

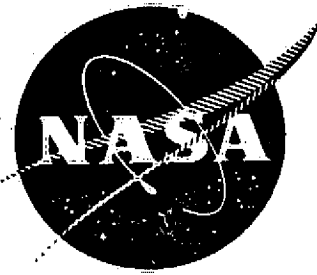
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NASA

CR-159575 Vol. II



ACOUSTIC AND AERODYNAMIC PERFORMANCE INVESTIGATION OF INVERTED VELOCITY PROFILE COANNULAR PLUG NOZZLES

Comprehensive Data Report

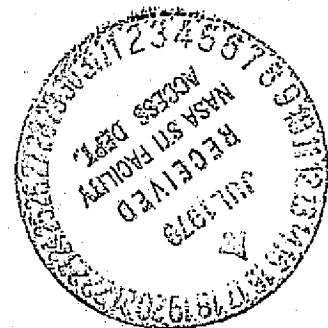
VOLUME II

P. R. Knott
J. T. Blozy
P. S. Staid

GENERAL ELECTRIC COMPANY

(NASA-CR-159575-Vol-2) ACOUSTIC AND AERODYNAMIC PERFORMANCE INVESTIGATION OF INVERTED VELOCITY PROFILE COANNULAR PLUG NOZZLES, COMPREHENSIVE DATA REPORT, VOLUME 2 Final Report (General Electric Co.) 523 p 63/71 27855
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Unclas

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NASA CONTRACT: NAS3-19777

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16. Abstract This Comprehensive Data Report, comprising three volumes, includes the basic test description and test results which are analyzed and documented in the comparison Final Reports, NASA CR-3149 and CR-2990. Volume I contains a description of the acoustic configurations, test facilities, data reduction techniques, test conditions, and detailed test results from the hot, static acoustic tests at the General Electric Anechoic Chamber. Volume II presents acoustic data comparisons in graphical form. Volume III contains the detailed aerodynamic test results plus the "concept screening and model design report."					
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7.0 ACOUSTIC DATA COMPARATIVE PLOTS

7.1 INTRODUCTION

In the following sections data plots are presented which examine the noise characteristics of the coannular nozzle. The effect of changes in both the nozzle flow parameters (i.e., velocity, temperature, pressure ratio) and the coannular nozzle geometry are presented. All data are normalized except for PWL spectra and the first 10 points, which are comparisons with JENOTS data.

Unless otherwise specified, the following plots are presented for each study.

For full size (513 in.²) at the 2400-ft sideline:

1. PNL directivity, normalized

For model size (29,399 in.²) at the 40-ft arc:

1. OASPL directivity, normalized
2. 1/3-octave band PWL spectra, unnormalized
3. 1/3-octave band SPL spectra at angles of 50°, 90°, 130°, and 140° to the inlet, normalized

The following normalization factors have been used in the plots:

1. PNL - $10 \text{ LOG}(FT/F_{\text{REF}})$

where:

PNL perceived noise level
FT total ideal thrust
F_{REF} reference ideal thrust (F_{REF} = 5130 lbf)

2. OASPL - A

where:

A = $10 \text{ LOG}(AT/R^2) + 10 \text{ LOG}(FT/(AT * F_{\text{REF}}))$
OASPL overall sound pressure level
AT total area
R distance
FT total ideal thrust
F_{REF} reference thrust/reference area (F_{REF} = 10 lbf/in.²)

3. SPL - $10 \text{ LOG}(A/R^2) - 10 \text{ LOG}(FT/(A * F_{\text{REF}}))$

where:

SPL sound pressure level
A total area
R distance
FT total ideal thrust
F_{REF} reference thrust/reference area (F_{REF} = 10 lbf/in.²)

Only a presentation of the data is made in this report. Data analysis is addressed in the main final report. On each plot the measured flow conditions are shown for all data points in the comparison.

7.2 COMPARISON OF ANECHOIC CHAMBER AND OUTDOOR TEST SITE (JENOTS) DATA

The purpose of this data analysis group is to compare data measured previously in the General Electric outdoor acoustic test site (JENOTS) with the acoustic measurements in the General Electric Anechoic Jet Noise Facility (Cell 41). Ten test points were chosen for this comparison. For these points the full-size comparison was made at 1812 in.² and both full-size and model-size data were not normalized since the test model was exactly the same in size and geometry. The JENOTS data was previously reported in NASA CR-135239.

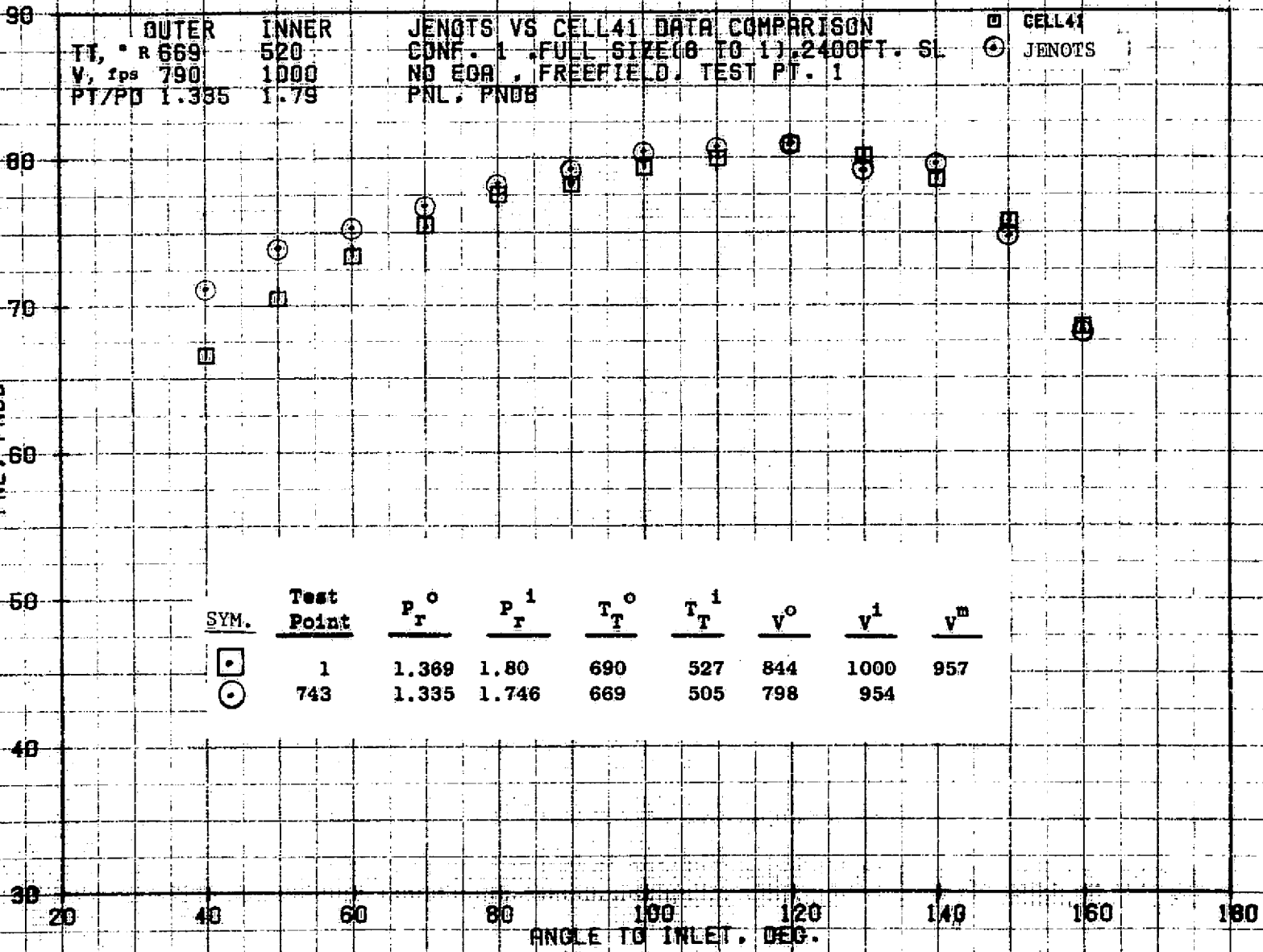
717

PNL, PNDB

OUTER INNER
 TT, ° R 669 520
 V, fps 790 1000
 PT/PD 1.335 1.79

JENOTS VS CELL41 DATA COMPARISON
 CONF. 1 FULL SIZE (8 TO 1) 2400FT. SL
 NO EGA, FREEFIELD, TEST PT. 1
 PNL, PNDB

□ CELL41
 ○ JENOTS

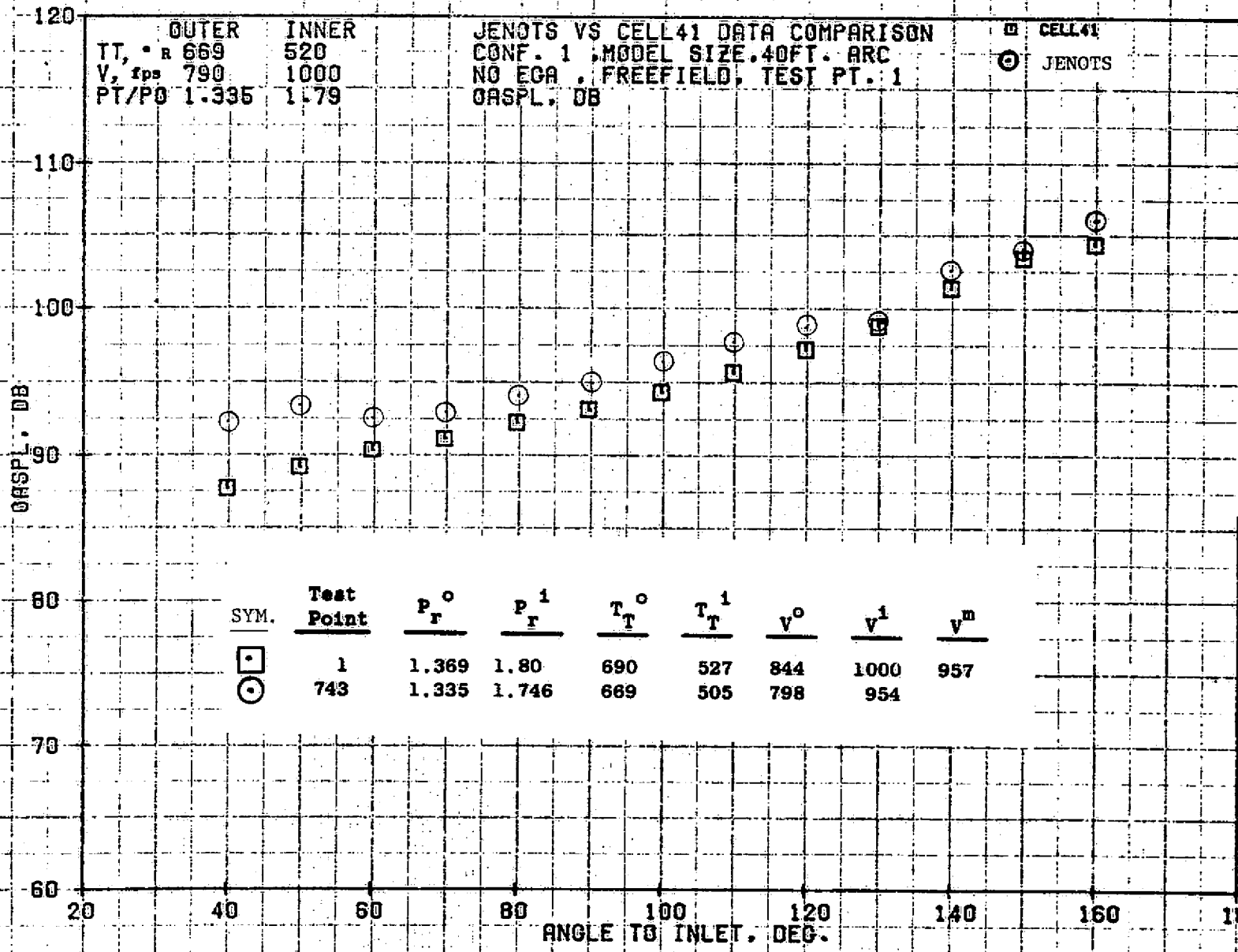


SYM.	Test Point	P_T^0	P_T^1	T_T^0	T_T^1	V^0	V^1	V^m
□	1	1.389	1.80	690	527	844	1000	957
○	743	1.335	1.746	669	505	798	954	

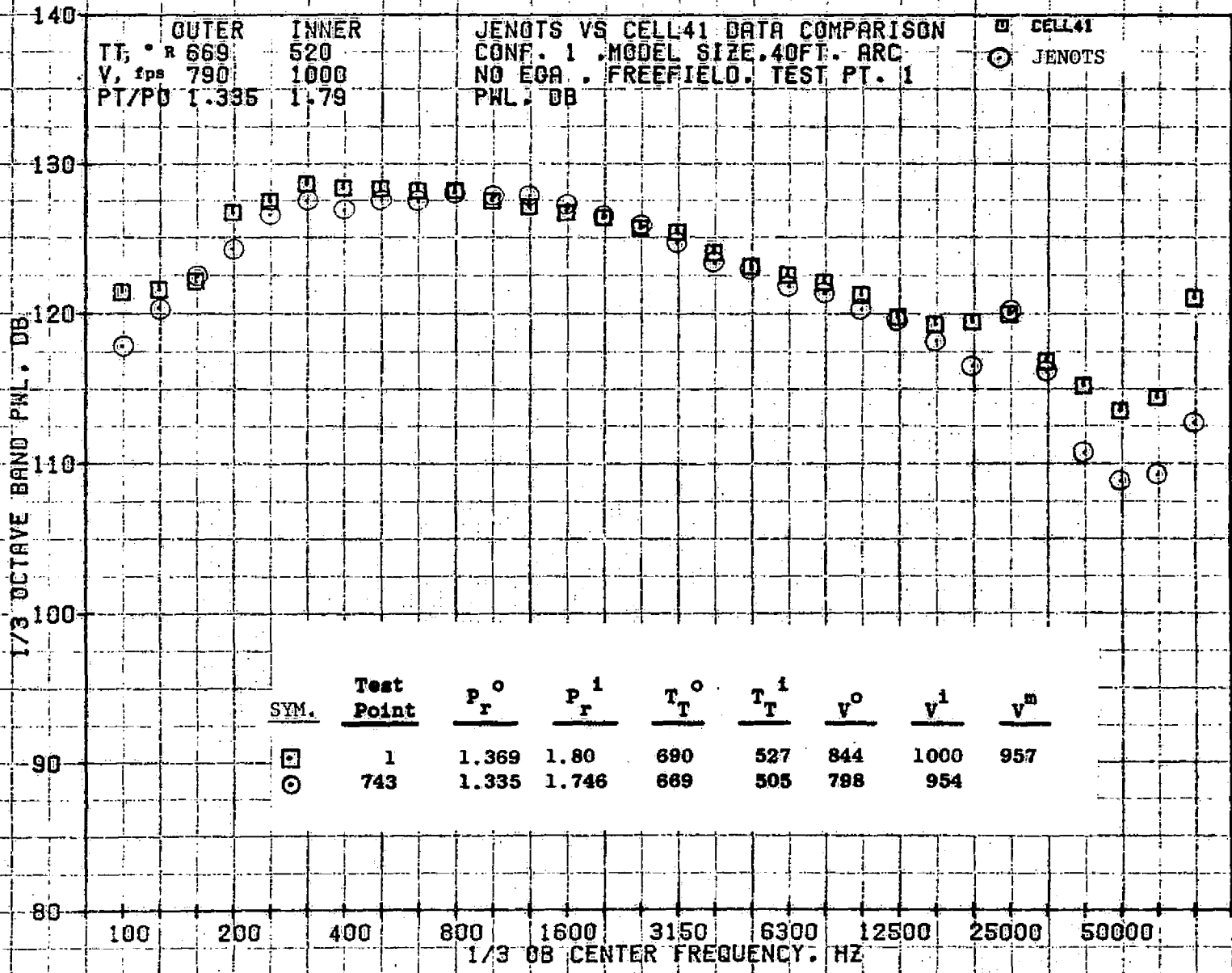
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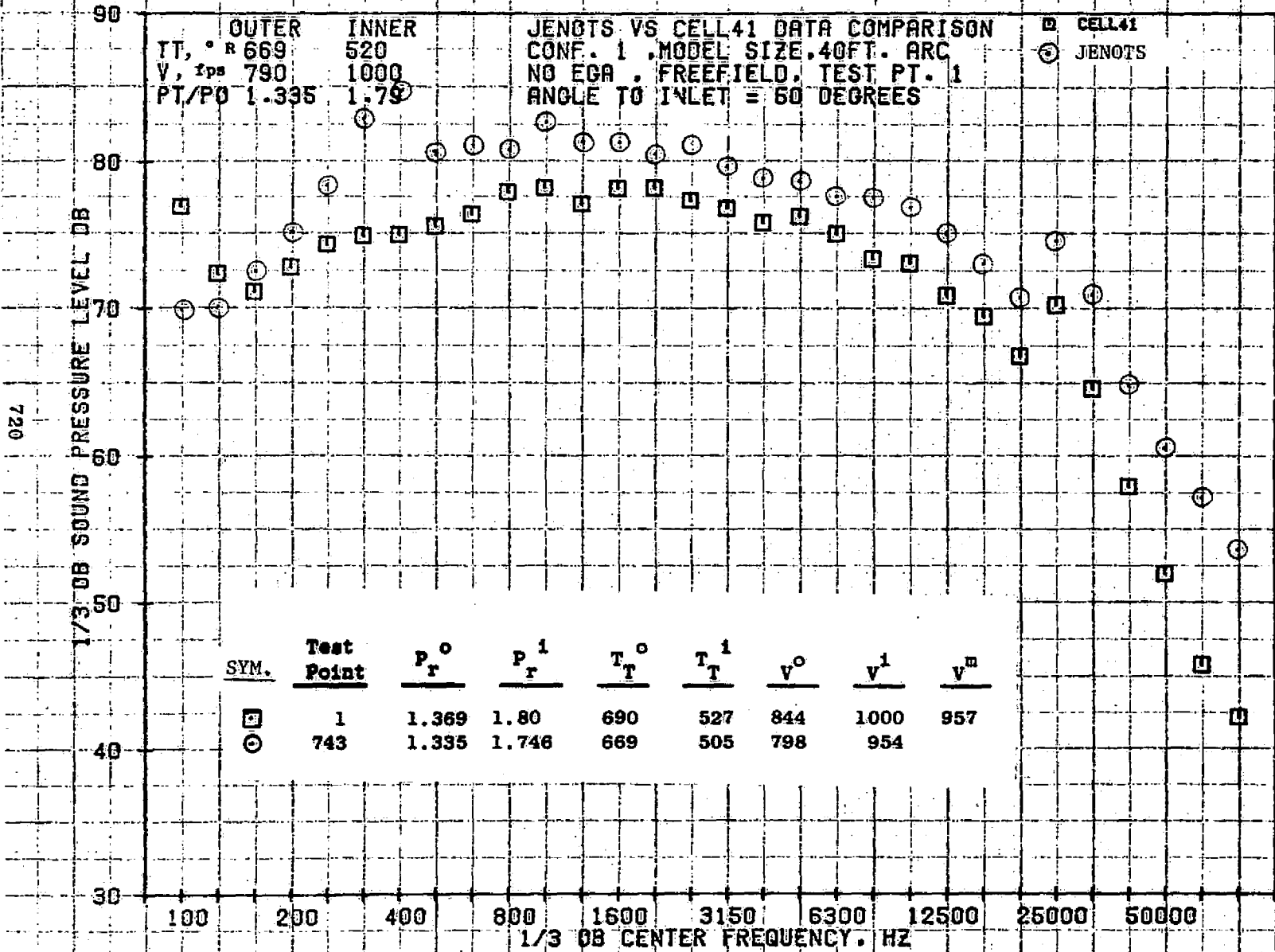
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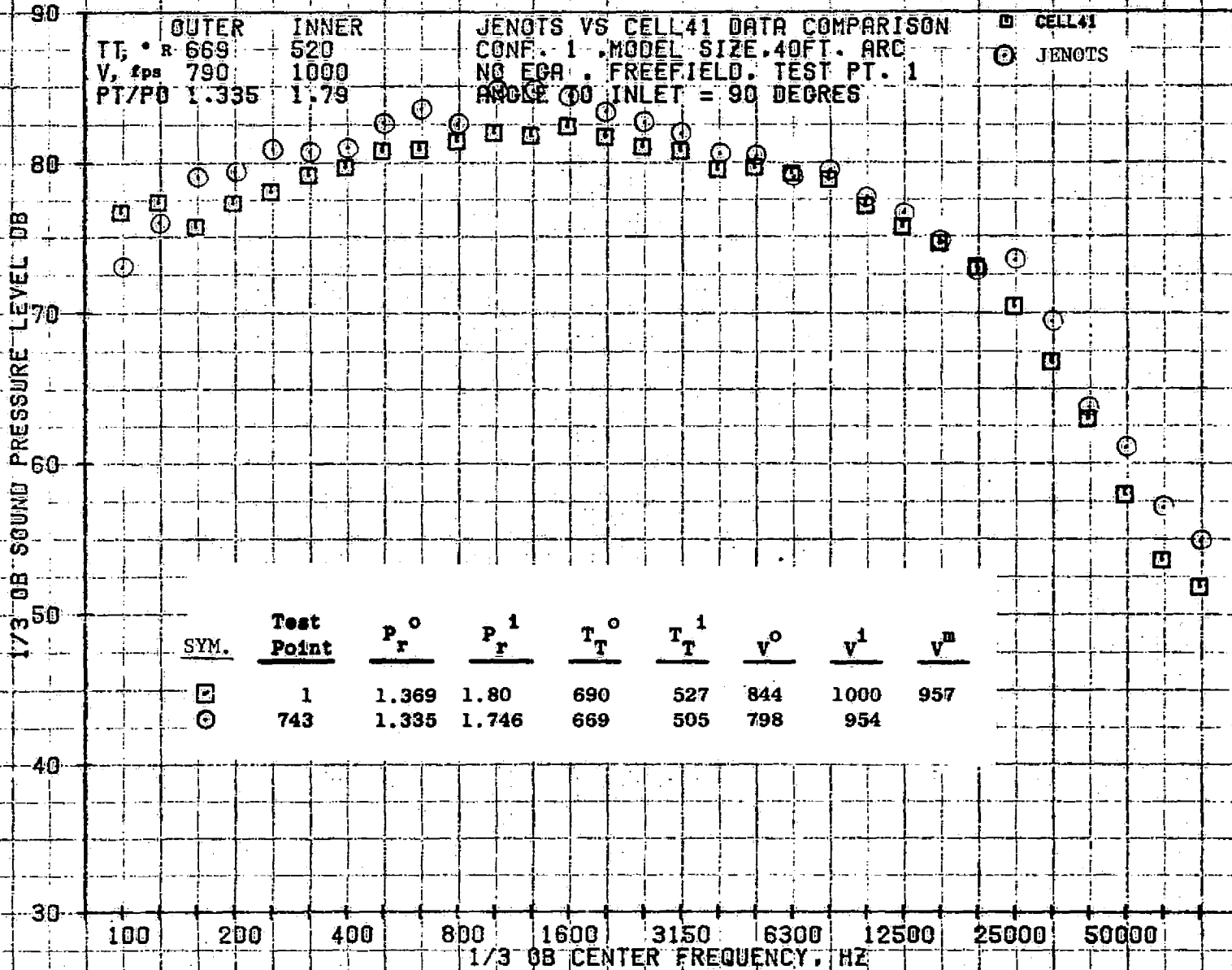
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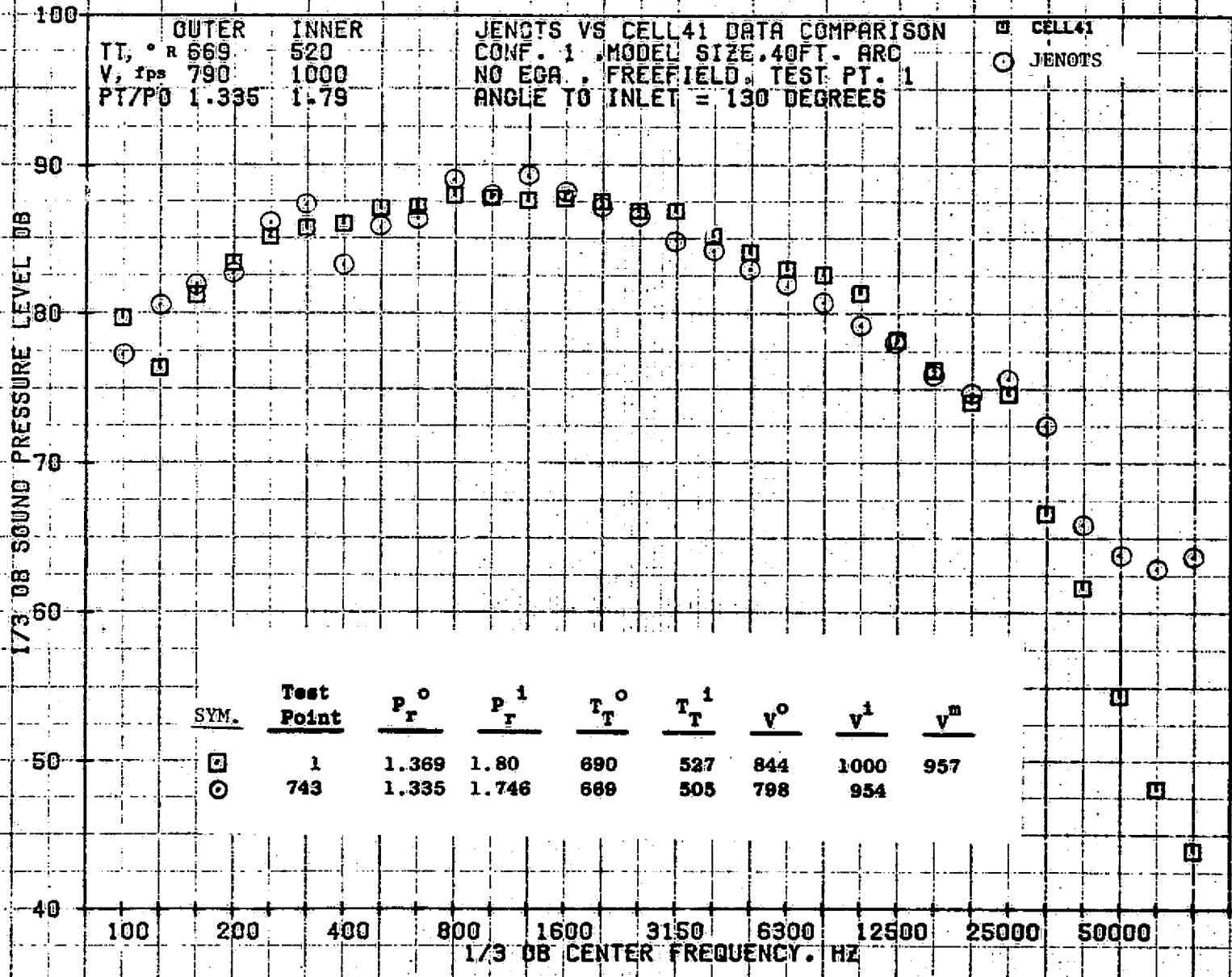


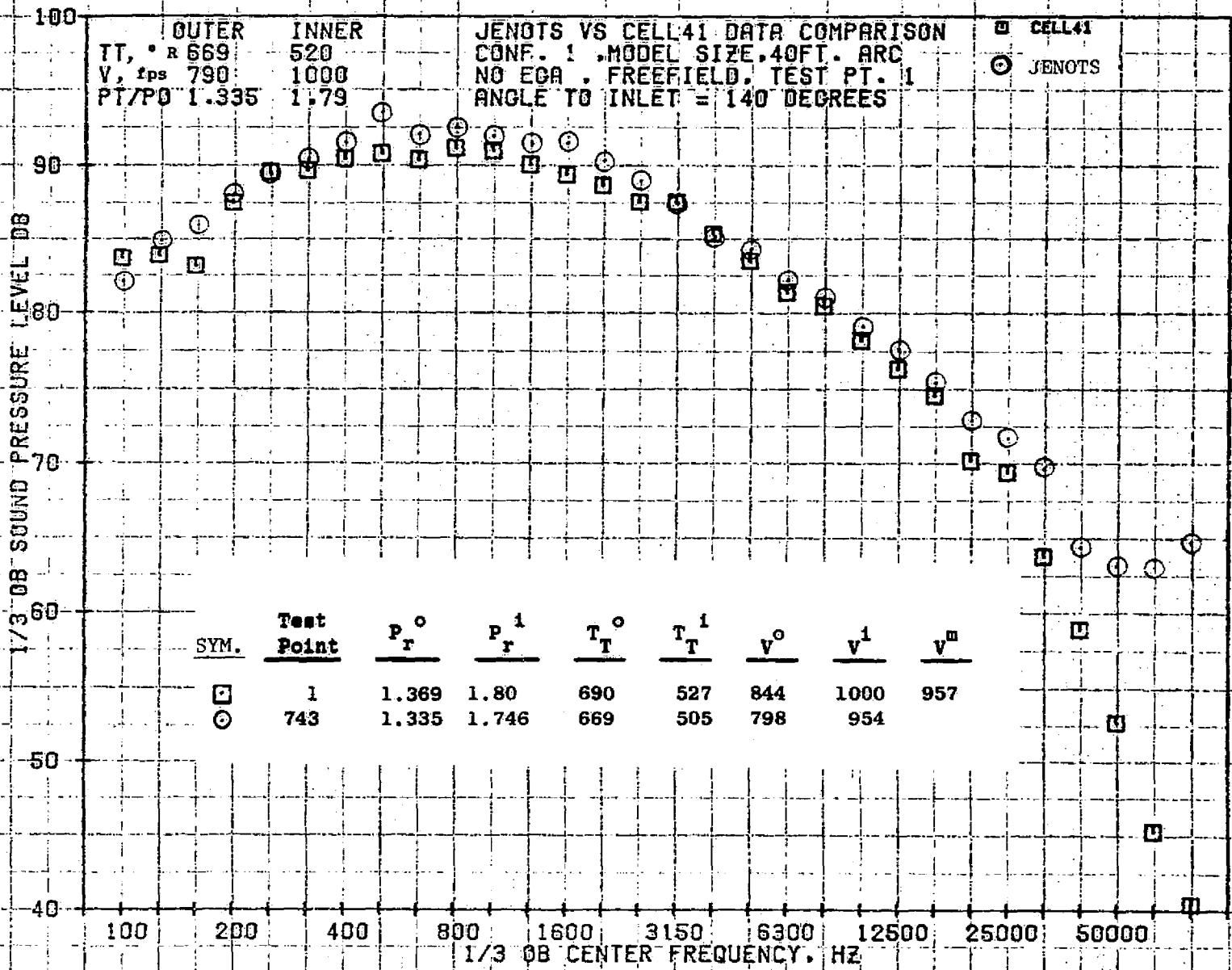
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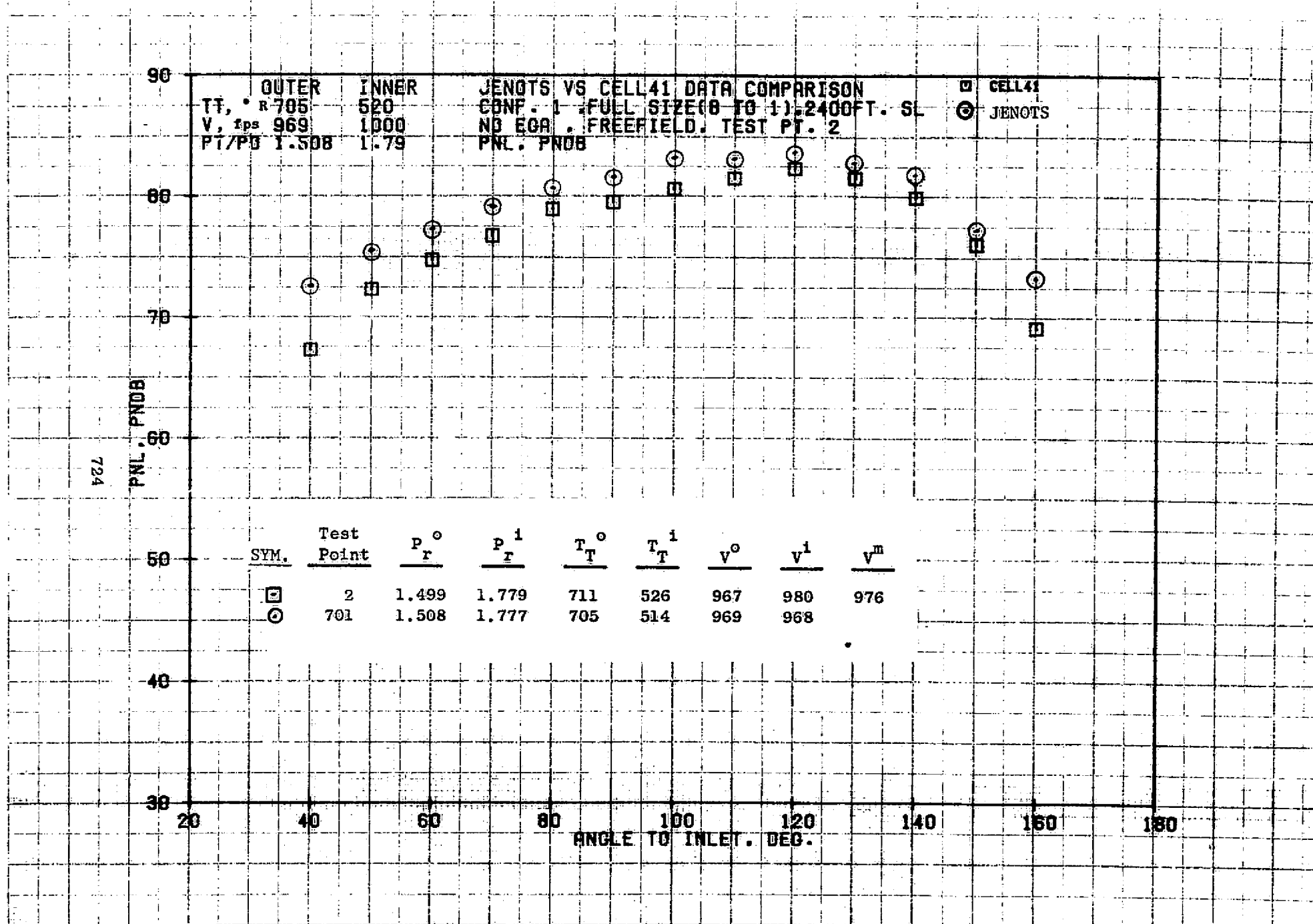






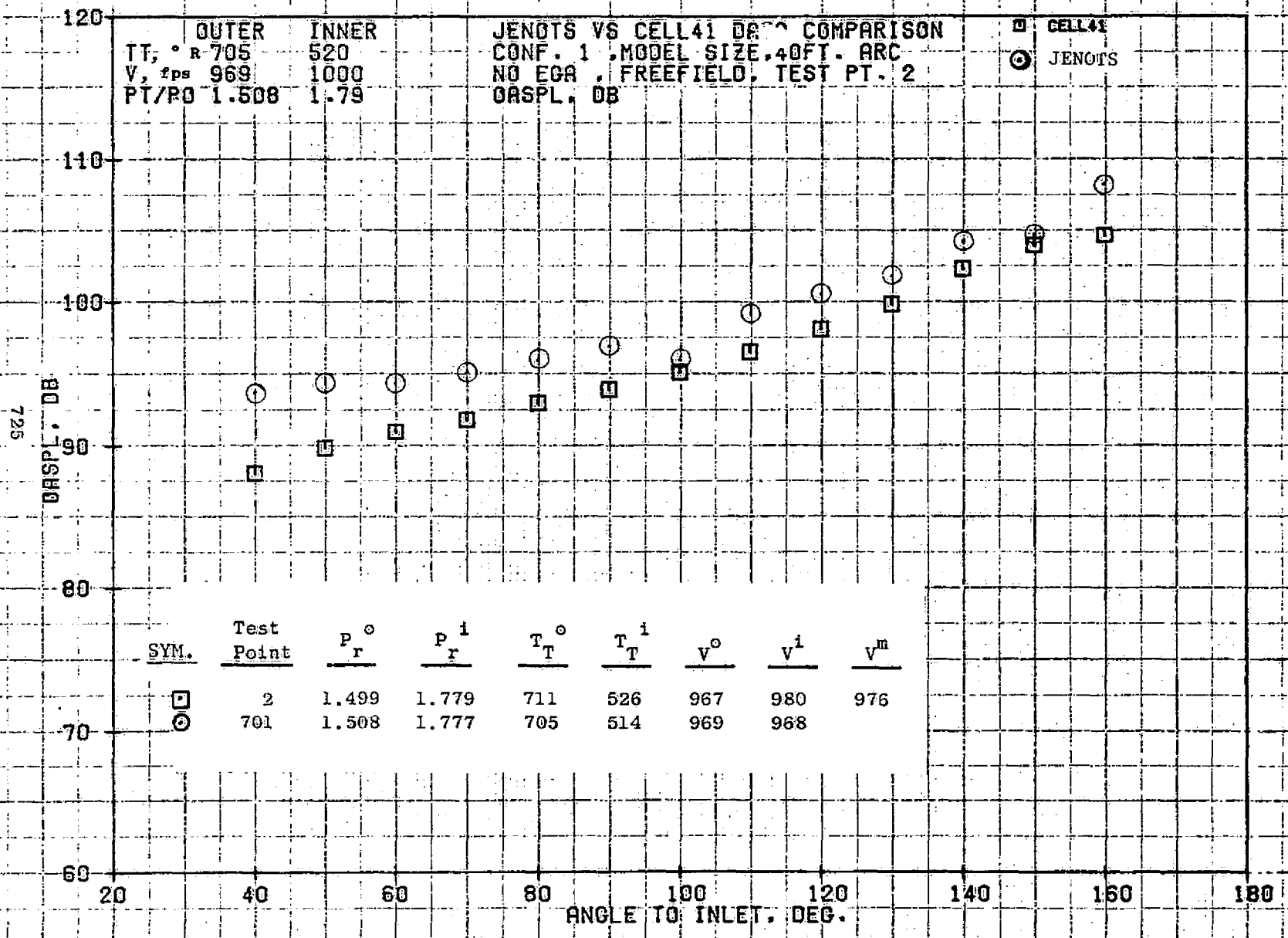


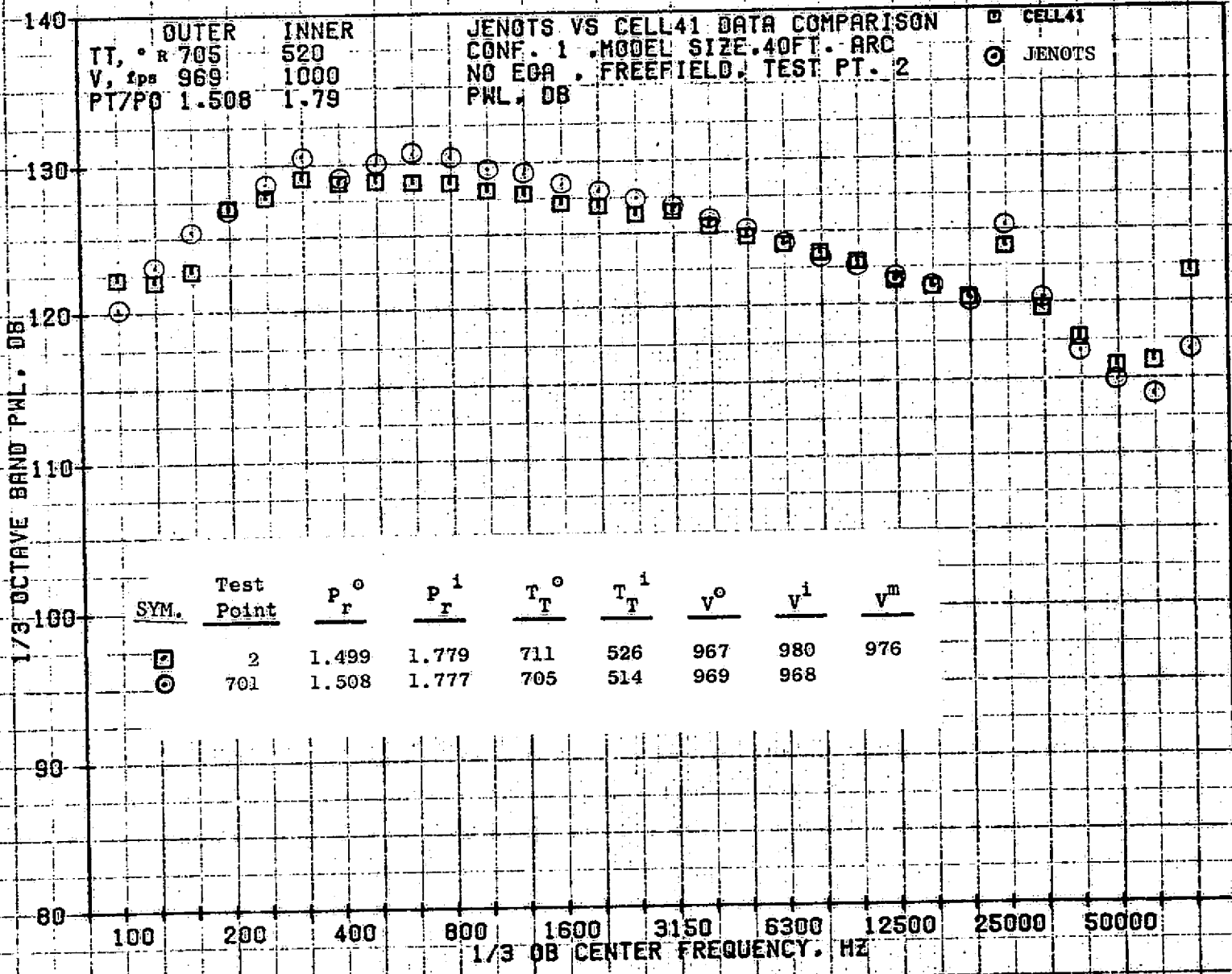
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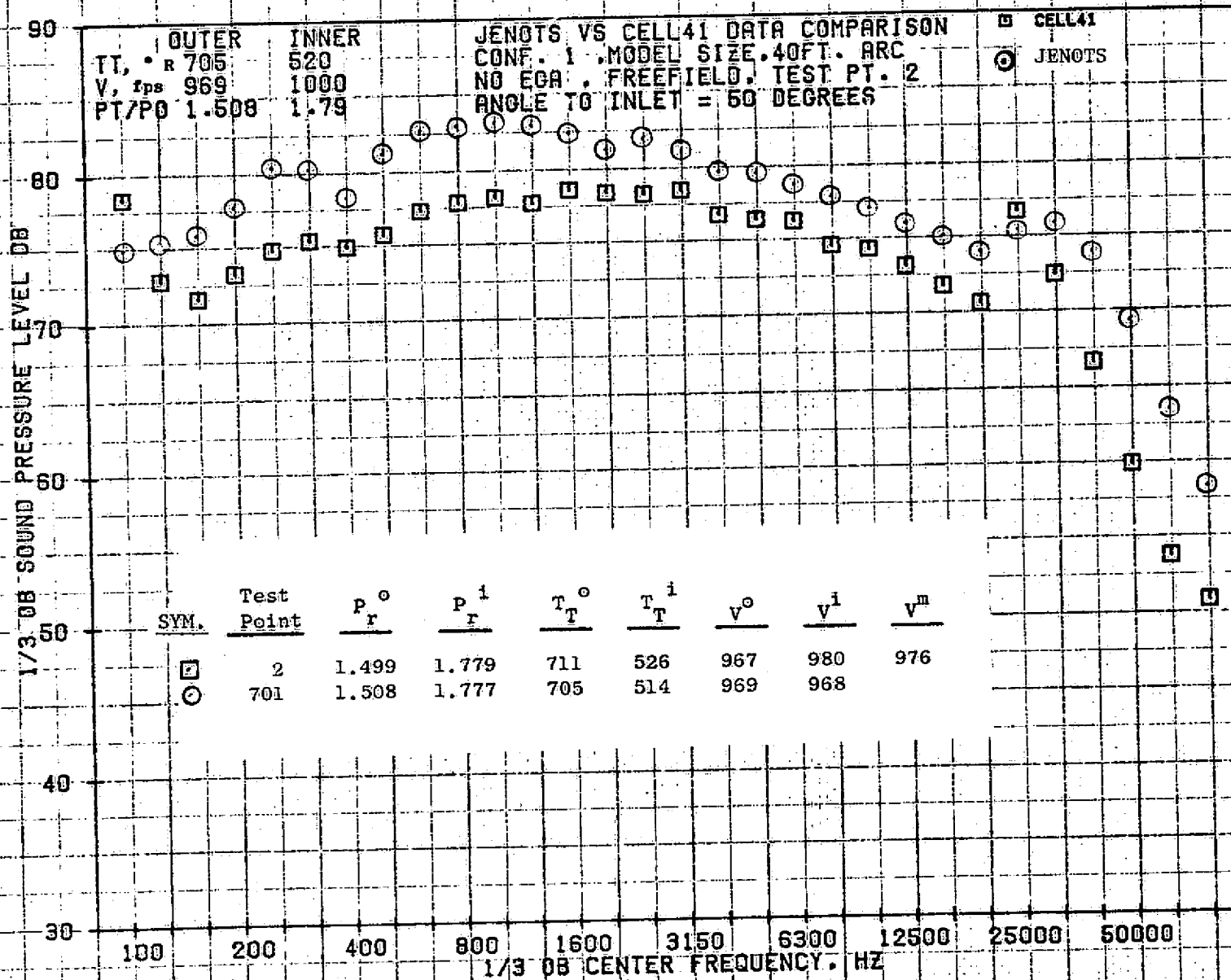
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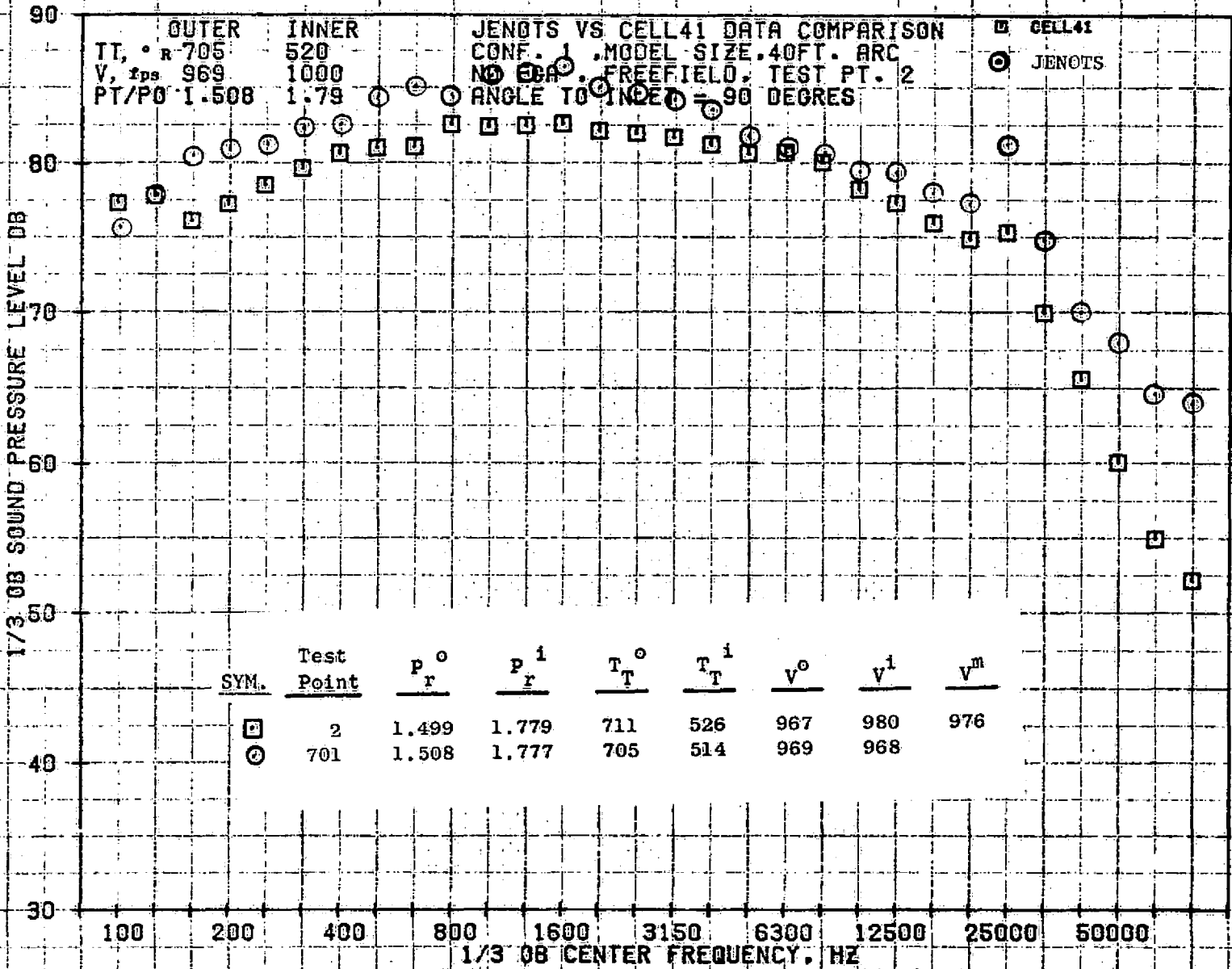


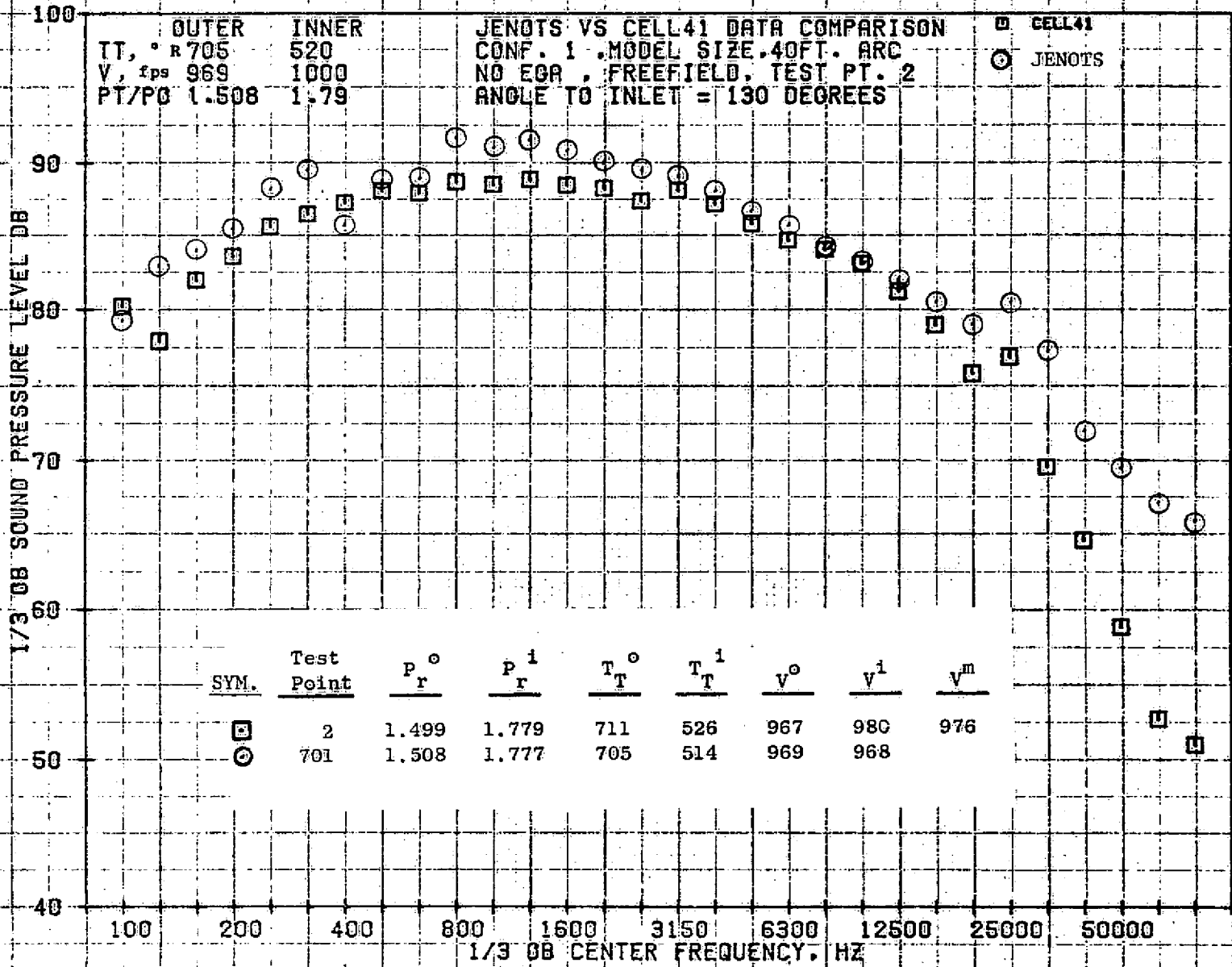
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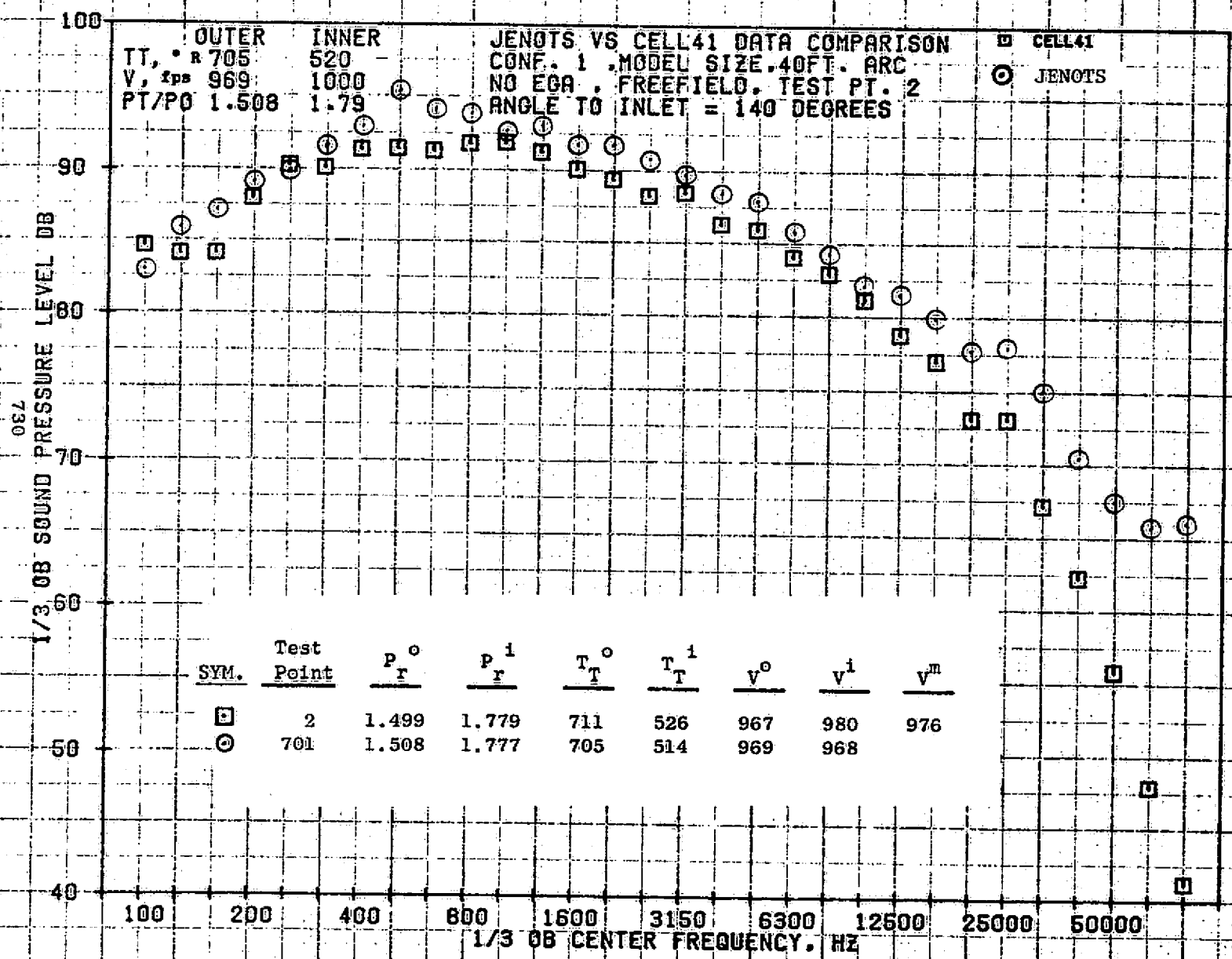
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728



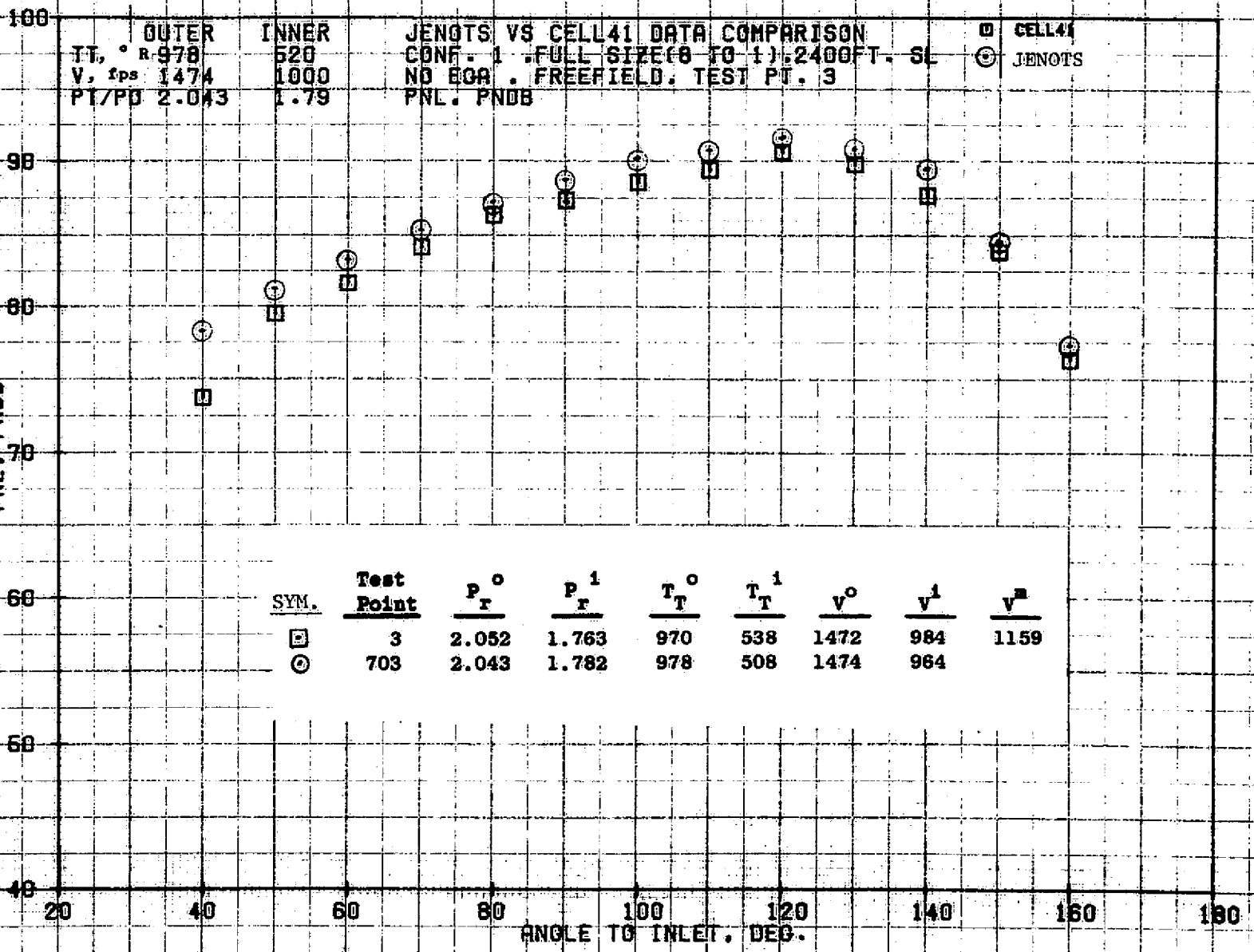




SYM.	Test Point	P_r^o	P_r^i	T_T^o	T_T^i	V^o	V^i	V^n
□	2	1.499	1.779	711	526	967	980	976
○	701	1.508	1.777	705	514	969	968	

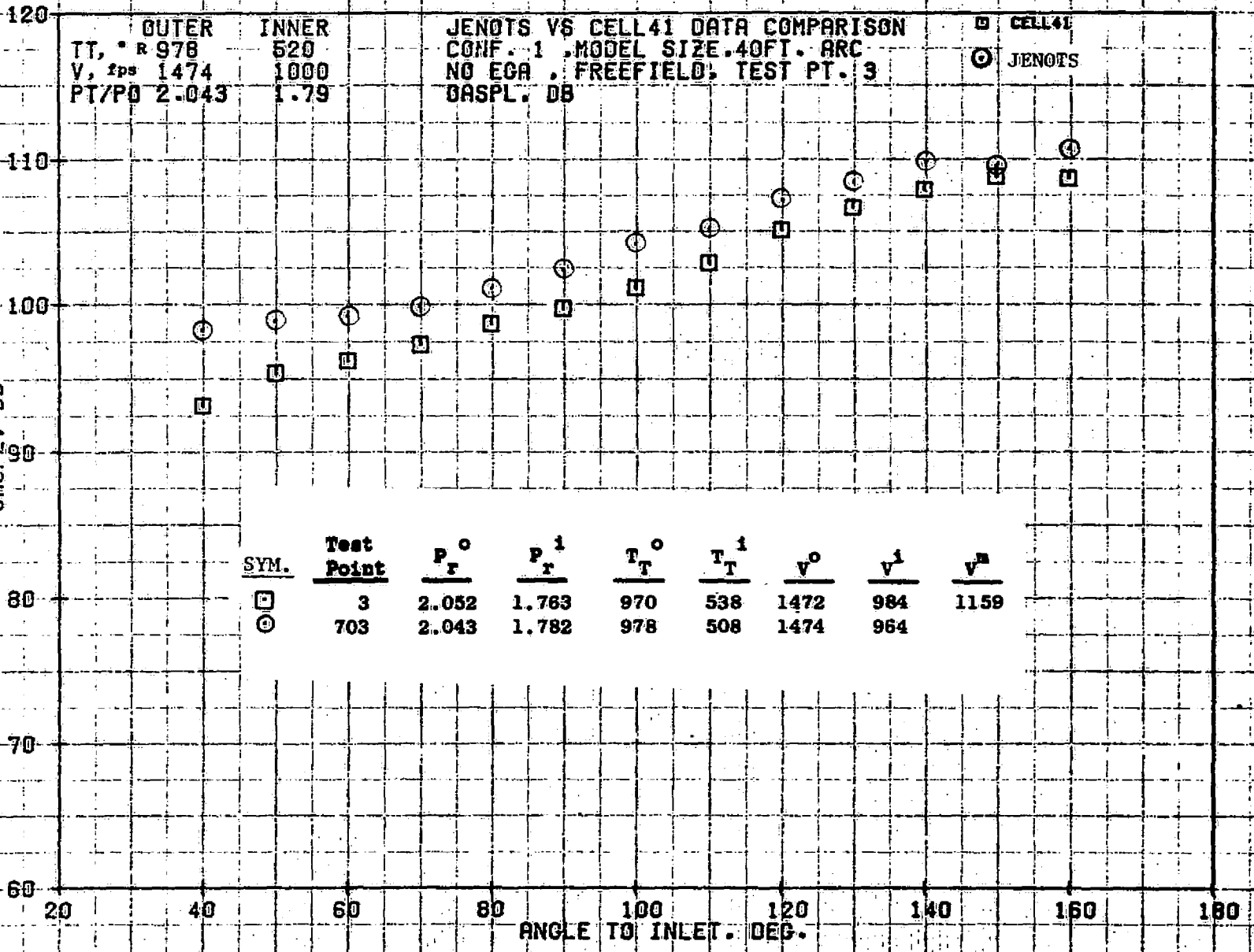
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PNL. PNDB

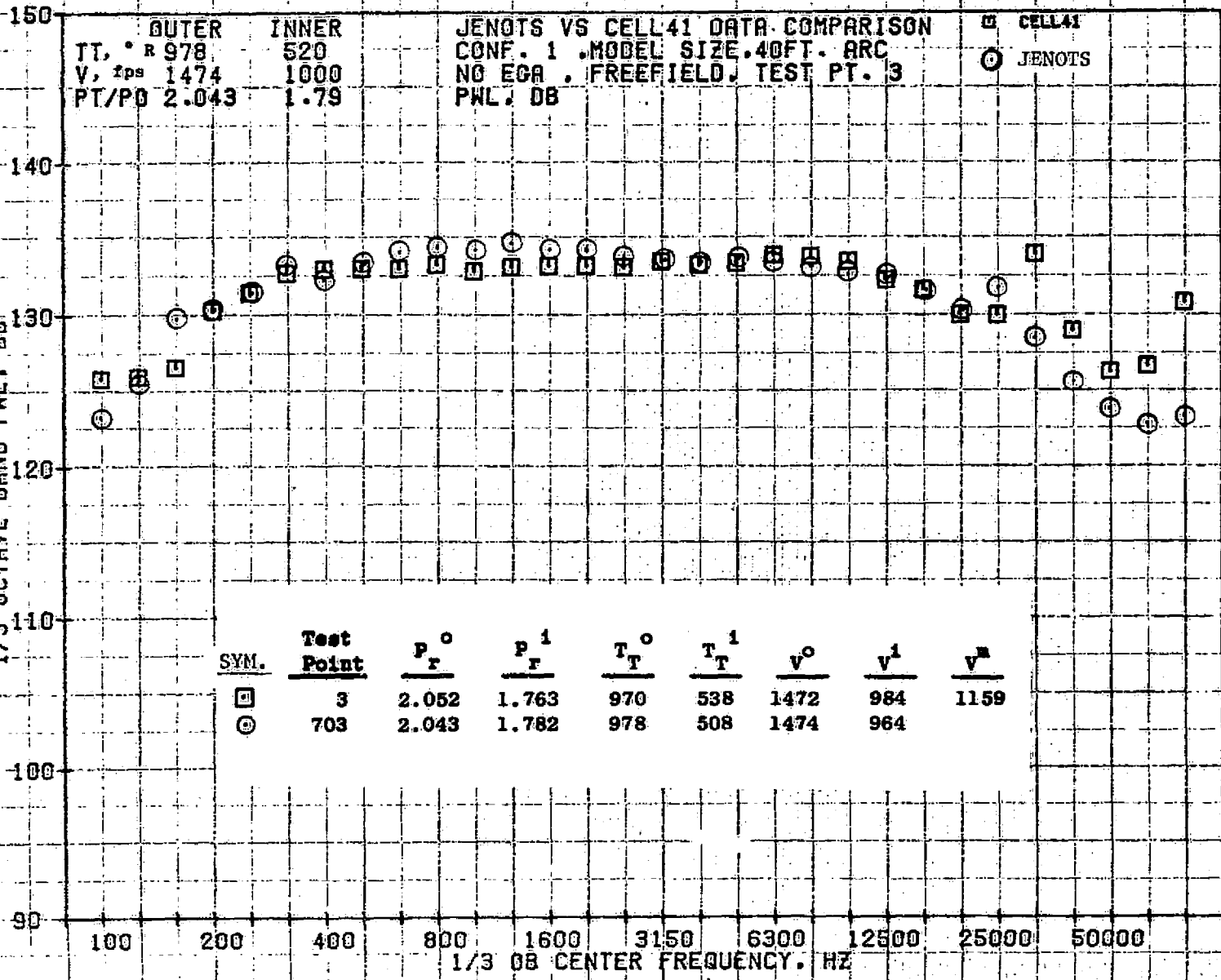


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73KOLLSTEDT



783
1/3 OCTAVE BAND PWL, DB



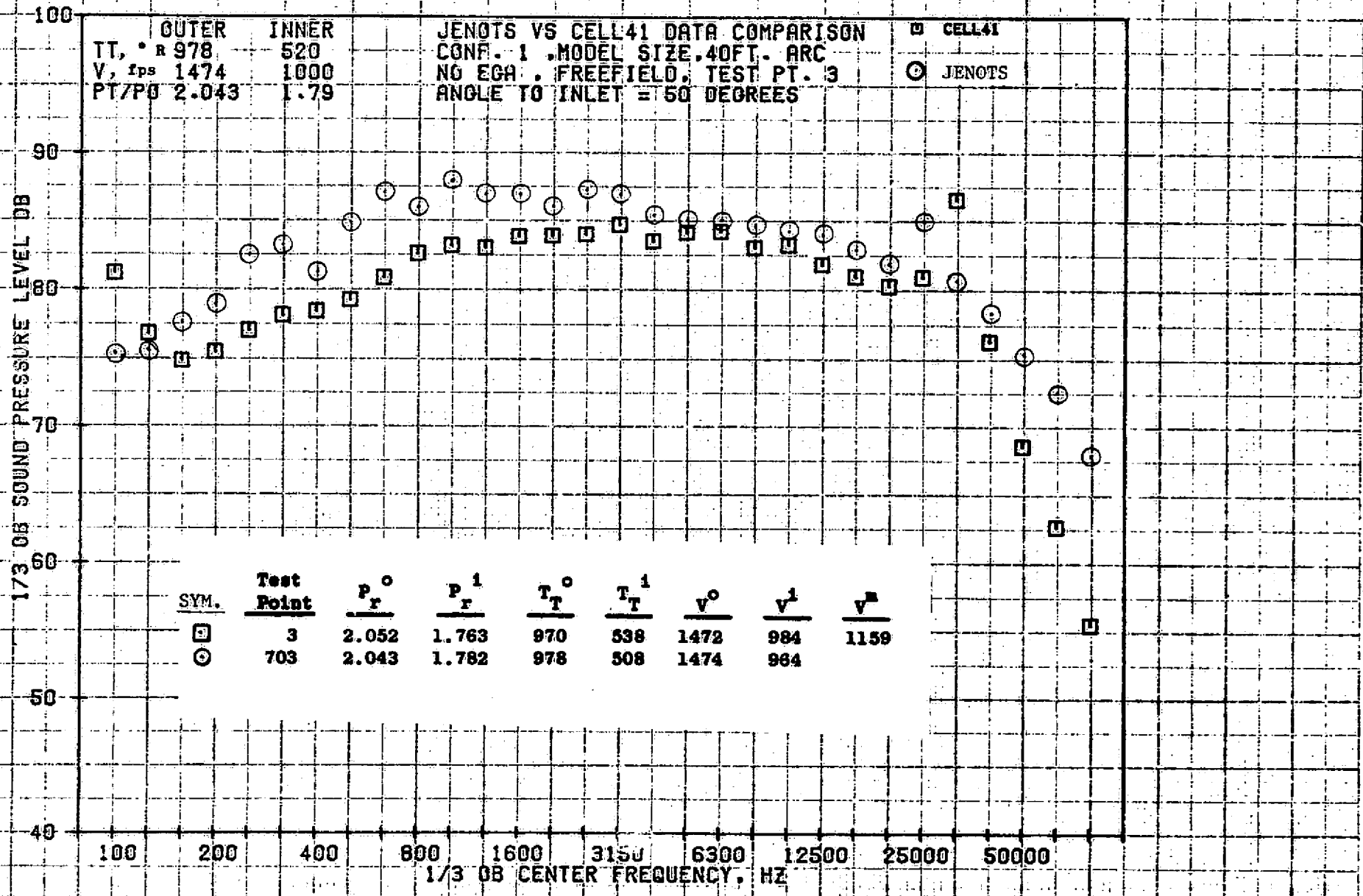
OUTER INNER
 T_T , ° R 978 520
 V , fps 1474 1000
 P_T/P_D 2.043 1.79

JENOTS VS CELL41 DATA COMPARISON
 CONF. 1 MODEL SIZE 40FT. ARC
 NO EGA. FREEFIELD TEST PT. 3
 PWL, DB

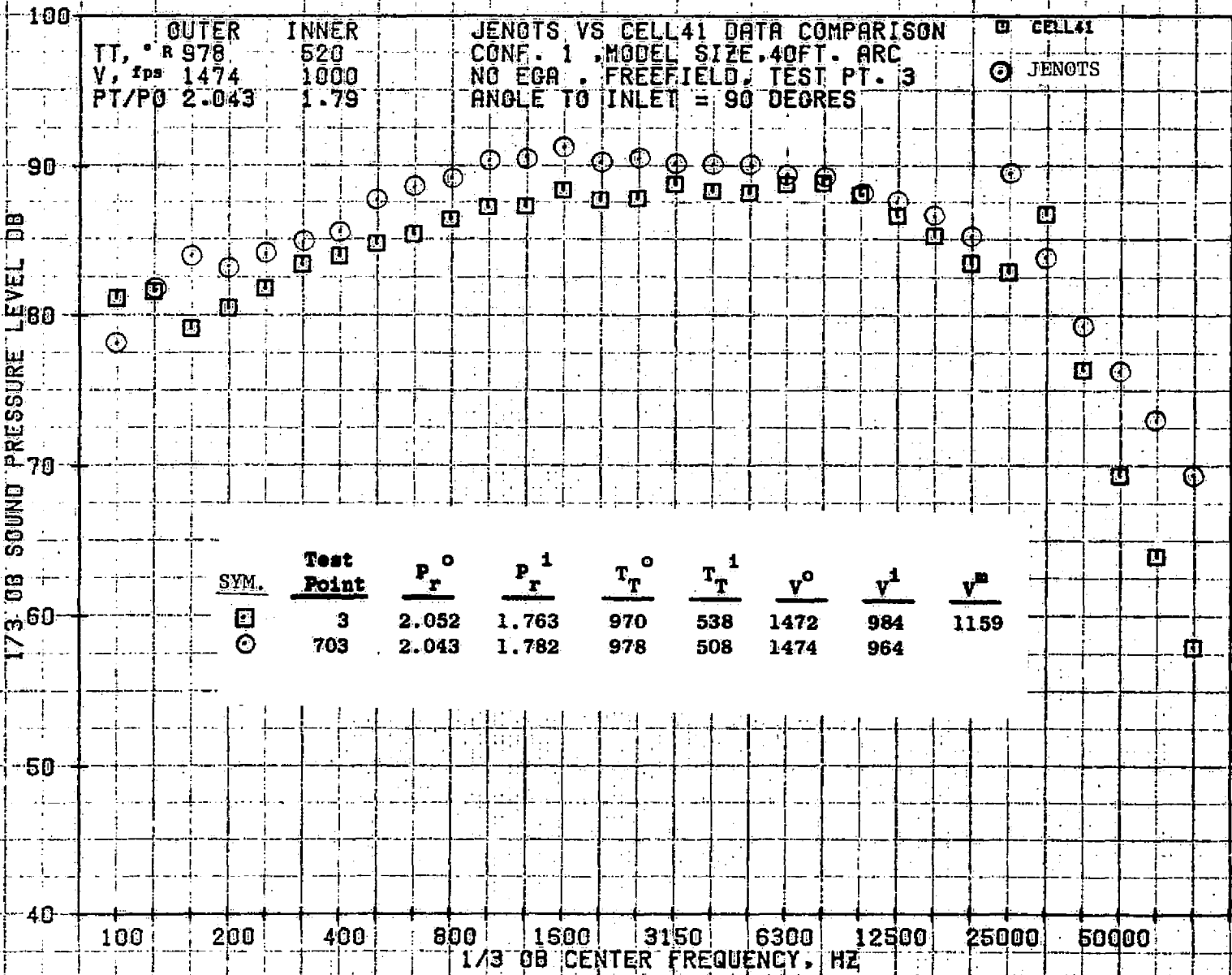
□ CELL41
 ○ JENOTS

1/3 OB CENTER FREQUENCY, HZ

734

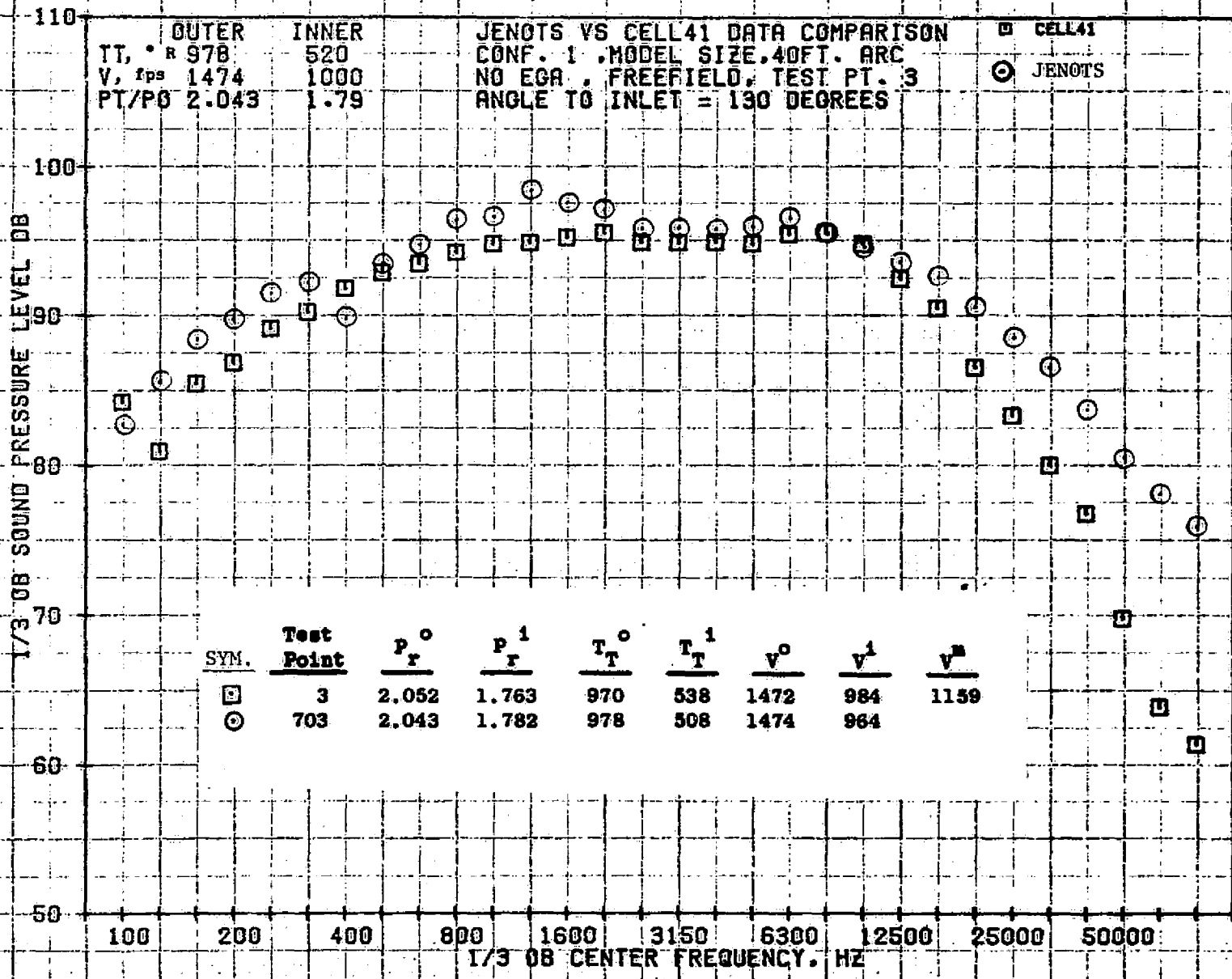


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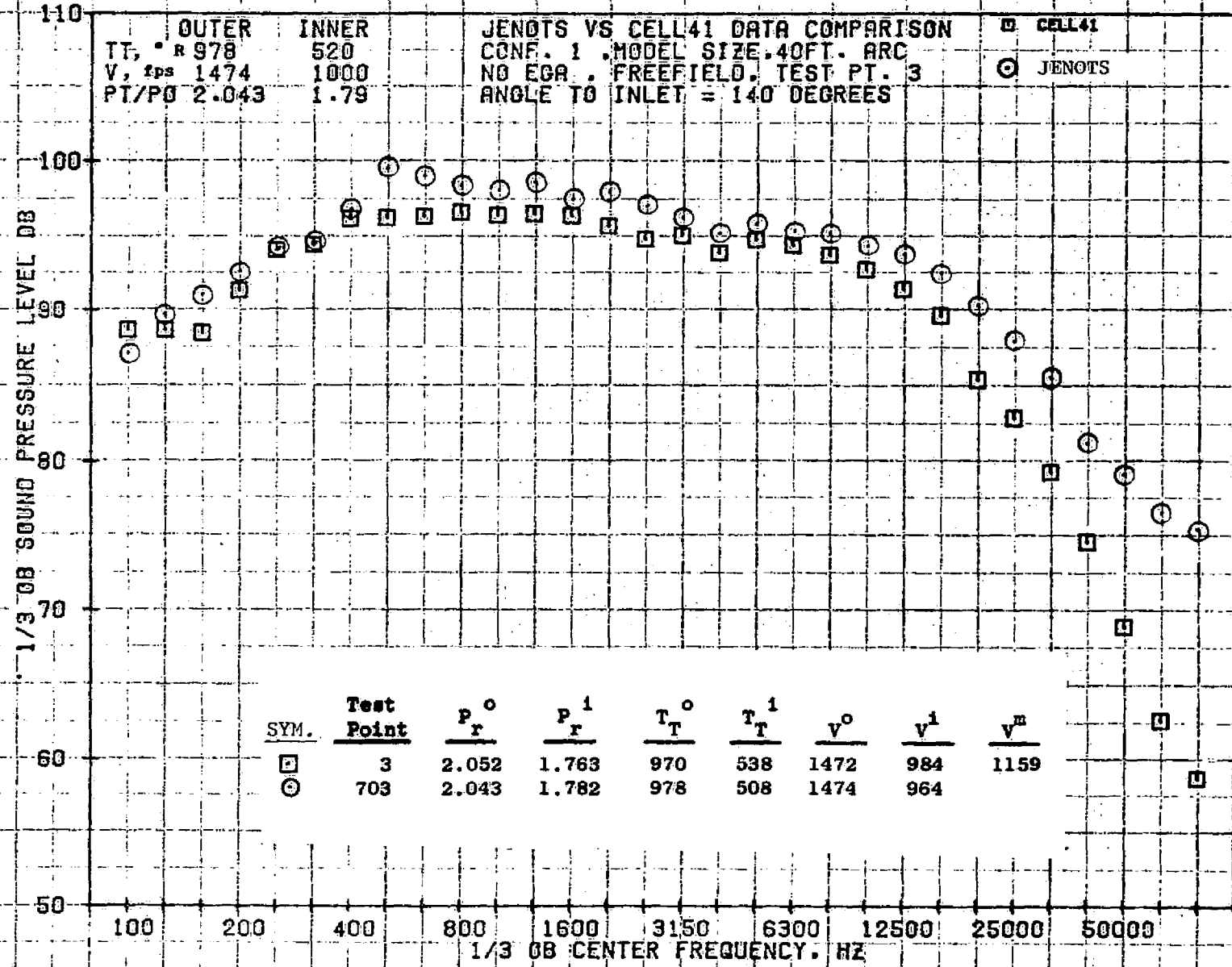


SYM.	Test Point	P_r^0	P_r^1	T_T^0	T_T^1	V^0	V^1	V^2
□	3	2.052	1.763	970	538	1472	984	1159
○	703	2.043	1.782	978	508	1474	964	

736



SYM.	Test Point	P_r^0	P_r^1	T_T^0	T_T^1	V^0	V^1	V^2
□	3	2.052	1.763	970	538	1472	984	1159
○	703	2.043	1.782	978	508	1474	964	



110

OUTER
TT, ° R 1356
V, fps 2018
PT/PD 2.71

INNER
520
1000
1.79

JENOTS VS CELL41 DATA COMPARISON
CONF - 1, FULL SIZE 08 TO 11, 2400FT. SL
NO EGA, FREEFIELD, TEST PT. 4
PNL, PNDB

□ CELL41
⊙ JENOTS

100

90

PNL, PNDB

738

70

60

50

20

40

60

80

100

120

140

160

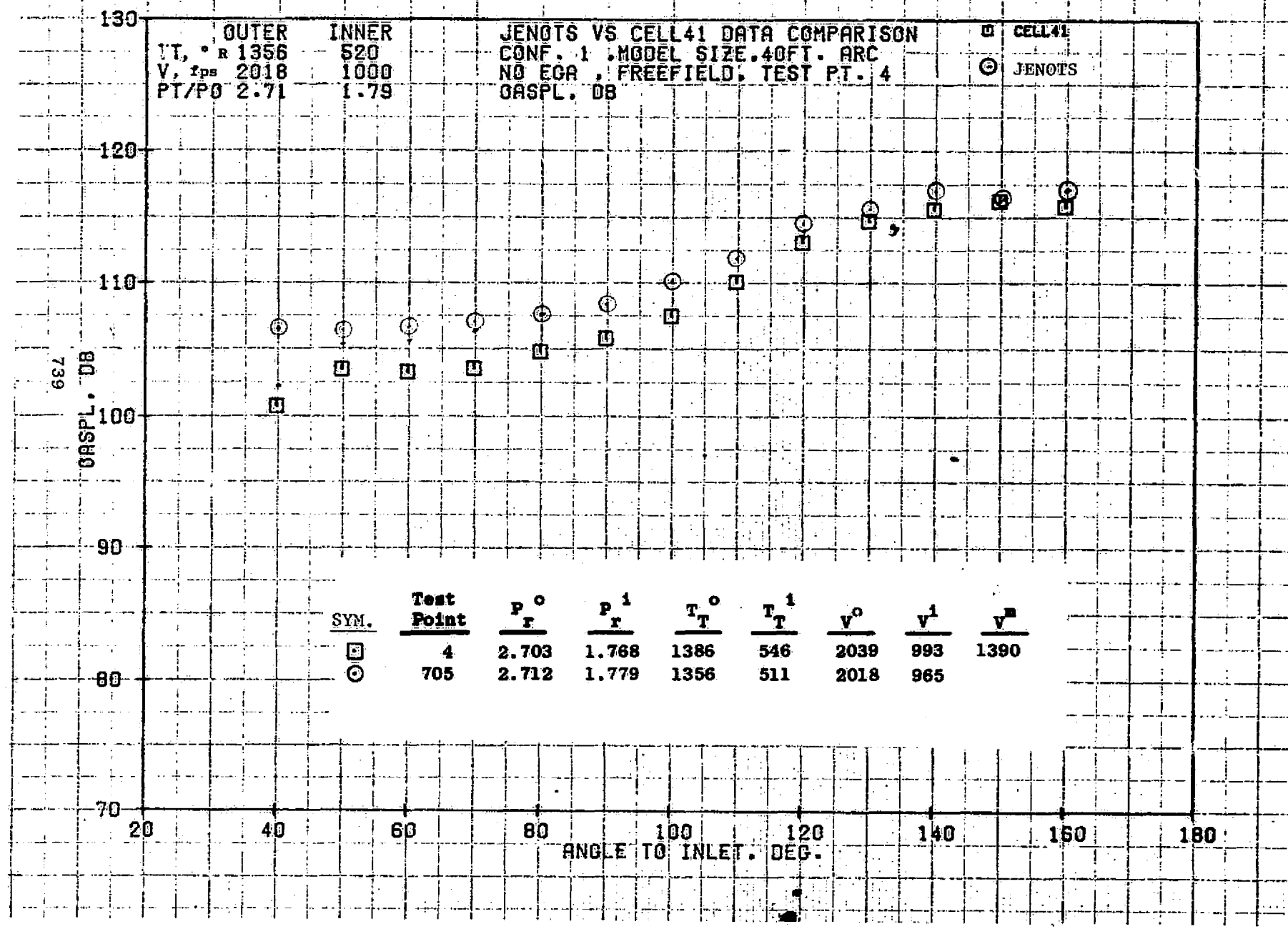
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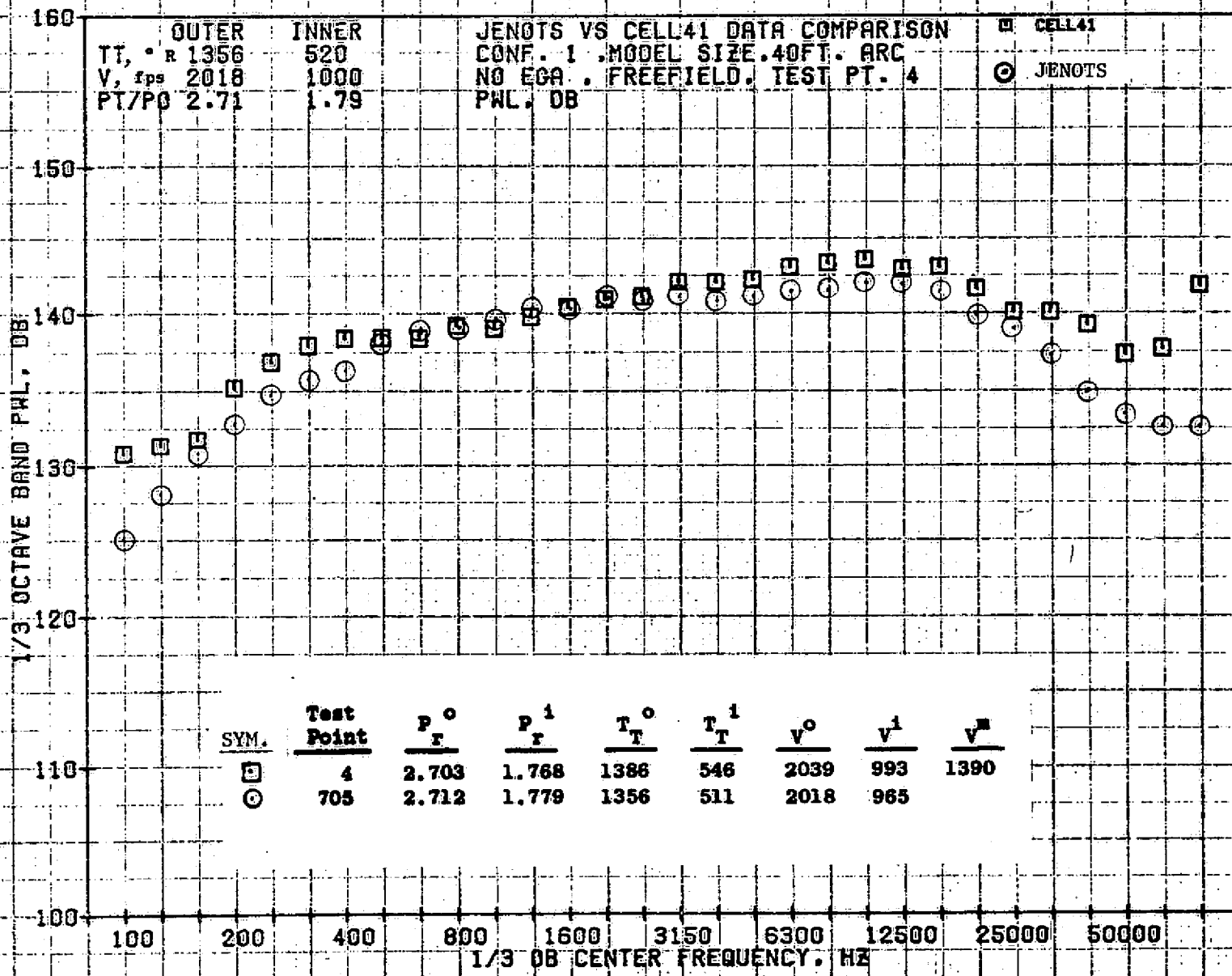
ANGLE TO INLET, DEG.

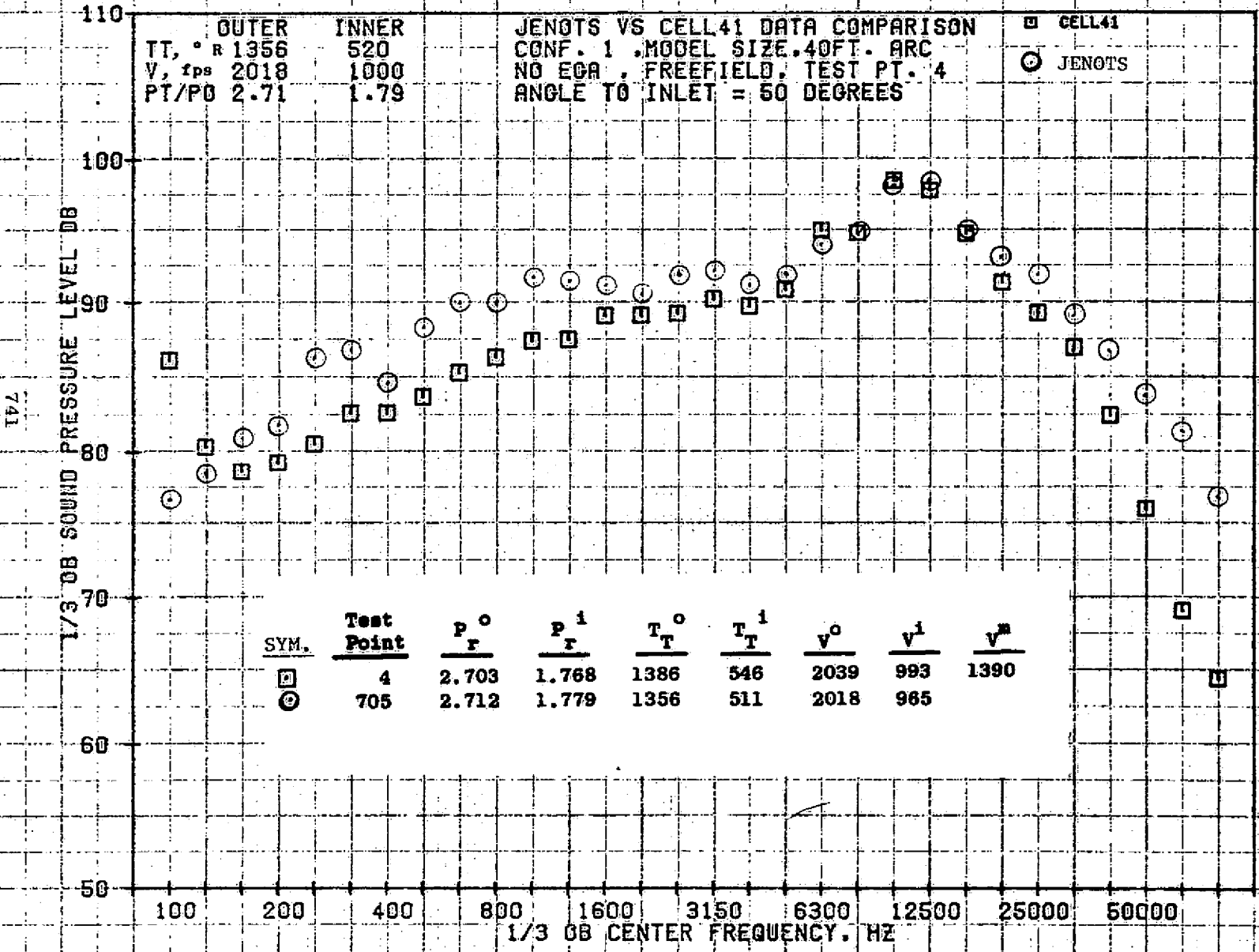
SYM.	Test Point	P_r^o	P_r^i	T_T^o	T_T^i	V^o	V^i	V^m
□	4	2.703	1.768	1386	546	2036	993	1390
⊙	705	2.712	1.779	1356	511	2018	965	

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1X583-001

73KOLLSTEDT







OUTER INNER
 TT, ° R 1356 520
 V, fps 2018 1000
 PT/PO 2.71 1.79

JENOTS VS CELL41 DATA COMPARISON
 CONF. 1 .MODEL SIZE .40FT. ARC
 NO EGR , FREEFIELD, TEST PT. 4
 ANGLE TO INLET = 50 DEGREES

□ CELL41
 ○ JENOTS

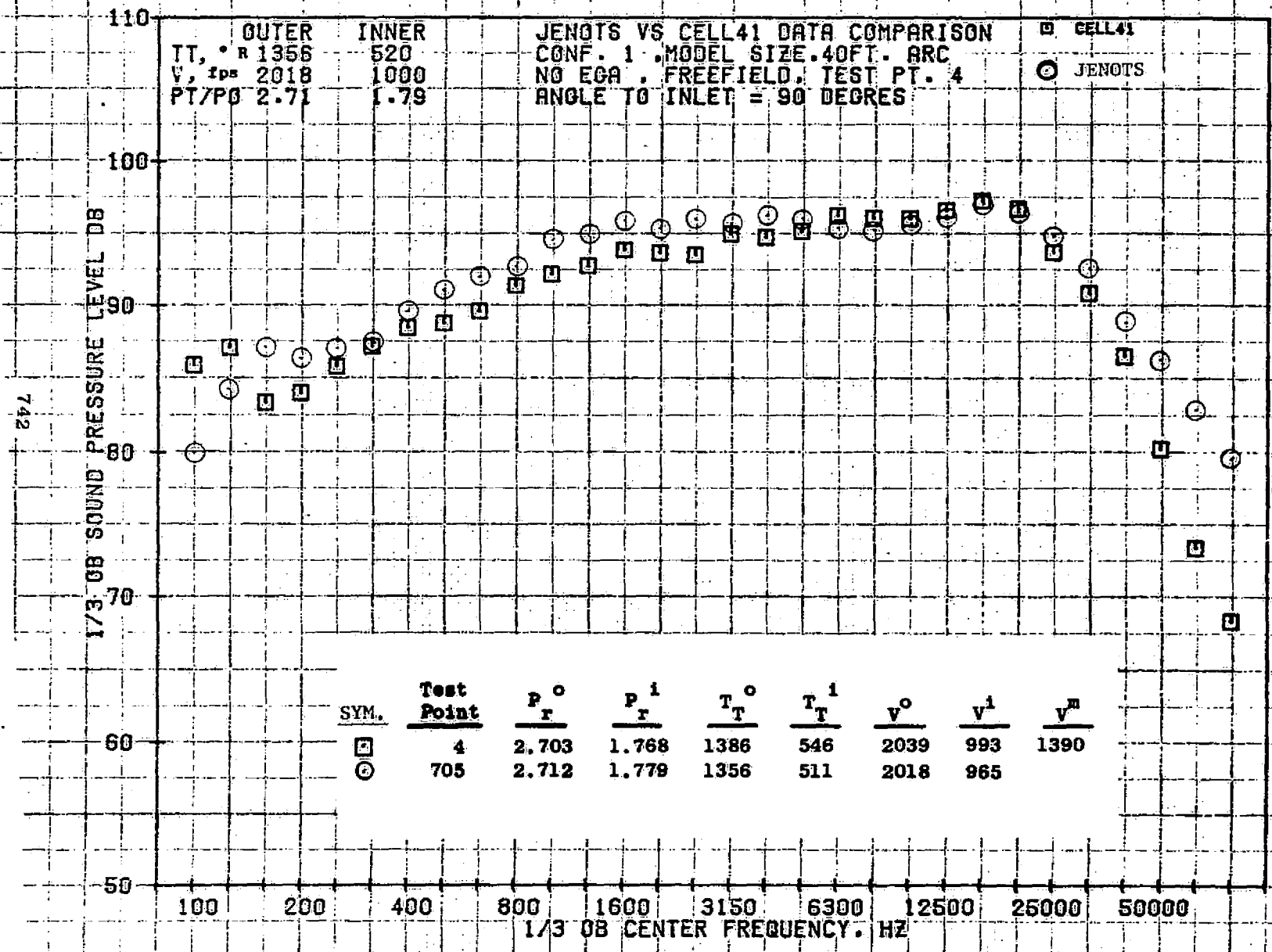
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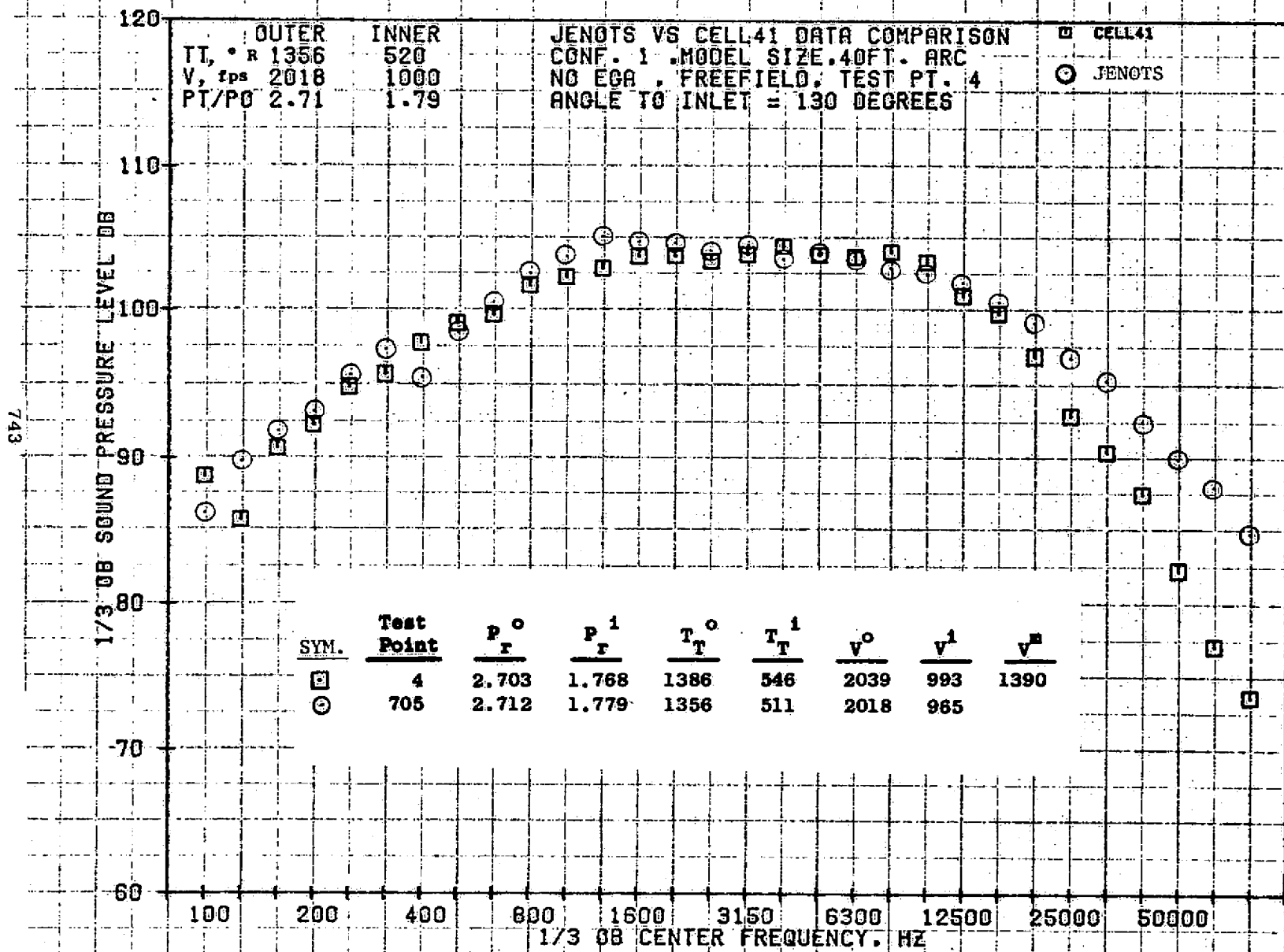
1/3 OB SOUND PRESSURE LEVEL DB

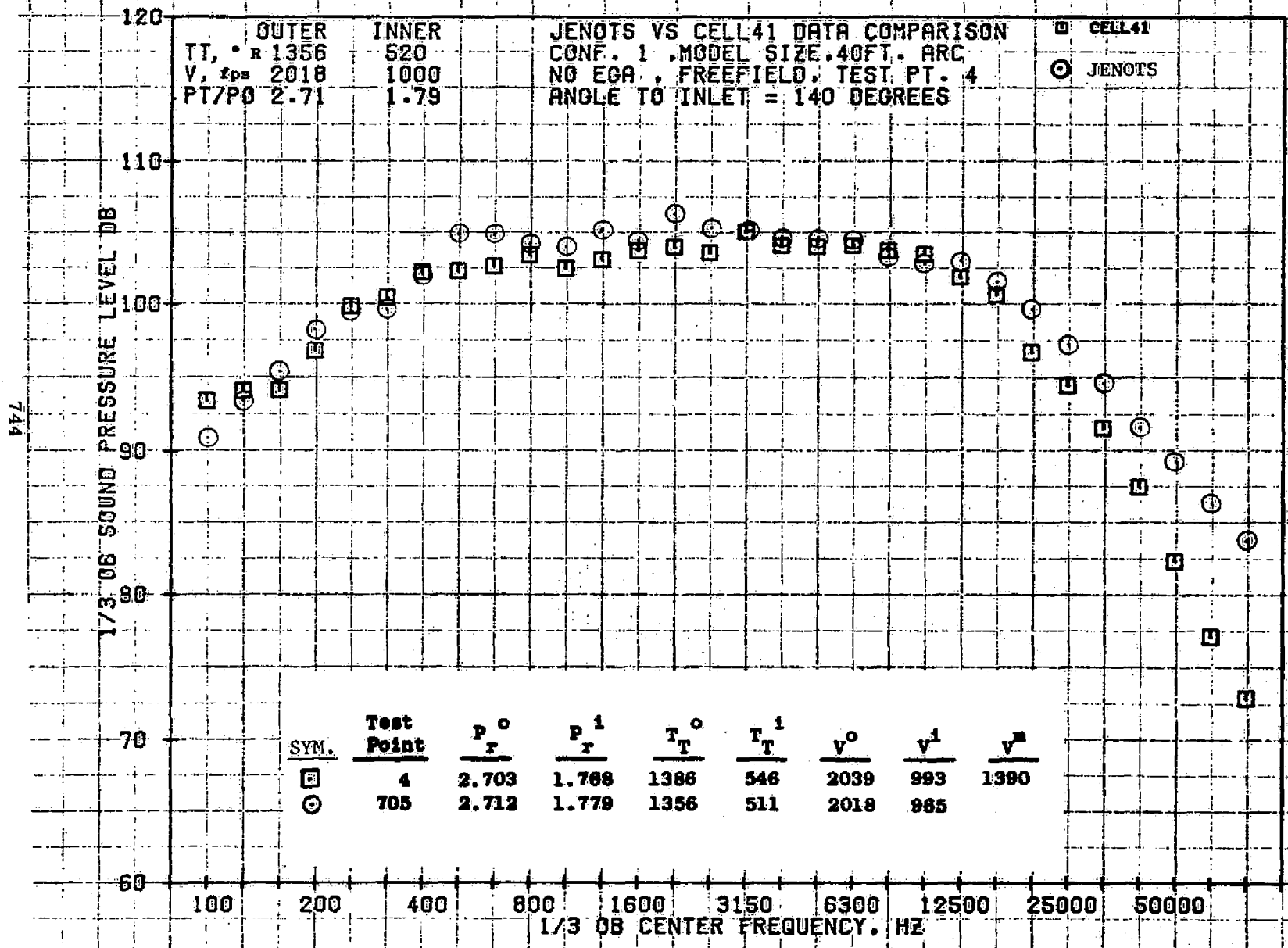
SYM.	Test Point	$\frac{P_r^o}{r}$	$\frac{P_r^i}{r}$	$\frac{T_T^o}{T}$	$\frac{T_T^i}{T}$	$\frac{V^o}{V}$	$\frac{V^i}{V}$	$\frac{V^m}{V}$
□	4	2.703	1.768	1386	546	2039	993	1390
○	705	2.712	1.779	1356	511	2018	965	

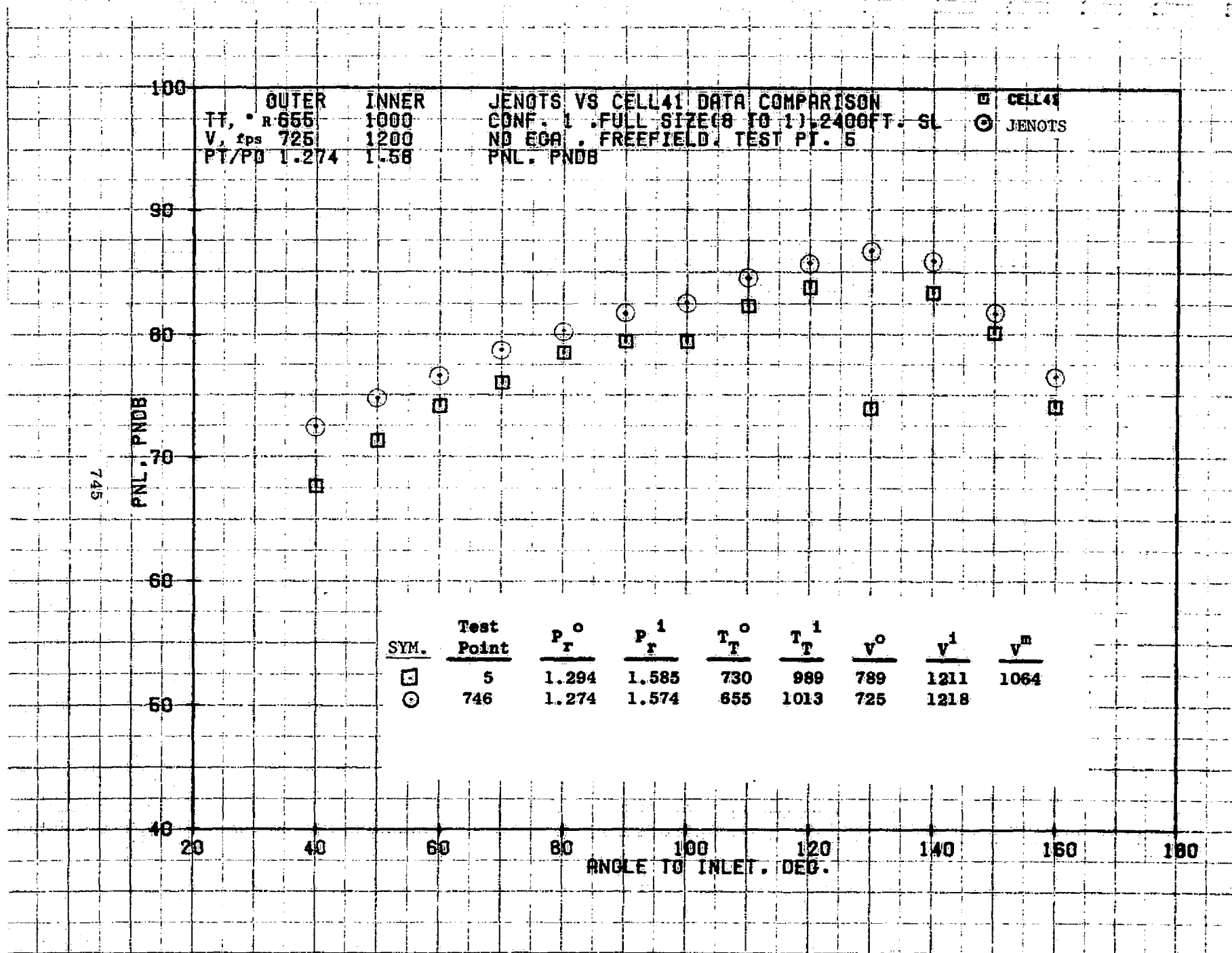
100 200 400 800 1600 3150 6300 12500 25000 50000

1/3 OB CENTER FREQUENCY. HZ





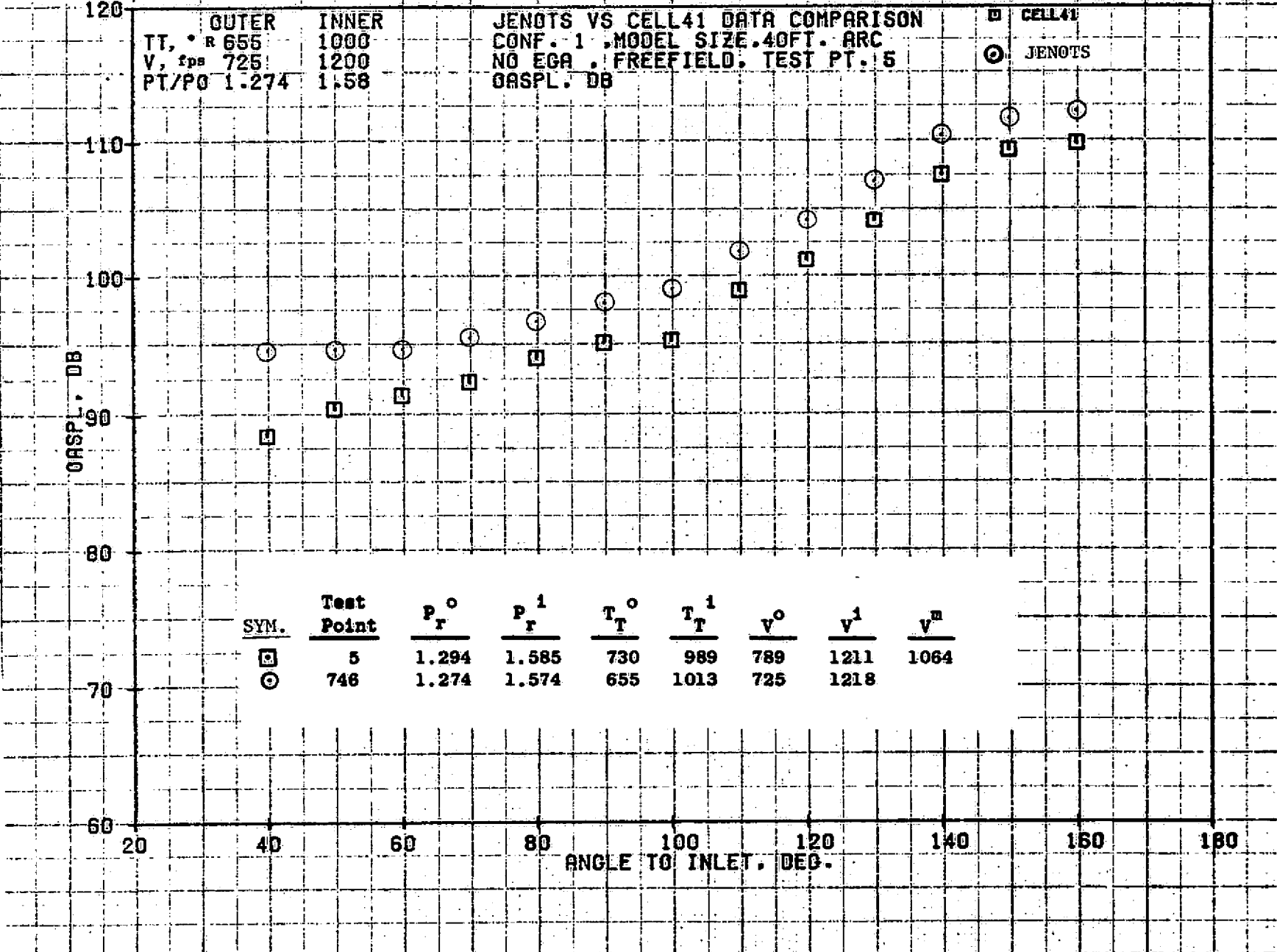




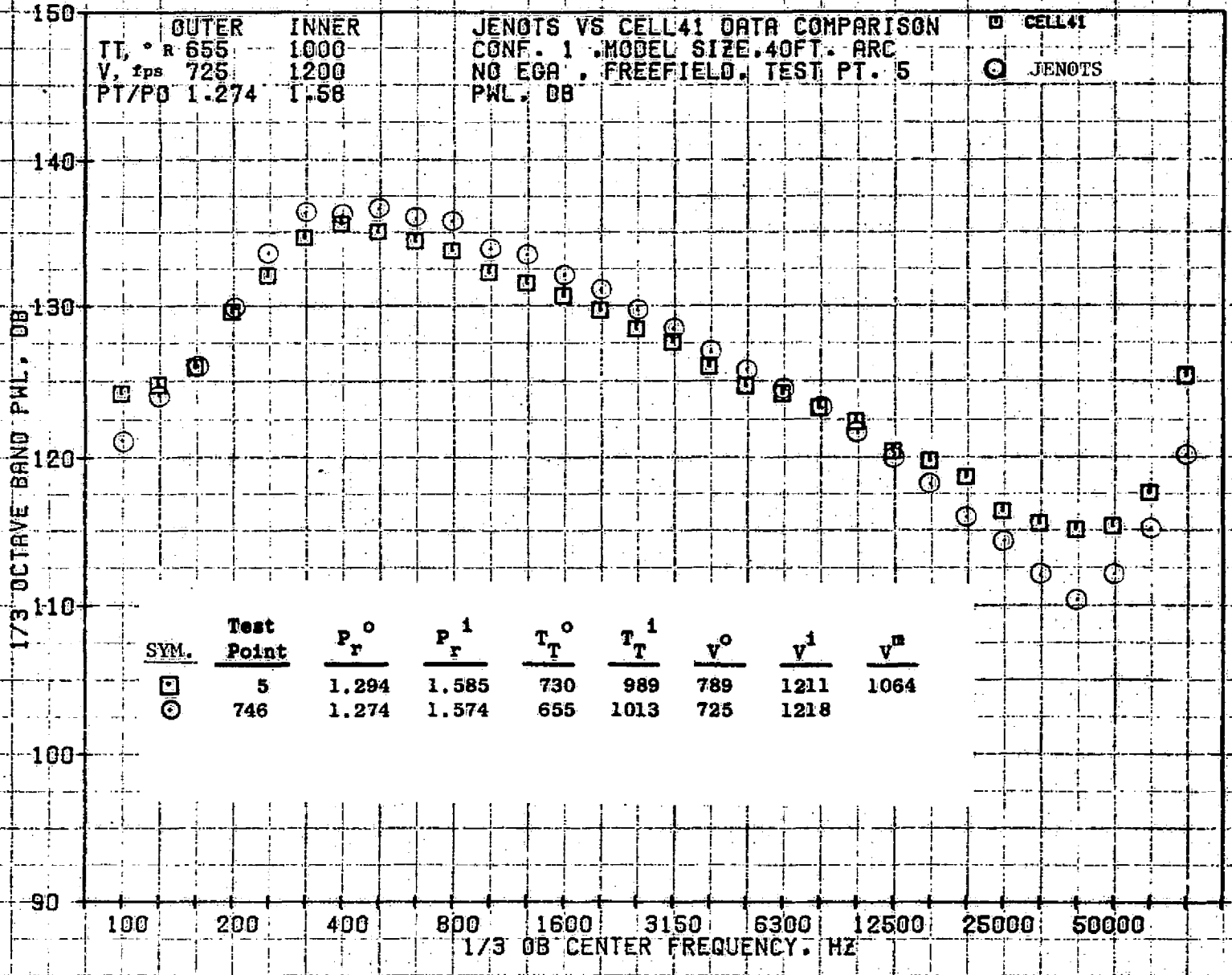
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746



747



OUTER
 T_T^0 R 655
 V , fps 725
 PT/PO 1.274

INNER
 1000
 1200
 1.58

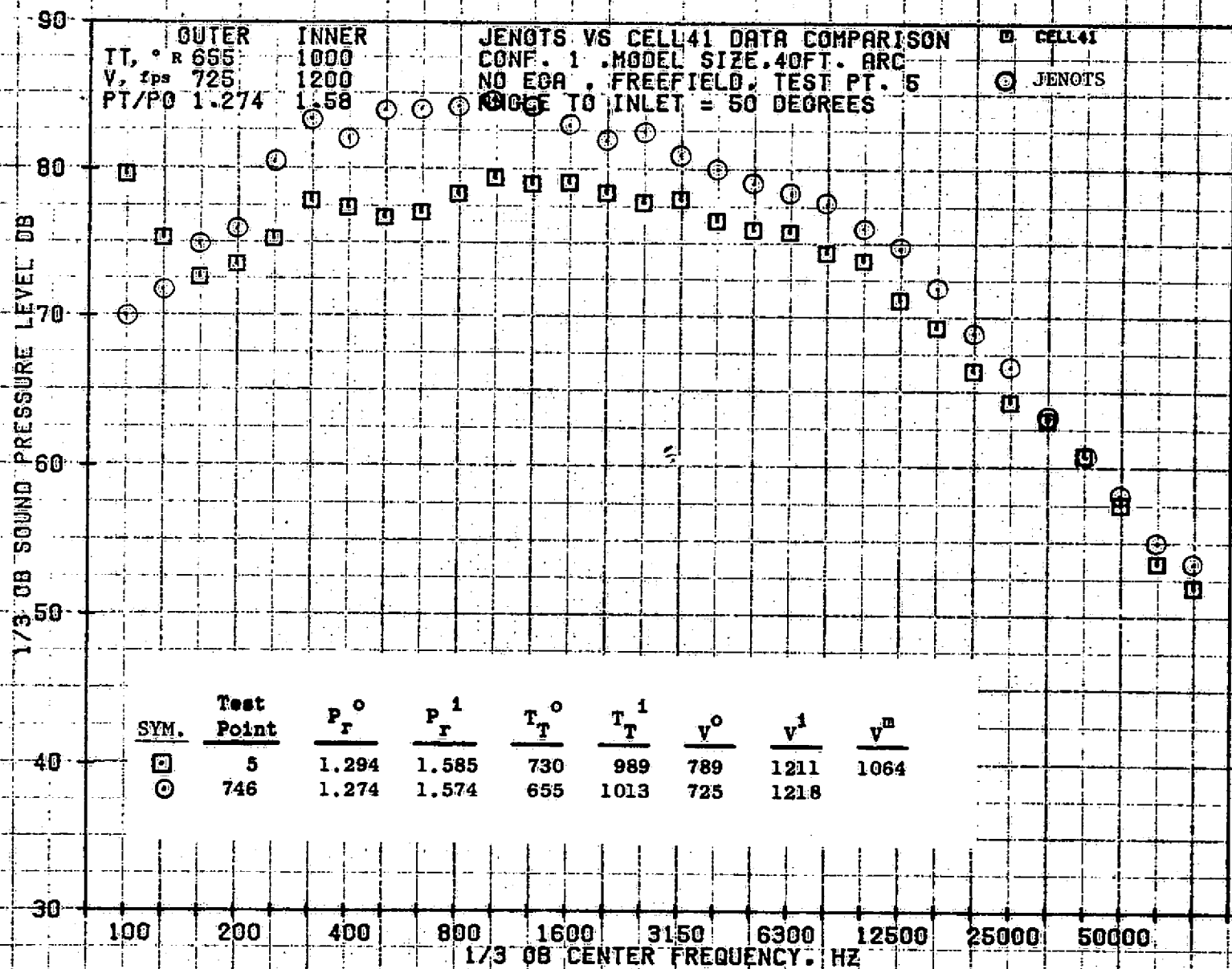
JENOTS VS CELL 41 DATA COMPARISON
 CONF. 1 MODEL SIZE 40FT. ARC
 NO EGA FREEFIELD TEST PT. 5
 PWL, DB

□ CELL 41
 ○ JENOTS

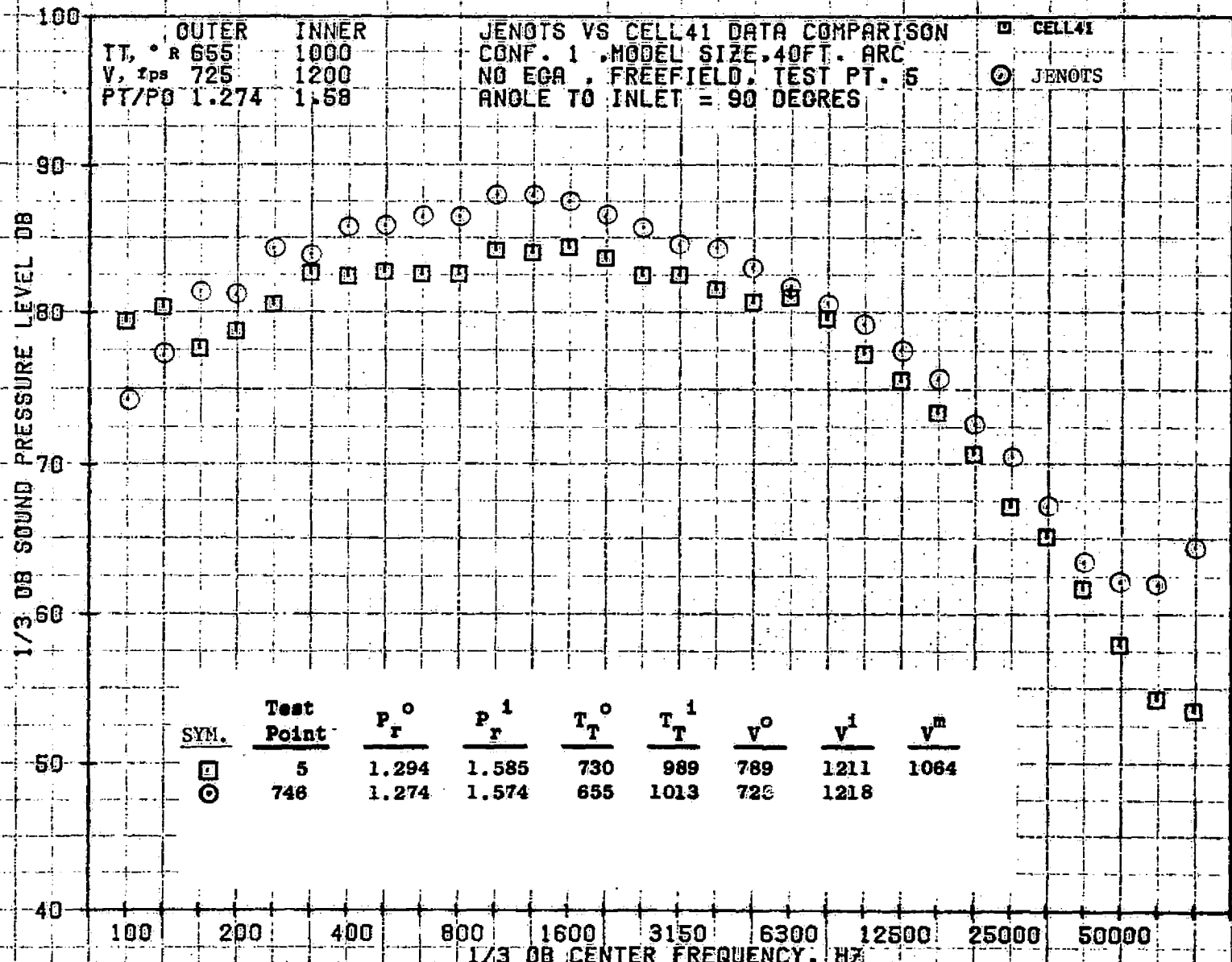
1/3 OCTAVE BAND PWL, DB

100 200 400 800 1600 3150 6300 12500 25000 50000
 1/3 OB CENTER FREQUENCY, HZ

748



749



OUTER
 $T_T, \text{ } ^\circ R$ 655
 $V, \text{ fps}$ 725
 PT/P_0 1.274

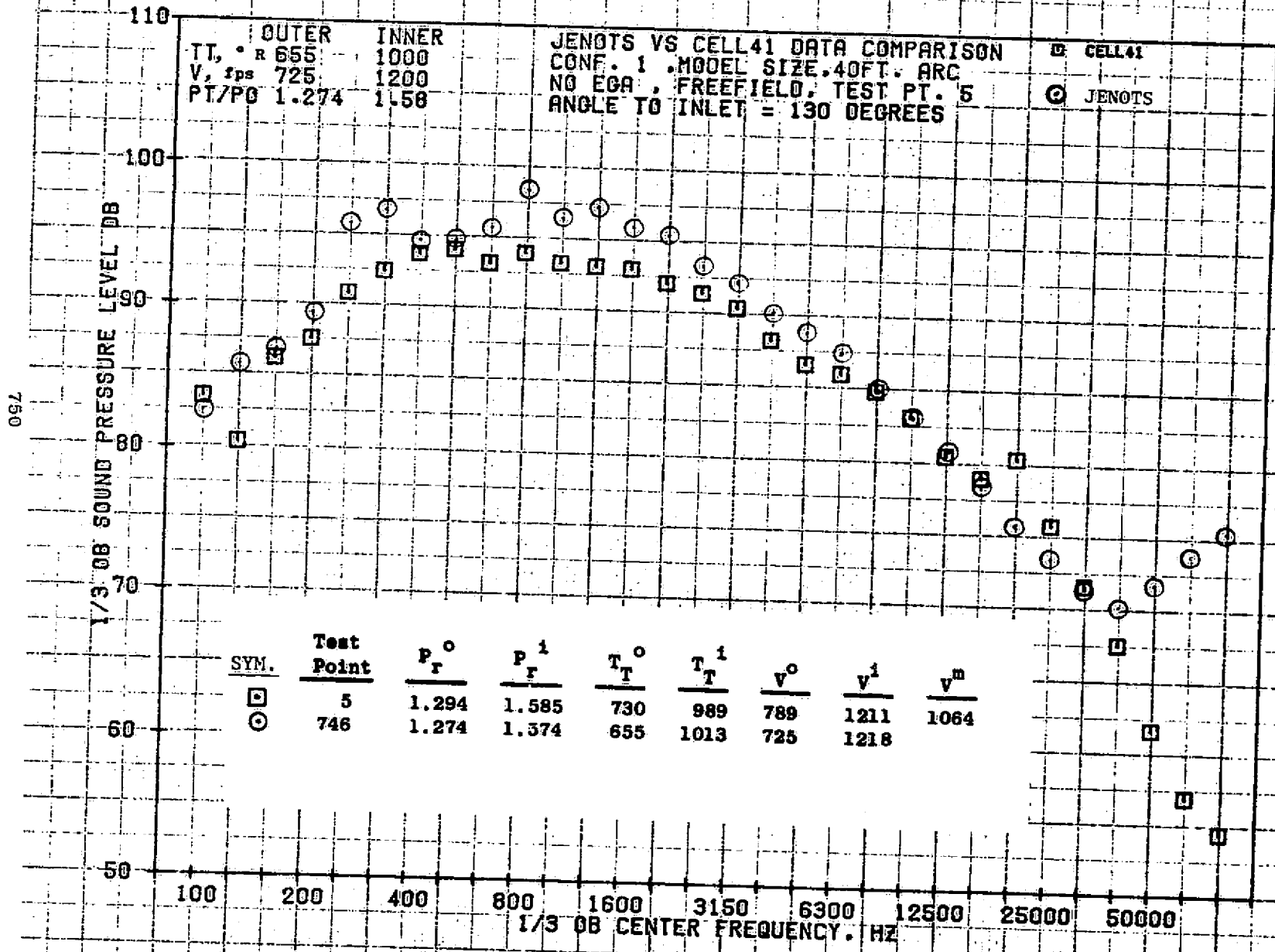
INNER
 1000
 1200
 1.58

JENOTS VS CELL41 DATA COMPARISON
 CONF. 1, MODEL SIZE, 40FT. ARC
 NO EGA, FREEFIELD, TEST PT. 5
 ANGLE TO INLET = 90 DEGREES

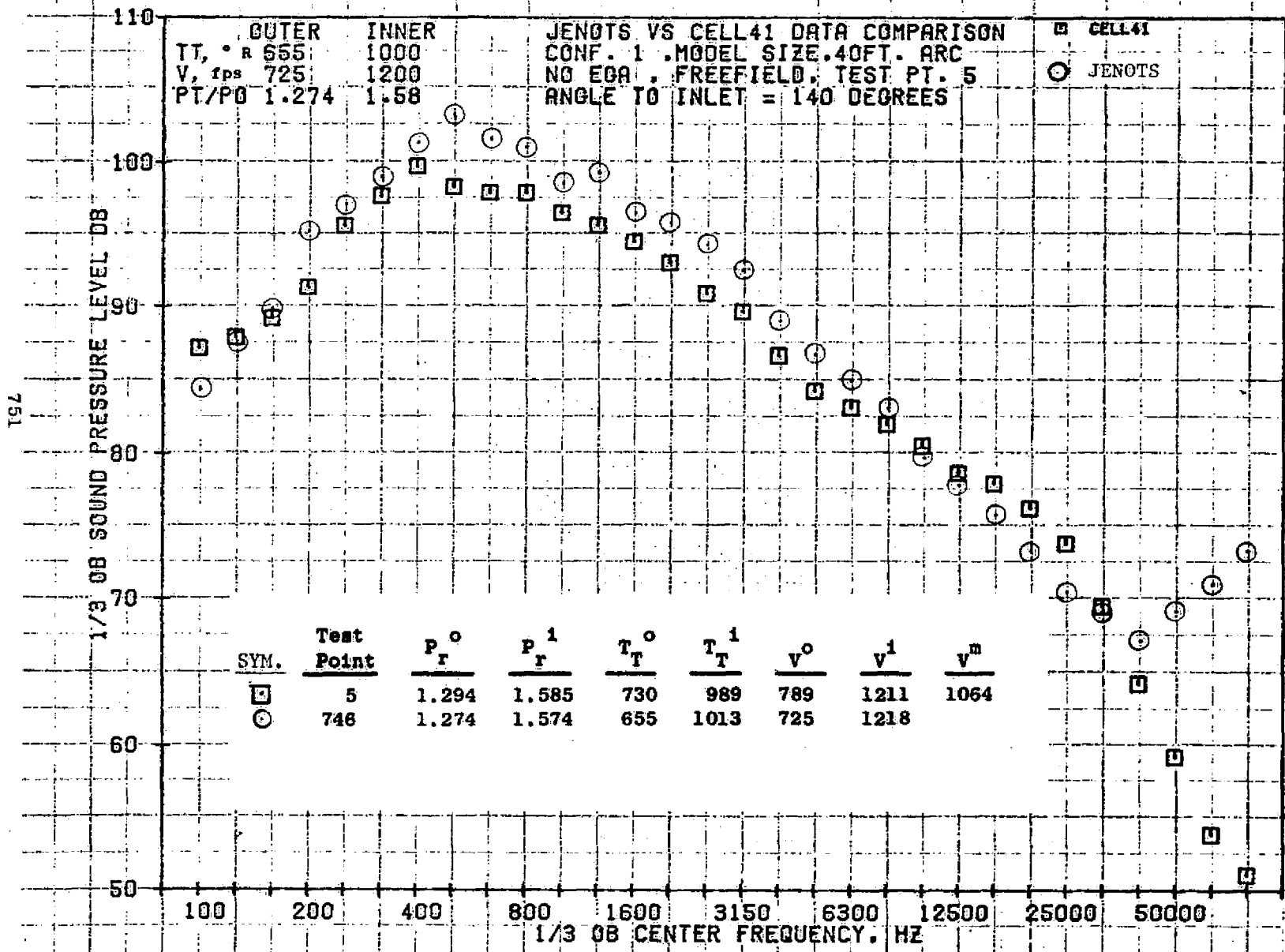
□ CELL41
 ○ JENOTS

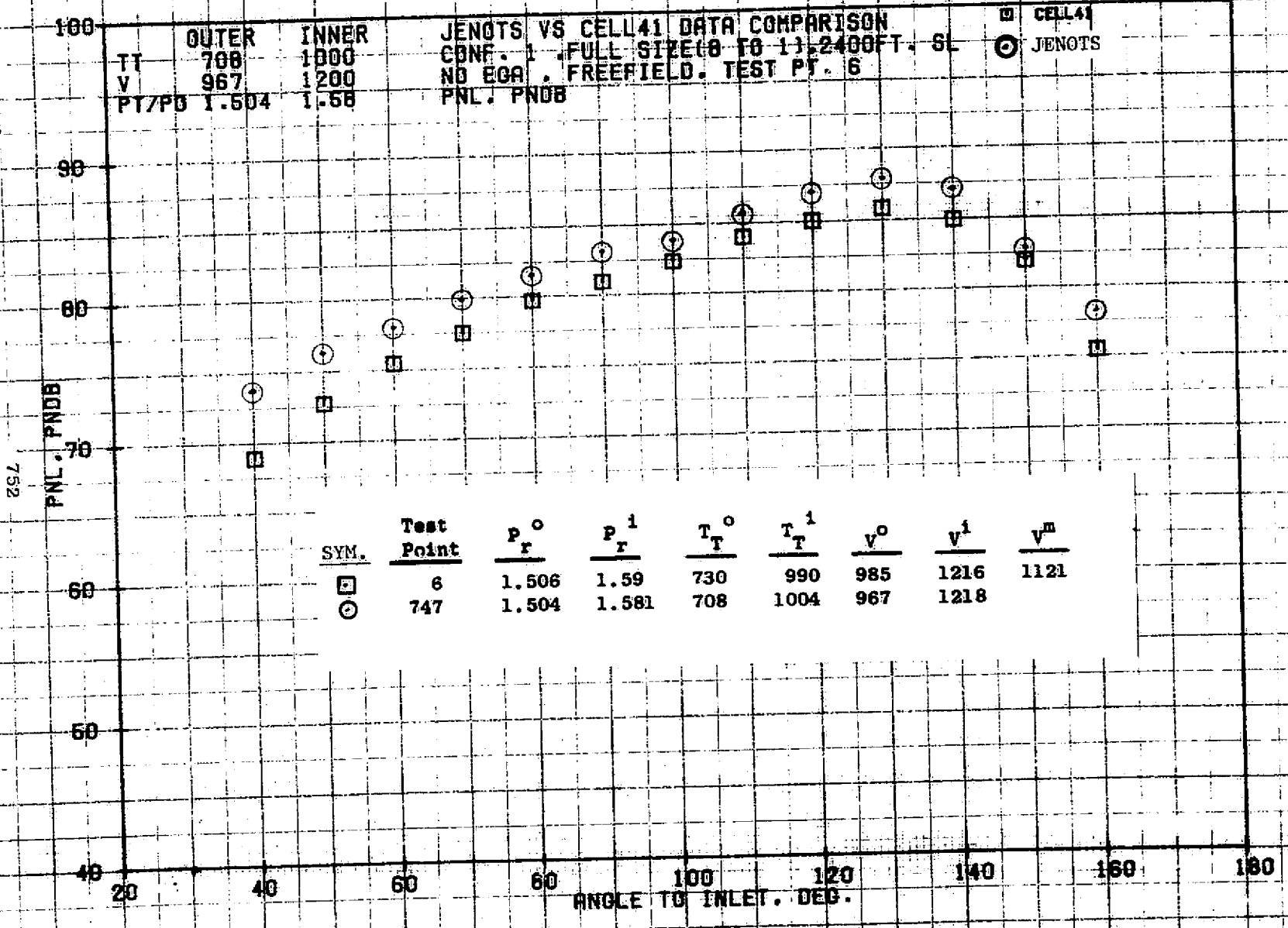
SYM.	Test Point	P_r^0	P_r^1	T_T^0	T_T^1	V^0	V^1	V^m
□	5	1.294	1.585	730	989	789	1211	1064
○	748	1.274	1.574	655	1013	728	1218	

100 200 400 800 1600 3150 6300 12500 25000 50000
 1/3 OB CENTER FREQUENCY, HZ



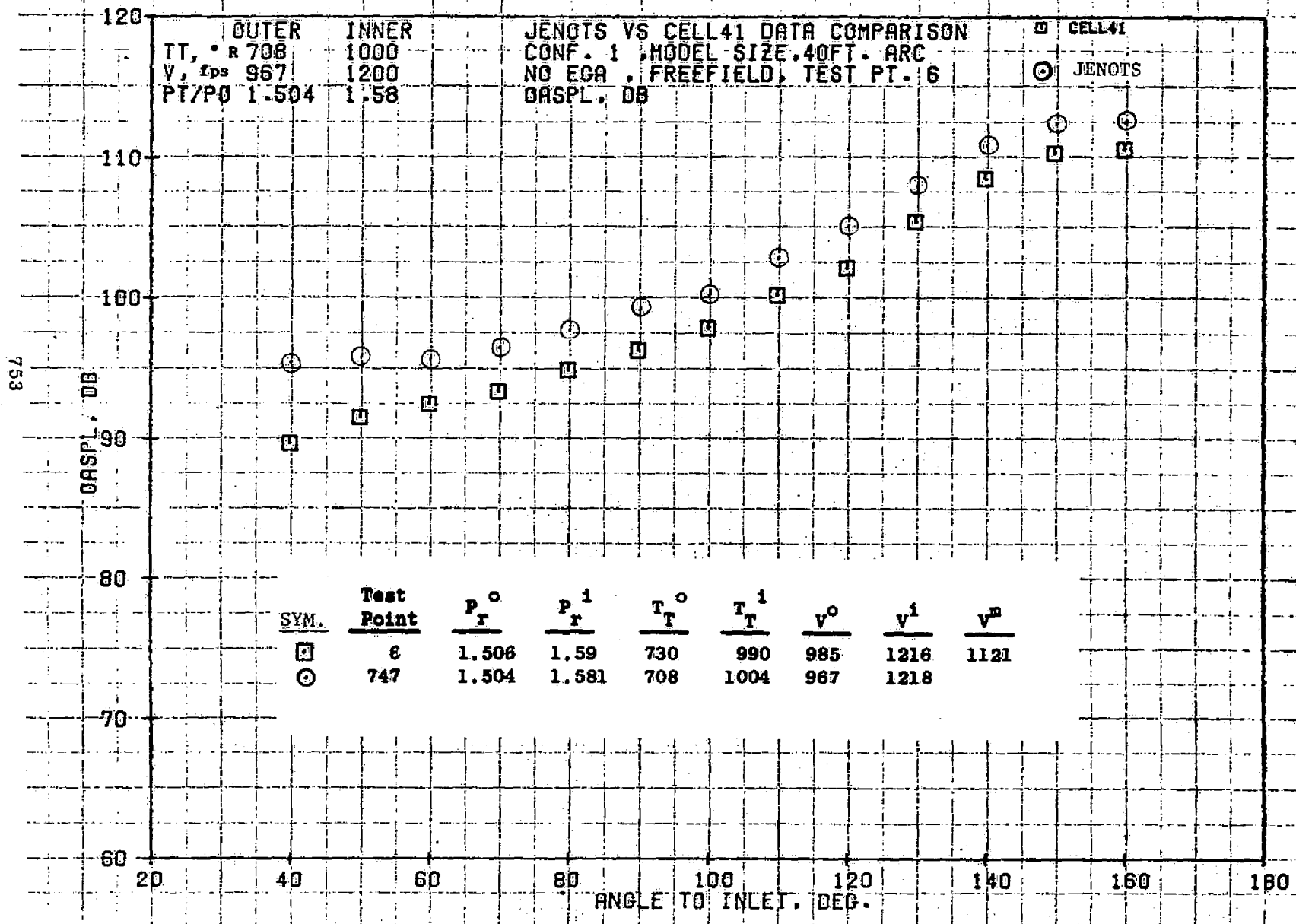
SYM.	Test Point	P_r^o	P_r^i	T_T^o	T_T^i	V^o	V^i	V^m
□	5	1.294	1.585	730	989	789	1211	1064
○	746	1.274	1.374	655	1013	725	1218	

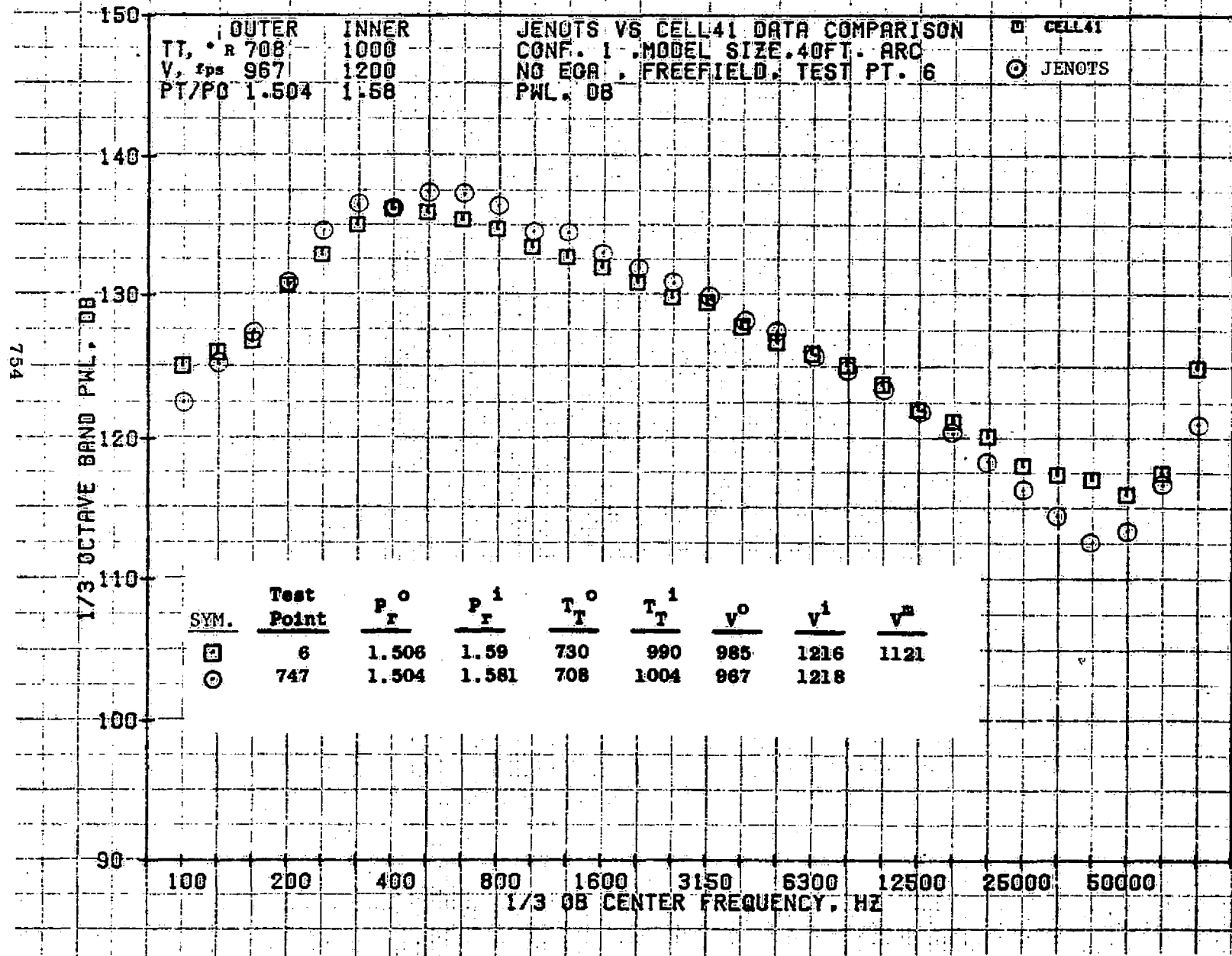


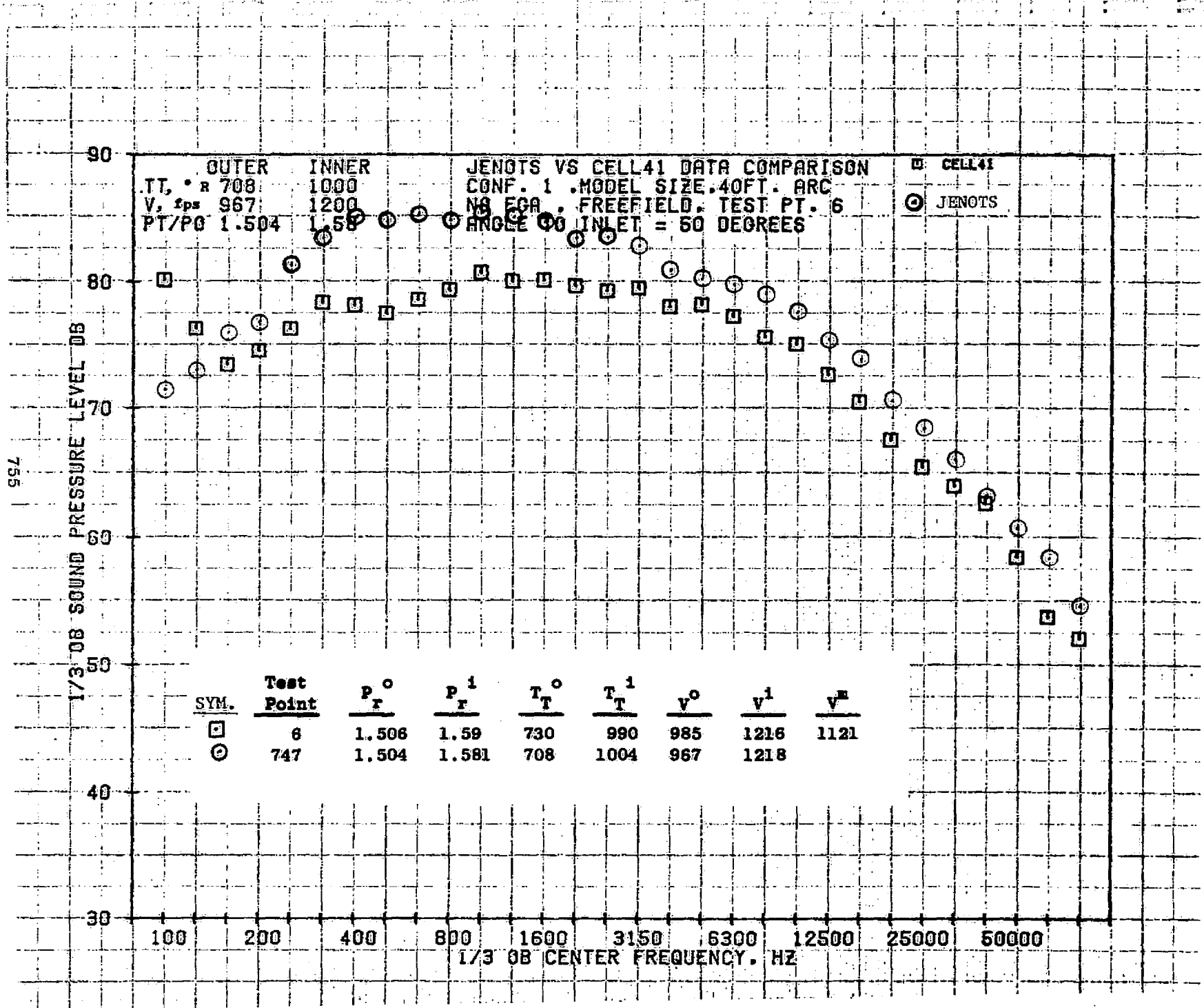


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73KOLLSTEDT







OUTER INNER
 TT, ° R 708 1000
 V, fps 967 1200
 PT/PG 1.504 1.58

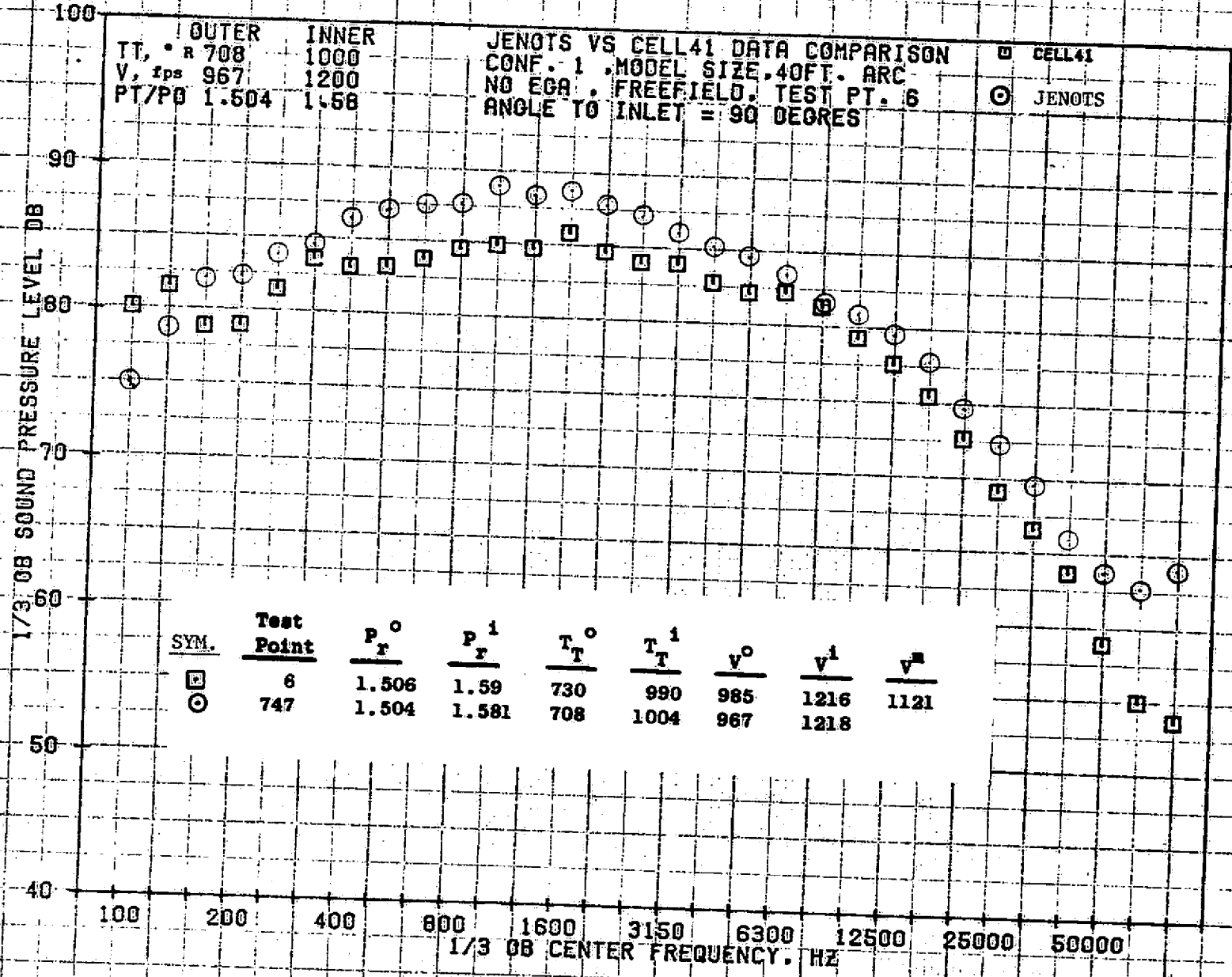
JENOTS VS CELL41 DATA COMPARISON
 CONF. 1 .MODEL SIZE.40FT. ARC
 NS ECA . FREEFIELD. TEST PT. 6
 ANGLE 30 INLET = 50 DEGREES

□ CELL41
 ○ JENOTS

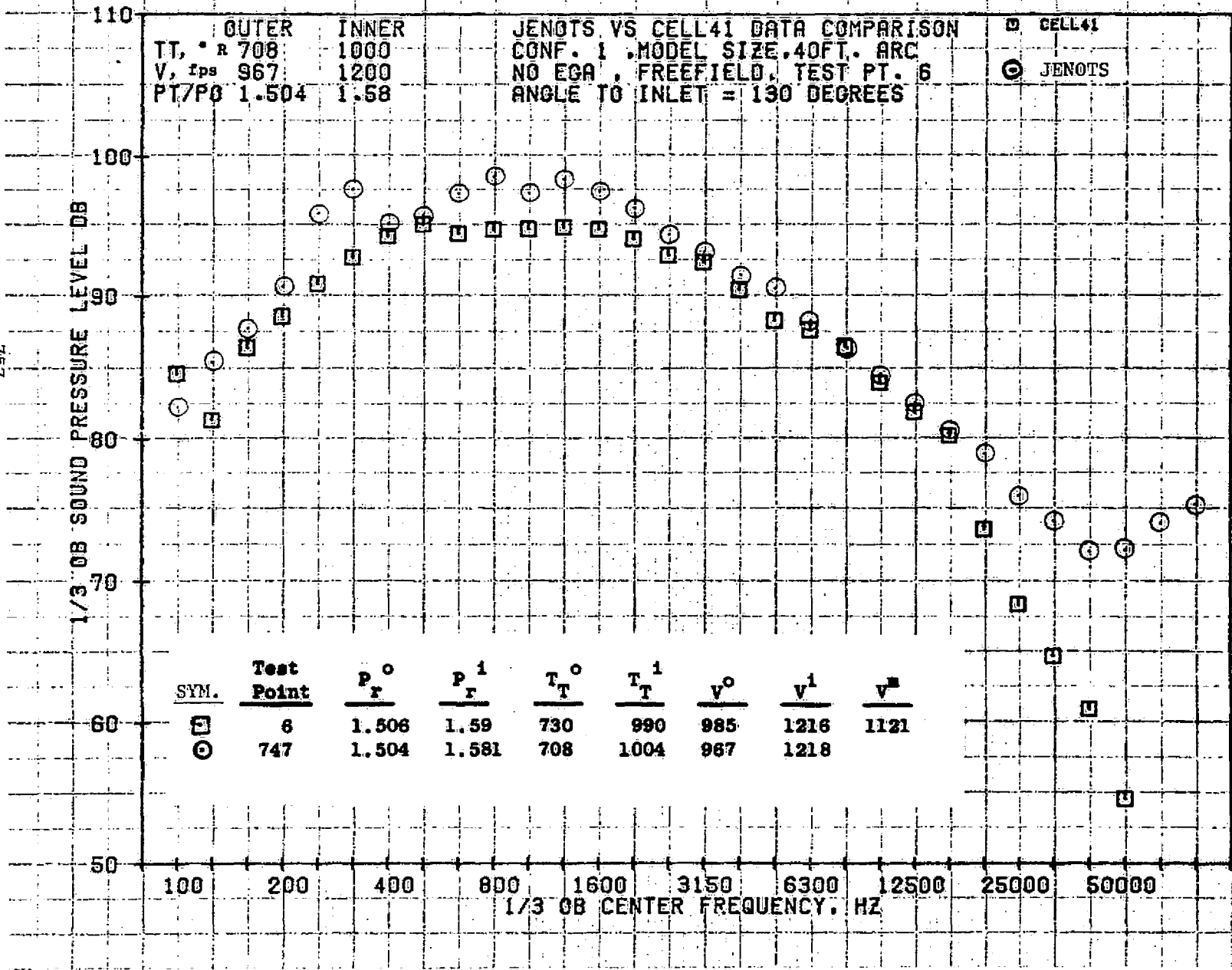
SYM.	Test Point	P_r^0	P_r^1	T_T^0	T_T^1	V^0	V^1	V^R
□	6	1.506	1.59	730	990	985	1216	1121
○	747	1.504	1.581	708	1004	967	1218	

755

756

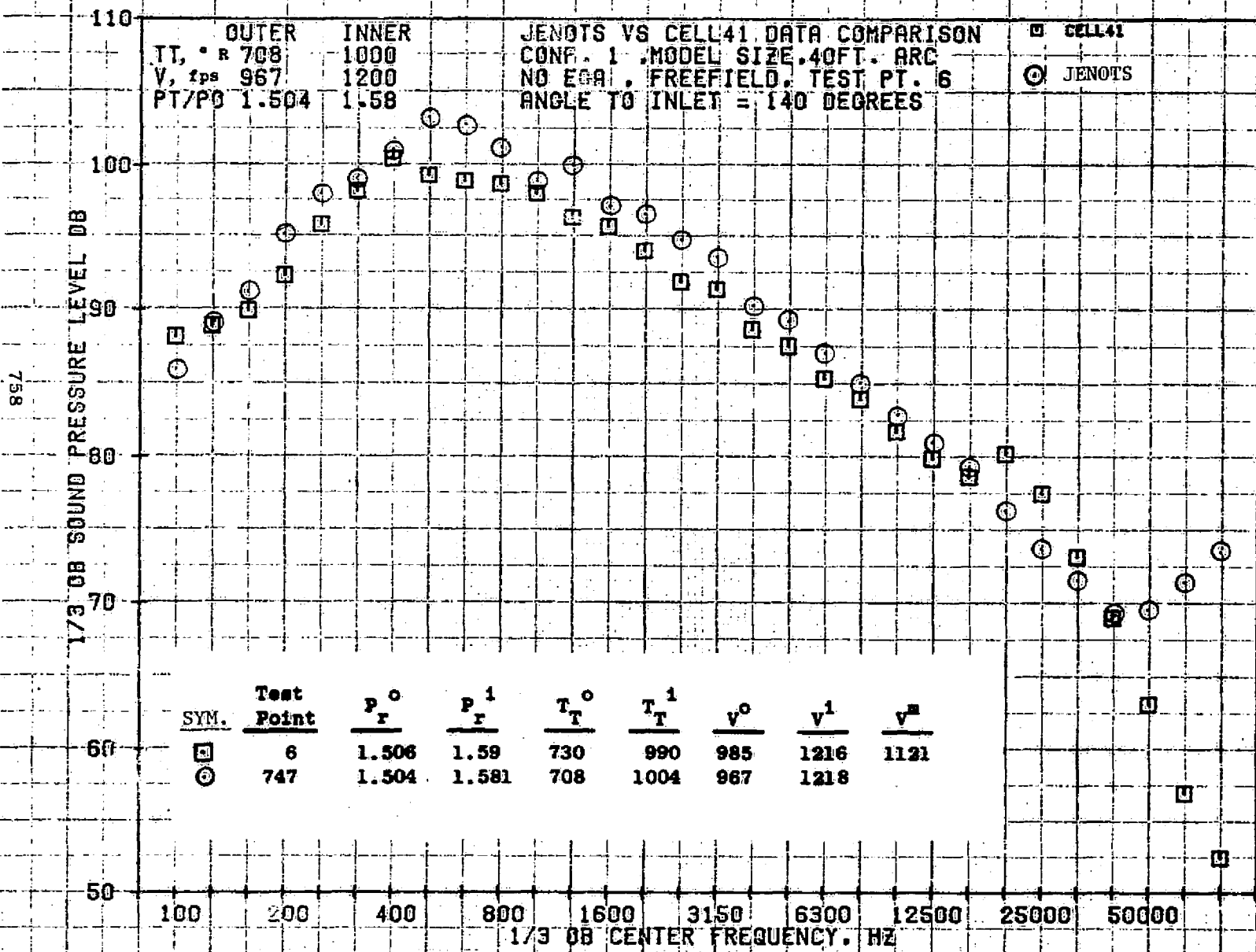


757

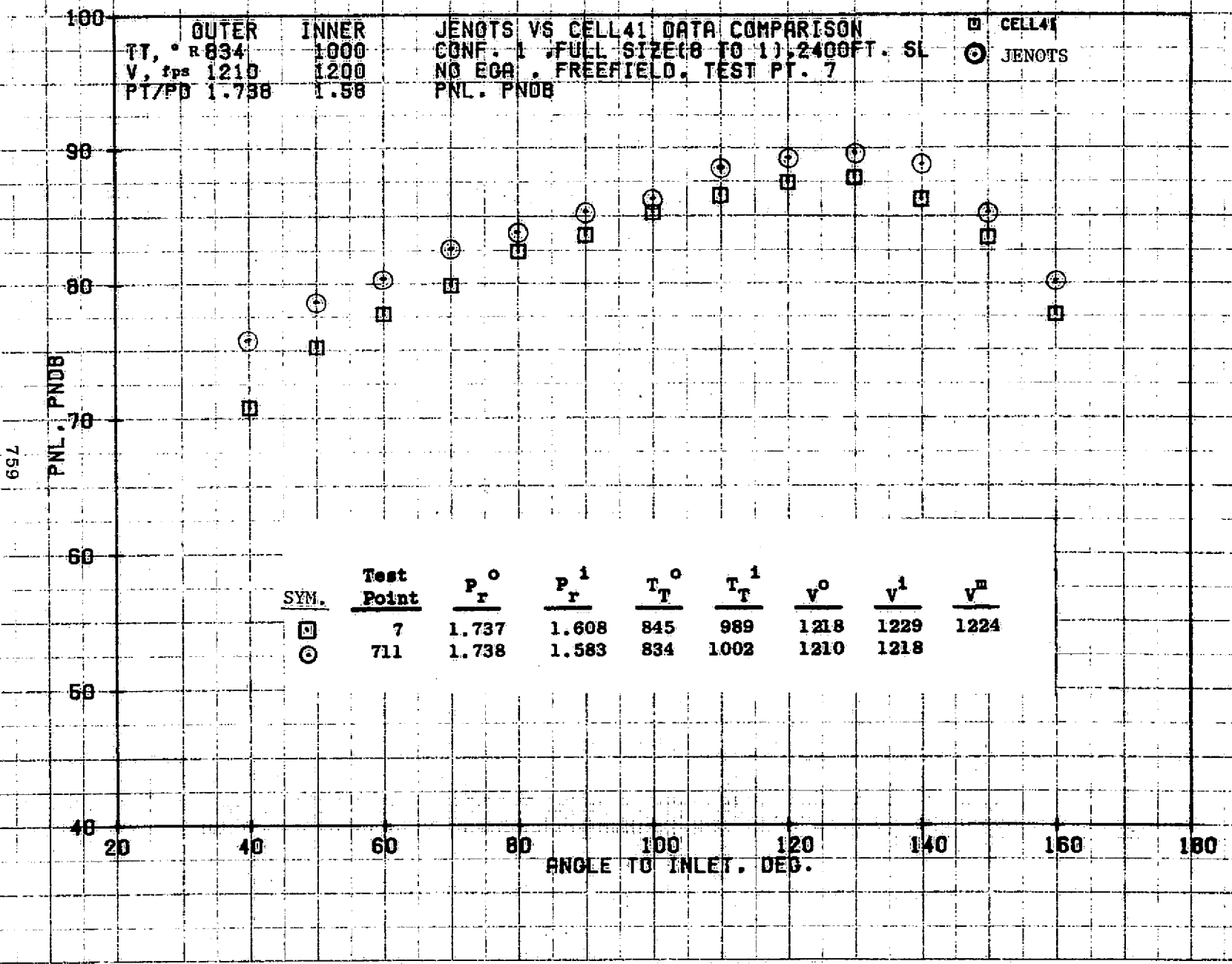


OUTER
 TT, ° R 708
 V, fps 967
 PT/PO 1.504

INNER
 1000
 1200
 1.58

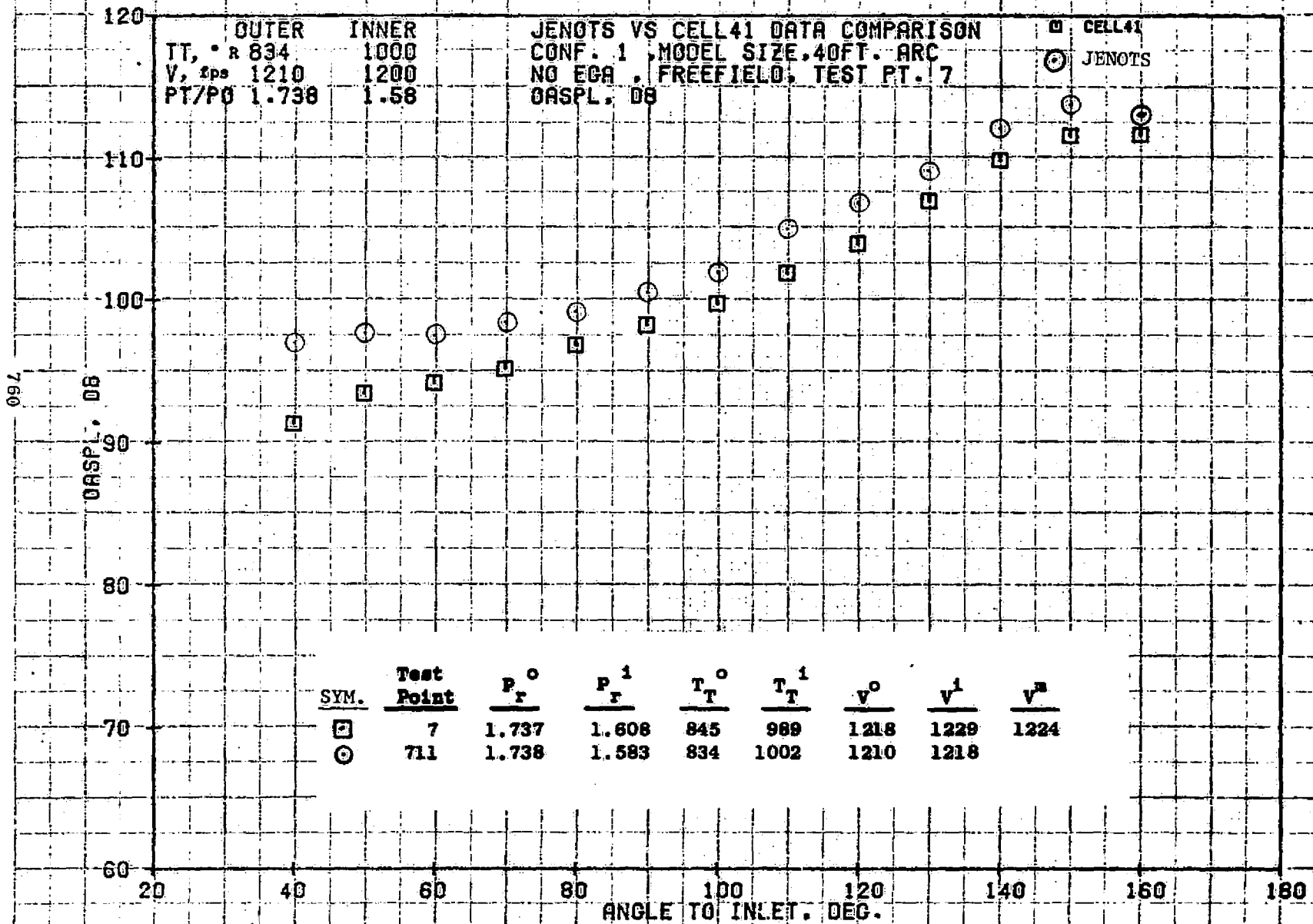


758



09/28/76
1X583-001

73KOLLSTEDT



760

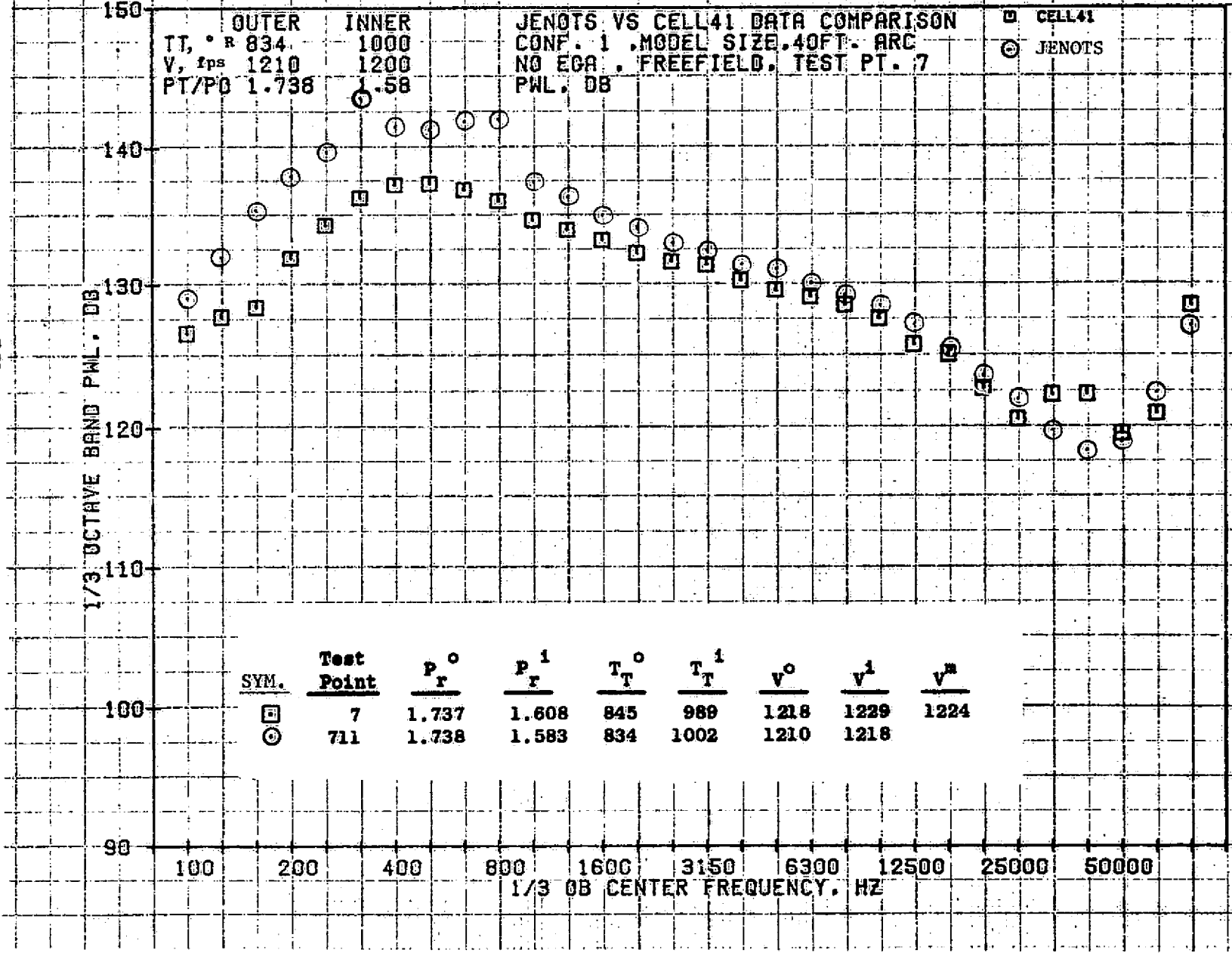
120
110
100
90
80
70
60

OASPL, DB

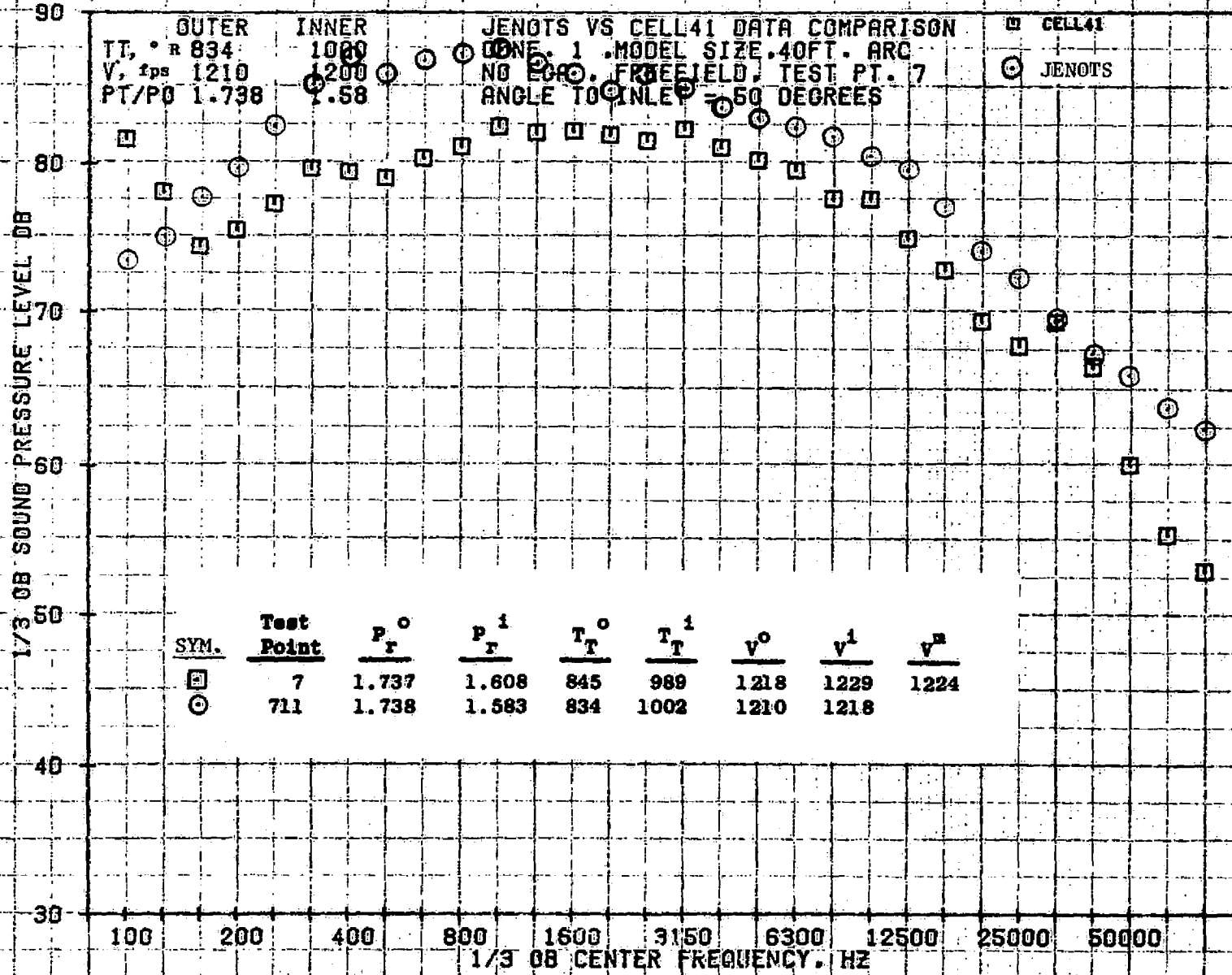
20 40 60 80 100 120 140 160 180

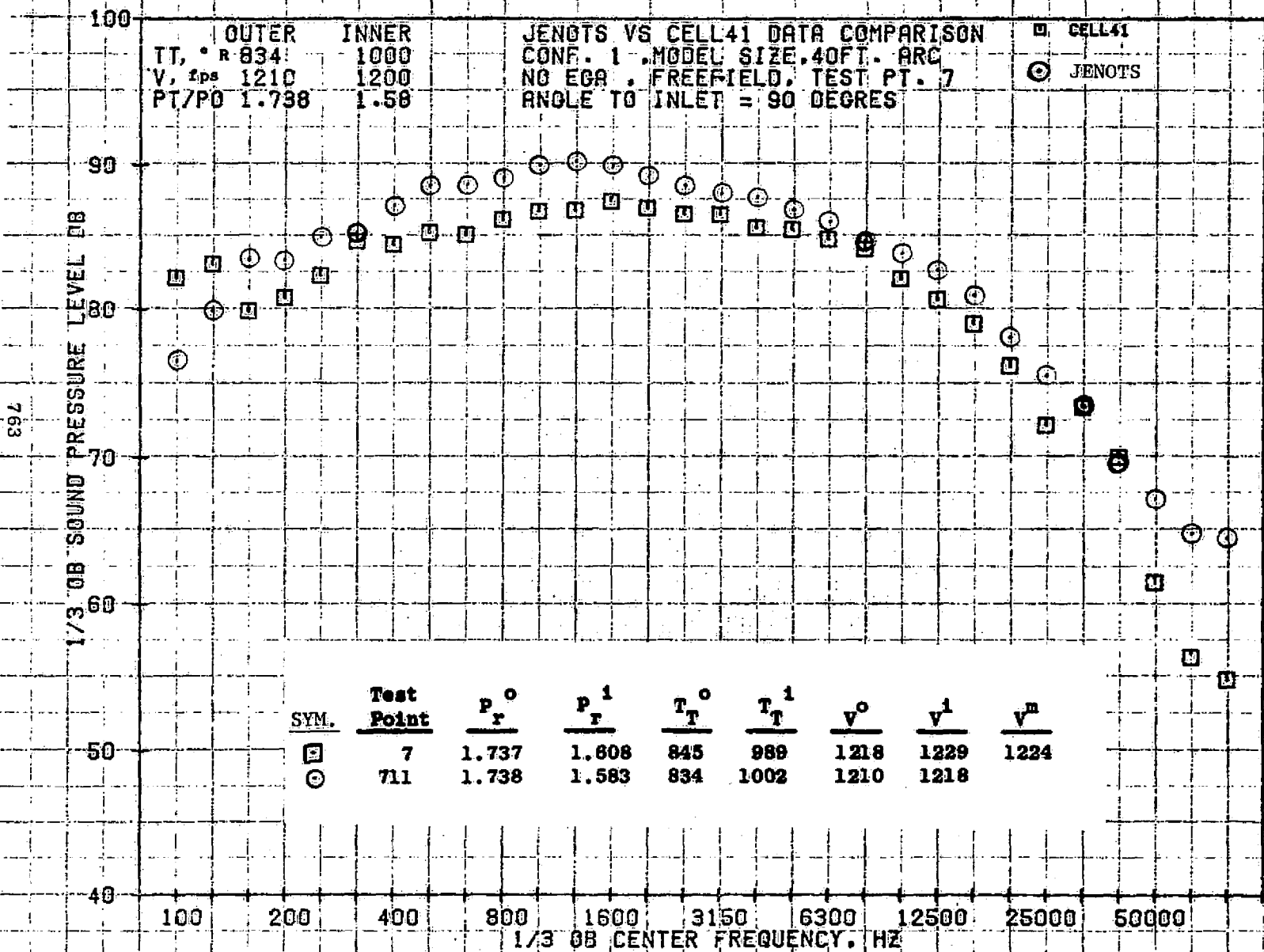
ANGLE TO INLET, DEG.

761

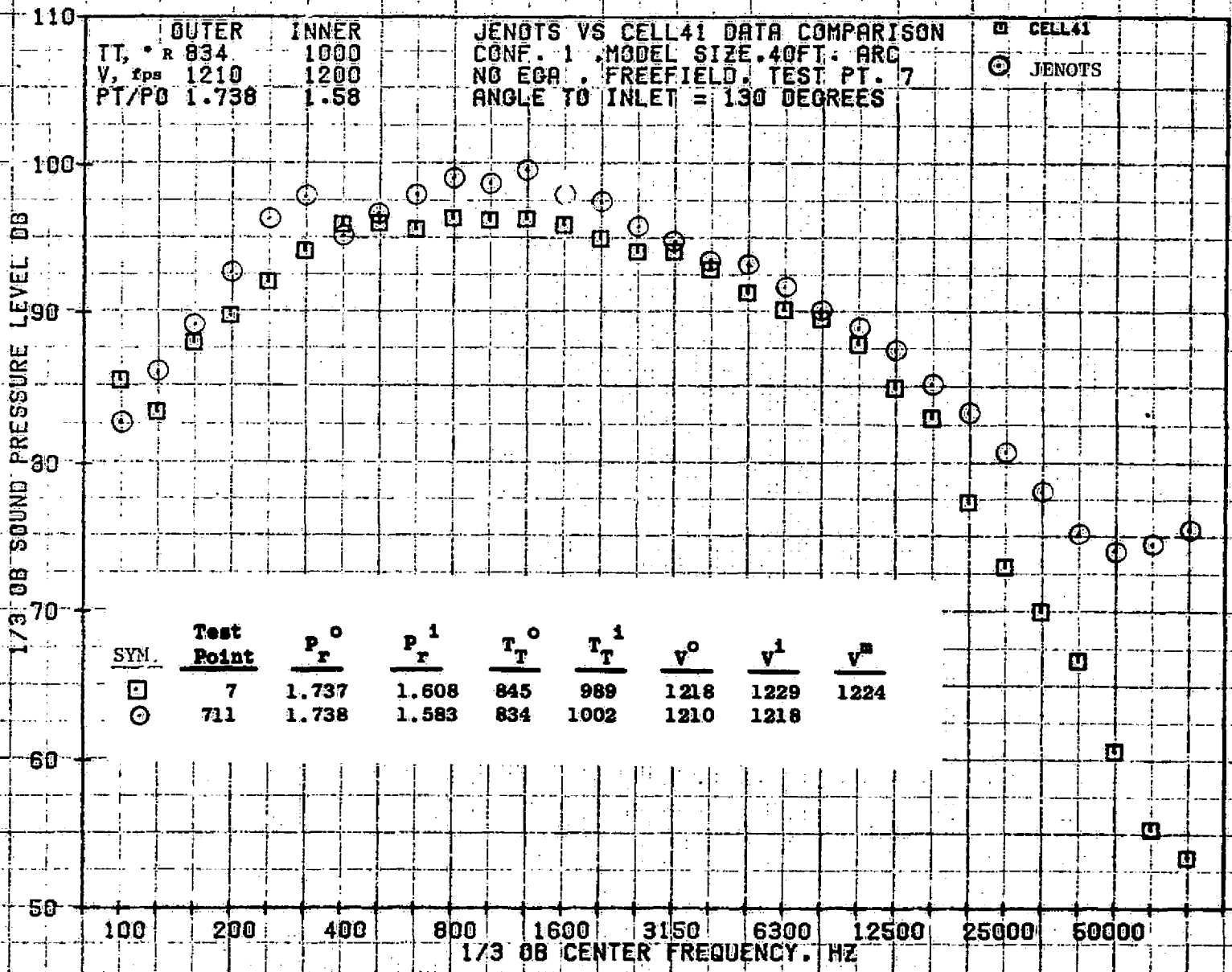


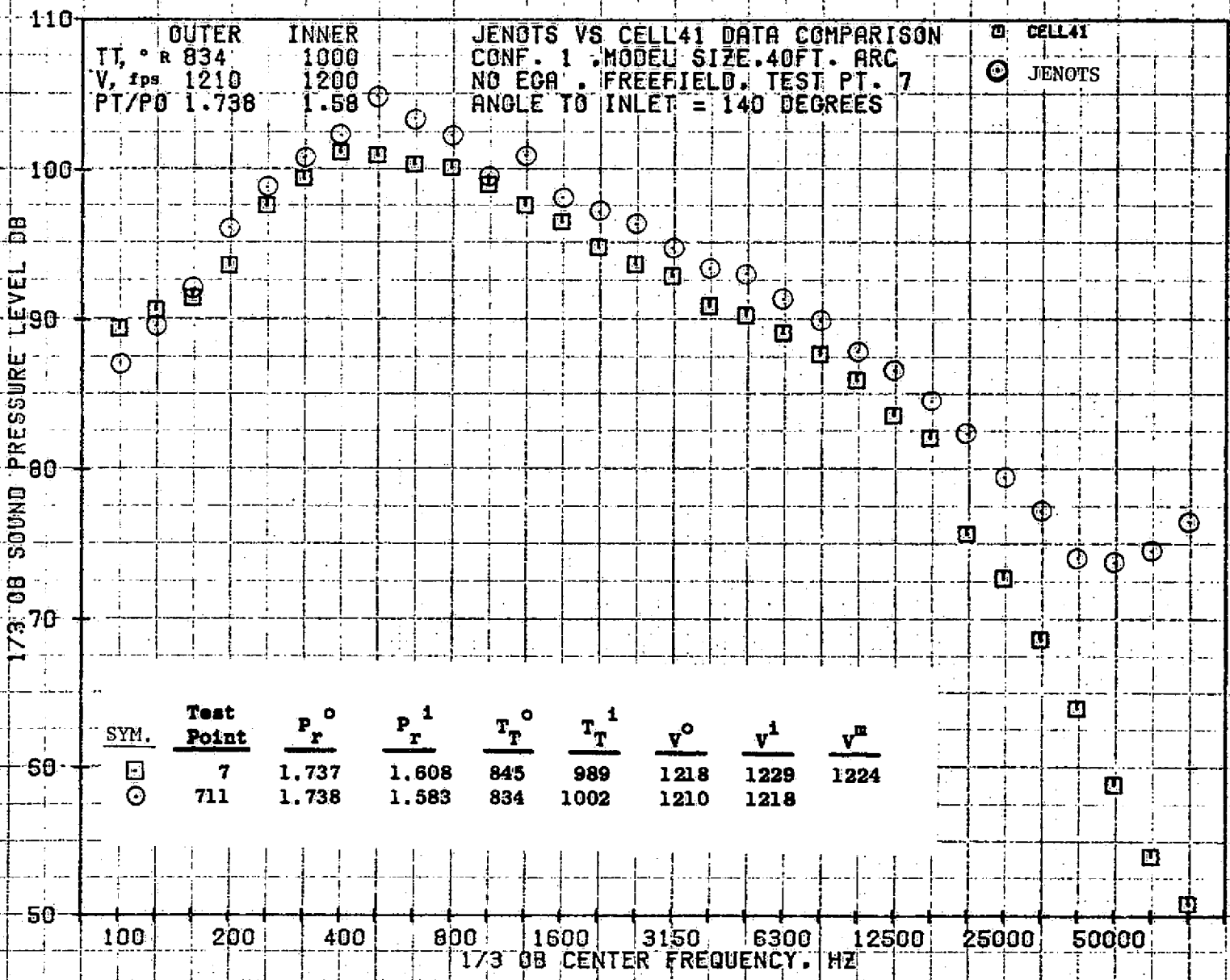
762





764





110

OUTER
 TT, ° R 1200
 V, fps 1811
 PT/PD 2.456

INNER
 1000
 1200
 1.56

JENOTS VS CELL 41 DATA COMPARISON
 CBNF. 1 FULL SIZE (8 TO 1) 2400 FT. SL
 NO BOA. FREEFIELD. TEST PT. 8
 PNL. PNDB

□ CELL 41
 ⊙ JENOTS

100

90

80

70

60

50

766

PNL. PNDB

SYM.	Test Point	P_r^o	P_r^i	T_T^o	T_T^i	V^o	V^i	V^m
□	8	2.524	1.595	1183	1005	1822	1229	1519
⊙	713	2.456	1.597	1200	1000	1811	1228	

20

40

60

80

100

120

140

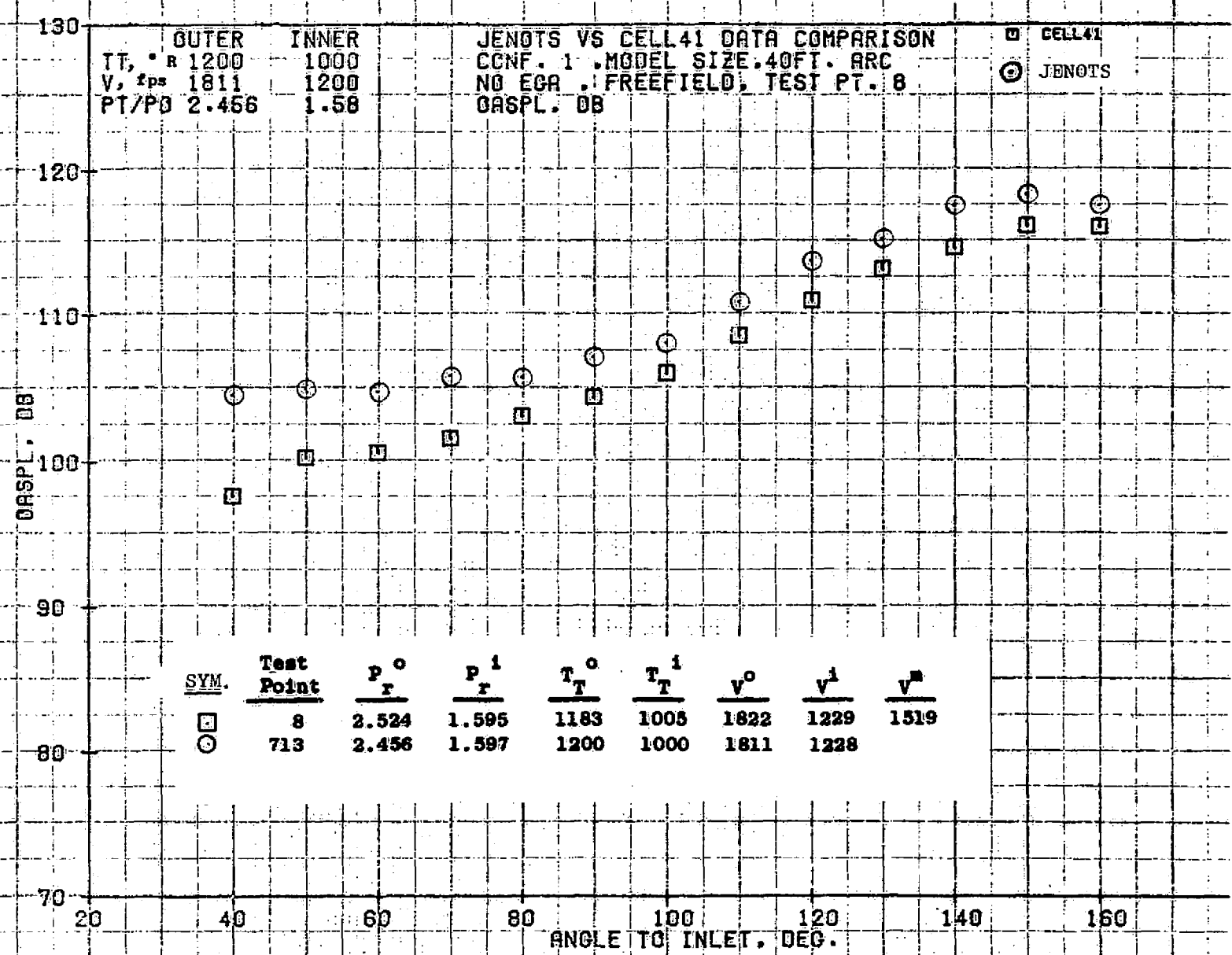
160

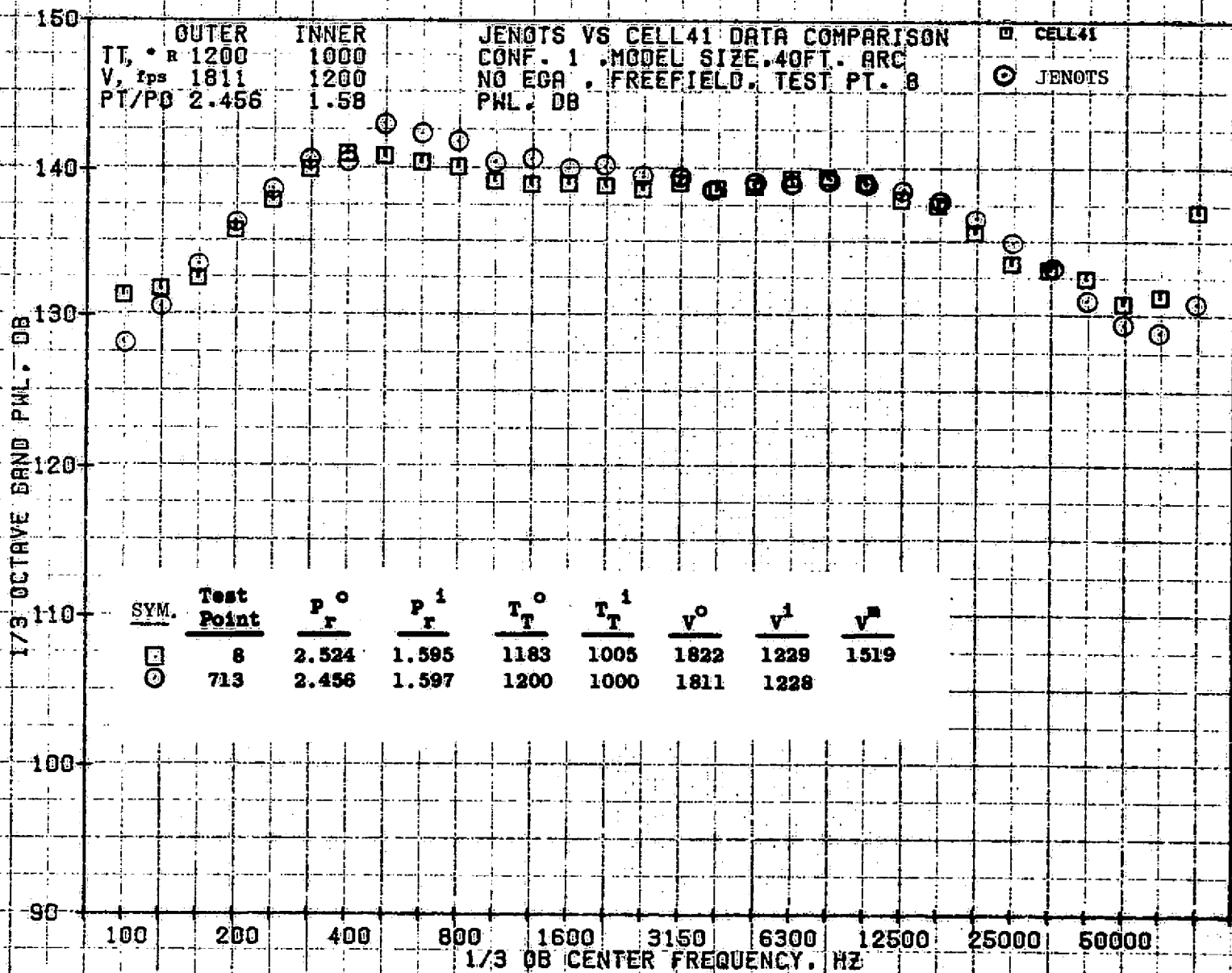
180

ANGLE TO INLET, DEG.

