLASHDOWN TIME = 415.83	141046.6	1304.974	0.605	0.070	6302.947	141.326	6303.903

TABLE 3.15

SEQUENTIAL MASS PROPERTIES
STS-29 RIGHT HAND

EVENTS/TIMES	WEIGHT (LBS)	CENTER OF GRAVITY LONG.	LAT.	VERT.	MOMENT OF INERTIA PITCH	ROLL	YAW
PRE-LAUNCH TIME = 0.00	1255967.6	1171.614	0.072	0.007	42439.683	877.956	42440.705
LIFT-OFF TIME = 0.24	1255262.7	1171.753	0.072	0.007	42395.714	876.621	42396.736
INTERMEDIATE BURN TIME = 20.00	1017869.0	1207.998	0.089	0.009	30903.479	761.890	30904.499
INTERMEDIATE BURN TIME = 40.00	797566.8	1231.878	0.113	0.011	21854.650	627.715	21855.664
MAX "Q" TIME = 54.00	667488.4	1229.801	0.135	0.013	18140.952	550.484	18141.958
INTERMEDIATE BURN TIME = 60.00	612997.9	1227.476	0.146	0.015	16756.976	515.980	16757.980
INTERMEDIATE BURN TIME = 80.00	421936.0	1215.855	0.211	0.021	12077.750	381.788	12078.742
MAX "G" TIME = 87.00	357146.9	1214.734	0.249	0.025	10665.221	330.832	10666.209
INTERMEDIATE BURN TIME = 100.00	251180.6	1227.119	0.352	0.035	8644.564	241.953	8645.543
WEB BURN TIME = 111.36	174637.2	1267.562	0.503	0.051	7313.501	172.451	7314.471
END OF ACTION TIME TIME = 123.84	144862.4	1314.842	0.605	0.061	6591.180	146.265	6592.145
SEPARATION TIME = 125.83	144235.5	1316.690	0.608	0.061	6559.568	145.837	6560.535
NOZZLE JETTISONED TIME = 195.83	141679.1	1306.972	0.609	0.061	6373.431	141.125	6374.385
MAX REENTRY "Q" TIME = 320.83	141461.2	1306.870	0.610	0.061	6362.032	140.932	6362.987
NOSE CAP DEPLOYMENT TIME = 350.83	141408.9	1306.848	0.610	0.061	6359.244	140.886	6360.199
DROGUE CHUTE DEPLOYMENT TIME = 351.43	141407.9	1306.847	0.610	0.061	6359.190	140.885	6360.143
FRUSTUM RELEASE TIME = 372.53	141371.1	1306.832	0.610	0.060	6357.216	140.852	6358.171
MAIN CHUTE LINE STRETCH TIME = 373.83	141368.9	1306.831	0.610	0.060	6357.095	140.850	6358.049
MAIN CHUTE 1ST DISREEFING TIME = 383.93	141351.2	1306.824	0.610	0.060	6356.145	140.835	6357.100
MAIN CHUTE 2ND DISREEFING TIME = 389.83	141341.0	1306.820	0.610	0.060	6355.592	140.826	6356.547
SPLASHDOWN TIME = 415.83	141296.7	1306.801	0.610	0.060	6353.165	140.787	6354.120

TABLE 3.16

SEQUENTIAL MASS PROPERTIES PREDICTED/ACTUAL COMPARISONS
STS-29 Left Hand

Event	Weight (lb)				Longitudinal CG (in)			
	Predicted[1]	Actual	Delta	% Error	Predicted[1]	Actual	Delta	% Error
Pre-Ignition	1,255,041	1,255,041	0	0.00	1,171.588	1,171.588	0.000	0.00
Liftoff	1,254,412	1,254,346	-66	0.01	1,171.715	1,171.724	+0.009	0.00
Action Time	144,707	144,583	-124	0.09	1,312.994	1,313.361	+0.367	0.03
Separation[2]	143,974	144,009	+35	0.02	1,314.957	1,314.840	-0.117	0.01
Nozzle Jettison	141,420	141,429	+9	0.01	1,305.146	1,305.149	+0.003	0.00
Nose Cap Deployment	141,161	141,159	-2	0.00	1,305.022	1,305.022	0.000	0.00
Drogue Chute Deployment	141,146	141,158	+12	0.01	1,305.015	1,305.022	+0.007	0.00
Main Chute Line Stretch	141,119	141,119	0	0.00	1,305.004	1,305.005	+0.001	0.00
Main Chute 1st Disreefing	141,107	141,101	-6	0.00	1,304.999	1,304.998	-0.001	0.00
Main Chute 2nd Disreefing	141,100	141,091	-9	0.01	1,304.996	1,304.994	-0.002	0.00
Splash Down	141,047	141,047	0	0.00	1,304.974	1,304.974	0.000	0.00

Notes:

1. Based on Mass Properties History Log Space Shuttle 360L003-LH, 25 October 1988 (TWR-17338).

2. The separation longitudinal center of gravity of 1,314.840 is 69% of the vehicle length.

TABLE 3.17

SEQUENTIAL MASS PROPERTIES PREDICTED/ACTUAL COMPARISONS
STS-29 Right Hand

Event	Weight (lb)				Longitudinal CG (in)			
	Predicted[1]	Actual	Delta	% Error	Predicted[1]	Actual	Delta	% Error
Pre-Ignition	1,255,968	1,255,968	0	0.00	1,171.614	1,171.614	0.000	0.00
Liftoff	1,255,339	1,255,263	-76	0.01	1,171.740	1,171.753	+0.013	0.00
Action Time	144,964	144,862	-102	0.07	1,314.570	1,314.842	+0.272	0.02
Separation[2]	143,230	144,235	+5	0.00	1,316.539	1,316.690	+0.151	0.01
Nozzle Jettison	141,670	141,679	+9	0.01	1,306.969	1,306.972	+0.003	0.00
Nose Cap Deployment	141,411	141,409	-2	0.00	1,306.848	1,306.848	0.000	0.00
Drogue Chute Deployment	141,396	141,408	+12	0.01	1,306.841	1,306.847	+0.006	0.00
Main Chute Line Stretch	141,369	141,369	0	0.00	1,306.830	1,306.831	+0.001	0.00
Main Chute 1st Disreefing	141,357	141,351	-6	0.00	1,306.825	1,306.824	-0.001	0.00
Main Chute 2nd Disreefing	141,350	141,341	-9	0.01	1,306.822	1,306.820	-0.002	0.00
Splash Down	141,297	141,297	0	0.00	1,306.801	1,306.801	0.000	0.00

Notes:

1. Based on Mass Properties History Log Space Shuttle 360L003-RH, 25 October 1988 (TWR-17339).
2. The separation longitudinal center of gravity of 1,316.690 is 67% of the vehicle length.

TABLE 3.18

PREDICTED/ACTUAL WEIGHT (lb) COMPARISONS

STS-29 LEFT HAND

Item	Minimum	Maximum	Predicted[3]	Actual	Delta	% Error	Notes
Inerts							
Prefire, Controlled		150,076	148,968	148,968	0	0.00	1
Propellant	1,104,714		1,104,894	1,104,894	0	0.00	1
Usable			1,104,037	1,104,157	+120	0.01	2
To Liftoff			533	597	+64	10.72	
Liftoff to Action			1,103,504	1,103,560	+56	0.01	2
Unusable			857	737	-120	16.28	
Action to Separation			667	508	-159	31.30	
After Separation			190	229	+39	17.03	
Slag			1,518	1,518	0	0.00	2

Notes:

1. Requirement per CPW1-3600A, Addendum G, Part I, (RSRM CEI Specification).
2. Slag included in usable propellant, liftoff to action.
3. Based on 25 October 1988, Mass Properties History Log Space Shuttle 360L003-LH (TWR-17338).

TABLE 3.19

PREDICTED/ACTUAL WEIGHT (lb) COMPARISONS

STS-29 RIGHT HAND

Item	Minimum	Maximum	Predicted[3]	Actual	Delta	% Error	Notes
Inerts							
Prefire, Controlled		150,076	149,231	149,231	0	0.00	1
Propellant	1,104,714		1,105,565	1,105,565	0	0.00	1
Usable			1,104,707	1,104,804	+97	0.01	2
To Liftoff			534	607	+73	12.03	
Liftoff to Action			1,104,173	1,104,197	+24	0.00	2
Unusable			858	761	-97	12.75	
Action to Separation			668	561	-107	19.07	
After Separation	—	-	190	200	+10	5.00	
Slag			1,518	1,518	0	0.00	2

Notes:

1. Requirement per CPW1-3600A, Addendum G, Part I, (RSRM CEI Specification).
2. Slag included in usable propellant, liftoff to action.
3. Based on 25 October 1988, Mass Properties History Log Space Shuttle 360L003-RH (TWR-17339).

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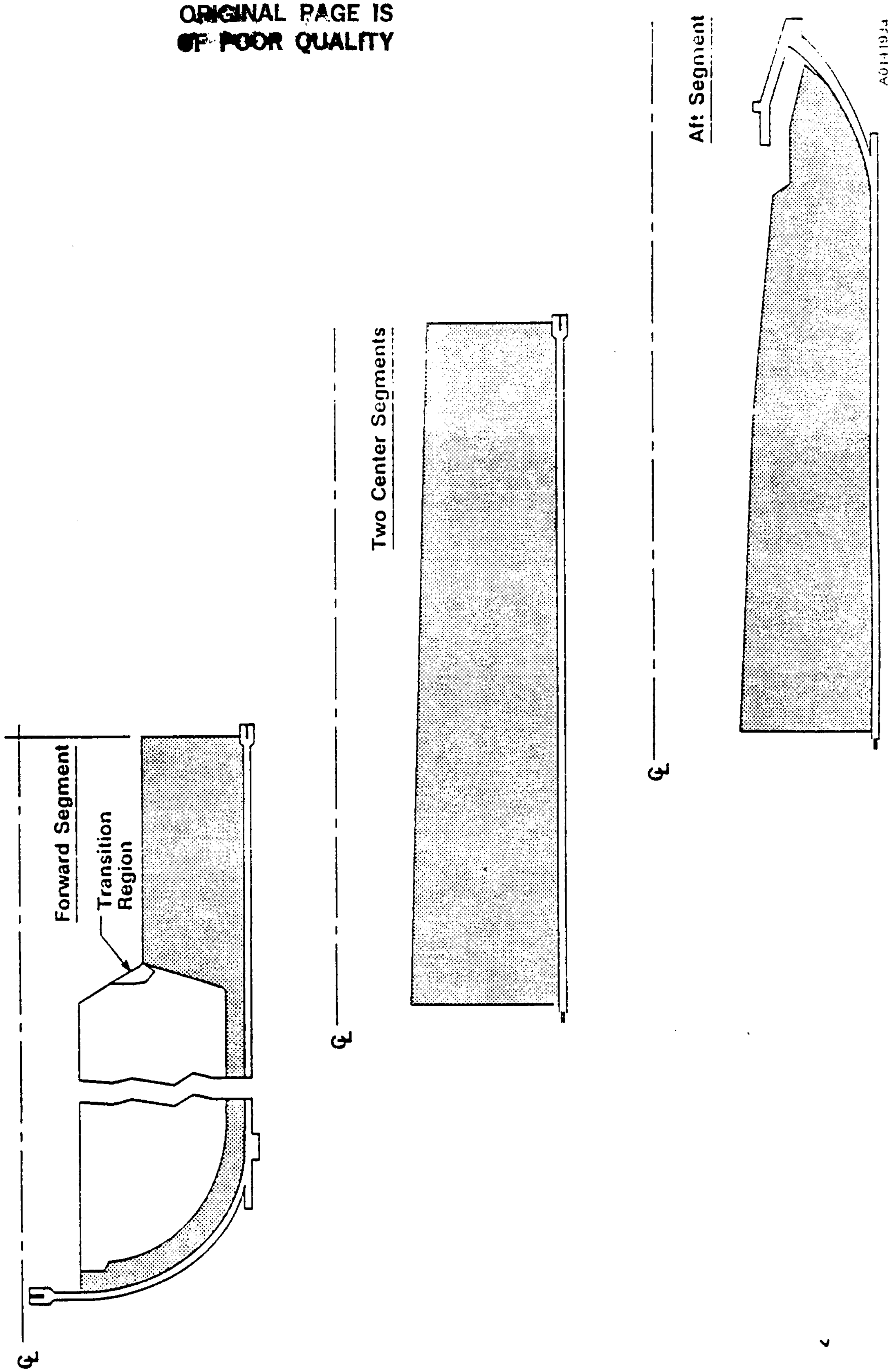