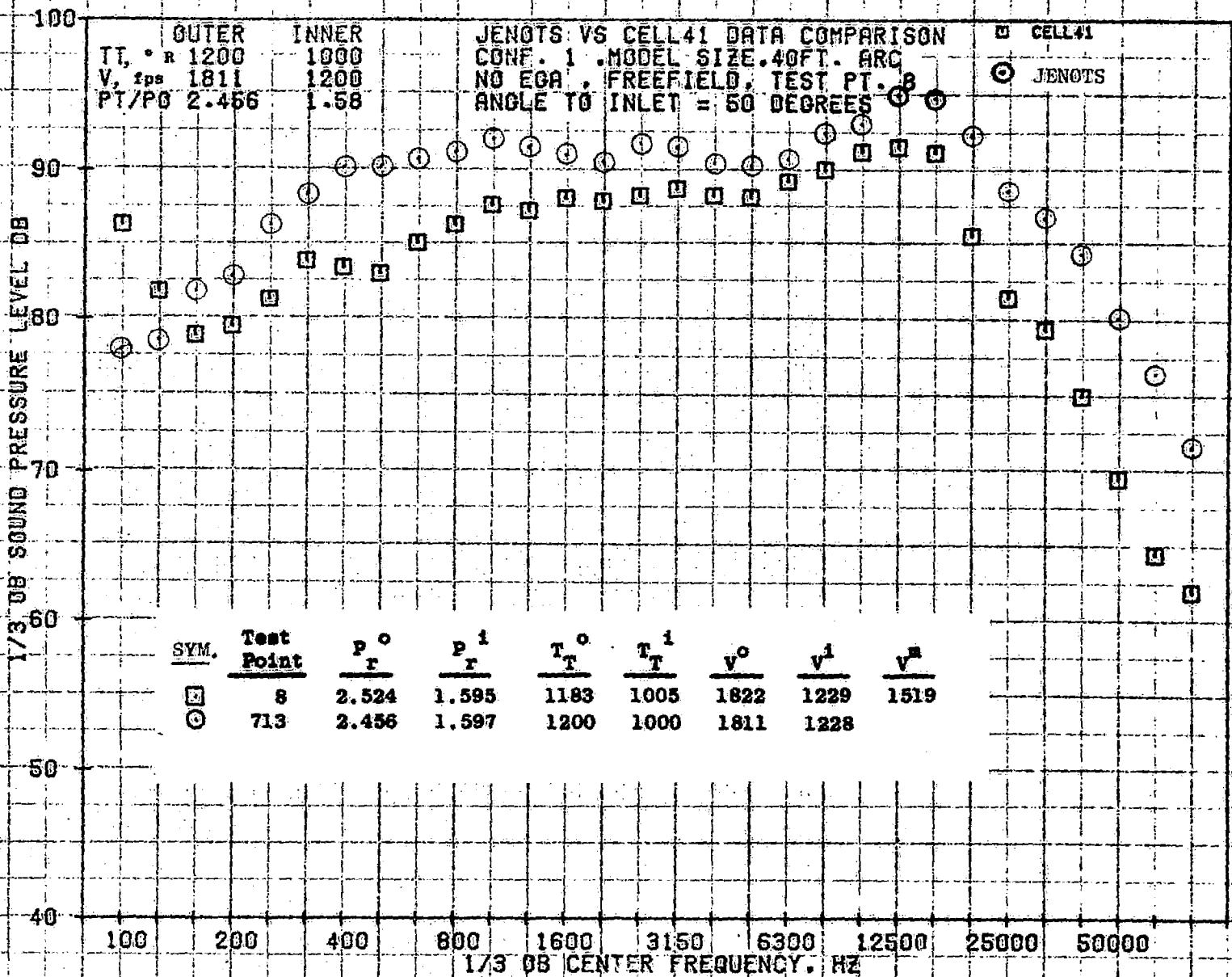
09/28/76
 1X583-001

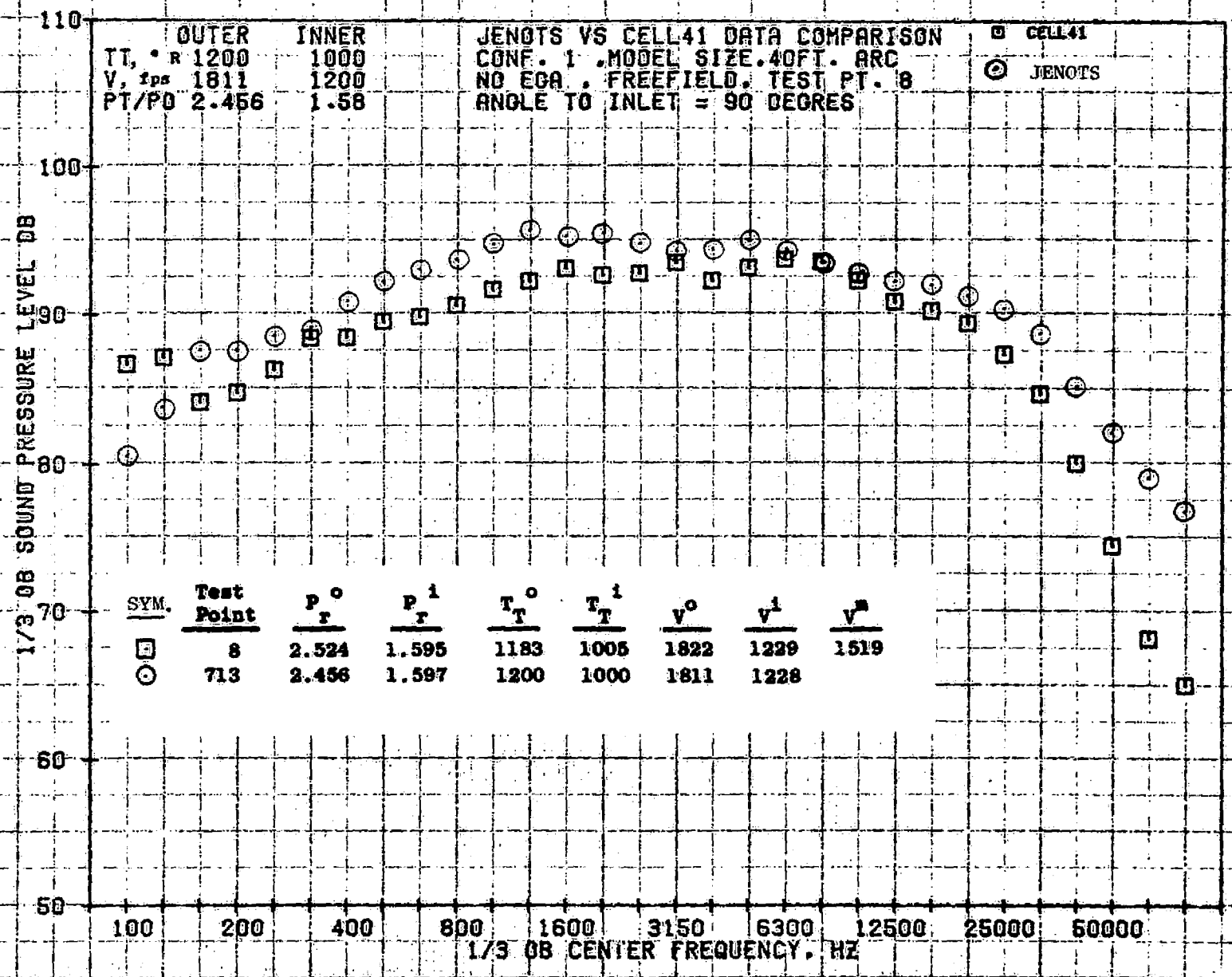
73KOLLSTEDT



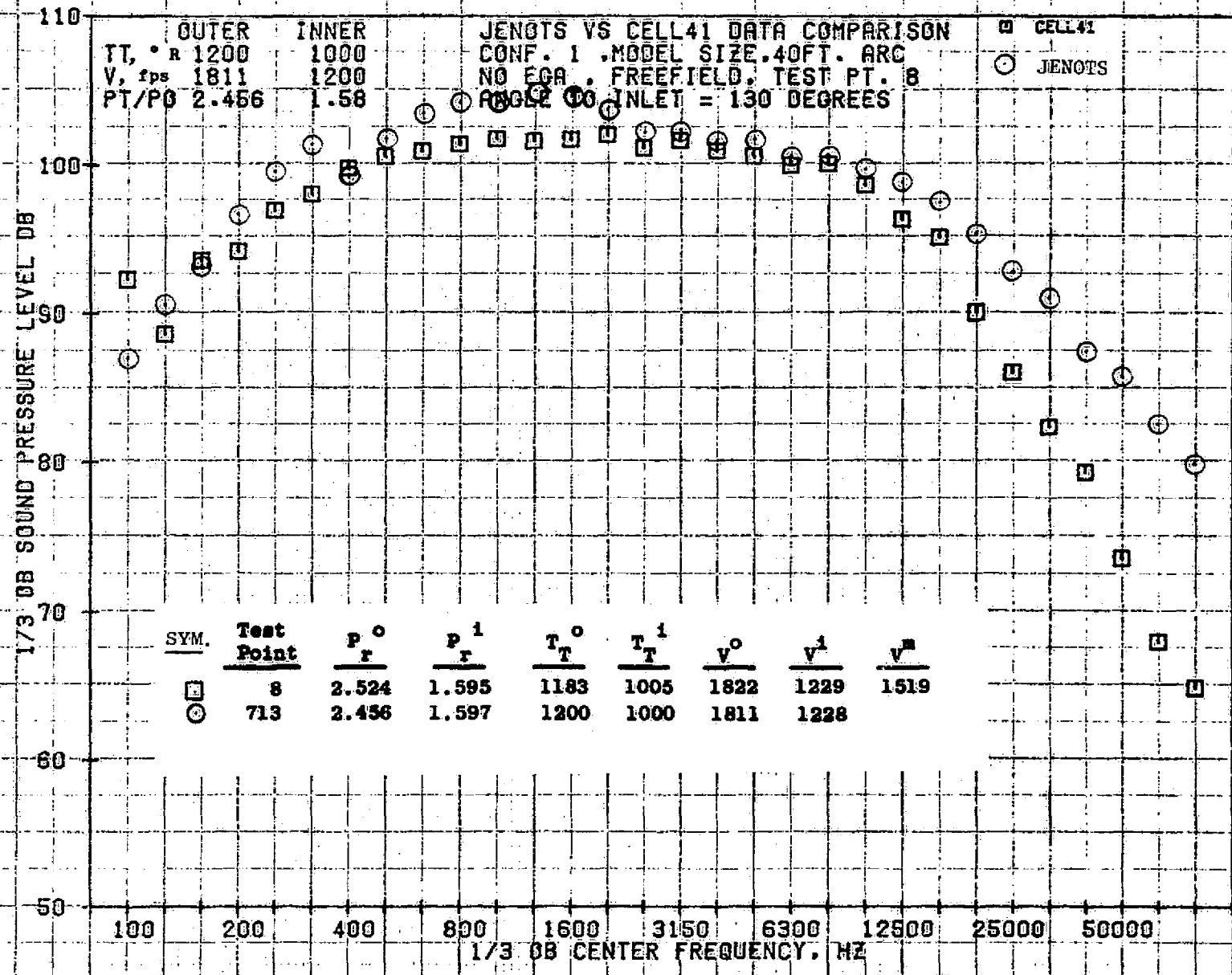


687





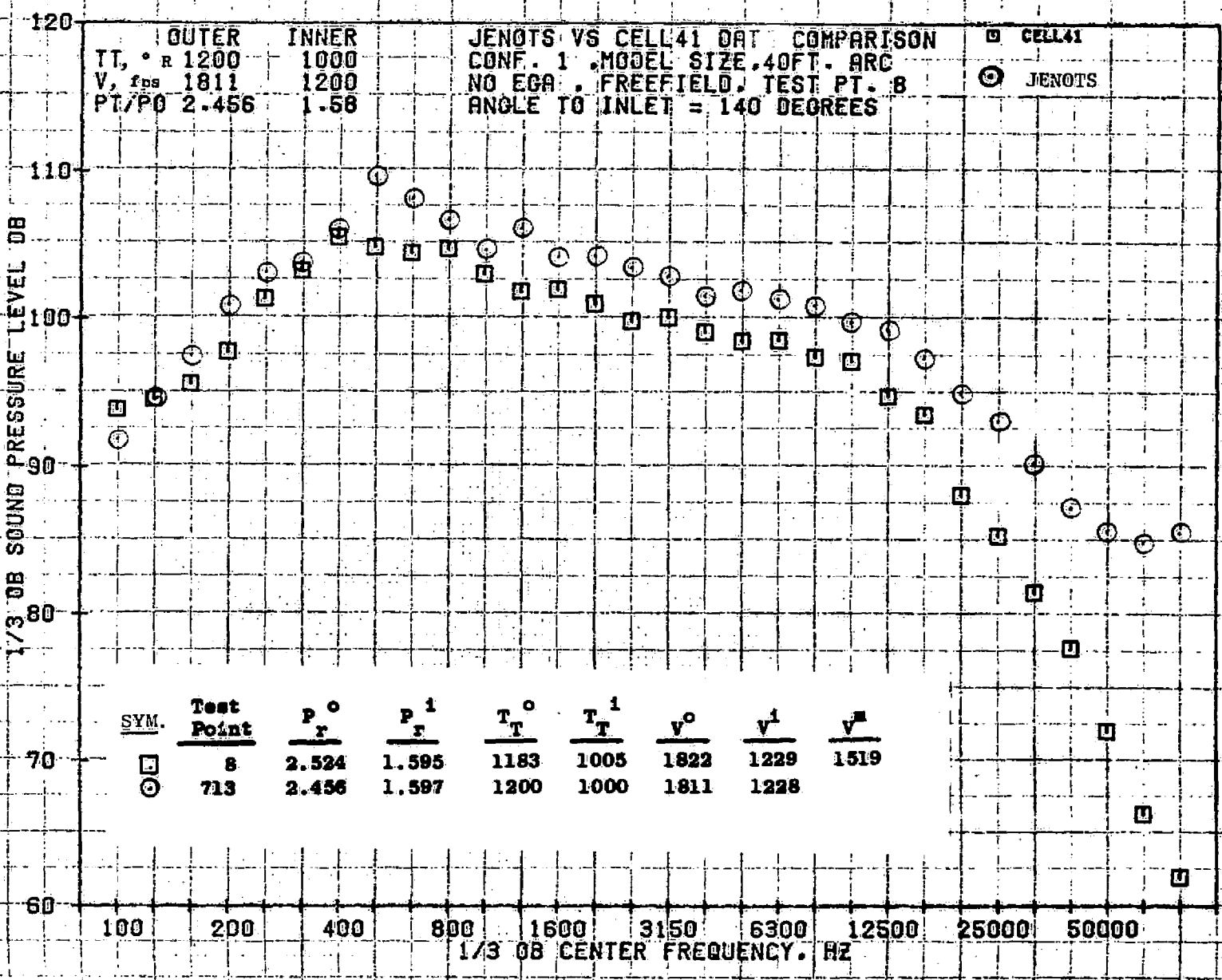
770

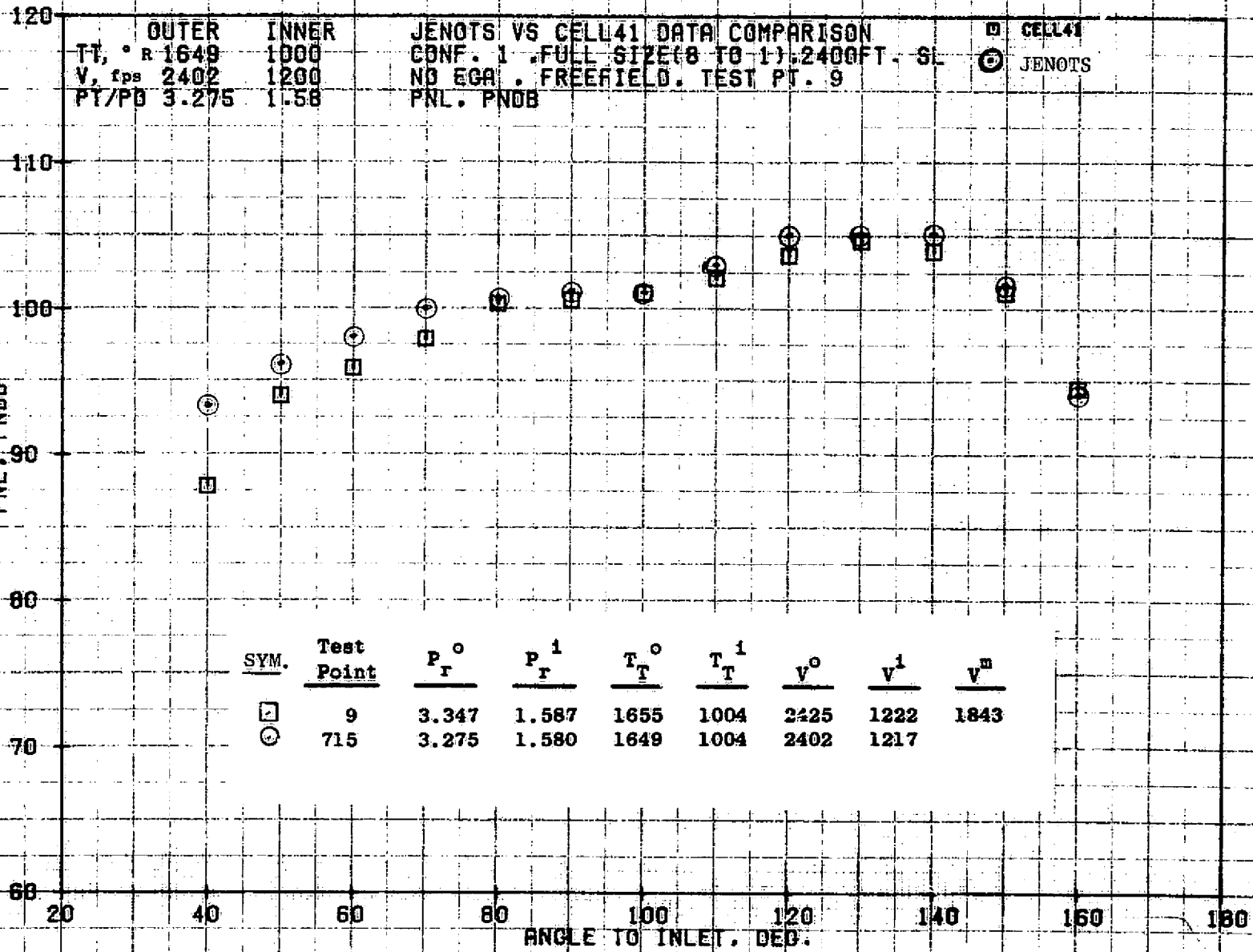


SYM.	Test Point	P_r^o	P_r^i	T_T^o	T_T^i	V^o	V^i	V^m
□	8	2.524	1.595	1183	1005	1822	1229	1519
○	713	2.456	1.597	1200	1000	1811	1228	

777

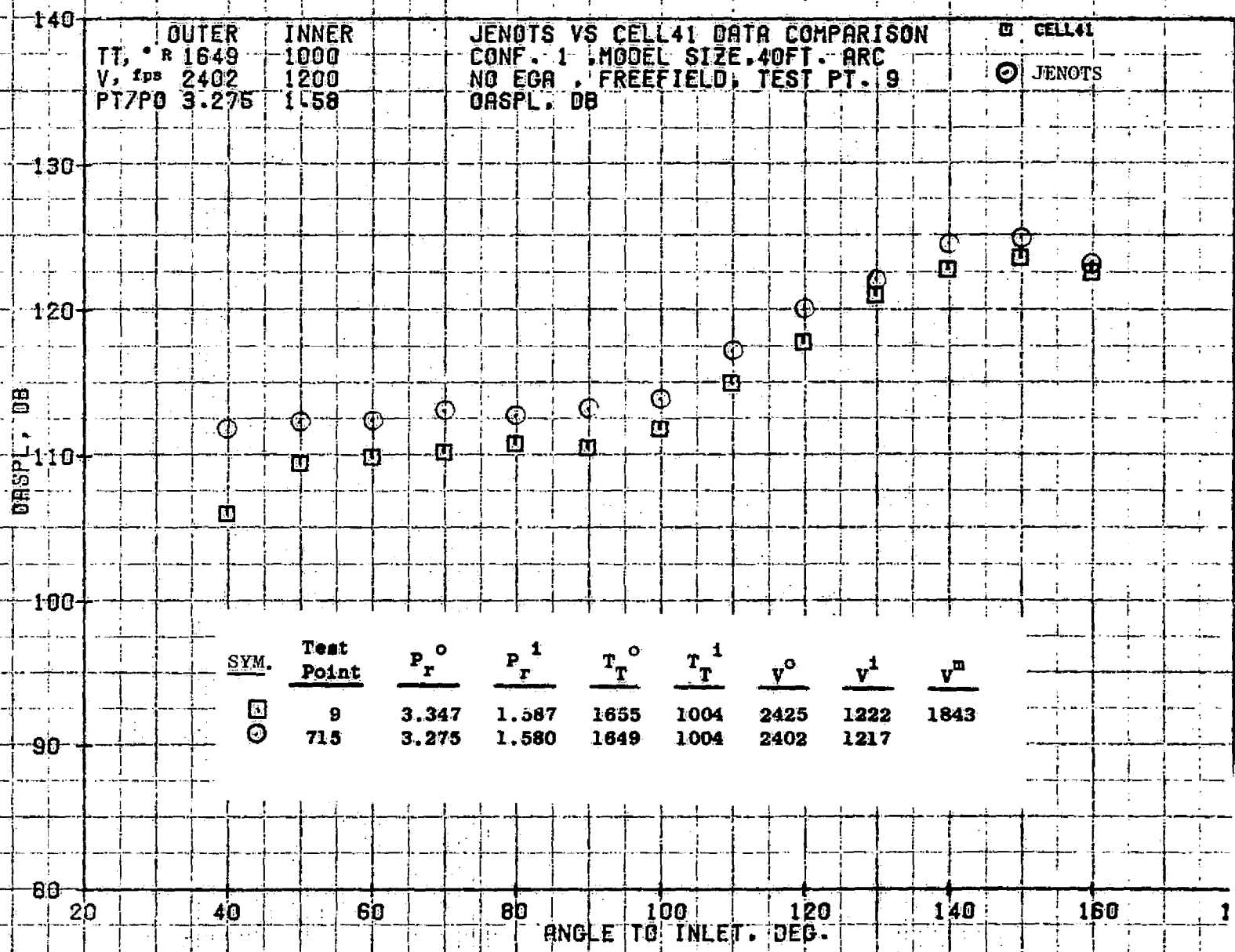
772

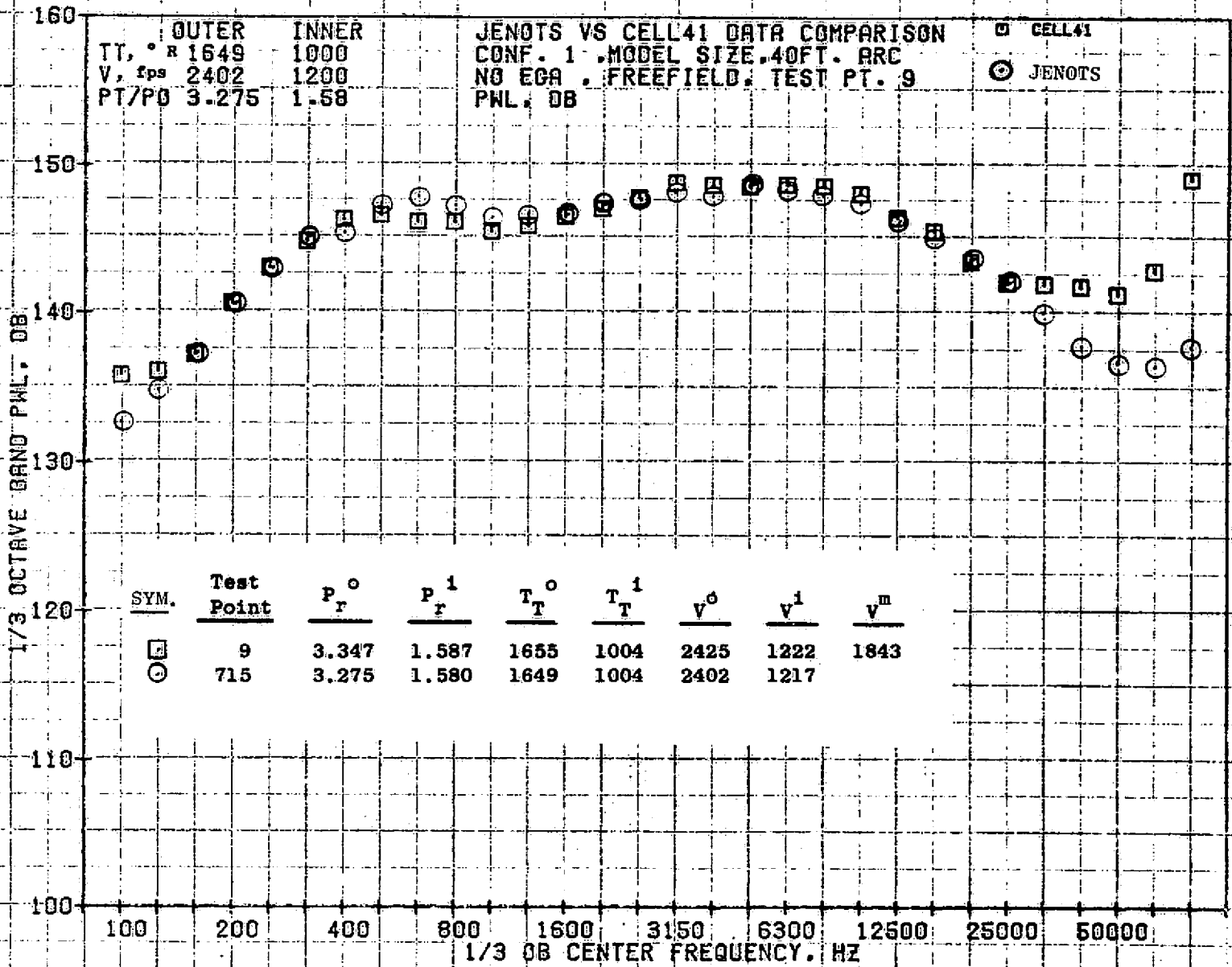




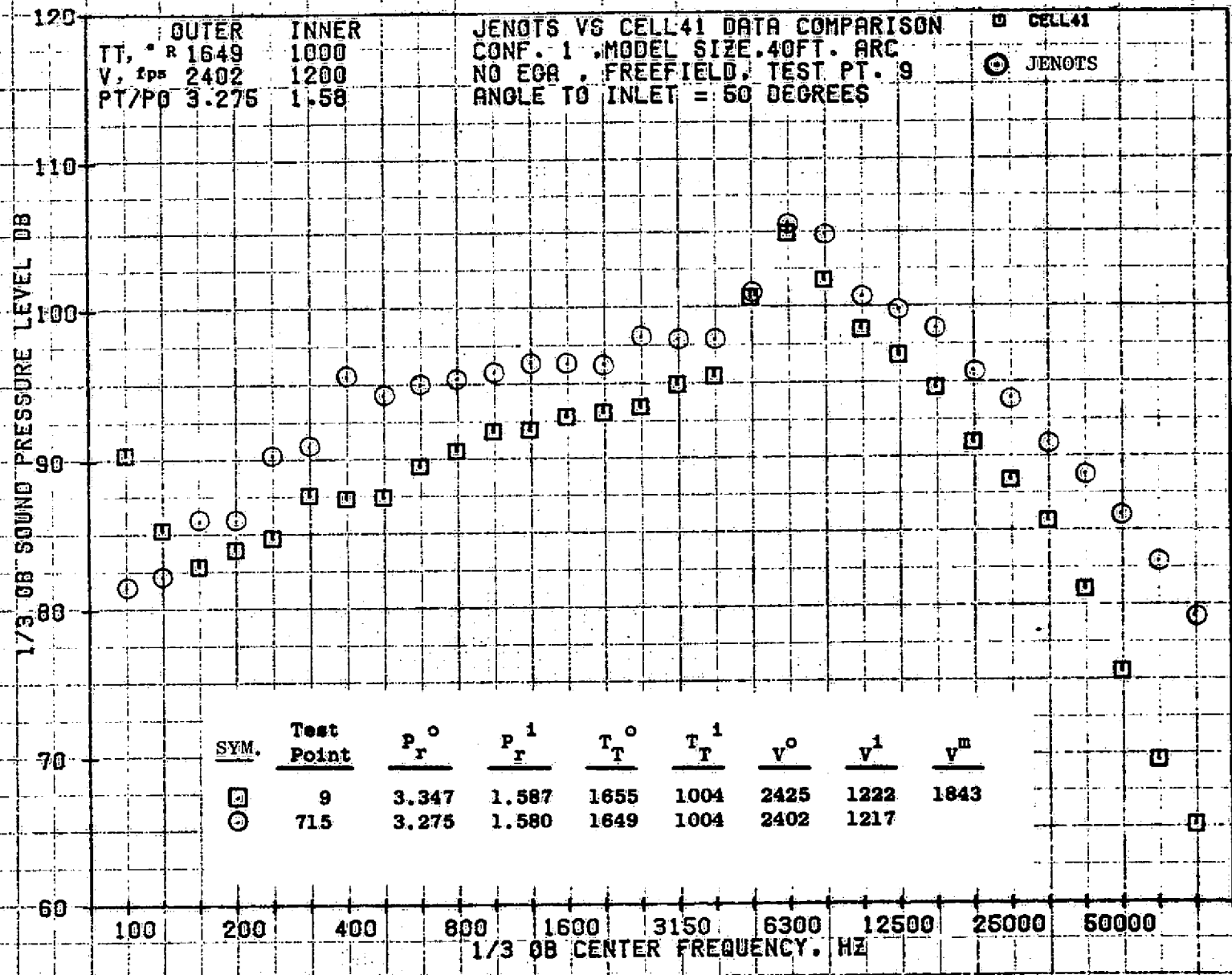
09/28/76
1X583-001

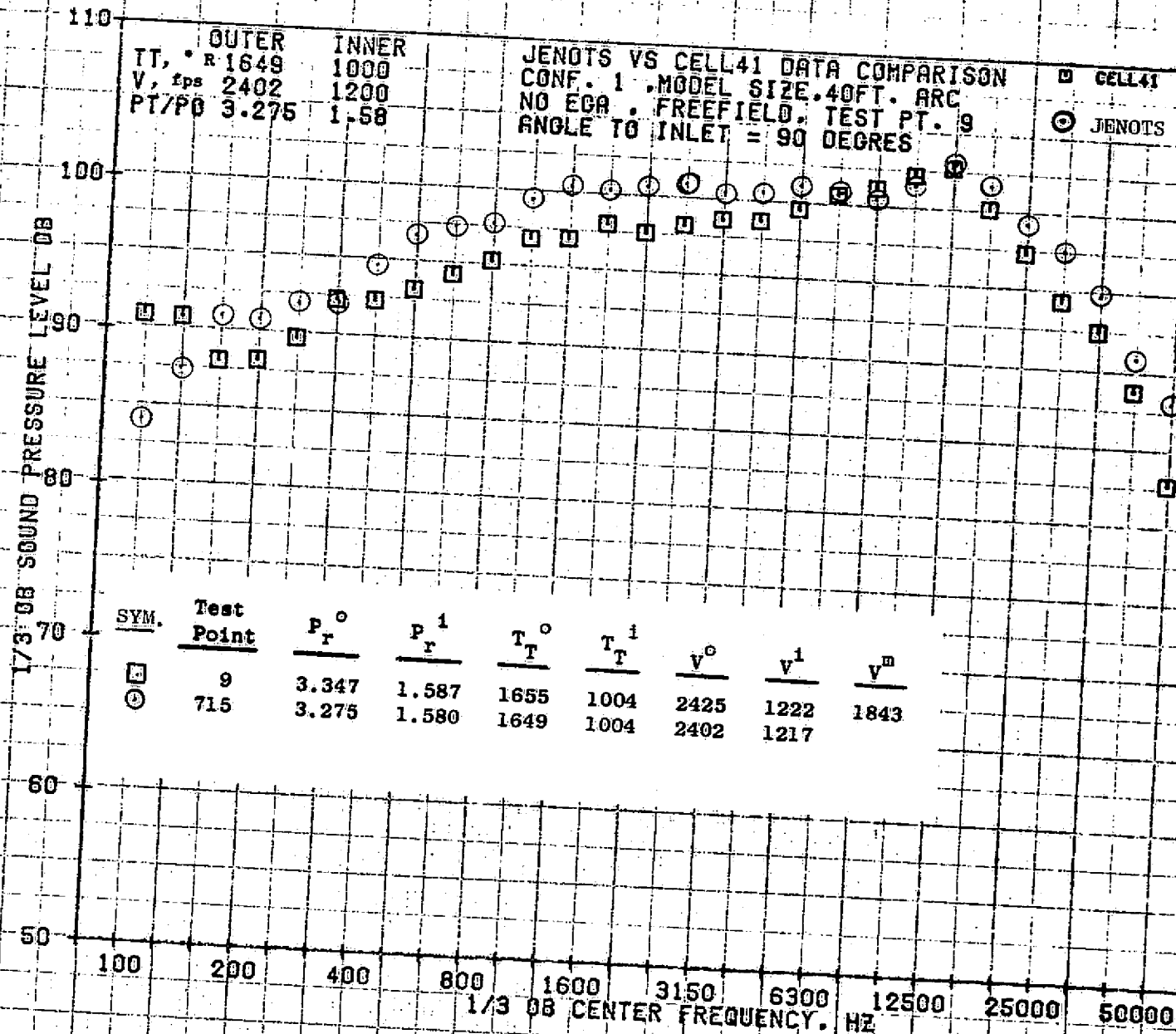
73KOLLSTEOT





776





OUTER
 R 1649
 INNER
 1000
 V, fps 2402
 1200
 PT/PO 3.275
 1.58

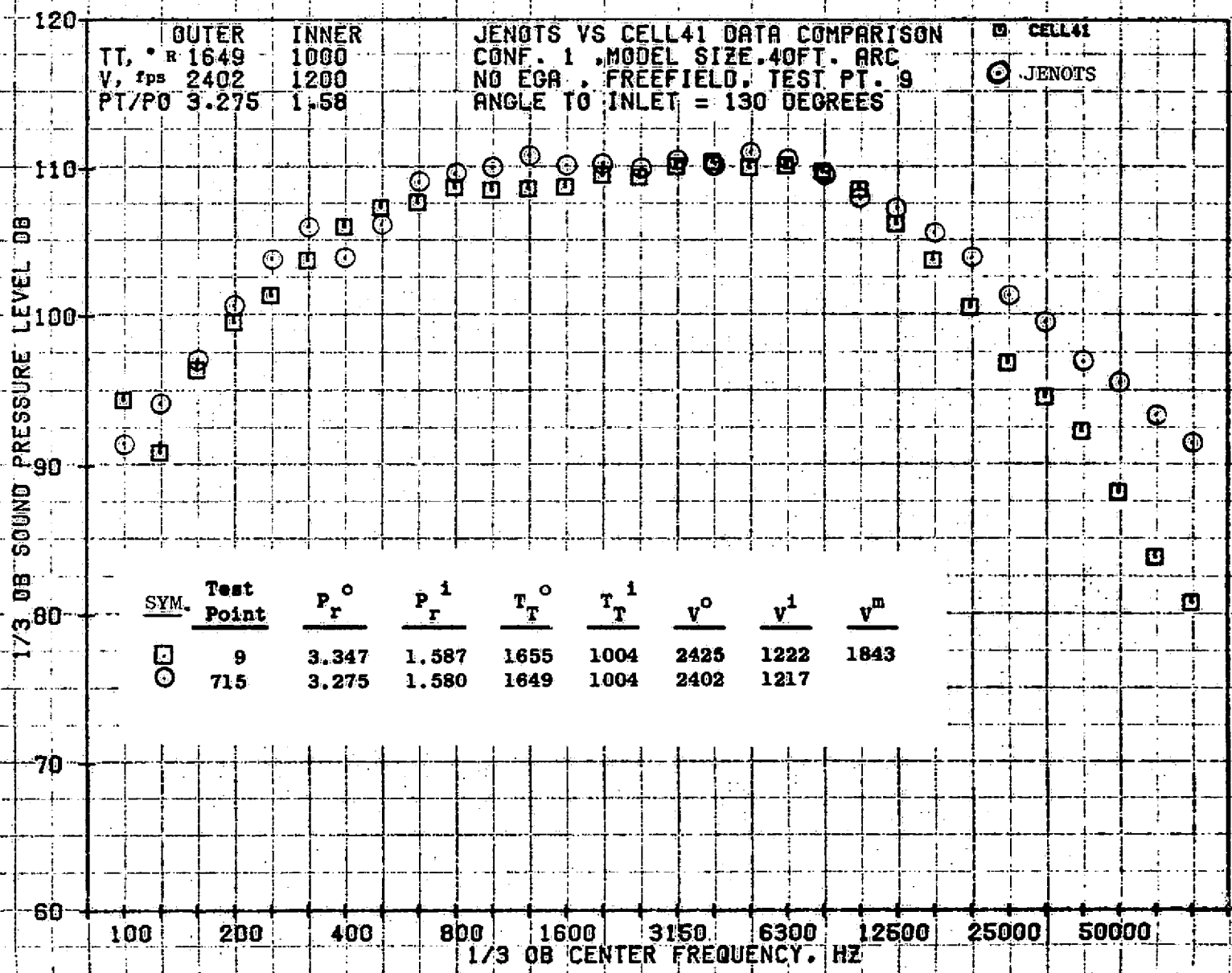
JENOTS VS CELL41 DATA COMPARISON
 CONF. 1 - MODEL SIZE, 40FT. ARC
 NO EGA - FREEFIELD, TEST PT. 9
 ANGLE TO INLET = 90 DEGRES

□ CELL41
 ○ JENOTS

1/3 DB SOUND PRESSURE LEVEL DB

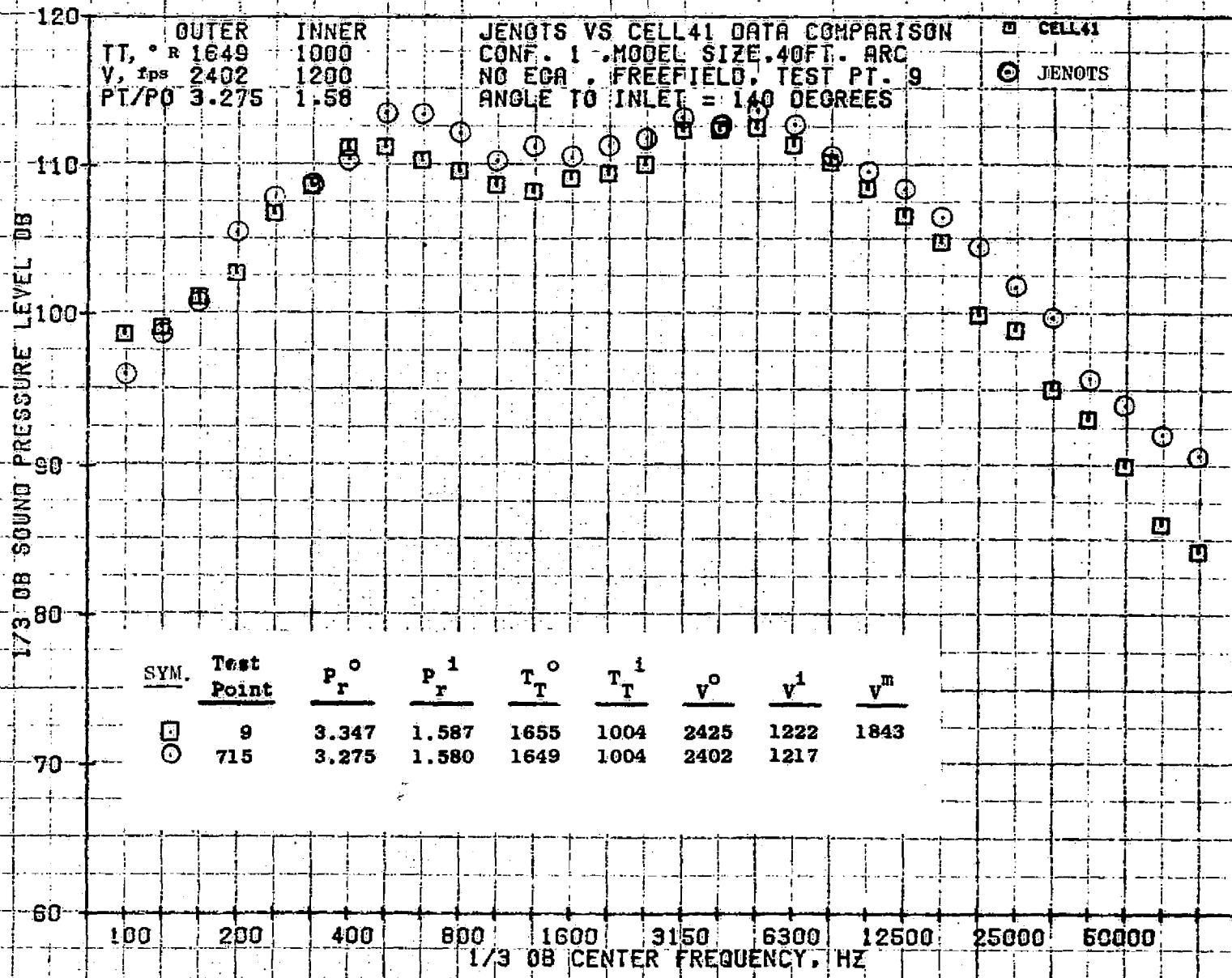
SYM.	Test Point	P_r^o	P_r^i	T_T^o	T_T^i	V^o	V^i	V^m
□	9	3.347	1.587	1655	1004	2425	1222	1843
○	715	3.275	1.580	1649	1004	2402	1217	

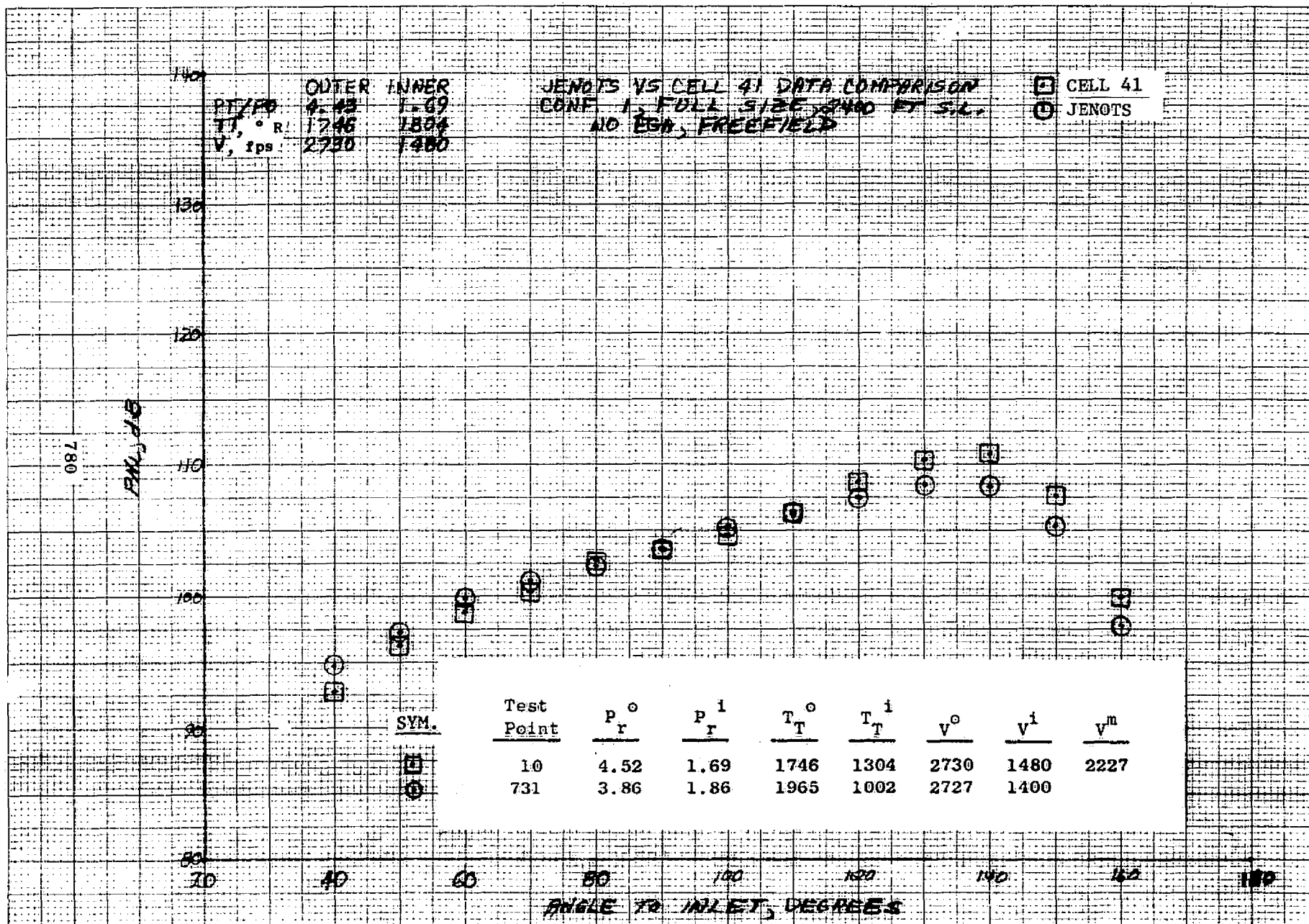
1/3 DB CENTER FREQUENCY, HZ



778

779





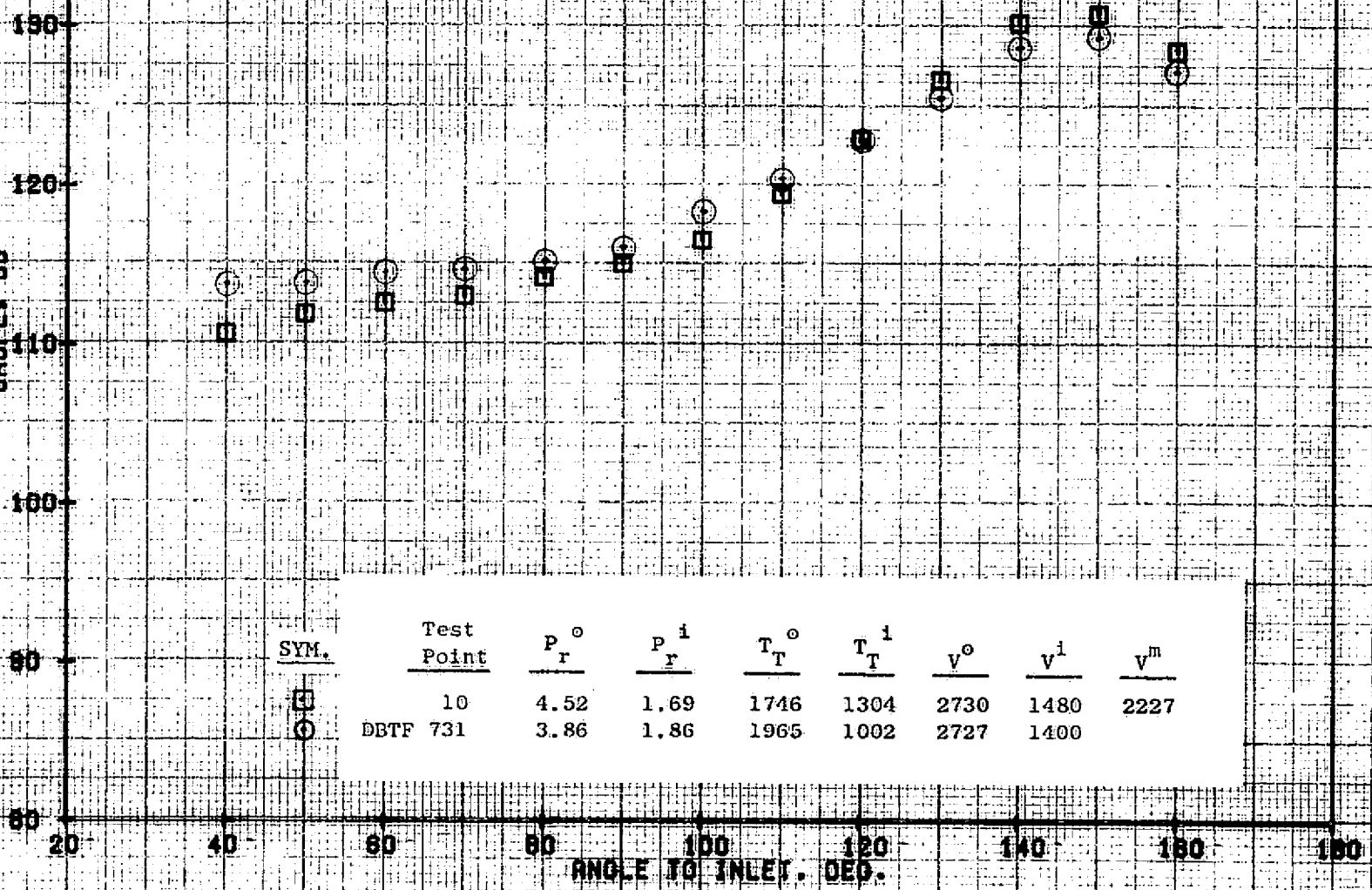
AT/PT 4.43 OUTER 1.69
 TT, ° R 1746 INNER 1304
 V, fps 2730 1480

JENOTS VS CELL 41 DATA COMPARISON
 CONF. 1, MODEL SIZE, 40 FT. ARC
 NO EGA, FREE FELD
 $R = [10 \log PT/R2 - 10 \log FT/(AT-FRETT)]$

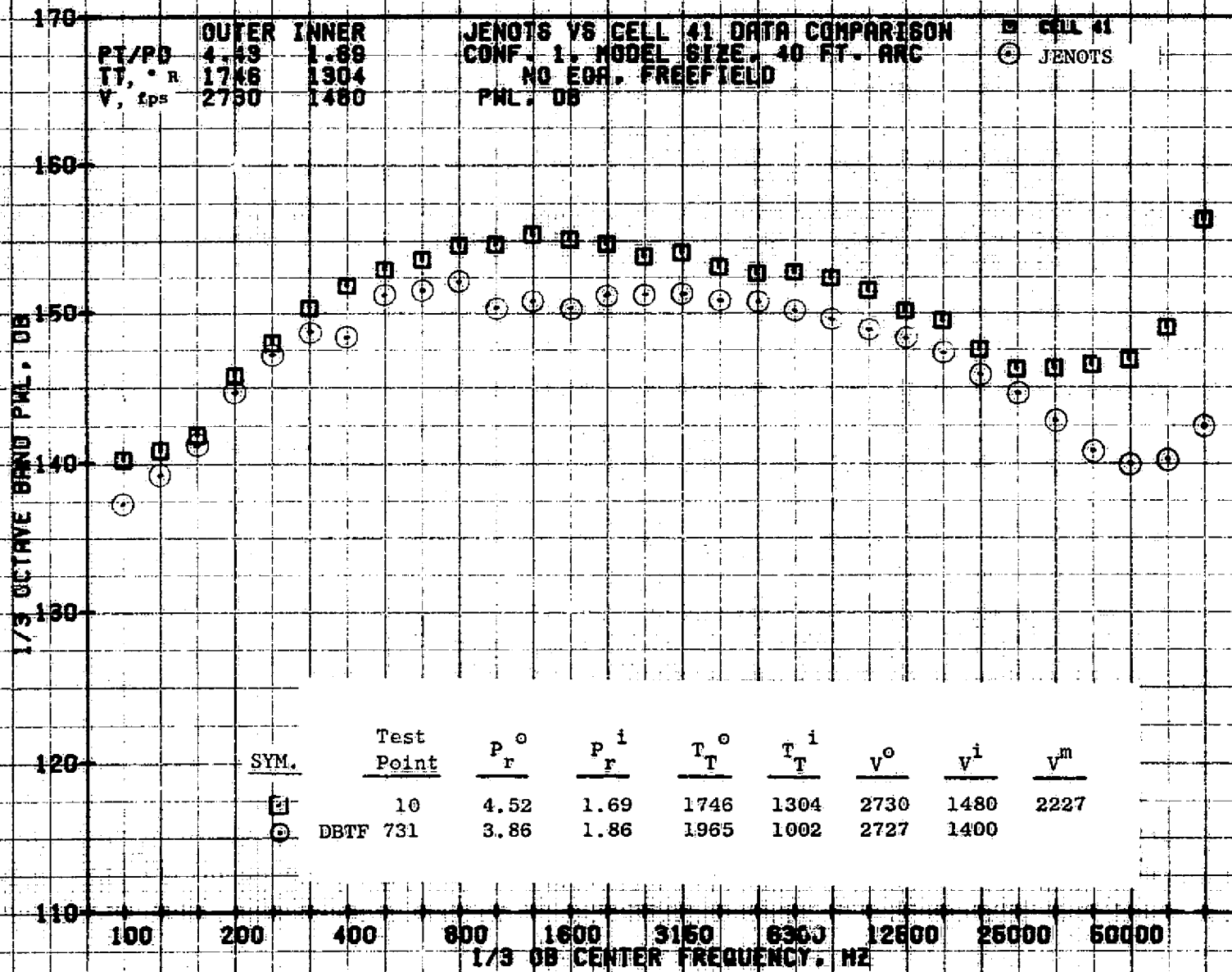
□ CELL 41
 ○ JENOTS

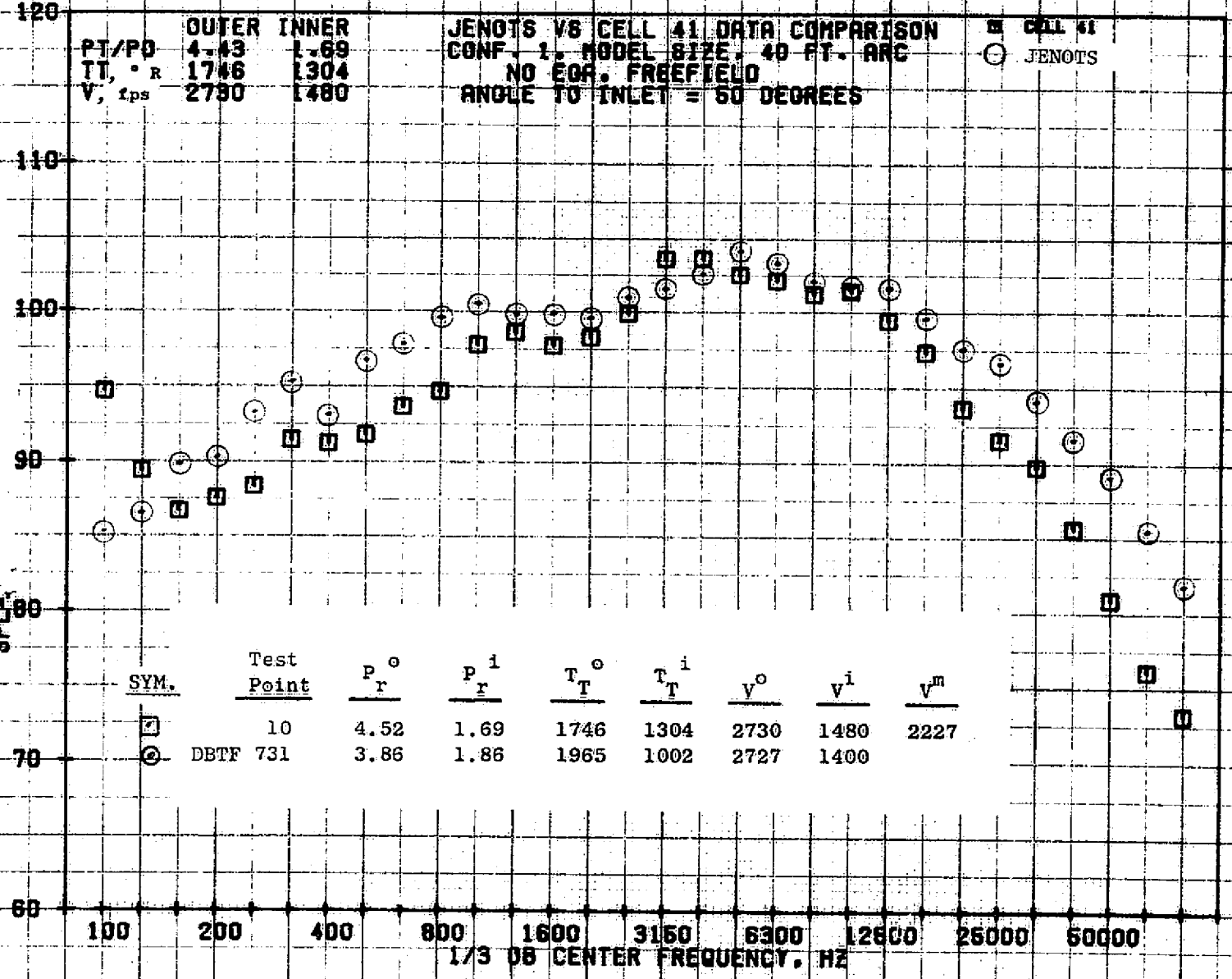
DB SPL, DB

781



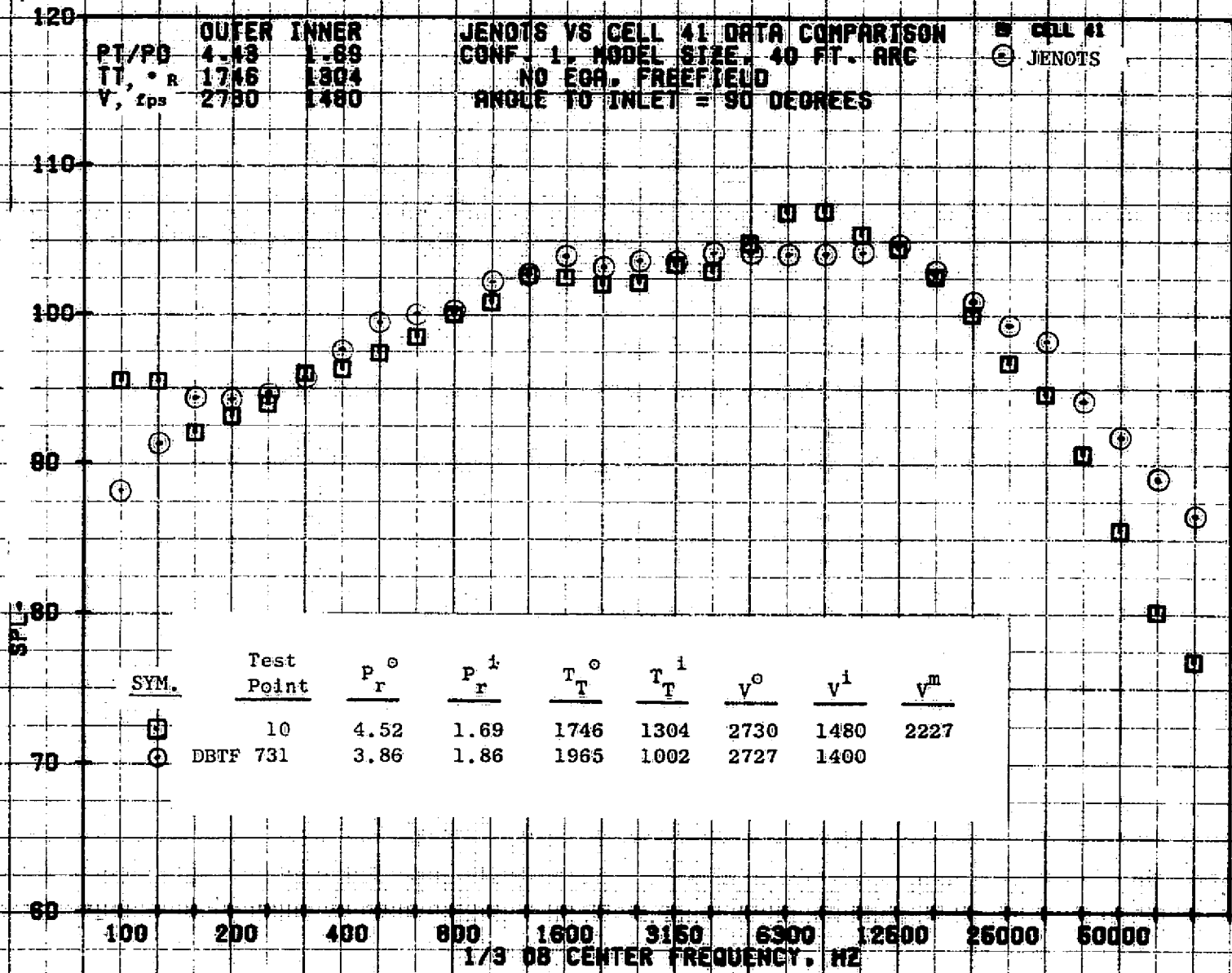
SYM.	Test Point	P_r^o	P_r^i	T_T^o	T_T^i	V^o	V^i	V^m
□	10	4.52	1.69	1746	1304	2730	1480	2227
○	DBTF 731	3.86	1.86	1965	1002	2727	1400	





11/01/76
1B391-001

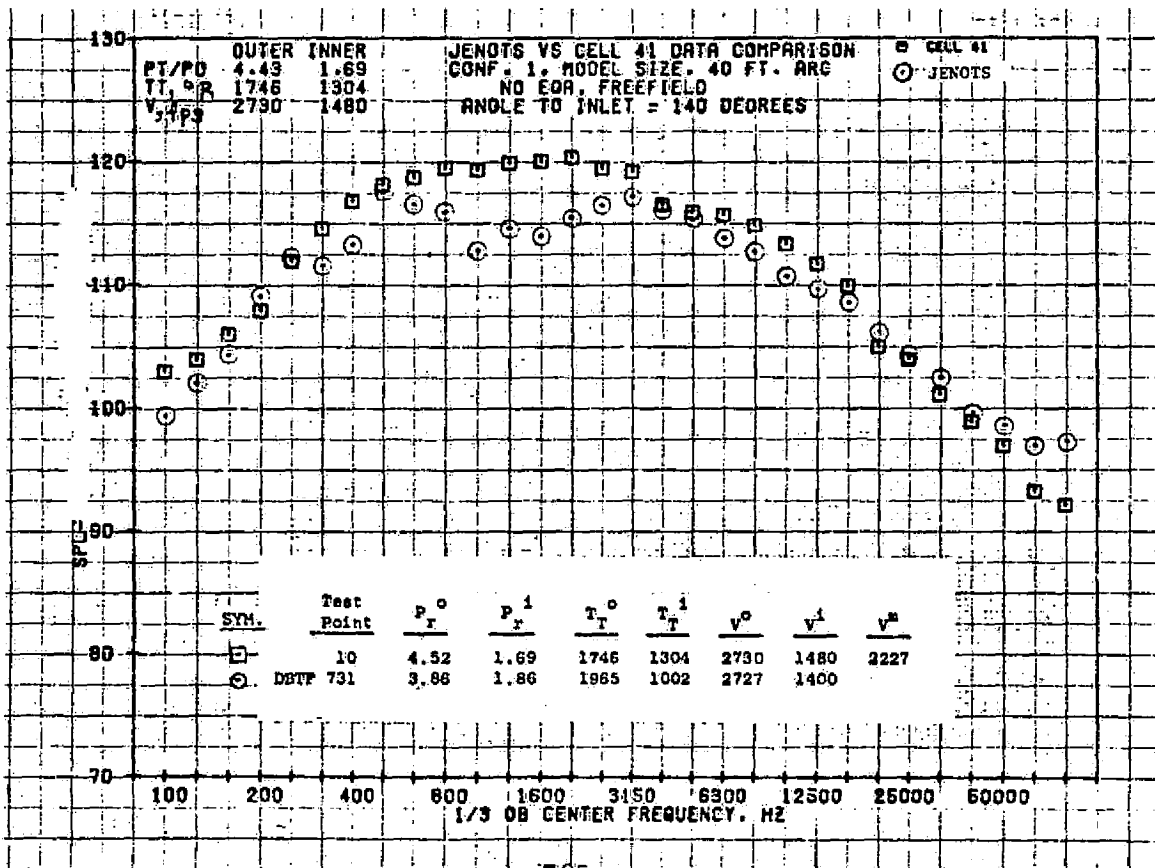
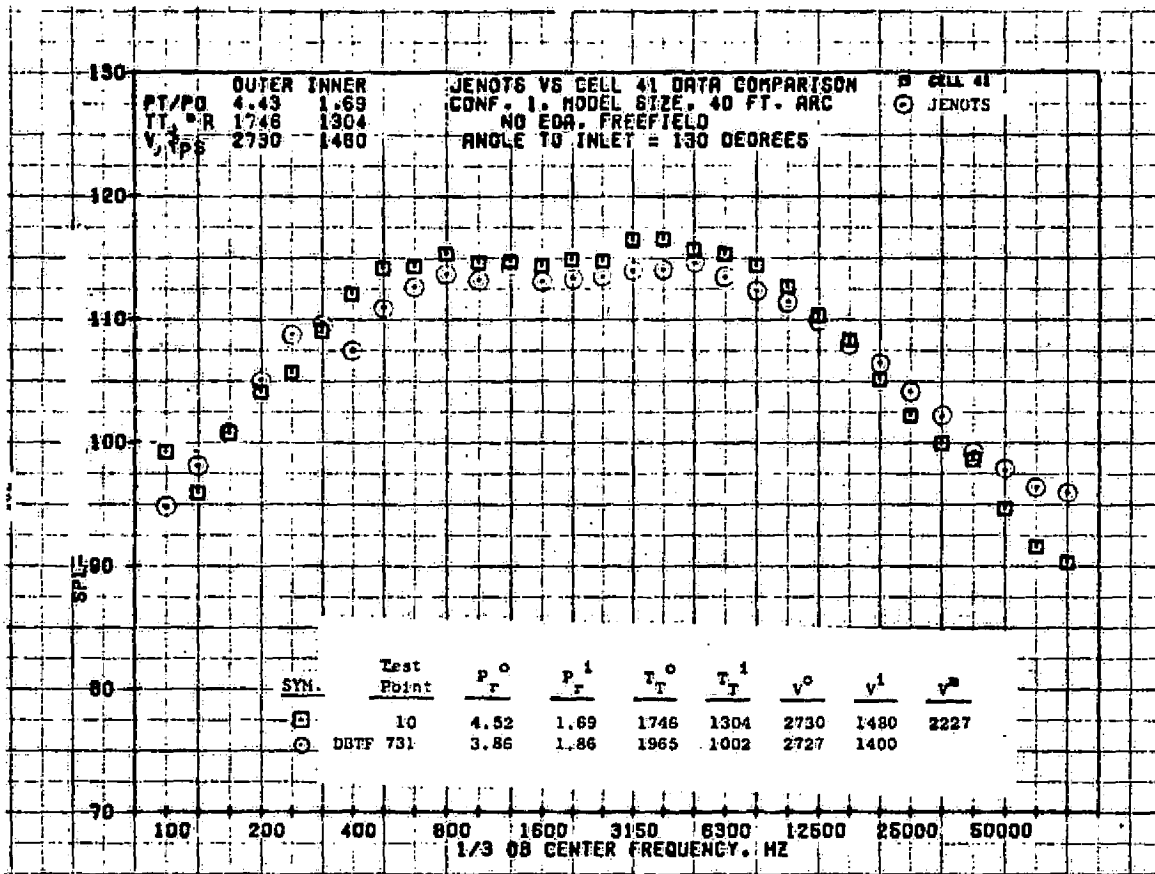
79 BURCH A.



784

SPL, dB

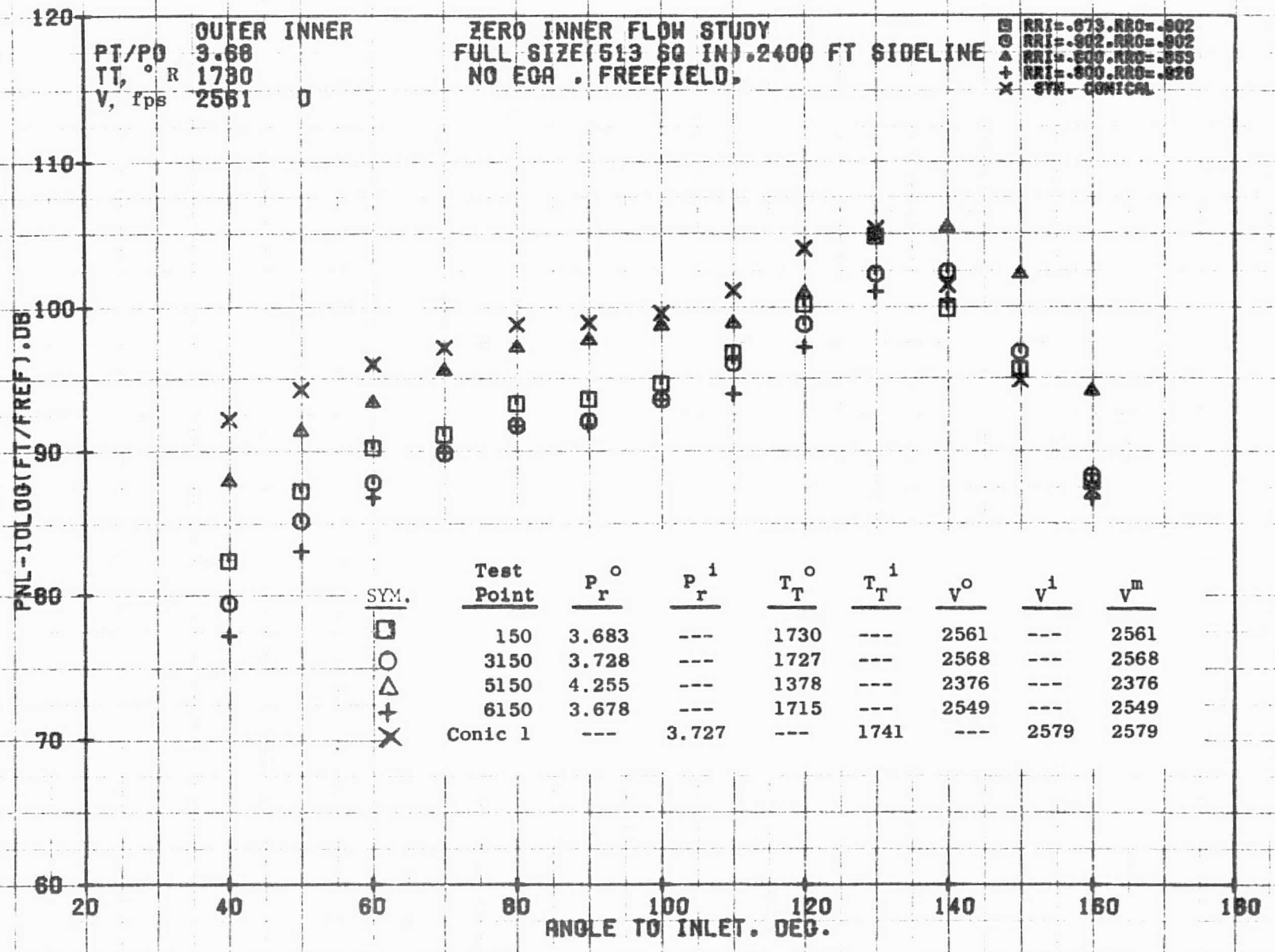
100 200 400 800 1600 3150 6300 12600 25000 50000
 1/3 octave CENTER FREQUENCY, HZ



7.3 COMPARISON OF DATA FOR IVP NOZZLES WITH LOW AMOUNTS OF INNER FLOW

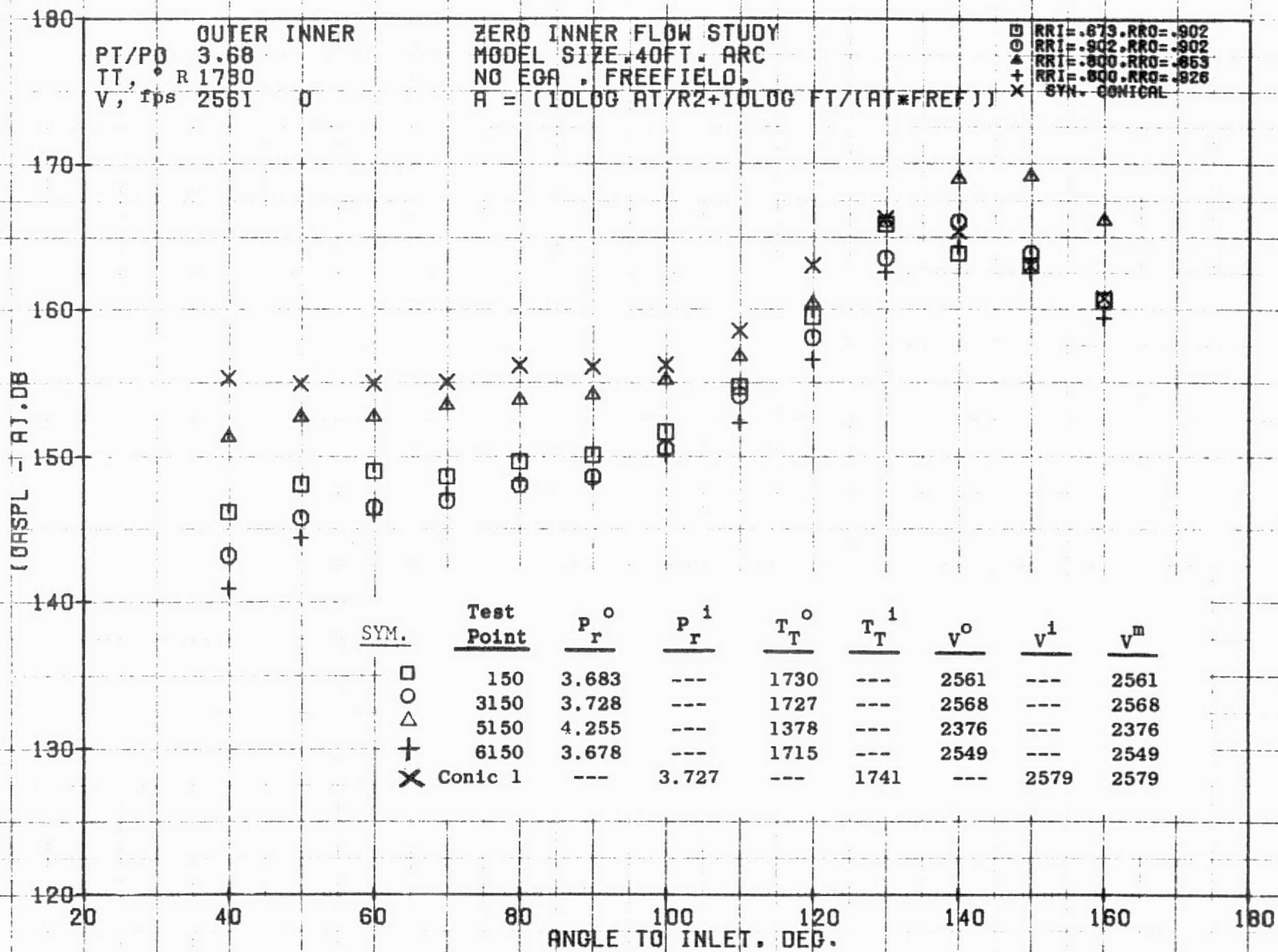
7.3.1 Zero Inner Flow Study

For configurations 1, 3, 5, and 6, acoustic measurements were made with no inner flow. For configurations 1 and 3 the outer radius ratio was 0.902 while for configurations 5 and 6, it was 0.853 and 0.926, respectively. The effect of the outer radius ratio on noise levels with zero inner flow is demonstrated in the following plots.



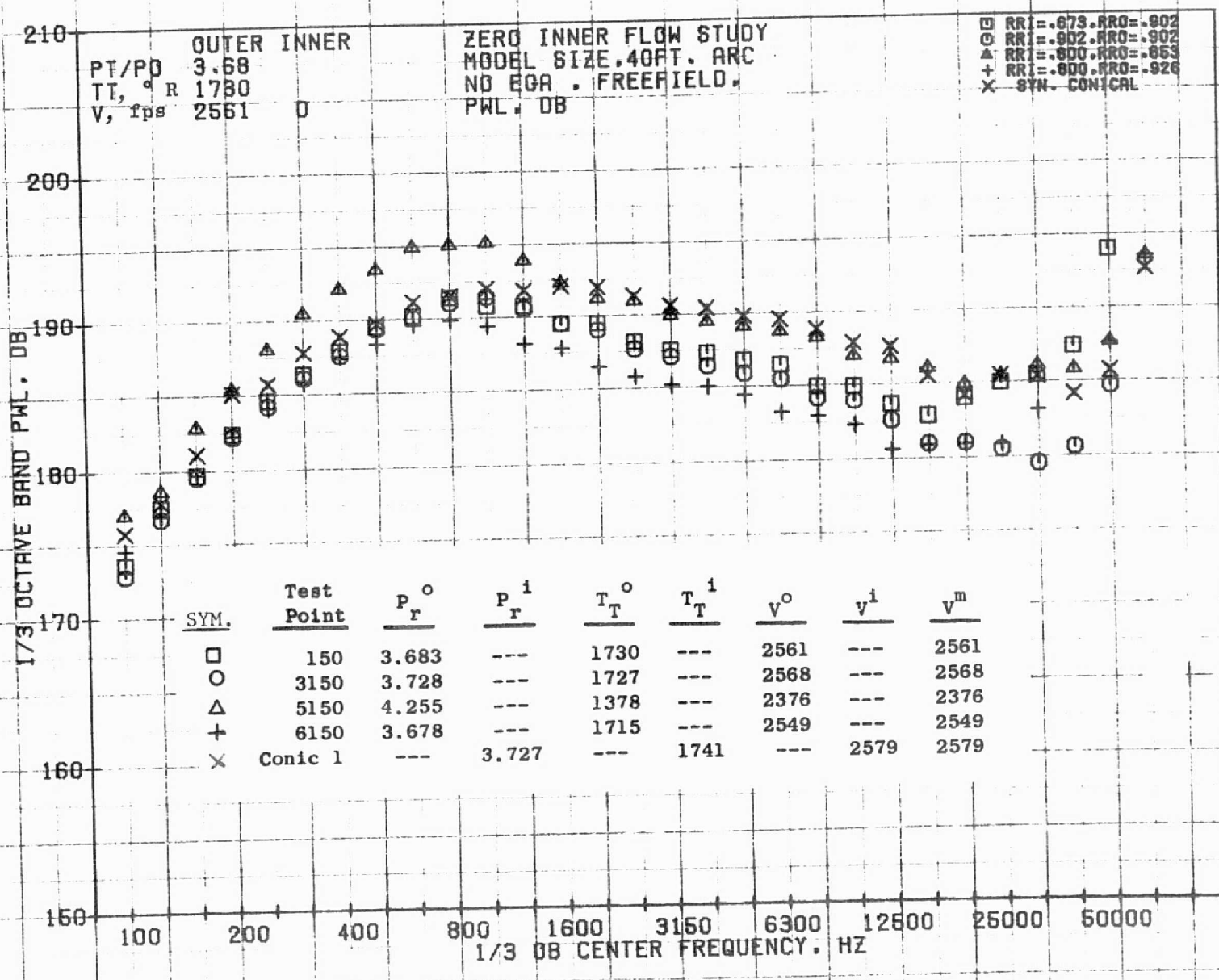
10/25/76
1X898-001

73KOLLSTEDT

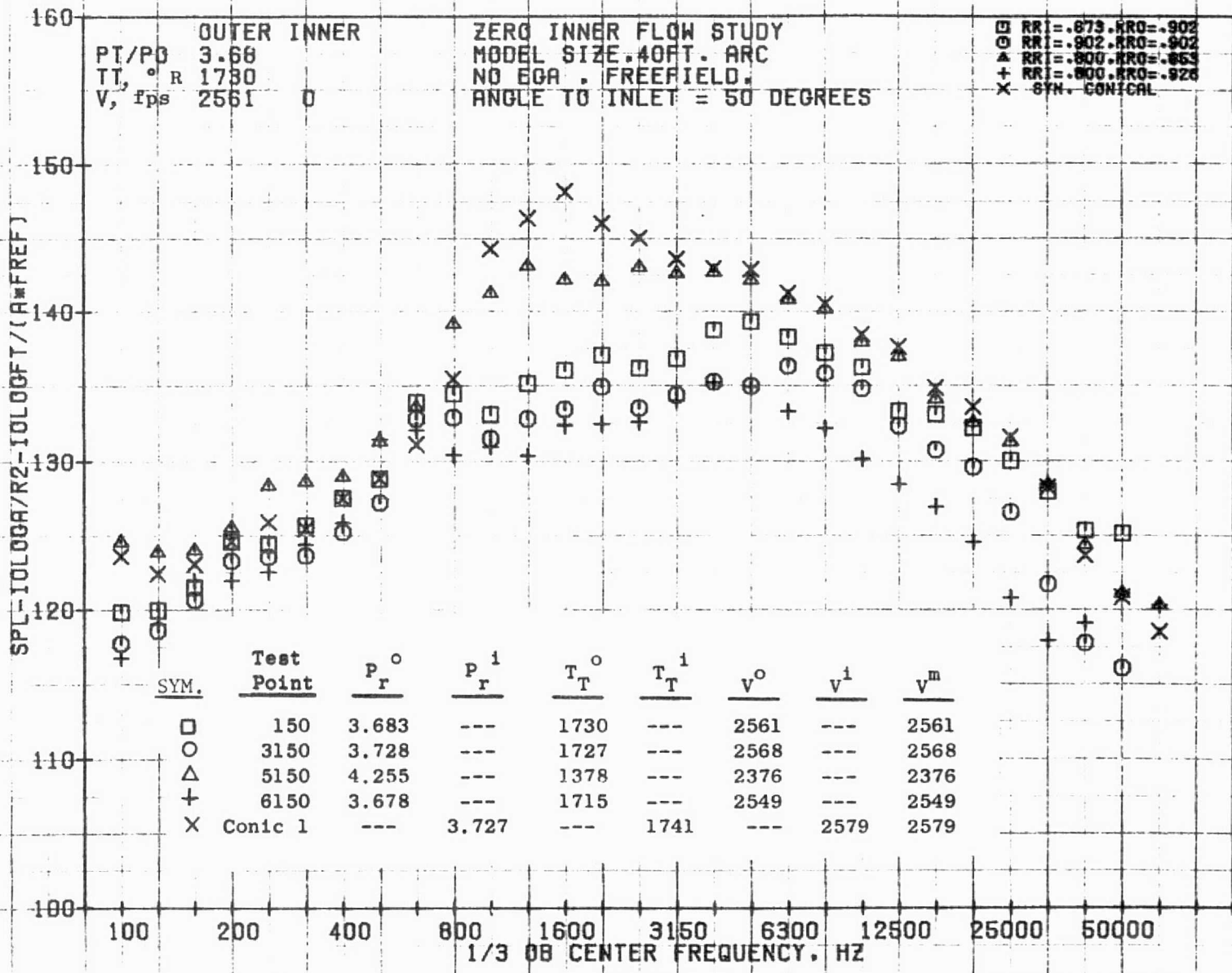


10/12/76
1X409-001

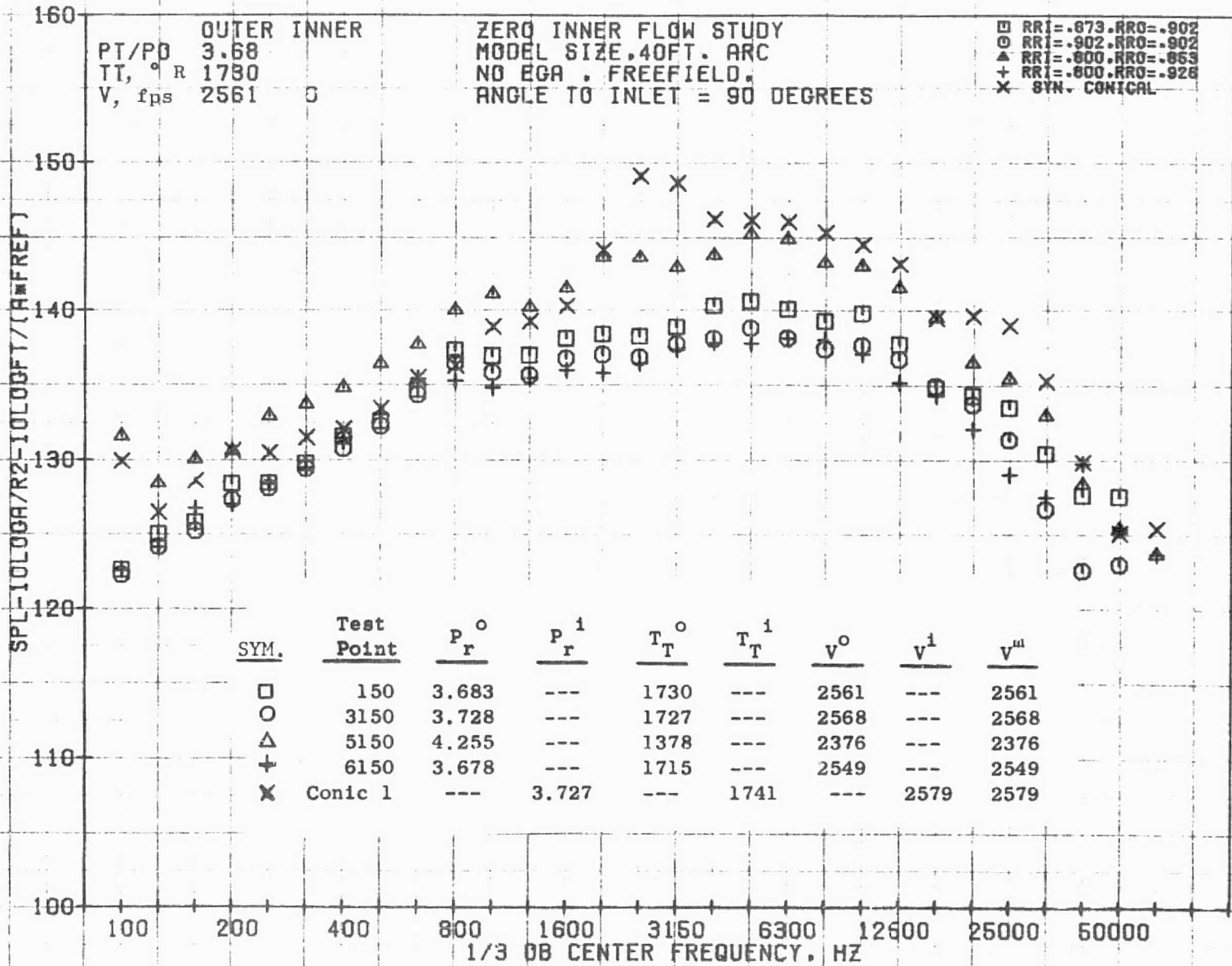
73KOLLSTEDT



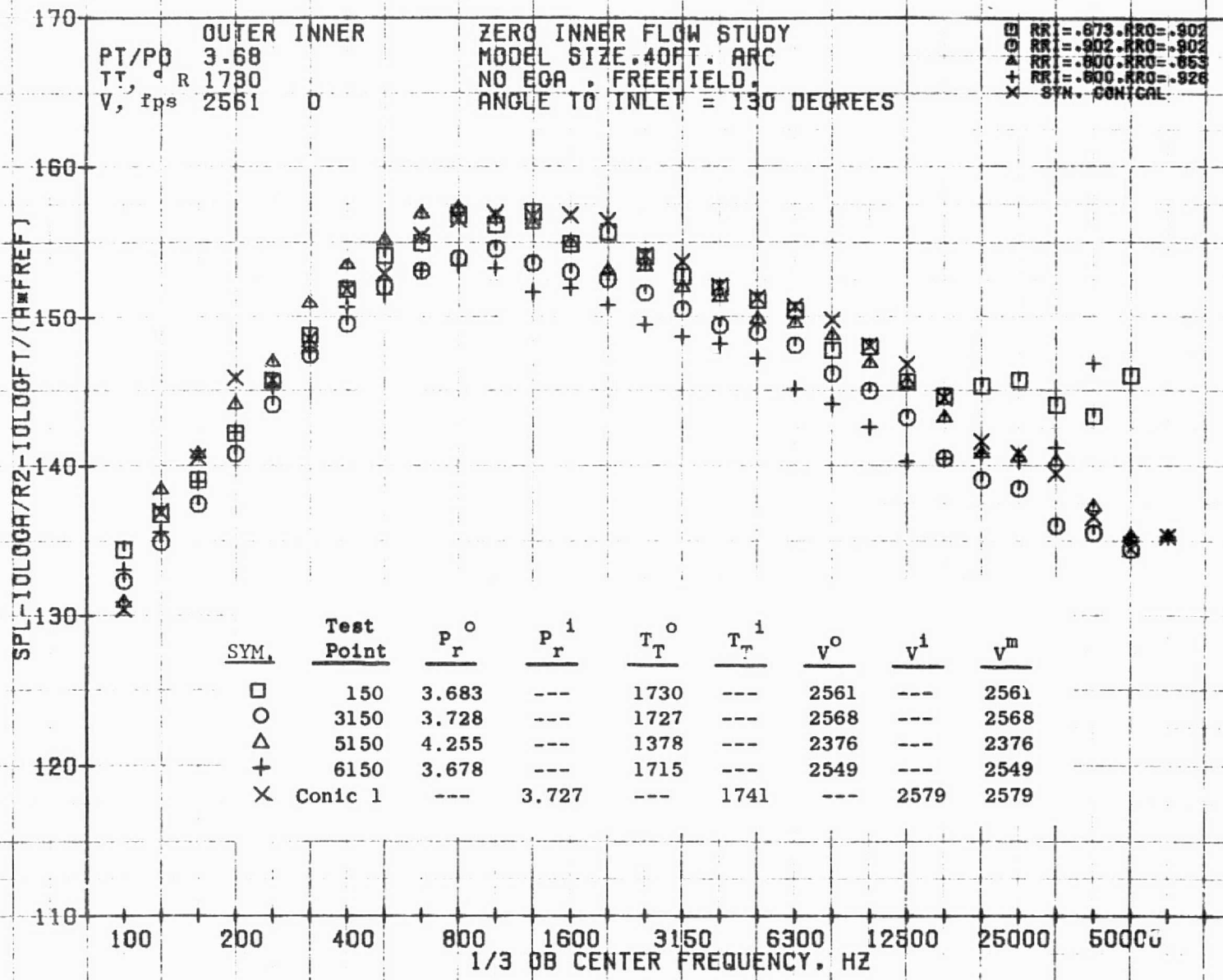
790



791

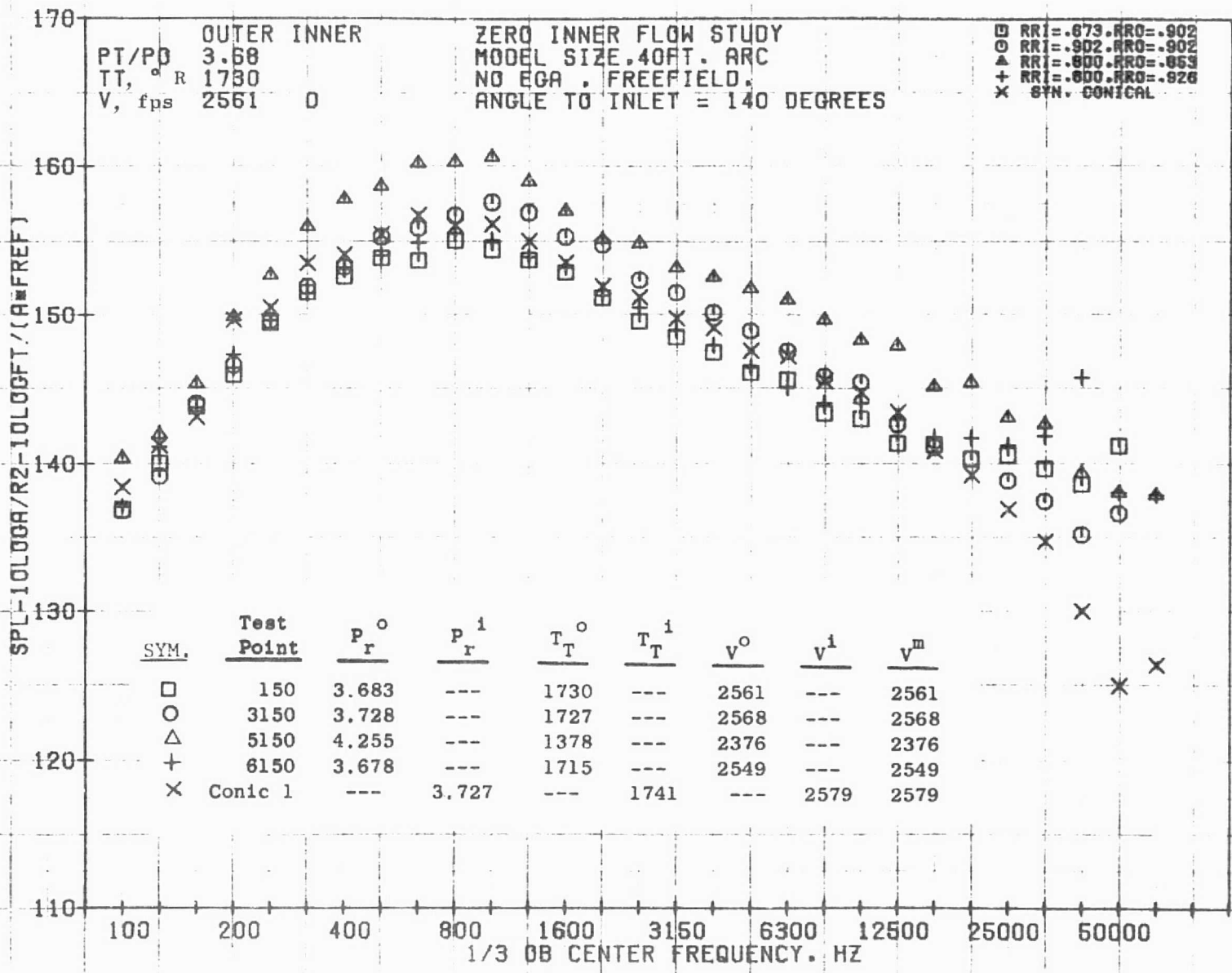


792



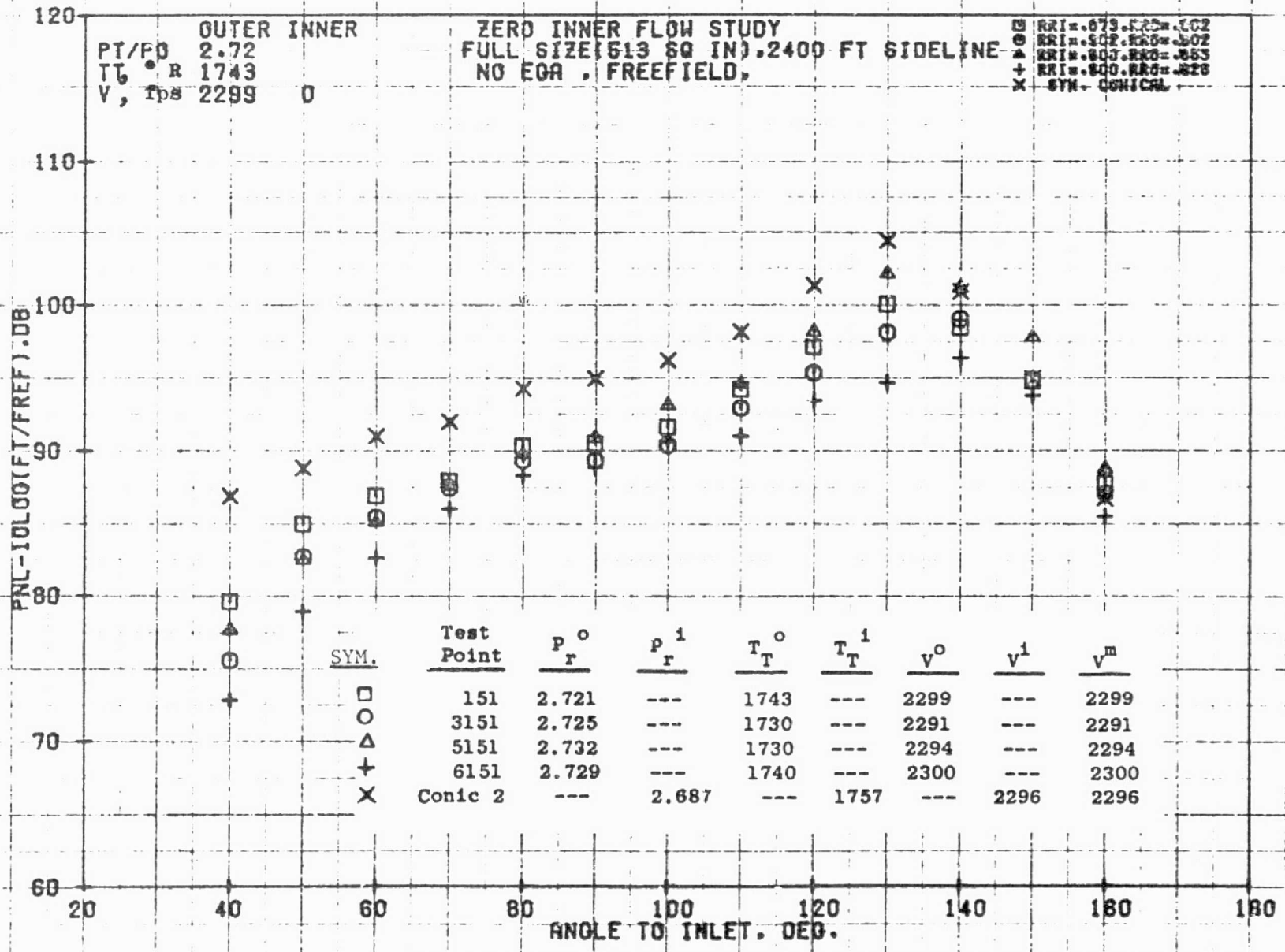
10/12/76
 1X409-001

73KOLLSTEDT



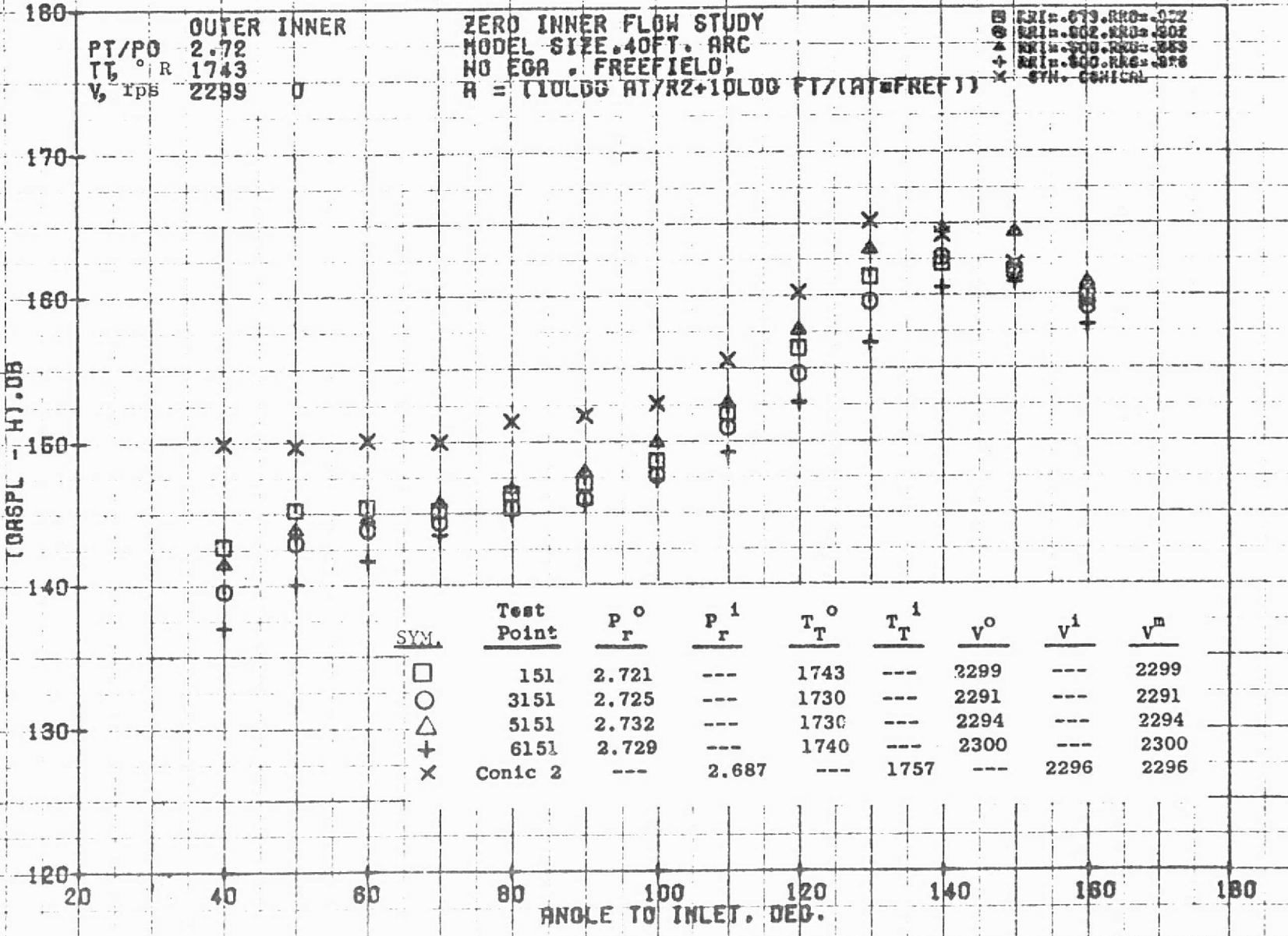
10/12/76
1X409-001

73KOLLSTEDT



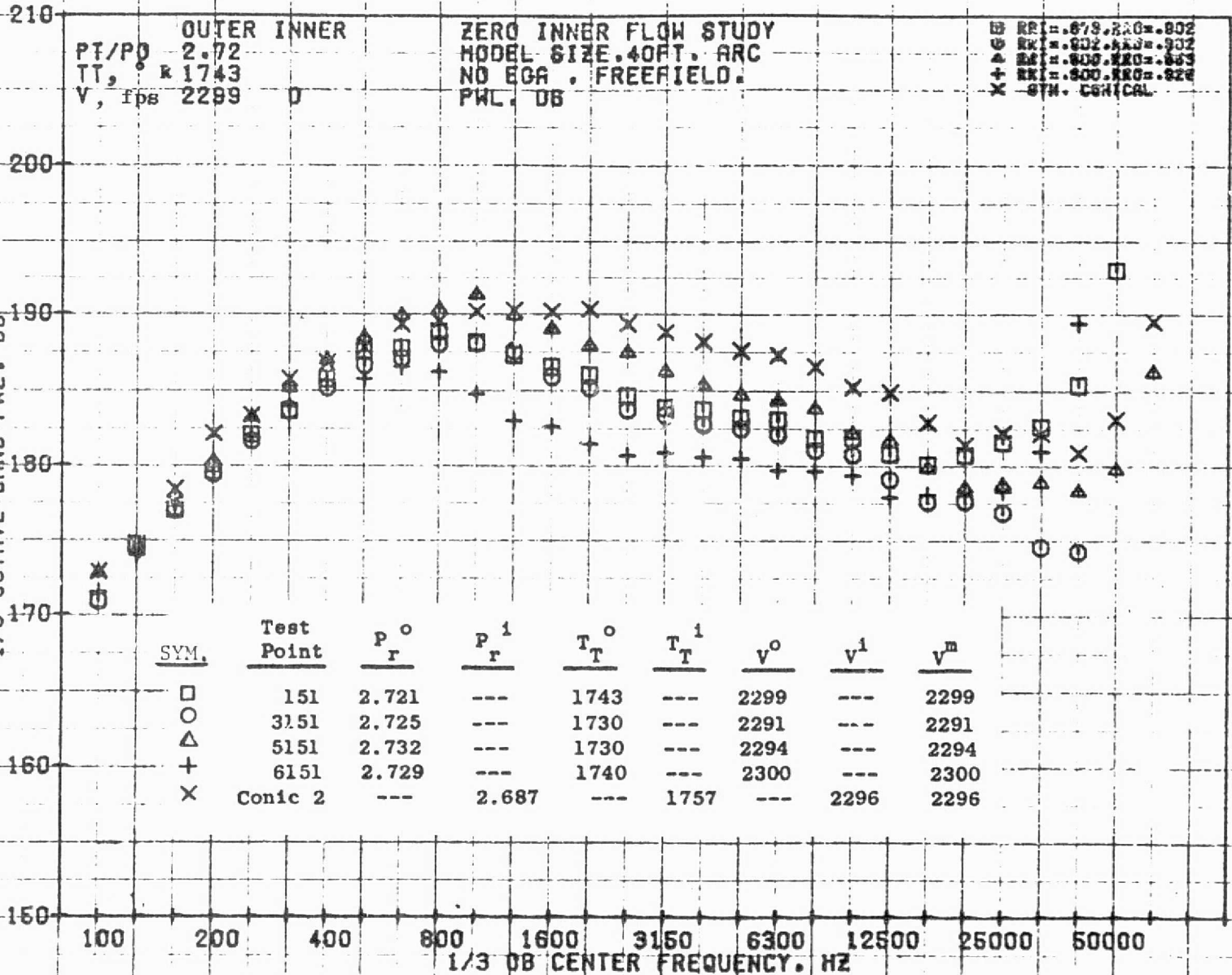
791

795

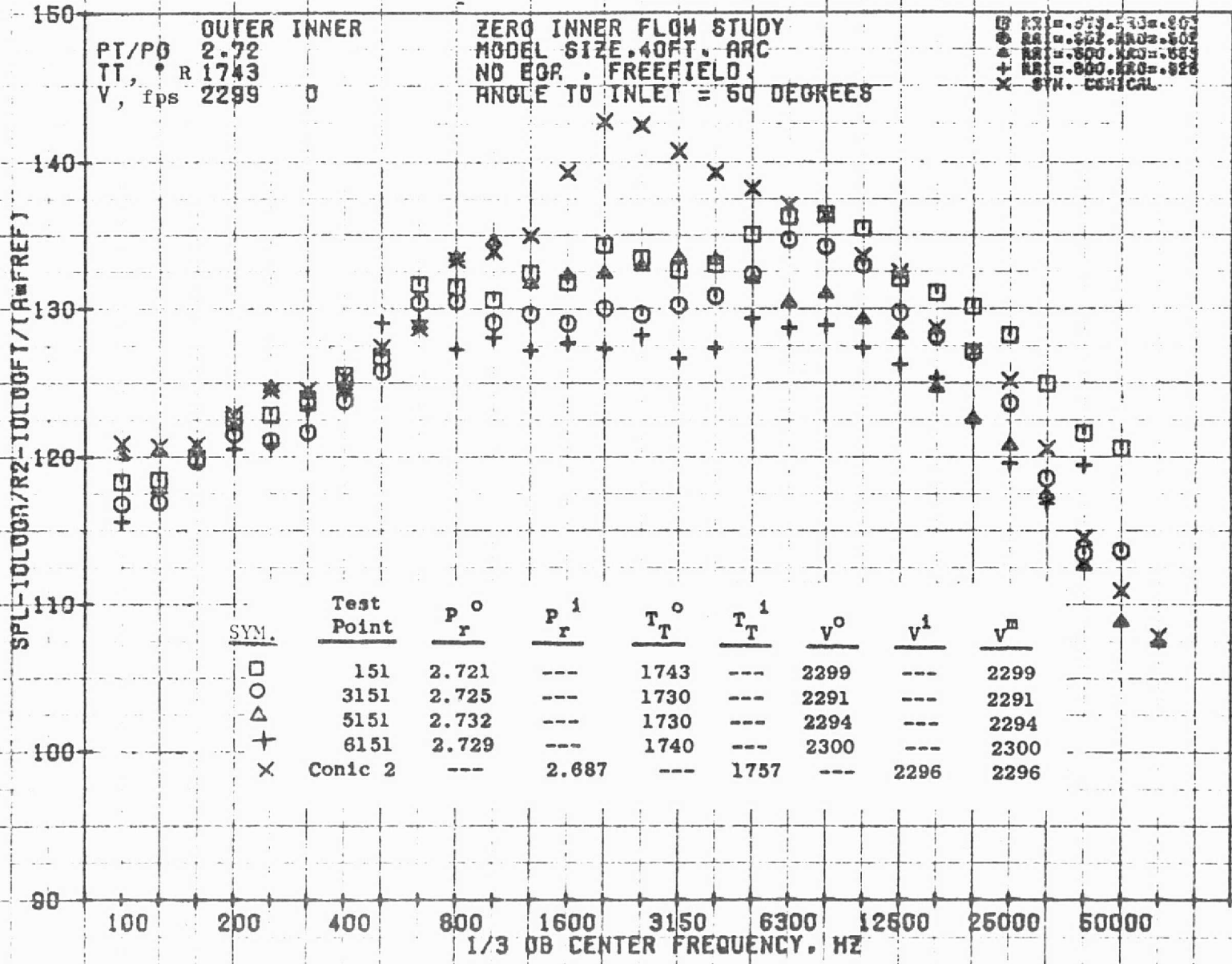


796

1/3 OCTAVE BAND PWL. DB

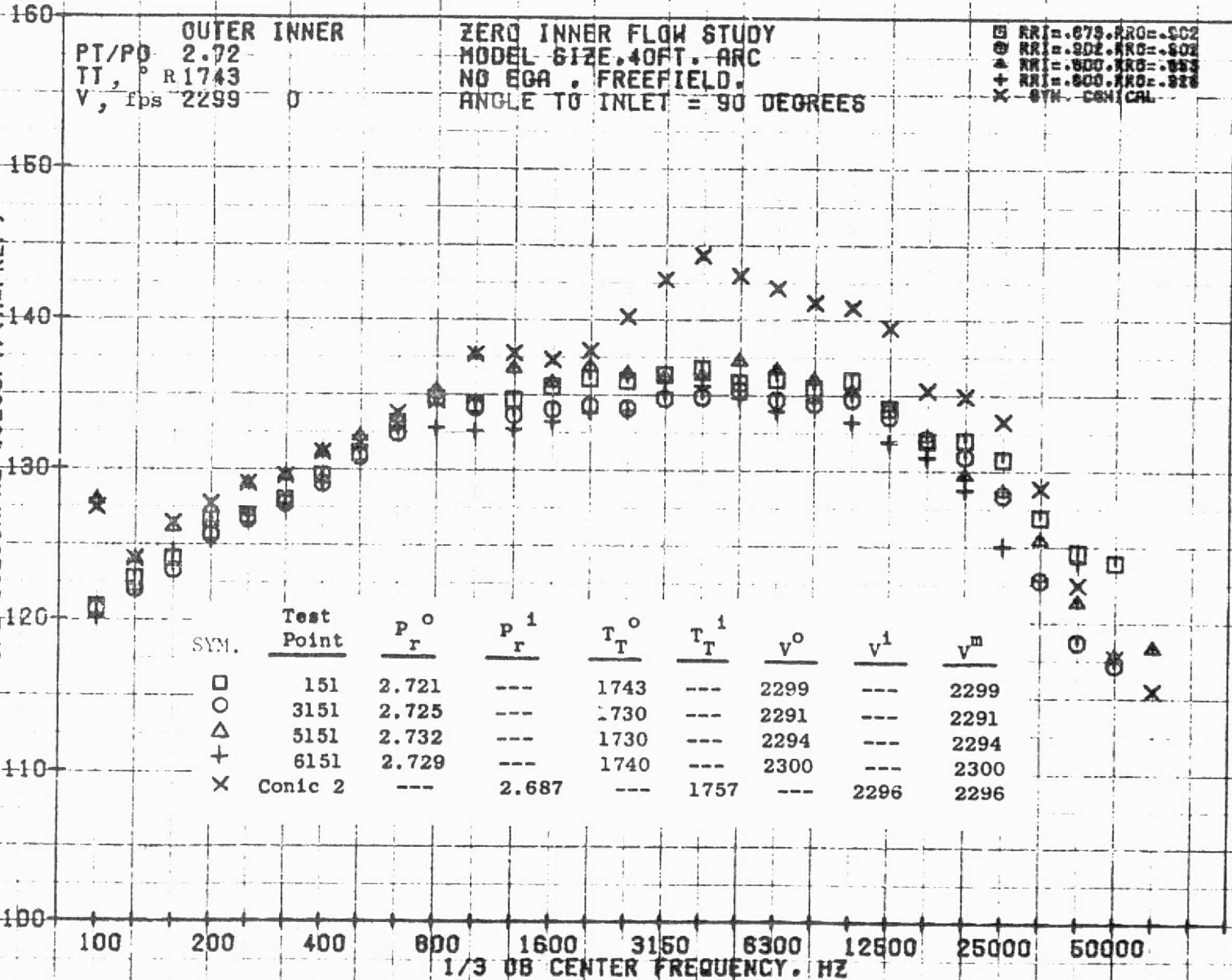


797



798

SPL - 10 LOG (R/R2 - 1) / LOG F / T (R = FREF)



OUTER INNER
 PT/P0 2.72
 TT, P R 1743
 V, fps 2299 0

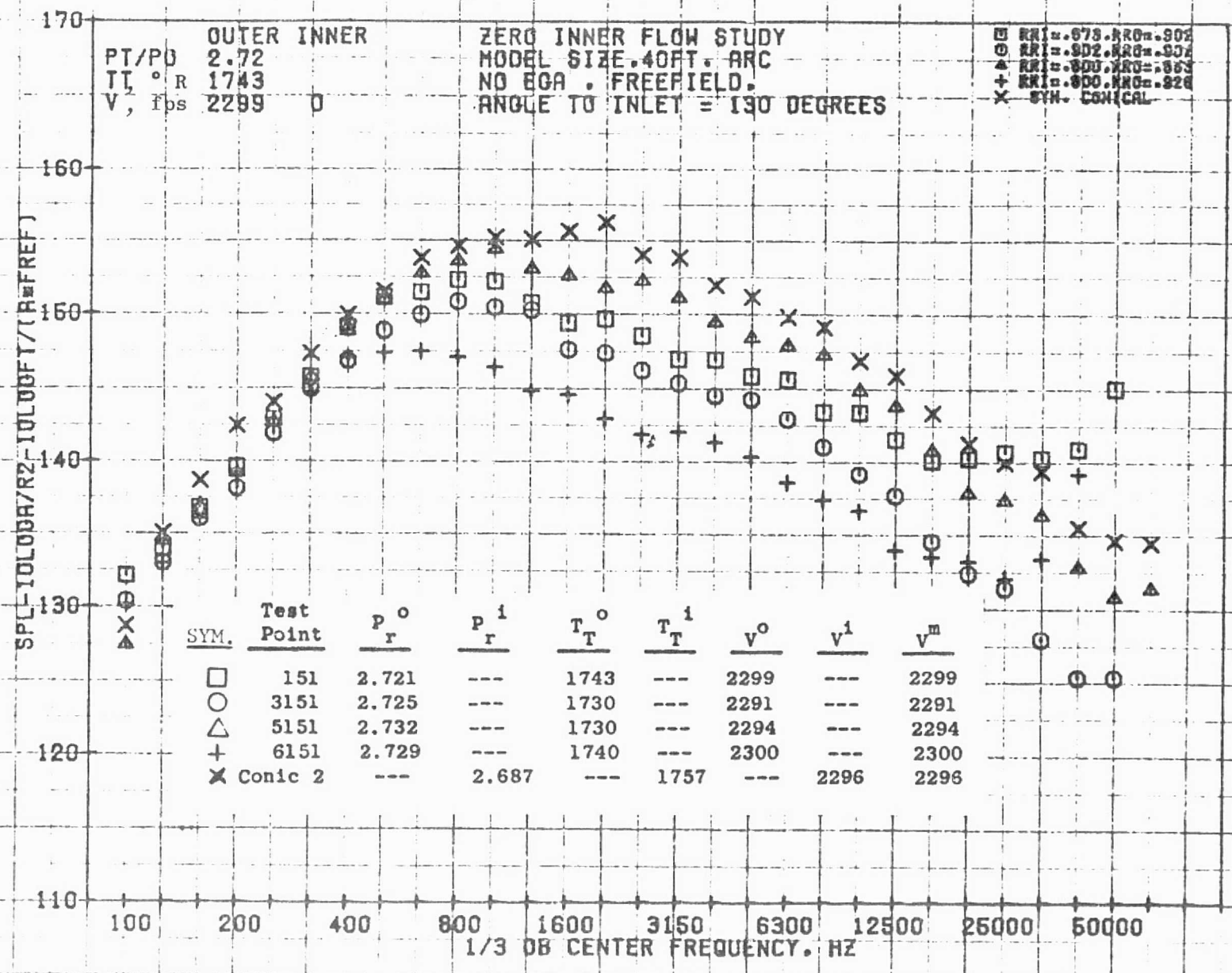
ZERO INNER FLOW STUDY
 MODEL SIZE .40 FT. ARC
 NO EGA, FREEFIELD,
 ANGLE TO INLET = 90 DEGREES

□ RRI=.679, RRO=.602
 ○ RRI=.902, RRO=.802
 △ RRI=.800, RRO=.893
 + RRI=.800, RRO=.928
 X SYN. CONICAL

SYM.	Test Point	P _r ^o	P _r ¹	T _T ^o	T _T ¹	V ^o	V ¹	V ^m
□	151	2.721	---	1743	---	2299	---	2299
○	3151	2.725	---	1730	---	2291	---	2291
△	5151	2.732	---	1730	---	2294	---	2294
+	6151	2.729	---	1740	---	2300	---	2300
X	Conic 2	---	2.687	---	1757	---	2296	2296

1/3 OBT CENTER FREQUENCY. HZ

759



170

OUTER INNER
 PI/PO 2.72
 TT, °R 1743
 V, fps 2299 0

ZERO INNER FLOW STUDY
 MODEL SIZE, 40FT. ARC
 NO EGA, FREEFIELD
 ANGLE TO INLET = 140 DEGREES

□ PR1=.675, RR0=.658
 ○ PR1=.902, RR0=.902
 △ PR1=.300, RR0=.853
 + PR1=.800, RR0=.928
 X SYN. CONICAL

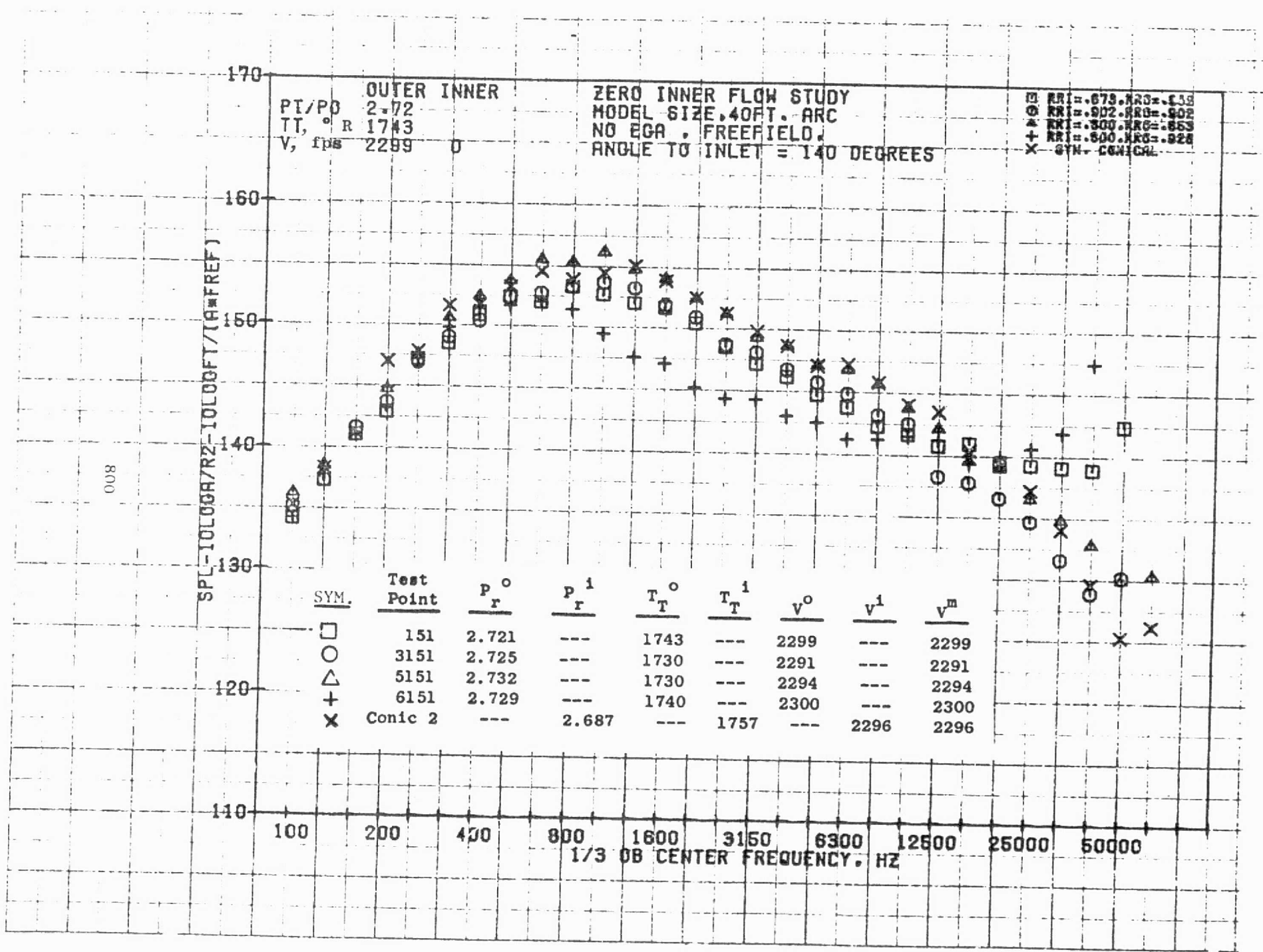
SPL-10LOGA/R2-10LOGFT/(A*REF)

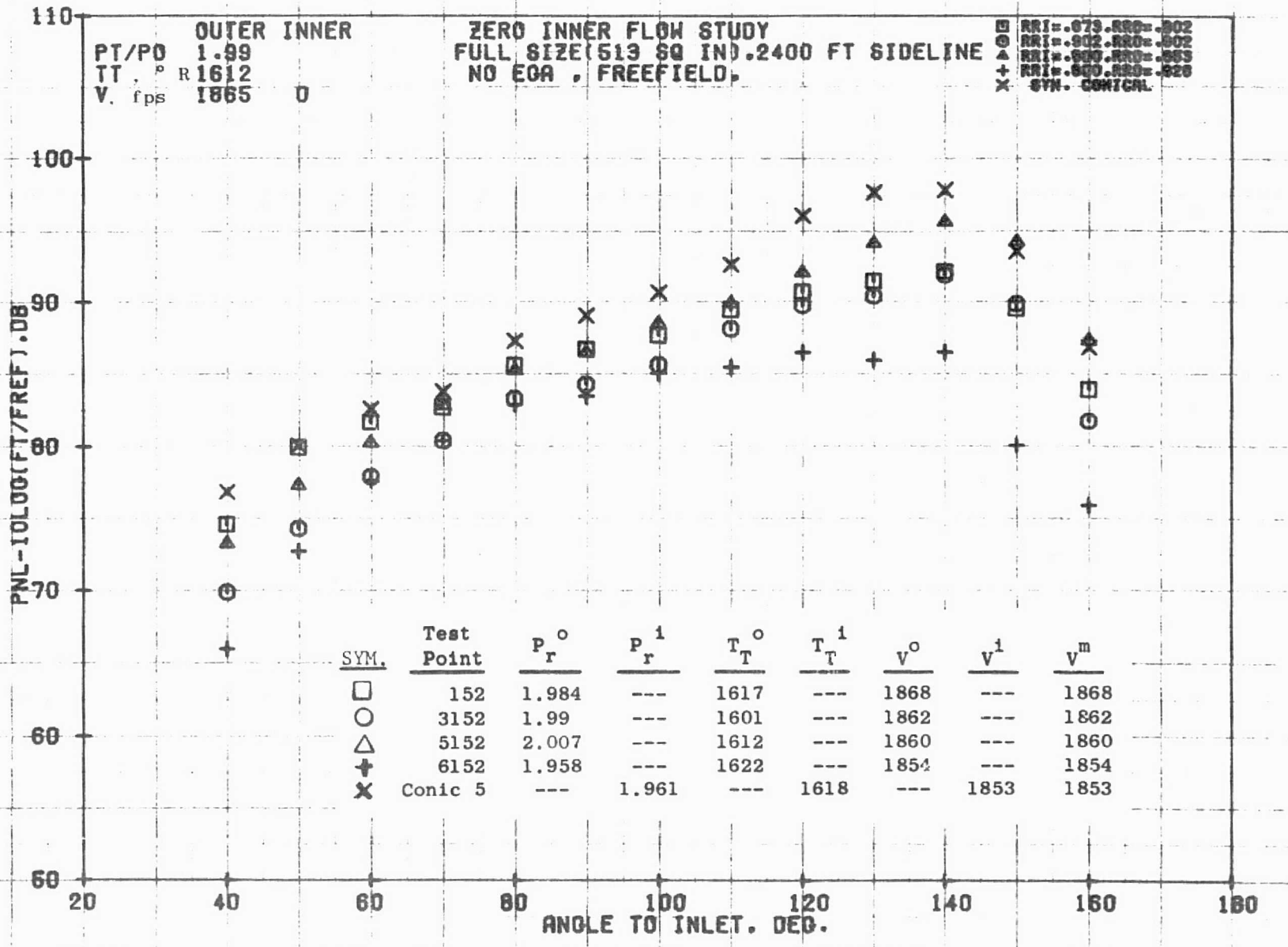
008

160
150
140
130
120
110

SYM.	Test Point	P_r^0	P_r^1	T_T^0	T_T^1	V^0	V^1	V^m
□	151	2.721	---	1743	---	2299	---	2299
○	3151	2.725	---	1730	---	2291	---	2291
△	5151	2.732	---	1730	---	2294	---	2294
+	6151	2.729	---	1740	---	2300	---	2300
X	Conic 2	---	2.687	---	1757	---	2296	2296

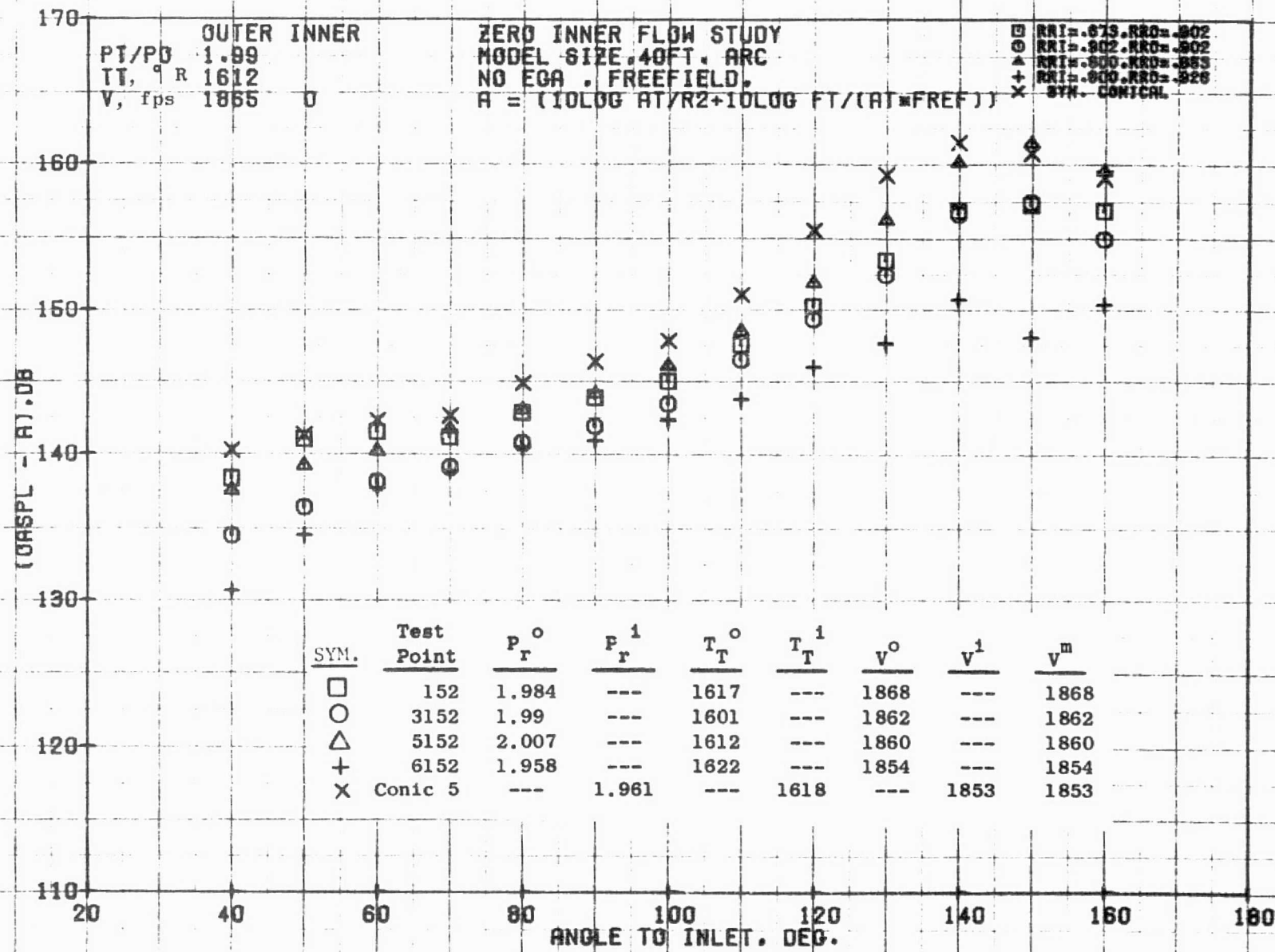
100 200 400 800 1600 3150 6300 12500 25000 50000
 1/3 OB CENTER FREQUENCY, HZ





10/25/76
1X896-001

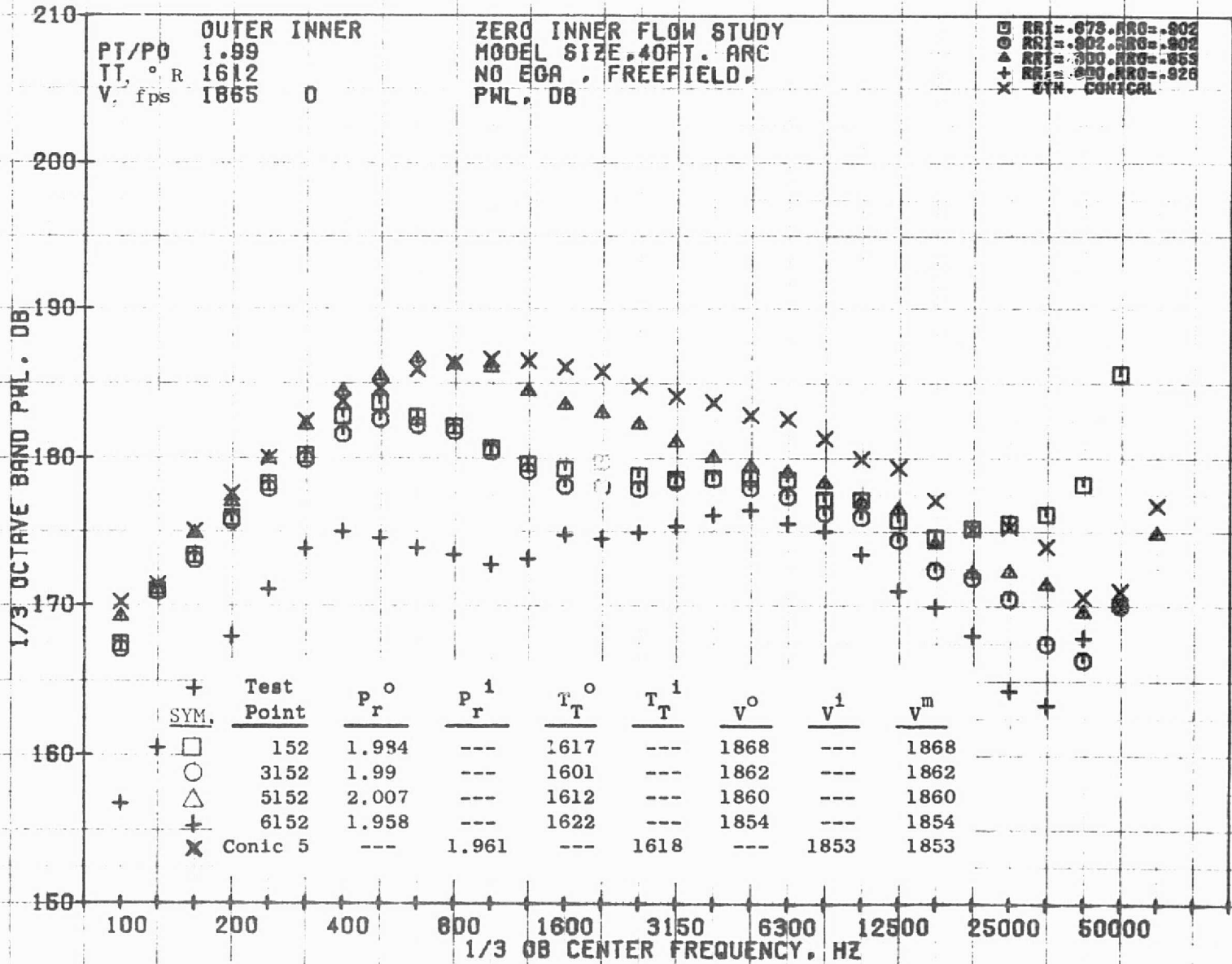
73KOLLSTEDT

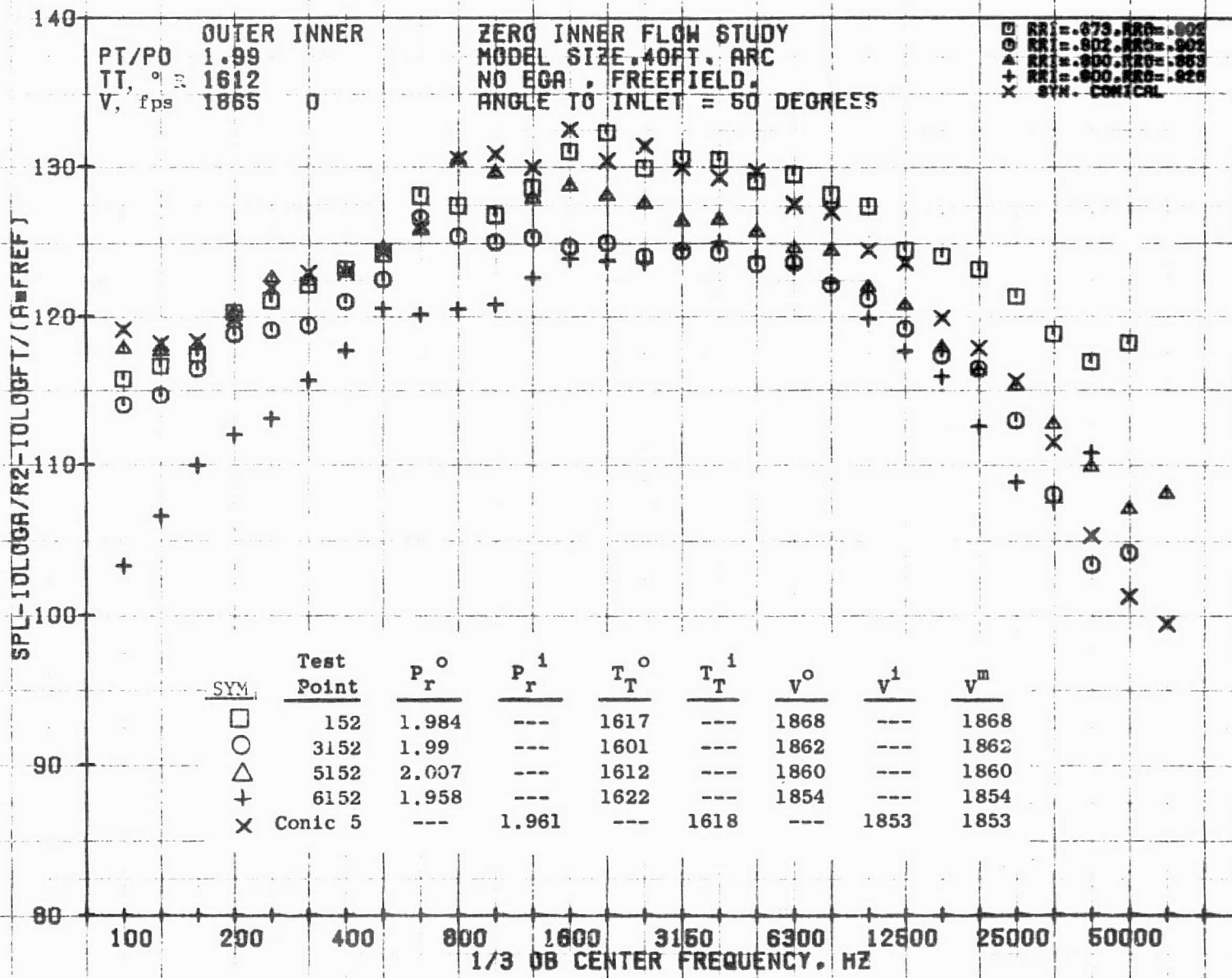


10/25/76
1X945-001

73KOLLSTEDT

808

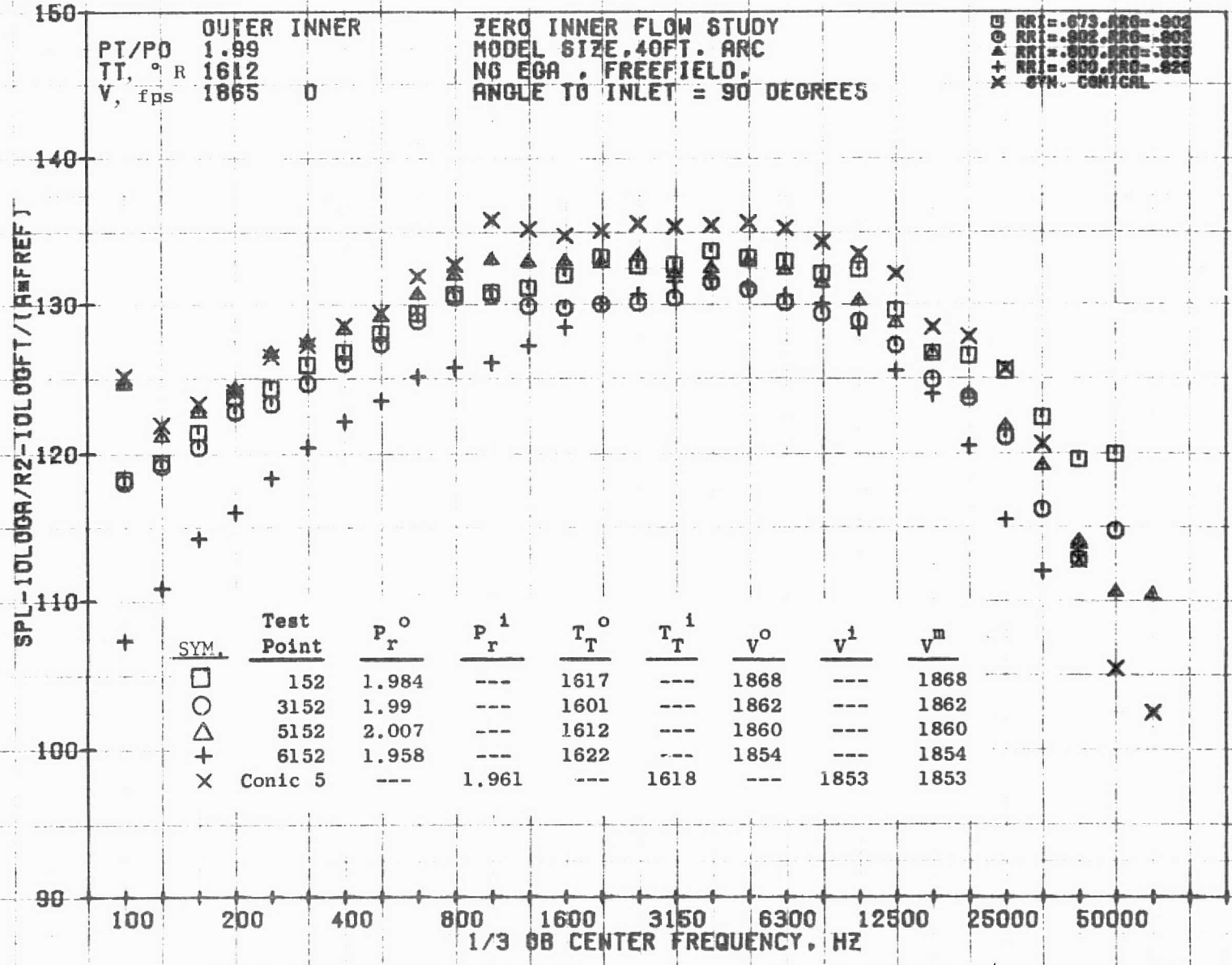




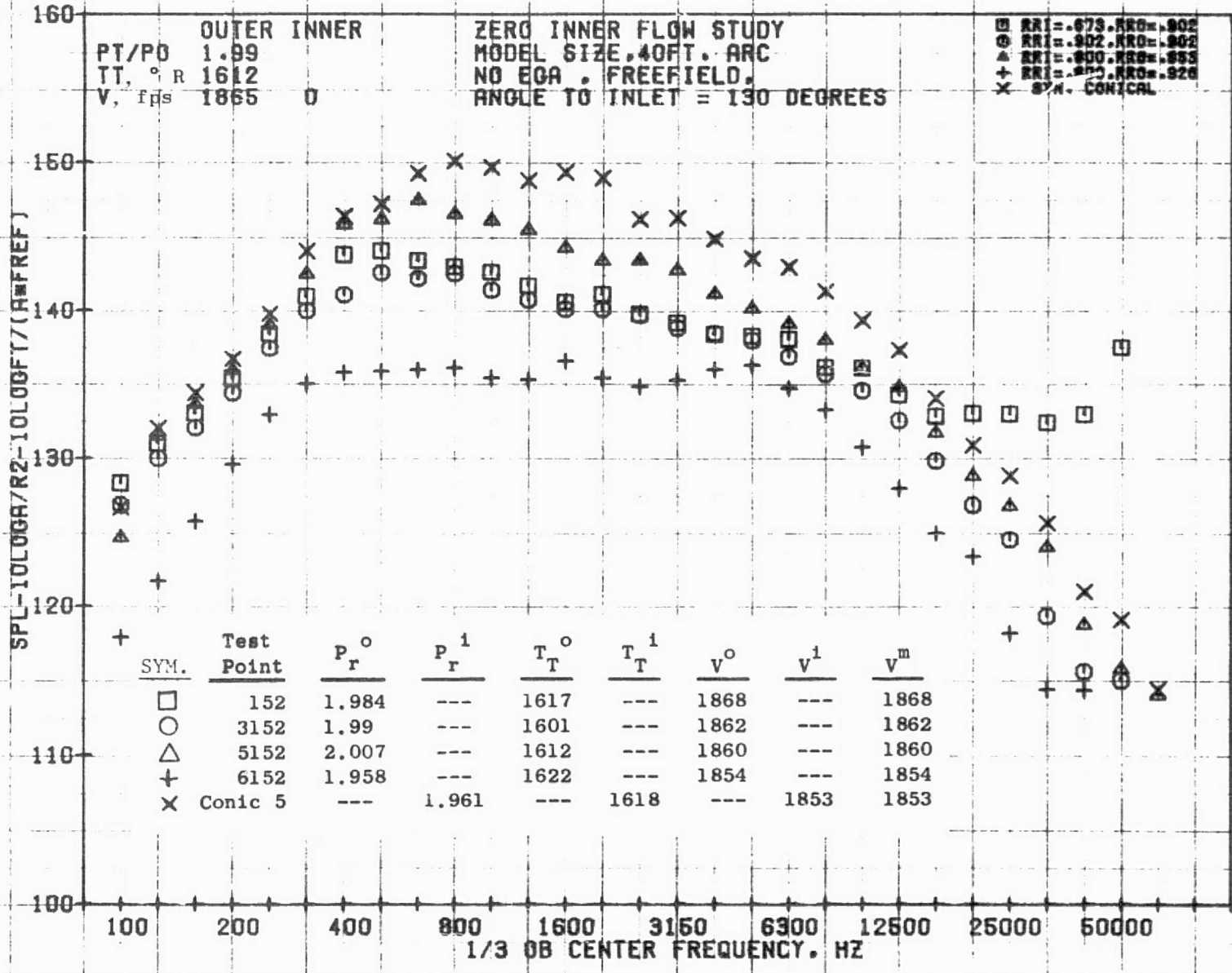
10/25/76
1X945-001

79KOLLSTEDT

805



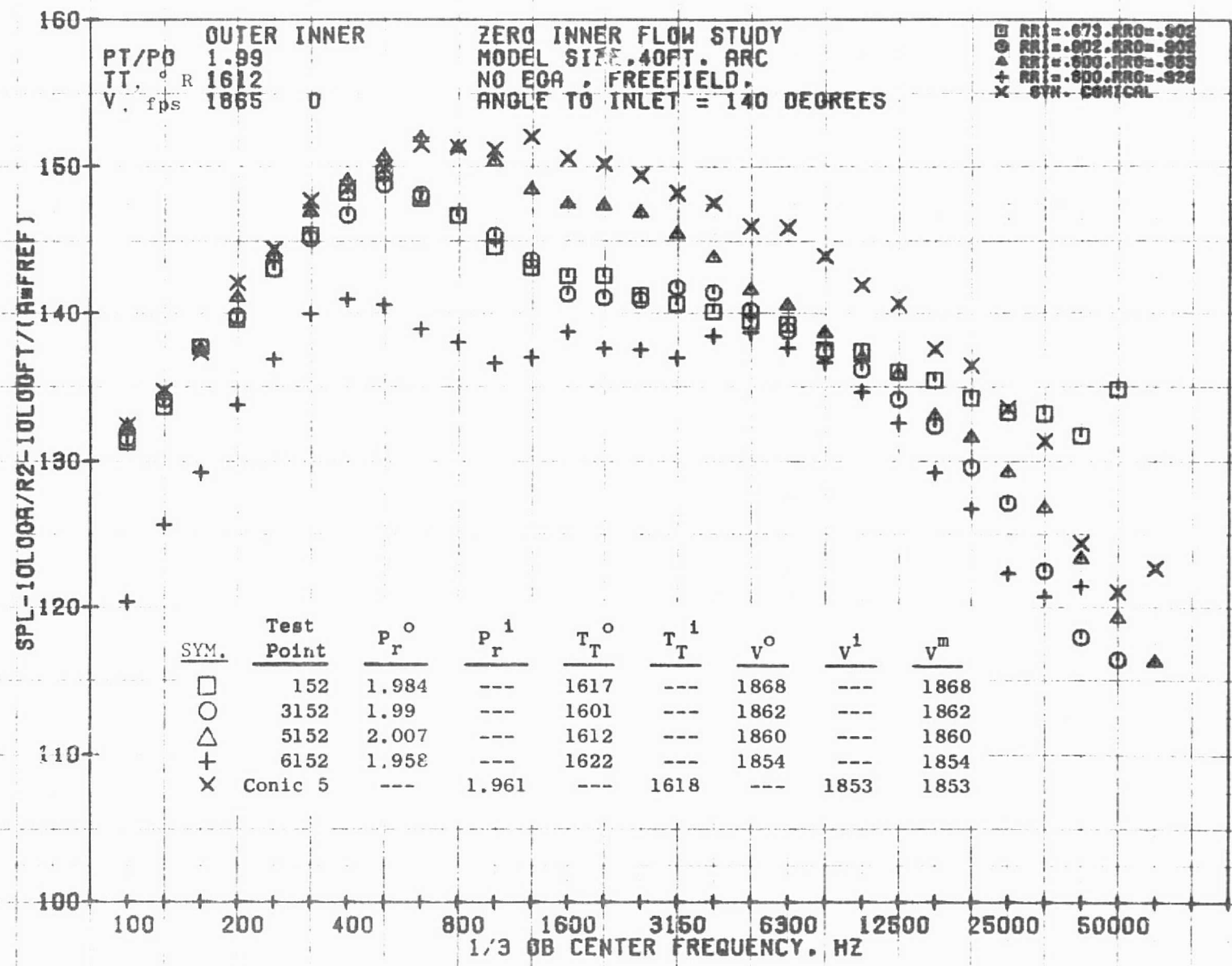
808



10/25/76
1X945-001

73KOLLSTEDT

807



10/25/76
1X945-001

73KOLLSTEOT

7.3.2 Low Inner Flow Study

The effect of low inner flows was investigated for configurations 1 and 3. Configurations 1 and 3 both have a 0.902 outer radius ratio, but configuration 1 has a 0.673 inner radius ratio compared to a 0.902 inner radius ratio for configuration 3. Low flow testing was initially performed on configuration 1 at weight flow ratios (W^i/W^o) of 0.02, 0.04, and 0.06. It was found that there was no significant noise suppression relative to the zero inner flow case so higher inner flow rates were tested. Noise suppression was seen at higher flow rates so that for configuration 3 the tests were performed primarily at weight flow ratios of 0.06, 0.09, and 0.12.

The following graphs are based on a variation of W^i/W^o (sometimes expressed as W_8/W_{28}) whereas the Tables 6 and 7 in Volume I used W^i/W_T and W^o/W_T parameters.

PT/PO
TT
V

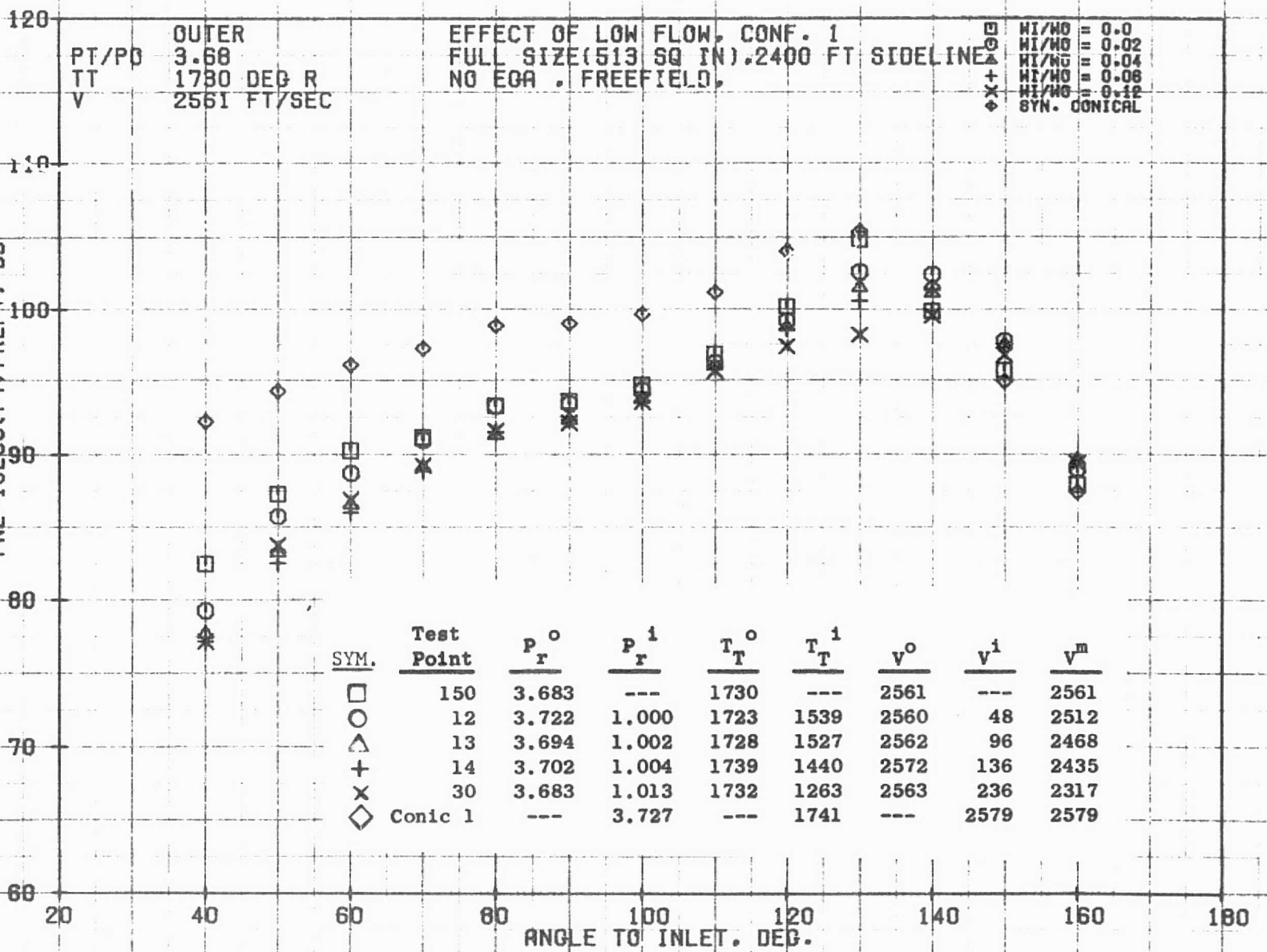
OUTER
3.68
1730 DEG R
2561 FT/SEC

EFFECT OF LOW FLOW, CONF. 1
FULL SIZE (513 SQ IN), 2400 FT SIDELINE
NO EGA, FREEFIELD,

□ HI/WO = 0.0
 ○ HI/WO = 0.02
 △ HI/WO = 0.04
 + HI/WO = 0.06
 × HI/WO = 0.12
 ◇ SYN. CONICAL

808

PNL - 10 LOG (FT/FREF), DB



SYM.	Test Point	P_r^o	P_r^i	T_T^o	T_T^i	V^o	V^i	V^m
□	150	3.683	---	1730	---	2561	---	2561
○	12	3.722	1.000	1723	1539	2560	48	2512
△	13	3.694	1.002	1728	1527	2562	96	2468
+	14	3.702	1.004	1739	1440	2572	136	2435
×	30	3.683	1.013	1732	1263	2563	236	2317
◇	Conic 1	---	3.727	---	1741	---	2579	2579

10/25/76
1X285-001

73KOLLSTEDT

180

PT/PO
TT
V

OUTER
3.68
1780 DEG R
2561 FT/SEC

EFFECT OF LOW FLOW, CONF. 1
MODEL SIZE, 40FT. ARC
NO EGA, FREEFIELD
 $A = (10 \log AT/RZ + 10 \log FT/(AT * P_{REF}))$

□ HI/HO = 0.0
○ HI/HO = 0.02
△ HI/HO = 0.04
+ HI/HO = 0.06
x HI/HO = 0.12
◇ SYN. CONICAL

810

(OASPL - H), DB

170

160

150

140

130

120

20

40

60

80

100

120

140

160

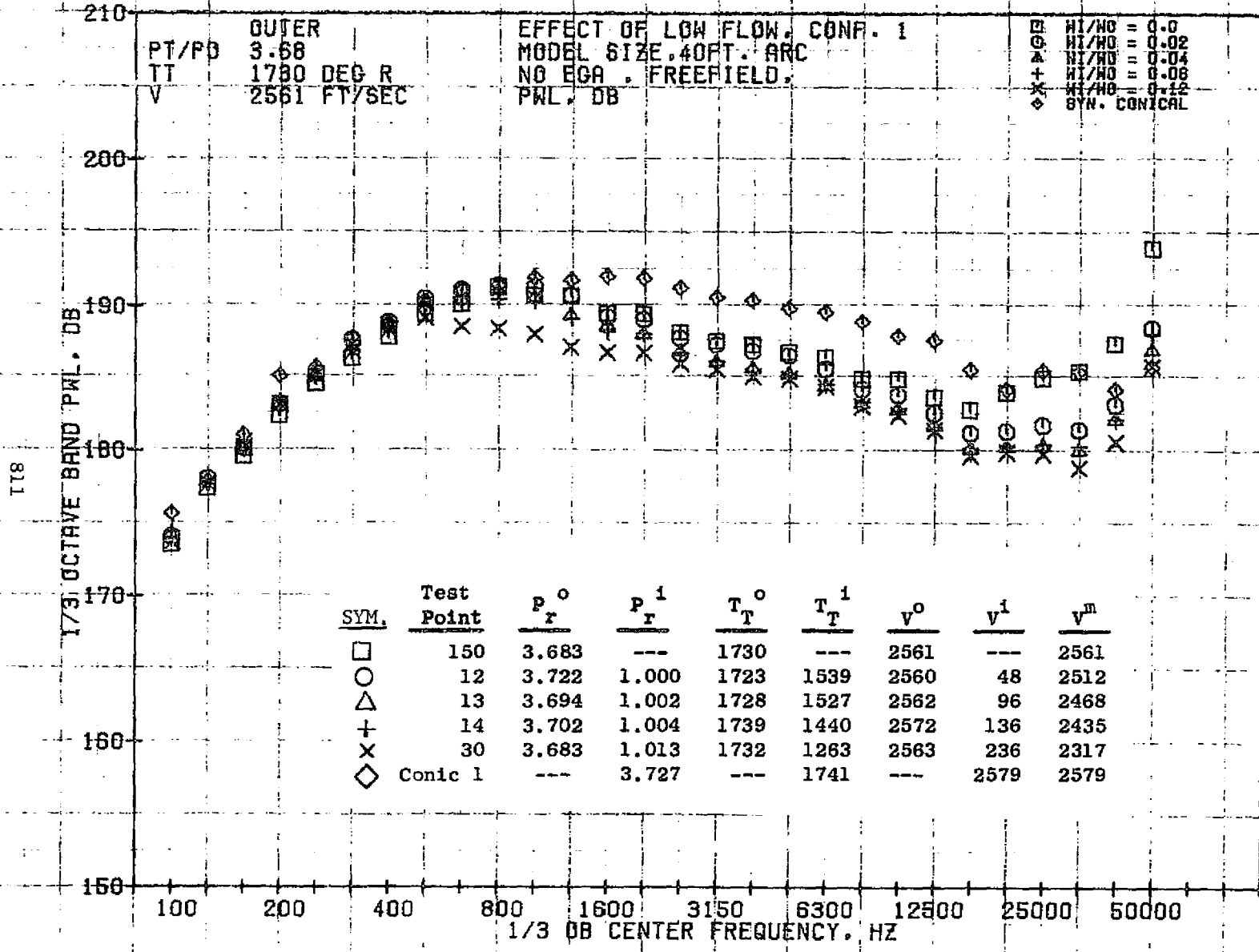
180

ANGLE TO INLET, DEG.

SYM.	Test Point	P_r^0	P_r^1	T_T^0	T_T^1	V^0	V^1	V^m
□	150	3.683	---	1730	---	2561	---	2561
○	12	3.722	1.000	1723	1539	2560	48	2512
△	13	3.694	1.002	1728	1527	2562	96	2468
+	14	3.702	1.004	1739	1440	2572	136	2435
x	30	3.683	1.013	1732	1263	2563	236	2317
◇	Conic 1	---	3.727	---	1741	---	2579	2579

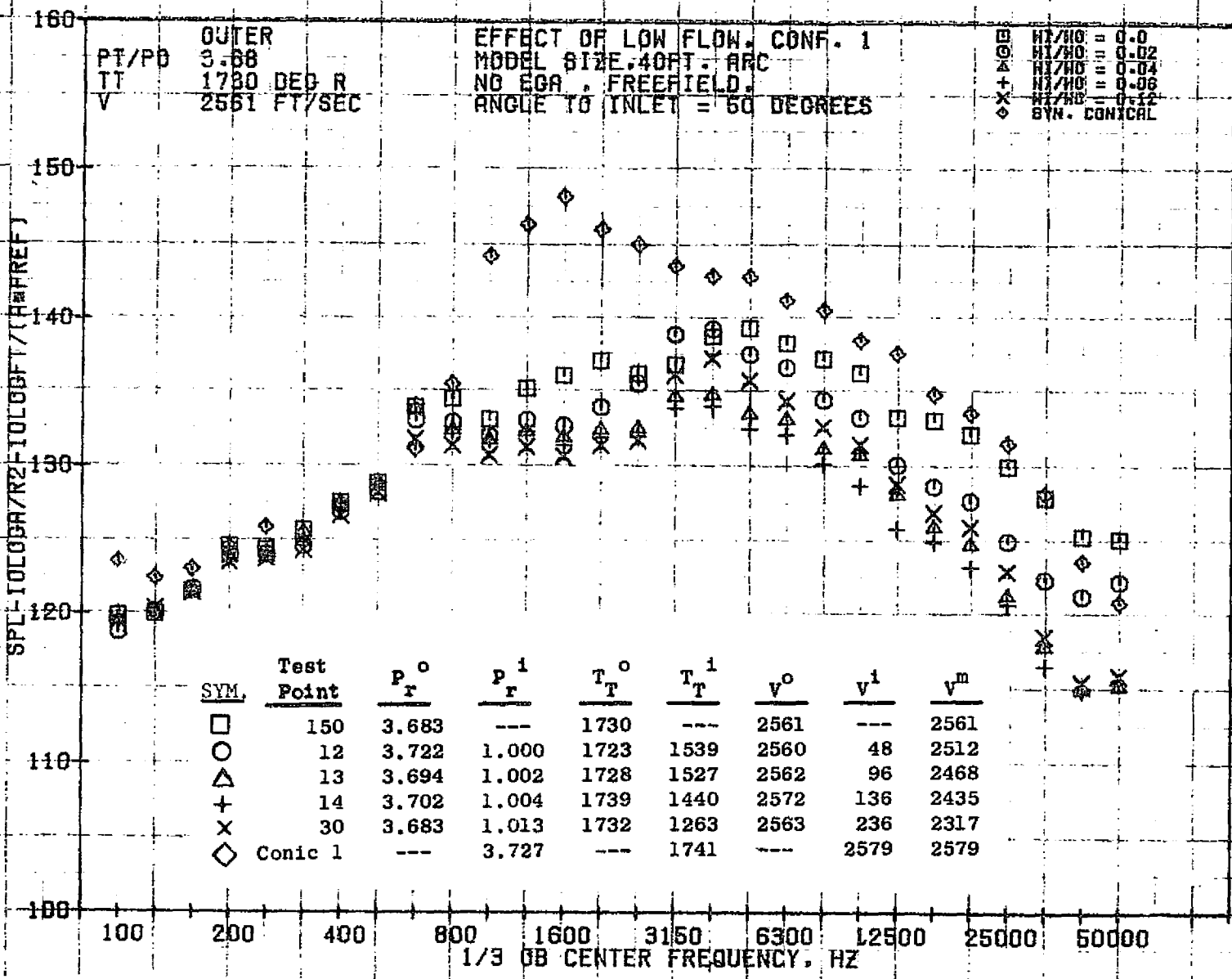
10/06/76
1X583-001

73KOLLSTEDT



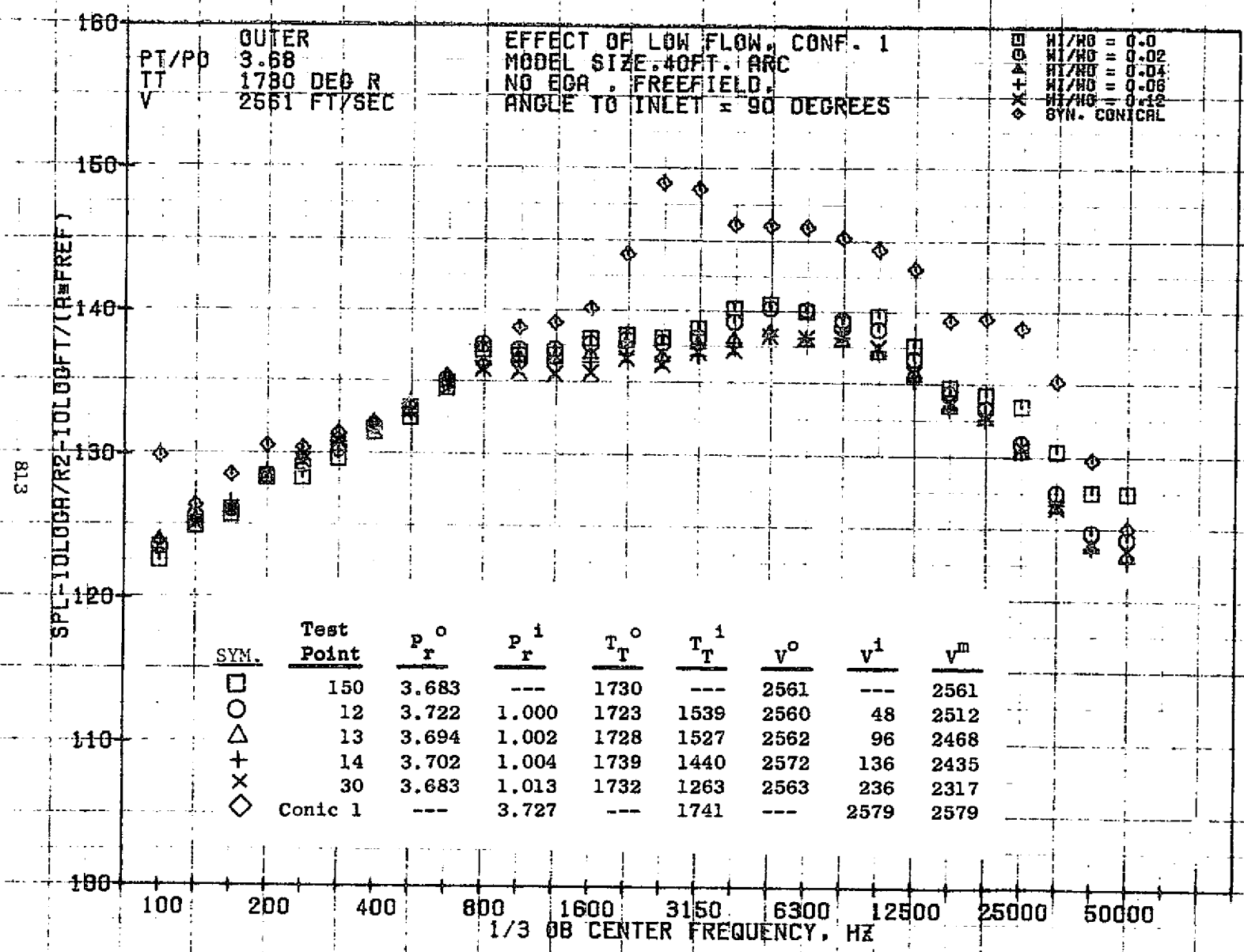
10/05/76
1X583-001

73KOLLSTEDT



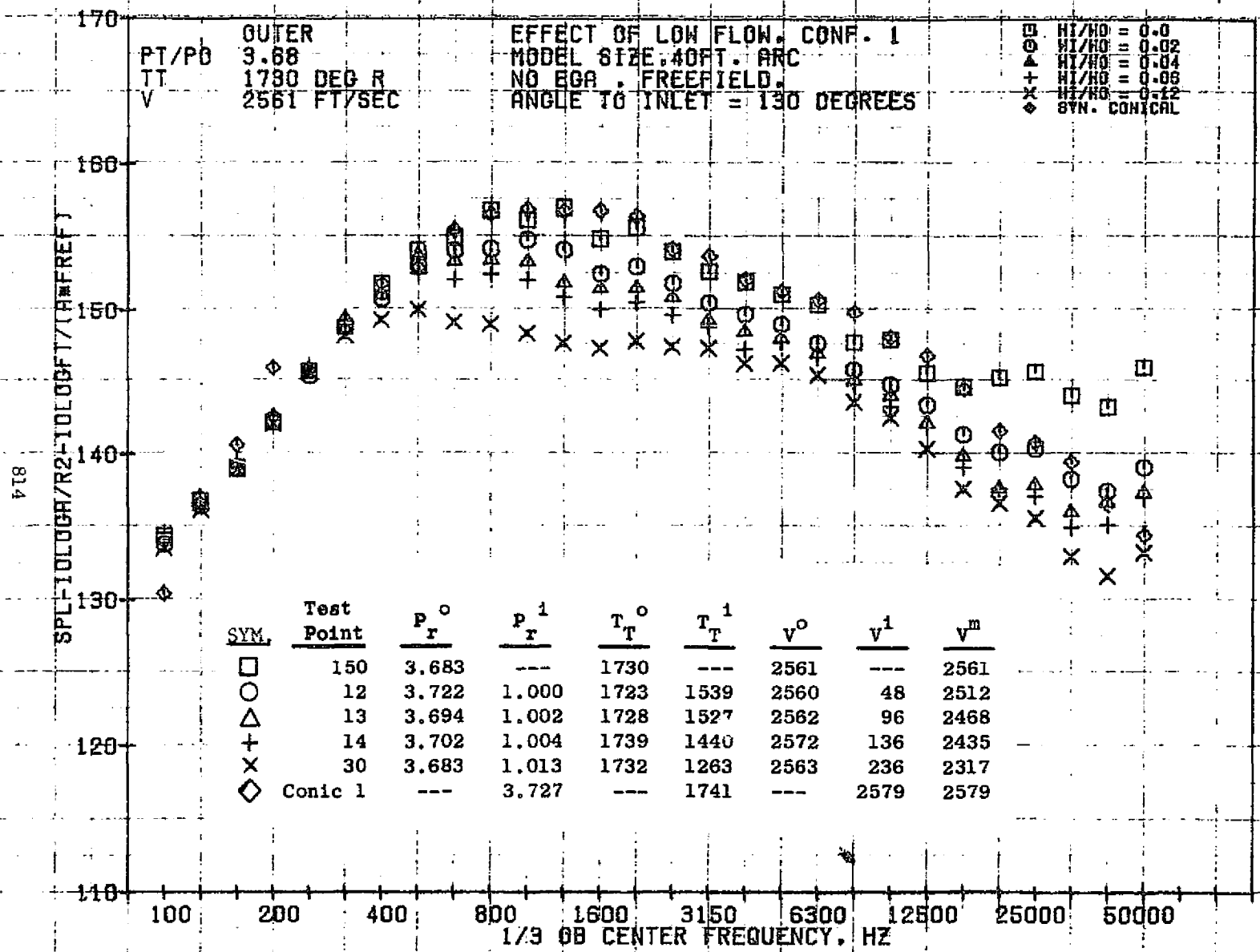
10/06/76
1X583-001

73KOLLSTEDT



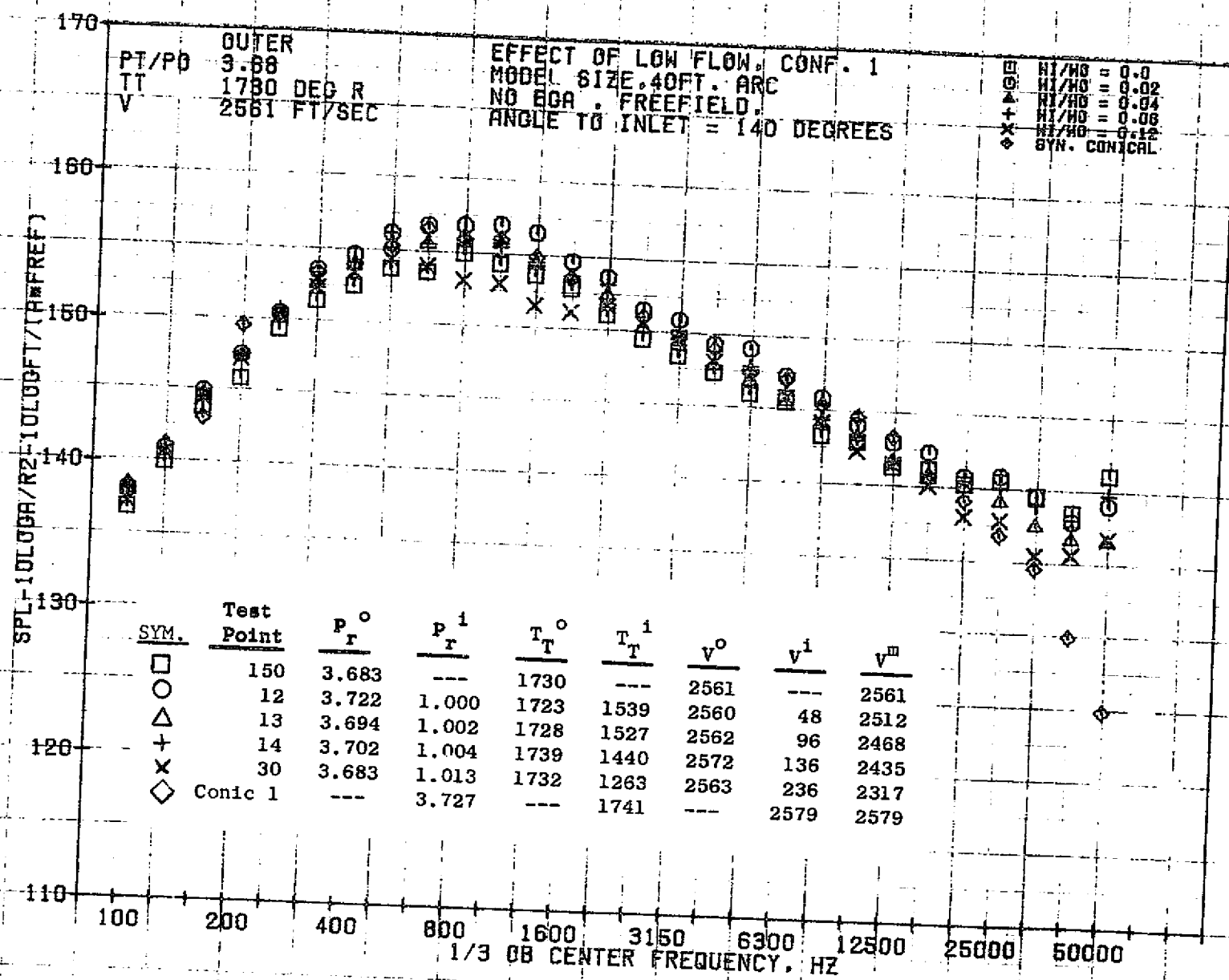
10/05/76
1X583-001

73KOLLSTEDT



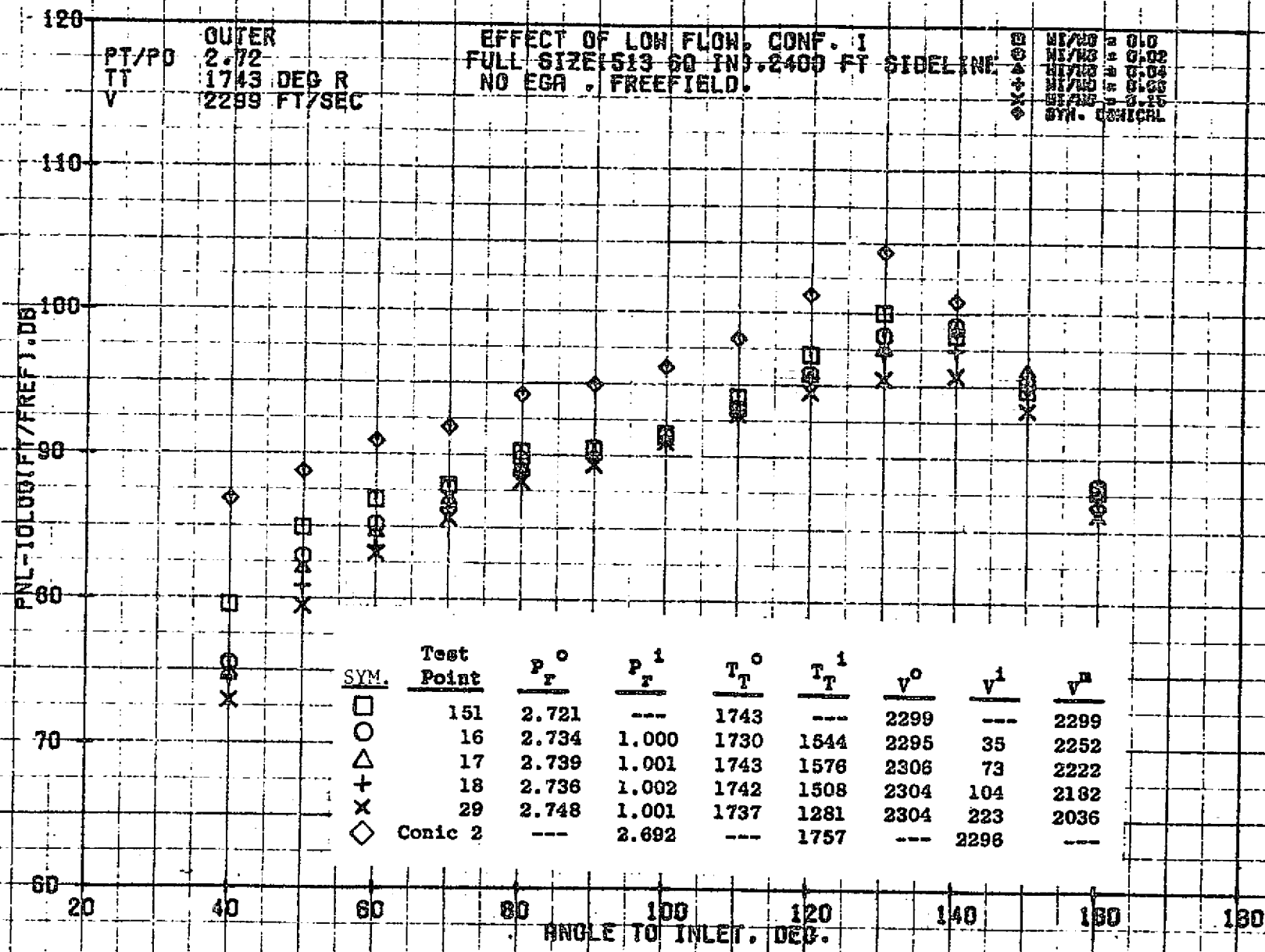
10/05/76
1X583-001

73KOLLSTEDT



10/05/76
1X583-001

73KOLLSTEDT



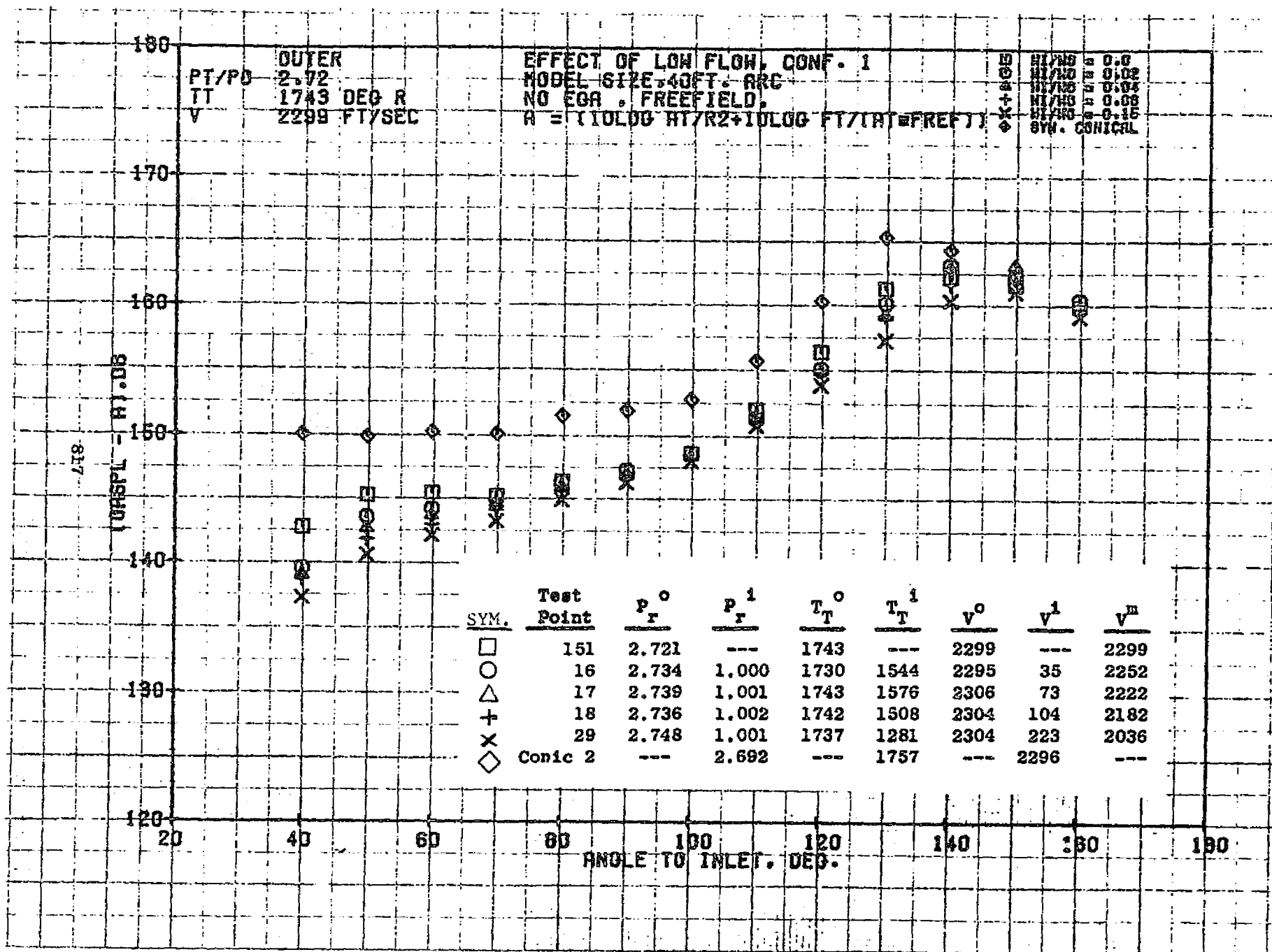
PT/PO
TT
V
OUTER
2.72
1743 DEG R
2299 FT/SEC

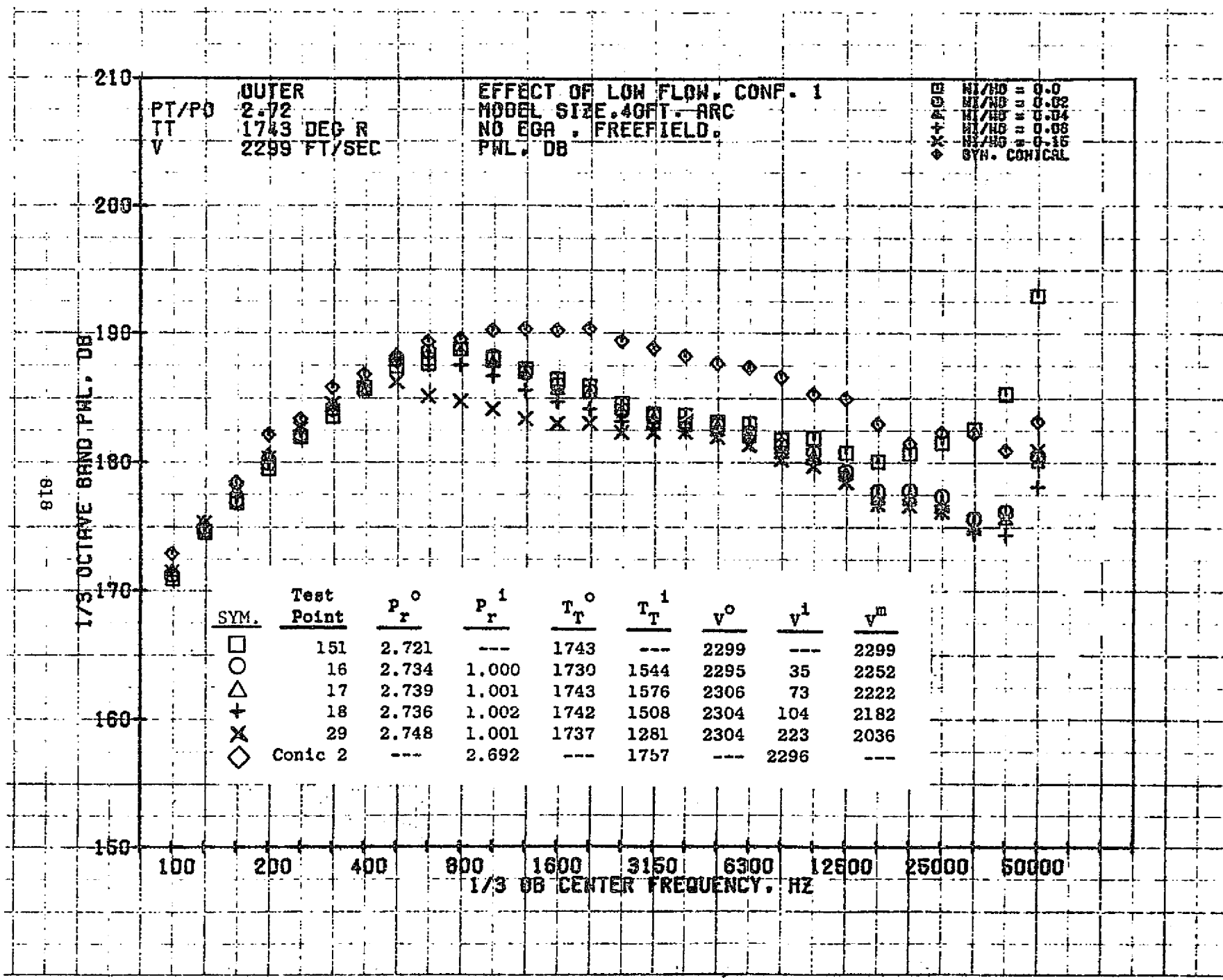
EFFECT OF LOW FLOW, CONF. 1
FULL SIZE 1513 60 IN. 2400 FT SIDELINE
NO EGA, FREEFIELD.

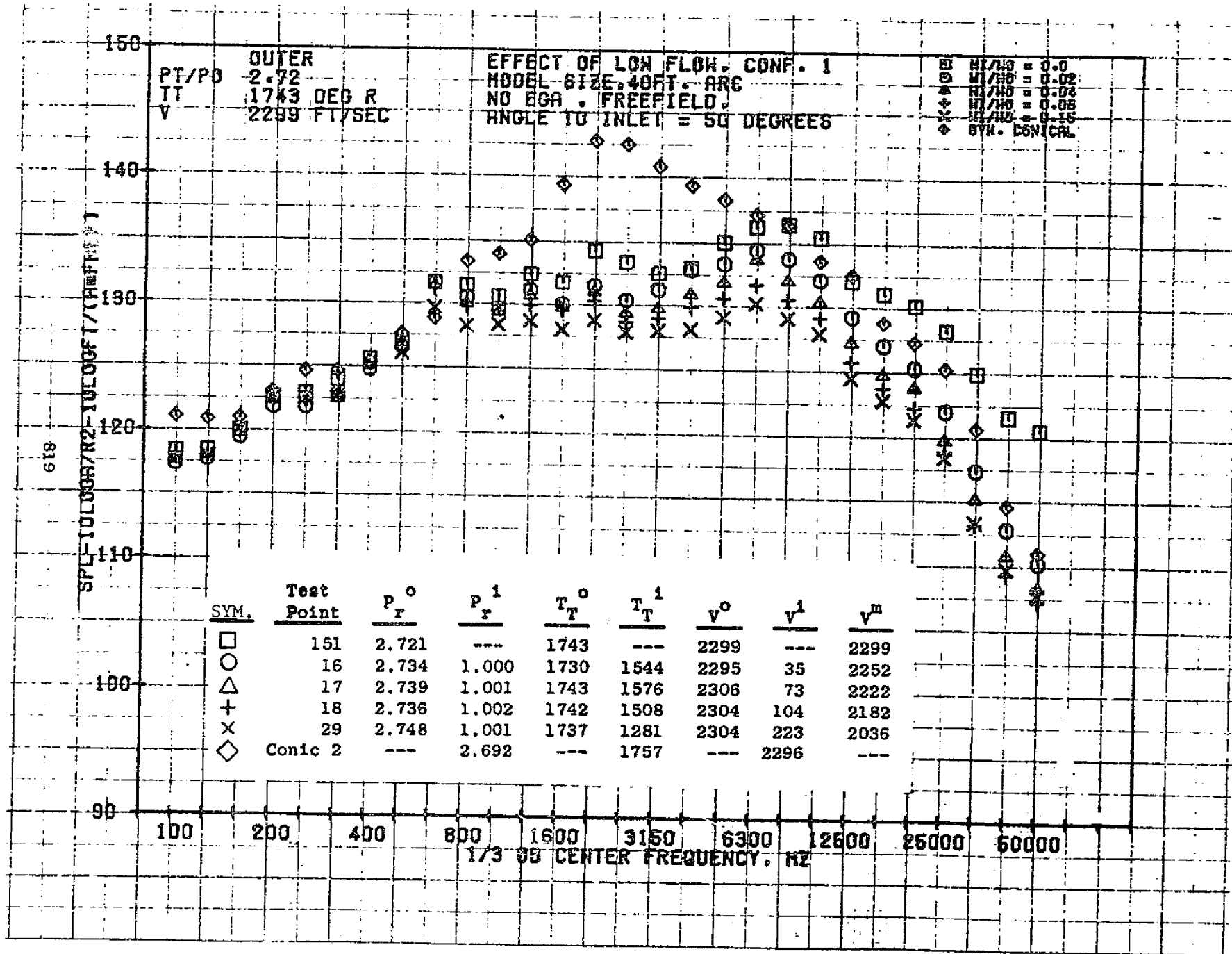
□ 0.02
 ○ 0.04
 △ 0.06
 + 0.10
 × 0.15
 ◇ CONICAL

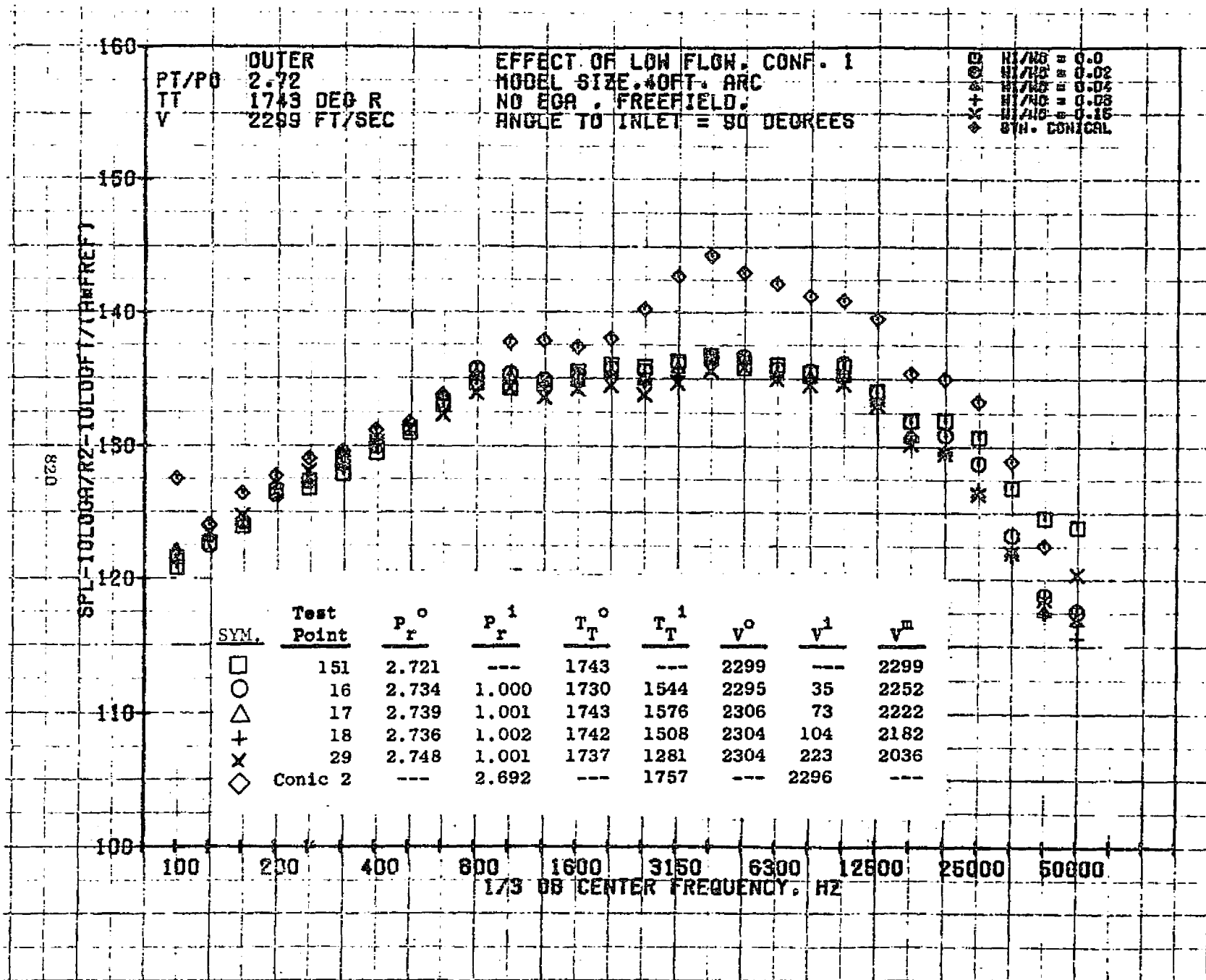
SYM.	Test Point	P_F^0	P_F^1	T_T^0	T_T^1	V^0	V^1	V^2
□	151	2.721	---	1743	---	2299	---	2299
○	16	2.734	1.000	1730	1544	2295	35	2252
△	17	2.739	1.001	1743	1576	2306	73	2222
+	18	2.736	1.002	1742	1508	2304	104	2182
×	29	2.748	1.001	1737	1281	2304	223	2036
◇	Conic 2	---	2.692	---	1757	---	2296	---

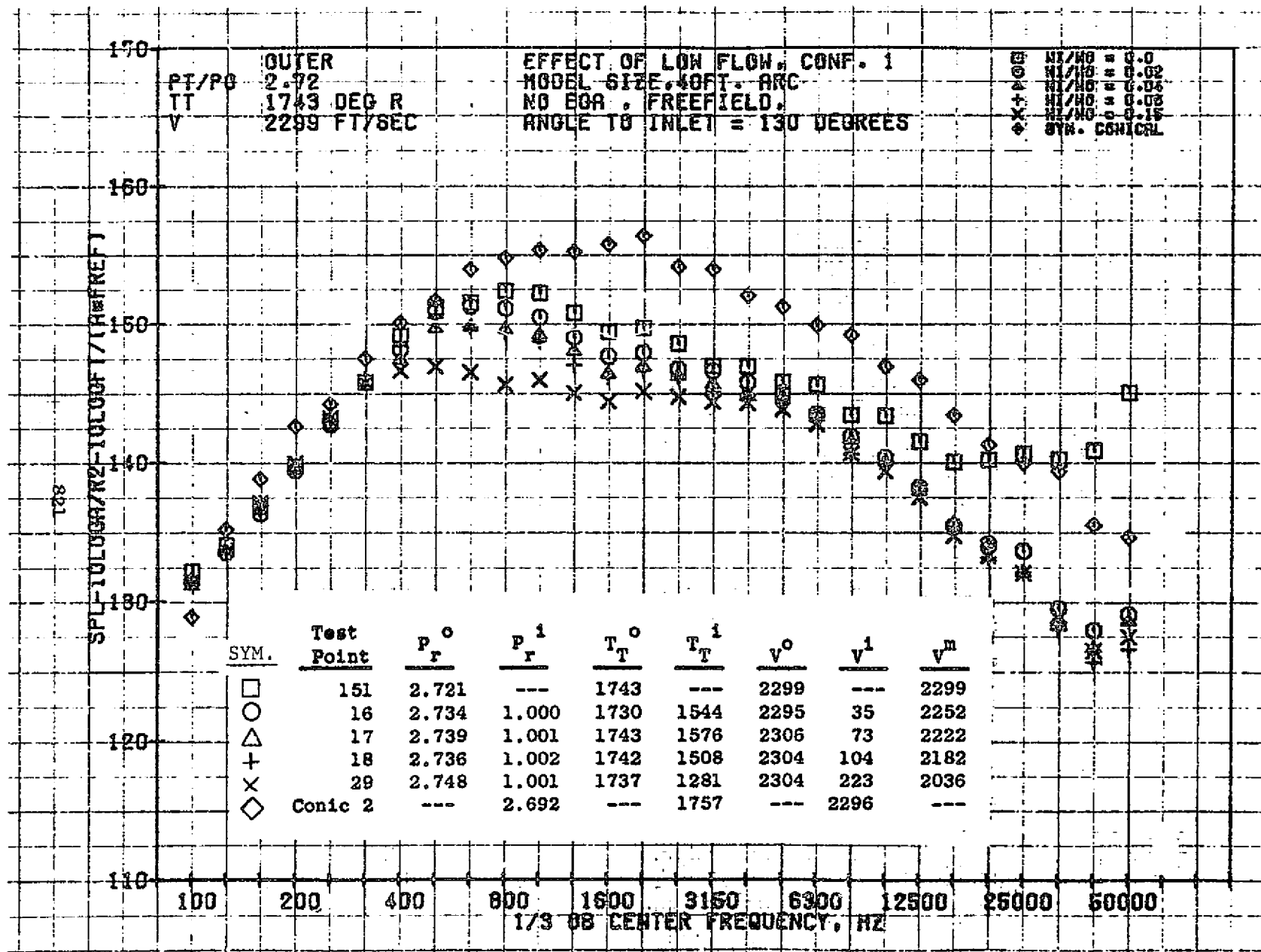
91.8

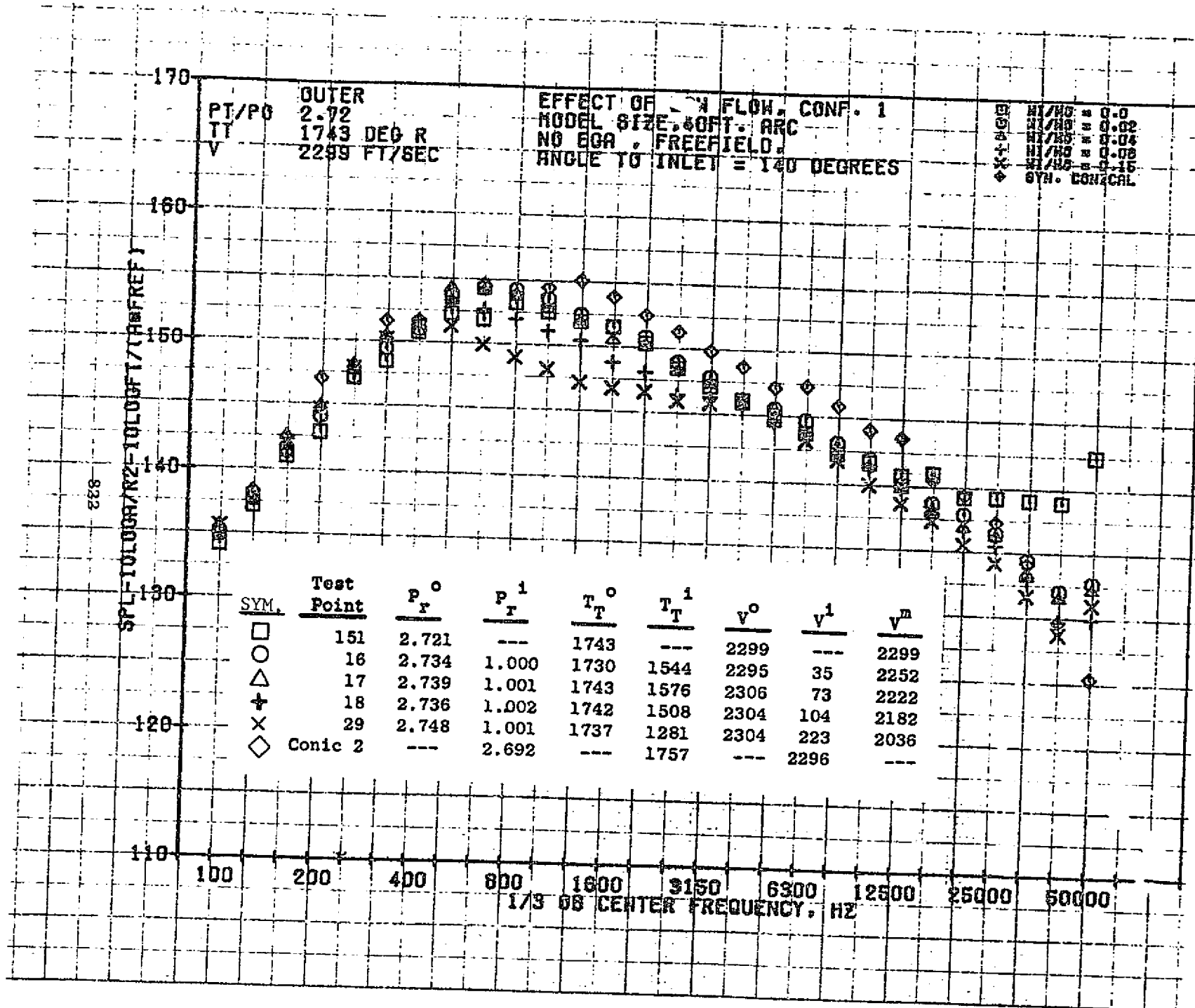


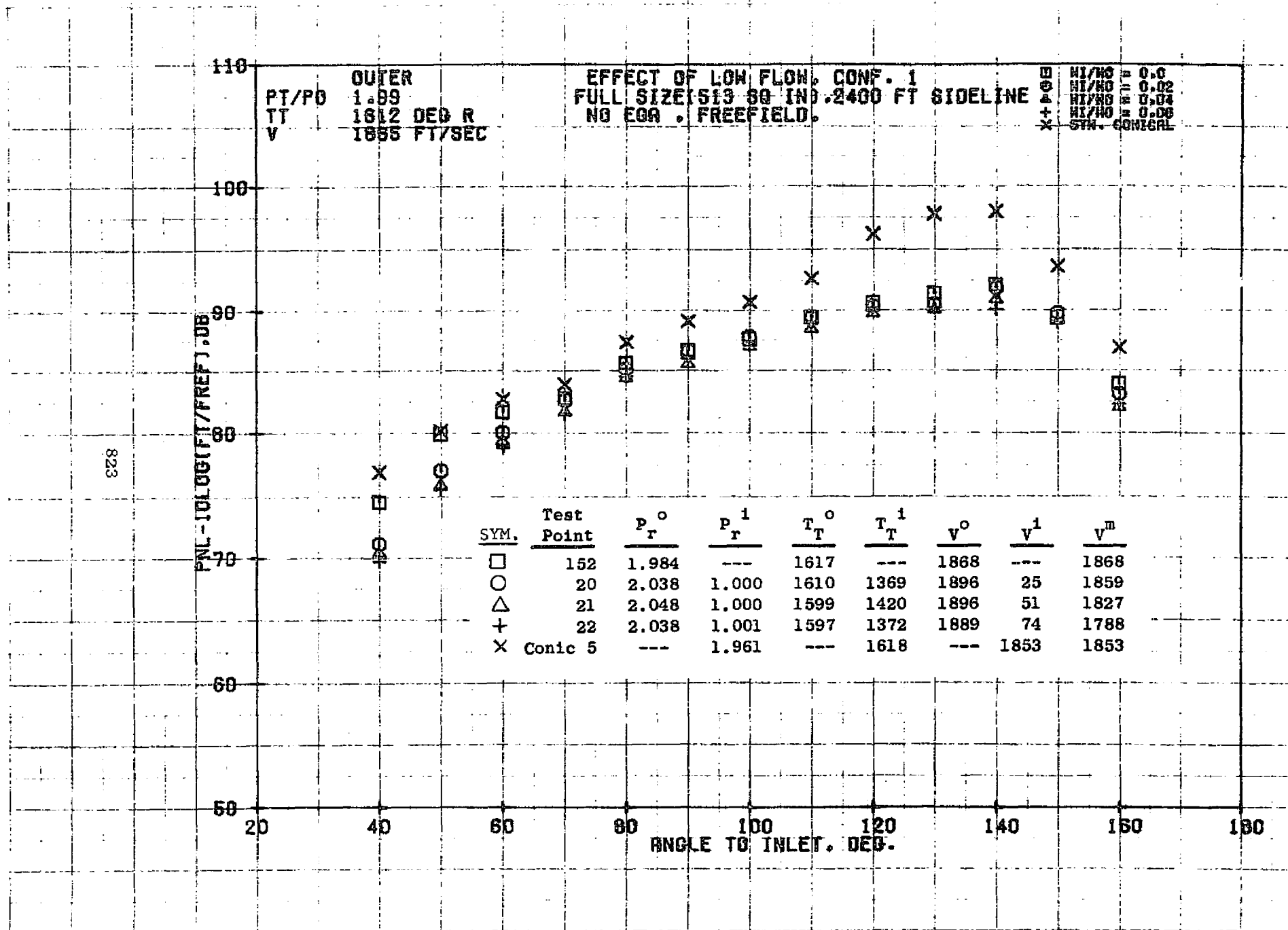












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 1X556-001

73KOLLSTEDT

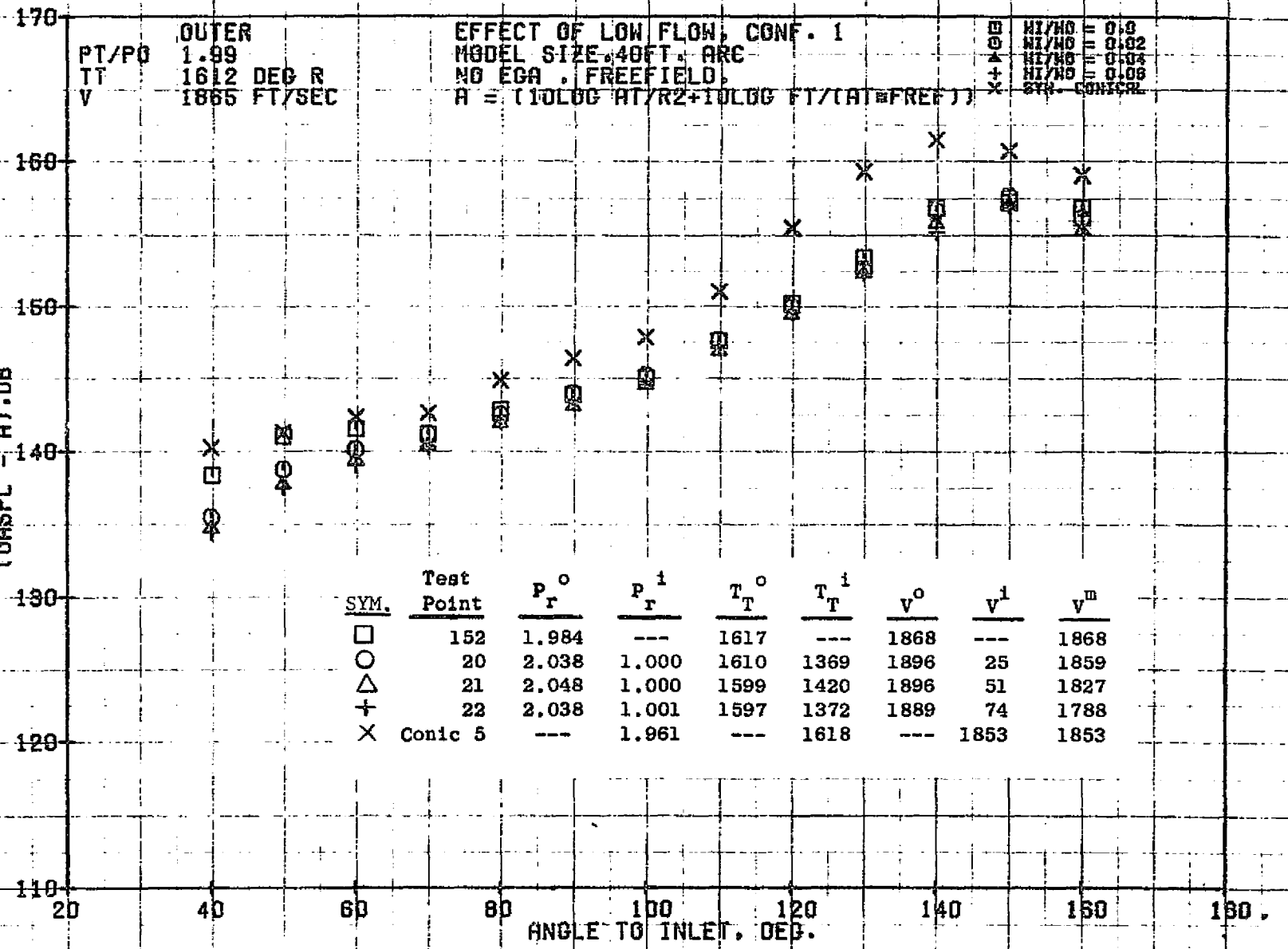
TORSP - AT, DB

824

OUTER
 PT/PO 1.99
 TT 1612 DEG R
 V 1865 FT/SEC

EFFECT OF LOW FLOW, CONF. 1
 MODEL SIZE 40FT. ARC
 NO EGA, FREEFIELD
 $A = (10LGG AT/R2 + 10LGG FT/(AT = FREF))$

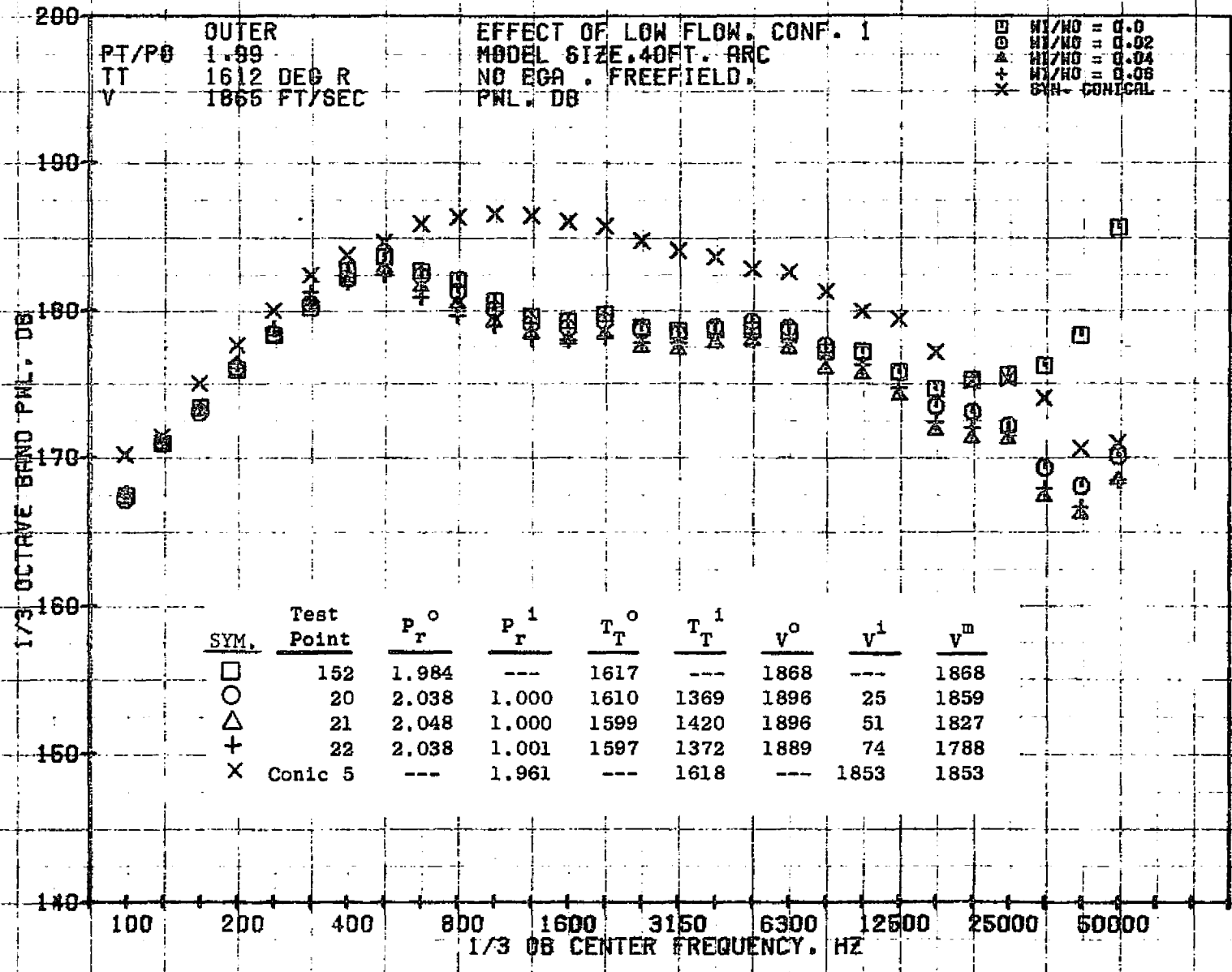
\square NI/HO = 0.0
 \triangle NI/HO = 0.02
 \circ NI/HO = 0.04
 $+$ NI/HO = 0.08
 \times STN. CONTROL



SYM.	Test Point	P_r^o	P_r^i	T_T^o	T_T^i	V^o	V^i	V^m
\square	152	1.984	---	1617	---	1868	---	1868
\circ	20	2.038	1.000	1610	1369	1896	25	1859
\triangle	21	2.048	1.000	1599	1420	1896	51	1827
$+$	22	2.038	1.001	1597	1372	1889	74	1788
\times	Conic 5	---	1.961	---	1618	---	1853	1853

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 1X334-001

73KOLLSTEDT



10/06/76
1X334-001

73KOLLSTEDT

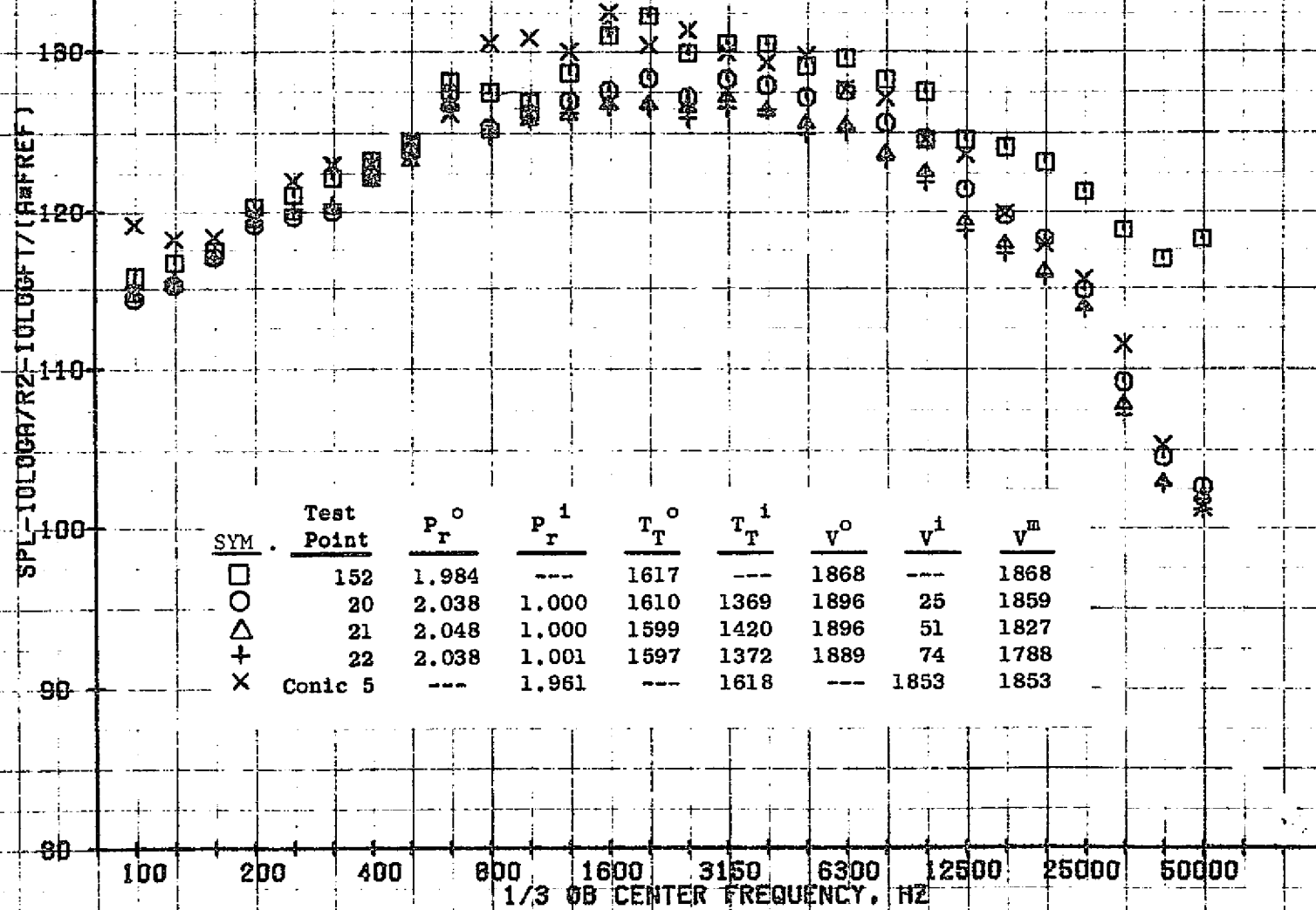
OUTER
 PT/PO 1.99
 TT 1612 DEG R
 V 1865 FT/SEC

EFFECT OF LOW FLOW, CONF. 1
 MODEL SIZE, 40FT. ARC
 NO EGA, FREEFIELD,
 ANGLE TO INLET = 60 DEGREES

□ NI/NO = 0.0
 ○ NI/NO = 0.02
 △ NI/NO = 0.04
 + NI/NO = 0.06
 X CONICAL

SPL - 10 LOG (G/R² - 10 LOG F² / (AMREF))

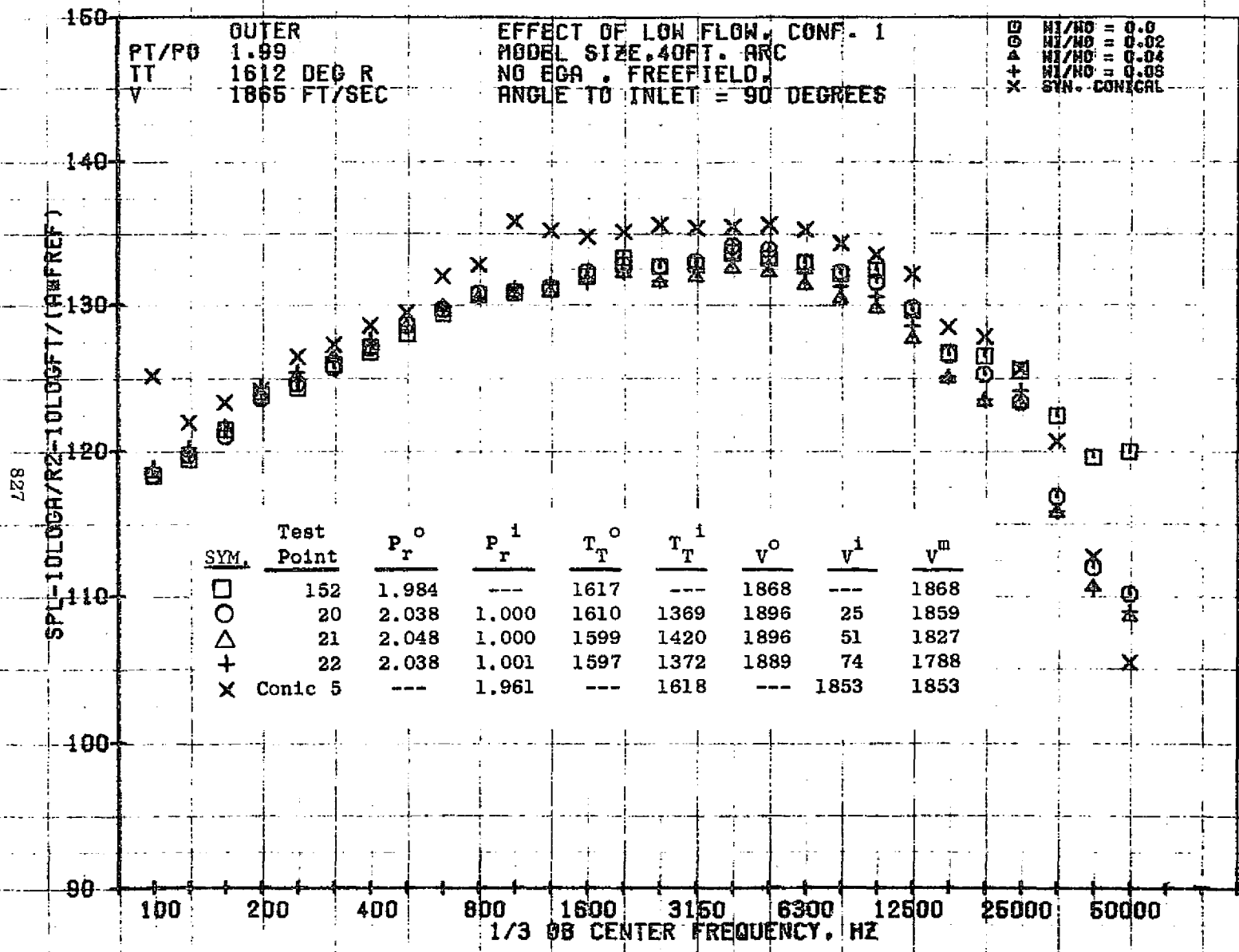
826



SYM	Test Point	P_r^o	P_r^i	T_T^o	T_T^i	V^o	V^i	V^m
□	152	1.984	---	1617	---	1868	---	1868
○	20	2.038	1.000	1610	1369	1896	25	1859
△	21	2.048	1.000	1599	1420	1896	51	1827
+	22	2.038	1.001	1597	1372	1889	74	1788
X	Conic 5	---	1.961	---	1618	---	1853	1853

10/06/76
 1X334-001

73KOLLSTEDT



828

SPL - 10 LOG (P/R² - 1) 0.009 FT / (PREF REF)

160

150

140

130

120

110

100

100

200

400

800

1600

3150

6300

12500

25000

50000

1/3 OB CENTER FREQUENCY, HZ

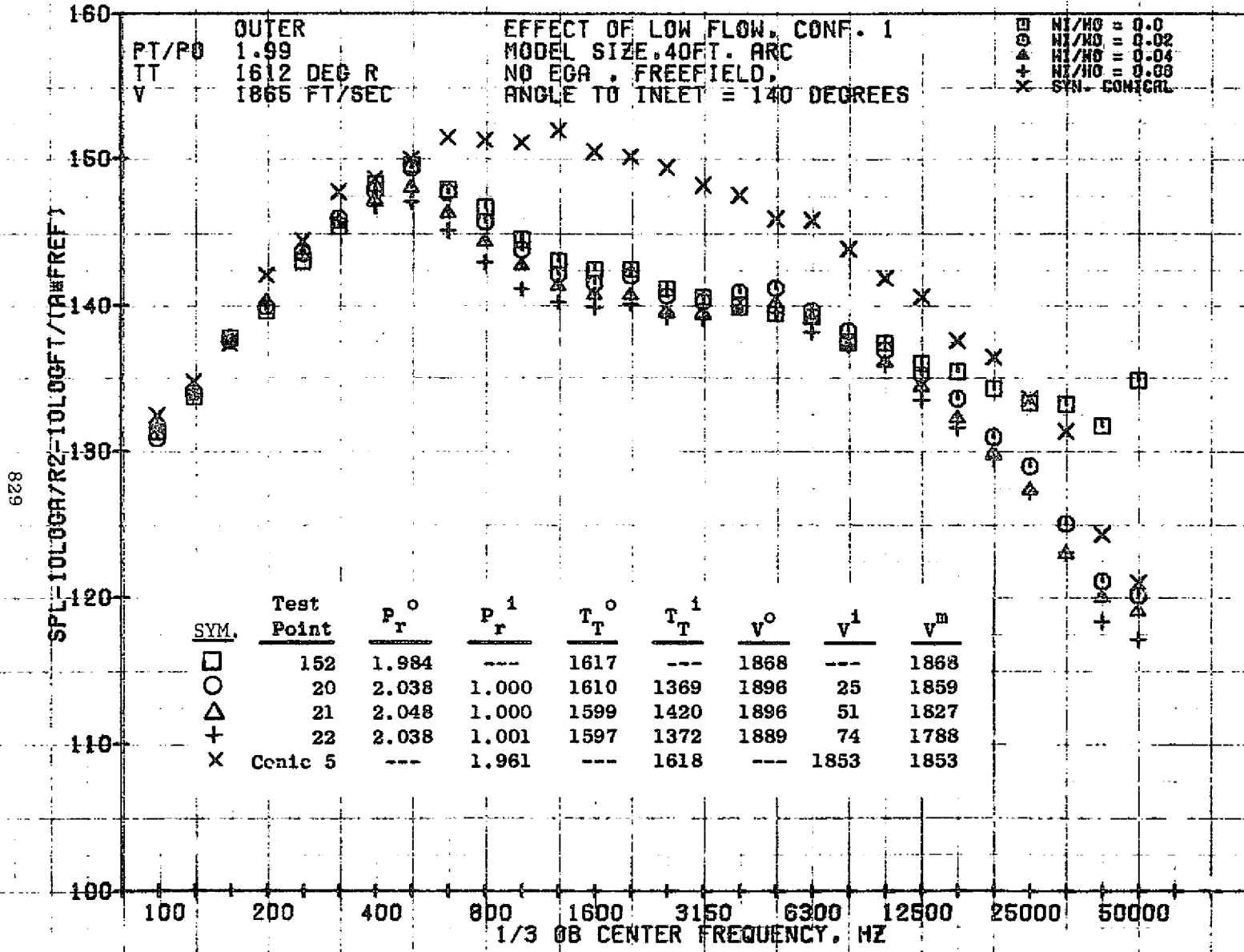
PT/P0
TT
VOUTER
1.99
1612 DEG R
1065 FT/SECEFFECT OF LOW FLOW, CONF. 1
MODEL SIZE .40 FT. ARC
NO BOA, FREEFIELD,
ANGLE TO INLET = 130 DEGREES

□	H1/H0 = 0.0
○	H1/H0 = 0.02
△	H1/H0 = 0.04
+	H1/H0 = 0.08
x	SYM. CONICAL

SYM.	Test Point	P_r^0	P_r^1	T_T^0	T_T^1	V^0	V^1	V^m
□	152	1.984	---	1617	---	1868	---	1868
○	20	2.038	1.000	1610	1369	1896	25	1859
△	21	2.048	1.000	1599	1420	1896	51	1827
+	22	2.038	1.001	1597	1372	1889	74	1788
x	Conic 5	---	1.961	---	1618	---	1853	1853

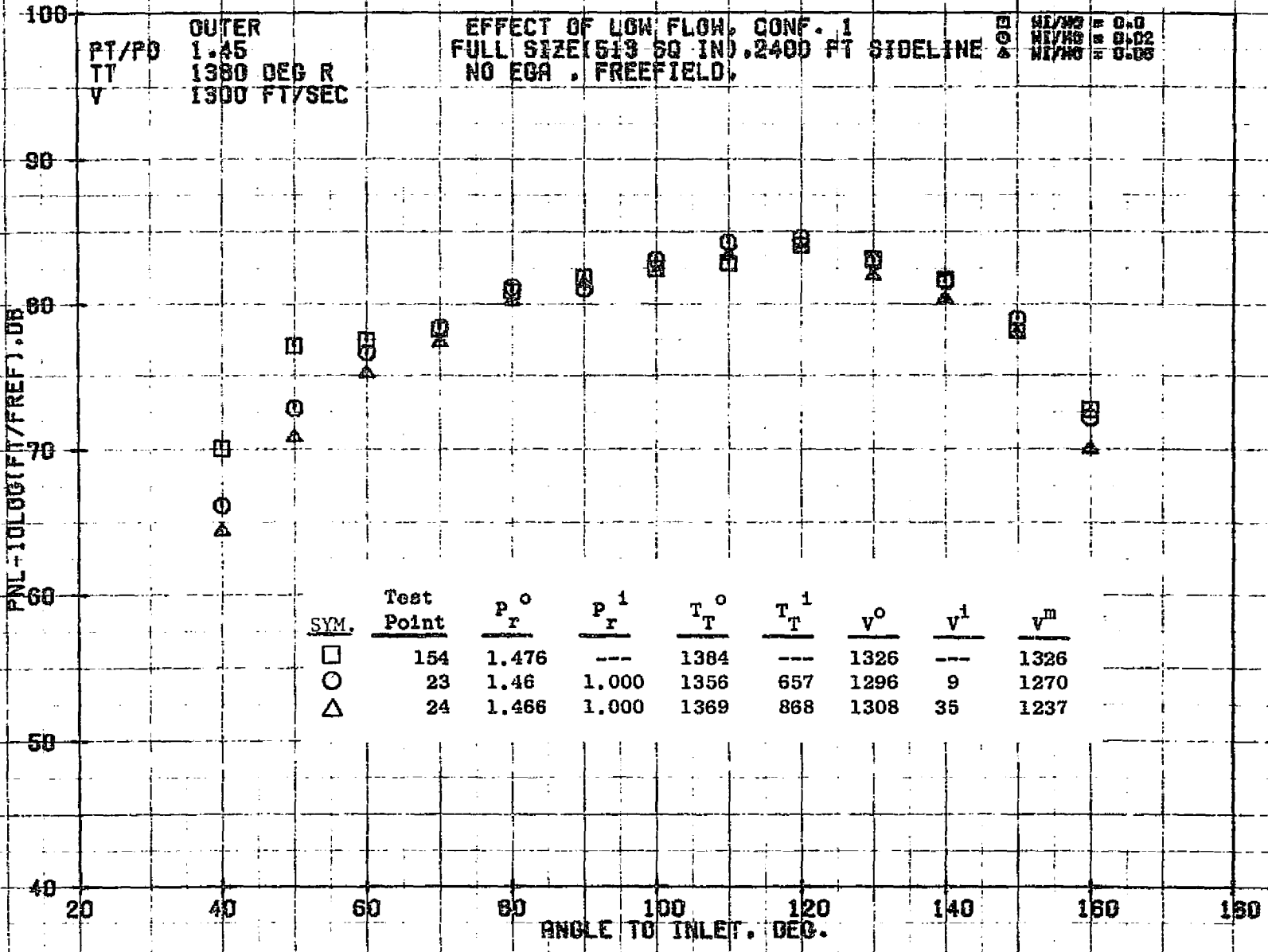
10/06/76
1X334-001

73KOLLSTEDT



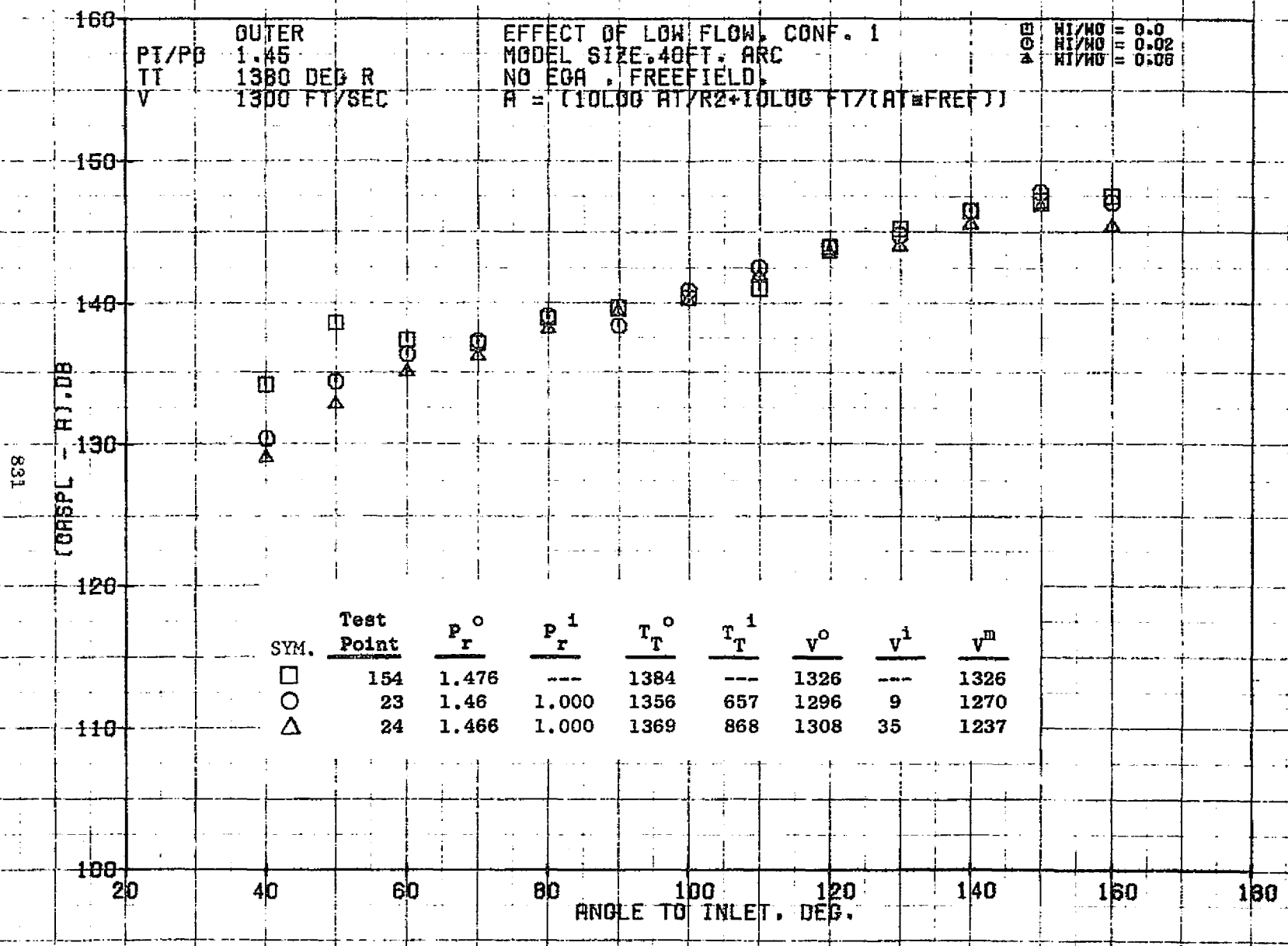
10/06/76
1X334-001

73KOLLSTEDT



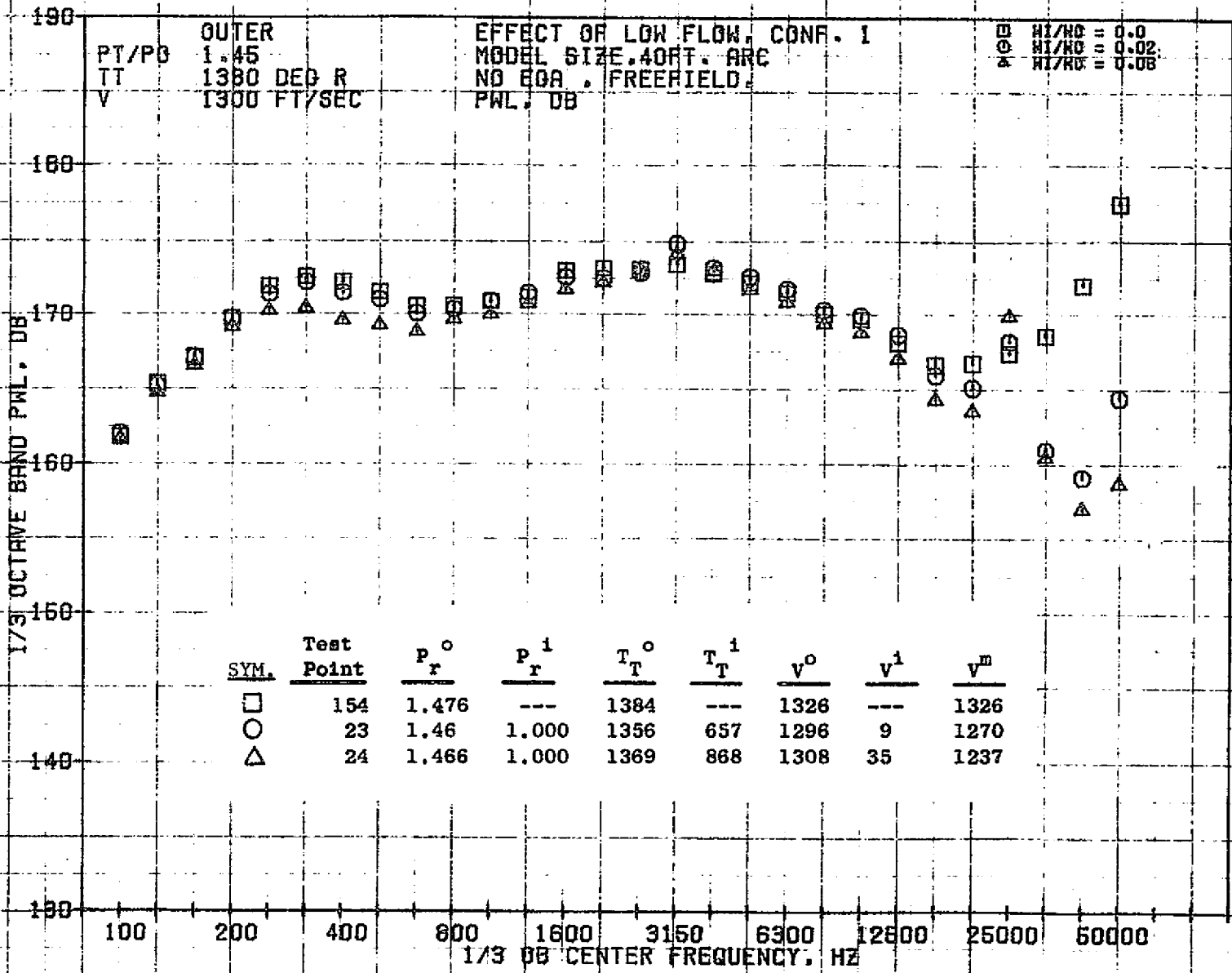
10/25/76
1X556-001

73KOLLSTEDT



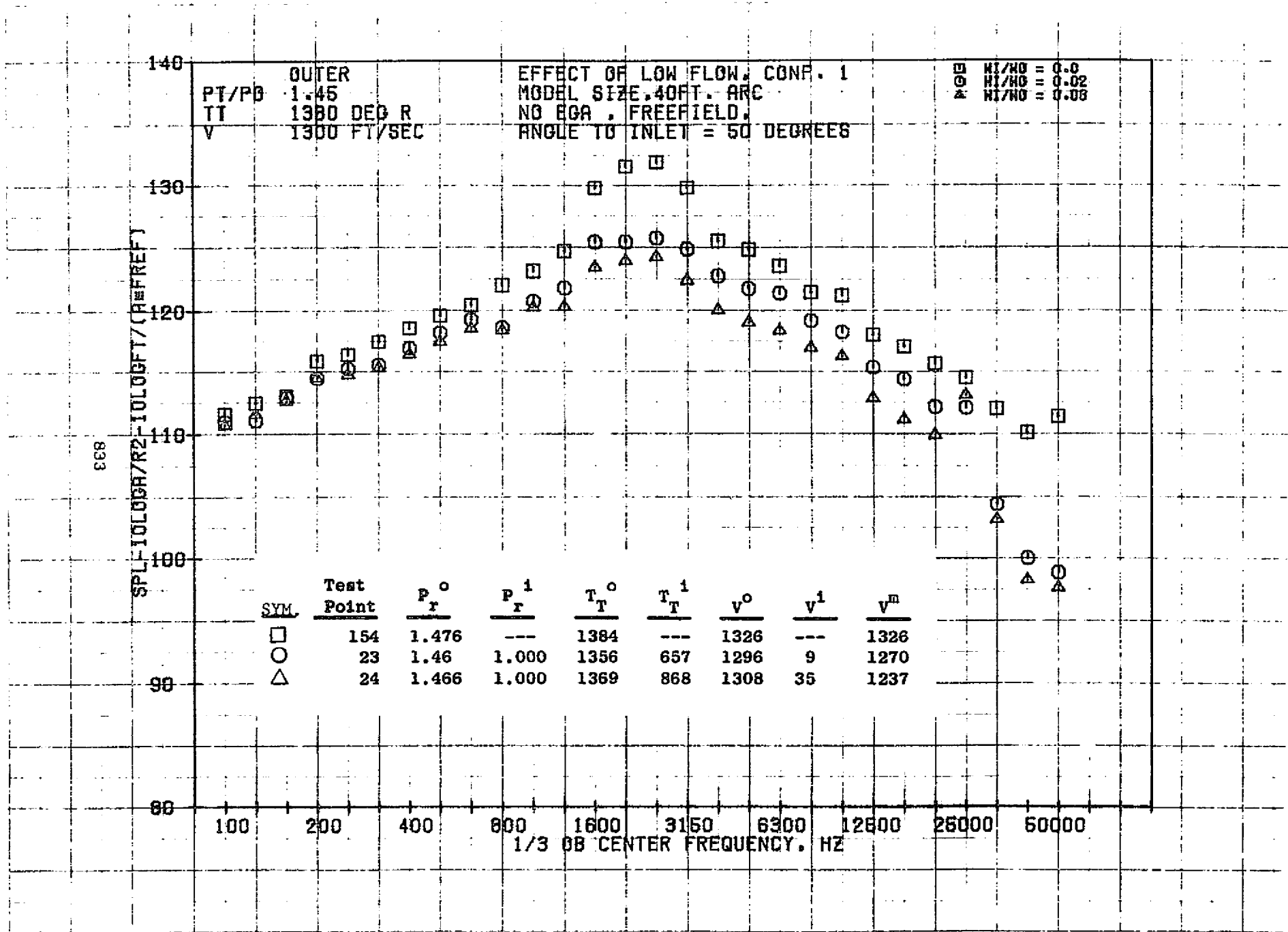
10/08/76
1X746-001

73KOLLSTEDT



10/08/76
1X746-001

73KOLLSTEDT



10/08/76
1X746-001

73KOLLSTEDT

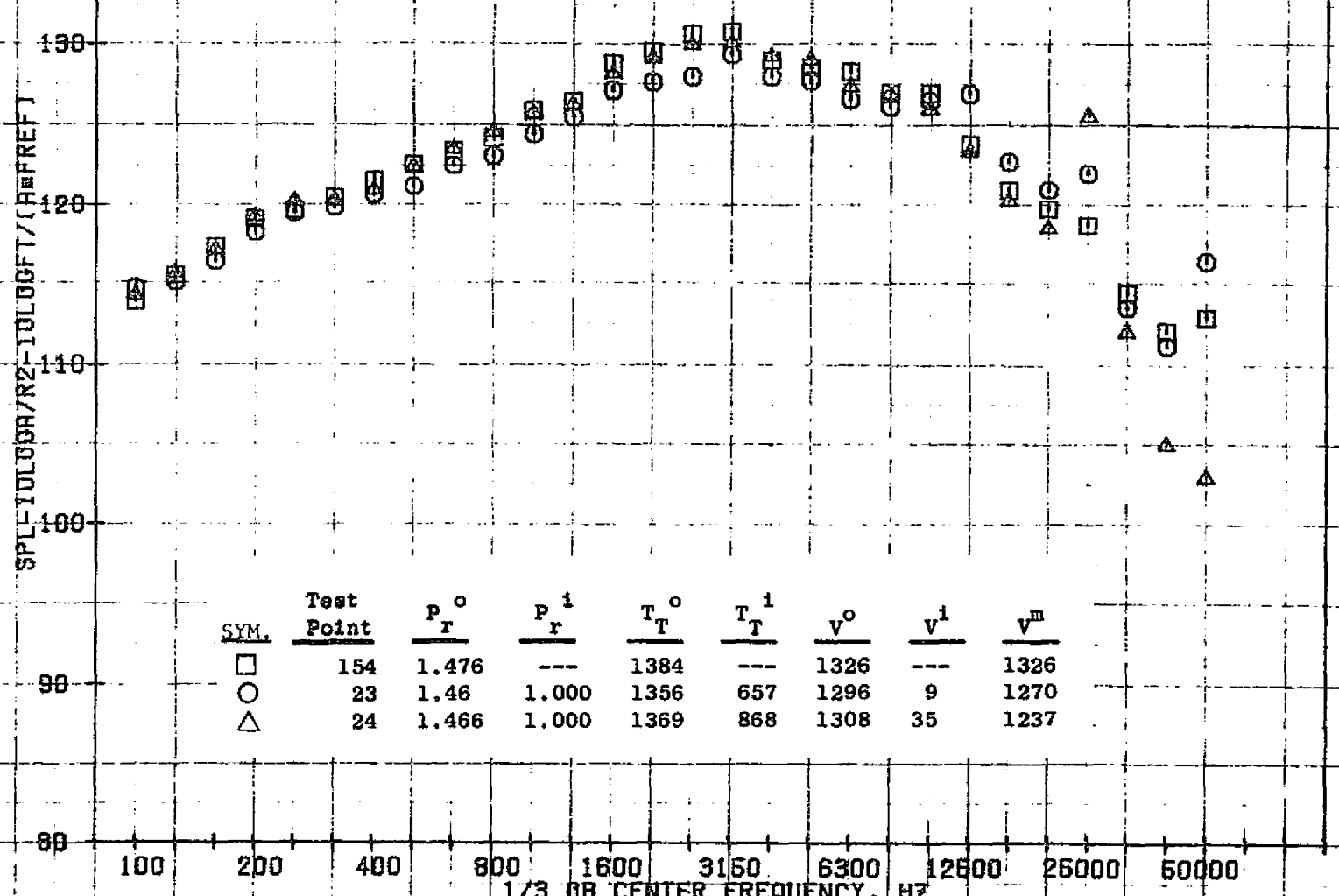
PT/PO 1.45
 TT 1390 DEG R
 V 1300 FT/SEC

OUTER
 EFFECT OF LOW FLOW, CONF. 1
 MODEL SIZE 40FT. ARC
 NO BGA, FREEFIELD,
 ANGLE TO INLET = 90 DEGREES

□ HI/RO = 0.0
 ○ HI/RO = 0.02
 △ HI/RO = 0.05

SPL-10LOGR/R2-10LOGFT/(HREF)

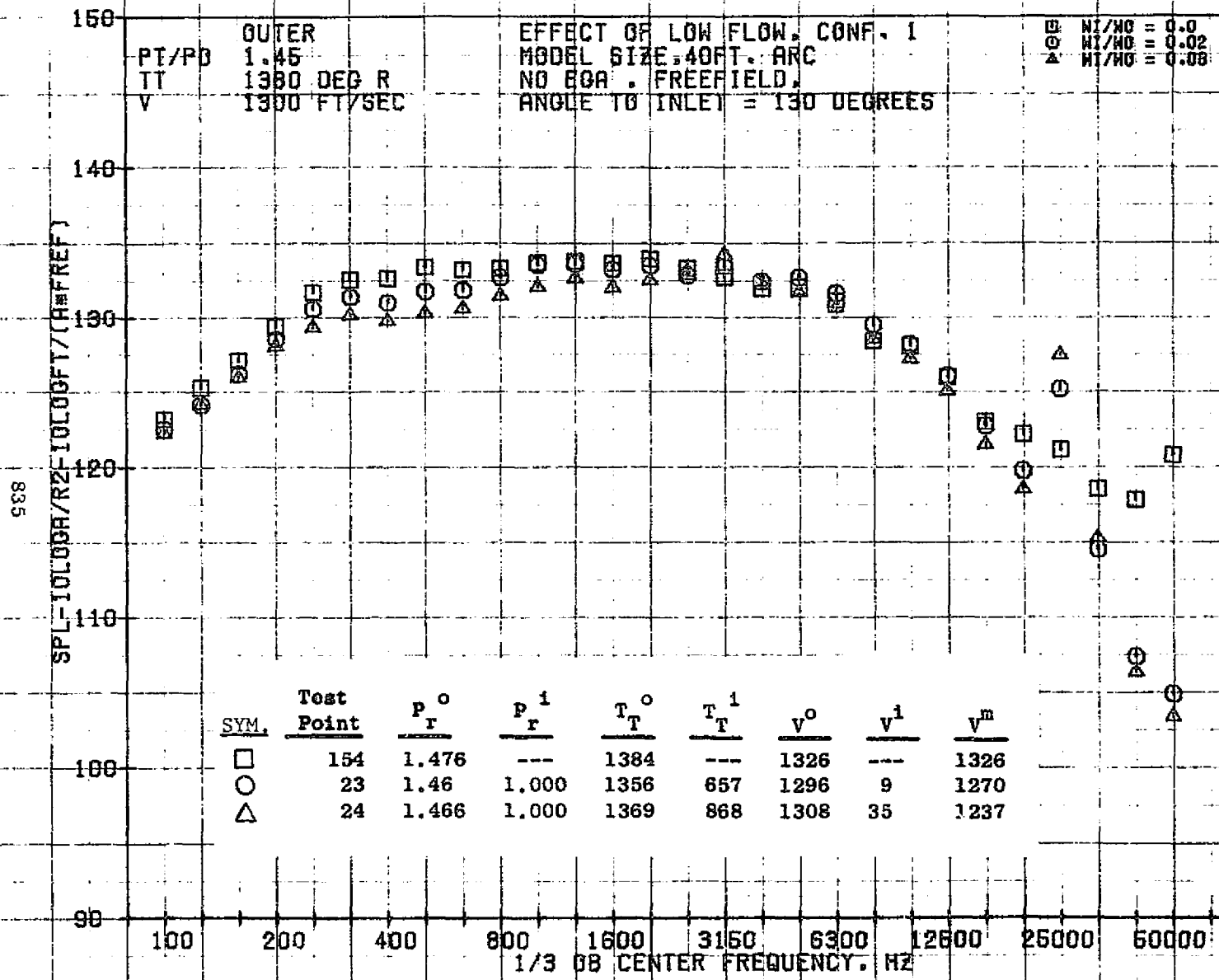
S.4



SYM.	Test Point	P_r^o	P_r^i	T_T^o	T_T^i	V^o	V^i	V^m
□	154	1.476	---	1384	---	1326	---	1326
○	23	1.46	1.000	1356	657	1296	9	1270
△	24	1.466	1.000	1369	868	1308	35	1237

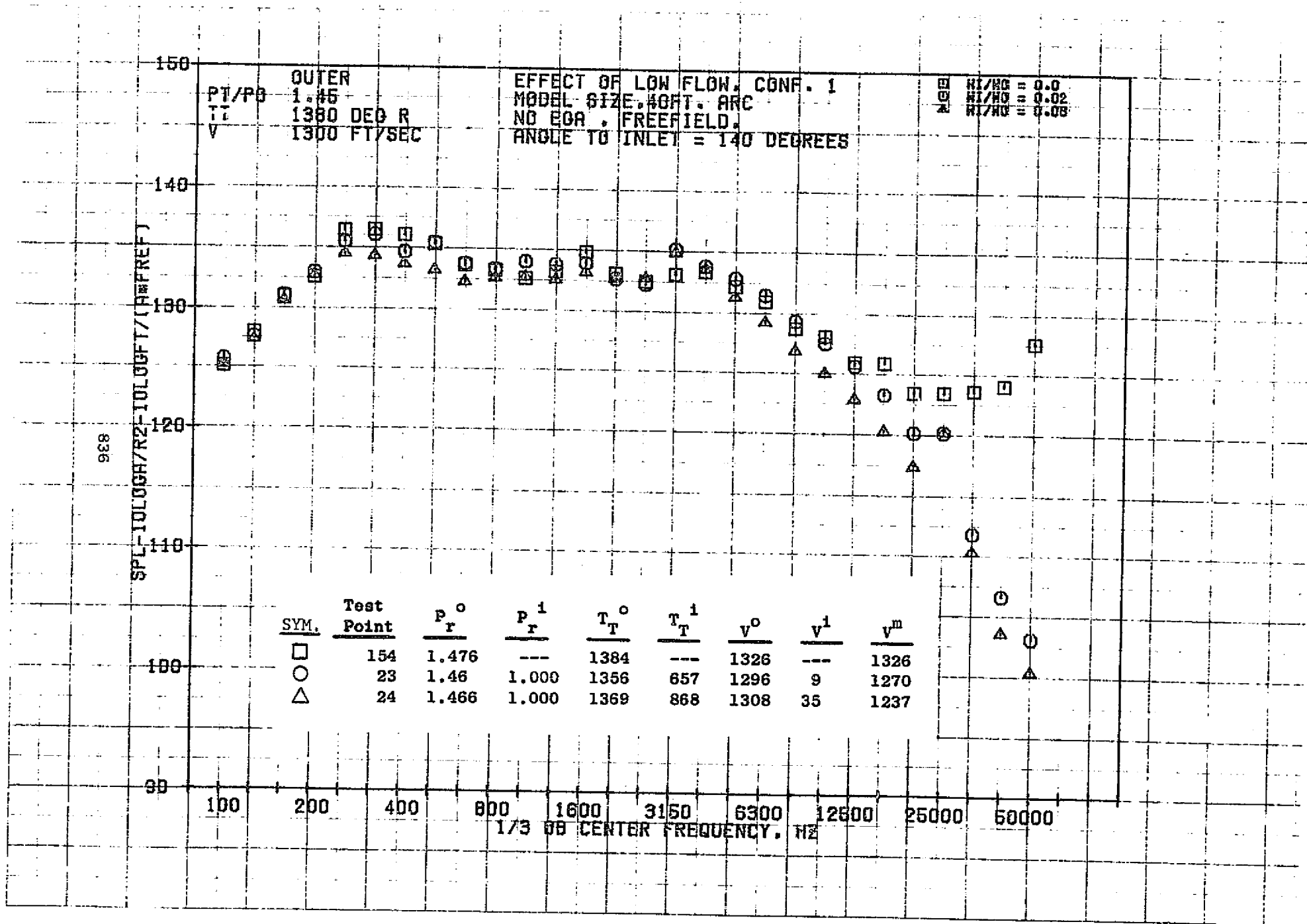
10/08/76
 1X746-001

73KOLLSTEDT



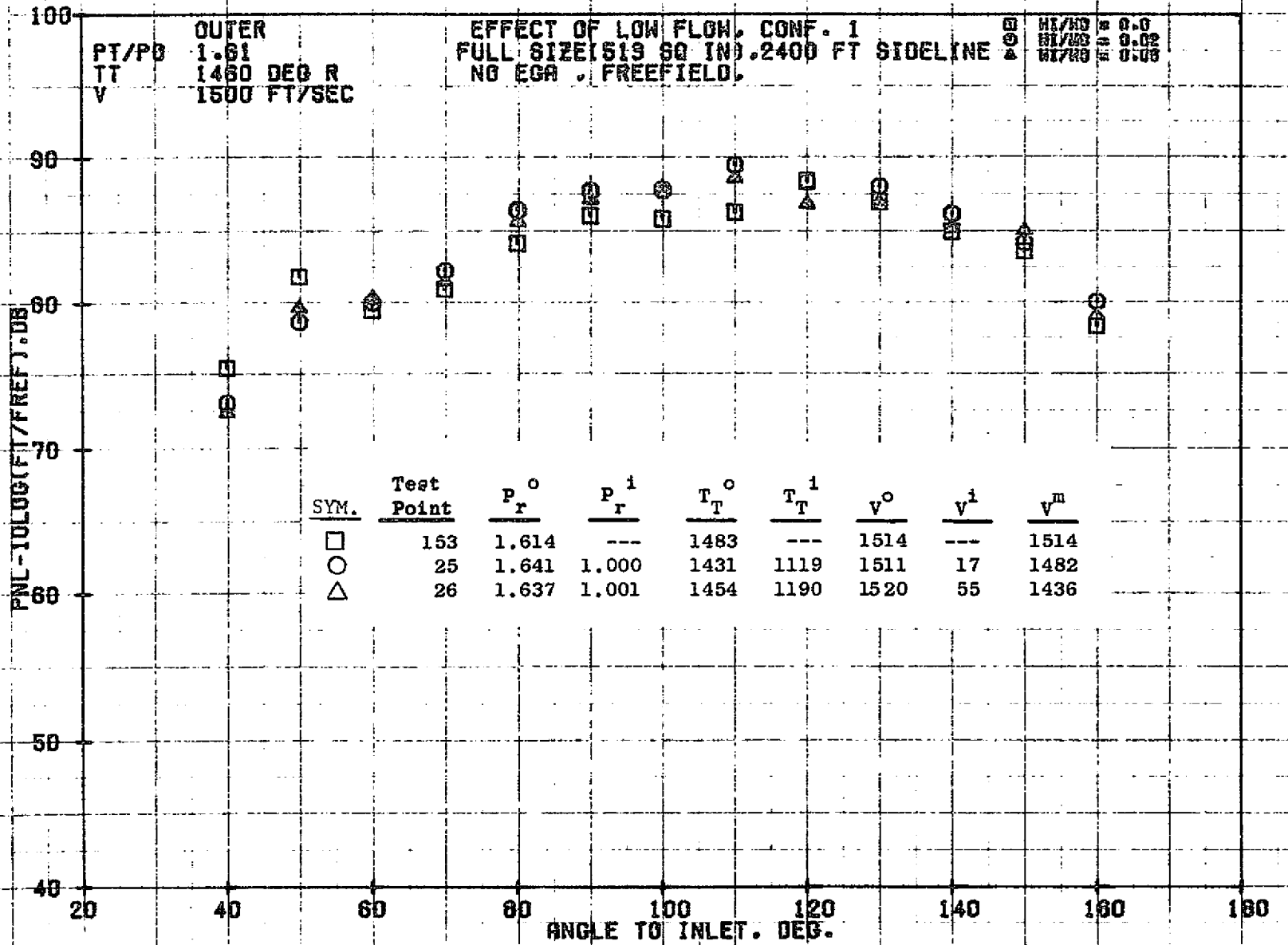
10/08/76
1X746-001

73KOLLSTEDT



10/08/76
1X746-001

73KOLLSTEDT



10/25/76
1X556-001

73KOLLSTEDT

160
150
140
130
120
110
100

838
[MSP] - A, DB

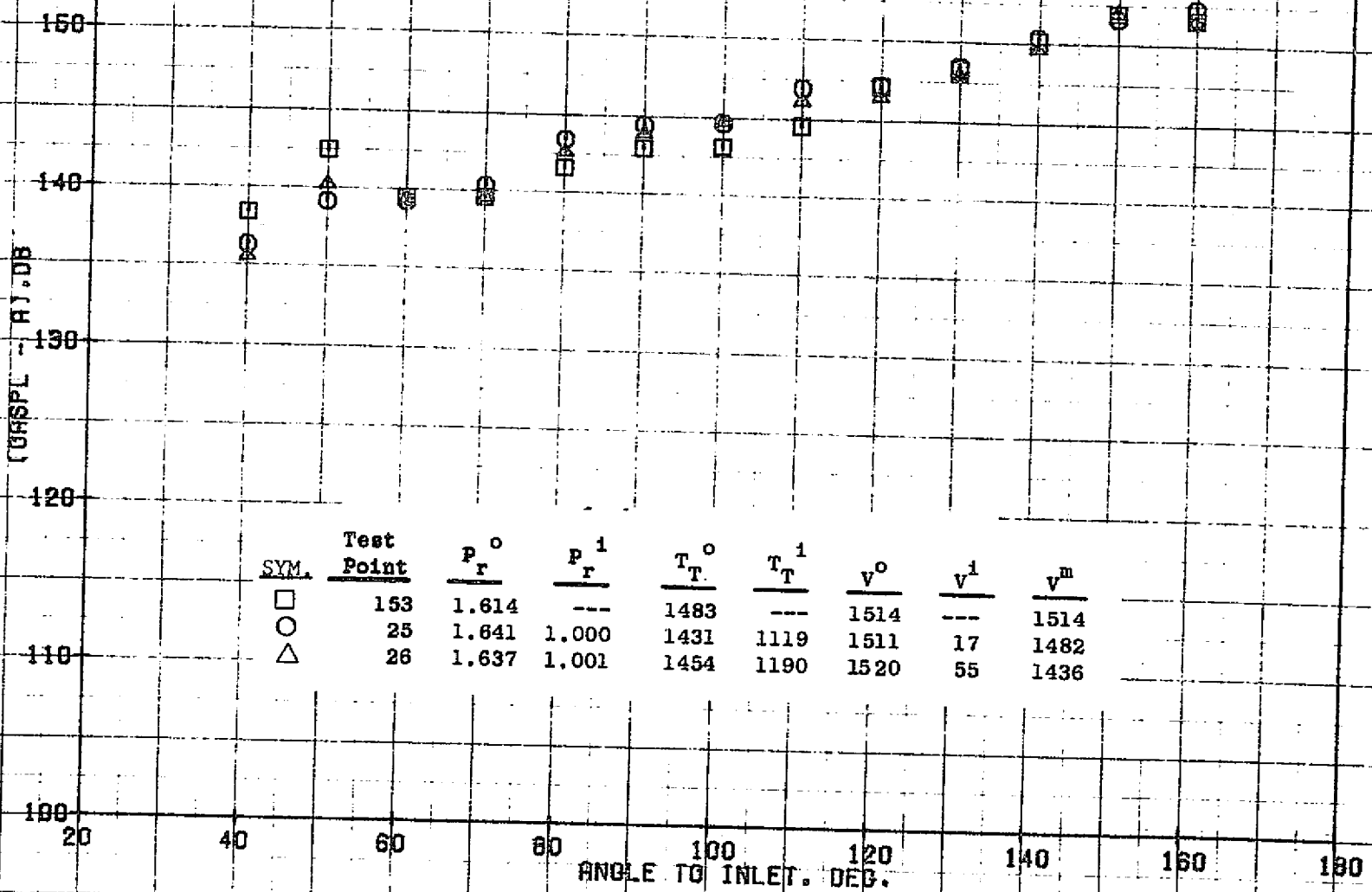
20 40 60 80 100 120 140 160 180

PT/PD
TT
V

OUTER
1.61
1460 DEG R
1500 FT/SEC

EFFECT OF LOW FLOW, CONF. 1
MODEL SIZE, 40FT ARC
NO EGA, FREEFIELD
 $R = (10 \log \frac{AT}{R^2} + 10 \log \frac{FT}{(AT - AREF)})$

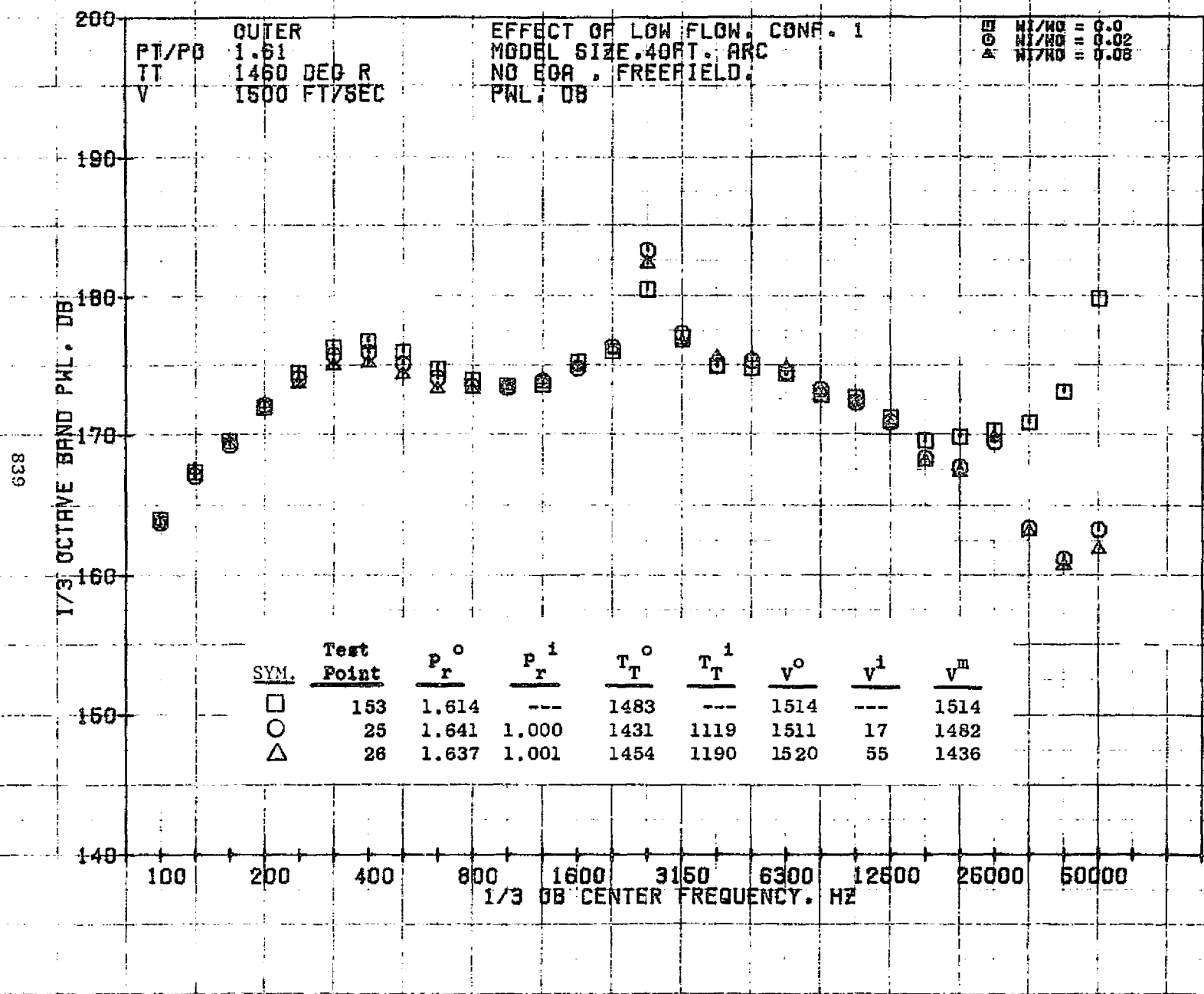
HI/HO = 0.10
HI/HO = 0.02
HI/HO = 0.08



SYM.	Test Point	P_r^0	P_r^1	T_T^0	T_T^1	V^0	V^1	V^m
□	153	1.614	---	1483	---	1514	---	1514
○	25	1.641	1.000	1431	1119	1511	17	1482
△	26	1.637	1.001	1454	1190	1520	55	1436

10/08/76
1X746-001

73KOLLSTEDT



10/08/76
IX746-001

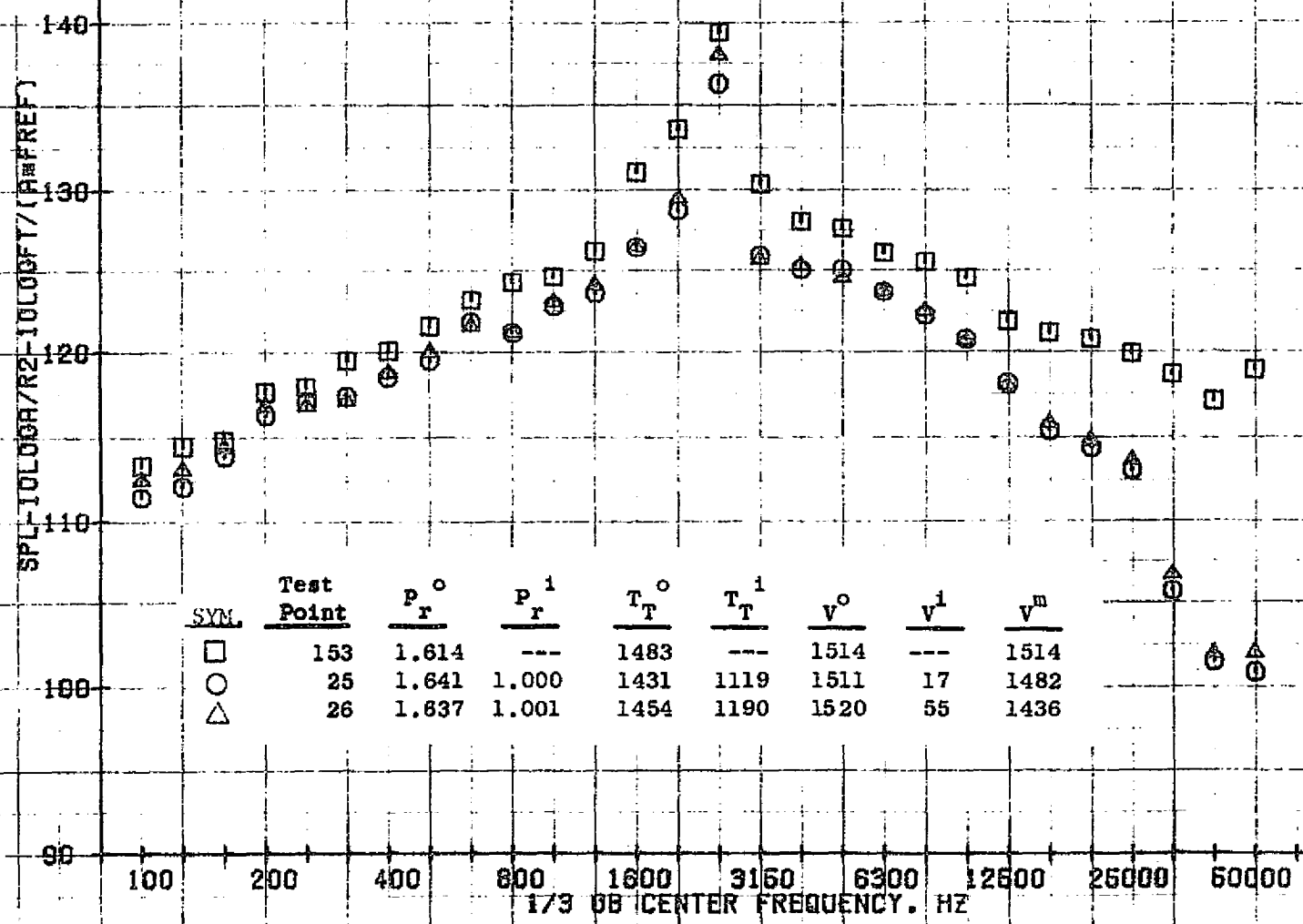
79KOLLSTEDT

OUTER
 PT/PO 1.61
 TI 1450 DEG R
 V 1500 FT/SEC

EFFECT OF LOW FLOW CONF. 1
 MODEL SIZE .40 FT. ARC
 NO BGA, FREEFIELD.
 ANGLE TO INLET = 50 DEGREES

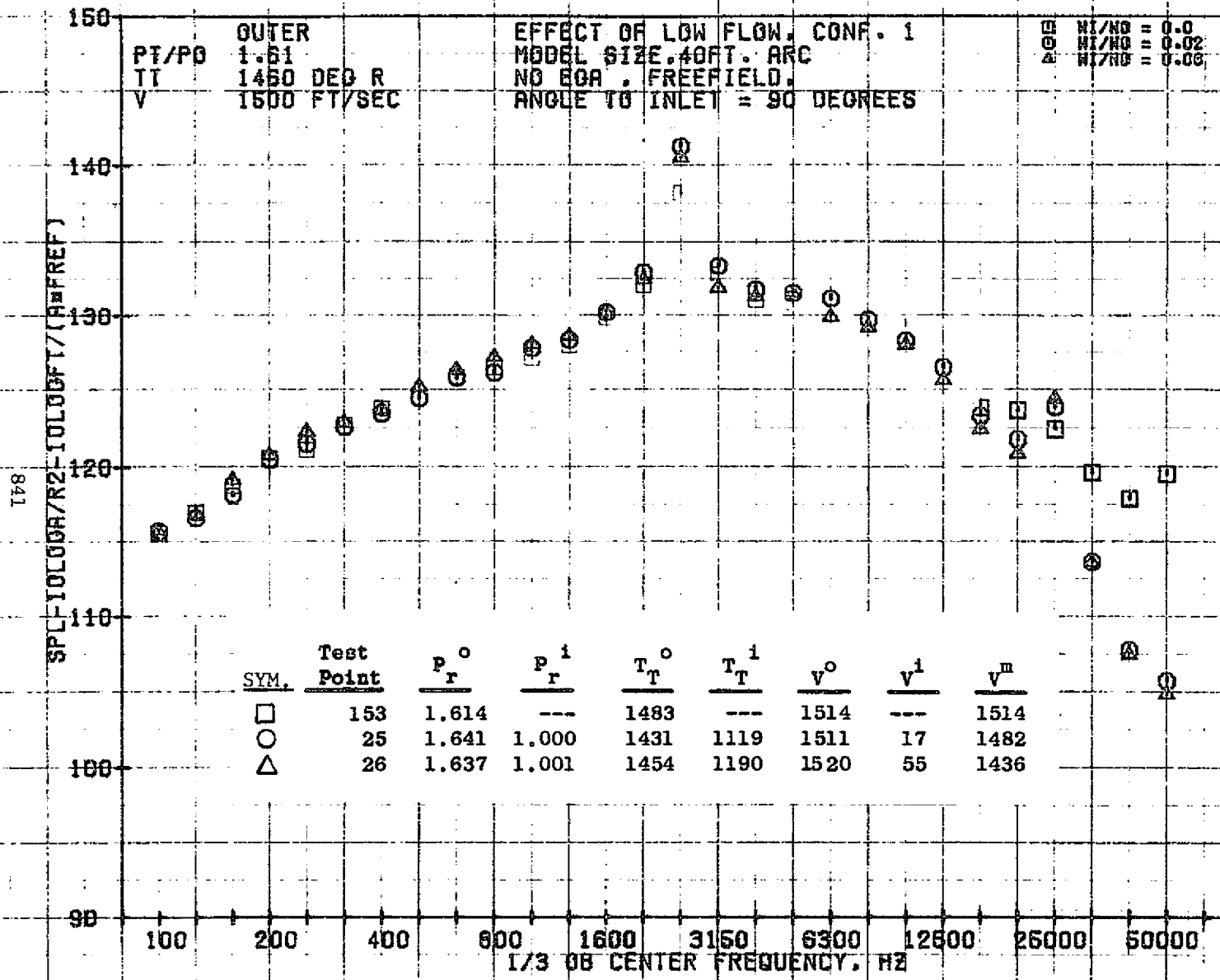
□ $H1/H0 = 0.0$
 ○ $H1/H0 = 0.0$
 △ $H1/H0 = 0.16$

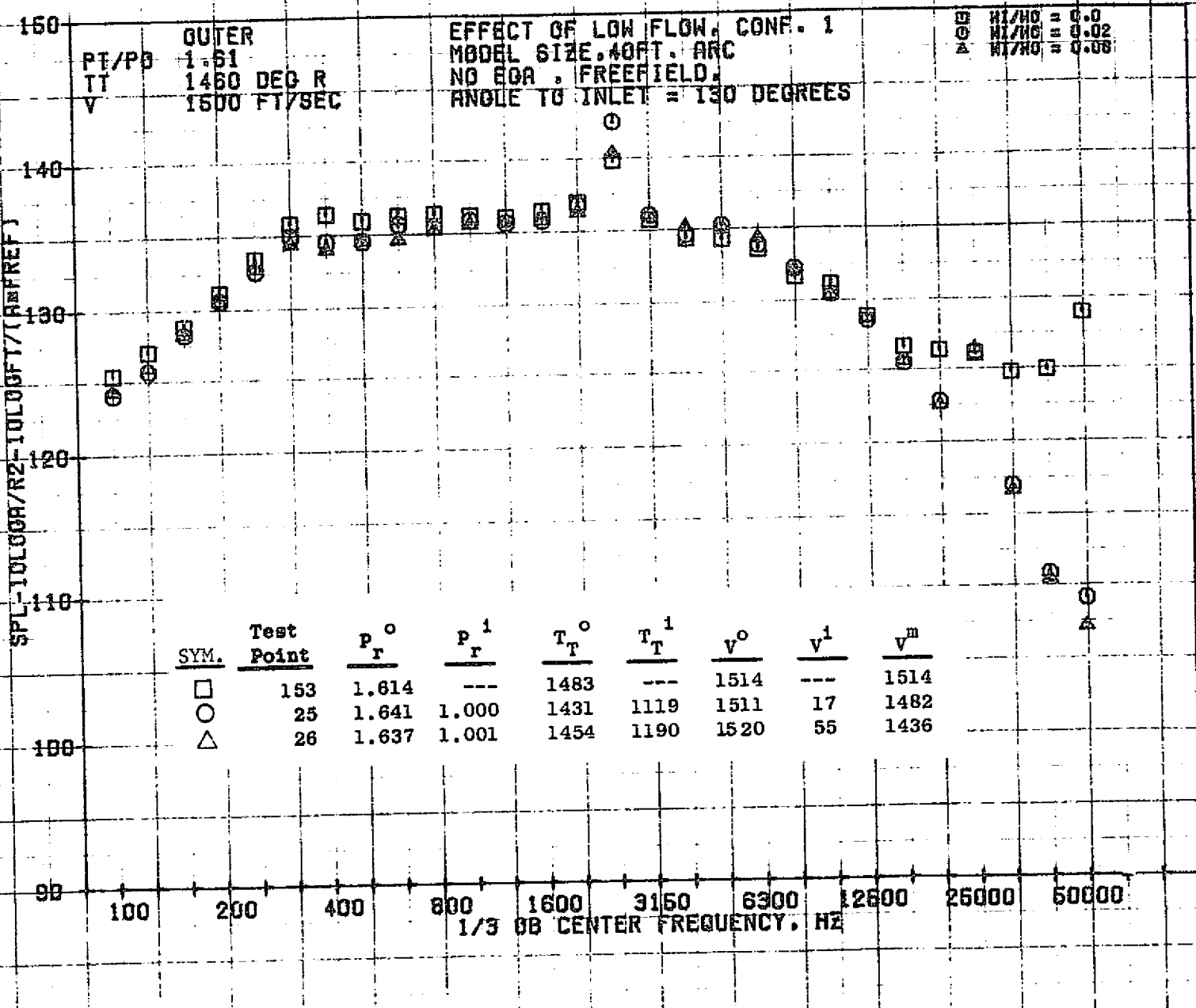
SPL-10LOG(P/R²-10LOG(P/T/(P=REF)))
 840



SYM.	Test Point	P_r^o	P_r^1	T_T^o	T_T^1	V^o	V^1	V^m
□	153	1.614	---	1483	---	1514	---	1514
○	25	1.641	1.000	1431	1119	1511	17	1482
△	26	1.637	1.001	1454	1190	1520	55	1436

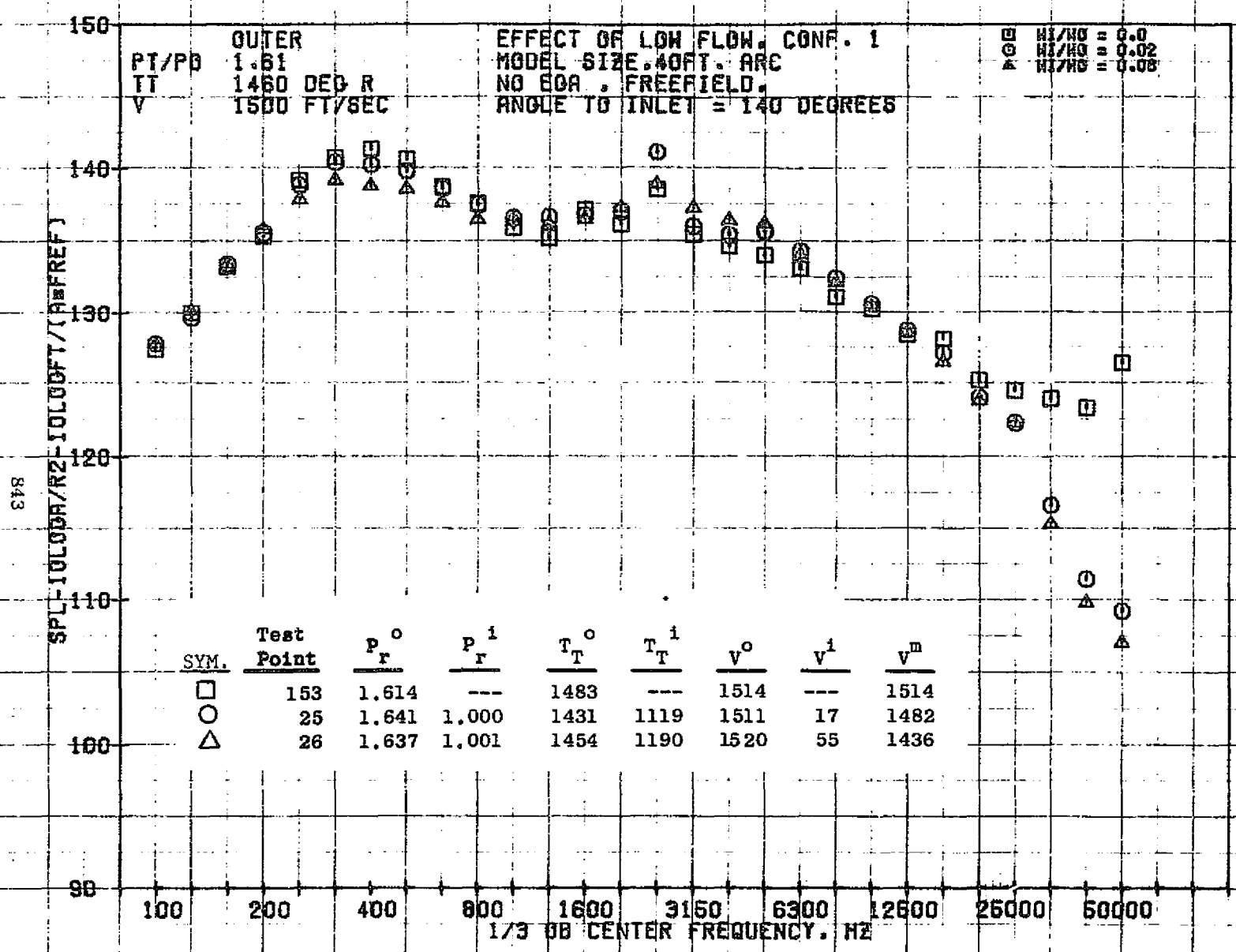
LISTEDT





10/08/76
1X746-001

73KOLLSTEDT



10/08/76
1X746-001

73KOLLSTEDT

120
110
100
90
80
70
60

PNL - 10 LOG (FT / FREE) . DB

20 40 60 80 100 120 140 160 180

ANGLE TO INLET . DEG.

PT/PO
TT
V

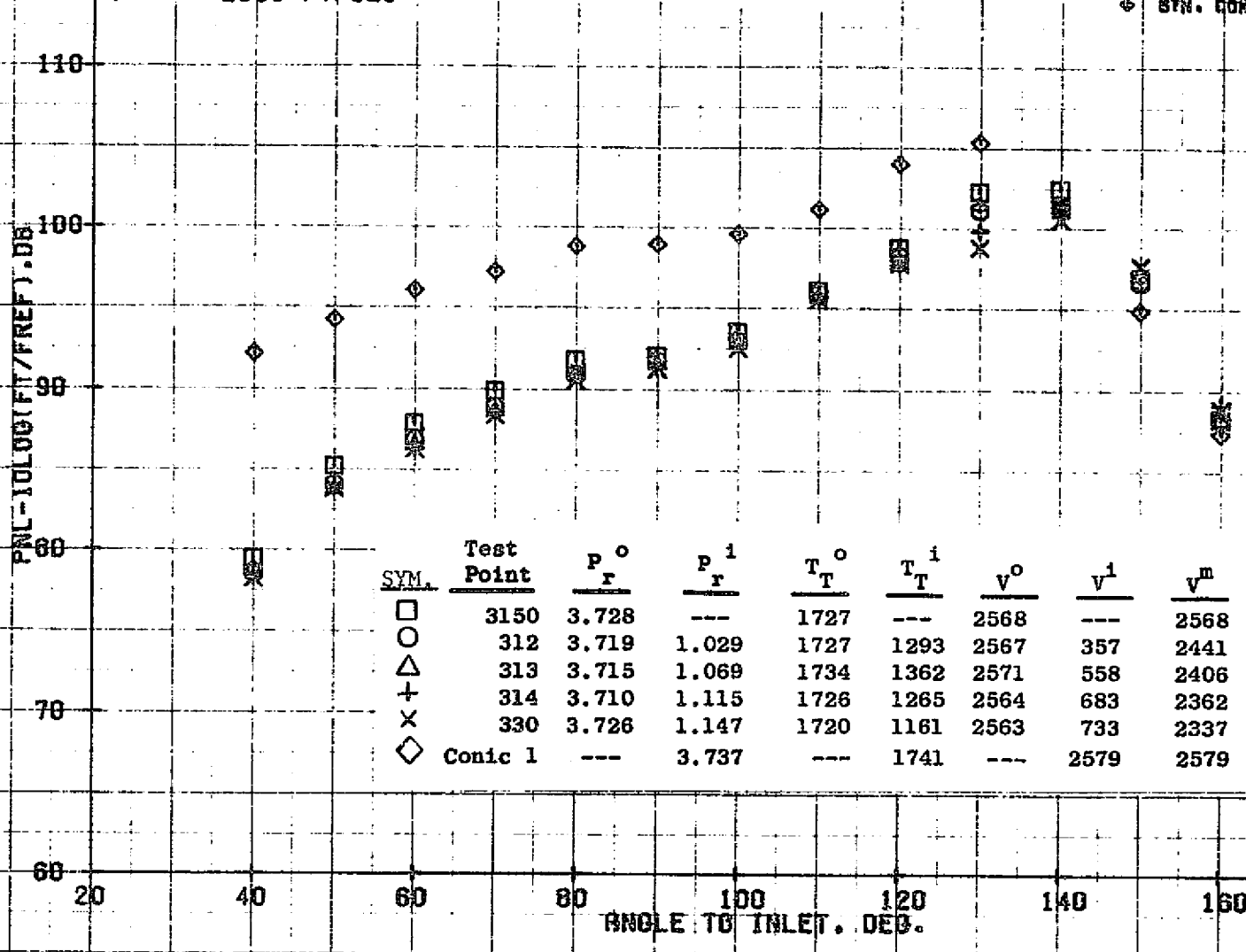
OUTER
3.69
1780 DEG R
2561 FT/SEC

EFFECT OF LOW FLOW, CONF. 3
FULL SIZE (513 SQ IN) . 2400 FT SIDELINE
NO EOR . FREEFIELD.

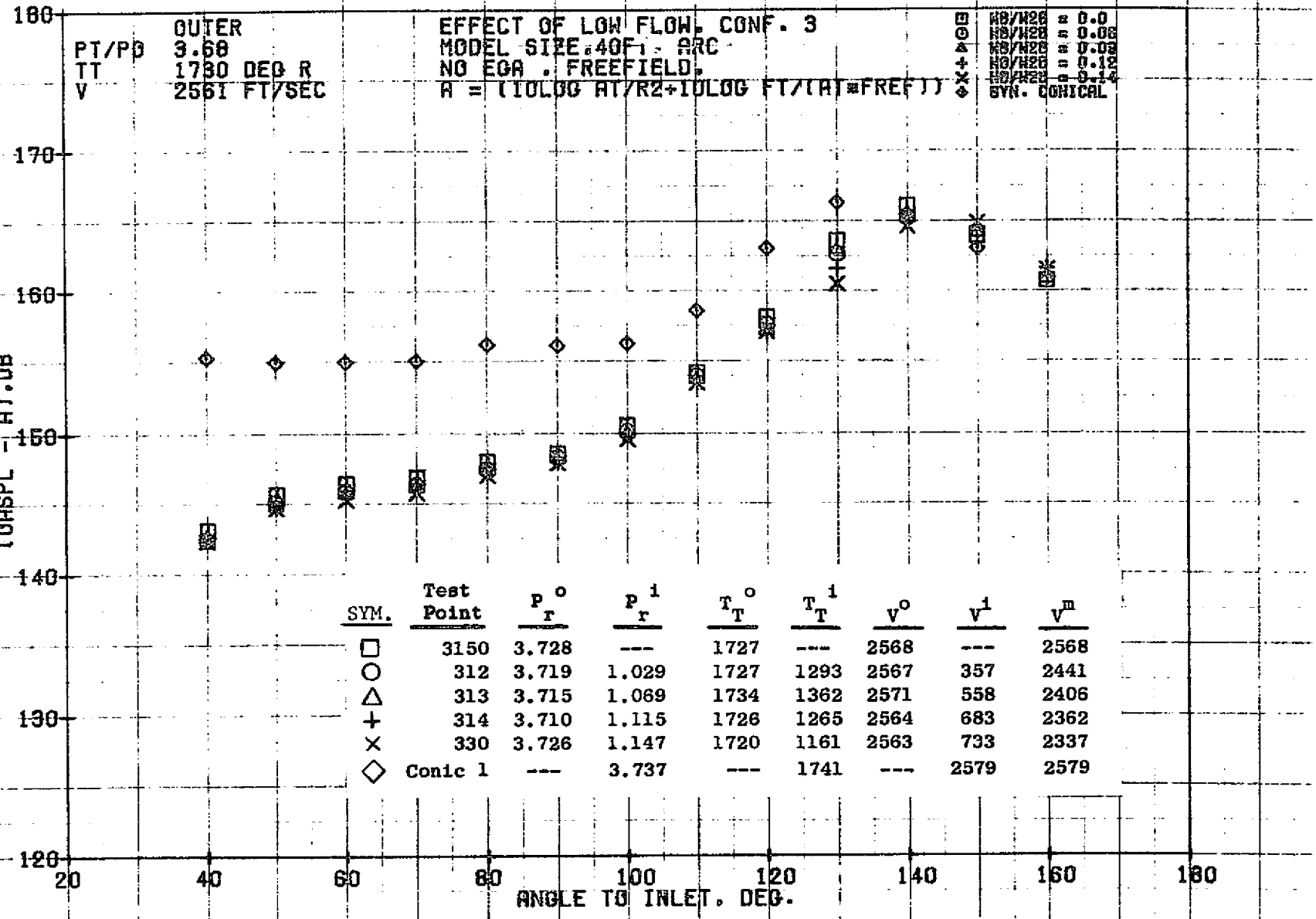
□ 0.0
○ 0.08
△ 0.08
+ 0.12
x 0.14
◇ SYN. CONIC.

844

SYM.	Test Point	P_r^o	P_r^i	T_T^o	T_T^i	V^o	V^i	V^m
□	3150	3.728	---	1727	---	2568	---	2568
○	312	3.719	1.029	1727	1293	2567	357	2441
△	313	3.715	1.069	1734	1362	2571	558	2406
+	314	3.710	1.115	1726	1265	2564	683	2362
x	330	3.726	1.147	1720	1161	2563	733	2337
◇	Conic 1	---	3.737	---	1741	---	2579	2579



845

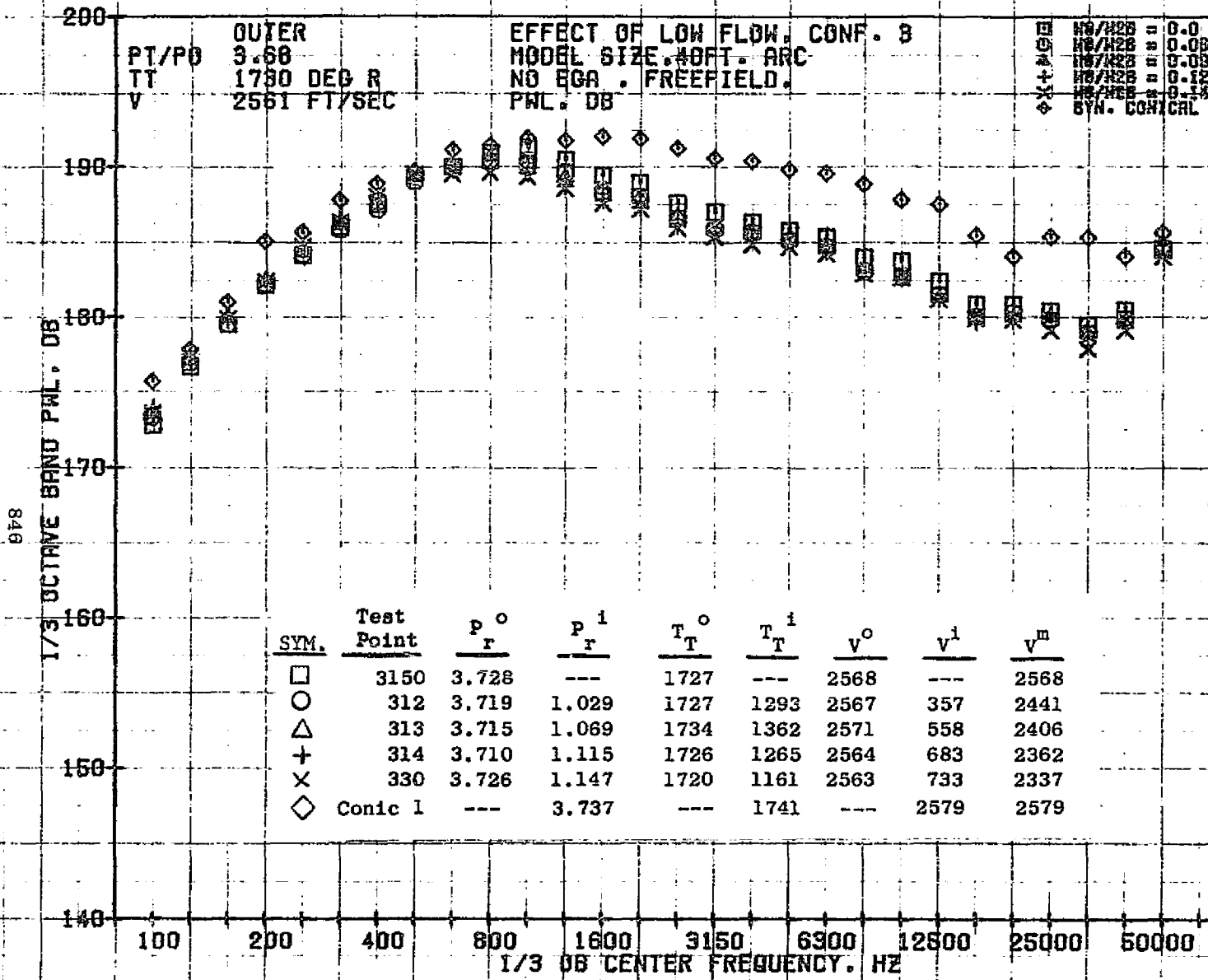


PT/PD
TT
V
OUTER
3.68
1730 DEG R
2561 FT/SEC

EFFECT OF LOW FLOW, CONF. 3
MODEL SIZE, 40F₁ ARC
NO EGA, FREEFIELD.
A = (10LOG AT/R2 + 10LOG FT/(AT) = FREF)

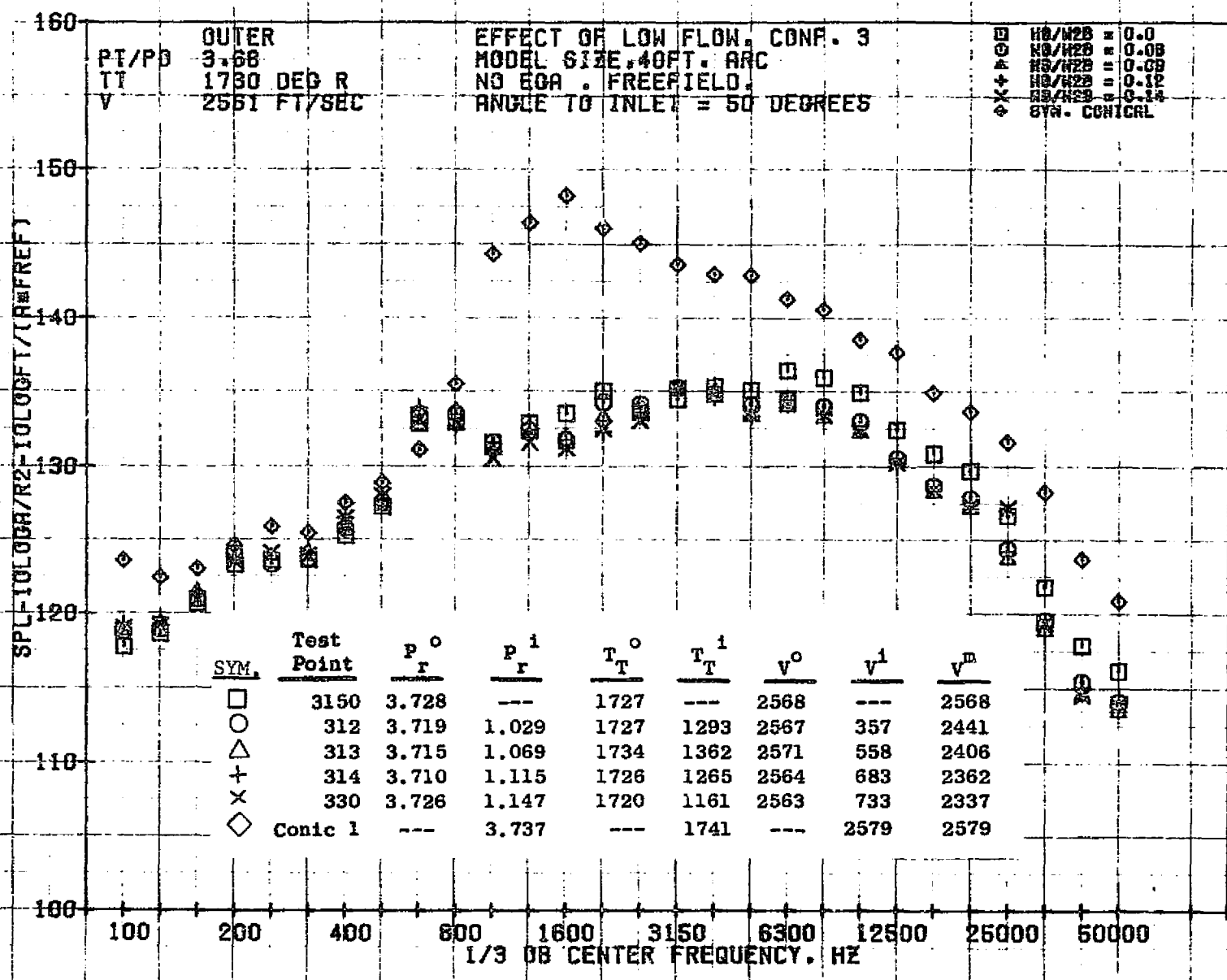
SYN. CONICAL
H0/H20 = 0.0
H0/H20 = 0.03
H0/H20 = 0.03
H0/H20 = 0.12
H0/H20 = 0.14

SYM.	Test Point	P _r ^o	P _r ⁱ	T _T ^o	T _T ⁱ	V ^o	V ⁱ	V ^m
□	3150	3.728	---	1727	---	2568	---	2568
○	312	3.719	1.029	1727	1293	2567	357	2441
△	313	3.715	1.069	1734	1362	2571	558	2406
+	314	3.710	1.115	1726	1265	2564	683	2362
x	330	3.726	1.147	1720	1161	2563	733	2337
◇	Conic 1	---	3.737	---	1741	---	2579	2579



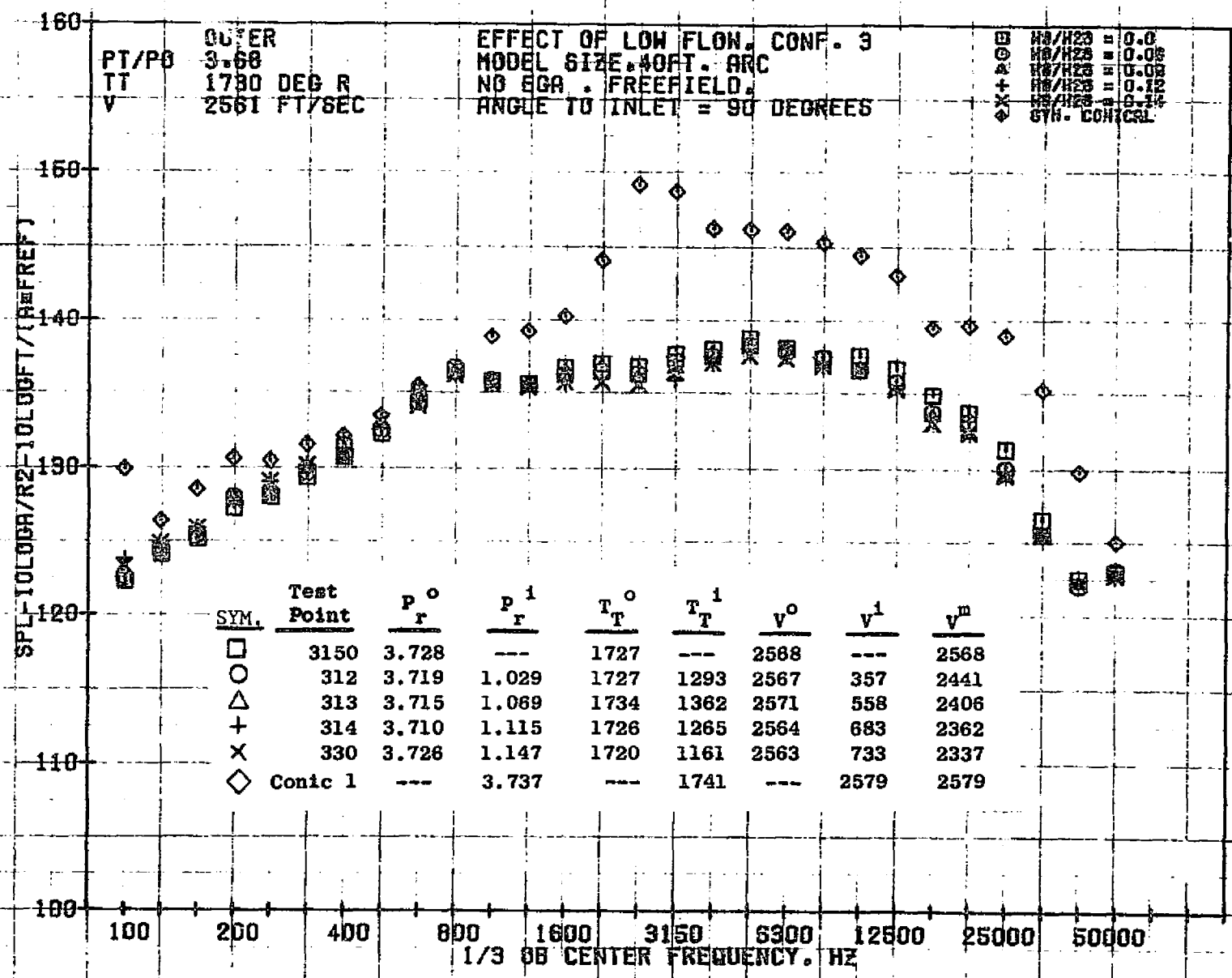
10/11/76
1X207-001

73KOLLSTEDT



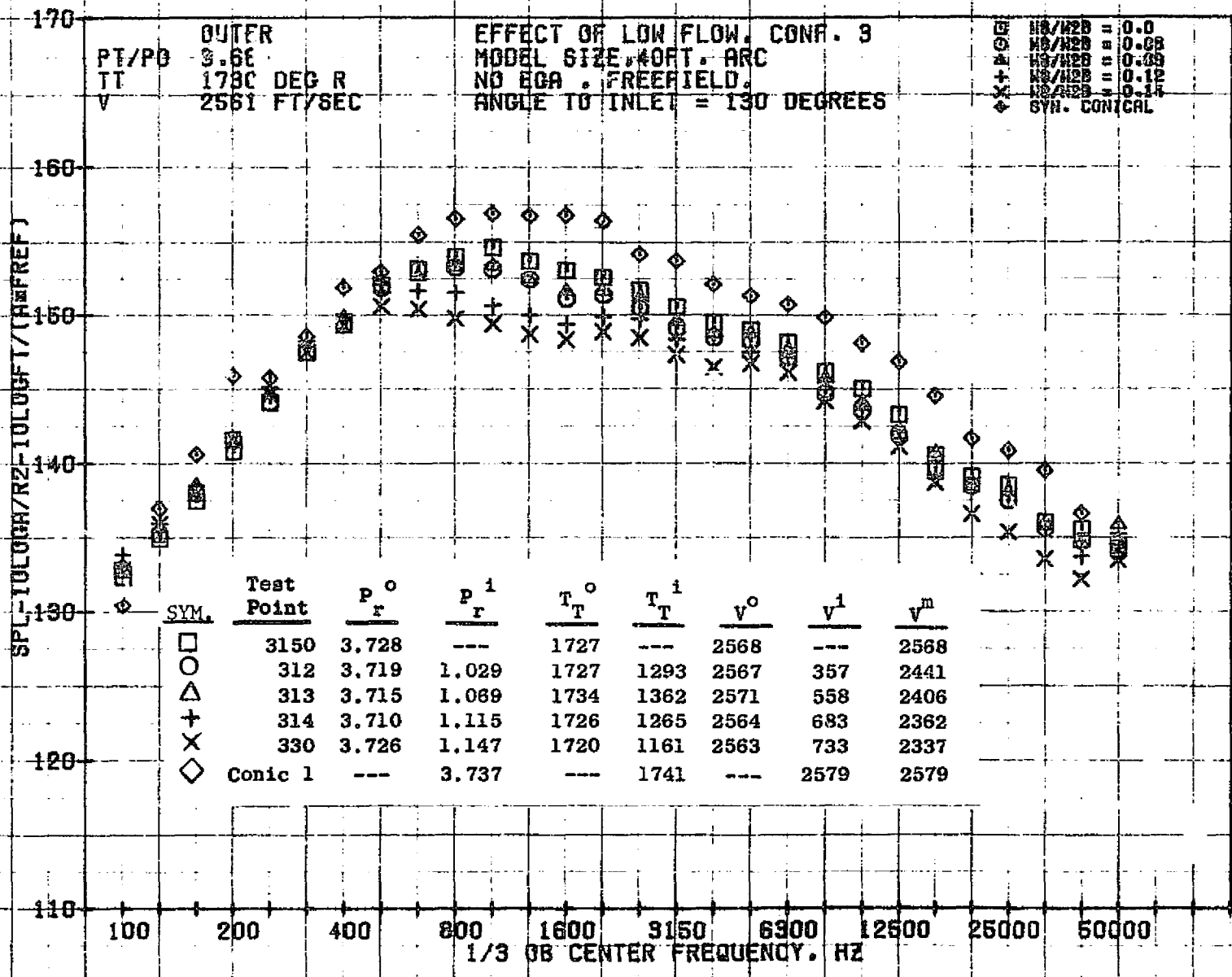
10/11/76
1X207-001

79KOLLSTEDT



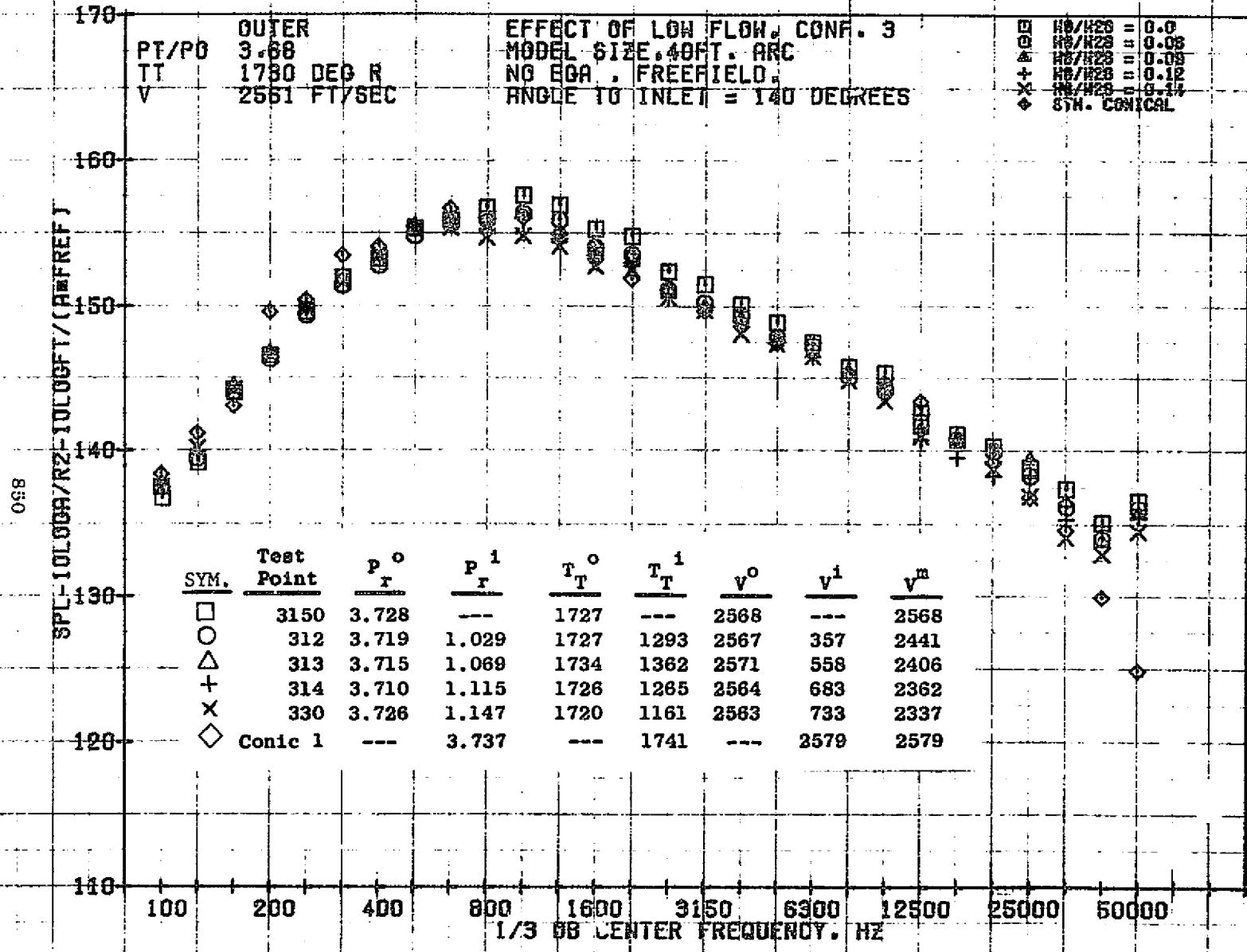
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1X207-001

73KOLLSTEDT



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1X207-001

73KOLLSTEDT



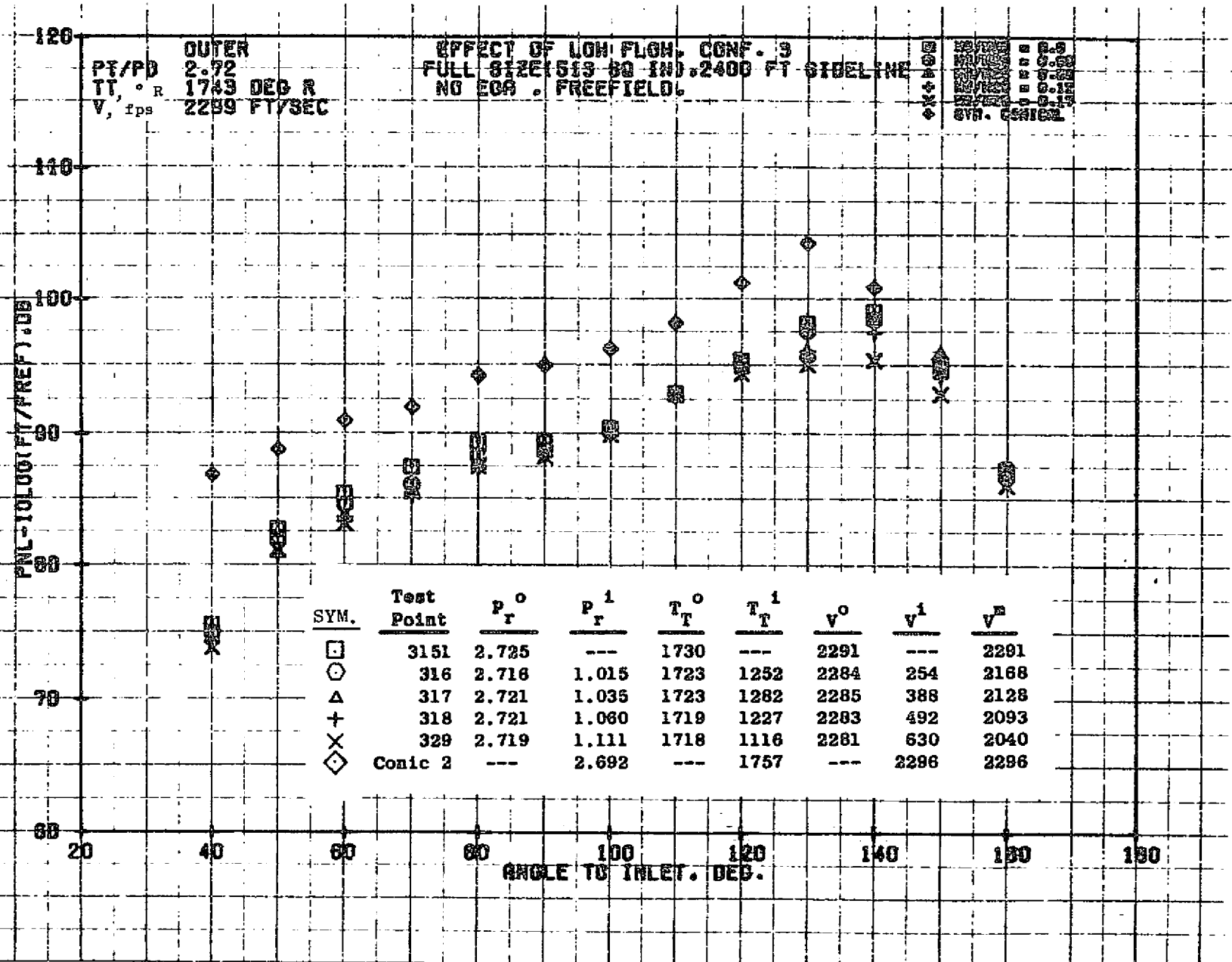
10/11/76
1X207-001

73KOLLSTEDT

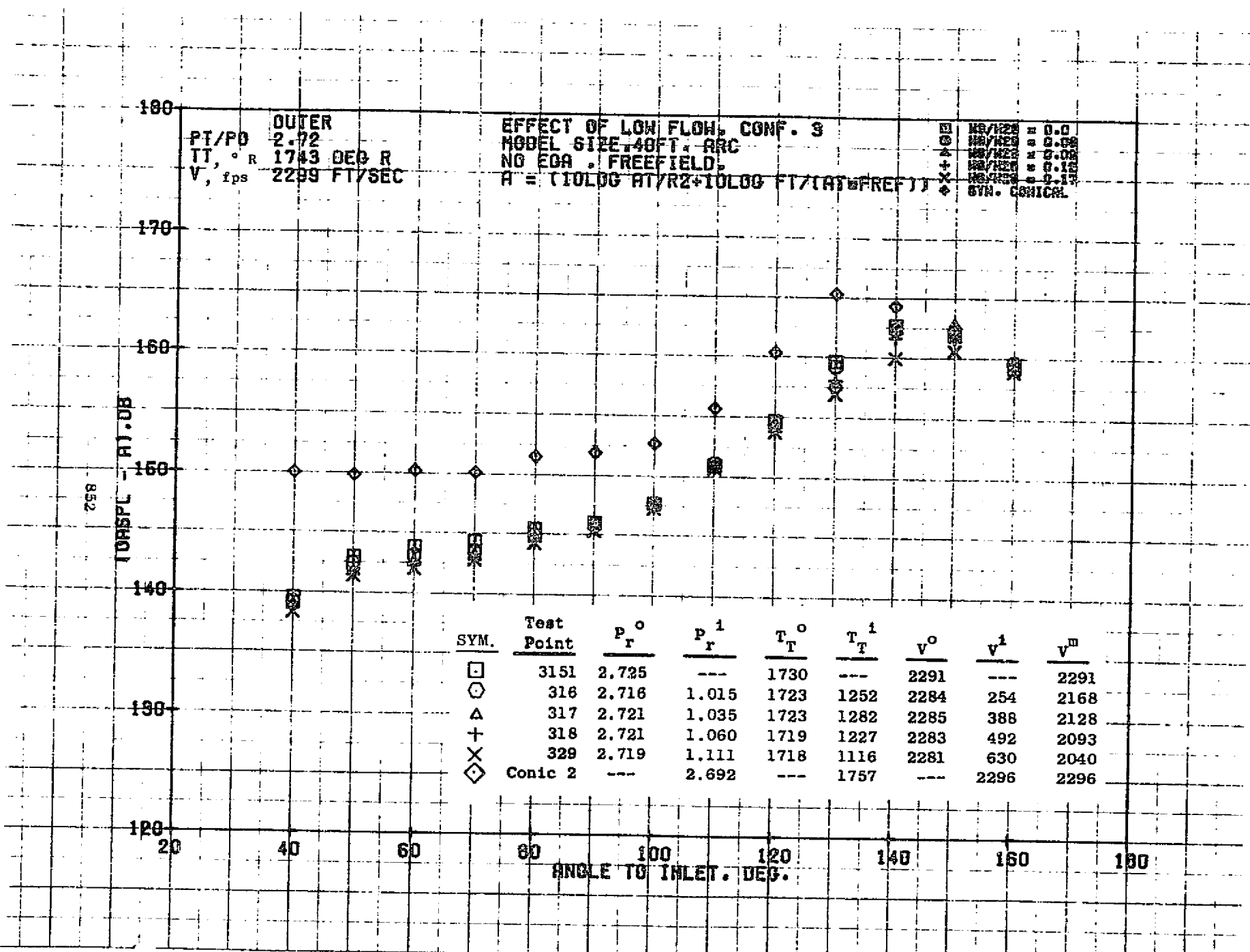
PT/PD OUTER
 TT, ° R 2.72
 V, fps 1743 DEG R
 2299 FT/SEC

EFFECT OF LOW FLOW, CONF. 3
 FULL SIZE 1513 80 IND. 2400 FT SIDELINE
 NO EOR. FREEFIELD.

851
 PNL-10100 (FT/PREF) : 08
 SYN. CENTER



SYM.	Test Point	P_r^o	P_r^i	T_T^o	T_T^i	V^o	V^i	V^F
□	315	2.725	---	1730	---	2291	---	2291
○	316	2.716	1.015	1723	1252	2284	254	2168
△	317	2.721	1.035	1723	1282	2285	388	2128
+	318	2.721	1.060	1719	1227	2283	492	2093
×	329	2.719	1.111	1718	1116	2281	630	2040
◇	Conic 2	---	2.692	---	1757	---	2296	2296

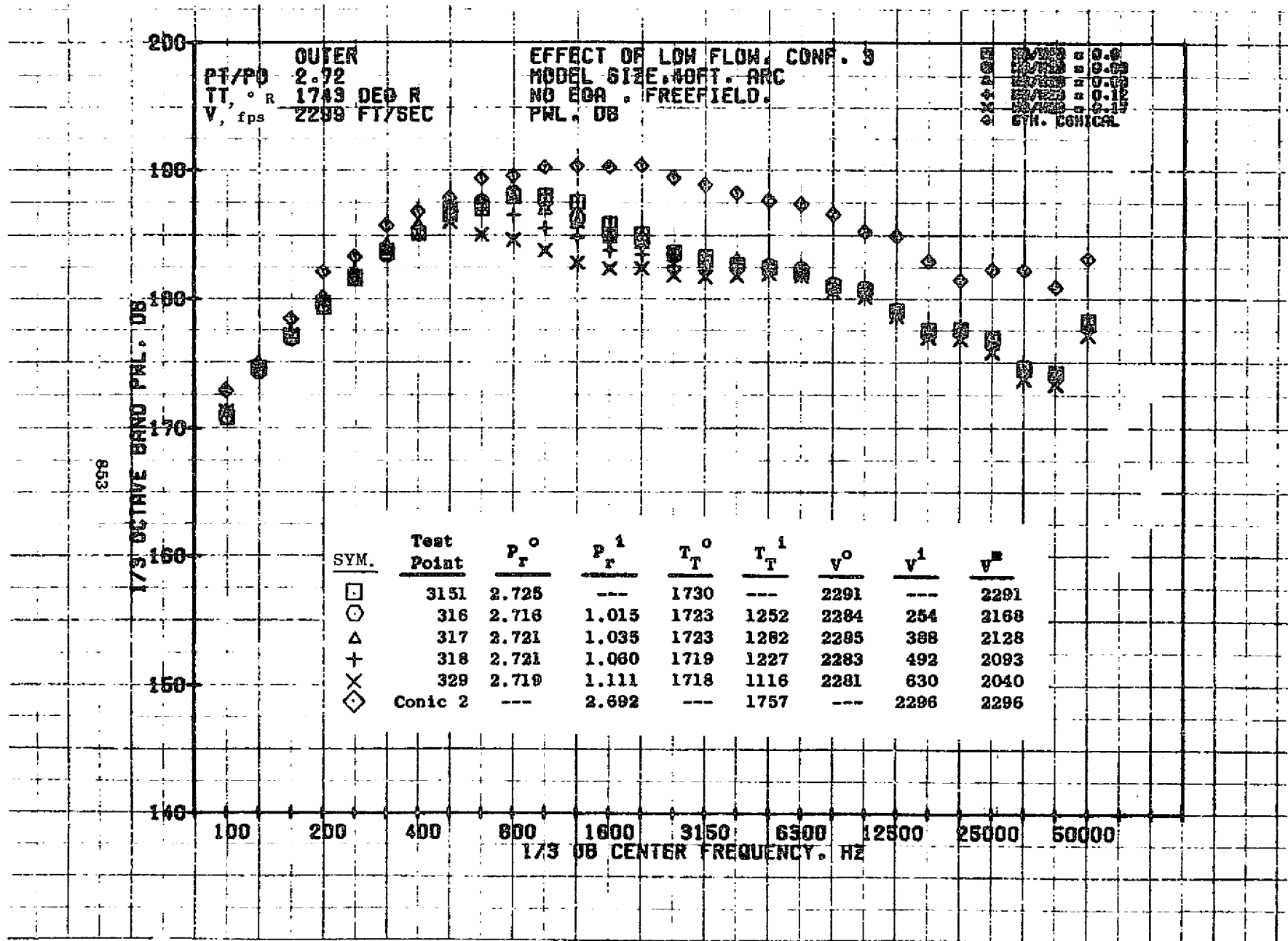


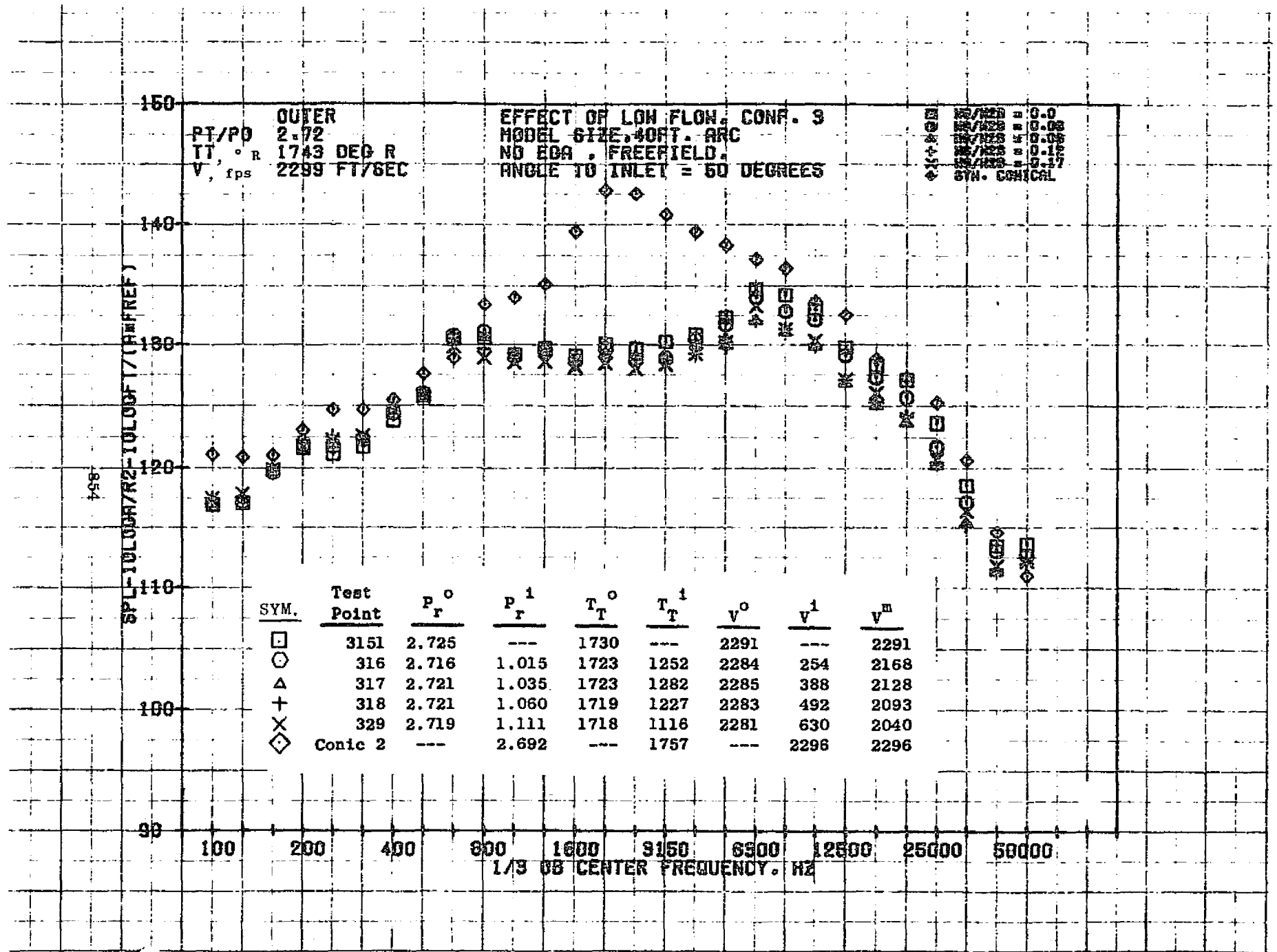
PI/PO OUTER
 2.72
 TT, ° R 1743 DEG R
 V, fps 2299 FT/SEC

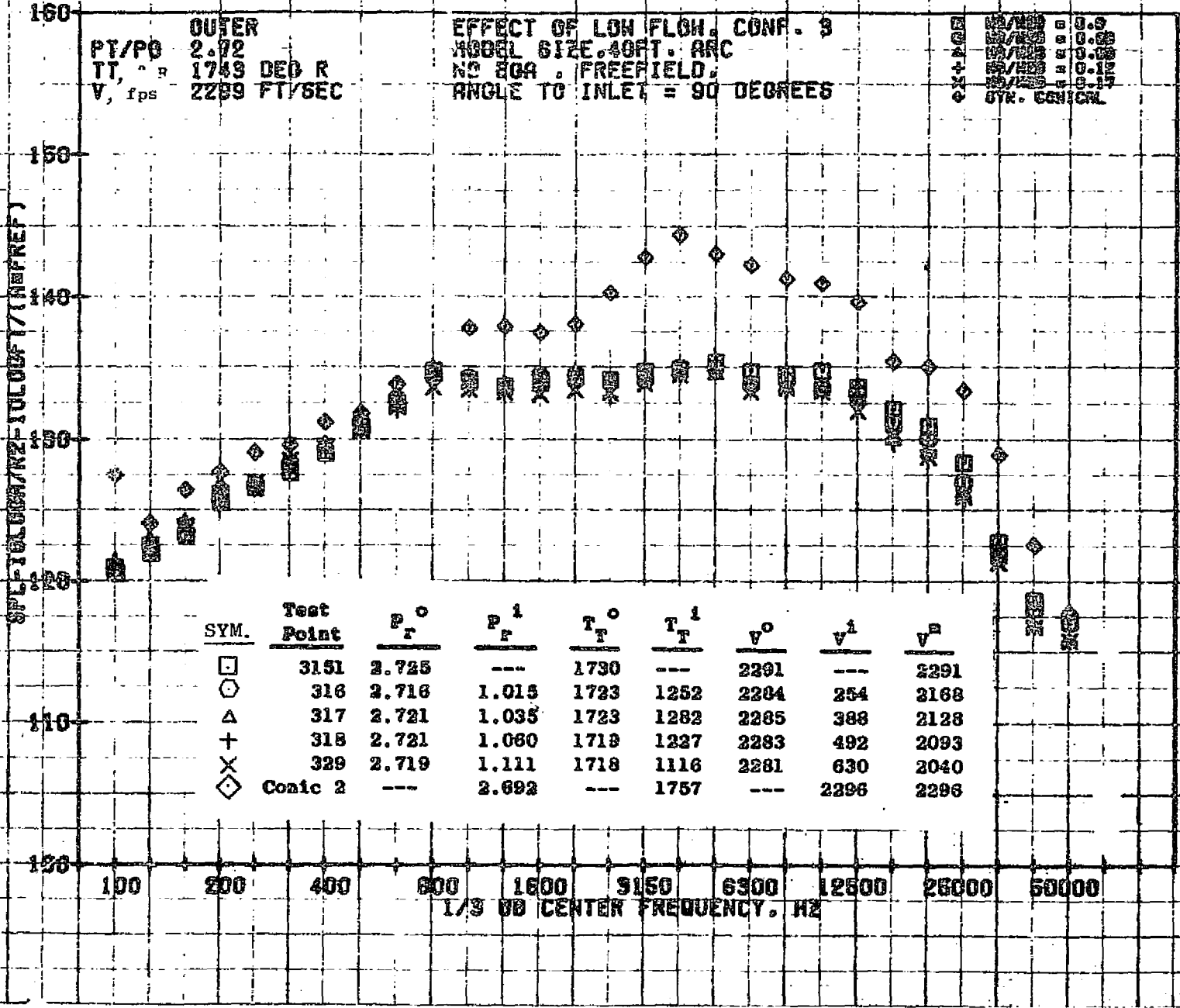
EFFECT OF LOW FLOW, CONF. 3
 MODEL SIZE 40 FT. ARC
 NO EDA. FREEFIELD
 $A = (10 \log RT/R2 + 10 \log FT/(AT \cdot FREF))$

HS/28 0.0
 HS/29 0.08
 HS/30 0.08
 HS/31 0.18
 HS/32 0.17
 SYN. CONICAL

SYM.	Test Point	P_r^0	P_r^1	T_T^0	T_T^1	V^0	V^1	V^m
□	3151	2.725	---	1730	---	2291	---	2291
○	316	2.716	1.015	1723	1252	2284	254	2168
△	317	2.721	1.035	1723	1282	2285	388	2128
+	318	2.721	1.060	1719	1227	2283	492	2093
x	329	2.719	1.111	1718	1116	2281	630	2040
◇	Conic 2	---	2.692	---	1757	---	2296	2296





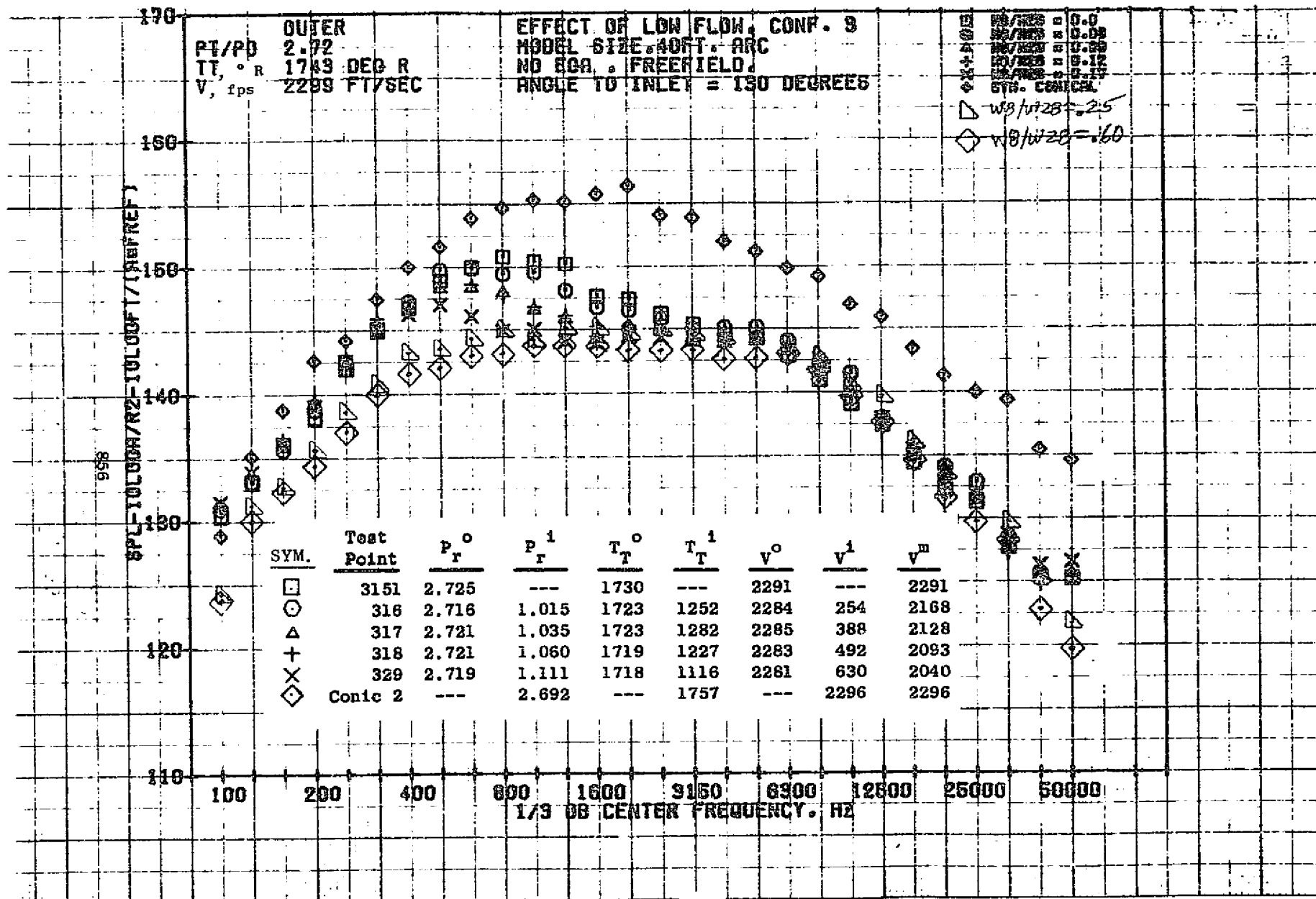


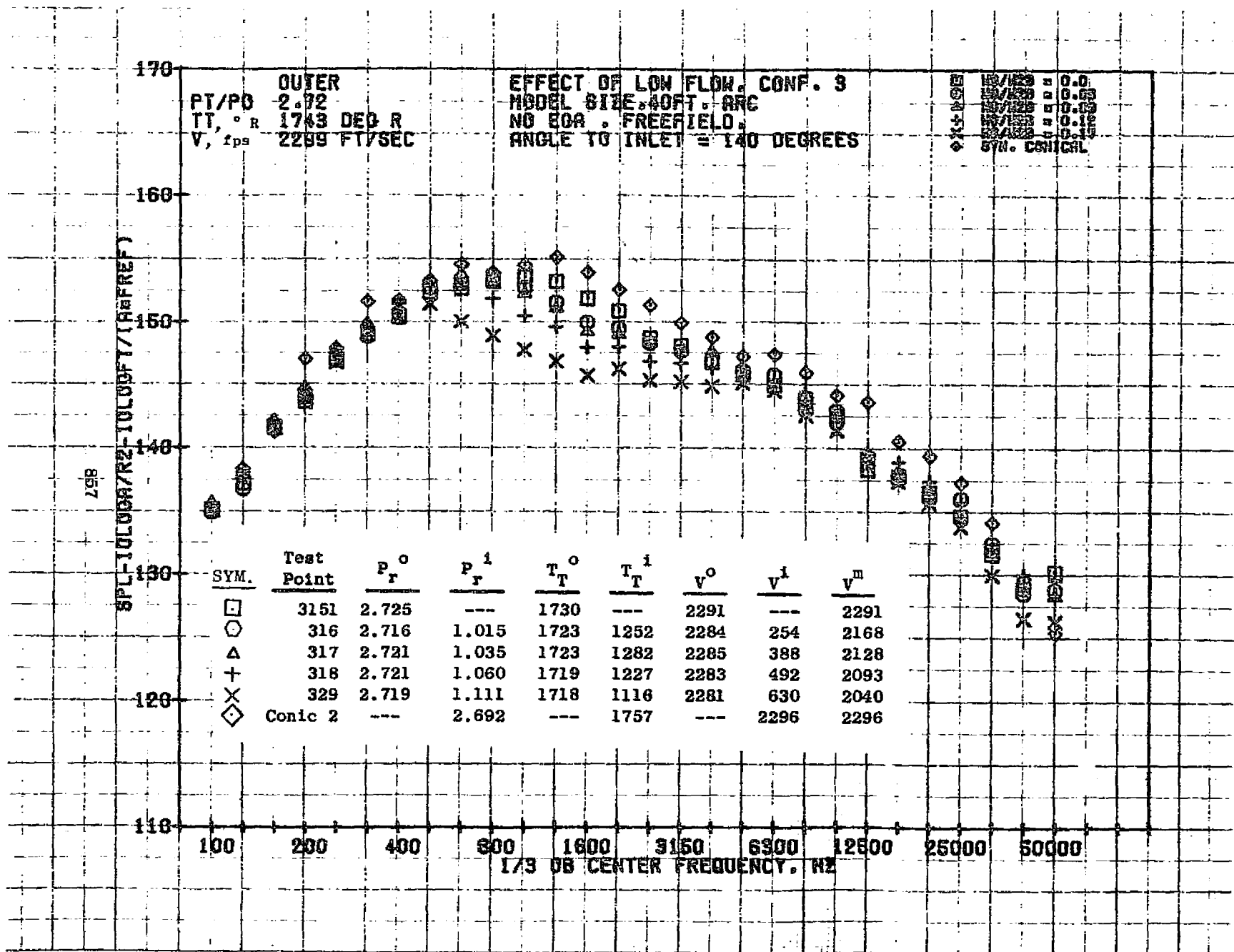
OUTER
 PT/PO 2.72
 TT, ° 1749 DEG R
 V, fps 2289 FT/SEC

EFFECT OF LOW FLOW, CONF. 9
 MODEL SIZE .40FT. ARC
 NO BGA, FREEFIELD,
 ANGLE TO INLET = 90 DEGREES

BETA 0.9
 MACH 0.68
 MACH 0.68
 MACH 0.12
 MACH 0.17
 SYN. CONICAL

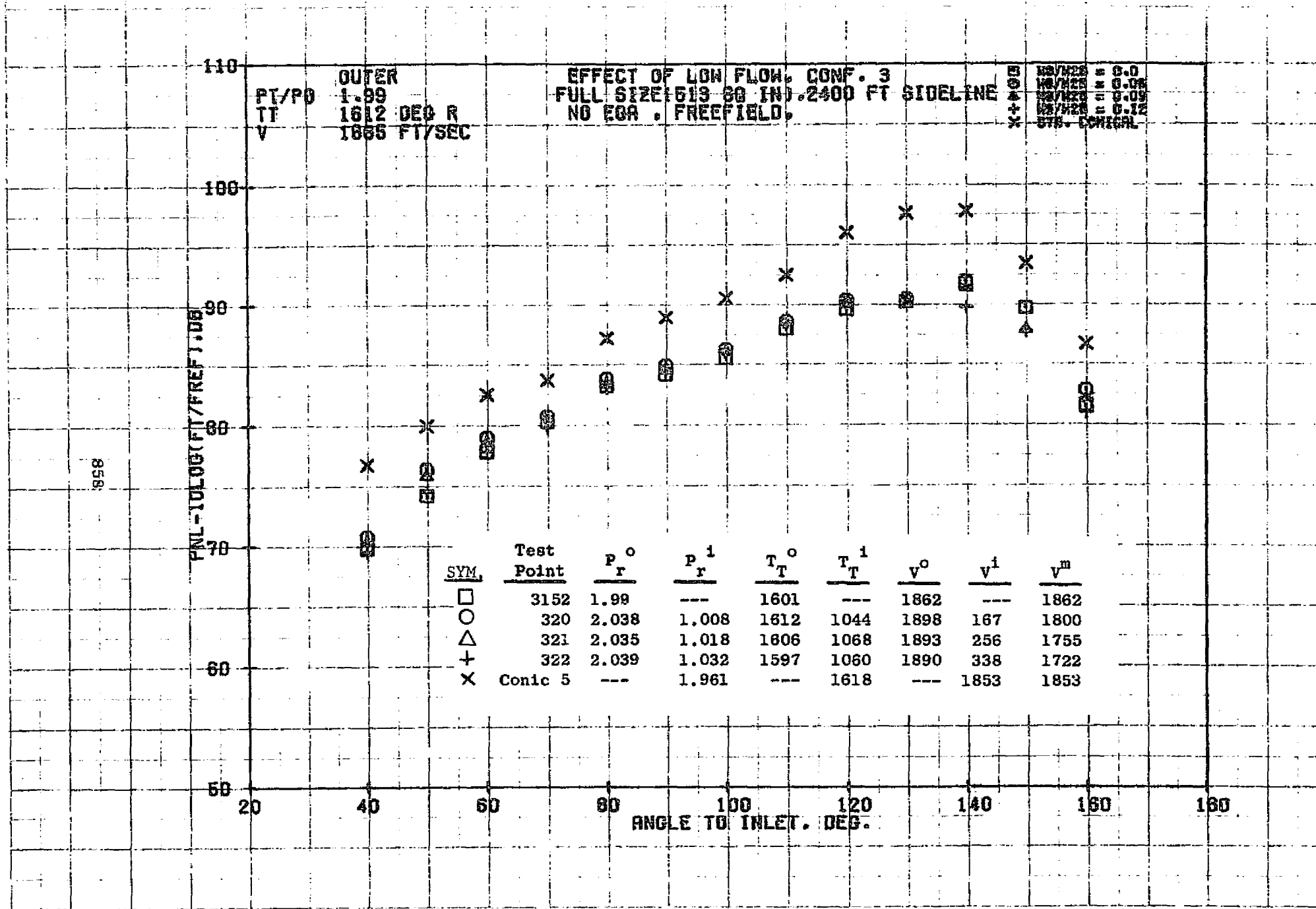
SYM.	Test Point	P_T^0	P_T^1	T_T^0	T_T^1	V^0	V^1	V^2
□	3151	2.725	---	1730	---	2291	---	2291
○	316	2.716	1.015	1723	1252	2204	254	2168
△	317	2.721	1.035	1723	1282	2285	388	2128
+	318	2.721	1.060	1719	1227	2283	492	2093
x	329	2.719	1.111	1719	1116	2281	630	2040
◇	Conic 2	---	2.692	---	1757	---	2296	2296





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1X207-001

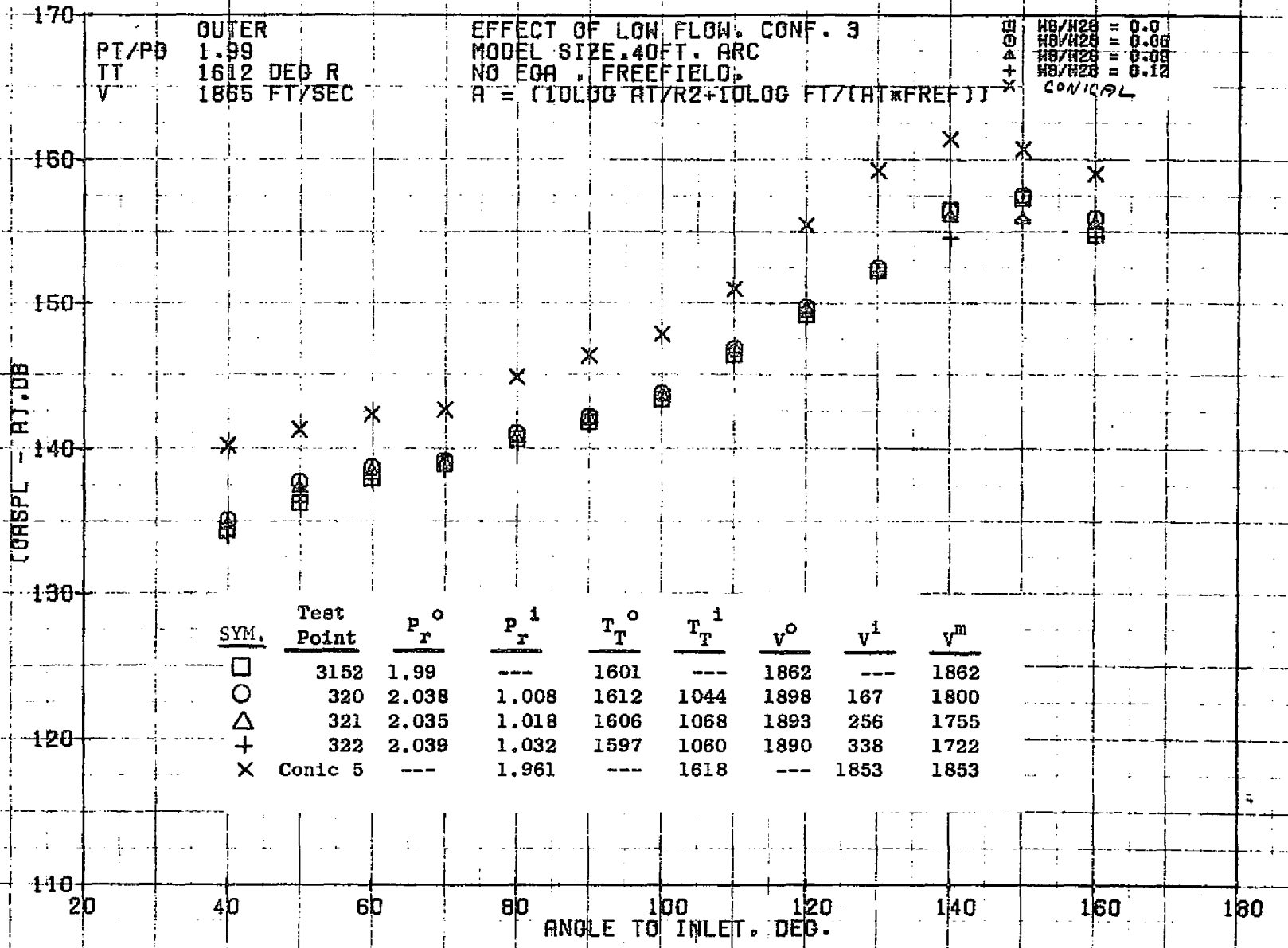
79KOLLSTEDT



10/25/76
1X558-001

73KOLLSTEDT

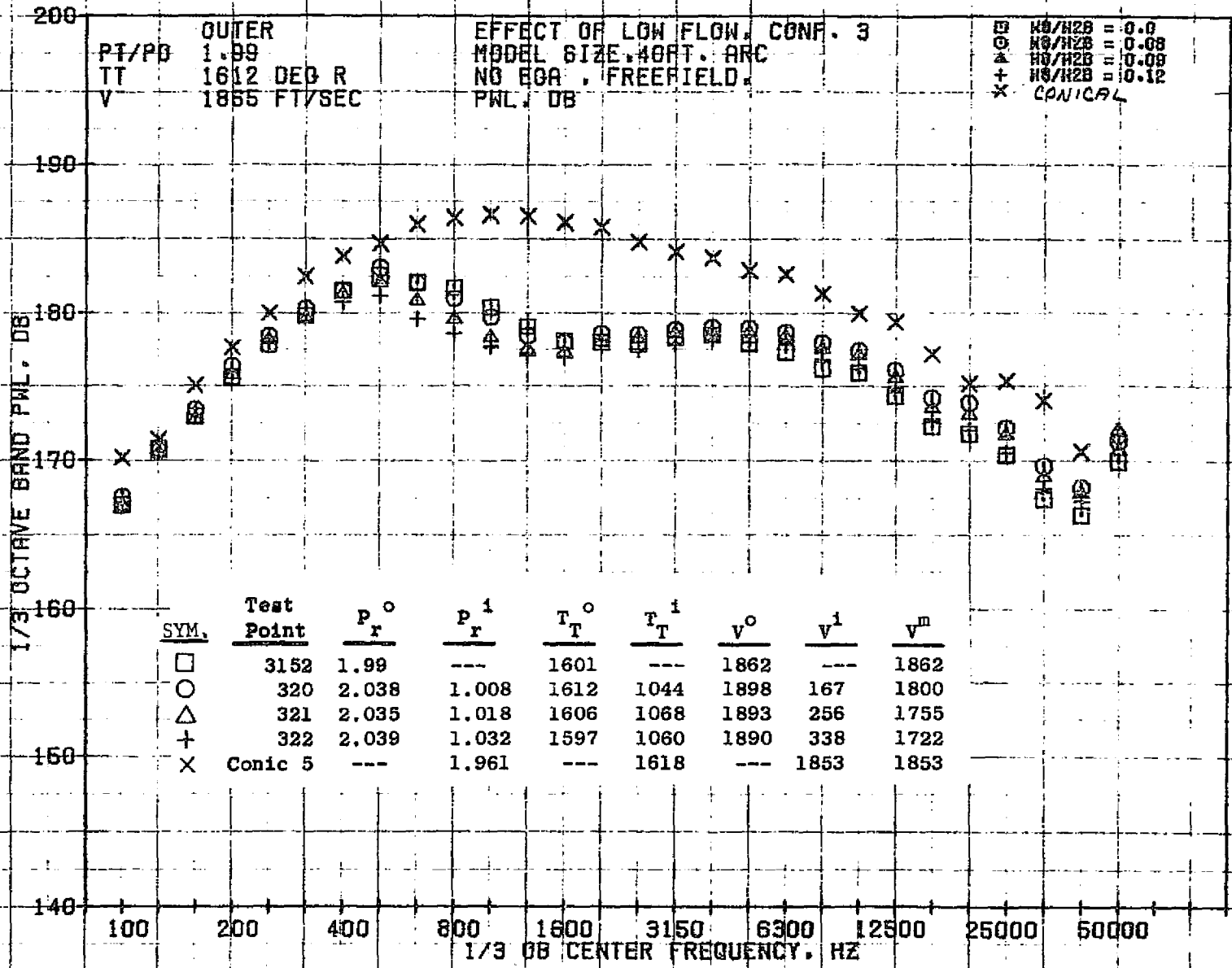
658



PT/P0 1.99
TT 1612 DEG R
V 1865 FT/SEC

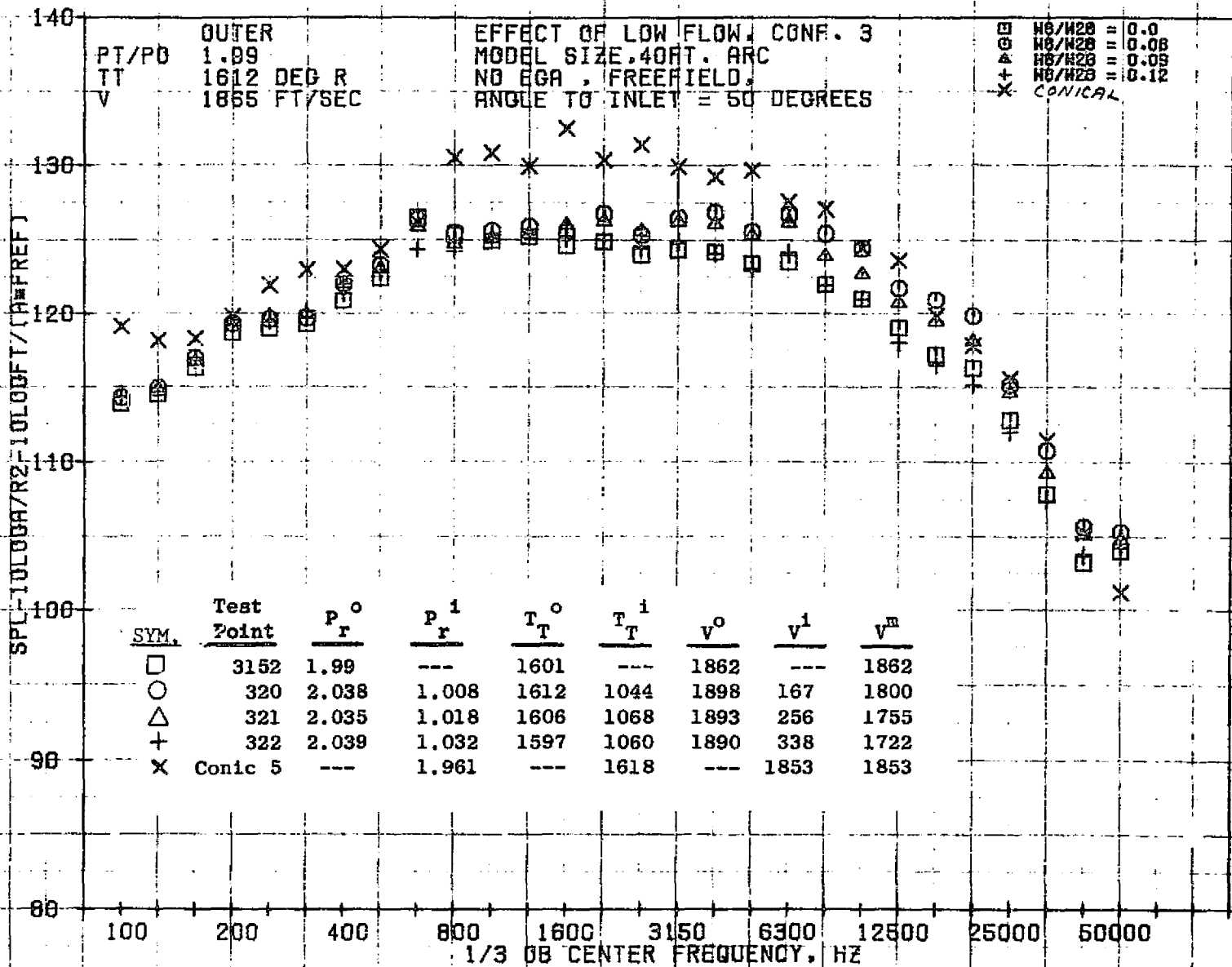
EFFECT OF LOW FLOW, CONF. 3
MODEL SIZE .40 FT. ARC
NO EOA, FREEFIELD.
 $A = (10 \log AT/R2 + 10 \log FT/(AT \cdot FREF))$

□ ○ △ + X
 $H8/H28 = 0.0$
 $H8/H28 = 0.06$
 $H8/H28 = 0.09$
 $H8/H28 = 0.12$
 CONICAL



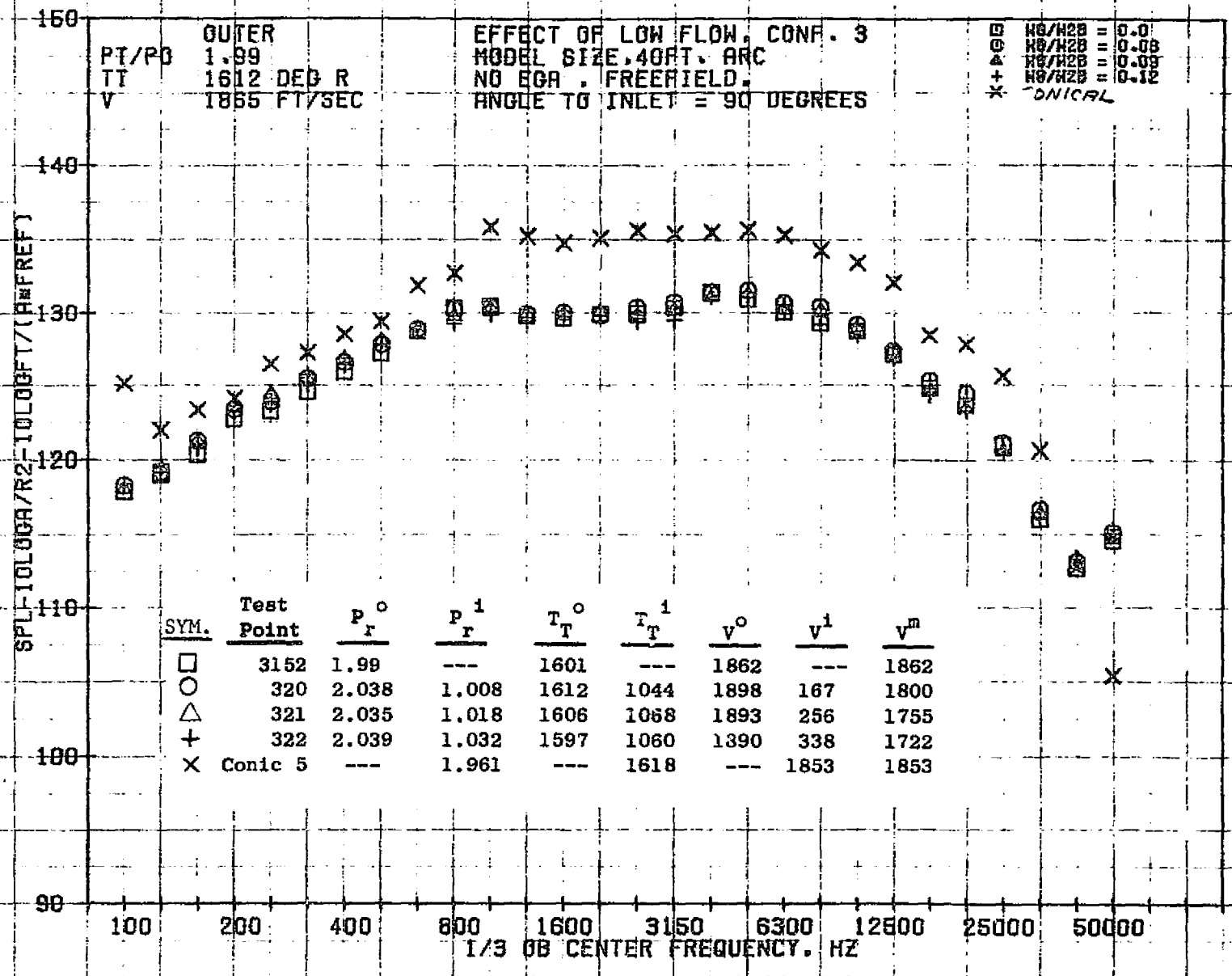
10/12/76
1X525-001

73KOLLSTEDT



10/12/76
1X525-001

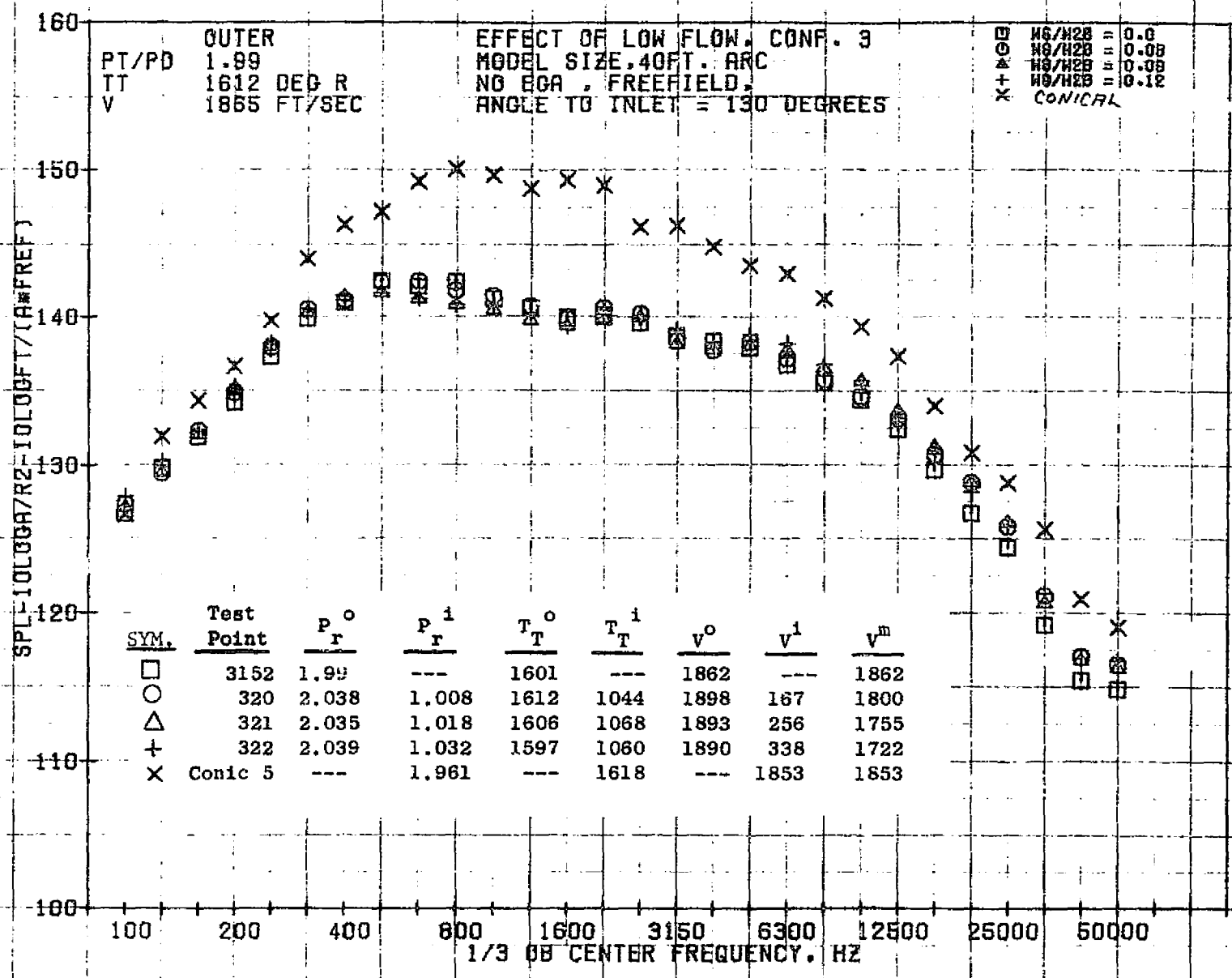
73KOLLSTEDT



10/12/76
1X525-001

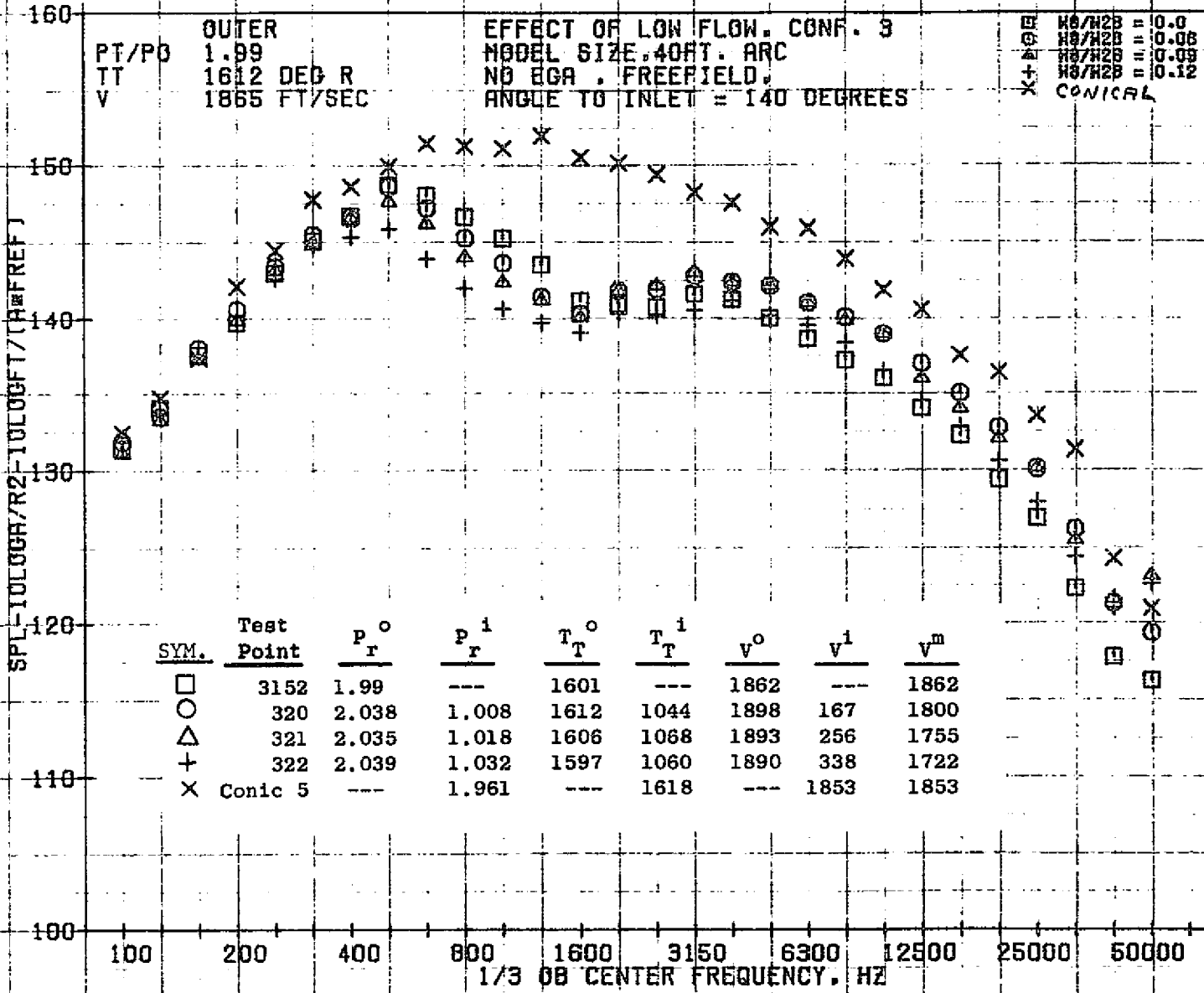
73KOLLSTEDT

898



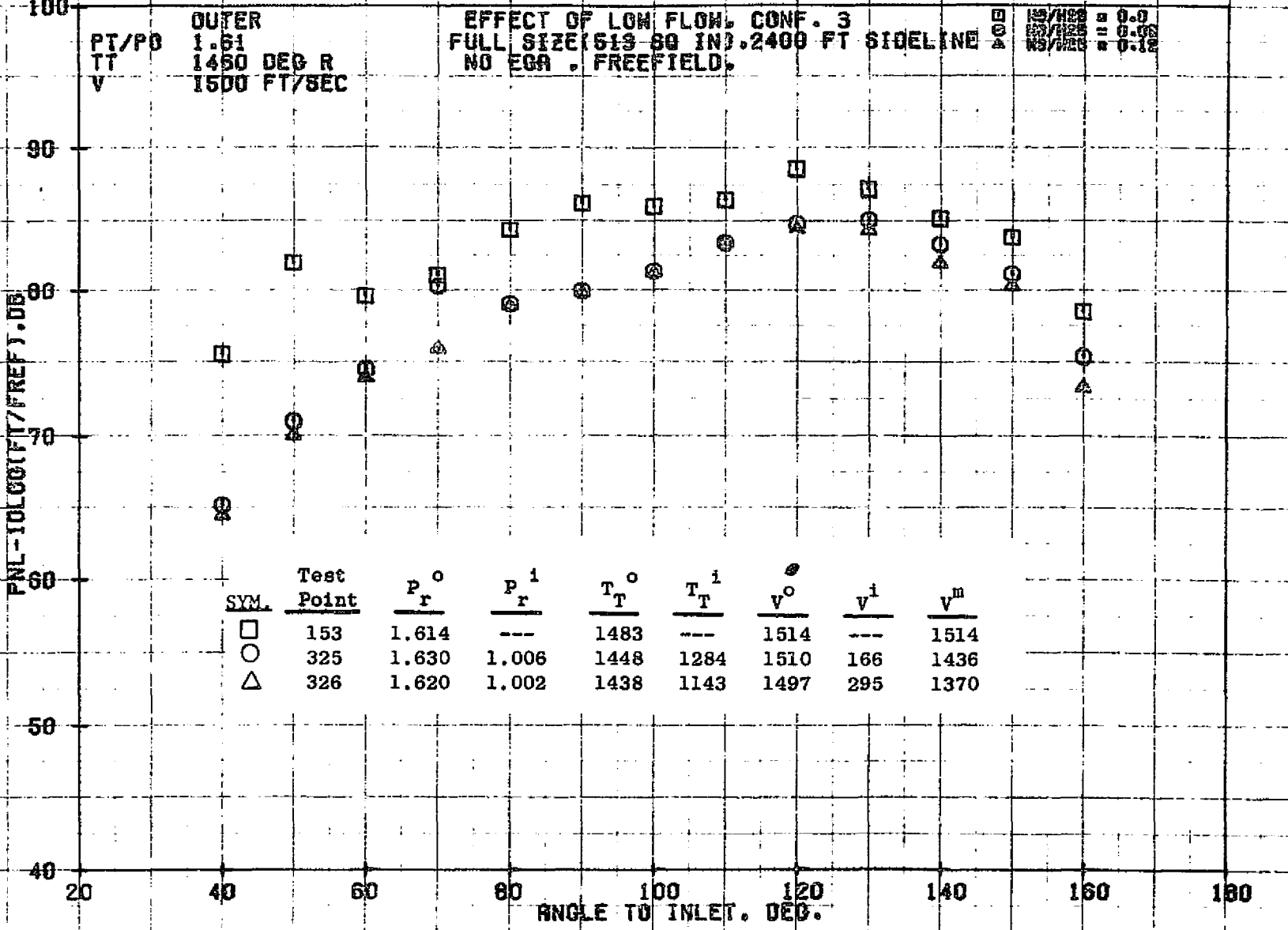
10/12/76
 1X525-001

73KOLLSTEDT



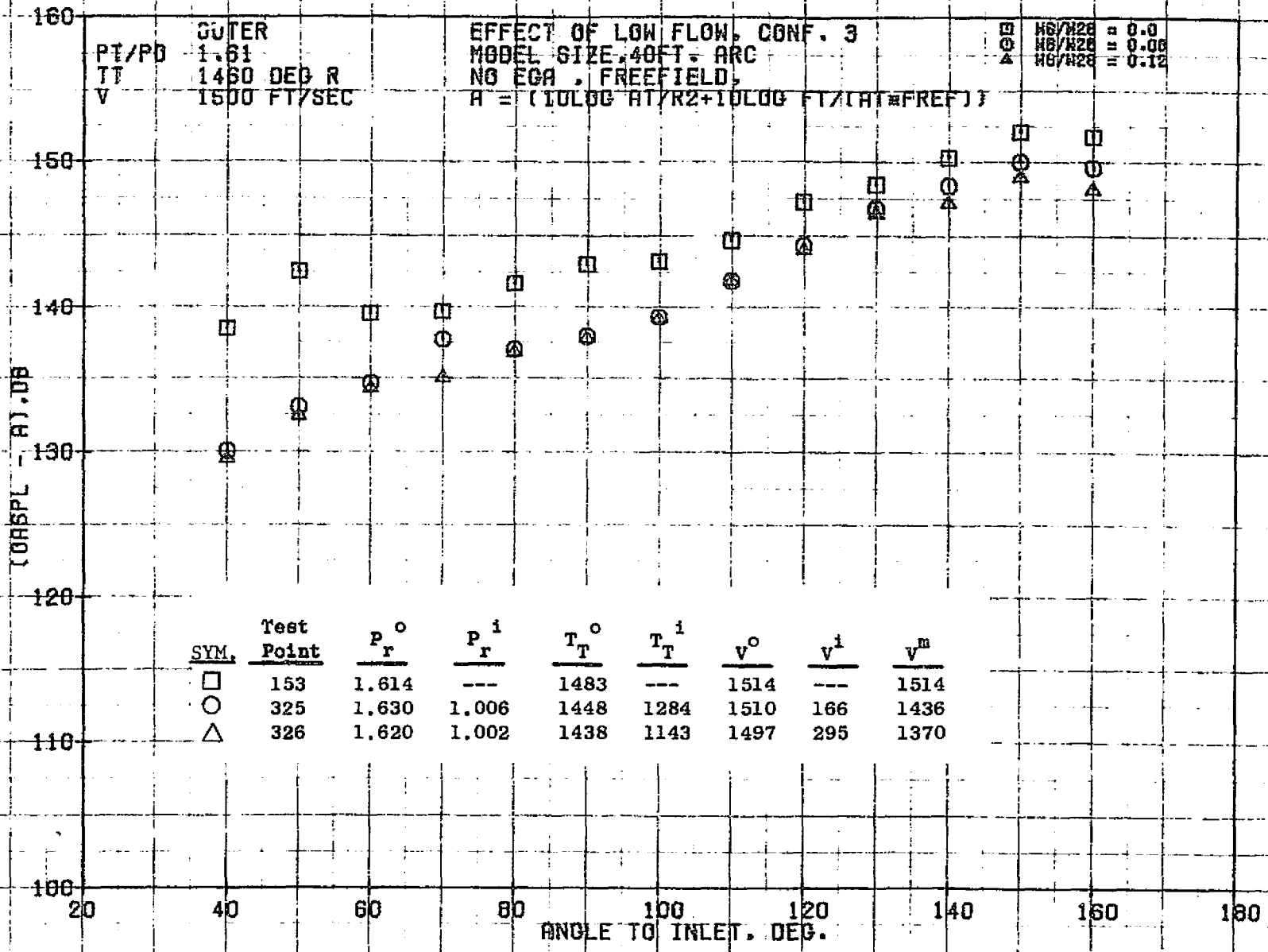
10/12/76
1X525-001

73KOLLSTEDT



10/25/76
1X558-001

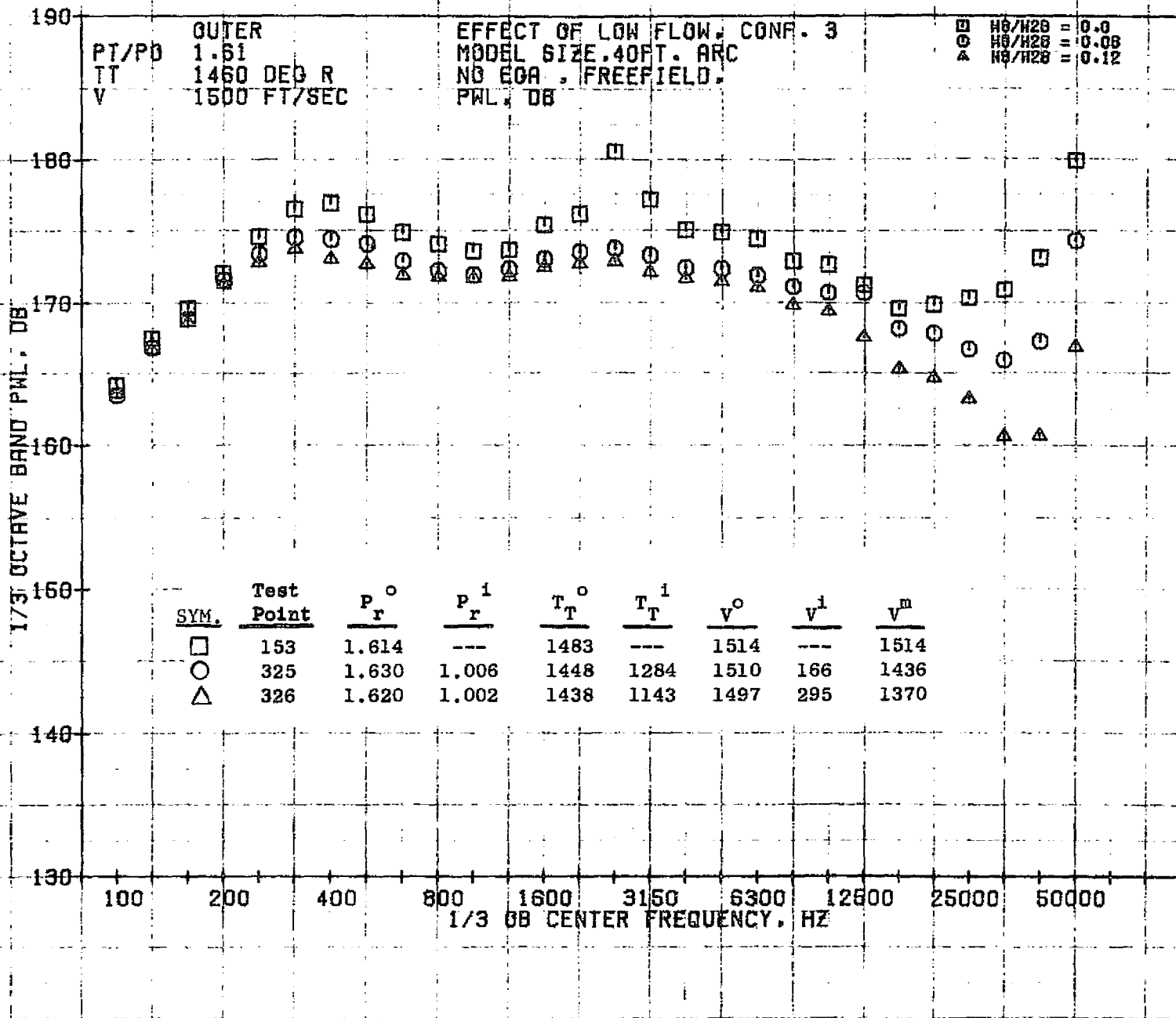
73KOLLSTEDT



10/12/76
1X525-001

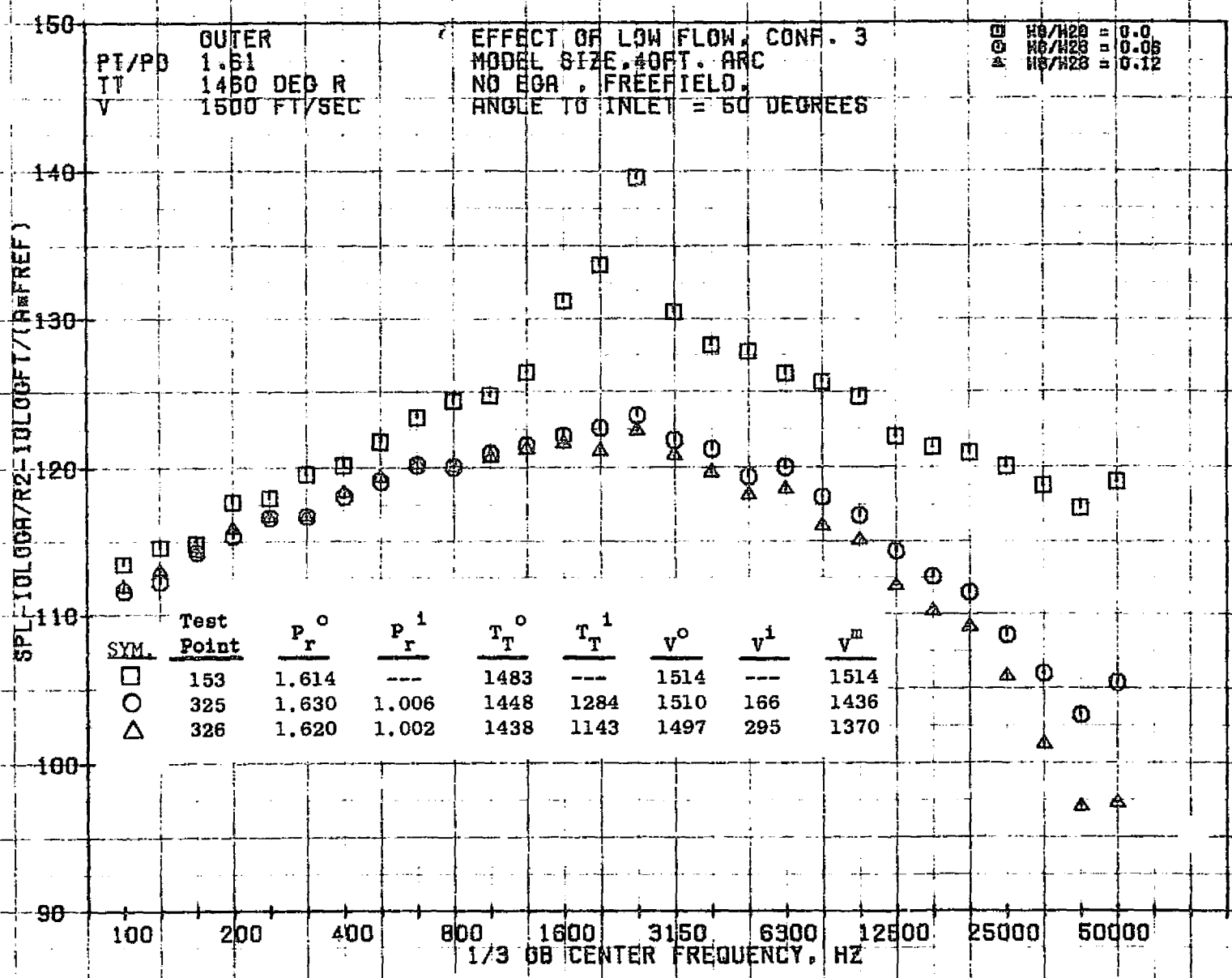
79KOLLSTEDT

867



10/12/76
1X525-001

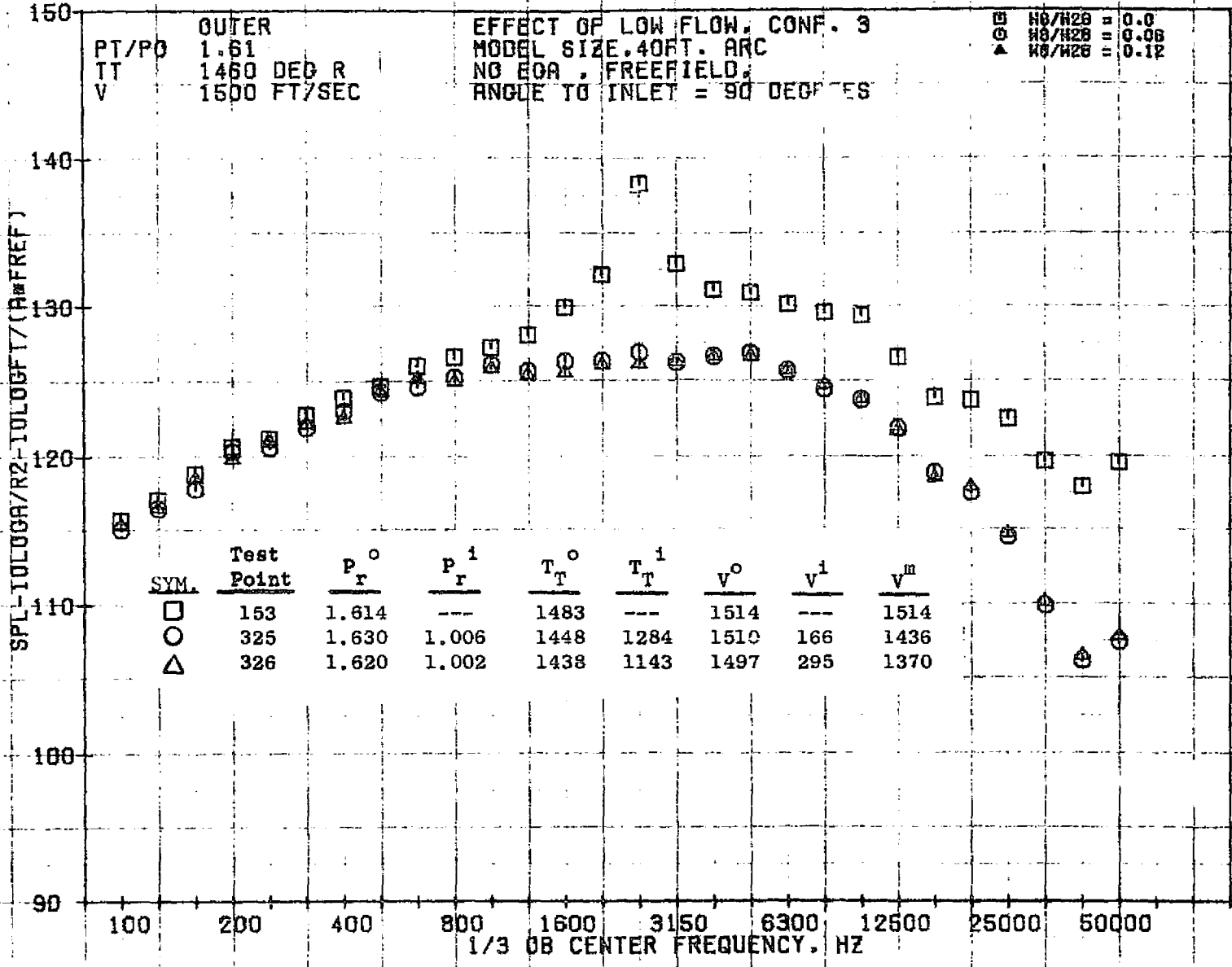
73KOLLSTEDT



10/12/76
1X525-001

73KOLLSTEDT

698



PT/PO
TT
V

OUTER
1.61
1460 DEG R
1500 FT/SEC

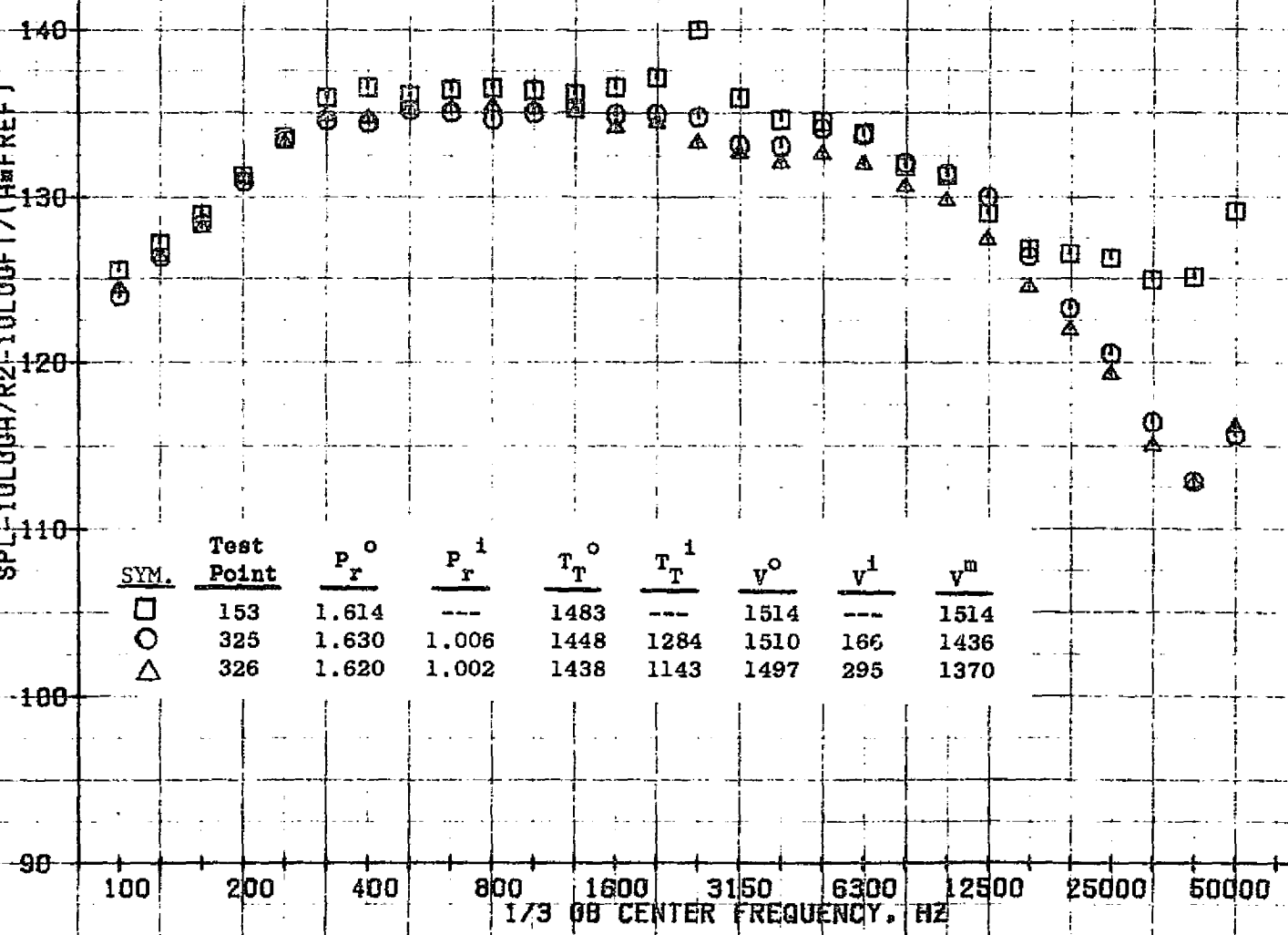
EFFECT OF LOW FLOW, CONF. 3
MODEL SIZE, 40 FT. ARC
NO EGA, FREEFIELD
ANGLE TO INLET = 130 DEGREES

\square $H_0/H_{20} = 0.0$
 \circ $H_0/H_{20} = 0.08$
 \triangle $H_0/H_{20} = 0.12$

870

SPL - 10 LOG (G/R² - 10 LOG FT / (H₀ FREF))

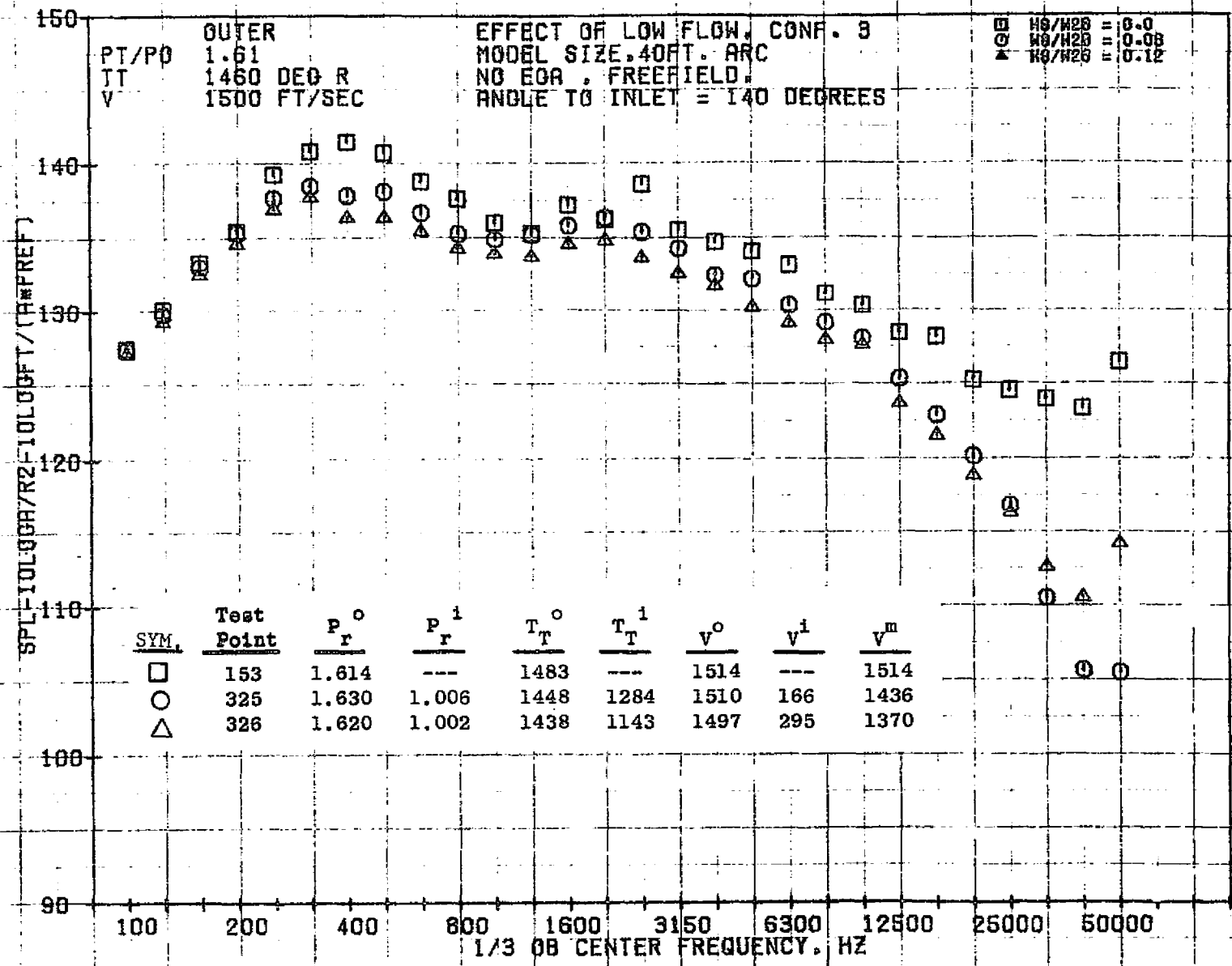
SYM.	Test Point	P_r^o	P_r^i	T_T^o	T_T^i	V^o	V^i	V^m
\square	153	1.614	---	1483	---	1514	---	1514
\circ	325	1.630	1.006	1448	1284	1510	166	1436
\triangle	326	1.620	1.002	1438	1143	1497	295	1370



10/12/76
1X525-001

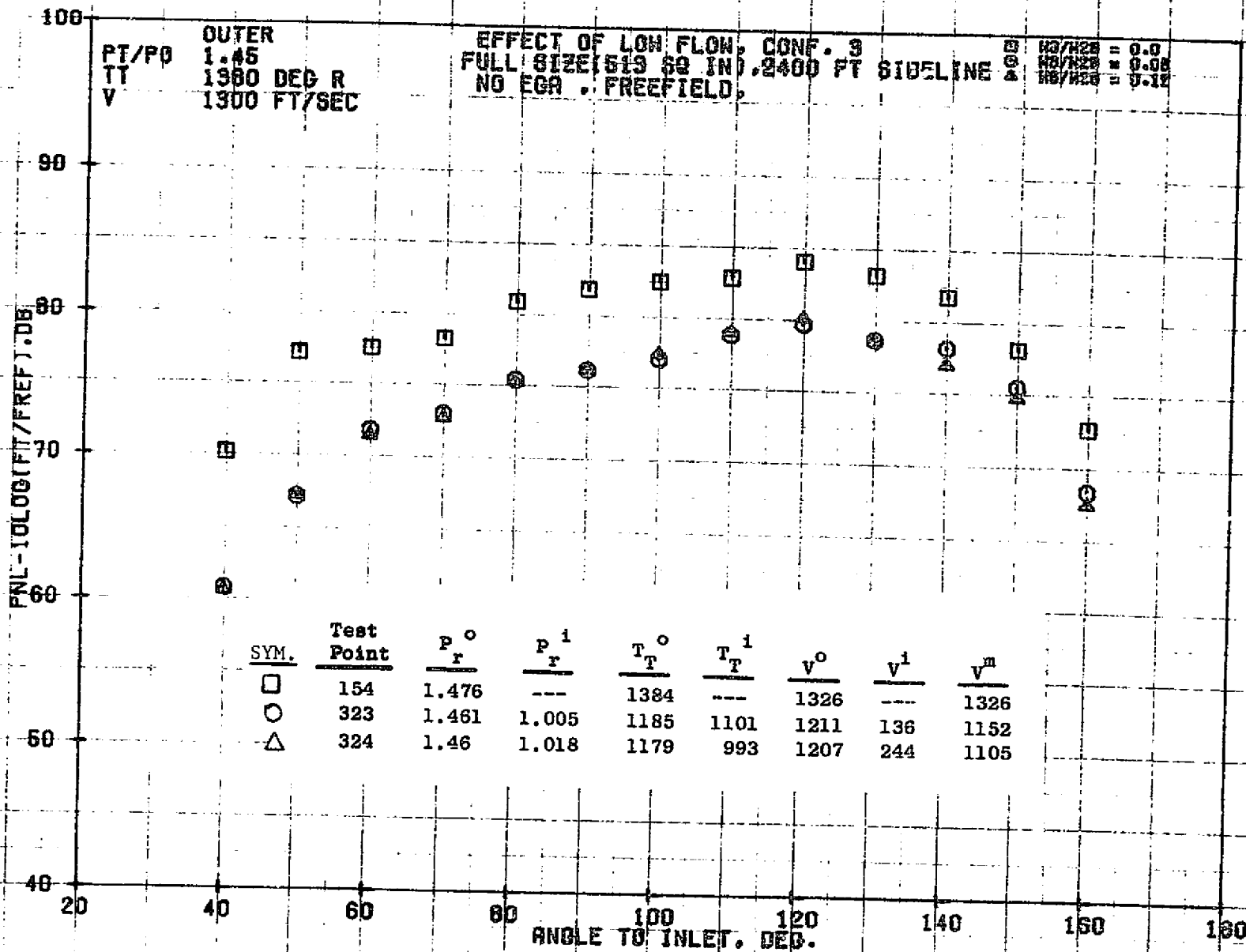
73KOLLSTEDT

871



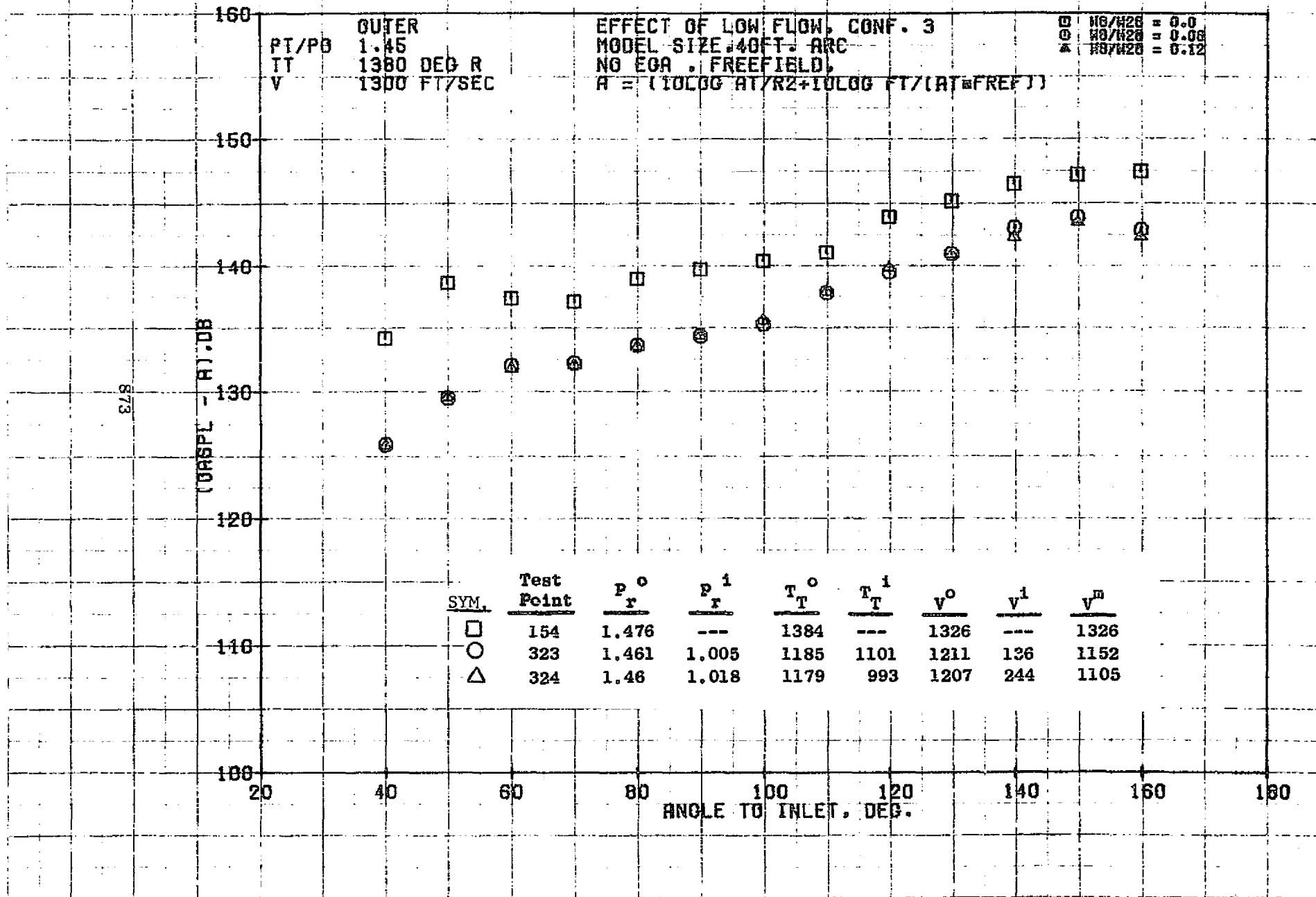
10/12/76
1X525-001

73KOLLSTEOT



10/25/76
1X556-001

73KOLLSTEDT



10/12/76
1X525-001

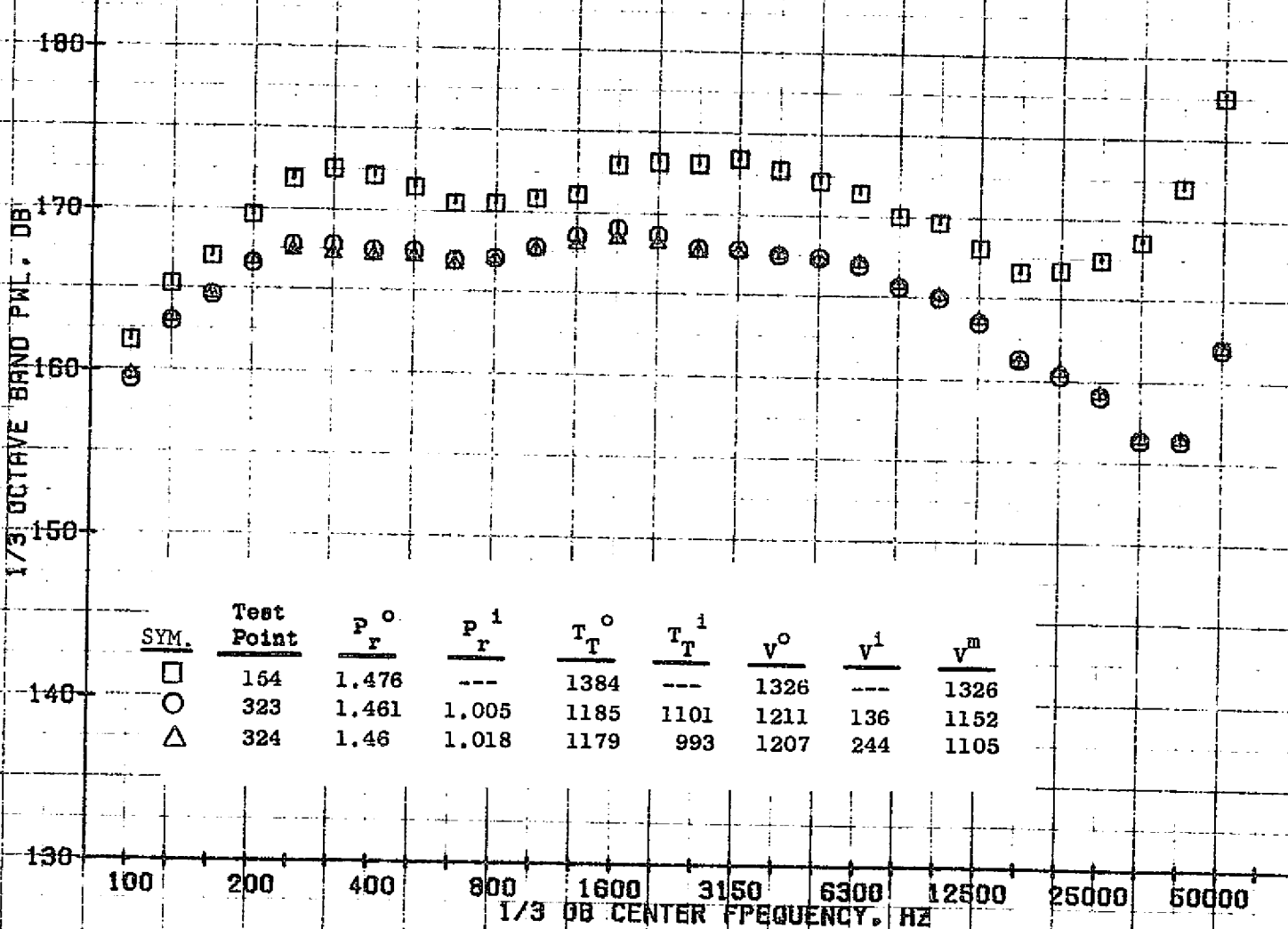
73KOLLSTEDT

PT/P0 1.45
 TT 1300 DEG R
 V 1300 FT/SEC

OUTER

EFFECT OF LOW FLOW, CONF. 3
 MODEL SIZE, 40 FT. ARC
 NO EOR, FREEFIELD,
 PWL, DB

\square H₀/H₂₀ = 0.0
 \circ H₀/H₂₀ = 0.08
 \triangle H₀/H₂₀ = 0.12



SYM.	Test Point	$\frac{P^0}{r}$	$\frac{P^1}{r}$	$\frac{T^0}{T}$	$\frac{T^1}{T}$	$\frac{V^0}{V}$	$\frac{V^1}{V}$	$\frac{V^m}{V}$
\square	154	1.476	---	1384	---	1326	---	1326
\circ	323	1.461	1.005	1185	1101	1211	136	1152
\triangle	324	1.46	1.018	1179	993	1207	244	1105

10/12/76
 1X525-001

73KOLLSTEDT

875

SPL - 10 LOG (P_r^o / R₂ - 10 LOG (P_rⁱ / (P_r^o REF)))

OUTER
 PT/PO 1.45
 TT 1380 DEG R
 V 1300 FT/SEC

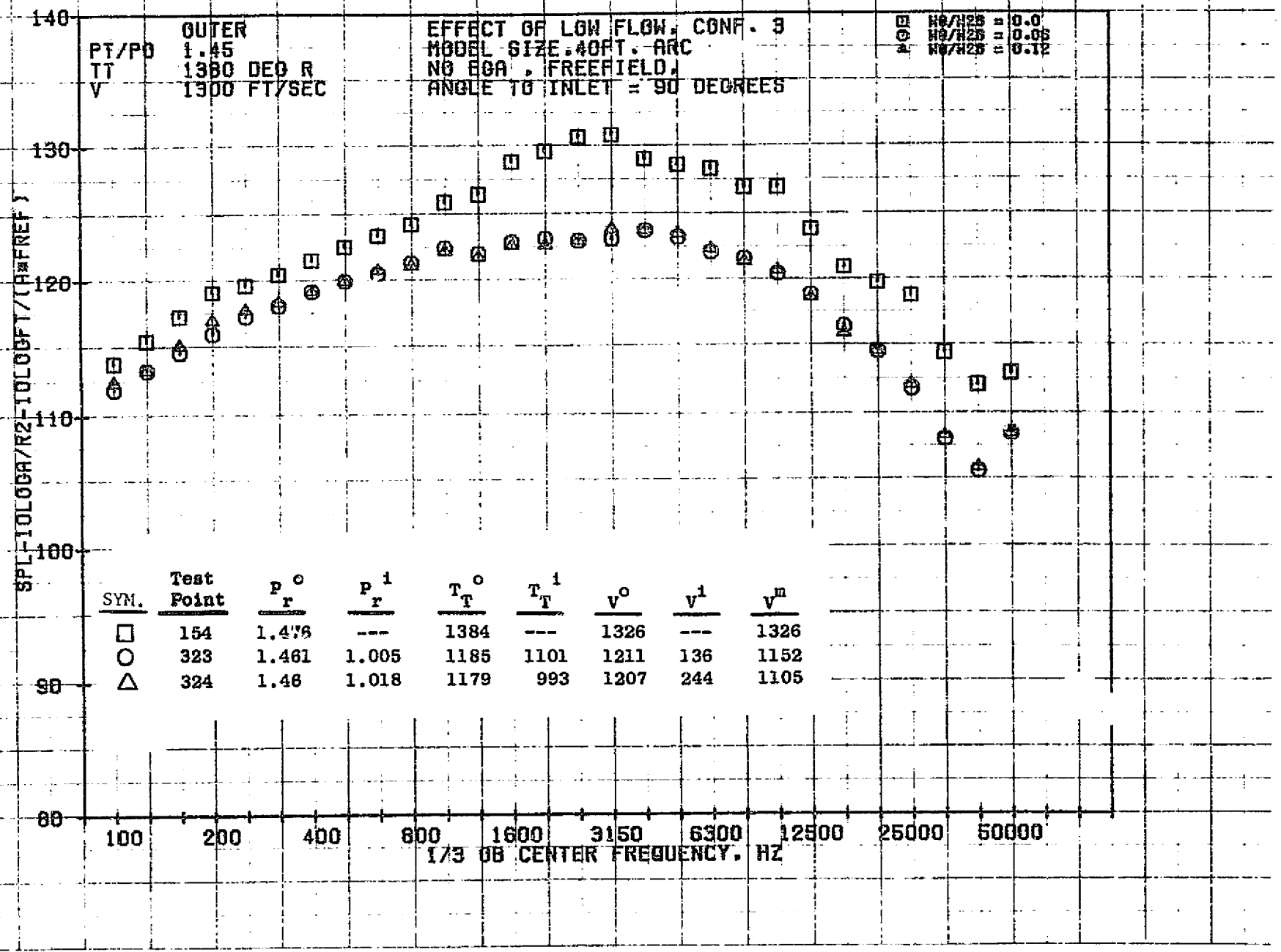
EFFECT OF LOW FLOW, CONF. 3
 MODEL SIZE .40 FT. ARC
 NO SGA, FREEFIELD,
 ANGLE TO INLET = 50 DEGREES

□ H₅/H_{2B} = 0.0
 ○ H₅/H_{2B} = 0.06
 △ H₅/H_{2B} = 0.12

SYM	Test Point	P _r ^o	P _r ⁱ	T _T ^o	T _T ⁱ	V ^o	V ⁱ	V ^m
□	154	1.476	---	1384	---	1326	---	1326
○	323	1.461	1.005	1185	1101	1211	136	1152
△	324	1.46	1.018	1179	993	1207	244	1105

100 200 400 800 1600 3150 6300 12500 25000 50000
 1/3 OB CENTER FREQUENCY, HZ

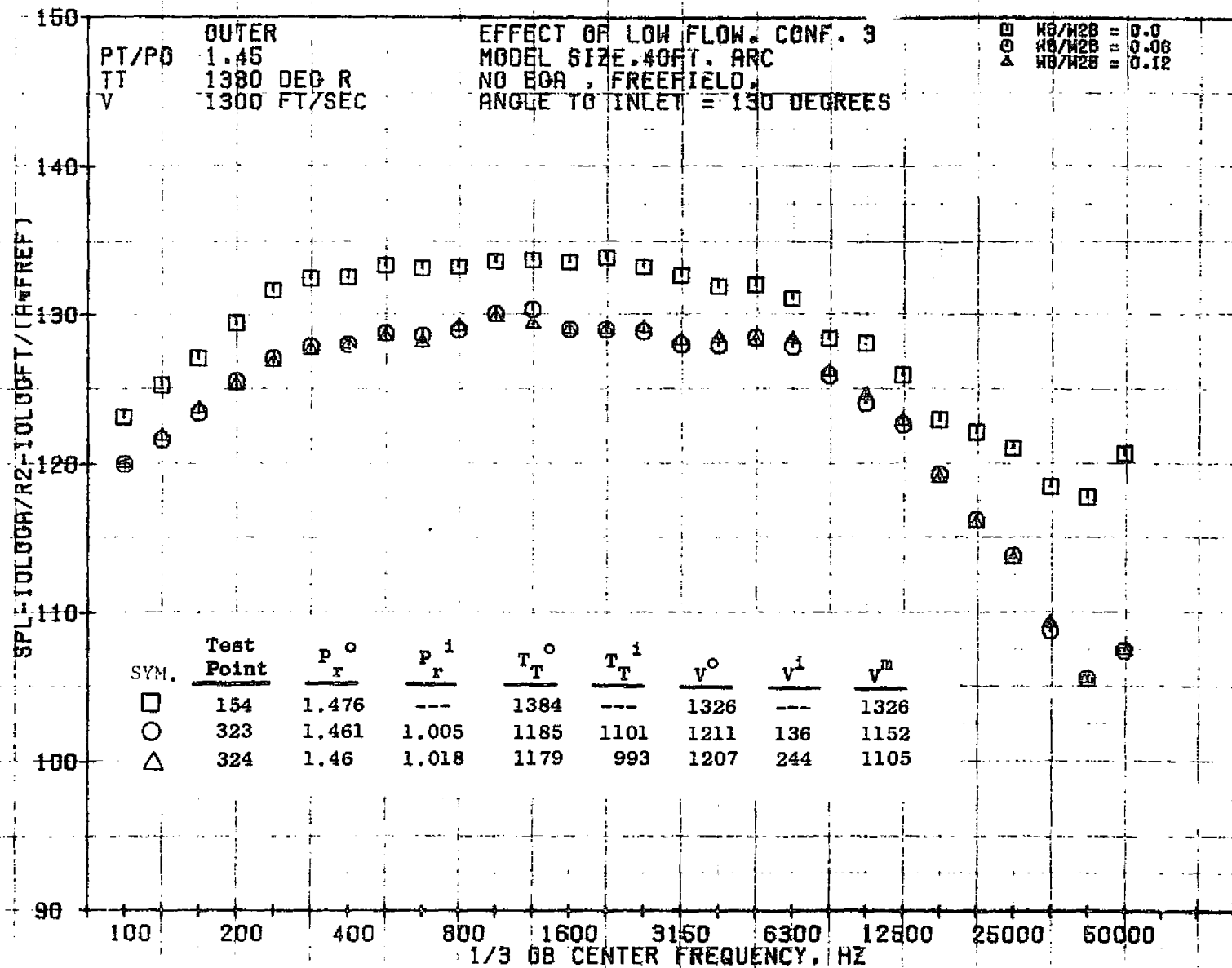
876



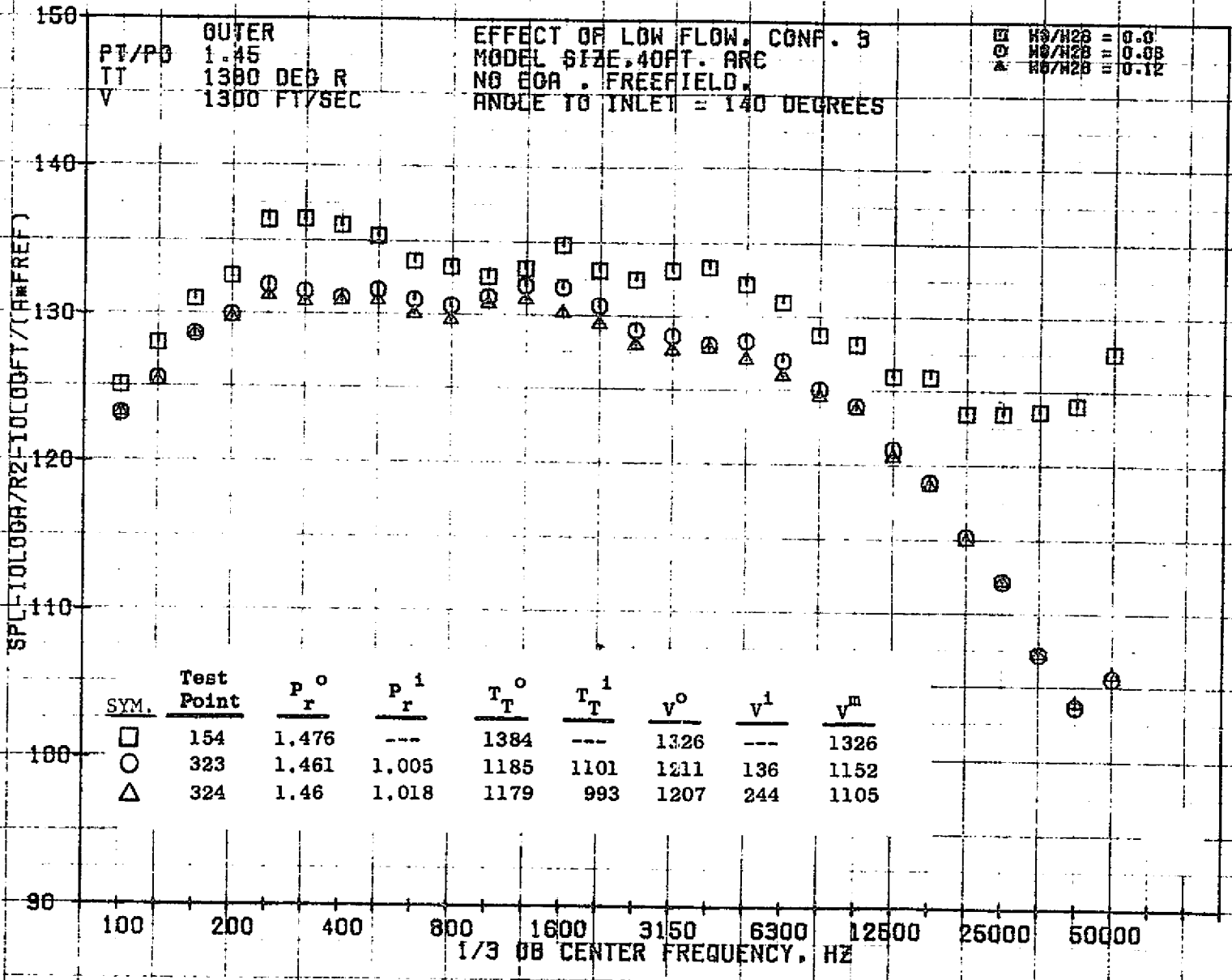
10/12/76
1X525-001

73KOLLSTEDT

877



878



10/12/76
1X525-001

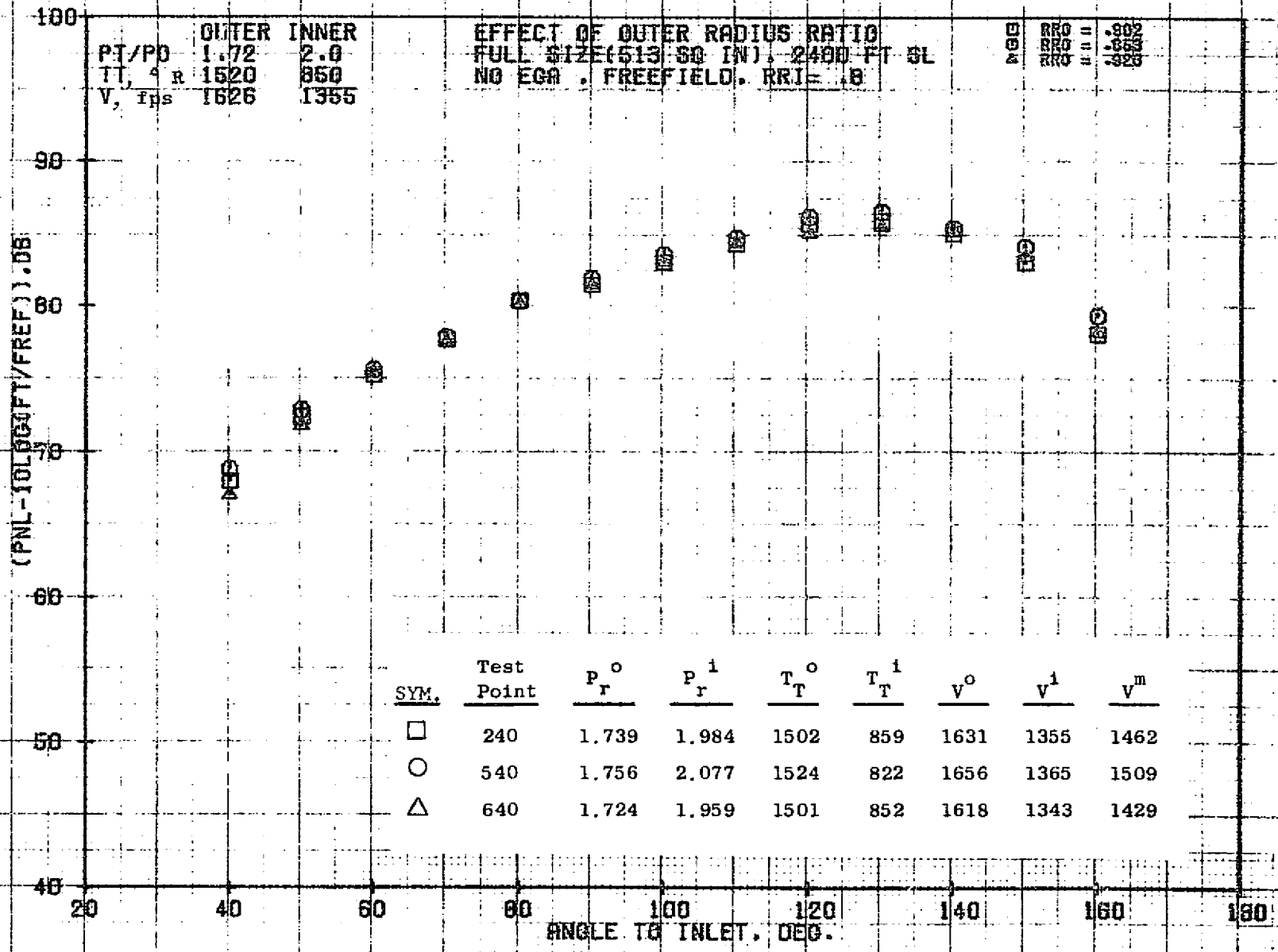
73KOLLSTEDT

7.4 COMPARISONS OF DATA FOR IVP NOZZLES WITH HIGH AMOUNTS OF INNER FLOW

The purpose of this test series was to examine the noise suppression characteristics of coannular nozzle configurations with high inner flows. Data presentations are described in the following sections.

7.4.1 Effect of Outer Radius Ratio

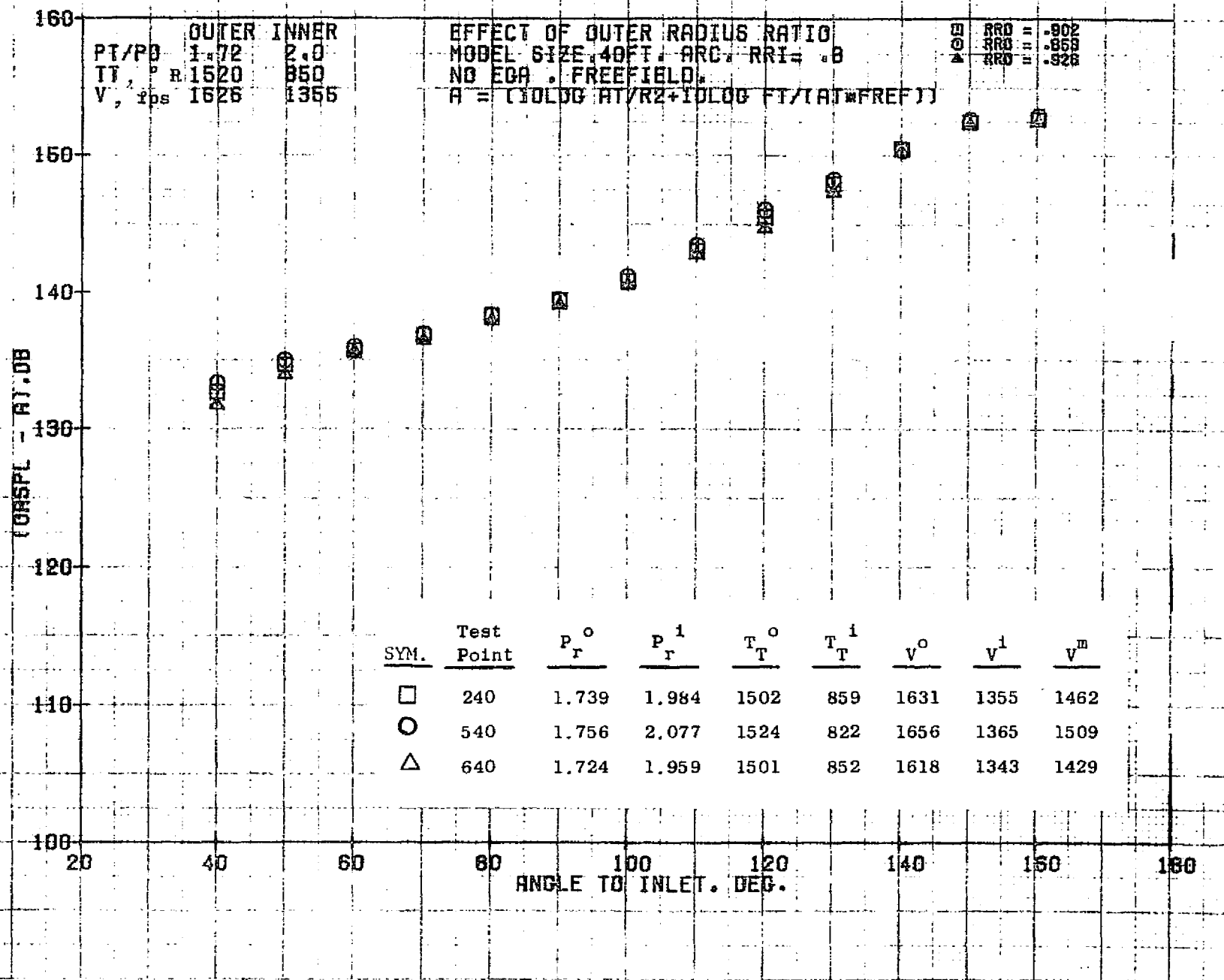
In this section, the test results from Configurations 2, 5, and 6 are compared. All three configurations have the same inner radius ratio (0.8) and plug geometry, but the outer radius ratio varies from 0.853 to 0.926.