Figure 1.1 RSRM Propellant Grain Design Configuration

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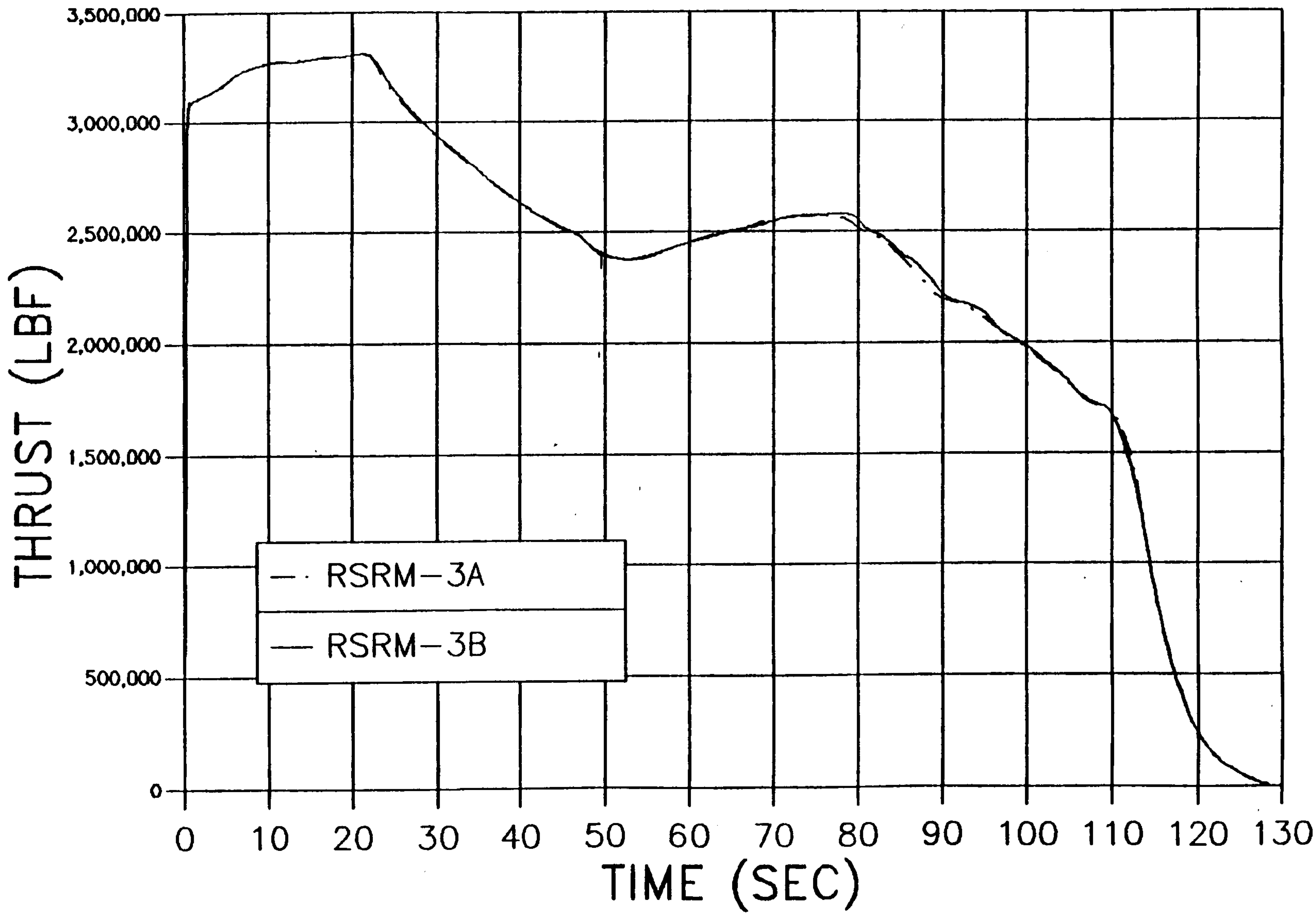

Figure 2.1 RSRM-3A AND 3B RECONSTRUCTED VACUUM THRUST-TIME TRACE AT DELIVERED CONDITIONS

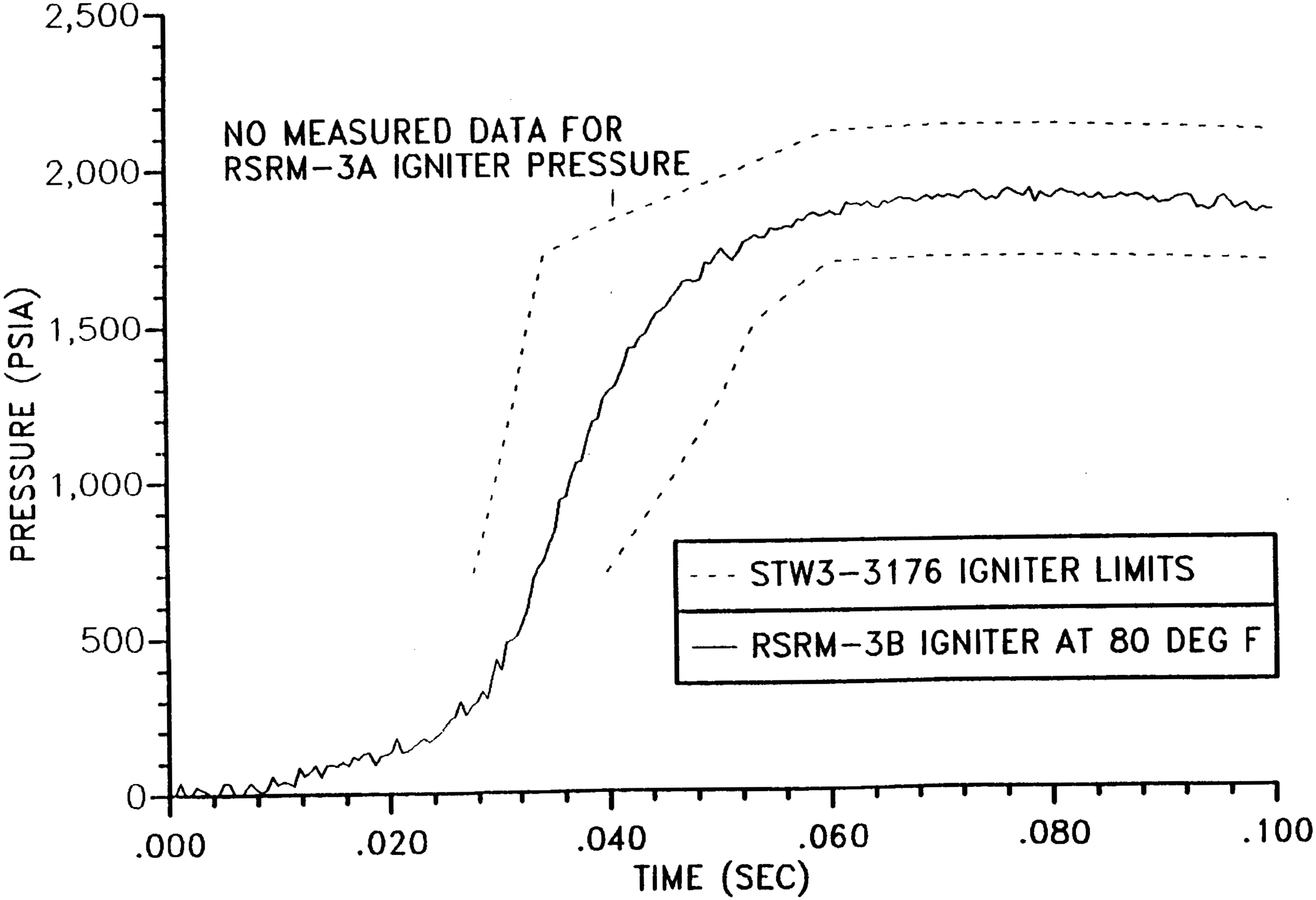

Figure 2.2 RSRM-3B IGNITER PRESSURE TRACE AT 80°F IN STW3-3176 LIMITS

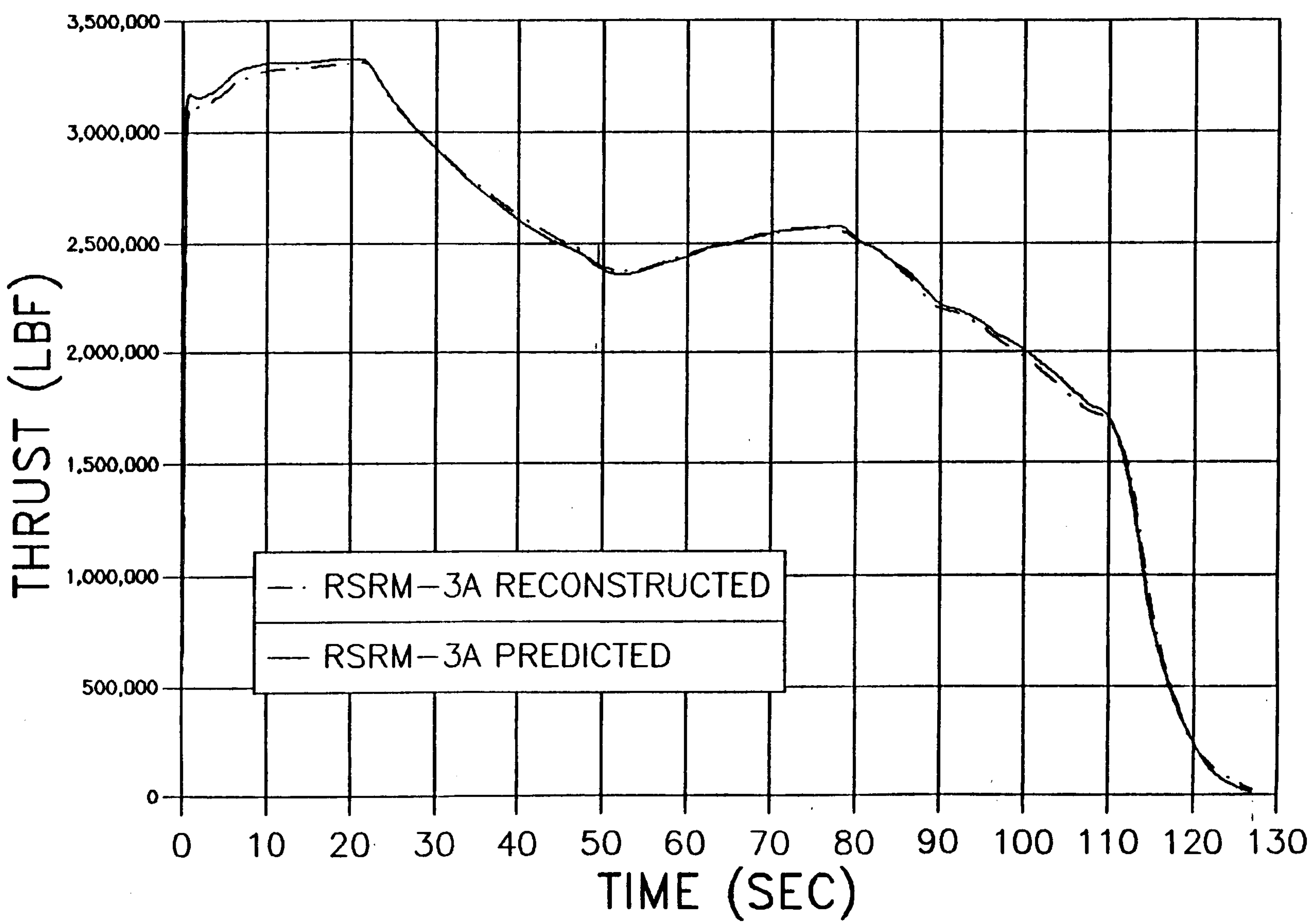

Figure 3.1 RSRM-3A PREDICTED VS. RECONSTRUCTED VACUUM THRUST

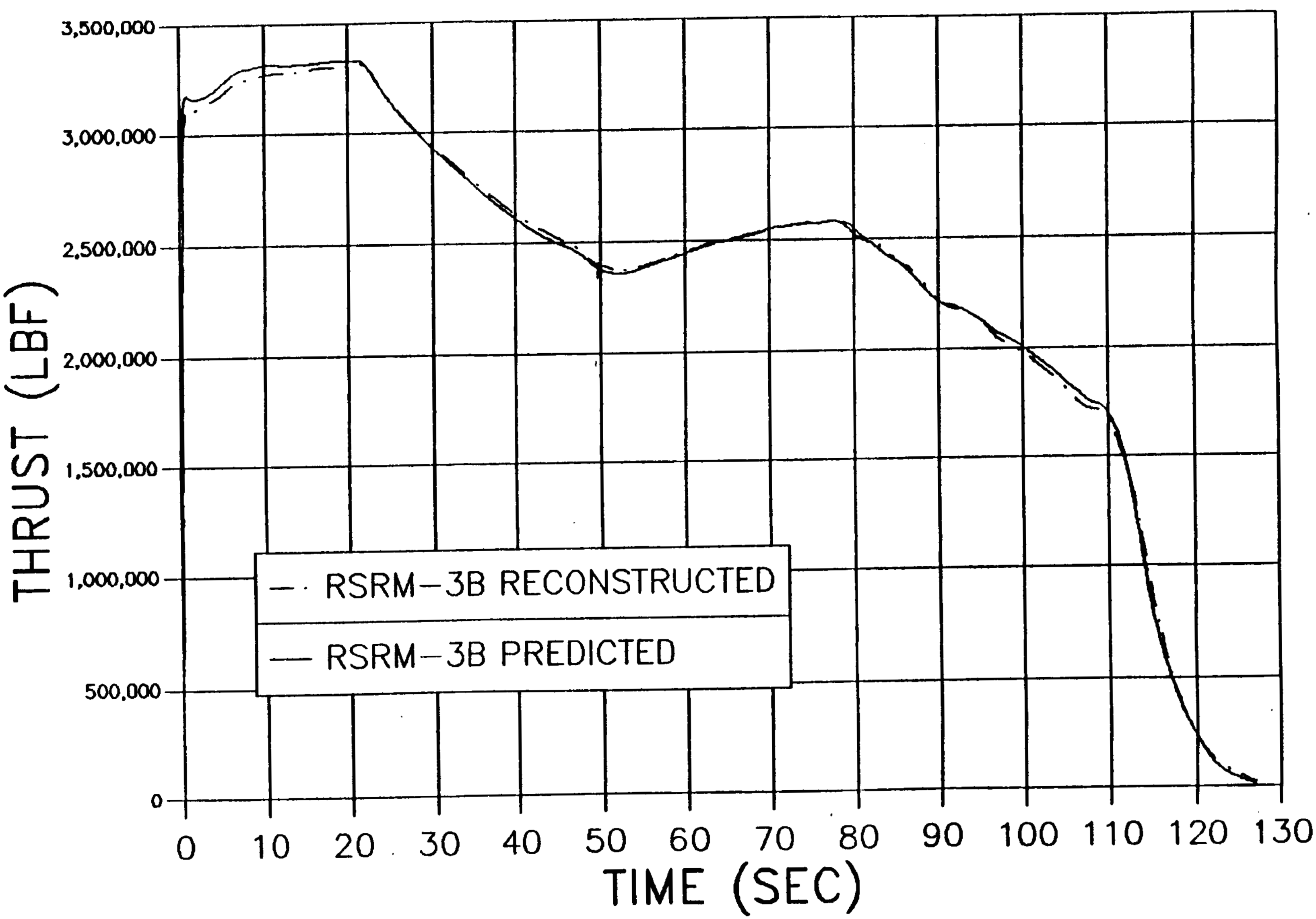

Figure 3.2 RSRM-3B PREDICTED VS. RECONSTRUCTED VACUUM THRUST