10/27/76
 1X008-001

73KOLLSTEDT

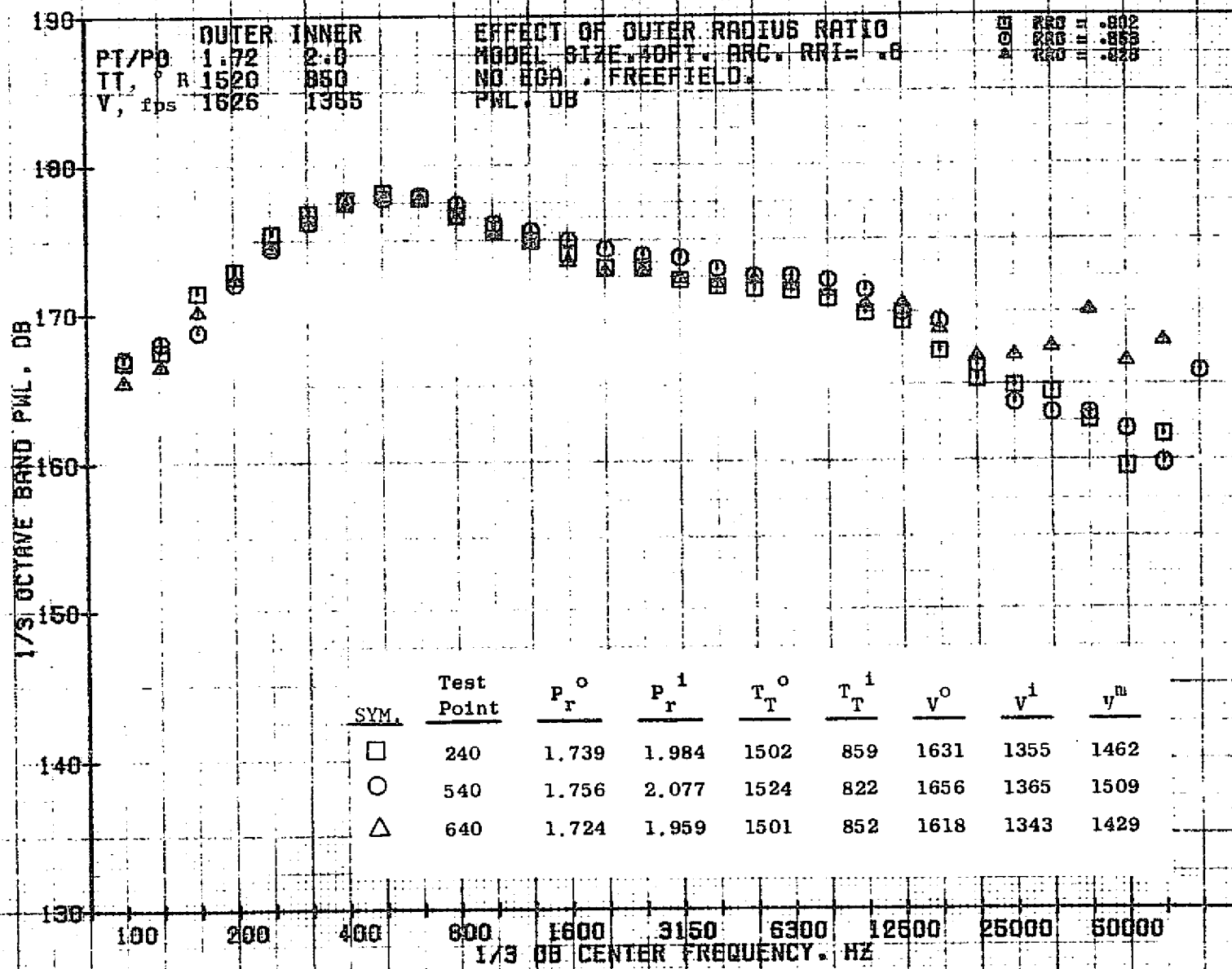
188



PT/PO OUTER INNER
 TT, P R 1520 850
 V, fps 1626 1355

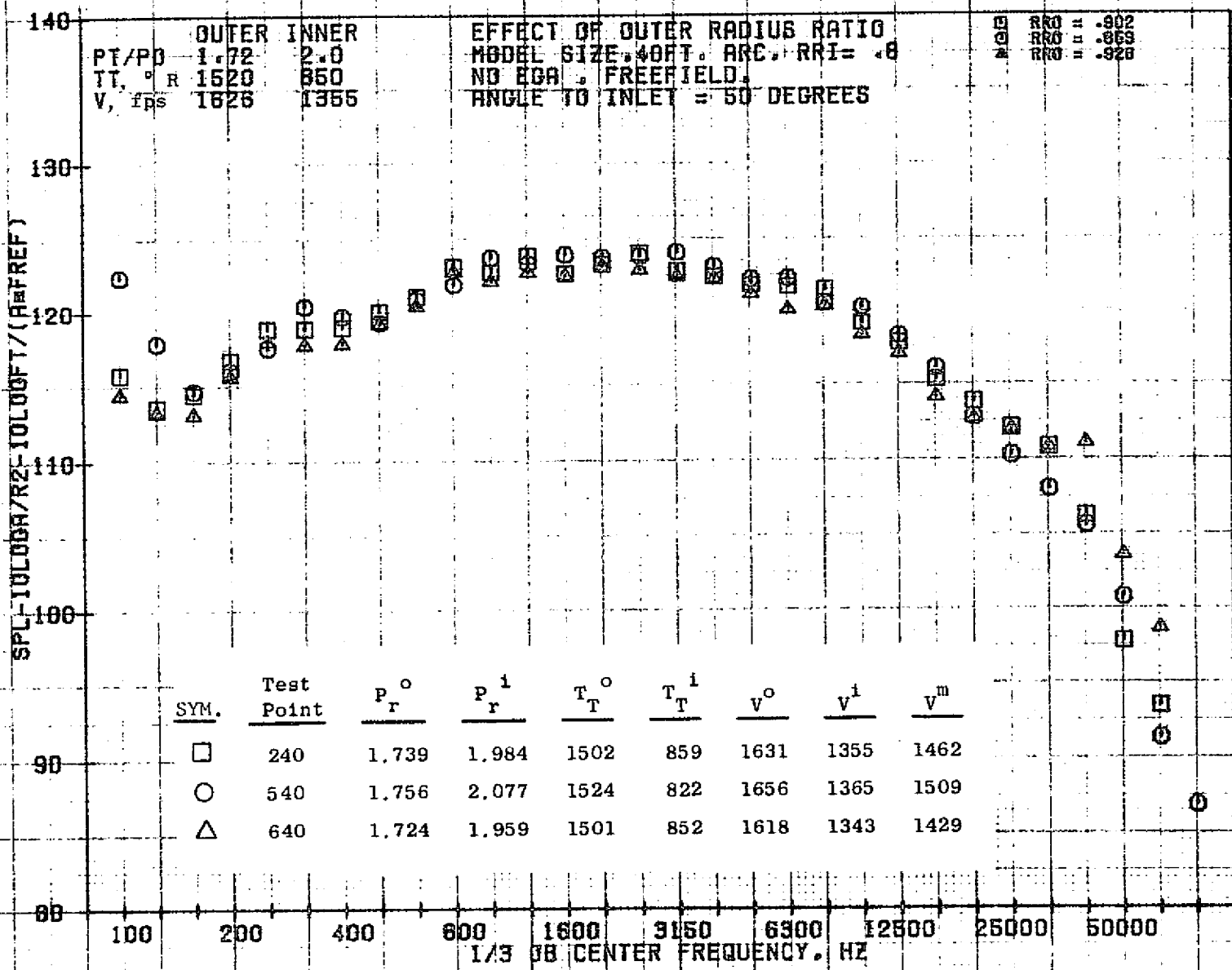
EFFECT OF OUTER RADIUS RATIO
 MODEL SIZE 40FT ARC RRI = .8
 NO EGR. FREEFIELD.
 $A = (10 \log AT/R^2 + 10 \log FT/(AT * FREQ))$

□	RRD	802
○	RRD	858
△	RRD	928



10/27/76
1X824-001

73KOLLSTEDT



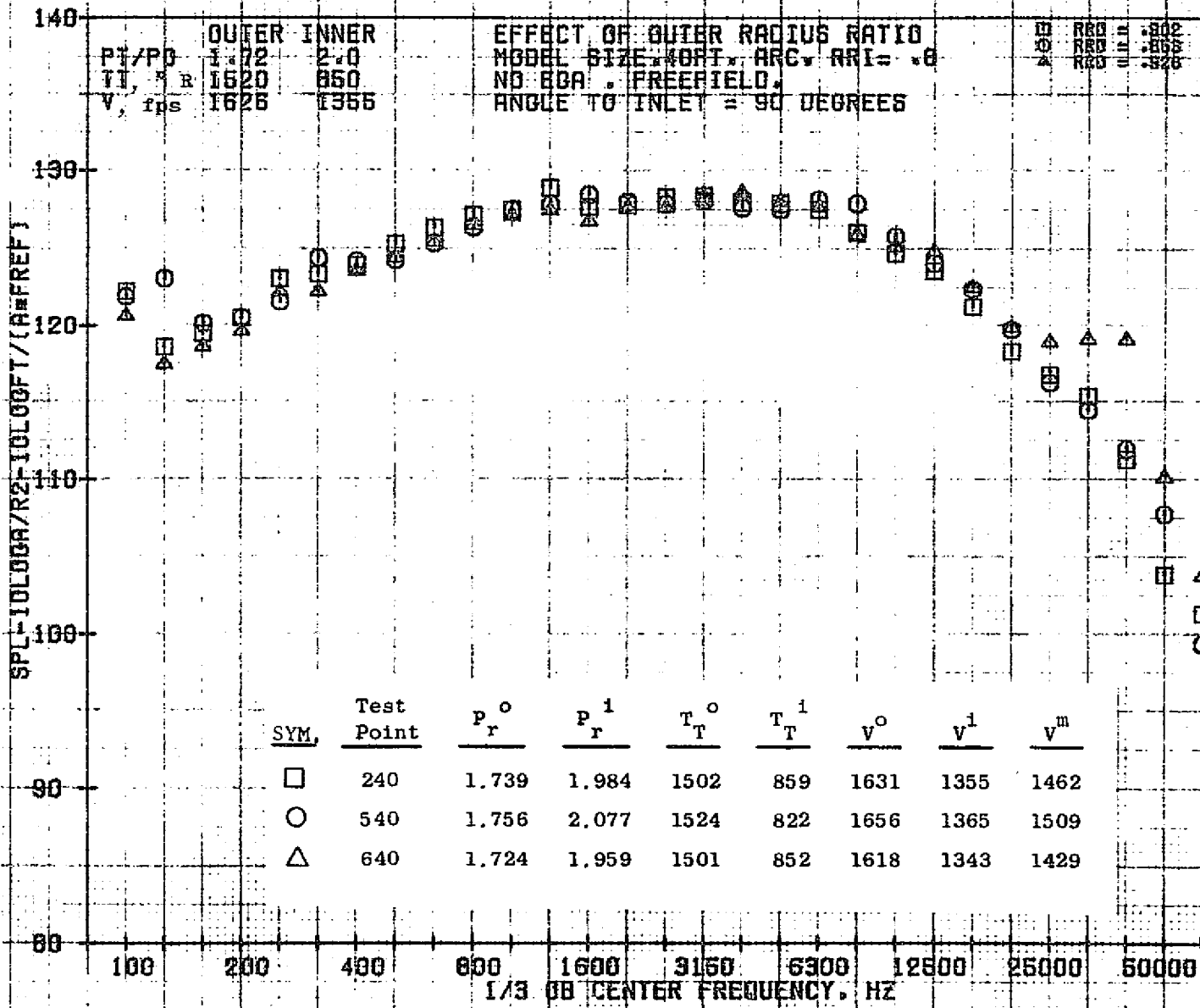
888

SYM.	Test Point	P_r^o	P_r^i	T_T^o	T_T^i	V^o	V^i	V^m
□	240	1.739	1.984	1502	859	1631	1355	1462
○	540	1.756	2.077	1524	822	1656	1365	1509
△	640	1.724	1.959	1501	852	1618	1343	1429

10/27/76
1X824-001

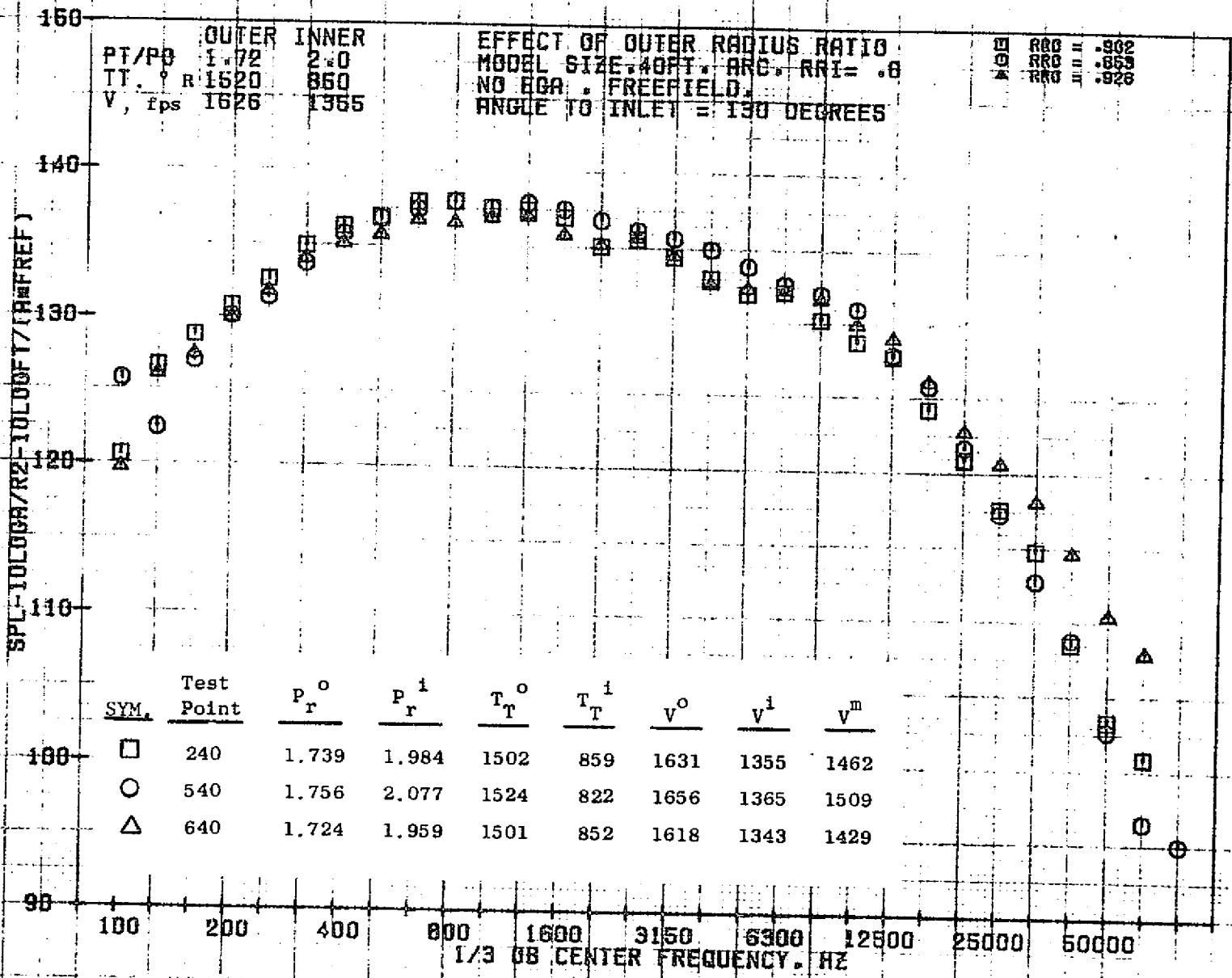
73KOLLSTEDT

884



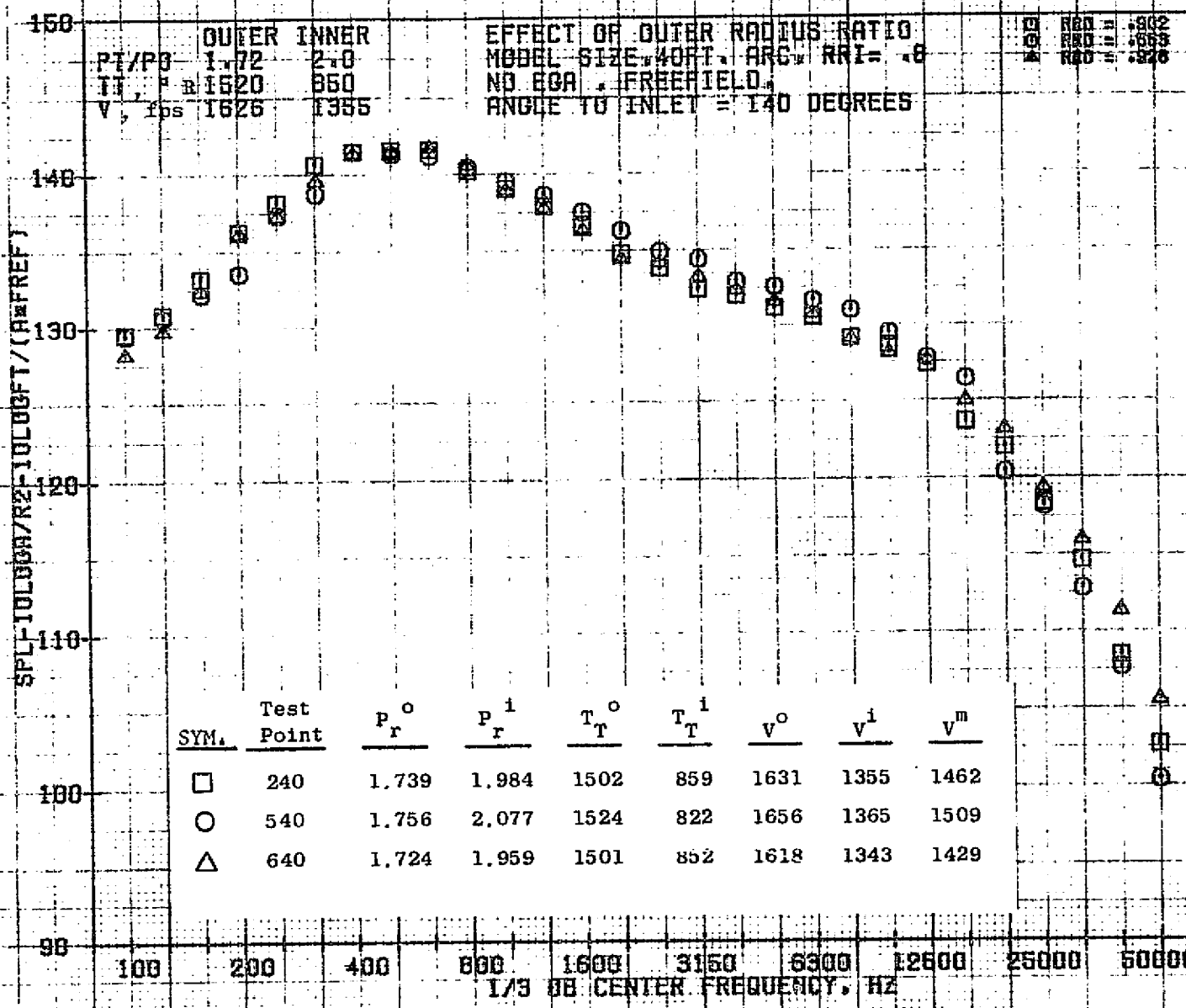
10/27/76
 1X824-001

73K011ST0T



10/27/76
1X824-001

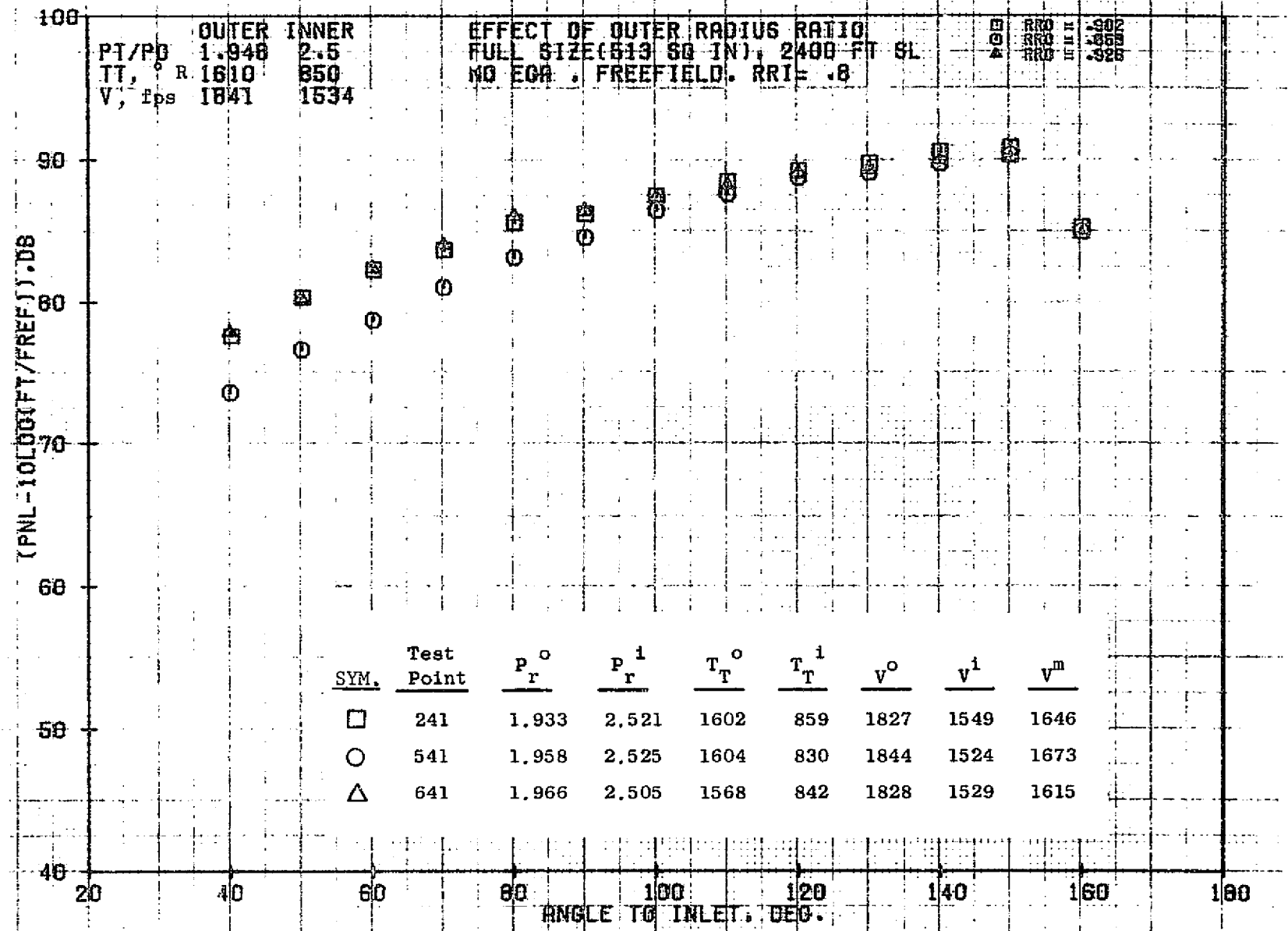
73K011 STFDT



10/27/76
1X824-001

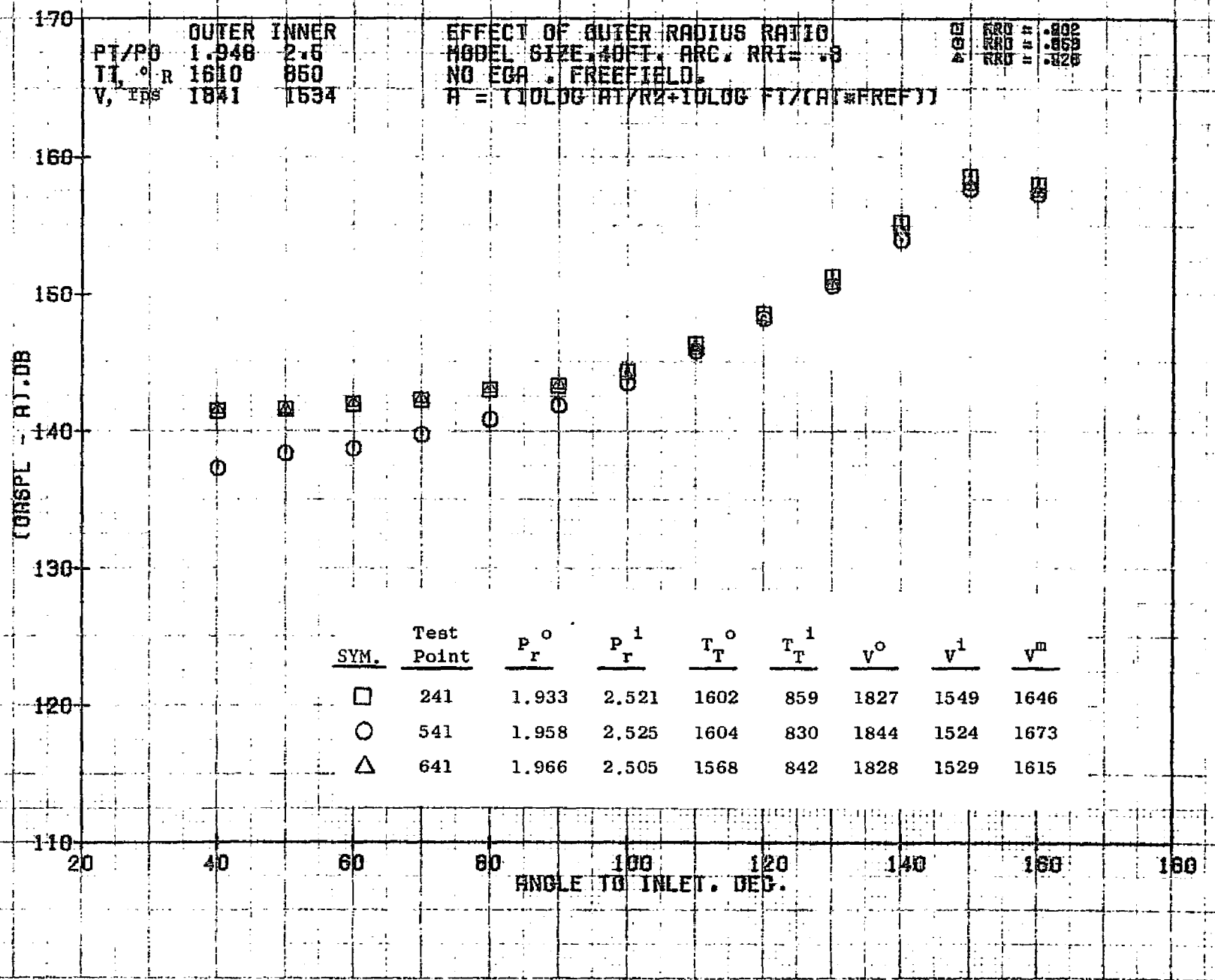
73KOLLSTEDT

887



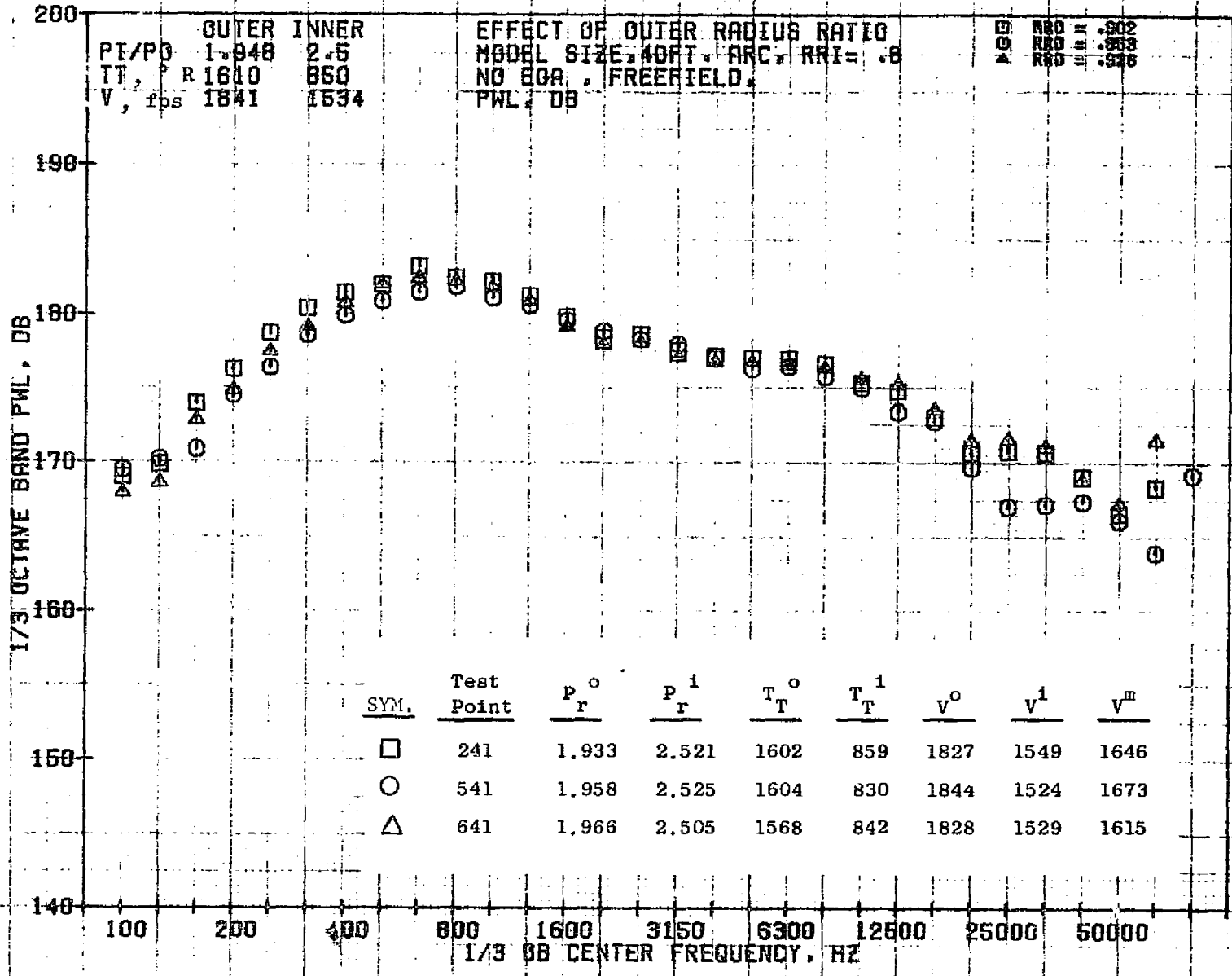
10/27/76
1X008-001

73K011 STFDT



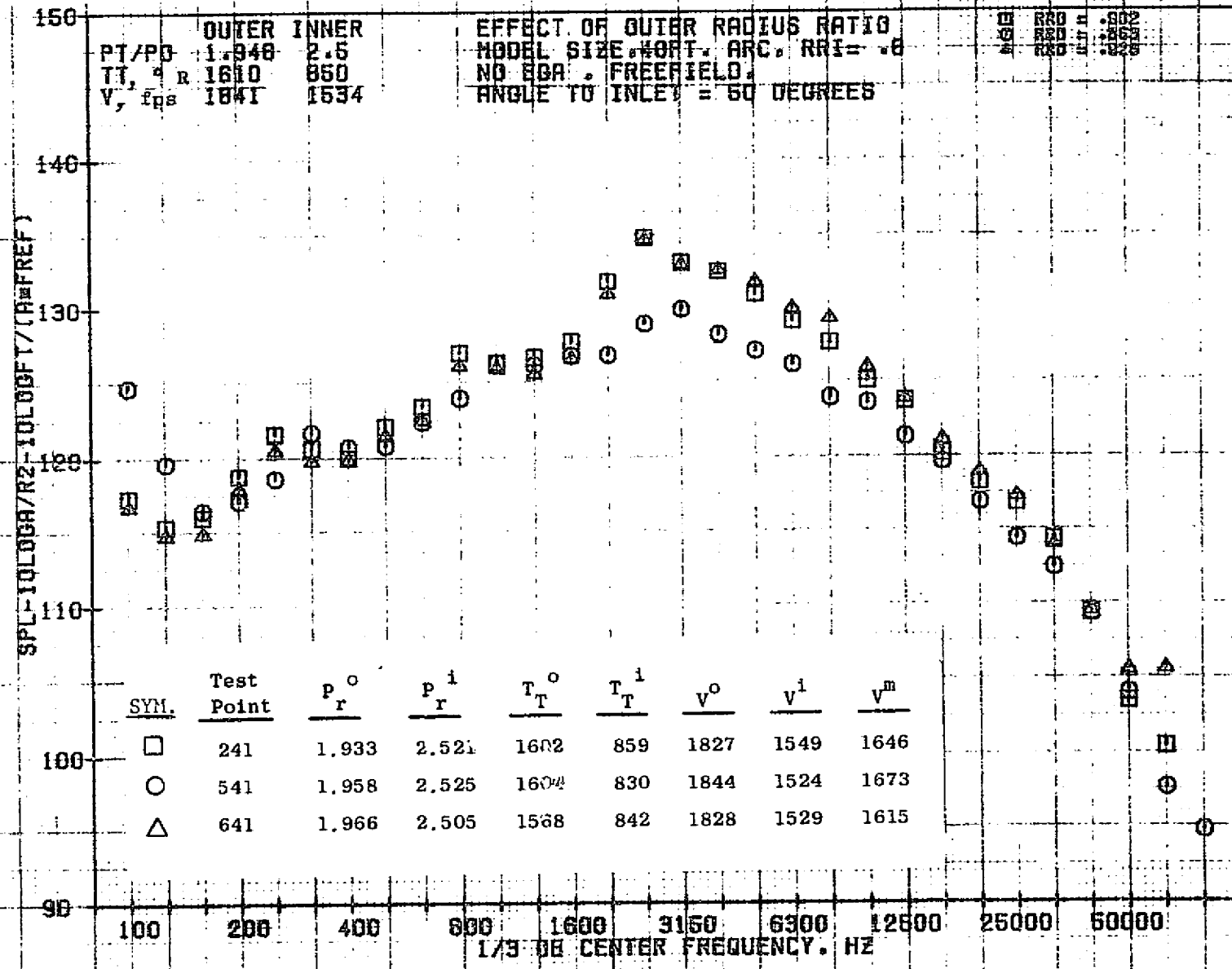
10/27/76
 1X824-001

73KOLLSTEDT

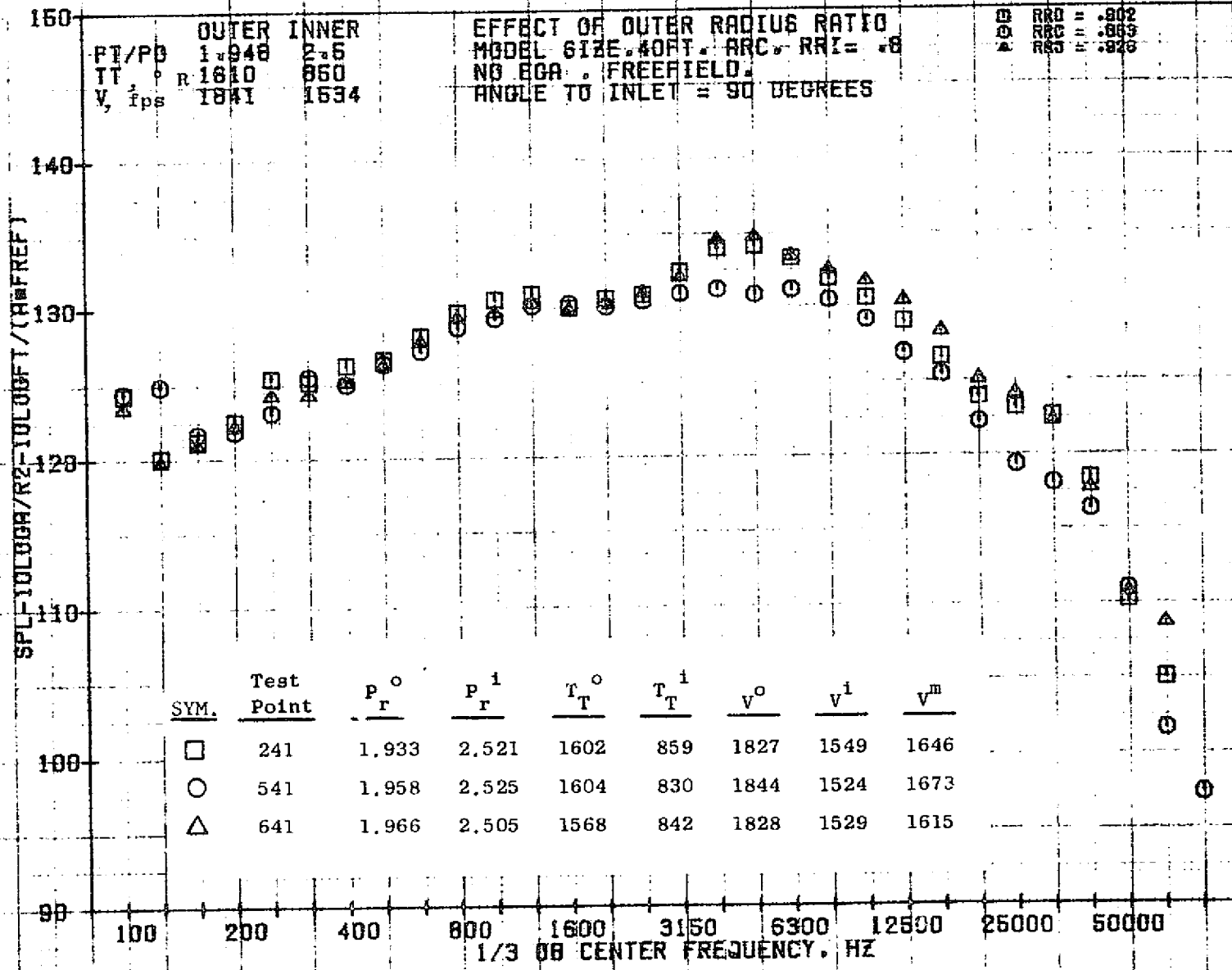


10/27/76
1X824-001

73KOLLSTEDT

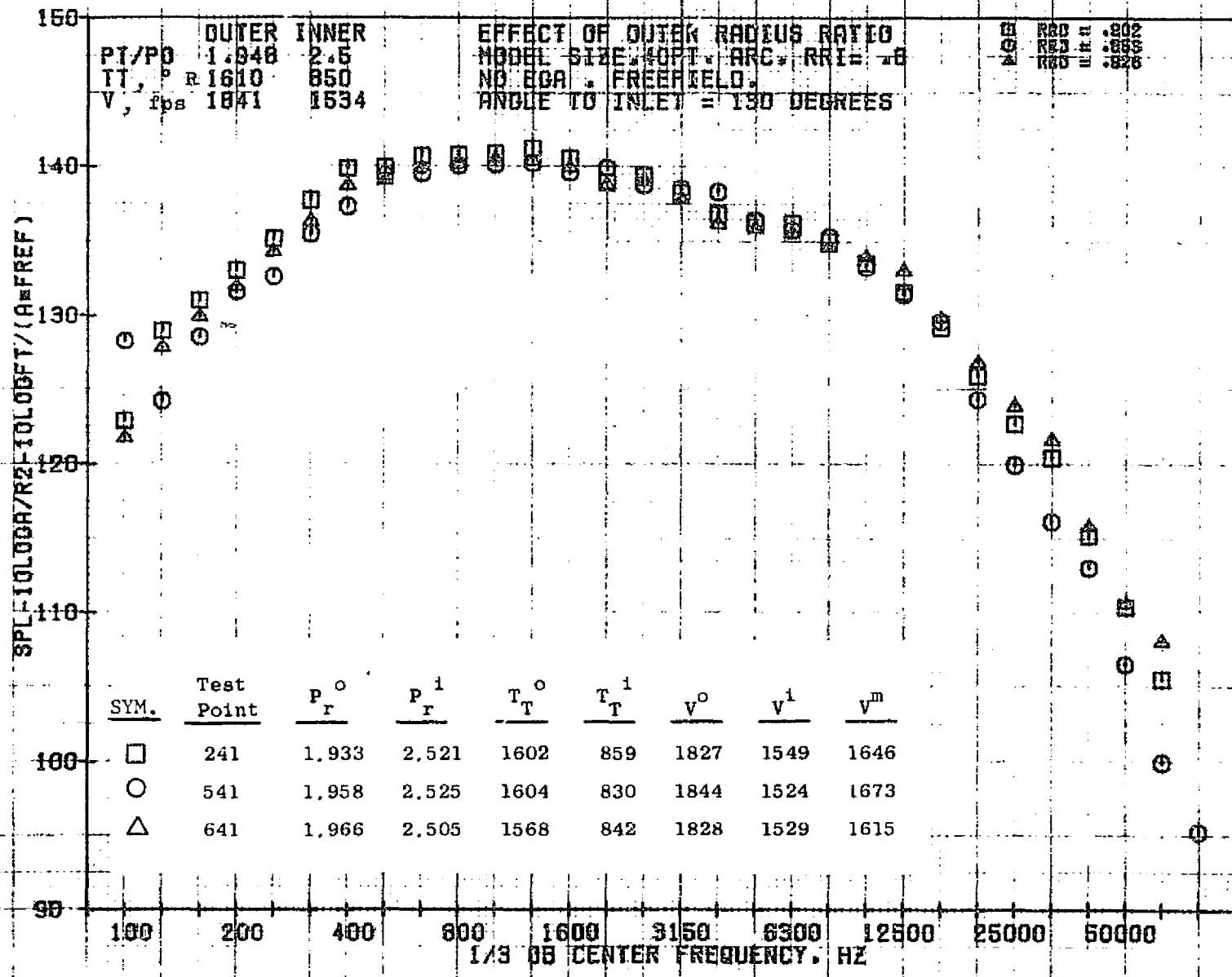


168



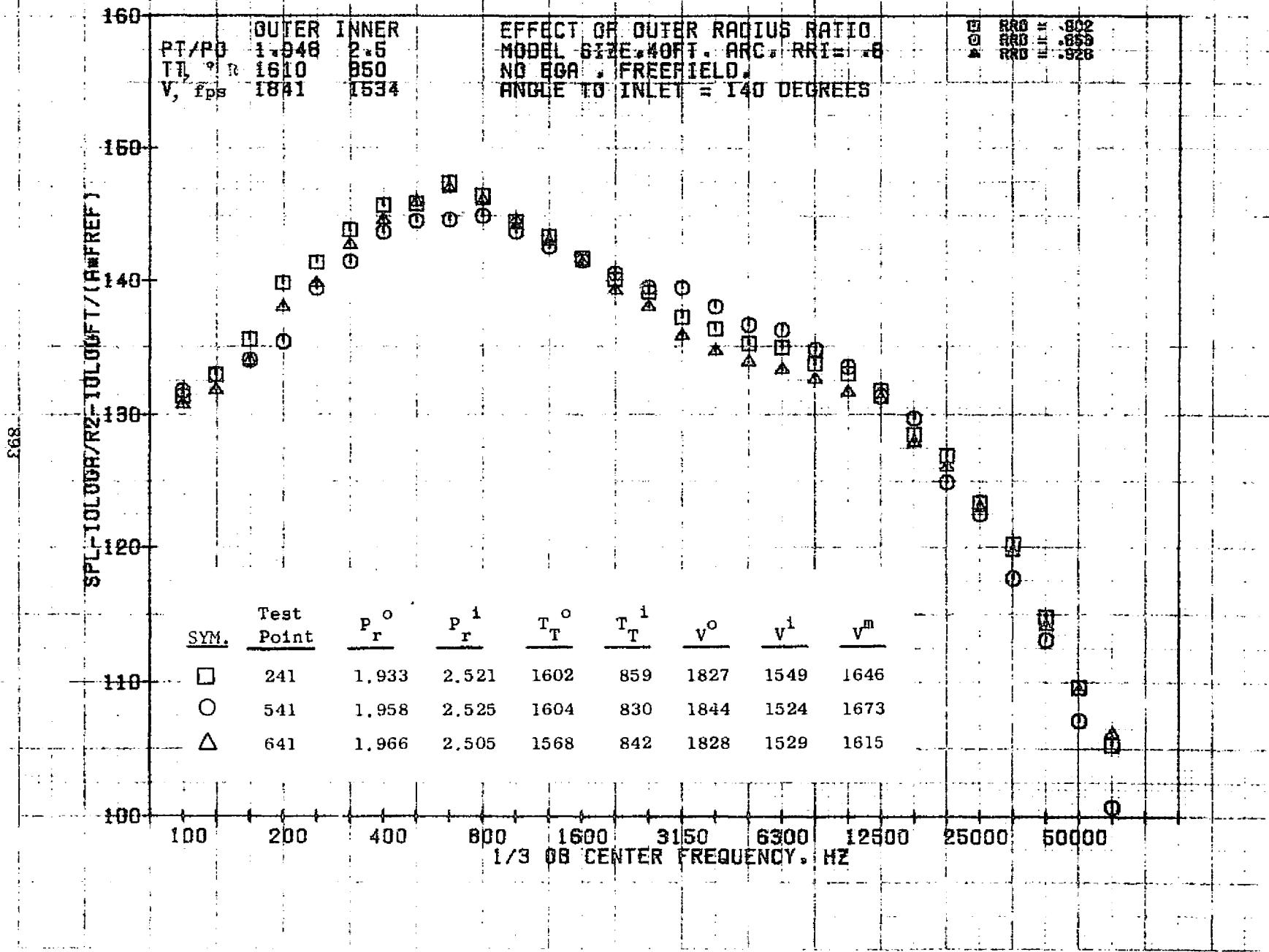
10/27/76
 1X824-001

73KOLLSTEDT



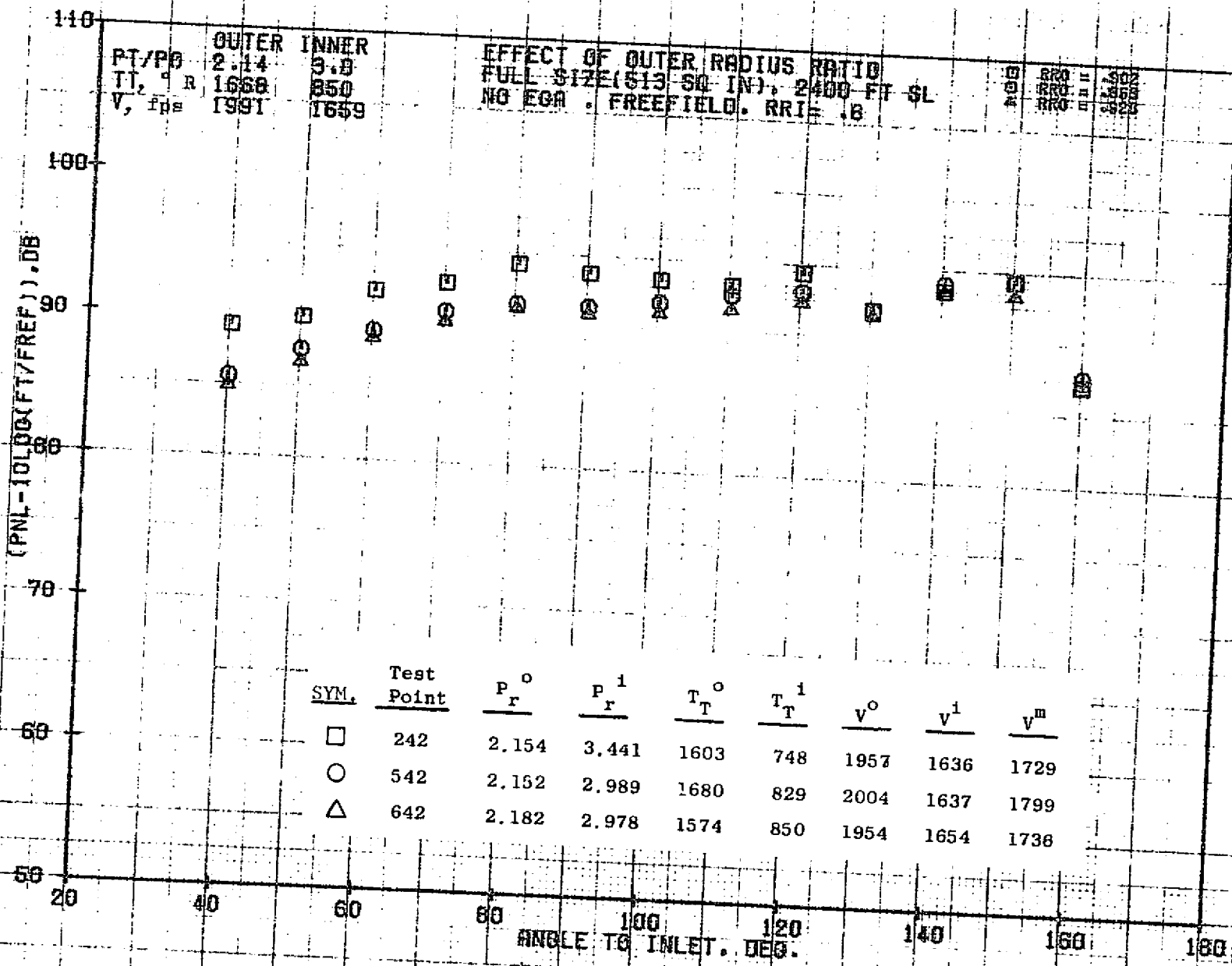
10/27/76
1X824-001

73KOLLSTEDT



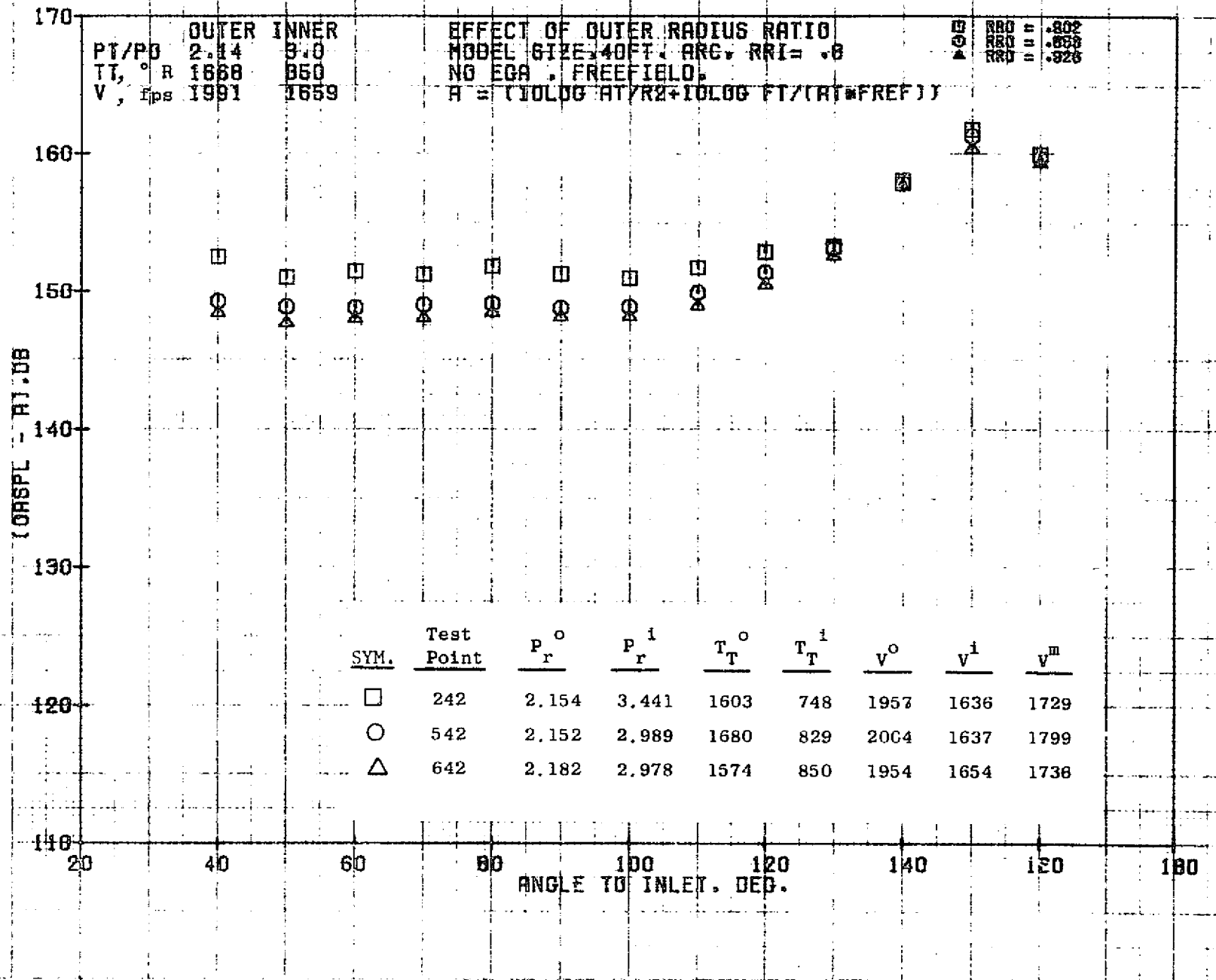
10/27/76
1X824-001

73KOLI STENT



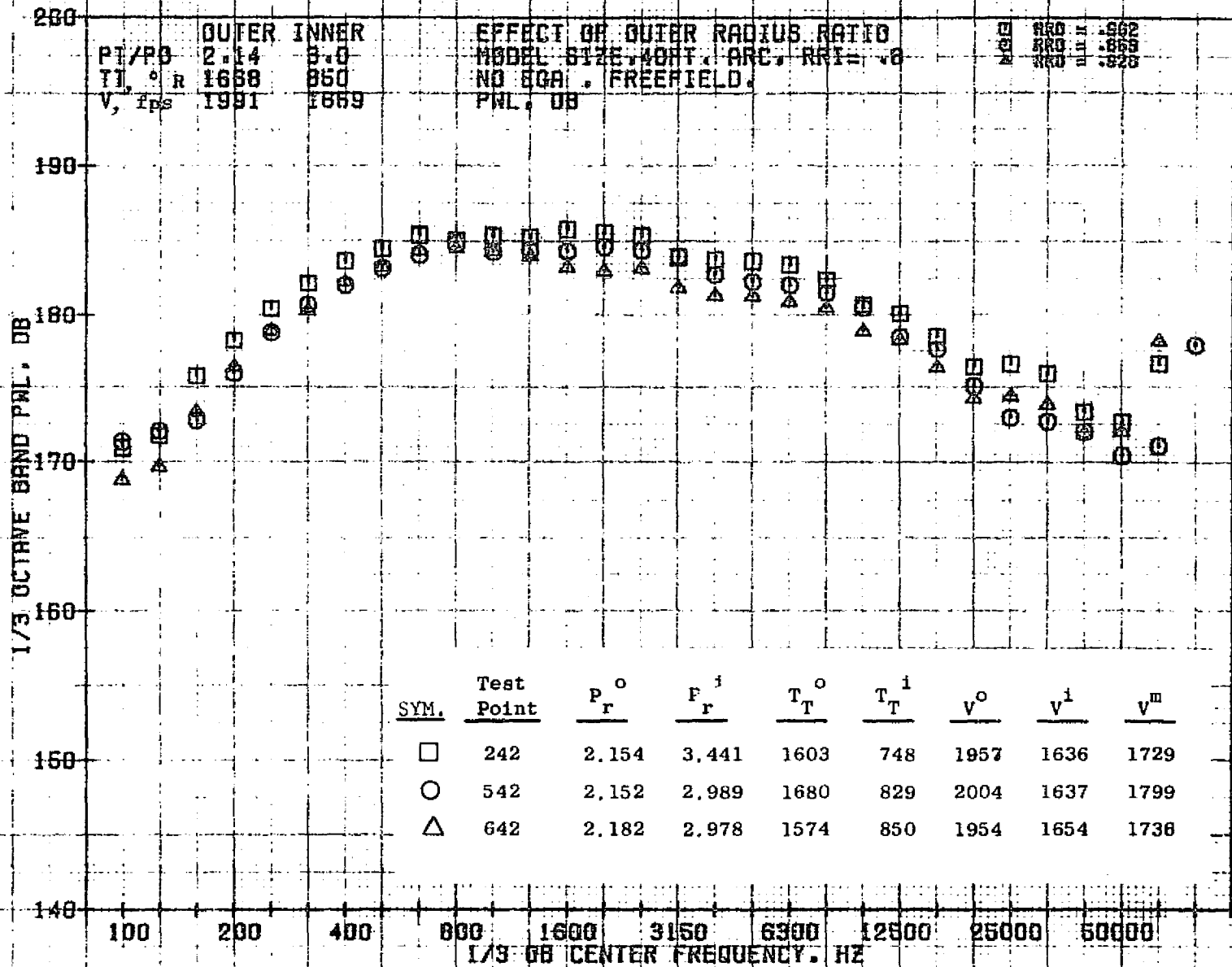
10/27/76
 1X008-001

73K01 L STEDT



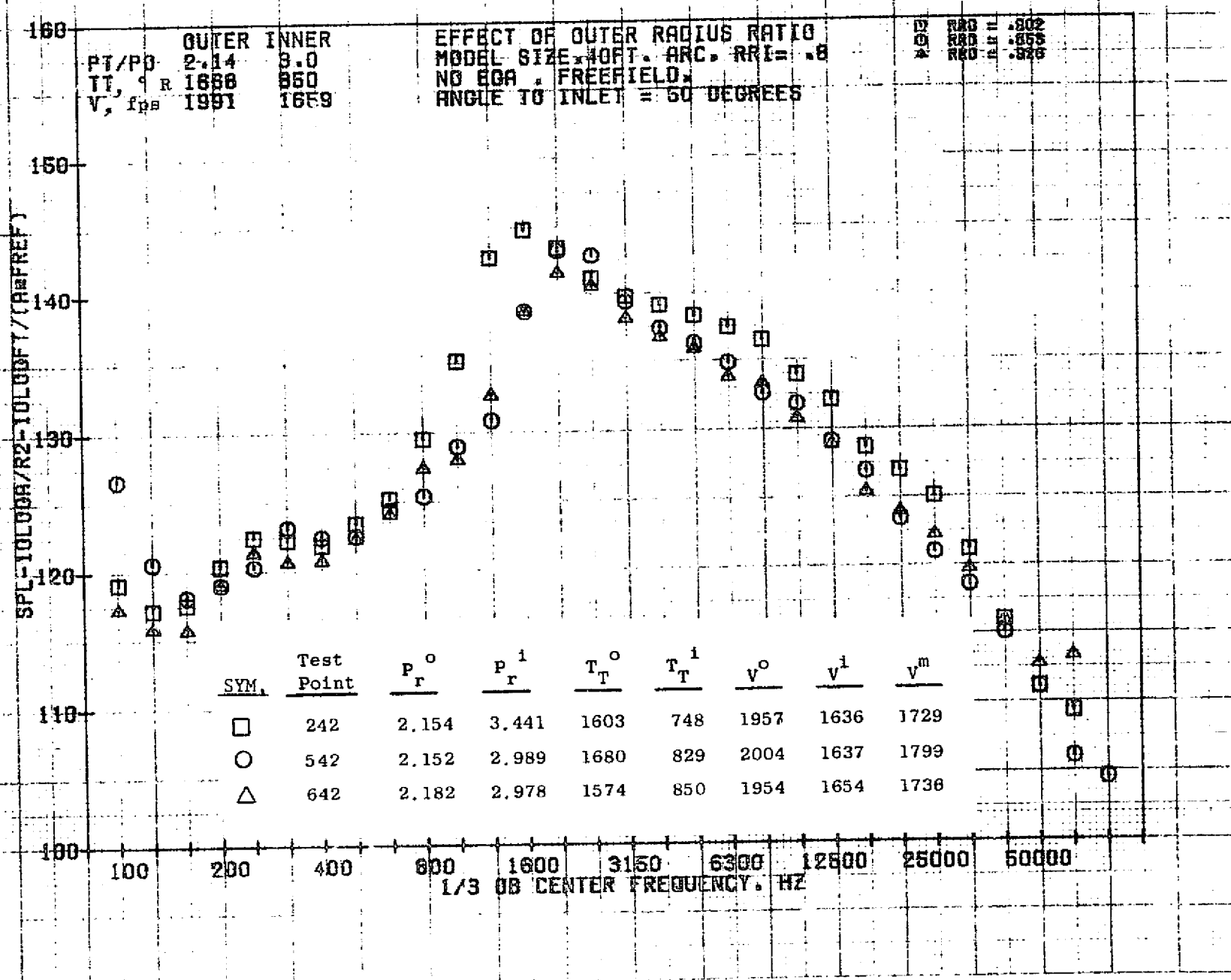
10/27/76
1X824-001

73KOLI STEDT



10/27/76
1X824-001

73KOLLSTEDT



PT/PO 2.14
 TT, ° R 1688
 V, f_{ps} 1991

INNER 3.0
 850
 1669

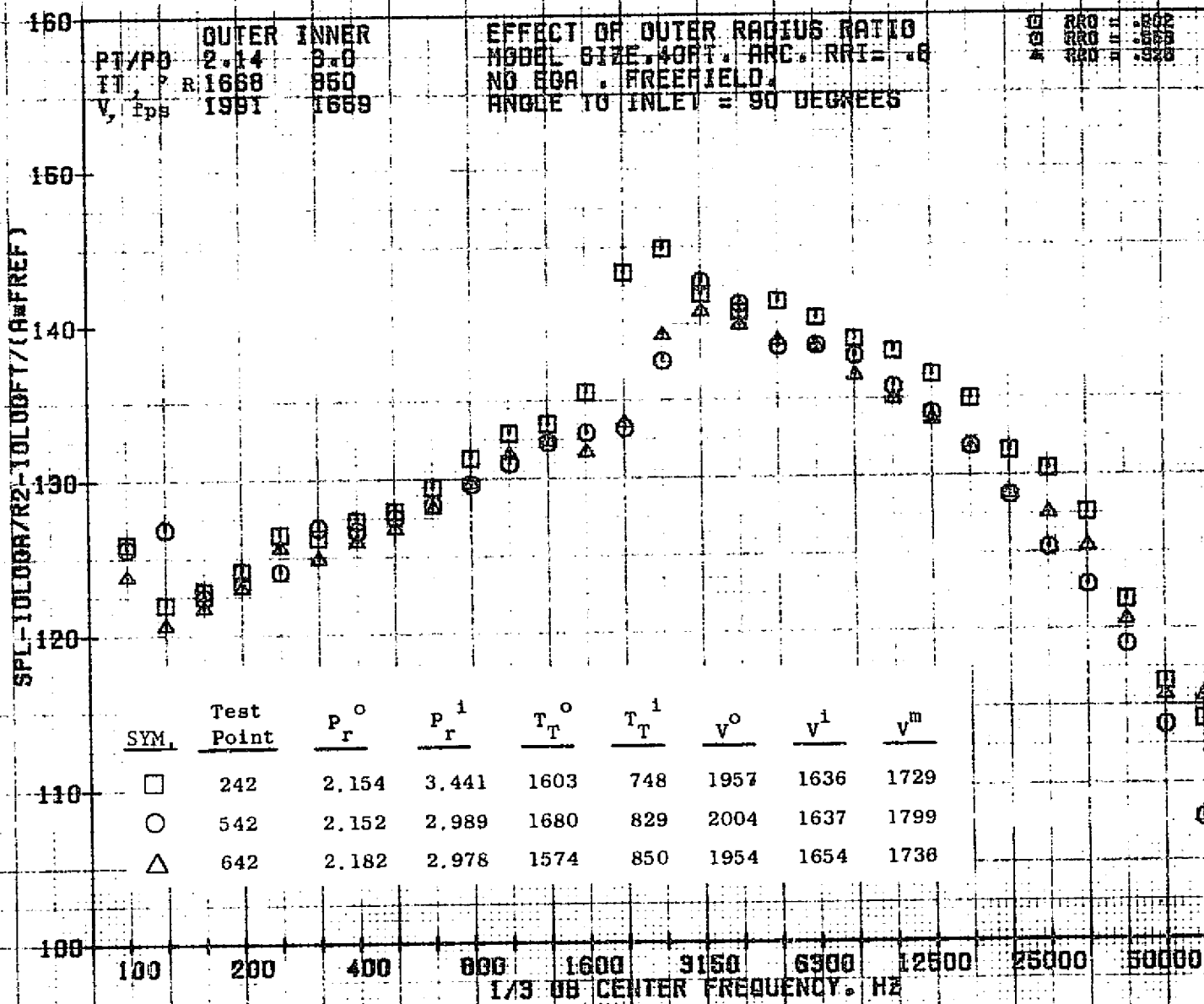
EFFECT OF OUTER RADIUS RATIO
 MODEL SIZE 40 FT. ARC. RRI = .8
 NO EGA, FREEFIELD,
 ANGLE TO INLET = 50 DEGREES

R20 .802
 R30 .855
 R60 .928

768

SYM.	Test Point	P_r^o	P_r^i	T_T^o	T_T^i	V^o	V^i	V^m
□	242	2.154	3.441	1603	748	1957	1636	1729
○	542	2.152	2.989	1680	829	2004	1637	1799
△	642	2.182	2.978	1574	850	1954	1654	1736

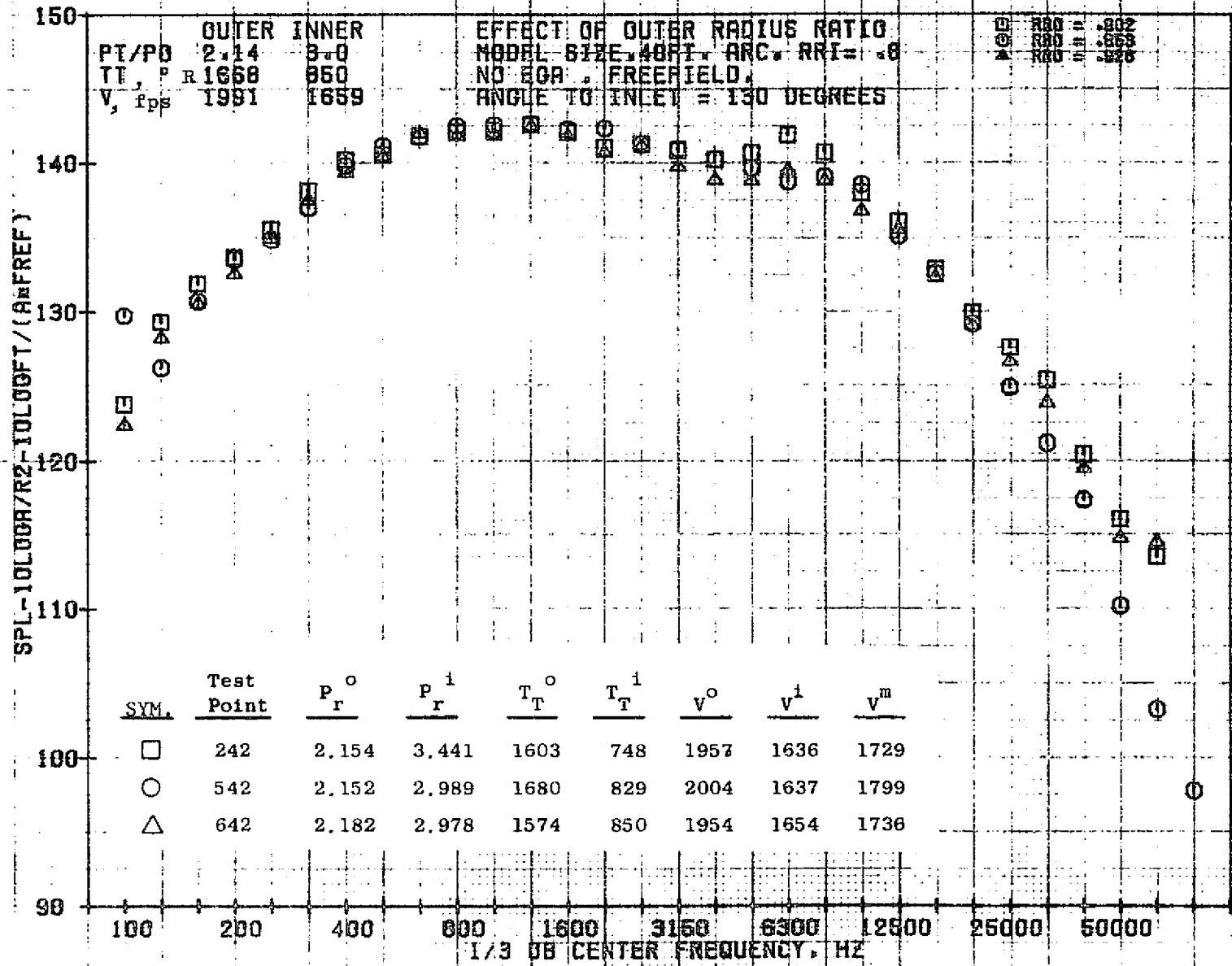
868



10/27/76
 1X824-001

73KOLLSTEDT

668



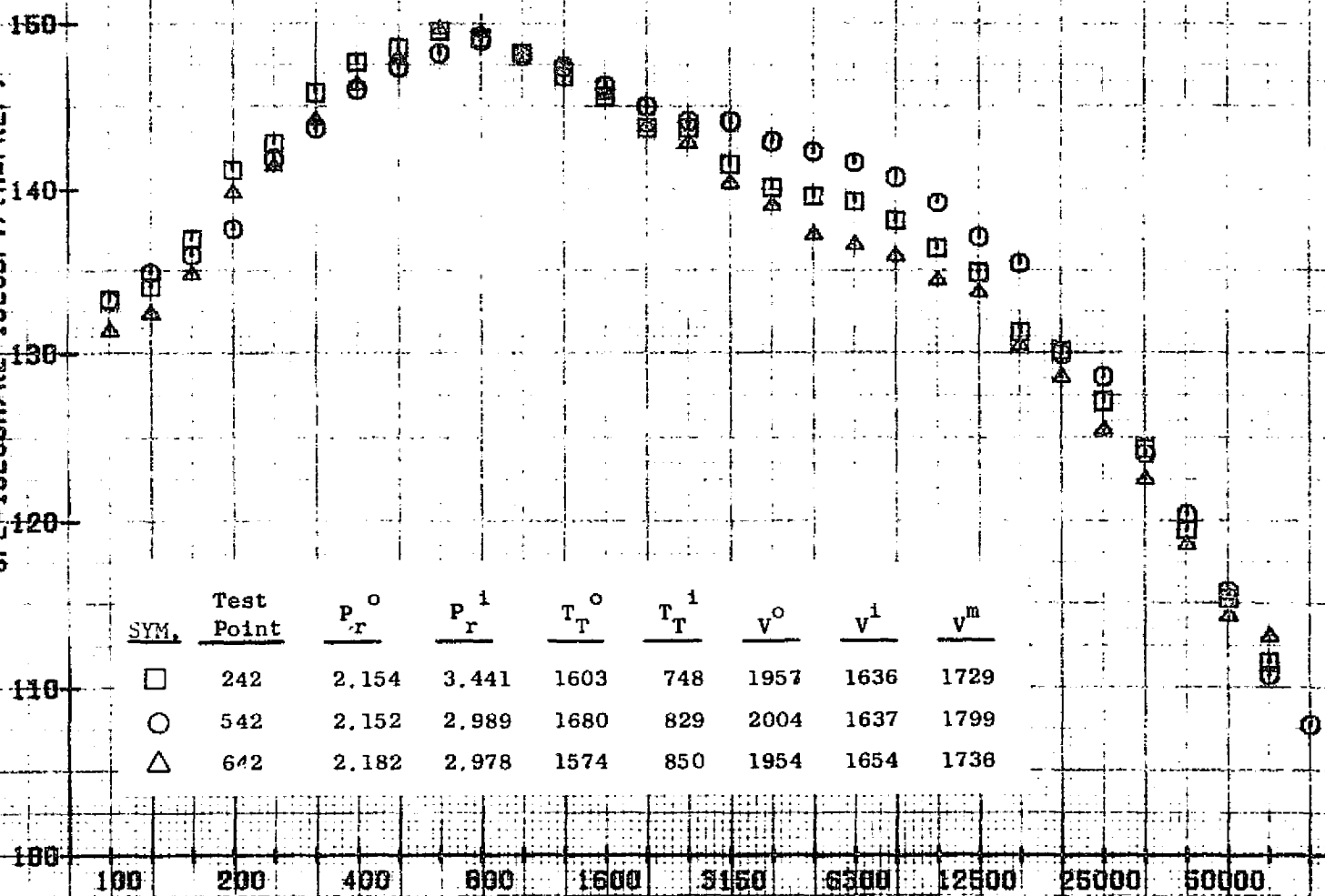
10/27/76
 1X824 001

73KOLLSTEDT

006

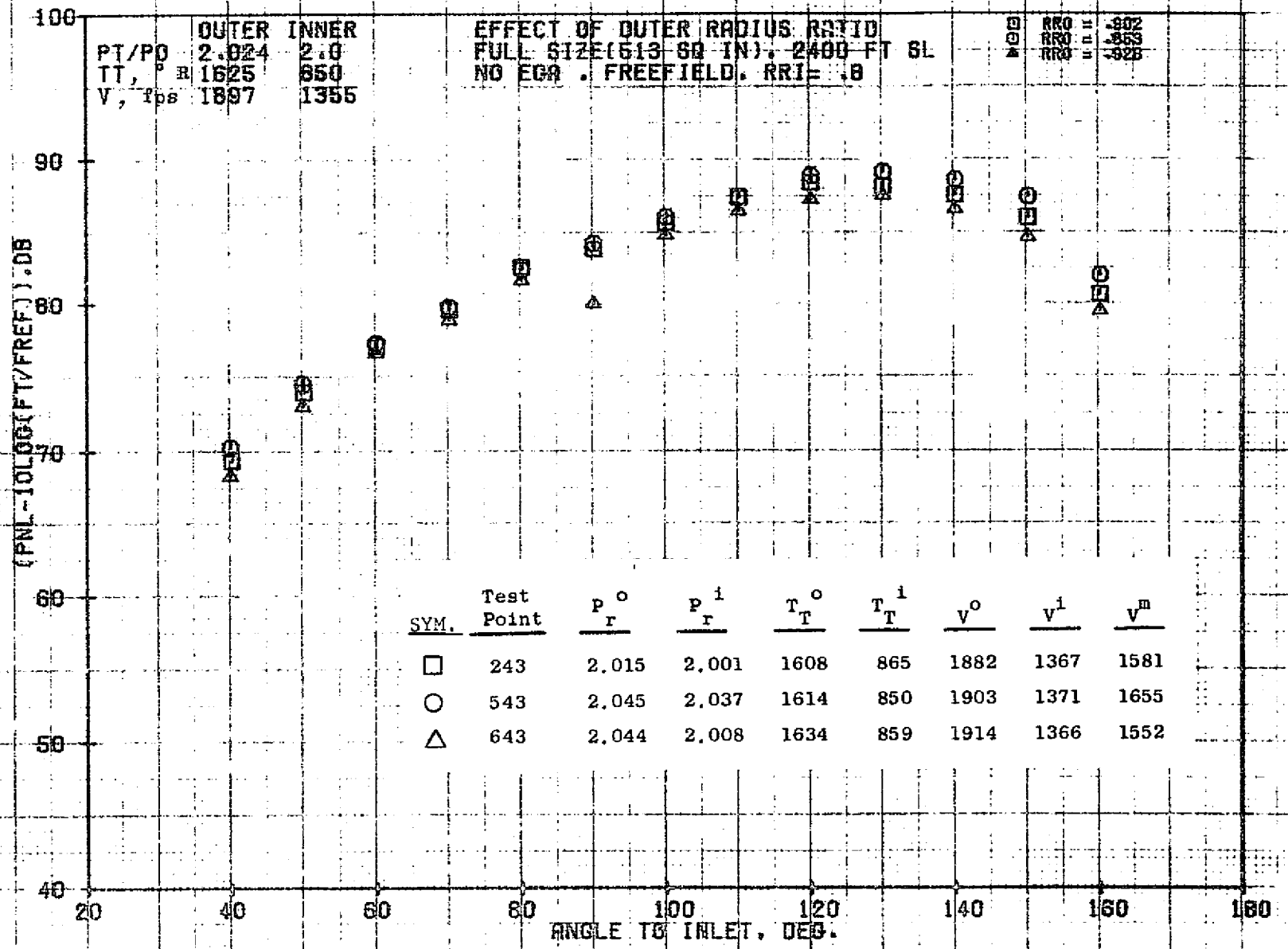
SPL - 10 LOG (P/P_{REF}) / 20 + 10 LOG (F/F_{REF})

160
 PT/PD 2.14 3.0
 TT, ° R 1688 850
 V, fms 1981 1659
 EFFECT OF OUTER RADIUS RATIO
 MODEL SIZE 40FT. ARC. RRI = .8
 NO BGA. FREEFIELD.
 ANGLE TO INLET = 140 DEGREES
 RRI = .802
 RRI = .852
 RRI = .928



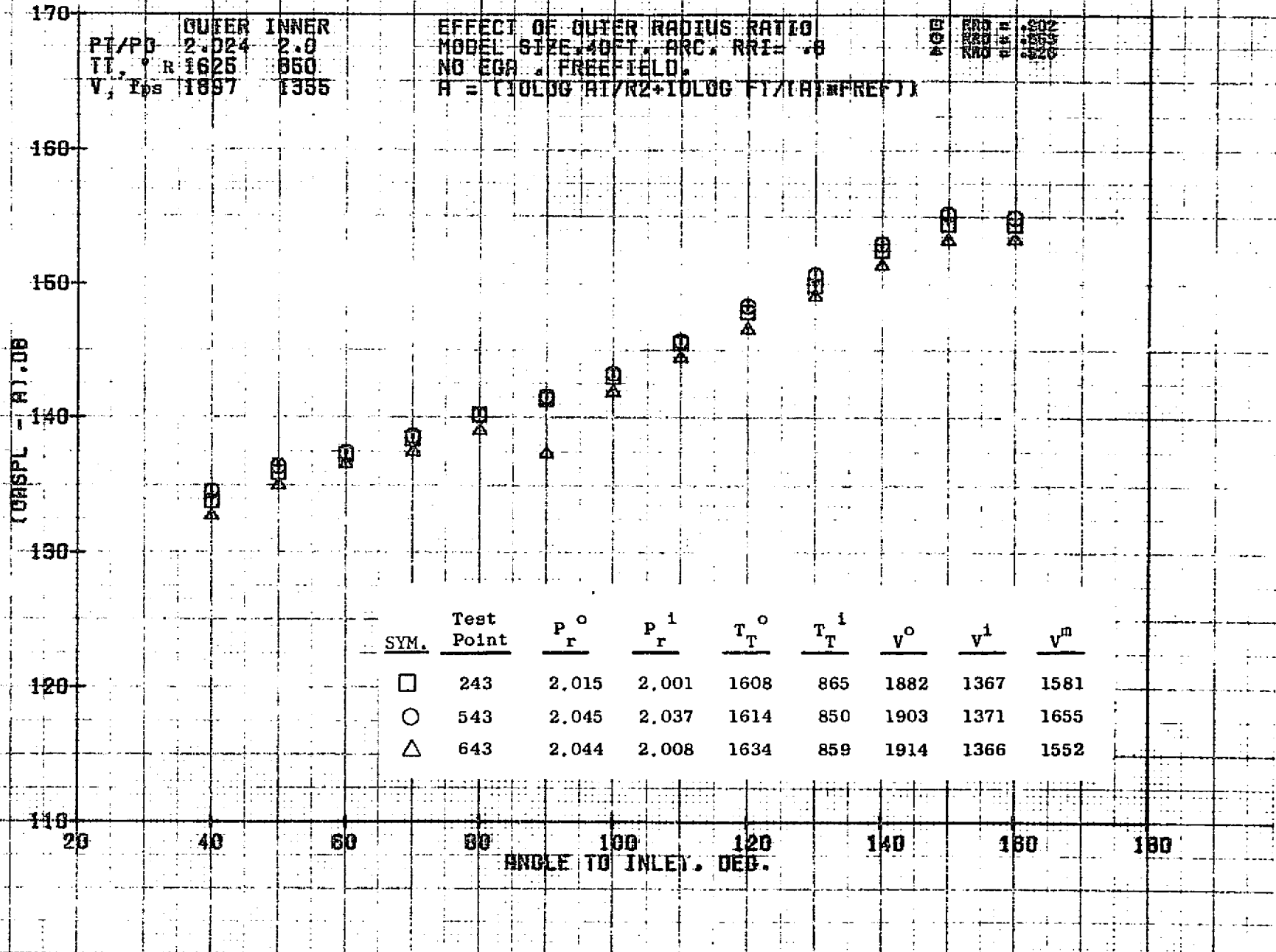
10/27/76
 1X824-001

73KOLLSTEDT



10/27/76
 1X008-001

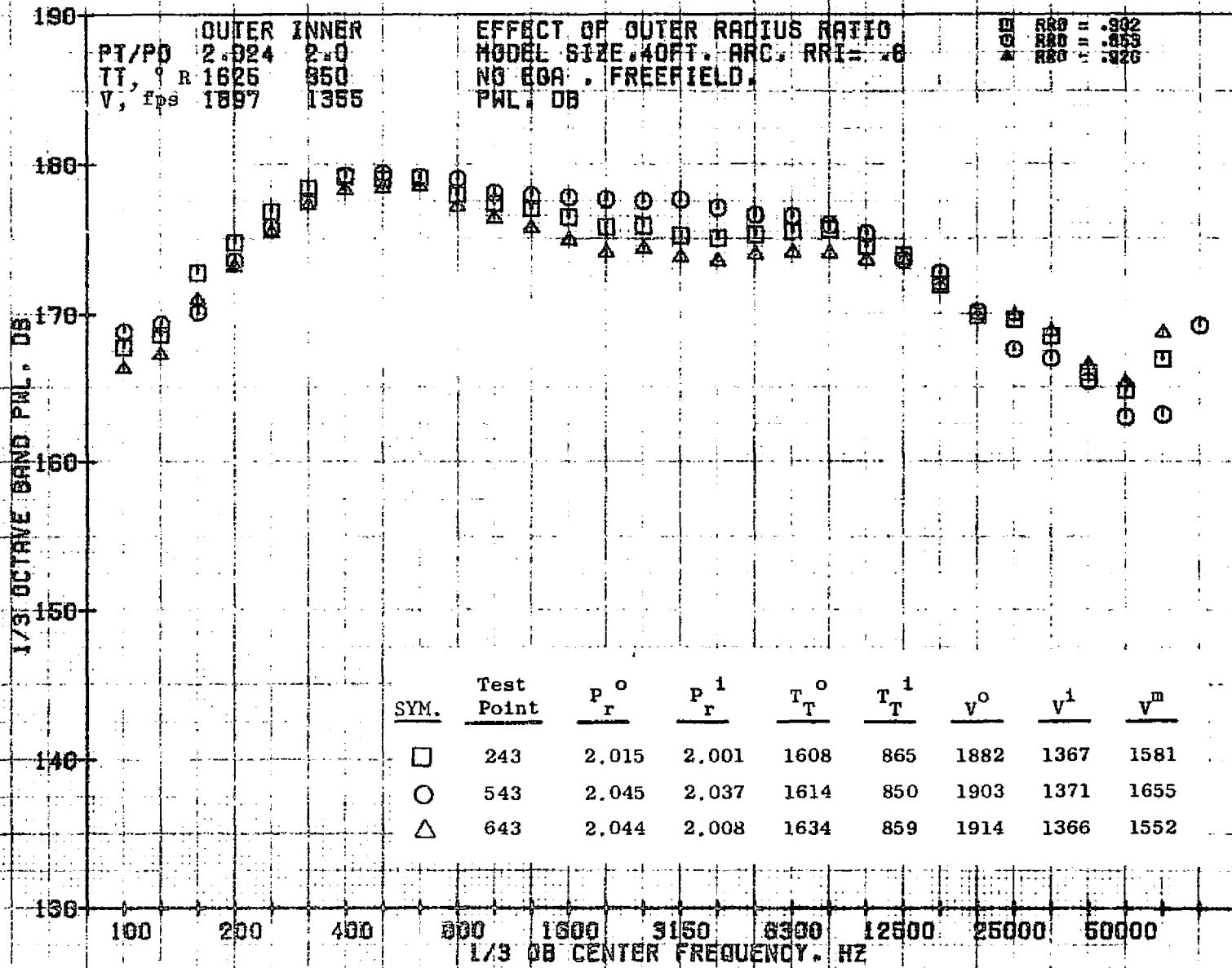
73KOLI STEDT



902

10/27/76
1X824-001

73KOLLSTEDT



10/27/76
1X824-001

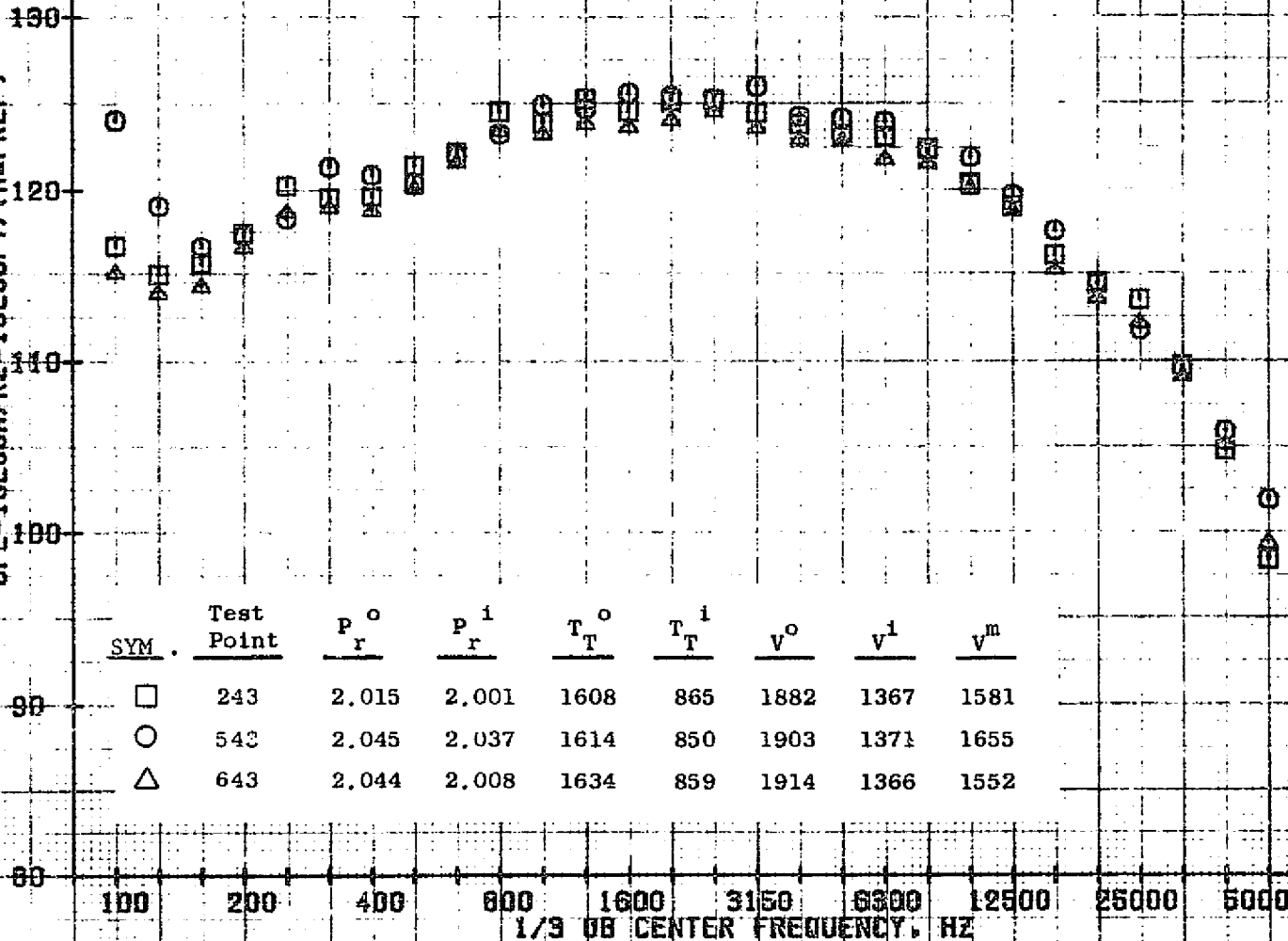
73KOLLSTEDT

904

SPL - 10 LOG (P_r^o / P_rⁱ - 1) / (R_r^o / R_rⁱ) (dB REF)

PT/PS OUTER INNER
 TL, ° R 1626 860
 V, fps 1897 1365

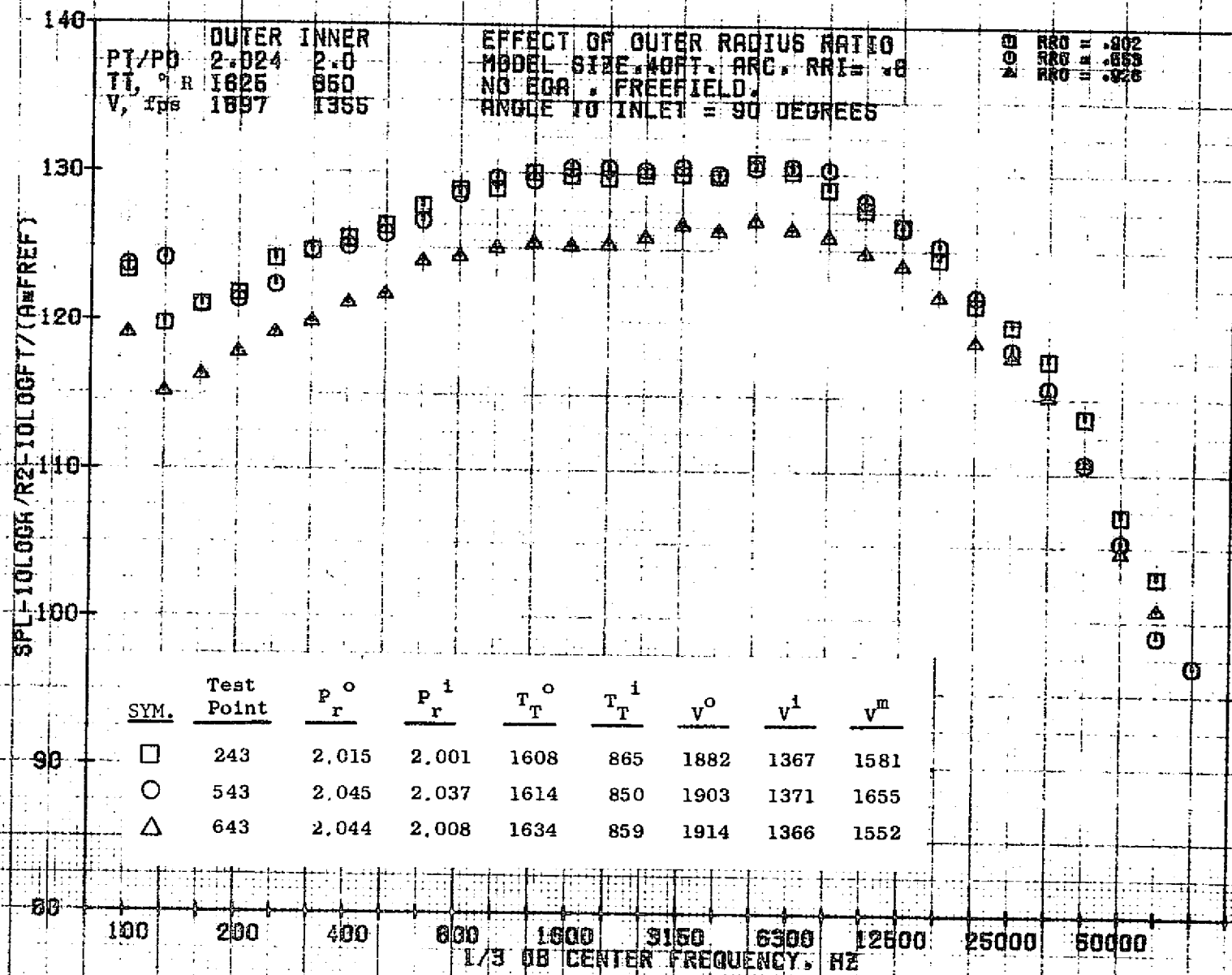
EFFECT OF OUTER RADIUS RATIO
 MODEL SIZE, HOPT. ARC: RRI = .8
 NO BOA, FREEFIELD,
 ANGLE TO INLET = 60 DEGREES



SYM	Test Point	P _r ^o	P _r ⁱ	T _T ^o	T _T ⁱ	V ^o	V ⁱ	V ^m
□	243	2.015	2.001	1608	865	1882	1367	1581
○	543	2.045	2.037	1614	850	1903	1371	1655
△	643	2.044	2.008	1634	859	1914	1366	1552

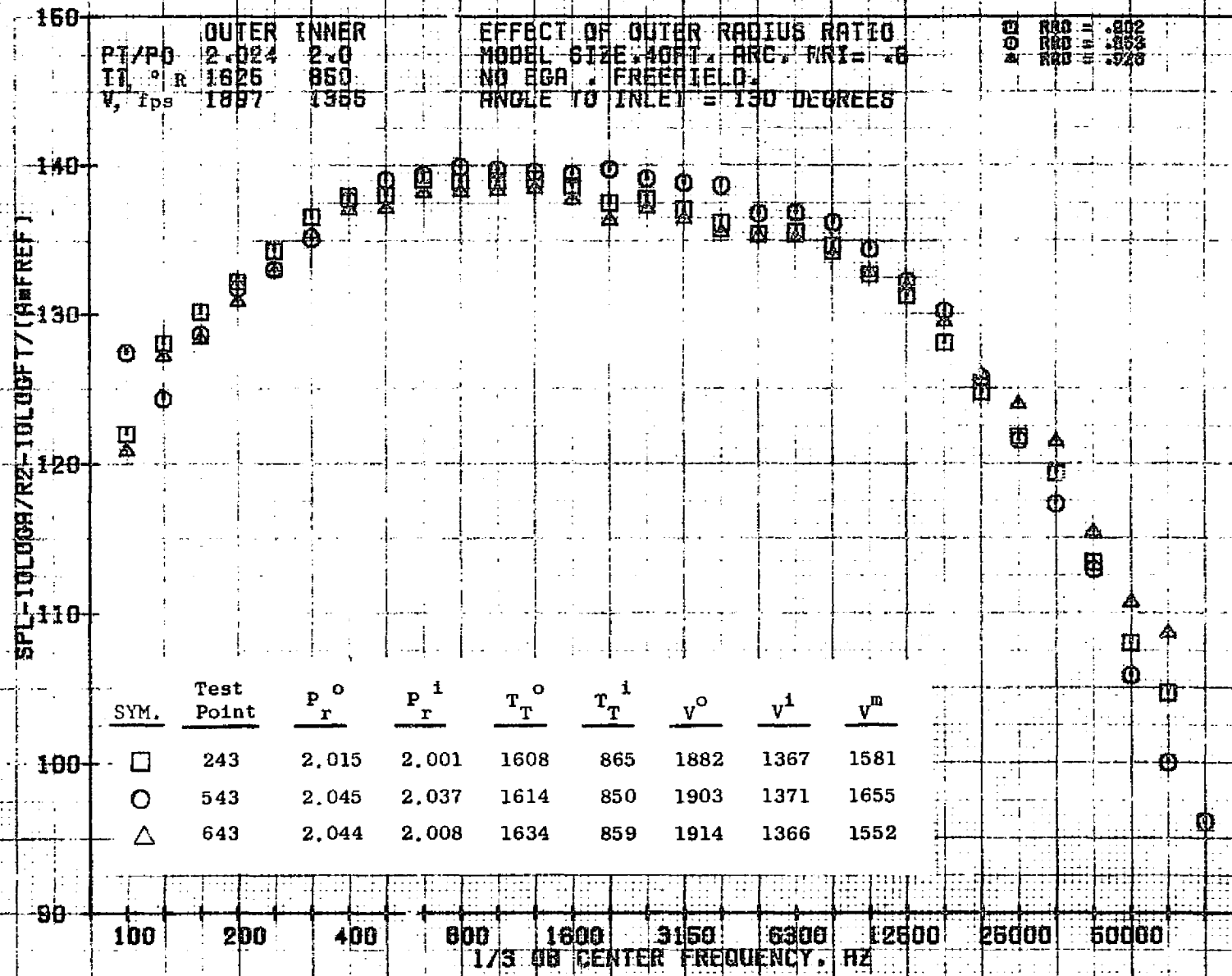
10/27/76
1X824-001

73KOLLSTEDT



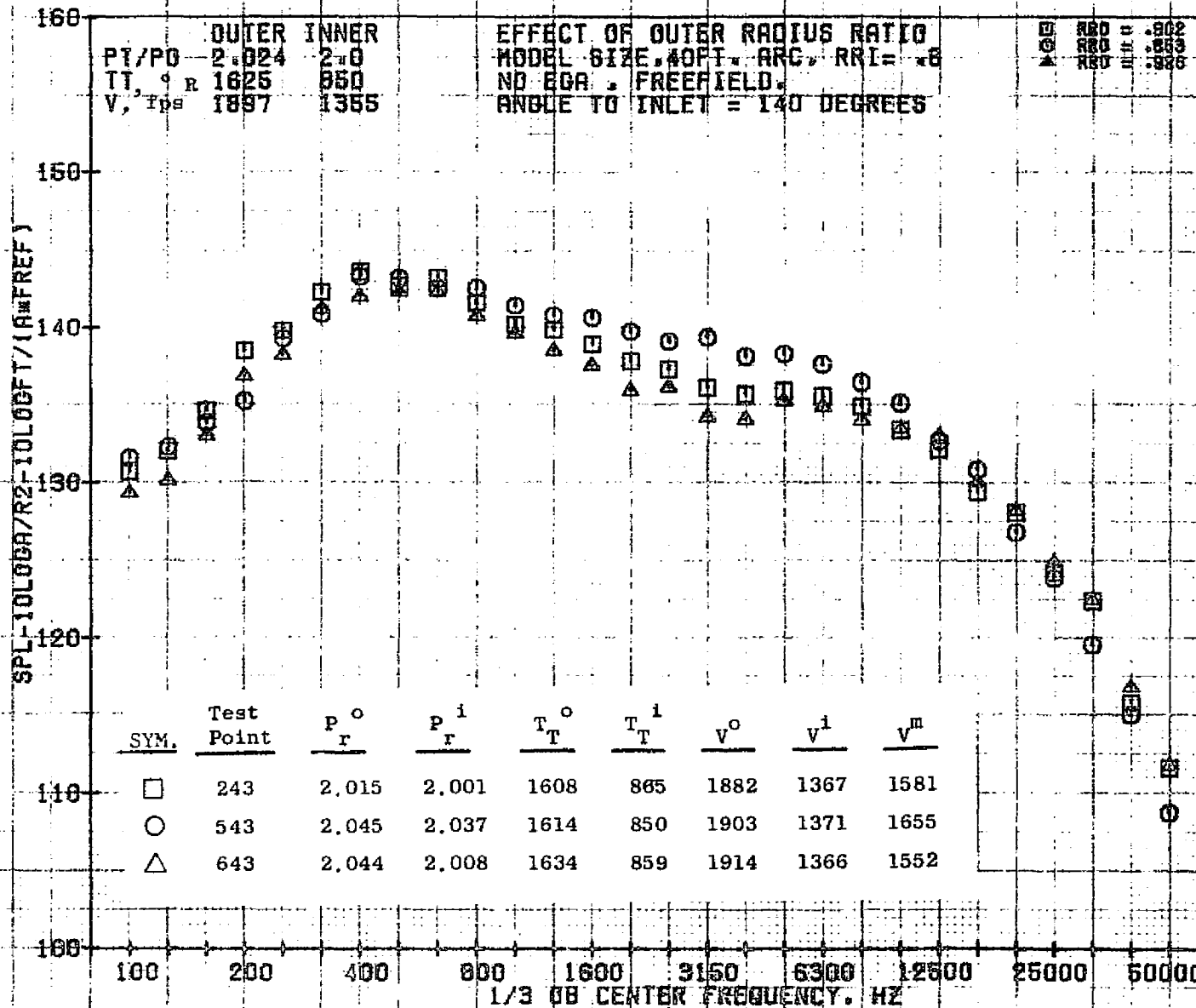
10/27/76
1X824-001

73KOLLSTEOT



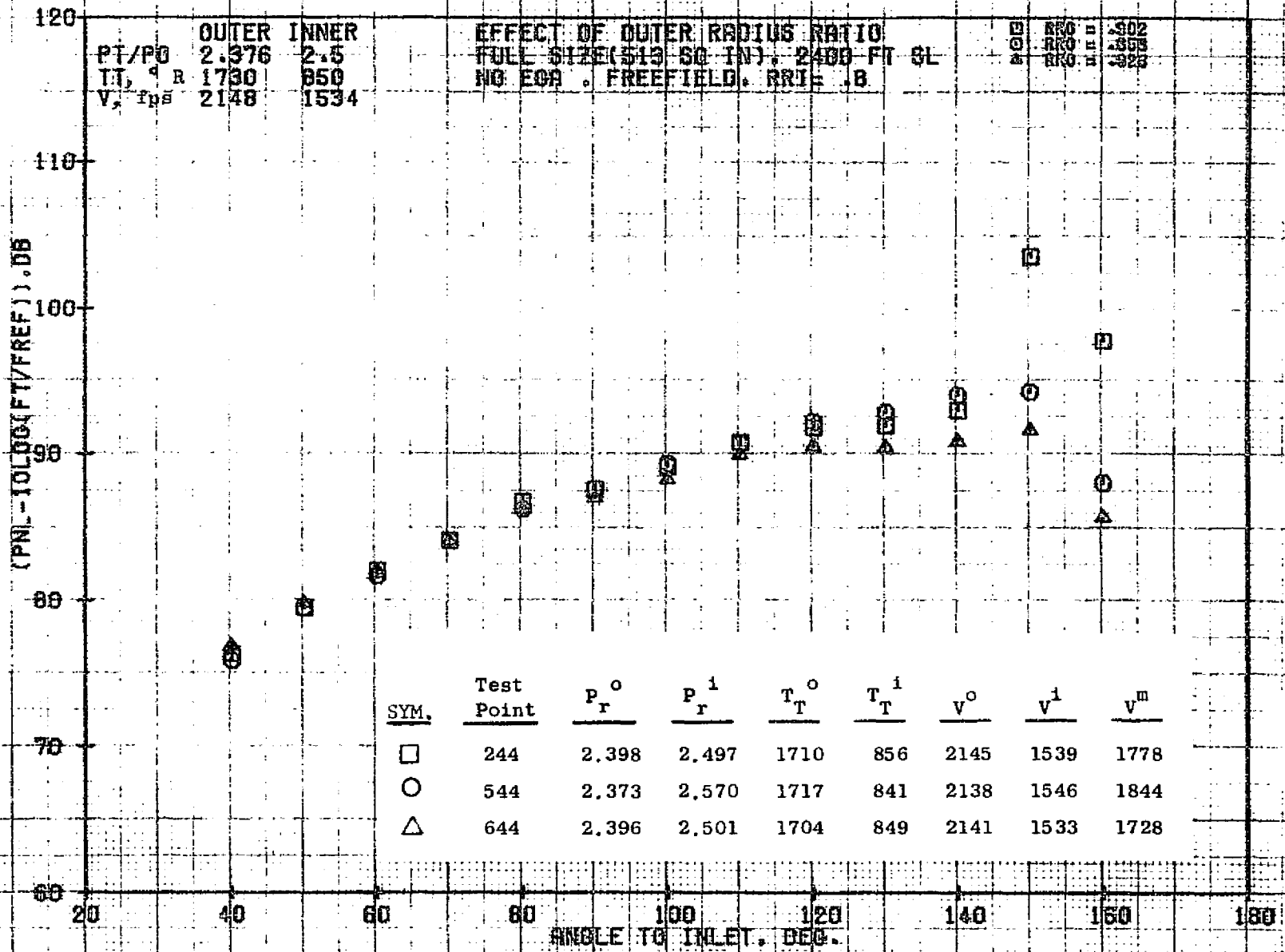
10/27/76
 1X824-001

73KOLLSTEDT



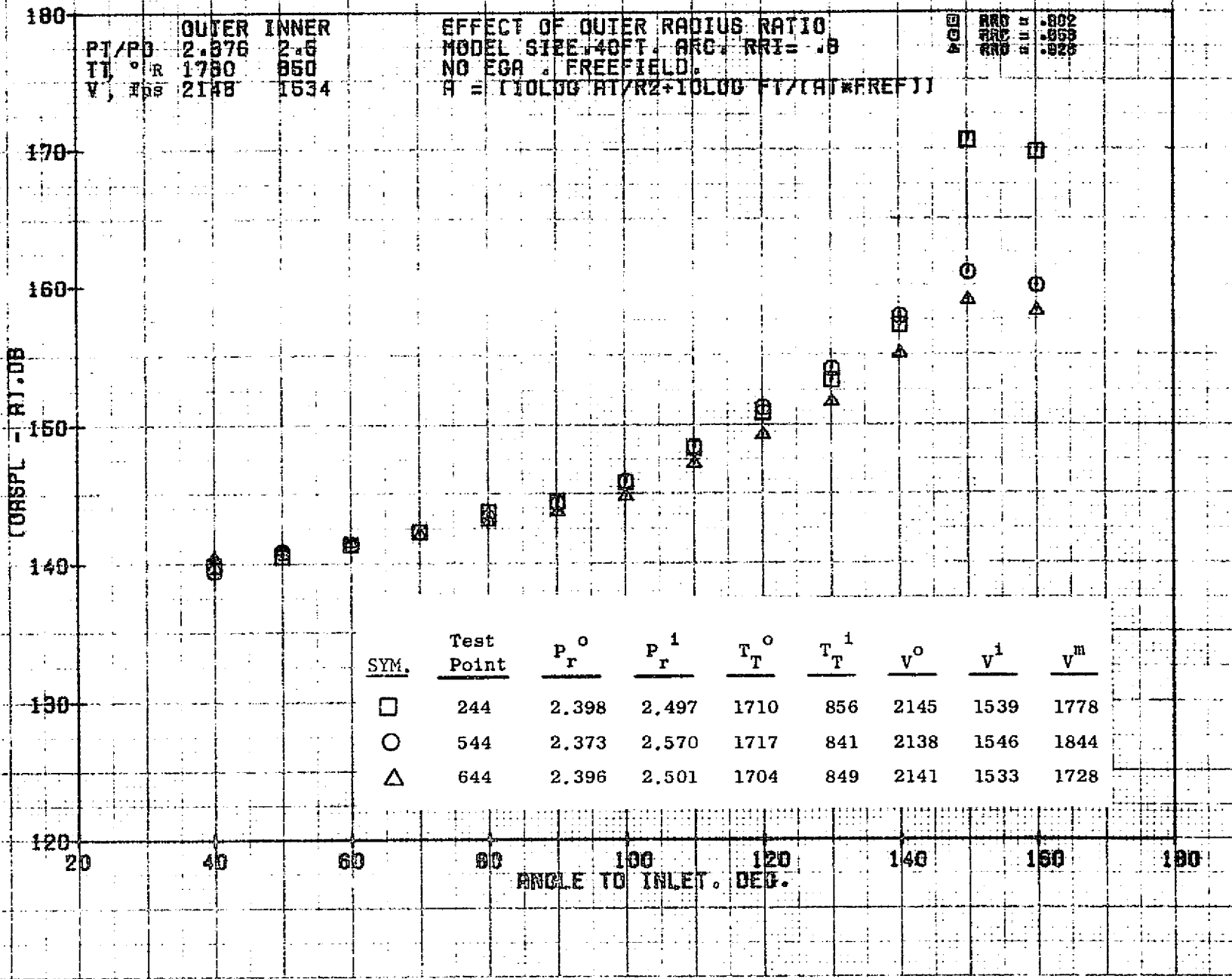
10/27/76
 LX824-C01

73KOLLSTEDT



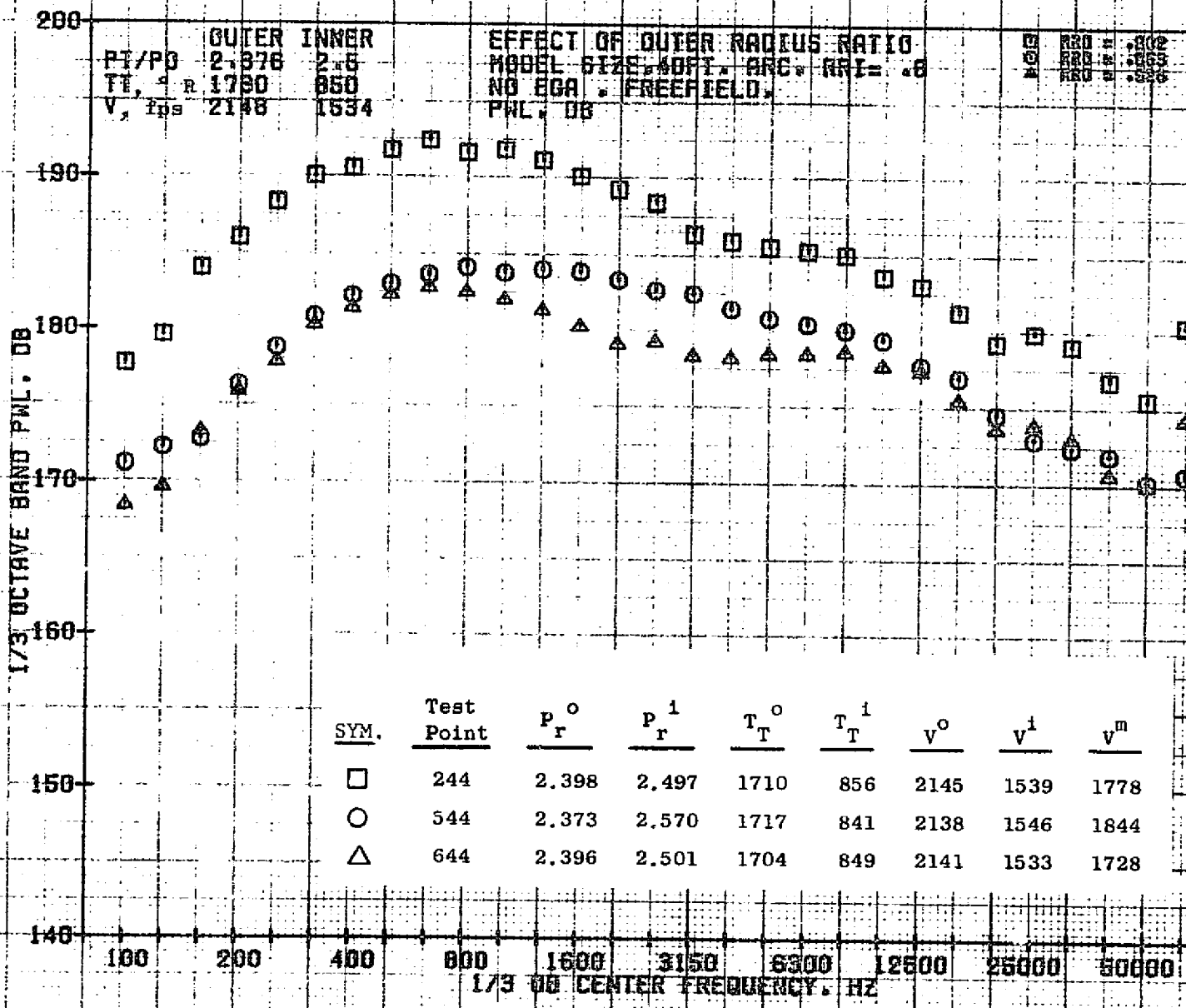
10/27/76
 1X008-001

73KOLLSTEDT



10/27/76
 1X824-001

73KOLLSTEDT



10/27/76
1X824-001

73KOLLSTEDT

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SPL - 10 LOG (P/R² - 10 LOG (DFT / (R² REF)))

OUTER INNER
 P_r^o / P_rⁱ 2.378 2.5
 T_T^o 1780 850
 V^o 2148 1534

EFFECT OF OUTER RADIUS RATIO
 MODEL SIZE 40 FT. ARC. RRI = .8
 NO EGR. FREEFIELD.
 ANGLE TO INLET = 50 DEGREES

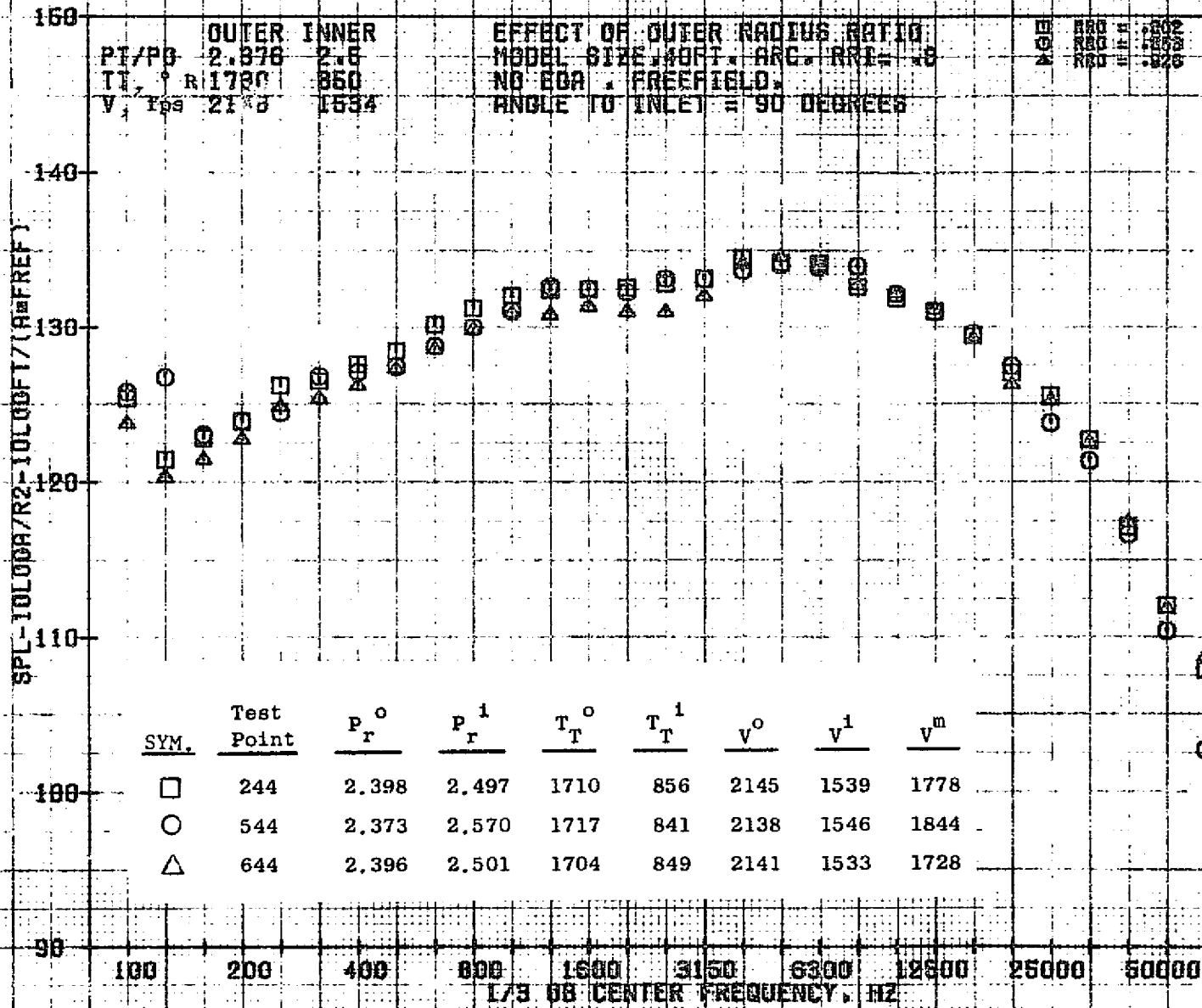
R₂ .802
 R₁ .883
 R₀ .828

SYM.	Test Point	P _r ^o	P _r ⁱ	T _T ^o	T _T ⁱ	V ^o	V ⁱ	V ^m
□	244	2.398	2.497	1710	856	2145	1539	1778
○	544	2.373	2.570	1717	841	2138	1546	1844
△	644	2.396	2.501	1704	849	2141	1533	1728

1/3 OB CENTER FREQUENCY, HZ

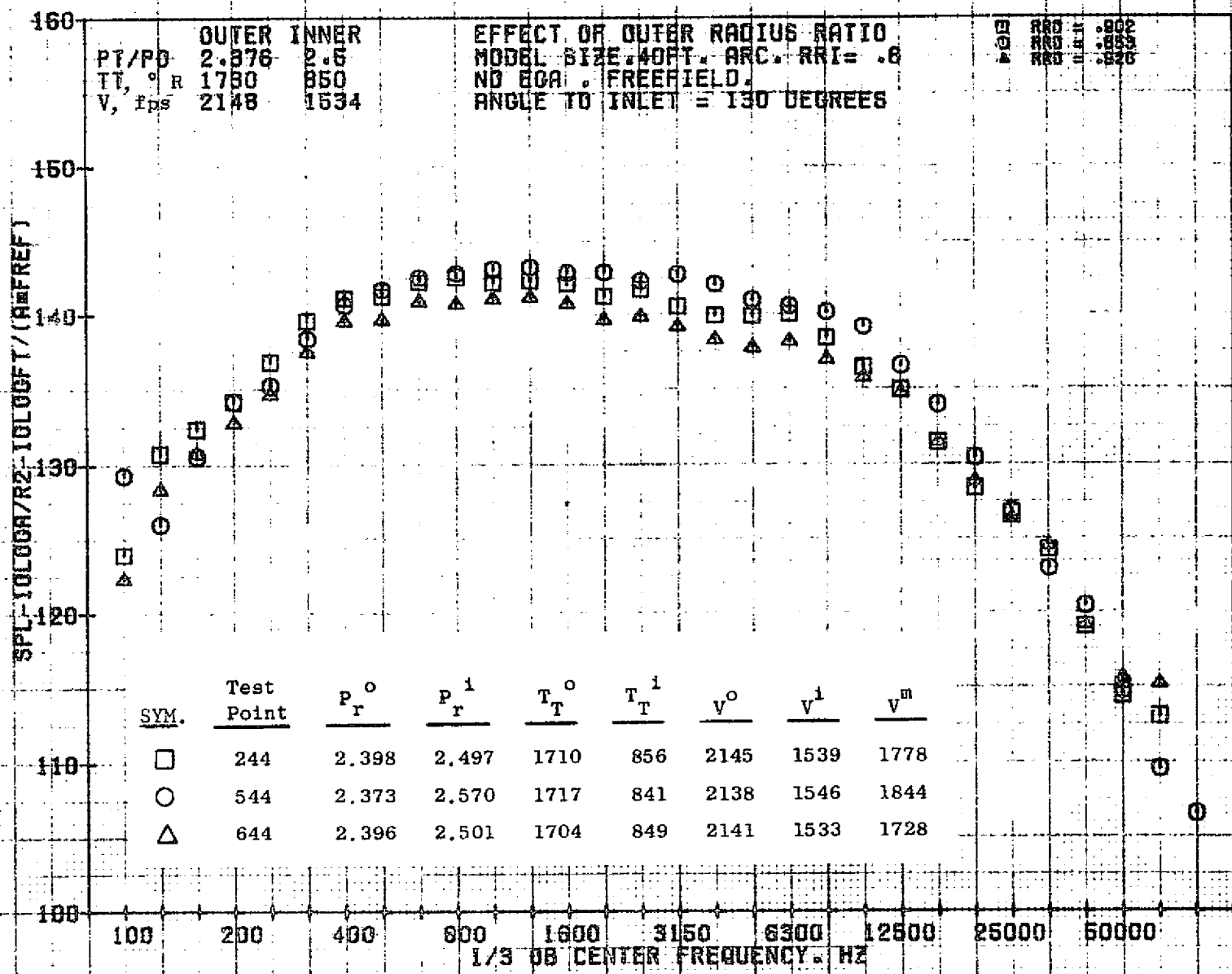
10/27/76
 1X824-001

73KOLLSTEDT



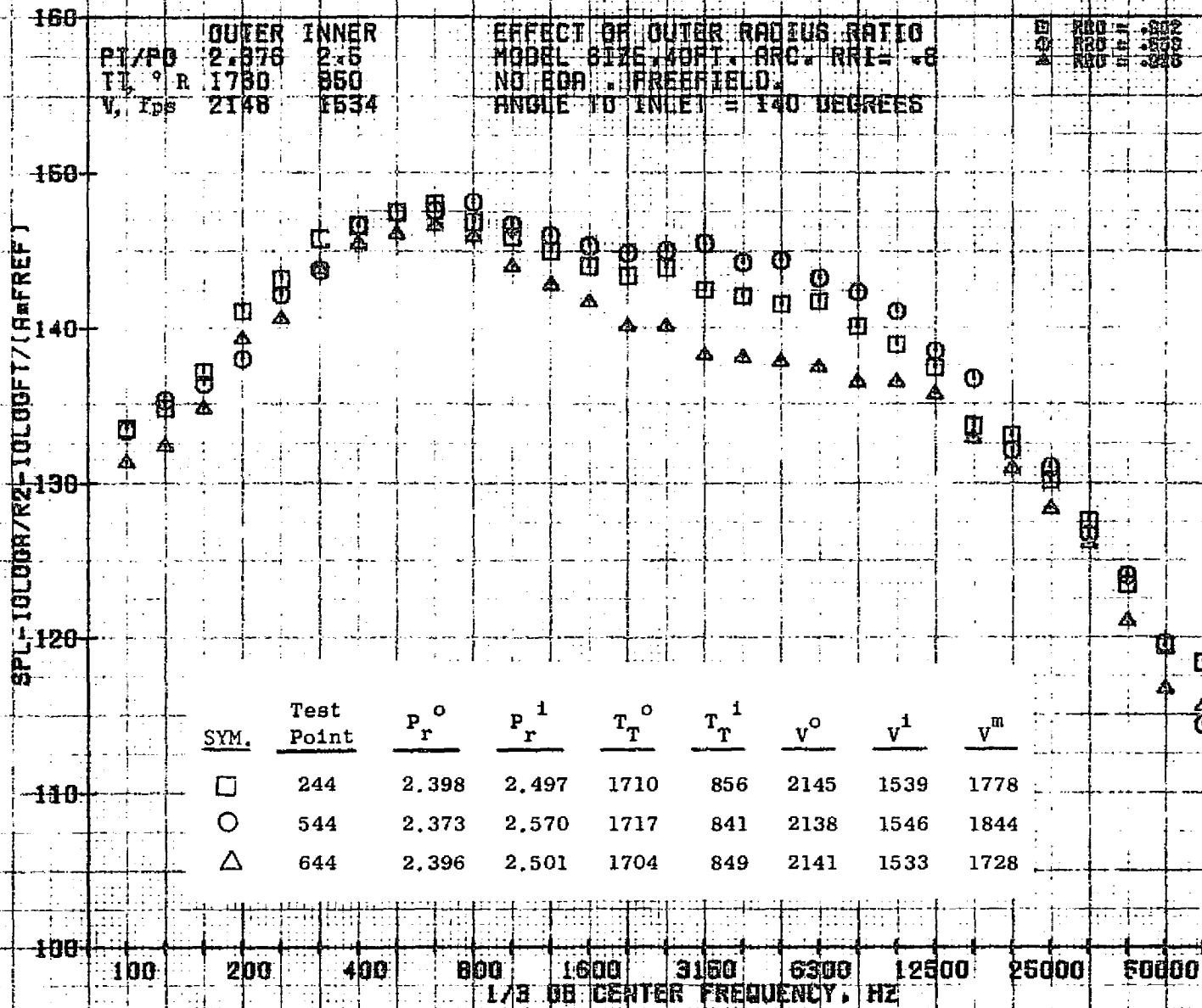
10/27/76
1X824-001

73KOLLSTEDT



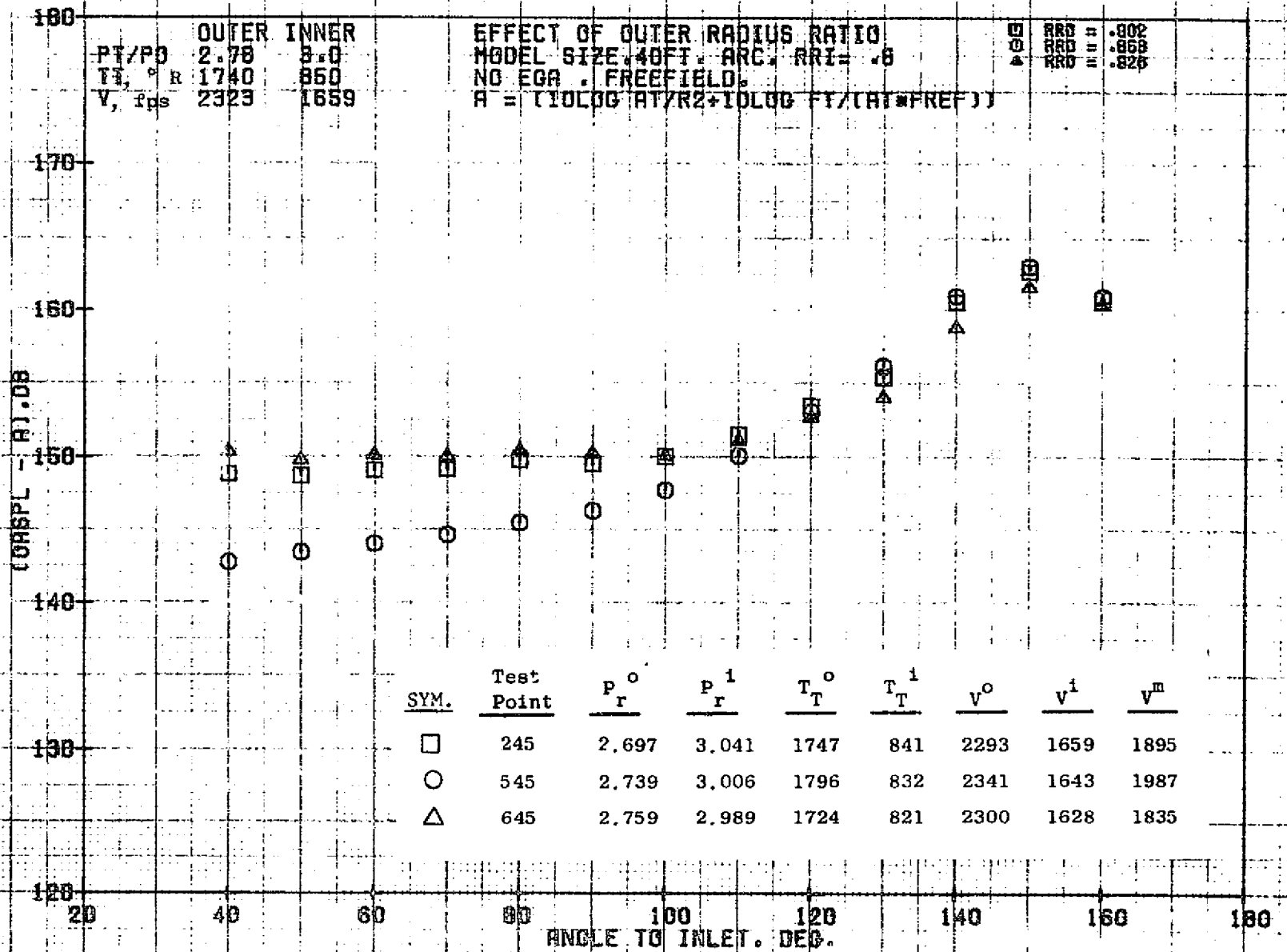
10/27/76
1X824-0G1

79KOLLSTEDT



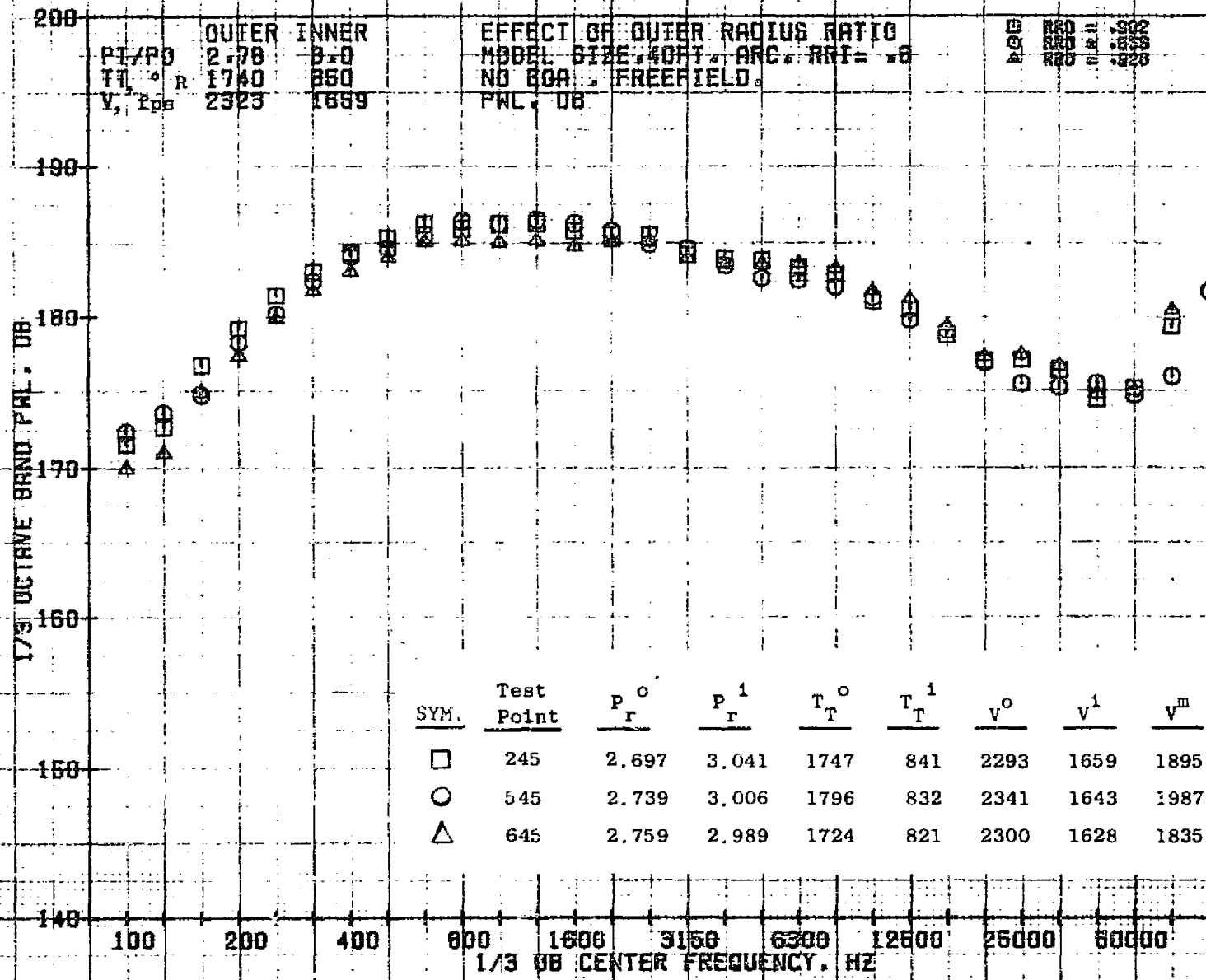
10/27/76
1X824-001

73KOLLSTEDT



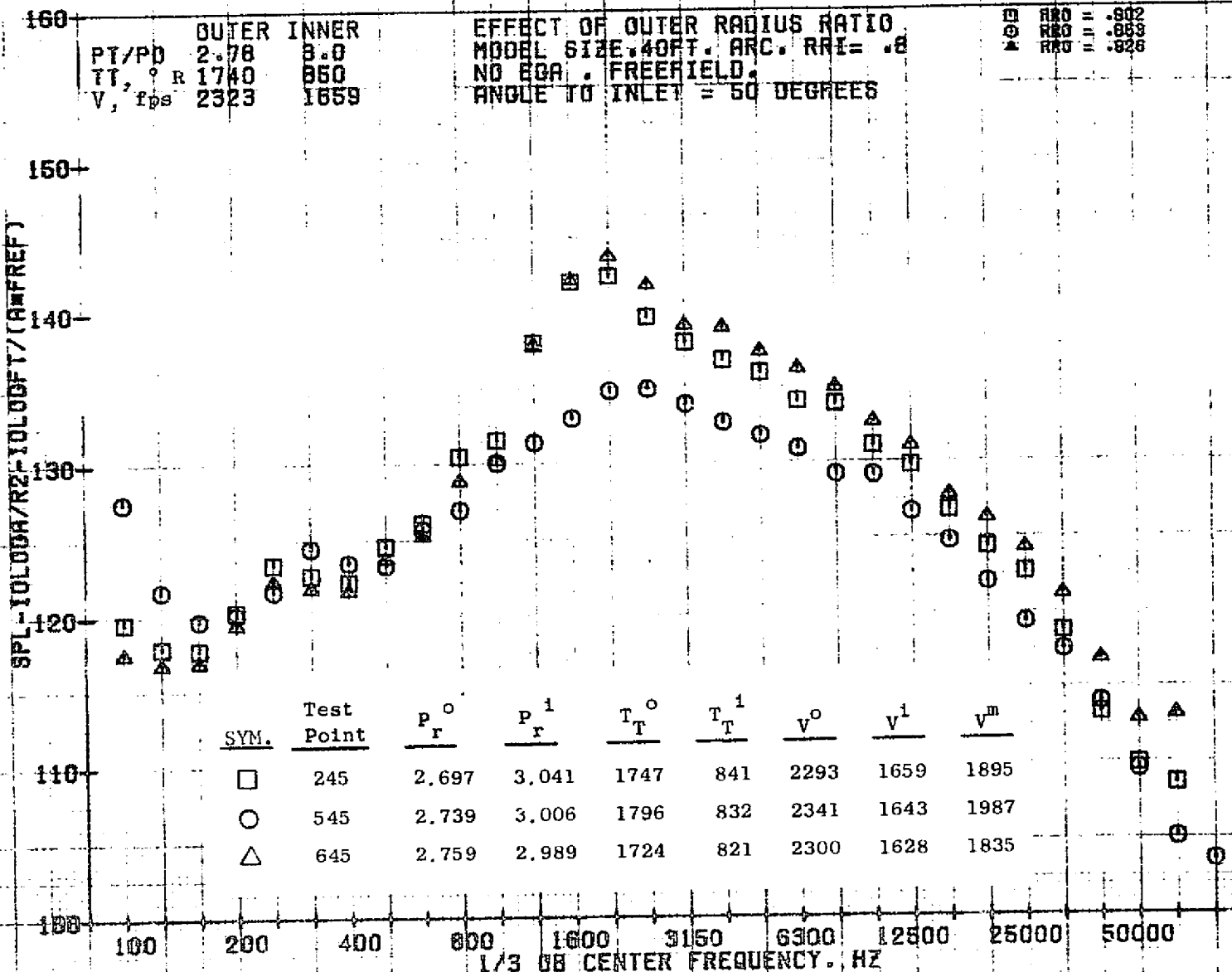
10/27/76
1X824-001

73KOLLSTERT

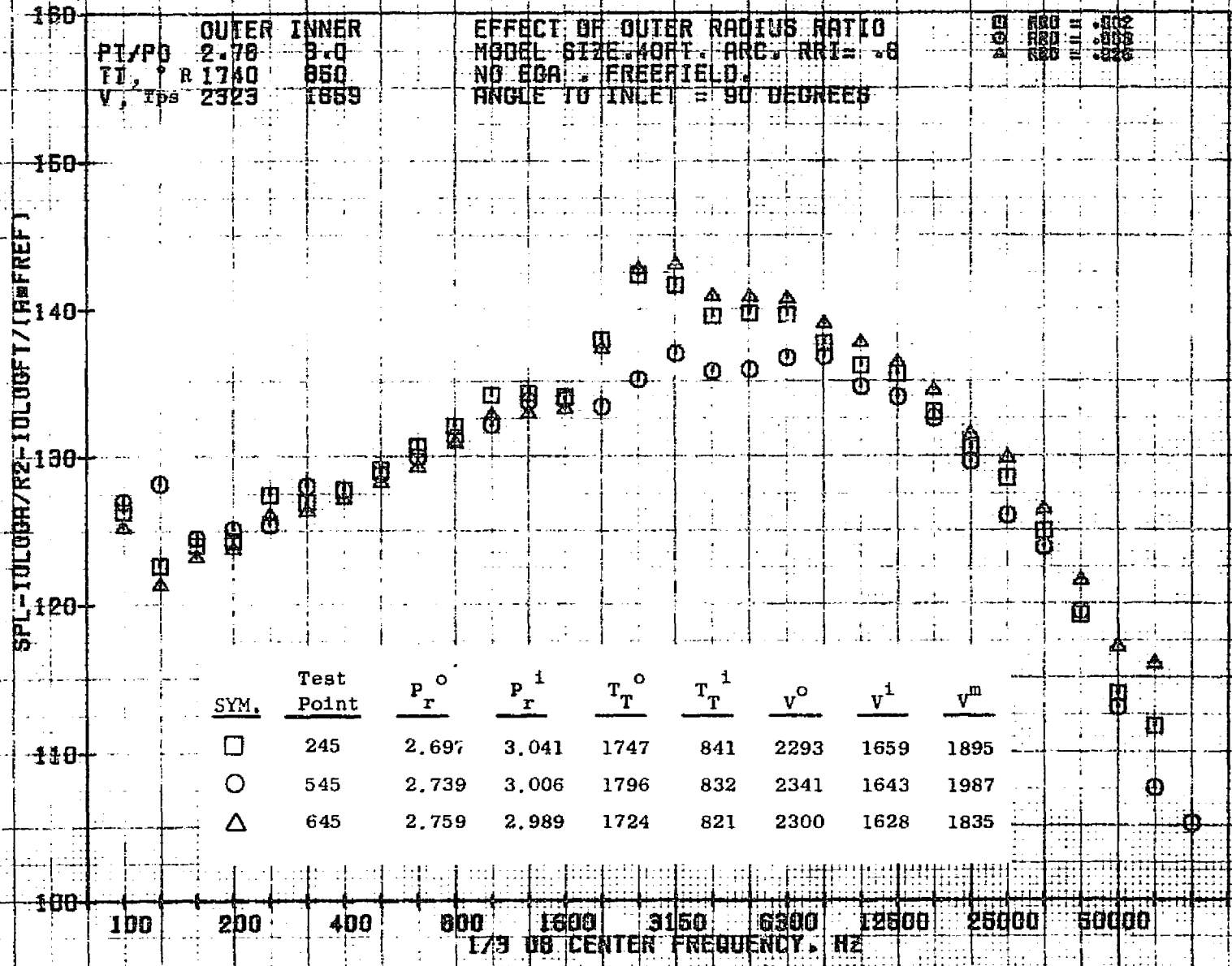


10/27/76
 1X824-001

73K3LLSTEDT



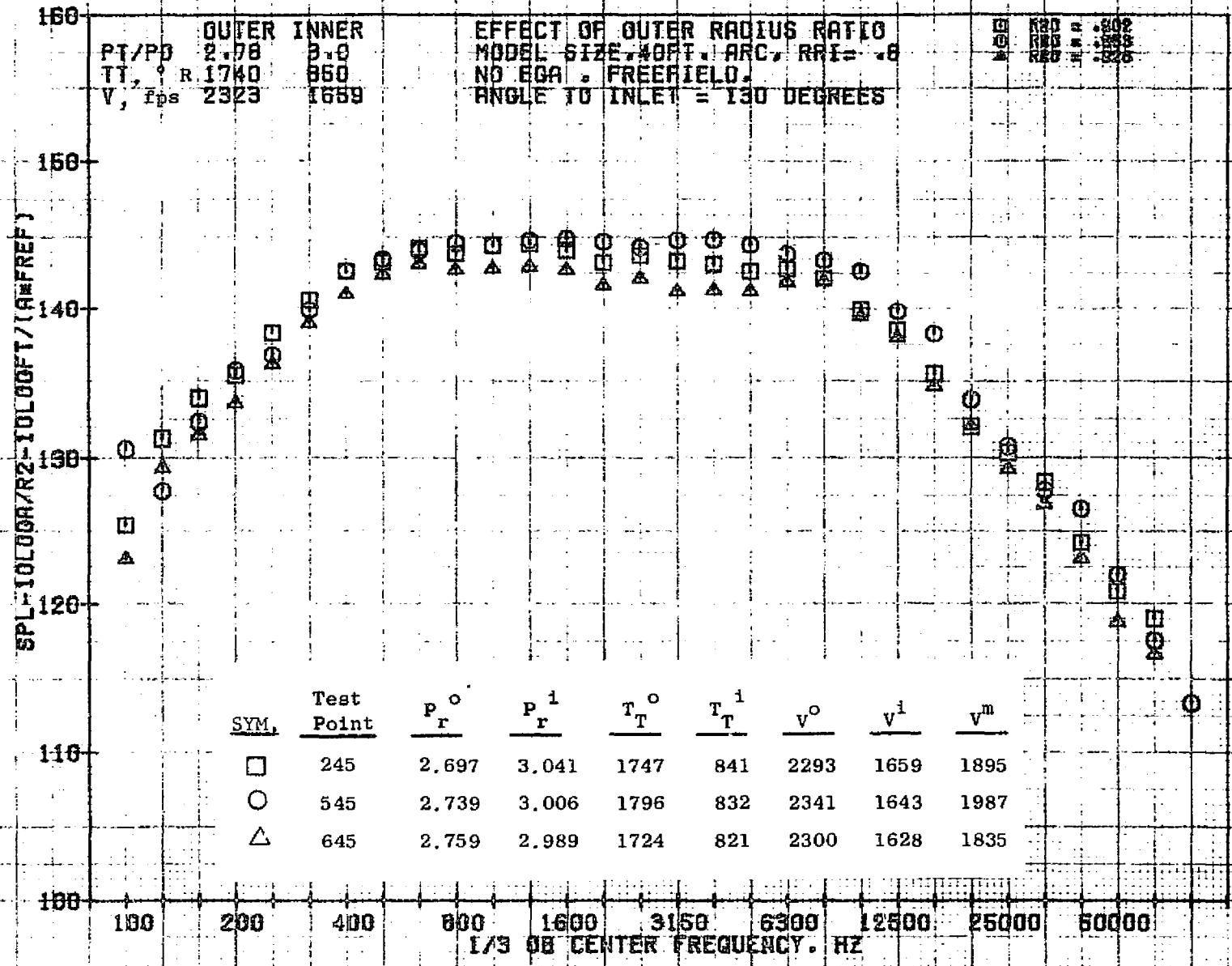
916



10/27/76
1X824-001

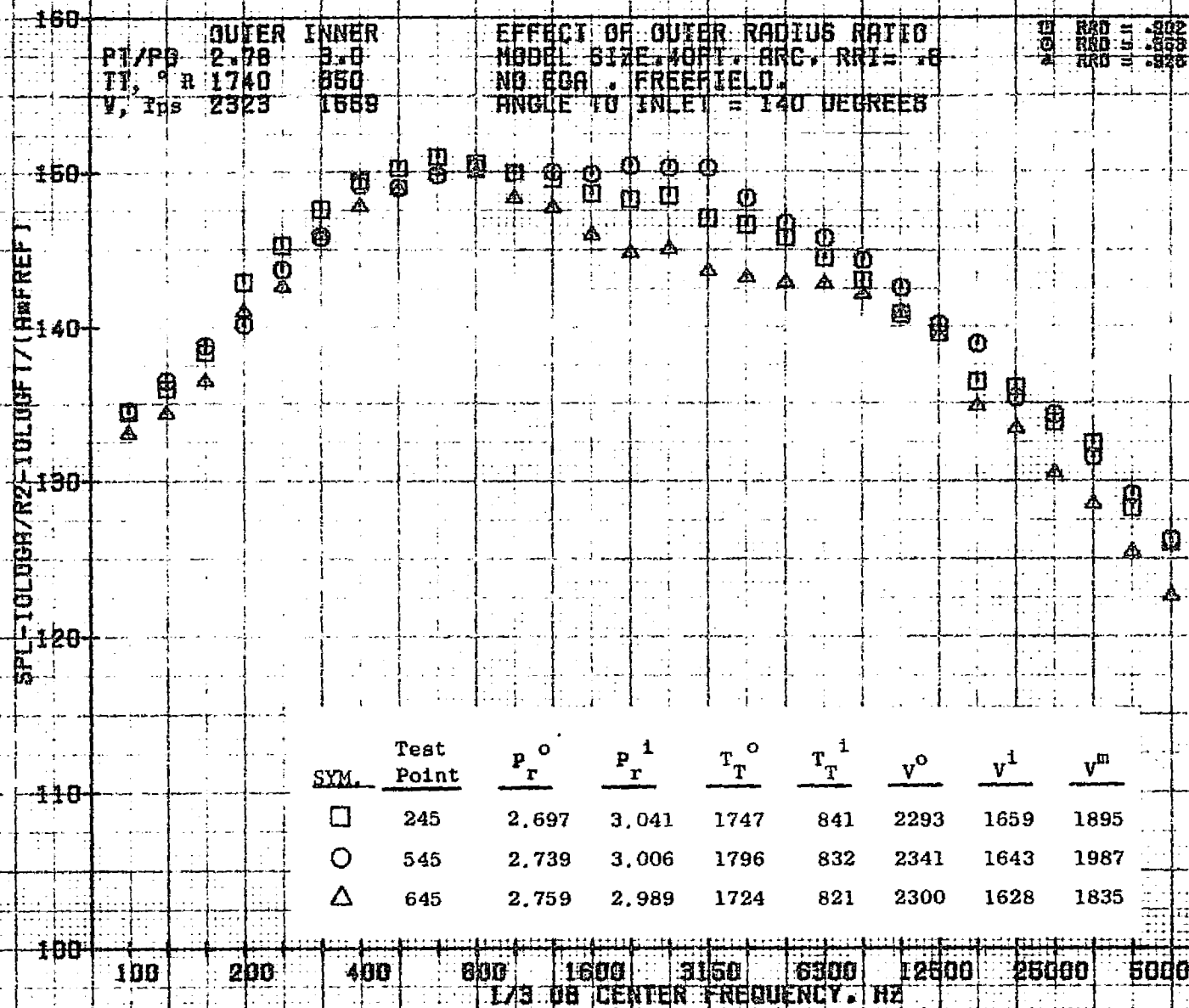
79KOLLSTEOT

616



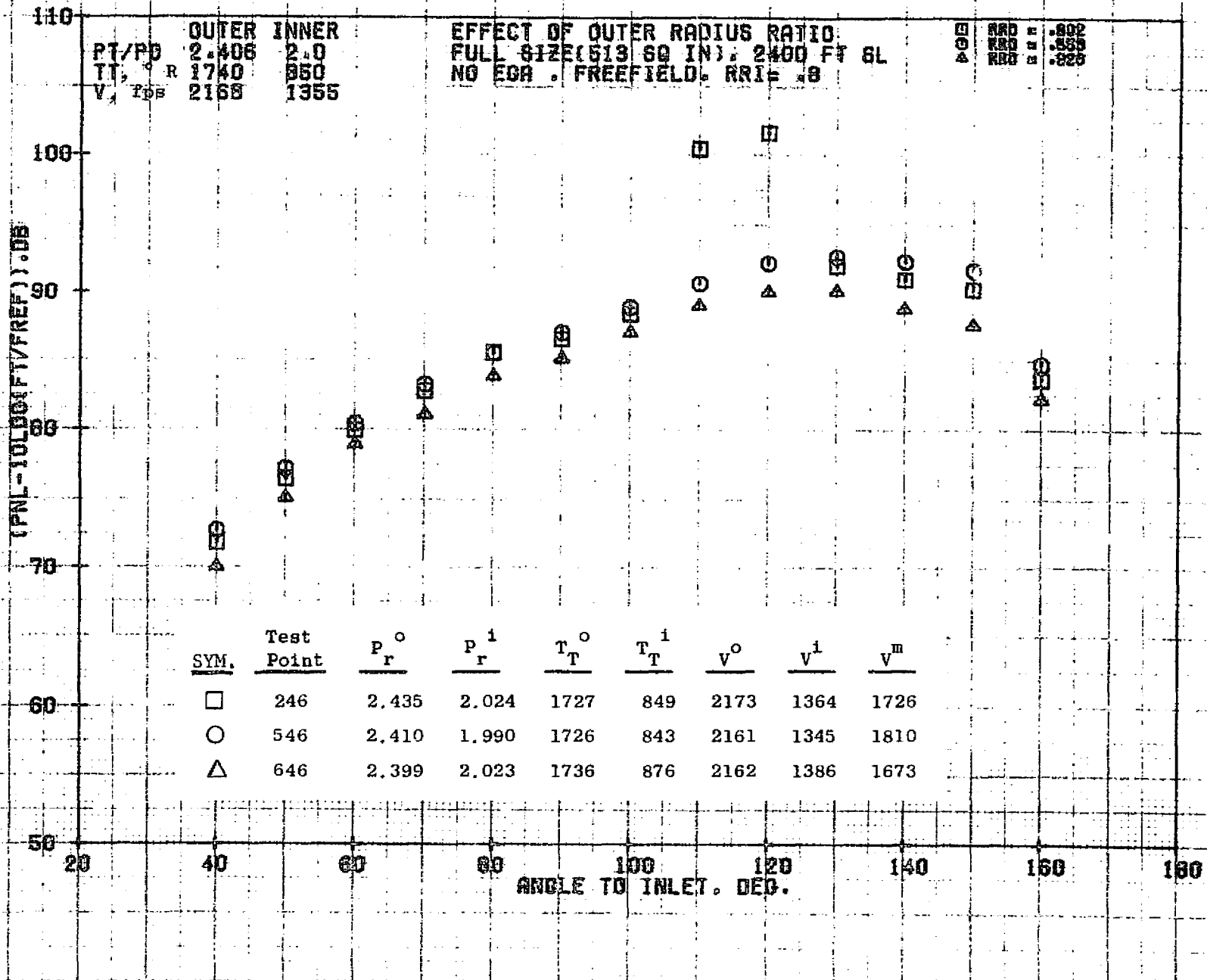
10/27/76
1X824-001

73KOLLSTEDT



10/27/76
1X824-001

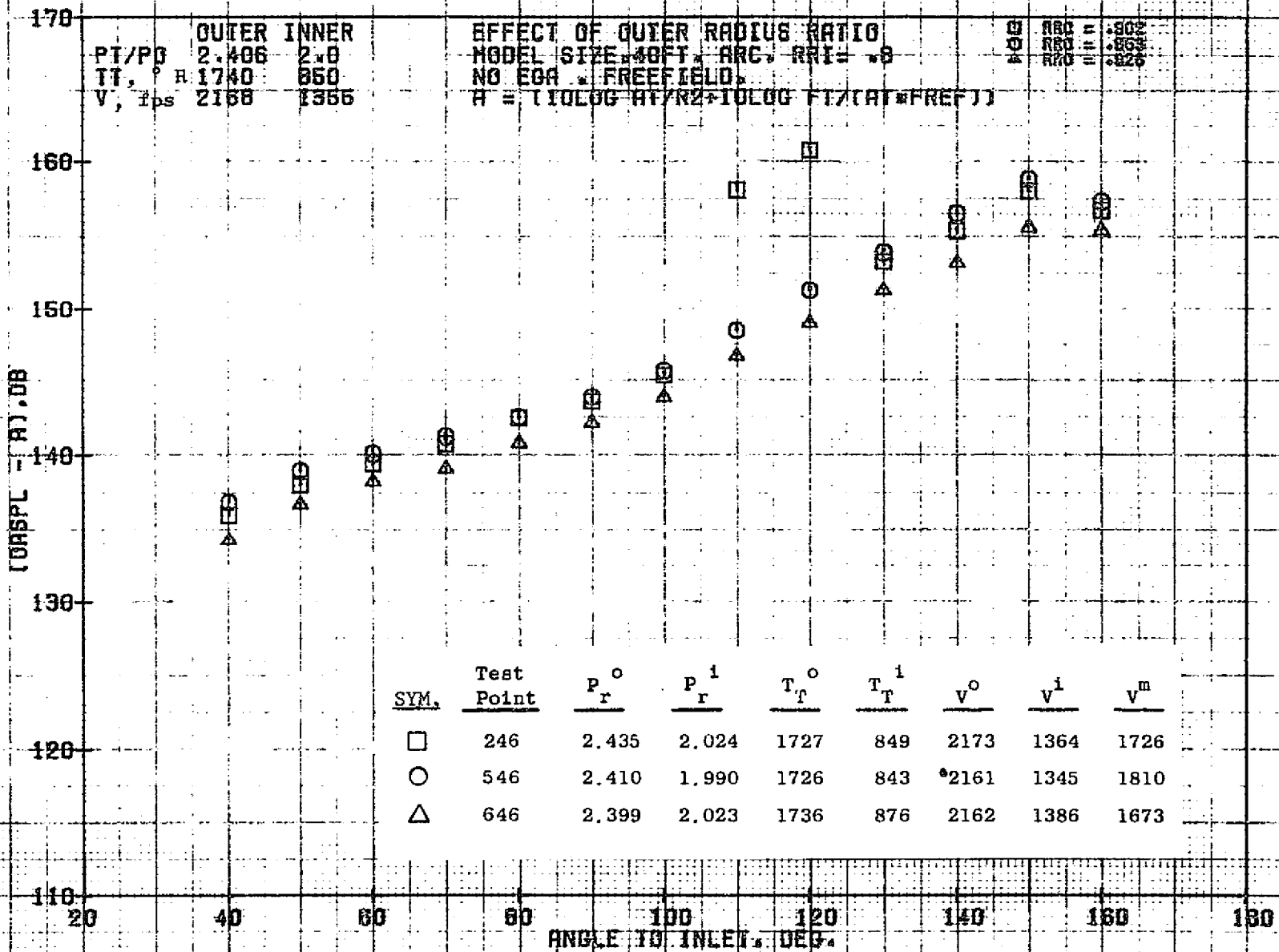
73KOLLSTEDT



921

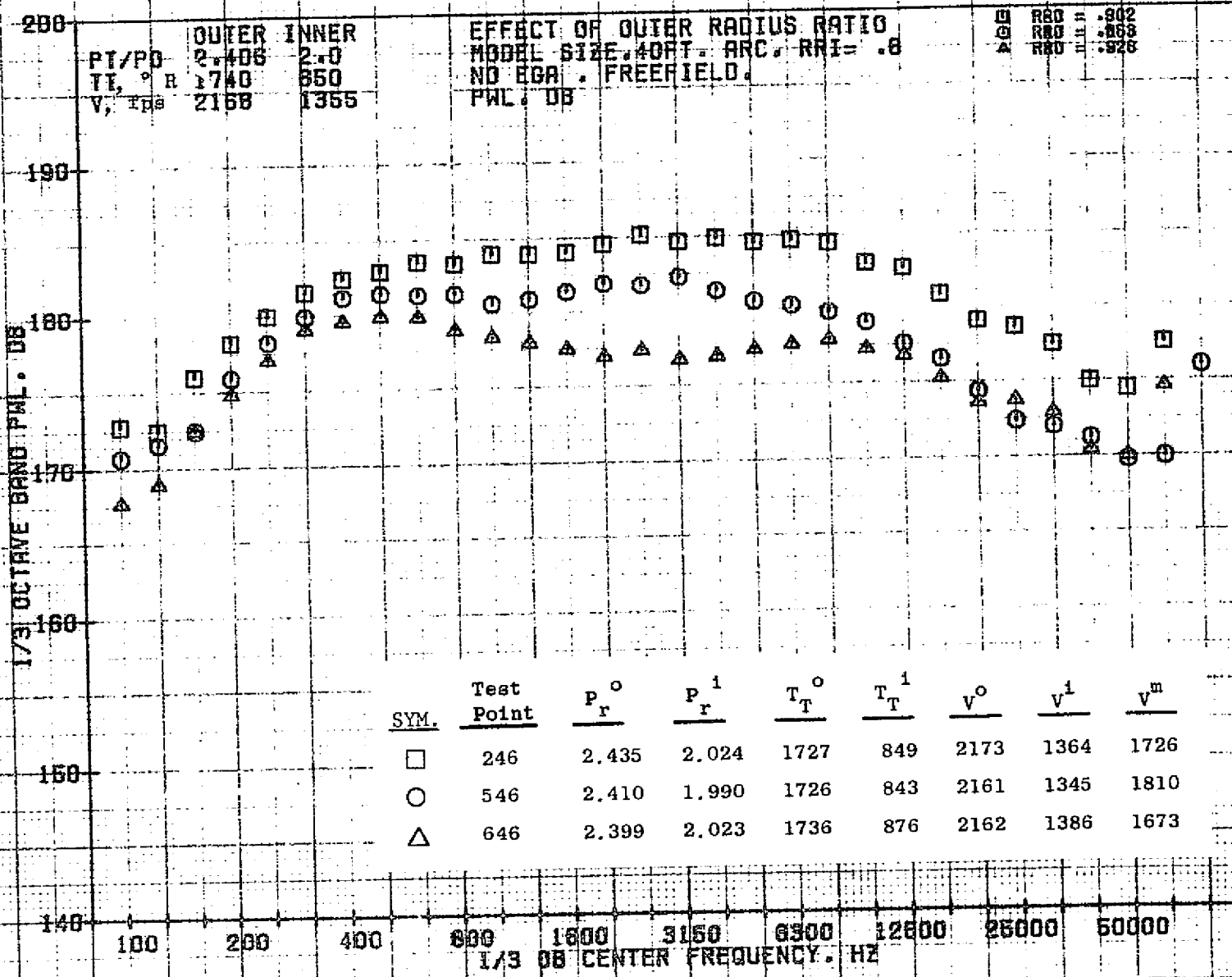
10/29/76
18124-001

79 BURCH A.



10/27/76
1X824-001

73KOLLSTEDT



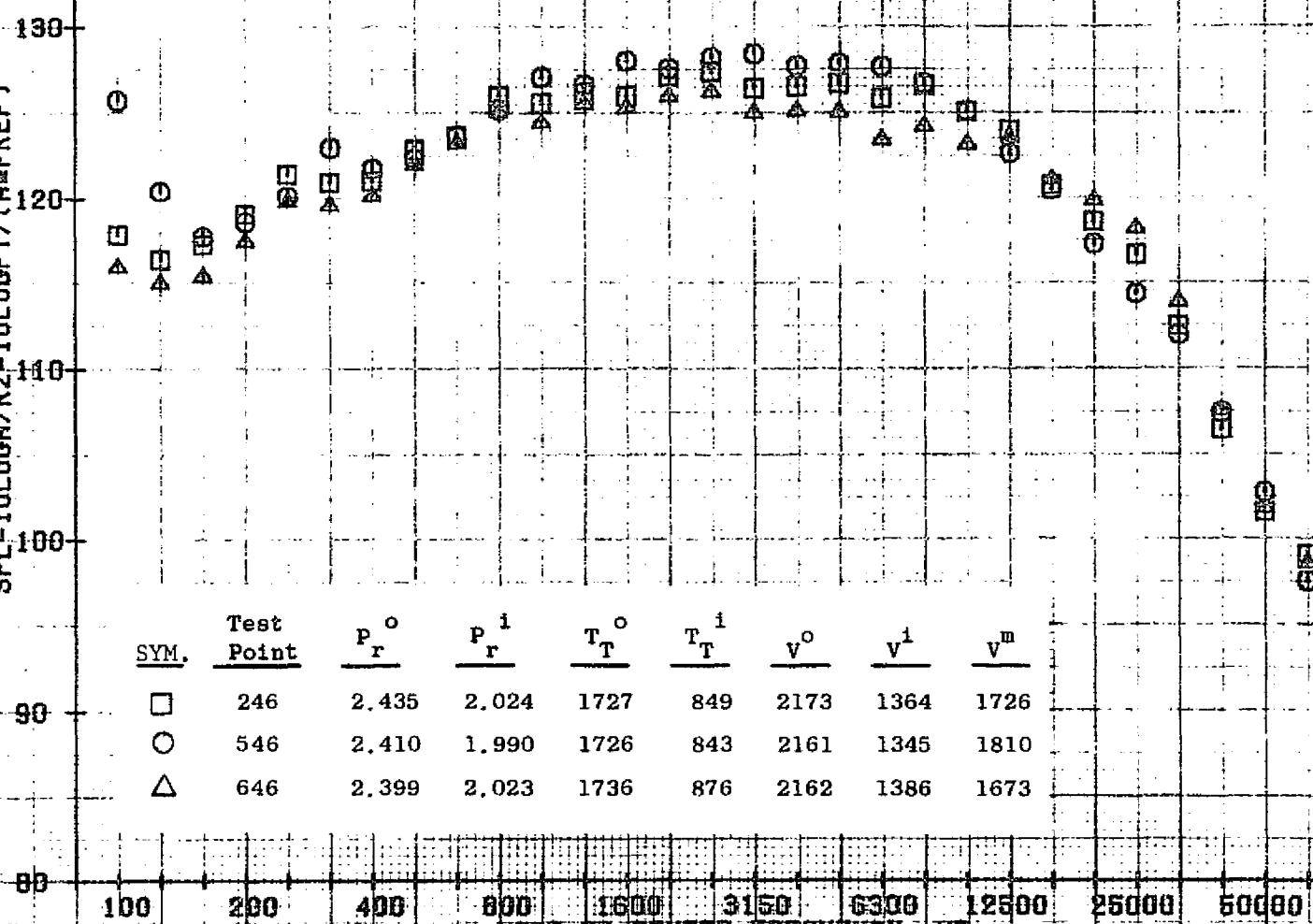
10/27/76
1X824-001

73KOLLSTEDT

924

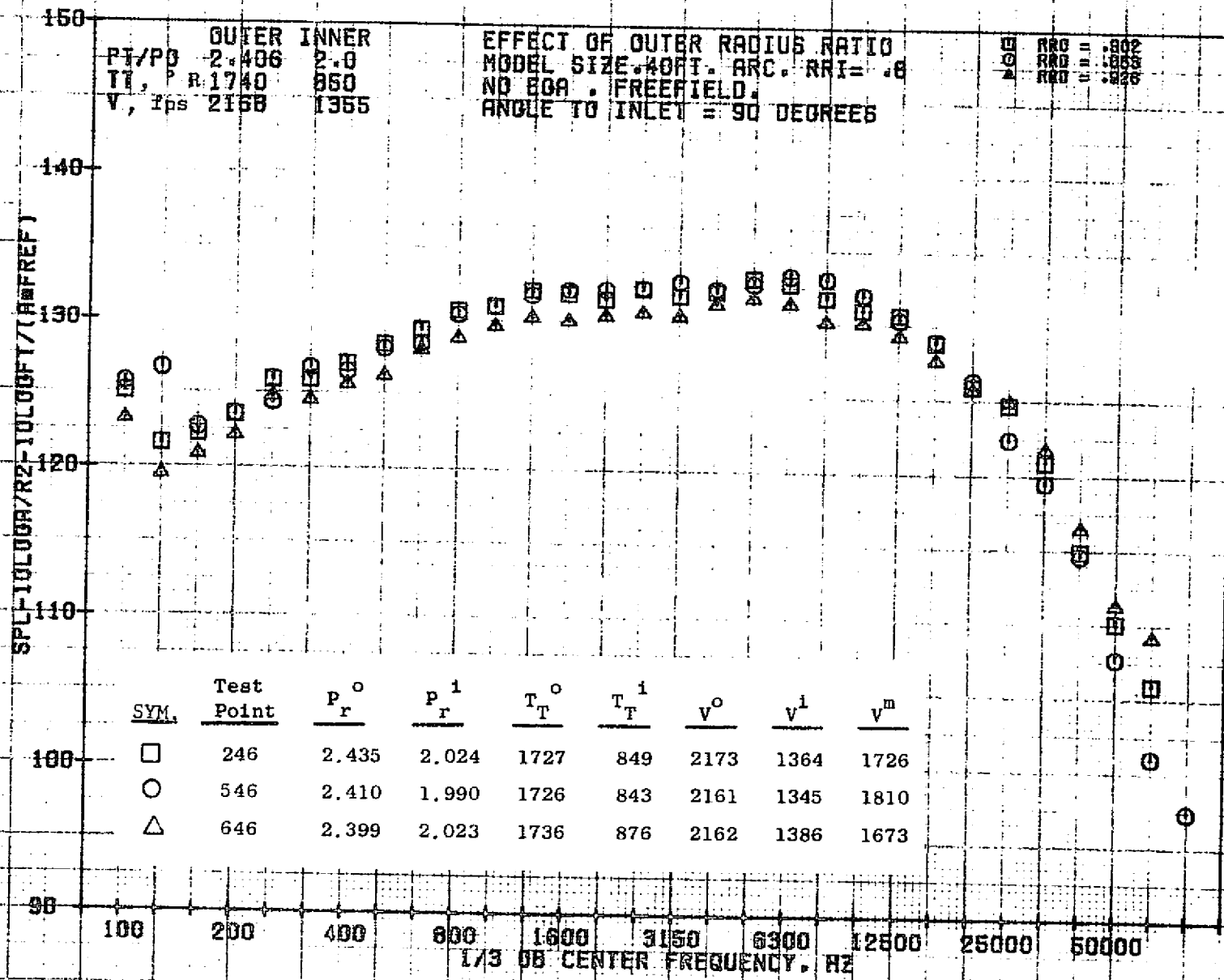
PT/PO OUTER INNER
 TT, ° R 1740 860
 V, fps 2168 1366
 EFFECT OF OUTER RADIUS RATIO
 MODEL SIZE 10 FT. ARC. RAT. = 8
 NO. EGA. FREEFIELD.
 ANGLE TO INLET = 60 DEGREES
 RAO: 11.802
 RAO: 11.802
 RAO: 11.802

SPL - 10 LOG (P/R²) - 10 LOG (V²/A) + 10 LOG (A/FREF)



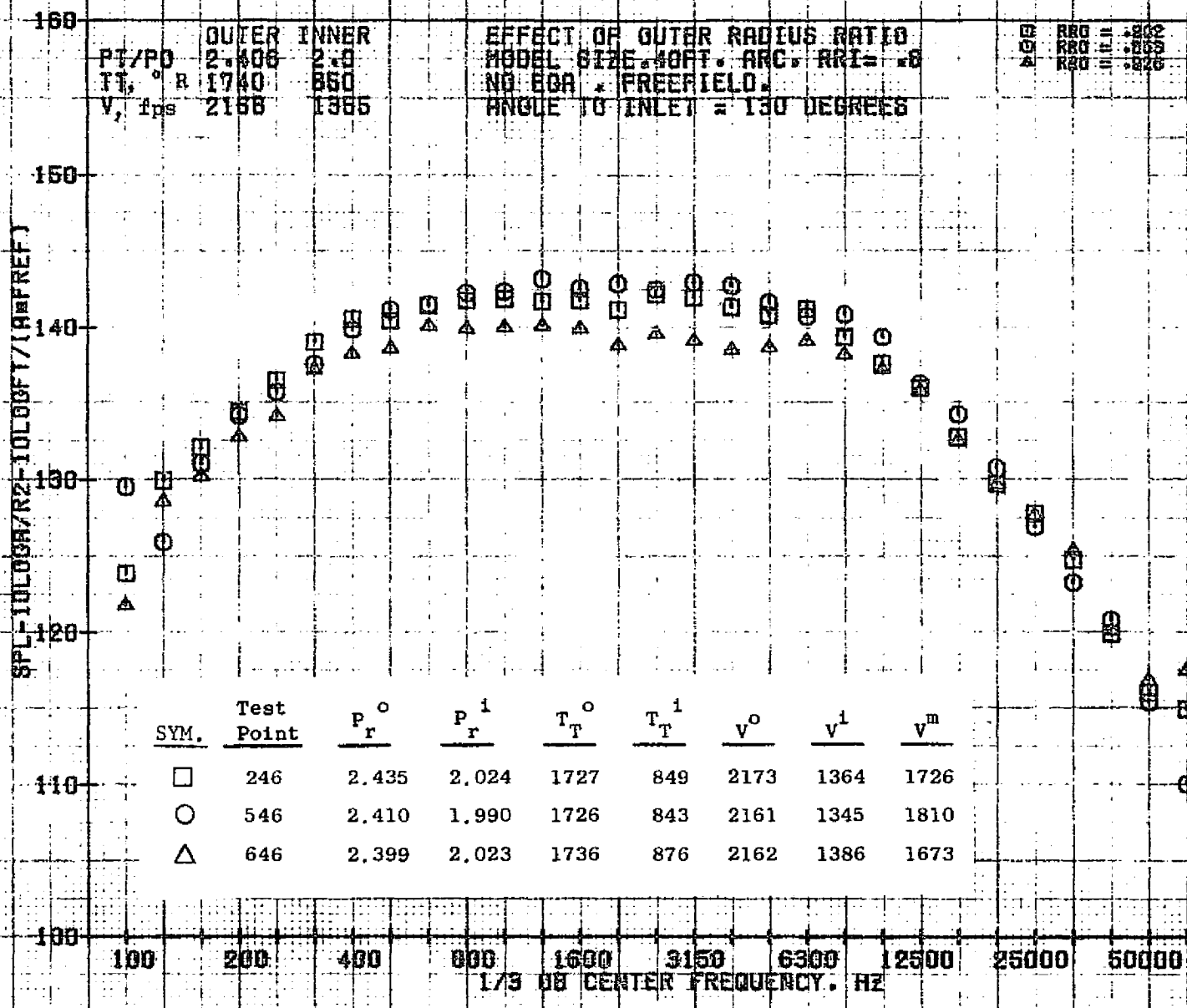
10/27/76
1X824-001

73KOLLSTEDT



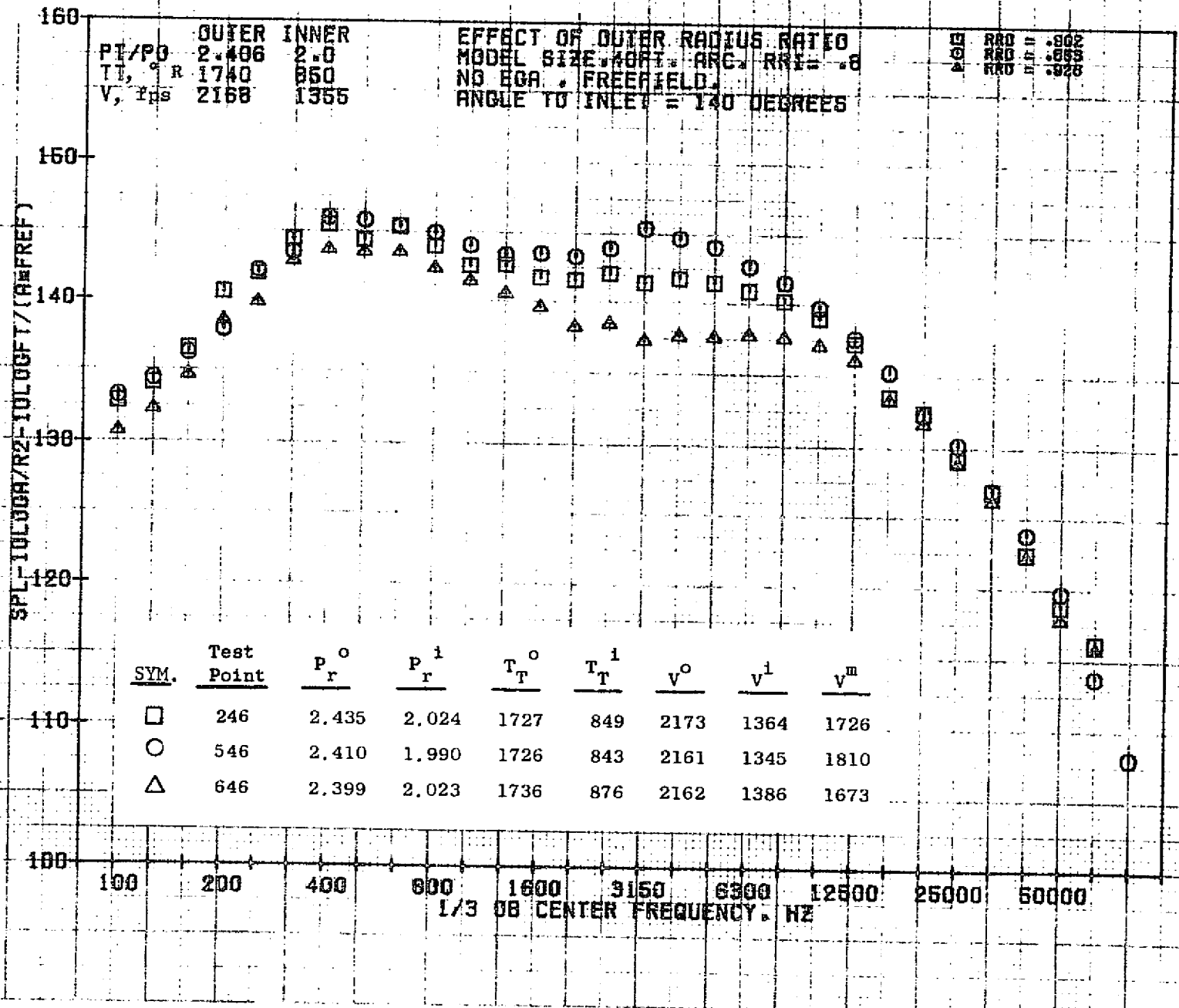
10/27/76
1X824-001

73KOLLSTEDT



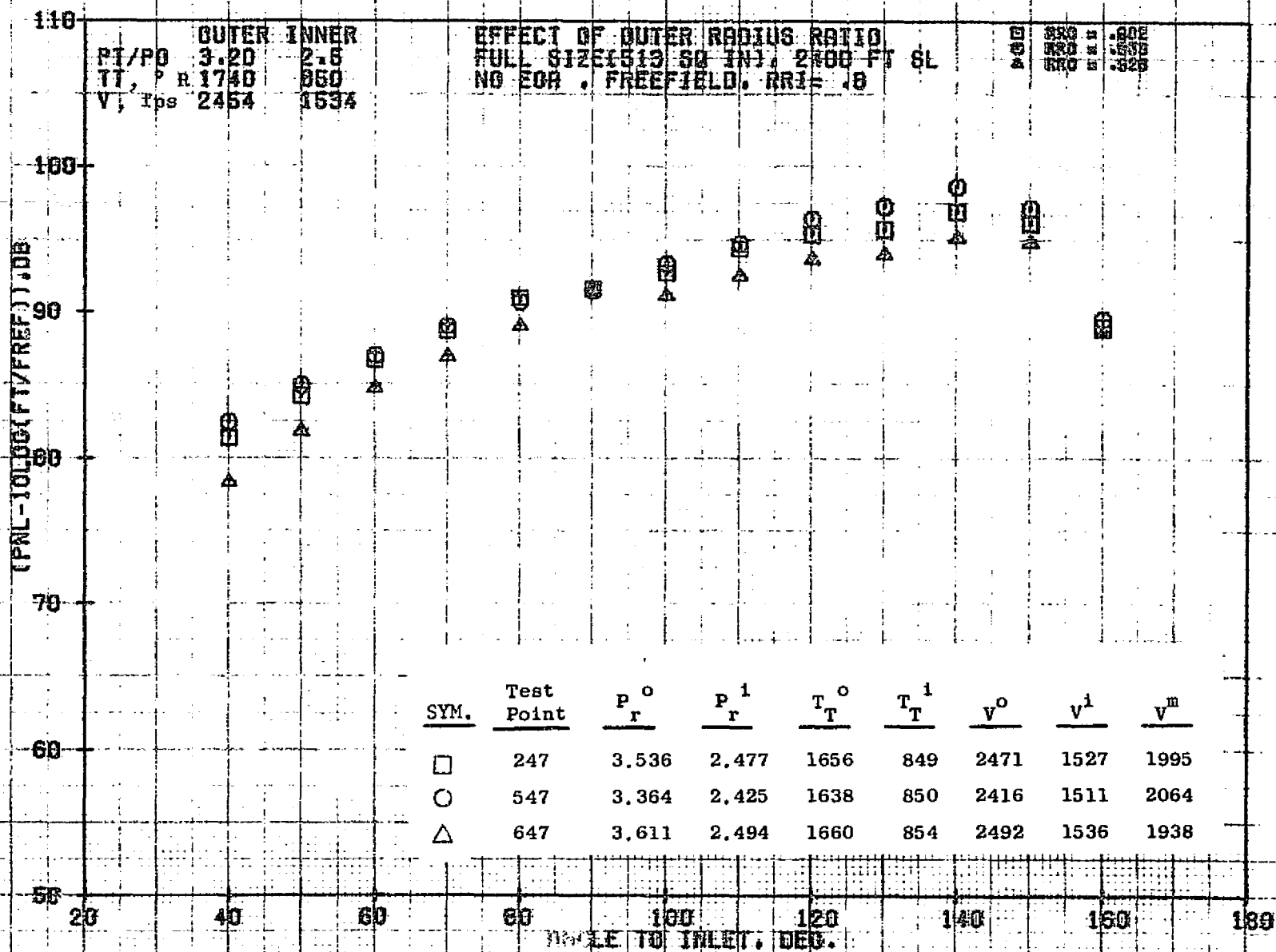
10/27/76
1X824-001

73KOLLSTEDT



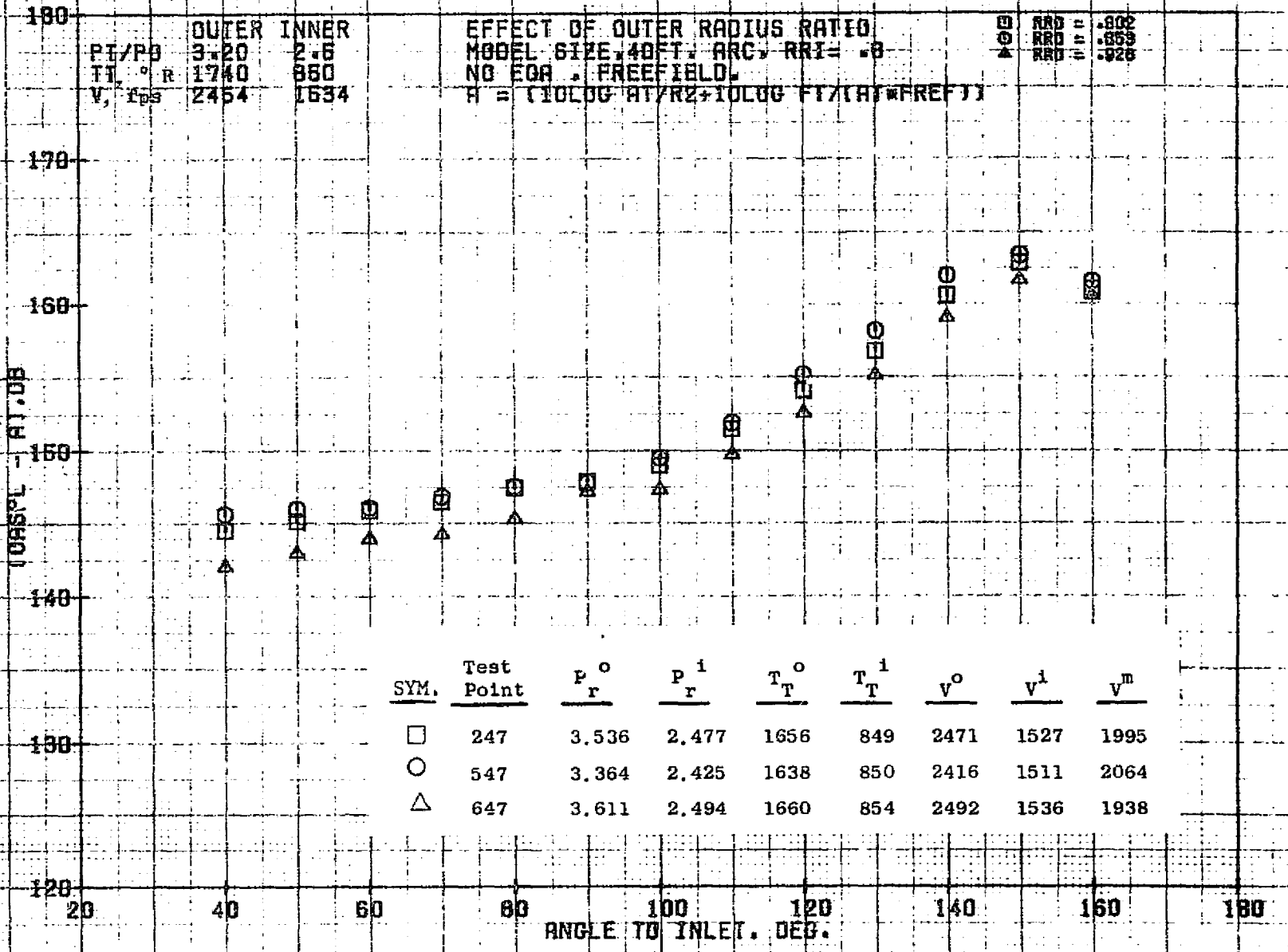
10/27/76
1X824-001

73KOLLSTEDT



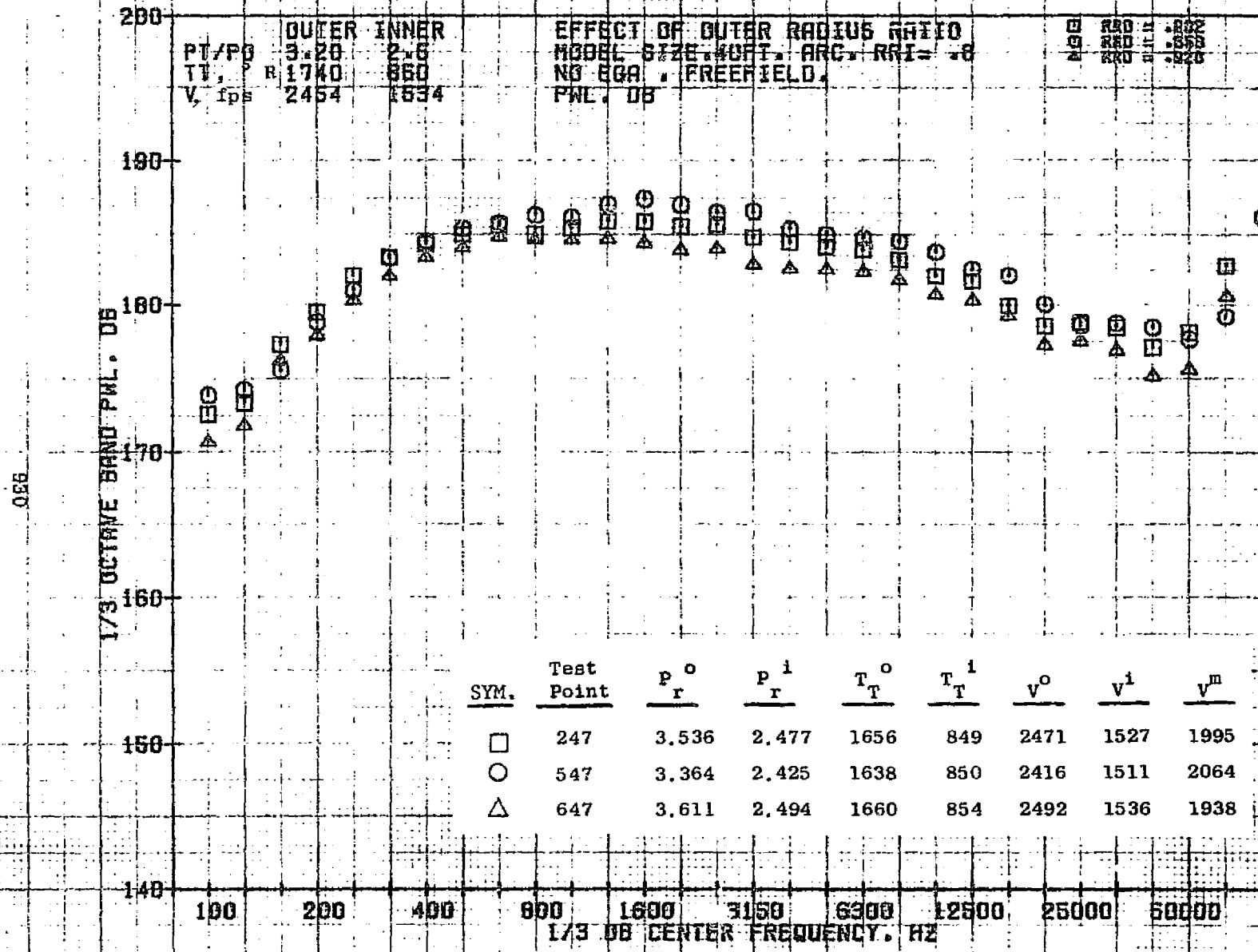
10/29/76
18124-001

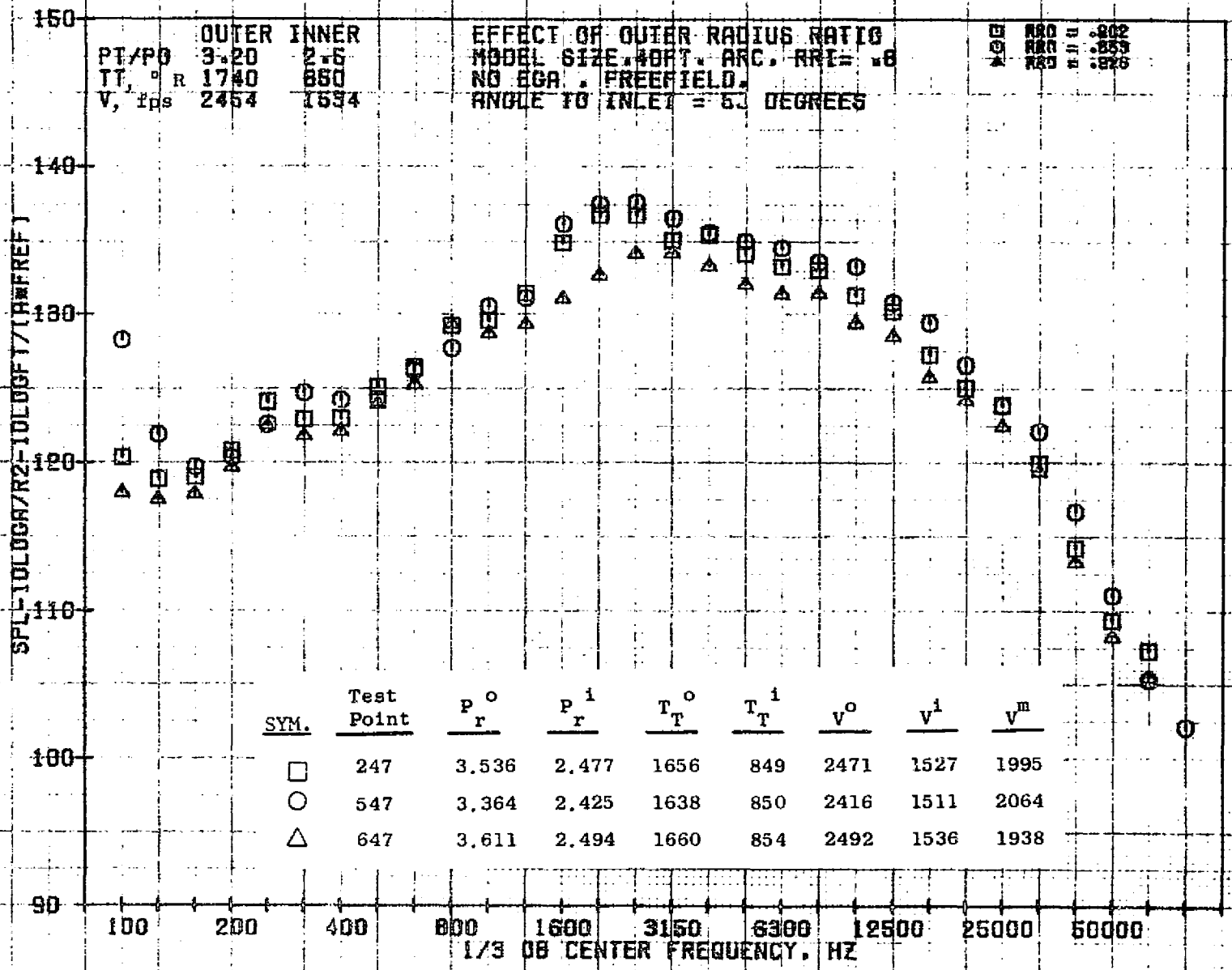
79 BURCH A.



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1X824-001

73KOLLSTEDT





10/27/76
1X824-001

73KOLLSTEDT

150
 140
 130
 120
 110
 100
 90

OUTER INNER
 PI/PO 3.20 2.5
 TT, ° R 1740 850
 V, fps 2454 1534

EFFECT OF OUTER RADIUS RATIO
 MODEL SIZE 40FT. ARC, RRI = .6
 NO ECA, FREEFIELD,
 ANGLE TO INLET = 90 DEGREES

□ RRI = .802
 ○ RRI = .853
 △ RRI = .826

SPL-10LOGR/REF-10LOGF/(A=FREEF)

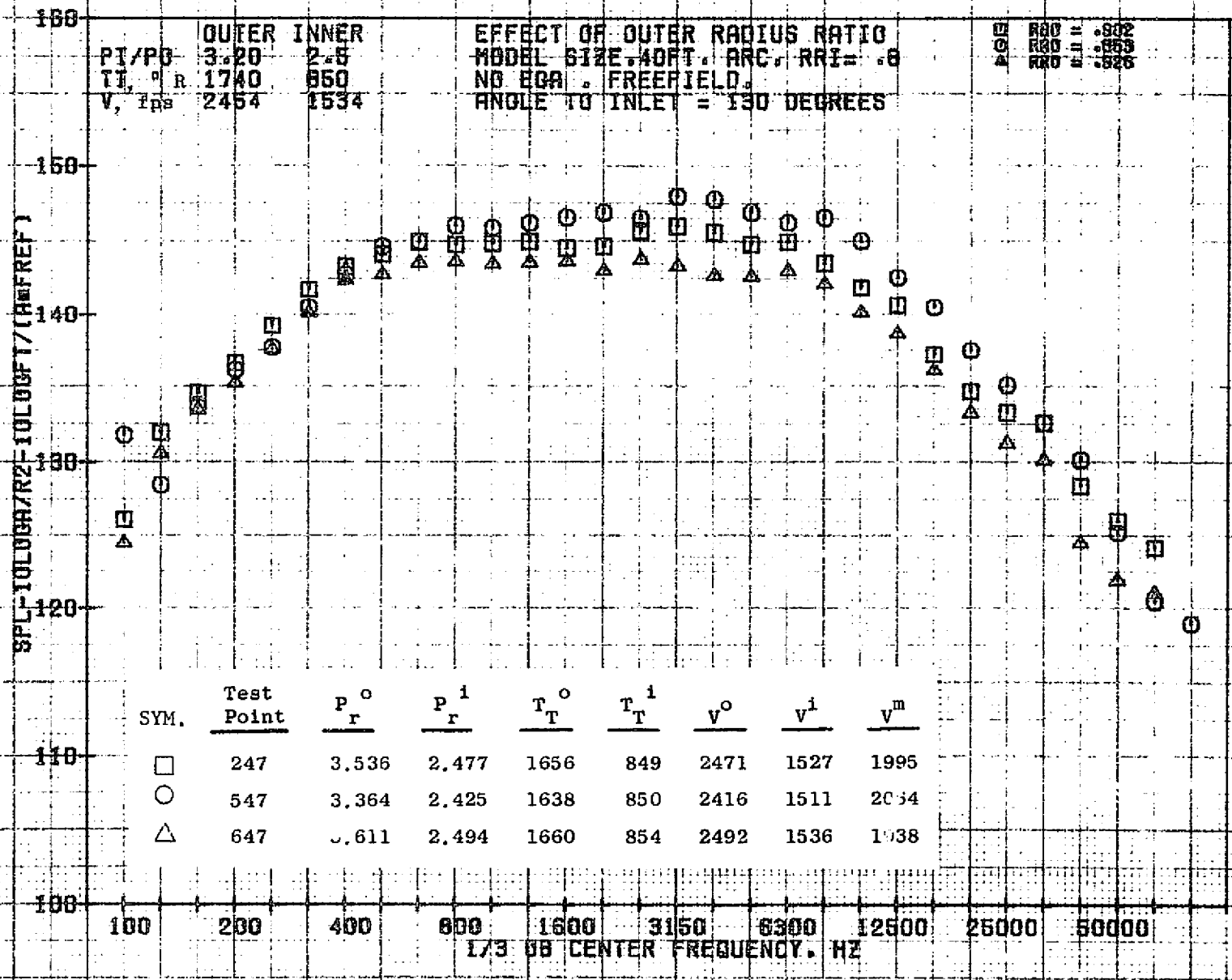
986

SYM.	Test Point	P_r^o	P_r^i	T_T^o	T_T^i	V^o	V^i	V^m
□	247	3.536	2.477	1656	849	2471	1527	1995
○	547	3.364	2.425	1638	850	2416	1511	2064
△	647	3.611	2.494	1660	854	2492	1536	1938

98
 100 200 400 800 1600 3150 6300 12500 25000 50000
 1/3 OCT CENTER FREQUENCY, HZ

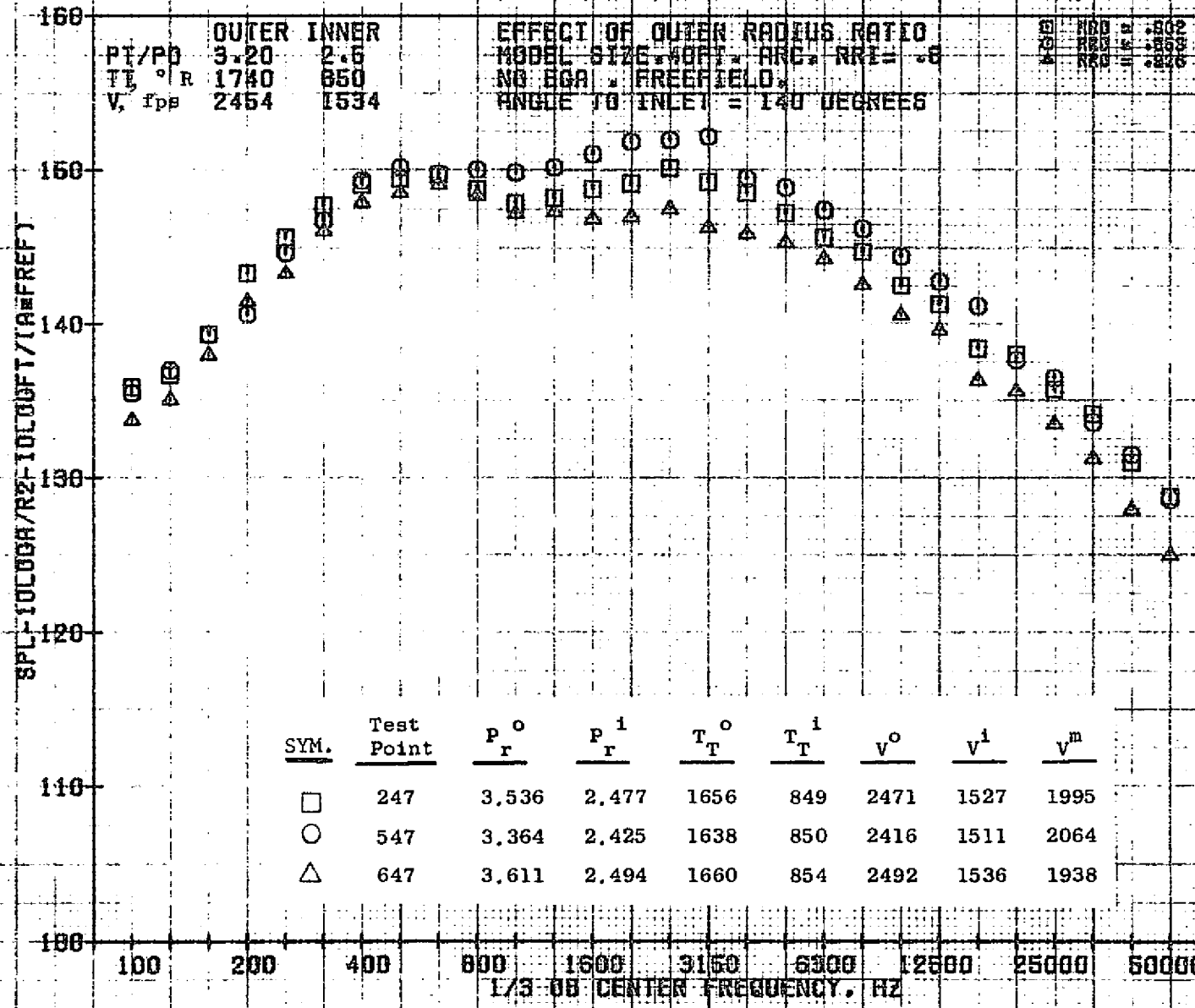
10/27/76
1X824-001

73KOLLSTEDT



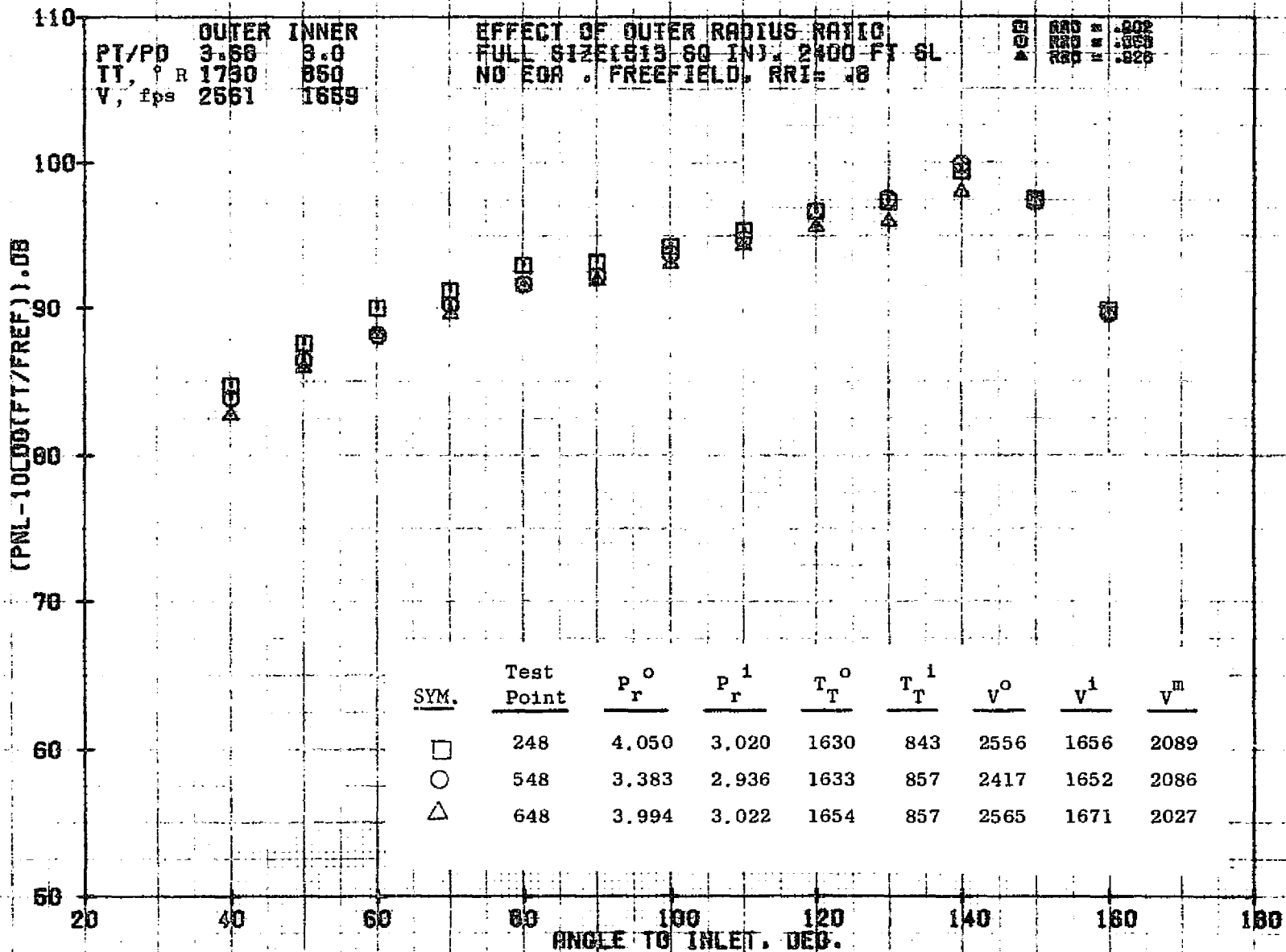
10/27/76
1X824-001

73KOLI STEDT



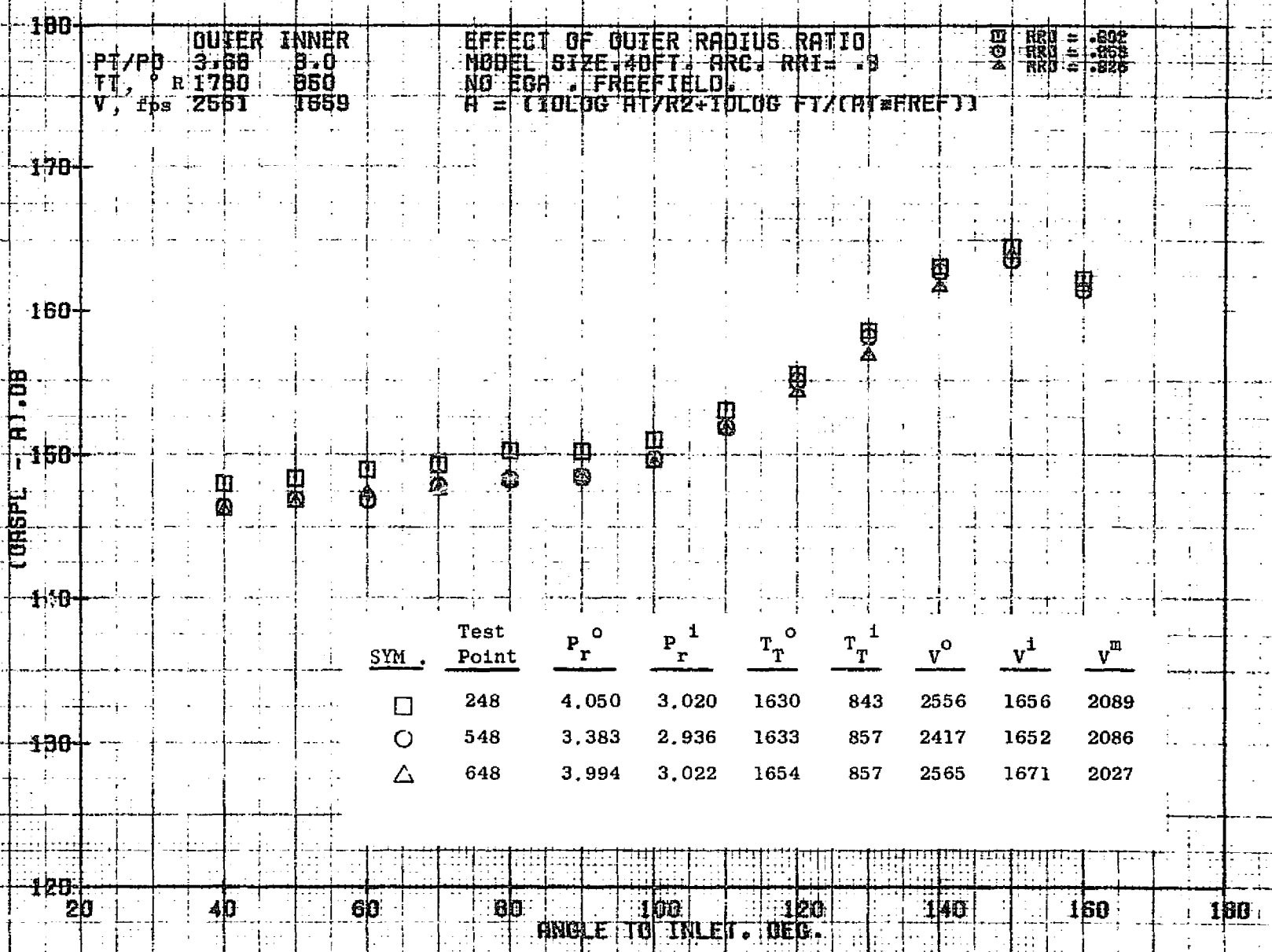
10/27/76
 1X824-001

73KOLLSTEDT



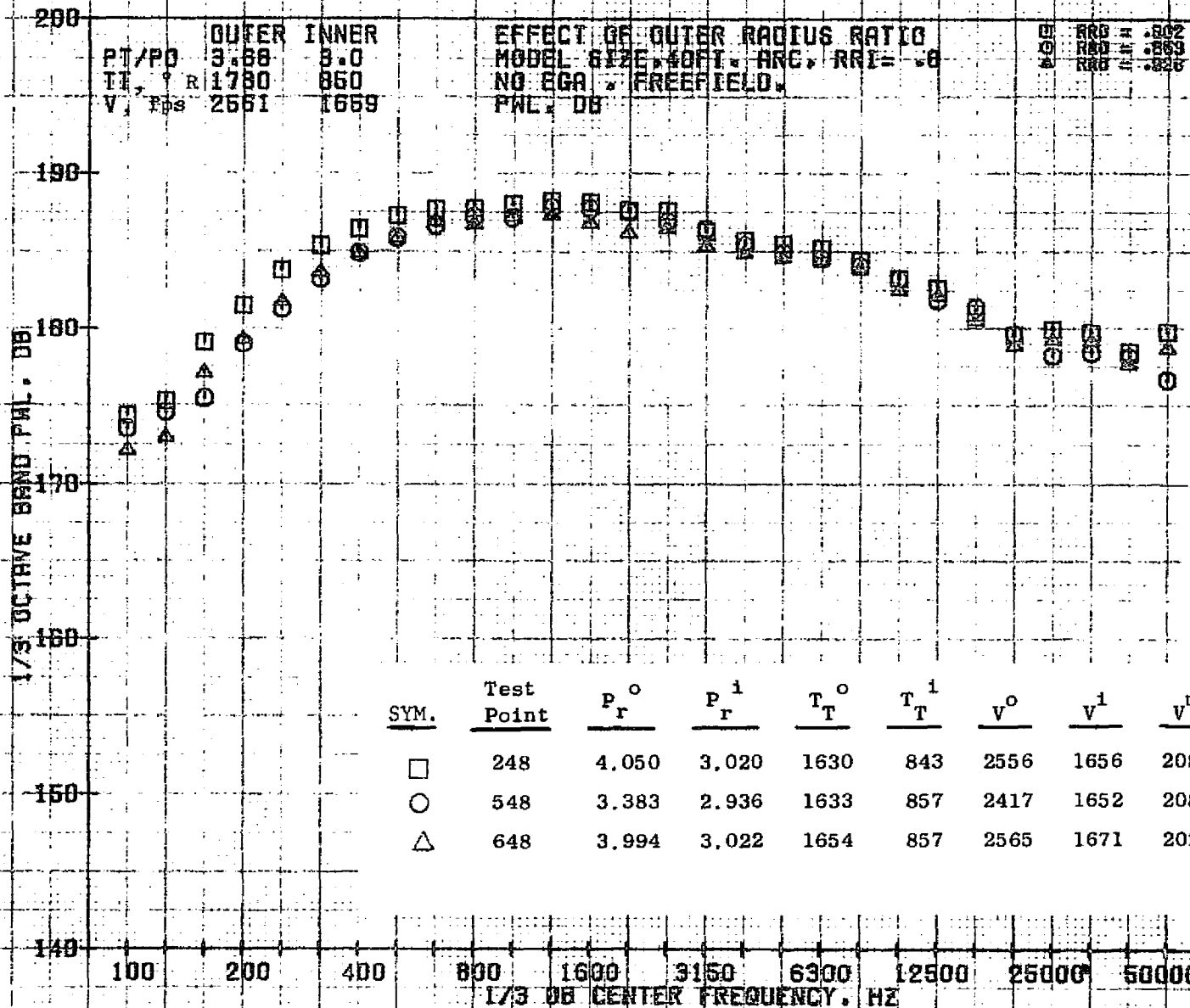
10/29/78
 18124-001

79 BURCH A.



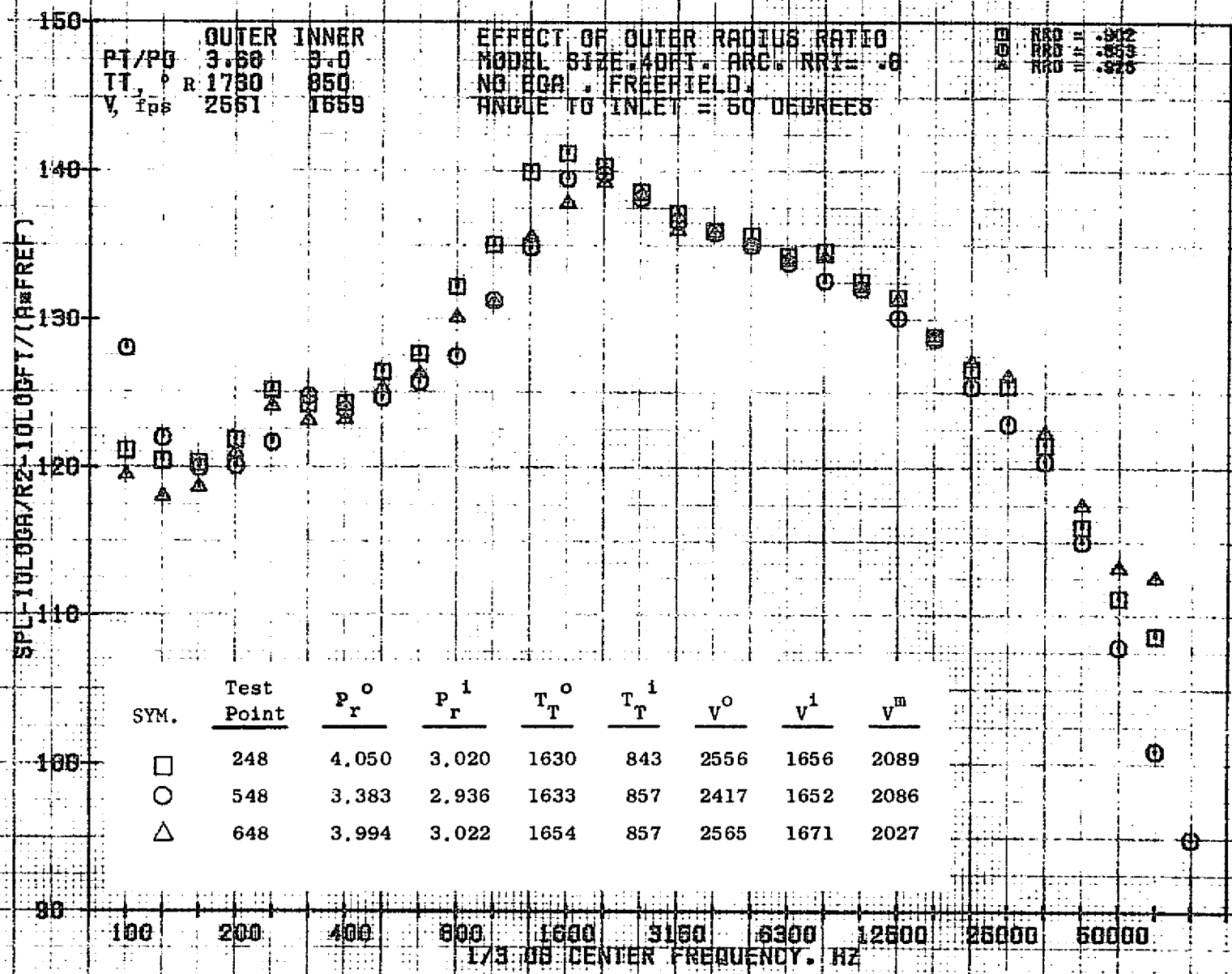
10/27/76
1X824-001

73KOLLSTEDT



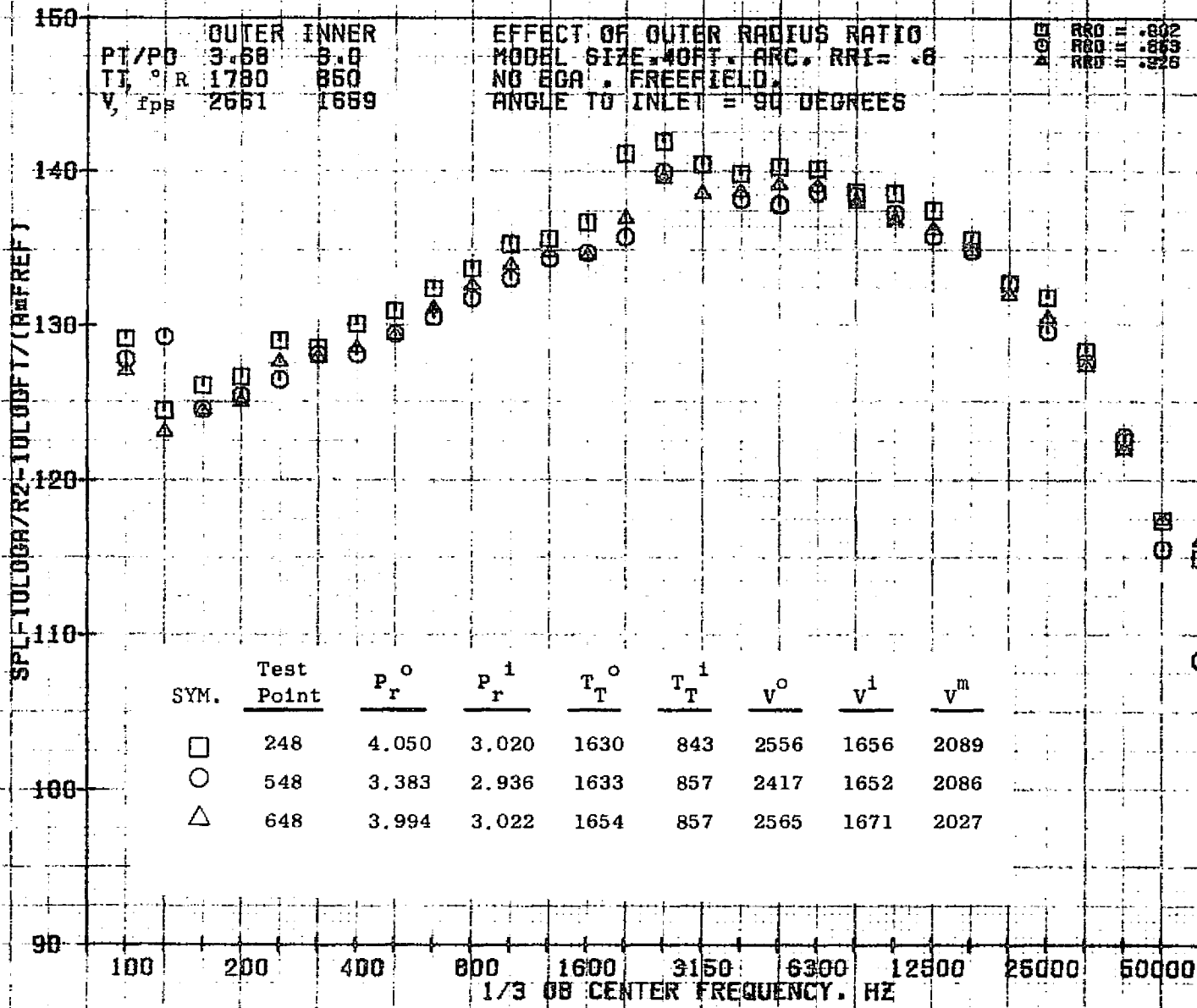
10/27/76
 1X824-001

73KOLLSTEDT

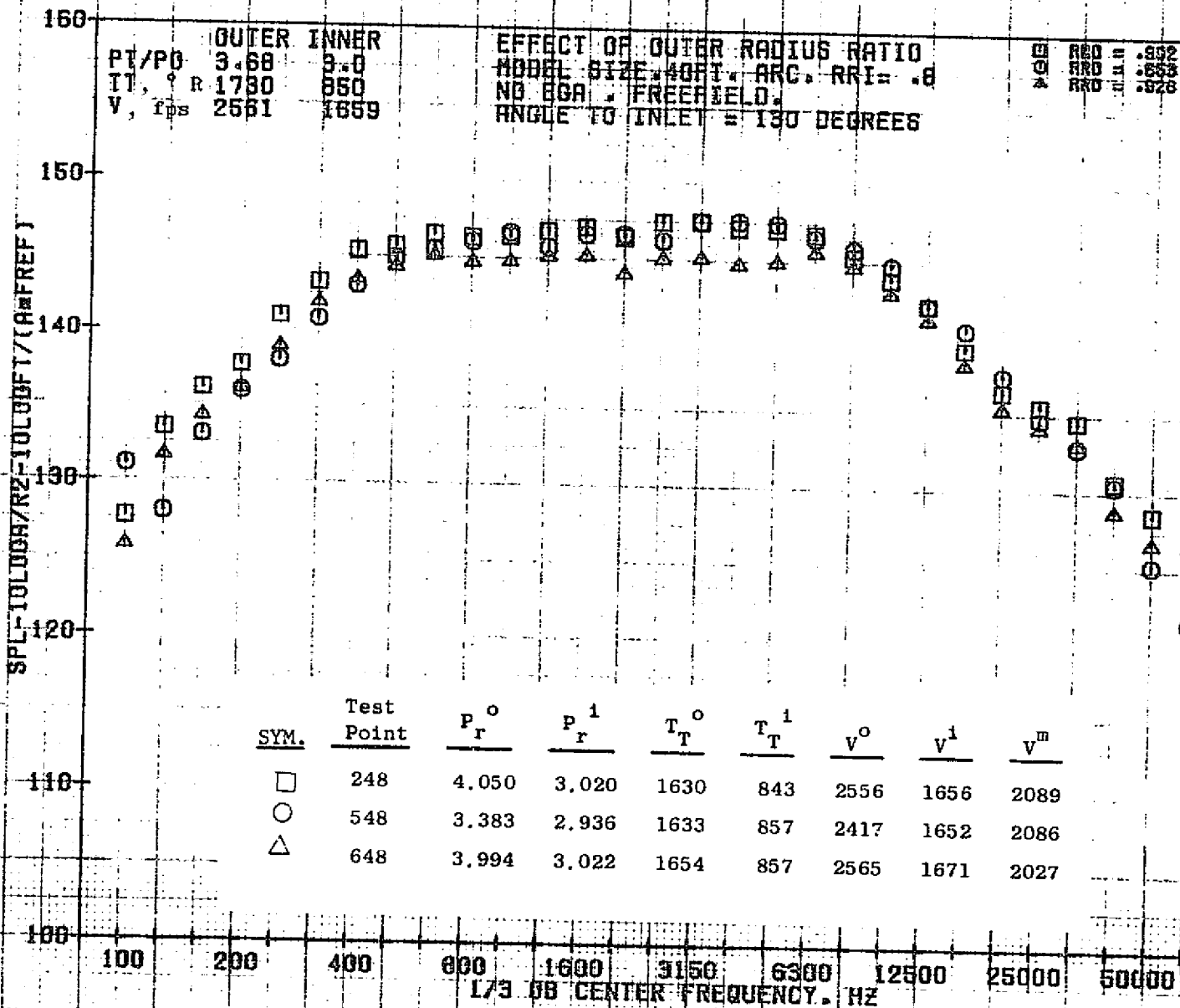


10/27/76
1X824-001

73KOLLSTEDT

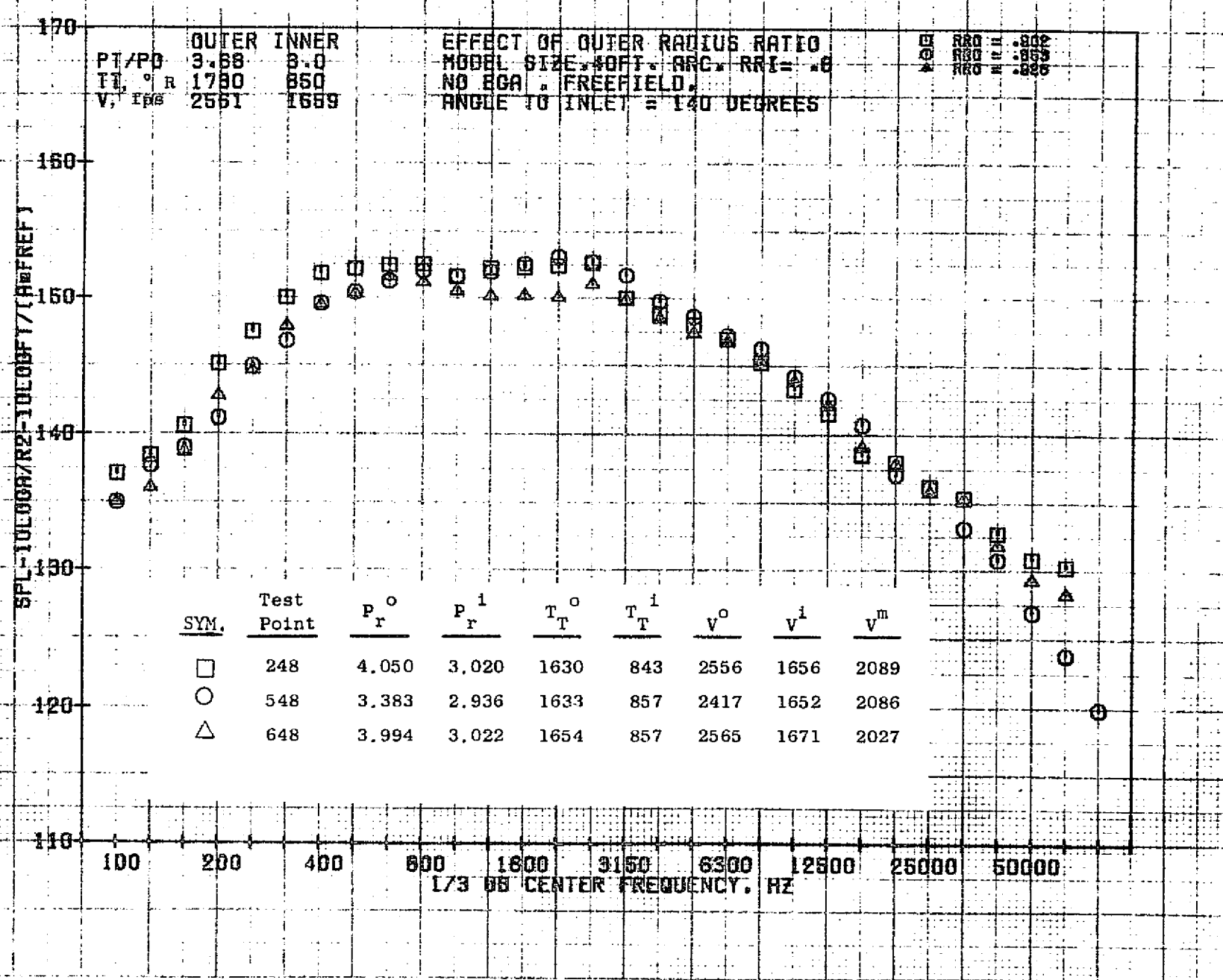


939



10/27/76
1X824-001

73KOLLSTEDT

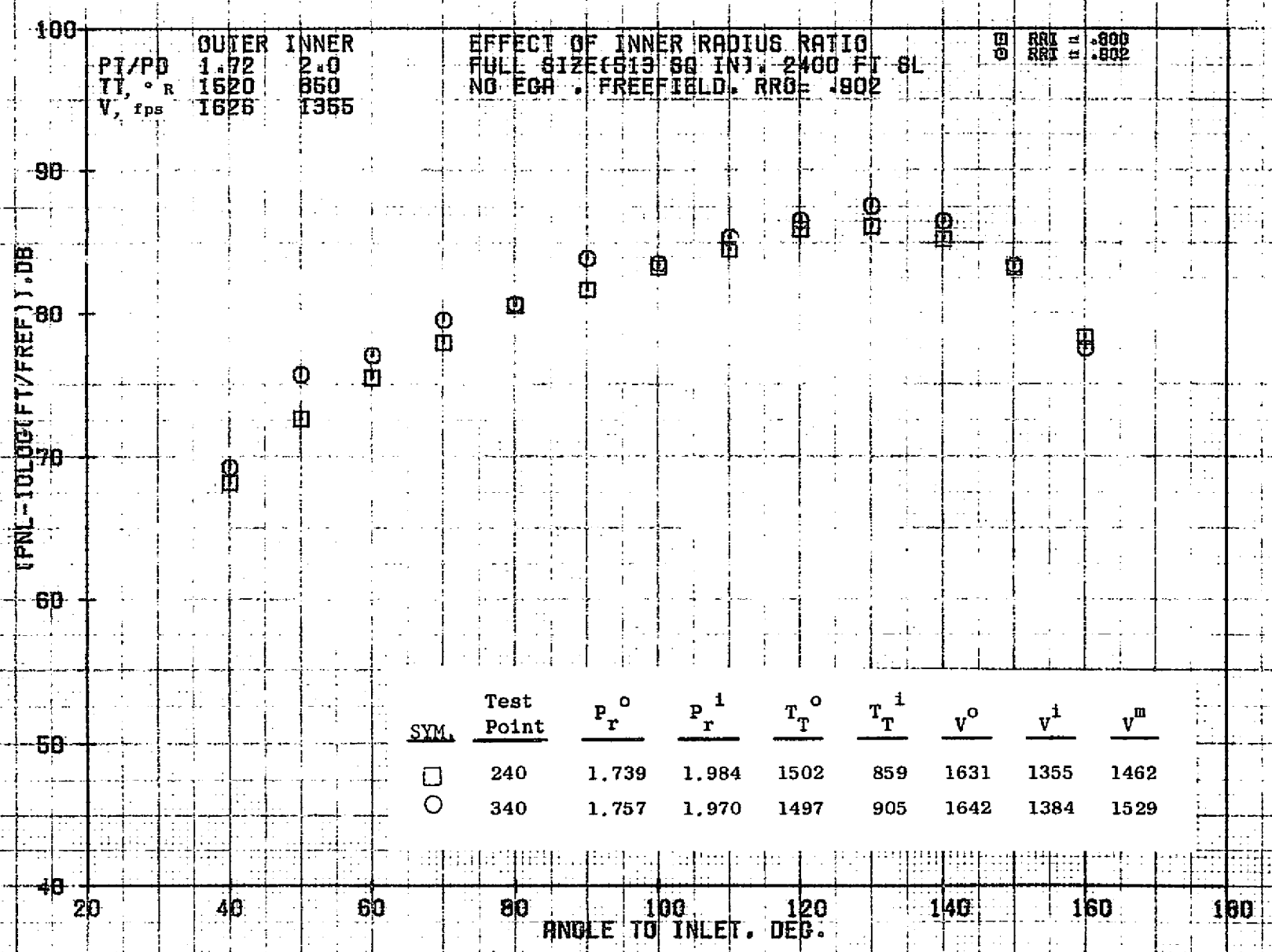


10/27/76
1X824-001

73KOLLSTEDT

7.4.2 Effect of Inner Radius Ratio

Configurations 2 and 3 have the same outer radius ratio (0.902) but different inner radius ratios, 0.800 and 0.902, respectively. The acoustic results are compared in this section. Configurations 5 and 7 are also compared. These two configurations have a 0.853 outer radius ratio and inner radius ratios of 0.800 and 0.902, respectively.