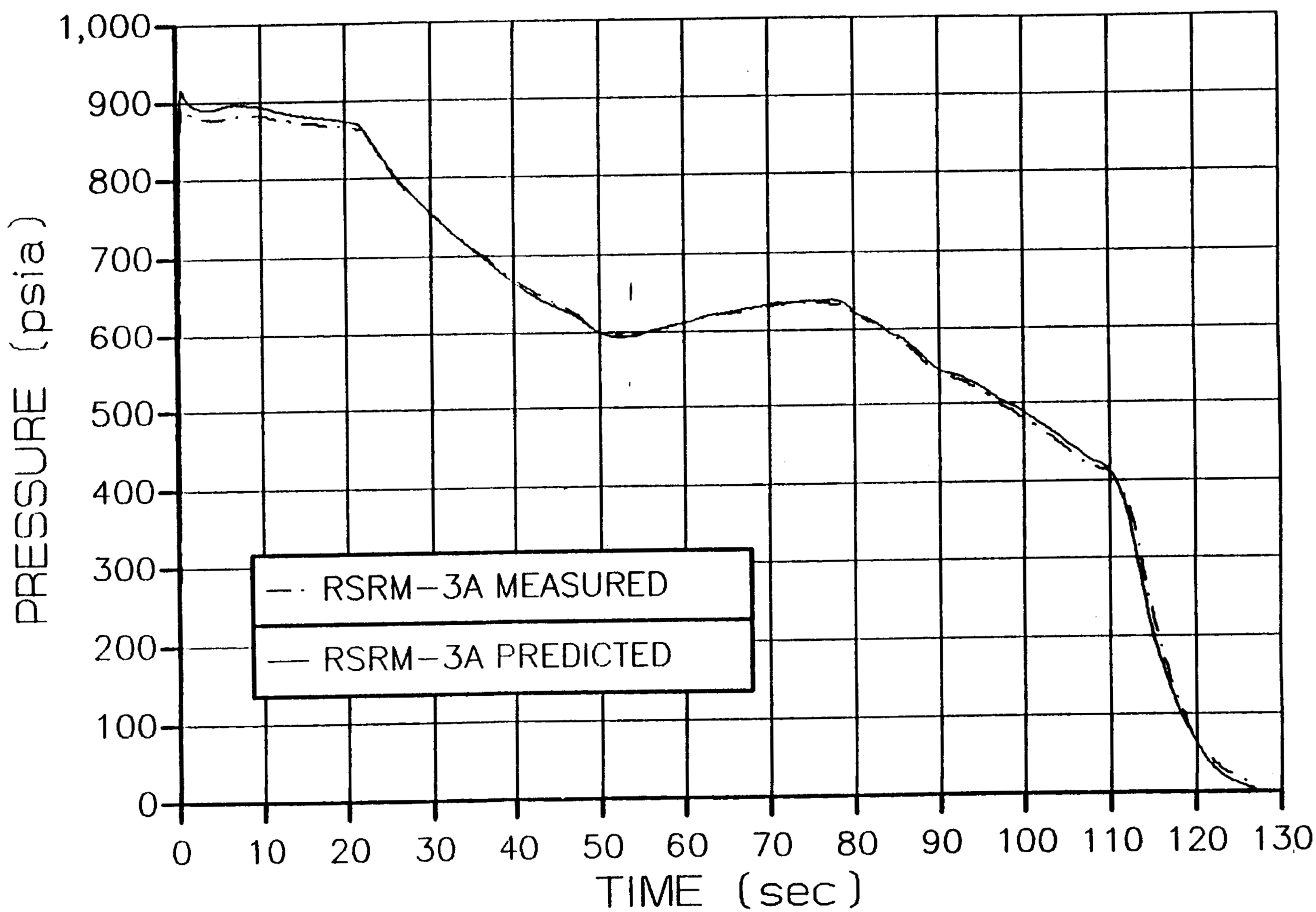

Figure 3.3 RSRM-3A PREDICTED VS. MEASURED HEADEND PRESSURE

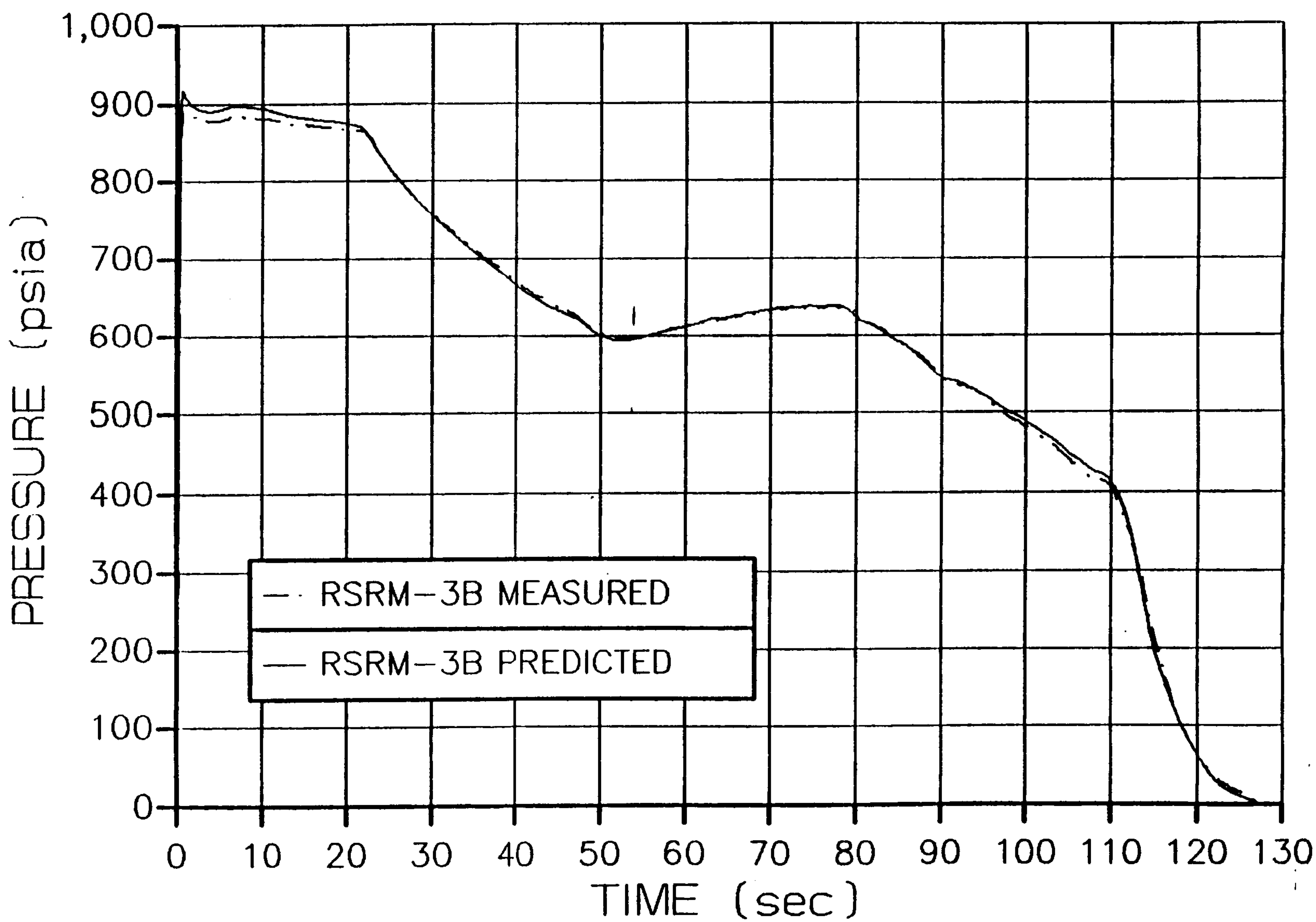

Figure 3.4 RSRM-3B PREDICTED VS. MEASURED HEADEND PRESSURE

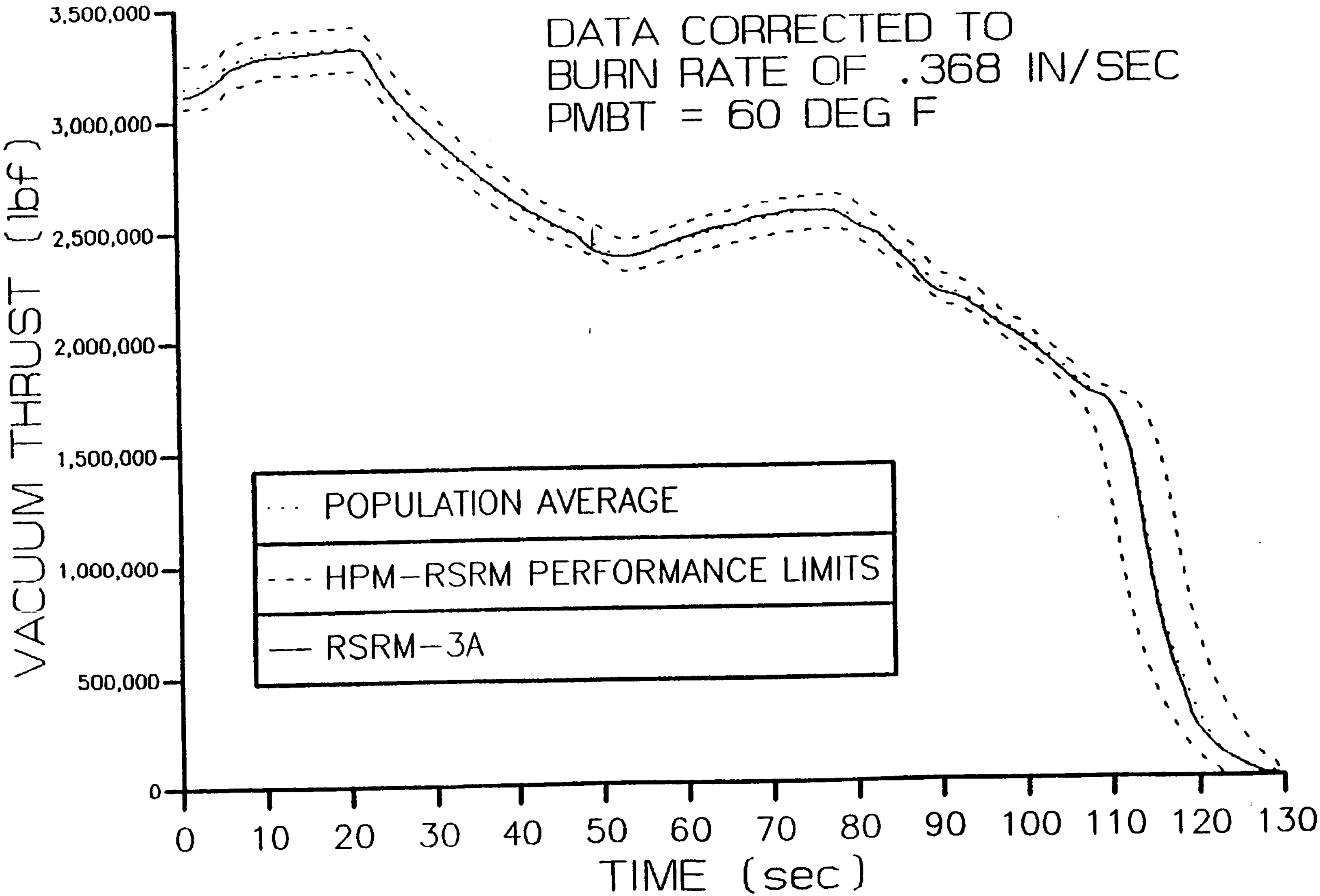

Figure 3.5 RSRM- 3AVS. HPM-RSRM NOMINAL IN 3% PERFORMANCE LIMITS

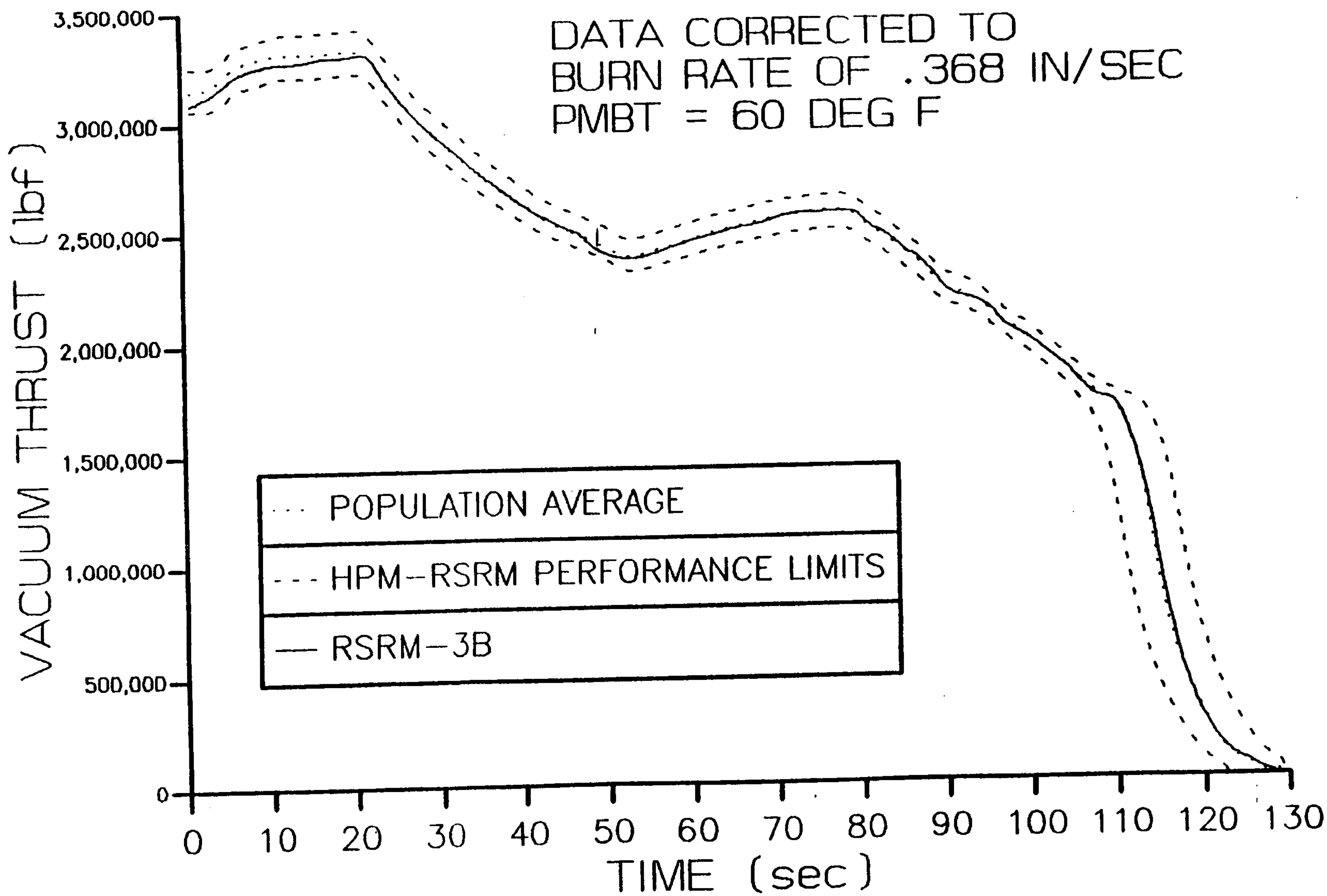

Figure 3.6 RSRM-3B VS. HP-RSRM NOMINAL IN POPULATION LIMITS

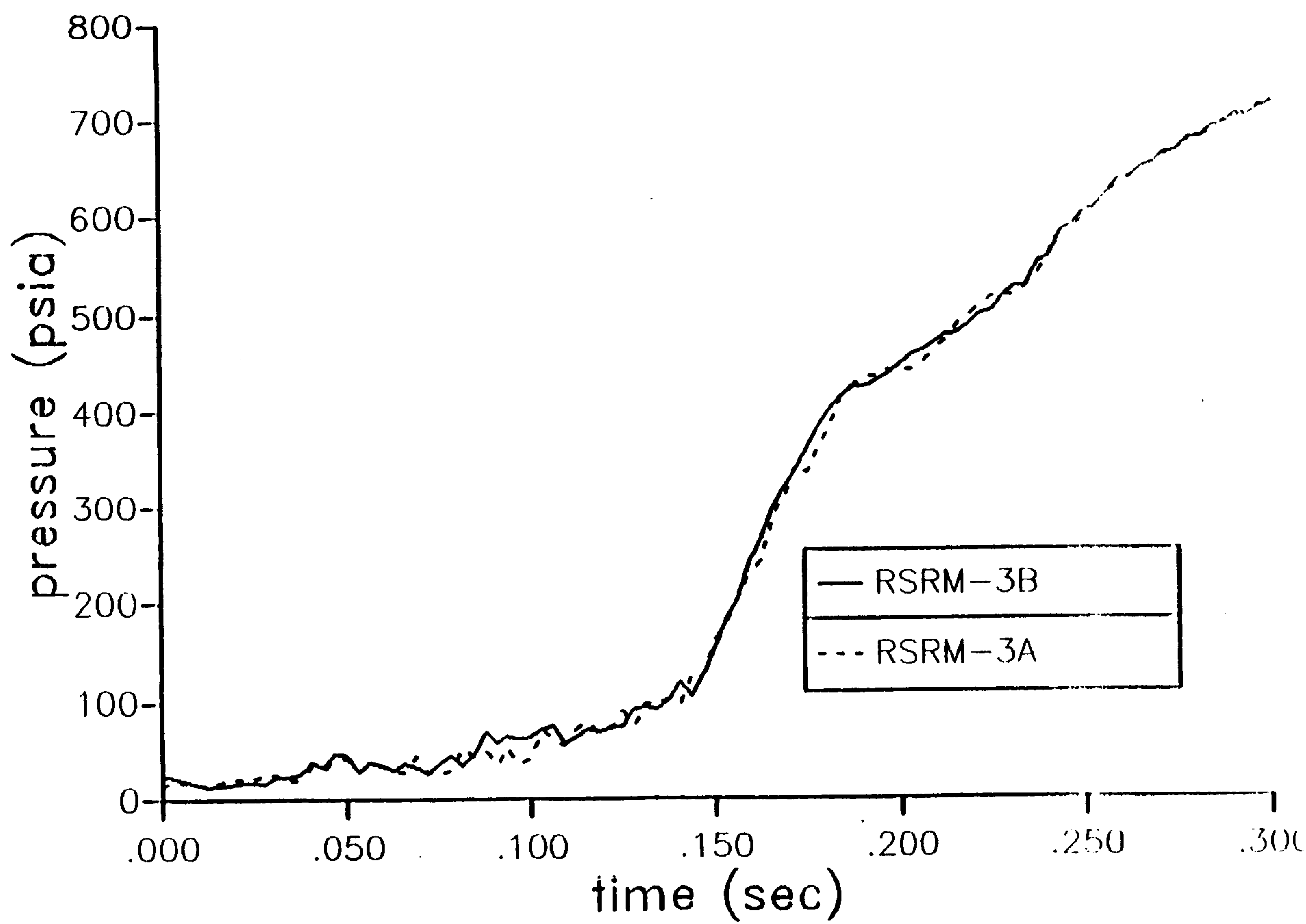

Figure 3.7 RAW PRESSURE DATA USED FOR PRESSURE RISE RATE CALCULATION

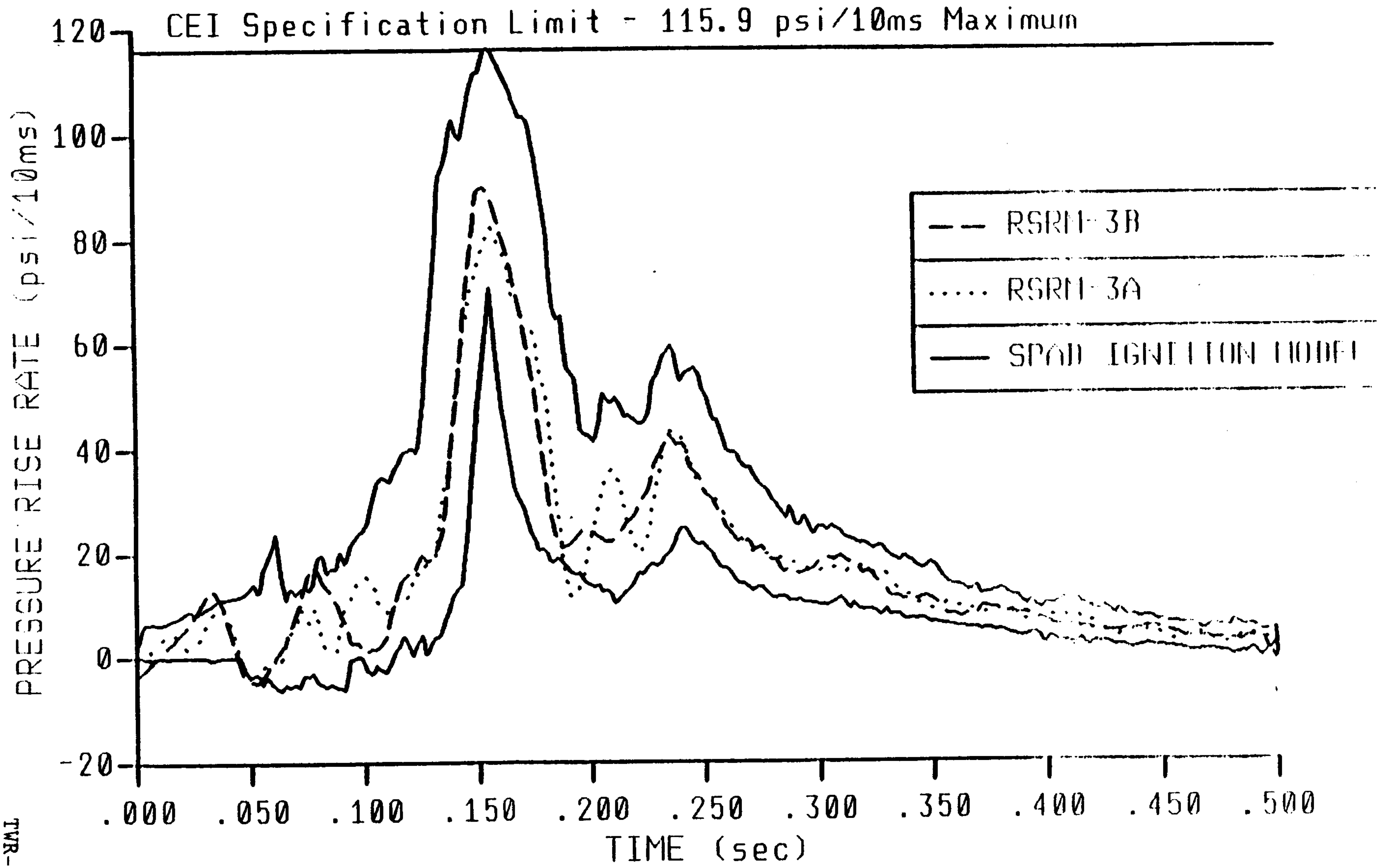

Figure 3.8 RSRM-3 PRESSURE RISE RATES COMPARED IN CEI SPEC. LIMITS

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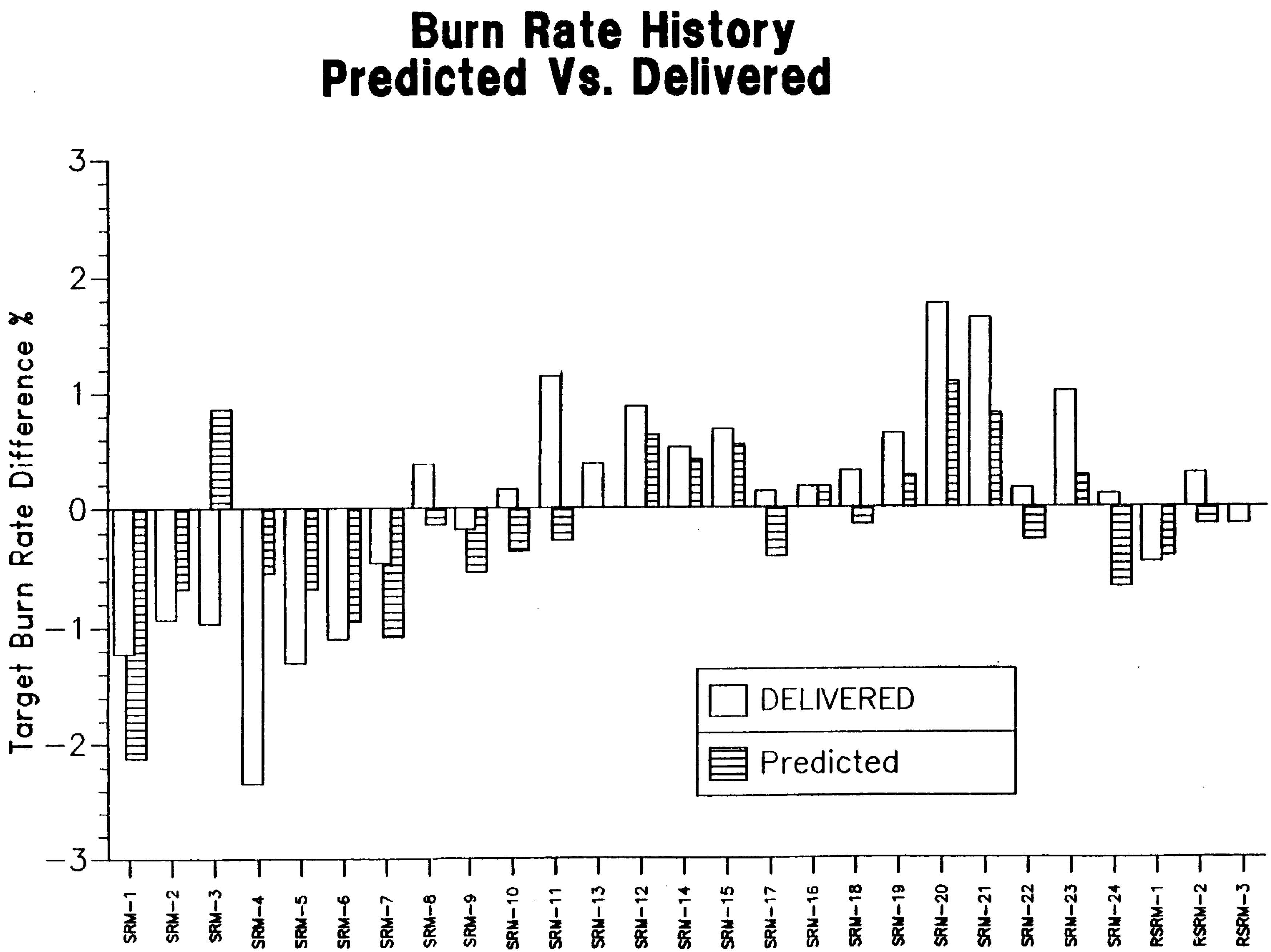