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18124-001

79 BURCH A.

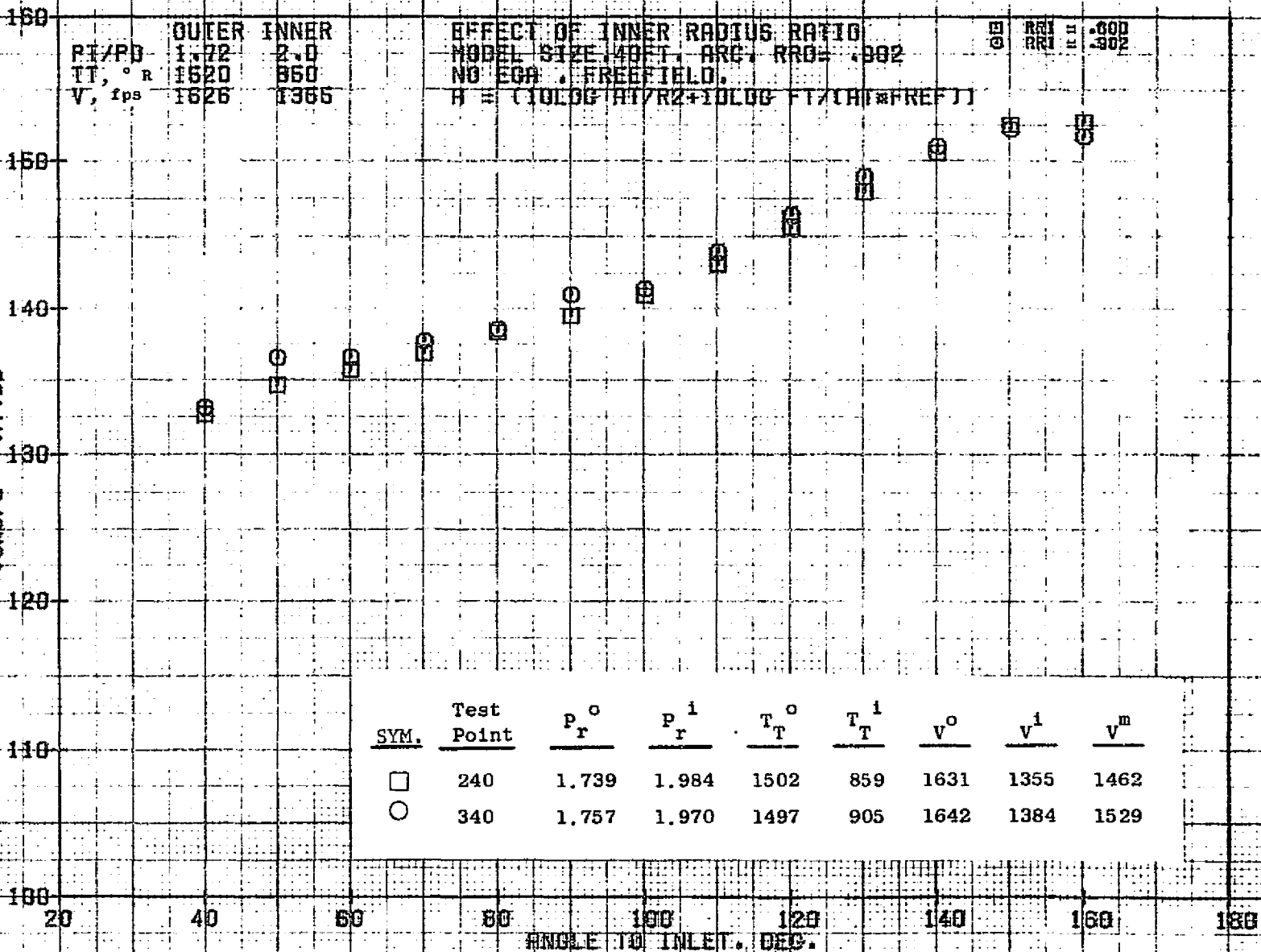
944

COASPL - (A).DB

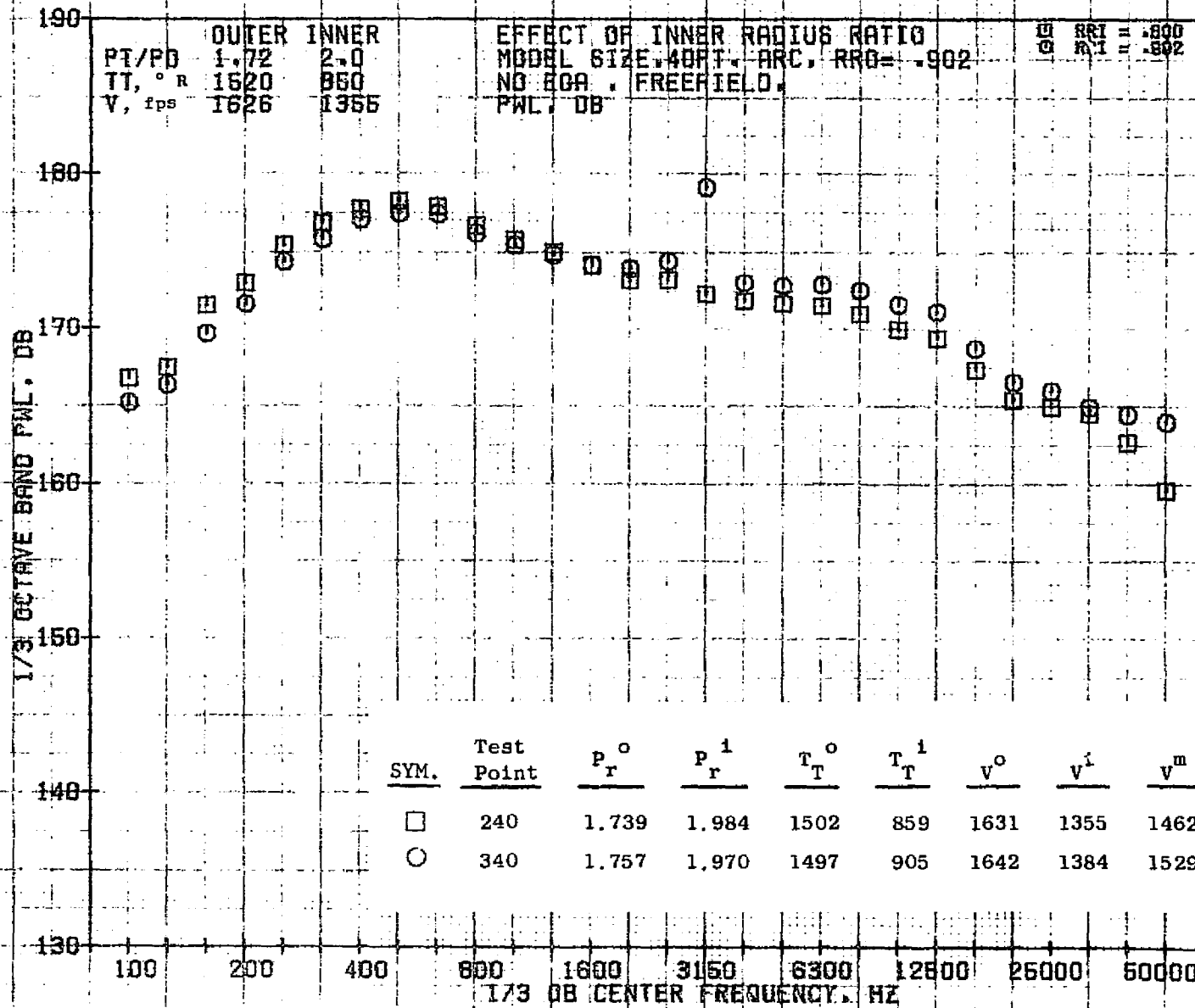
	OUTER	INNER
RT/RD	1.72	2.0
TT, ° R	1520	850
V, fps	1626	1385

EFFECT OF INNER RADIUS RATIO
 MODEL SIZE 140 FT. ARC. RROE .982
 NO ECA. FREEFIELD.
 $H = (10 \log RT/RD + 10 \log TT/TA) - FREQ$

RAI	1.000
ARI	1.302

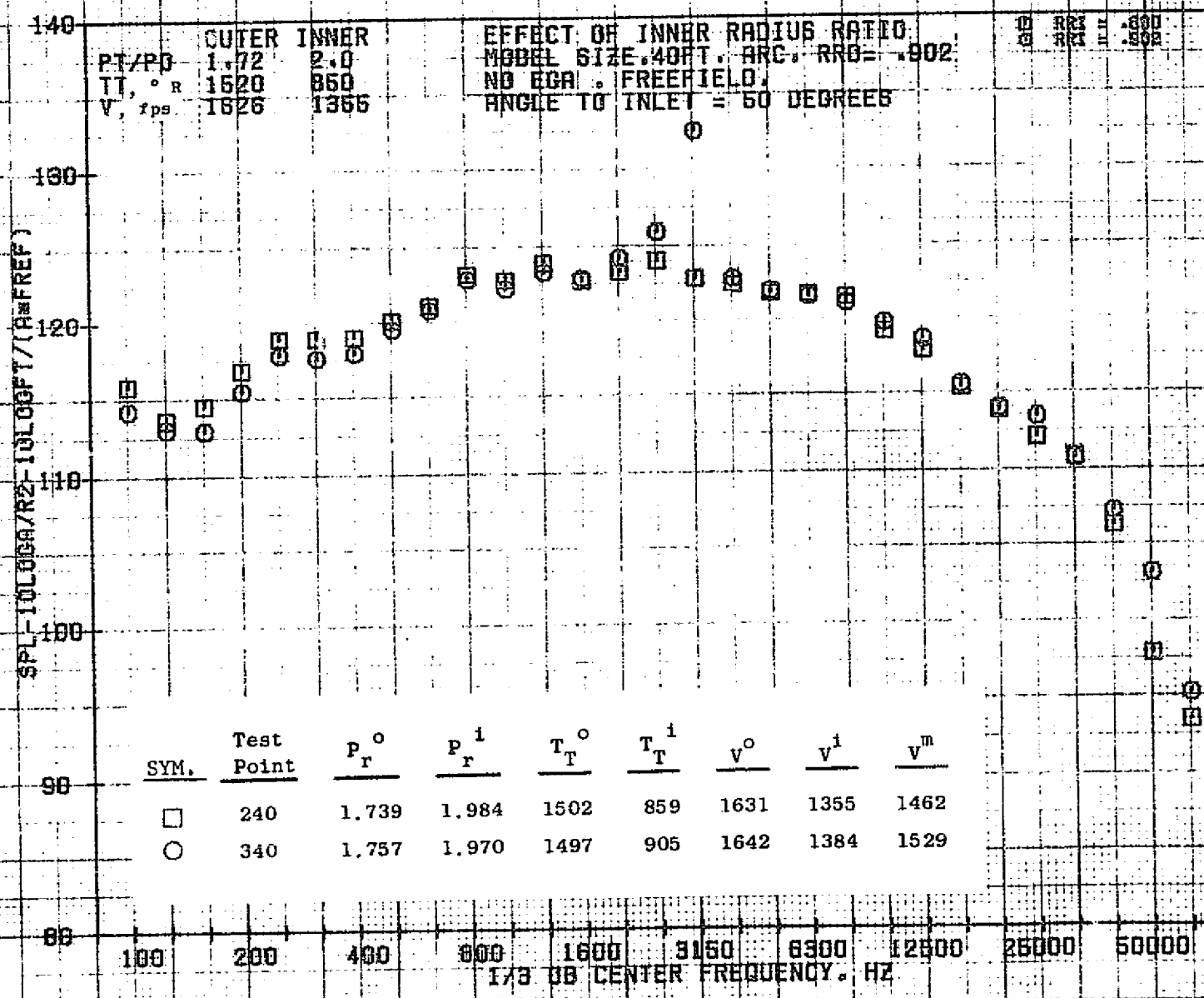


SYM.	Test Point	P_r^o	P_r^i	T_T^o	T_T^i	V^o	V^i	V^m
□	240	1.739	1.984	1502	859	1631	1355	1462
○	340	1.757	1.970	1497	905	1642	1384	1529



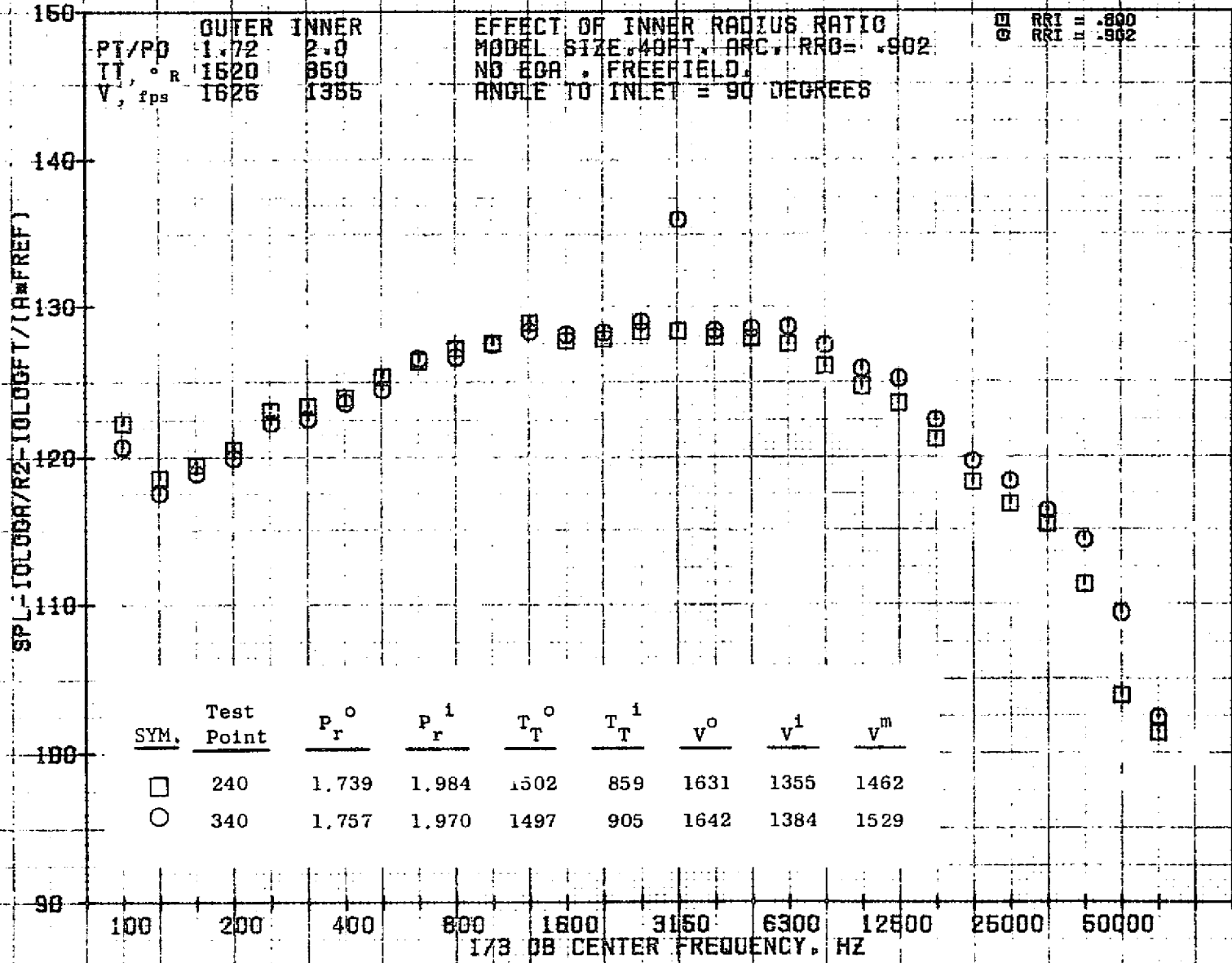
10/29/76
18161-001

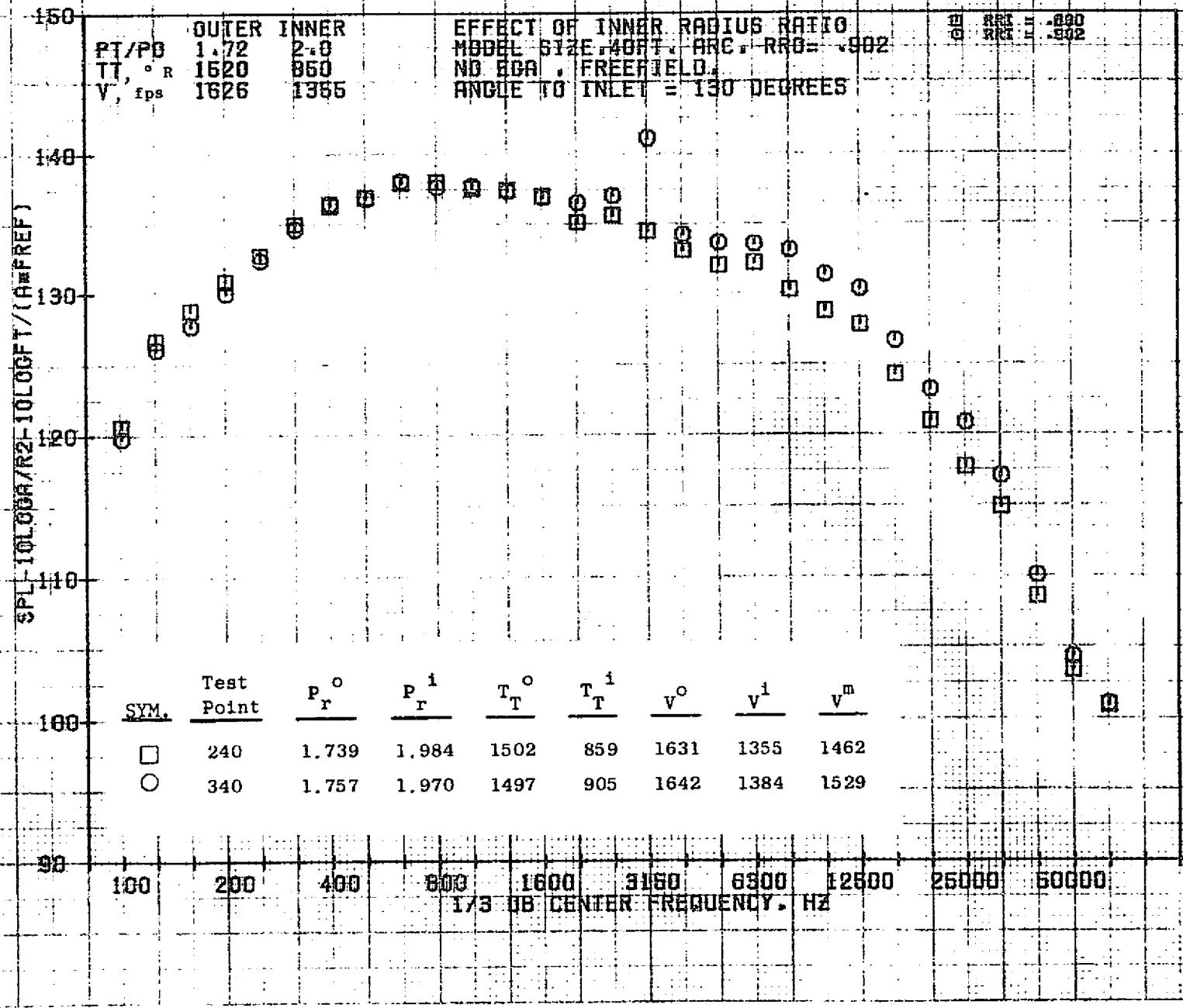
79 BURCH A.



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18161-001

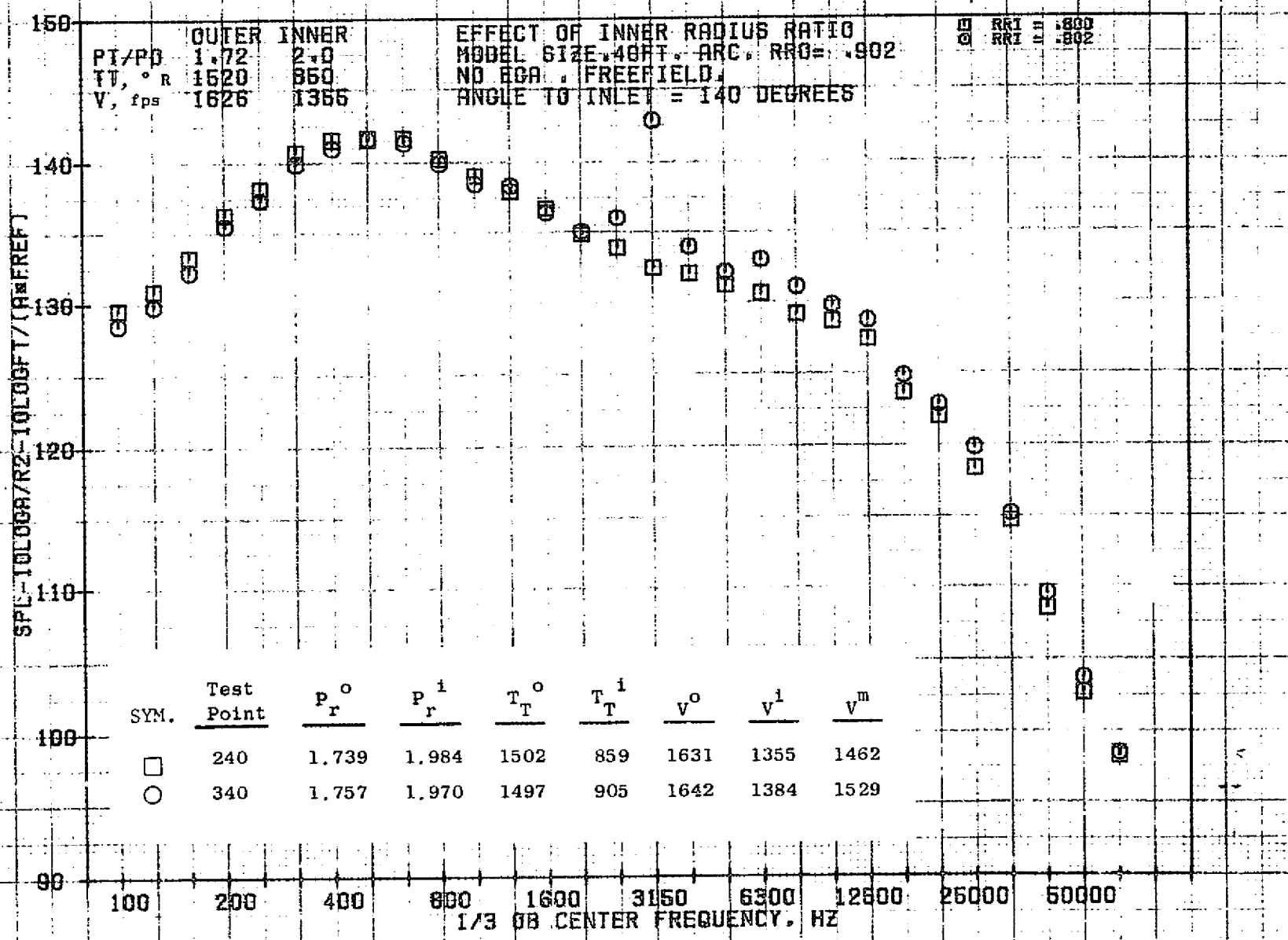
79 BURCH A.

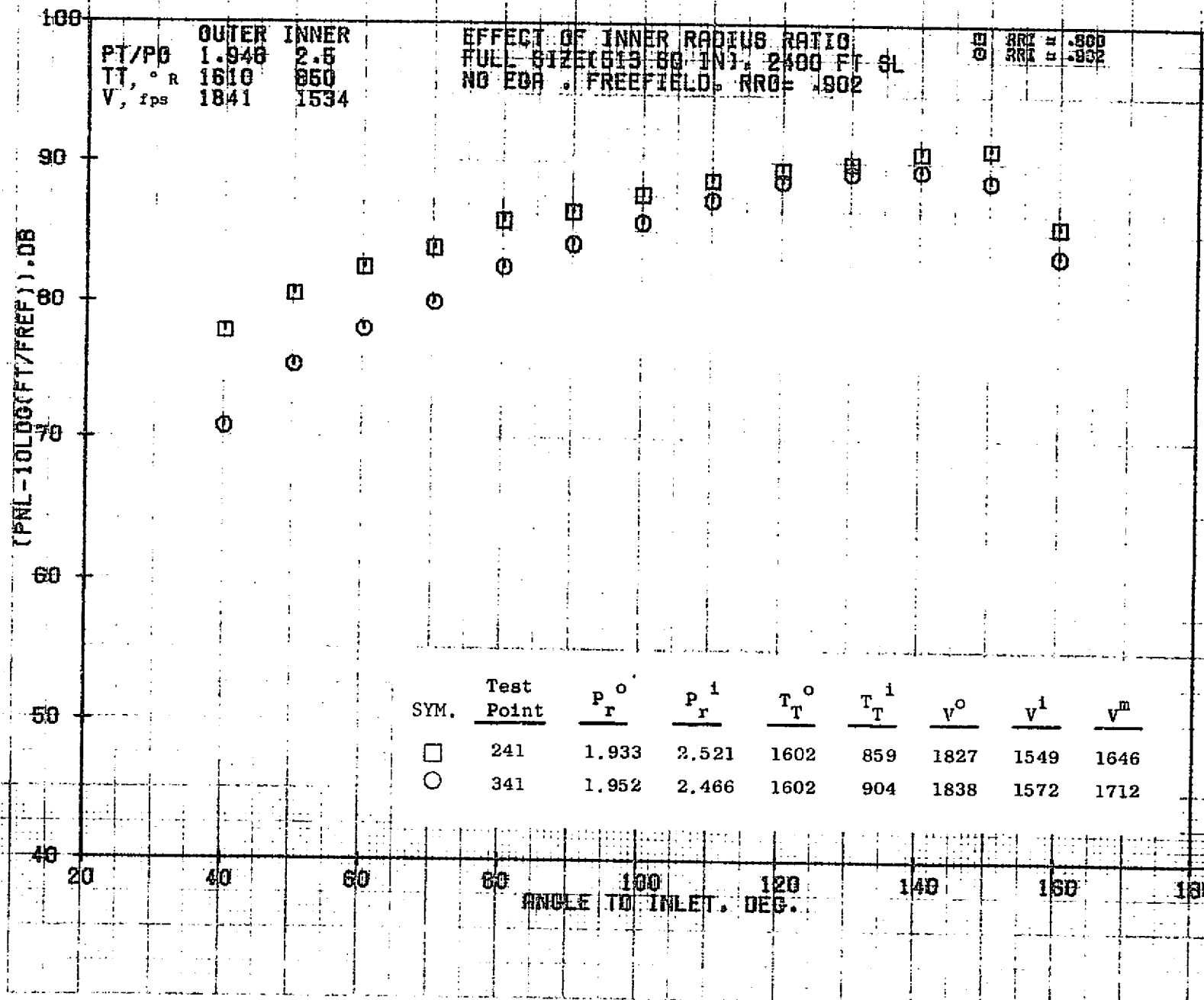




10/29/76
18161-001

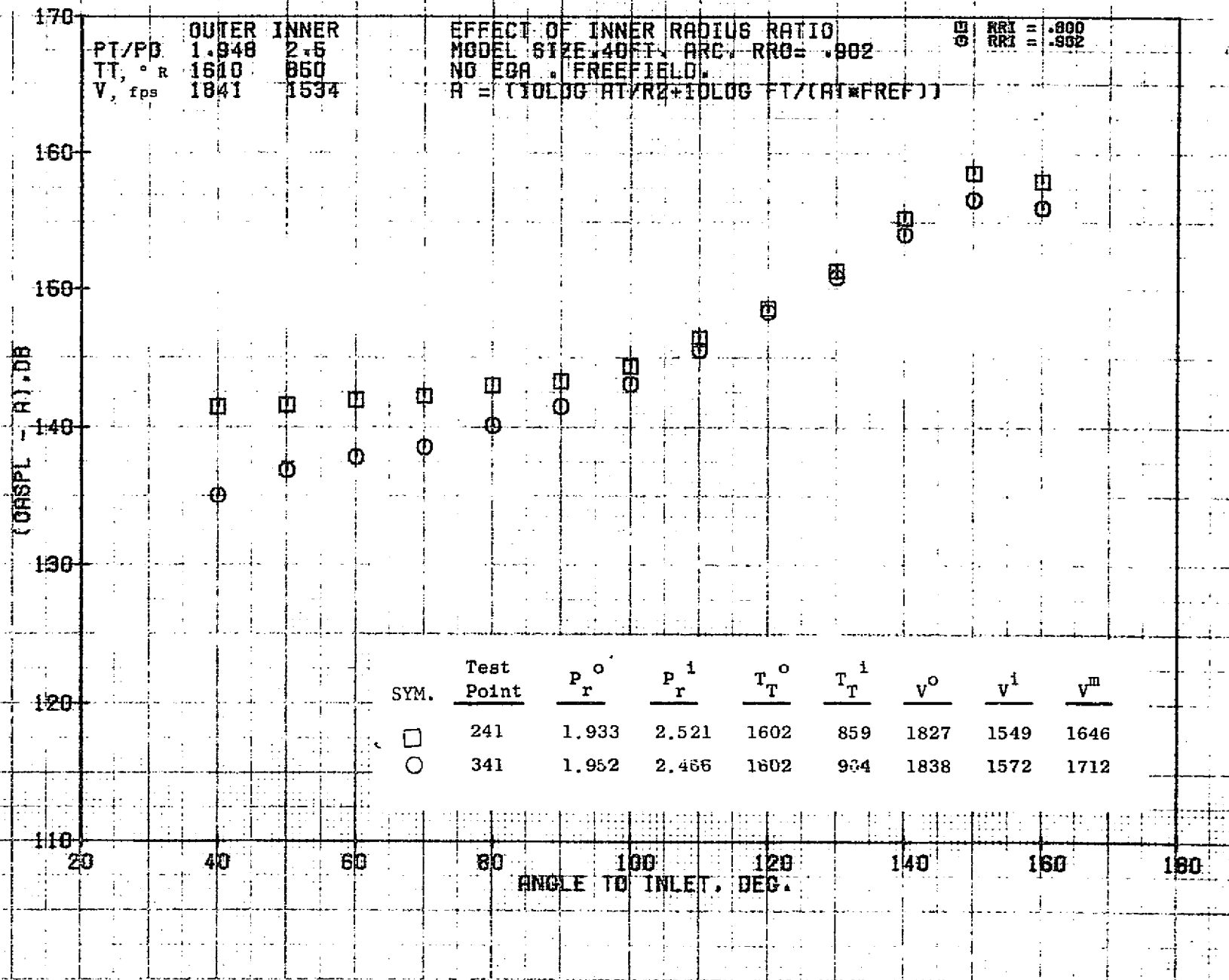
79 BURCH A.





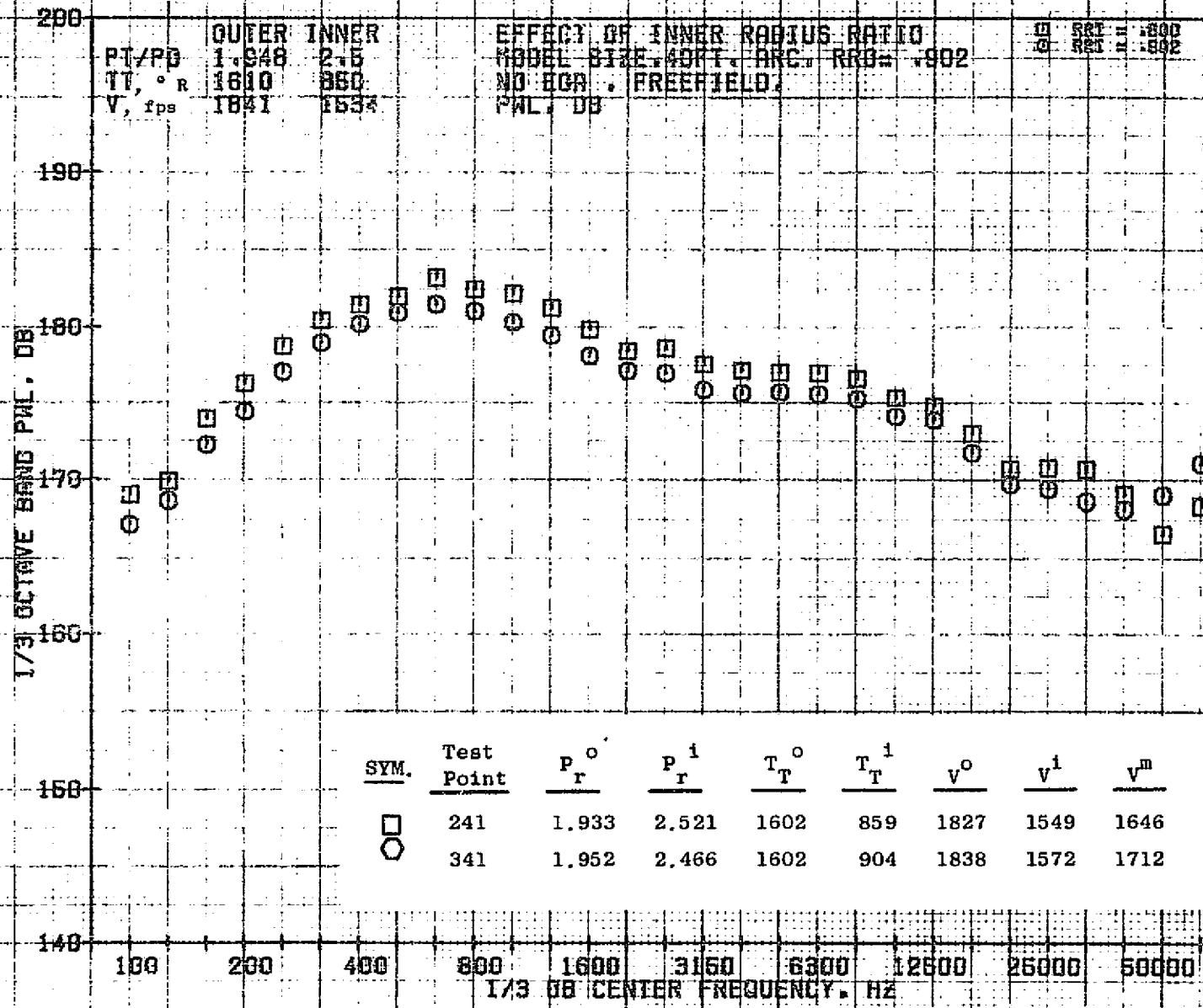
10/29/76
 18124-001

79 BURCH A.



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1B161-001

79 BURCH A.

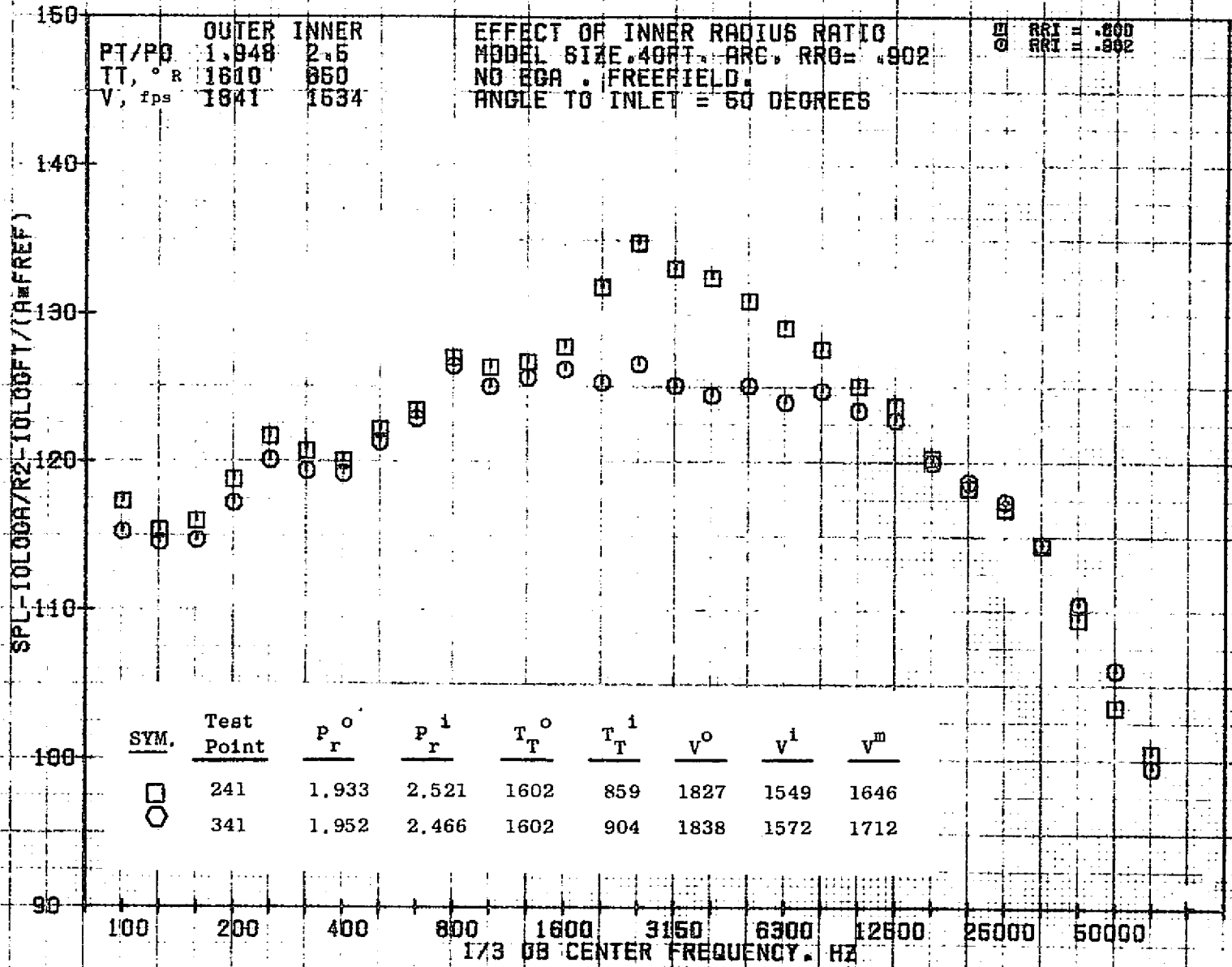


952

SYM.	Test Point	P_r^o	P_r^i	T_T^o	T_T^i	V^o	V^i	V^m
□	241	1.933	2.521	1602	859	1827	1549	1646
○	341	1.952	2.466	1602	904	1838	1572	1712

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18161-001

79 BURCH A.



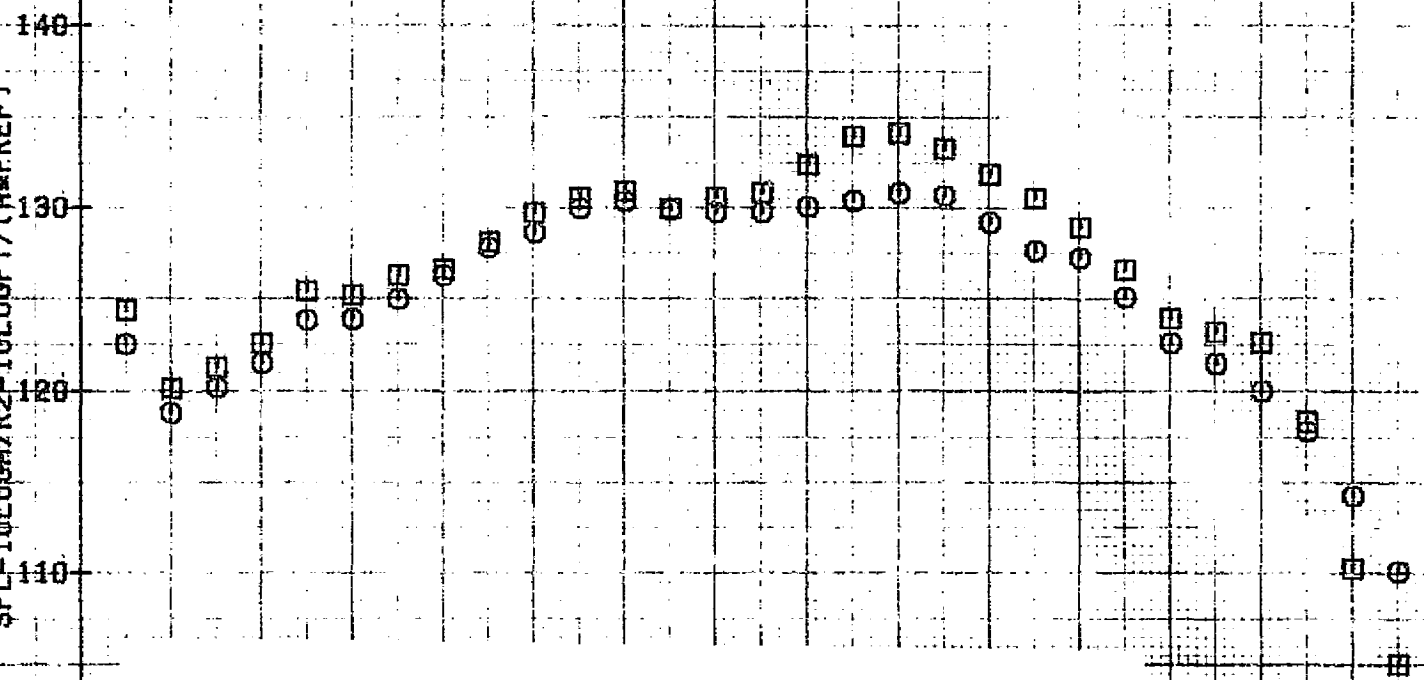
10/29/76
18161-001

79 BURCH A.

150
 PT/PO OUTER INNER
 1.948 2.6
 TT, ° R 1810 850
 V, fps 1841 1634
 EFFECT OF INNER RADIUS RATIO
 MODEL SIZE 40FT. ARC. RRB = .902
 NO. EGAS. FREEFIELD.
 ANGLE TO INLET = 90 DEGREES

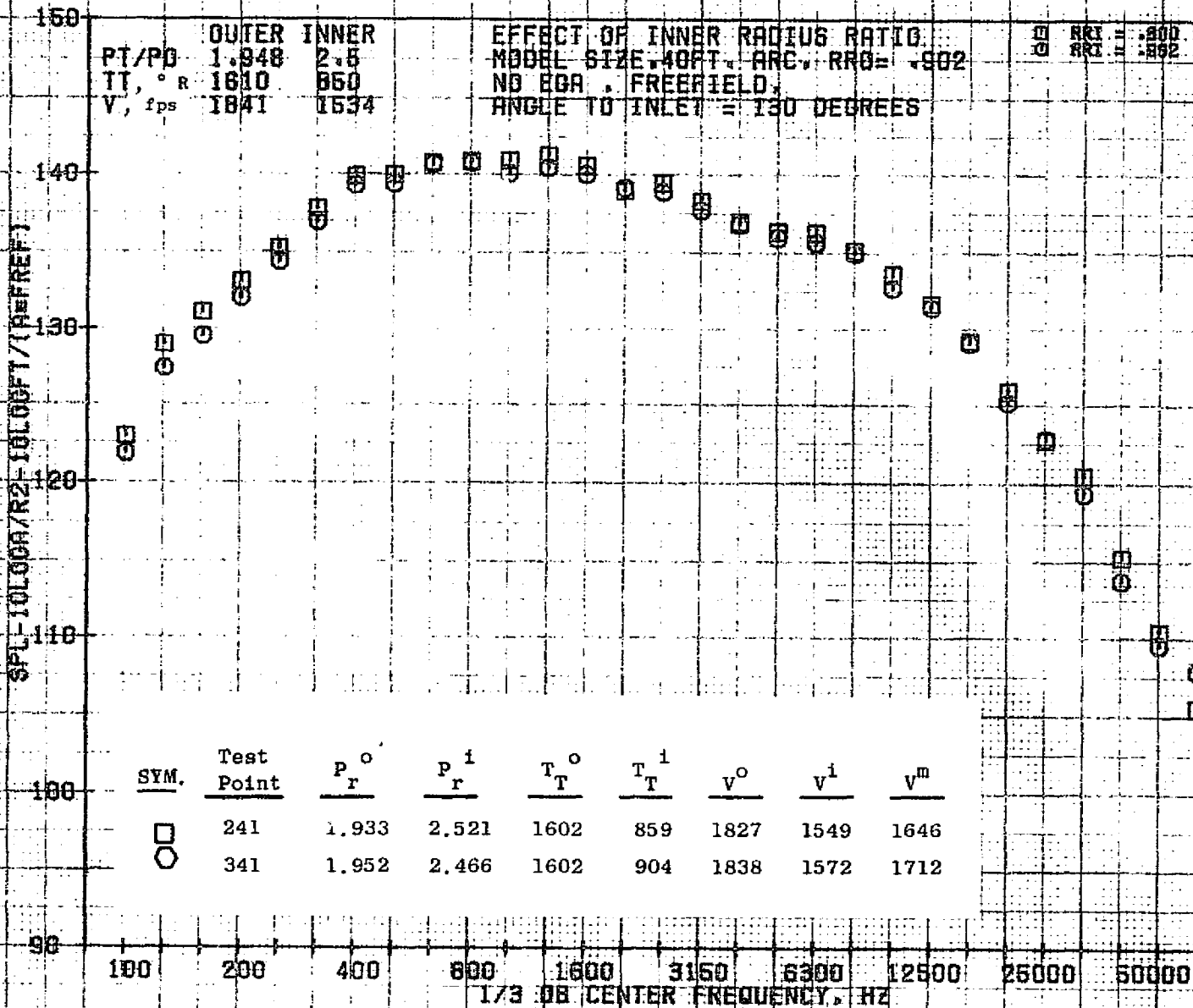
SPL - 10 LOG (P/PREF) / (R/RREF)

954



SYM.	Test Point	P_r^o	P_r^i	T_T^o	T_T^i	V^o	V^i	V^m
□	241	1.933	2.521	1602	859	1827	1549	1646
○	341	1.952	2.466	1602	904	1838	1572	1712

90
 100 200 400 800 1600 3150 6300 12500 25000 50000
 1/3 OAV CENTER FREQUENCY, HZ



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18161-001

79 BURCH A.

160
 150
 140
 130
 120
 110
 100

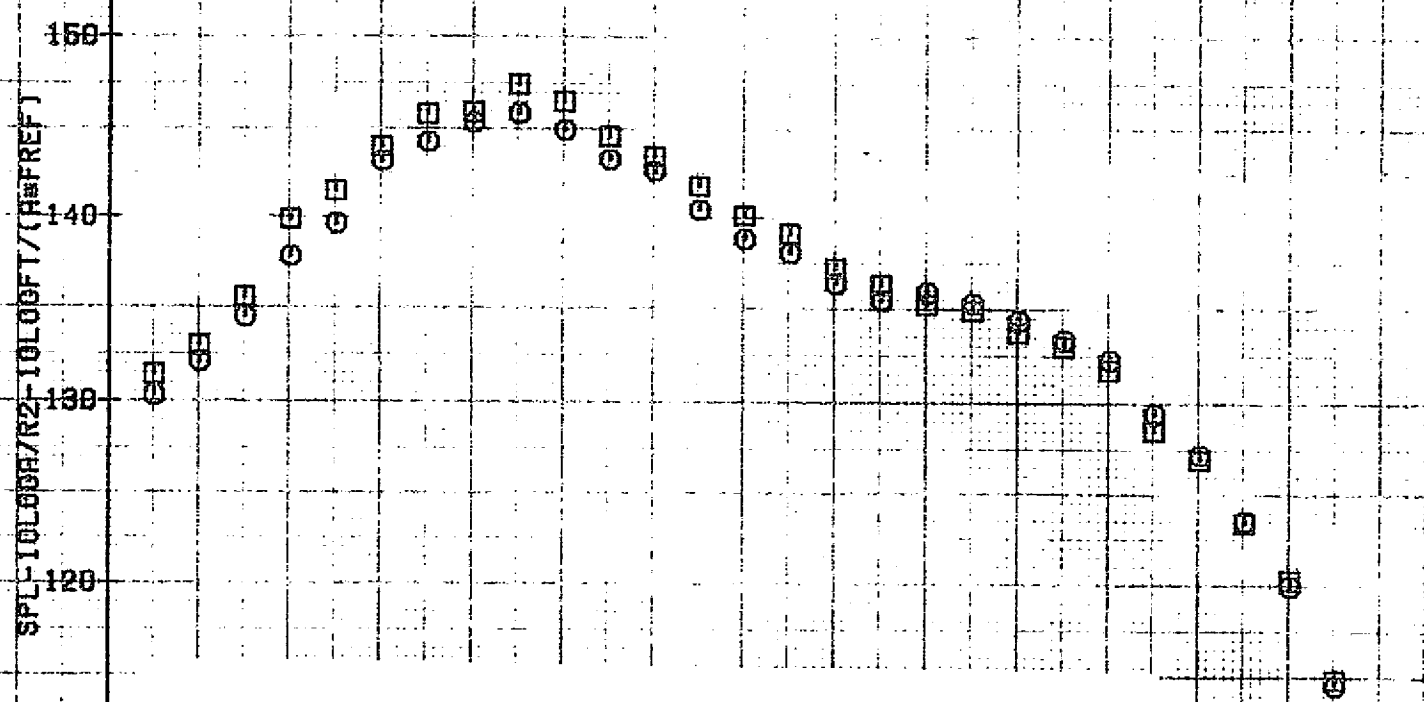
956

SPL - 10 LOG (P_r^o/R_r² - 10 LOG (P_rⁱ/R_r² + 10 LOG (P_T^o/R_T² - 10 LOG (P_Tⁱ/R_T² + 10 LOG (V^o/R_v² - 10 LOG (Vⁱ/R_v² + 10 LOG (V^m/R_v²)

OUTER INNER
 P_r^o/P_rⁱ 1.948 2.5
 T_T^o, ° R 1610 850
 V, fps 1841 1534

EFFECT OF INNER RADIUS RATIO
 MODEL SIZE, 40 FT. ARC, R/R₀ = .902
 NO ECA, FREEFIELD,
 ANGLE TO INLET = 140 DEGREES

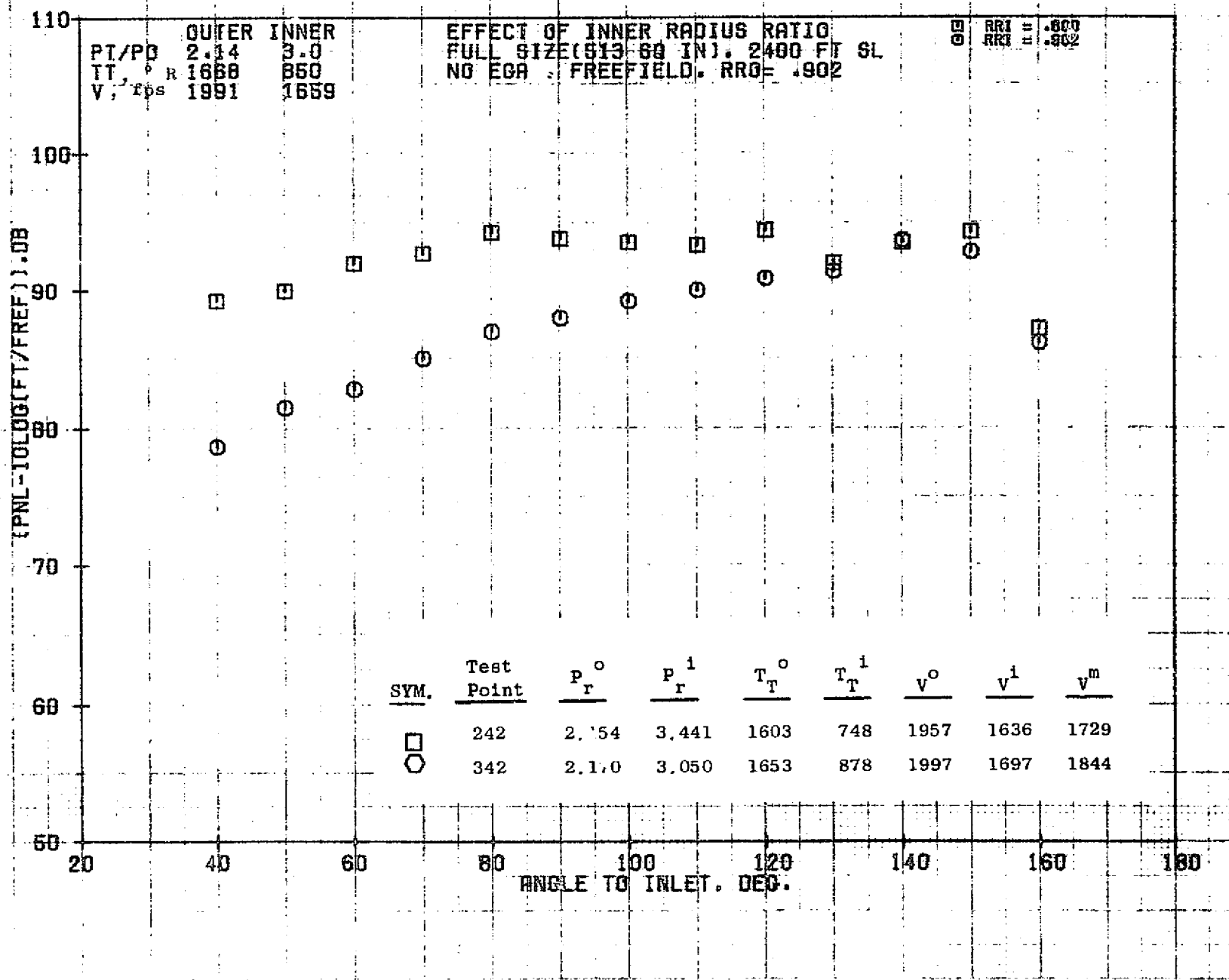
R_r^o .800
 R_rⁱ .902

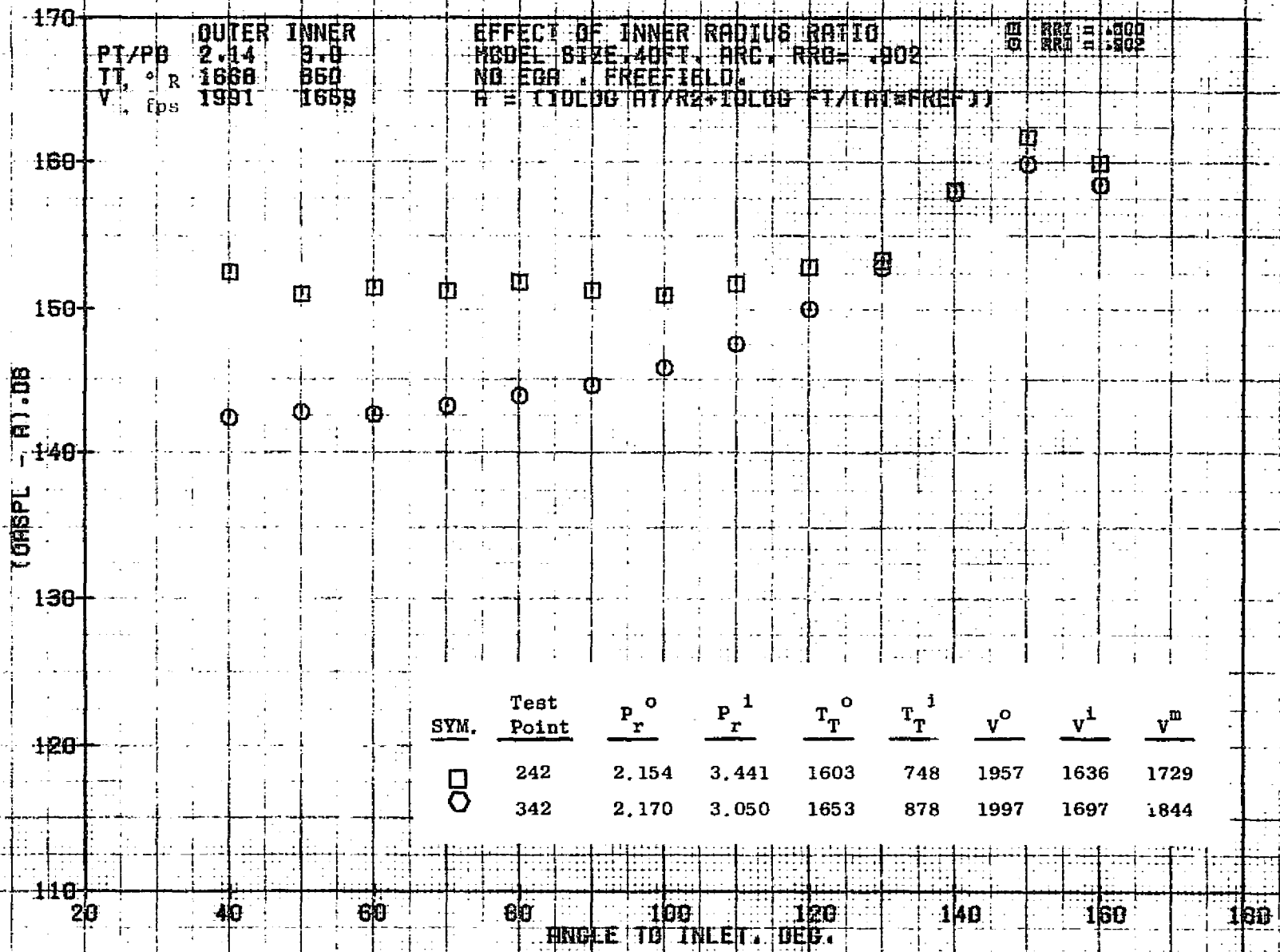


SYM.	Test Point	P _r ^o	P _r ⁱ	T _T ^o	T _T ⁱ	V ^o	V ⁱ	V ^m
□	241	1.933	2.521	1602	859	1827	1549	1646
○	341	1.952	2.466	1602	904	1838	1572	1712

100 200 400 800 1600 3150 6300 12500 25000 50000
 1/3 O₈ CENTER FREQUENCY, HZ

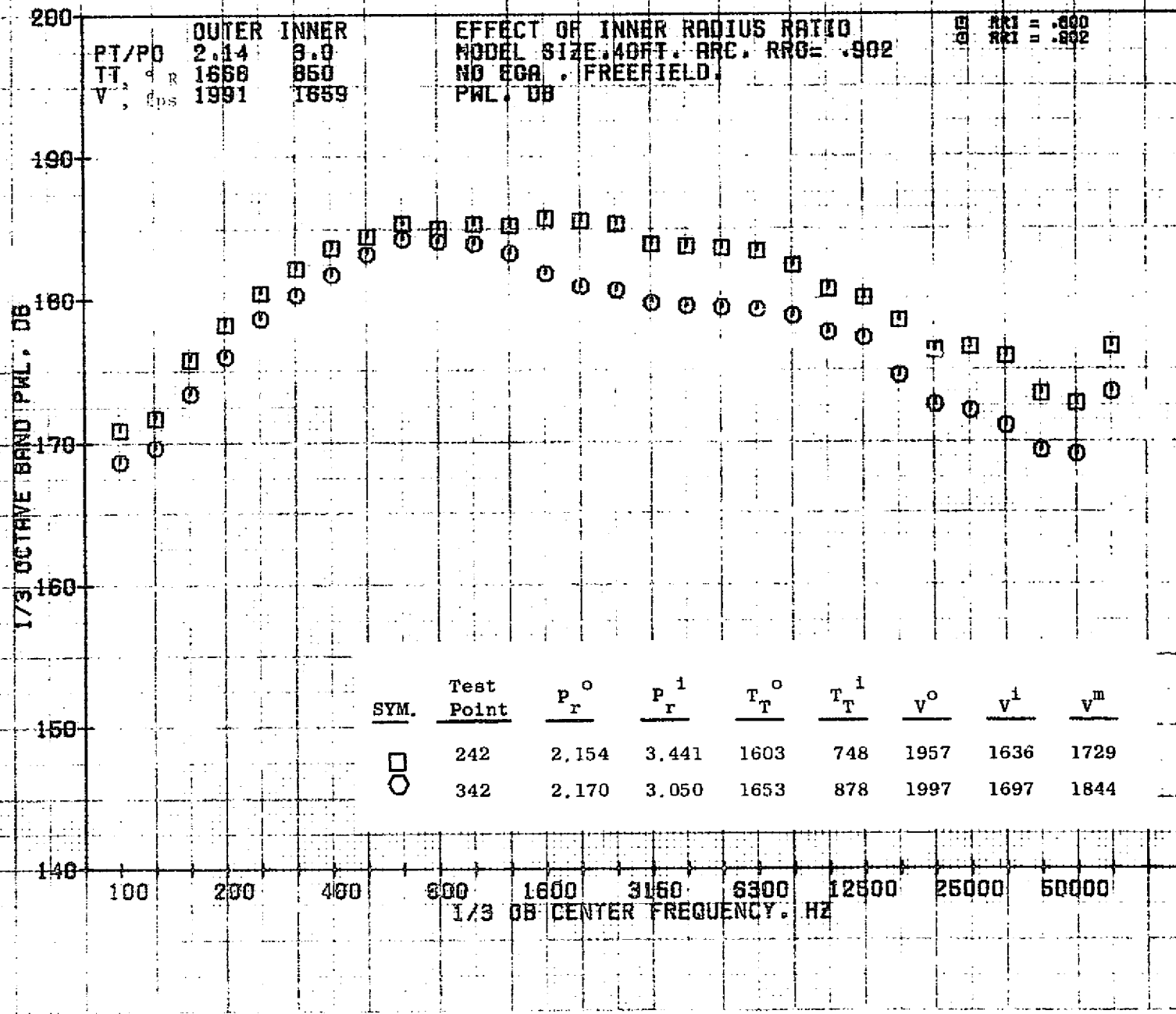
256





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18161-001

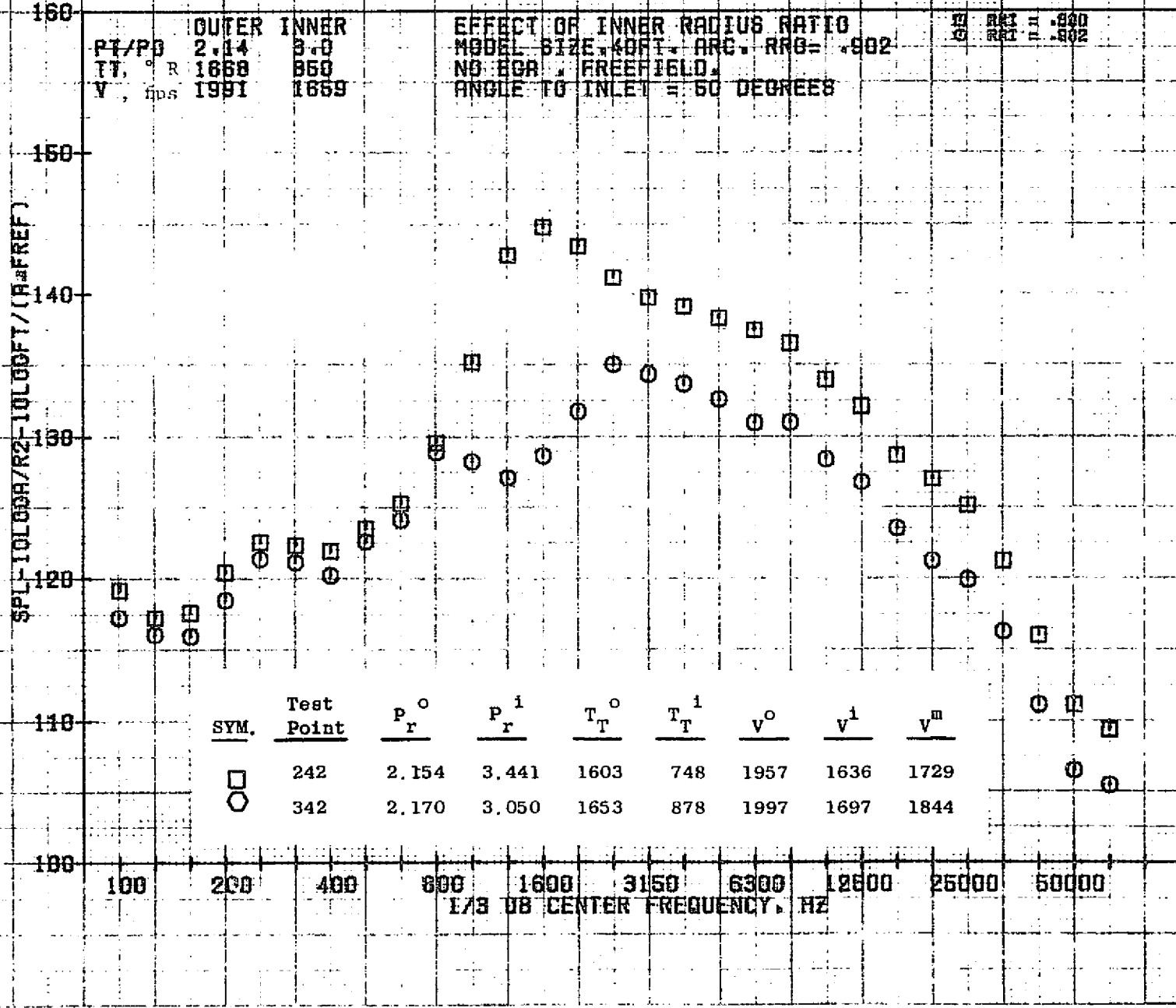
79 BURCH A.



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 18161-001

79 BURCH R.

096



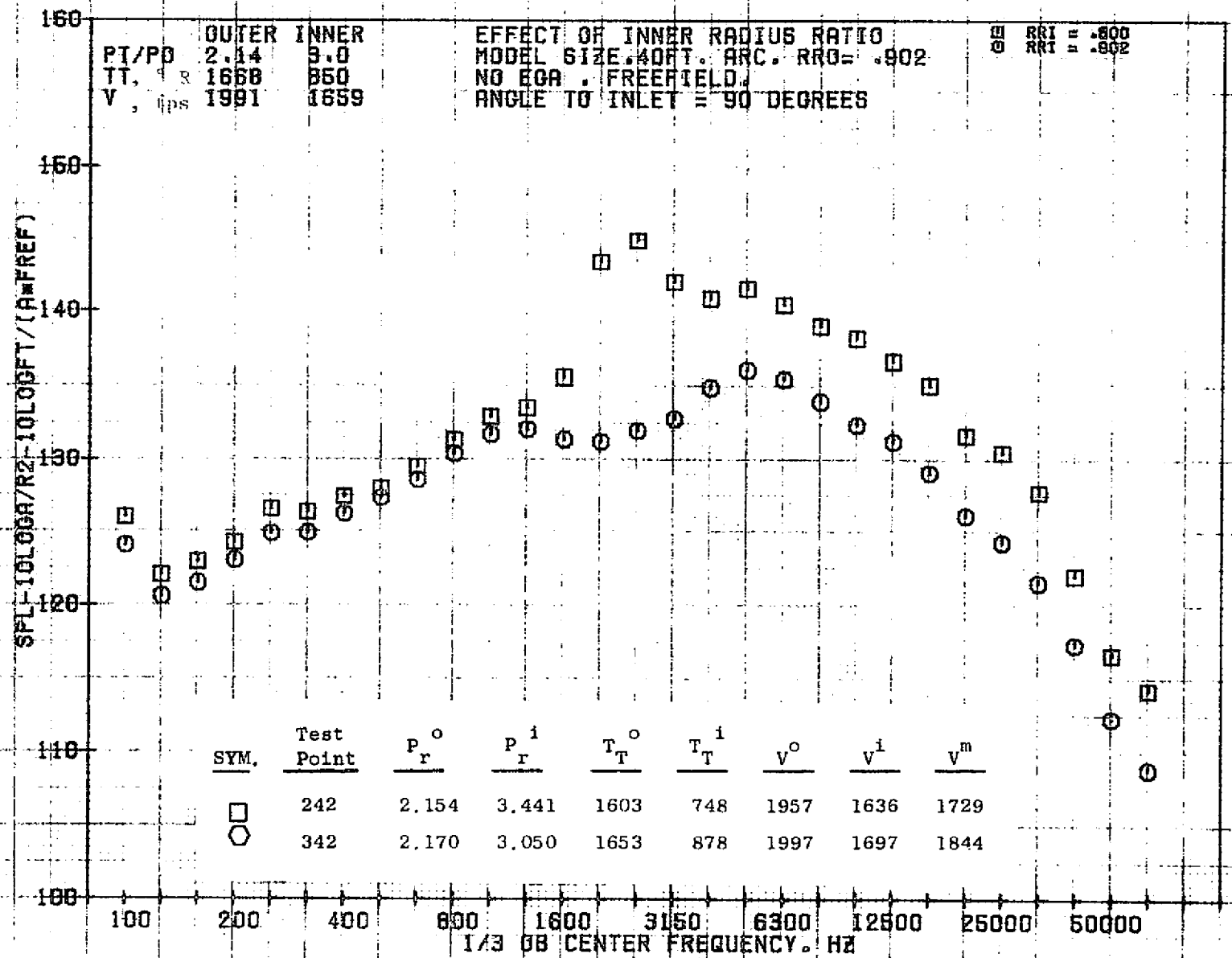
OUTER INNER
 R1/R2 2.14 3.0
 TT, ° R 1868 860
 V, fps 1991 1869

EFFECT OF INNER RADIUS RATIO
 MODEL SIZE, 40 FT. ARC. RAG = .902
 NO. BGR. FREEFIELD
 ANGLE TO INLET = 60 DEGREES

REF. 111 800
 REL. 802

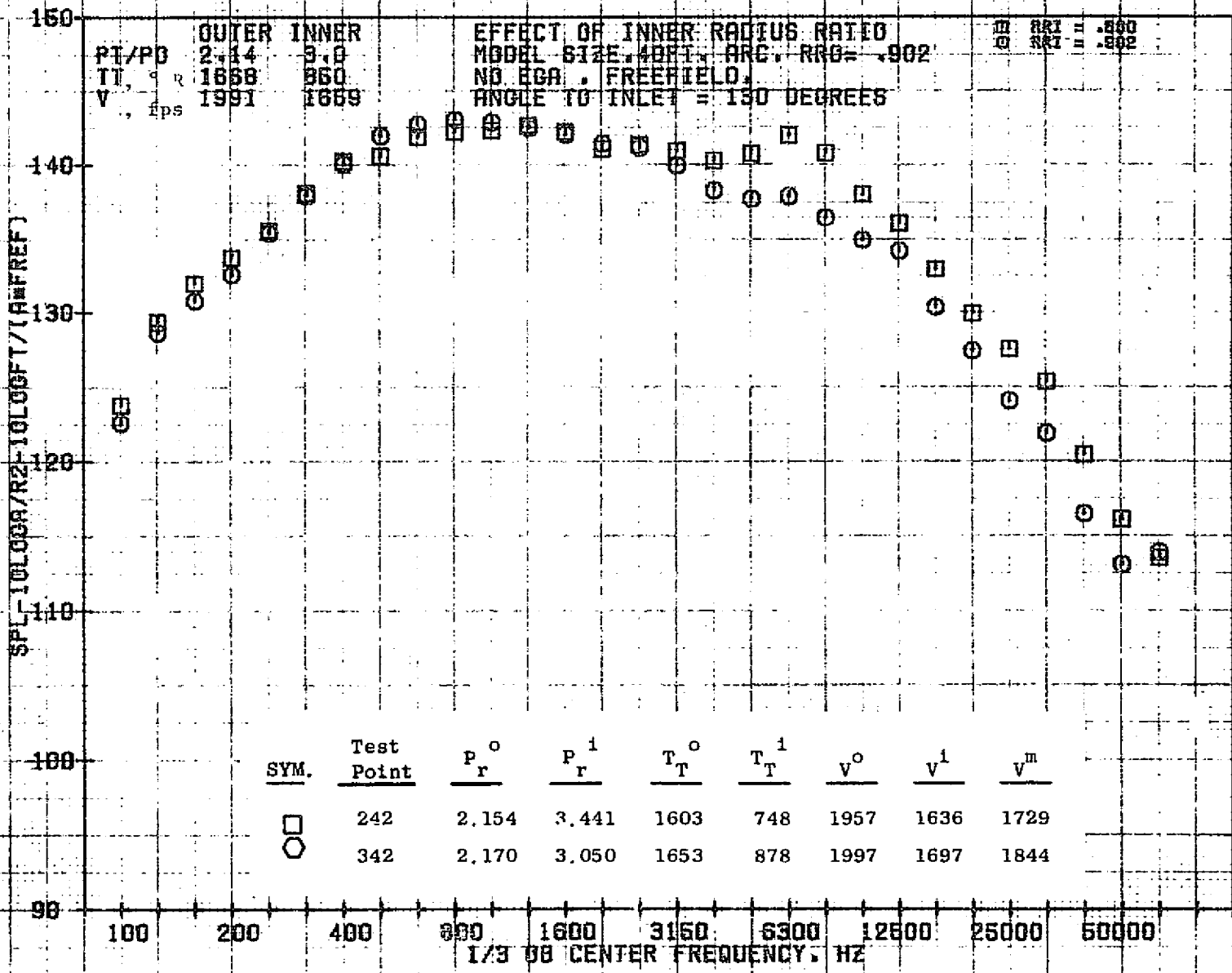
SPL - 10 log(R/R2 - 10 log(DFT / (R2 * FREF)))

SYM.	Test Point	P_r^o	P_r^i	T_T^o	T_T^i	V^o	V^i	V^m
□	242	2.154	3.441	1603	748	1957	1636	1729
○	342	2.170	3.050	1653	878	1997	1697	1844



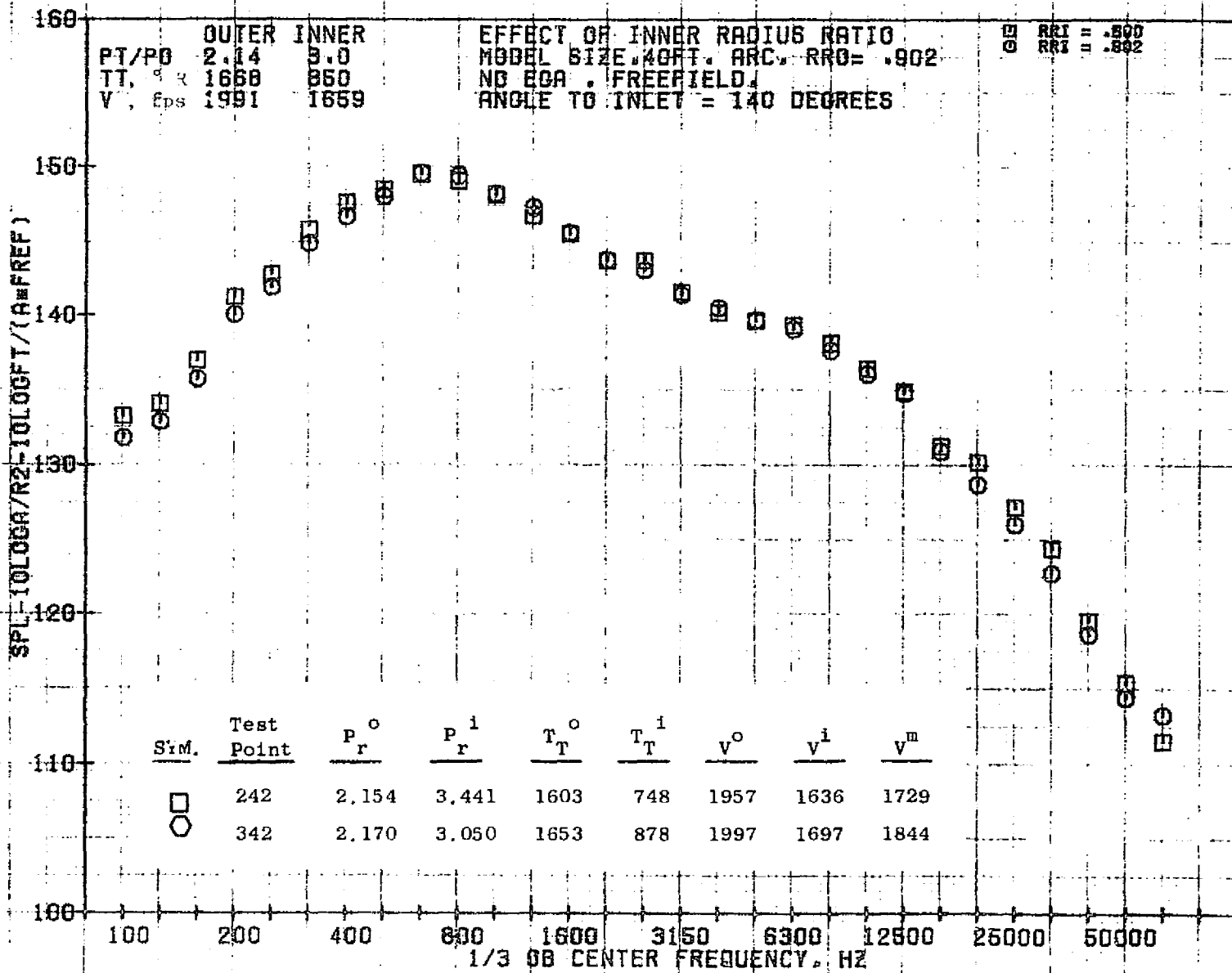
196

962



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18161-001

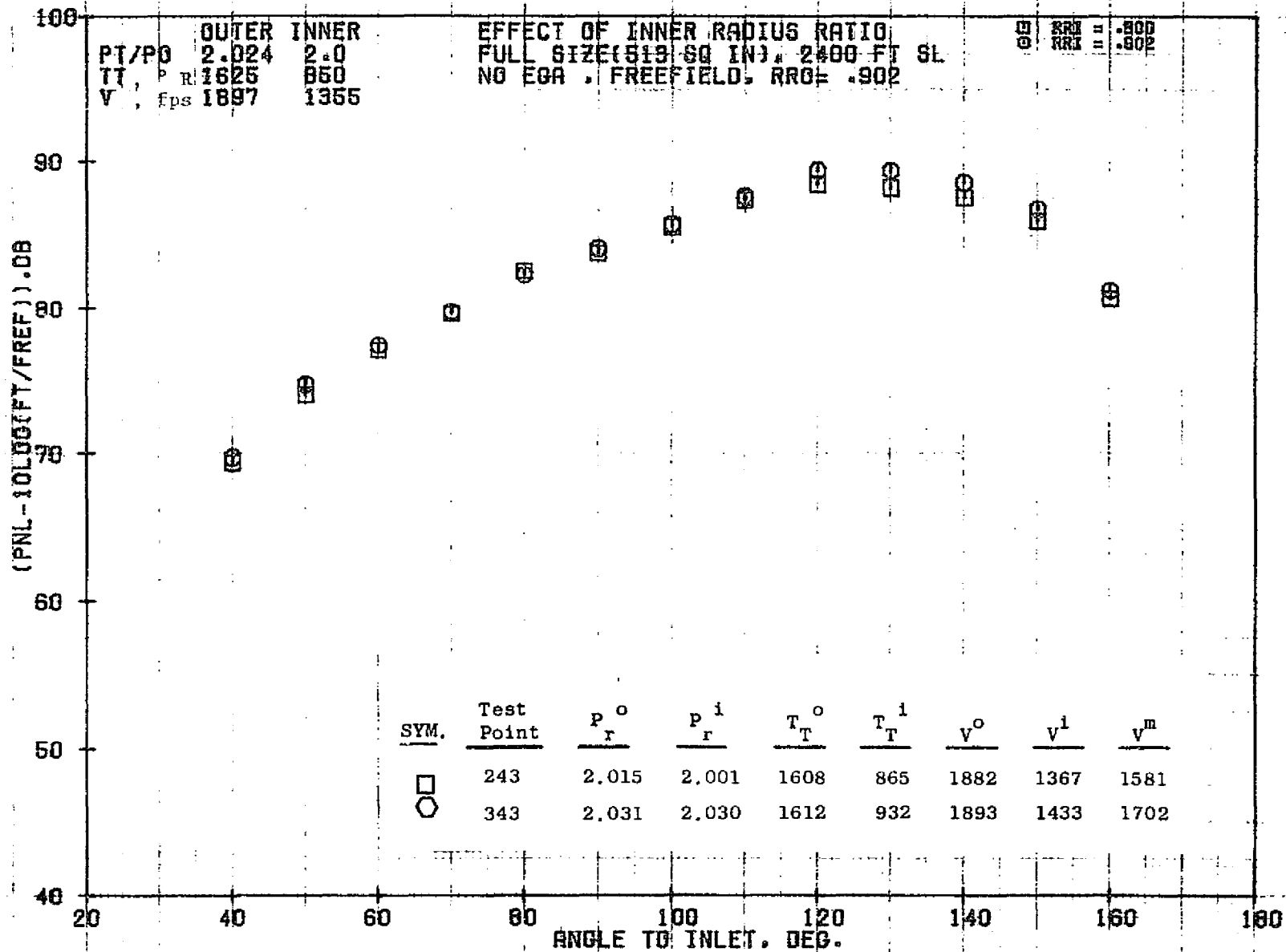
79 BURCH A.



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79 BURCH A.

964



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1B124-001

79 BURCH A.

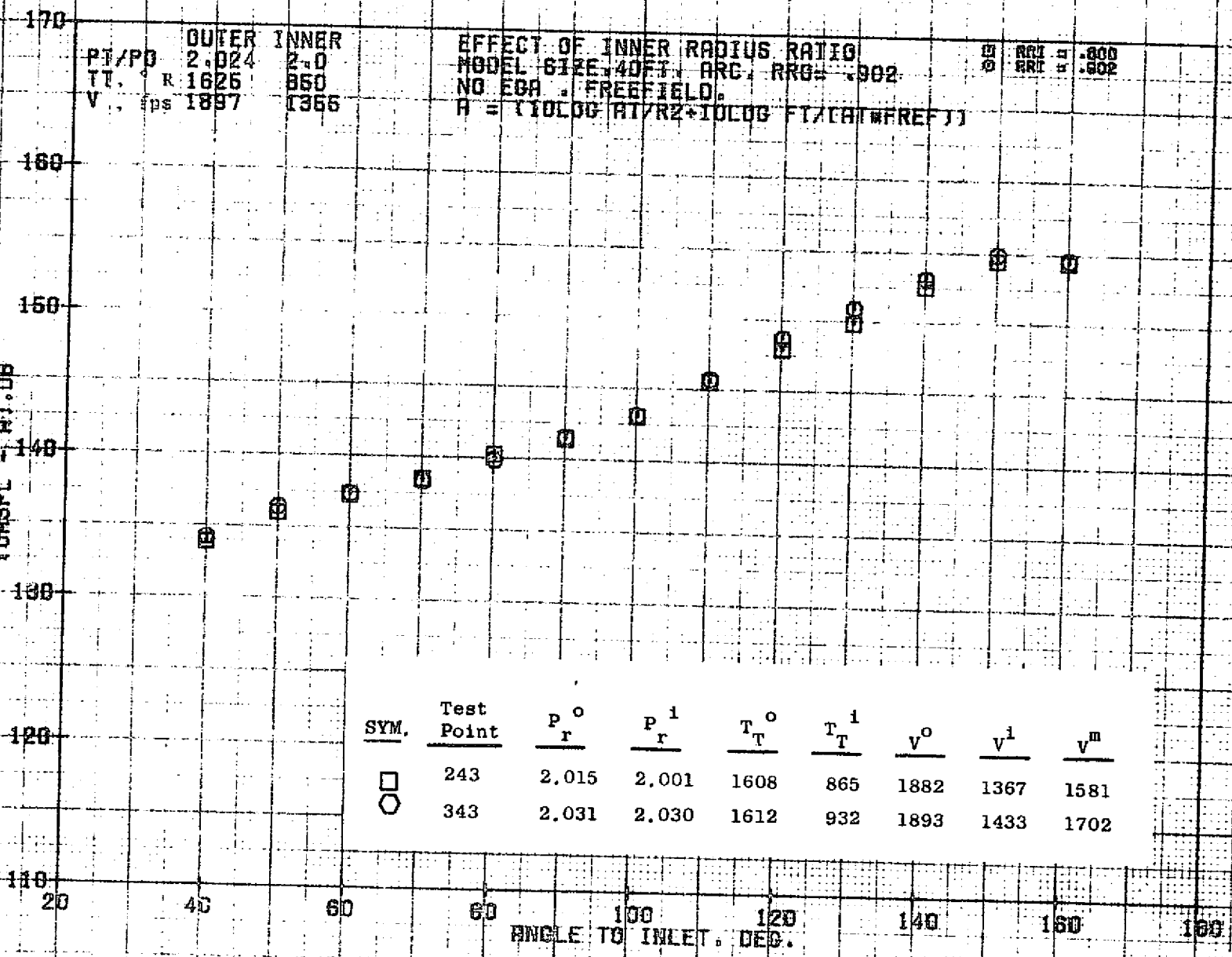
PT/PD 2.024 2.0
 TT. ° R 1625 860
 V. fps 1897 1366

EFFECT OF INNER RADIUS RATIO
 MODEL SIZE 40 FT. ARC. RRG = .902
 NO. EGA FREEFIELD.
 $A = 110 \log \frac{R_1}{R_2} + 10 \log \frac{F_1}{C_1 + W_{REF}}$

□ RRI = .800
 ○ RRI = .602

COR SPL - (R) DB

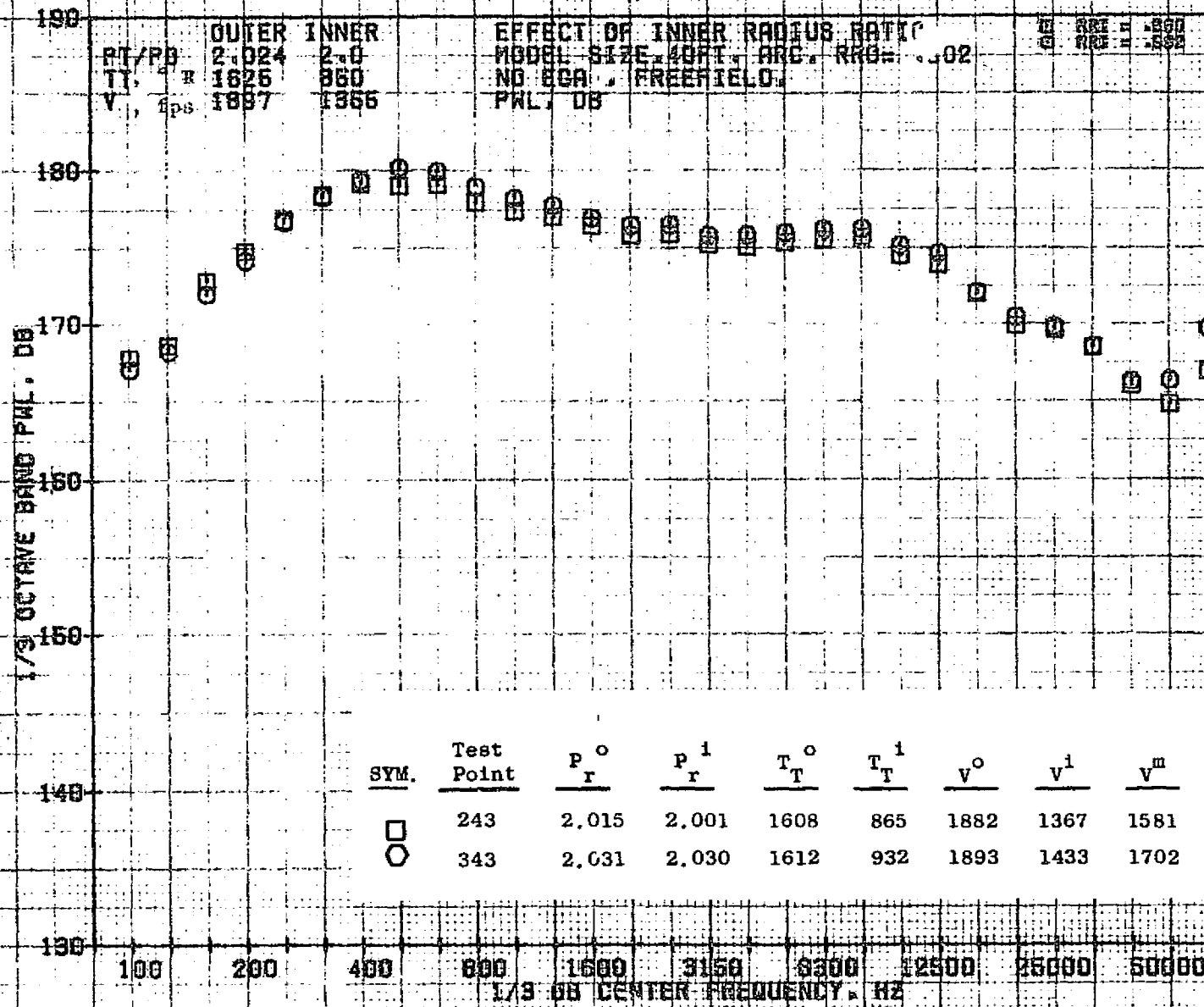
590

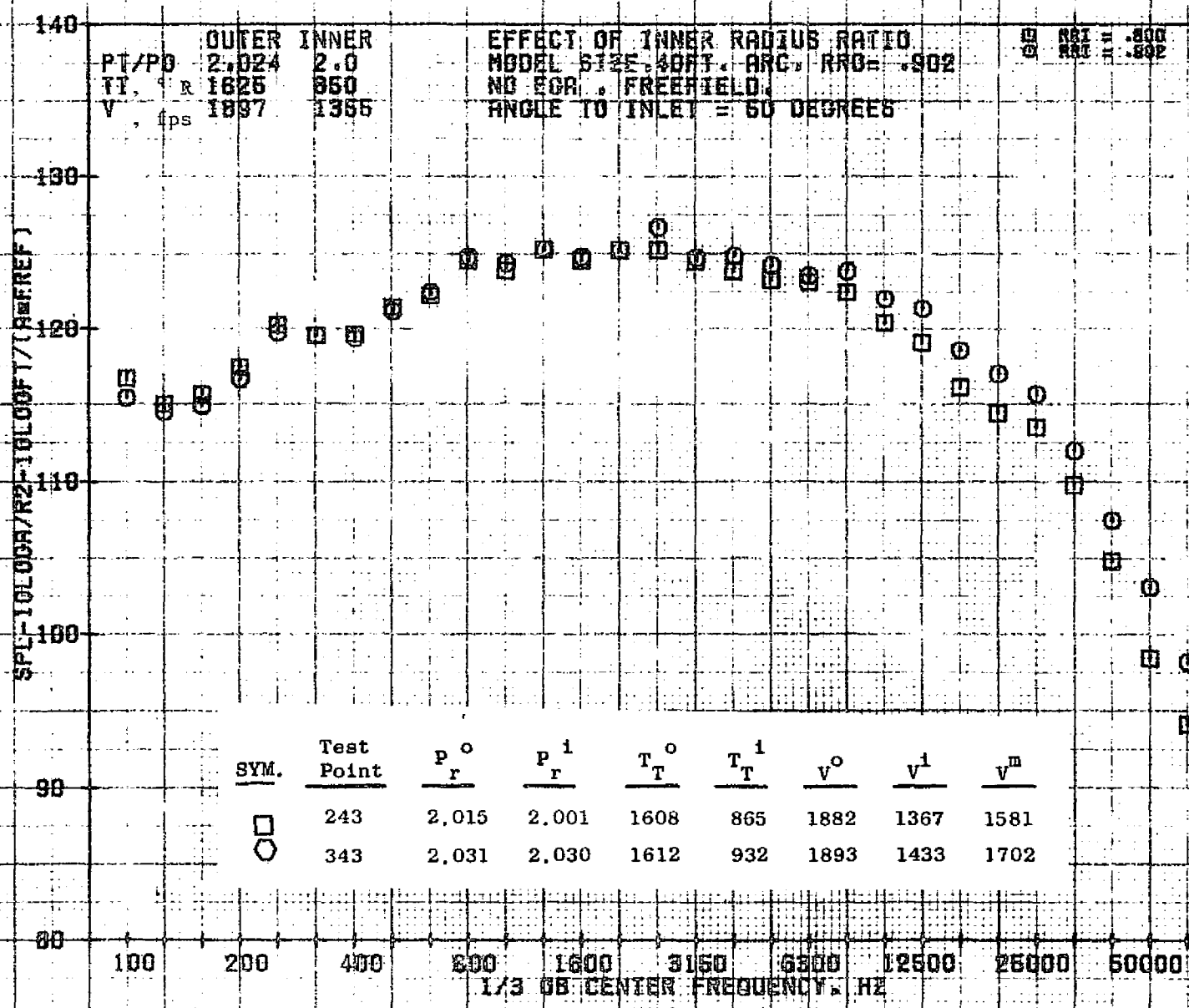


SYM.	Test Point	P_r^o	P_r^i	T_T^o	T_T^i	V^o	V^i	V^m
□	243	2.015	2.001	1608	865	1882	1367	1581
○	343	2.031	2.030	1612	932	1893	1433	1702

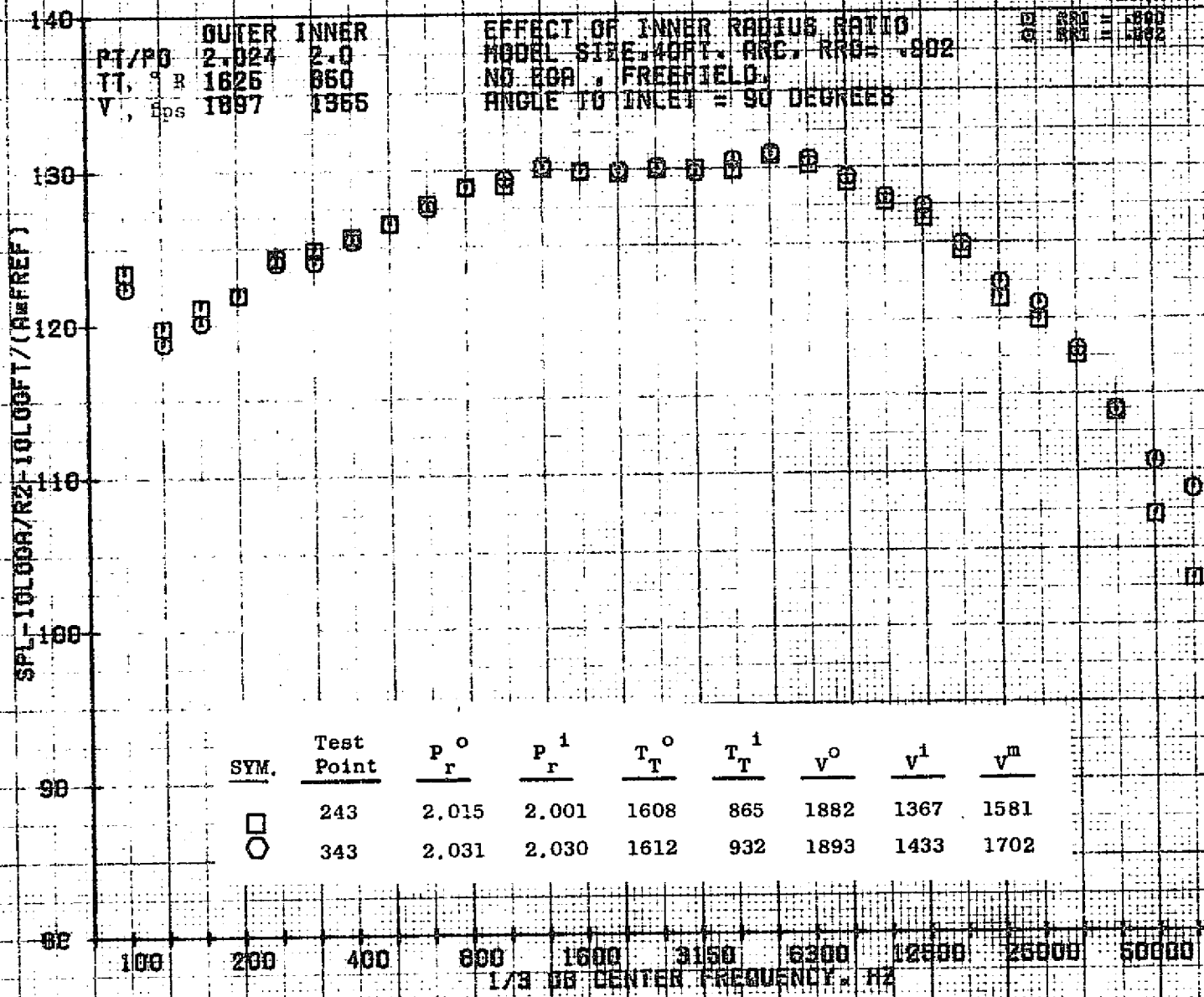
10/29/76
 18161-001

79 BURCH A.





987



10/29/76
18161-001

79 BURCH A.

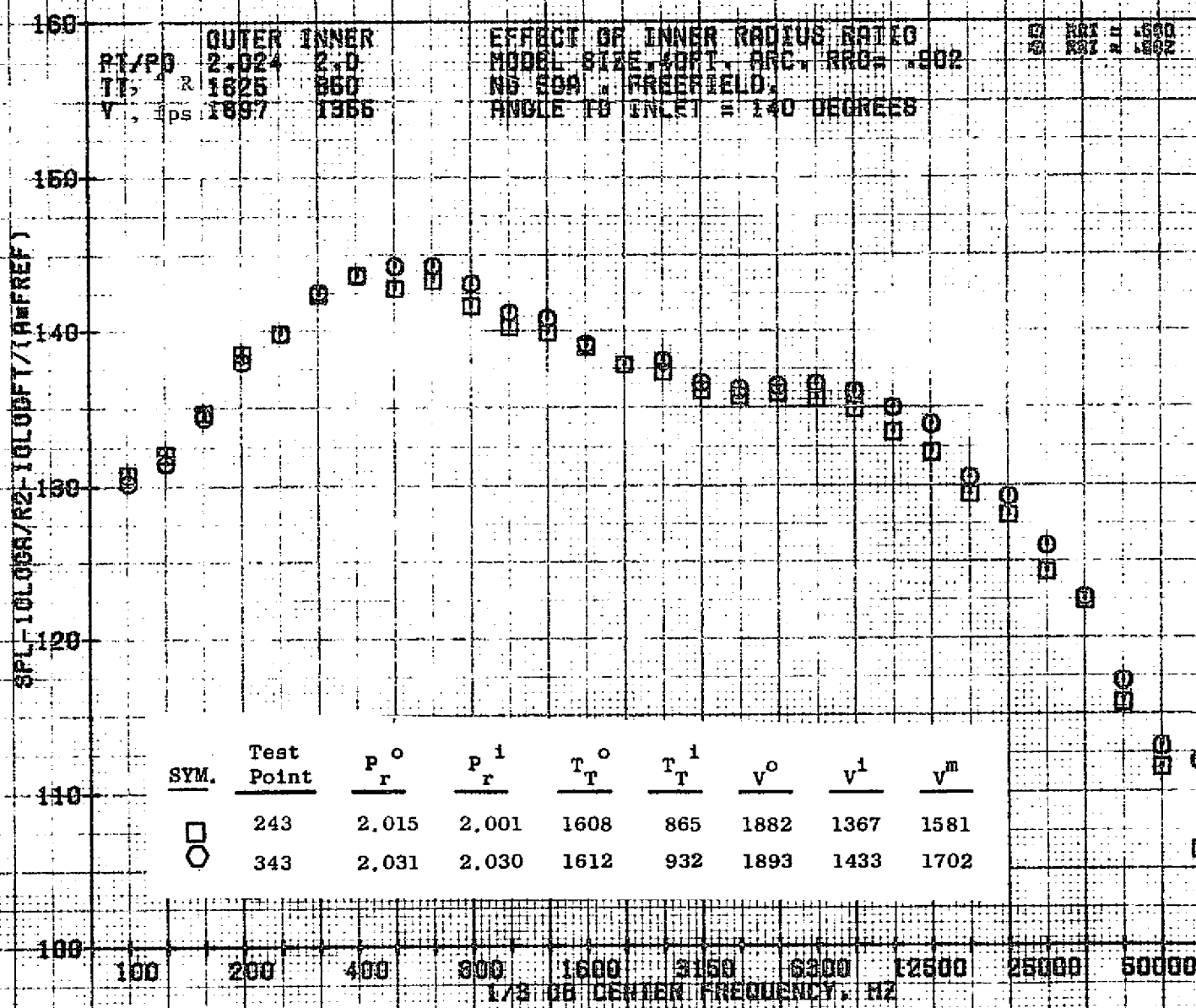
OUTER INNER
 PI/PO 2.024 2.0
 TI T_T R 1625 860
 V^o Vⁱ V^m 1897 1365
 EFFECT OF INNER RADIUS RATIO
 MODEL SIZE 40FT. ARC. RRG = .902
 NO. OF A. FREEFIELD.
 ANGLE TO INLET = 130 DEGREES

SPL - 10 LOG (P_r^o / P_rⁱ) - 10 LOG (T_T^o / T_Tⁱ) ((A_m / P_r^o / P_rⁱ)

696

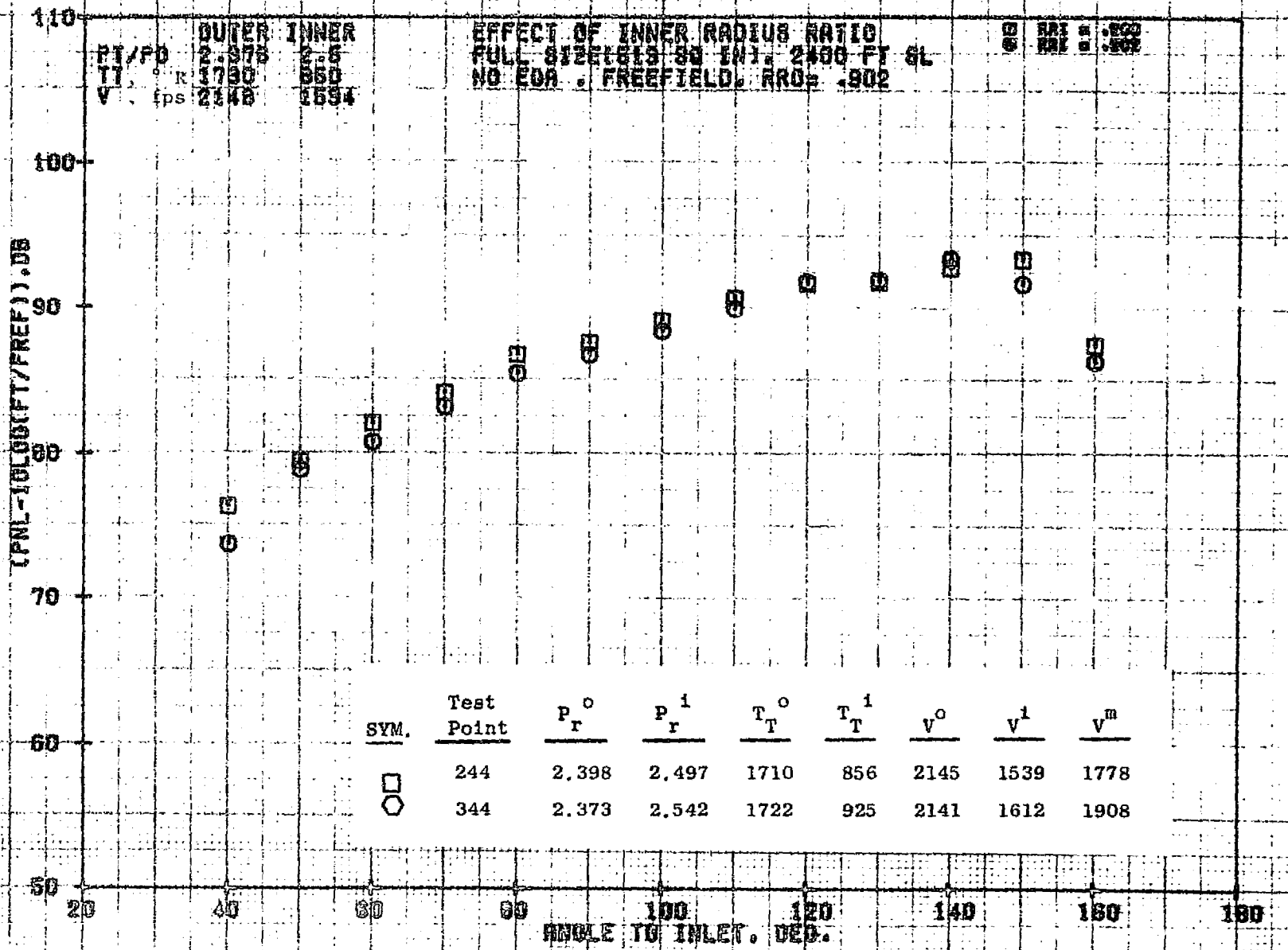
SYM.	Test Point	P _r ^o	P _r ⁱ	T _T ^o	T _T ⁱ	V ^o	V ⁱ	V ^m
□	243	2.015	2.001	1608	865	1882	1367	1581
○	343	2.031	2.030	1612	932	1893	1433	1702

1/3 OF CENTER FREQUENCY, HZ



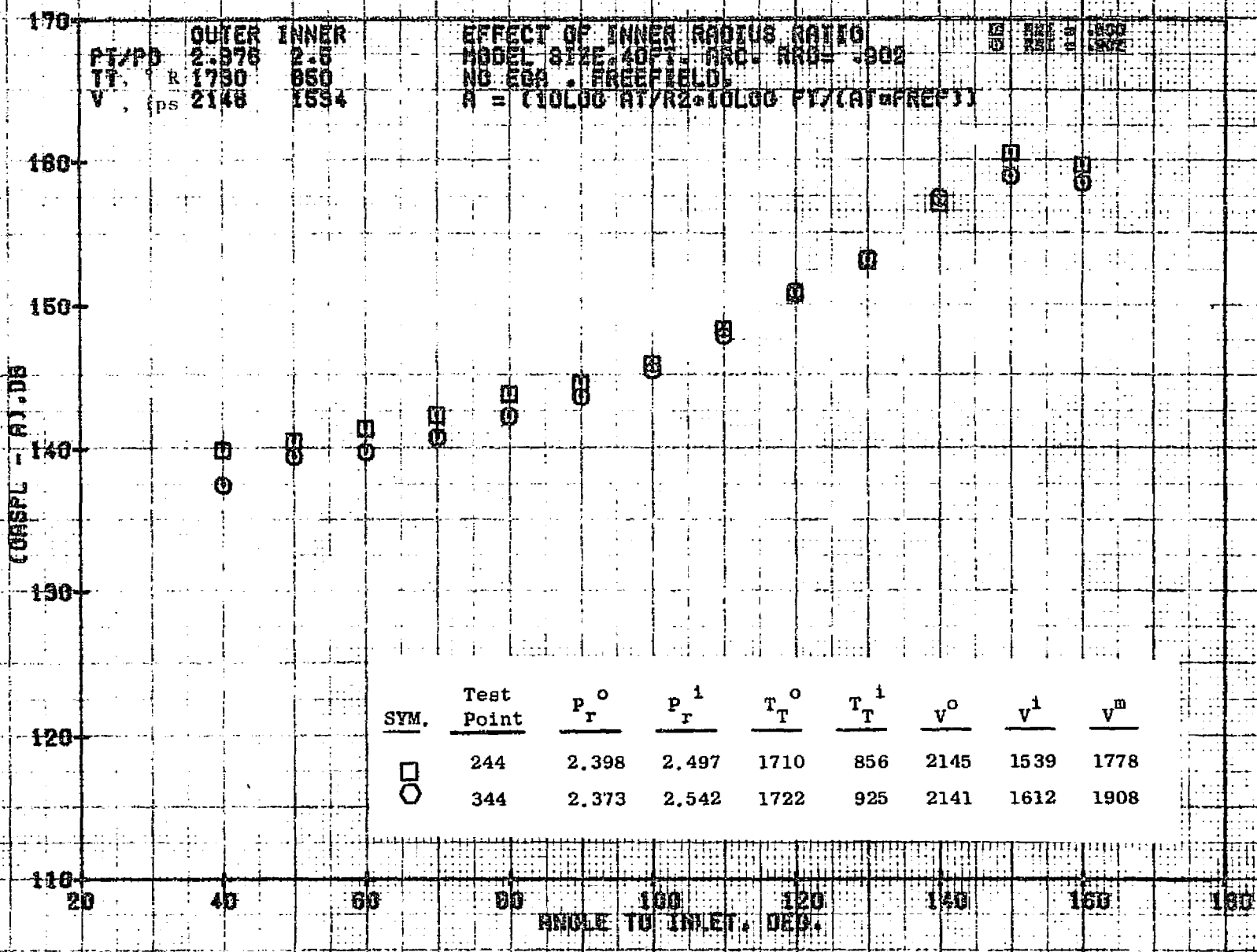
10/29/76
18161-001

79 BURCH A.



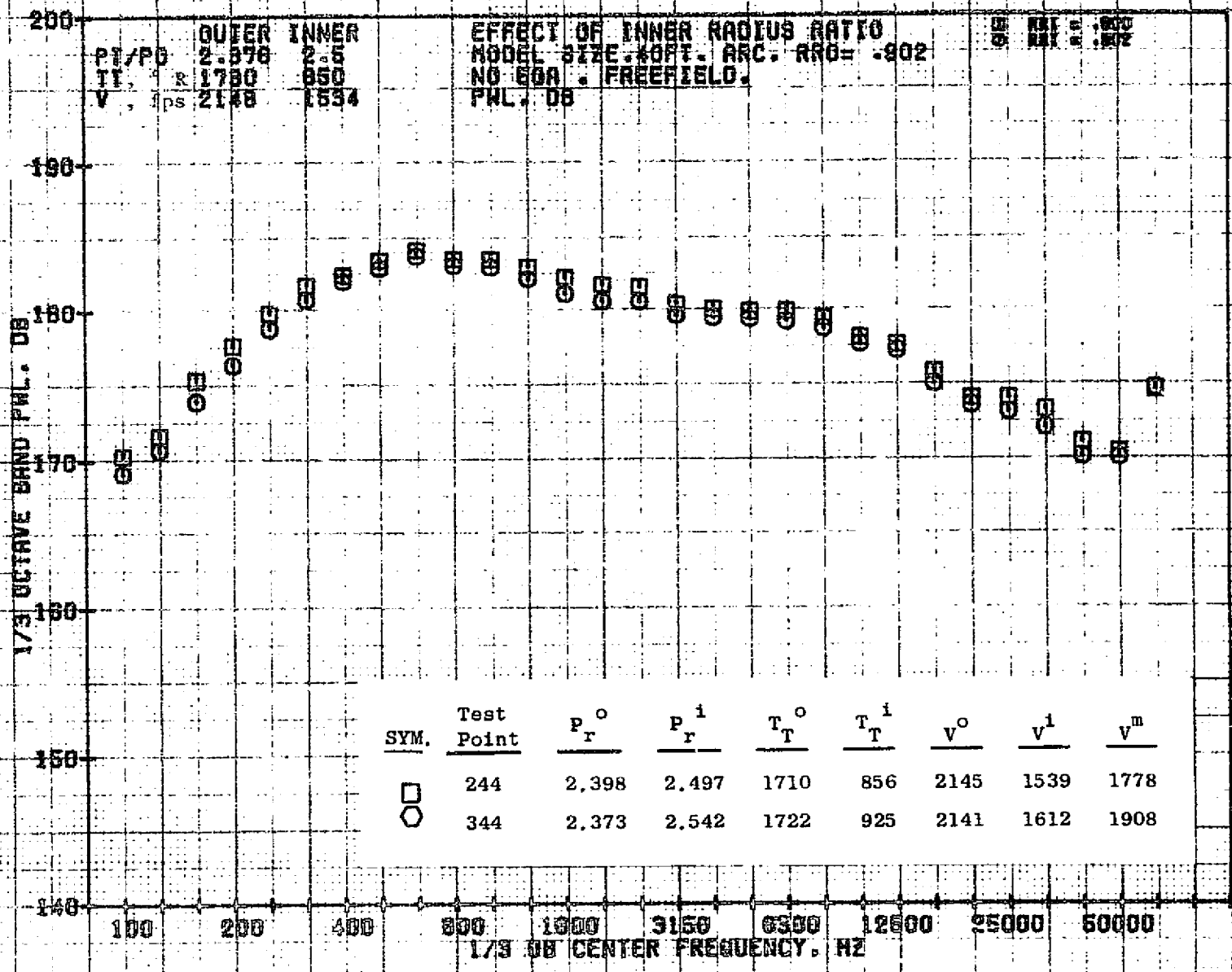
11/04/76
 18690-001

79 BURCH A.



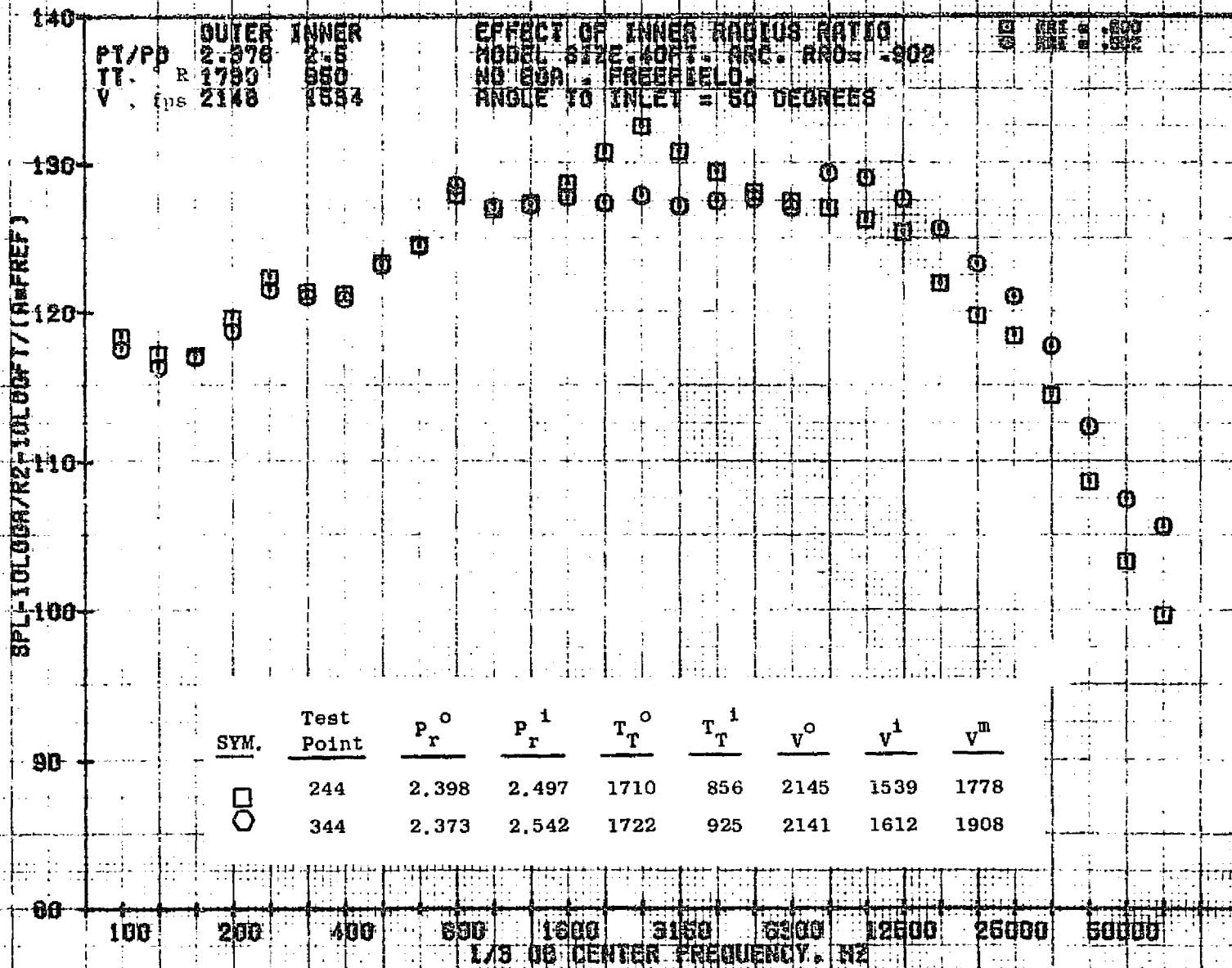
11/04/76
18727-001

79 BURCH A.



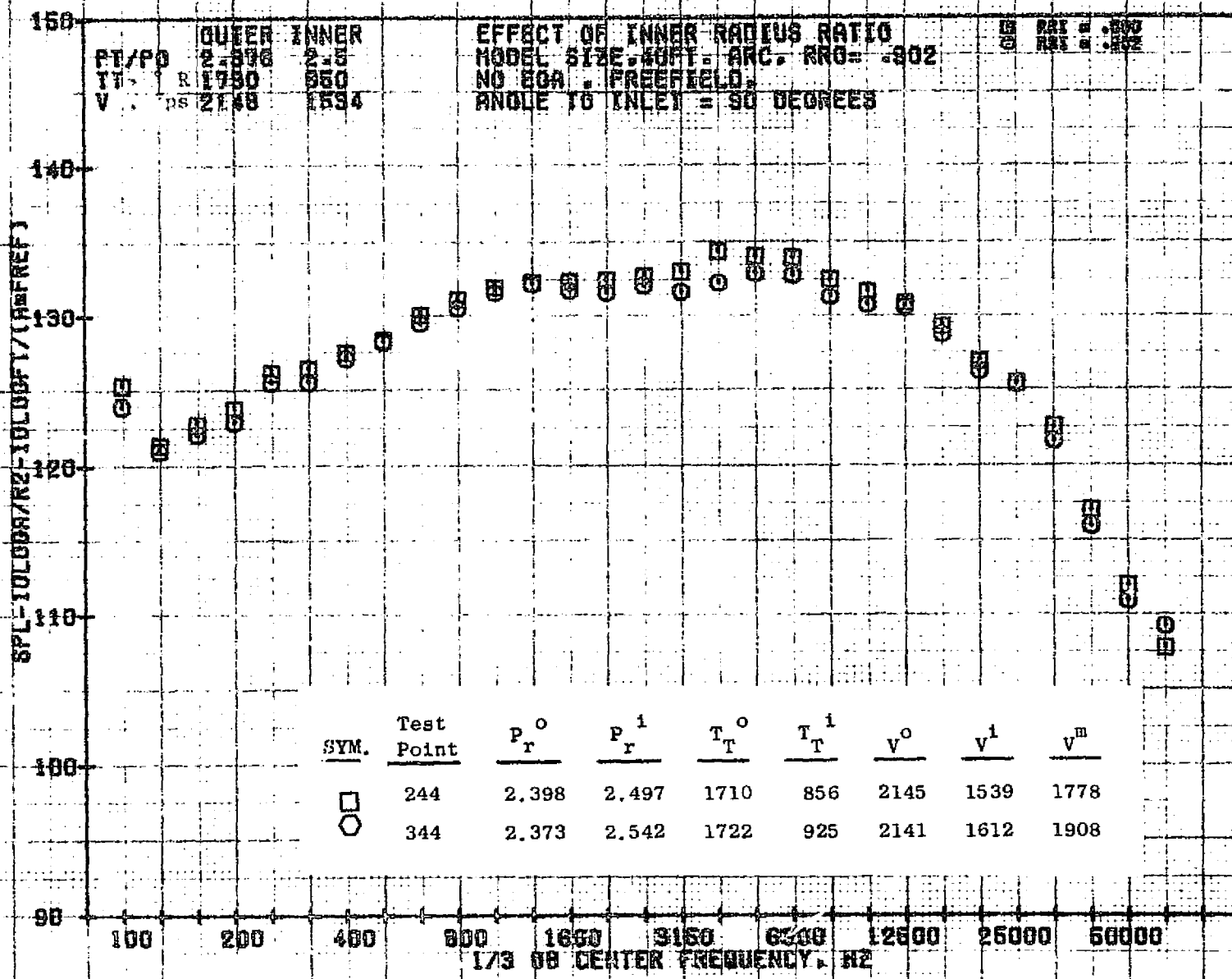
11/04/76
16727-001

79 BURCH A.



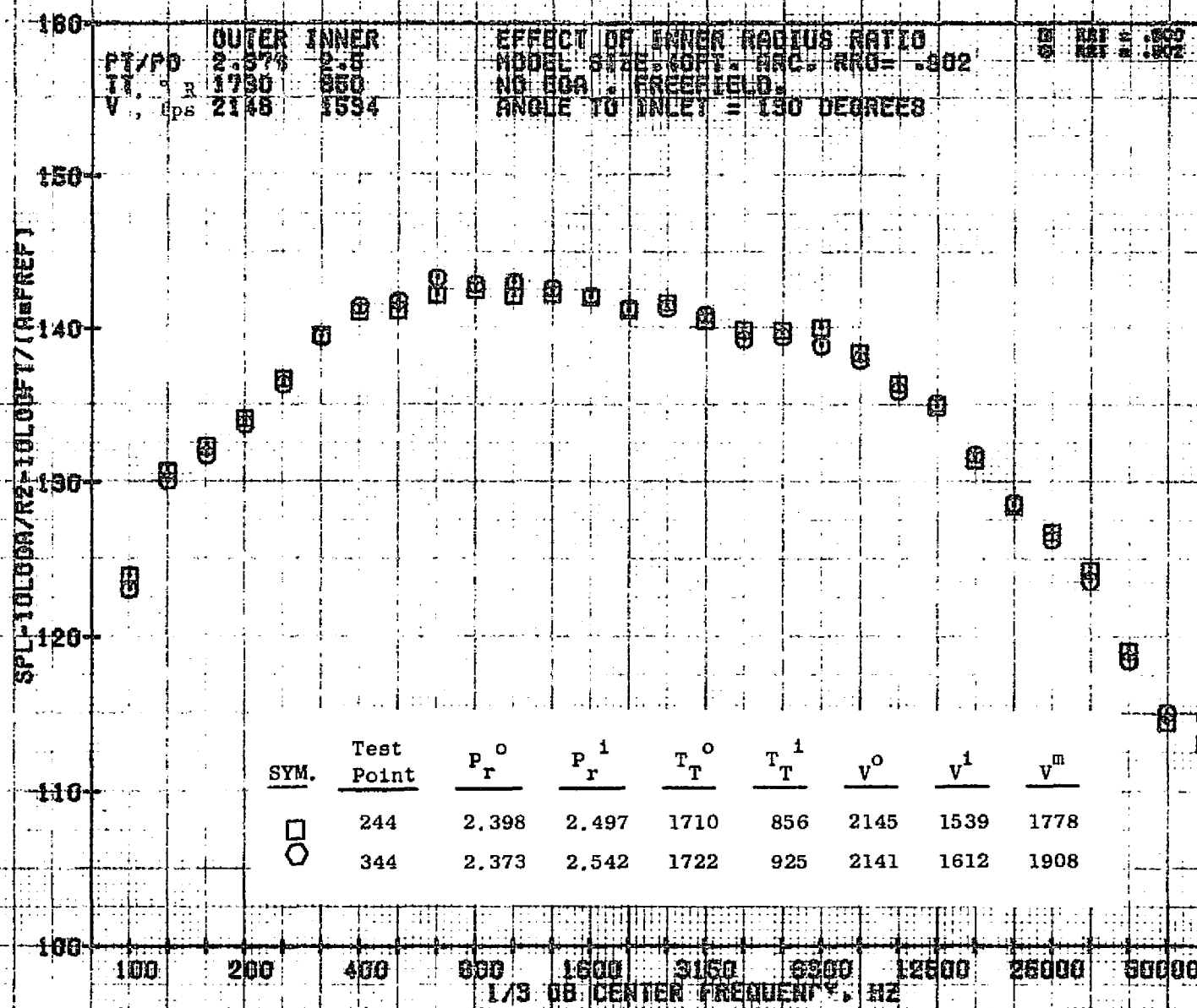
97A

975



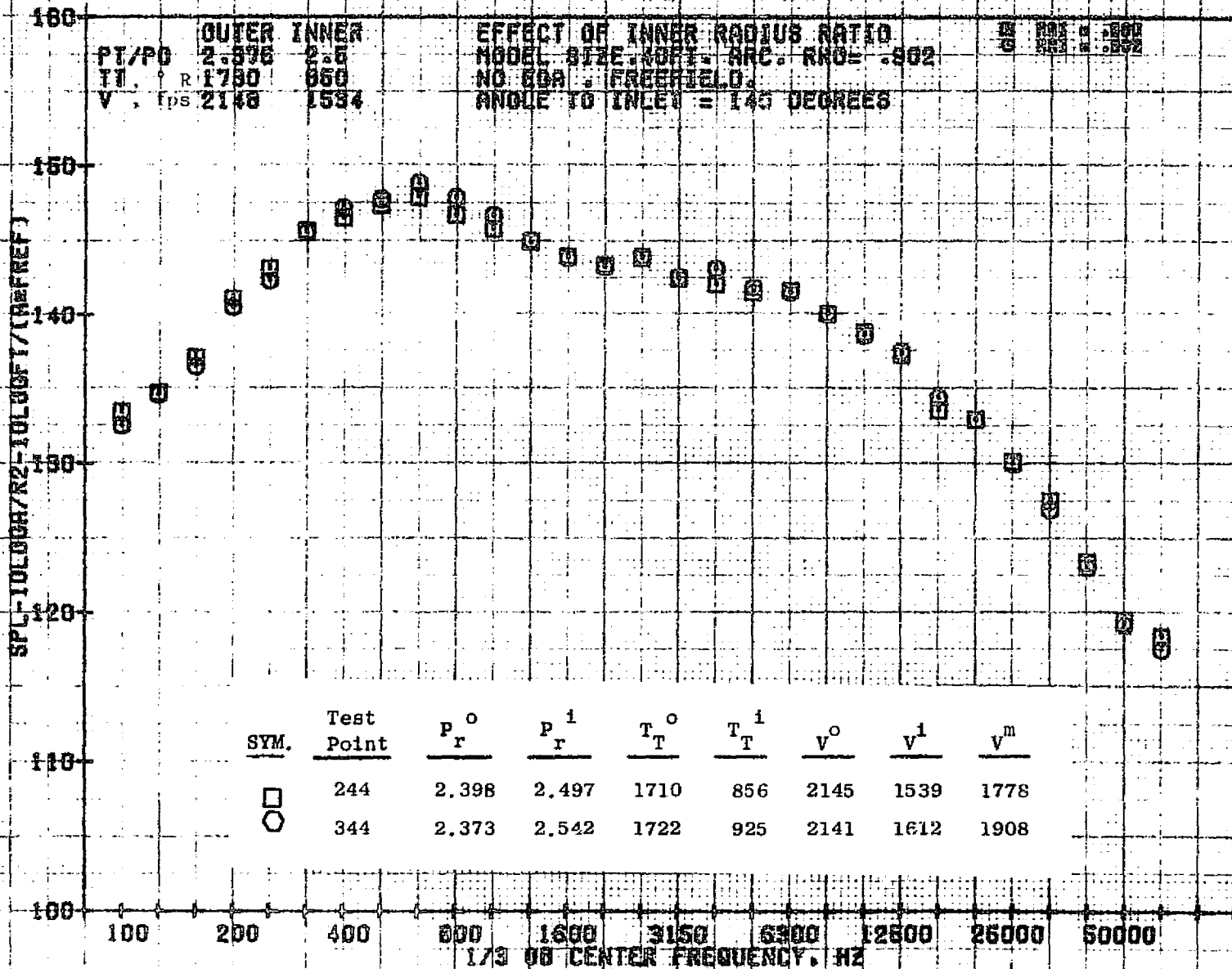
11/04/78
18727-001

79 BURCH A.



11/04/76
18727-001

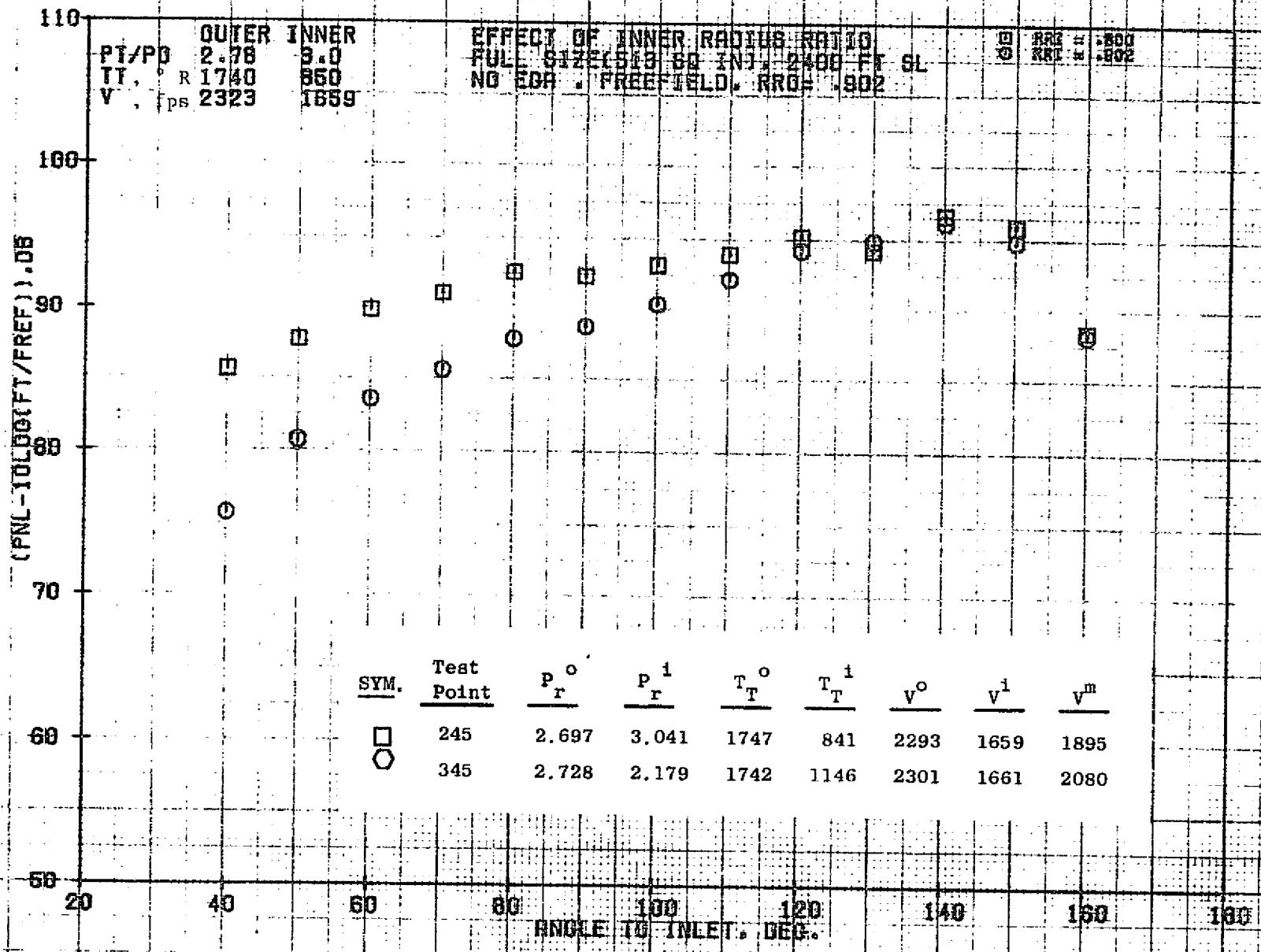
79 BURCH A.



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18727-001

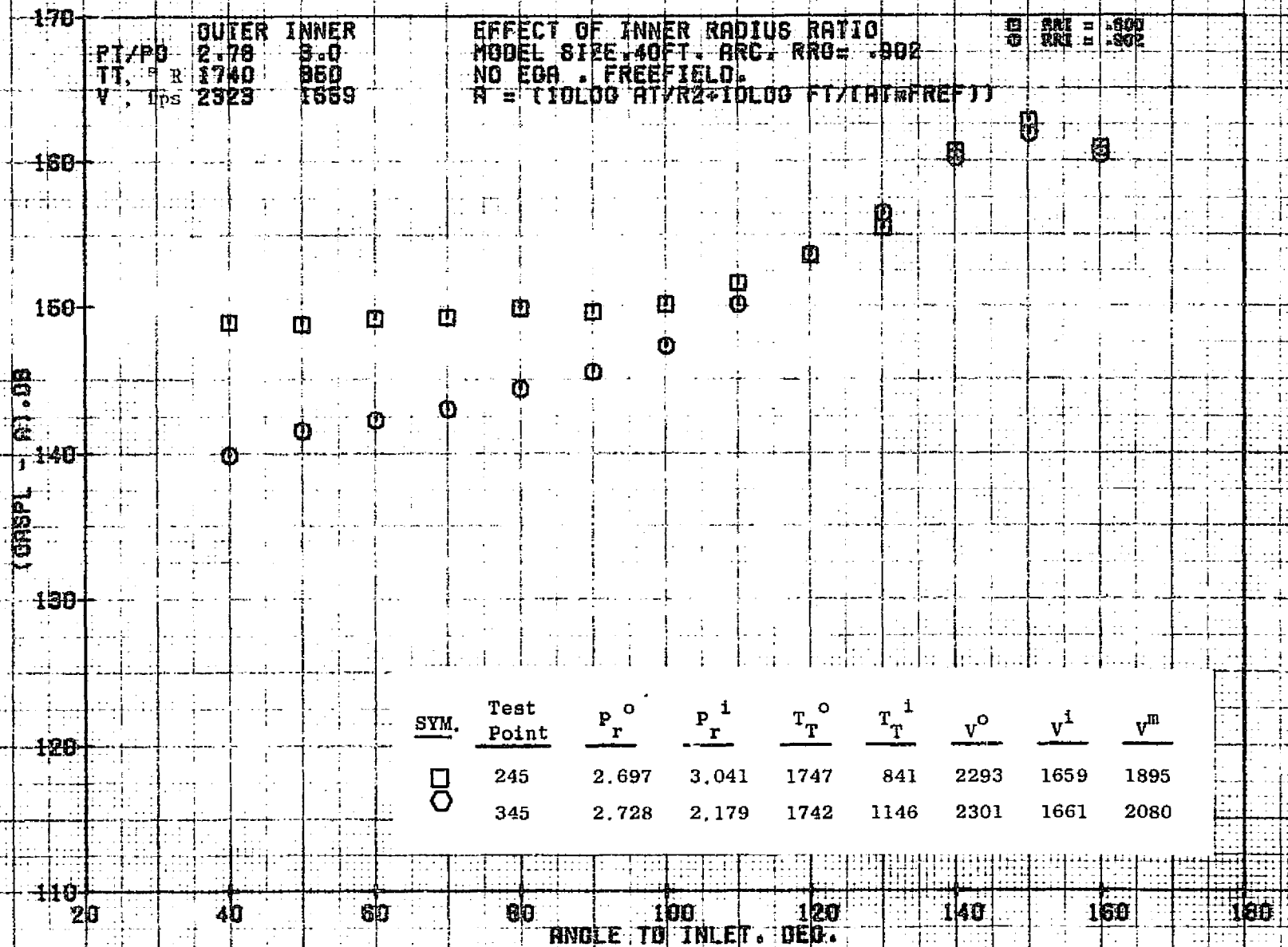
79 BURCH A.

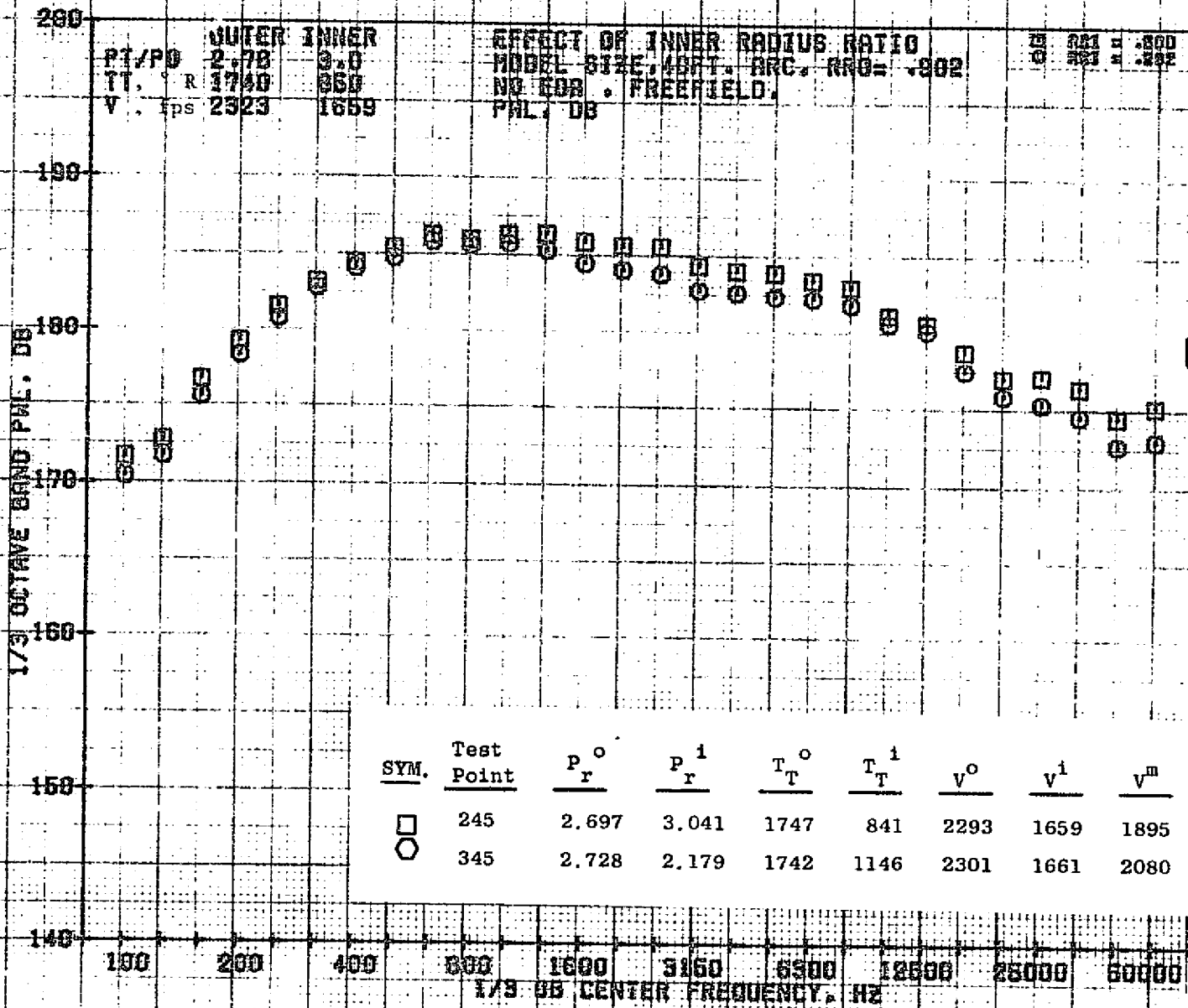
978



10/29/76
 18124-001

79 BURCH A.

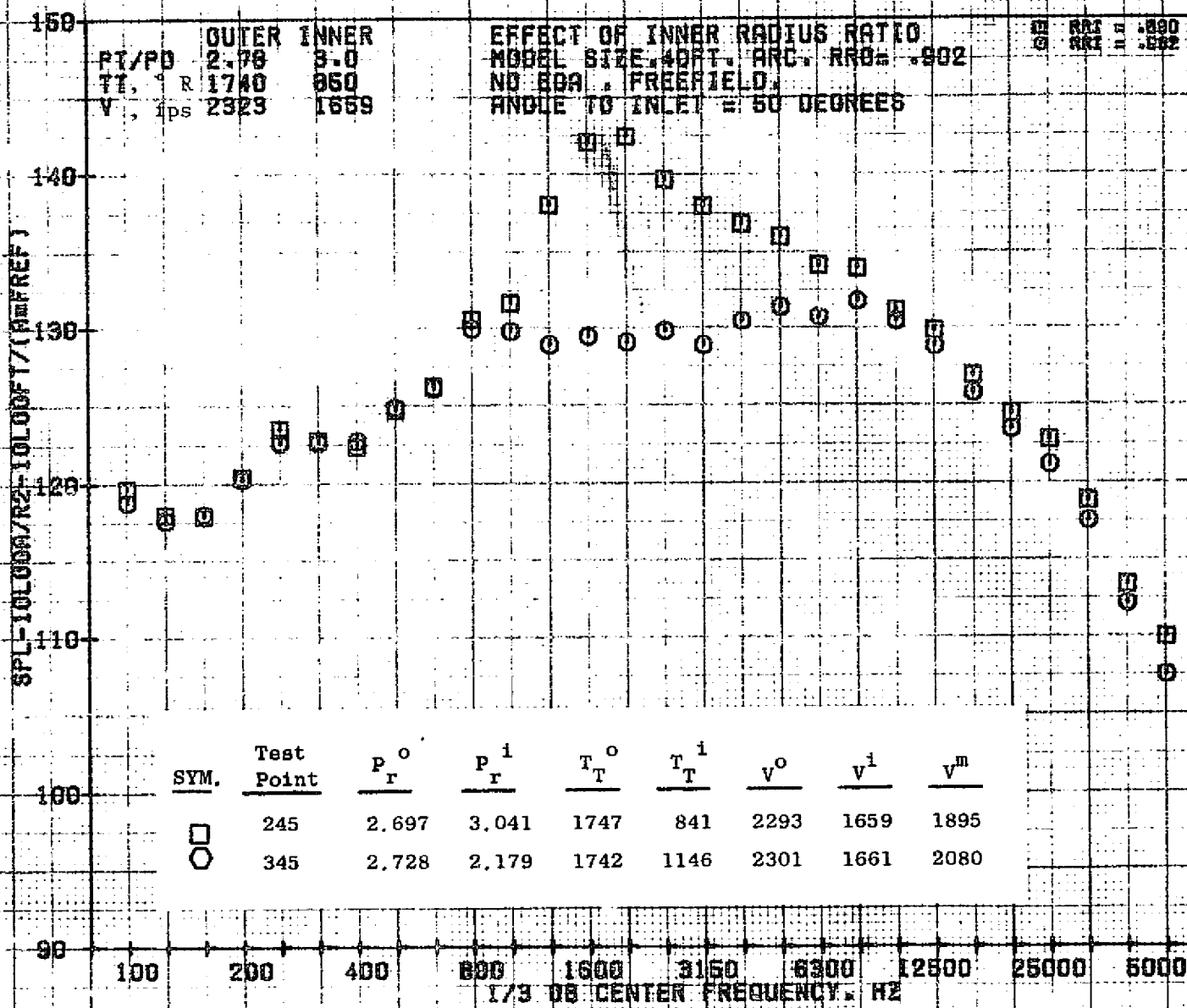


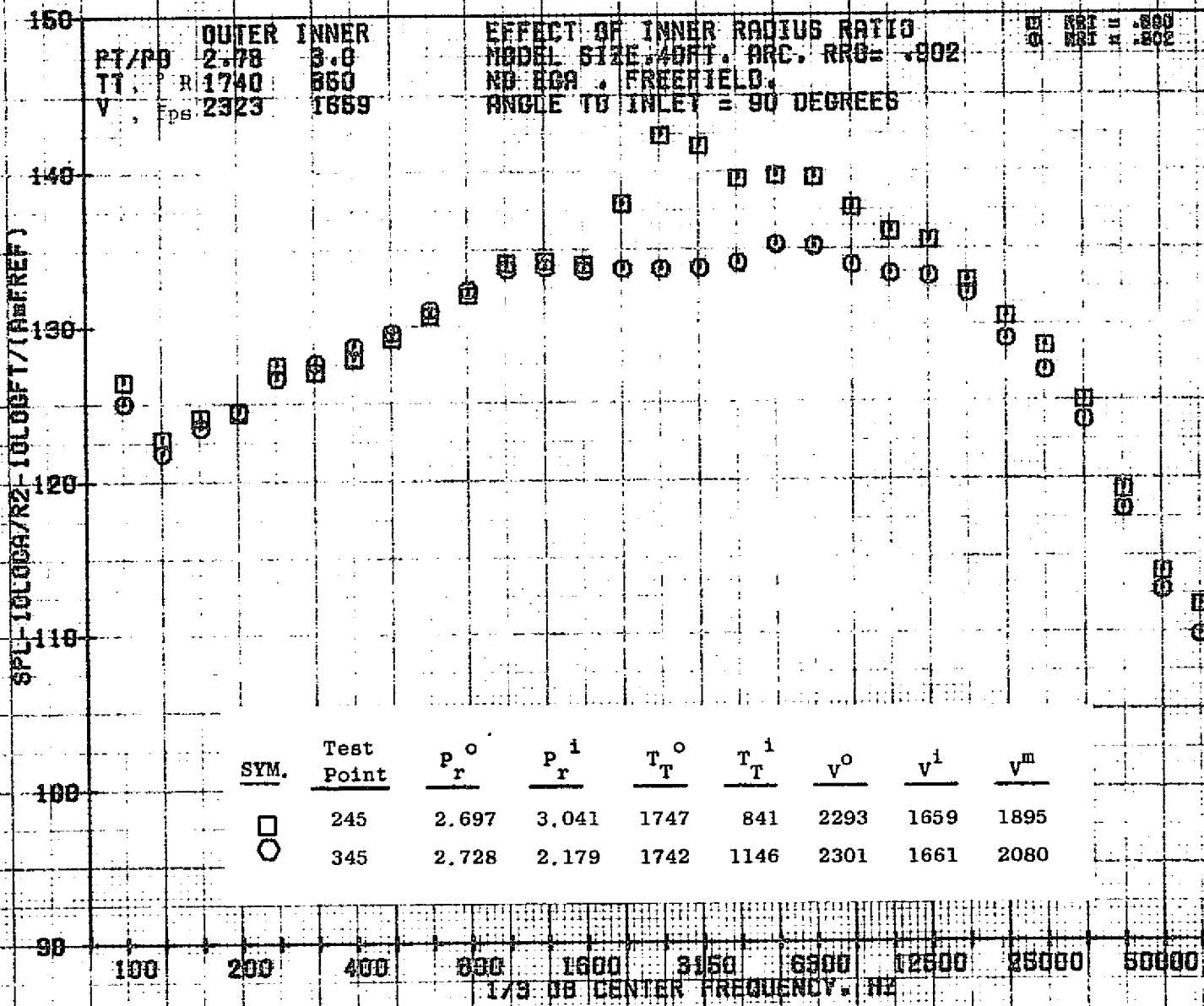


SYM.	Test Point	P_r^0	P_r^1	T_T^0	T_T^1	V^0	V^1	V^m
□	245	2.697	3.041	1747	841	2293	1659	1895
○	345	2.728	2.179	1742	1146	2301	1661	2080

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18161-001

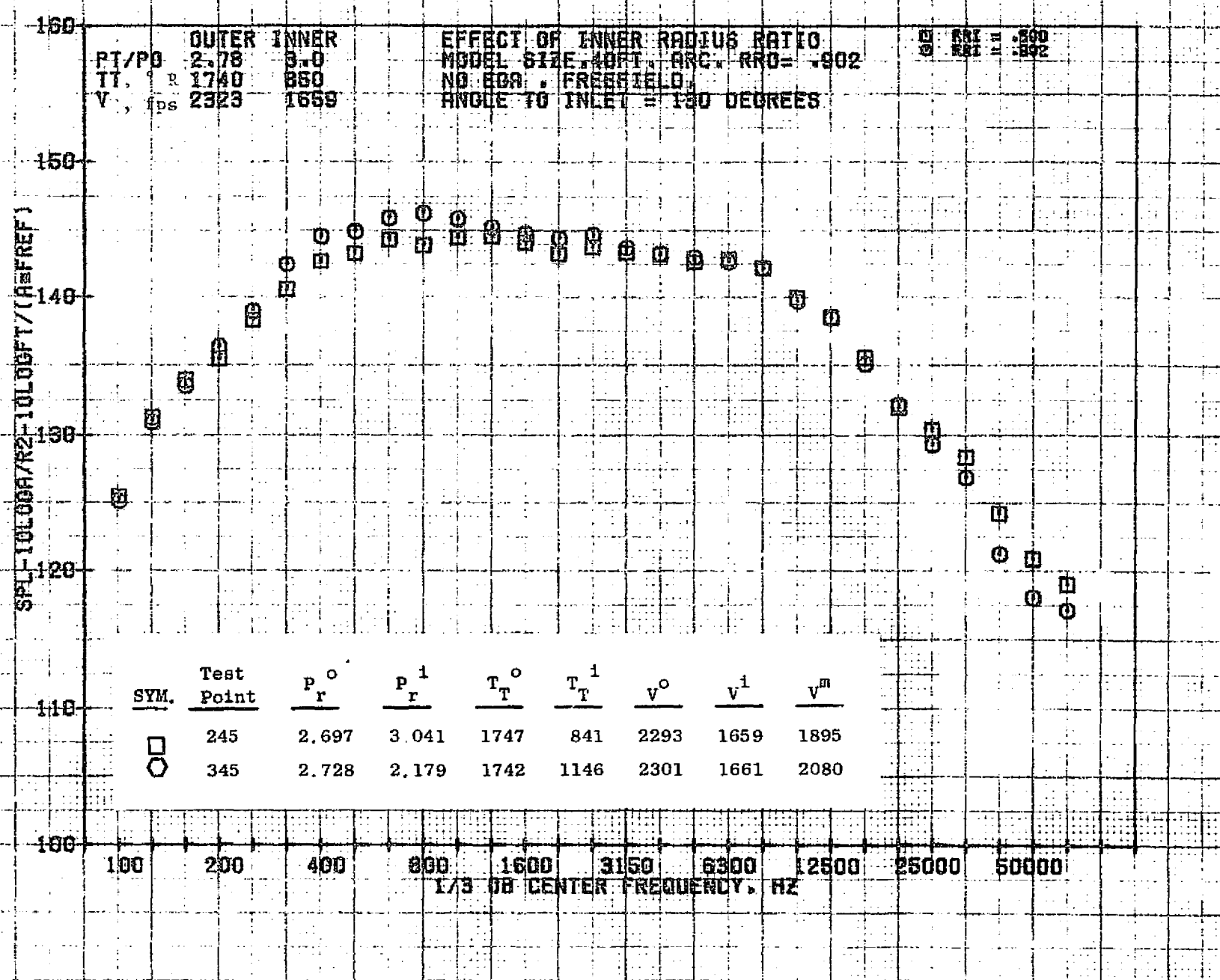
79 BURCH A.



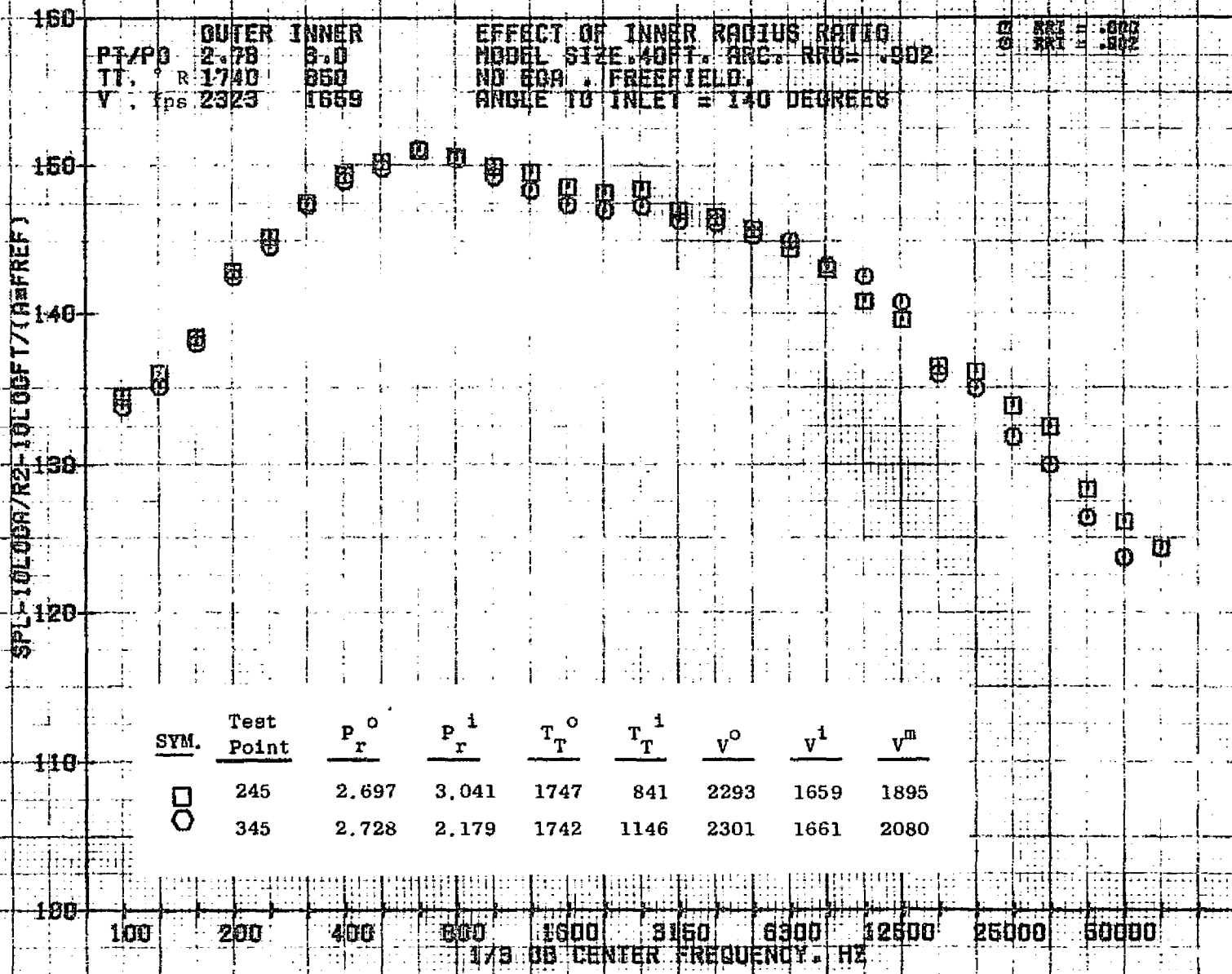


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 18161-001

79 BURCH A.

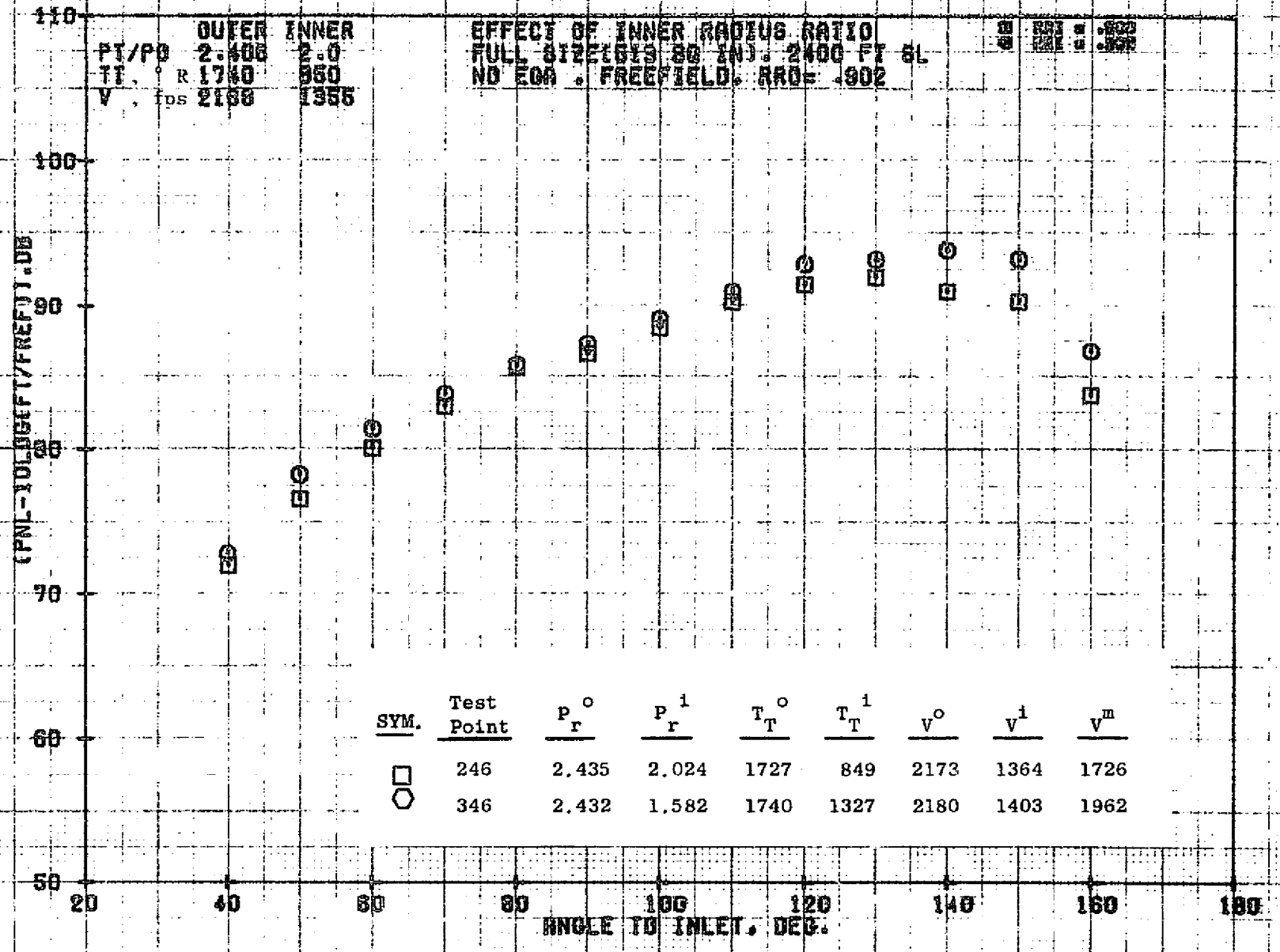


886



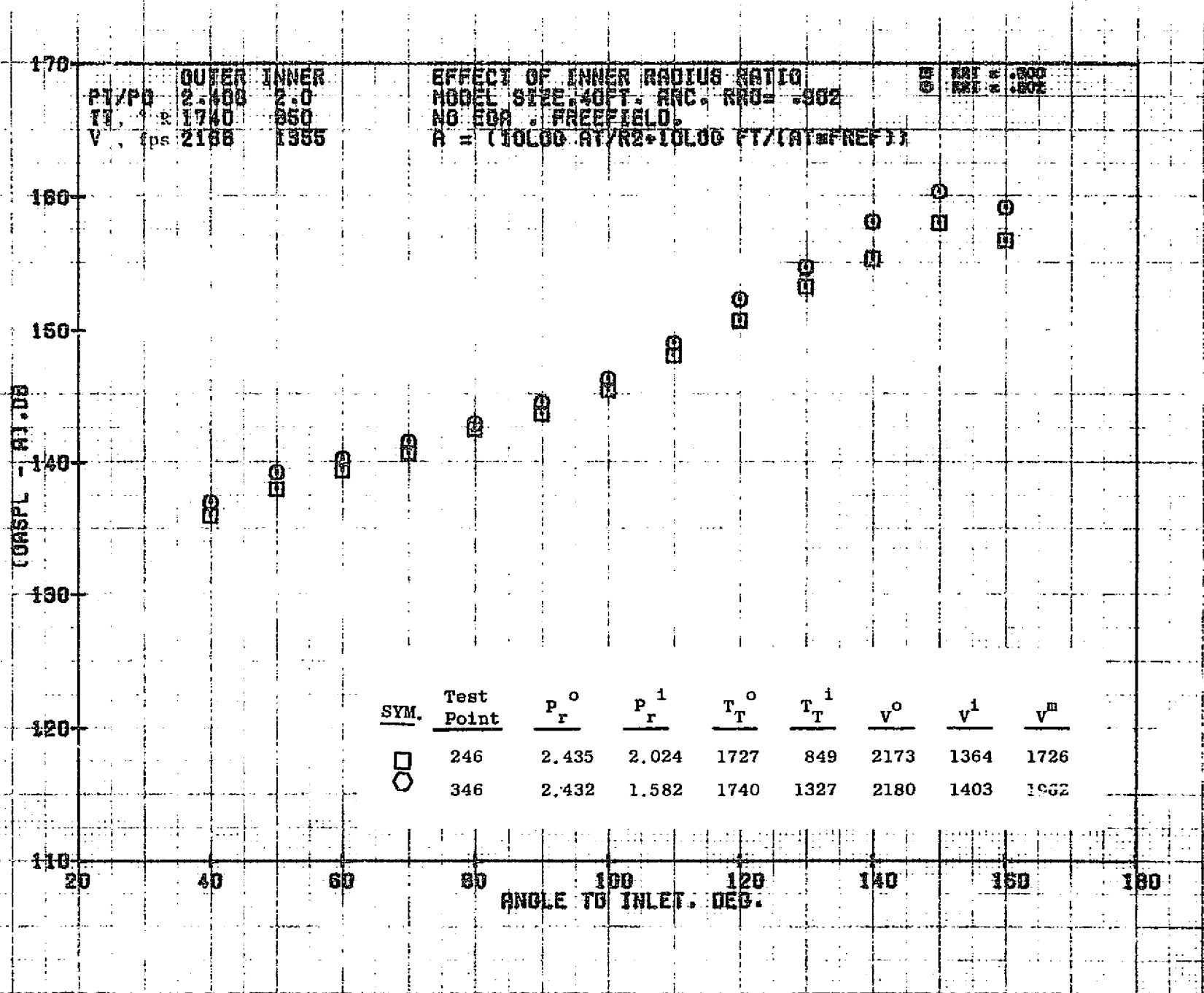
10/29/76
1B161-001

79 BURCH A.



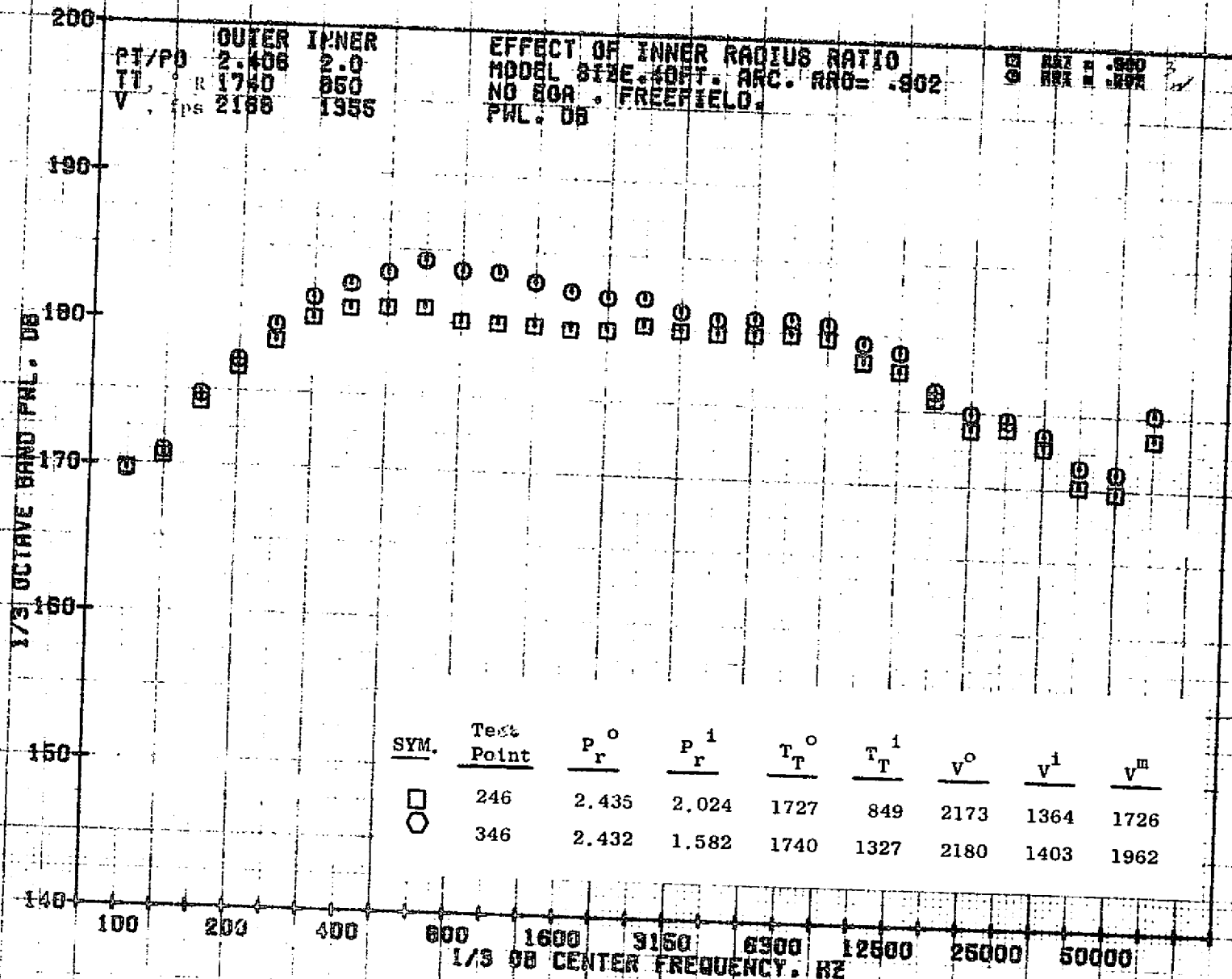
11/04/76
18880-001

79 BURCH A.



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18727-001

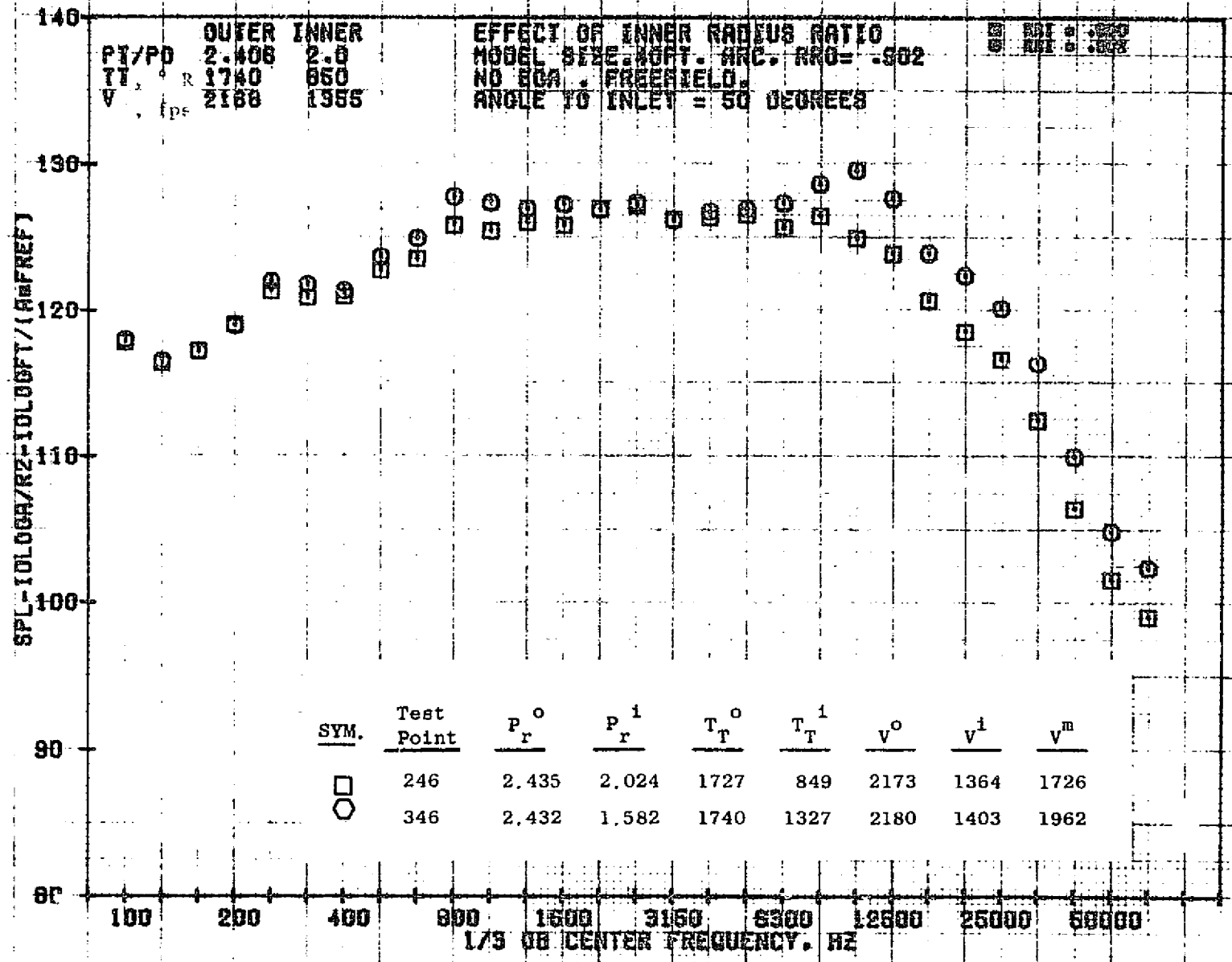
79 BURCH A.



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 18727-001

79 BURCH A.

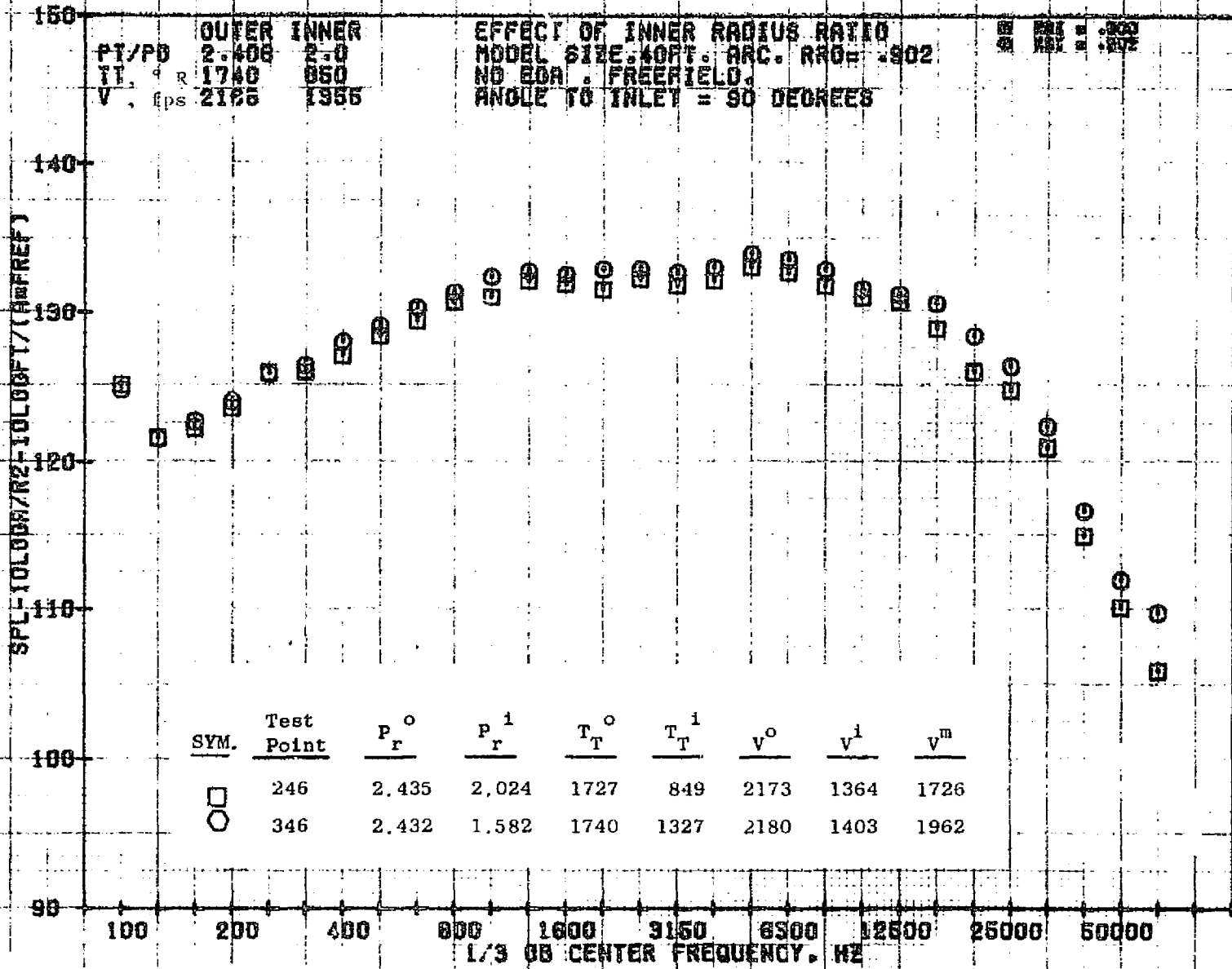
986



11/04/76
18727-001

79 BURCH A.

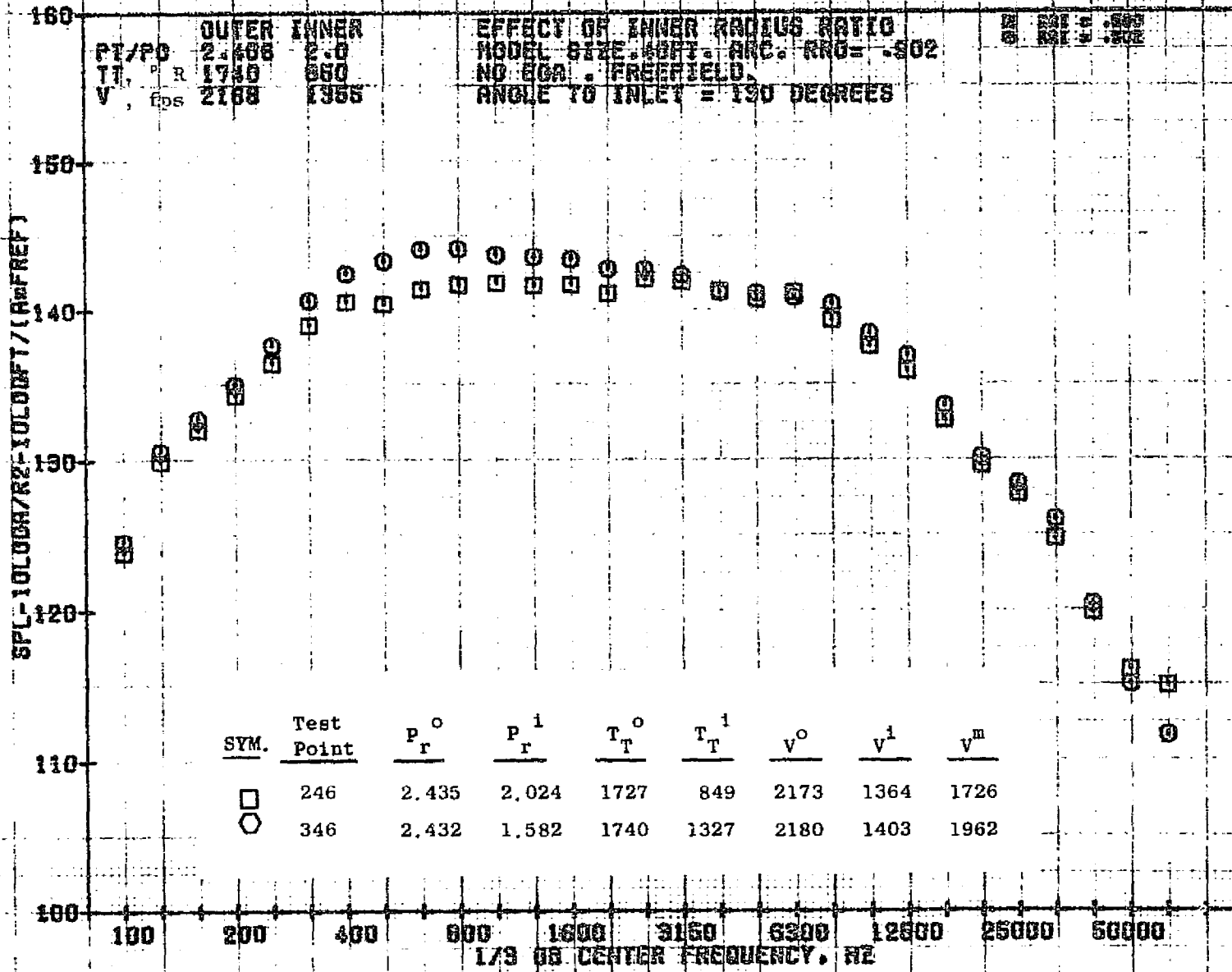
686



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 18727-001

79 BURCH A.

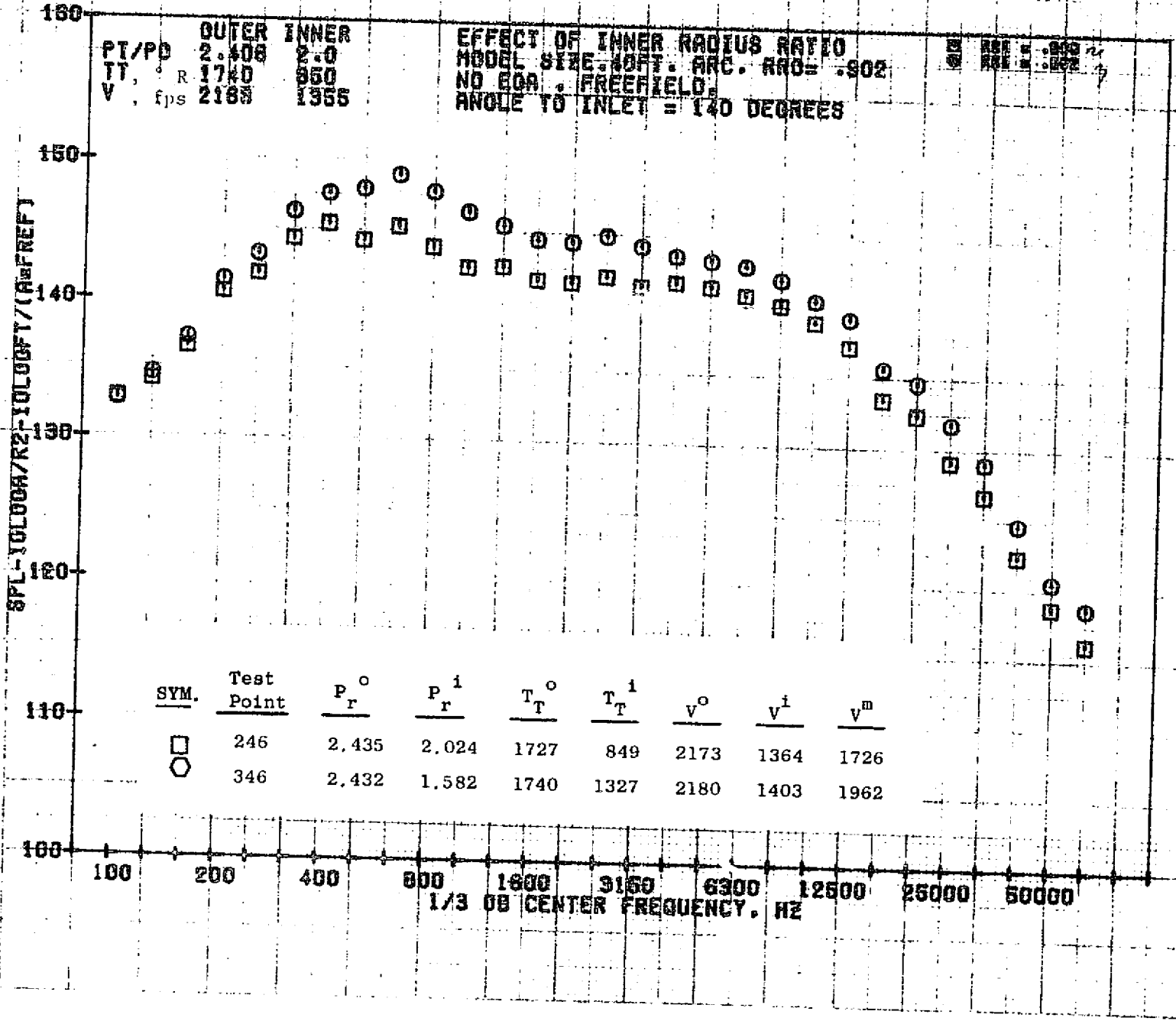
066



11/04/76
18727-001

79 BURCH A.

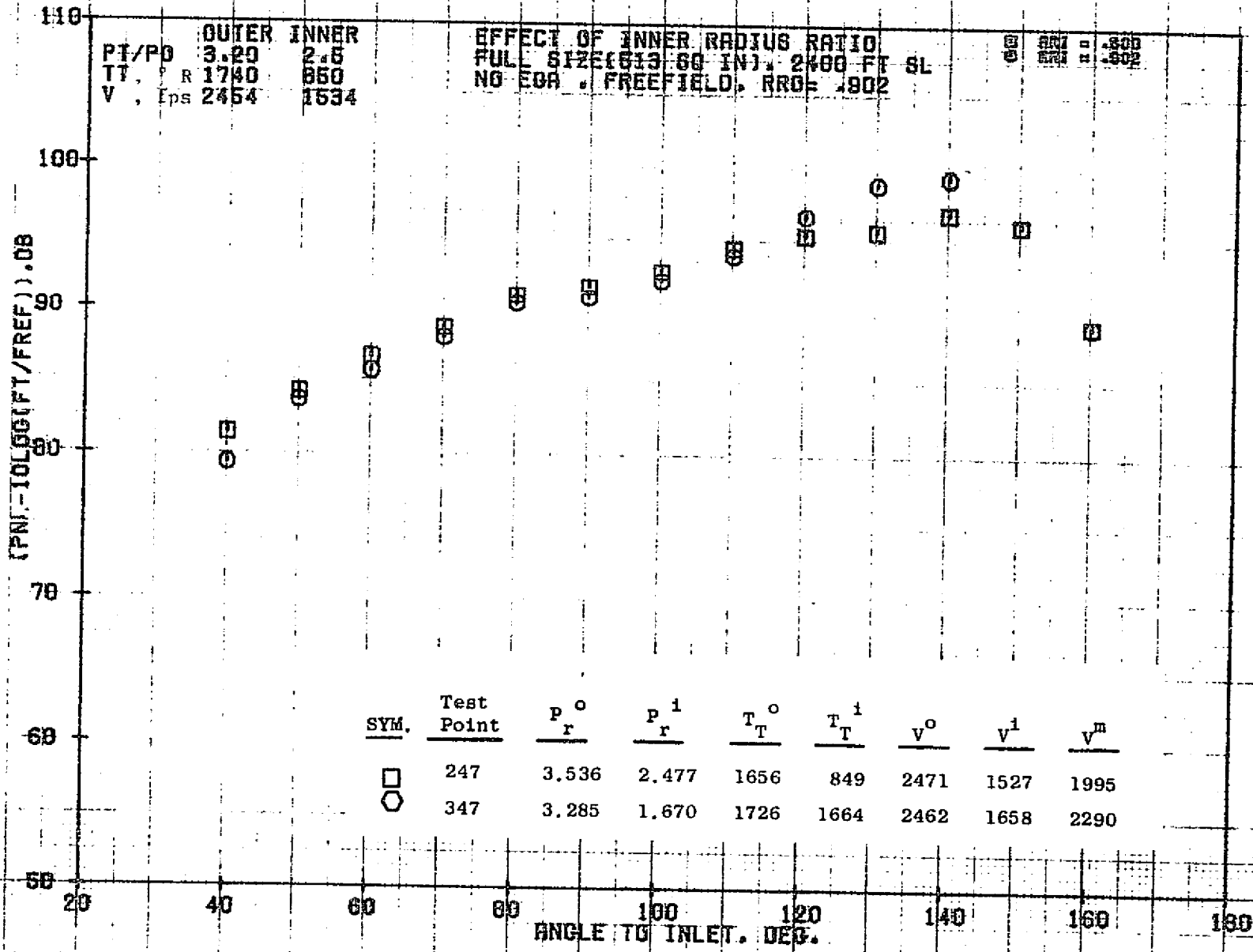
166



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18727-001

79 BURCH A.

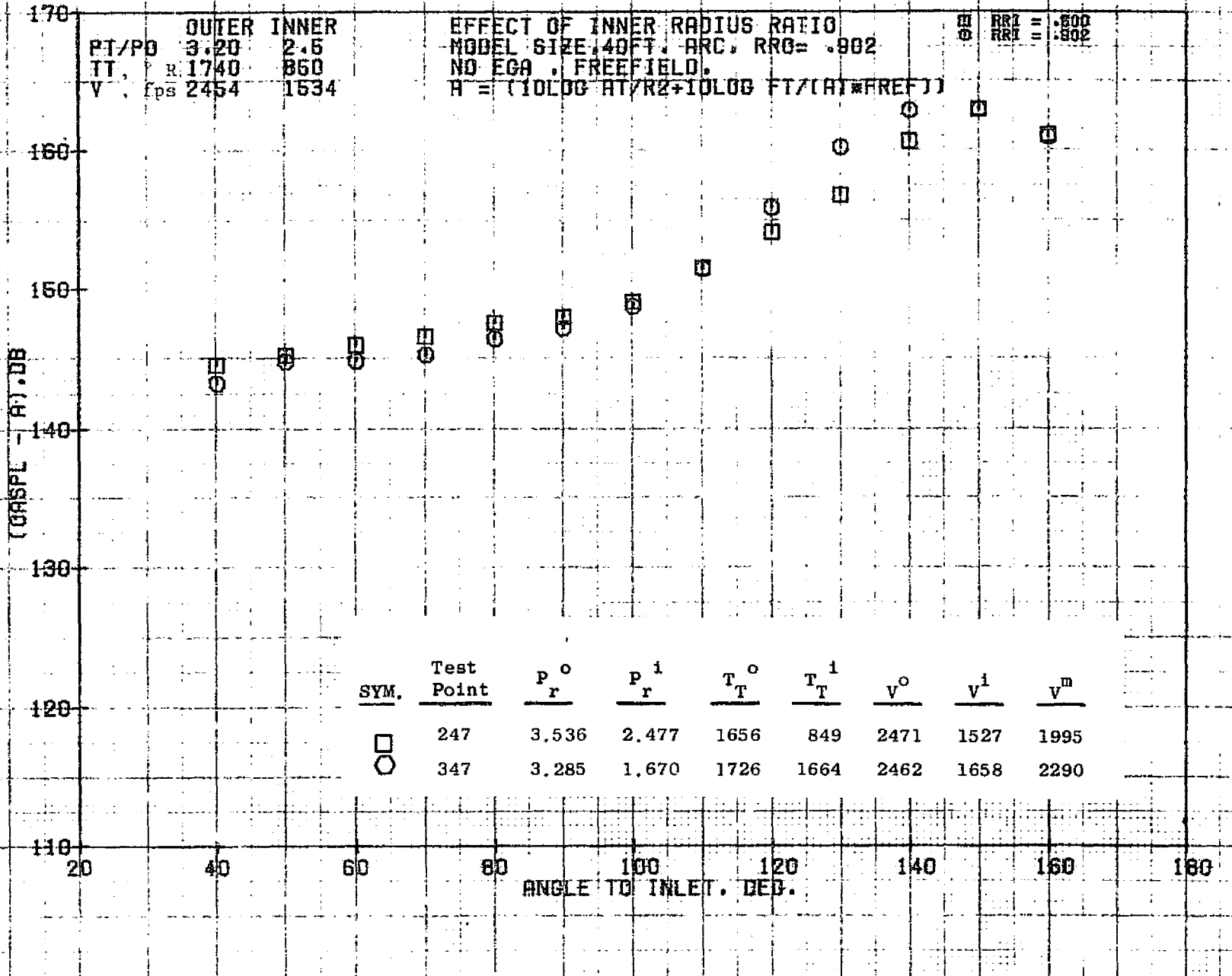
992

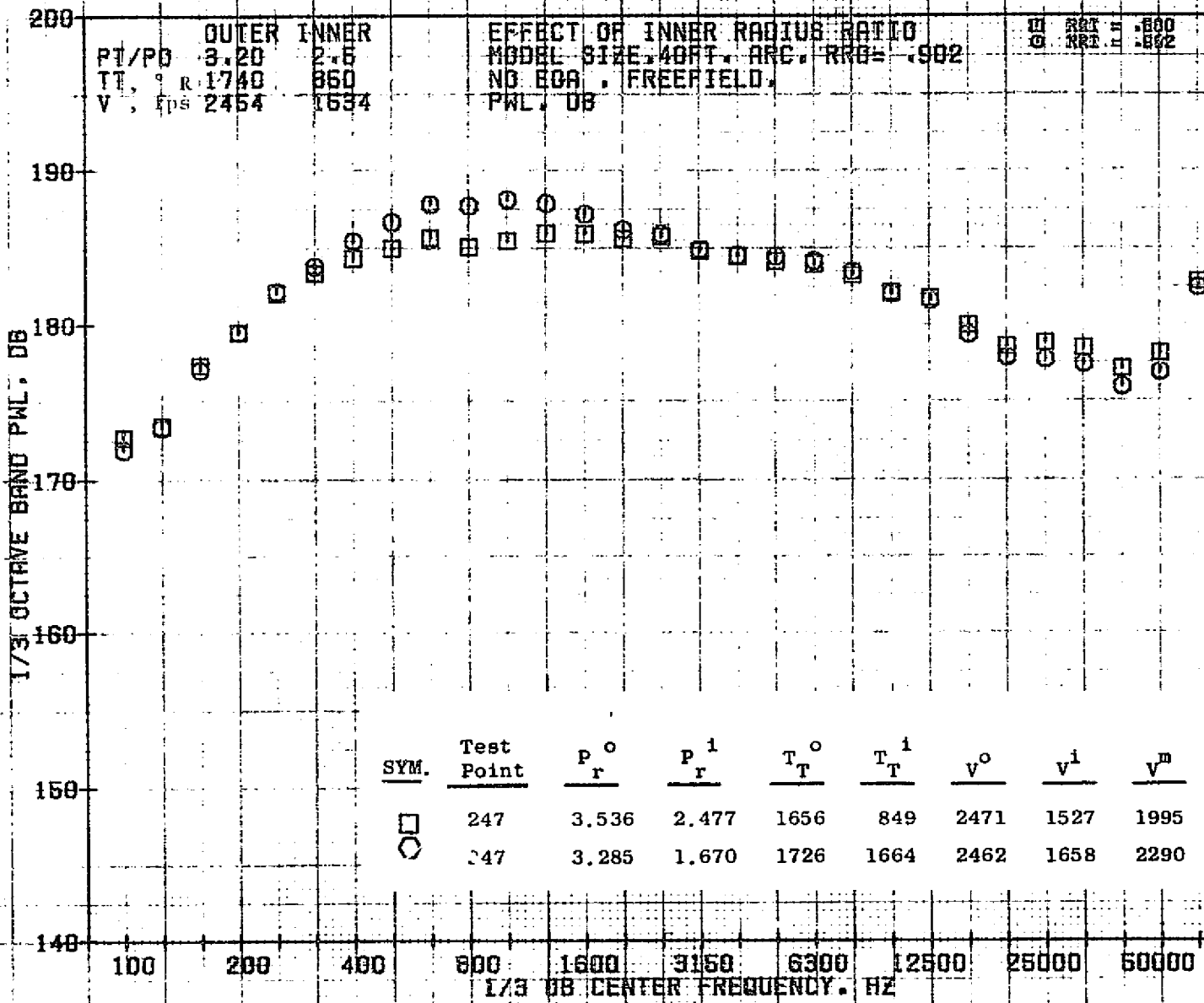


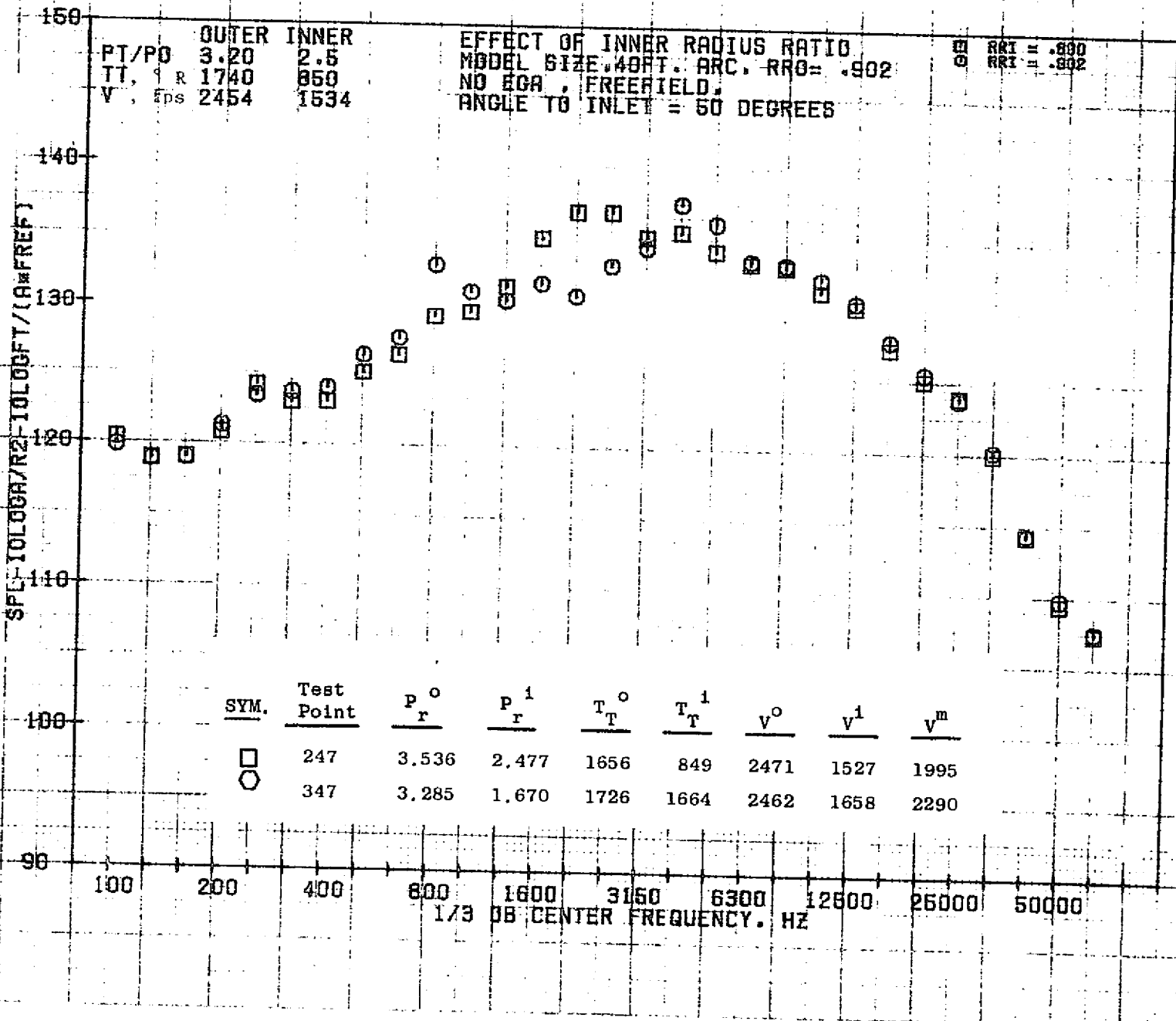
10/29/76
18124-001

79 BURCH A.

966



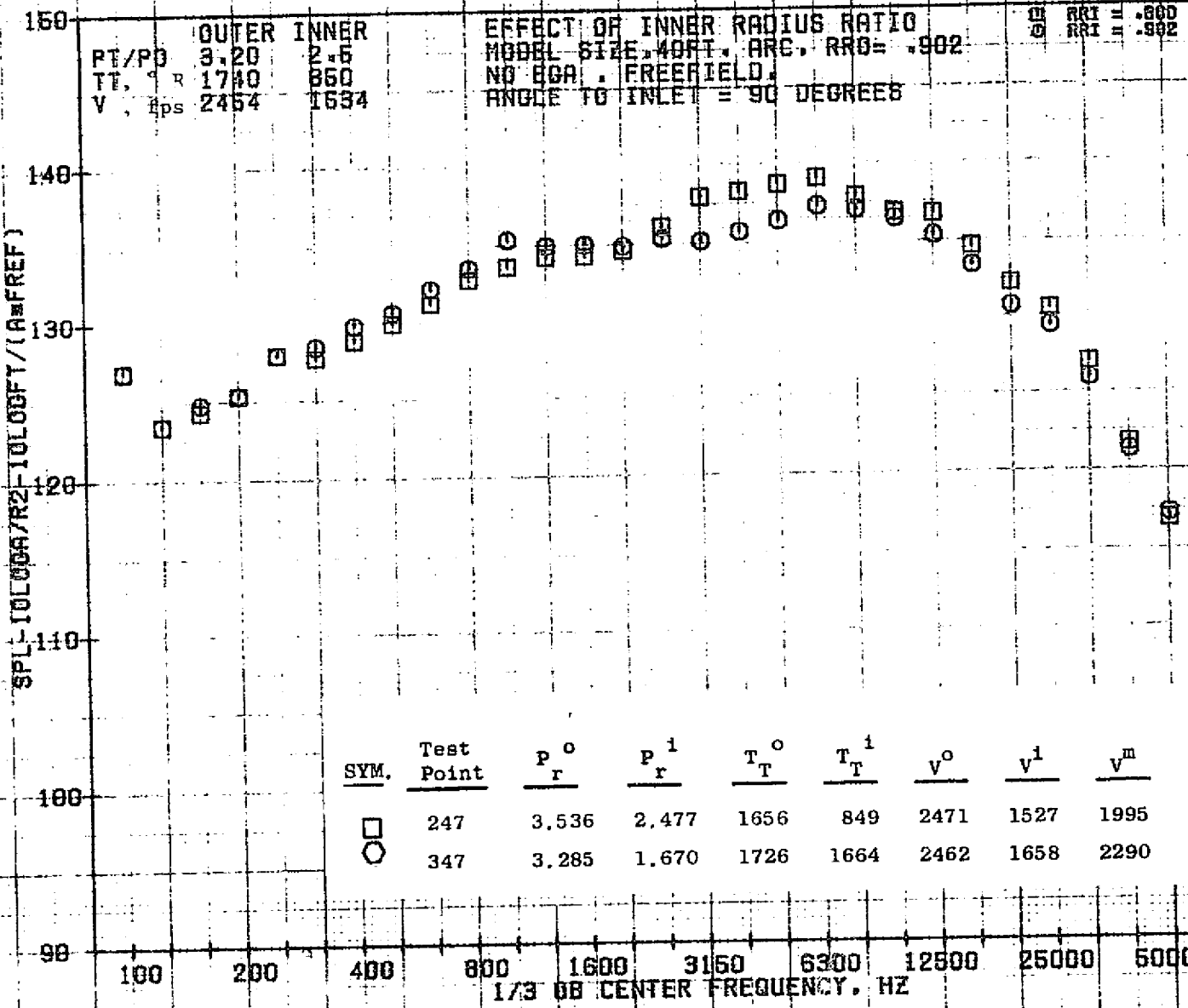




10/29/76
 1B161-001

79 BURCH A.

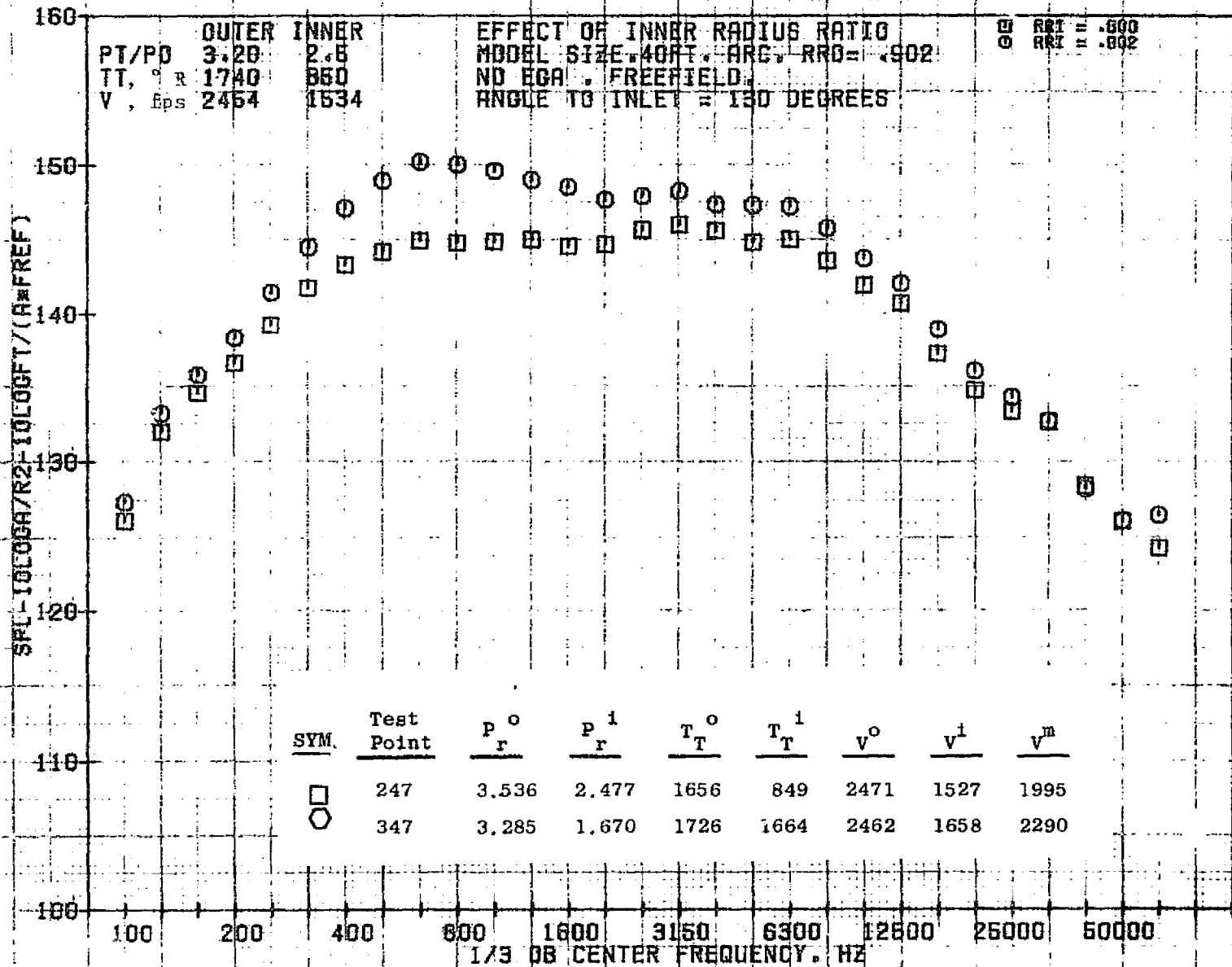
966



SYM.	Test Point	P_r^o	P_r^i	T_T^o	T_T^i	V^o	V^i	V^m
□	247	3.536	2.477	1656	849	2471	1527	1995
○	347	3.285	1.670	1726	1664	2462	1658	2290

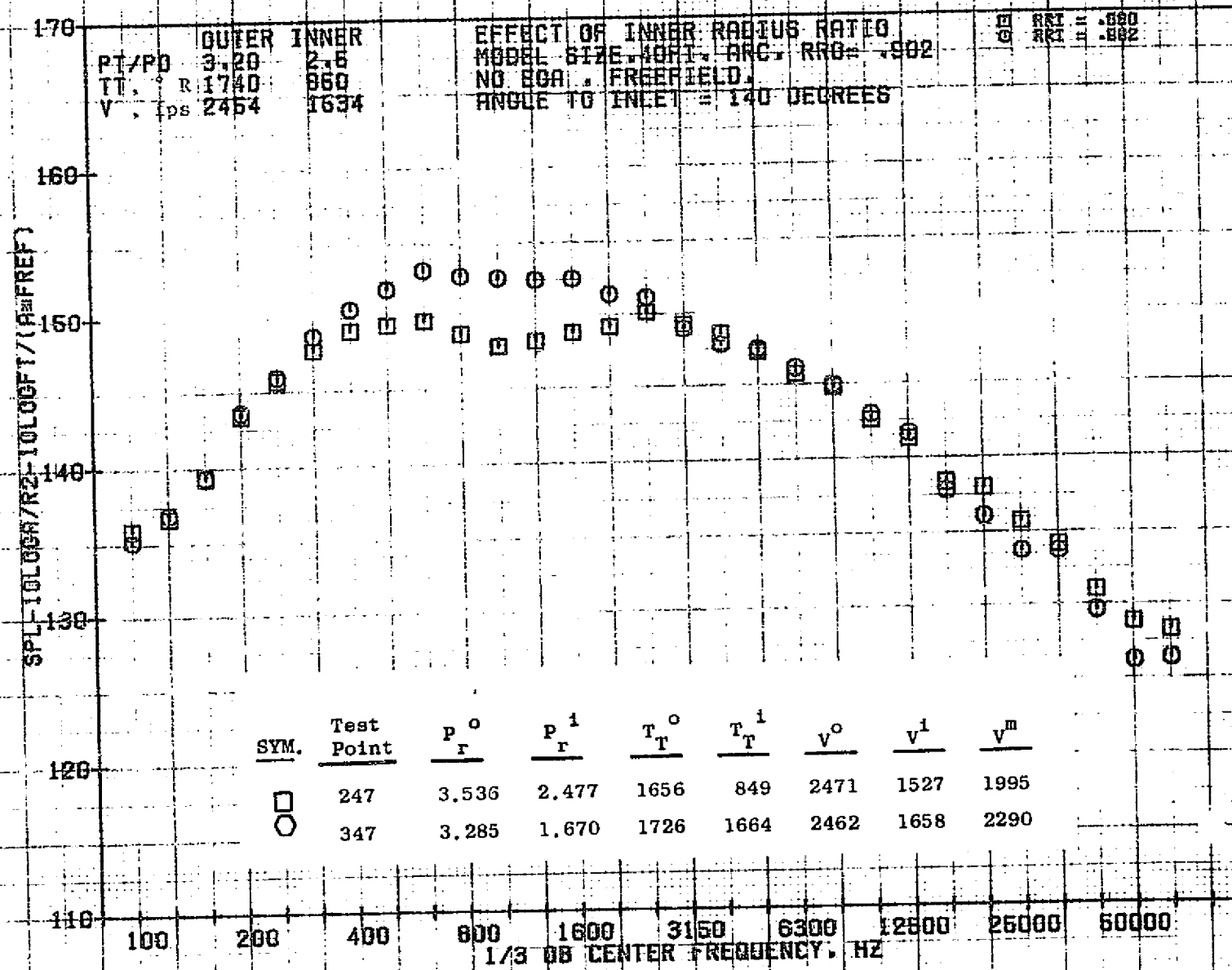
10/29/76
1R161-001

79 BURCH A.



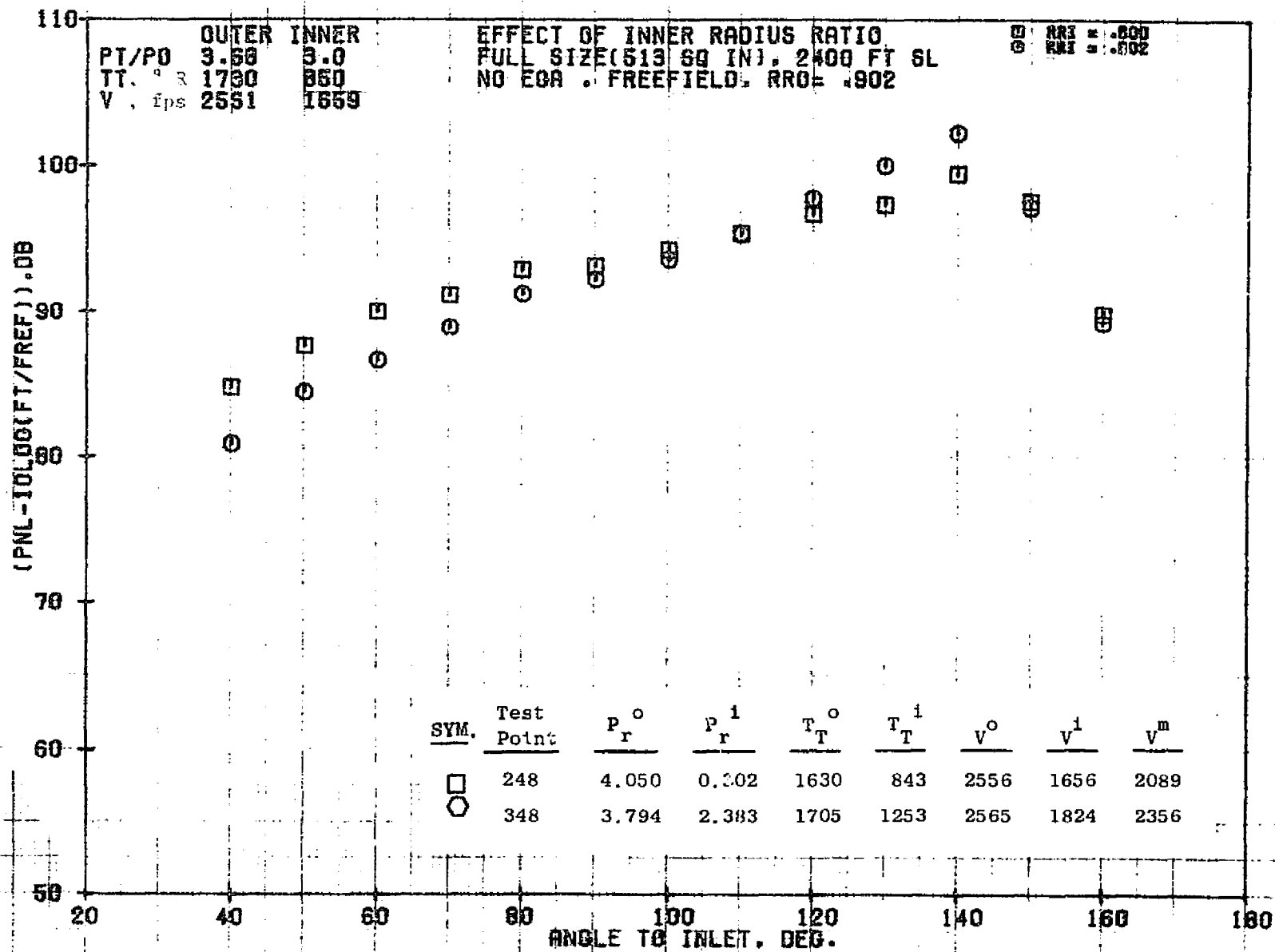
10/29/76
 1B161-001

79 BURCH A.



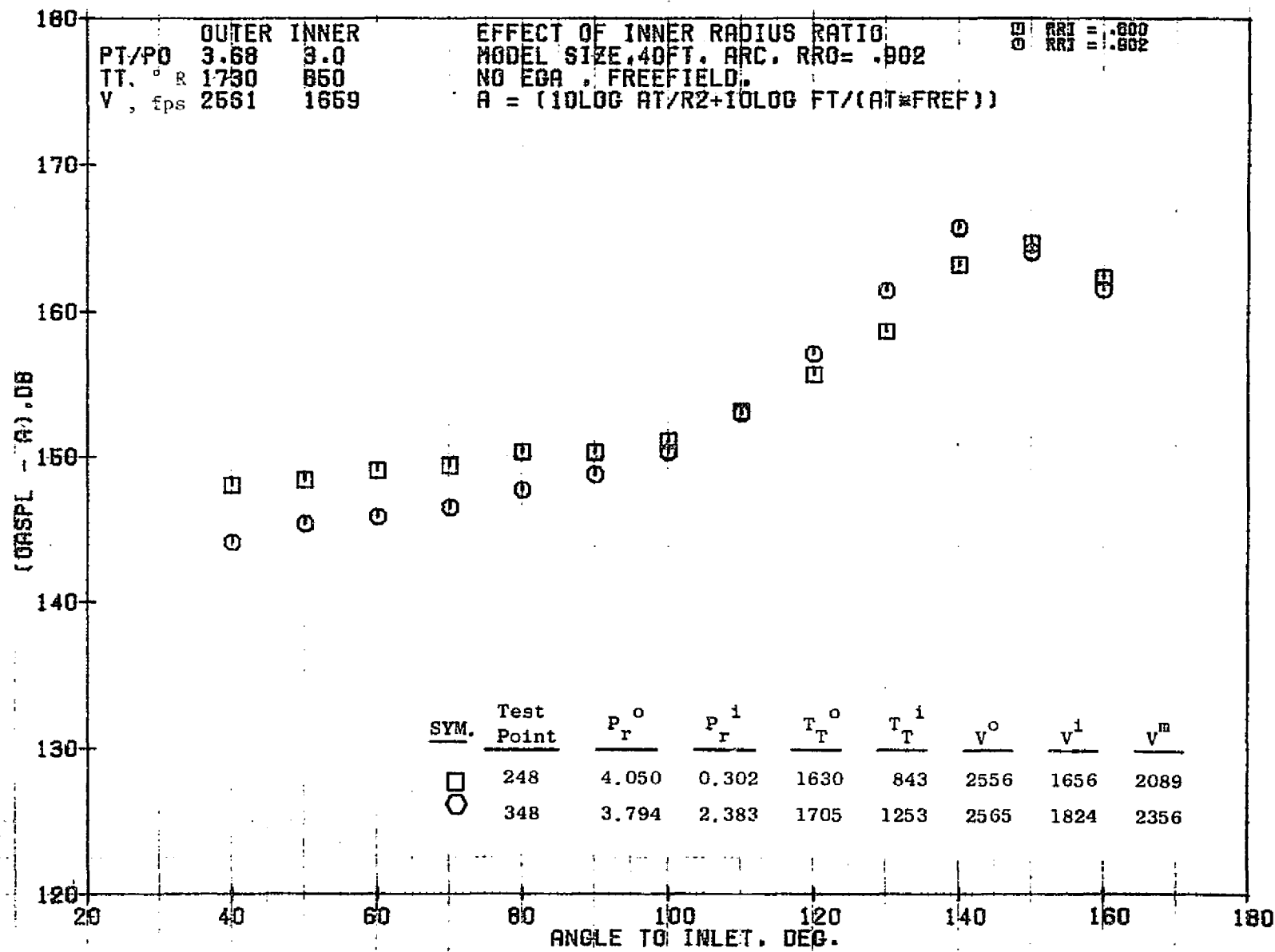
10/29/76
18161-001

79 BURCH A.



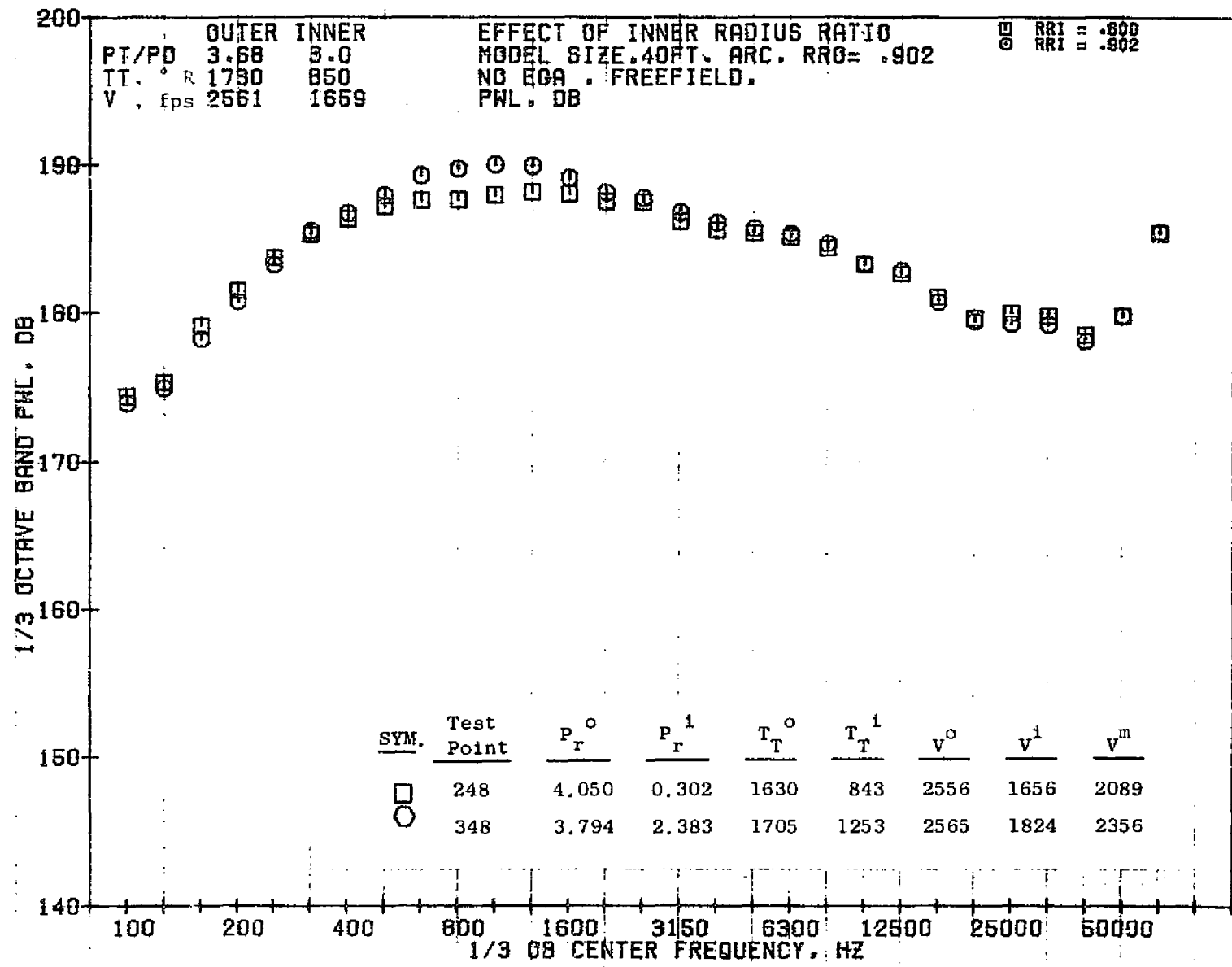
10/29/76
 18124-001

79 BURCH A.



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18161-001

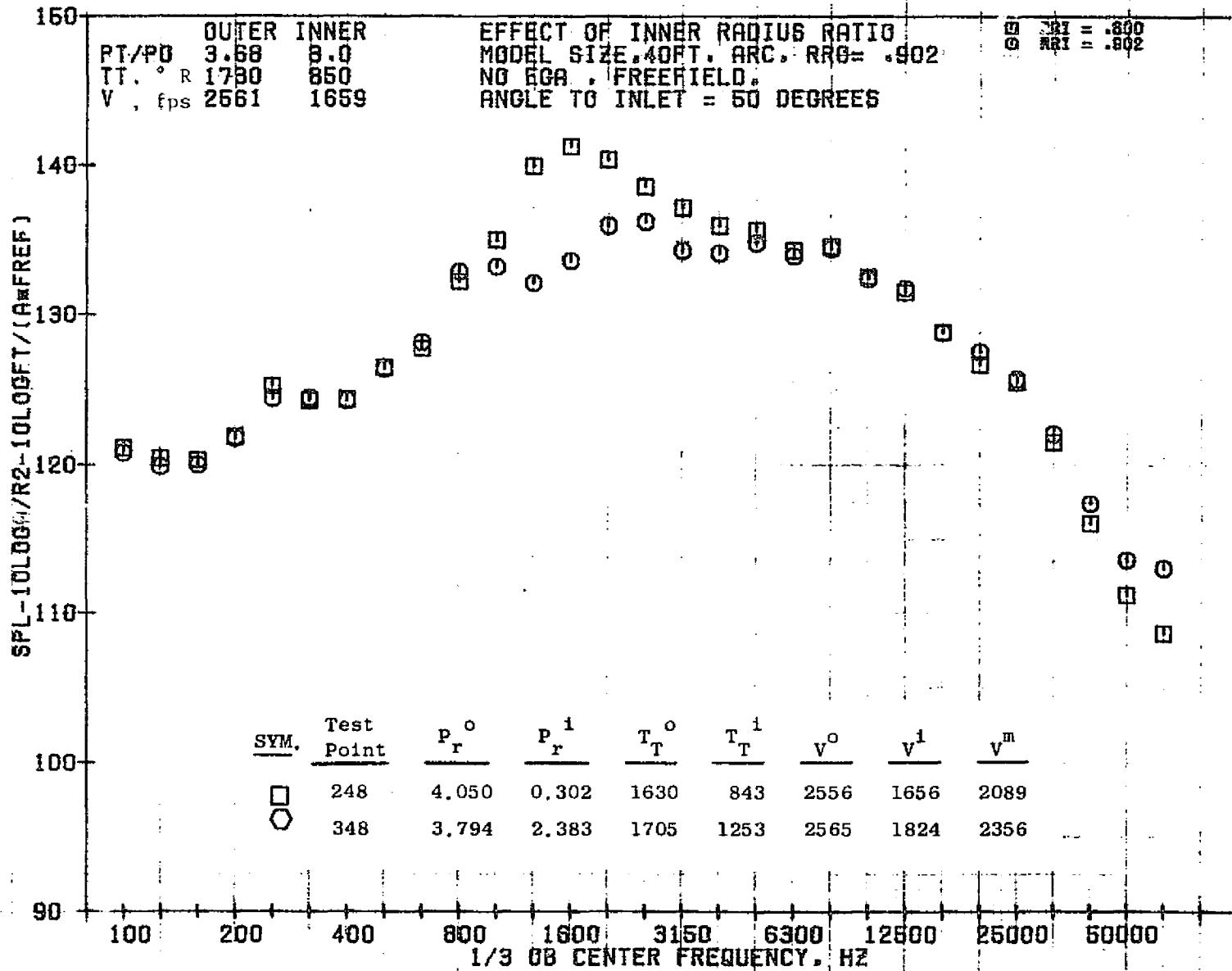
79 BURCH A.