Figure 3.9 COMPARISON OF ACTUAL, PREDICTED AND TARGET BURN RATES

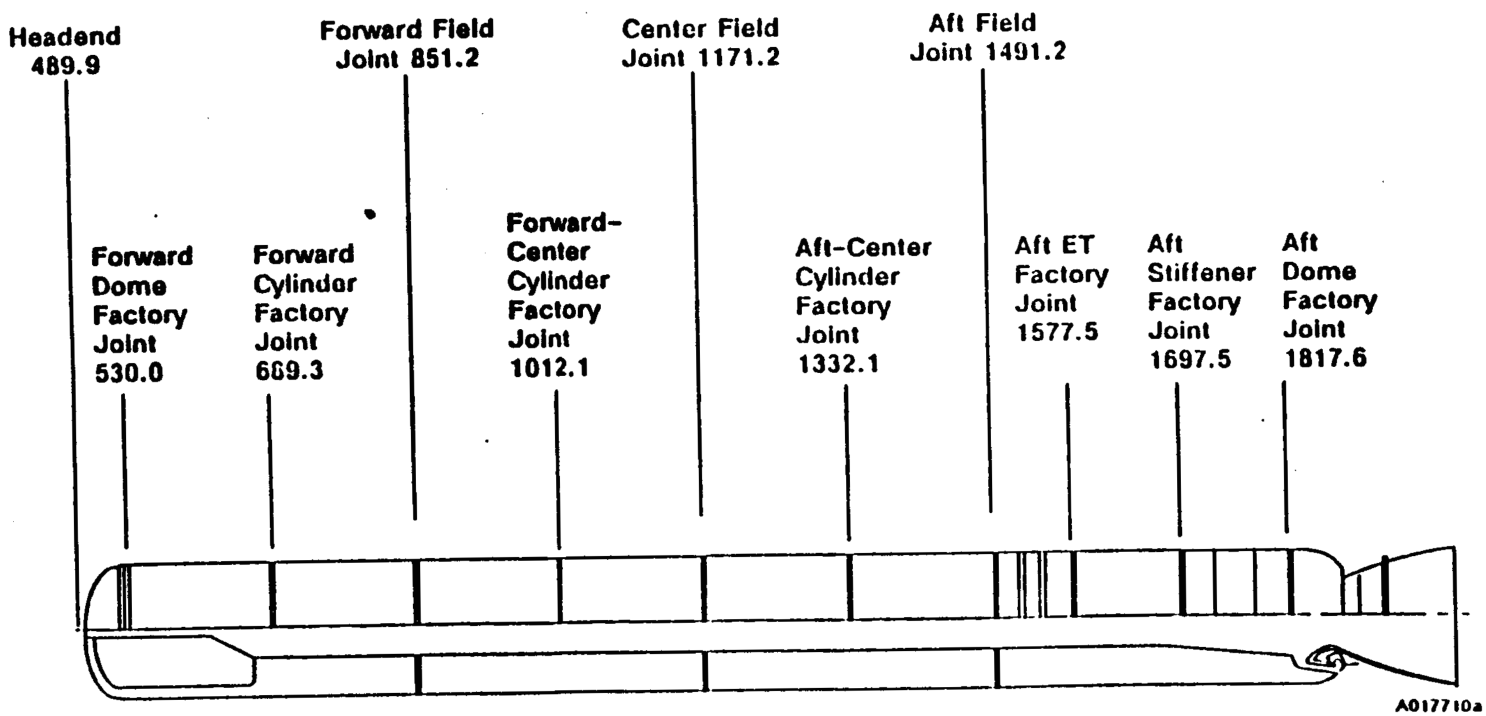

Figure 3.10 RSRM Axial Station Location Summary

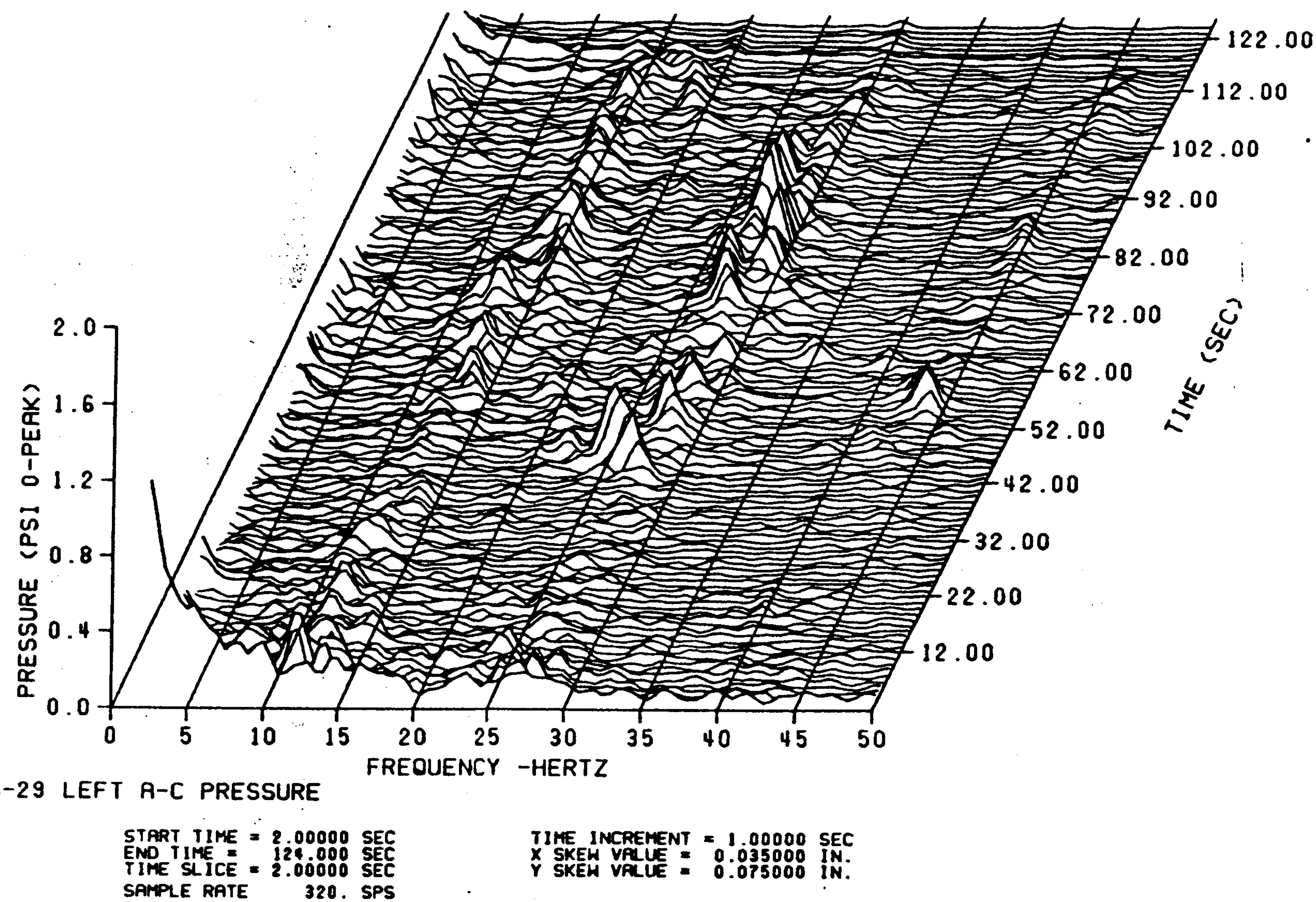

Figure 3.11 RSRM-3A WATERFALL PRESSURE PLOT

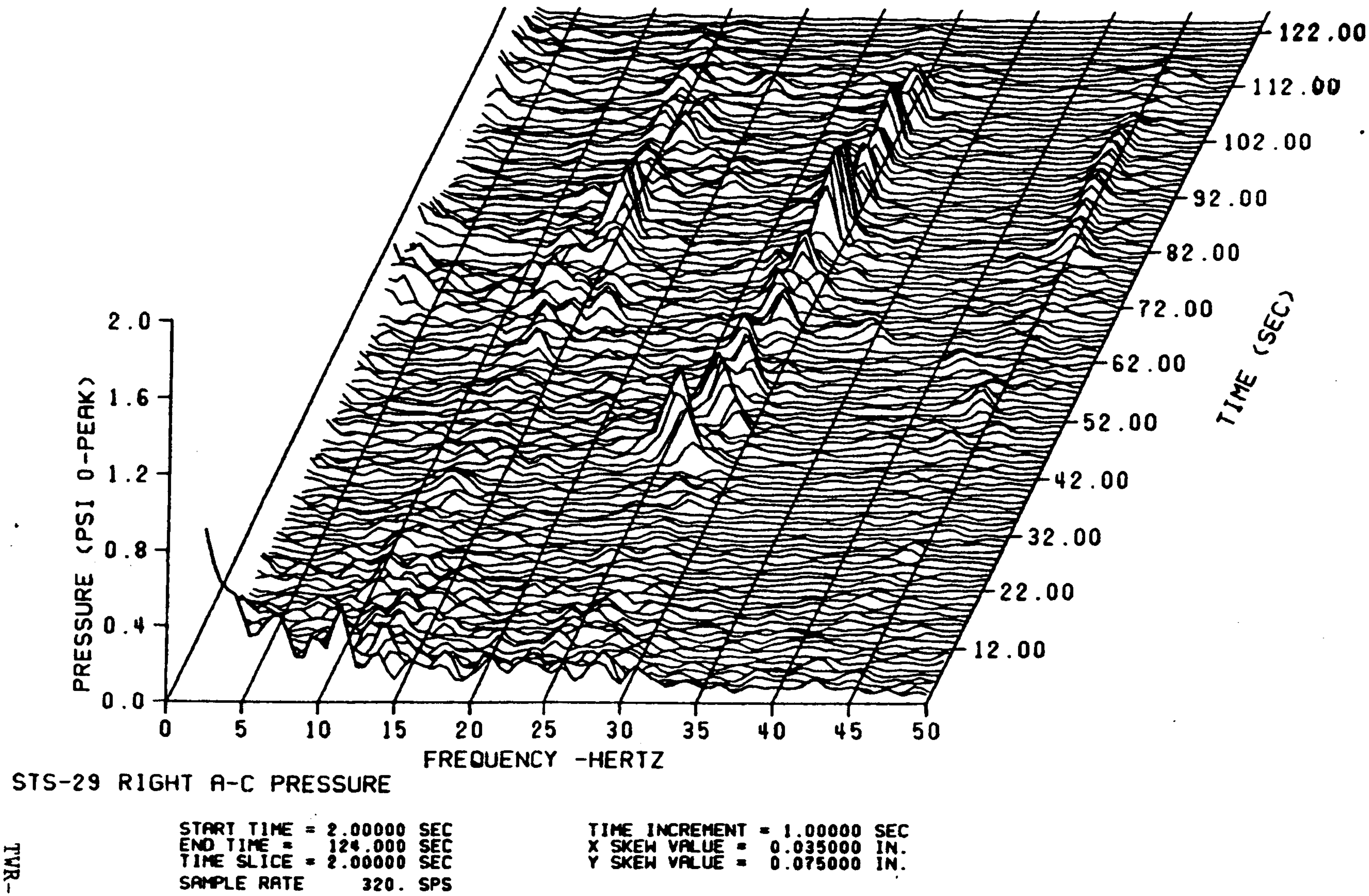

Figure 3.12 RSRM-3B WATERFALL PRESSURE PLOT

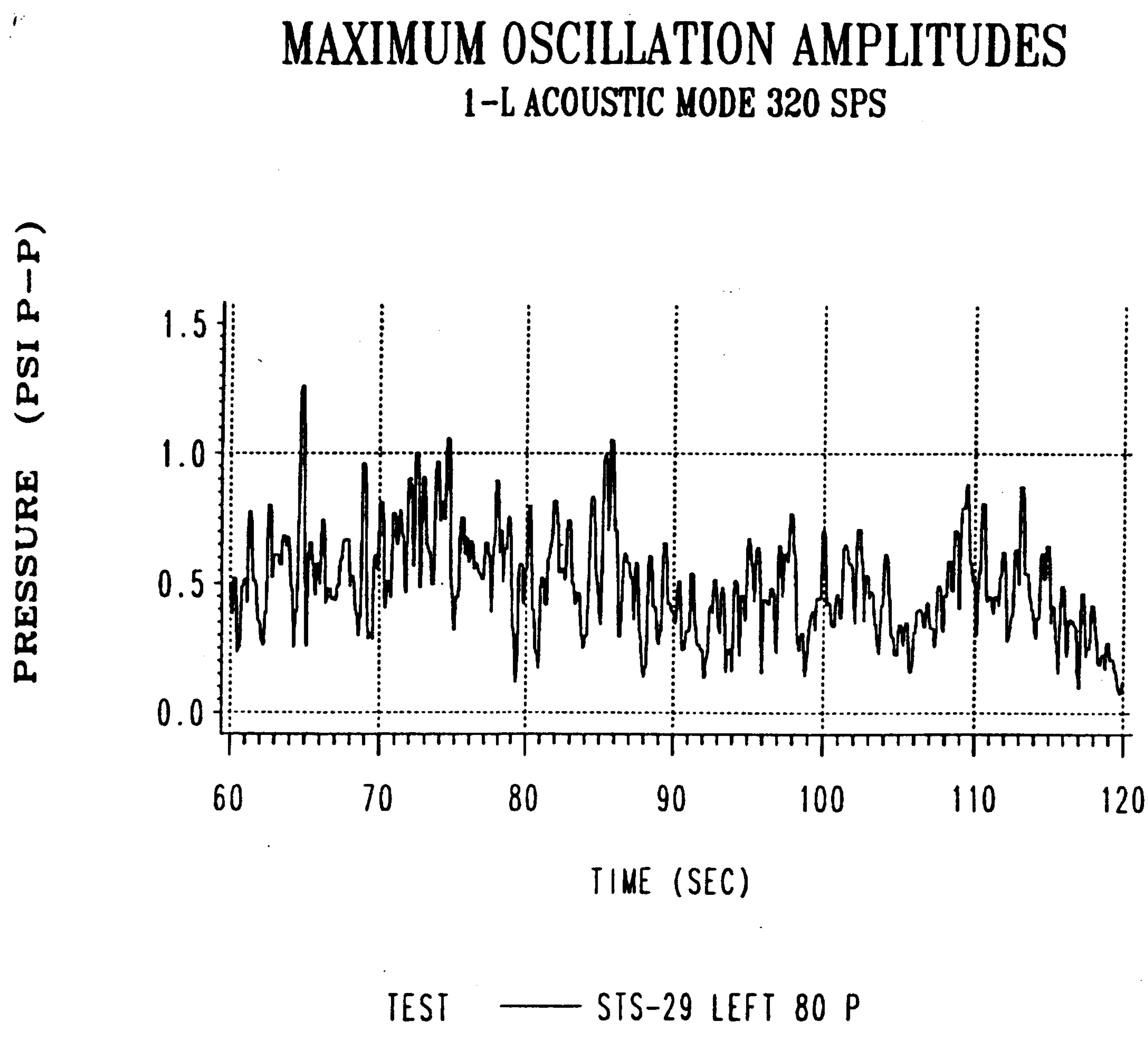

Figure 3.13 RSRM-3A MAXIMUM PRESSURE OSCILLATION AMPLITUDE (1-L MODE)

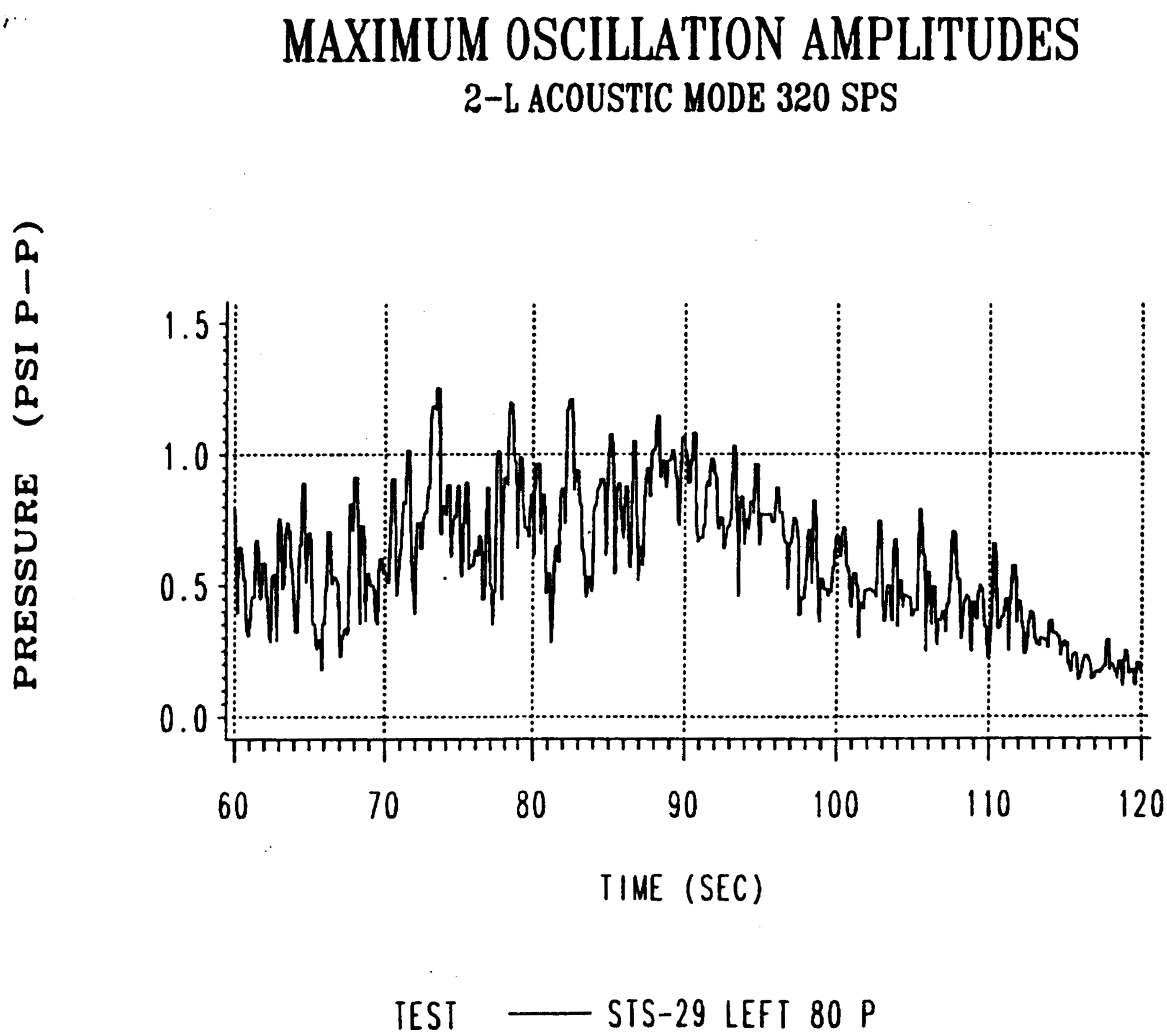

Figure 3.14 RSRM-3A MAXIMUM PRESSURE OSCILLATION AMPLITUDE (2-L MODE)

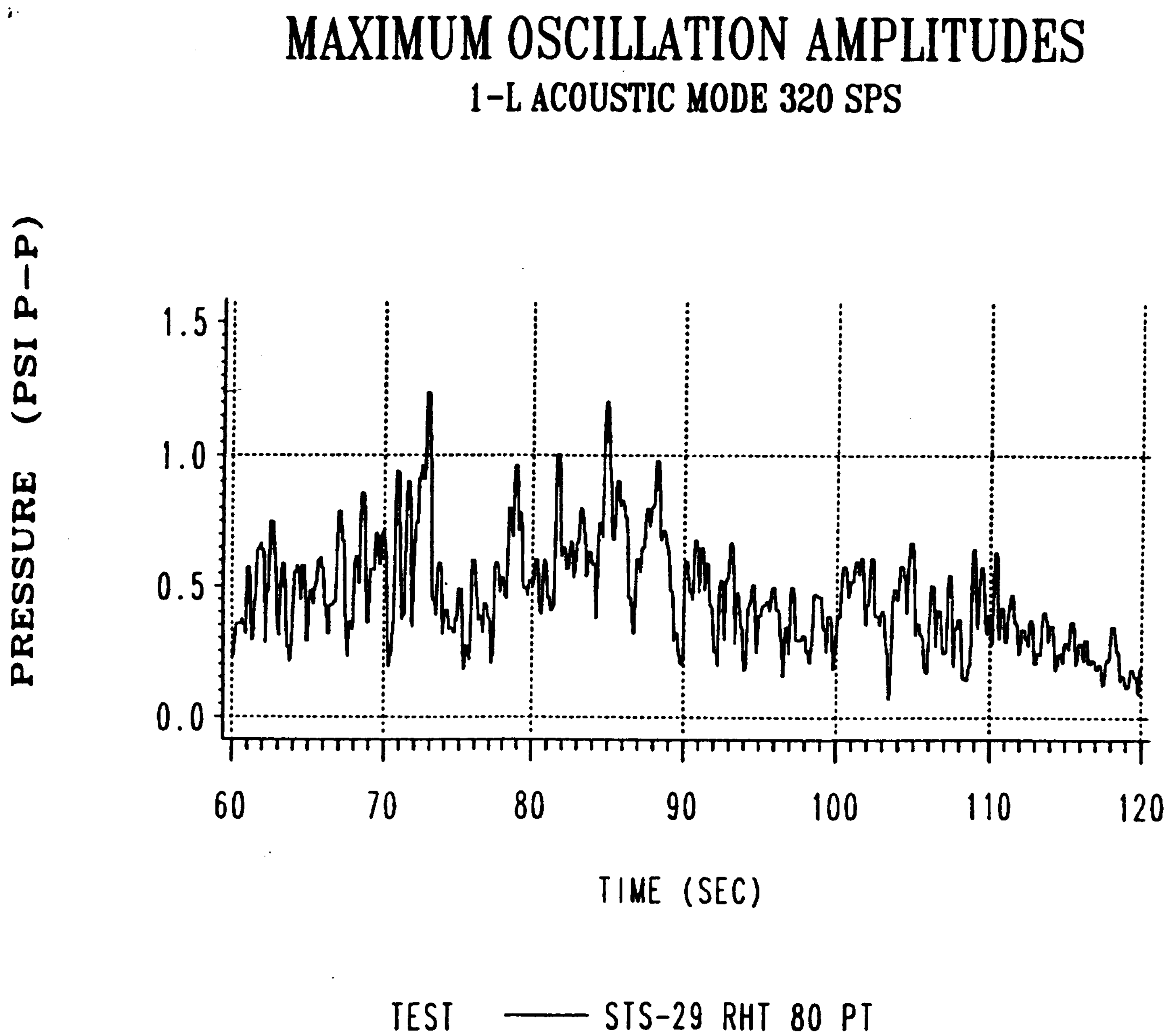

Figure 3.15 RSRM- 3B MAXIMUM PRESSURE OSCILLATION AMPLITUDE (1-L MODE)

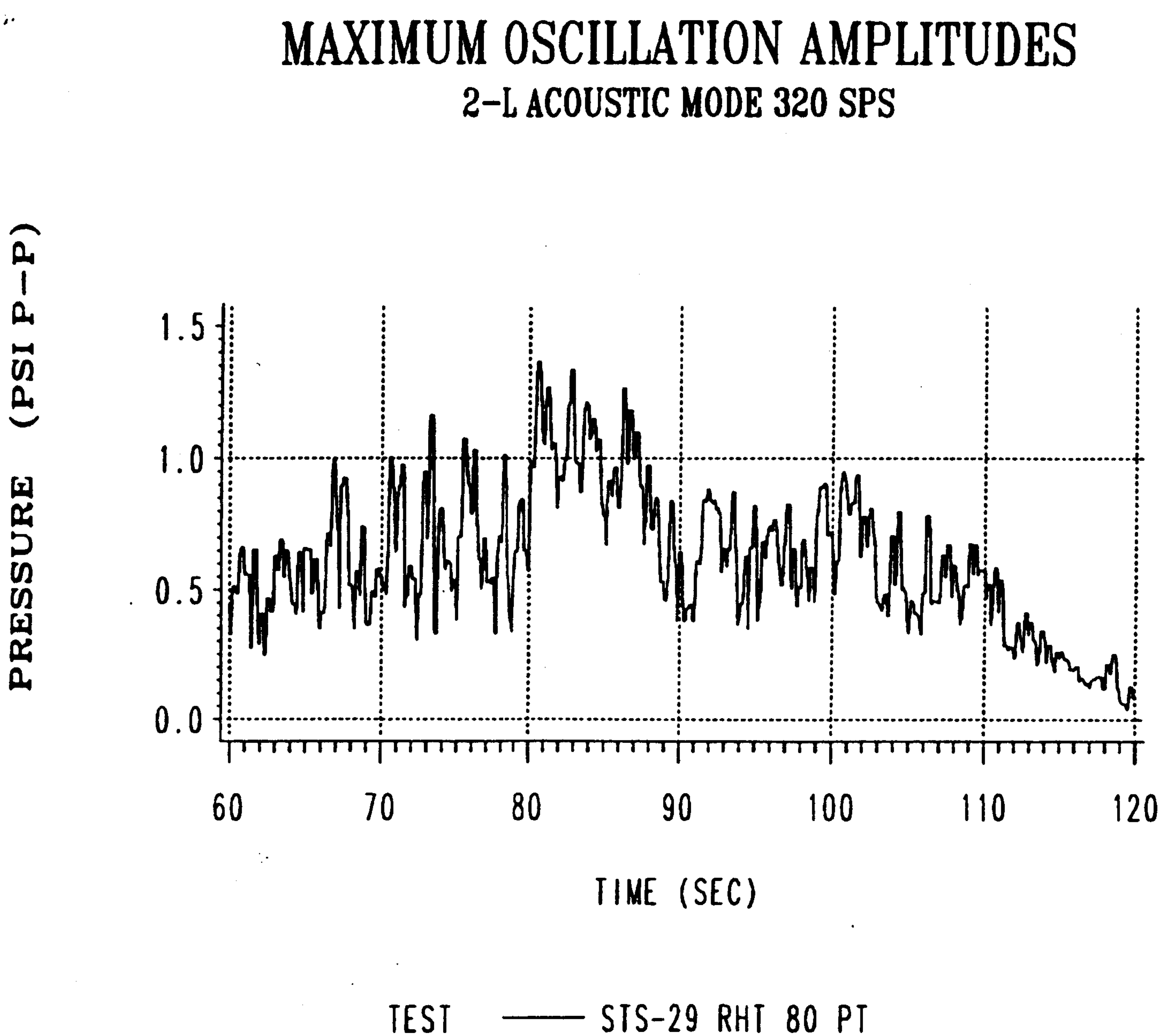

Figure 3.16 RSRM-3B MAXIMUM PRESSURE OSCILLATION AMPLITUDE (2-L MODE)

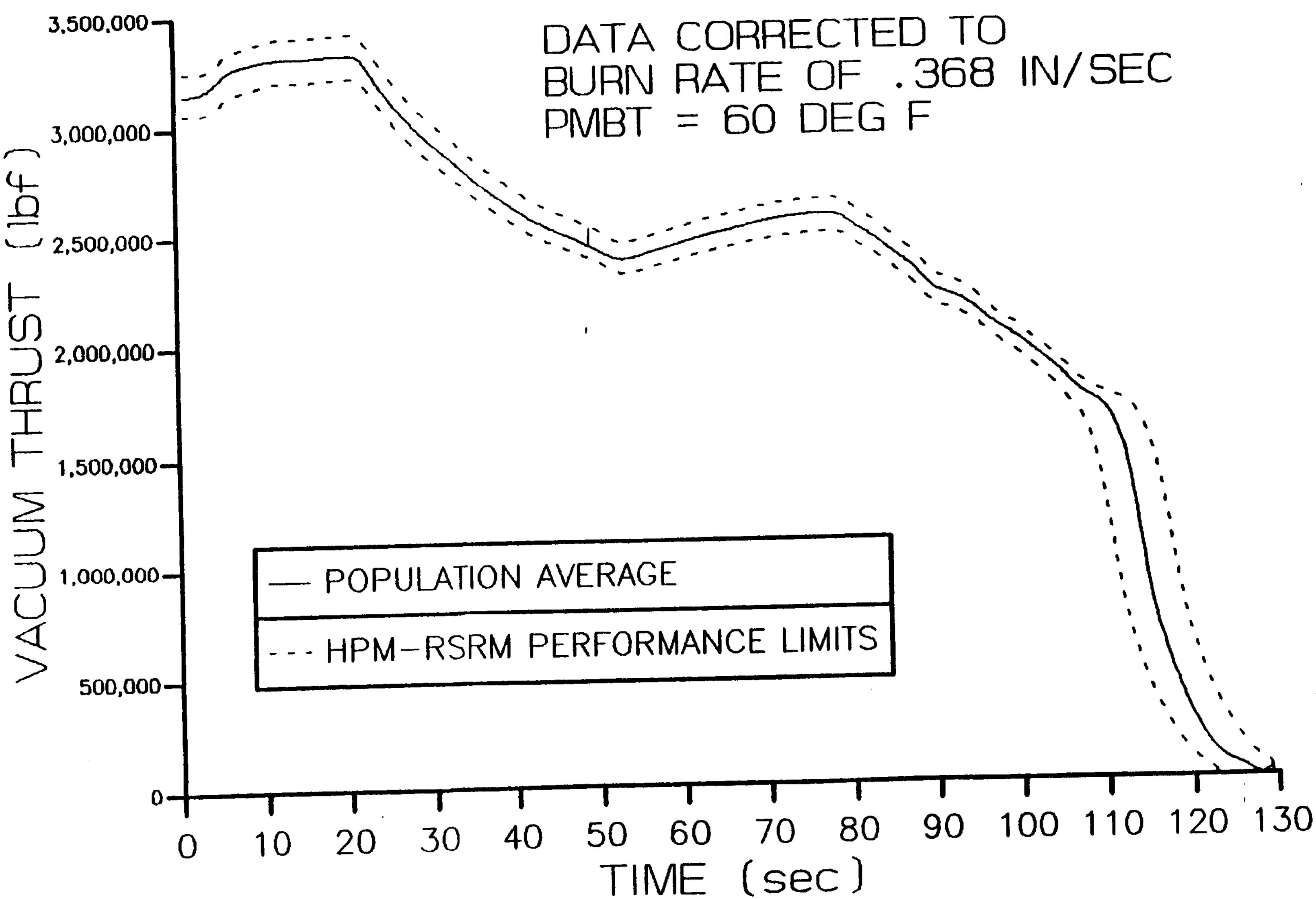

Figure 3.17 RSRM/HPM NOMINAL VACUUM THRUST TRACE IN CEI SPEC. LIMITS

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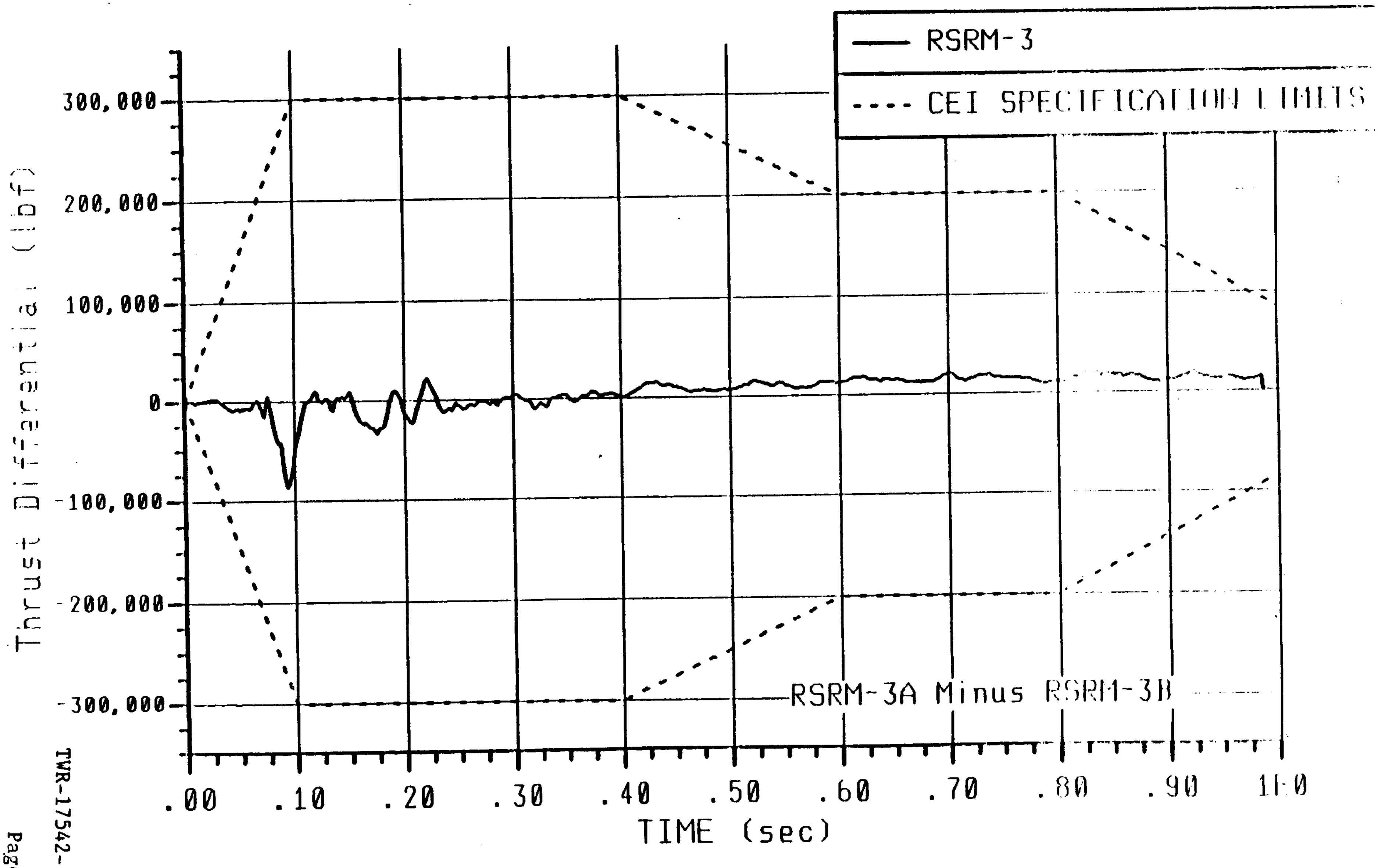