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18161-001

79 BURCH A.

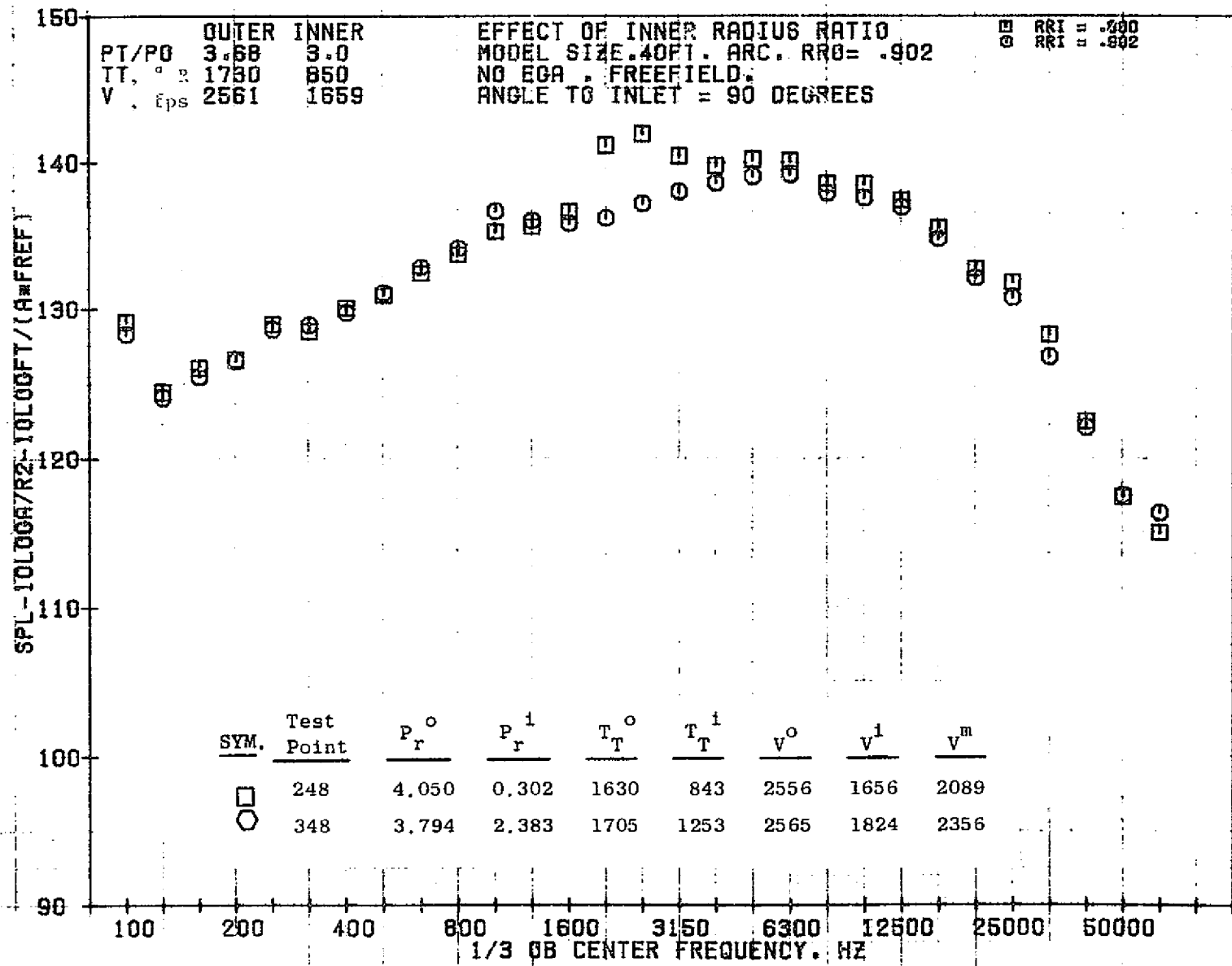
1002



10/29/76
18161-001

79 BURCH A.

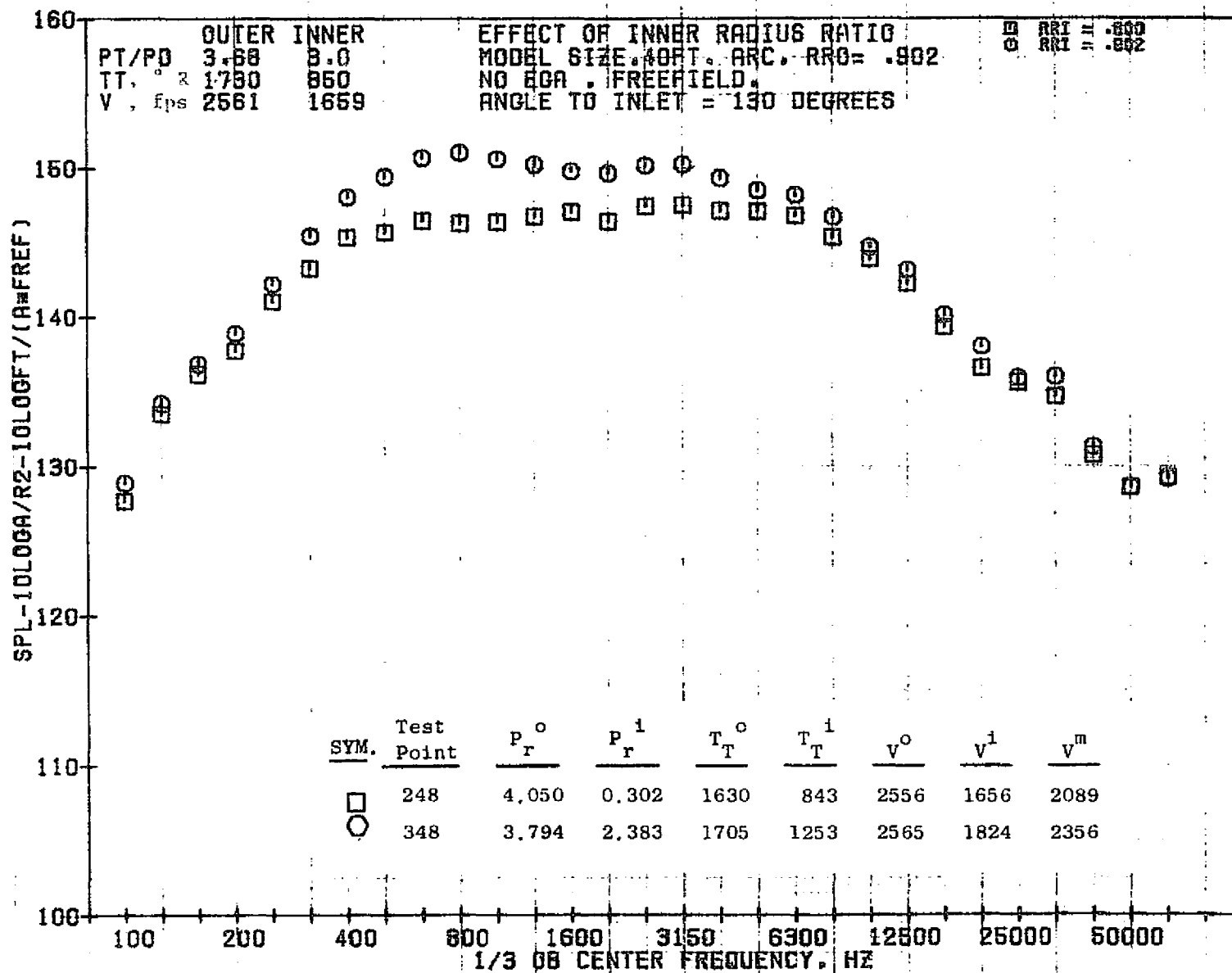
1000



10/29/76
 18161-001

79 BURCH A.

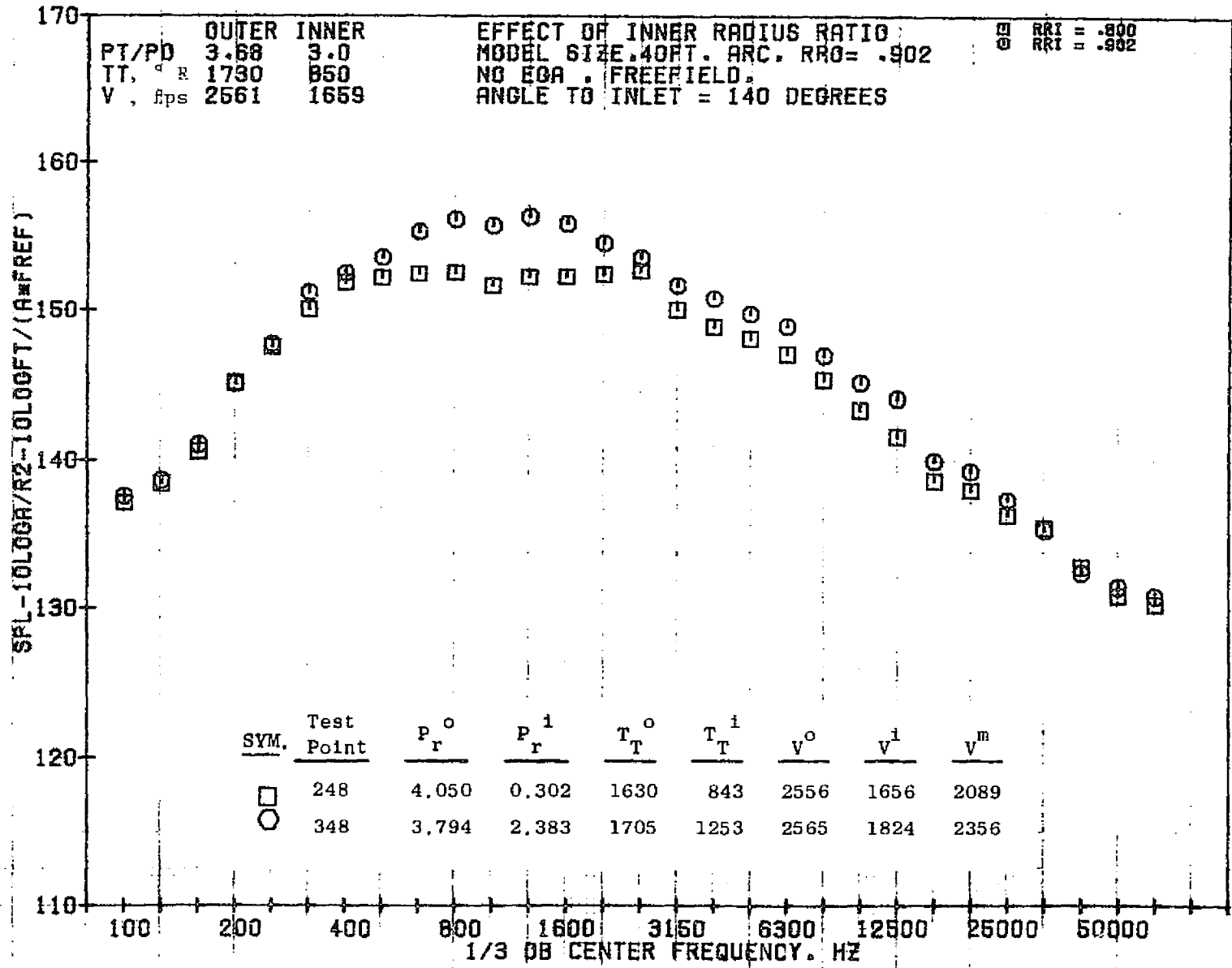
1004



10/29/76
 18161-001

79 BURCH A.

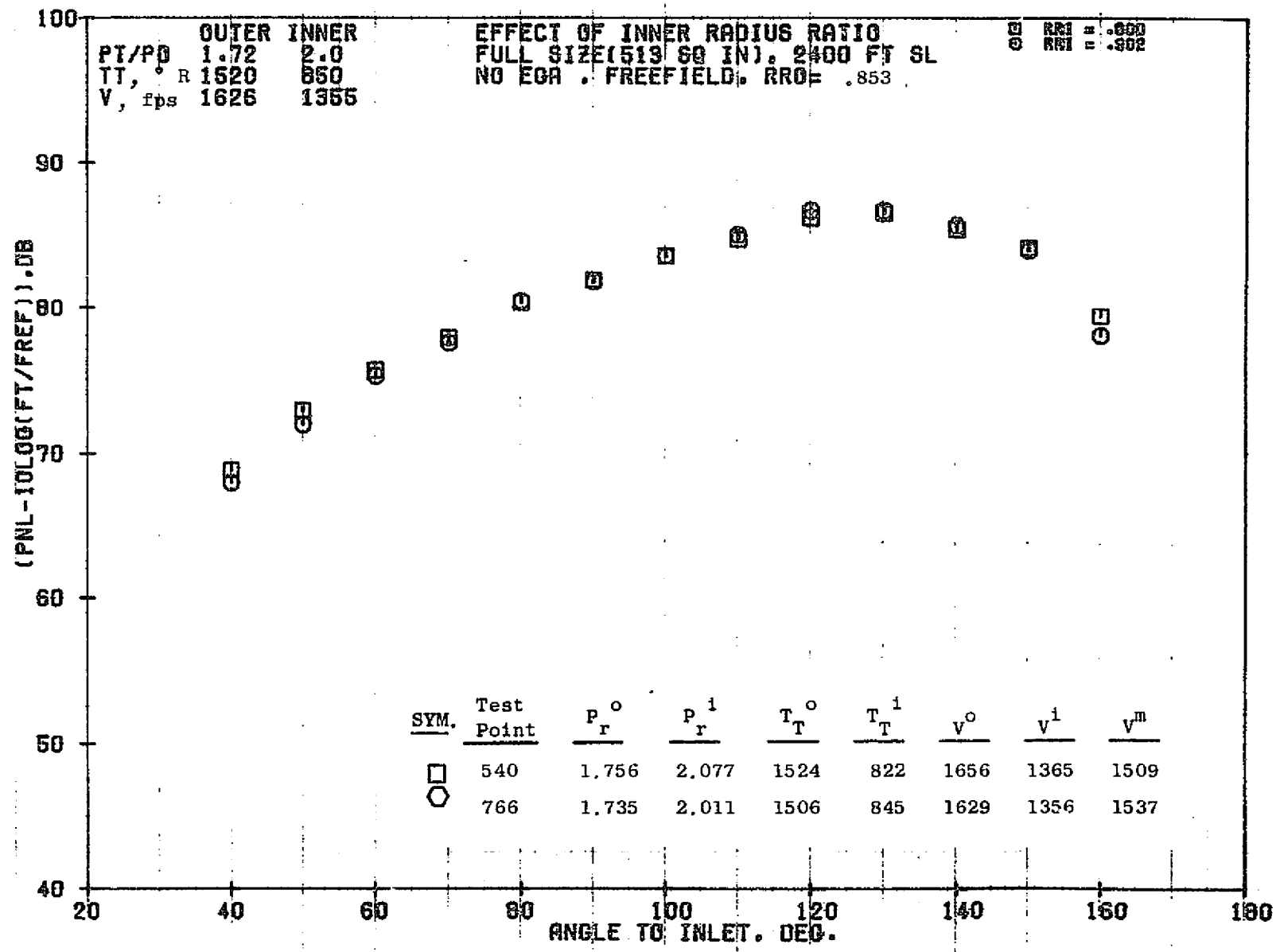
1005



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18161-001

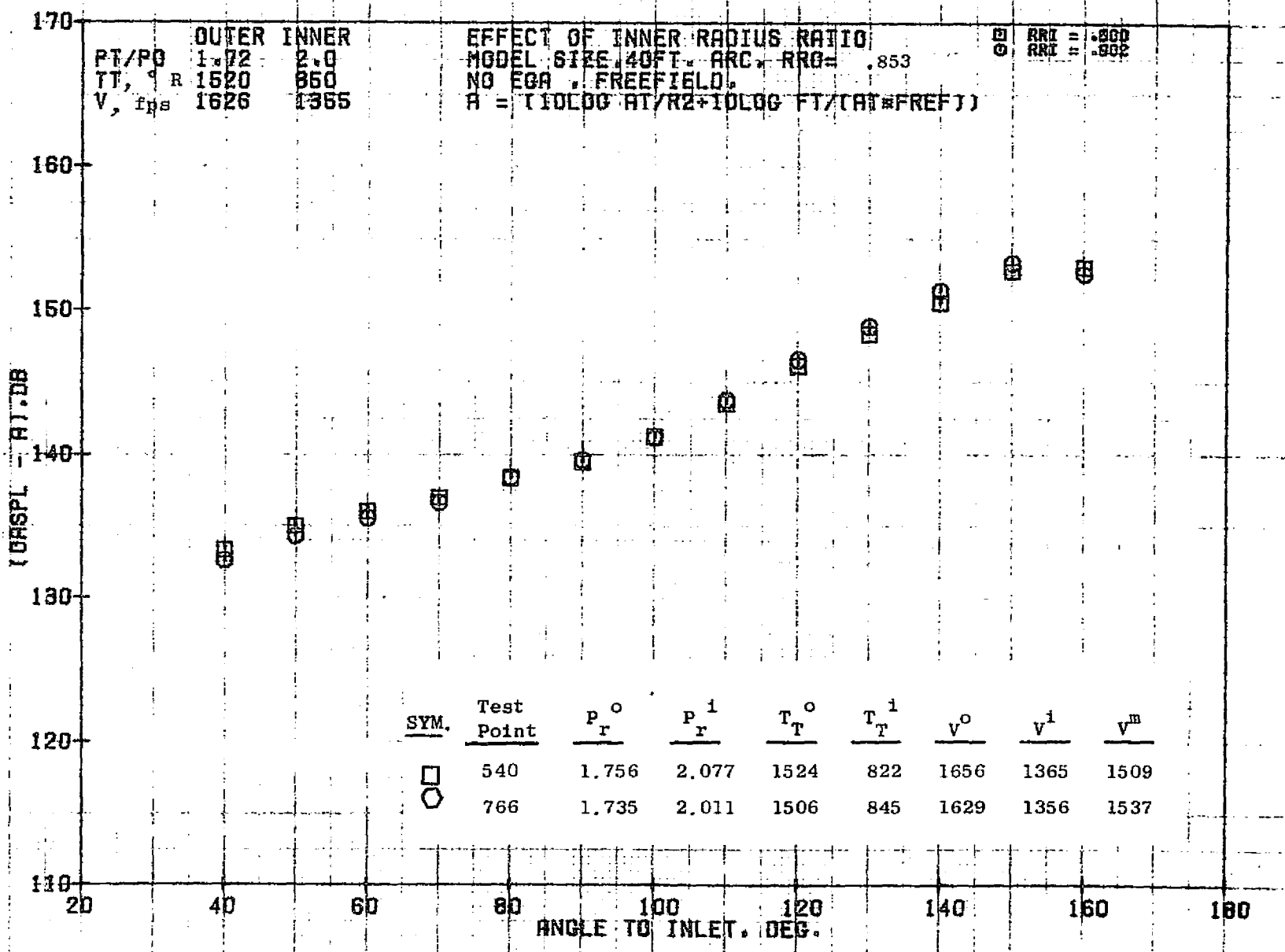
79 BURCH A.

1006



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18124-001

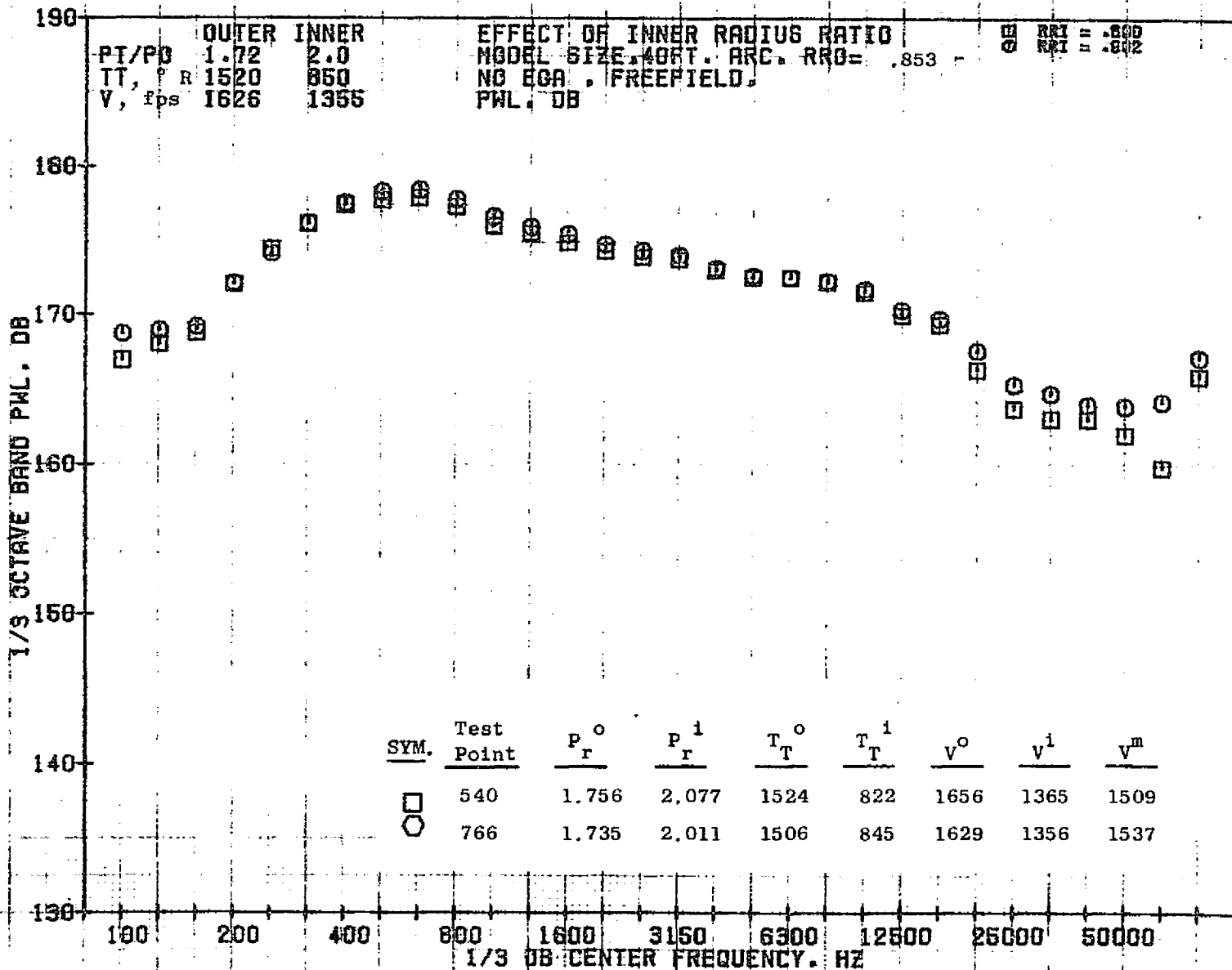
79 BURCH A.



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18161-001

79 BURCH A.

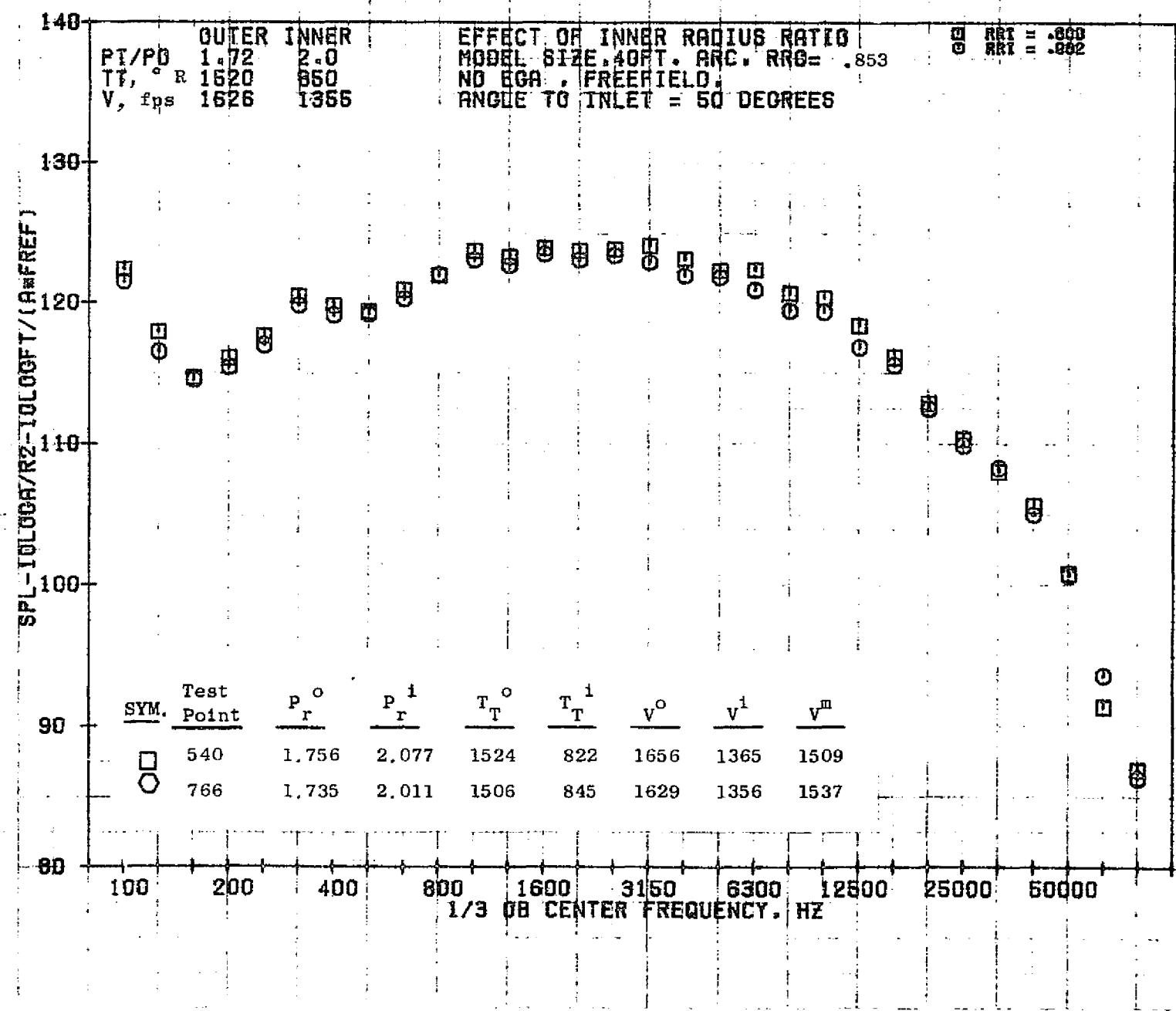
1001



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1B161-001

79 BURCH A.

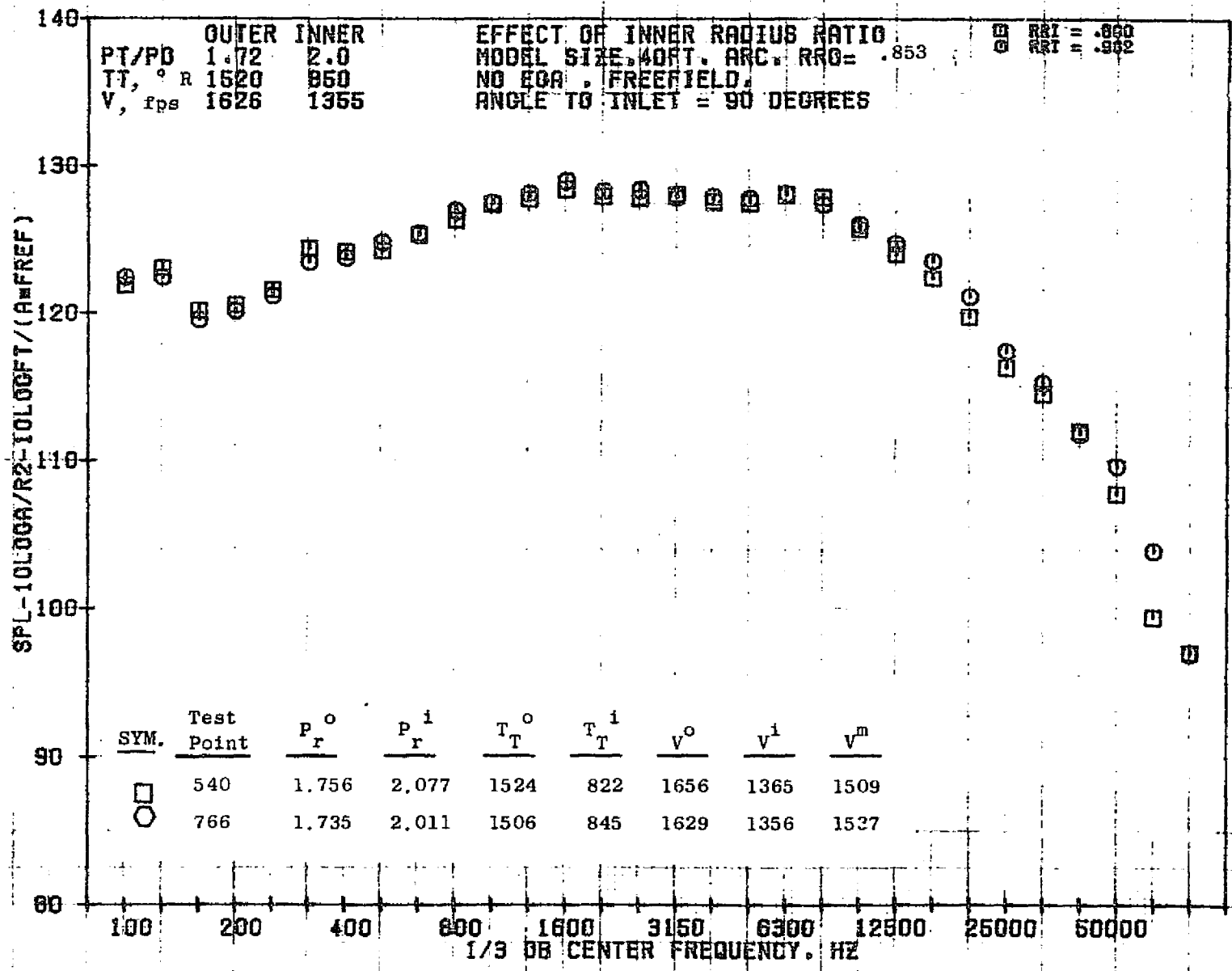
600T



10/29/76
18161-001

79 BURCH A.

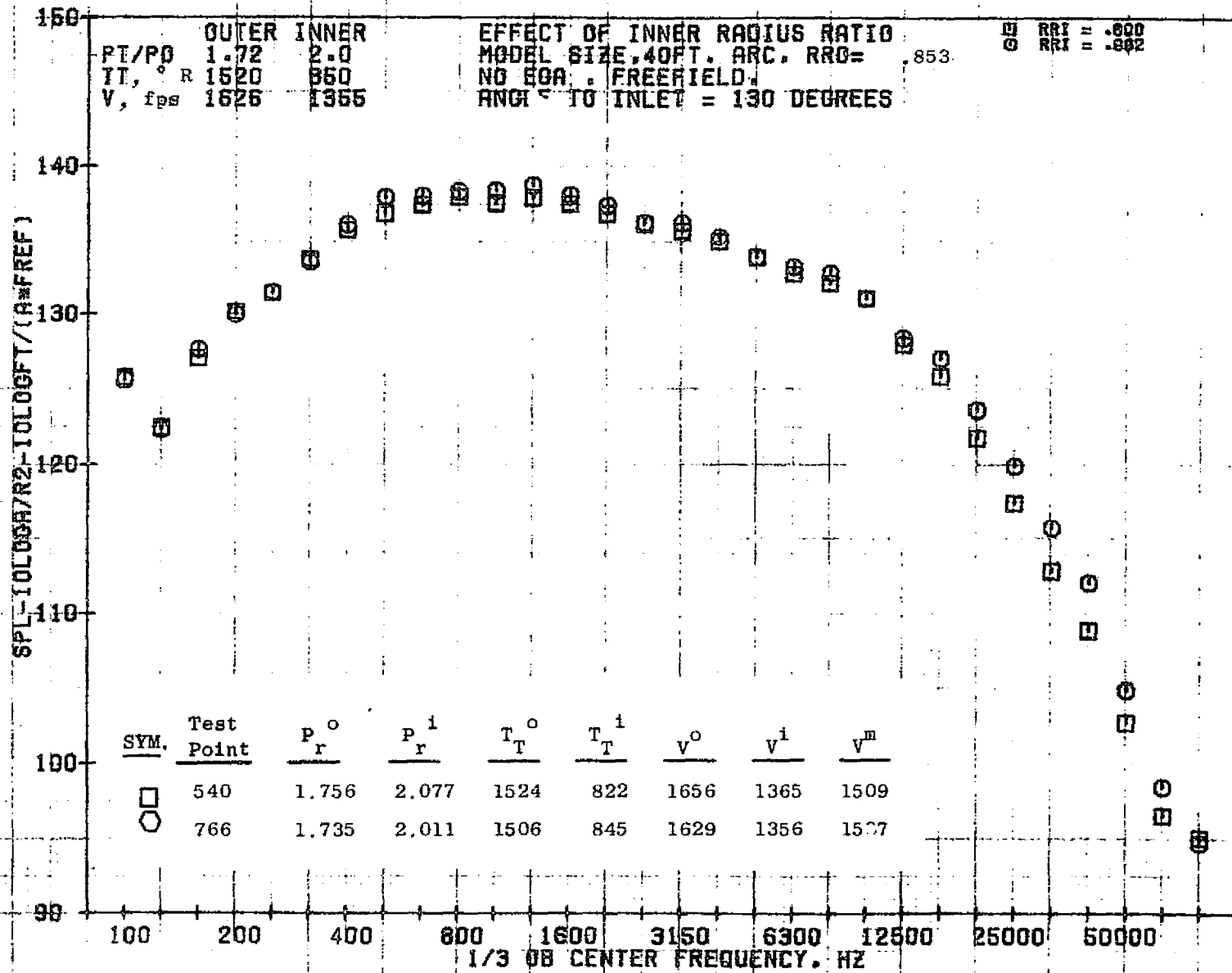
0101



10/29/76
 18161-001

79 BURCH A.

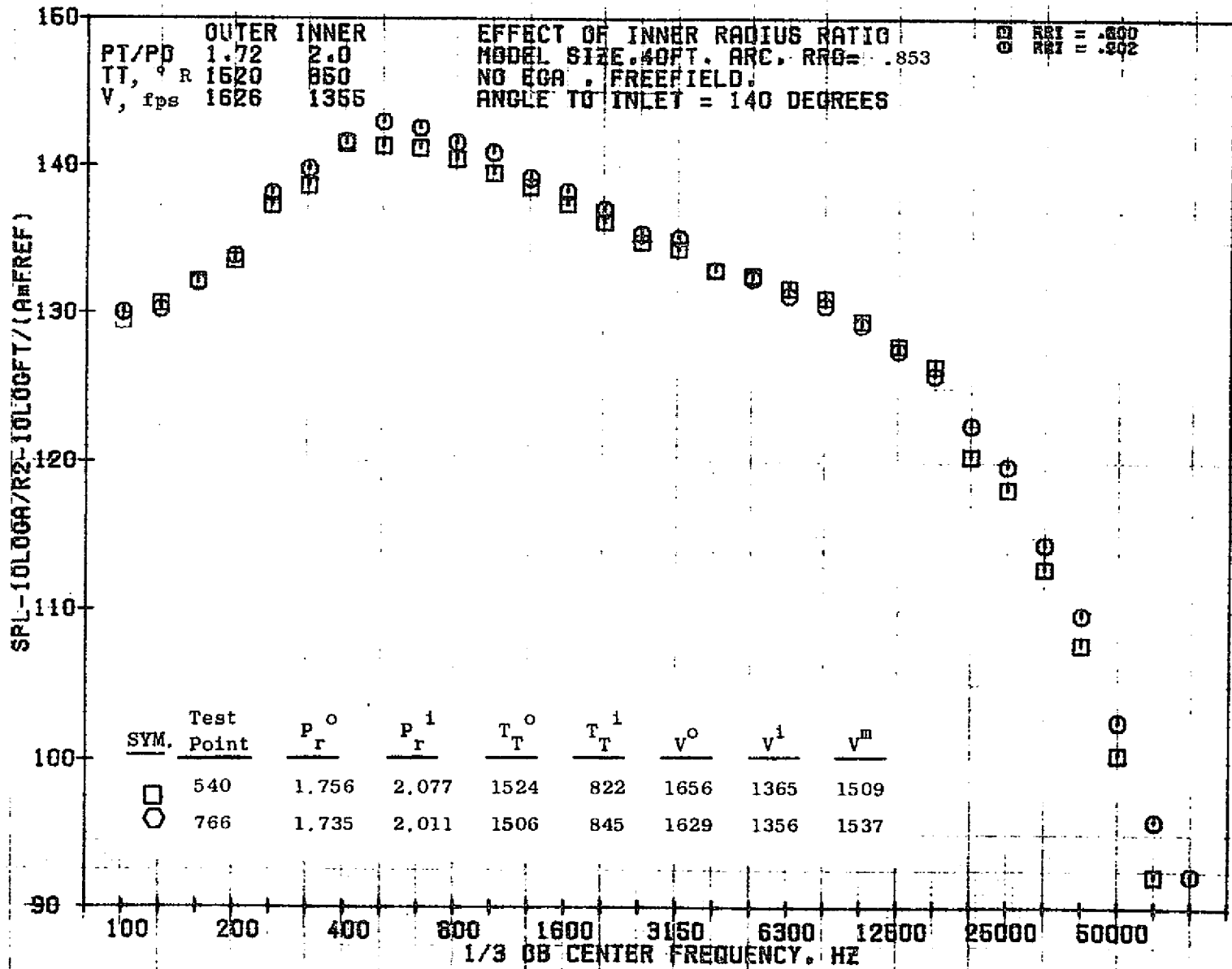
1101



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 18161-001

79 BURCH A.

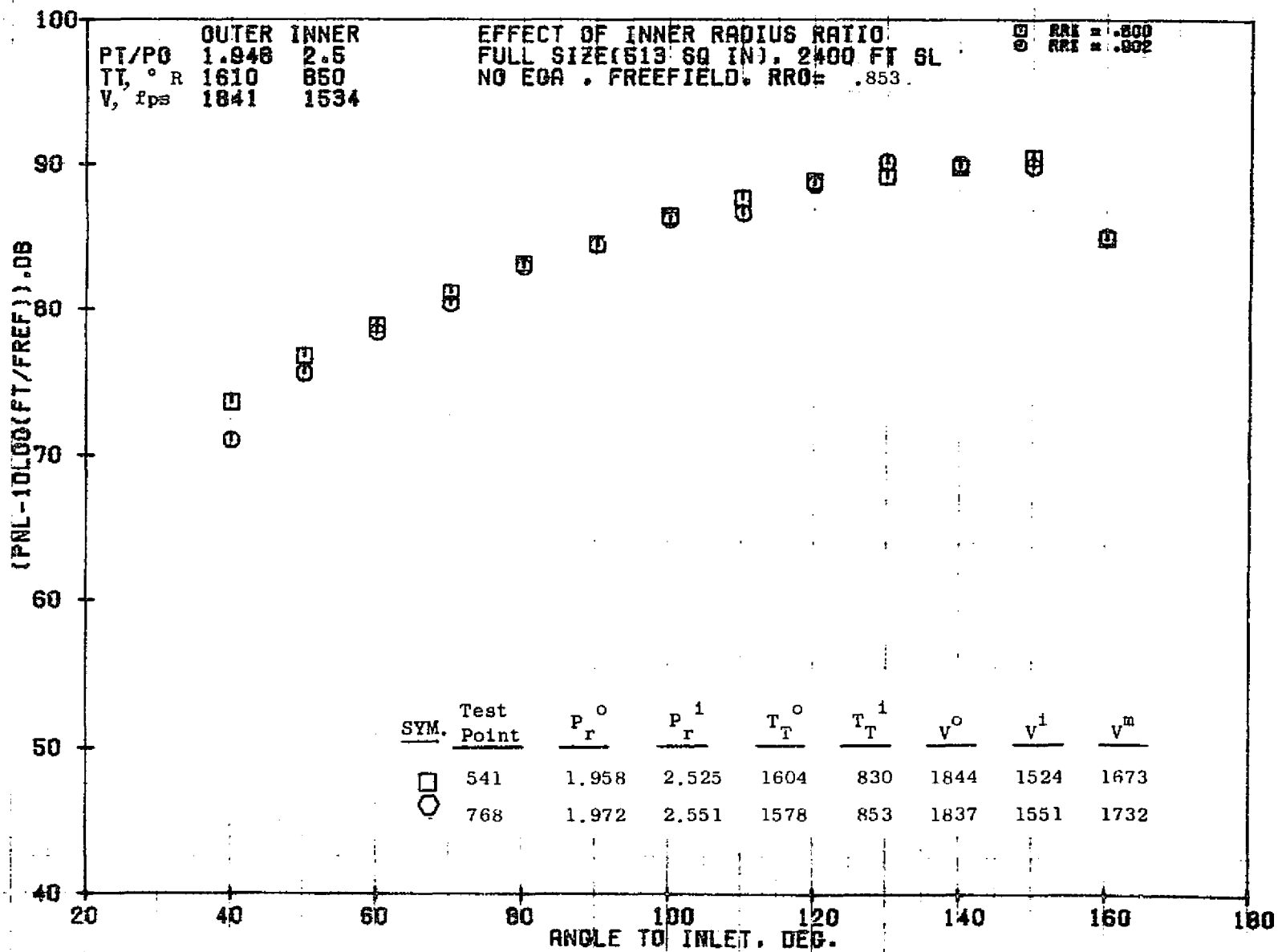
1012



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 18161-001

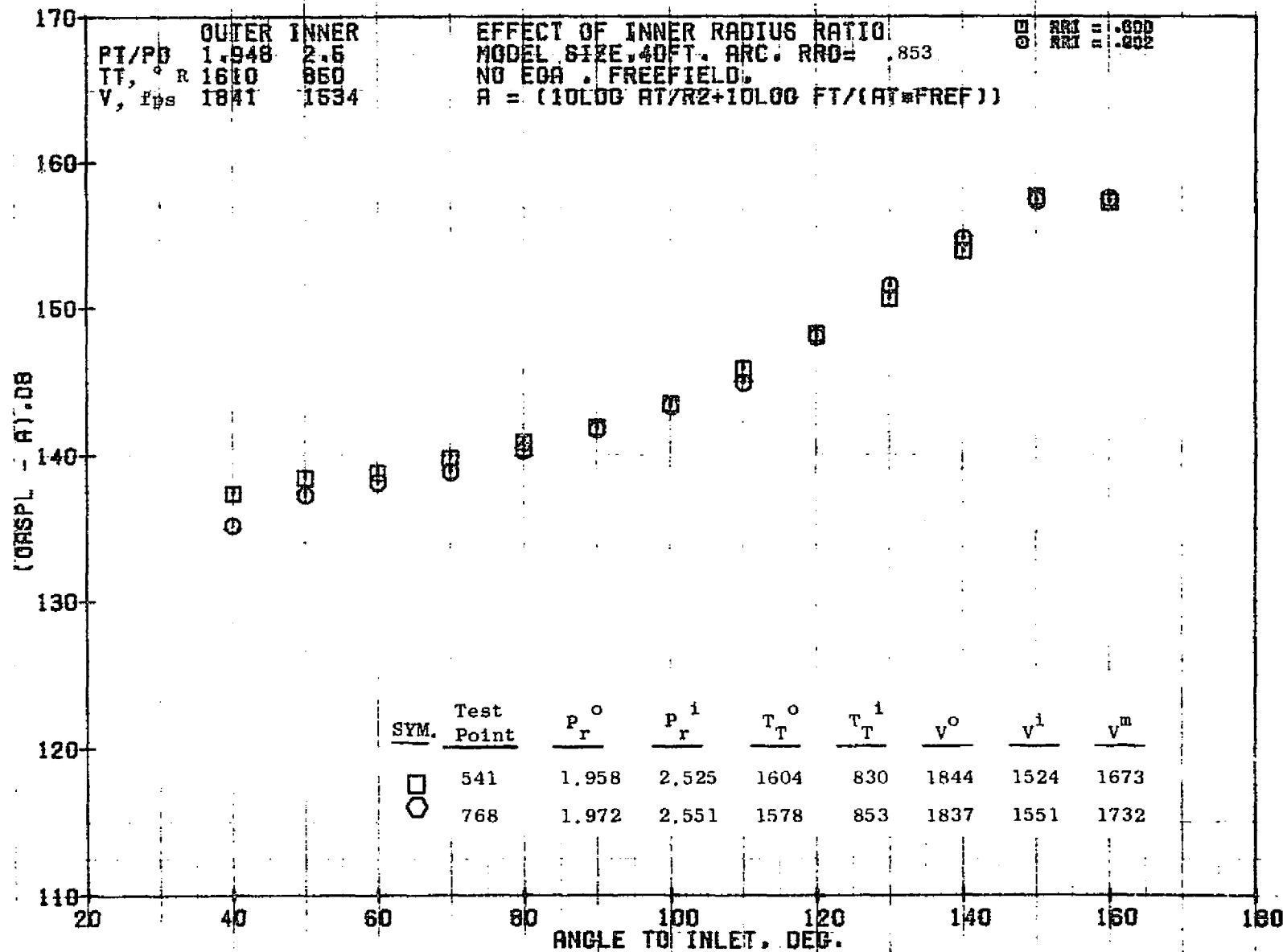
79 BURCH A.

1013



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18124-001

79 BURCH

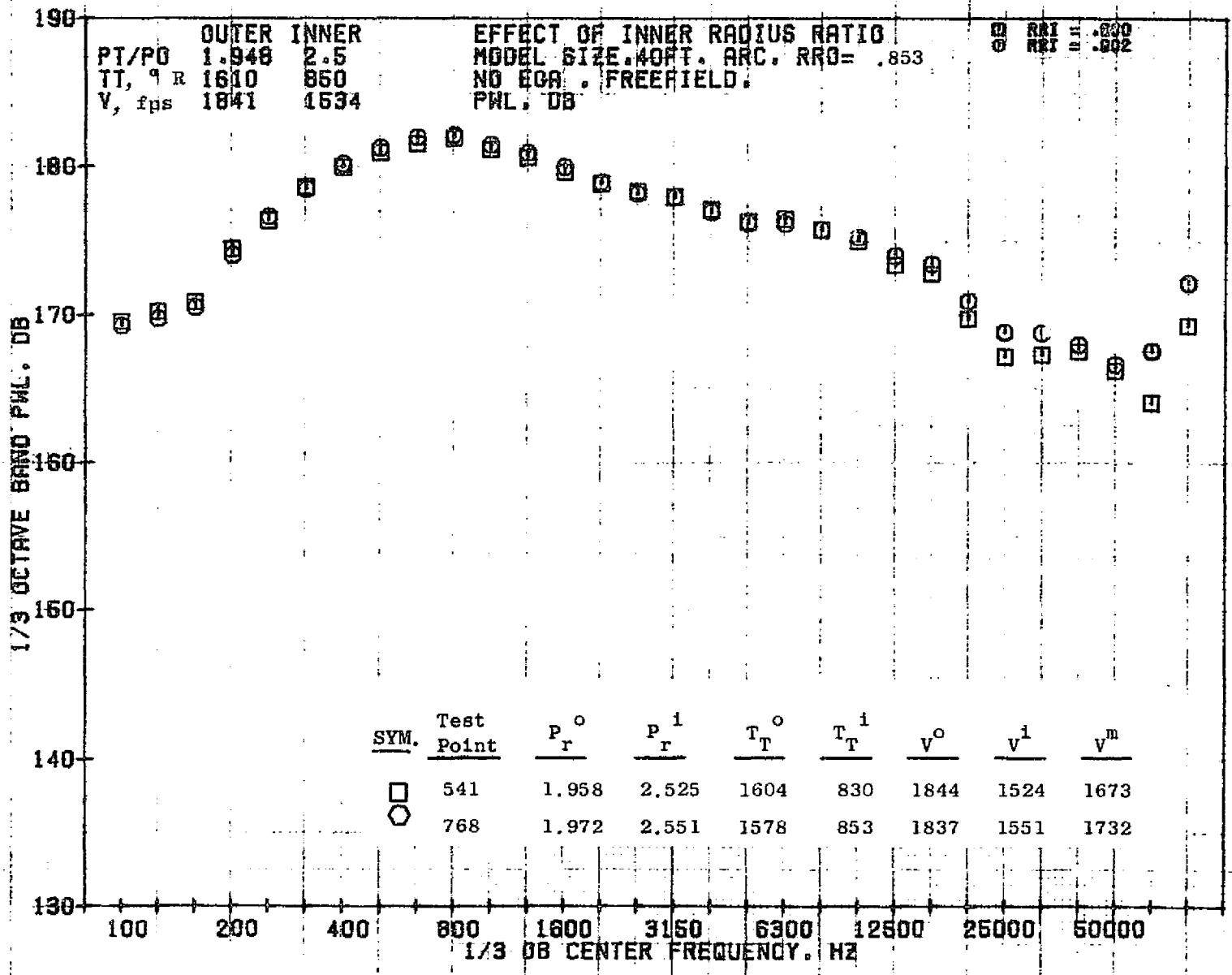


1014

10/29/76
18161-001

79 BURCH A.

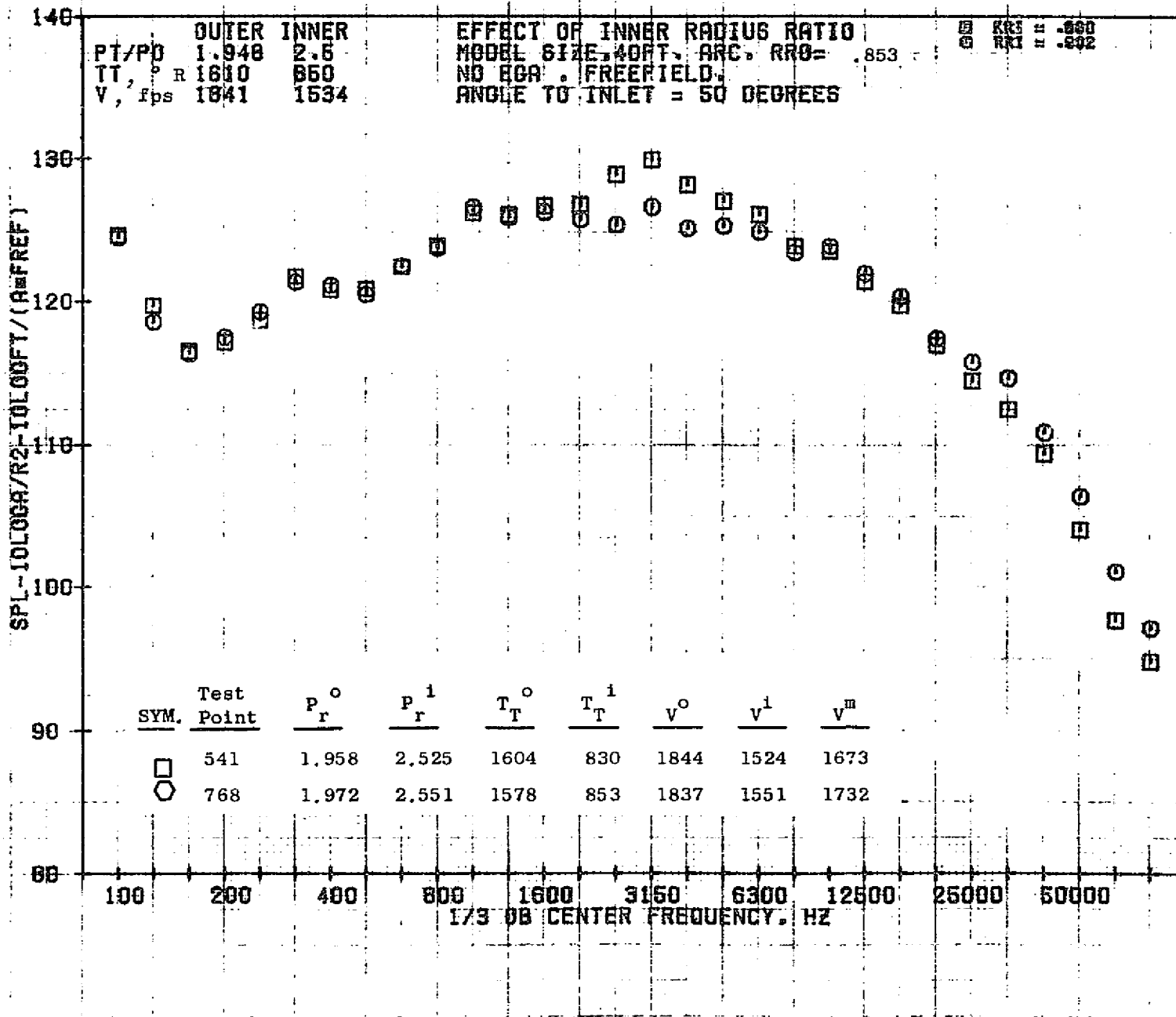
1015



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18161-001

79 BURCH A.

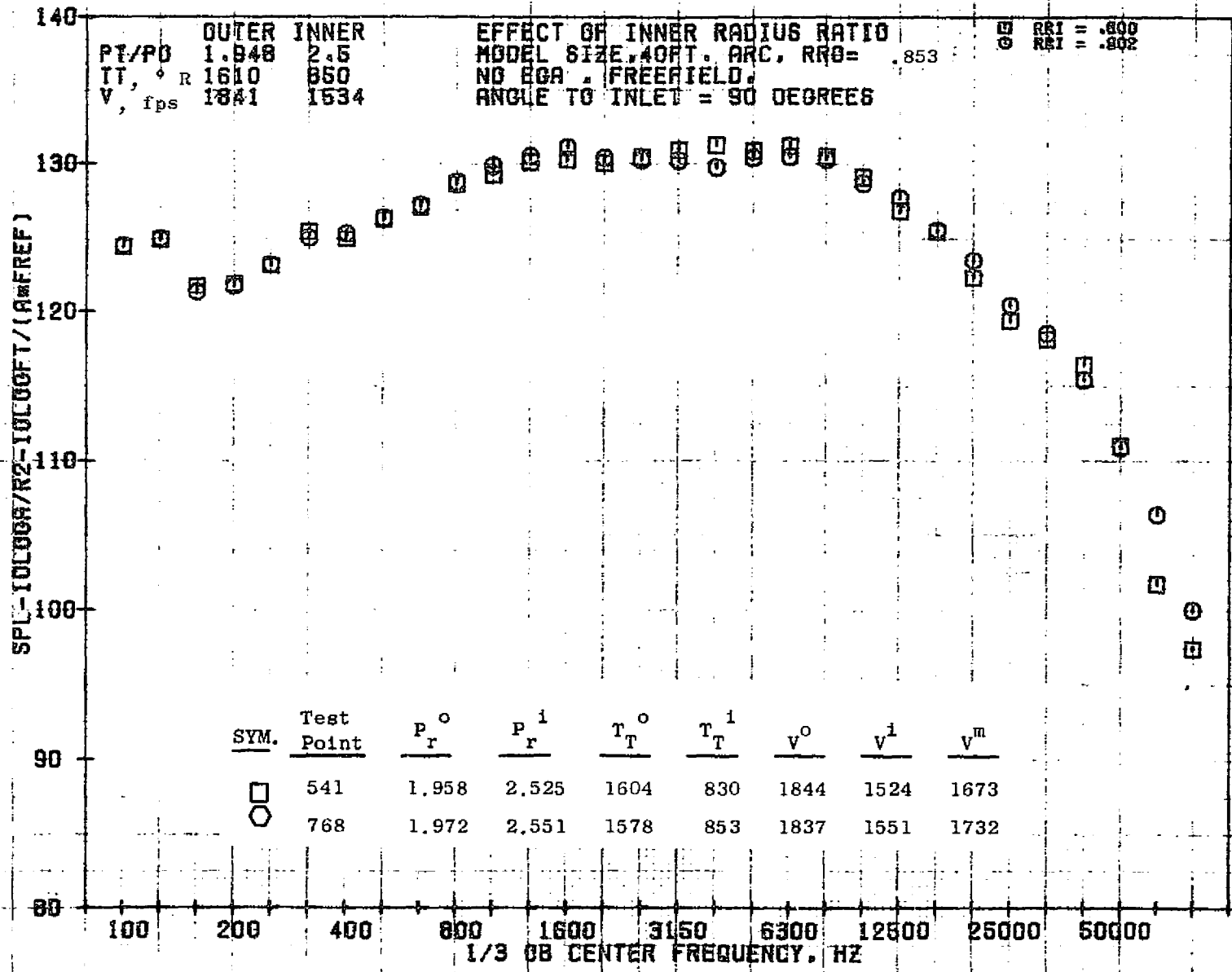
9101



10/29/76
 18161-001

79 BURCH A.

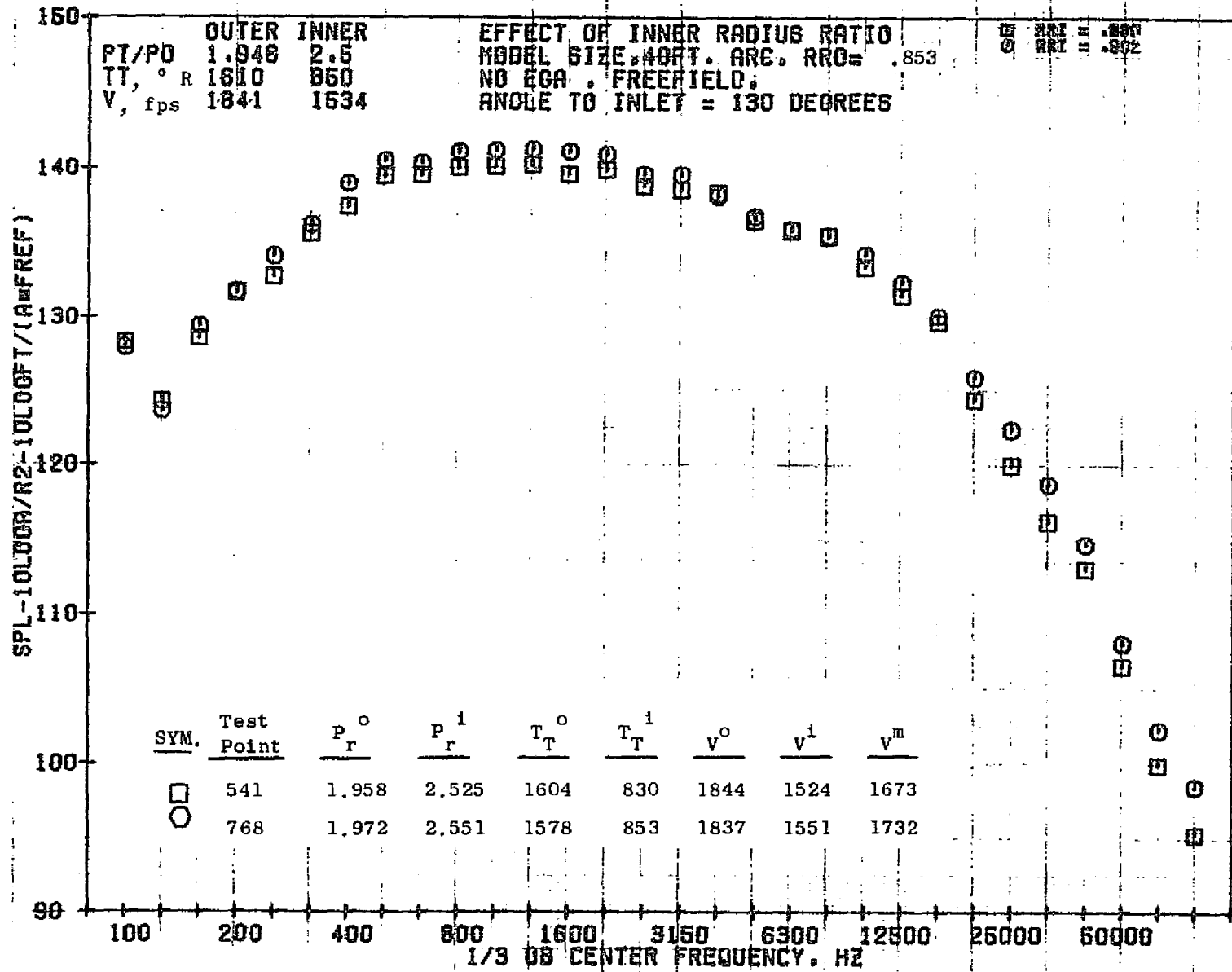
1017



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18161-001

79 BURCH A.

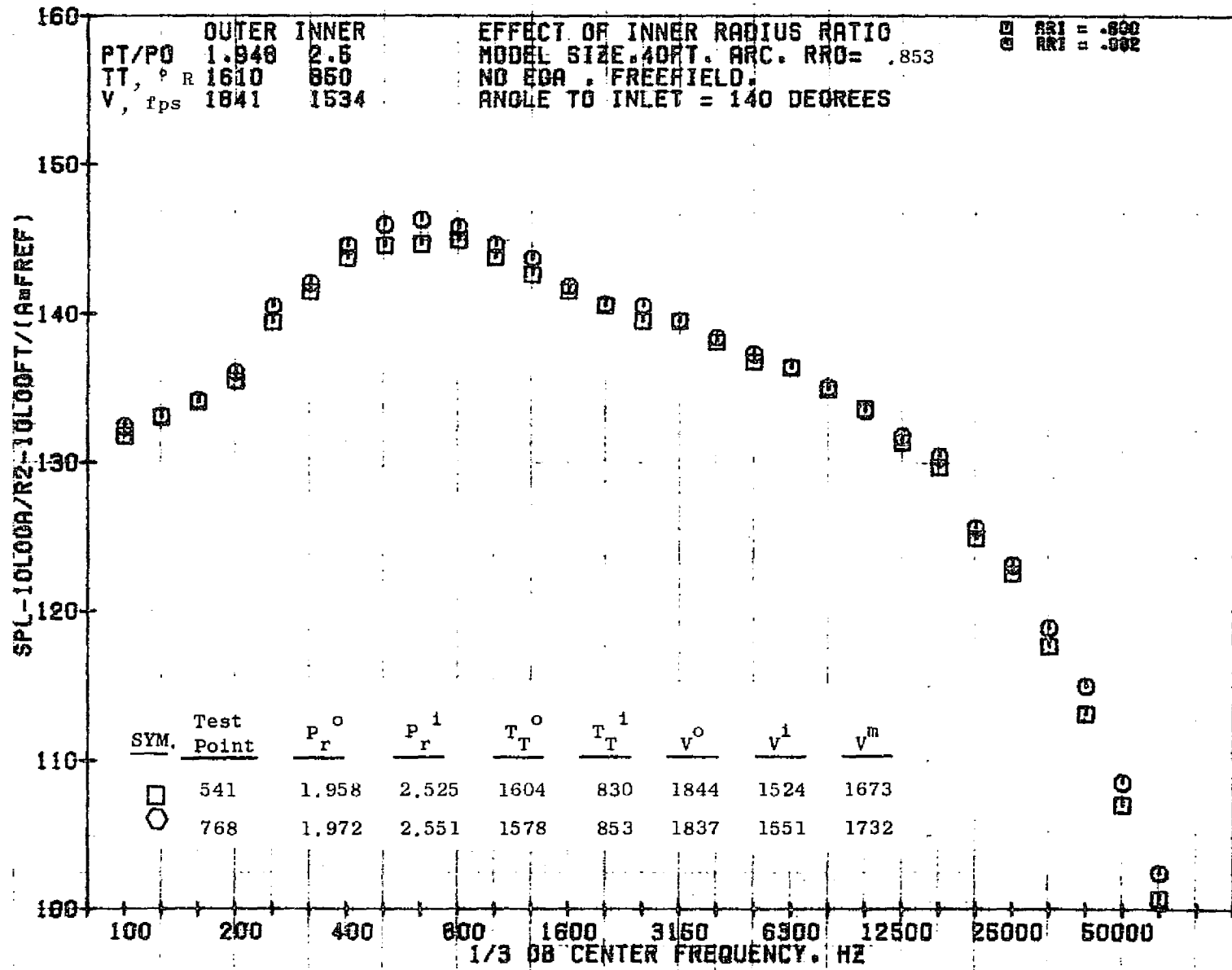
1018



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 18161-001

79 BURCH A.

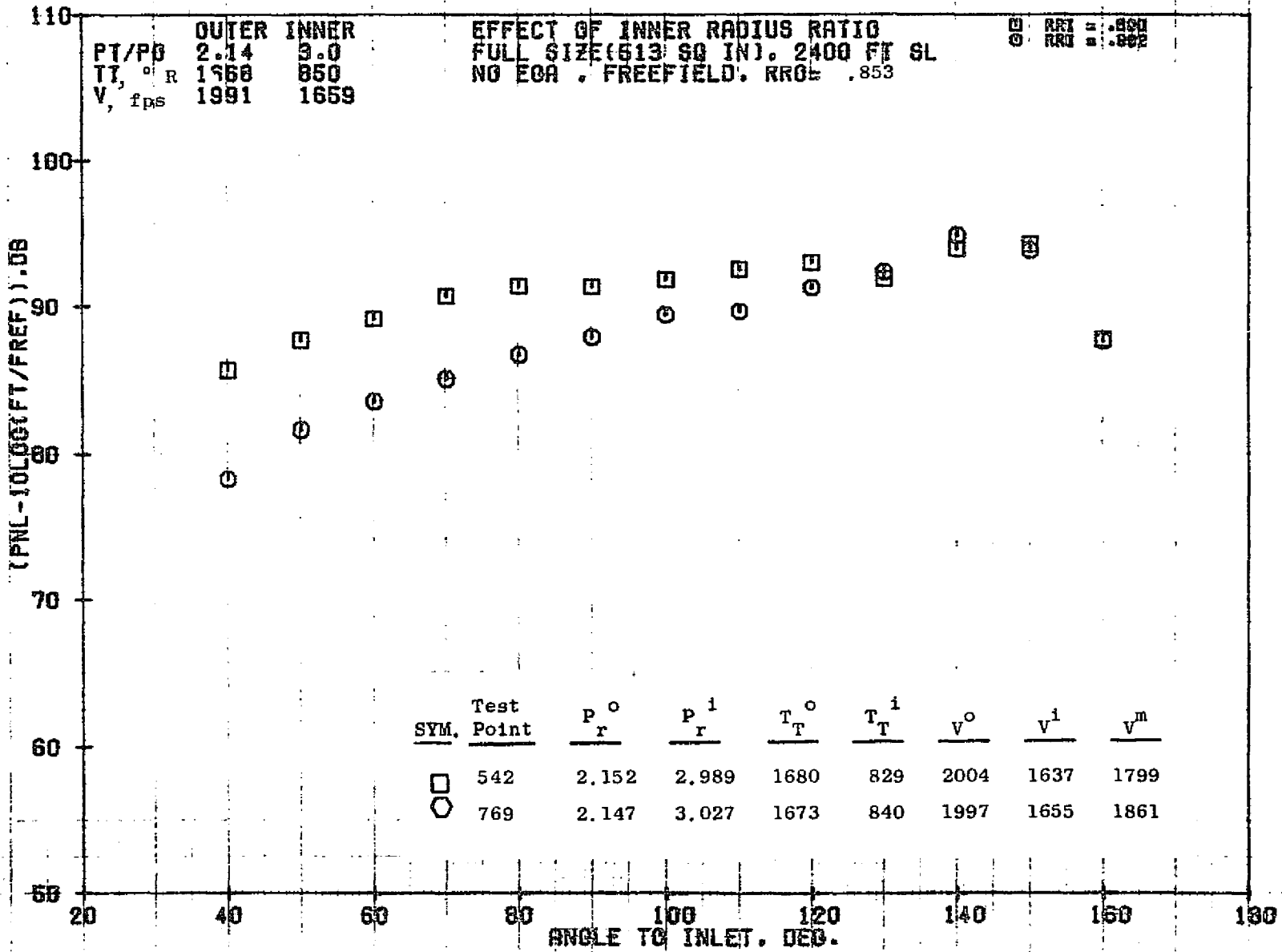
6101



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 18161-001

79 BURCH A.

1020



PT/PR 2.14 3.0
 TT, °R 1968 850
 V, fps 1991 1659

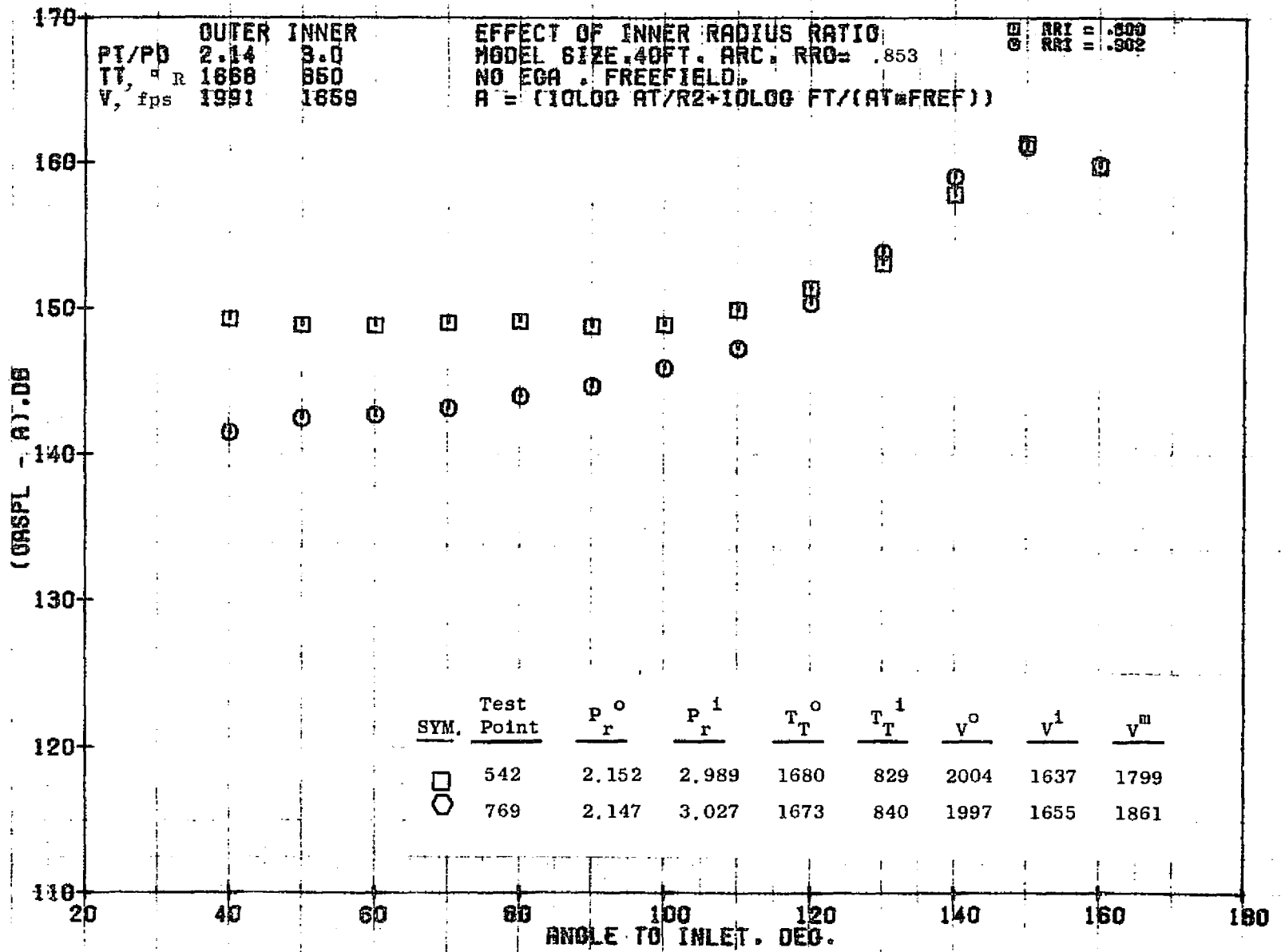
EFFECT OF INNER RADIUS RATIO
 FULL SIZE (513 SQ IN), 2400 FT SL
 NO EOR, FREEFIELD, RROE .853

□ RRT = .890
 ○ RRO = .892

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 18124-001

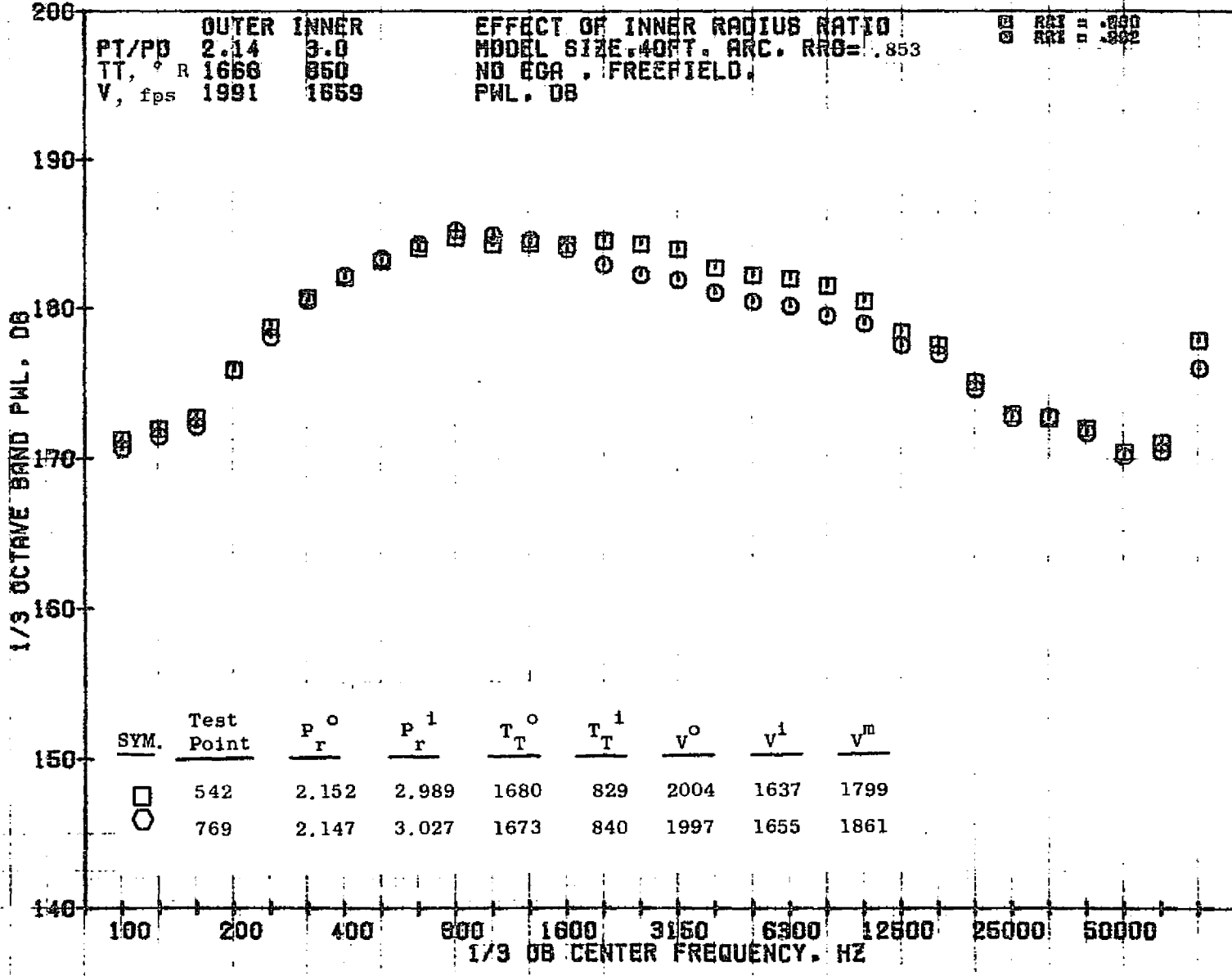
79 BURCH A.

1021



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18161-001

79 BURCH A.

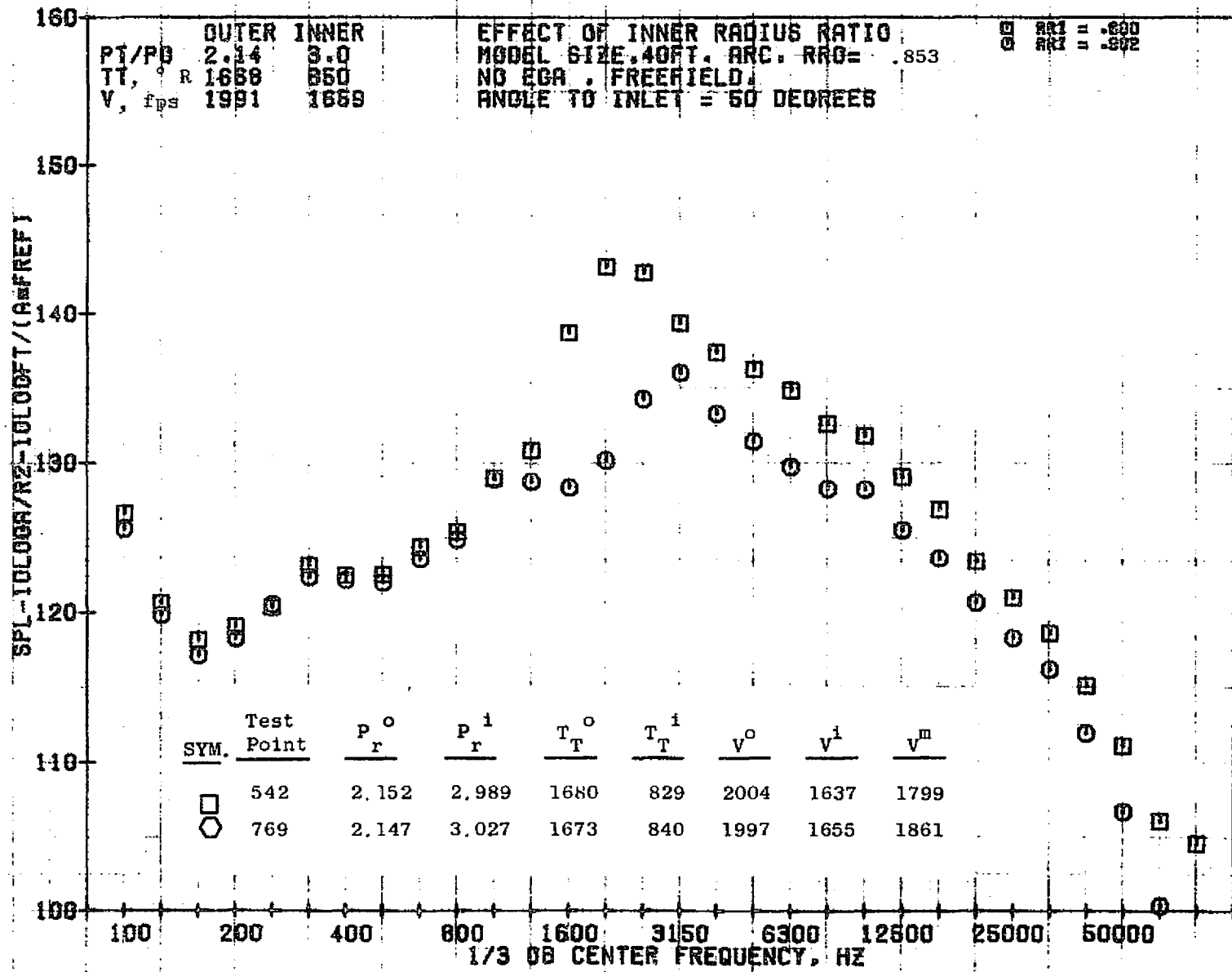


1022

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18161-001

79 BURCH A.

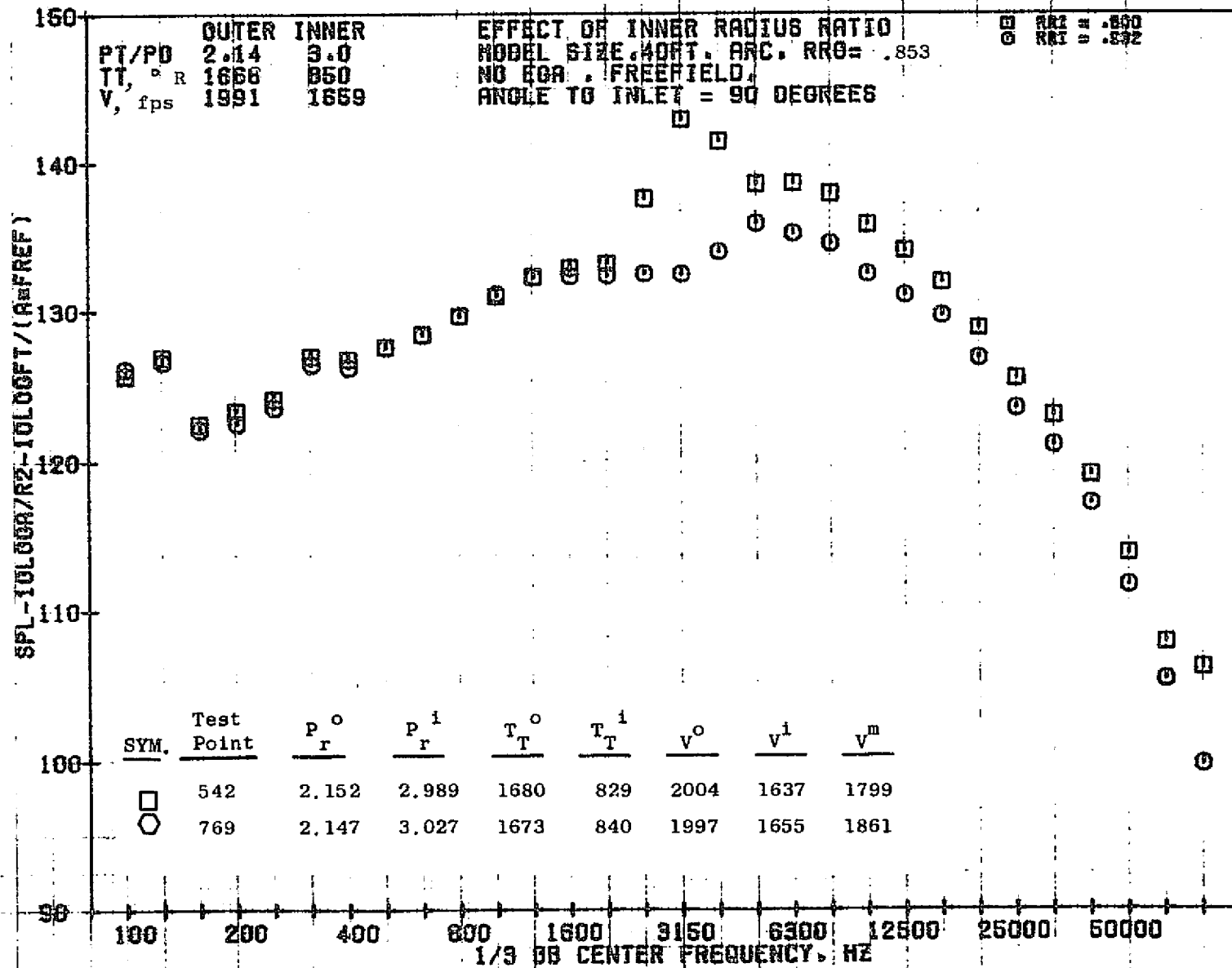
1023



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18161-001

79 BURCH A.

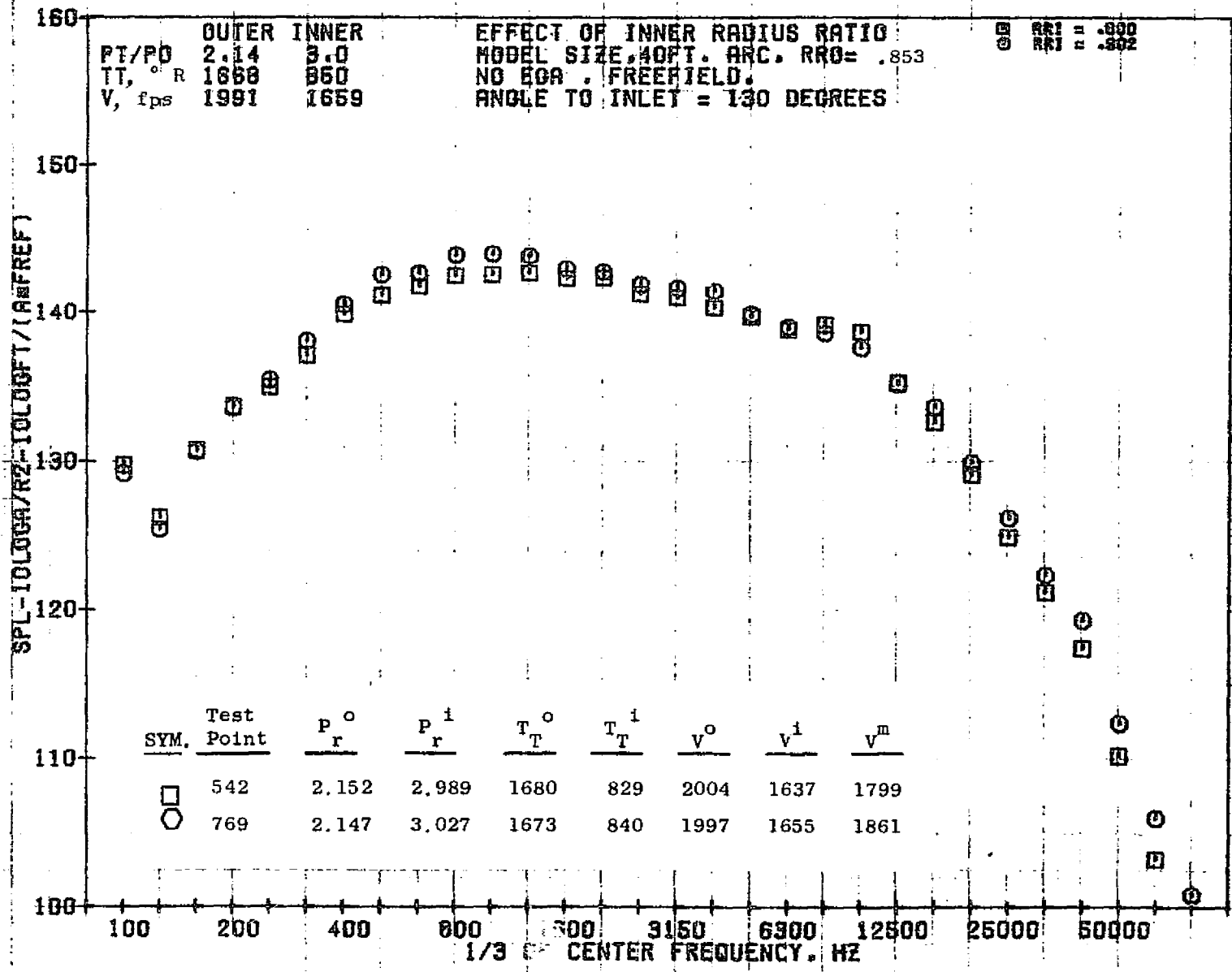
1024



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 19161-001

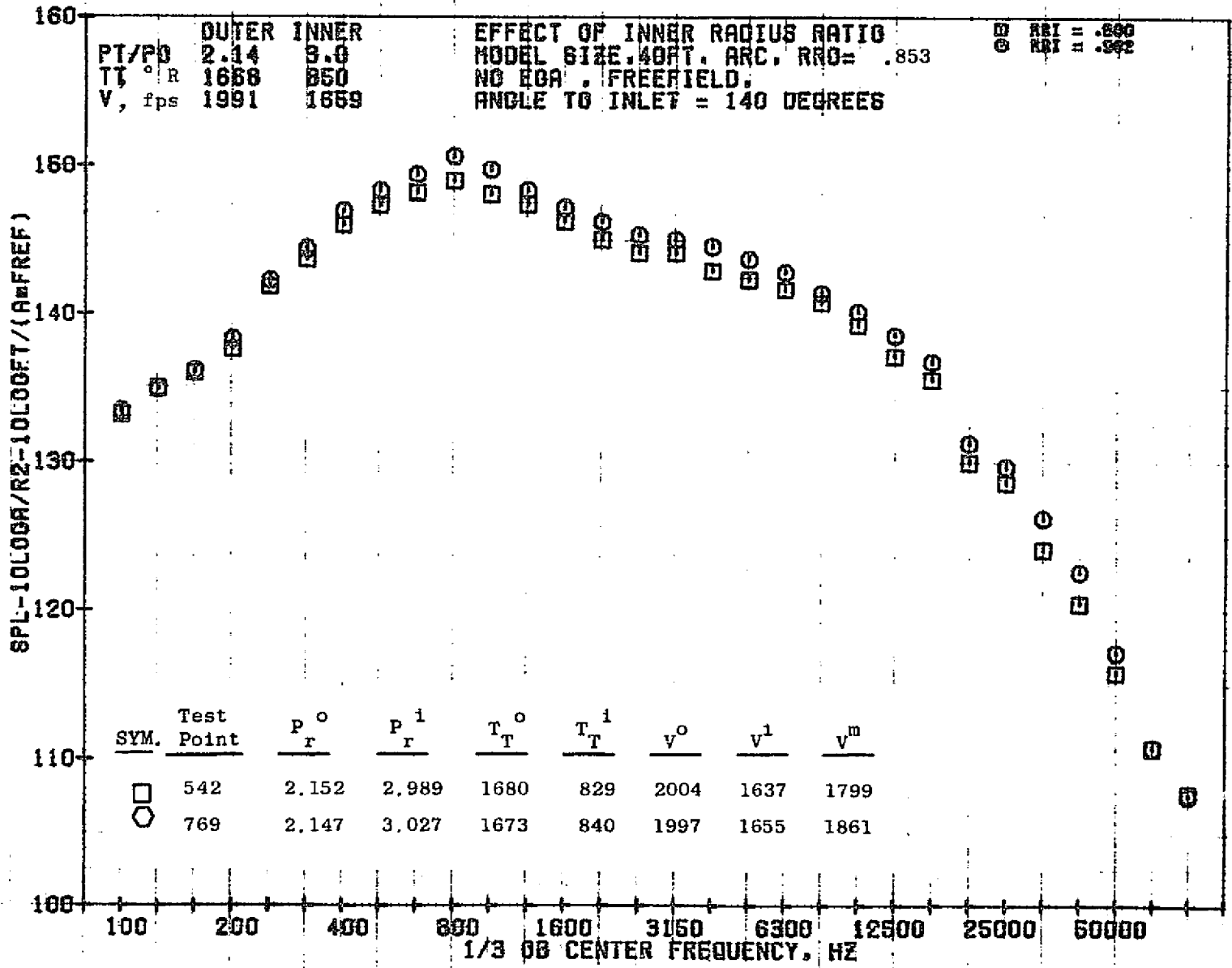
79 BURCH A.

1025



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 1B161-031

79 BURCH A.

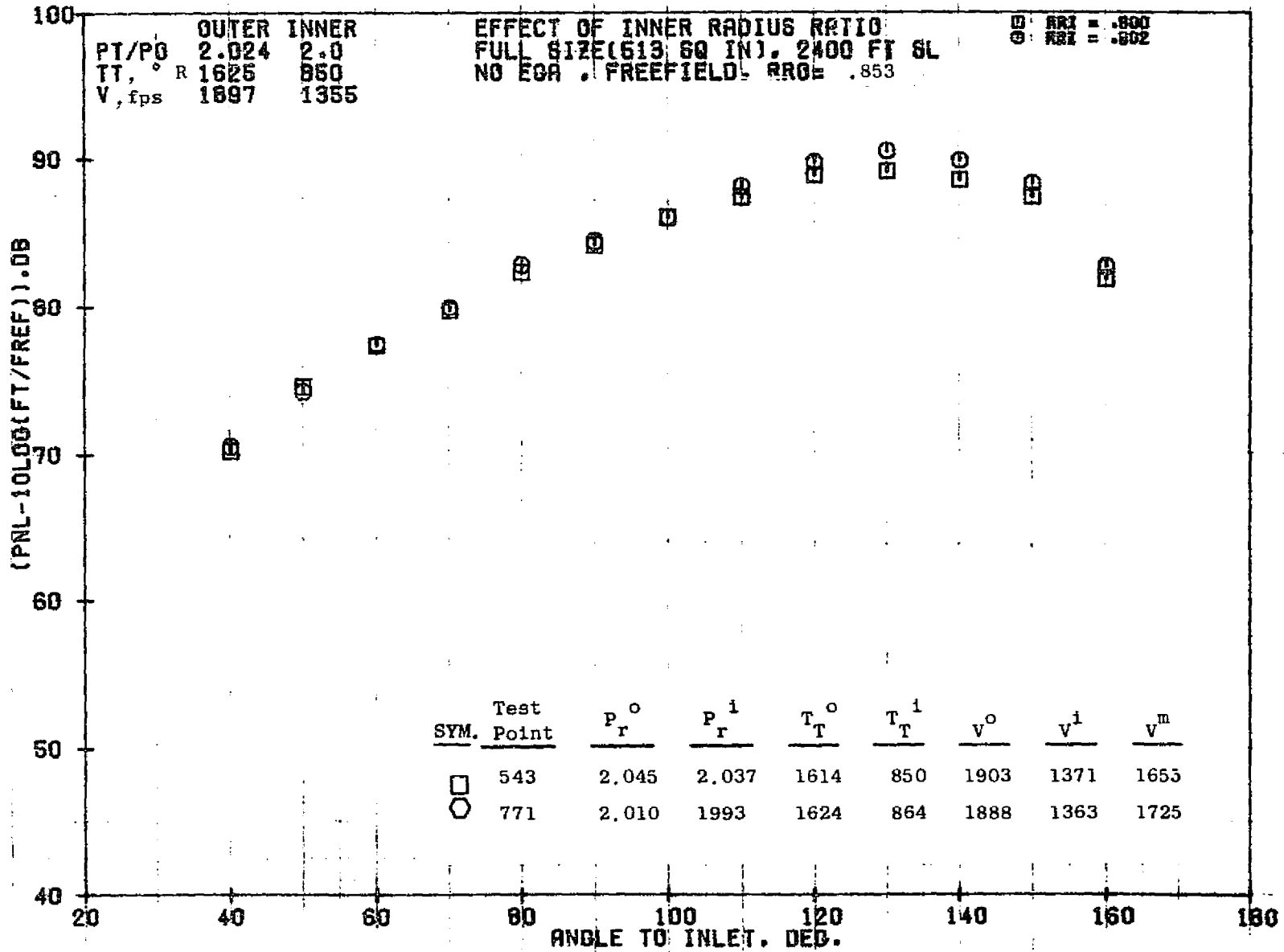


1026

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 1B161-001

79 BURCH A.

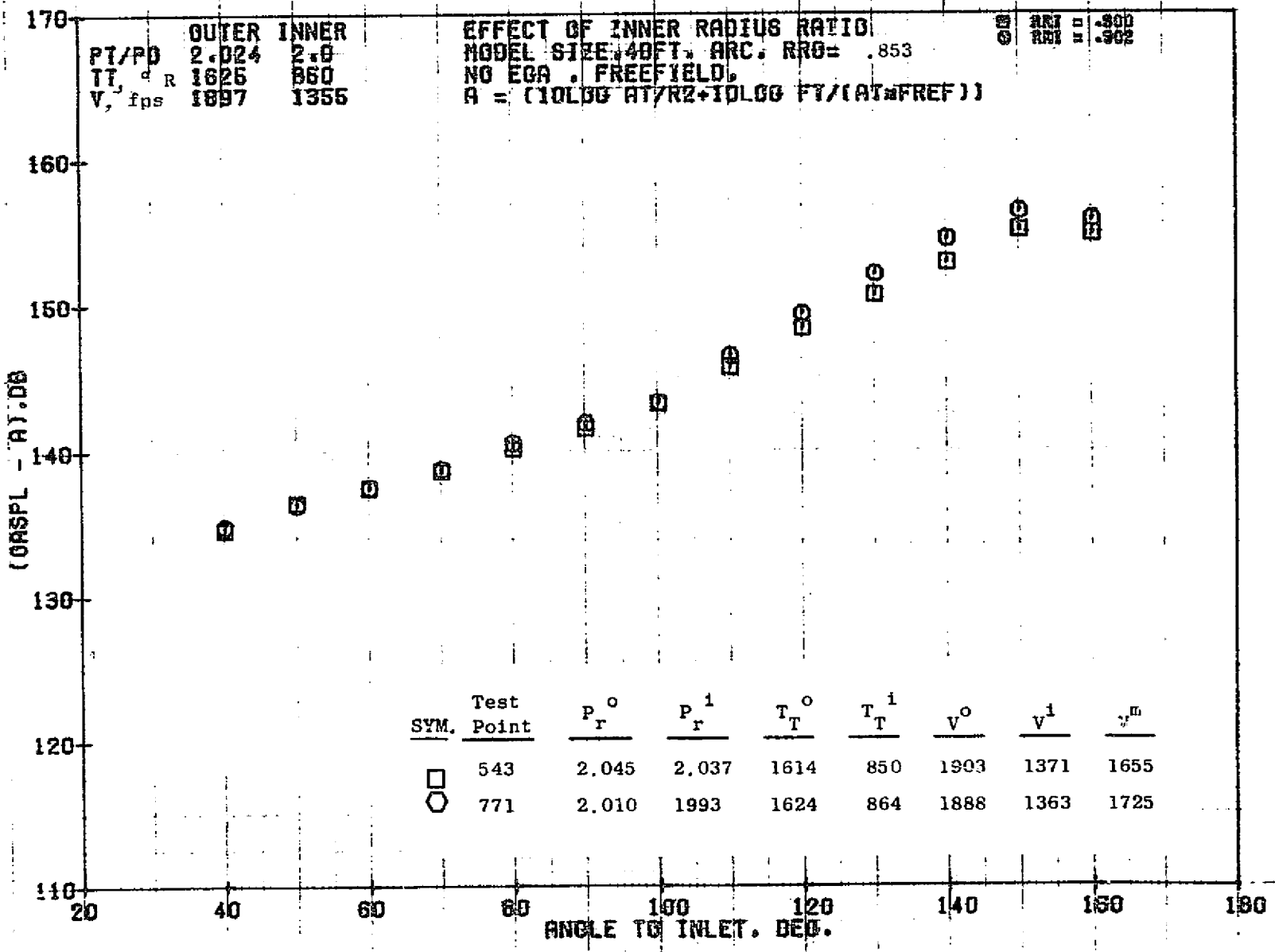
1027



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 18124-001

79 BURCH A.

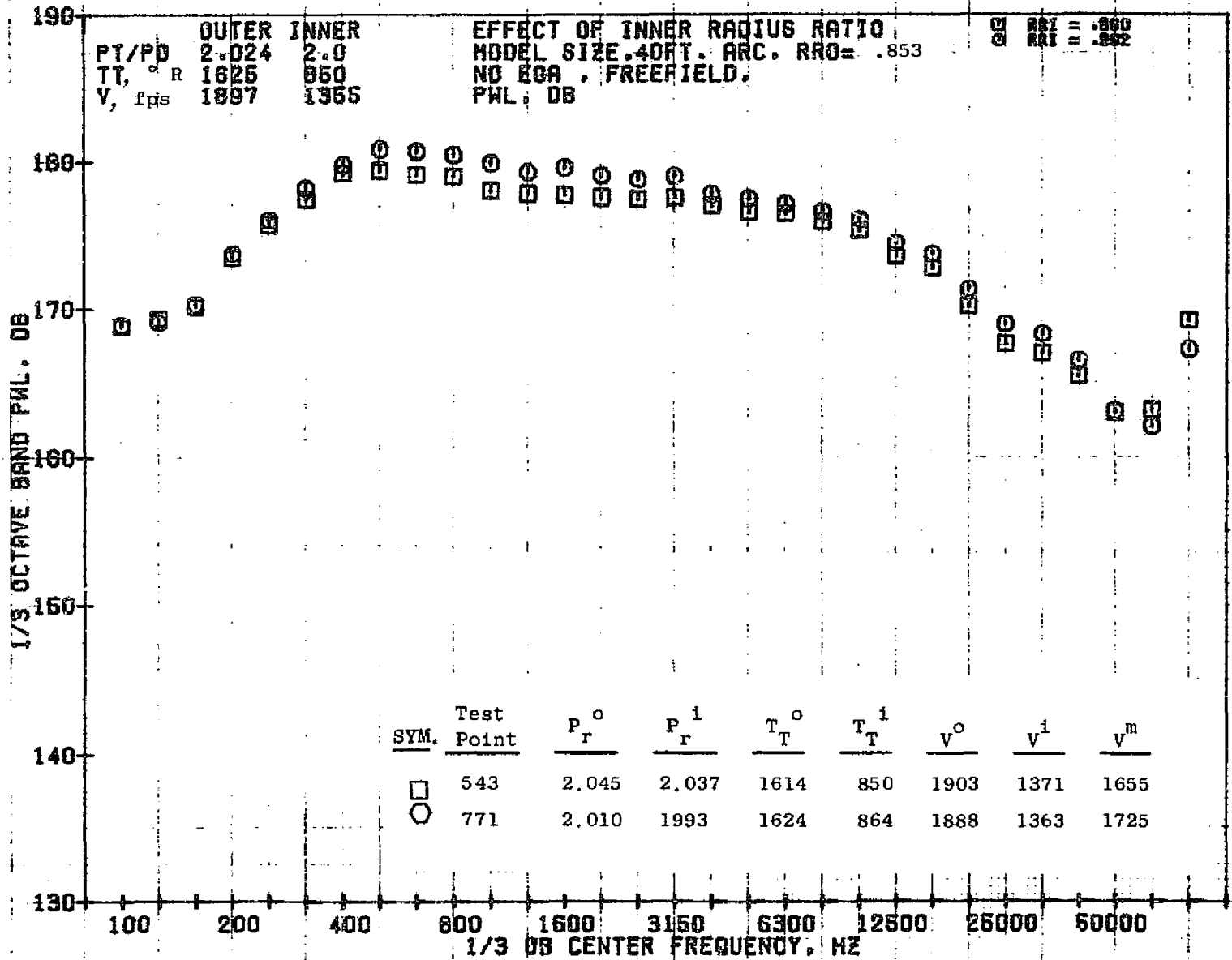
1028



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 18161-001

79 BURCH A.

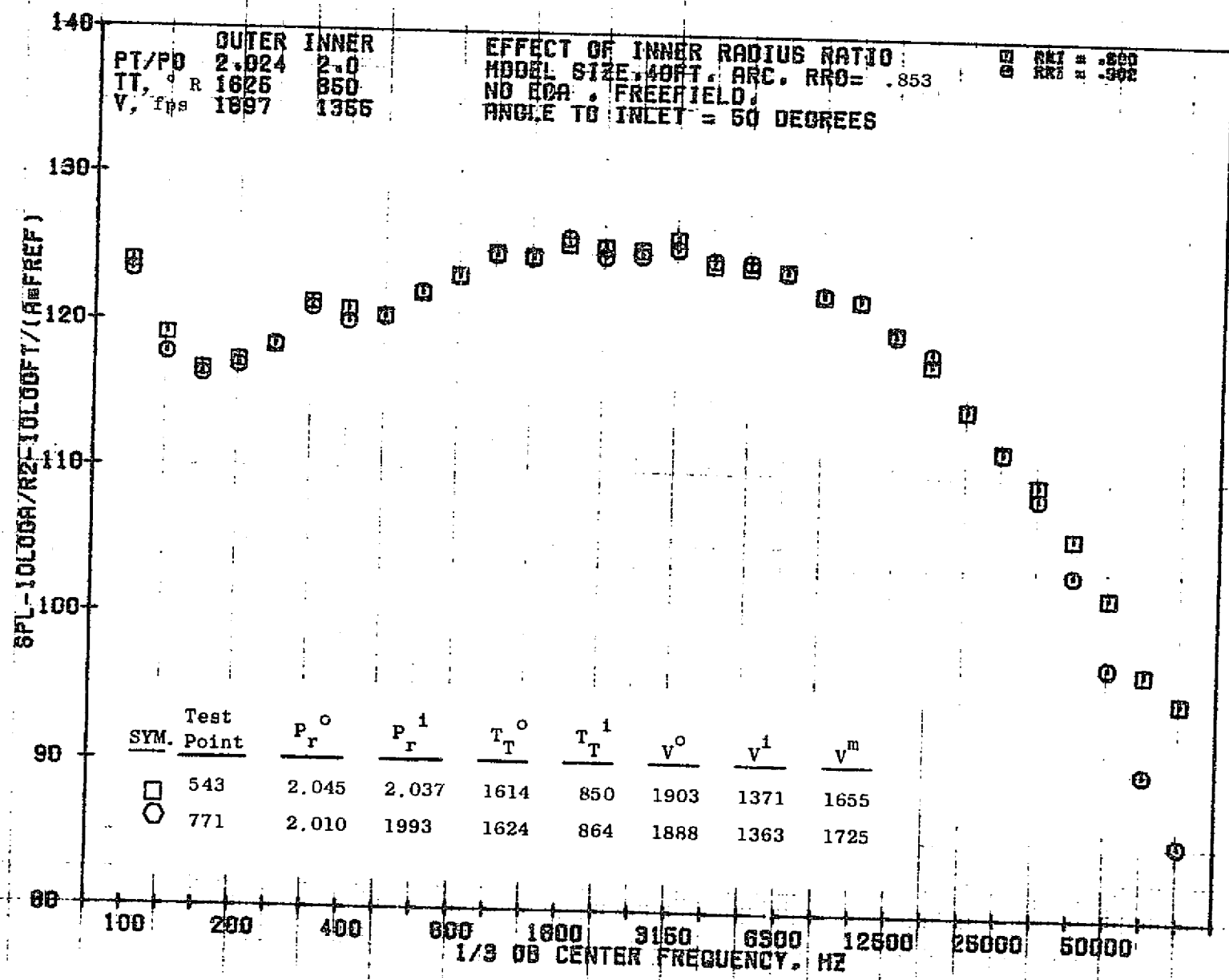
1029



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 18161-001

79 BURCH A.

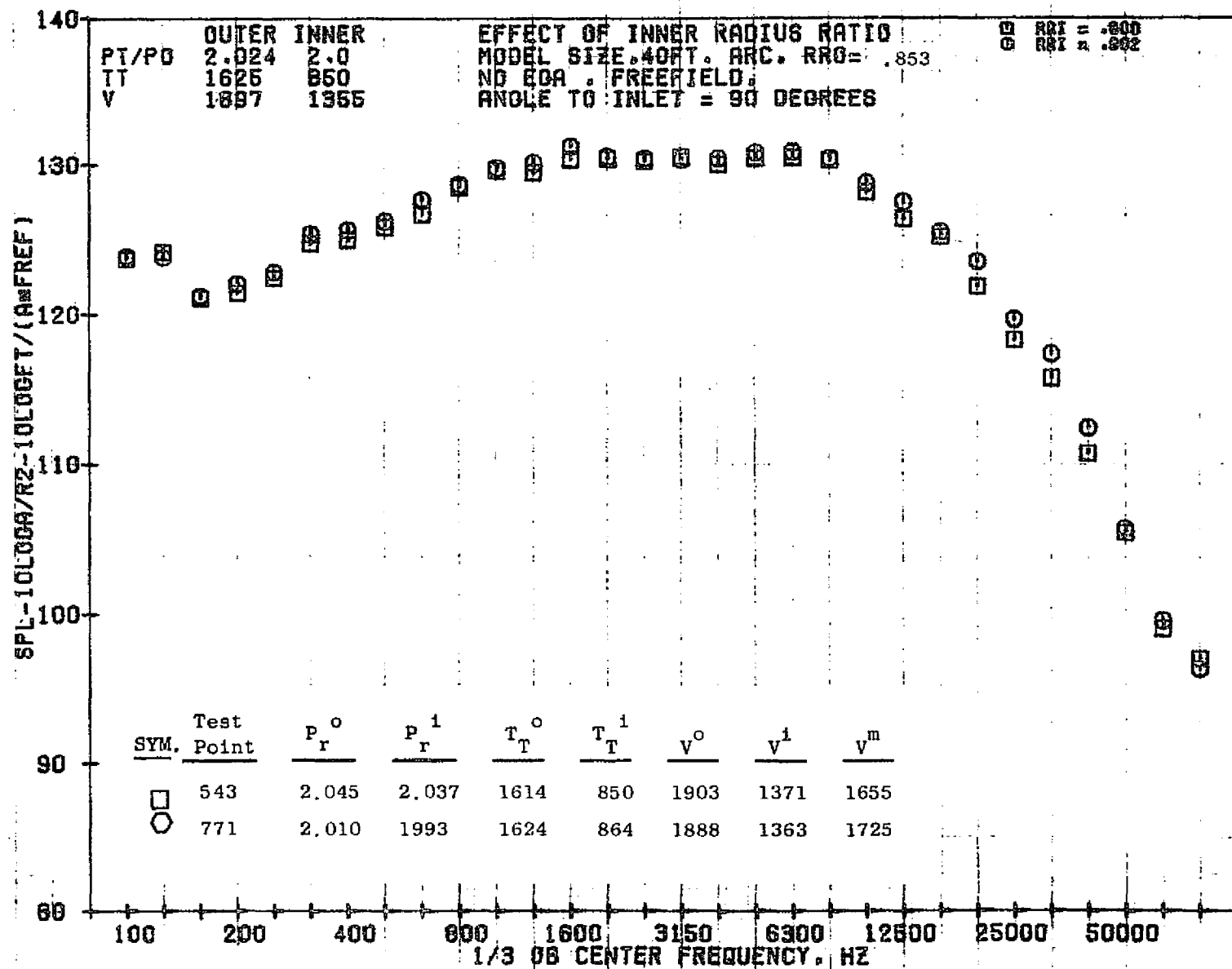
1030



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 18161-001

79 BURCH A.

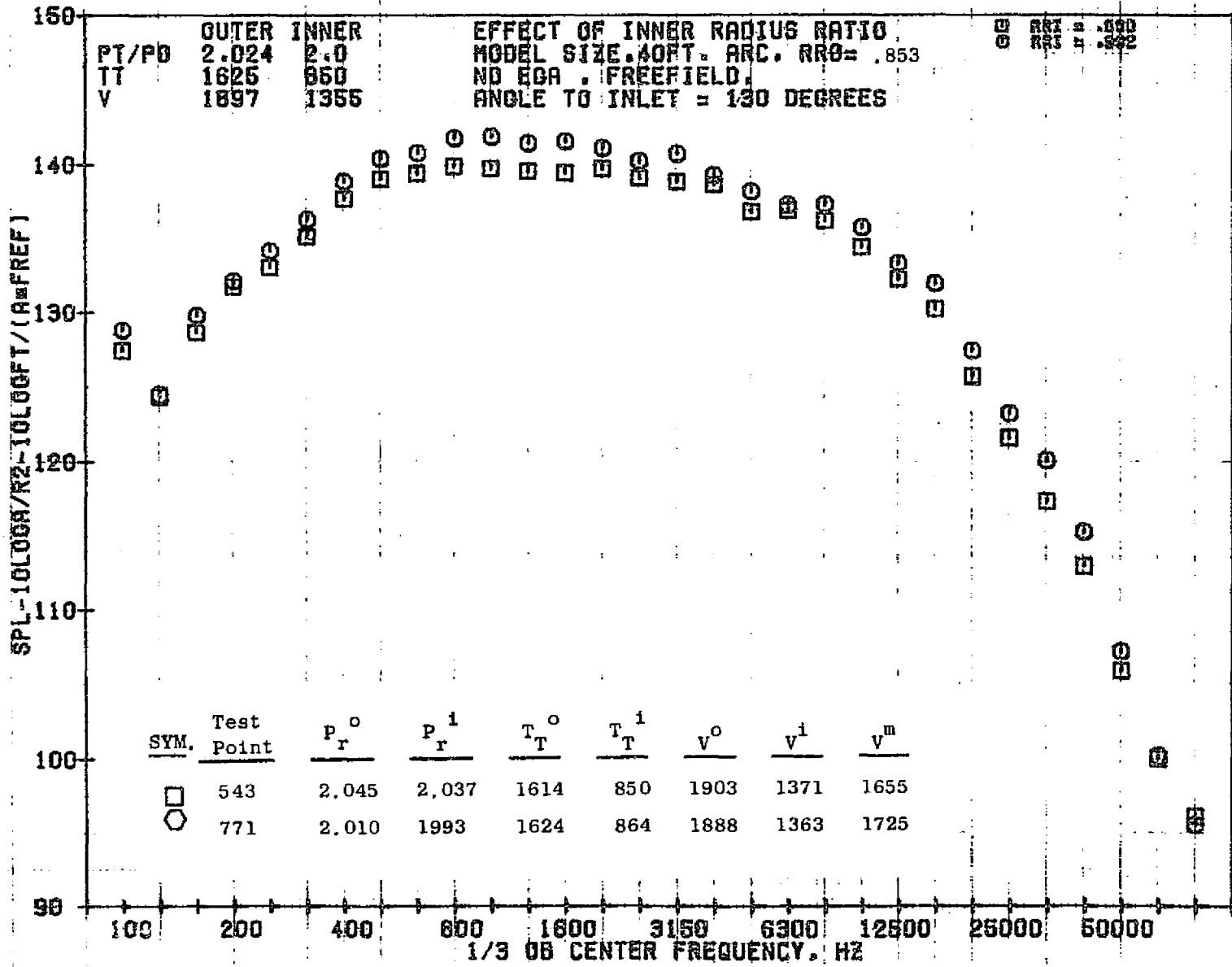
1031



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 18161-001

79 BURCH A.

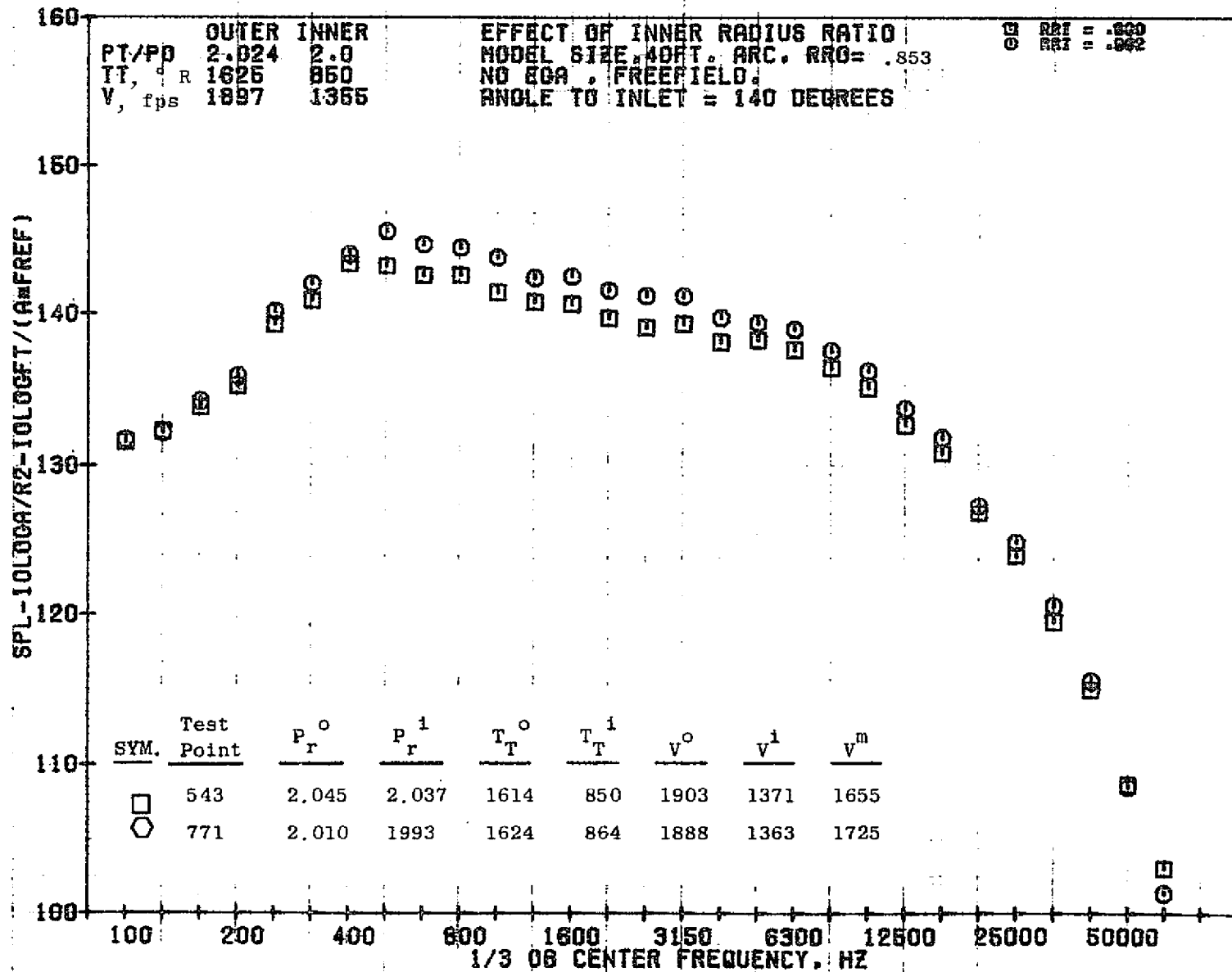
1032



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 18161-001

79 BURCH A.

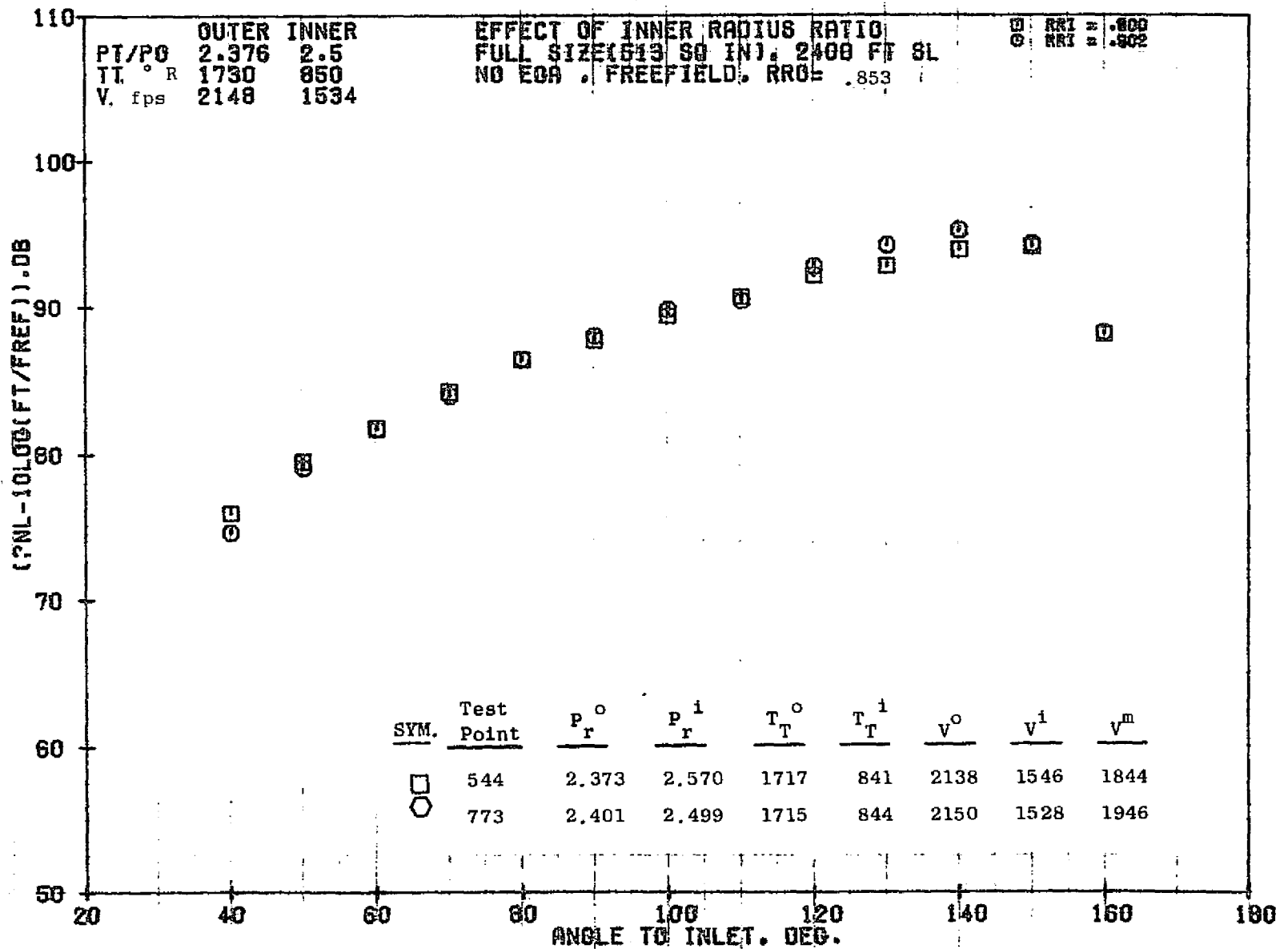
1033



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 18161-001

79 BURCH A.

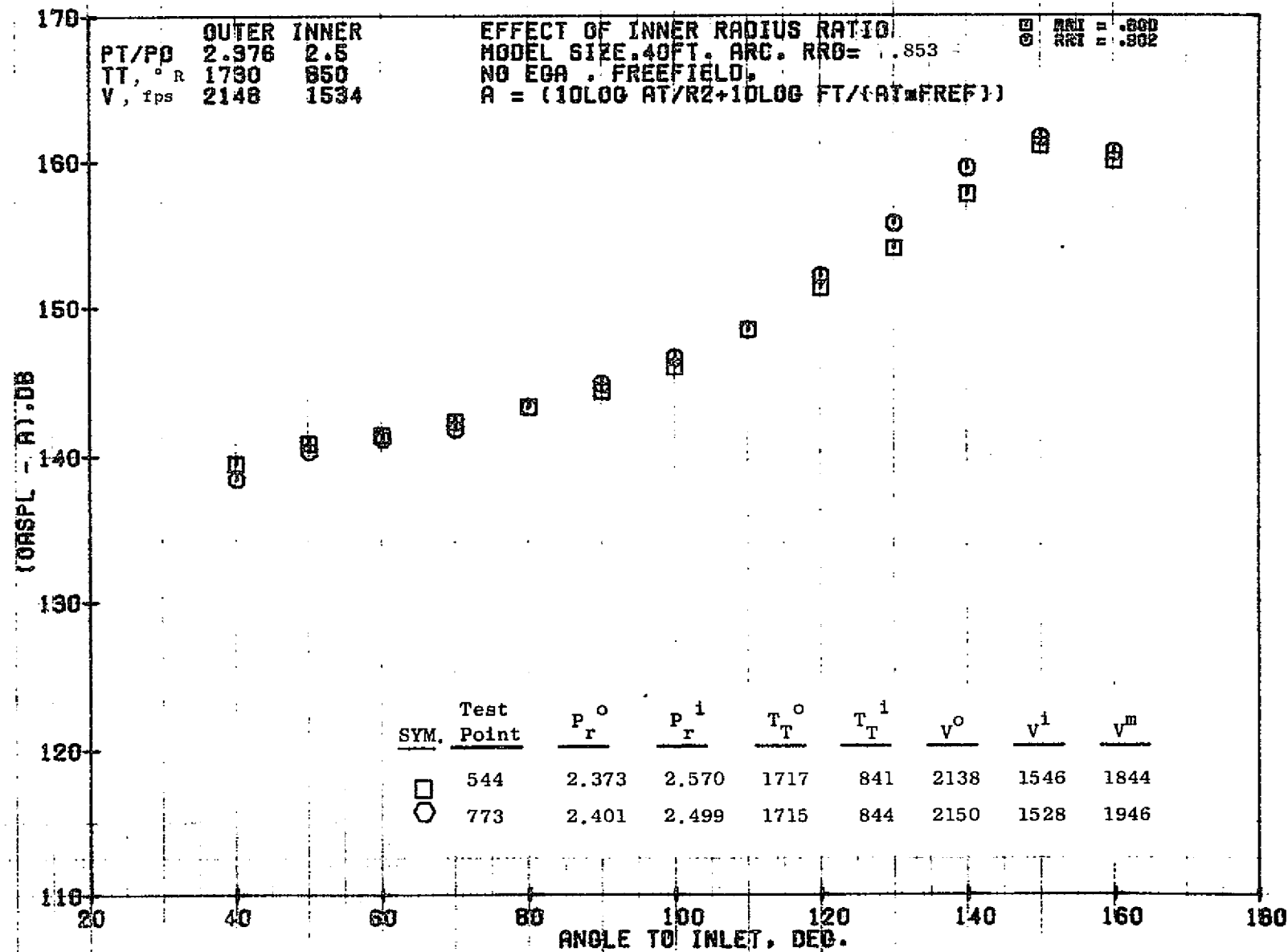
1034



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18124-001

79 BURCH A.

1085

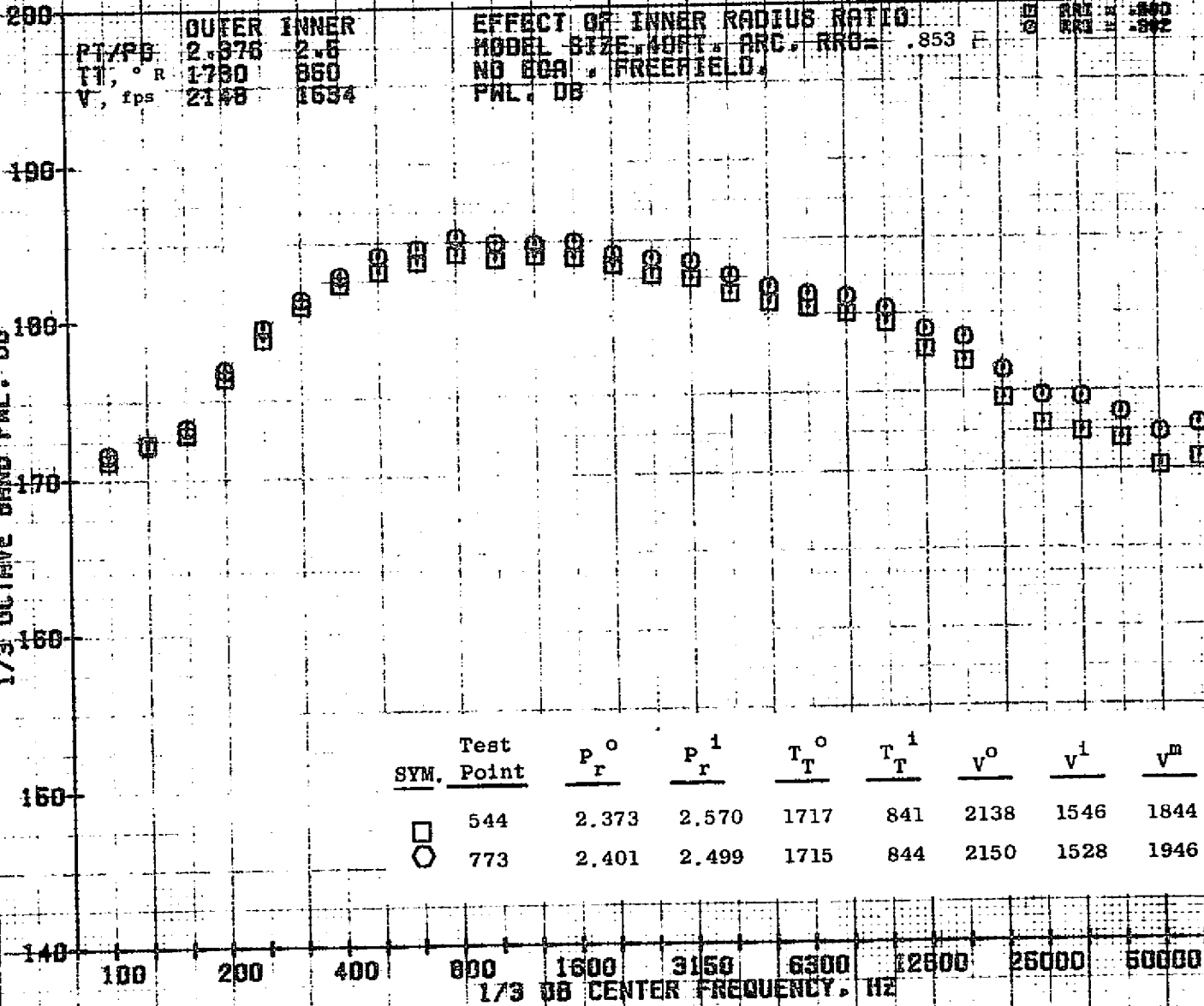


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 1B161-001

79 BURCH A.

scot

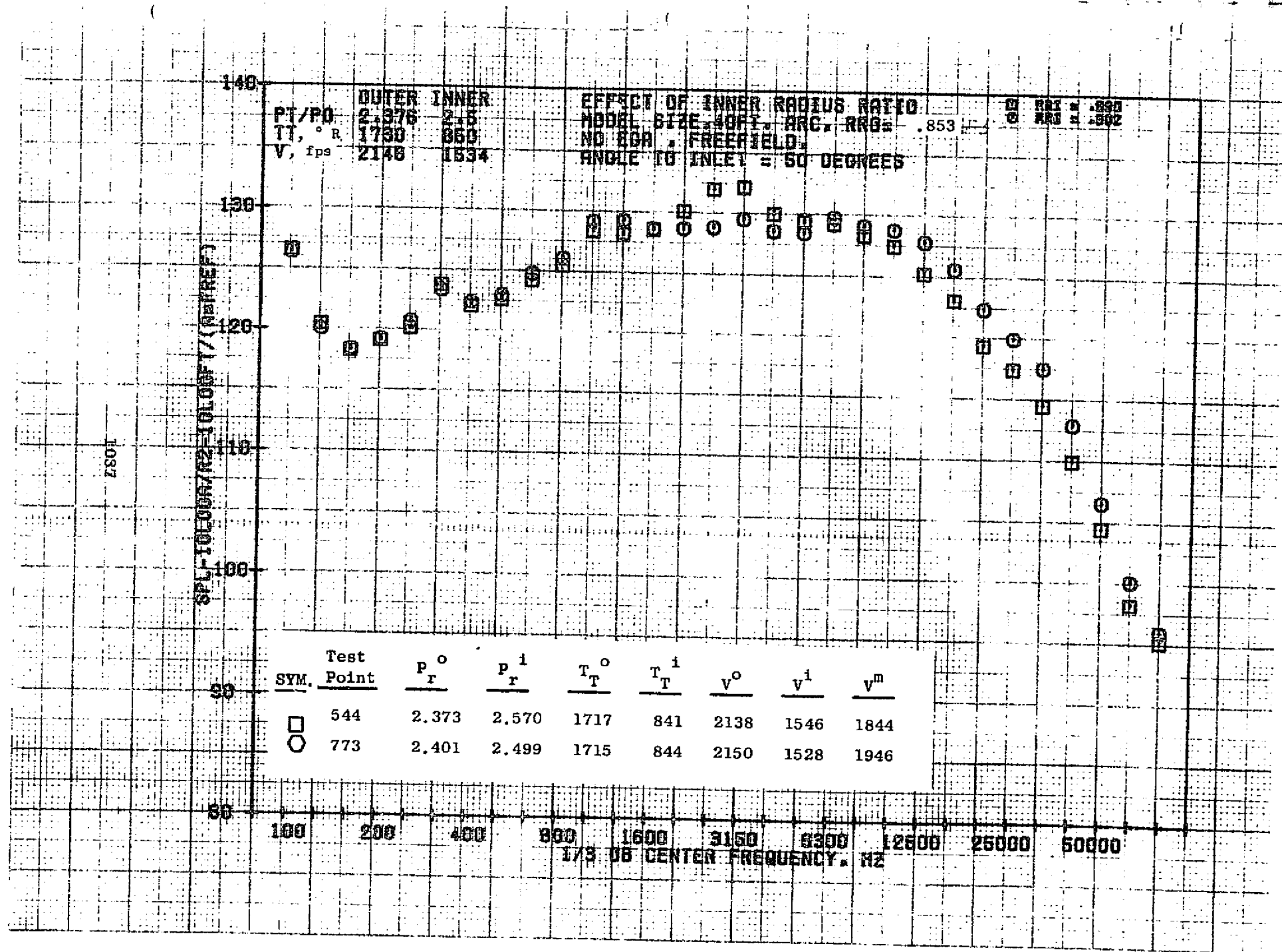
1/3 OCTAVE BAND PNL, DB



PI/PB 2.976
 T_T⁰ 1780
 V, fps 2148
 OUTER 2.8
 INNER 860
 1634

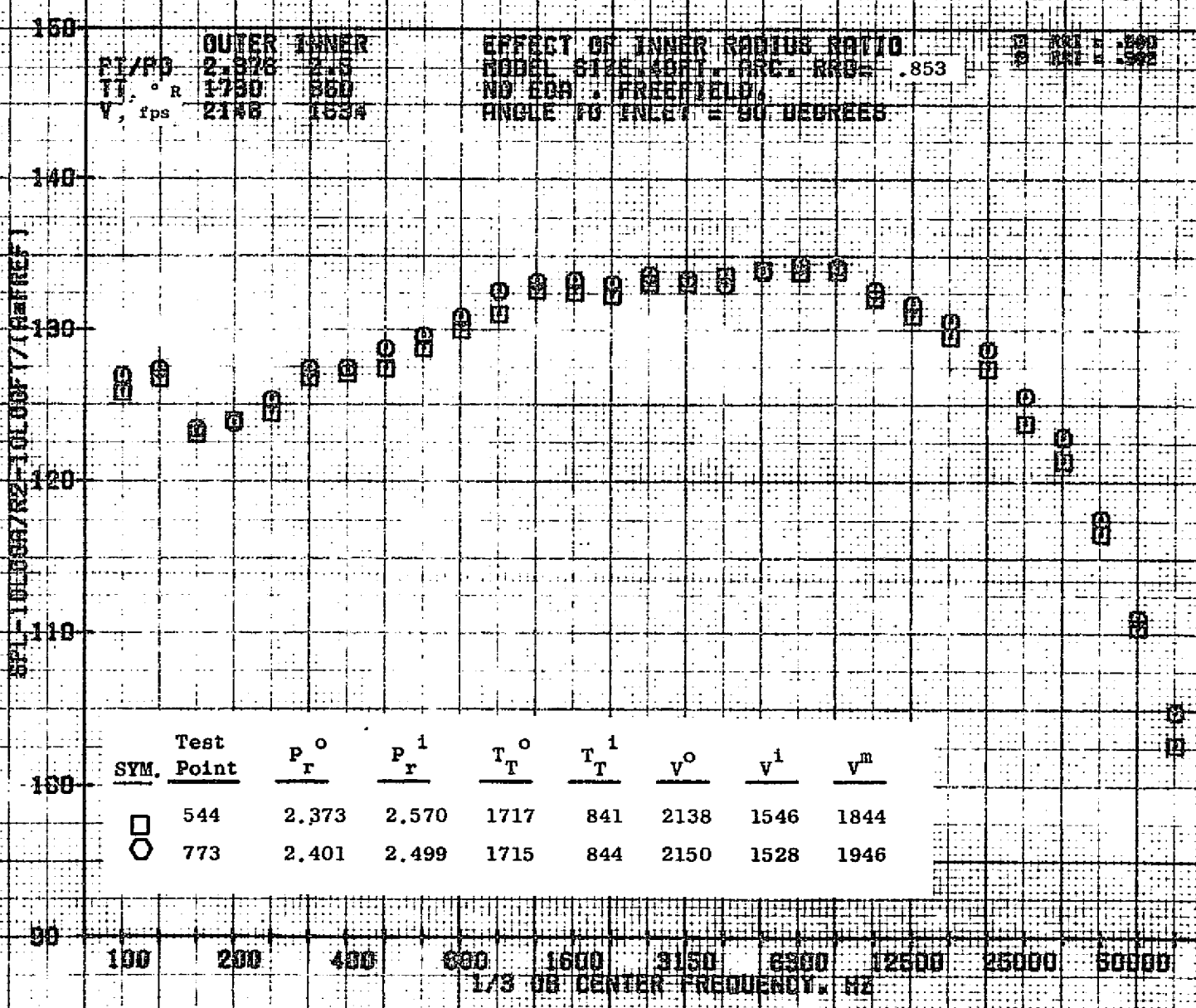
EFFECT OF INNER RADIUS RATIO
 MODEL SIZE, 40FT. ARC, RRO = .853 F
 NO COA, FREEFIELD,
 PNL, DB

T_T¹ 841
 V¹ 1528



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 18161-001

79 BURCH A.



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18161-001

78 BURCH A.

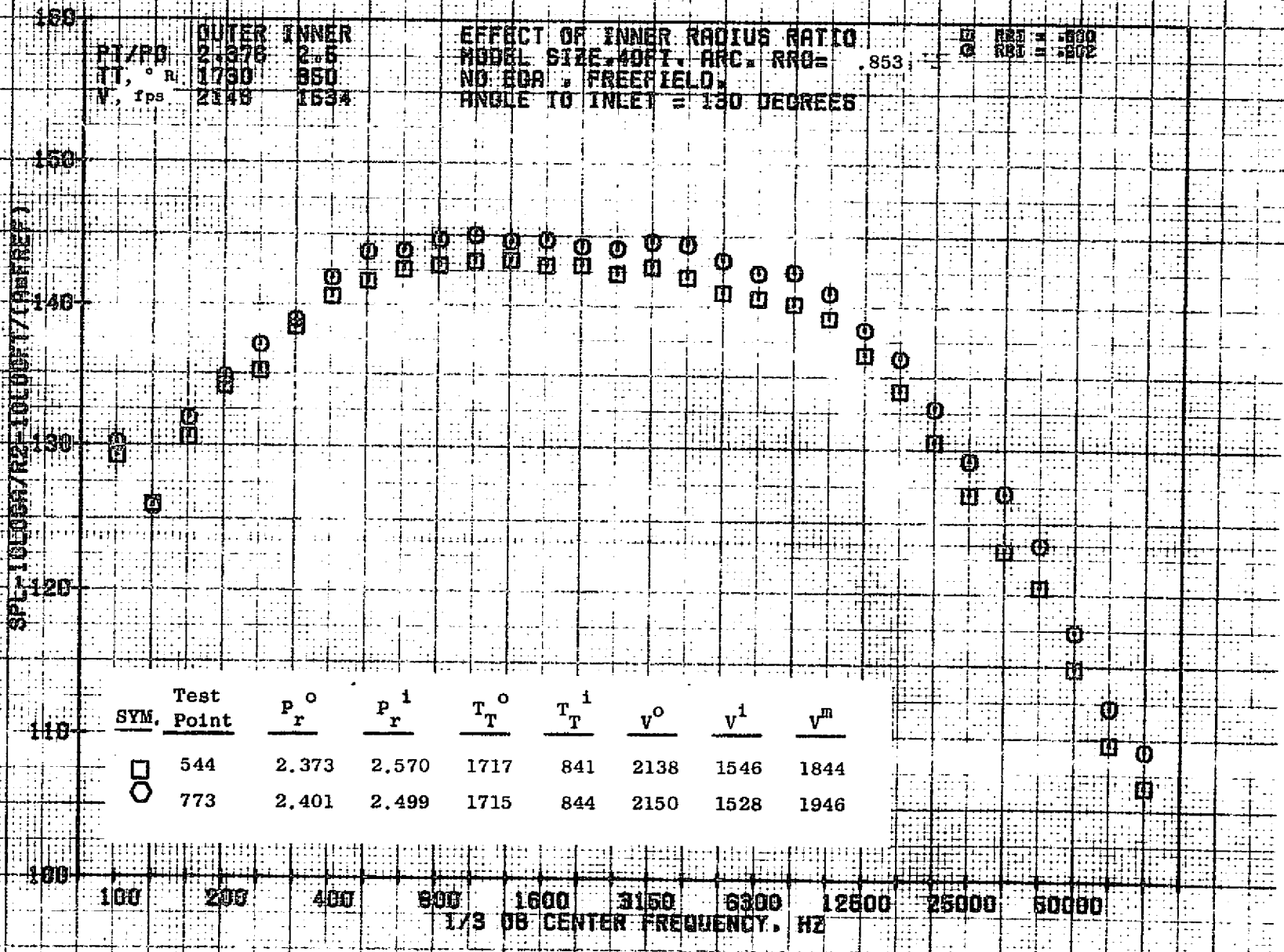
OUTER INNER
 P_1/P_0 2.373 2.5
 T_T^o 1717 850
 V^o 2148 1534

EFFECT OF INNER RADIUS RATIO
 MODEL SIZE 40 FT. ARC. RAO = .853
 NO. 80A, FREE FIELD
 ANGLE TO INLET = 130 DEGREES

\square R83 = .800
 \circ R83 = .802

SPL: 10LOG(P2/10LOG(P1/(PREF)))

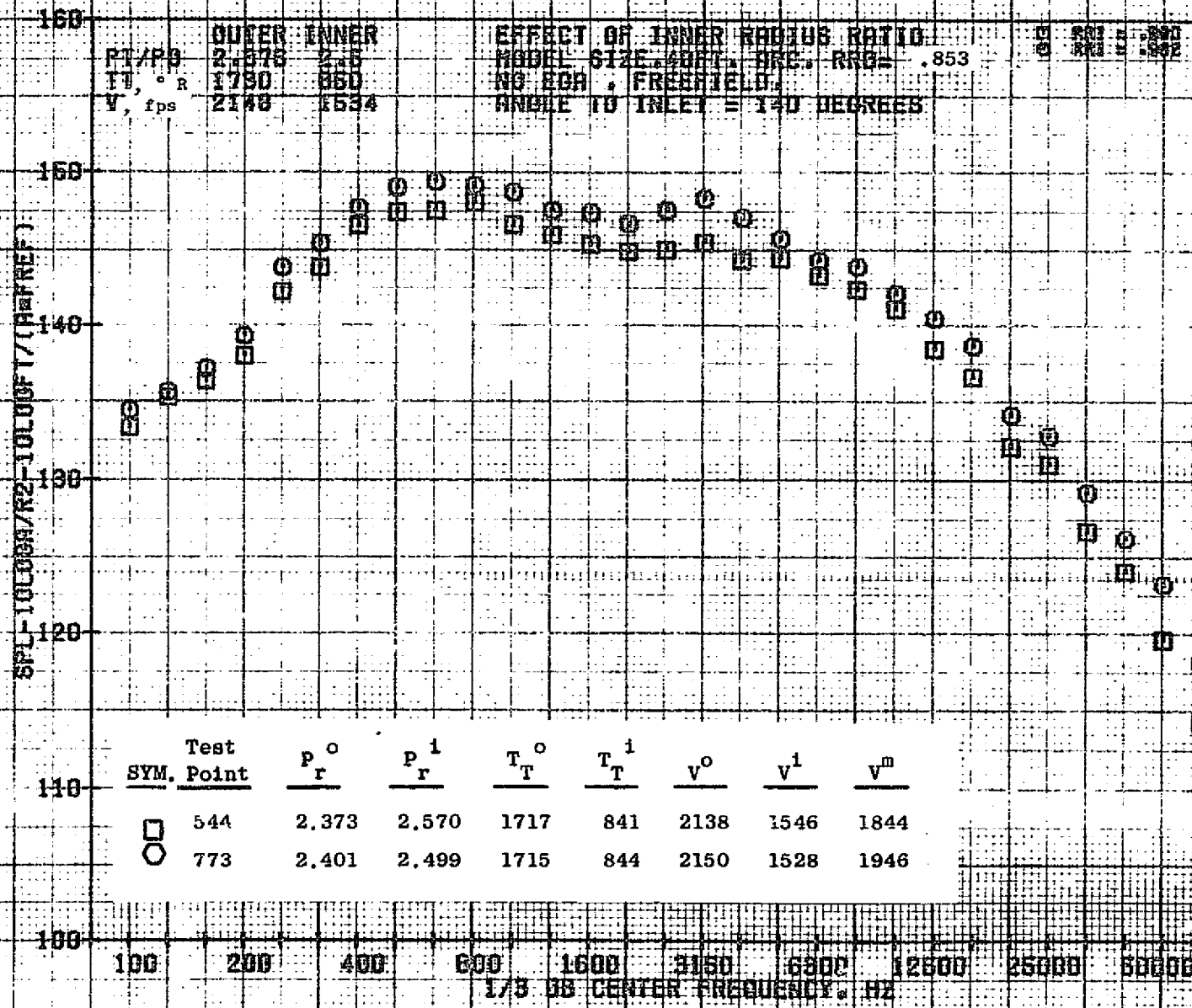
1039



SYM.	Test Point	P_r^o	P_r^i	T_T^o	T_T^i	V^o	V^i	V^m
\square	544	2.373	2.570	1717	841	2138	1546	1844
\circ	773	2.401	2.499	1715	844	2150	1528	1946

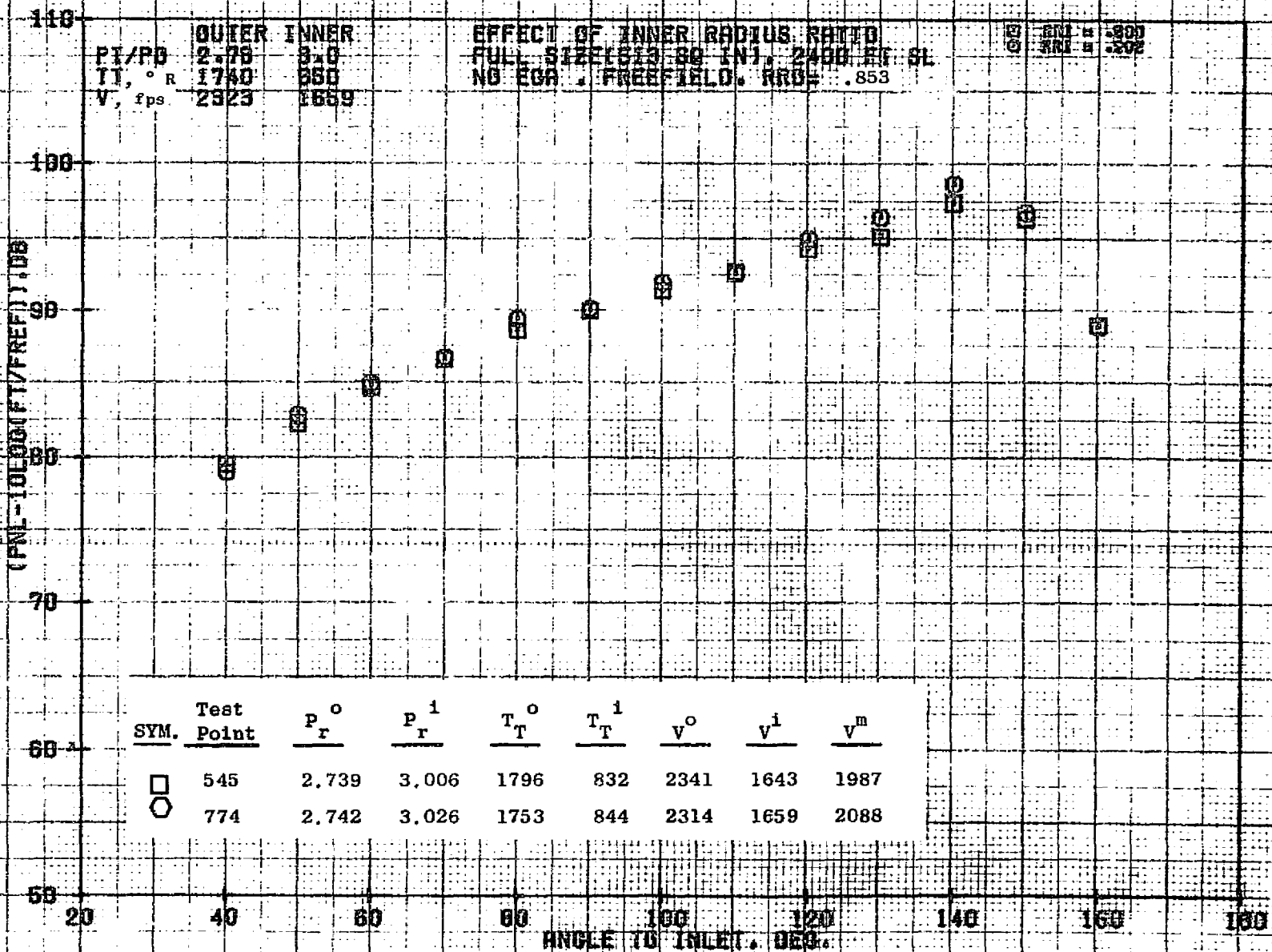
10/29/76
 18161-001

79 BURCH A.



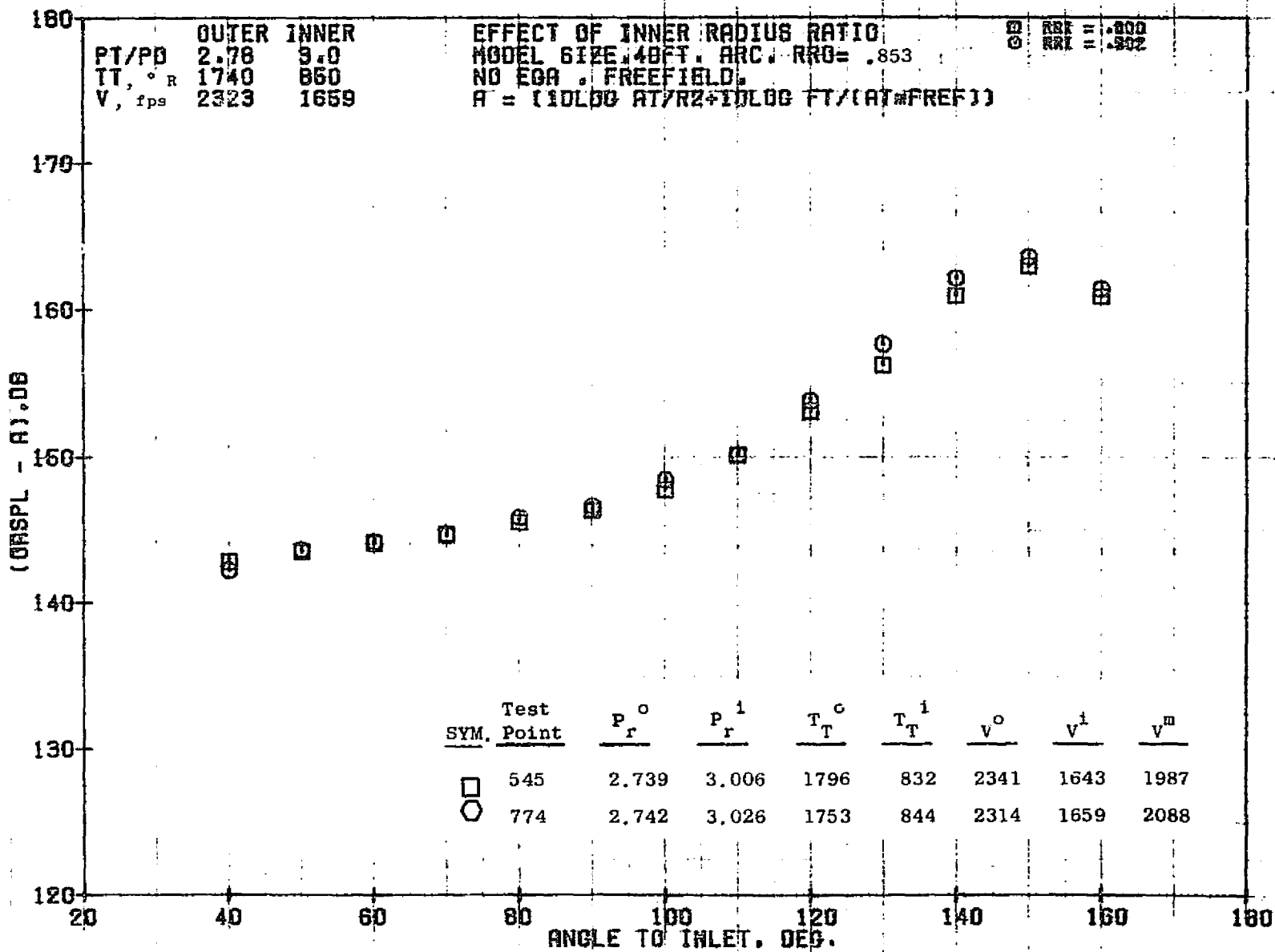
10/29/76
18161-001

79 BURCH A.



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 18124-001

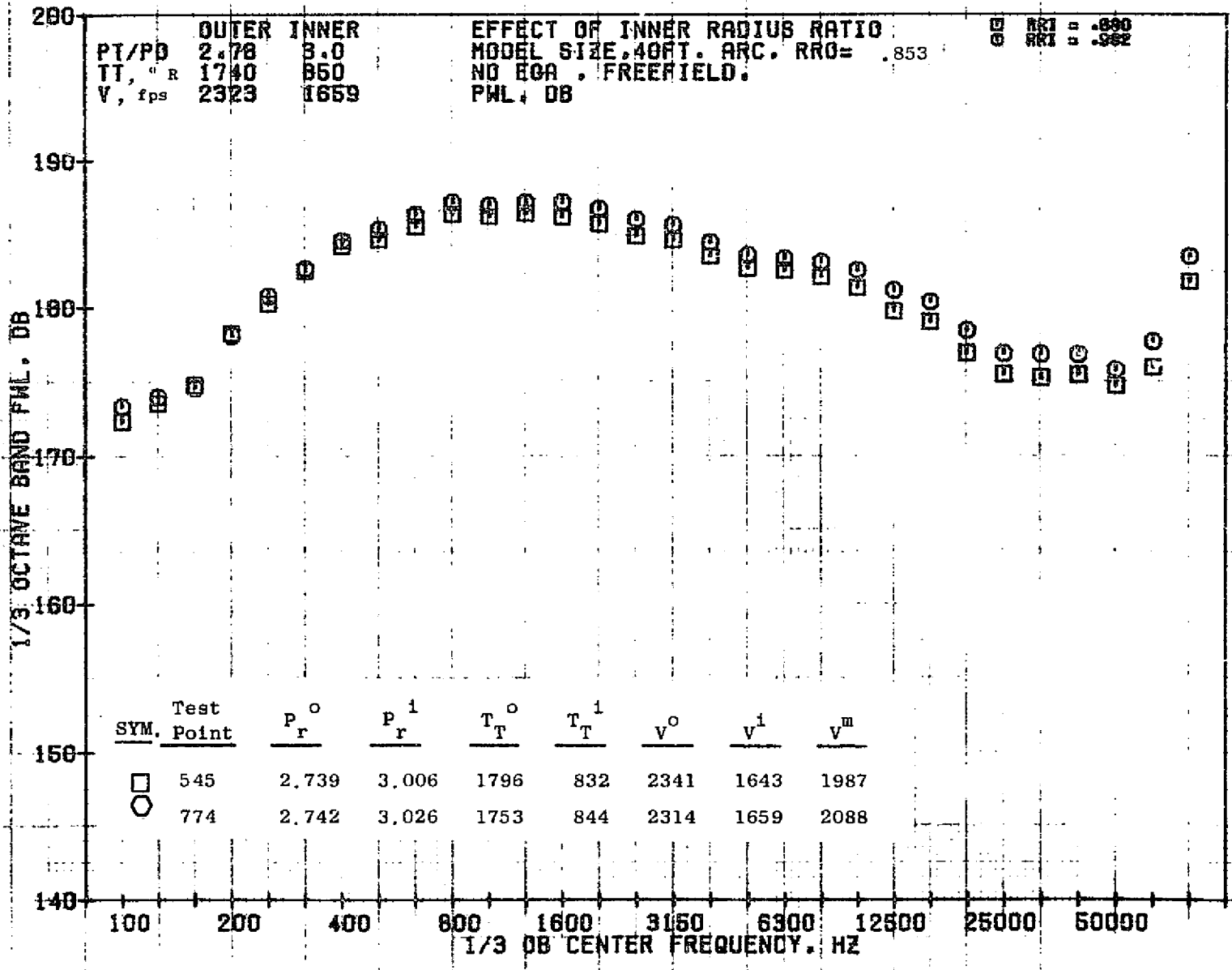
79 BURCH A.



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1B161-001

79 BURCH A.

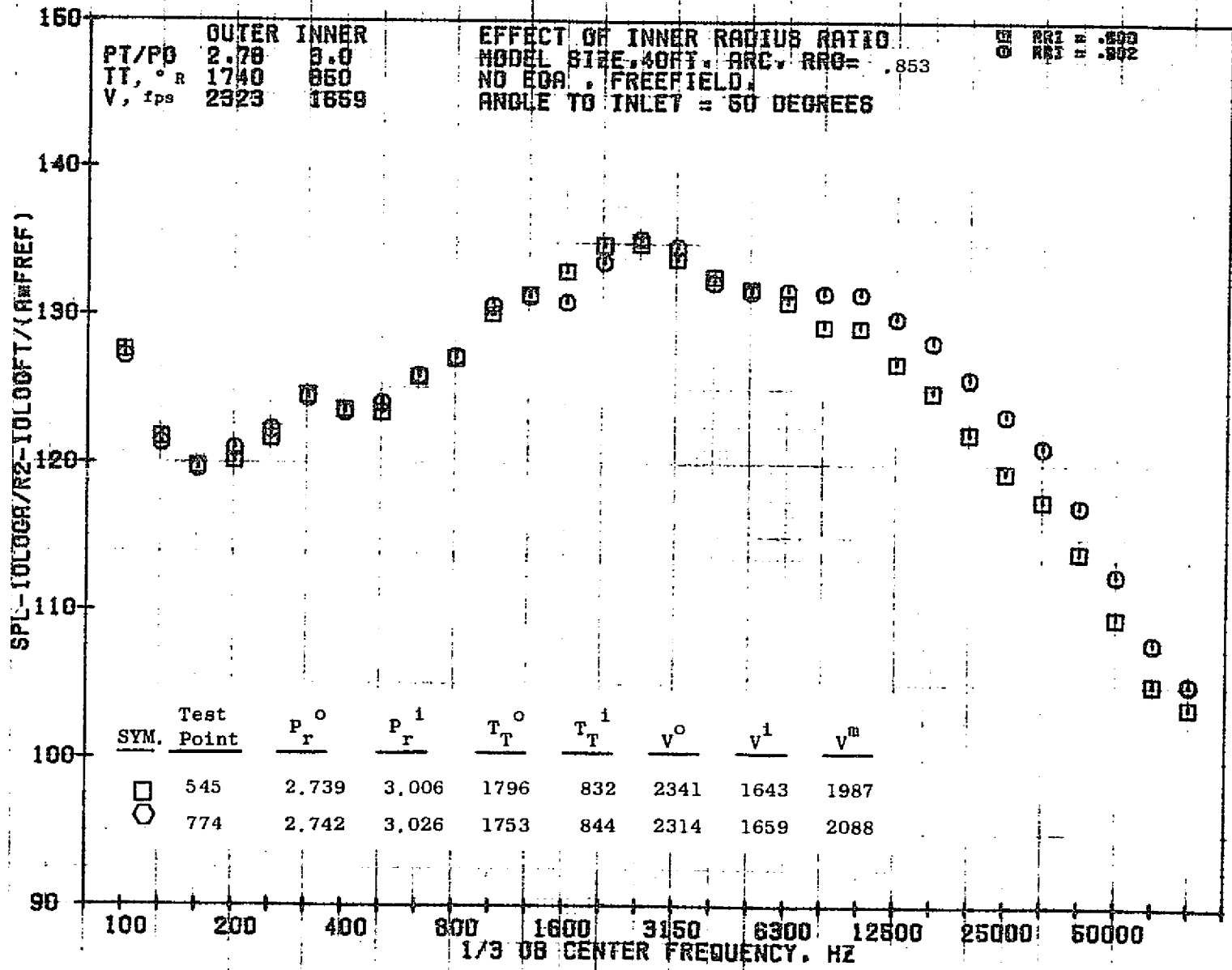
1043



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18161-001

79 BURCH A.

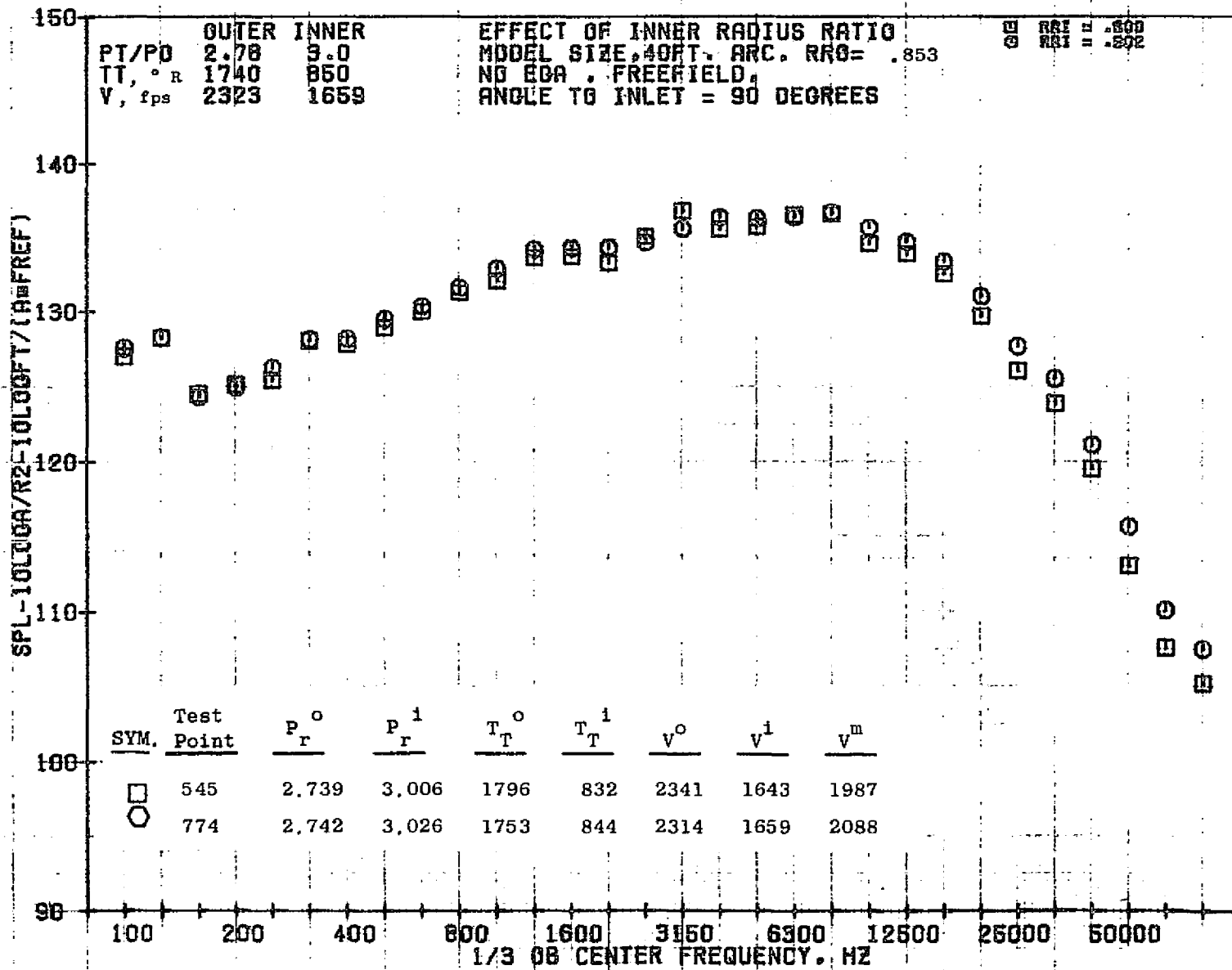
1044



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 18161-001

79 BURCH A.

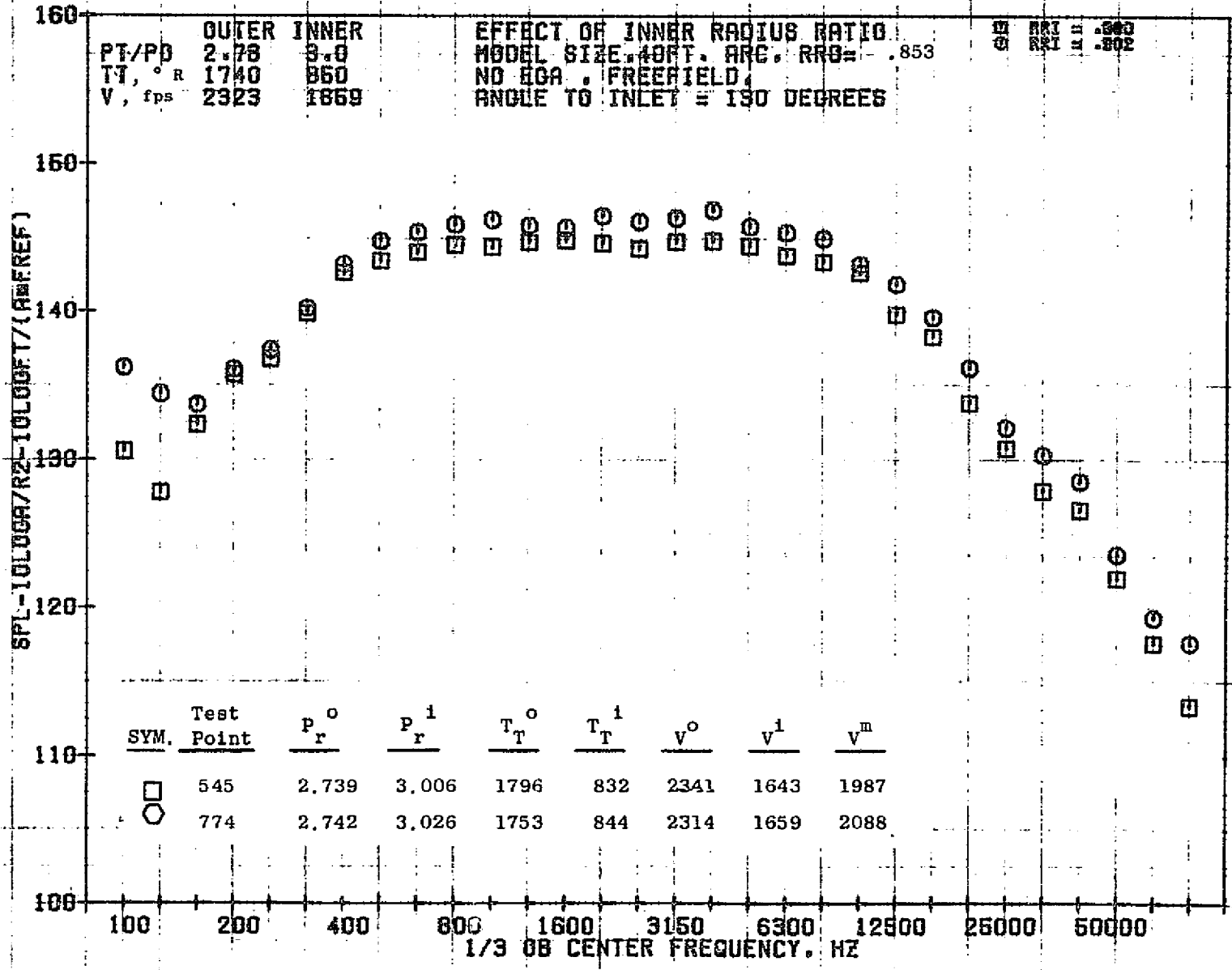
1045



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 18161-001

79 BURCH A.

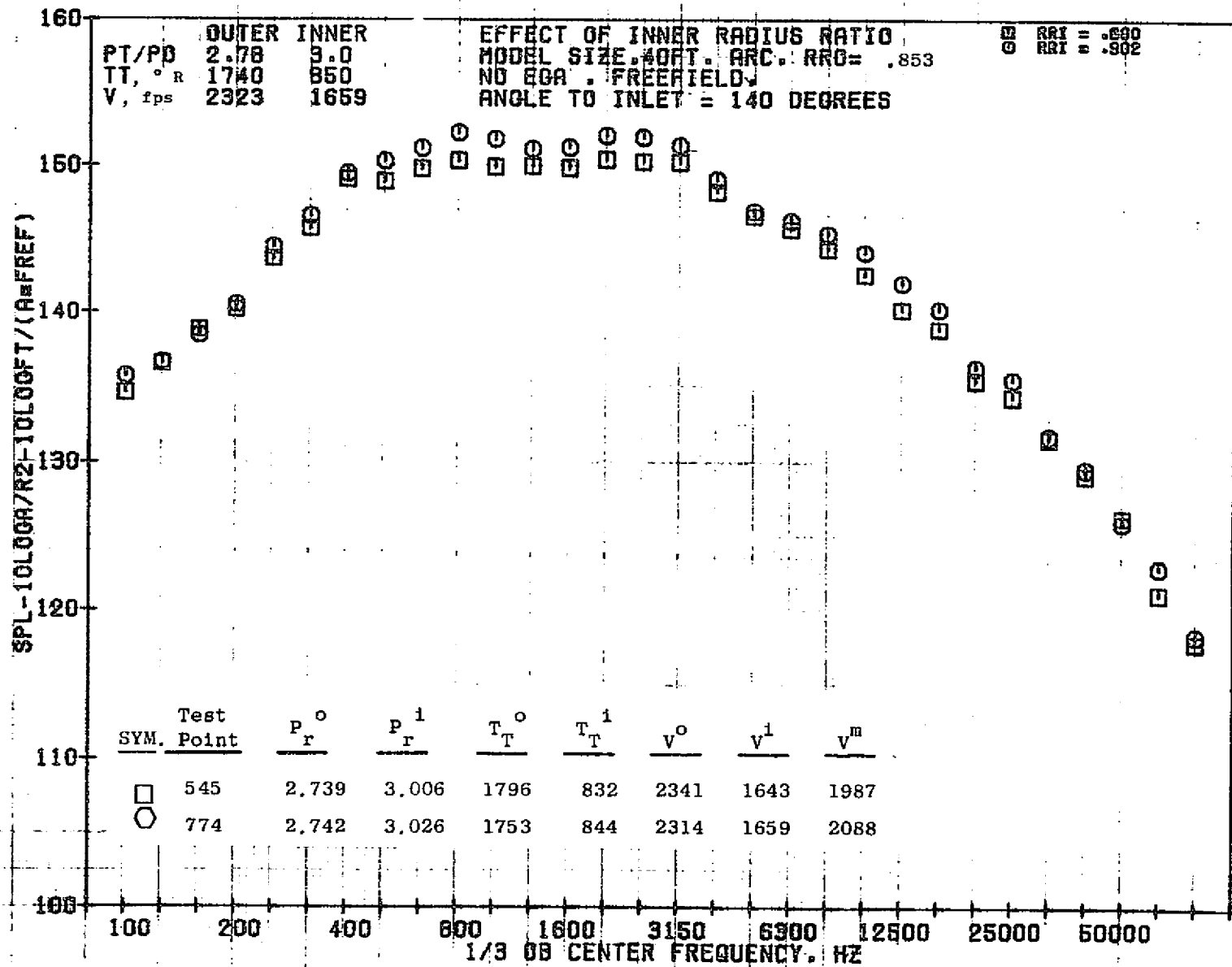
1046



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79 BURCH A.

1047



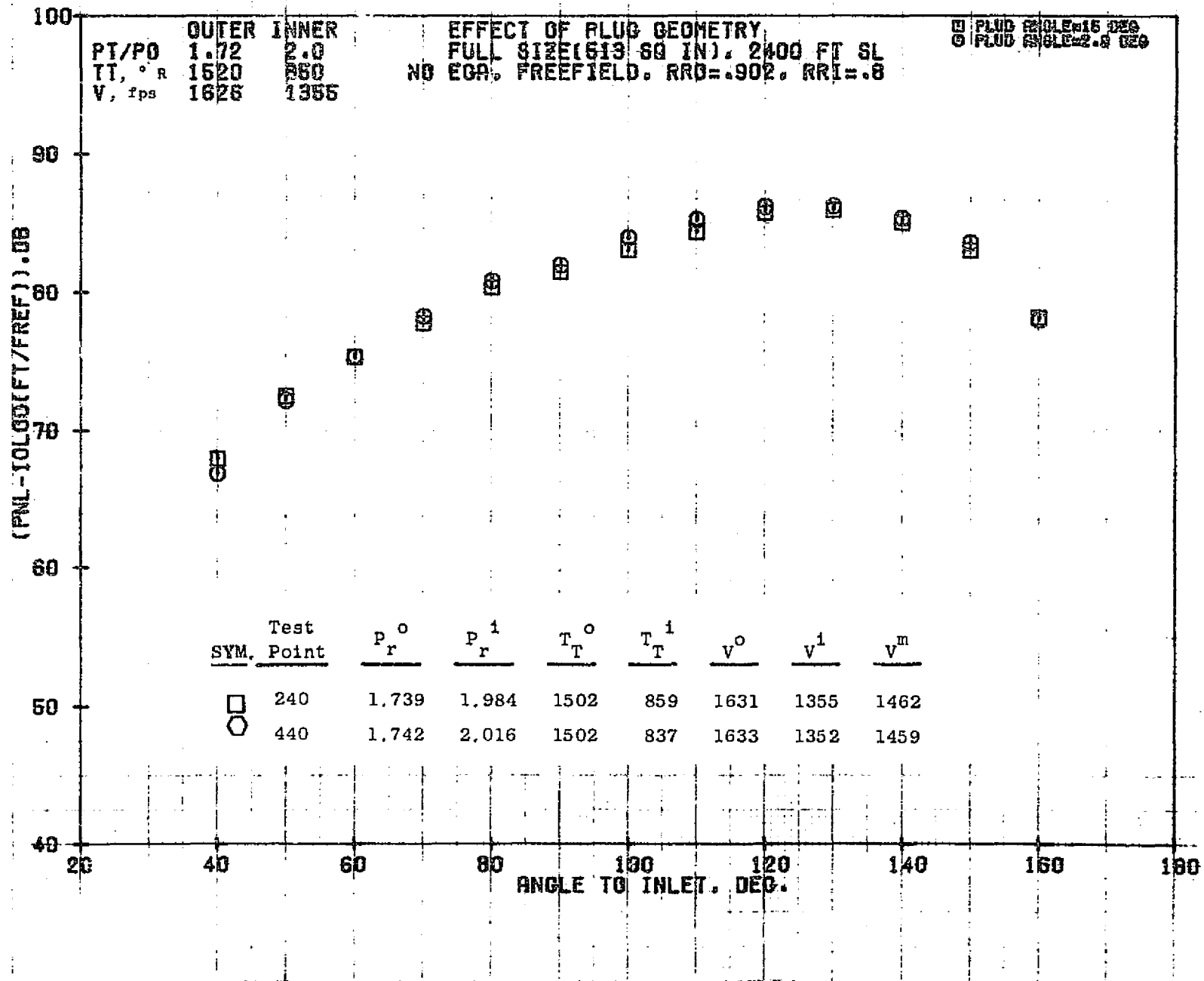
10/29/76
 18161-001

79 BURCH A.

7.4.3 Effect of Plug Geometry

The effect of plug geometry is examined in this section. Configurations 2 and 4 have the same inner and outer radius ratios but different plug geometries. Configuration 2 has a smooth plug contour while Configuration 4 has a somewhat flat plug crown.