Figure 3.18 RSRM-3 IGNITION THRUST IMBALANCE

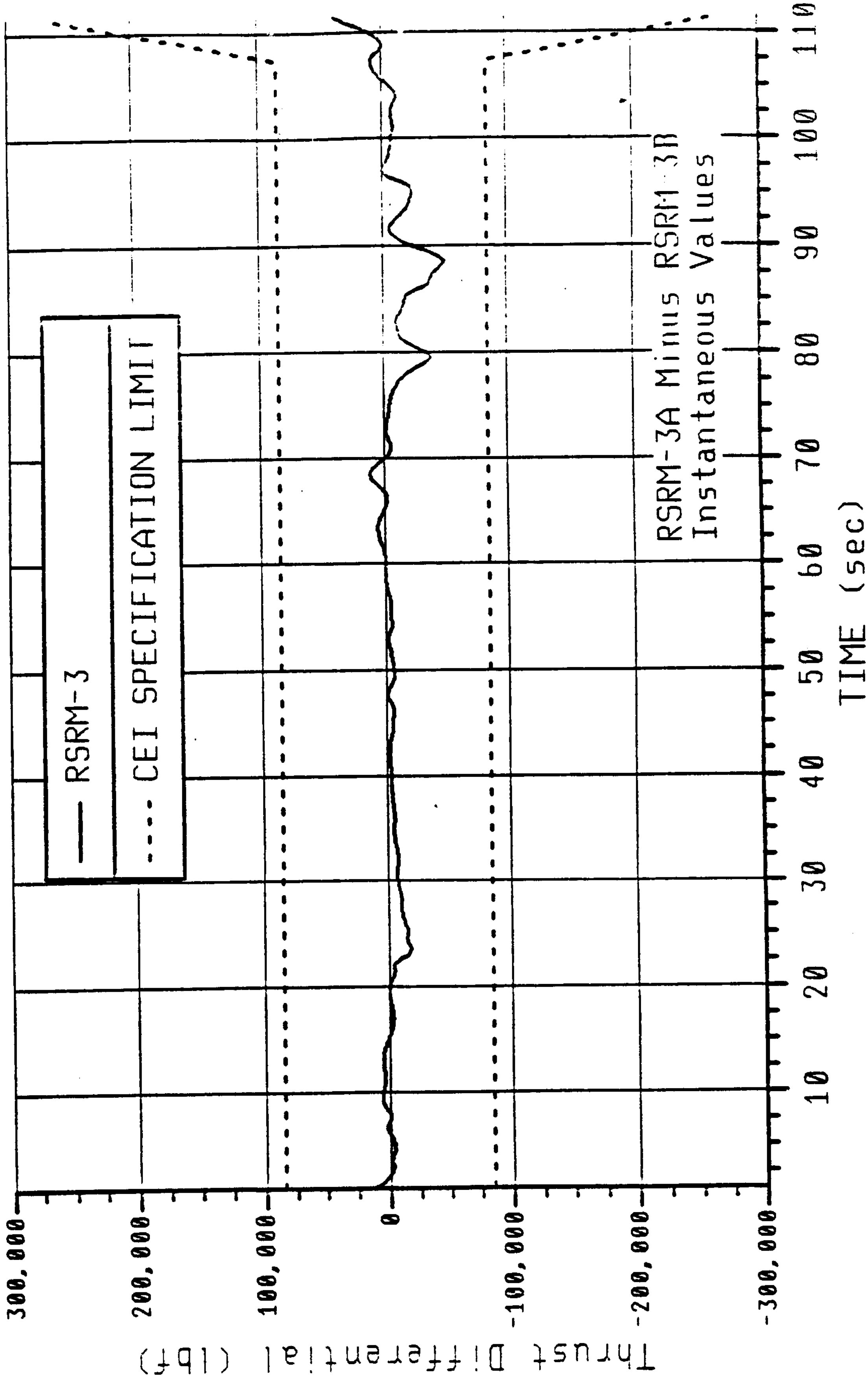

Figure 3.19 RSRM-3 STEADY STATE THRUST IMBALANCE (INSTANTANEOUS)

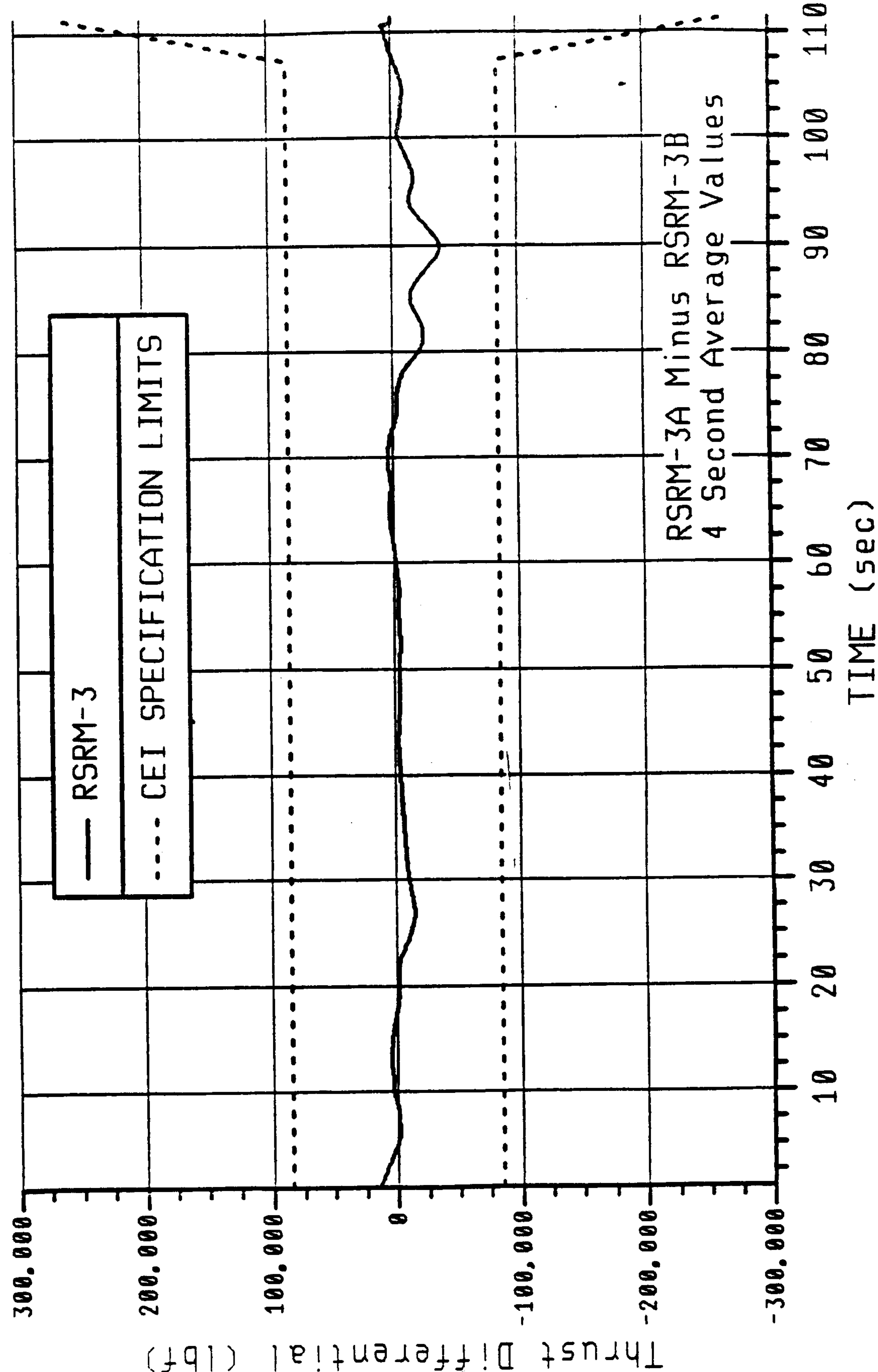

Figure 3.20 RSRM-3 STEADY STATE THRUST IMBALANCE (4 SEC AVERAGE)

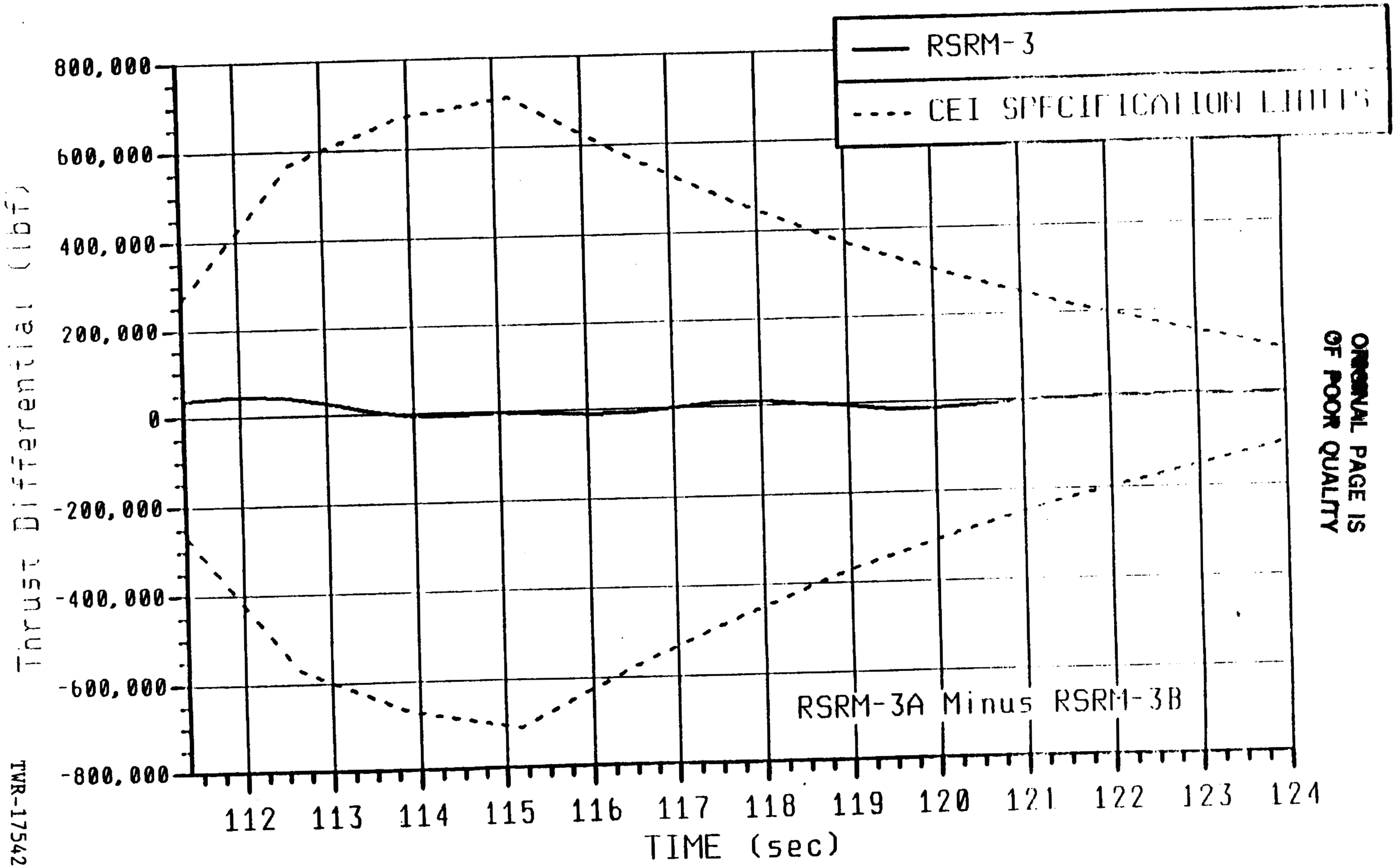

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Figure 3.21 RSRM-3 TAILOFF THRUST IMBALANCE (INSTANTANEOUS)