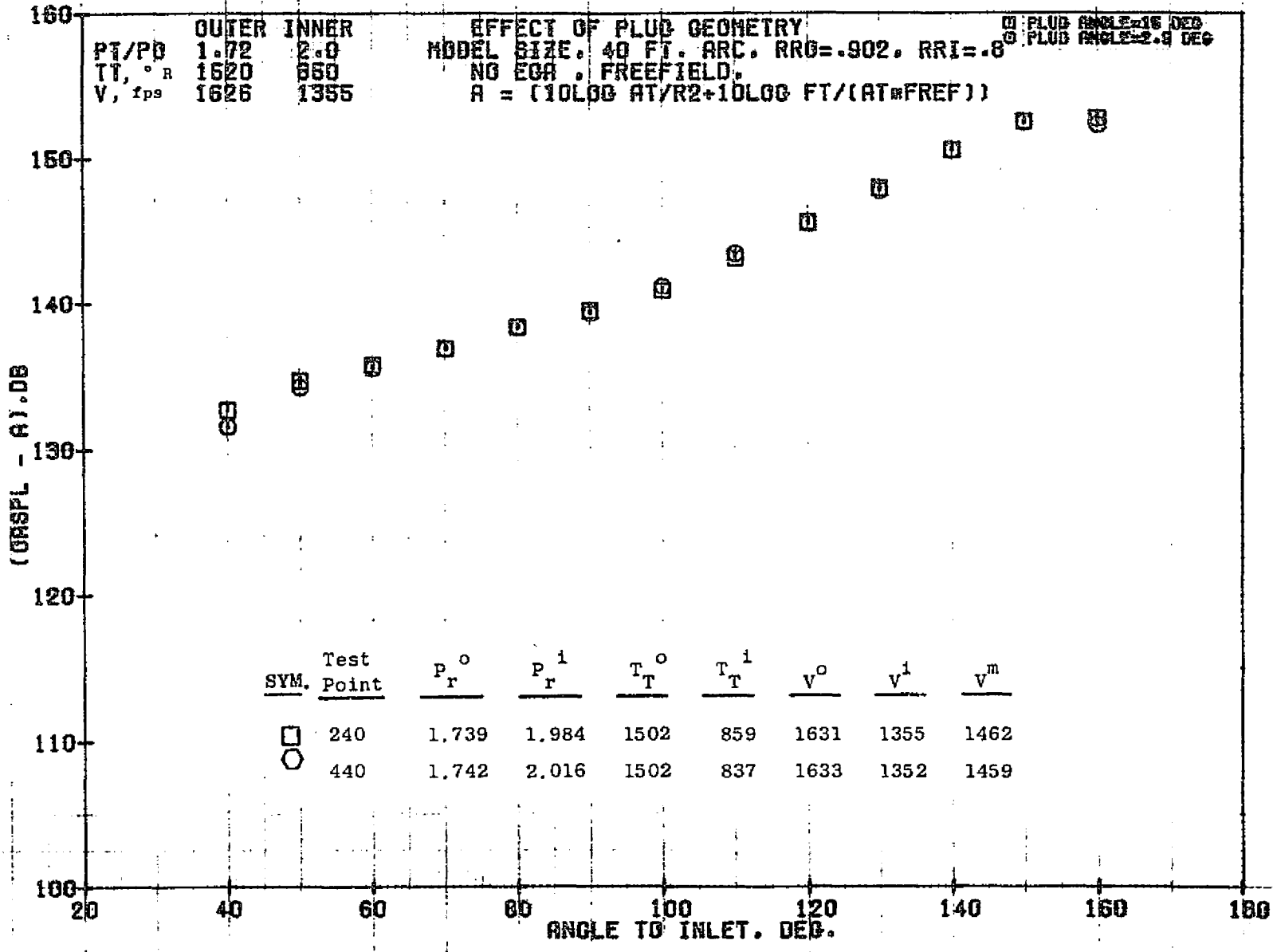
1049



10/29/76
 18130-001

79 BURCH A.

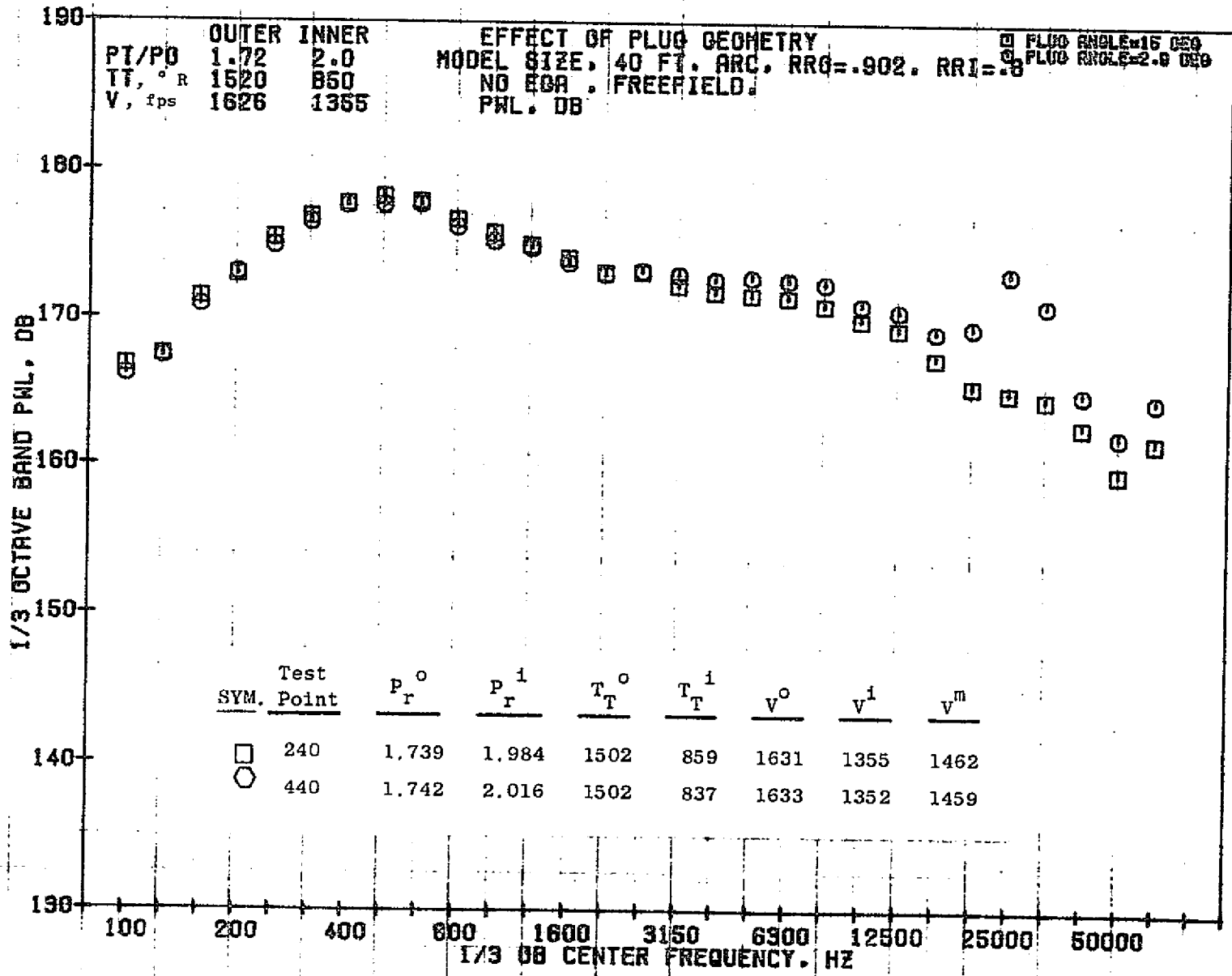
1050



10/29/76
 18159-001

79 BURCH A.

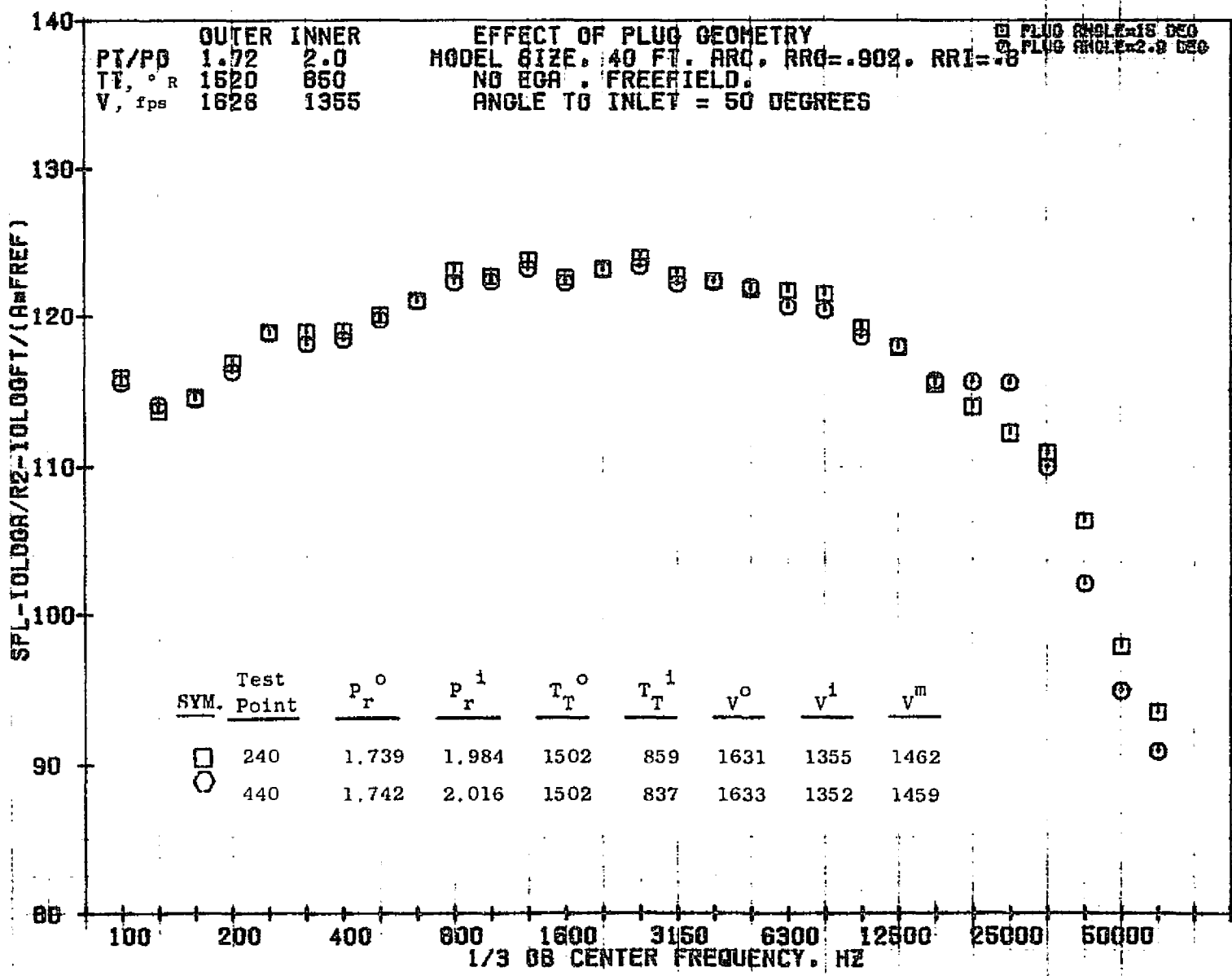
1051



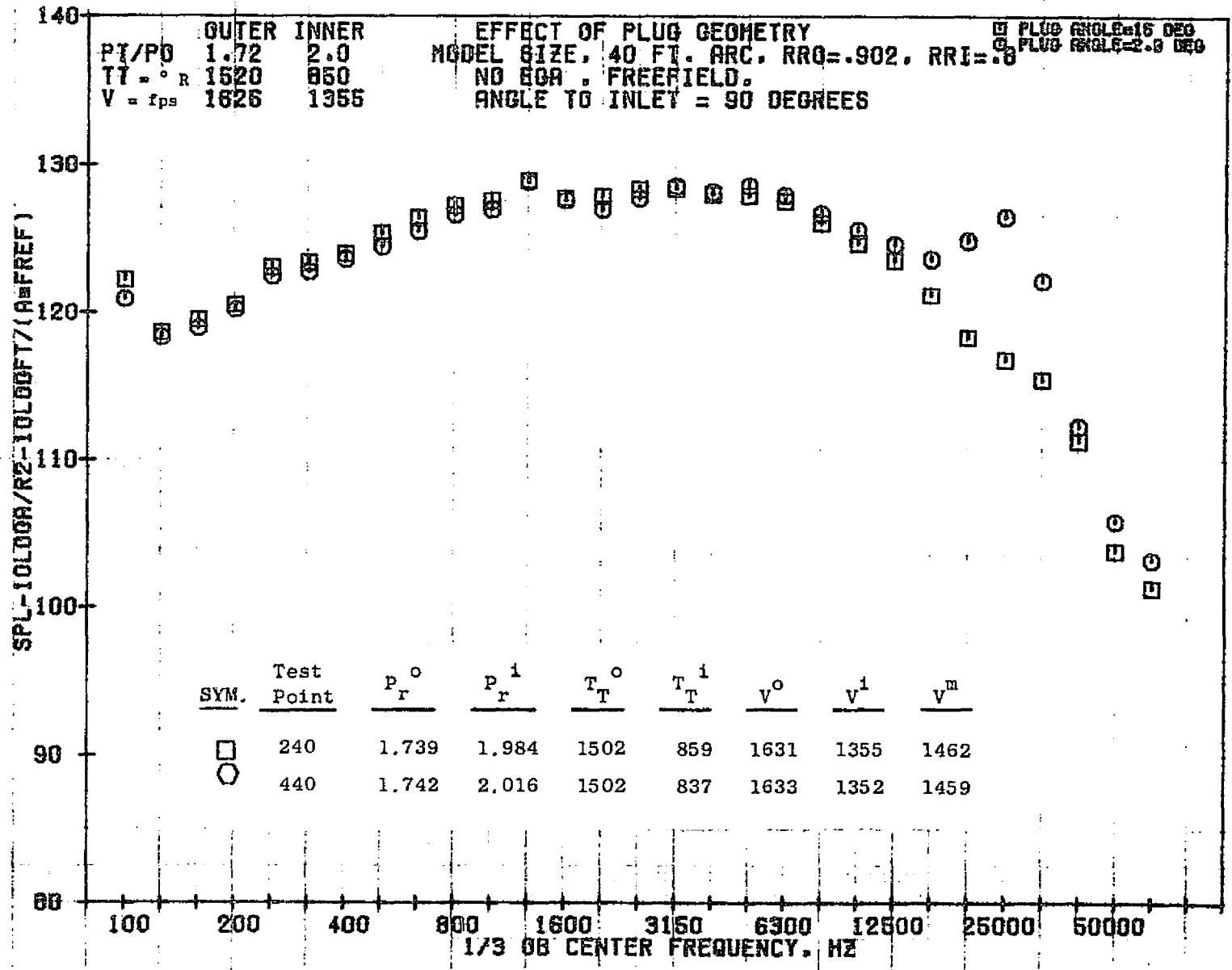
10/29/76
 18159-001

79 BURCH A.

1052



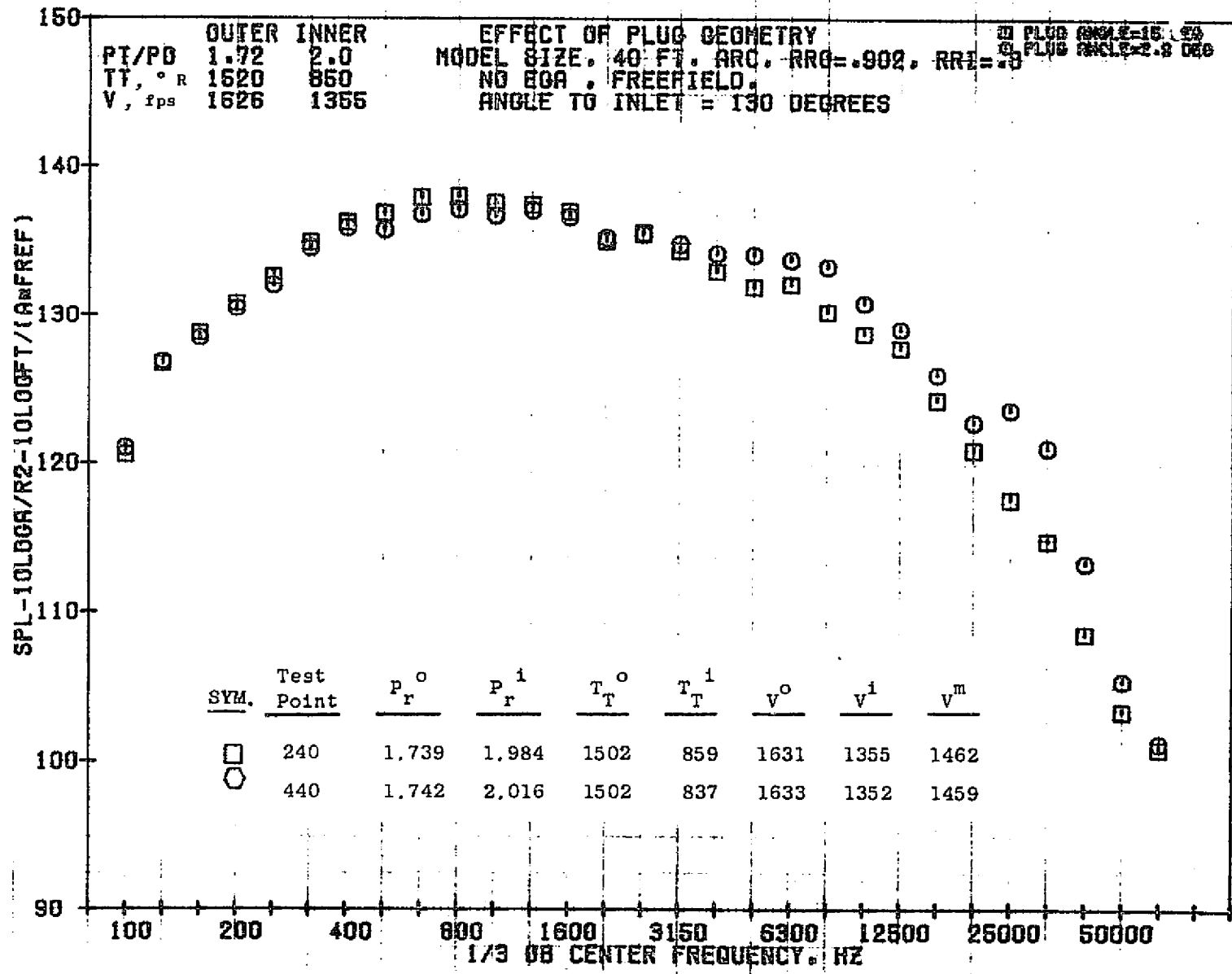
1053



10/29/76
 18159-001

79 BURCH A.

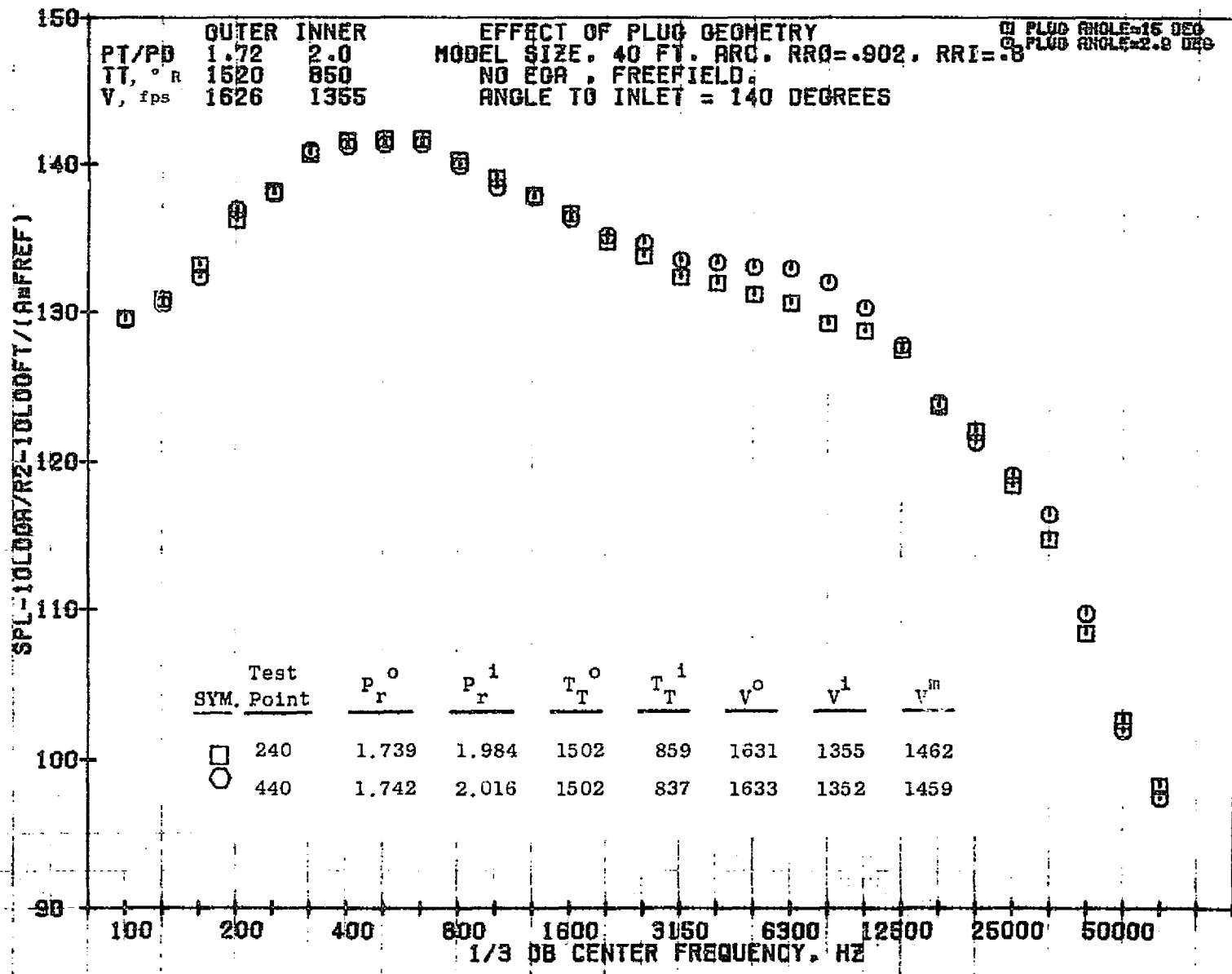
1054



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 1B159-001

79 BURCH A.

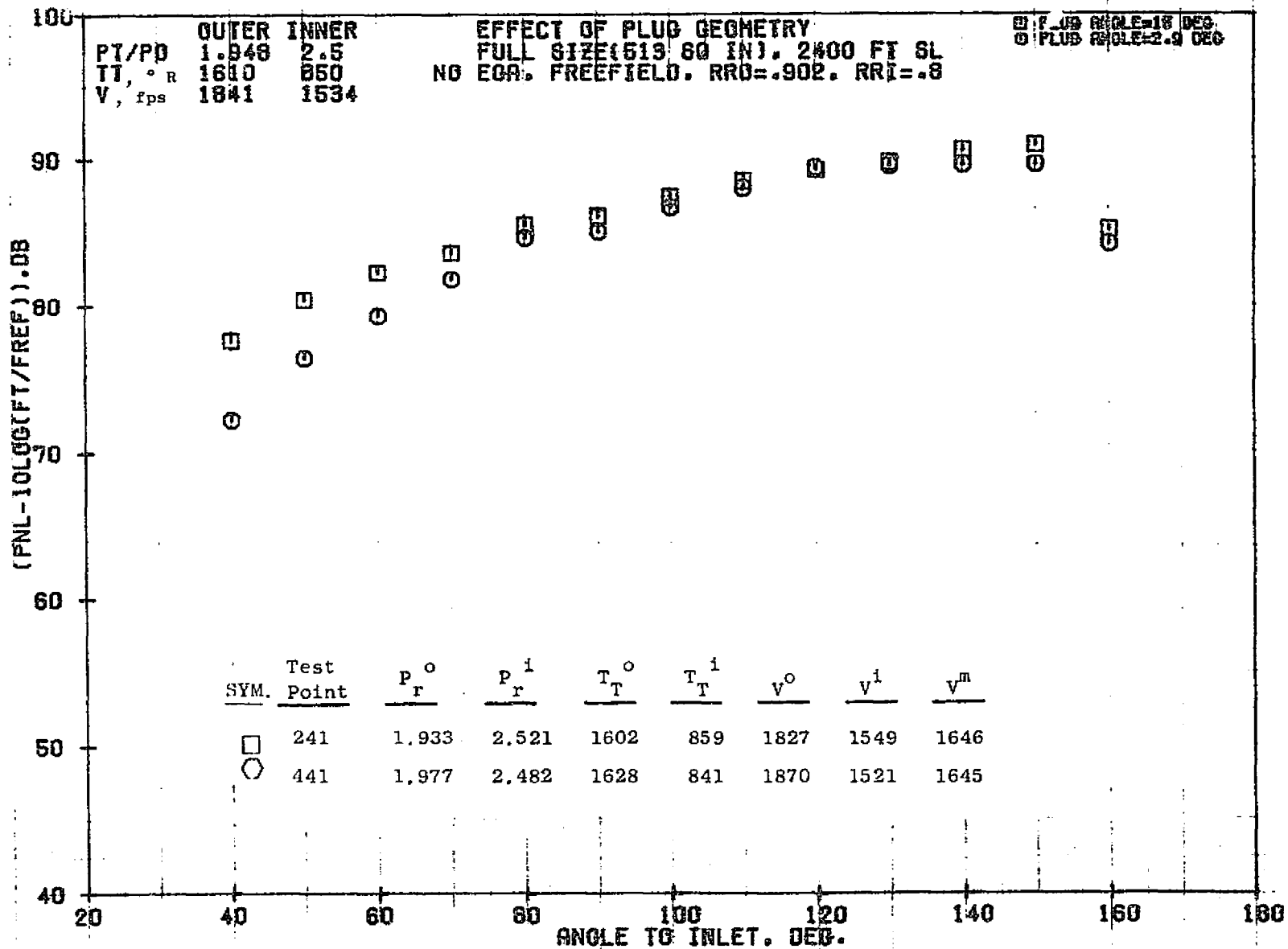
1055



10/29/76
 1B159-001

79 BURCH A.

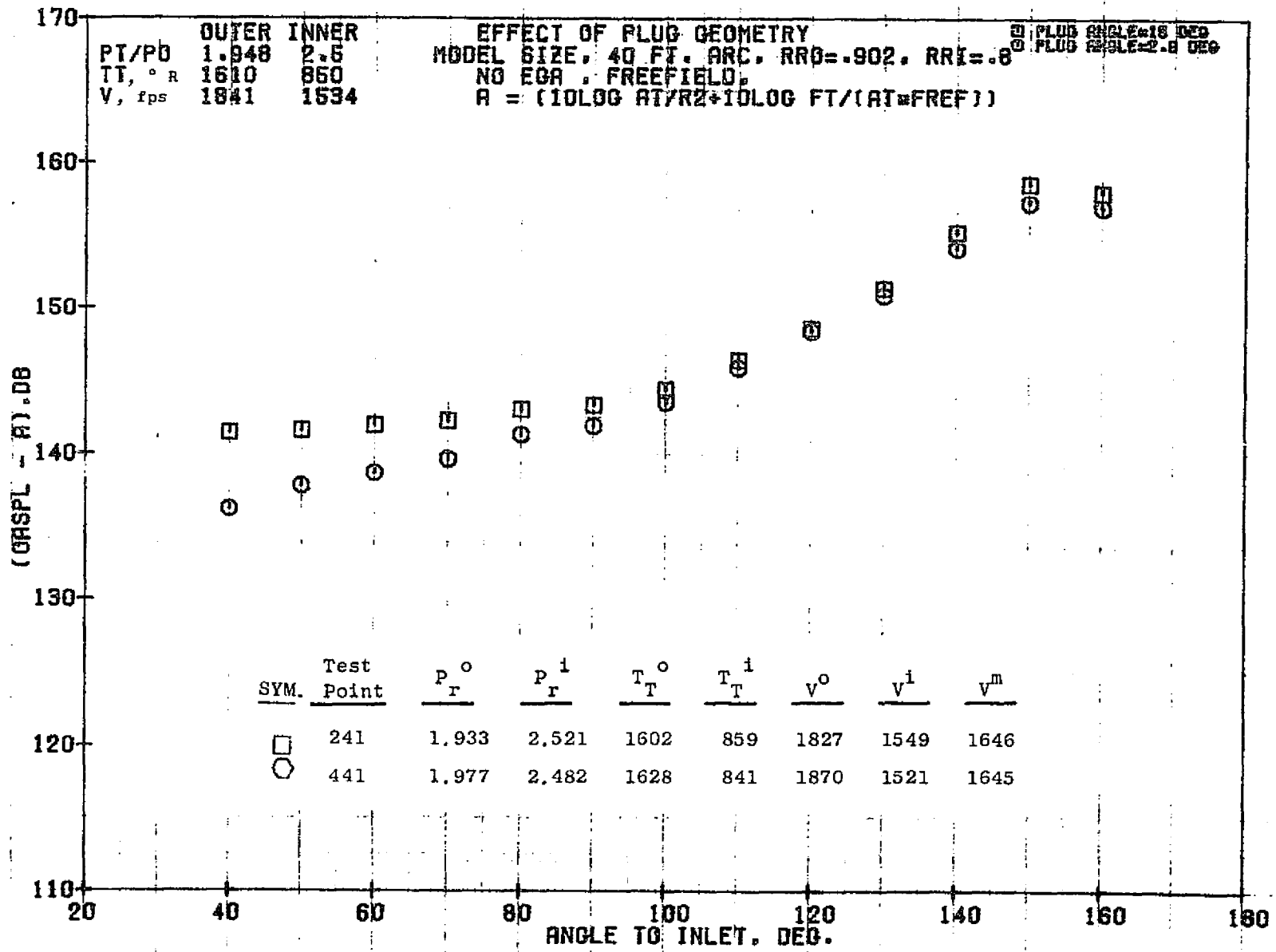
1056



10/29/76
 18130-001

79 BURCH A.

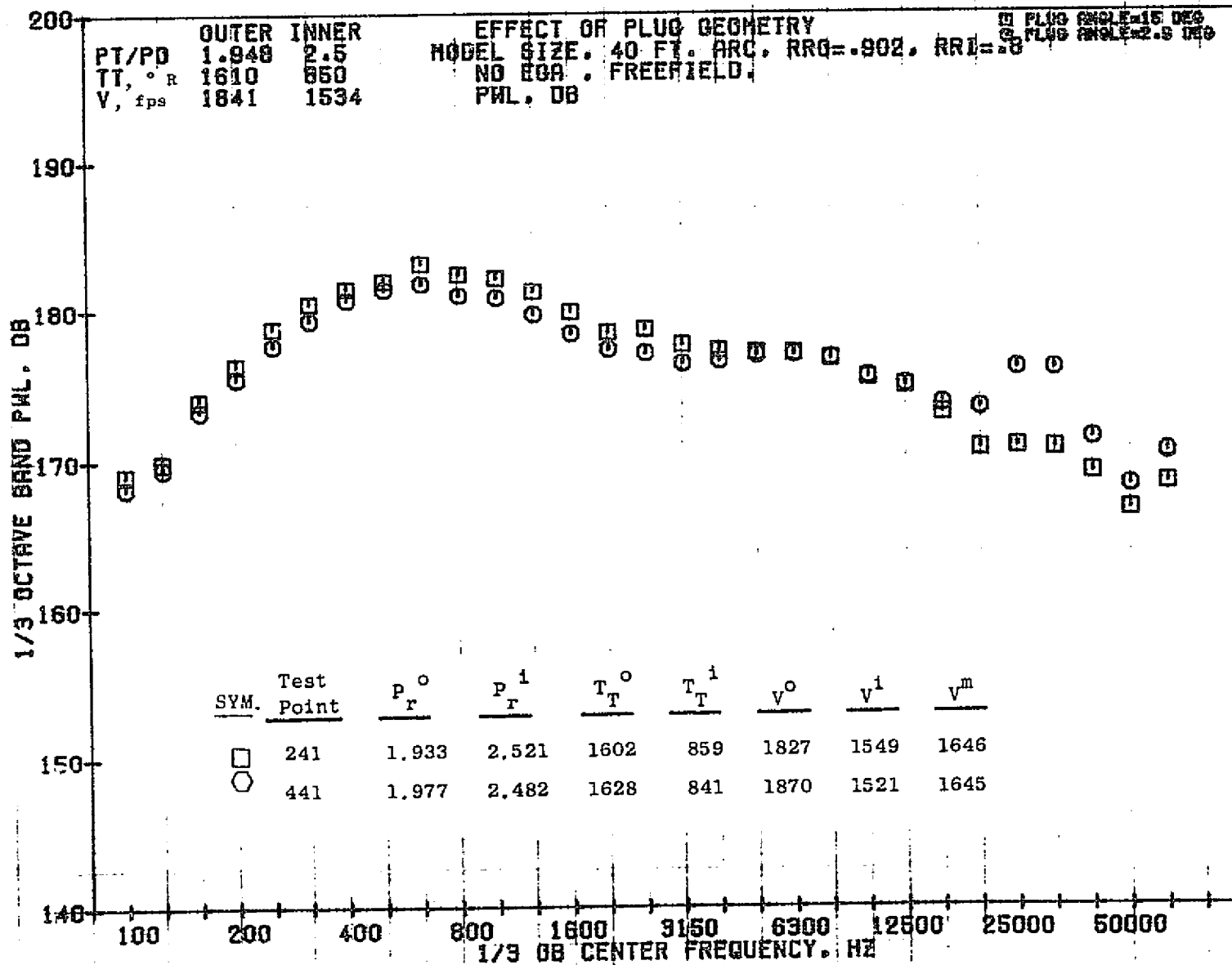
1097



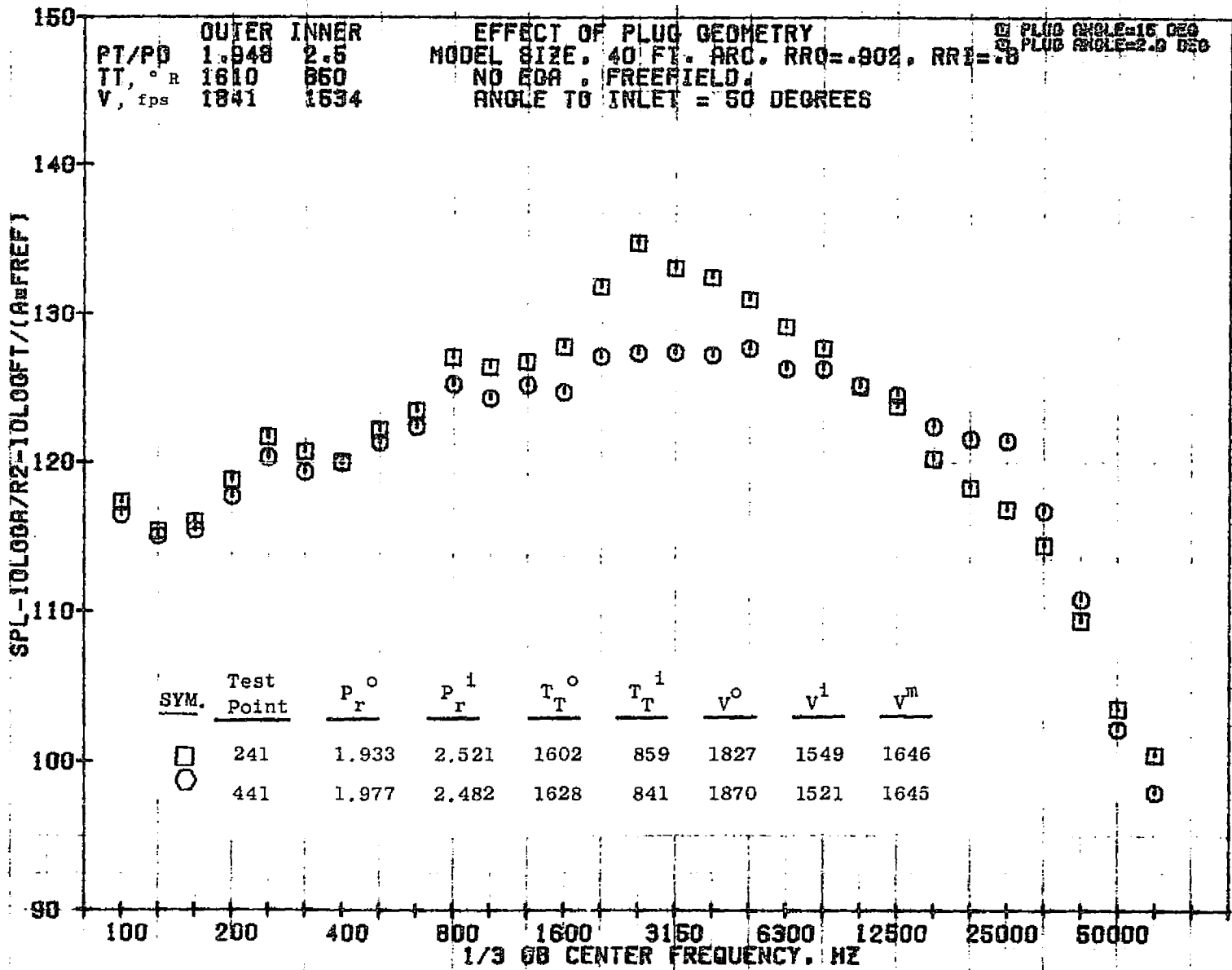
10/29/76
 18159-001

79 BURCH A.

1058



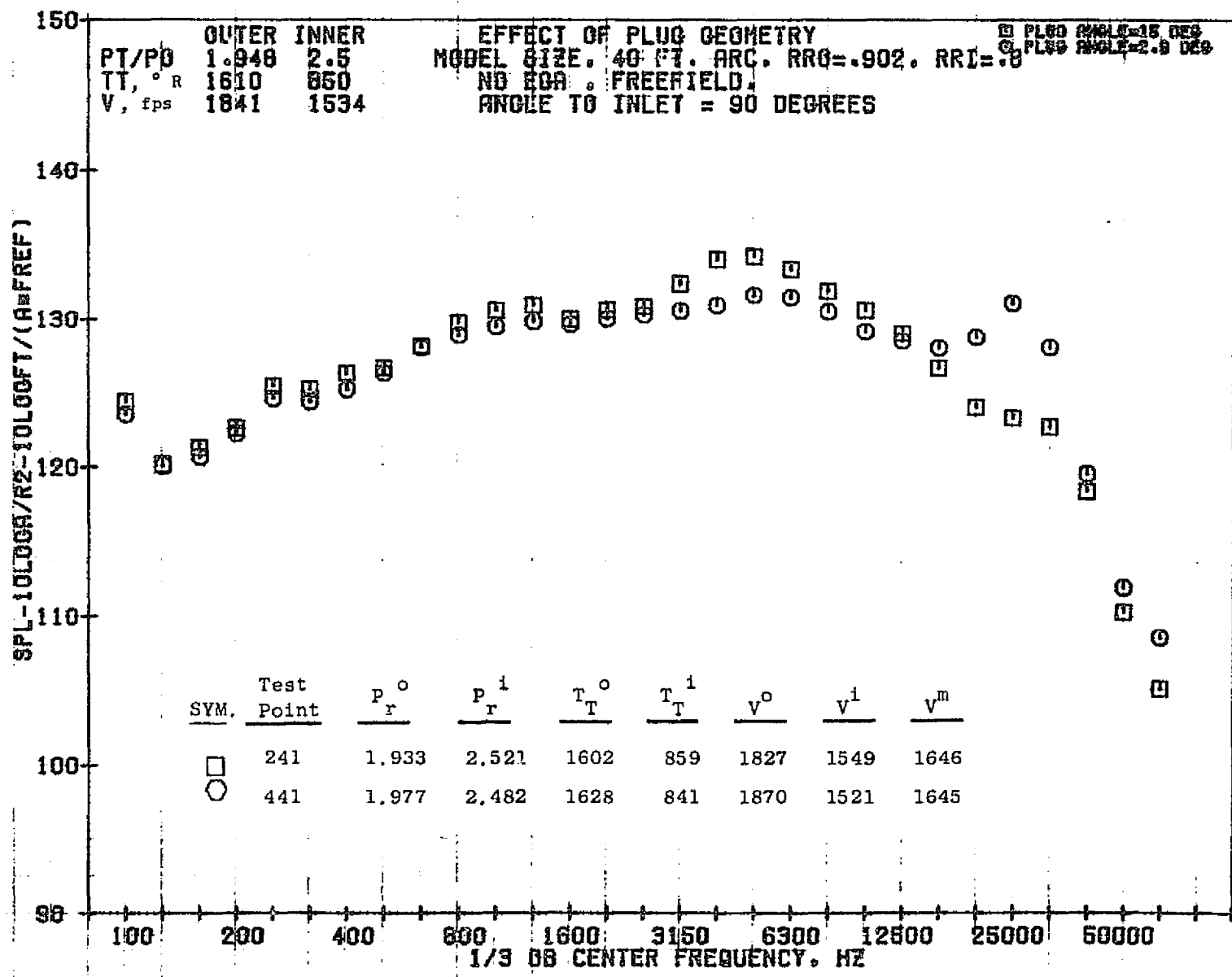
6501



10/29/76
 18159-001

79 BURCH A.

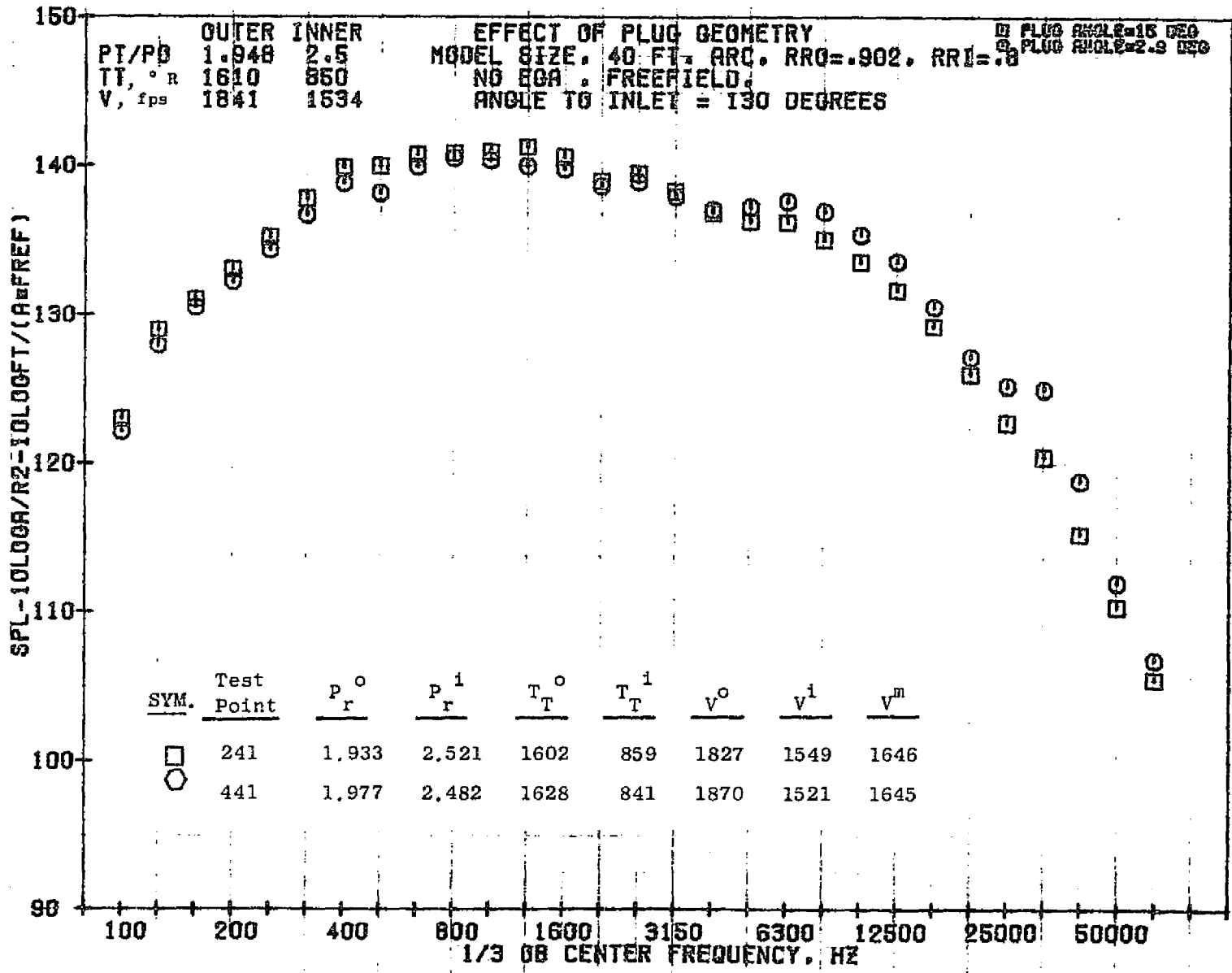
1060



10/29/76
 18159-001

79 BURCH A.

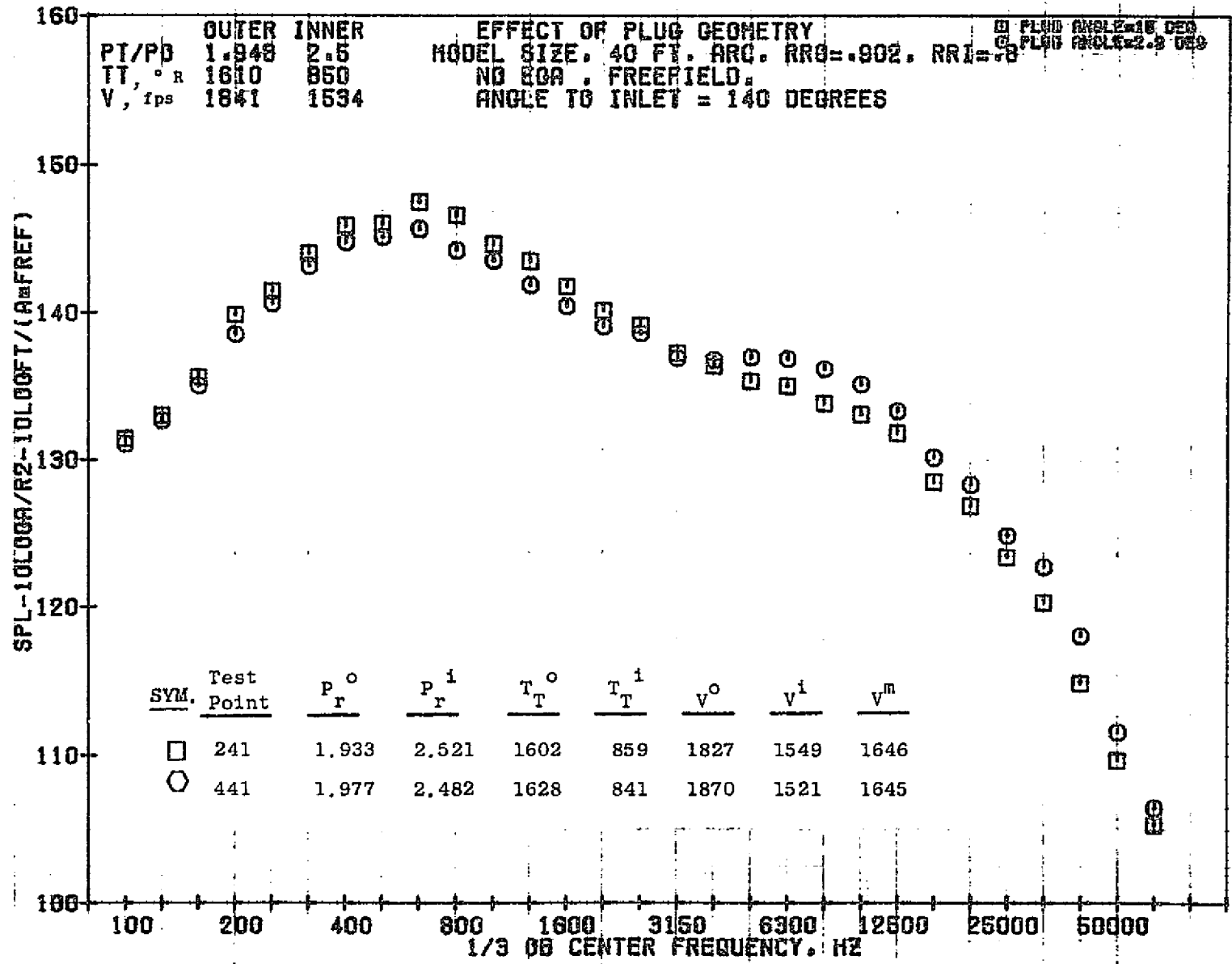
1901



10/29/76
 18159-001

79 BURCH A.

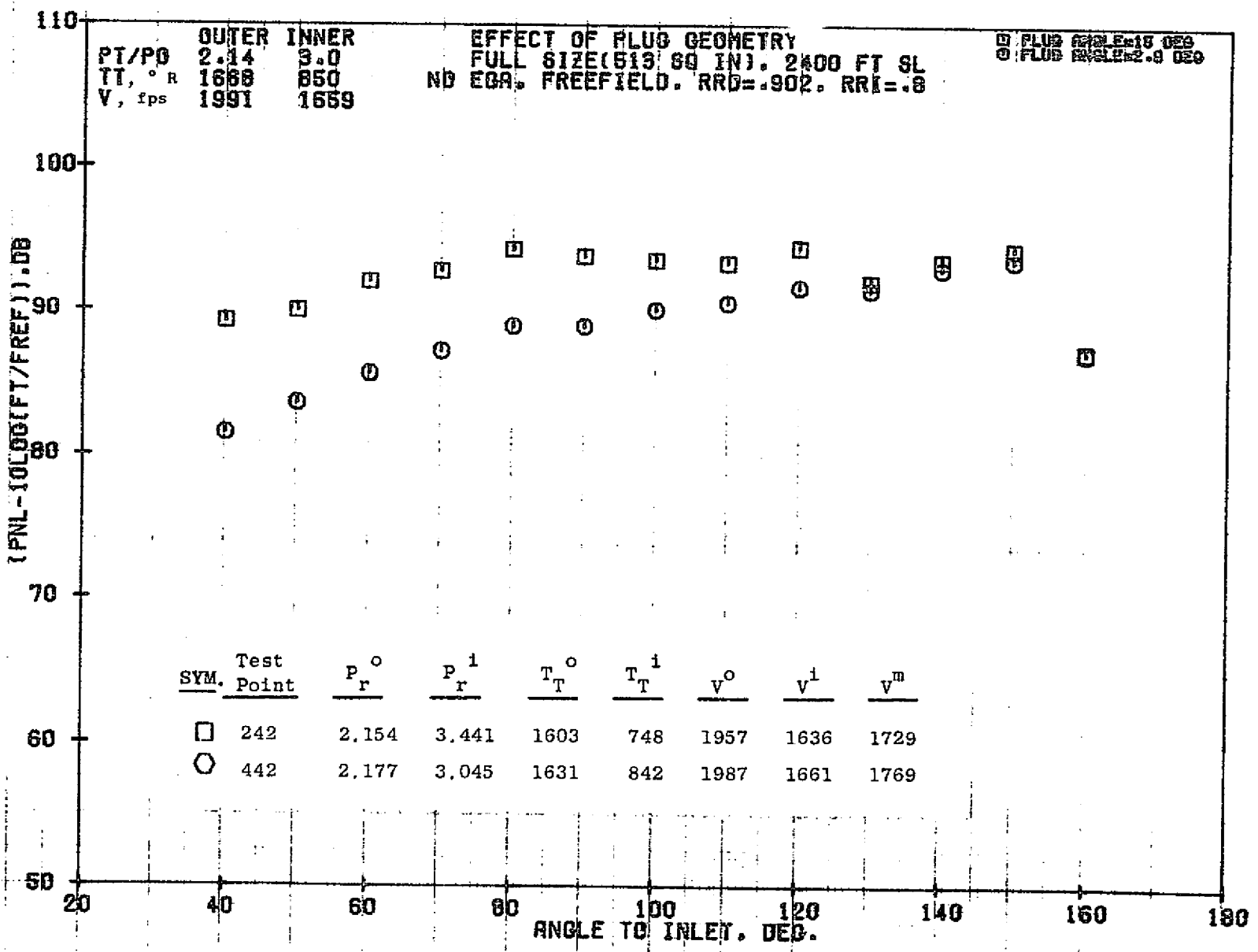
1062



10/29/76
 18159-001

79 BURCH A.

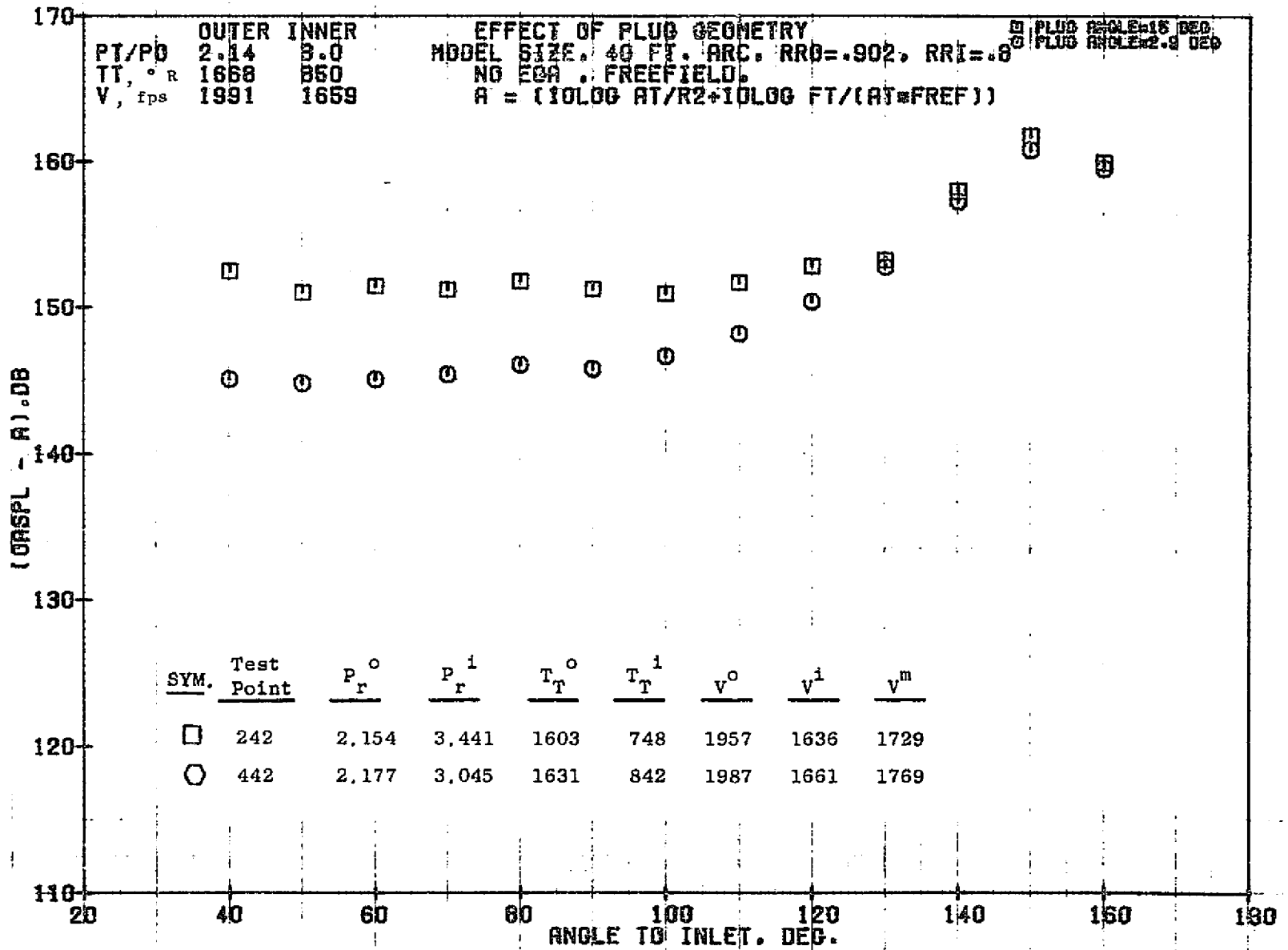
1063



10/29/76
 18130-001

79 BURCH A.

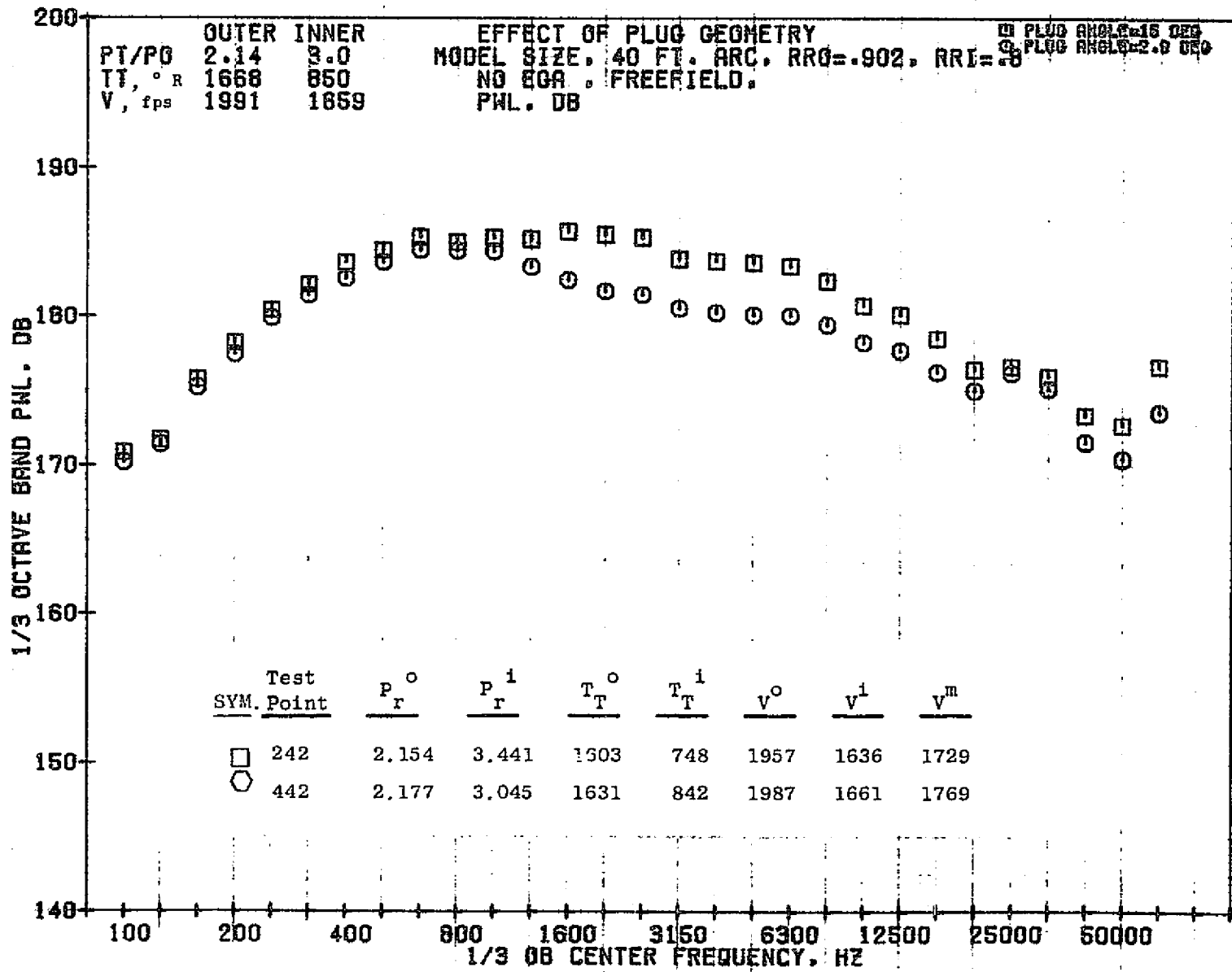
1064



10/29/76
 18159-001

79 BURCH A.

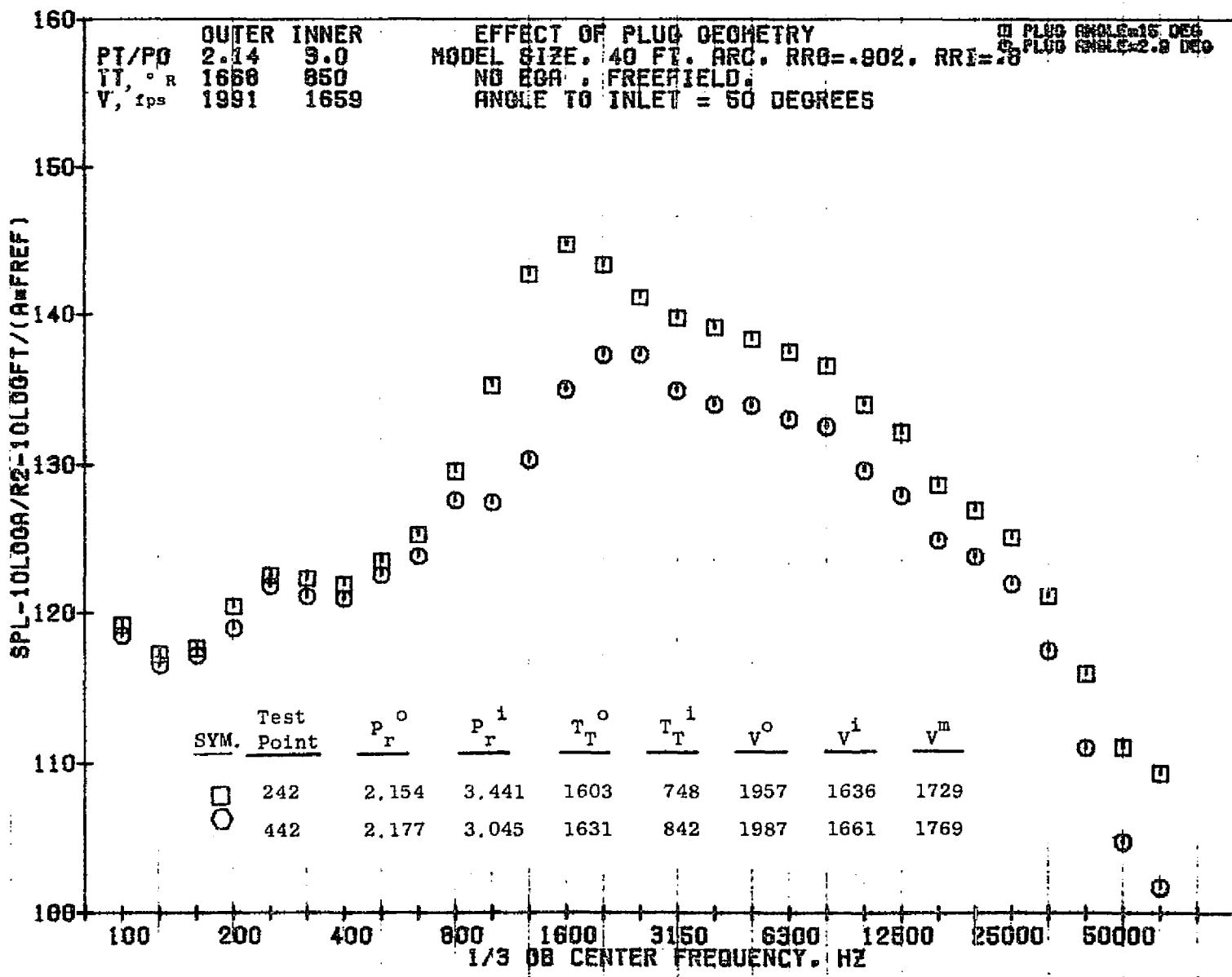
1065



10/29/76
 18159-001

79 BURCH A.

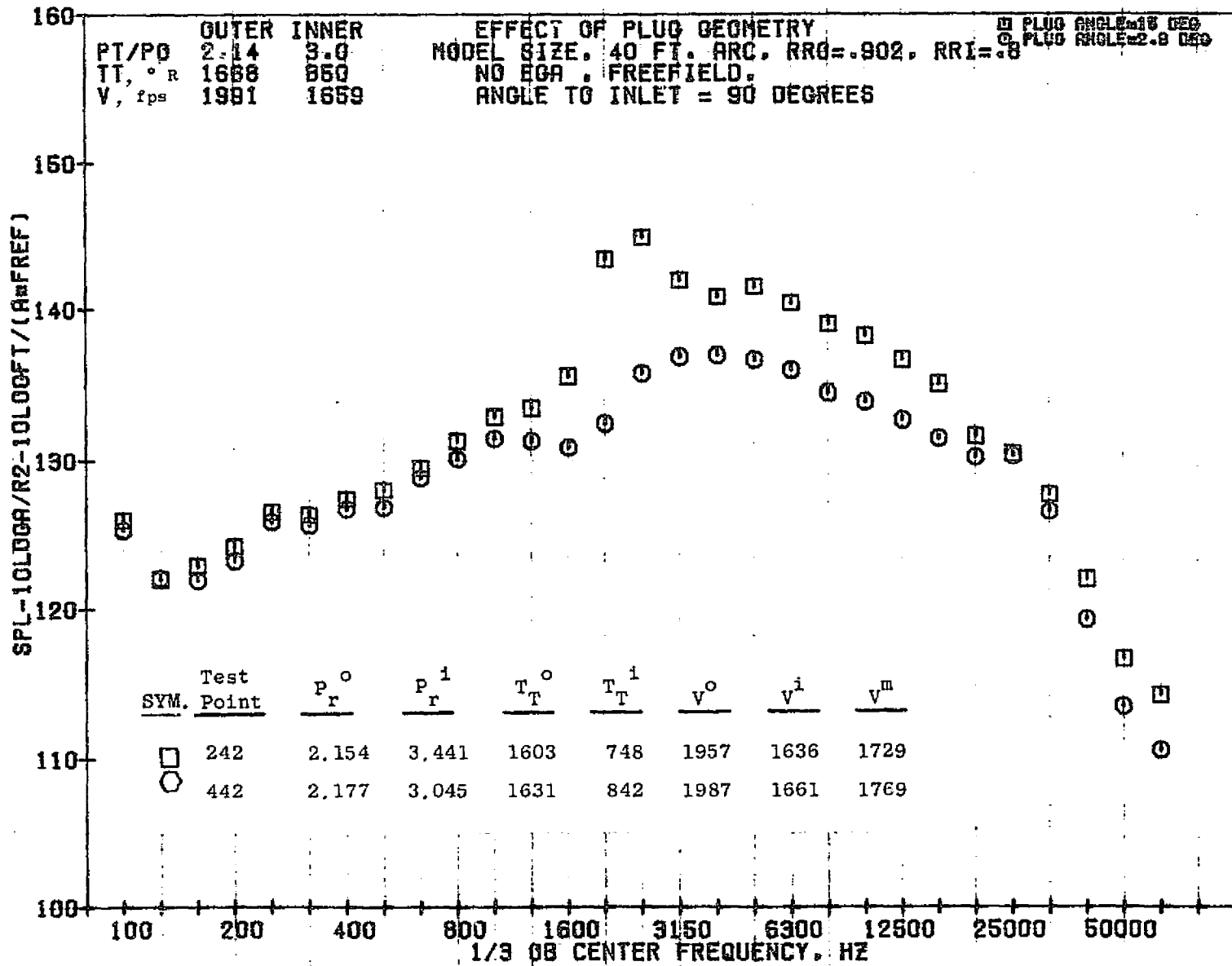
1066



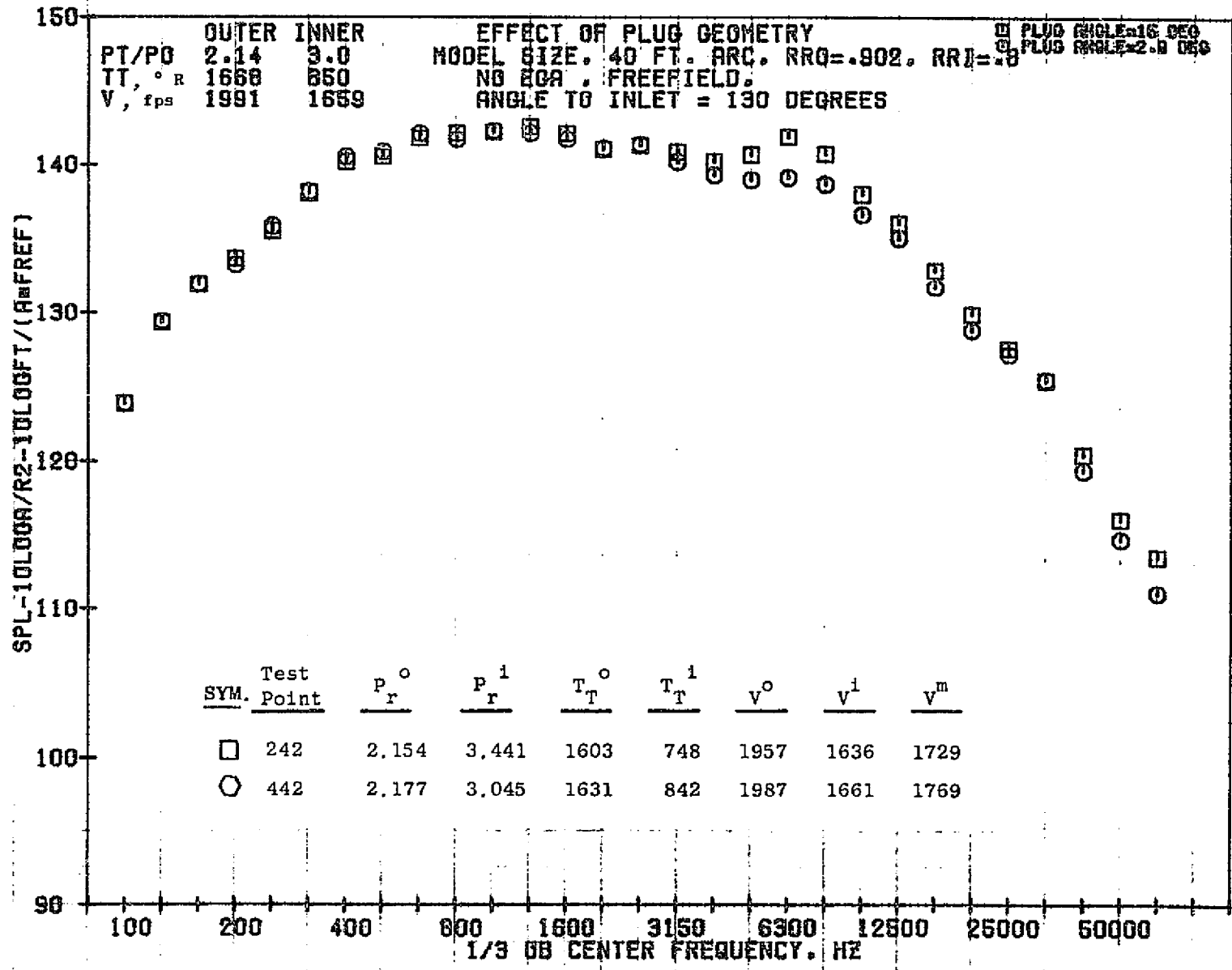
10/29/76
 18159-001

79 BURCH R.

1067



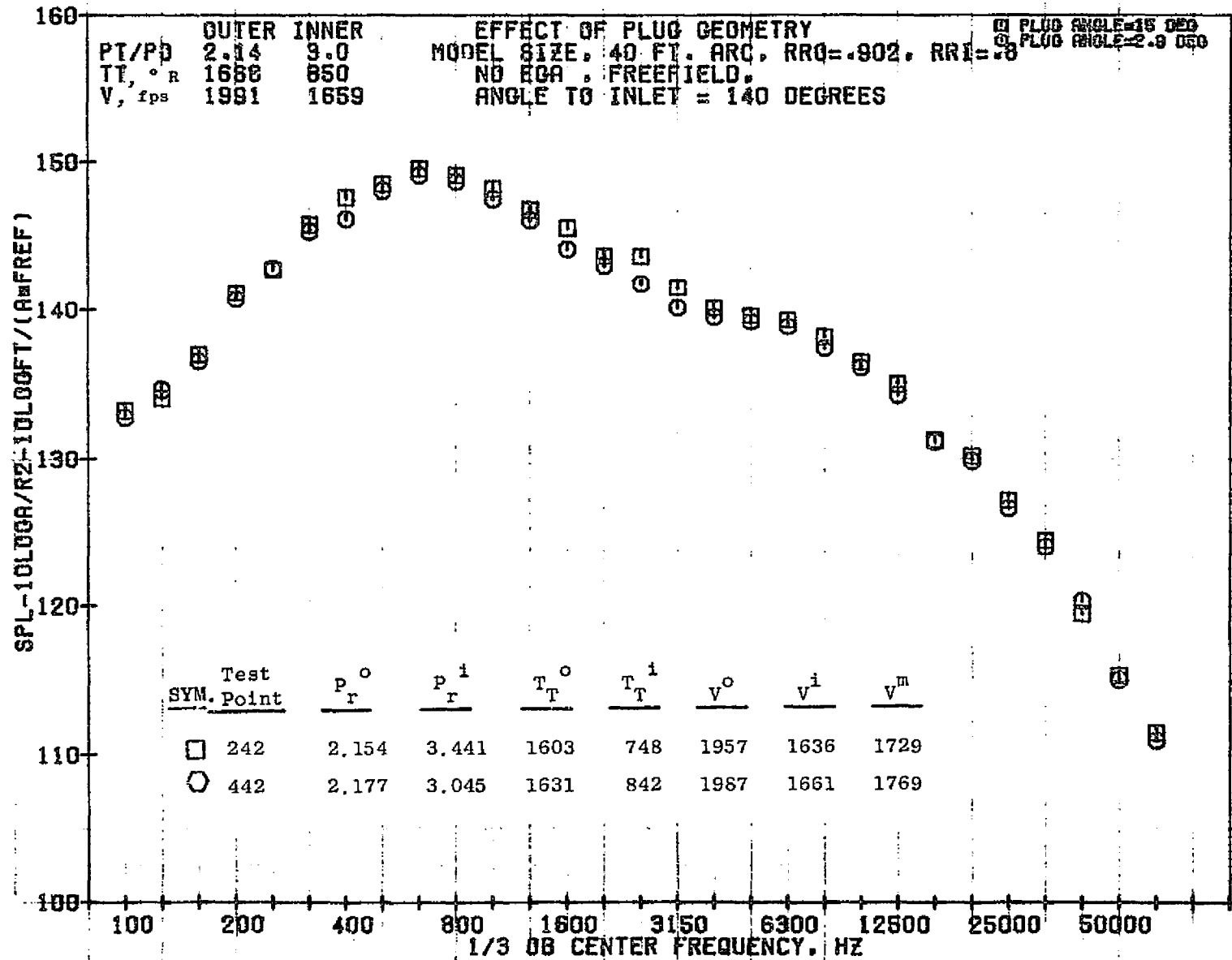
1068



10/29/76
 1B159-001

79 BURCH A.

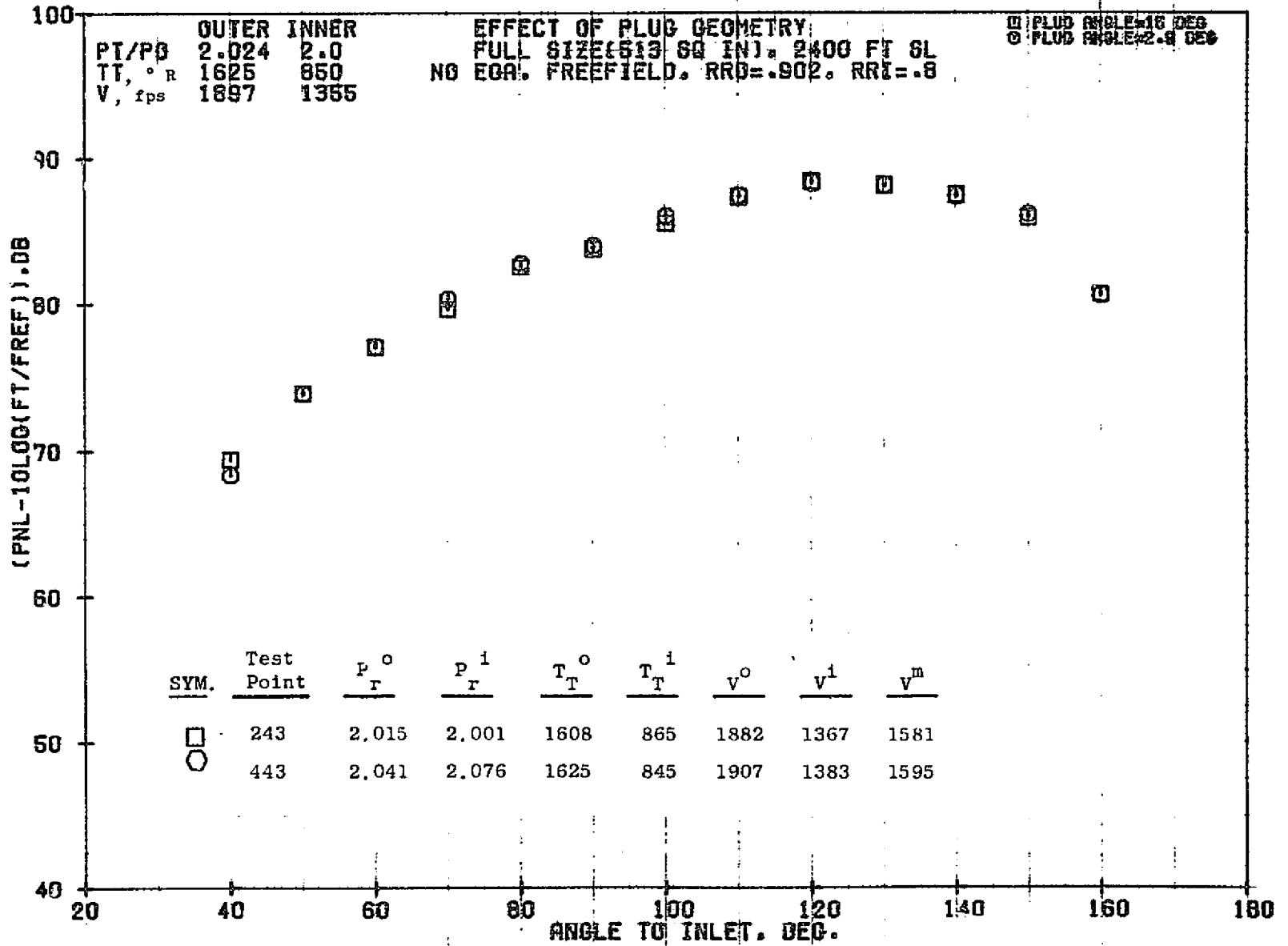
6901



10/29/76
 1B159-001

79 BURCH A.

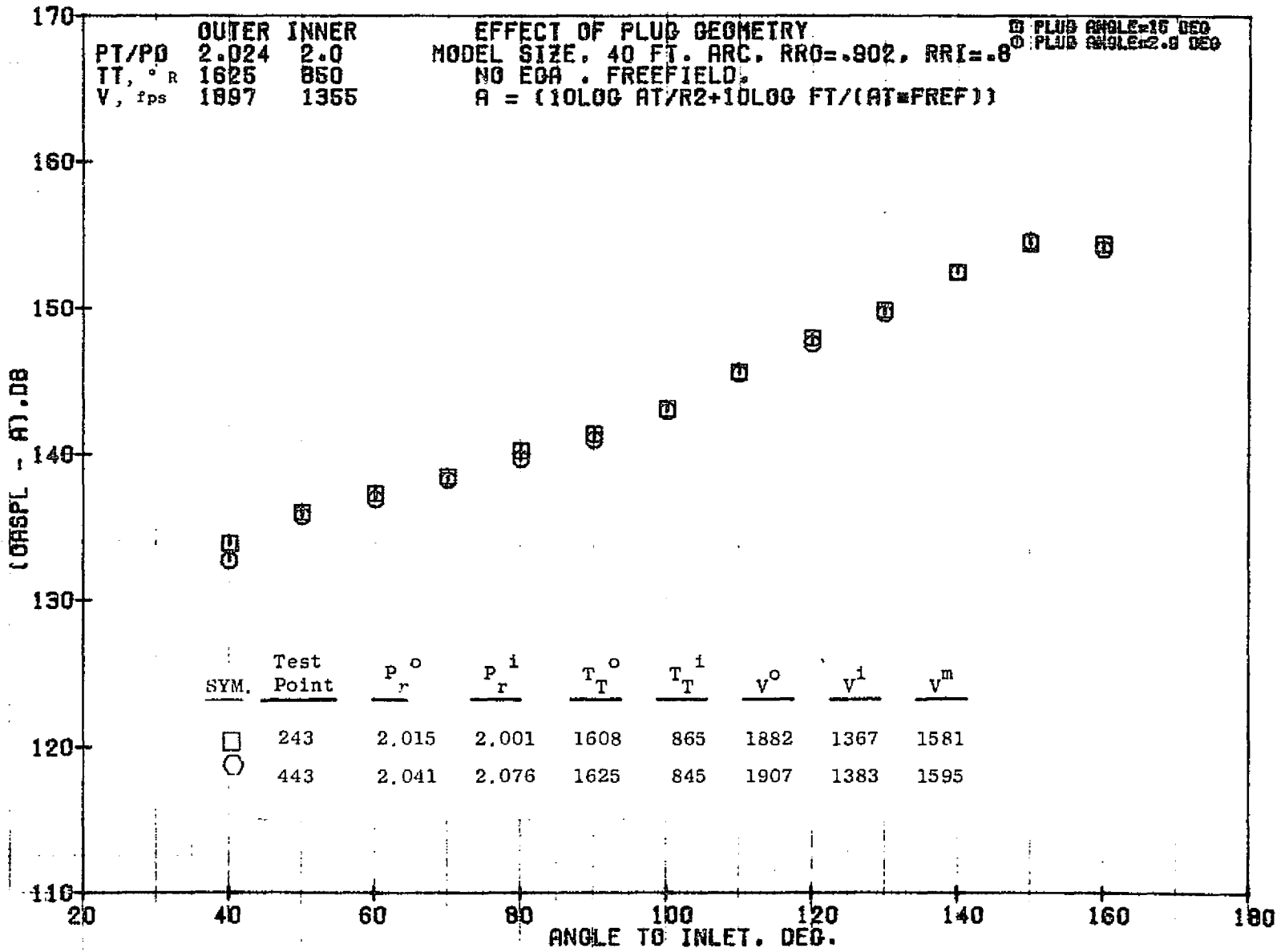
1070



10/29/76
 18130-001

79 BURCH A.

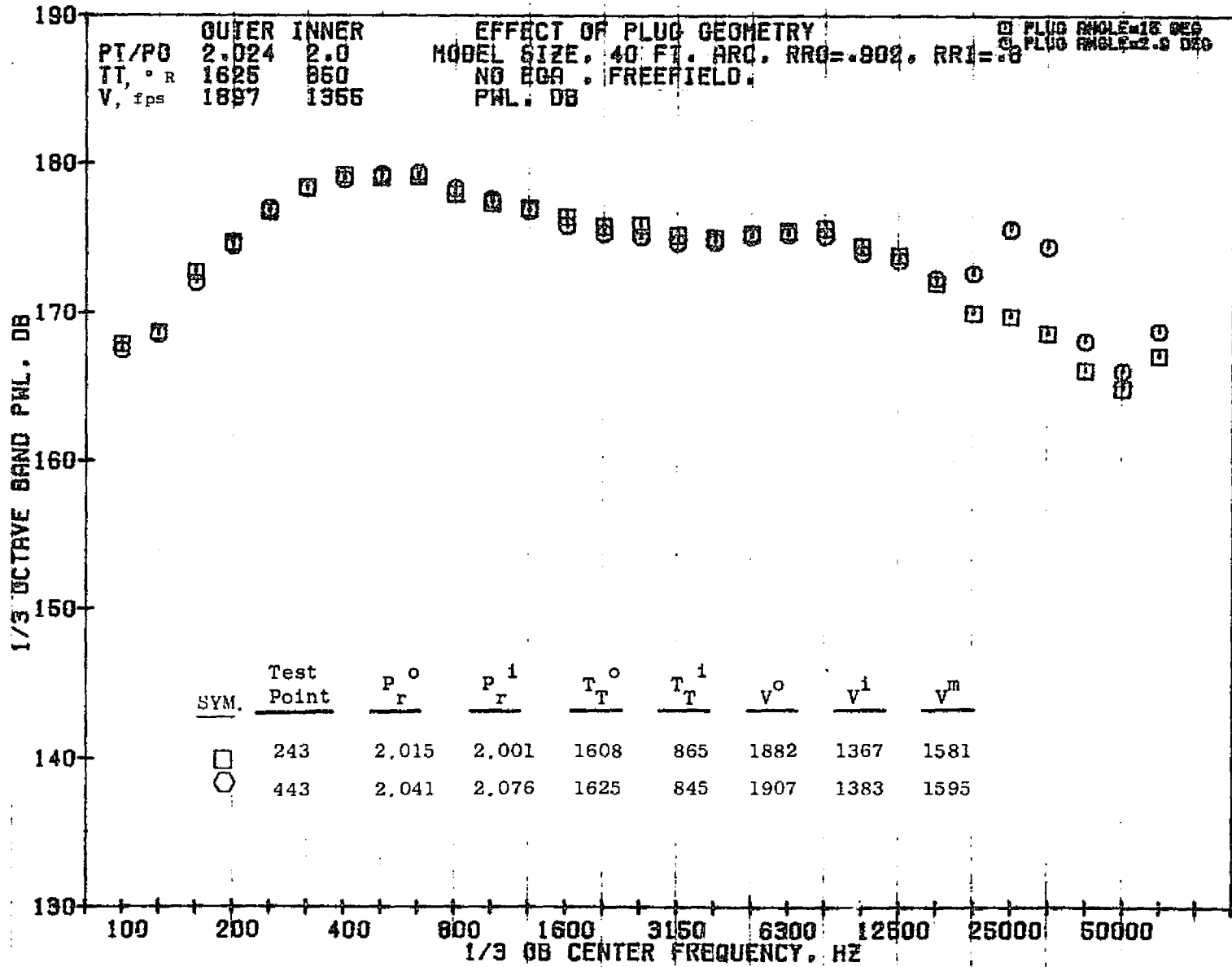
1071



10/29/76
 18159-001

79 BURCH A.

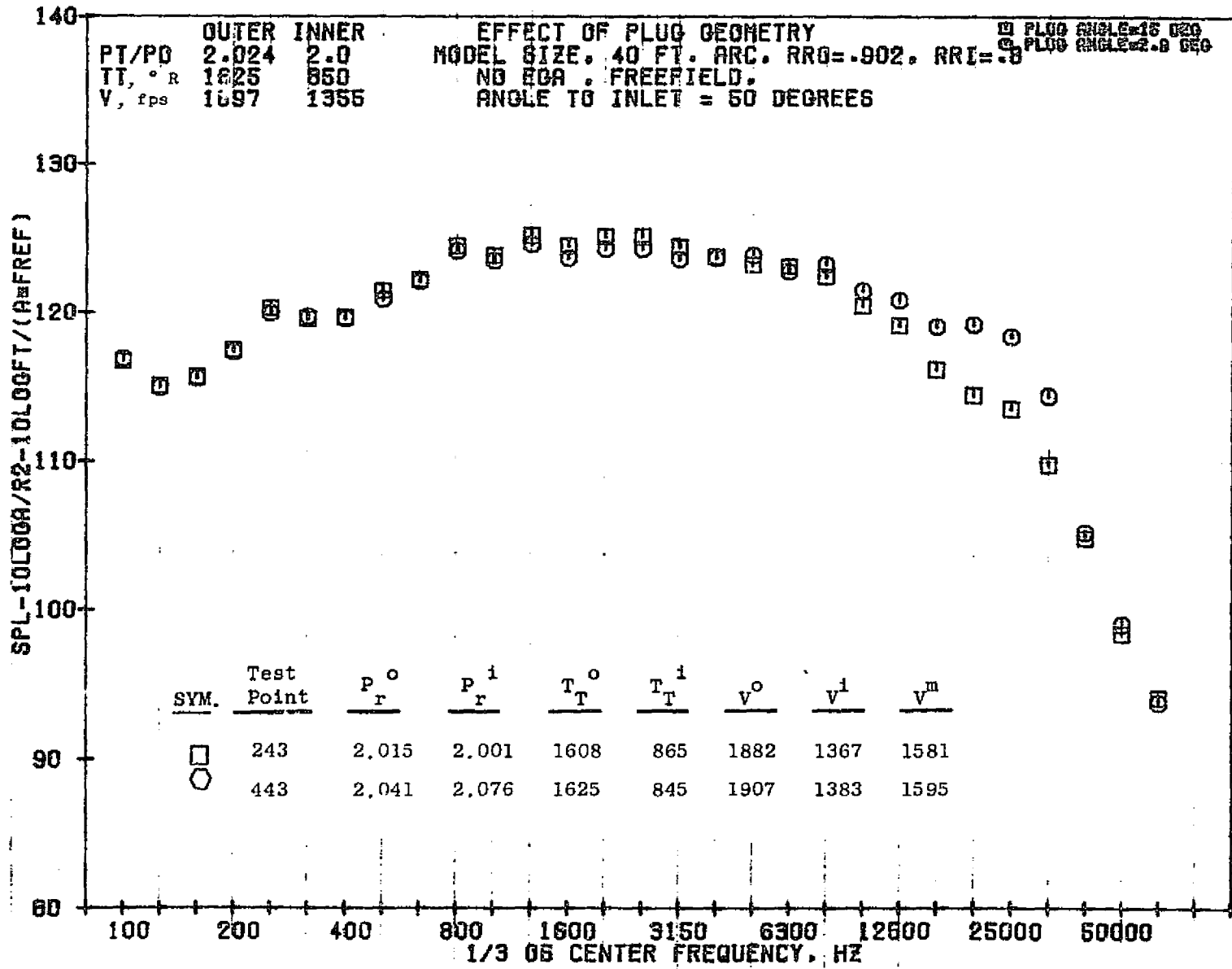
1072



10/29/76
 18159-001

79 BURCH A.

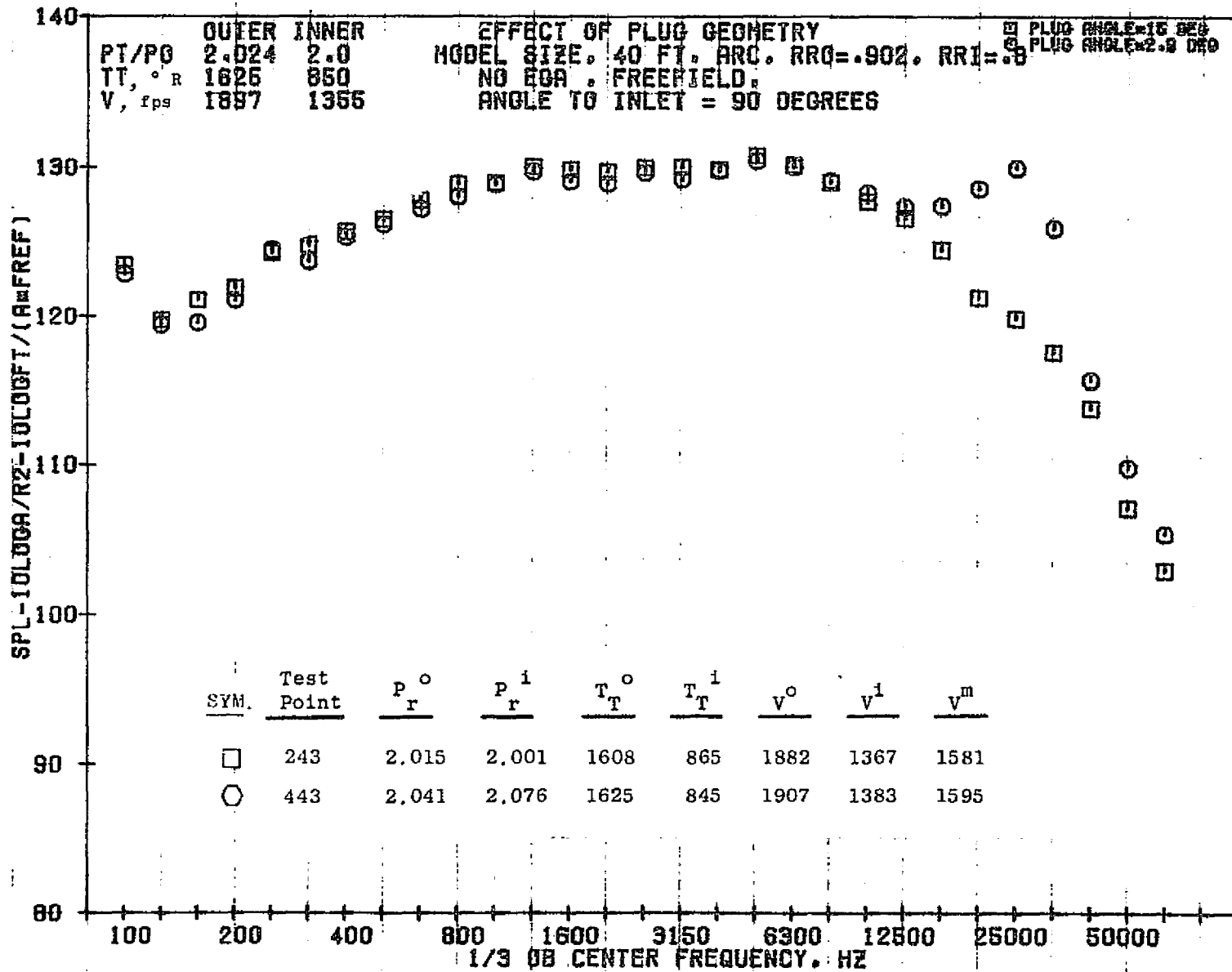
1073



10/29/76
18159-001

79 BURCH A.

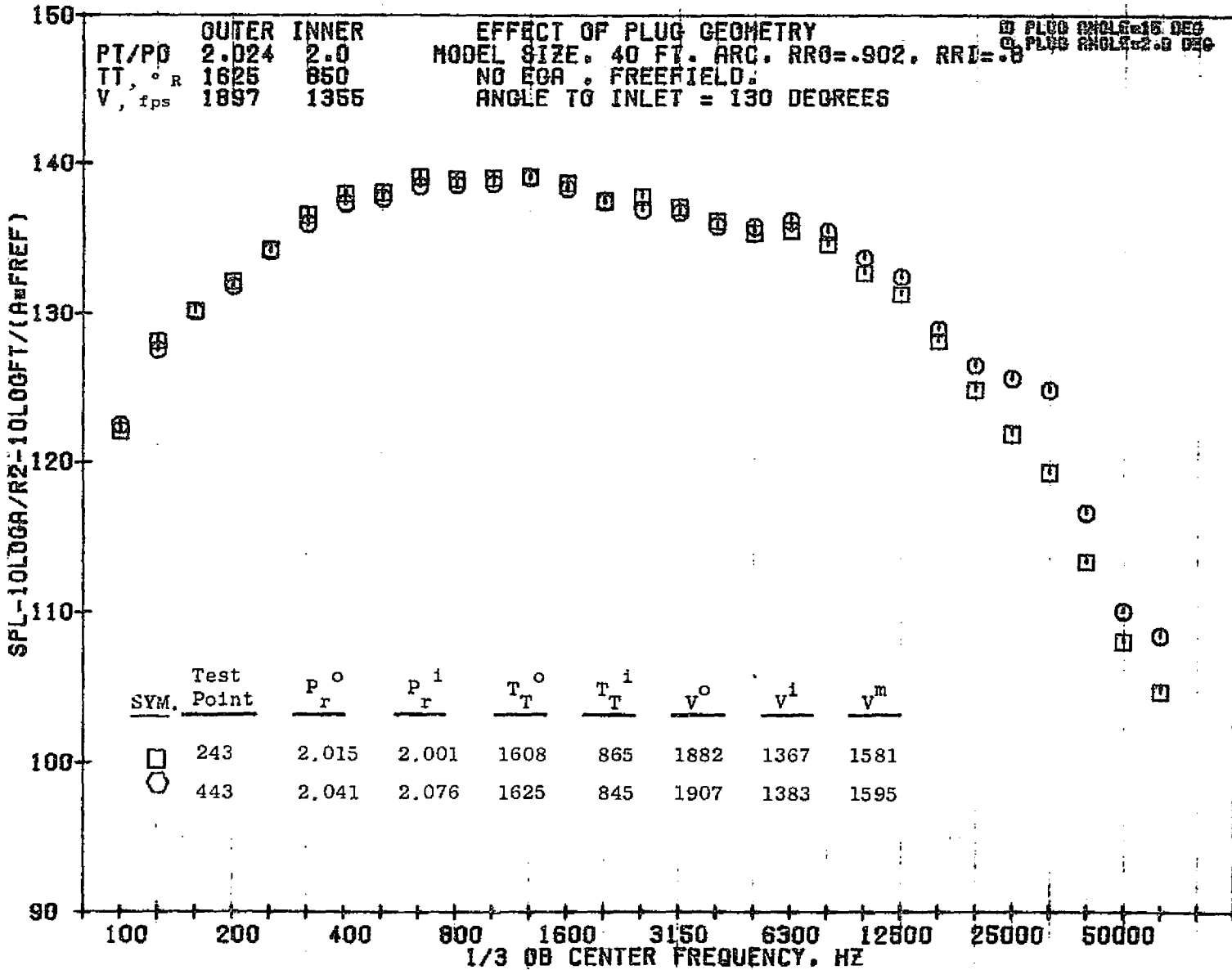
1074



10/29/76
 18159-001

79 BURCH A.

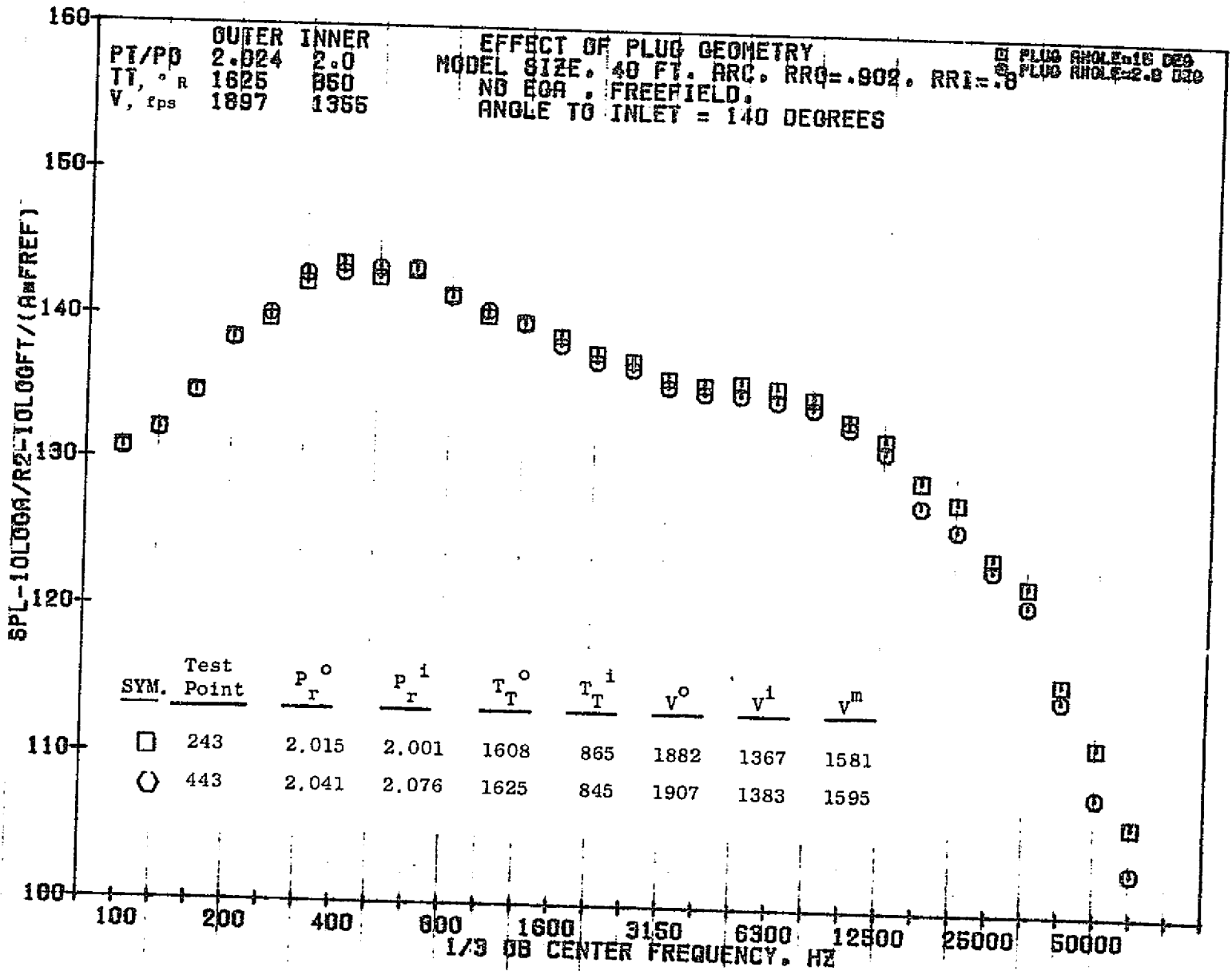
1075



10/29/76
 18159-001

79 BURCH A.

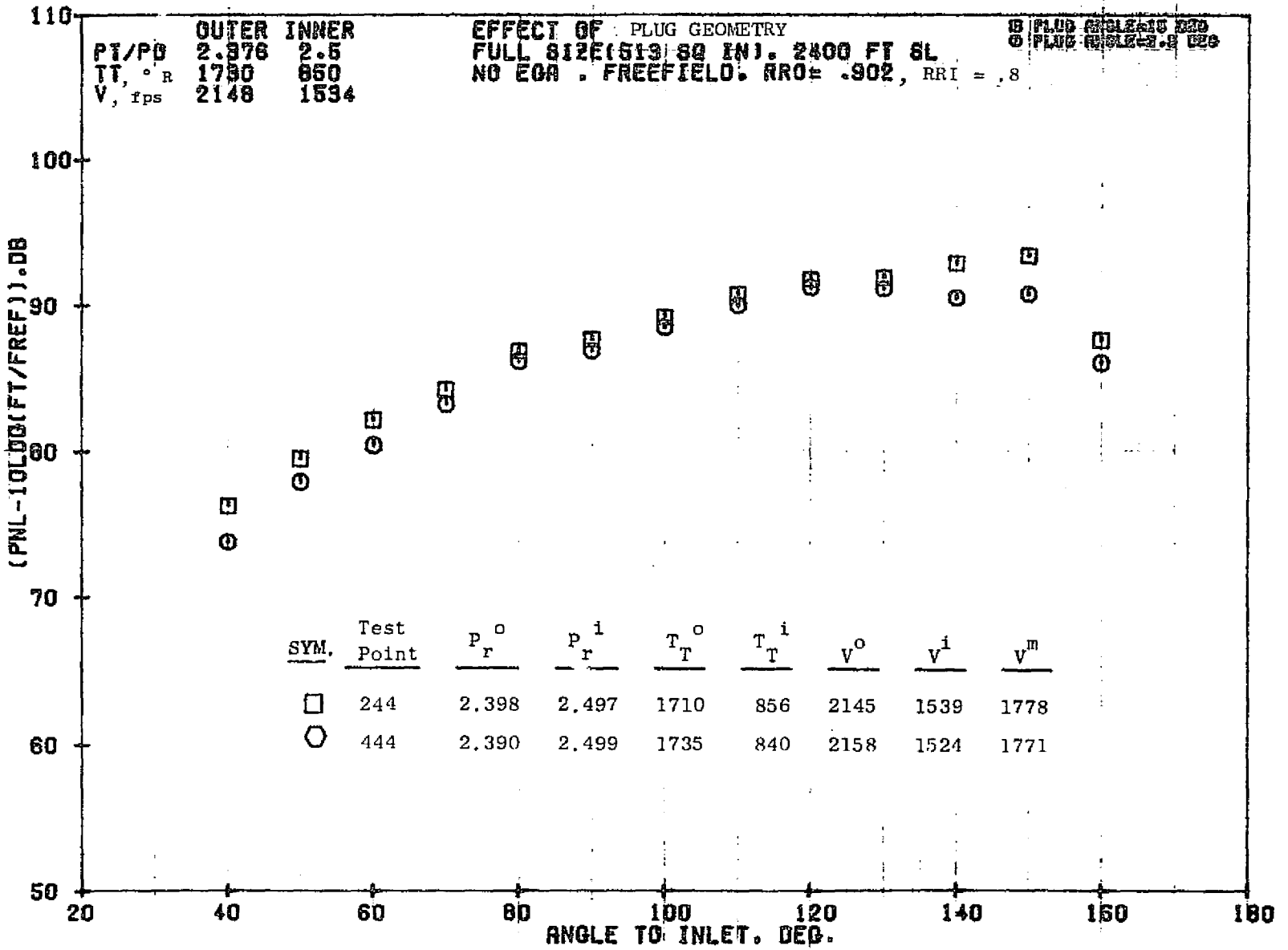
1076



10/29/76
 1B159-001

79 BURCH A.

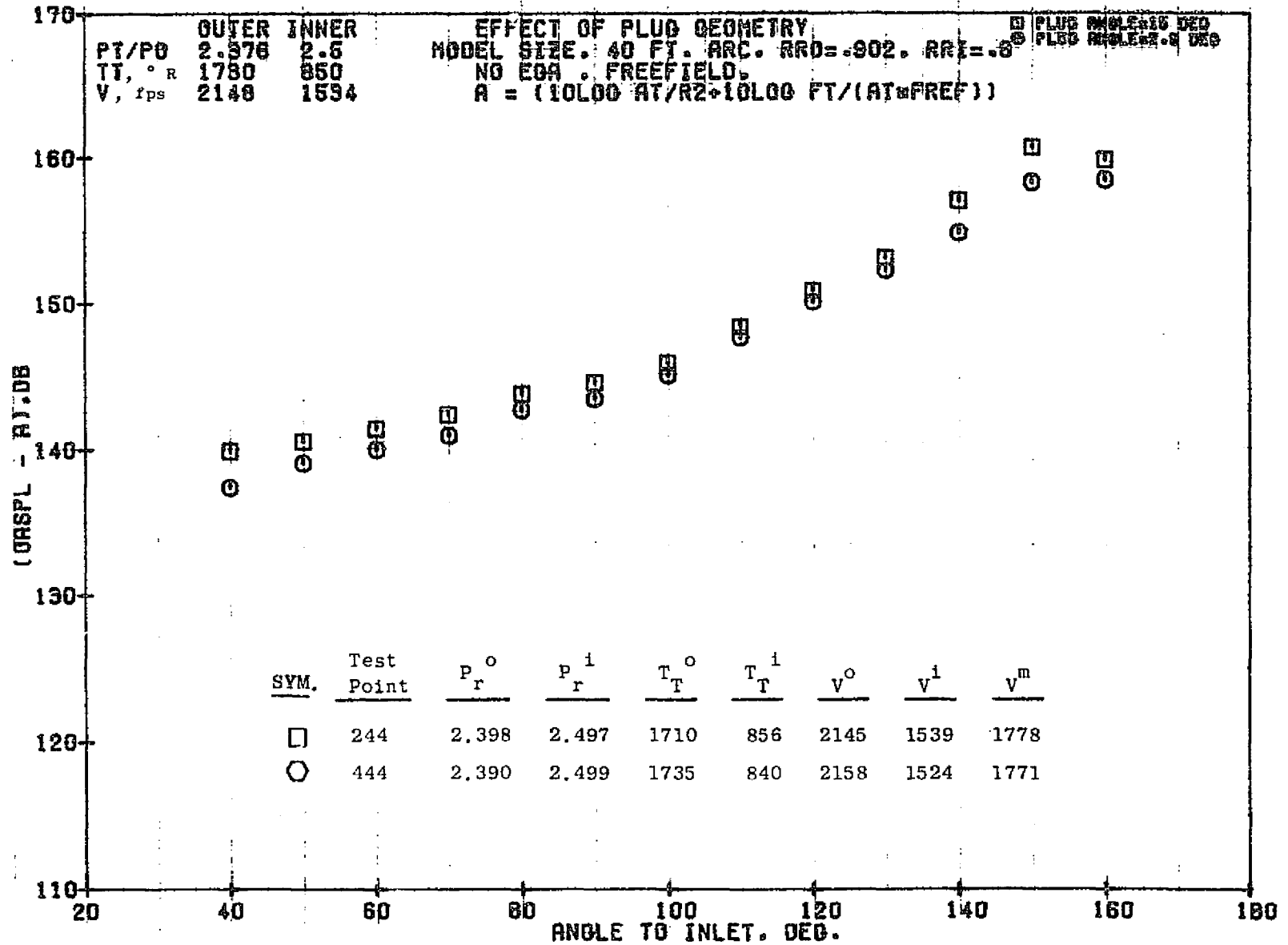
1077



11/04/76
 18680-001

79 BURCH A.

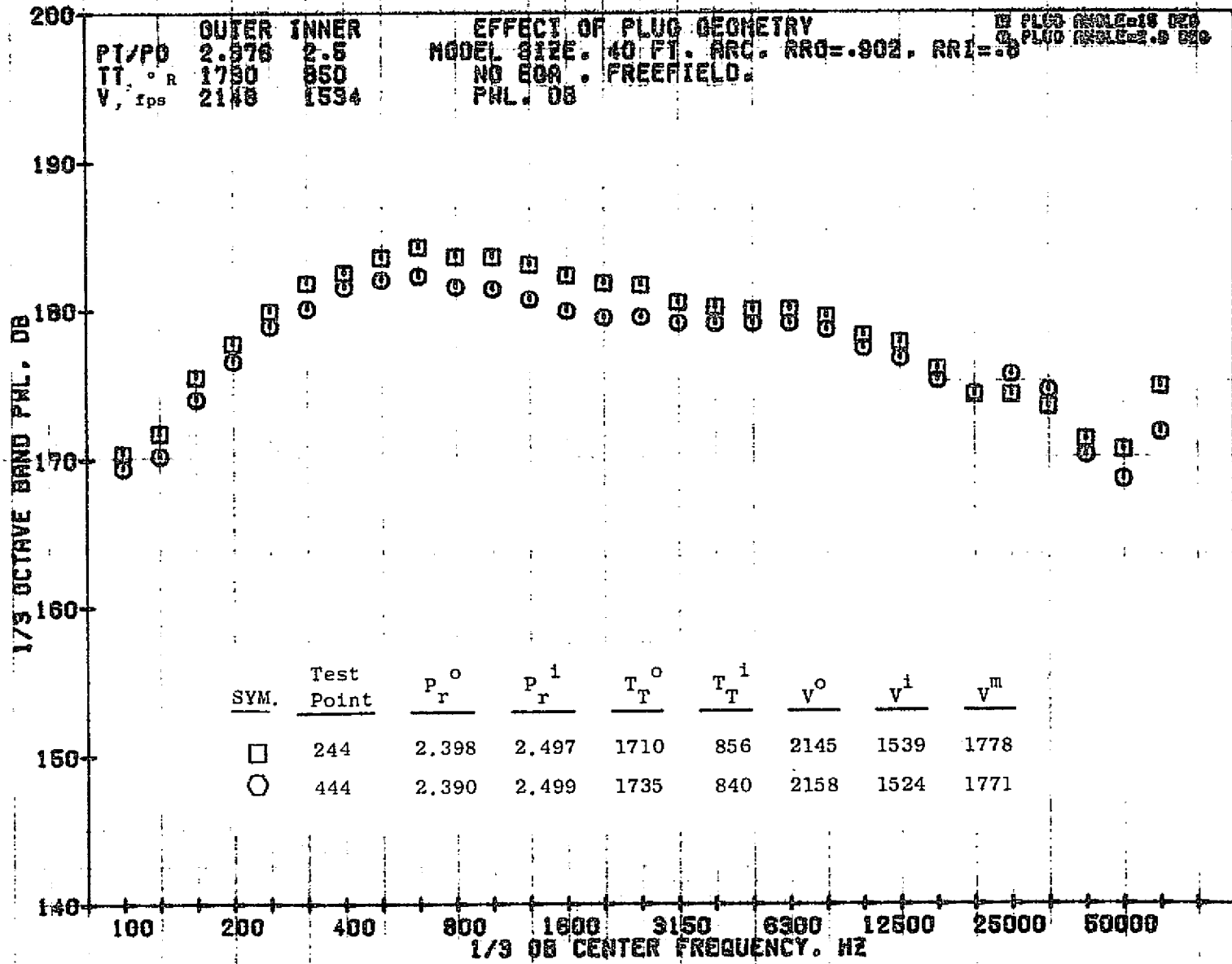
1078



11/04/76
18727-001

79 BURCH A.

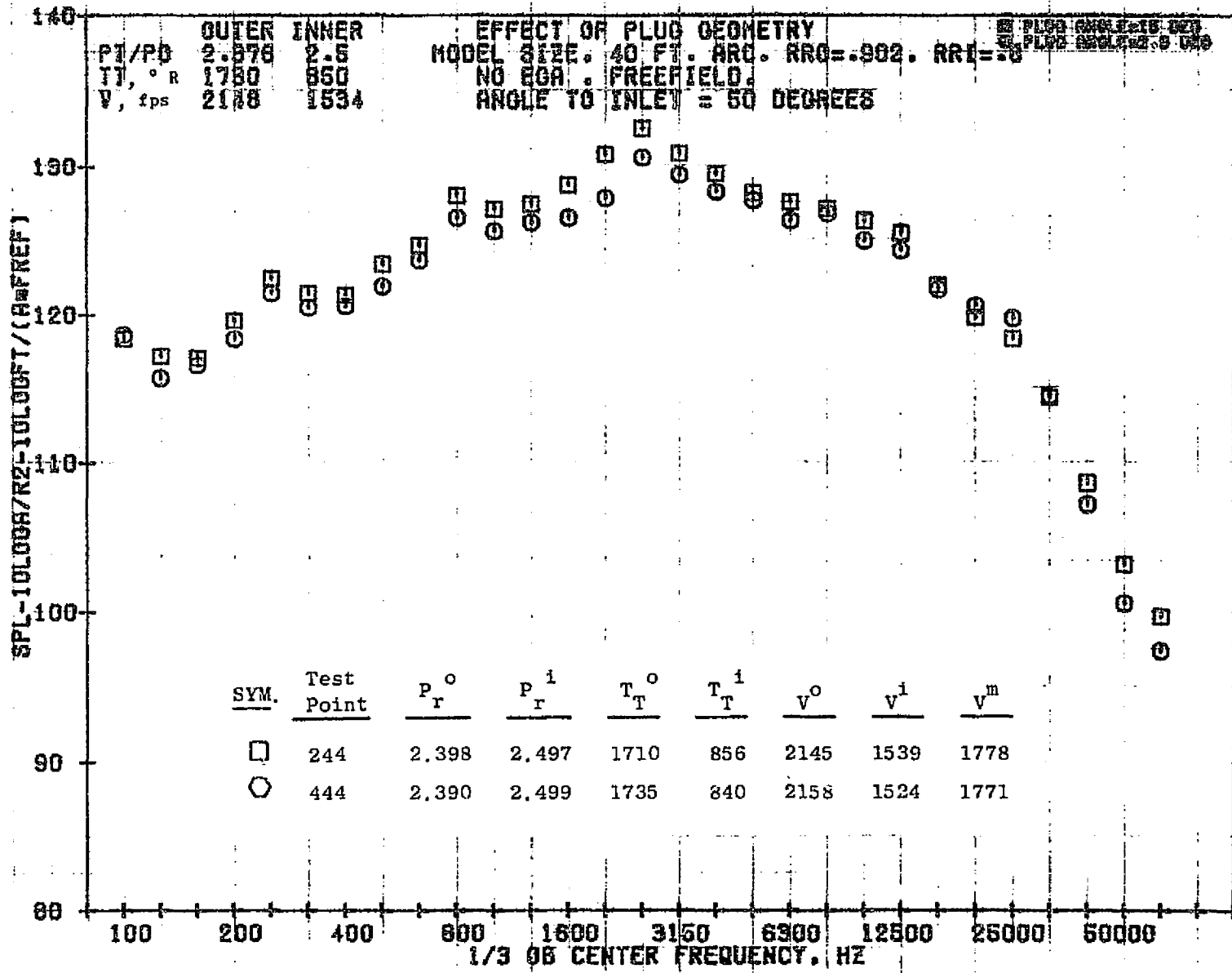
1079



11/04/76
 18727-001

79 BURCH A.

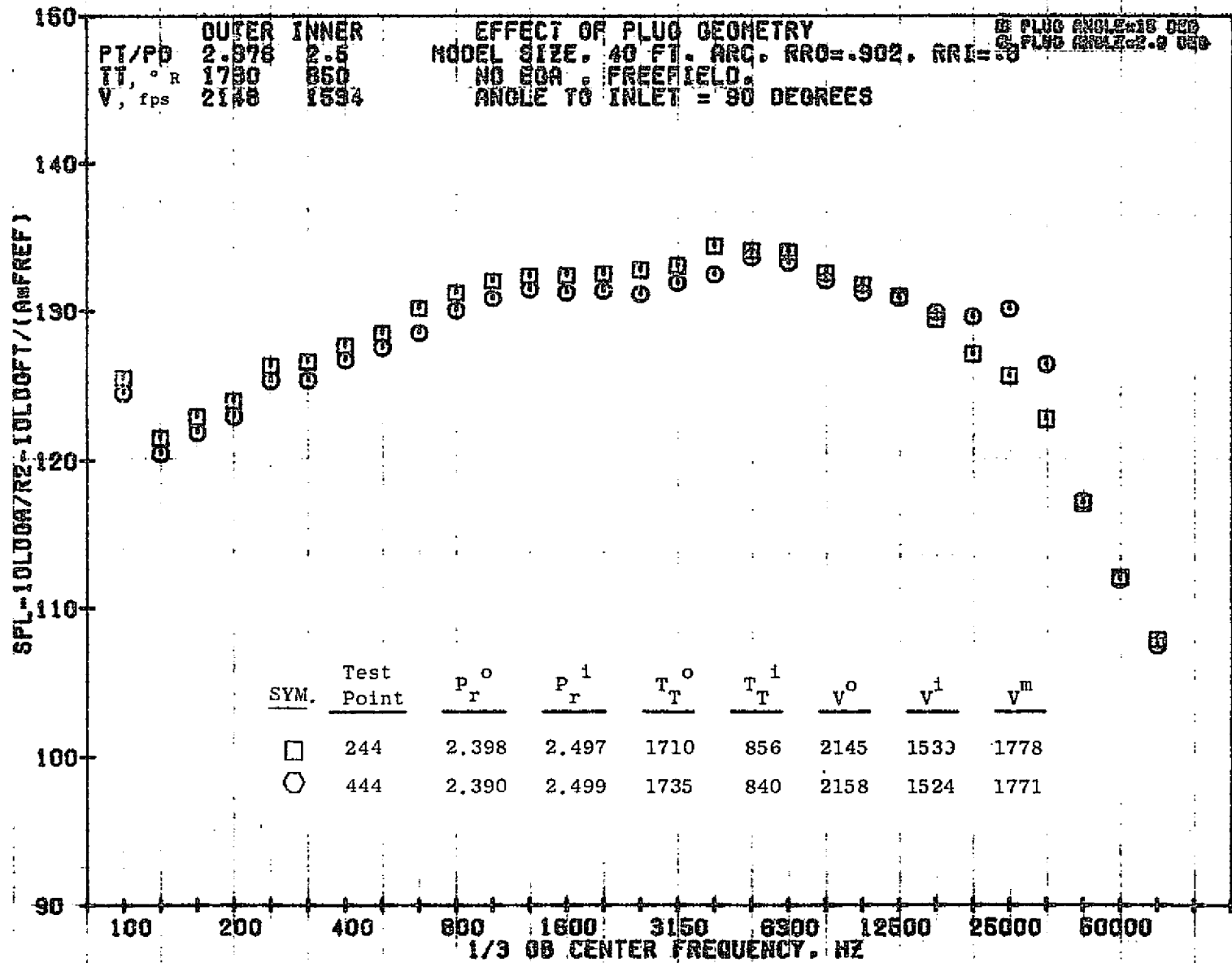
0801



11/04/76
 18727-001

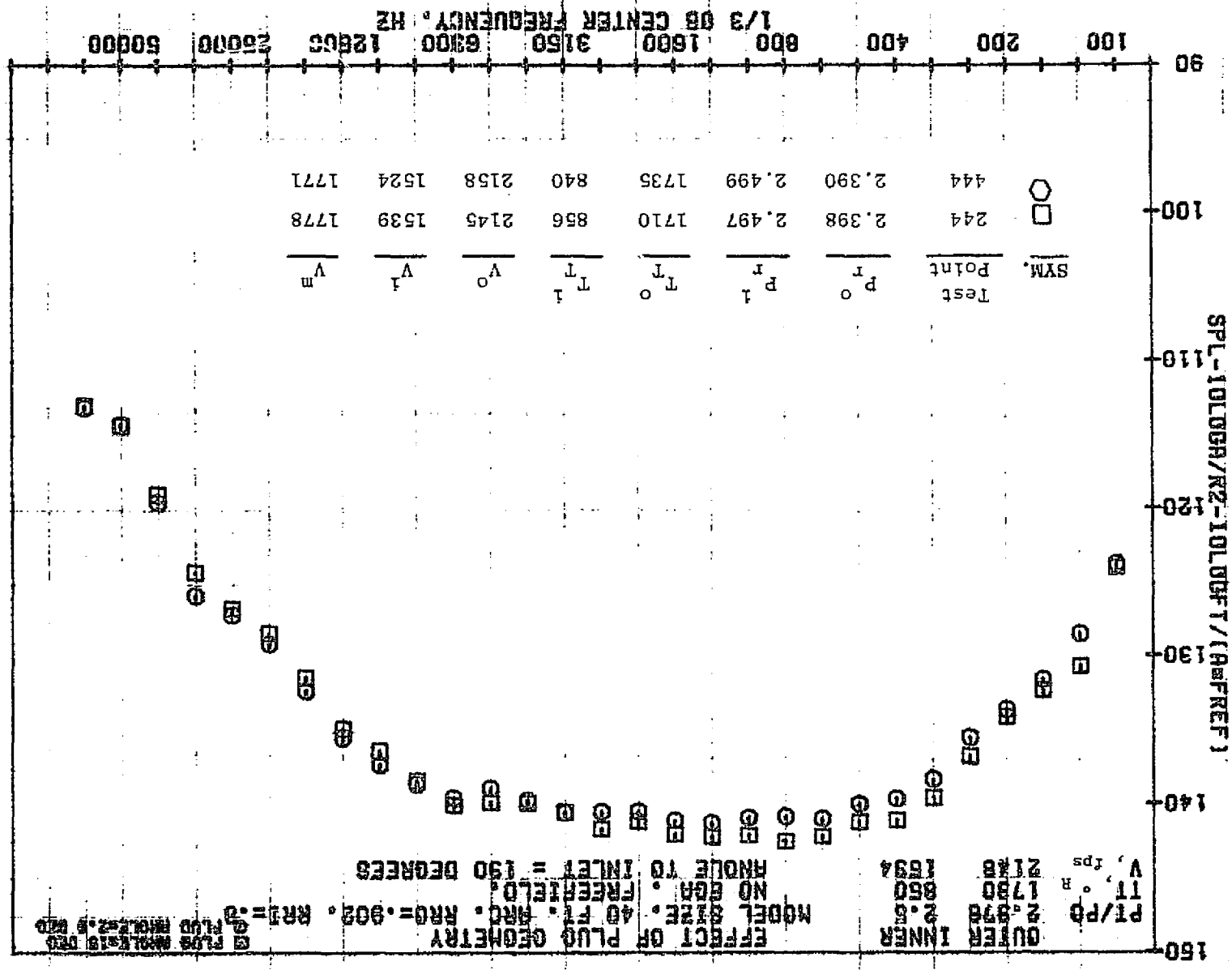
79 BURCH A.

1801



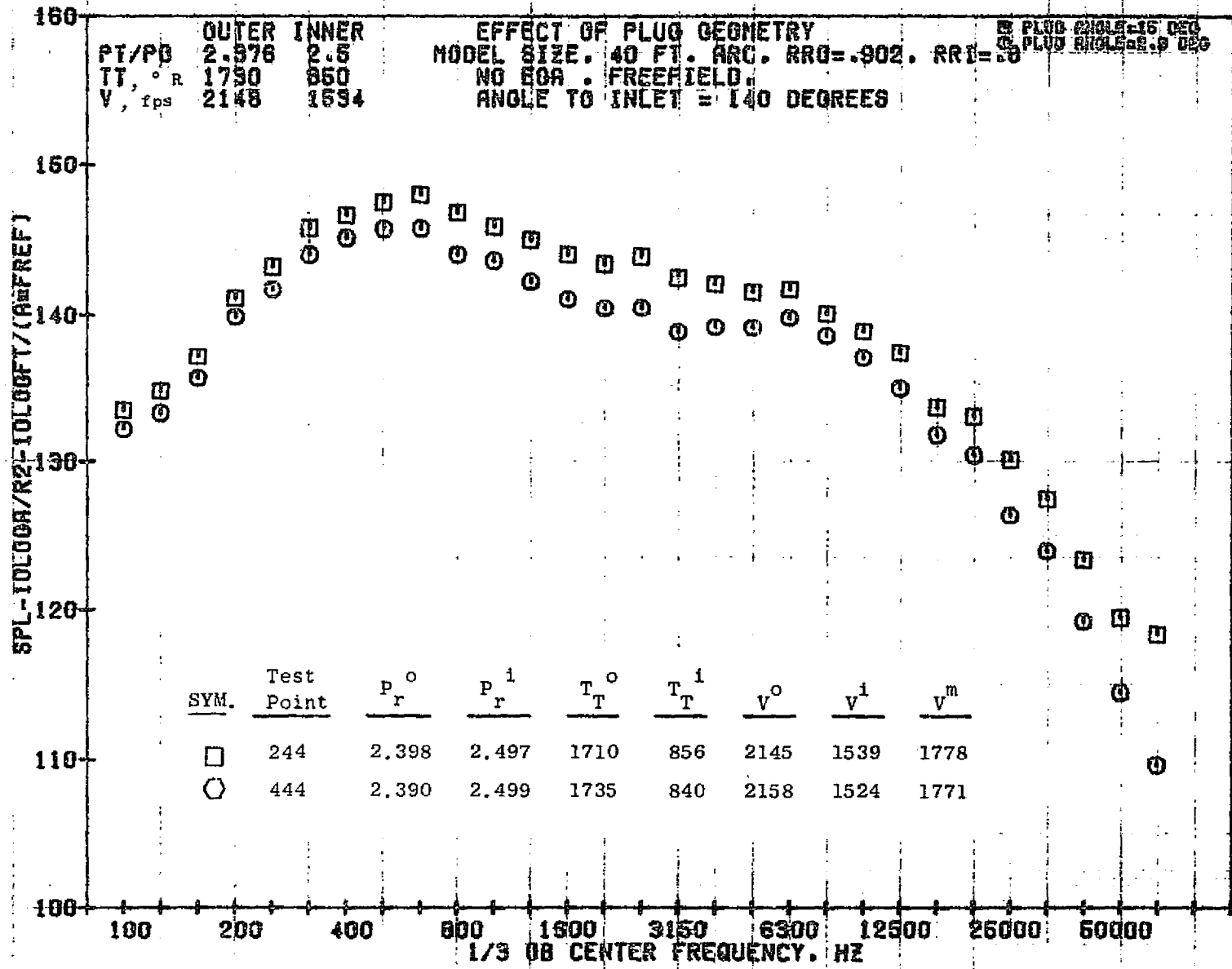
11/04/76
 18727-001

79 BURCH A.



EFFECT OF PLUG GEOMETRY
 MODEL SIZE: 40 FT. HND. RHO=.902. RRI=.0
 NO BGM. FREEFIELD.
 HOLE TO INLET = 190 DEGREES
 P/PD 2.878 2.518
 TT 1780 860
 V, fps 2118 1894
 OUTER INNER
 PI/PD 2.878 2.518
 TT 1780 860
 V, fps 2118 1894

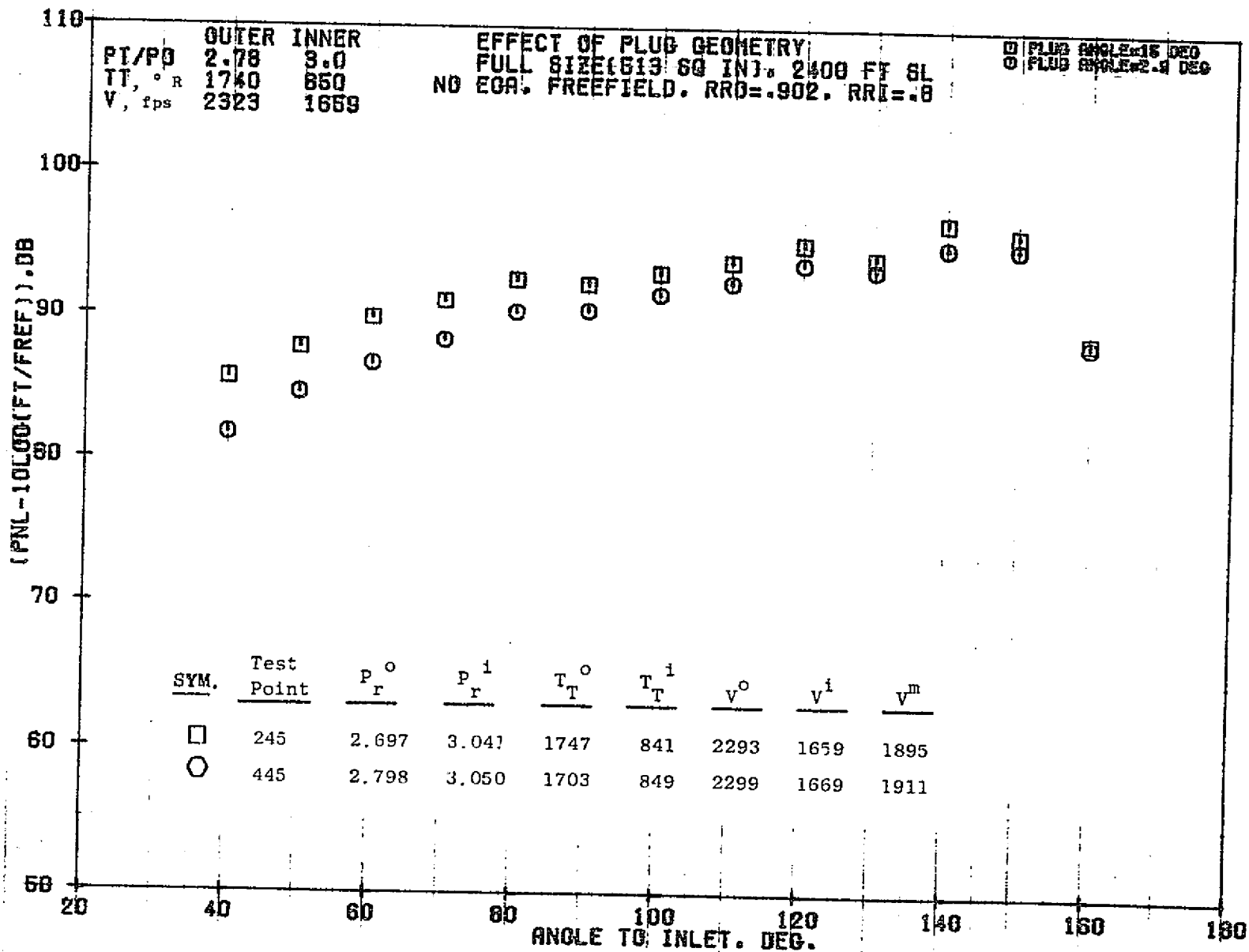
1083



11/04/76
18727-001

79 BURCH A.

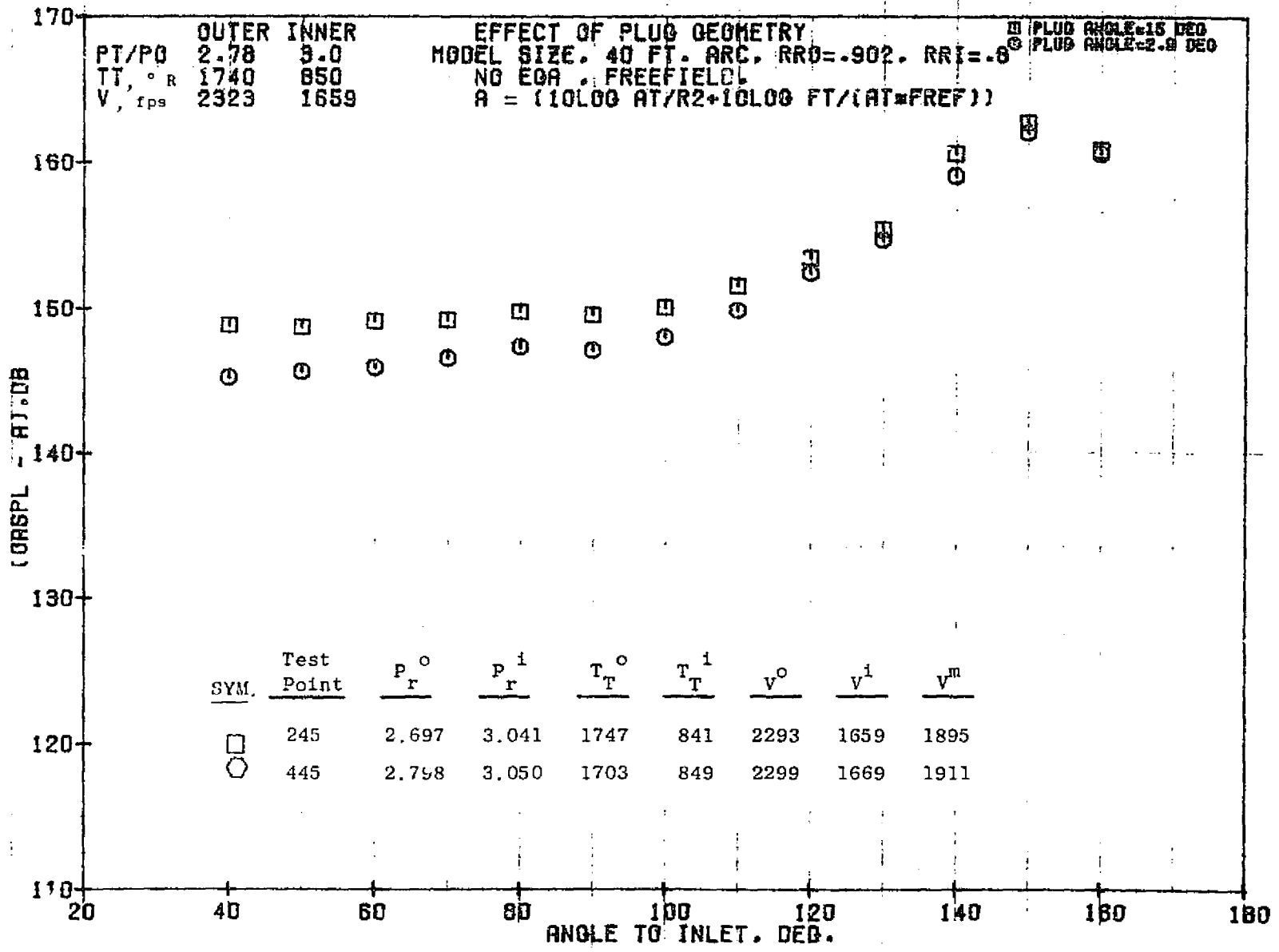
1084



10/29/76
 18130-001

79 BURCH A.

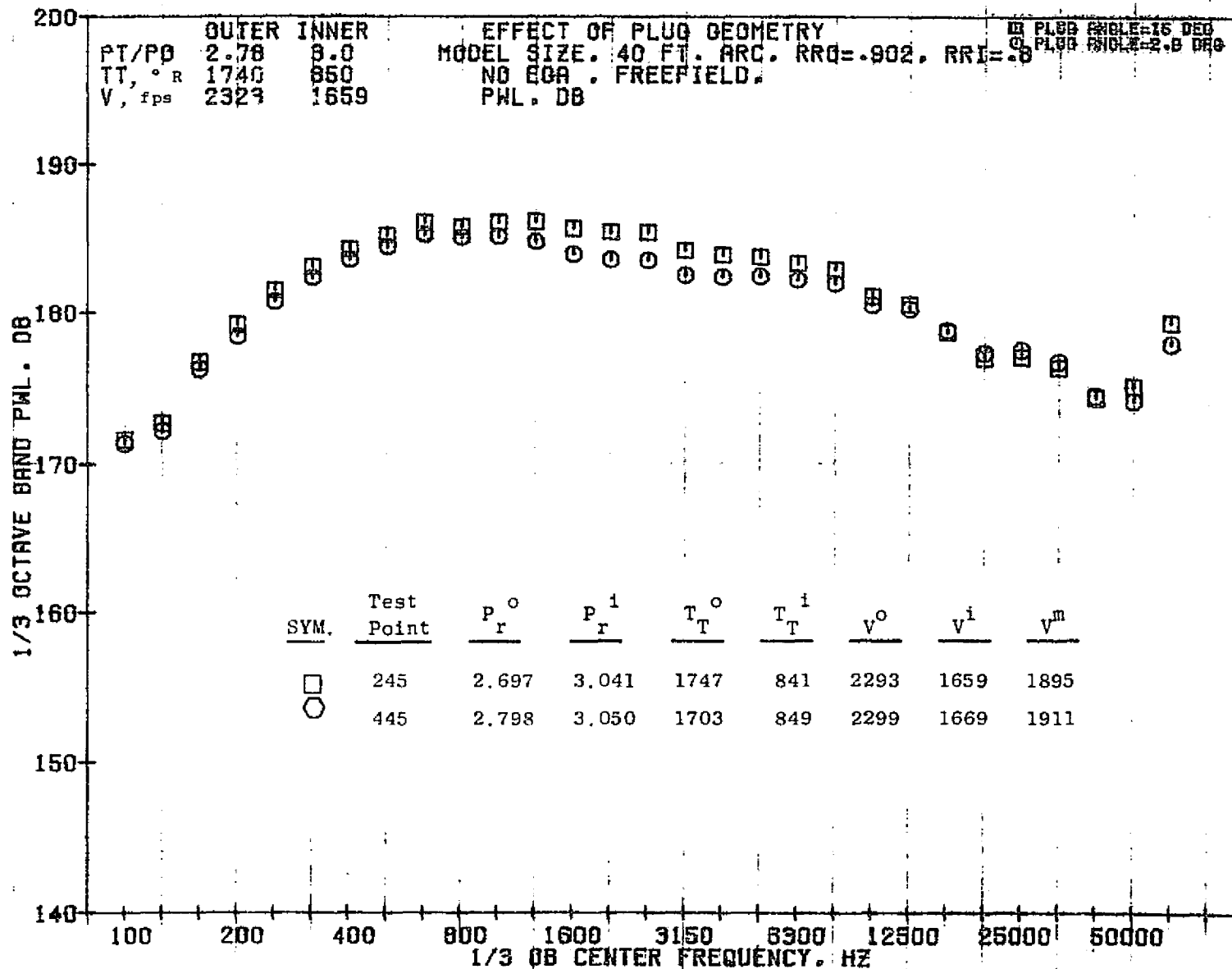
1085



11/03/76
 18360-001

79 BURCH A.

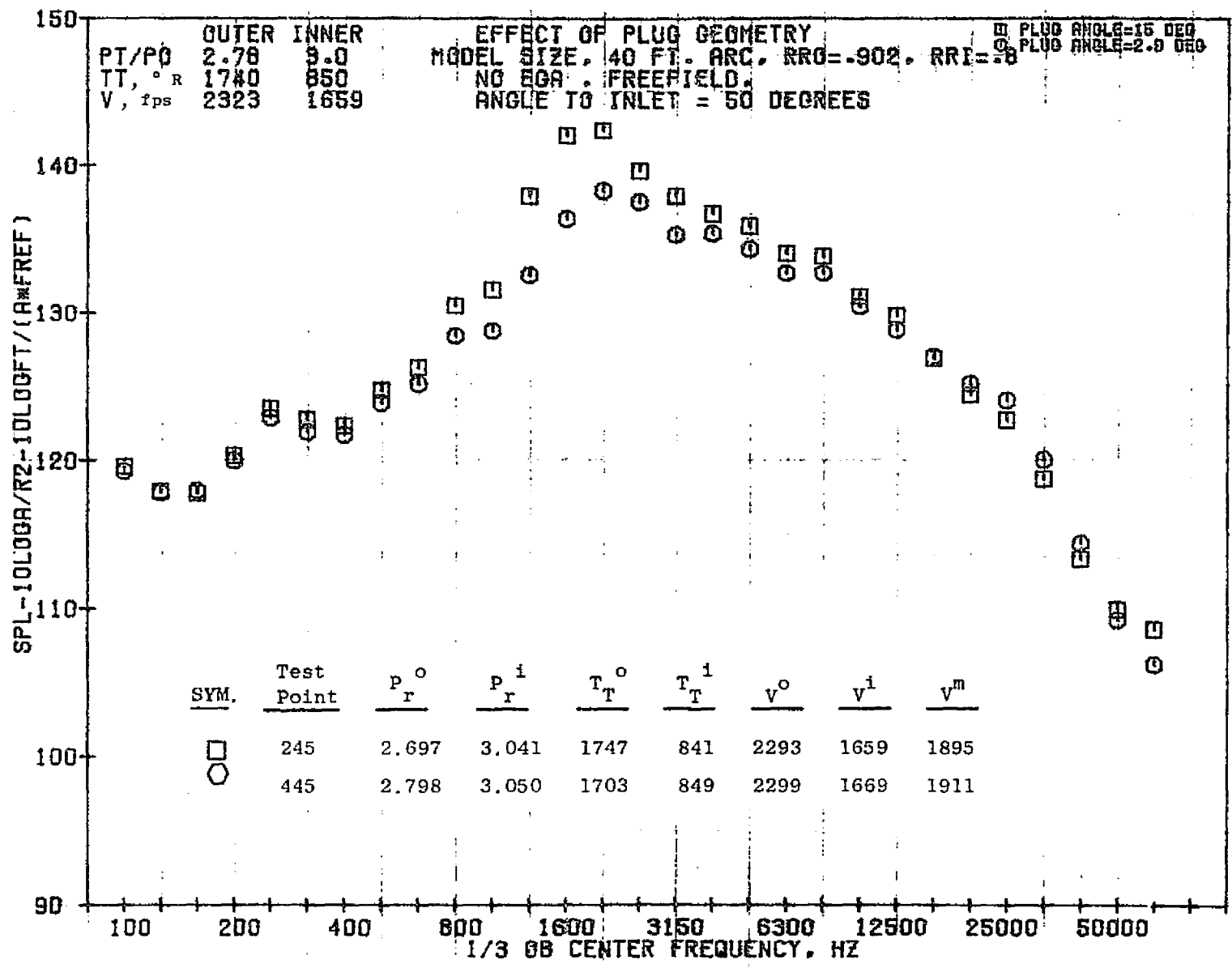
1086



11/03/76
18360-001

79 BURCH A.

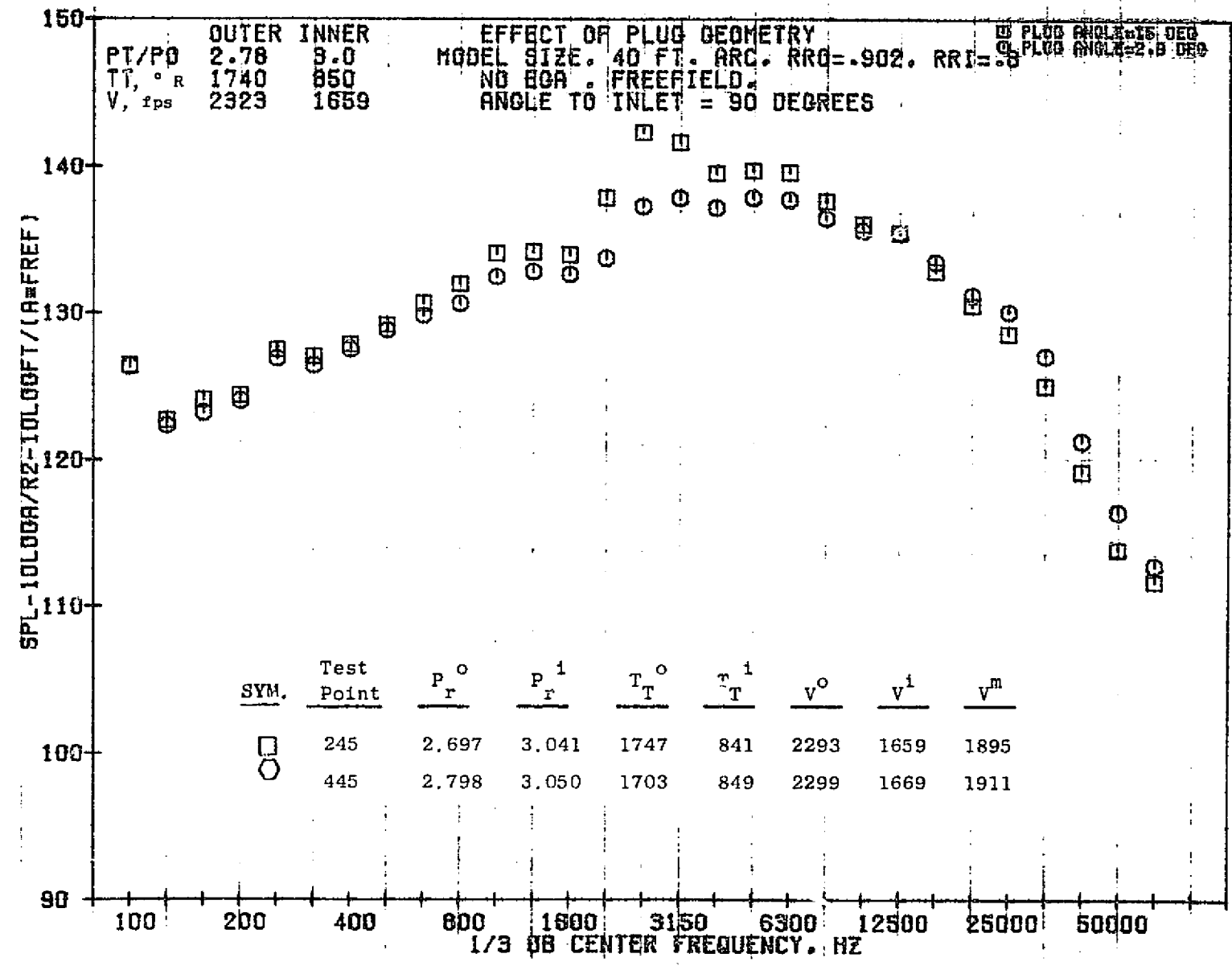
1087



11/03/76
 18360-001

79 BURCH A.

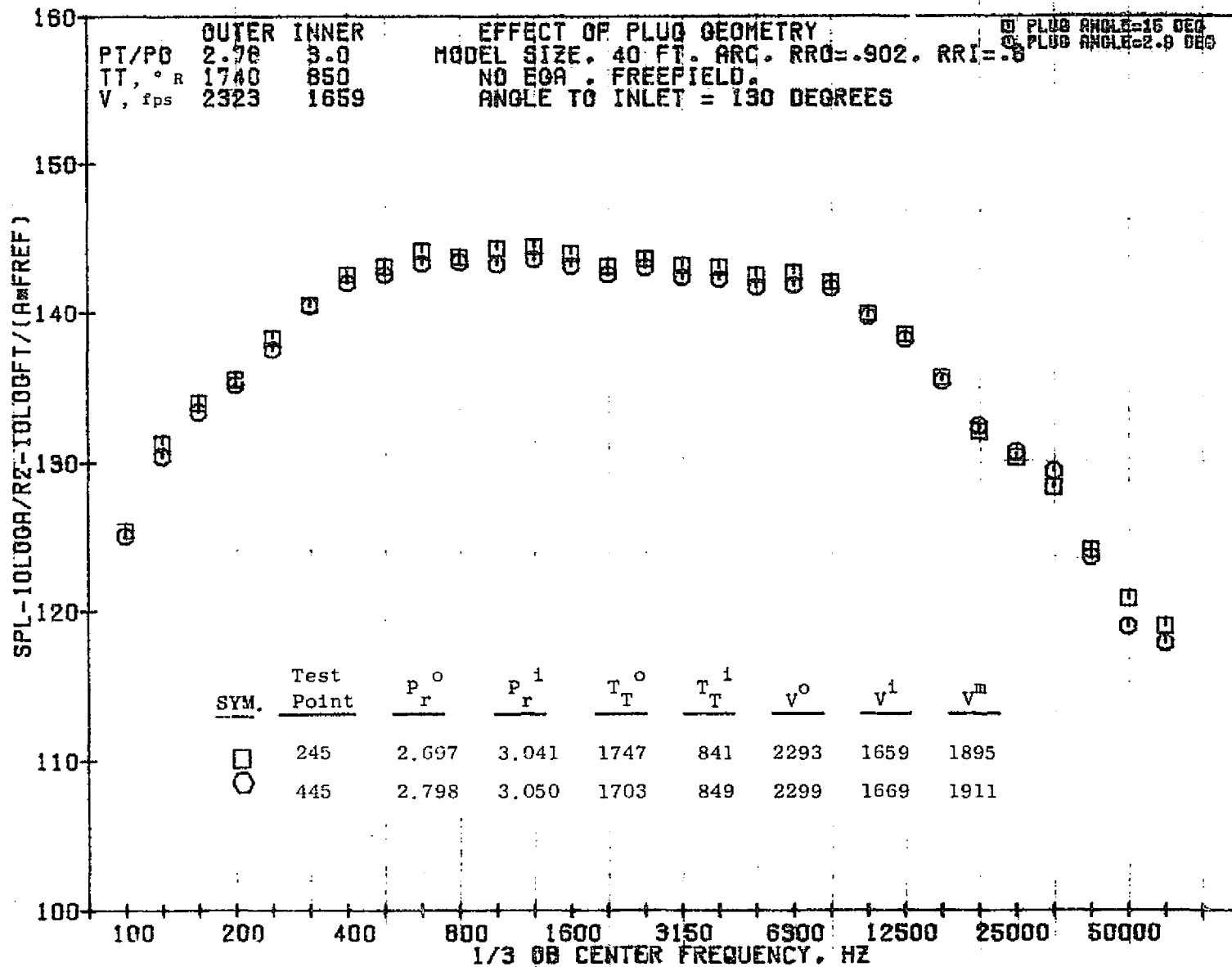
8801



11/03/76
18360-001

79 BURCH A.

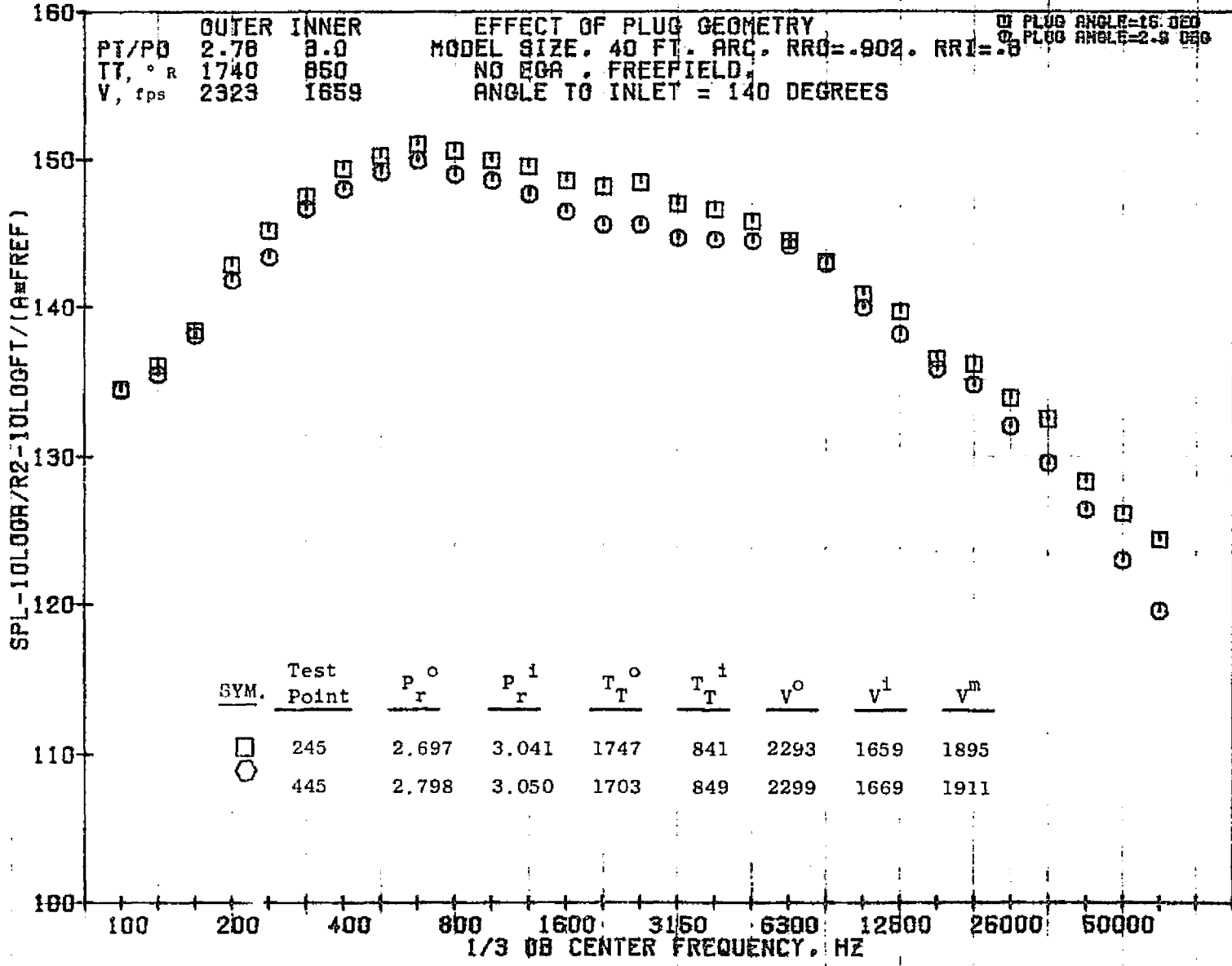
6801



11/03/78
 18360-001

79 BURCH A.

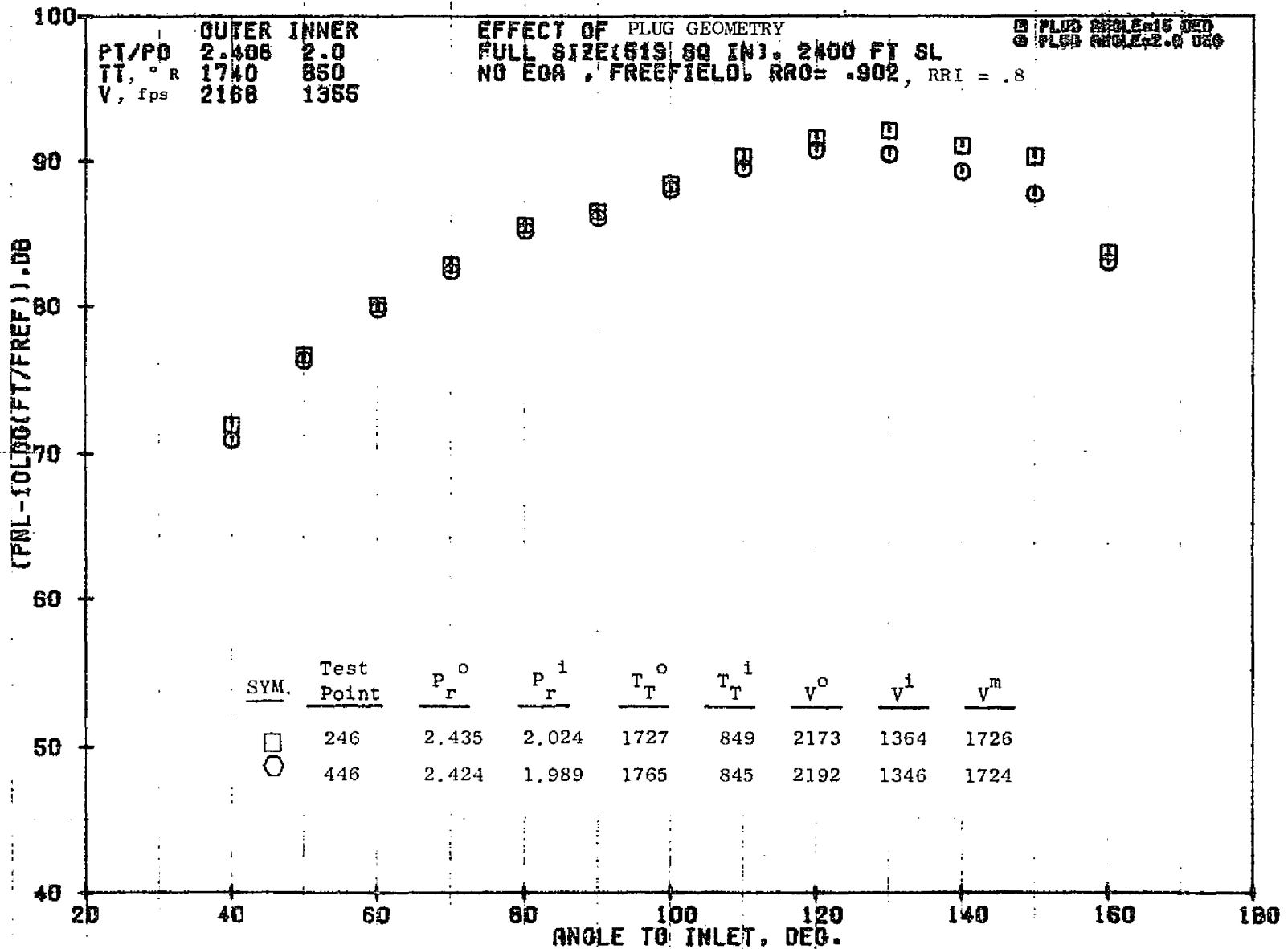
10601



11/03/76
 18360-001

79 BURCH A.

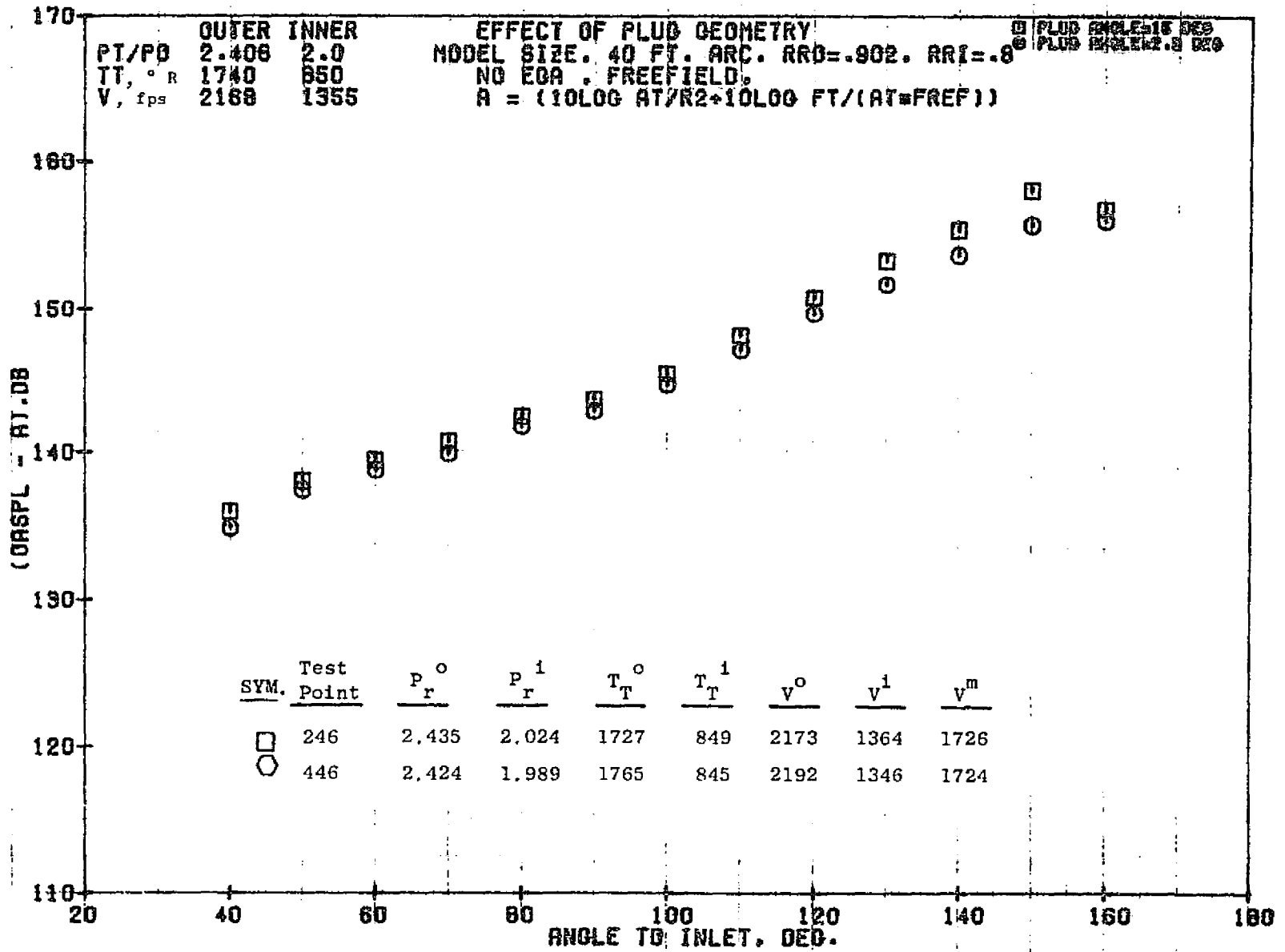
1601



11/04/76
 18680-001

79 BURCH A.

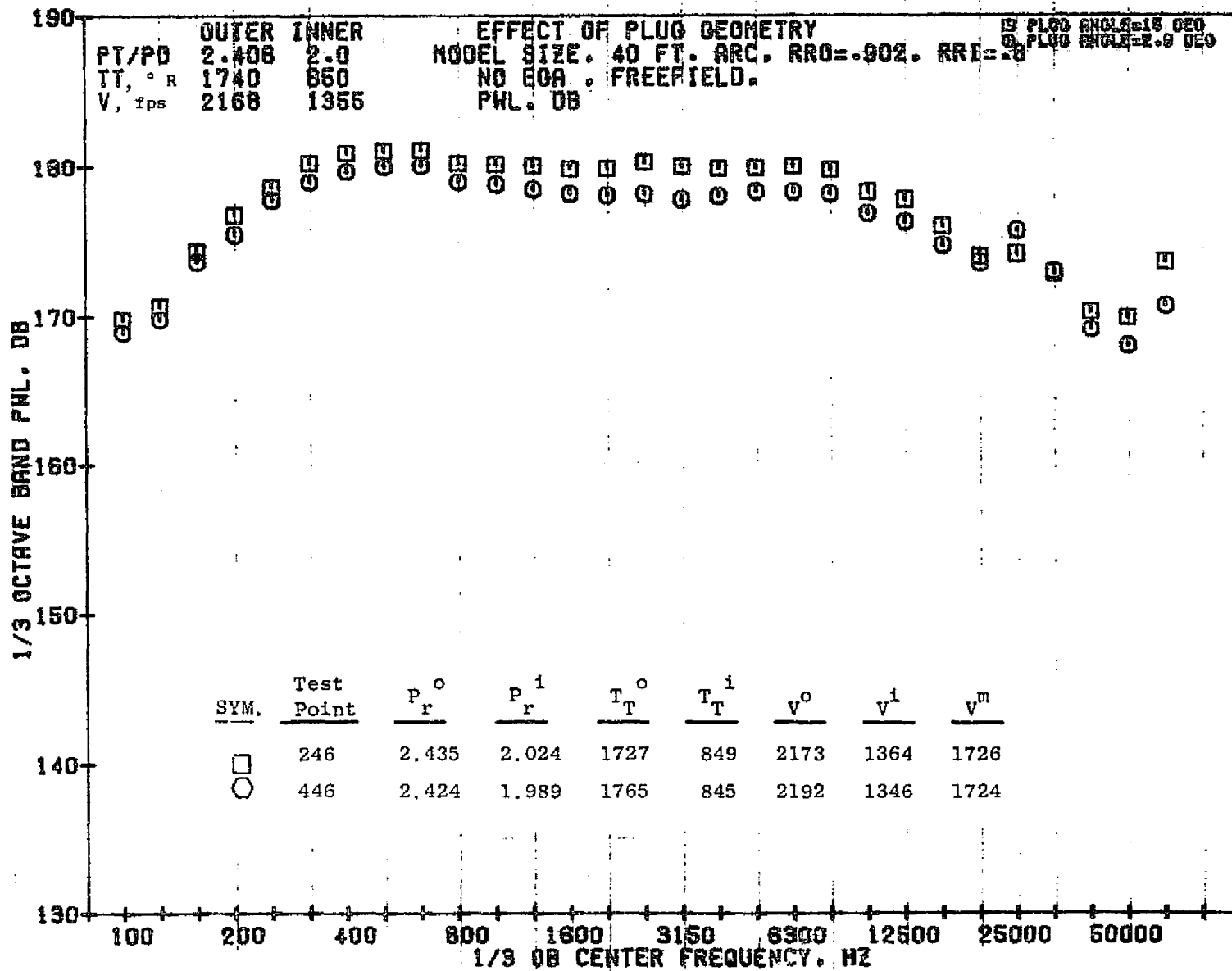
1092



11/04/76
 18727-001

79 BURCH A.

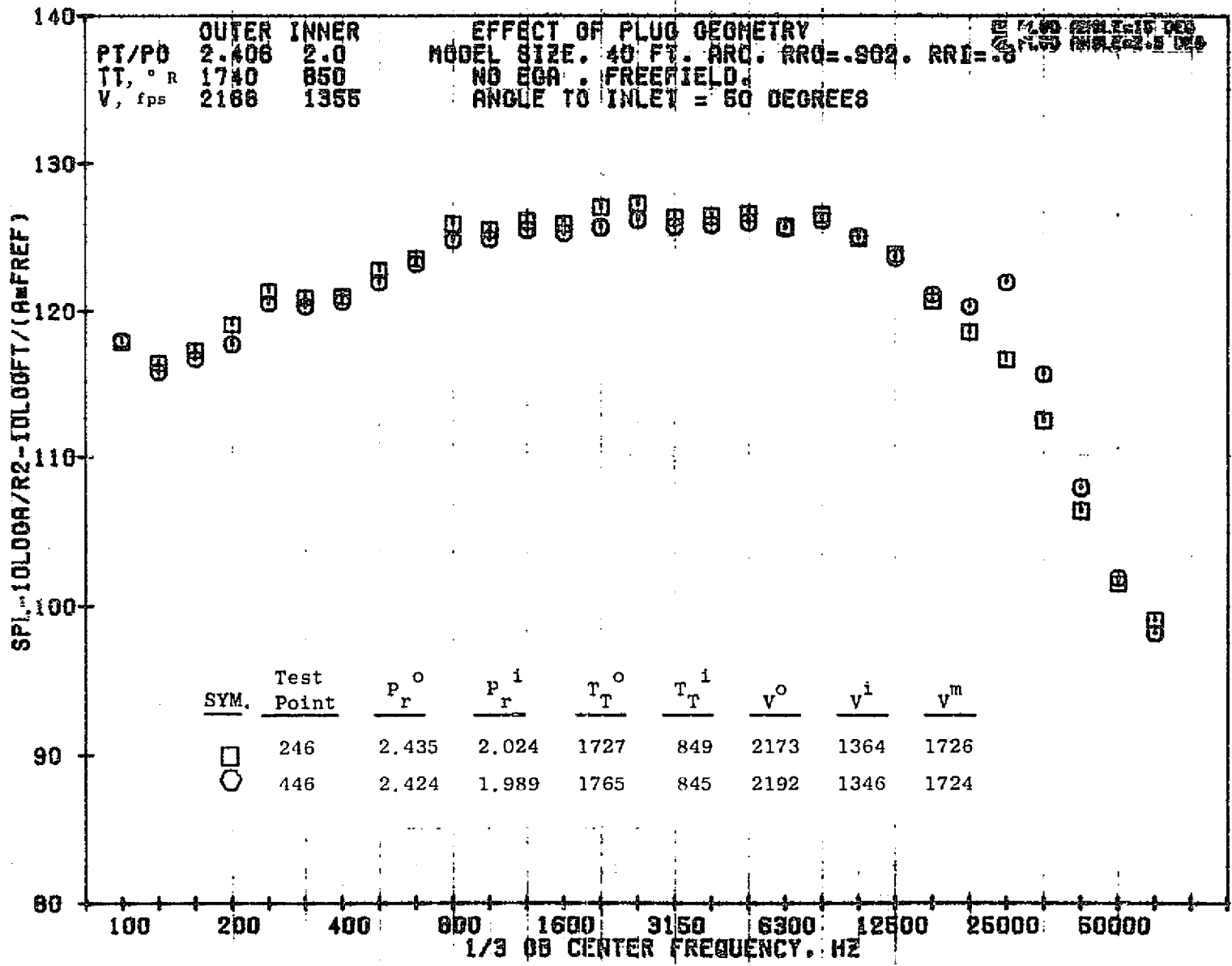
1093



11/04/76
 18727-001

79 BURCH A.

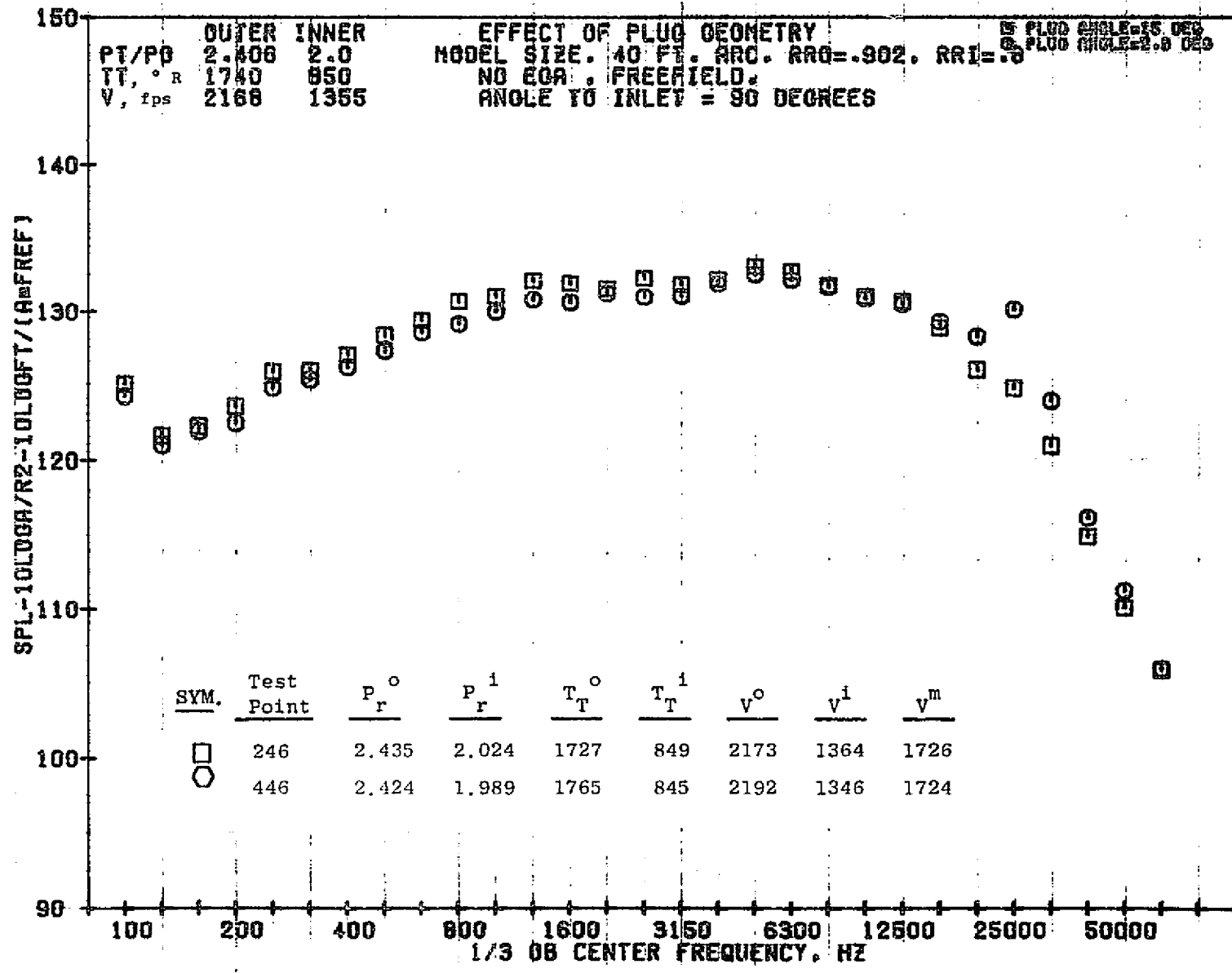
1094



11/04/76
18727-001

79 BURCH A.

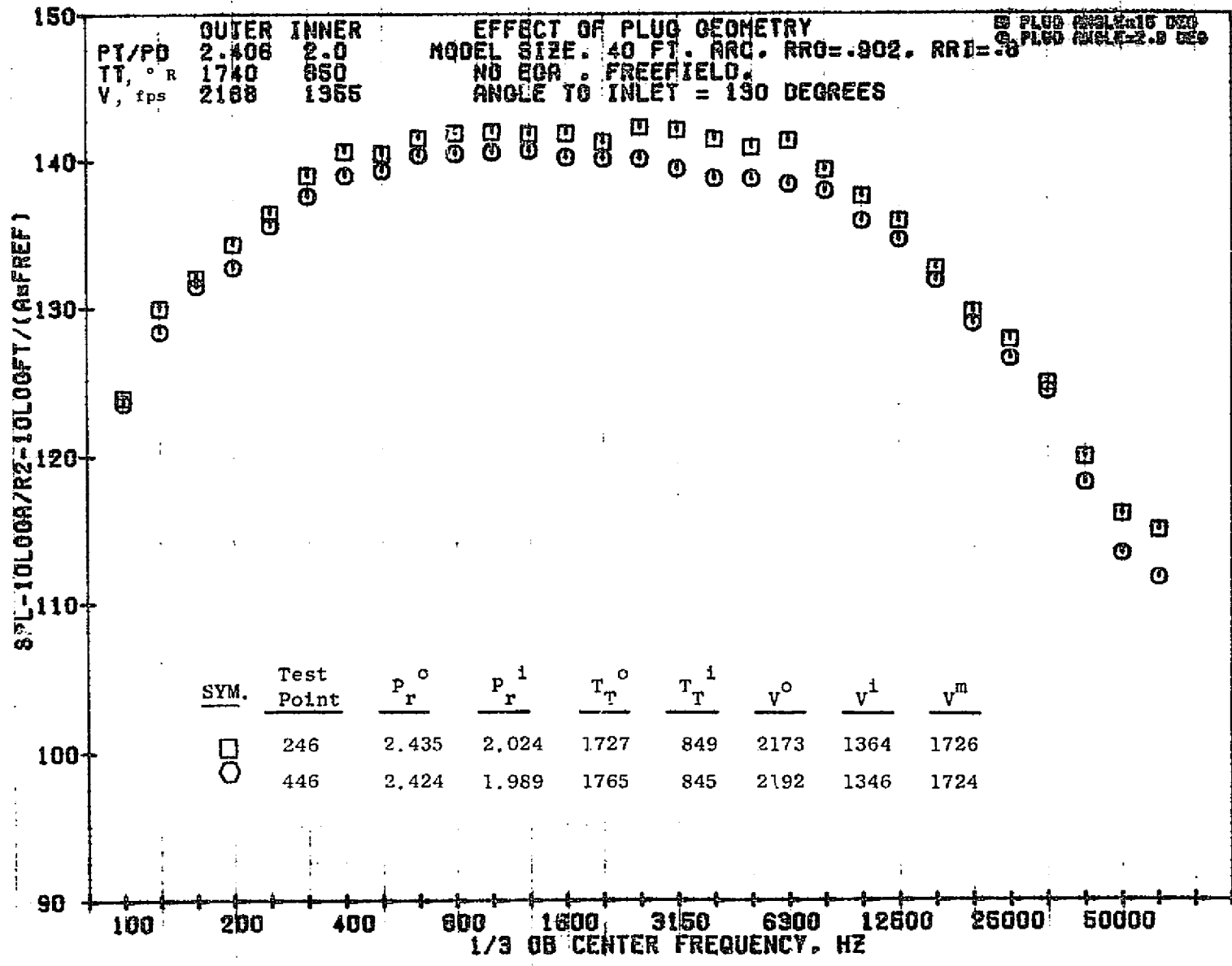
9601



11/04/76
 18727-001

79 BURCH A.

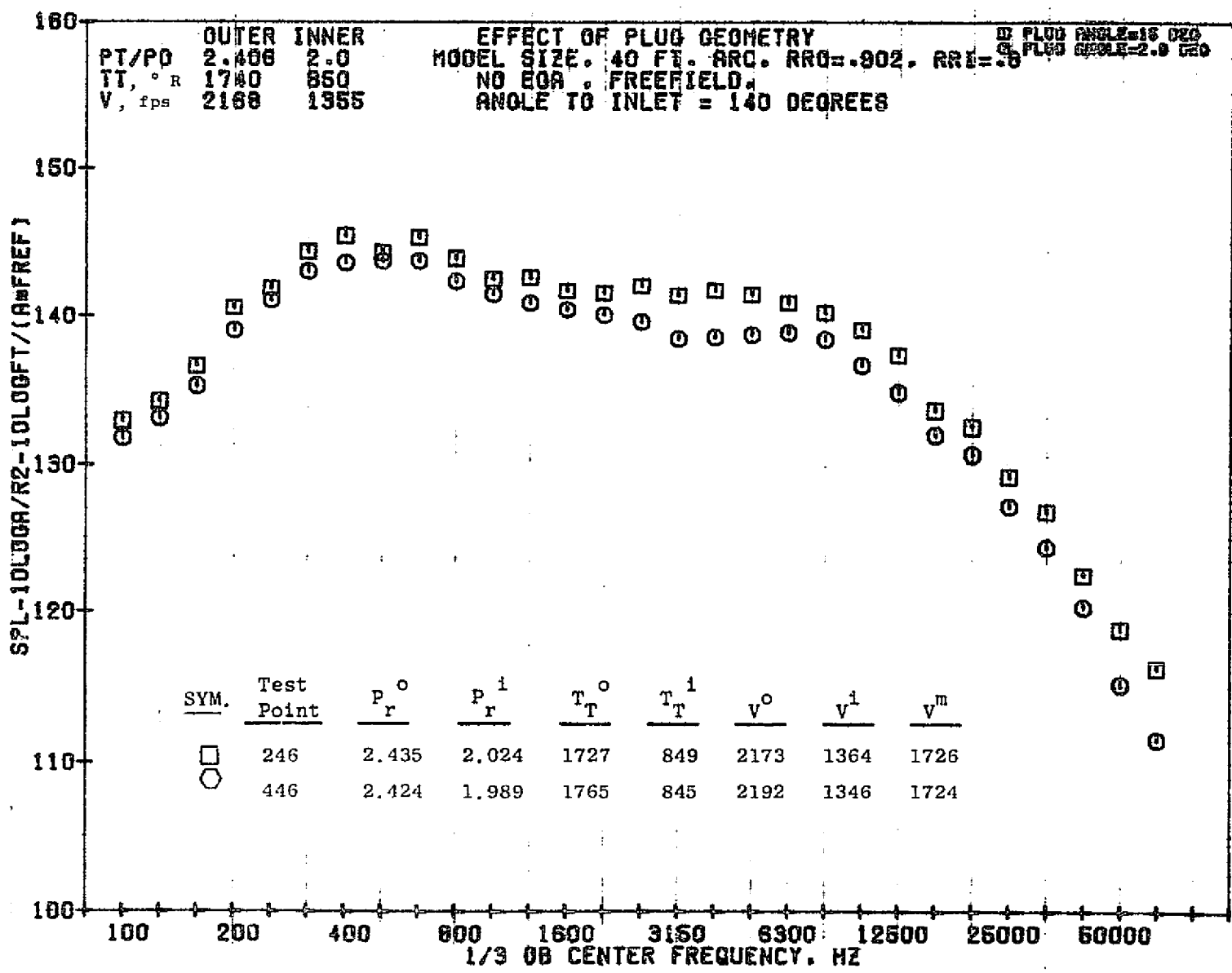
1096



11/04/76
 18727-001

79 BURCH A.

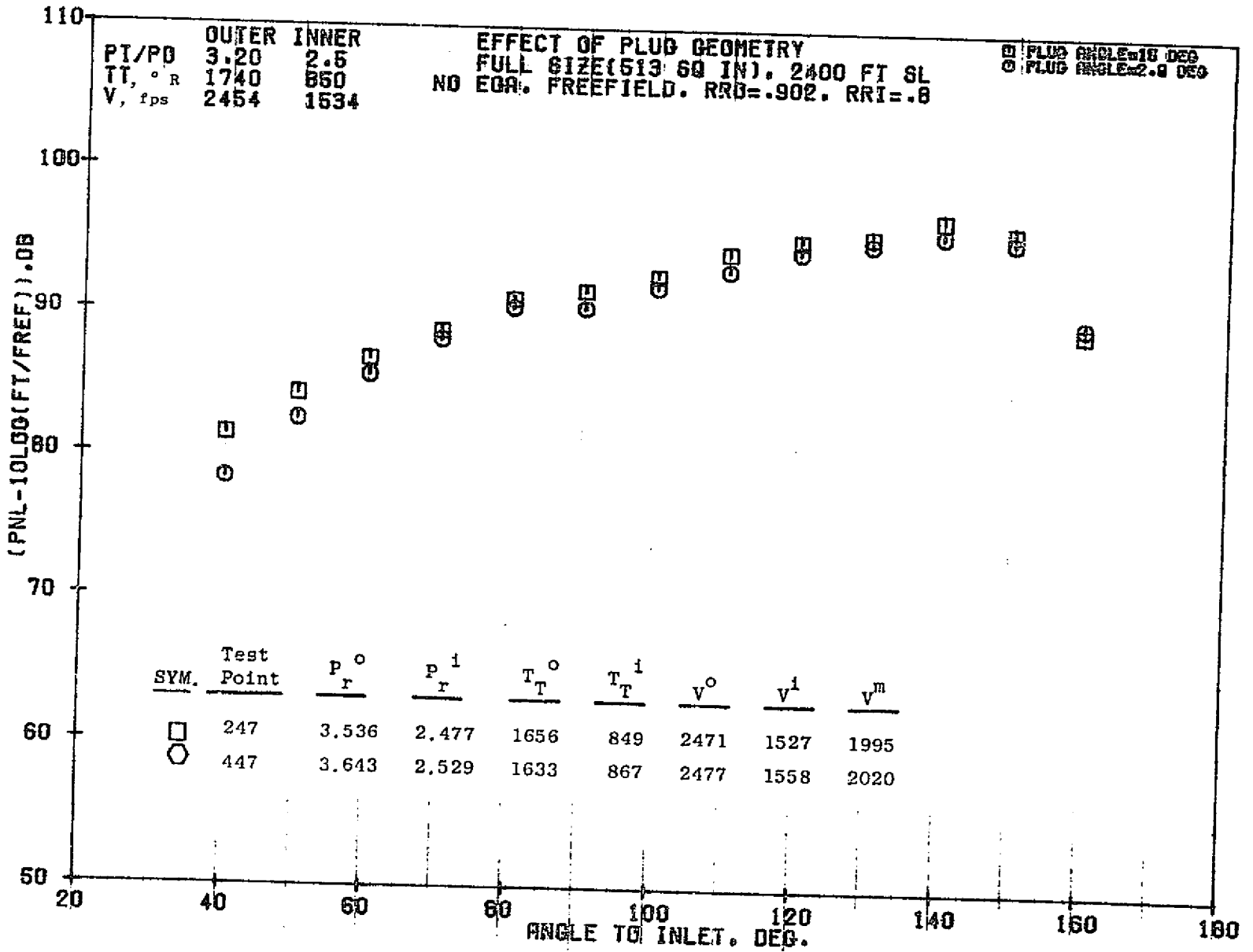
1097



11/04/76
 18727-001

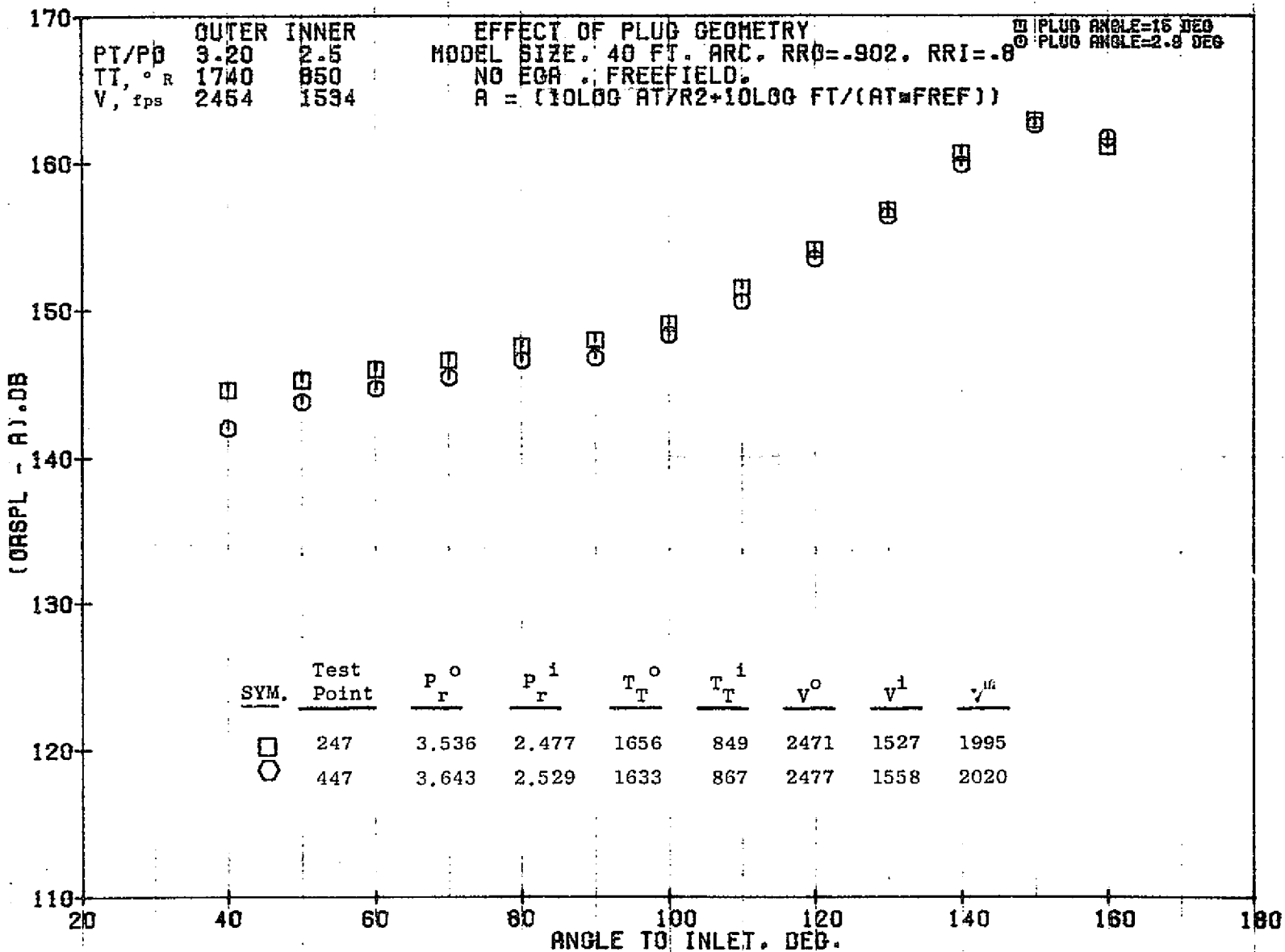
79 BURCH A.

1098



10/29/76
 18130-001

79 BURCH A.

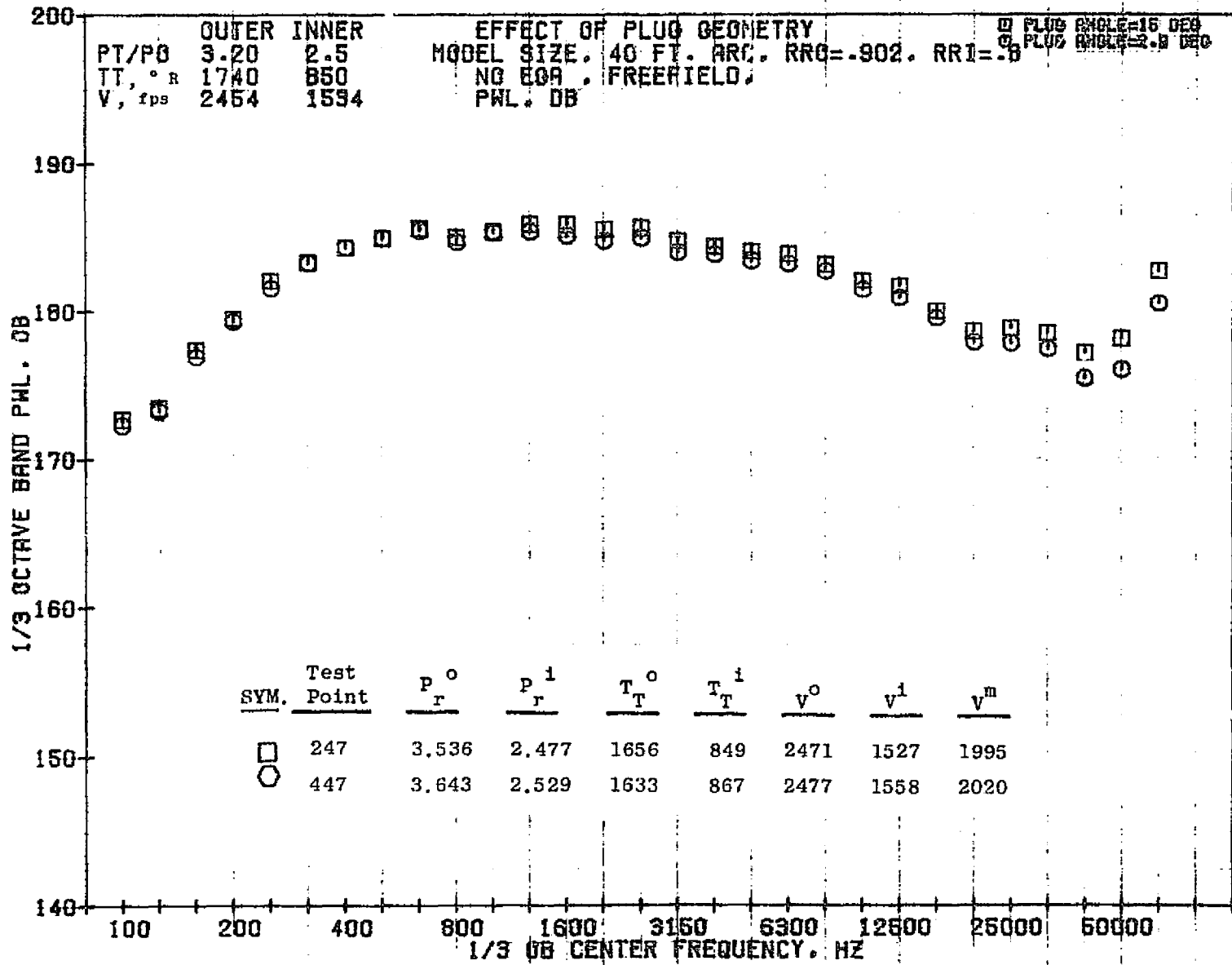


10801

11/03/76
1B350-001

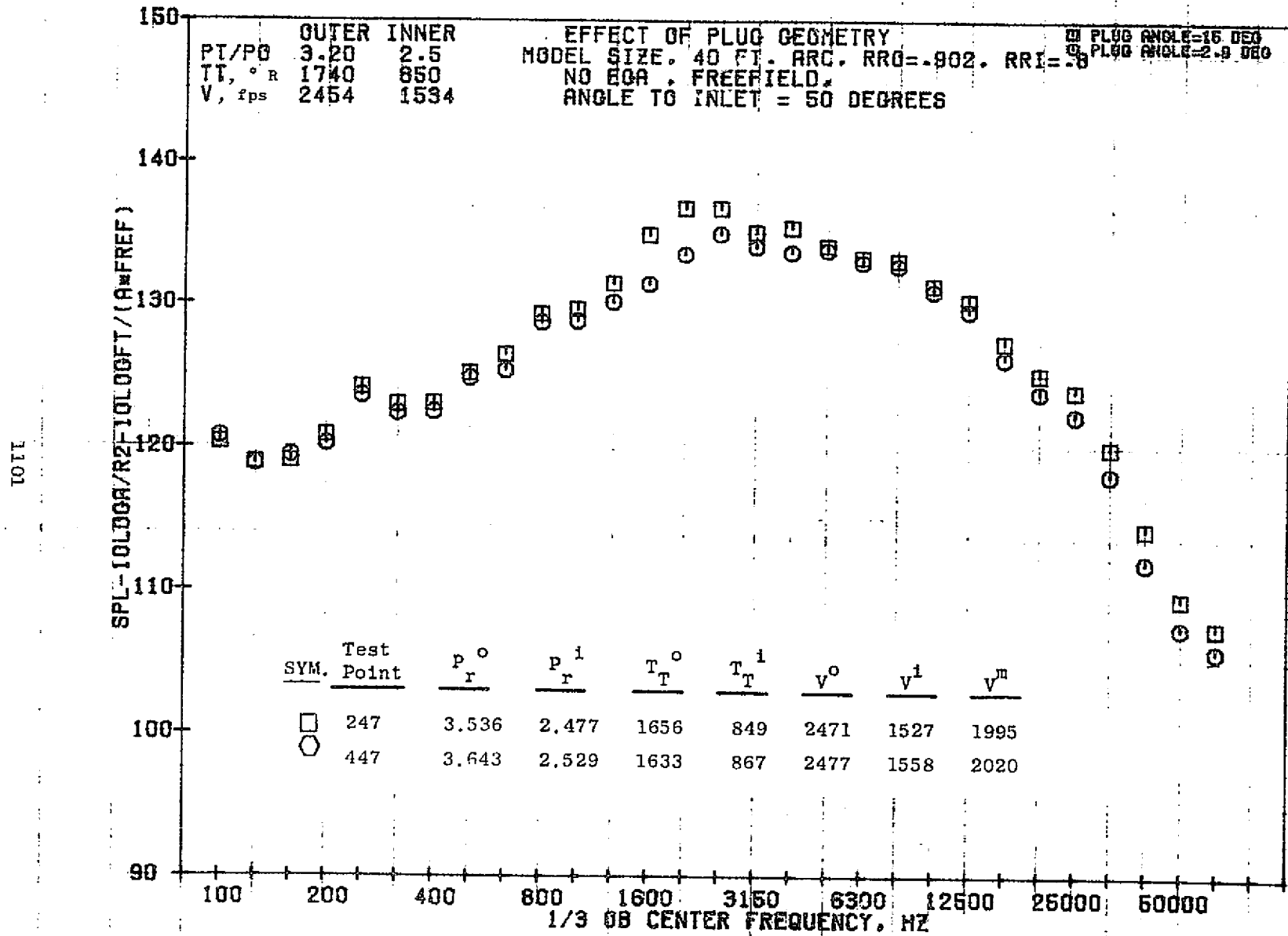
79 BURCH A.

1100



11/03/76
18360-001

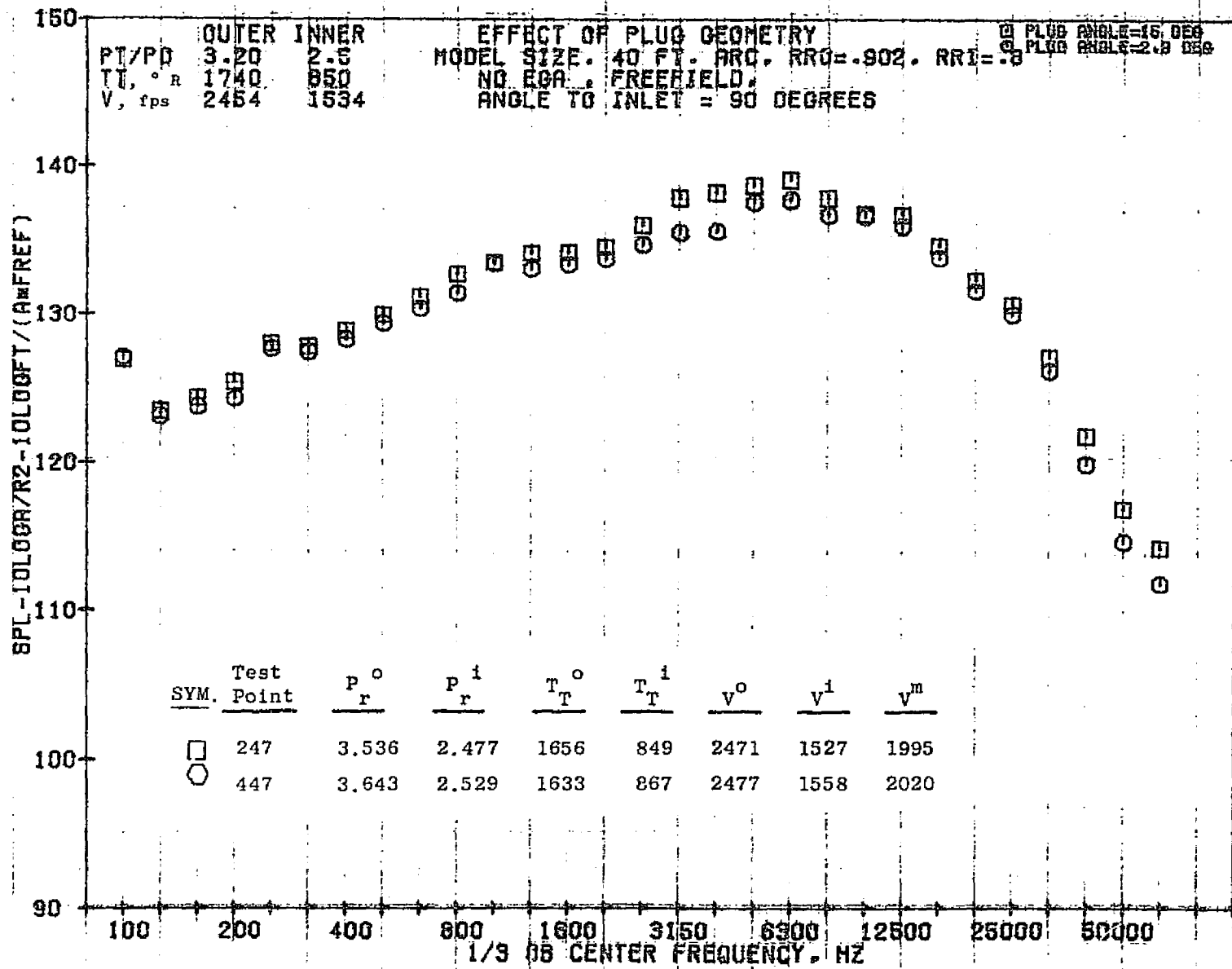
79 BURCH A.



11/03/76
 18360-001

79 BURCH A.

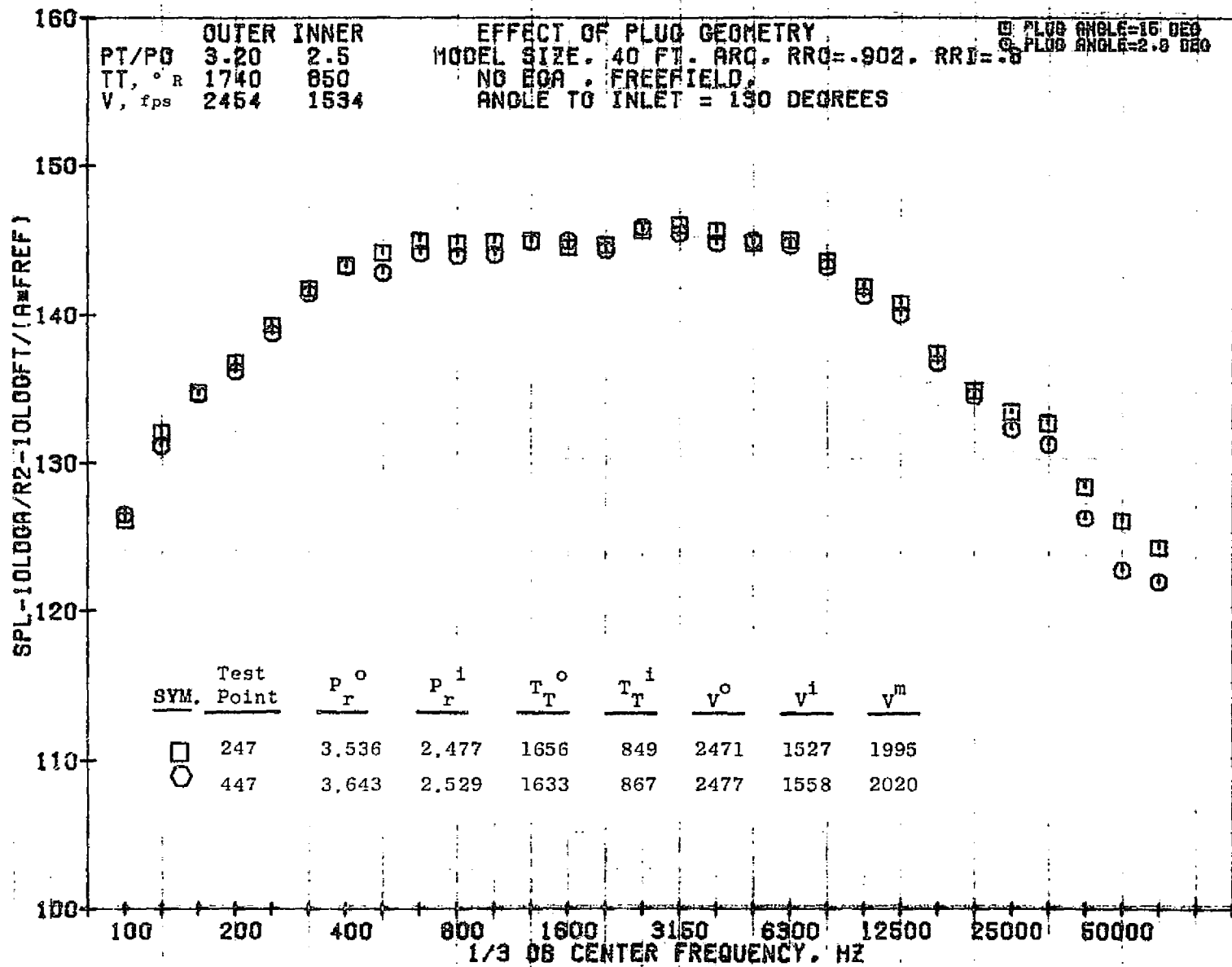
1102



11/03/76
 18360-001

79 BURCH A.

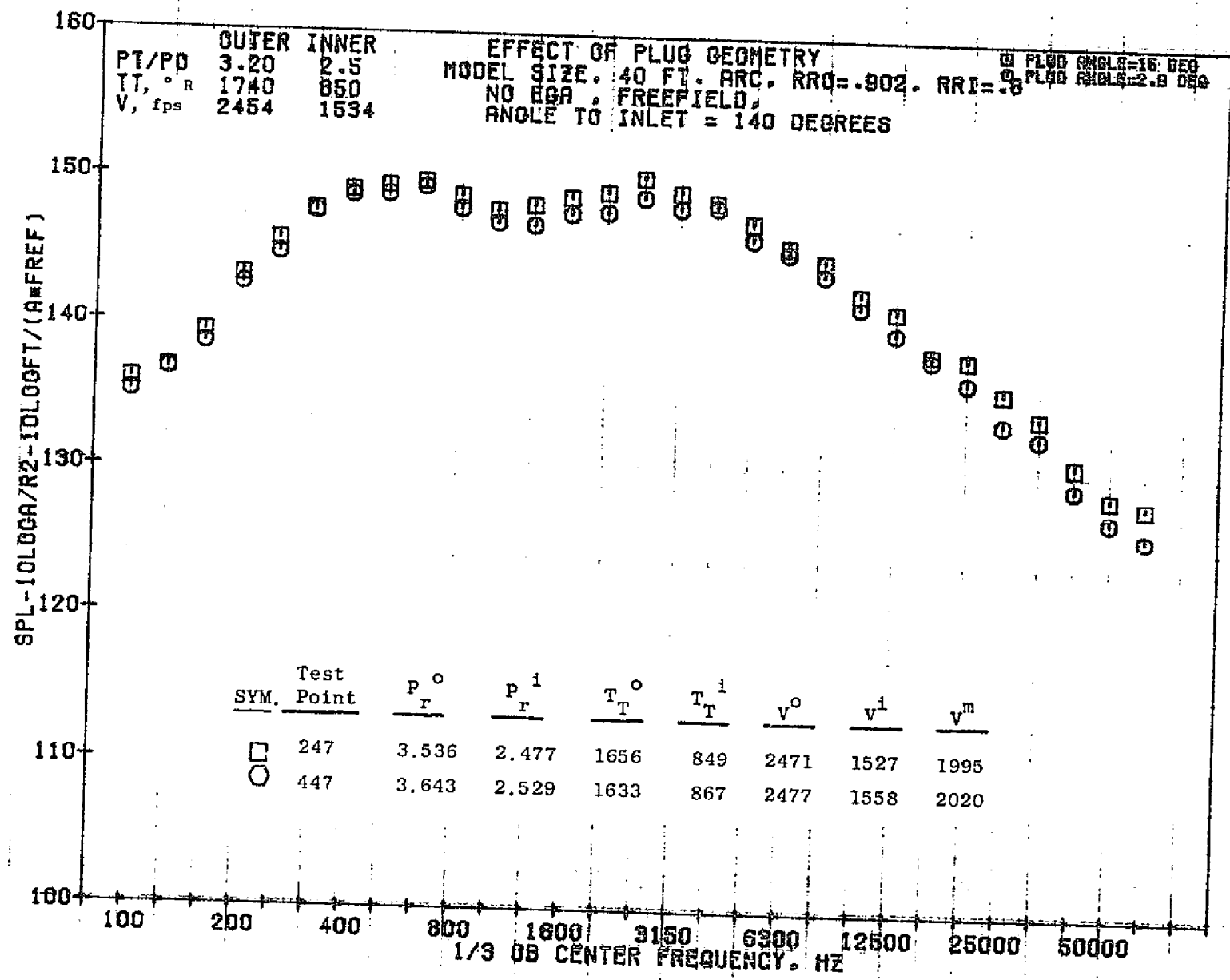
11011



11/03/76
 1A360-001

79 BIRCH A.

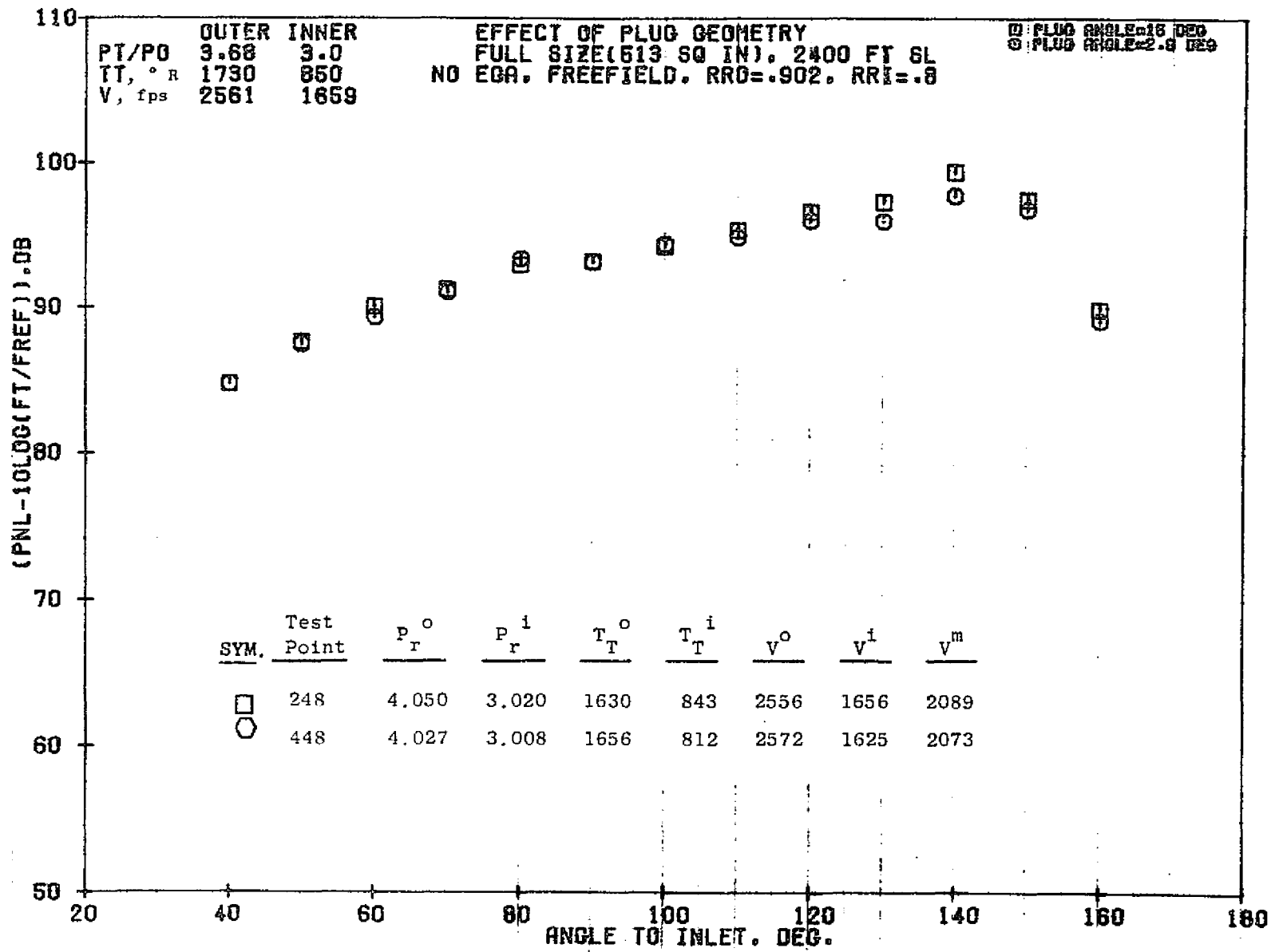
1101



11/03/76
 1B360-001

79 BIRCH A.

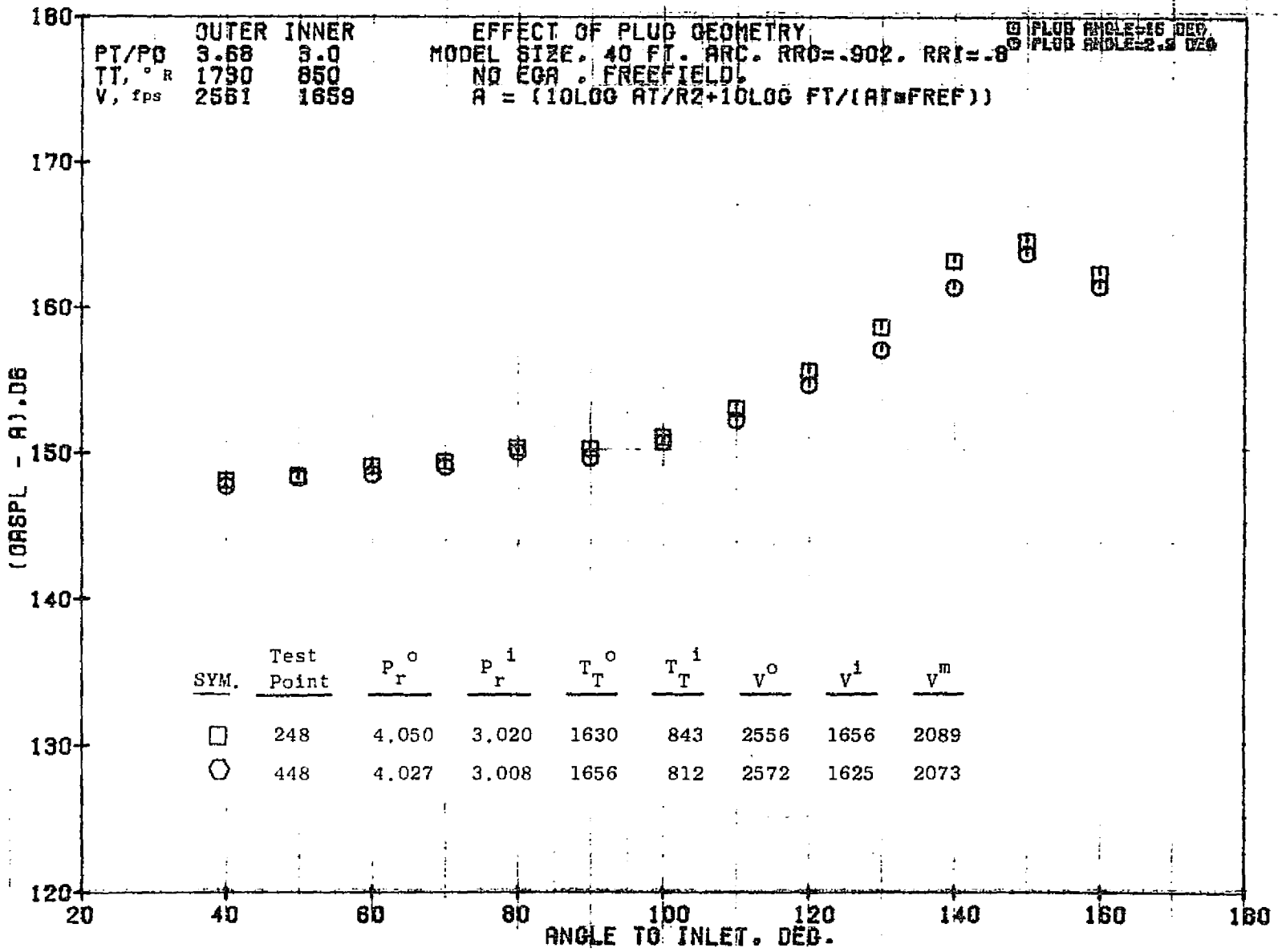
1105



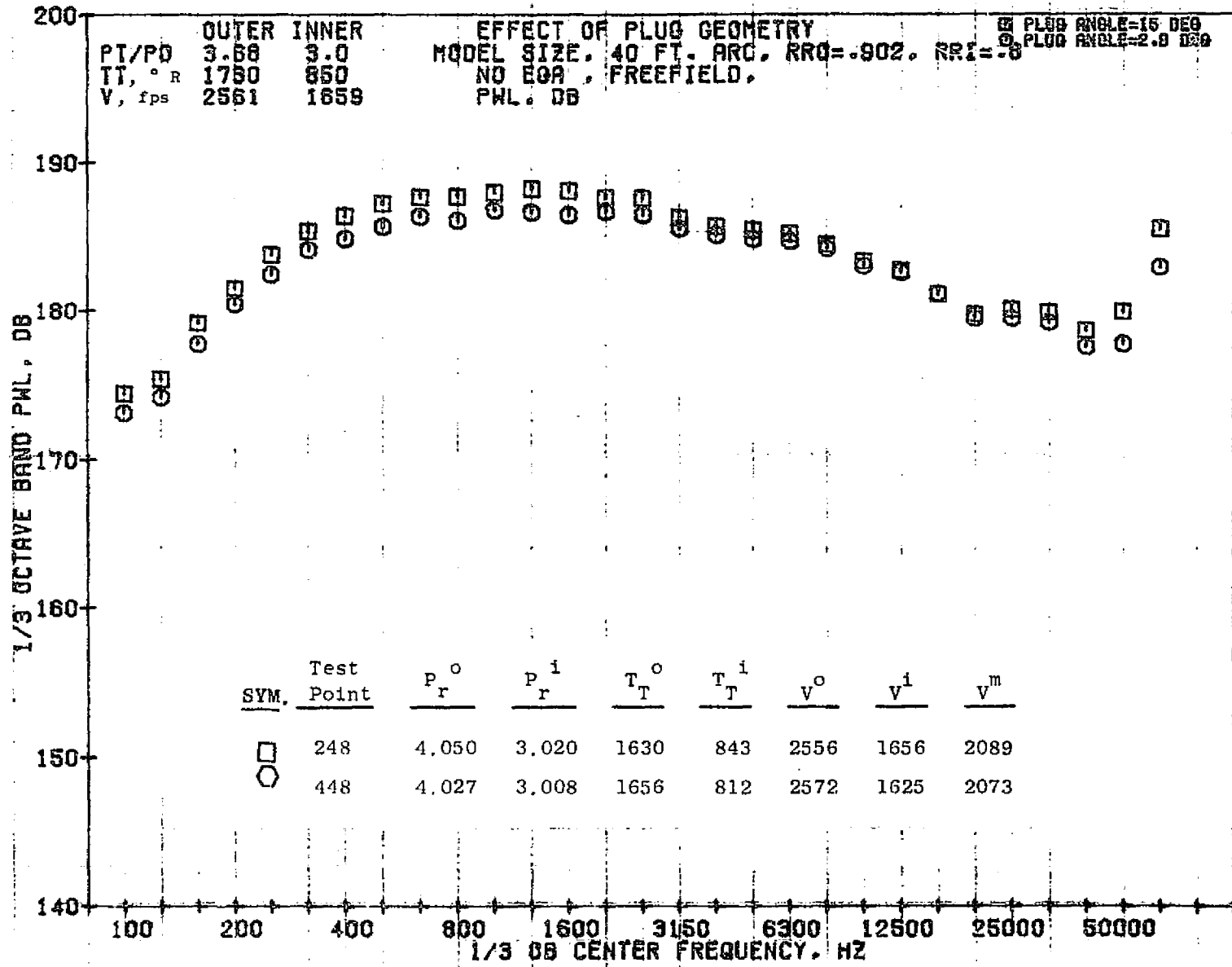
10/29/76
 18130-011

79 BURCH A.

9011
1106



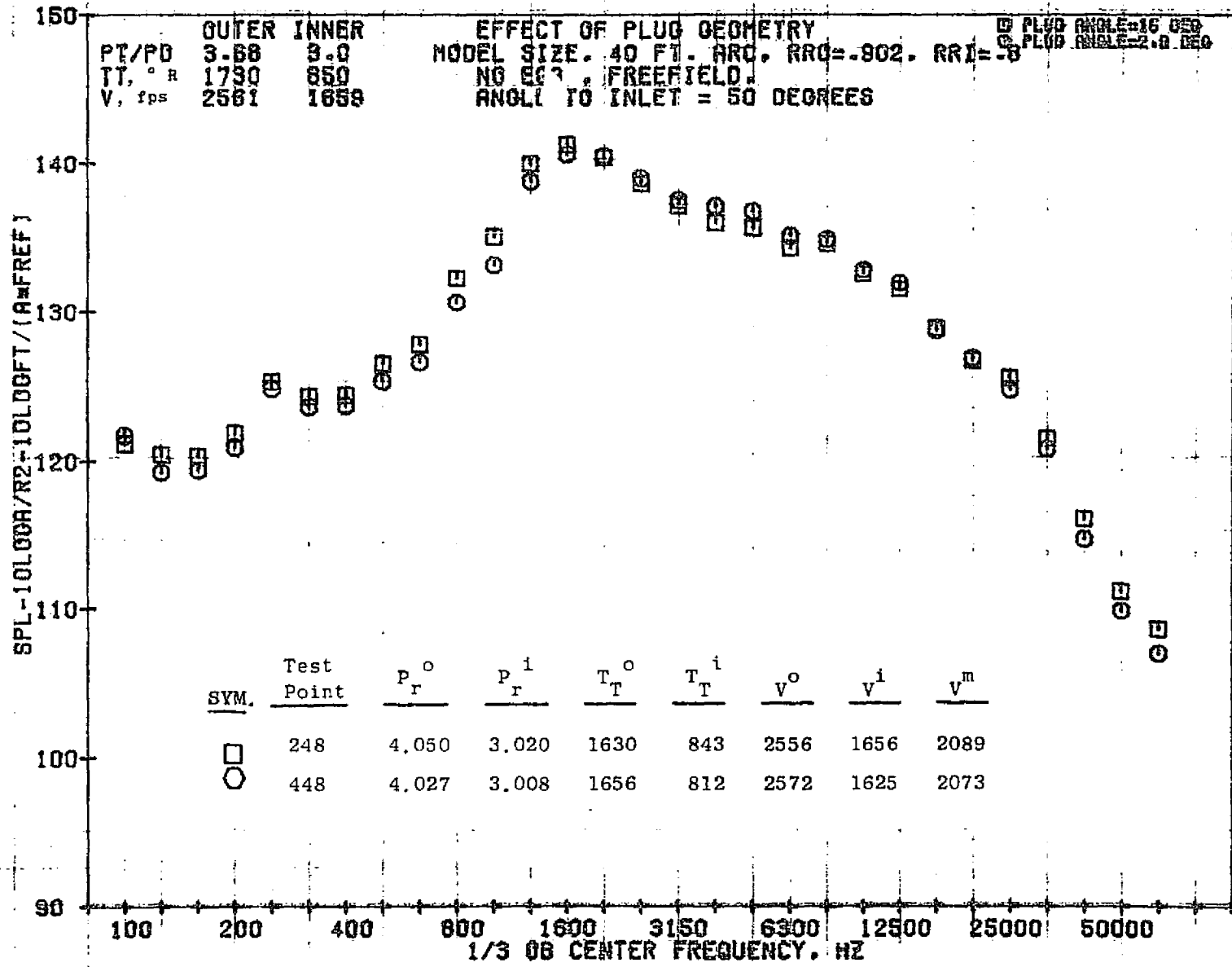
1107



11/03/76
 1B360-001

79 BIRCH A.

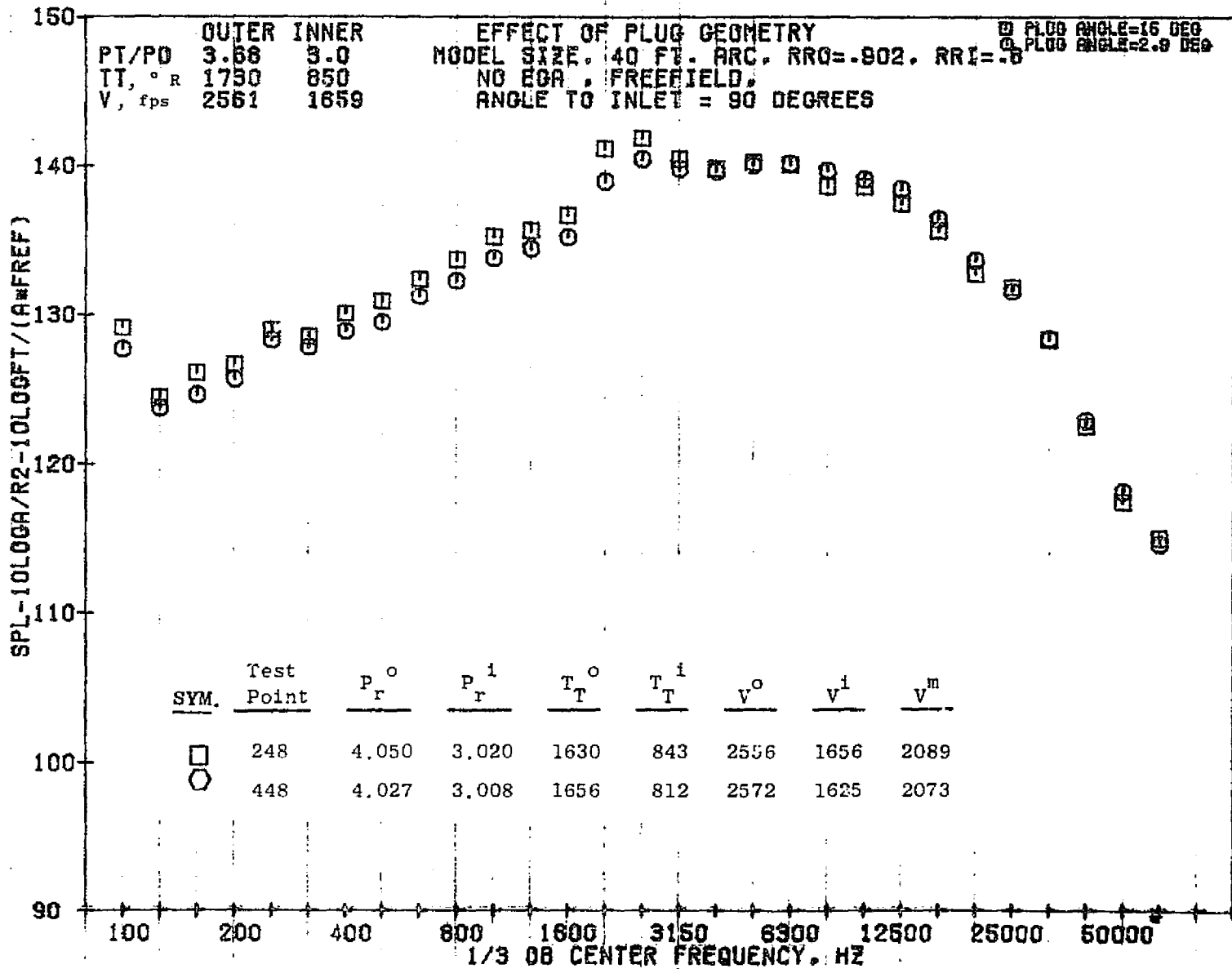
8011



11/03/76
 1R280-001

79 BURCH A.

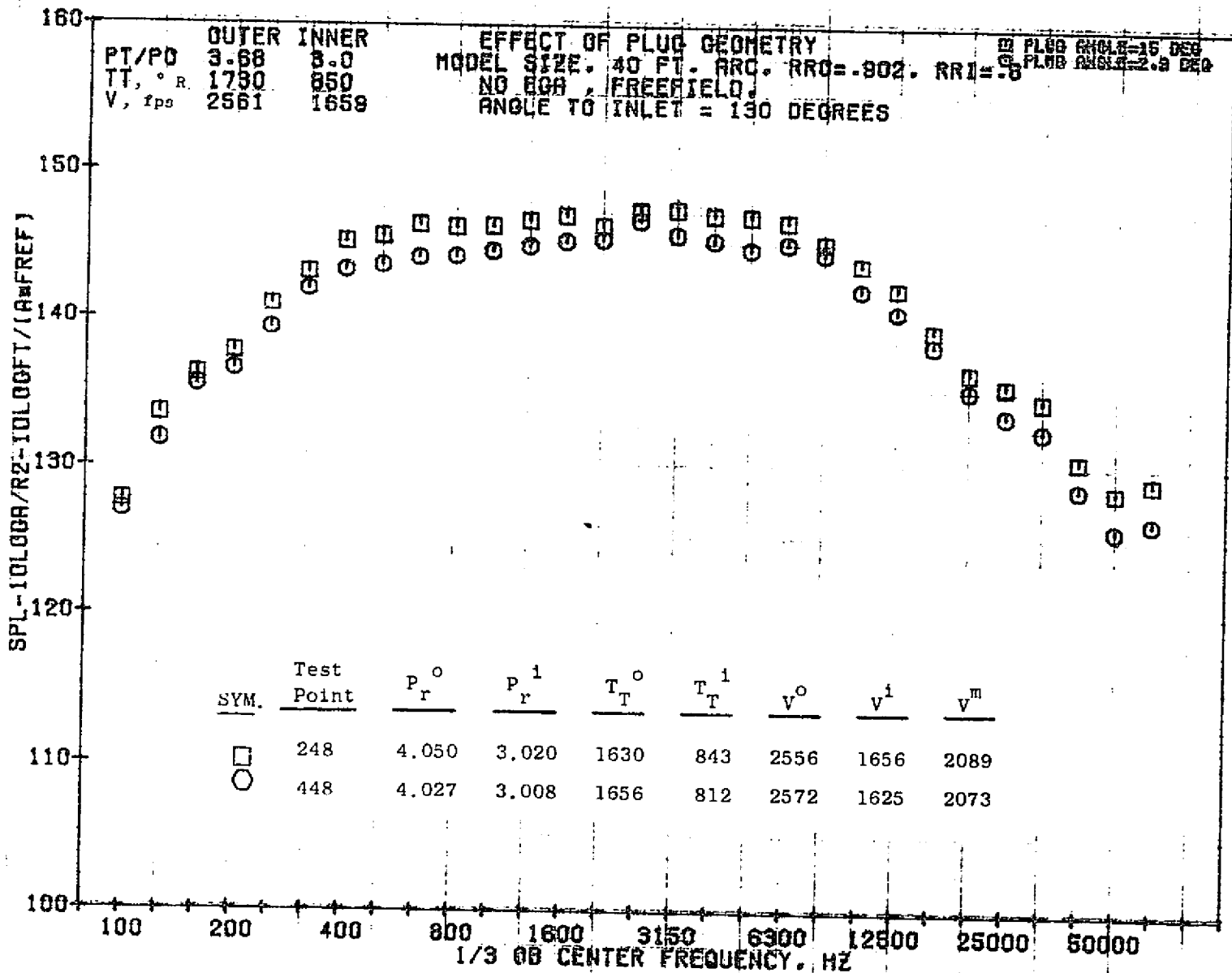
6011



11/03/76
18360-001

79 AIRCH A.

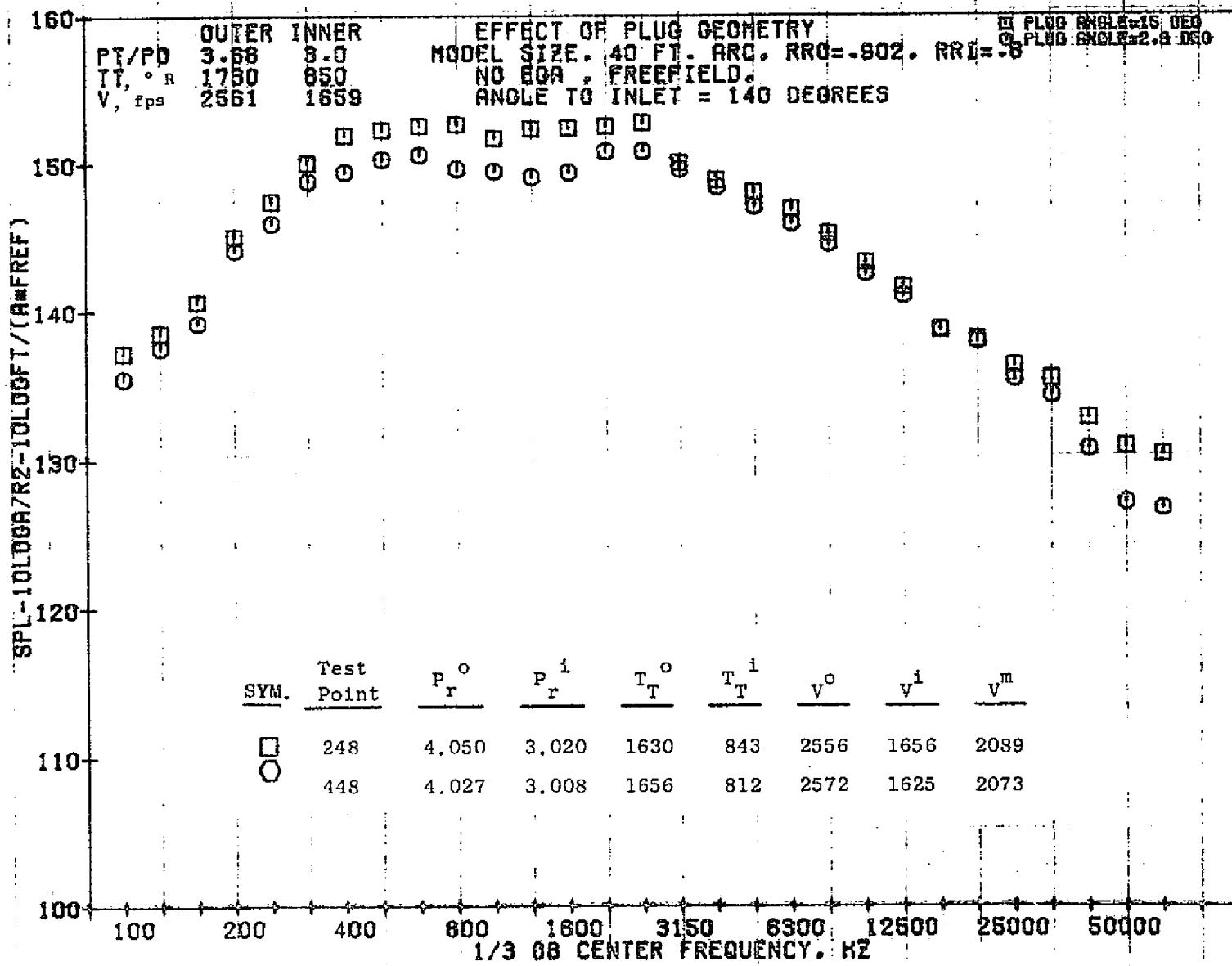
0111



11/03/76
 LR260-001

79 BURCH A.

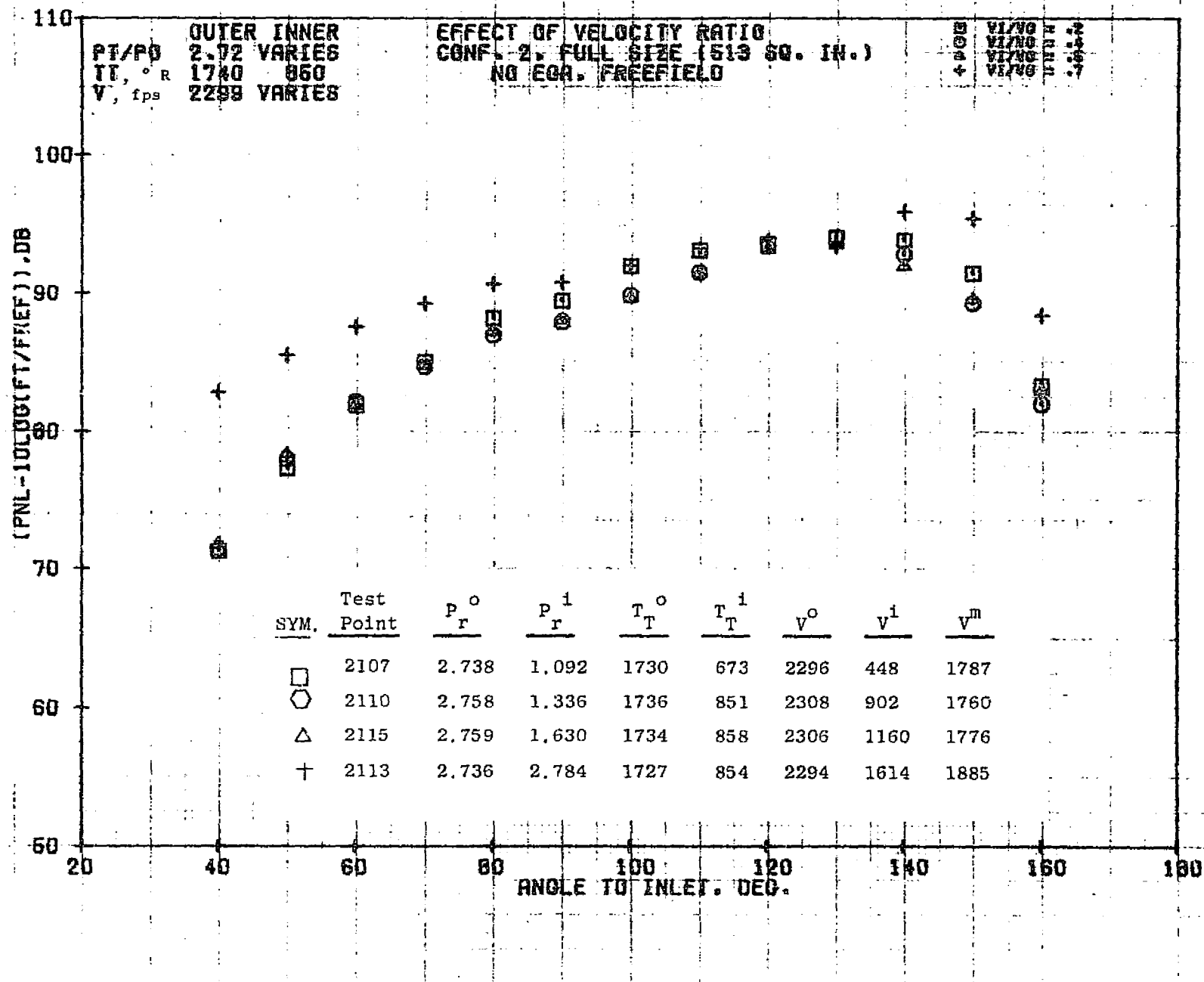
1111



7.4.4. Effect of Velocity Ratio

For Configurations 2 through 7, test points were run with the outer stream aerodynamic parameters held constant while the inner stream velocity was varied to determine the effect of velocity ratio. The results are shown in this section.

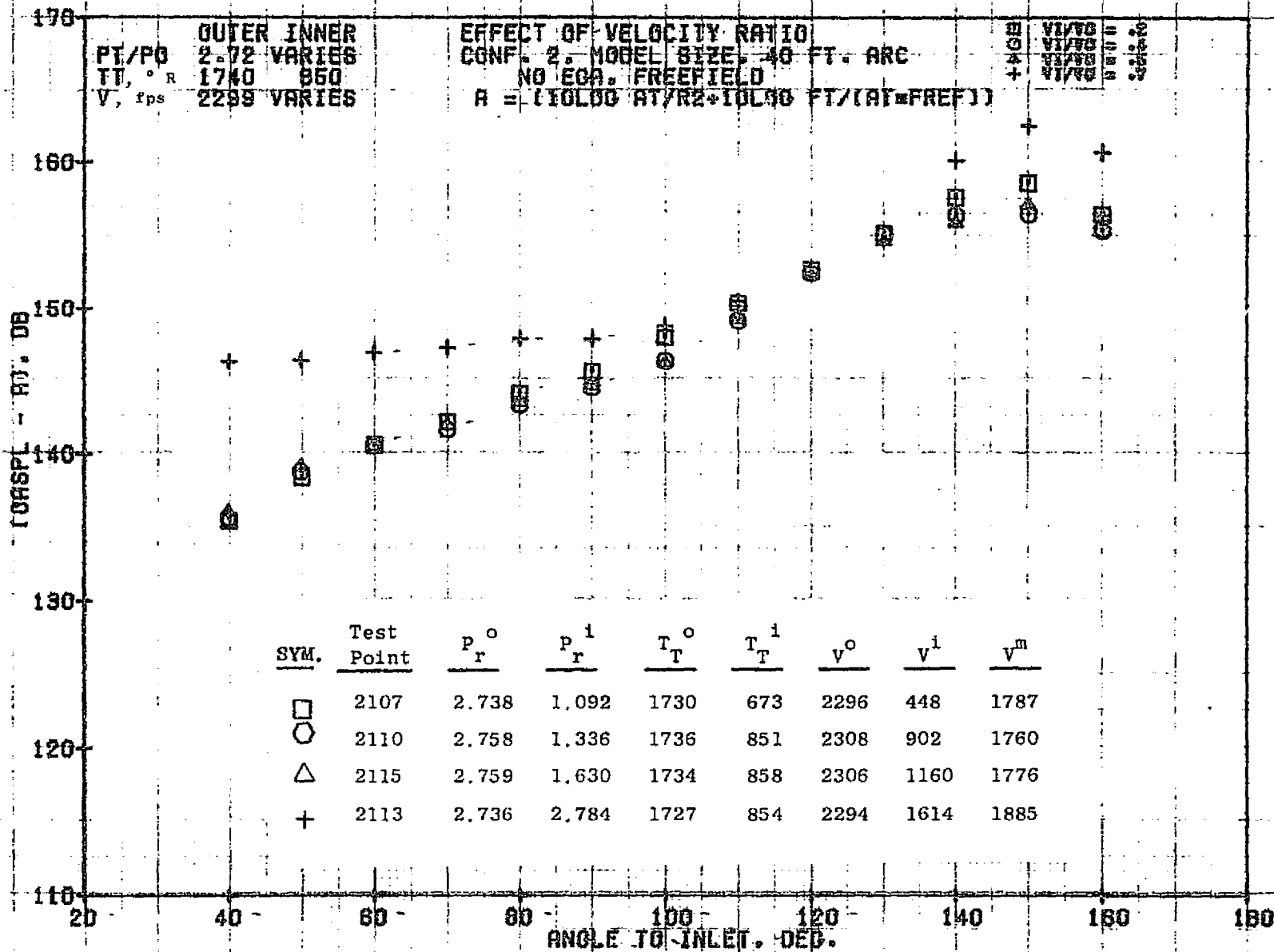
1113



11/01/76
18421-001

79 BURCH A.

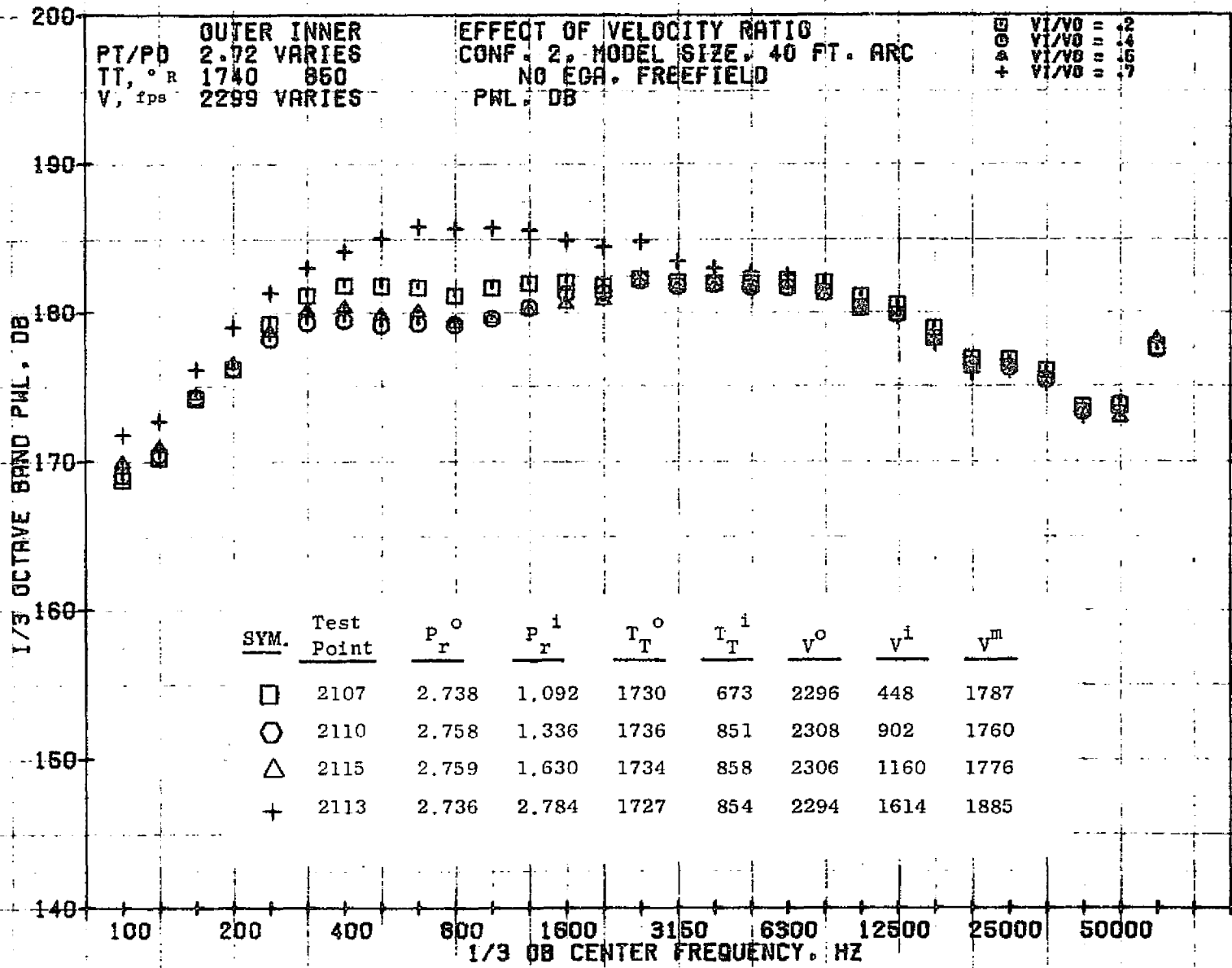
1114

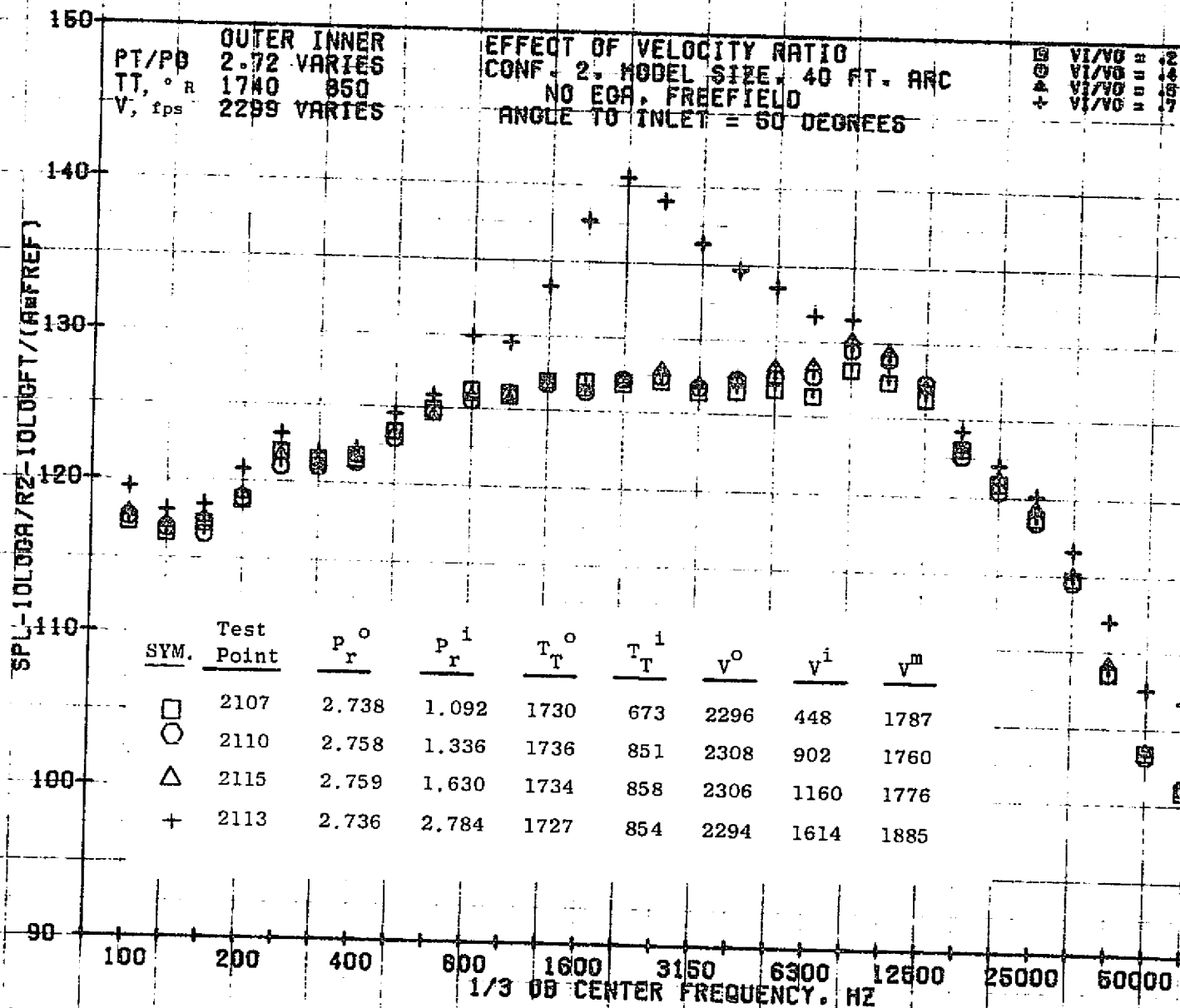


11/09/76
1R343-001

79 BURCH A.

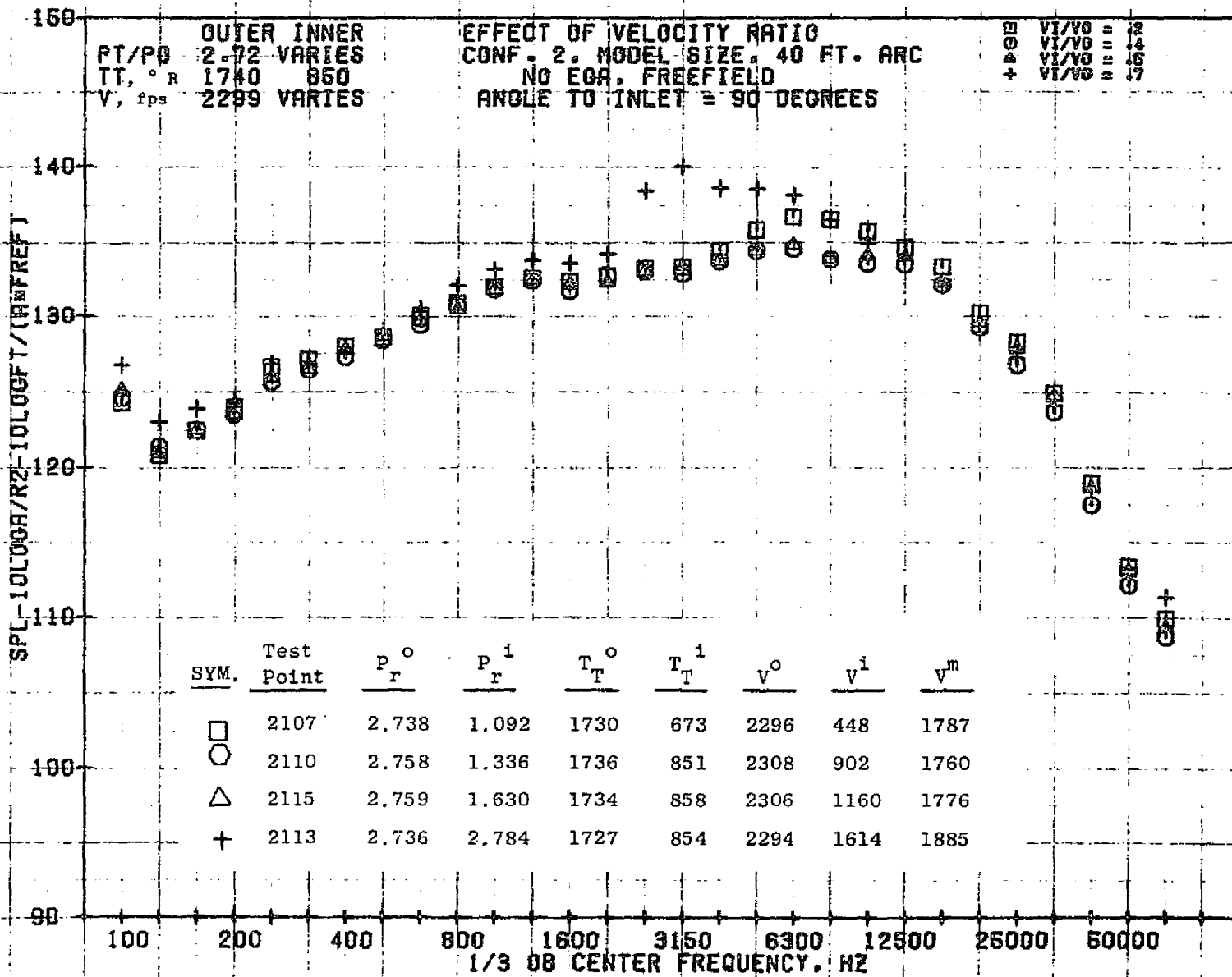
1111





11/01/76
 18391-001

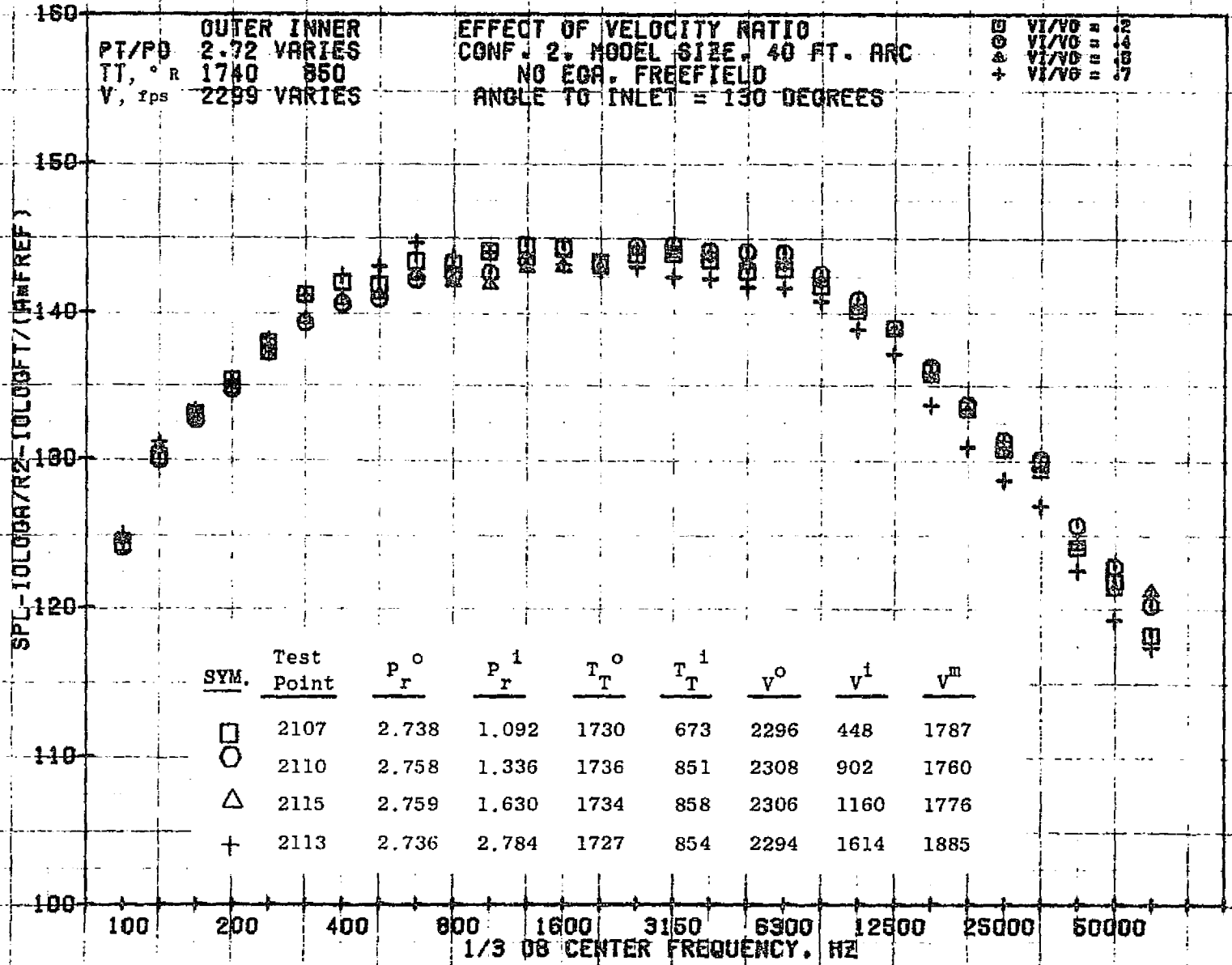
79 BURCH A.



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18391-001

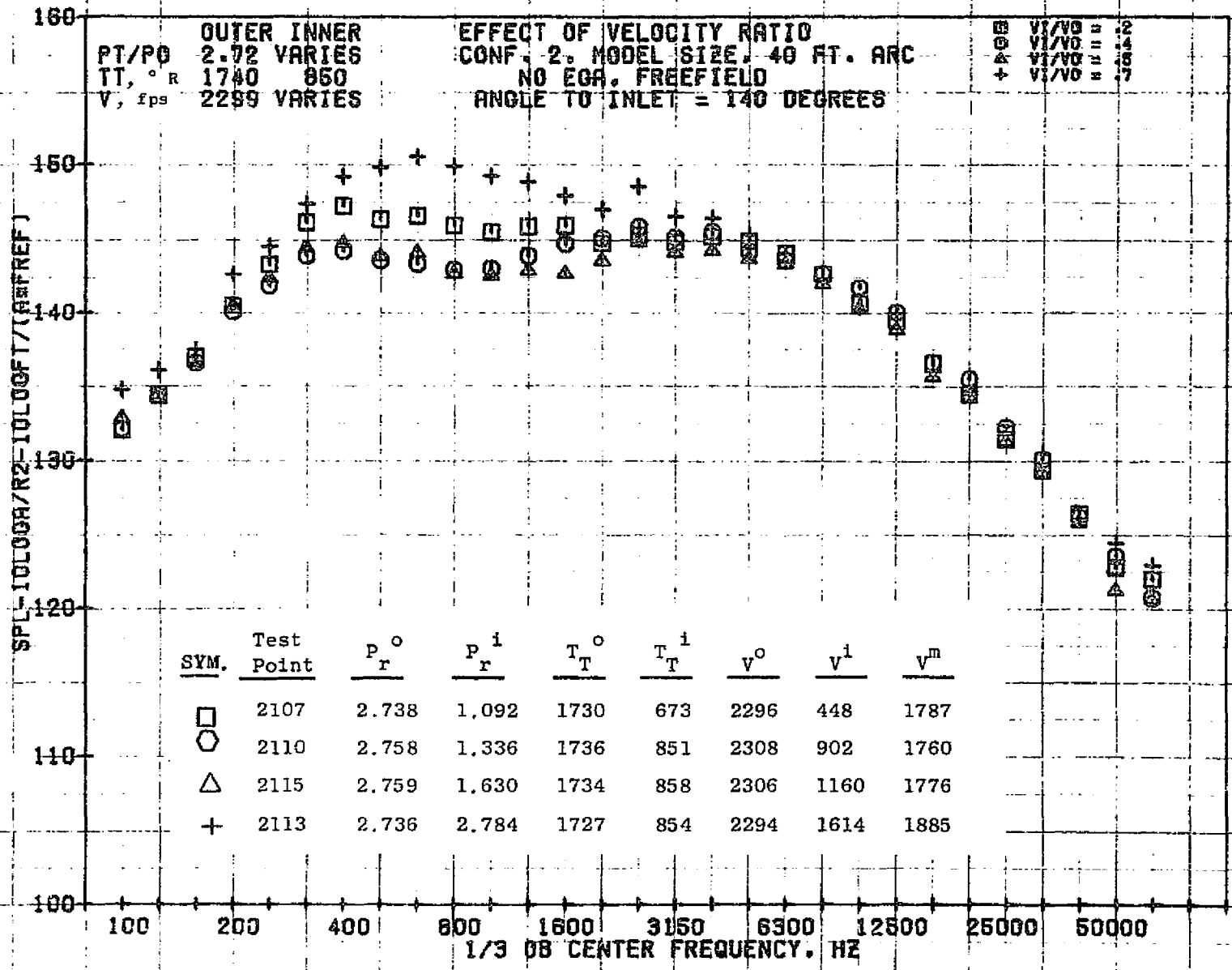
79 BURCH A.

1118



11/01/76
 1B391-001

79 BURCH A.

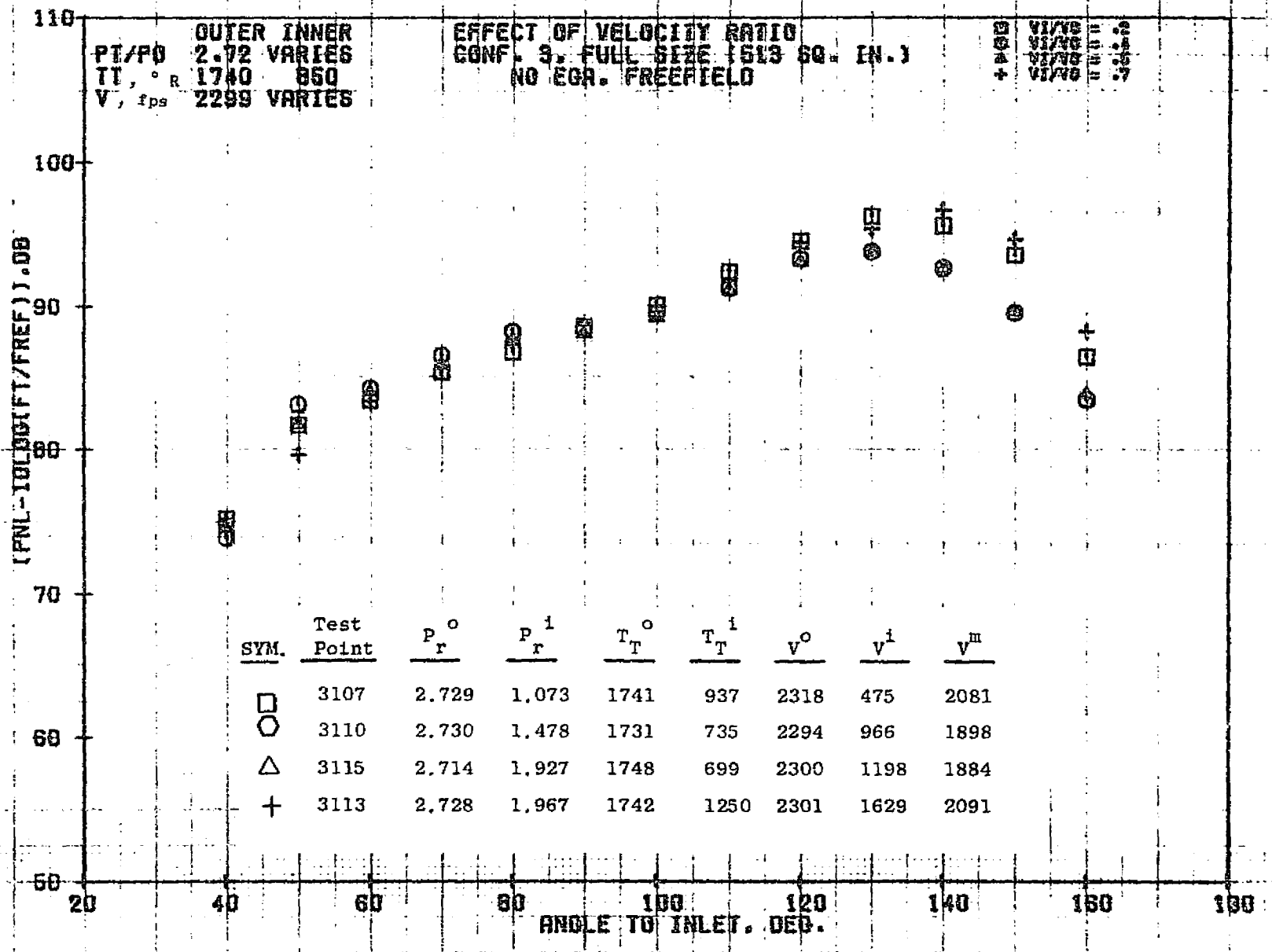


6111

SYM.	Test Point	P_r^o	P_r^i	T_T^o	T_T^i	V^o	V^i	V^m
□	2107	2.738	1.092	1730	673	2296	448	1787
○	2110	2.758	1.336	1736	851	2308	902	1760
△	2115	2.759	1.630	1734	858	2306	1160	1776
+	2113	2.736	2.784	1727	854	2294	1614	1885

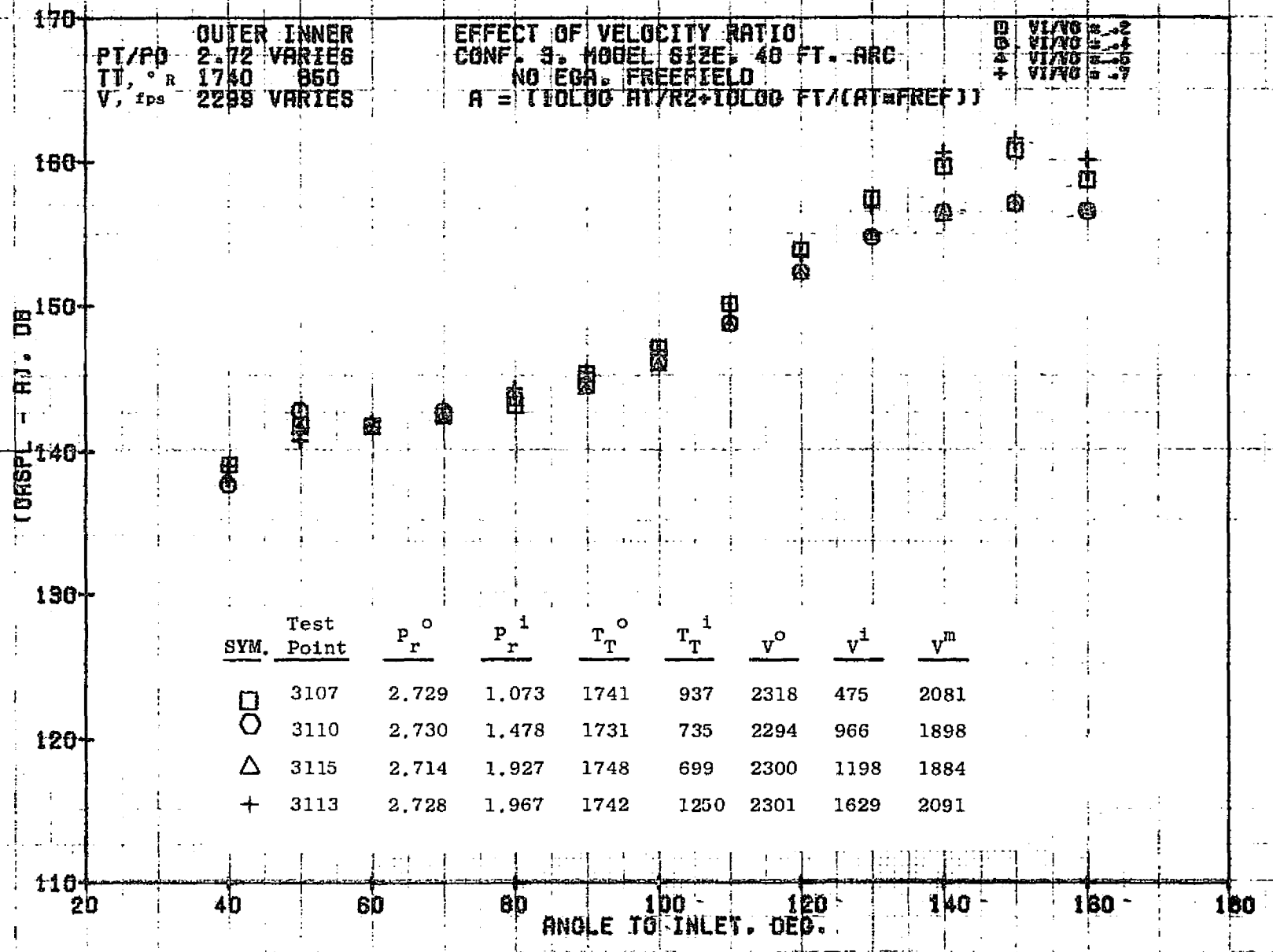
11/01/76
18391-001

79 BURCH A.



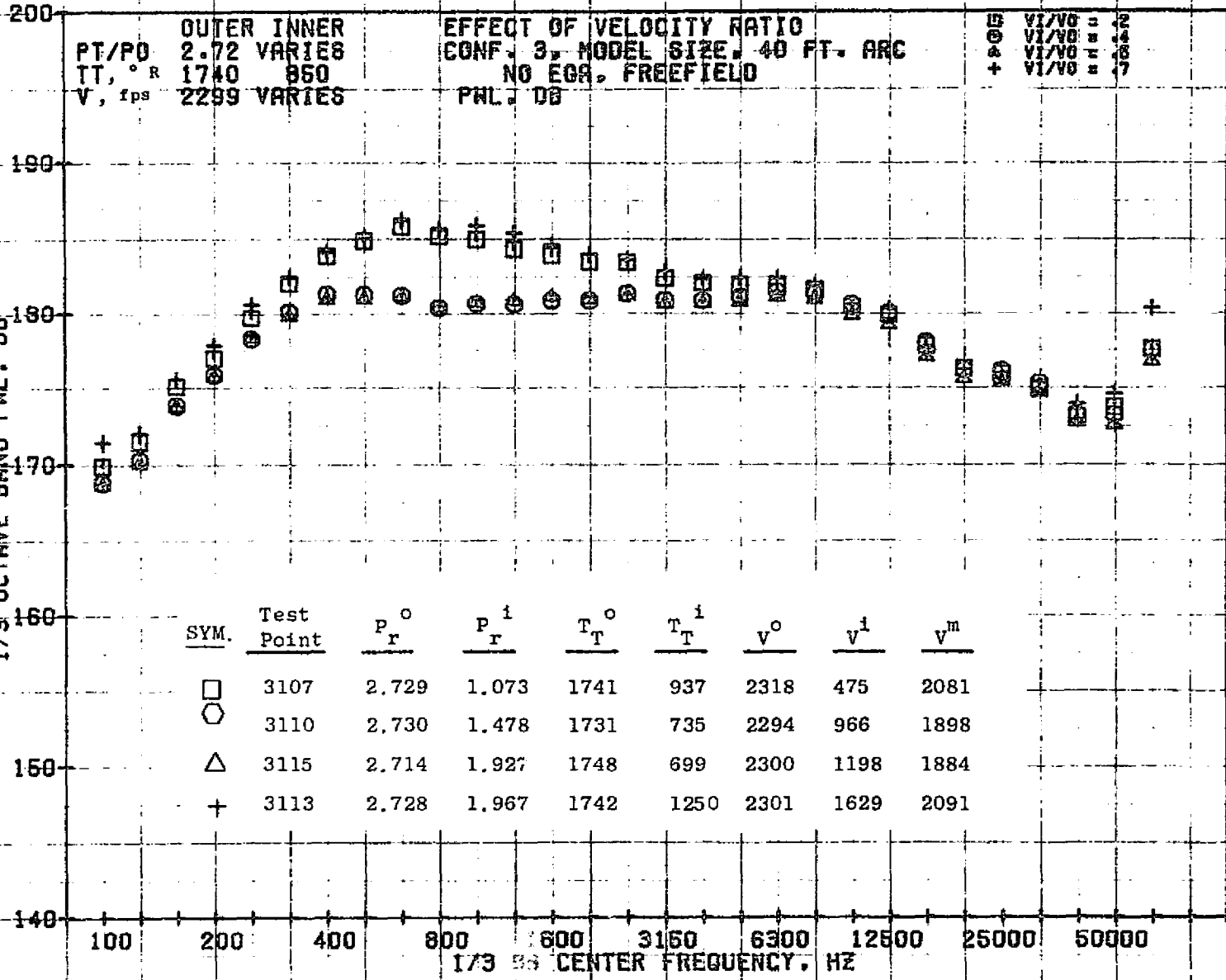
11/01/76
 18421-001

79 BURCH A.



1122

1/3 OCTAVE BAND PNL. DB



OUTER INNER
PT/PO 2.72 VARIES
TT, °R 1740 850
V, fps 2299 VARIES

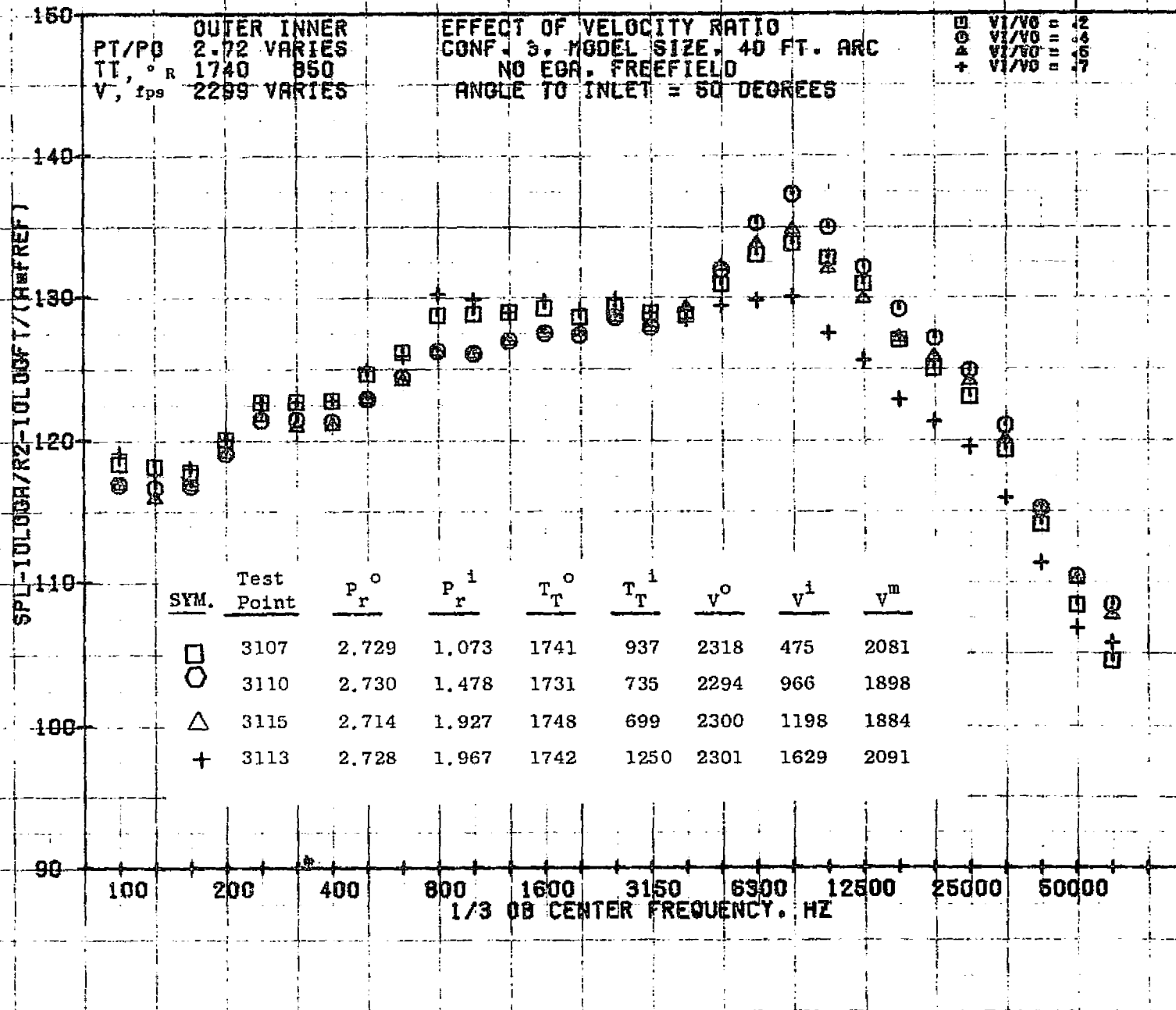
EFFECT OF VELOCITY RATIO
CONF. 3, MODEL SIZE, 40 FT. ARC
NO EGR, FREEFIELD
PNL, DB

□ V1/V0 = 1.4
○ V1/V0 = 1.6
+ V1/V0 = 1.7

SYM.	Test Point	P_r^o	P_r^i	T_T^o	T_T^i	V^o	V^i	V^m
□	3107	2.729	1.073	1741	937	2318	475	2081
○	3110	2.730	1.478	1731	735	2294	966	1898
△	3115	2.714	1.927	1748	699	2300	1198	1884
+	3113	2.728	1.967	1742	1250	2301	1629	2091

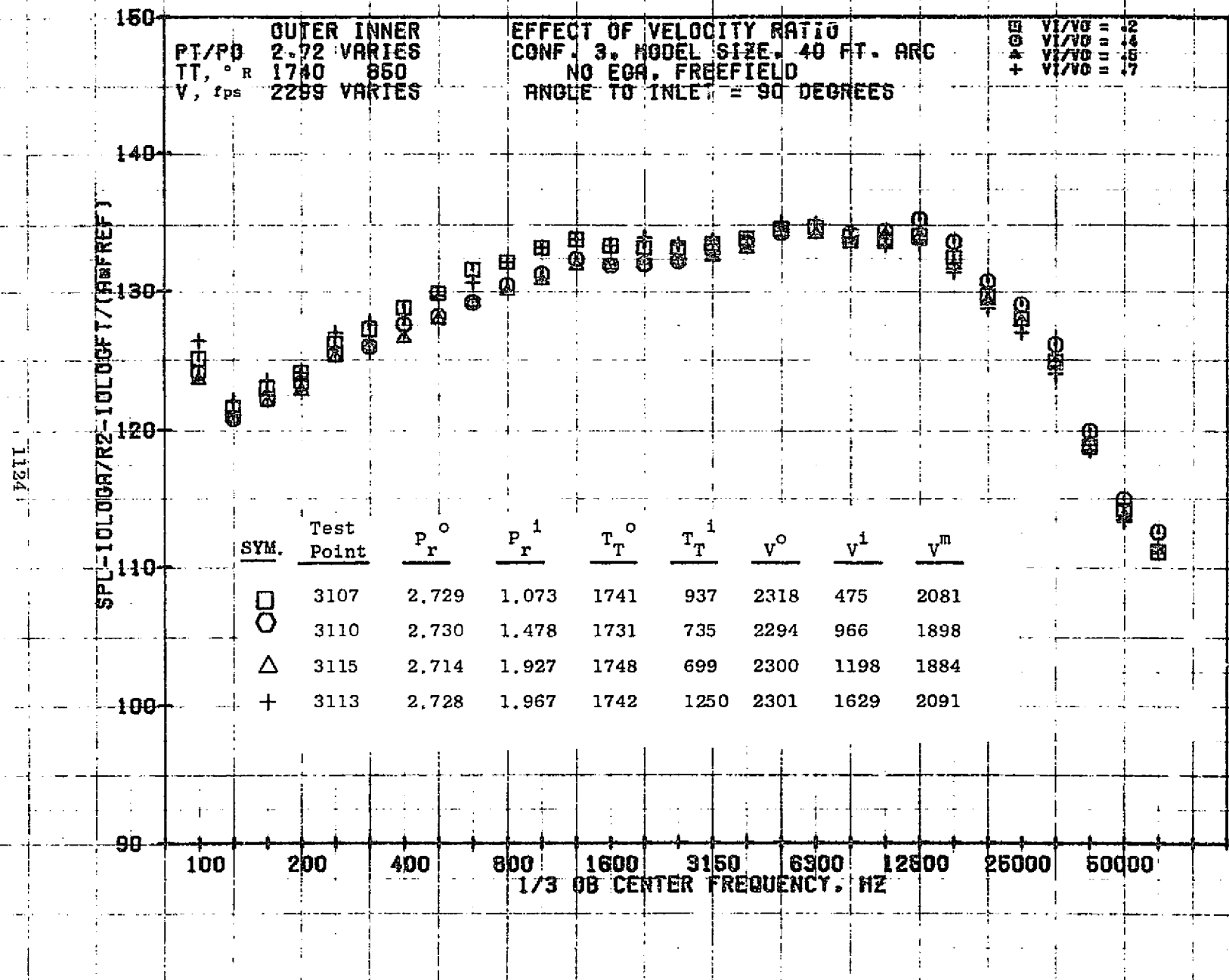
11/01/76
18391-001

79 BURCH A.



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 1B391-001

79 BURCH A.

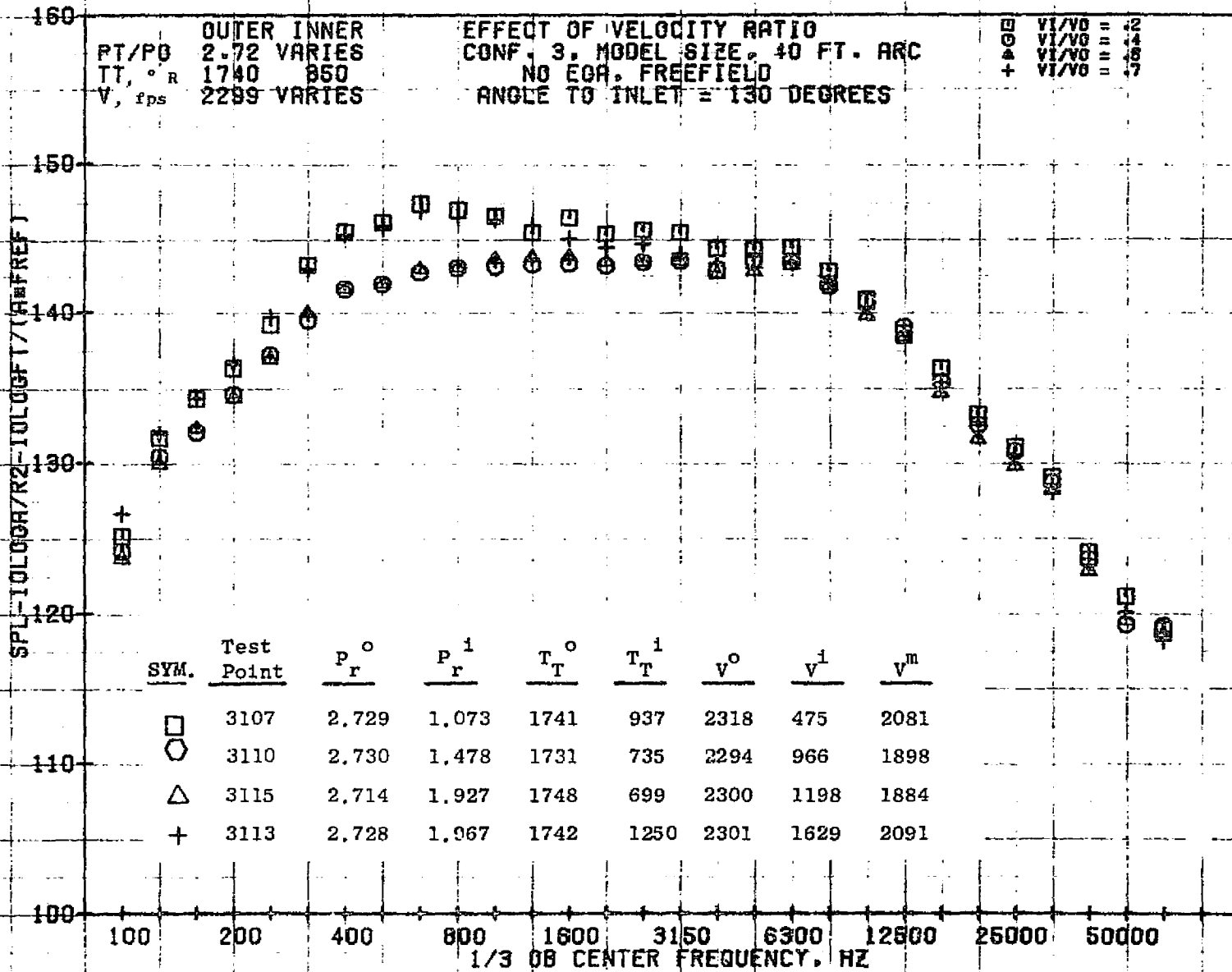


OUTER INNER
 PT/PD 2.72 VARIES
 TT, °R 1740 850
 V, fps 2299 VARIES

EFFECT OF VELOCITY RATIO
 CONF. 3. MODEL SIZE. 40 FT. ARC
 NO EGA, FREEFIELD
 ANGLE TO INLET = 90 DEGREES

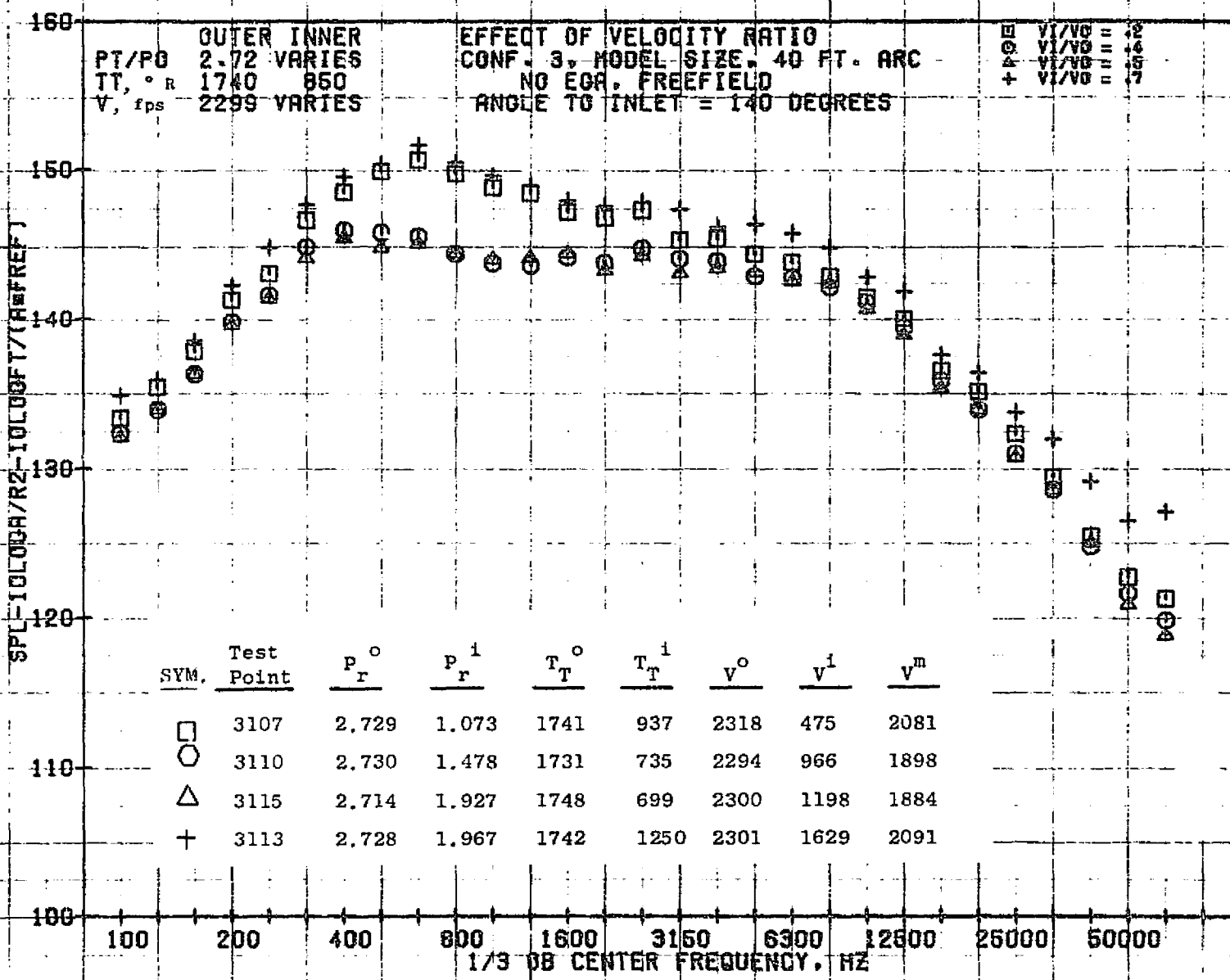
EGA
 + V¹/V⁰ = 1.2
 V¹/V⁰ = 1.4
 V¹/V⁰ = 1.5
 V¹/V⁰ = 1.7

SYM.	Test Point	P _r ⁰	P _r ¹	T _T ⁰	T _T ¹	V ⁰	V ¹	V ^m
□	3107	2.729	1.073	1741	937	2318	475	2081
○	3110	2.730	1.478	1731	735	2294	966	1898
△	3115	2.714	1.927	1748	699	2300	1198	1884
+	3113	2.728	1.967	1742	1250	2301	1629	2091



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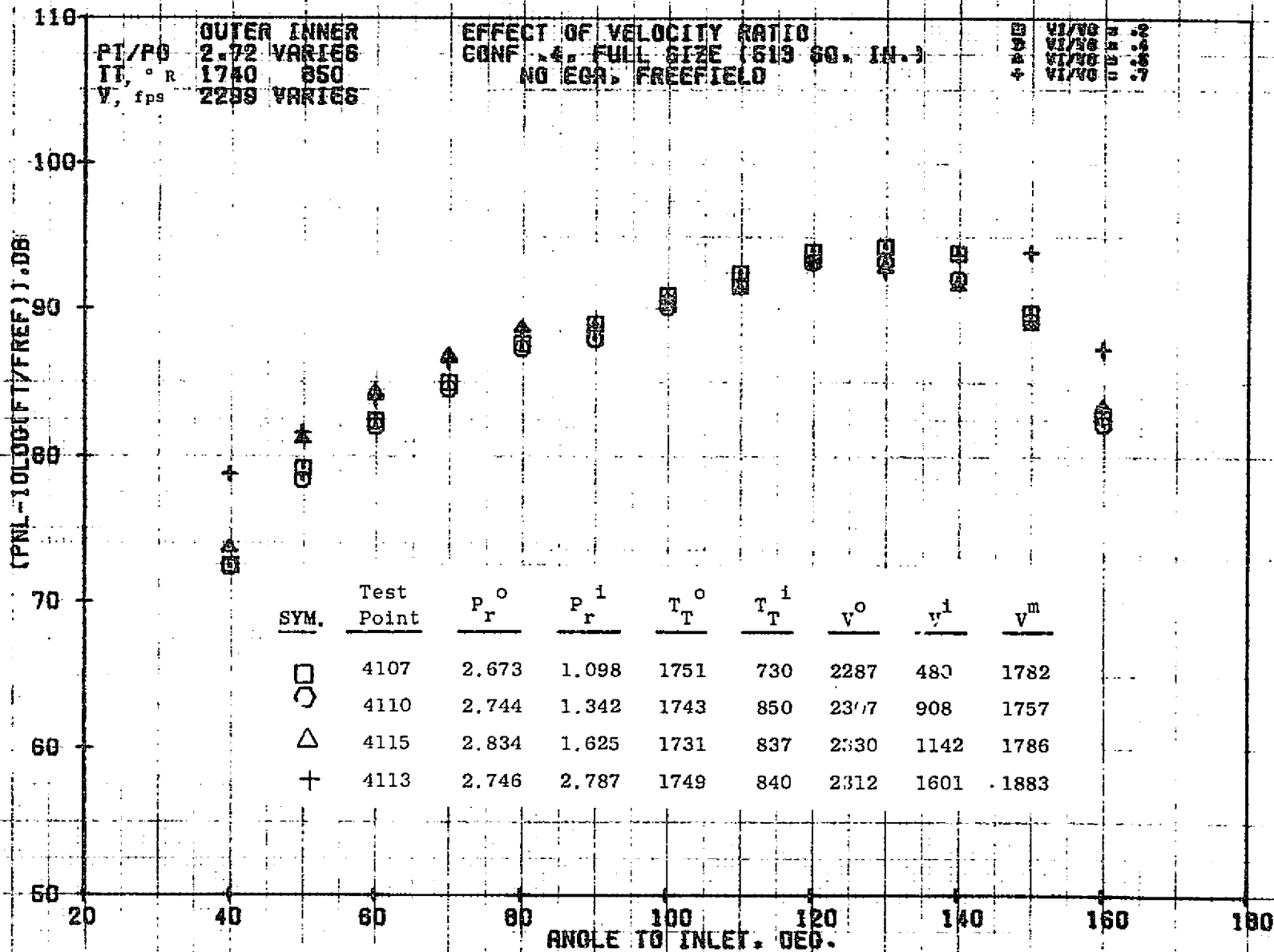
79 BURCH A.



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18391-001

79 BURCH A.

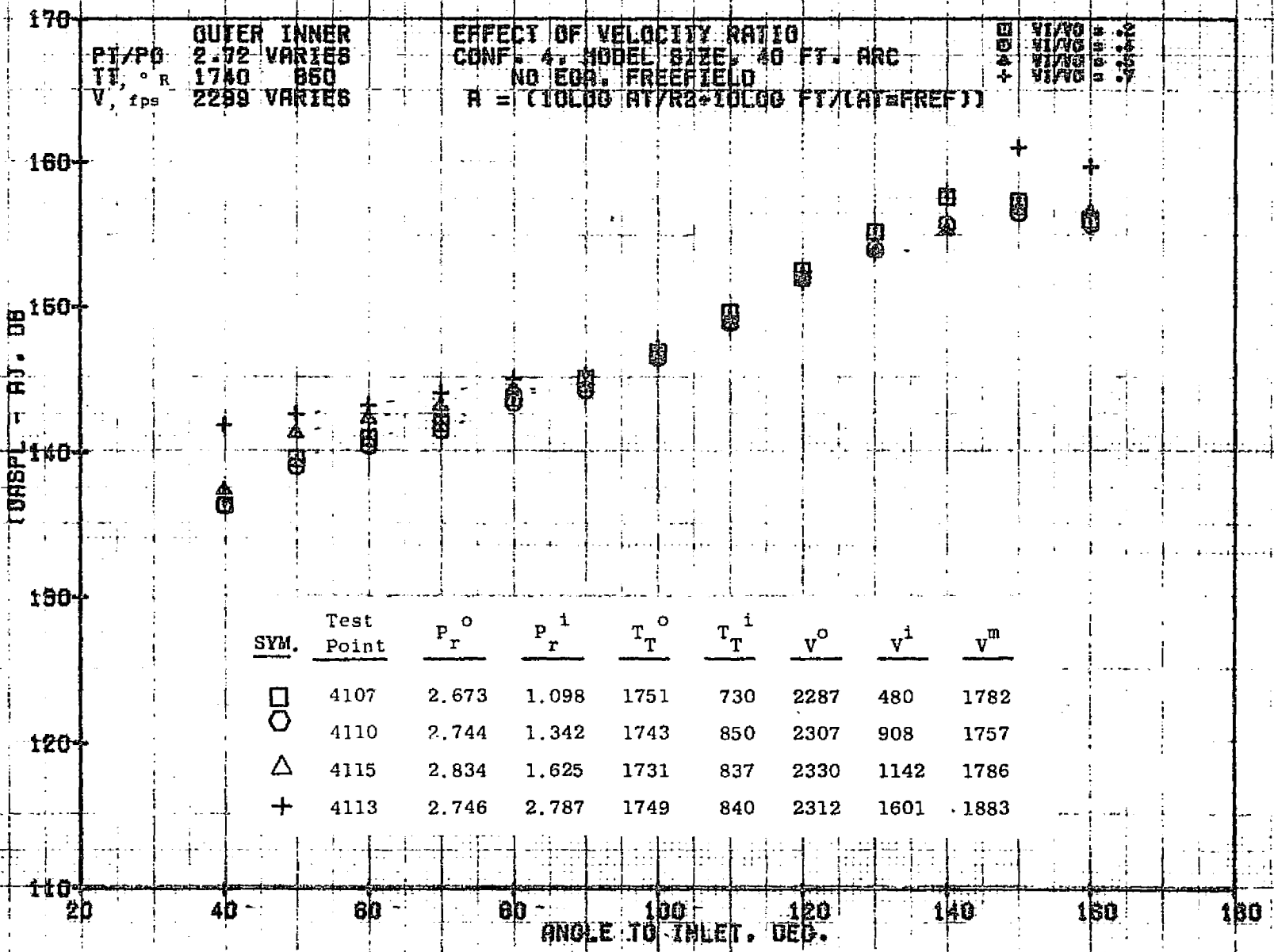
1127

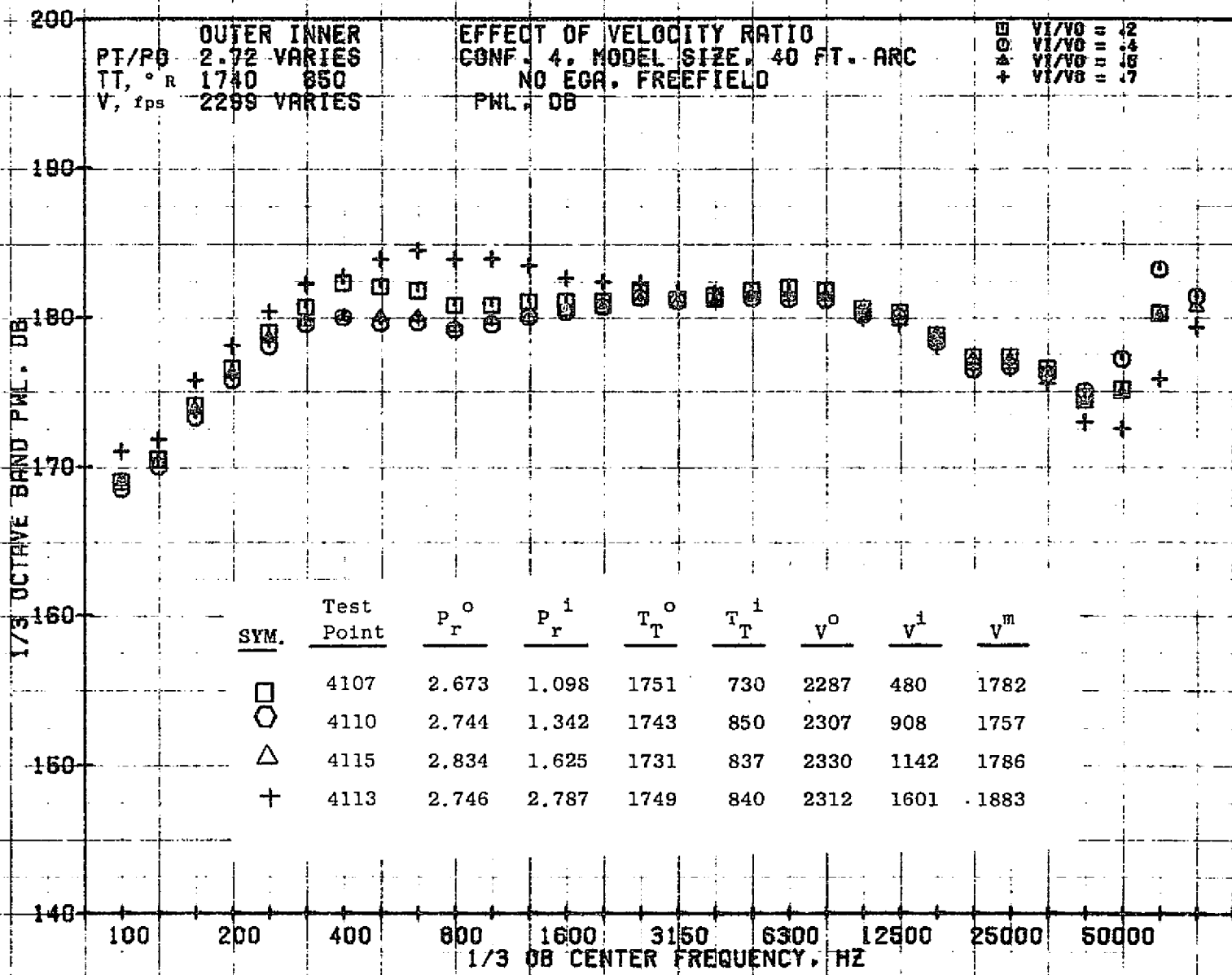


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 18421-001

79 BURCH A.

1128

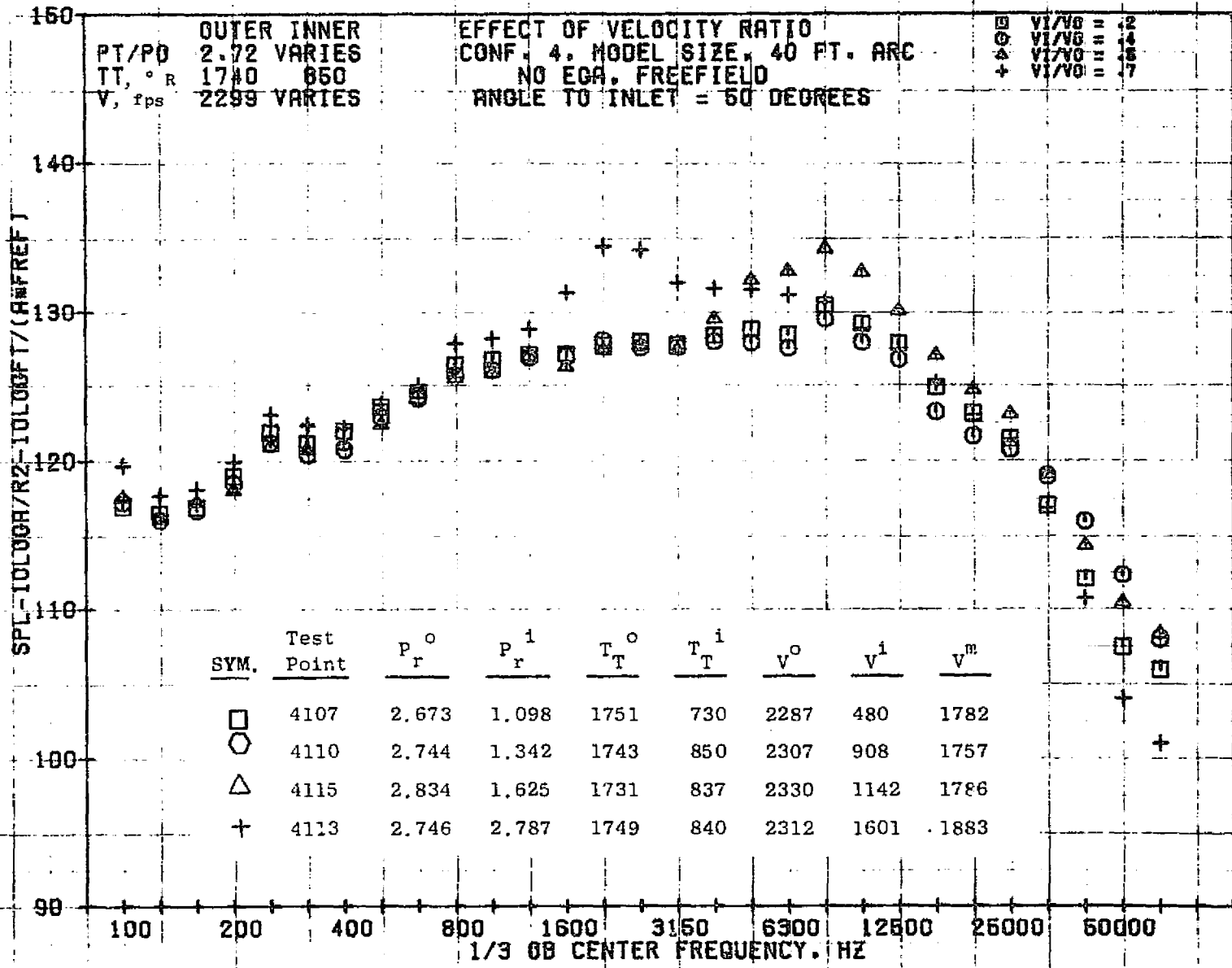




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79 BURCH A.

1130



PT/PD 2.72 VARIES
 TT, ° R 1740 650
 V, fps 2299 VARIES

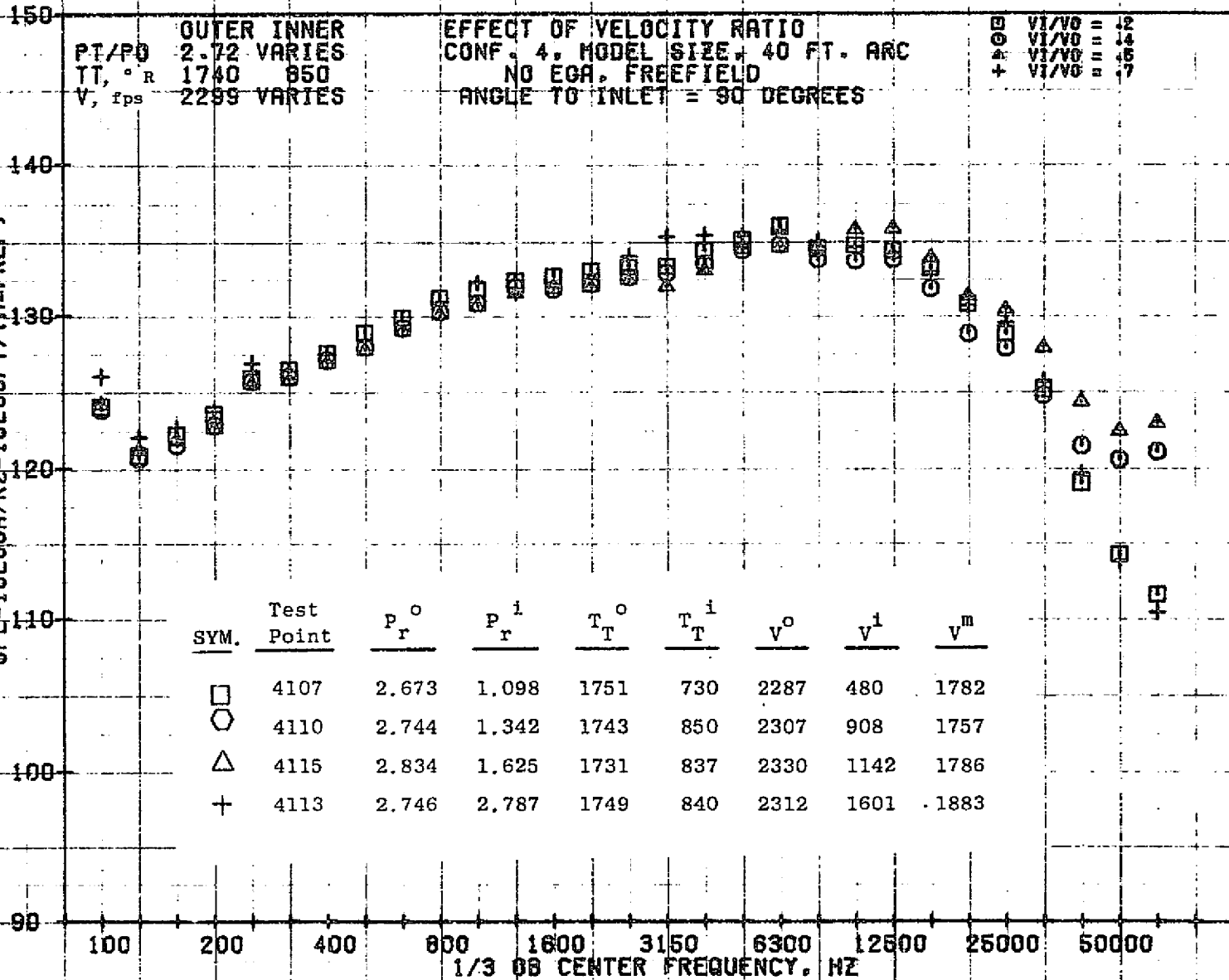
EFFECT OF VELOCITY RATIO
 CONF. 4, MODEL SIZE, 40 FT. ARC
 NO EGA, FREEFIELD
 ANGLE TO INLET = 50 DEGREES

□ V1/V0 = .2
 ○ V1/V0 = .4
 △ V1/V0 = .6
 + V1/V0 = .7

SYM.	Test Point	P_r^o	P_r^i	T_T^o	T_T^i	V^o	V^i	V^m
□	4107	2.673	1.098	1751	730	2287	480	1782
○	4110	2.744	1.342	1743	850	2307	908	1757
△	4115	2.834	1.625	1731	837	2330	1142	1786
+	4113	2.746	2.787	1749	840	2312	1601	1883

1131

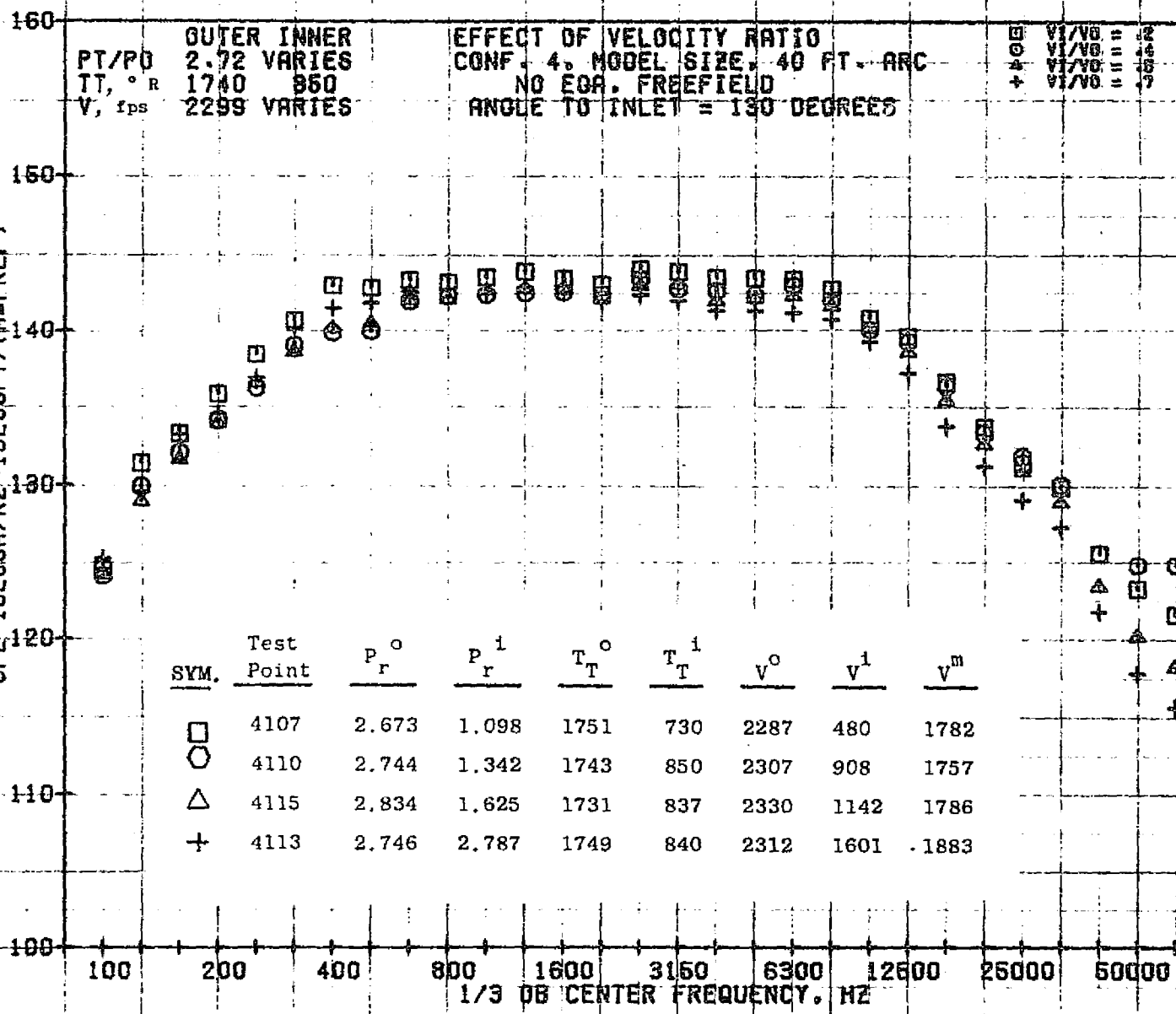
SPL-10LOGH/RZ-10LOGFT/(REF REF)

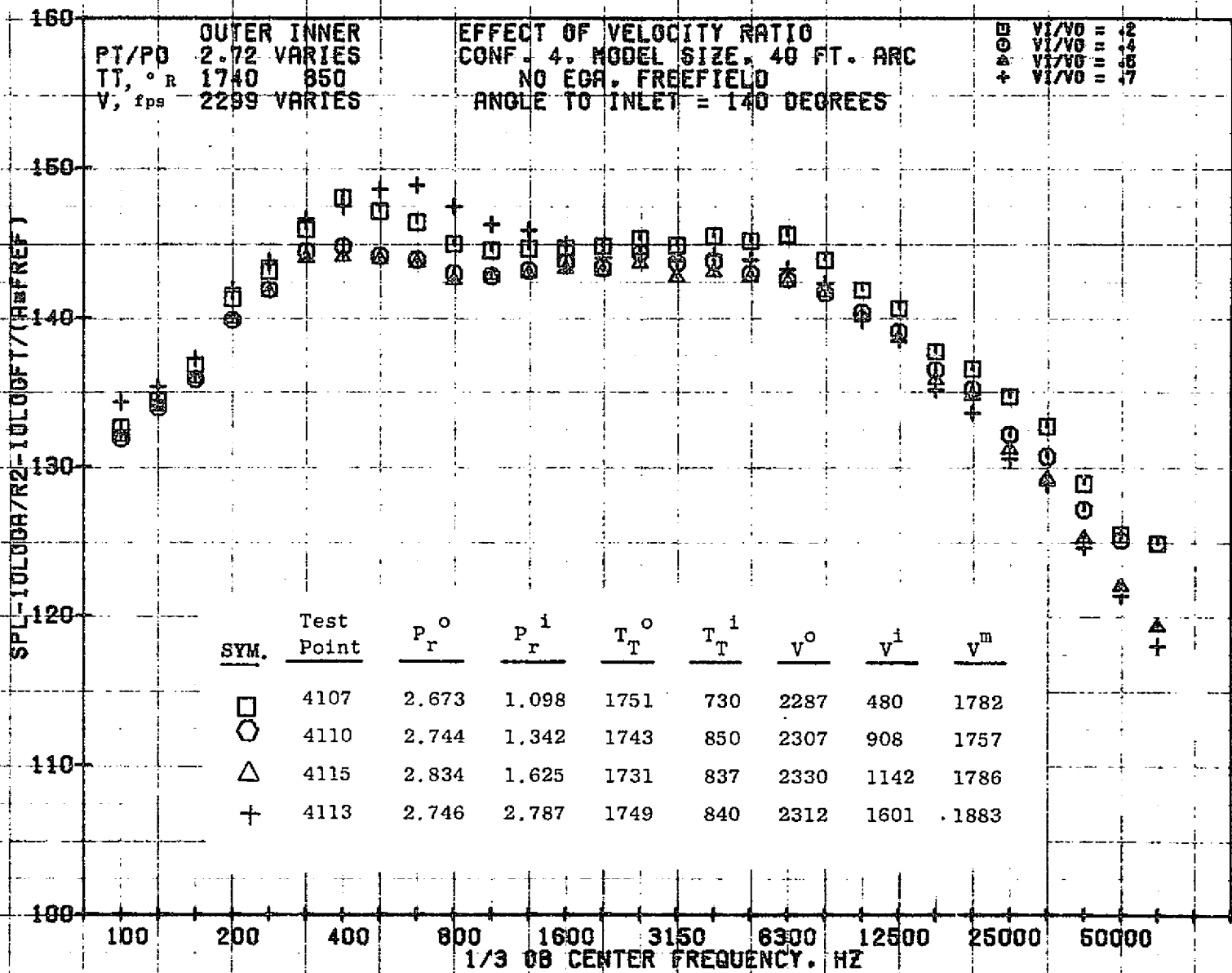
11/01/76
1B391-001

79 BURCH A.

1132

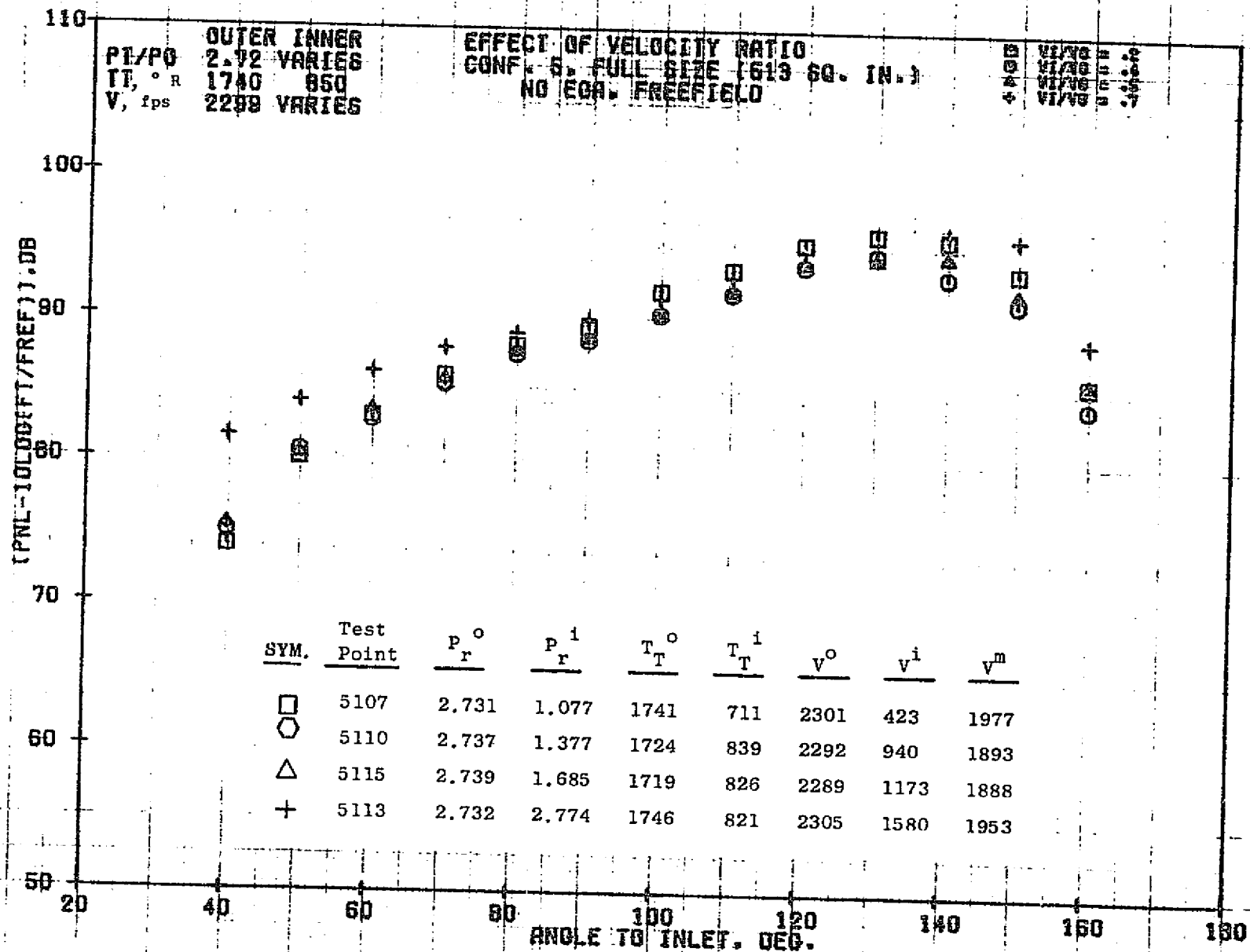
SPL - 10 LOG (P_r^o / R² - 10 LOG (P_rⁱ / (A_R FREQ²))





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18391-001

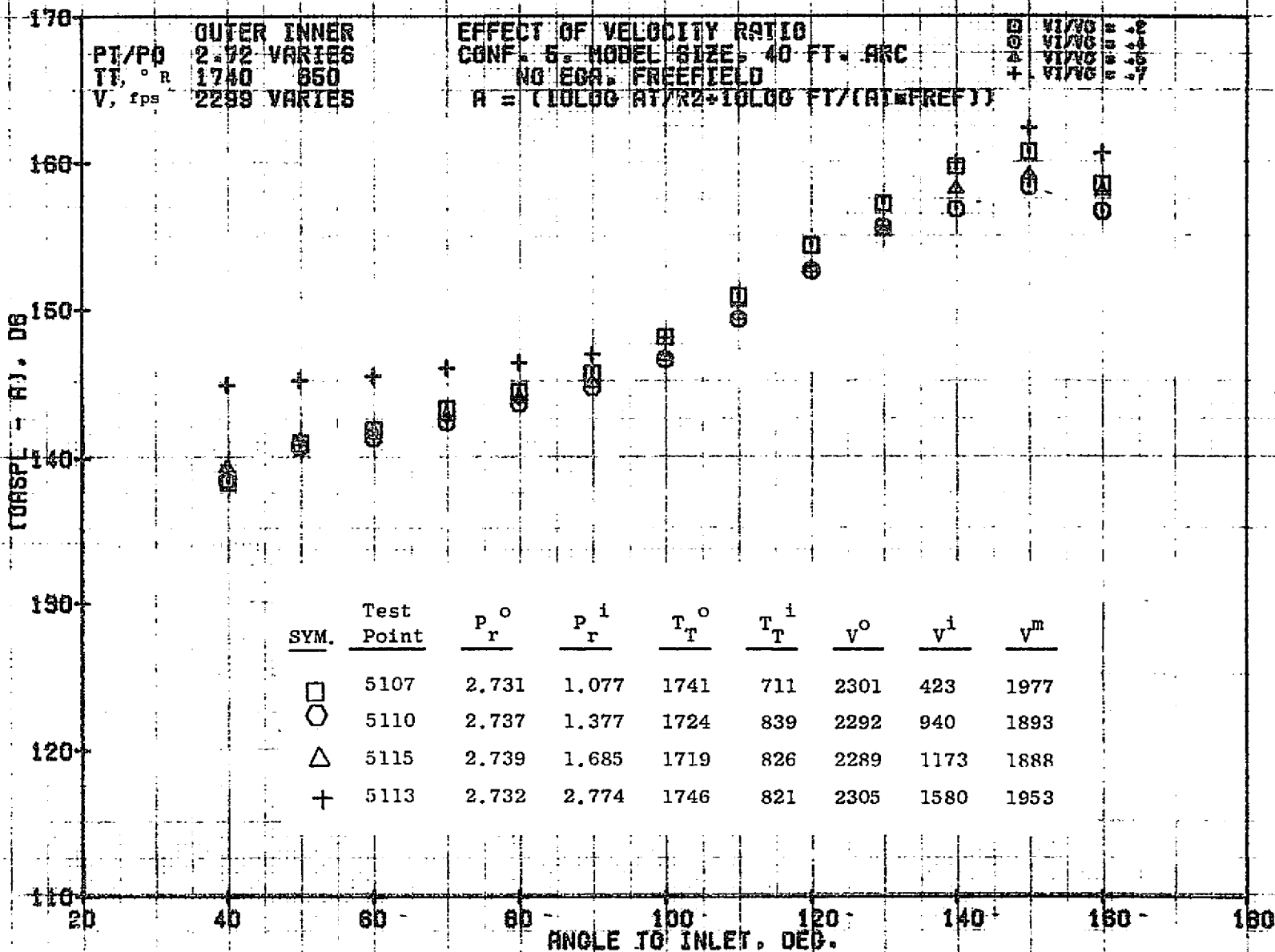
79 BURCH A.



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16421-001

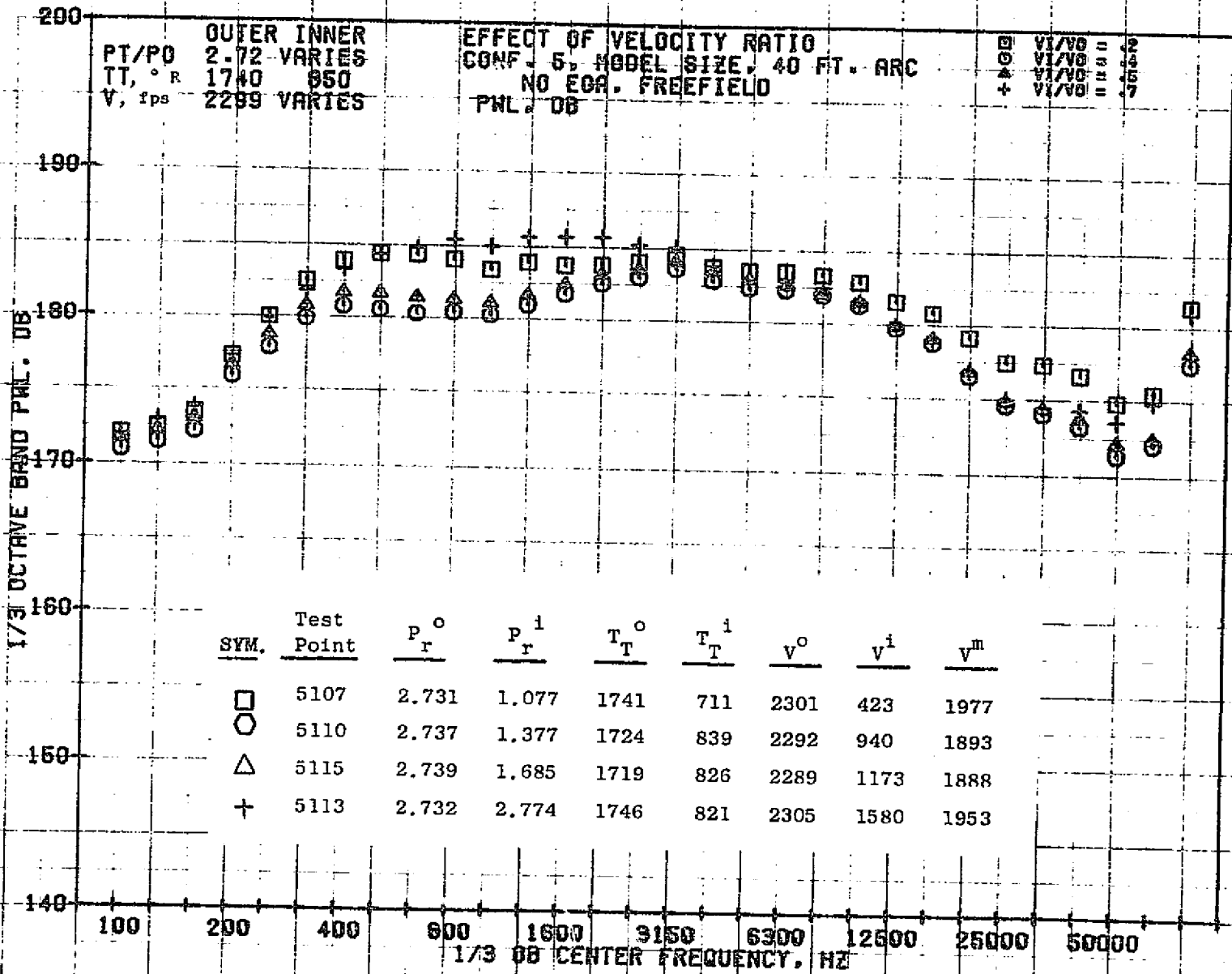
79 BURCH A.

1135



11/09/76
18343-001

79 BURCH A.

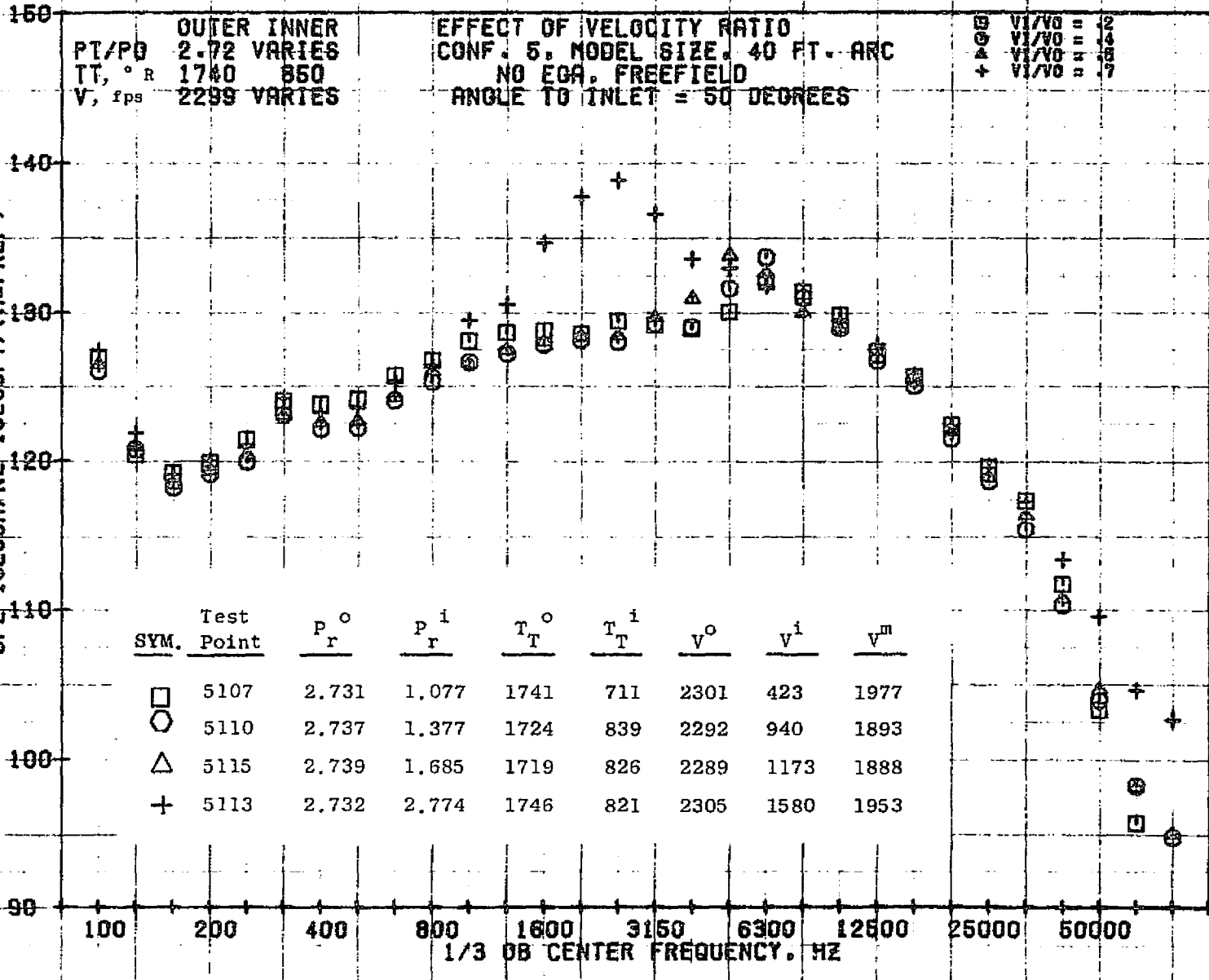


11/01/76
 18391-001

79 BURCH A.

1137

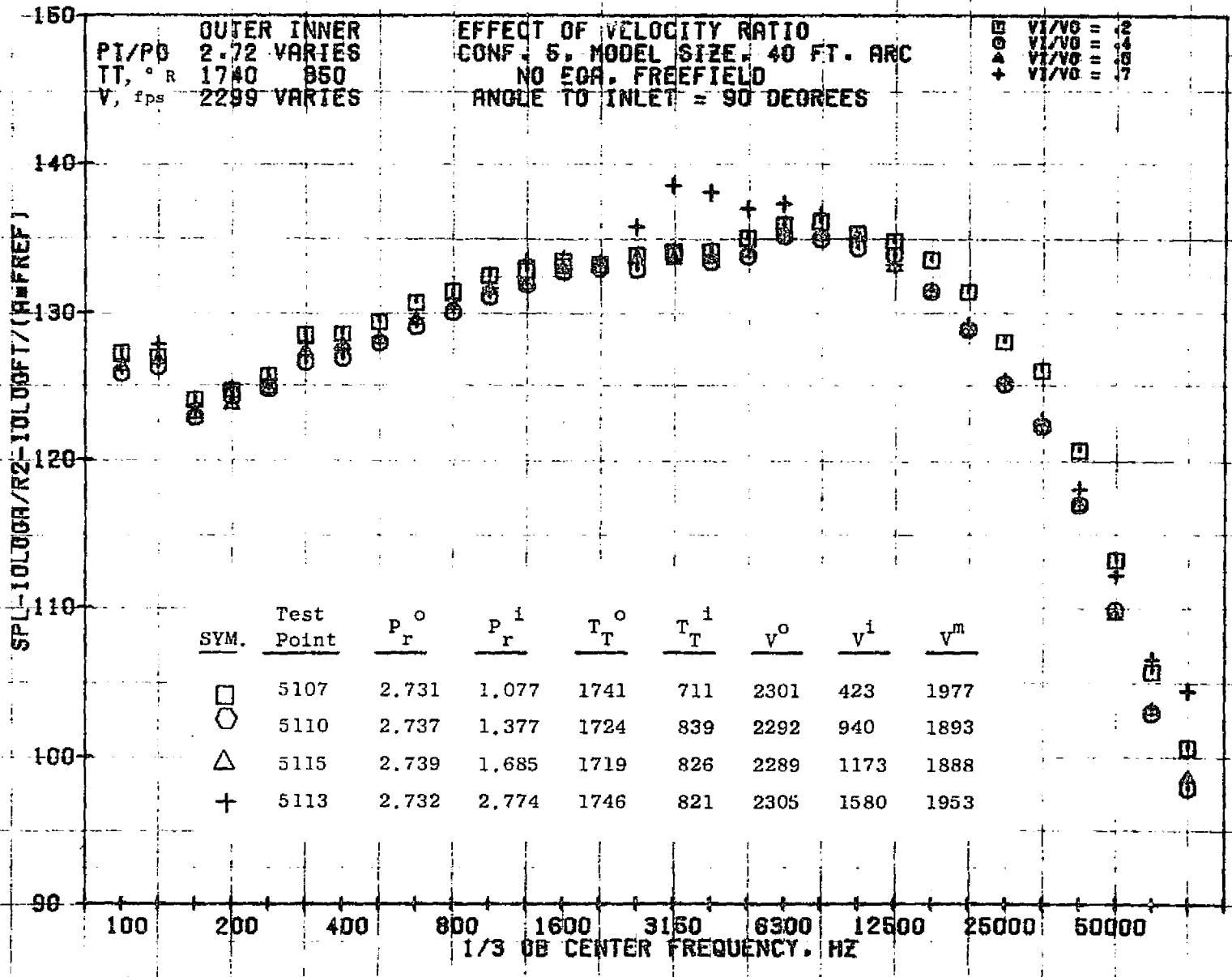
SPL - 10 LOG (P_r^o / R₂ - 10 LOG (P_rⁱ / (R₂ REF)))



11/01/76
 1B391-001

79 BURCH A.

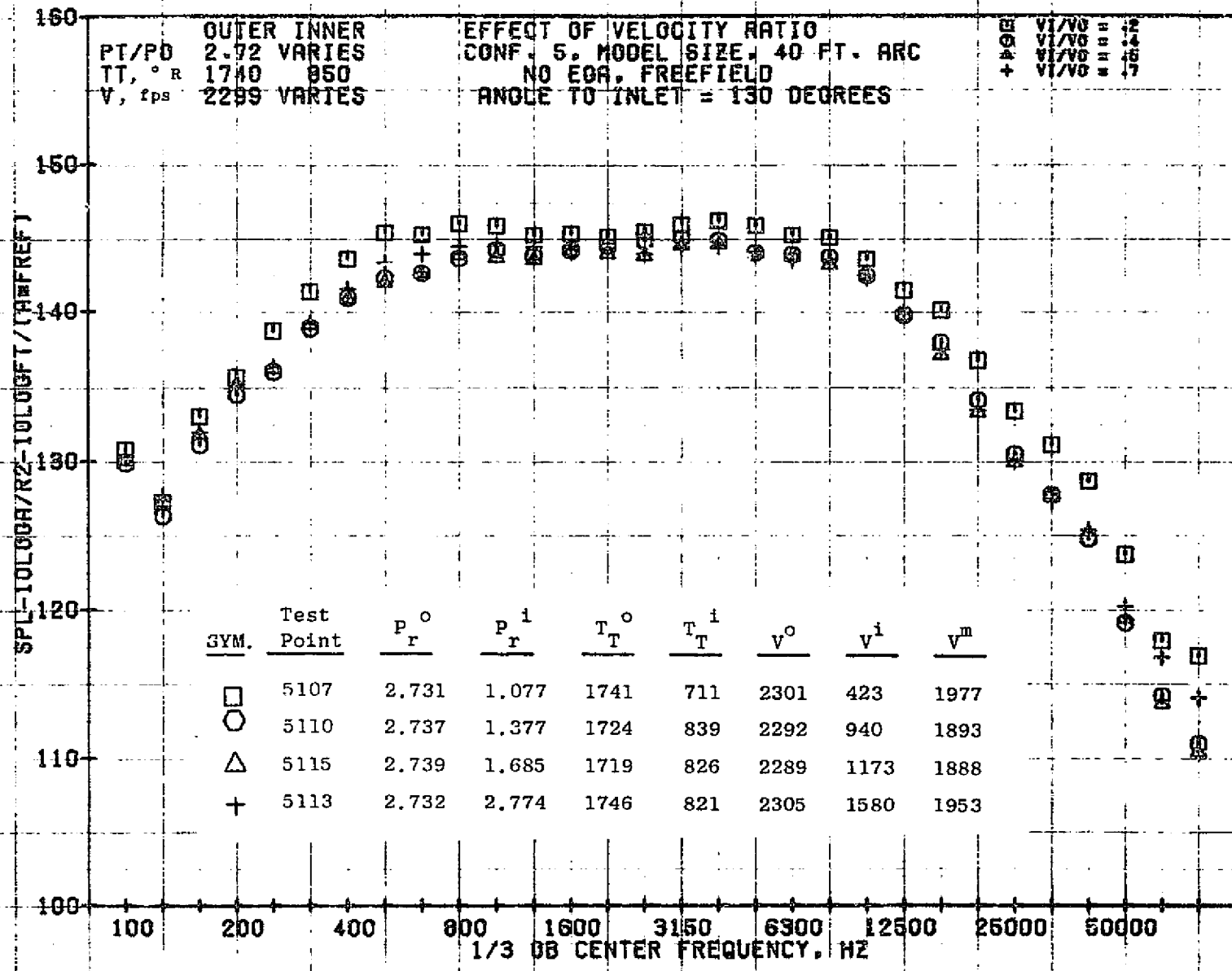
1138



SYM.	Test Point	P_r^o	P_r^i	T_T^o	T_T^i	V^o	V^i	V^m
□	5107	2.731	1.077	1741	711	2301	423	1977
○	5110	2.737	1.377	1724	839	2292	940	1893
△	5115	2.739	1.685	1719	826	2289	1173	1888
+	5113	2.732	2.774	1746	821	2305	1580	1953

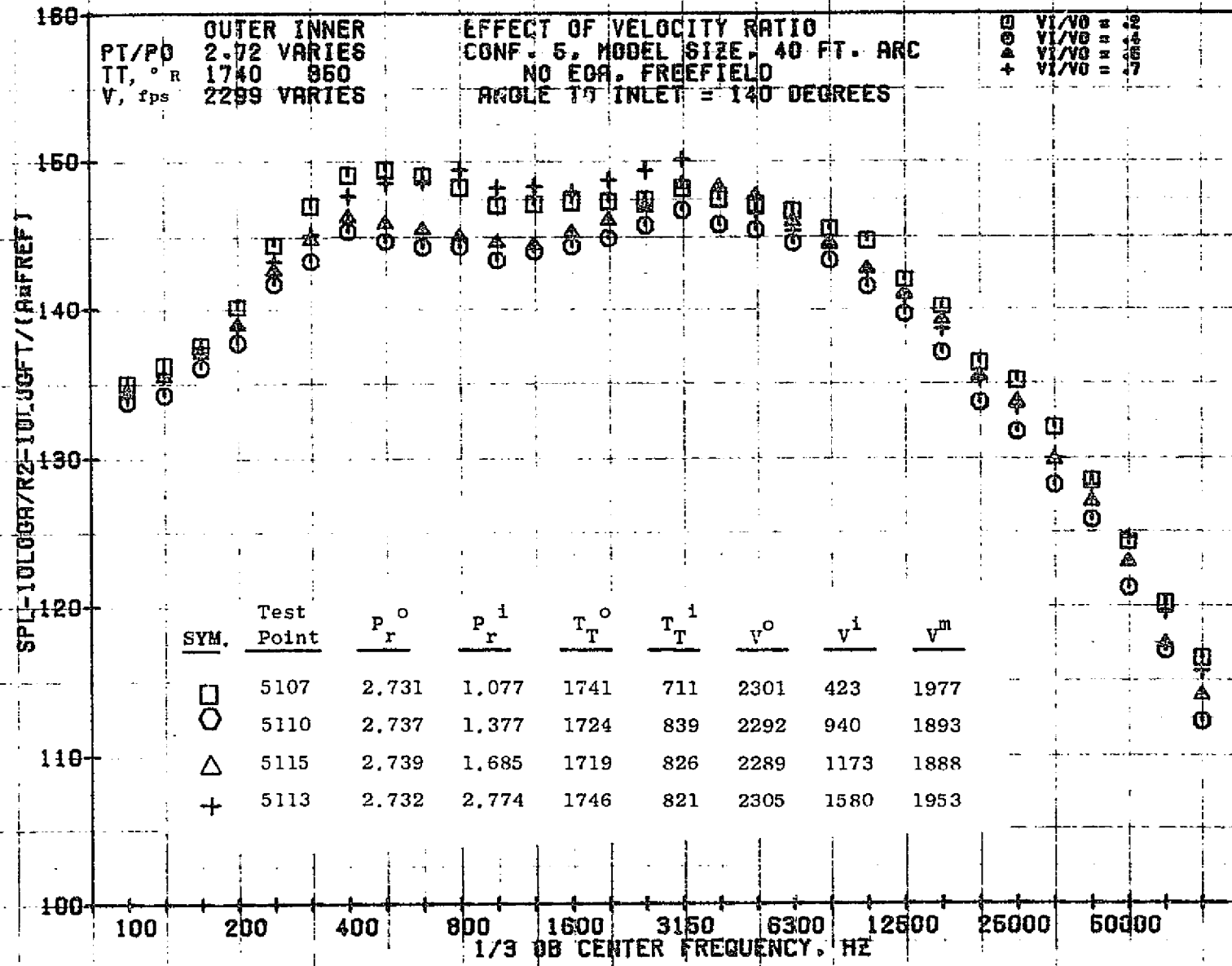
11/01/76
18391-001

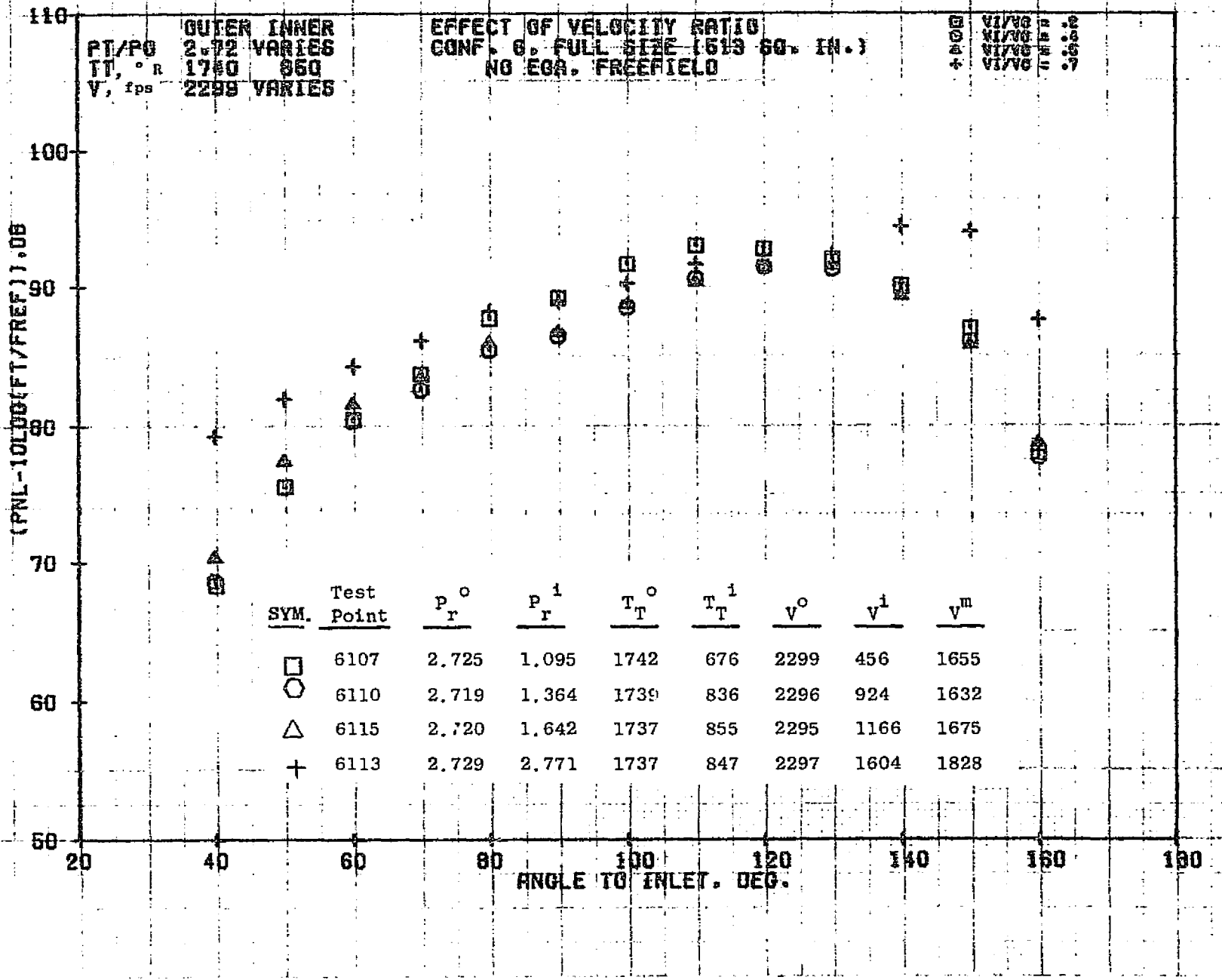
79 BURCH A.



11/01/76
18391-001

79 BURCH A.

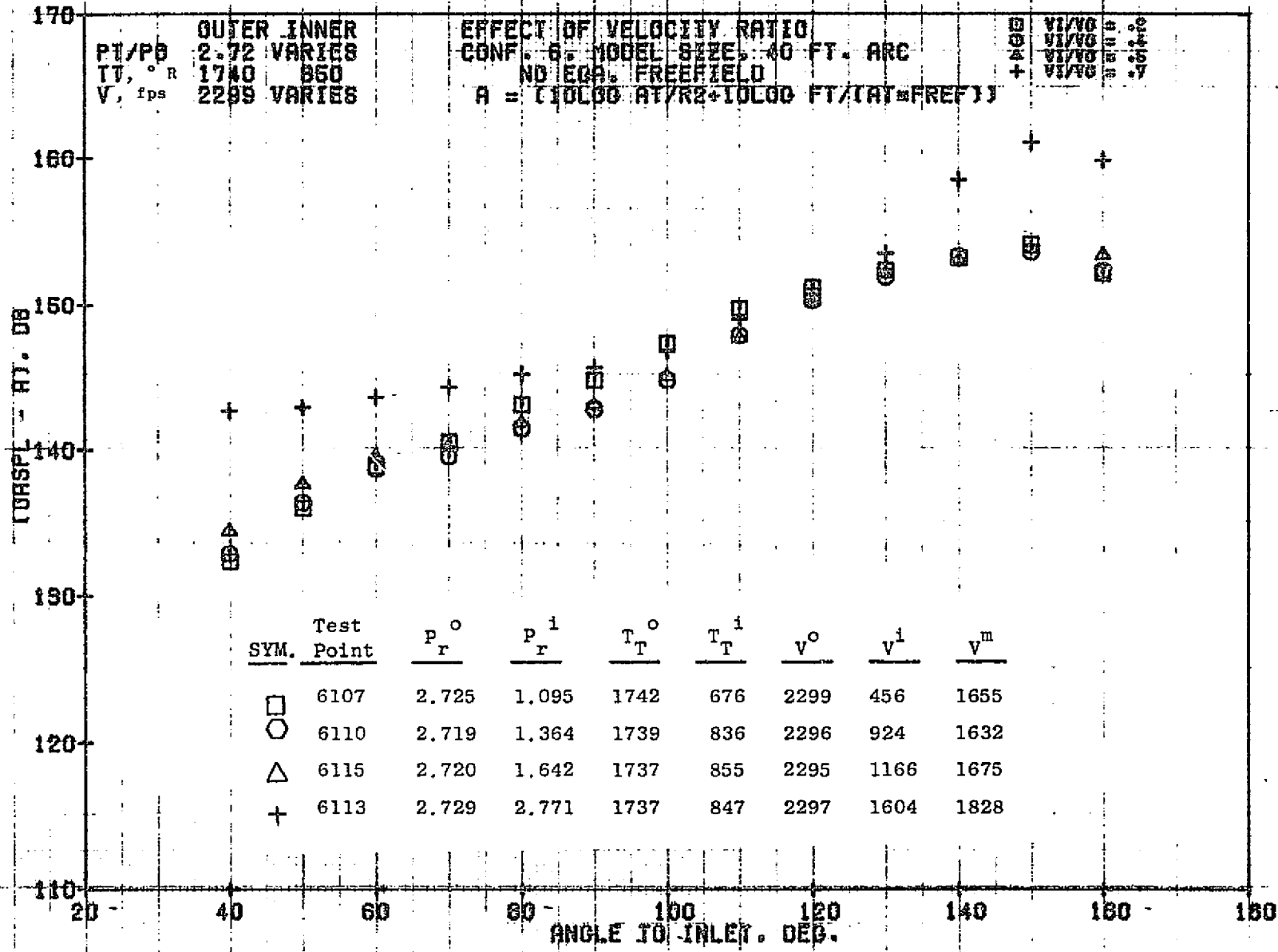




11/01/76
18421-001

79 BURCH A.

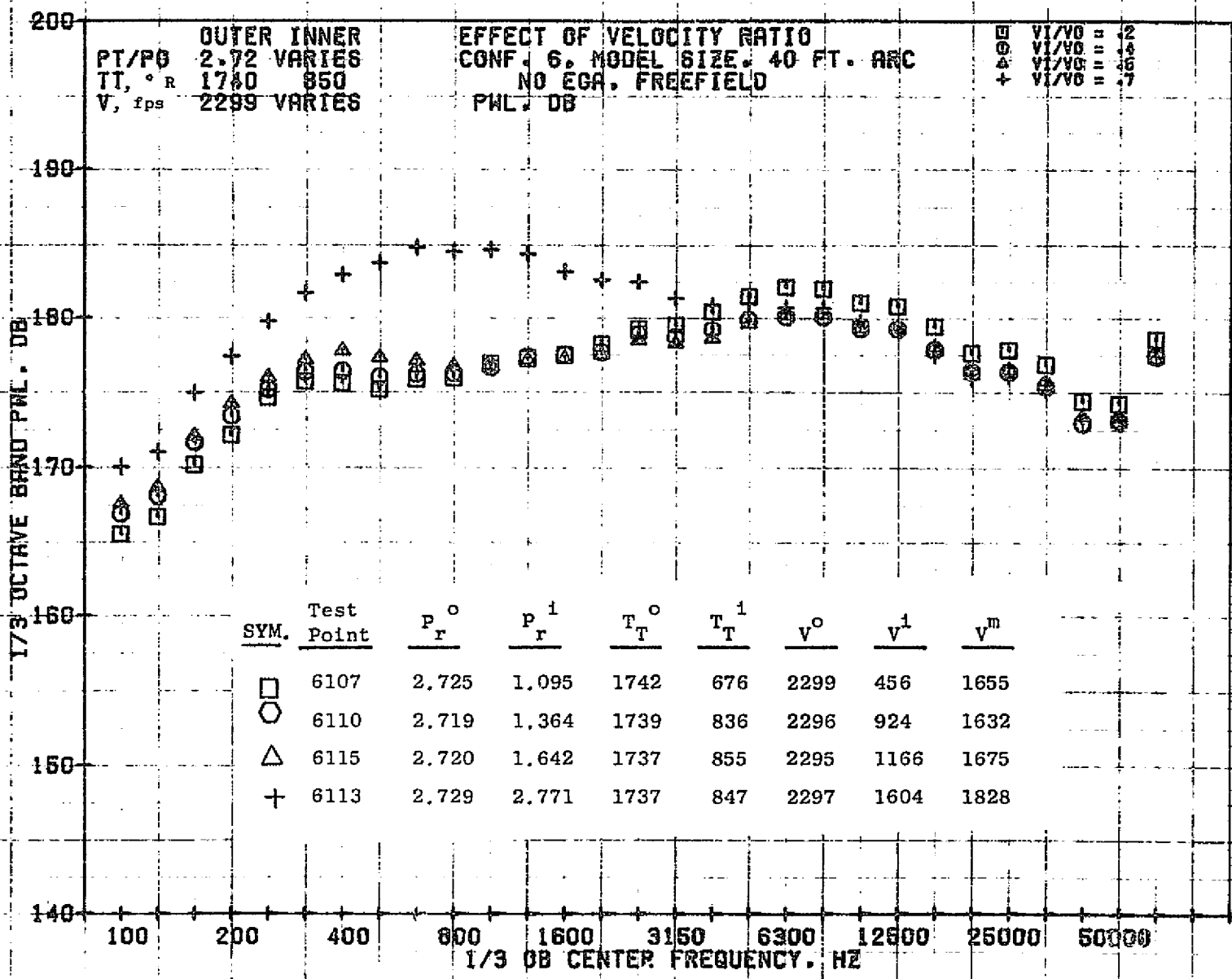
1142



11/09/76
 1R443-001

79 AIRCRAFT

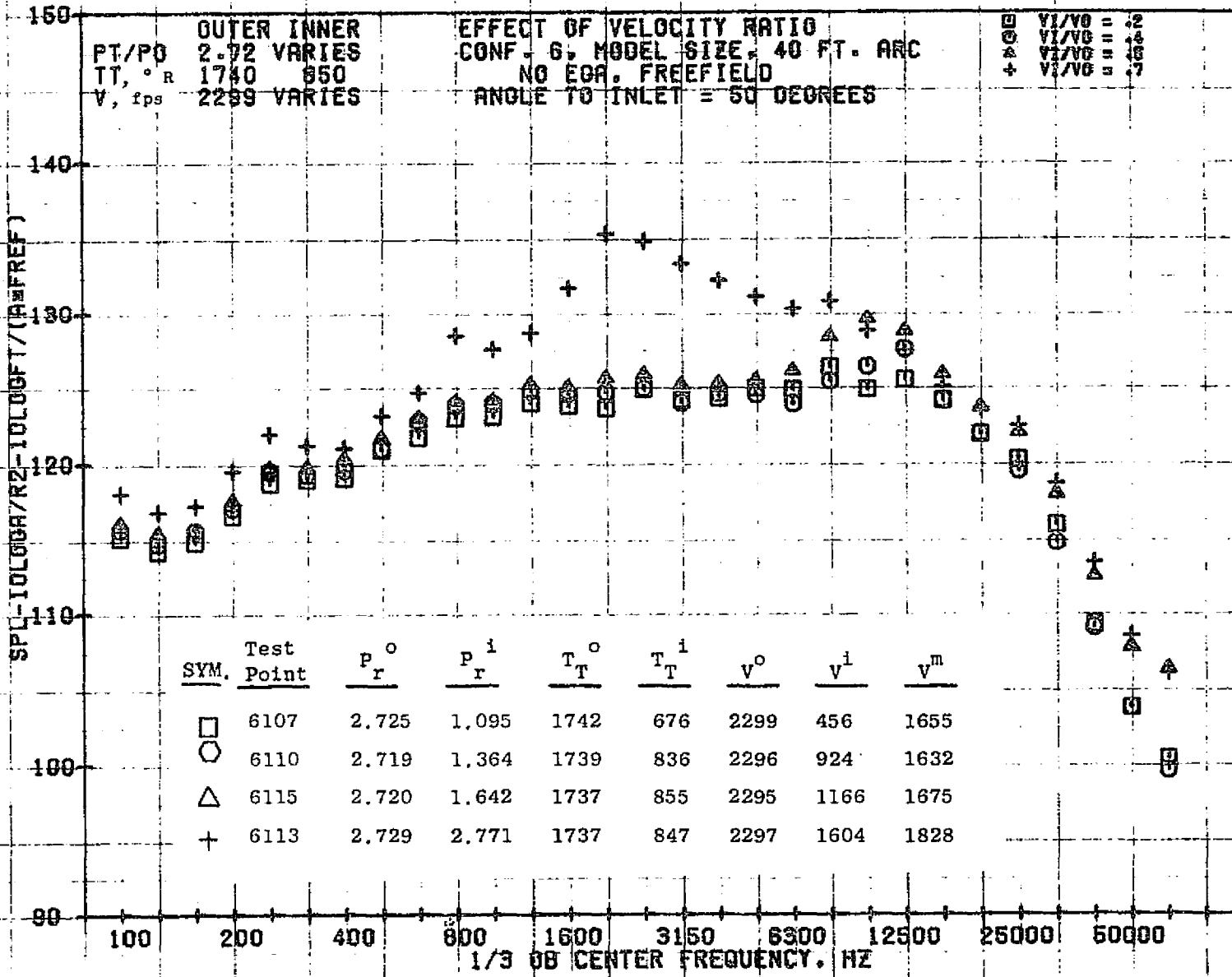
1143



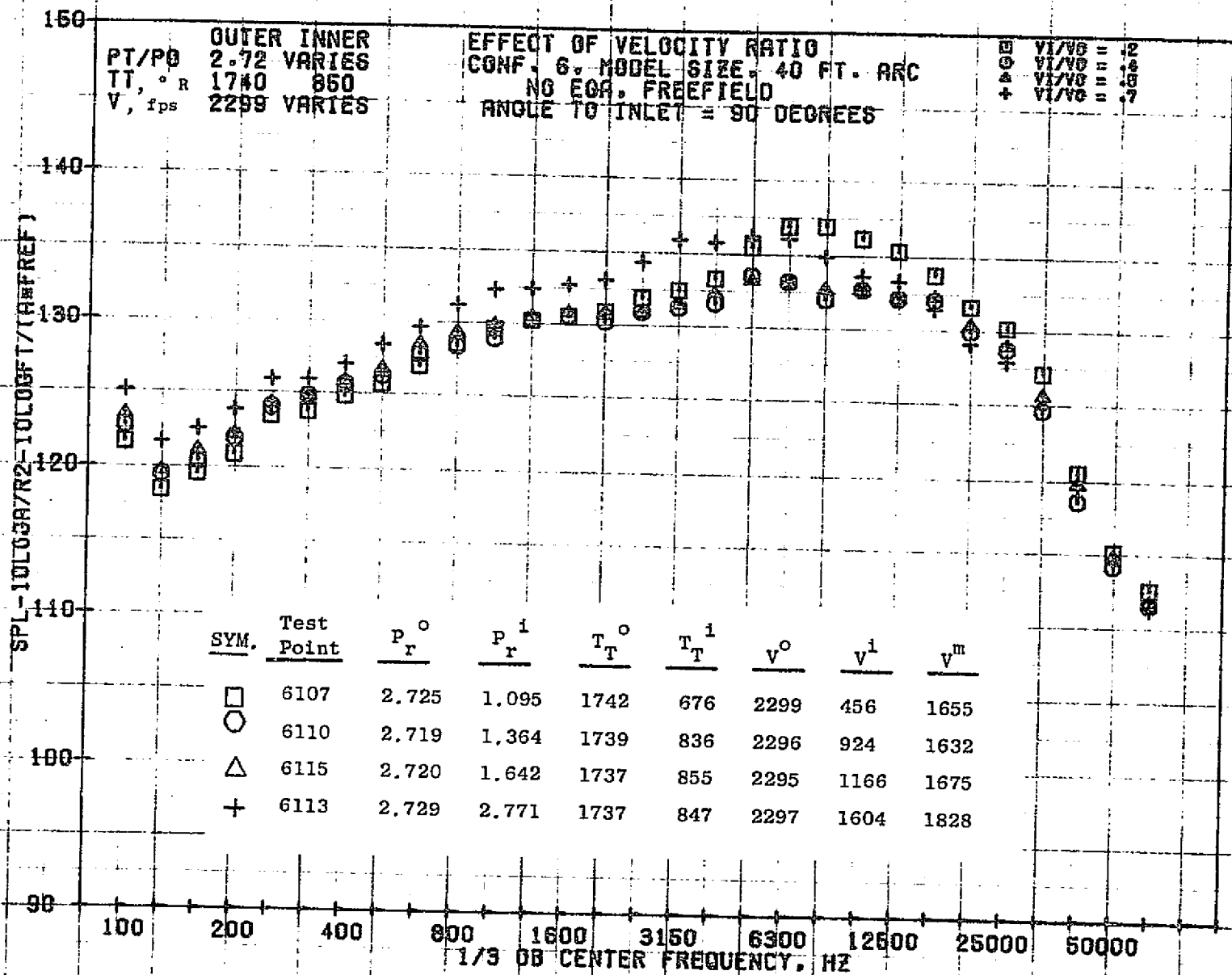
11/01/76
18391-001

79 BURCH A.

1144

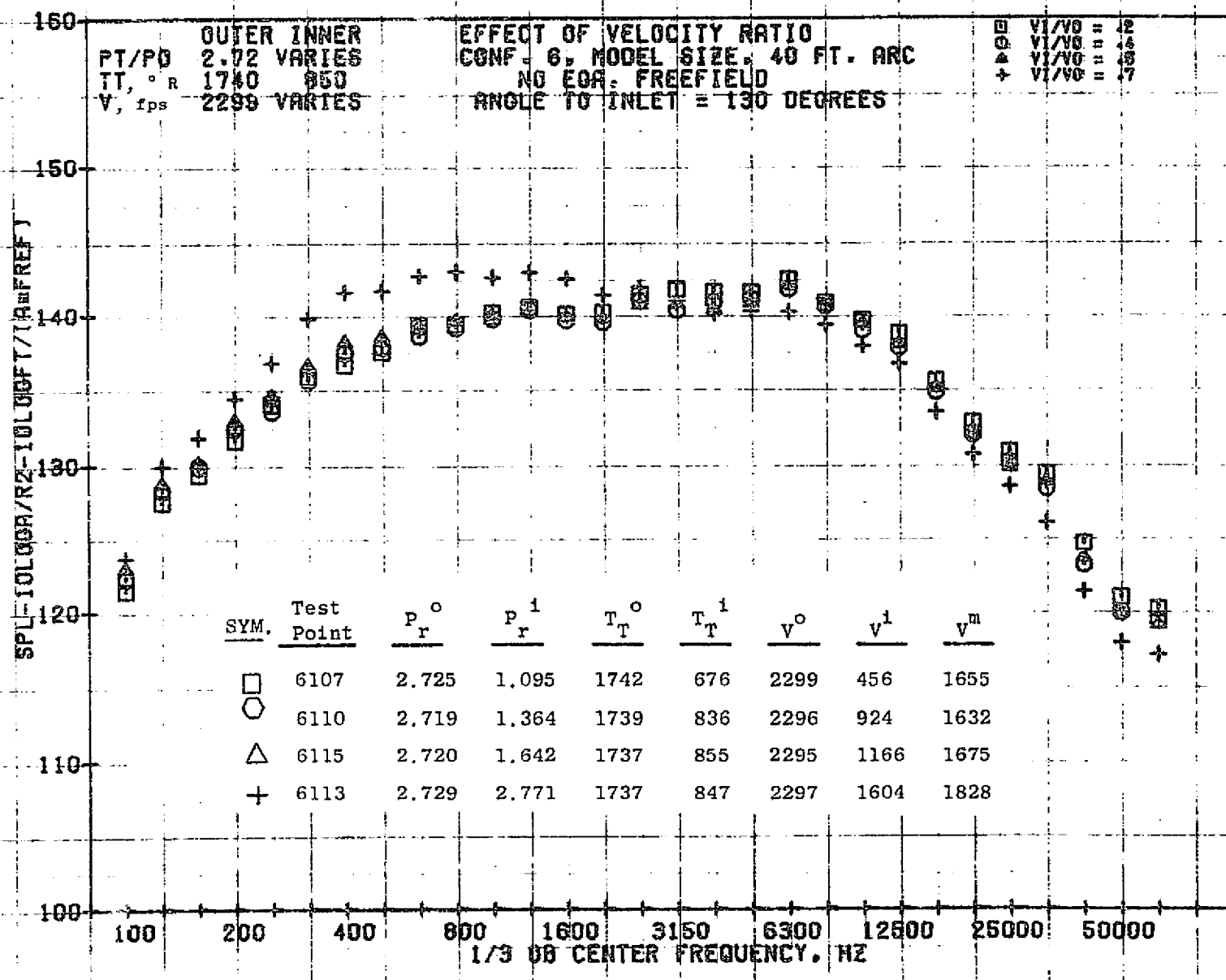


1145



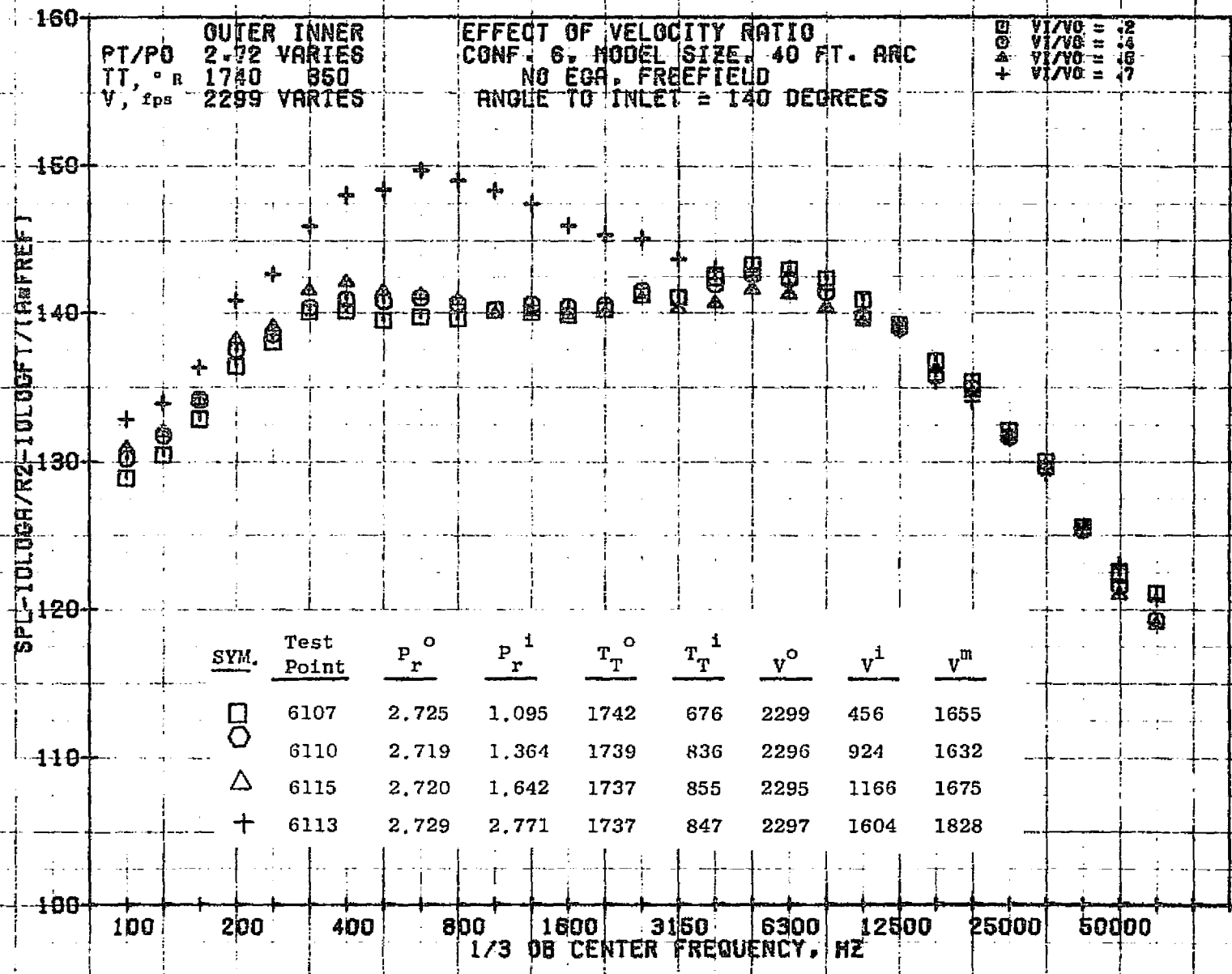
11/01/76
 18391-001

79 BURCH A.

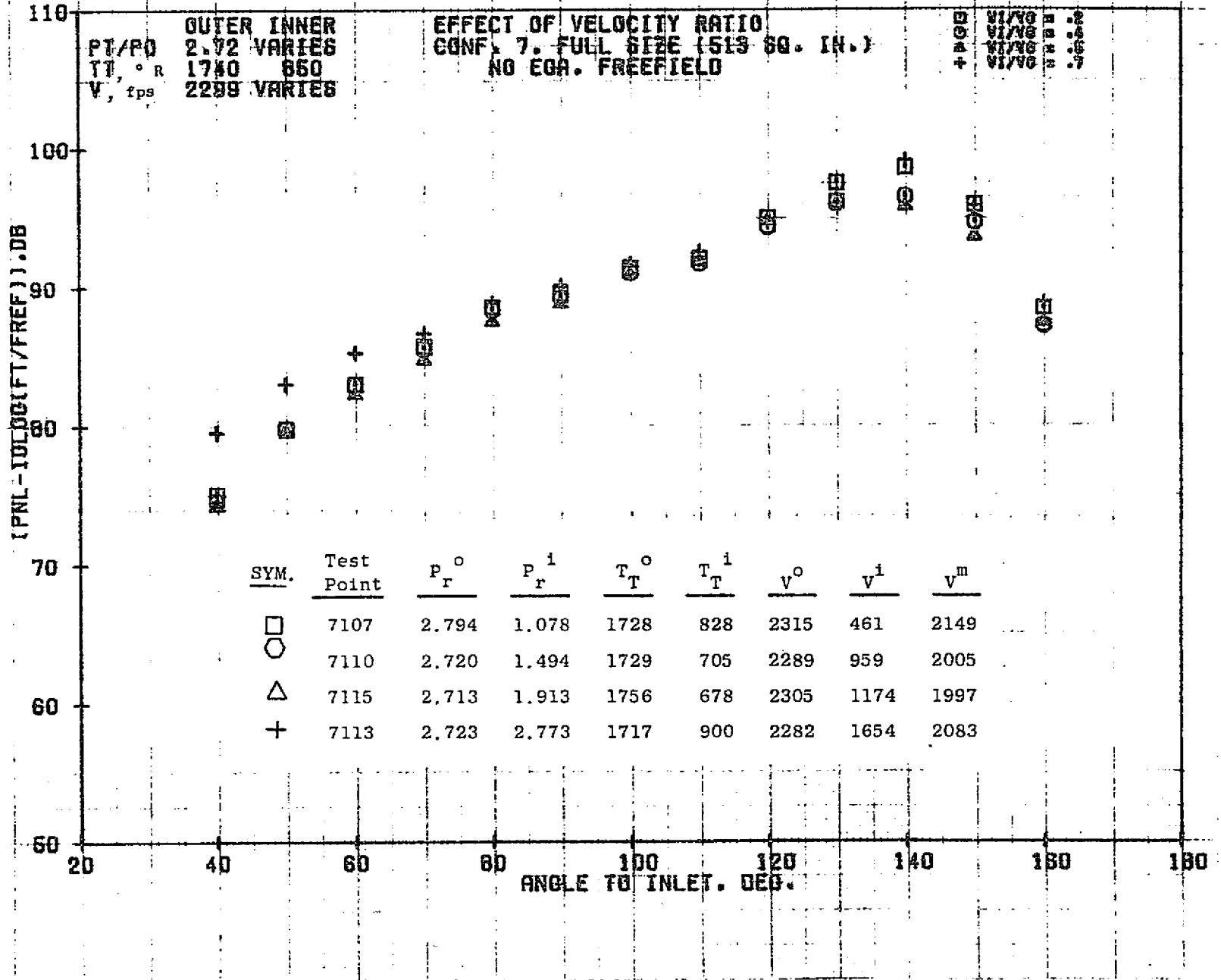


11/01/76
 18391-001

79 BURCH A.

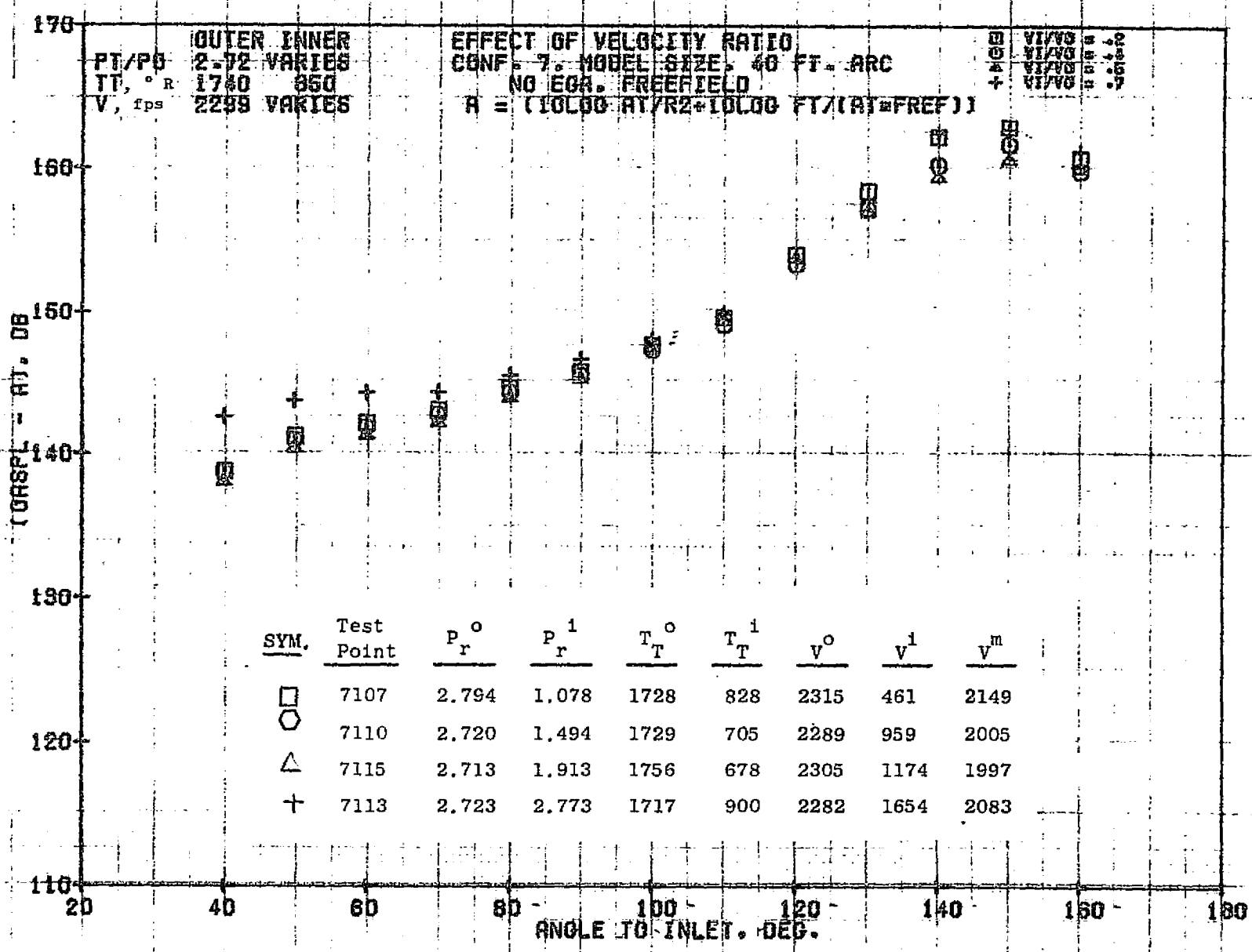


1148



11/01/76
18421-001

79 BURCH A.

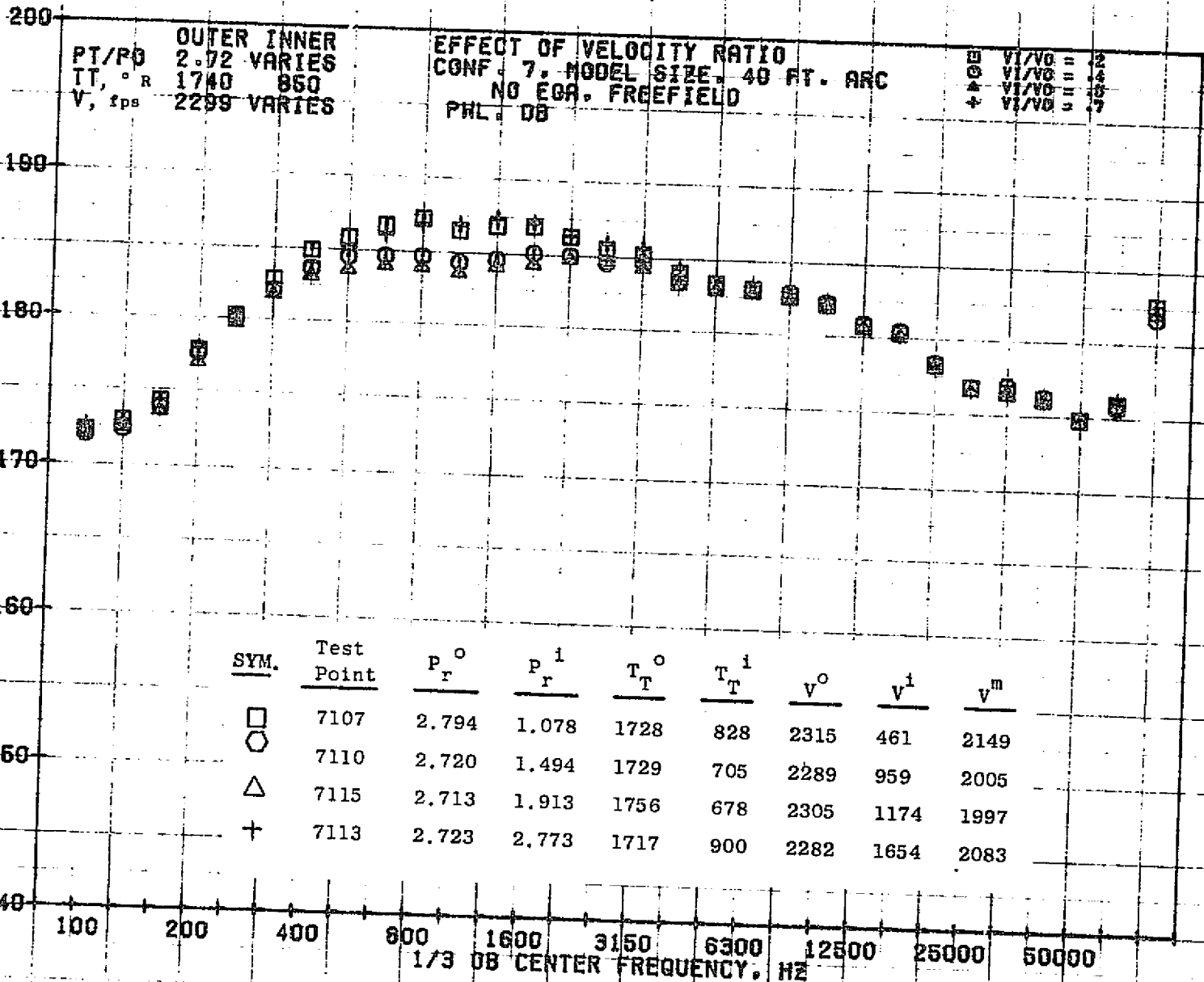


11/09/76
1R343-001

79 AIRCRAFT

1150

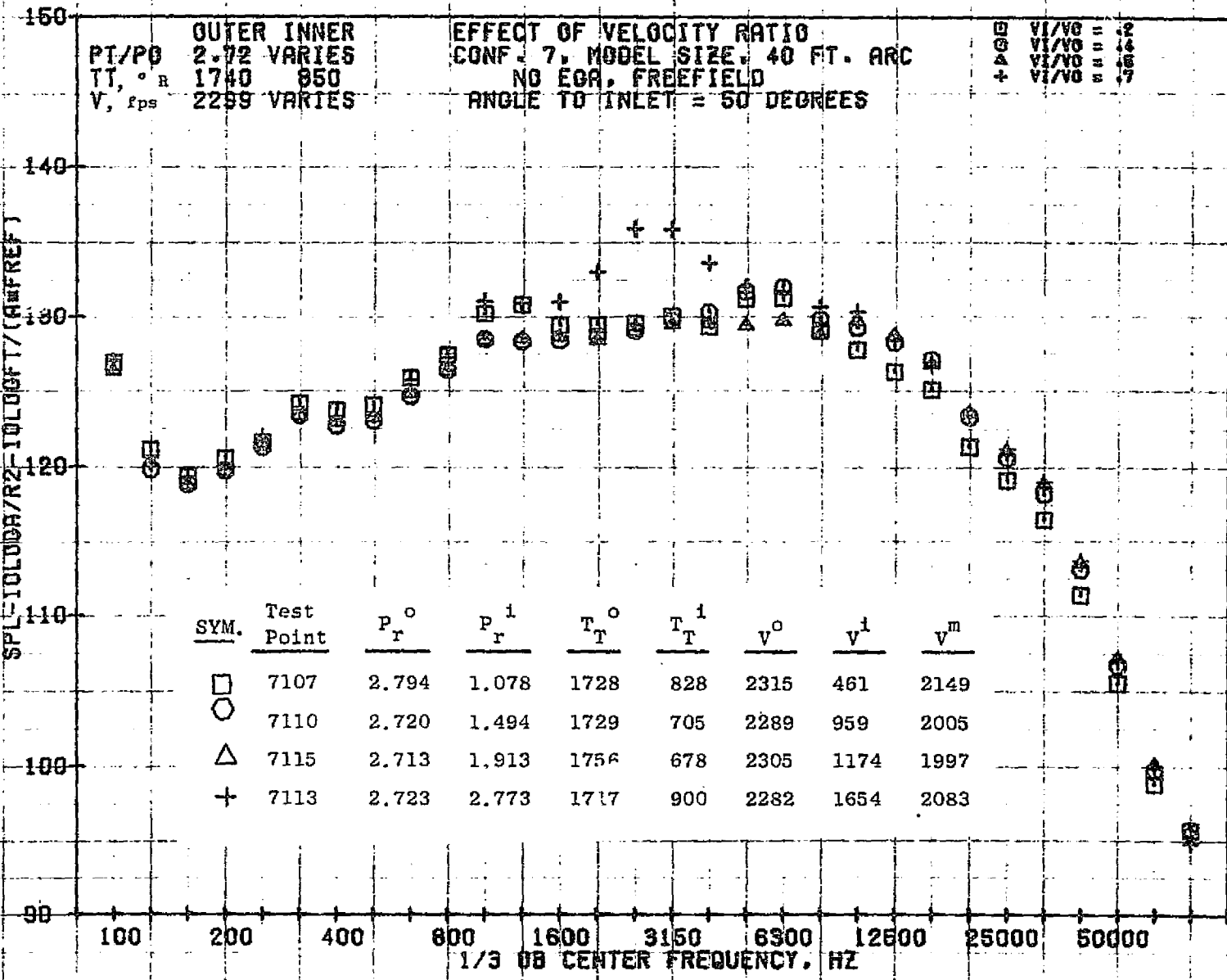
1/3 OCTAVE BAND PNL, DB

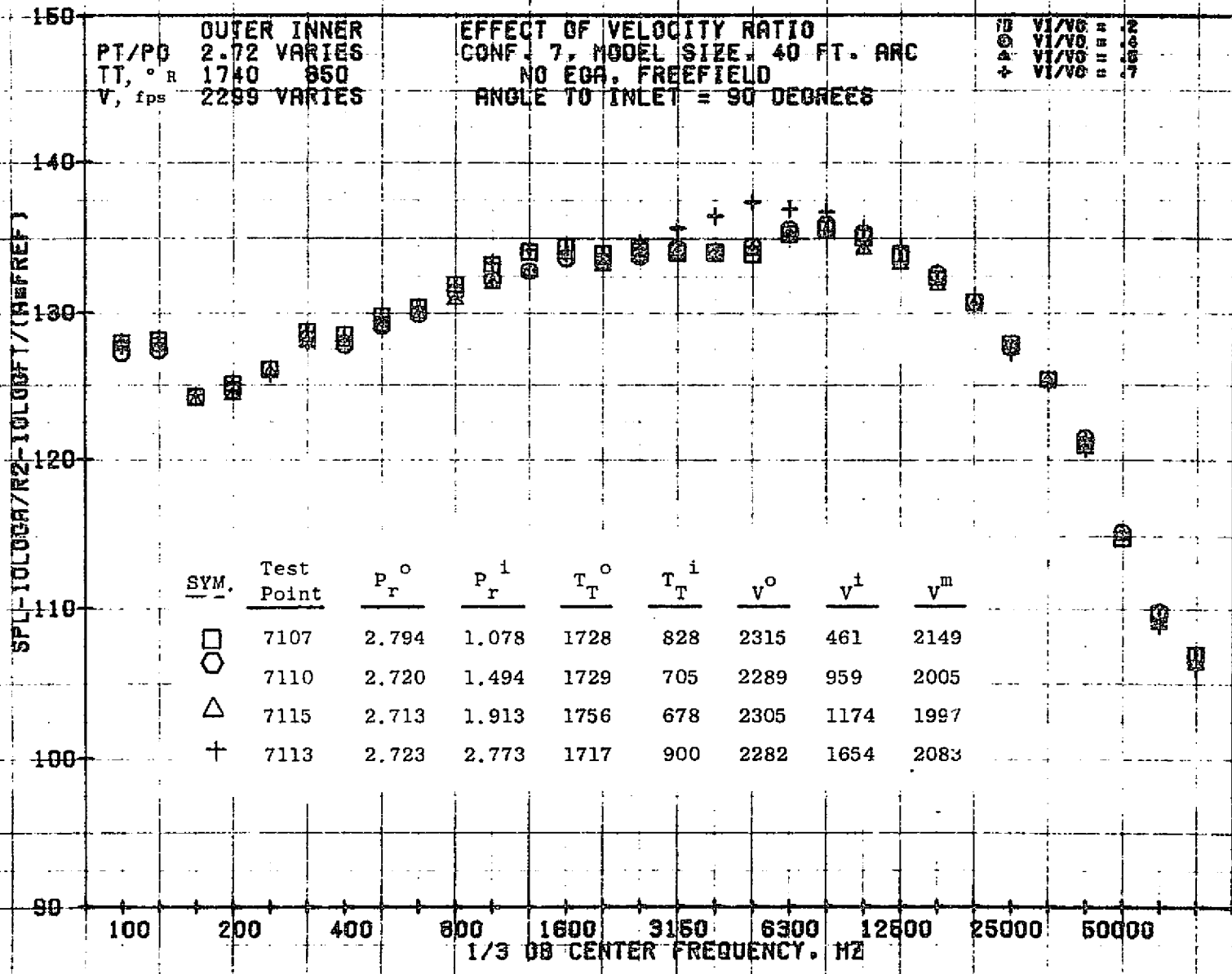


11/01/76
1B391-001

79 BURCH A.

1911

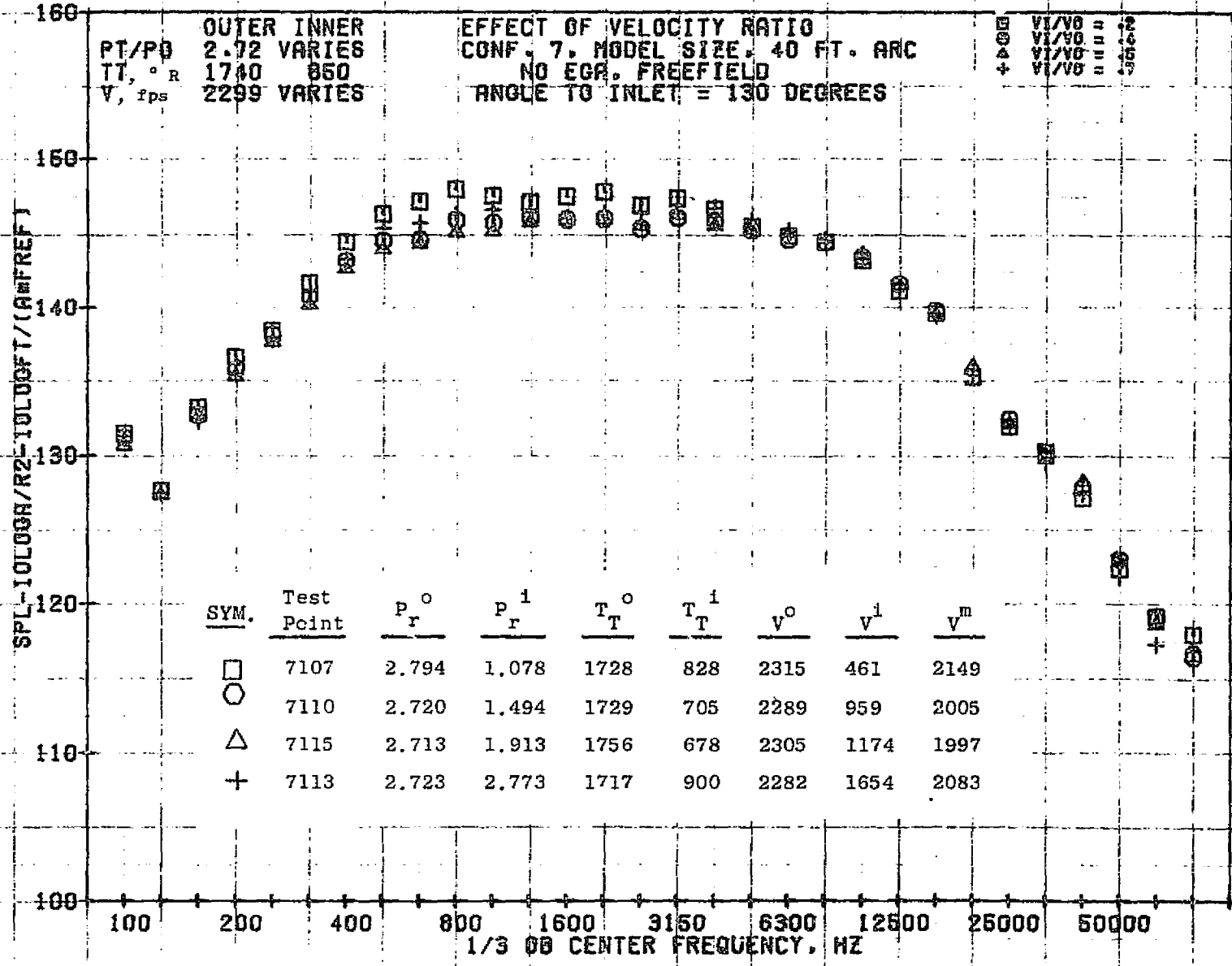




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18391-001

79 BURCH A.

1153

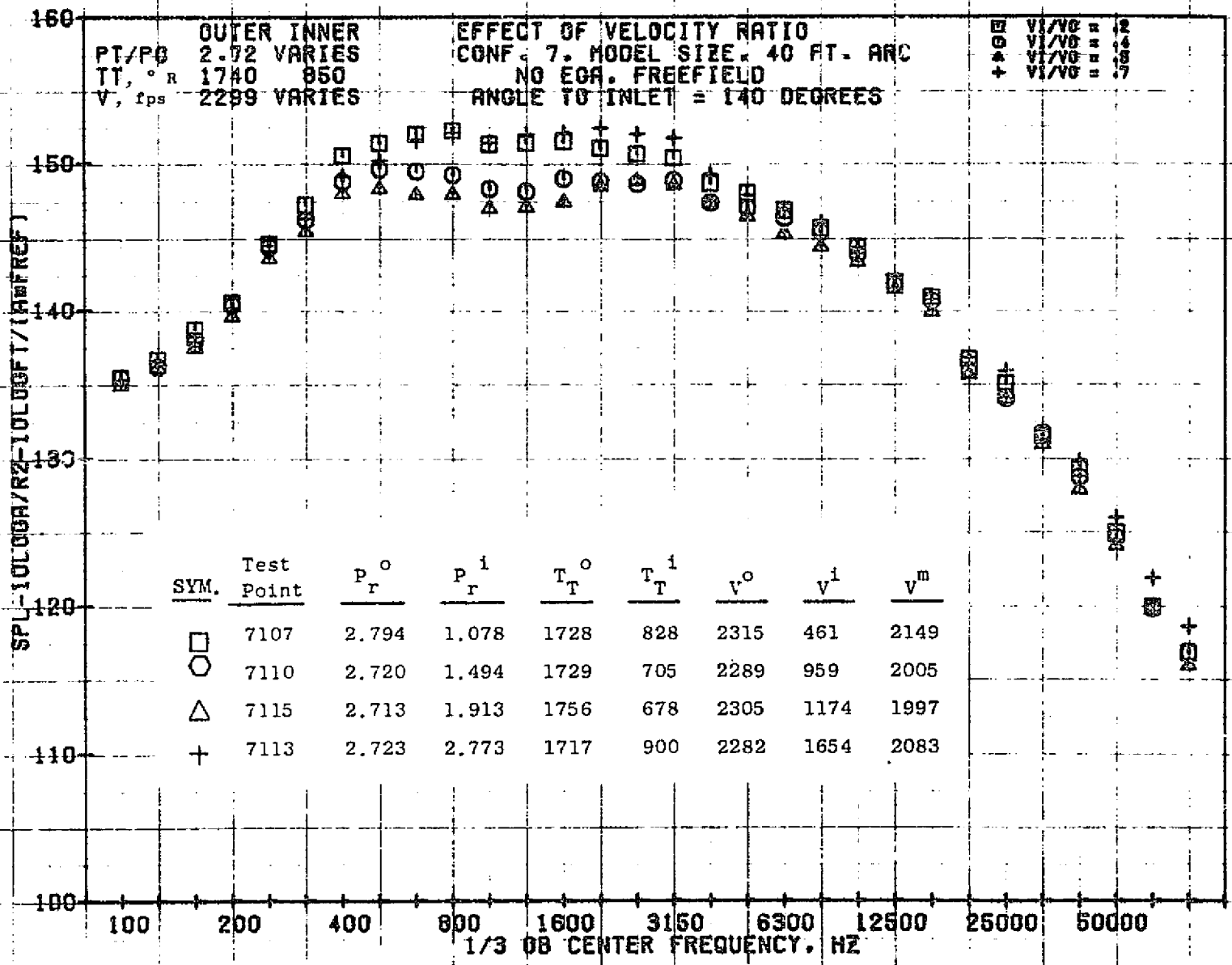


PT/PD 2.72 VARIES
 TT, ° R 1740 850
 V, fps 2299 VARIES

EFFECT OF VELOCITY RATIO
 CONF. 7, MODEL SIZE, 40 FT. ARC
 NO ECA, FREEFIELD
 ANGLE TO INLET = 130 DEGREES

□ VI/V0 = 2.6
 ○ VI/V0 = 1.9
 △ VI/V0 = 1.5
 + VI/V0 = 1.3

SYM.	Test Point	P_r^o	P_r^i	T_T^o	T_T^i	V^o	V^i	V^m
□	7107	2.794	1.078	1728	828	2315	461	2149
○	7110	2.720	1.494	1729	705	2289	959	2005
△	7115	2.713	1.913	1756	678	2305	1174	1997
+	7113	2.723	2.773	1717	900	2282	1654	2083



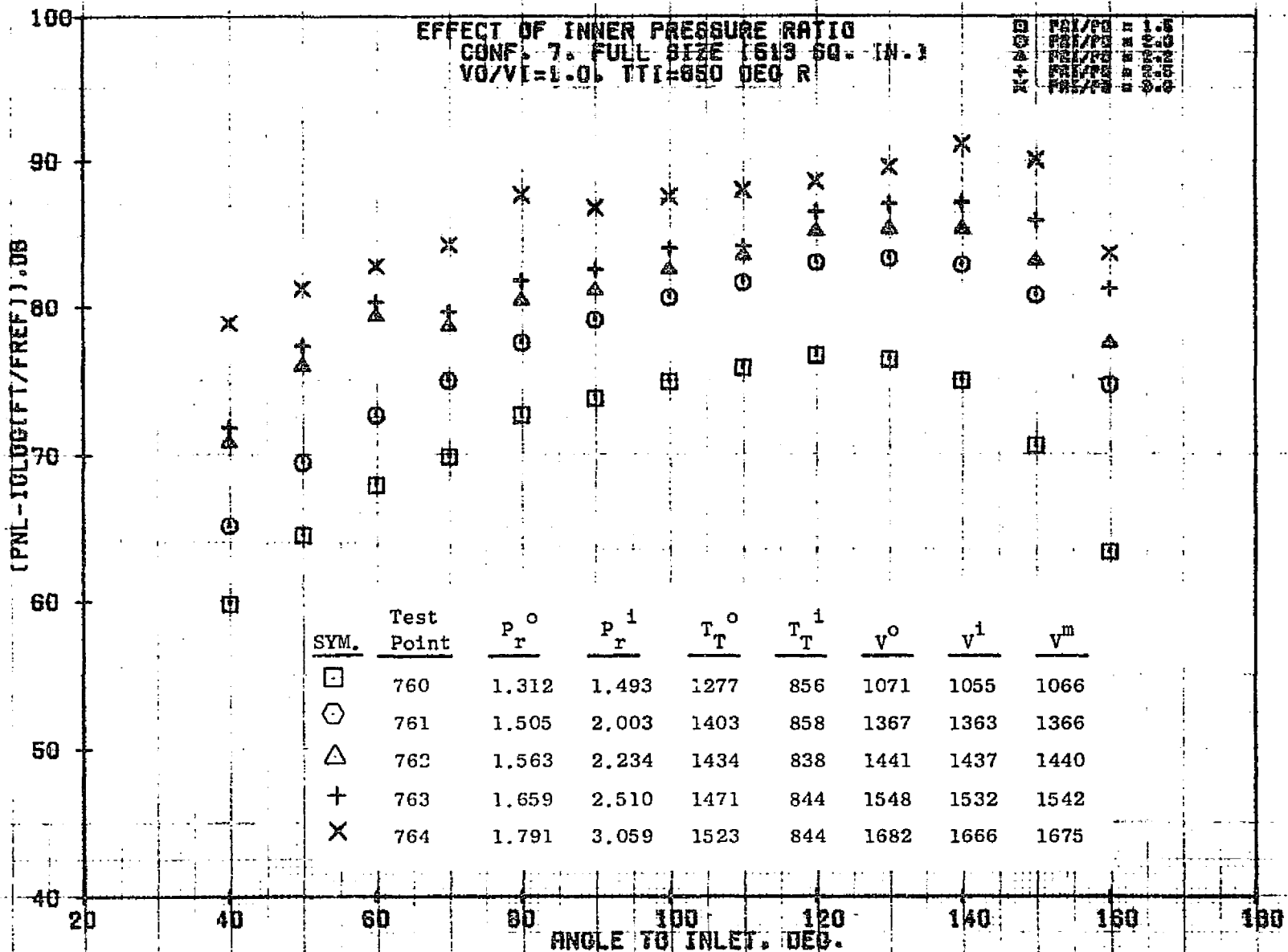
11/01/76
 18391-001

79 BURCH A.

7.4.5 Effect of Inner Pressure Ratio at Constant Velocity Ratio

For Configuration 7, a test series was run in which the velocity ratio was held constant at different levels and the inner pressure ratio was varied. The results are shown in this section.

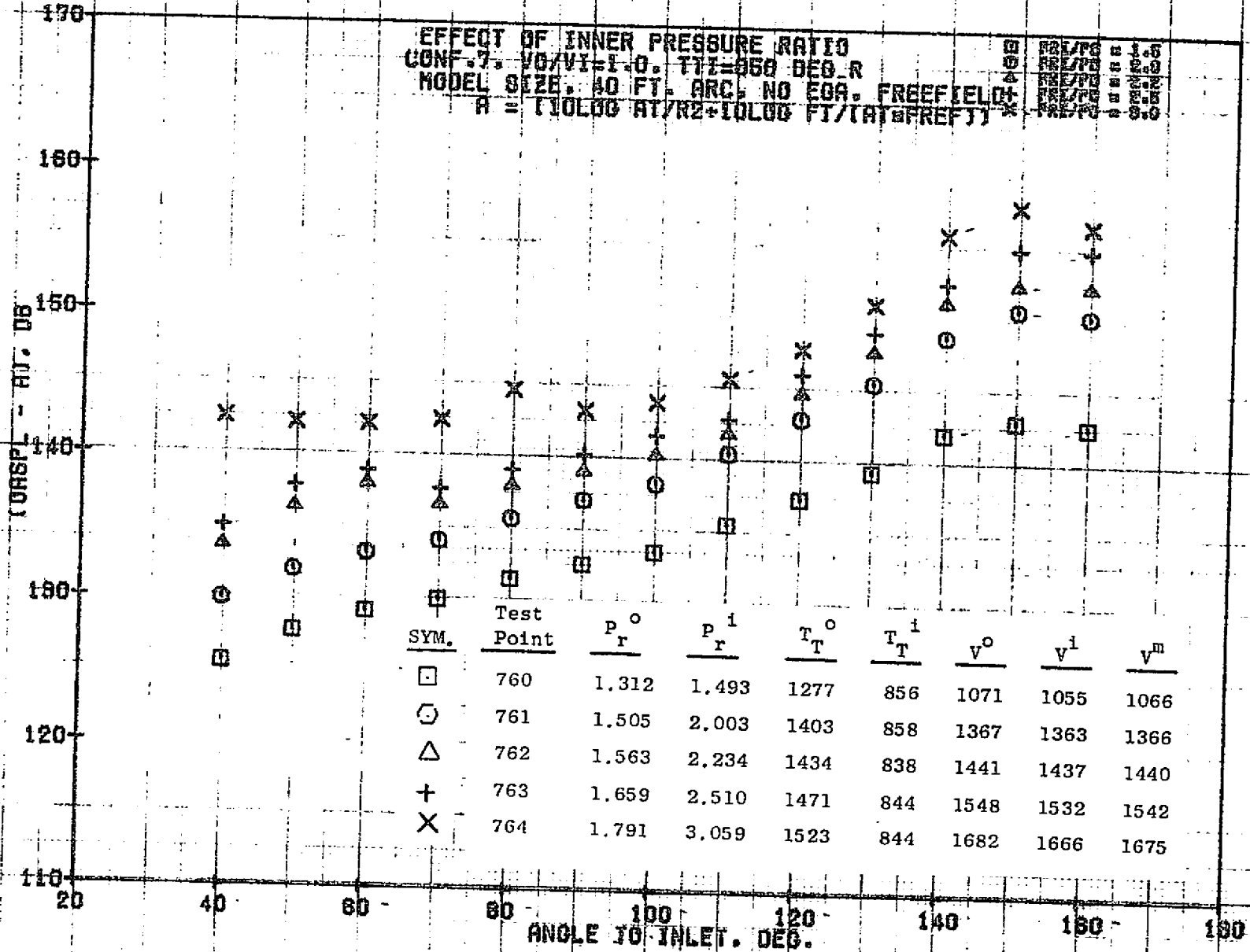
95T
1156



11/01/76
18421-001

79 BURCH A.

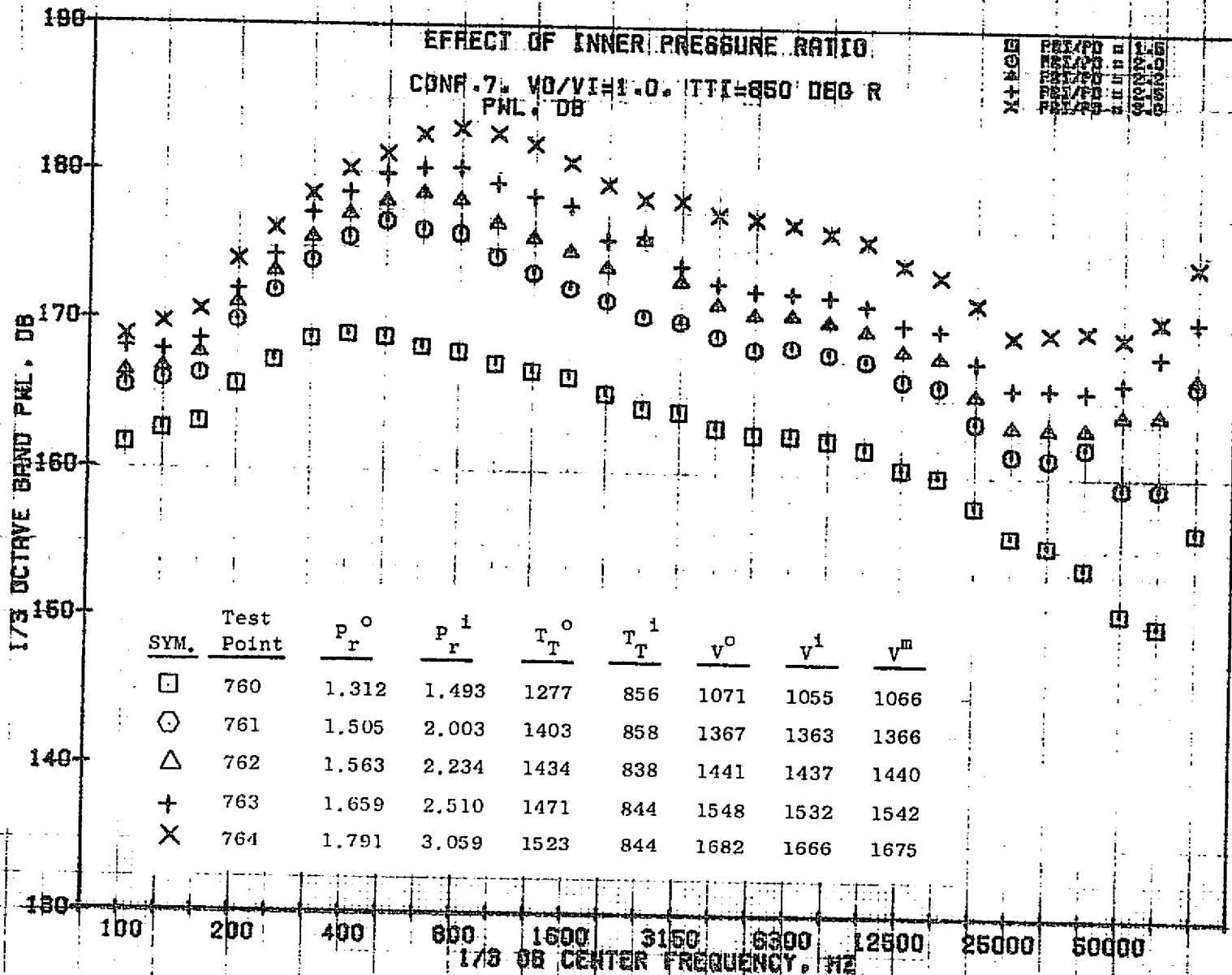
1187



11/09/76
18336-001

79 AIRCH A.

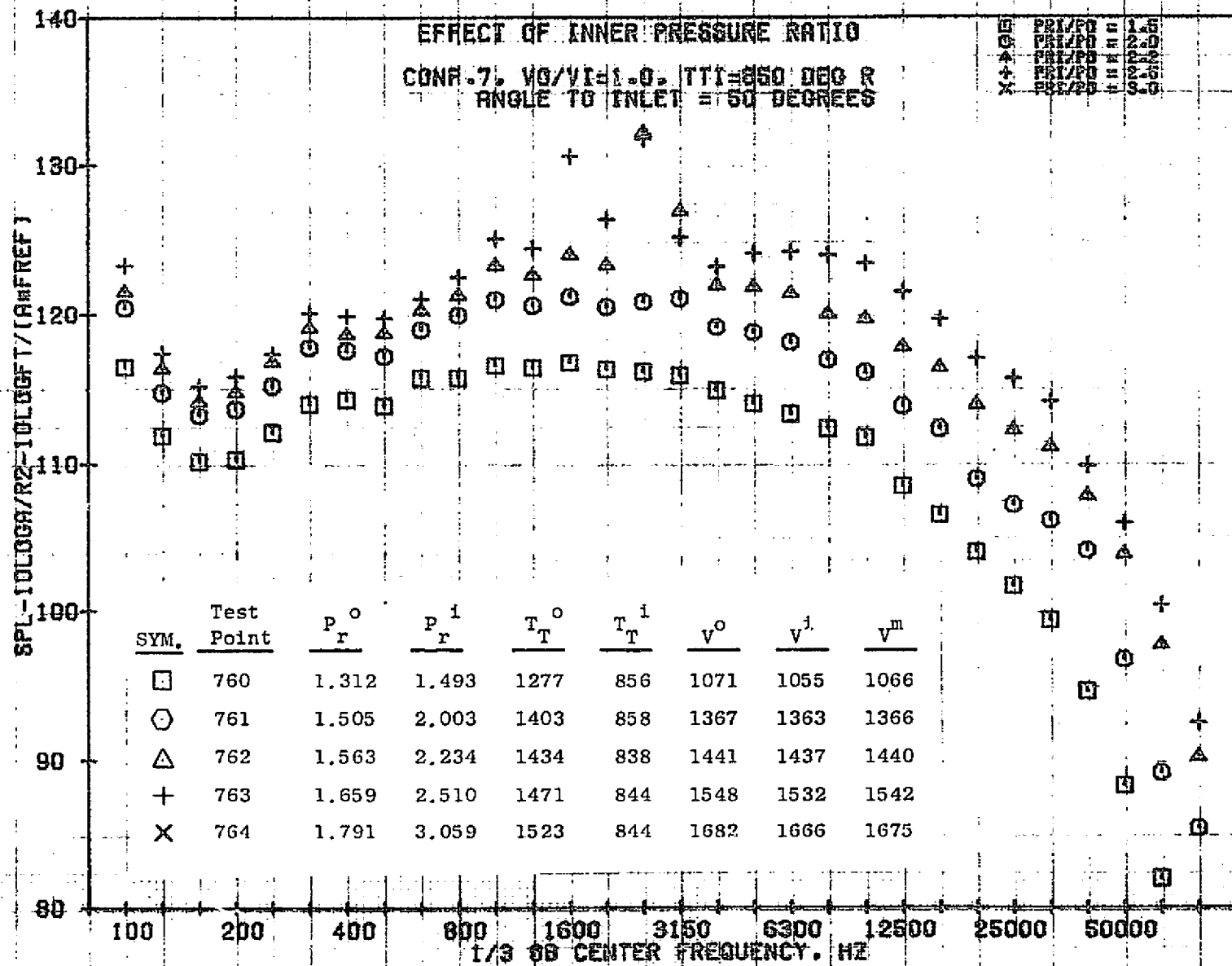
1158



11/03/76
 18575-001

79 BURCH A.

69TI

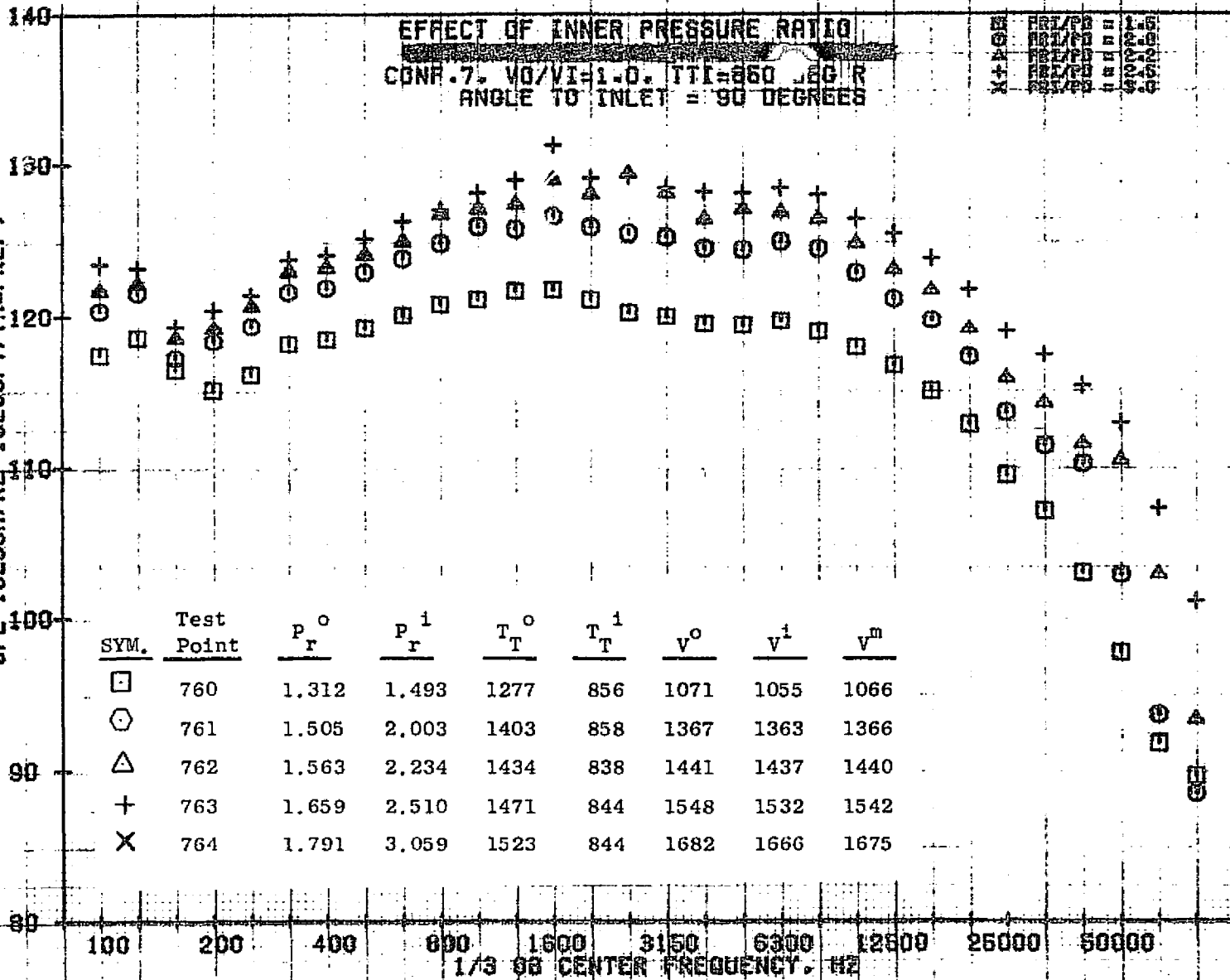


11/03/76
18575-001

79 BURCH A.

0977

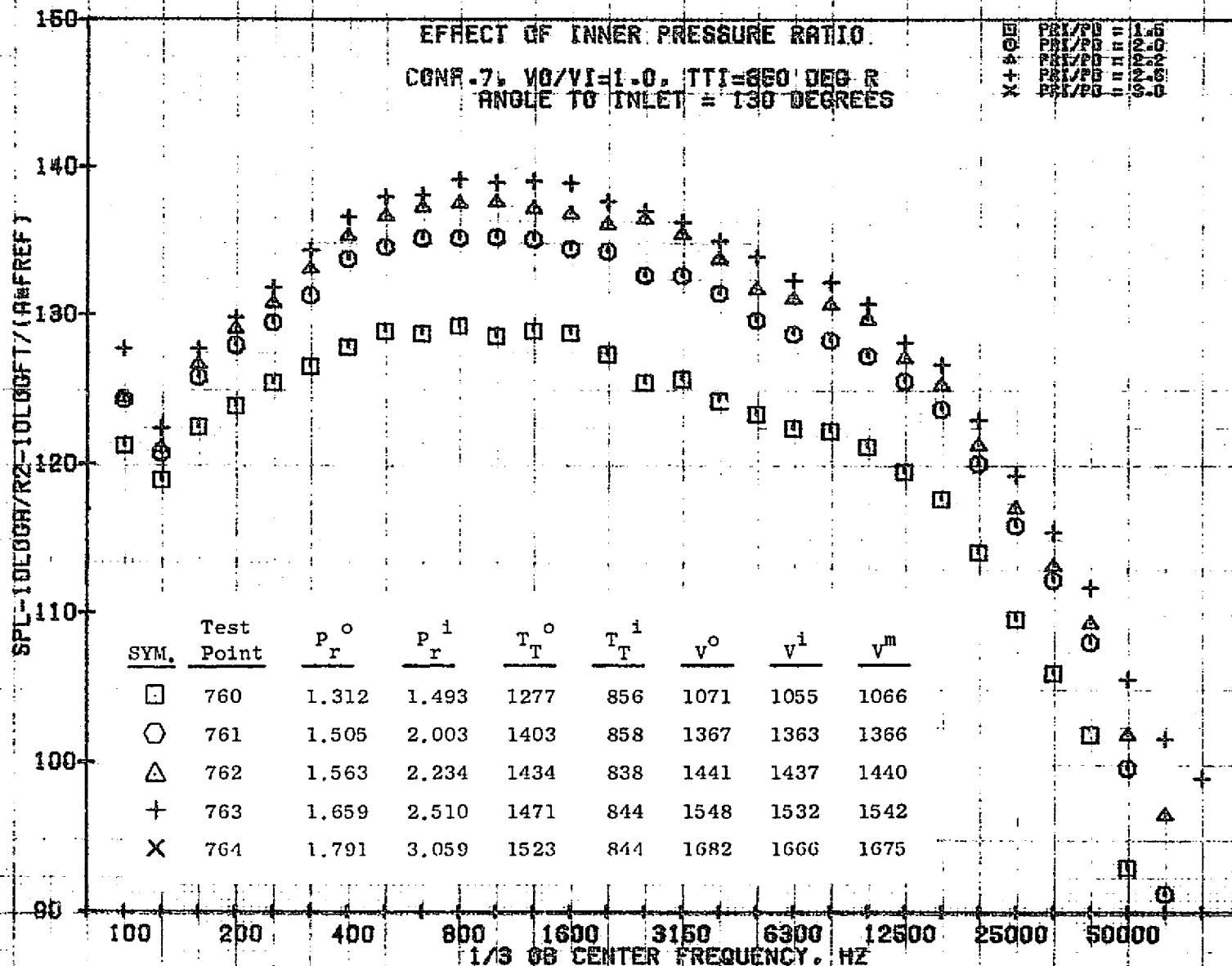
SPL - 10LDB08/R2-10L03FT/(AMPREF)



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18675-001

79 BURCH A.

1161

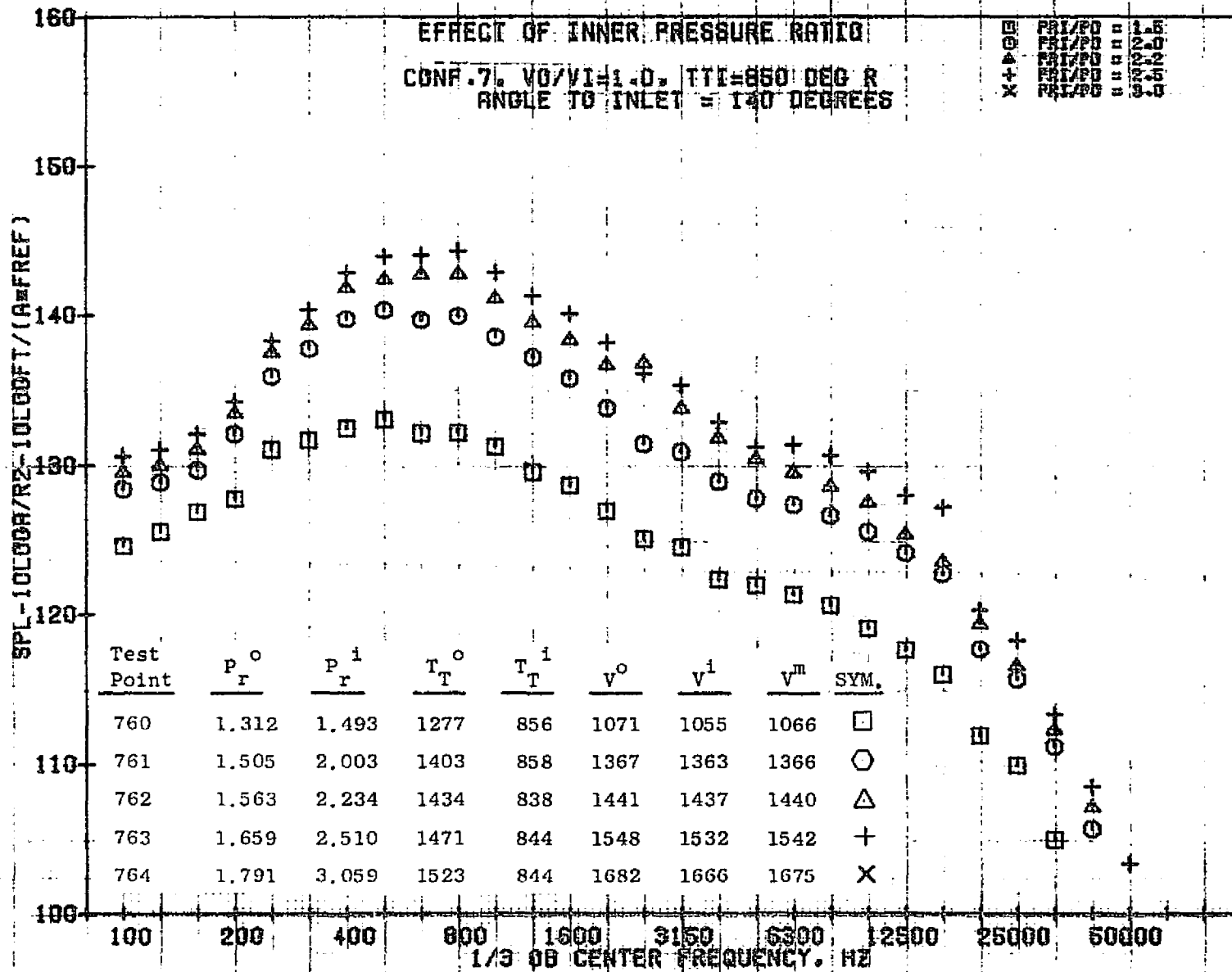


X	P _r ^o /P _r ⁱ	T _{T^o}	V ^o
+	P _r ^o /P _r ⁱ	T _{T^o}	V ^o
△	P _r ^o /P _r ⁱ	T _{T^o}	V ^o
○	P _r ^o /P _r ⁱ	T _{T^o}	V ^o
□	P _r ^o /P _r ⁱ	T _{T^o}	V ^o

11/03/76
 1B575-001

79 BURCH R.

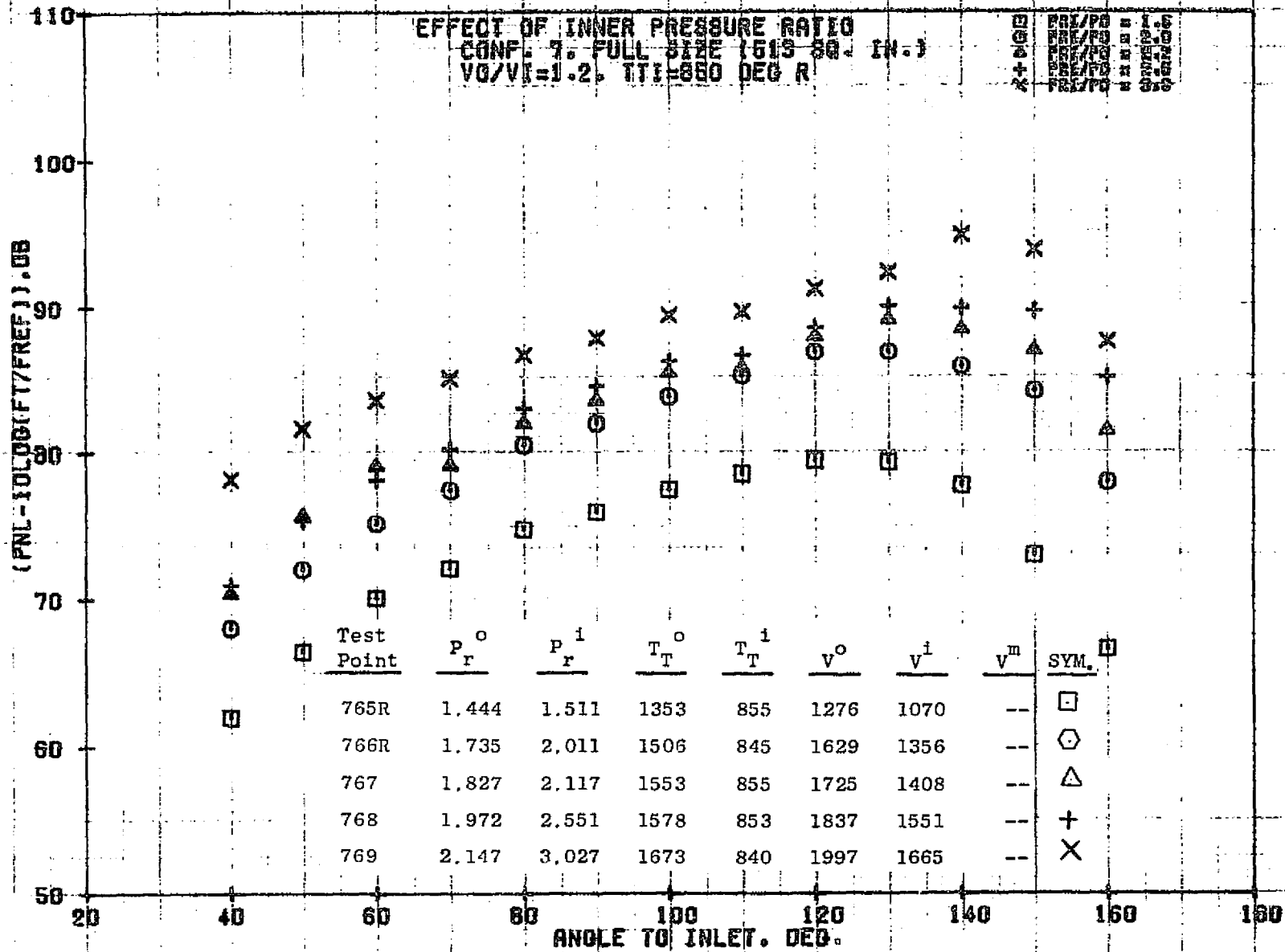
1162



11/03/76
18575-001

79 BURCH A.

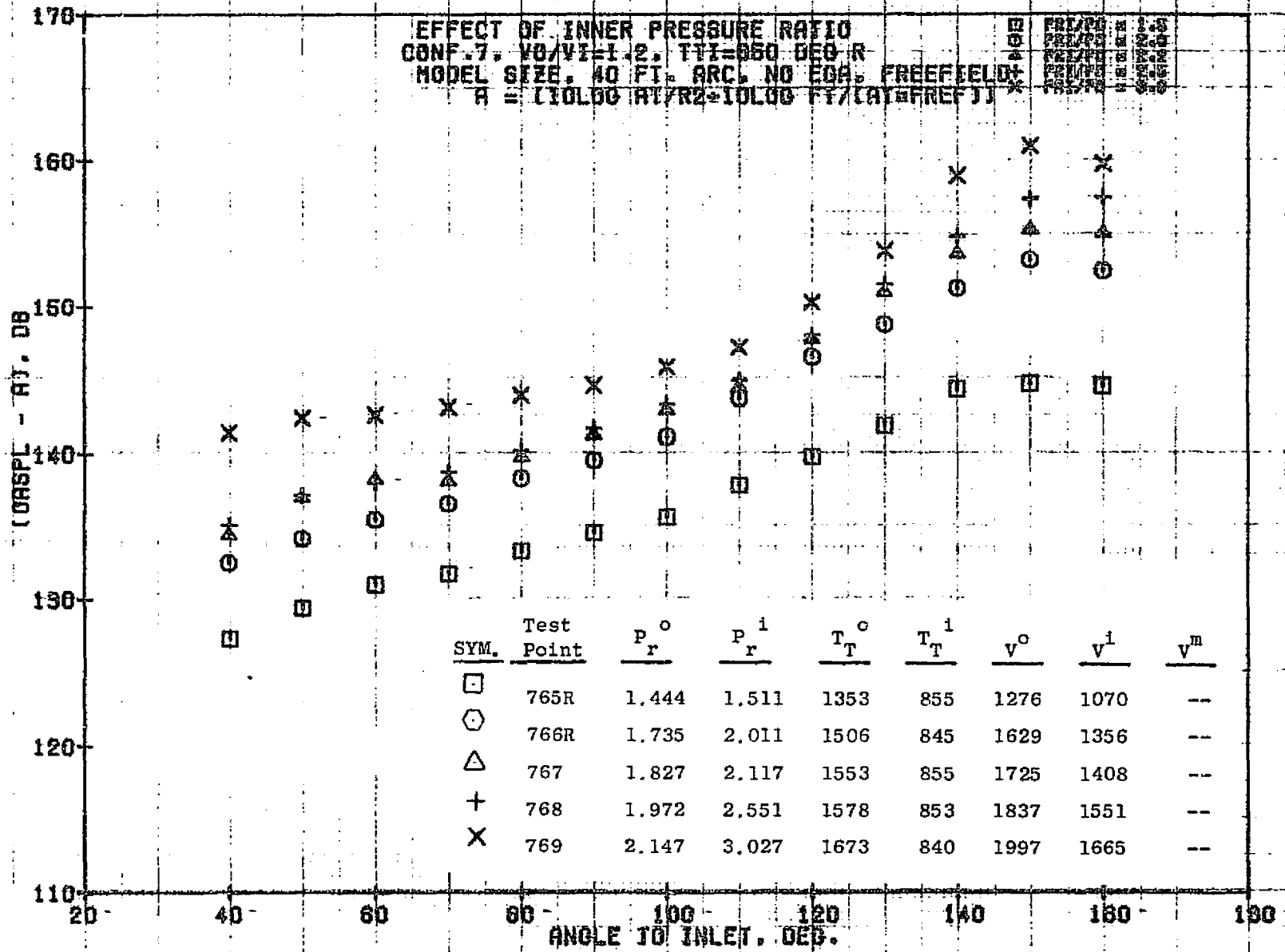
1163



11/04/76
 1B680-001

79 BURCH A.

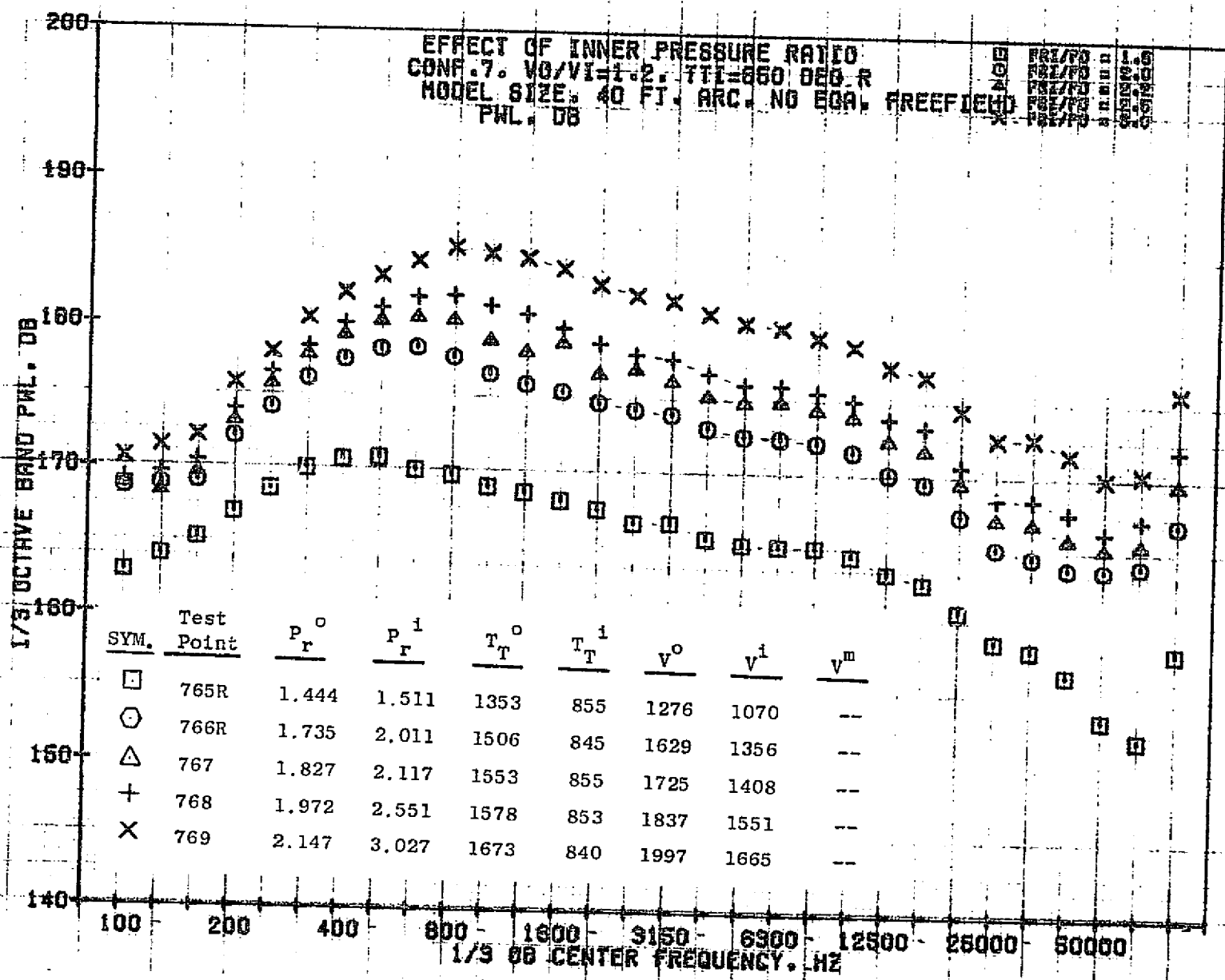
1164



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 1A336-001

79 AIRCH A...

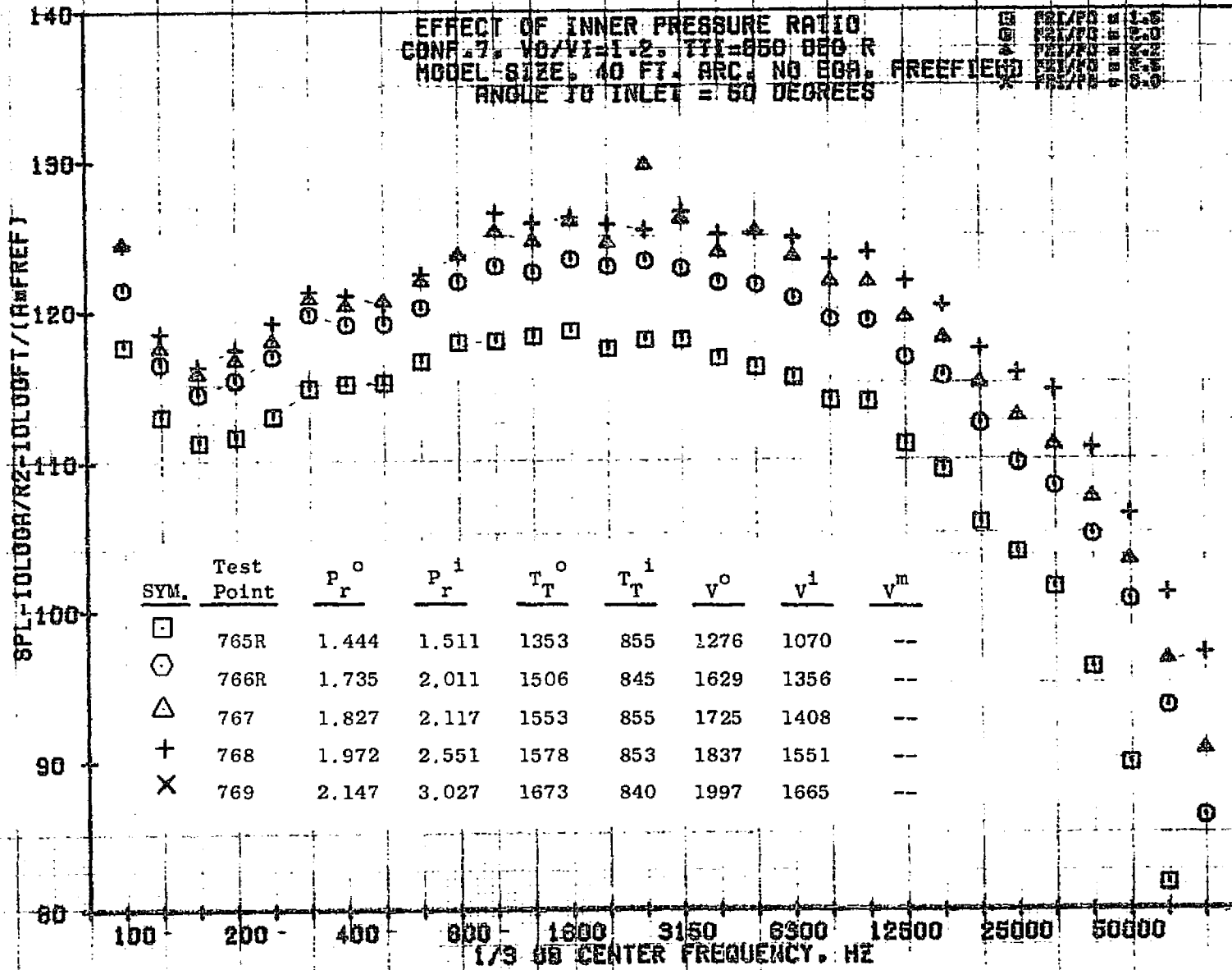
1165



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 1R33A-001

79 BURCH R.

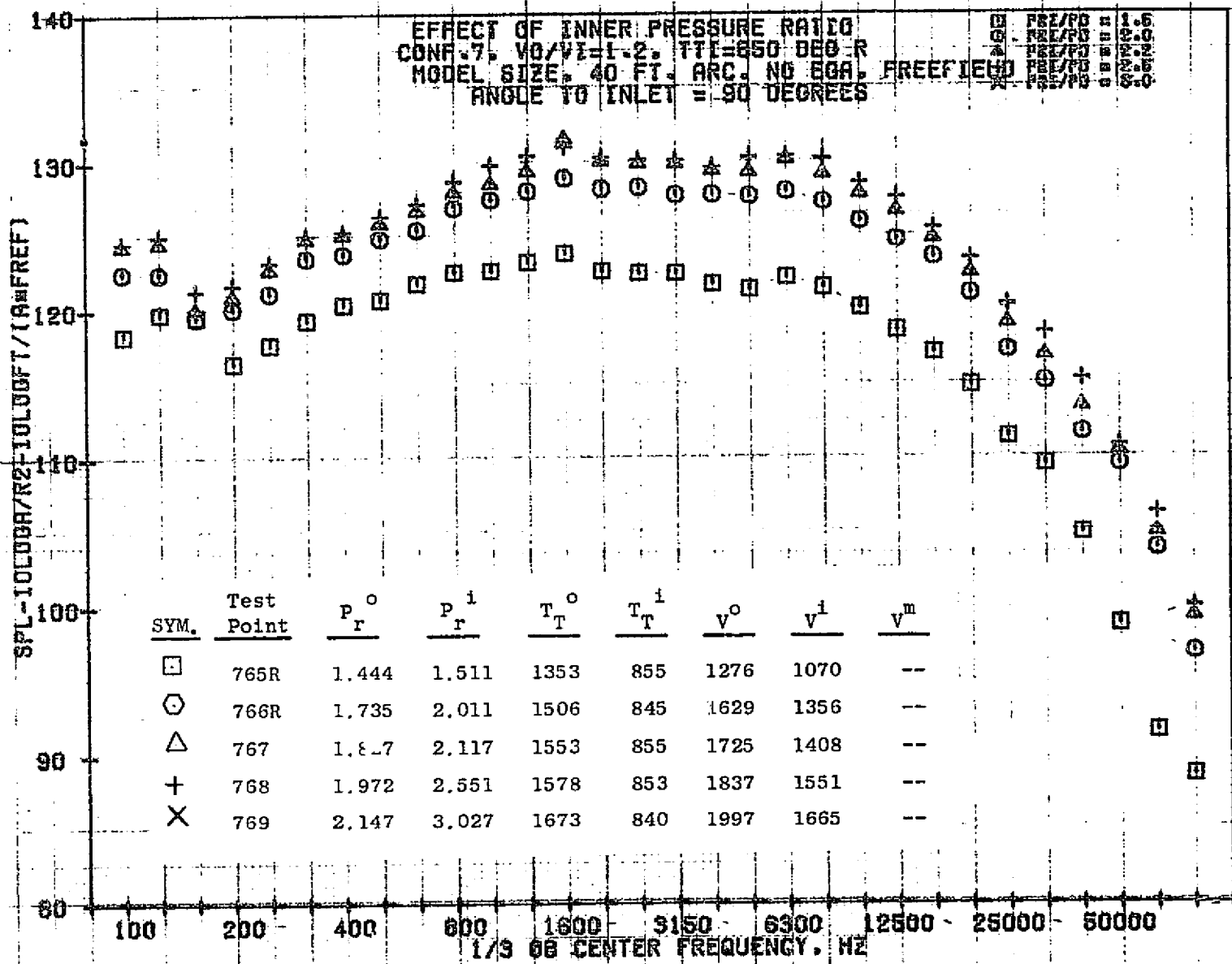
1166



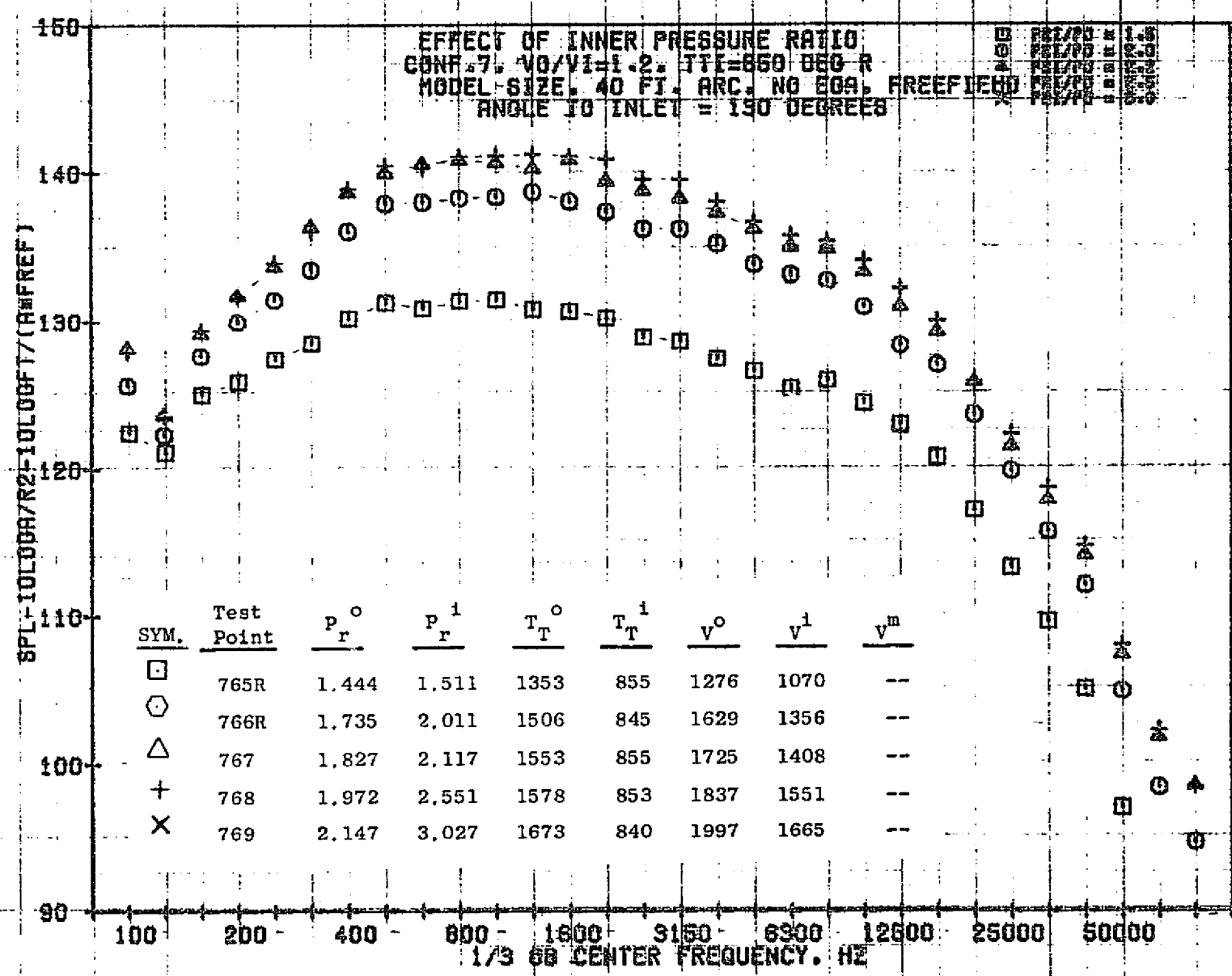
11/09/78
 18336-001

79 AIRCH A.

4911

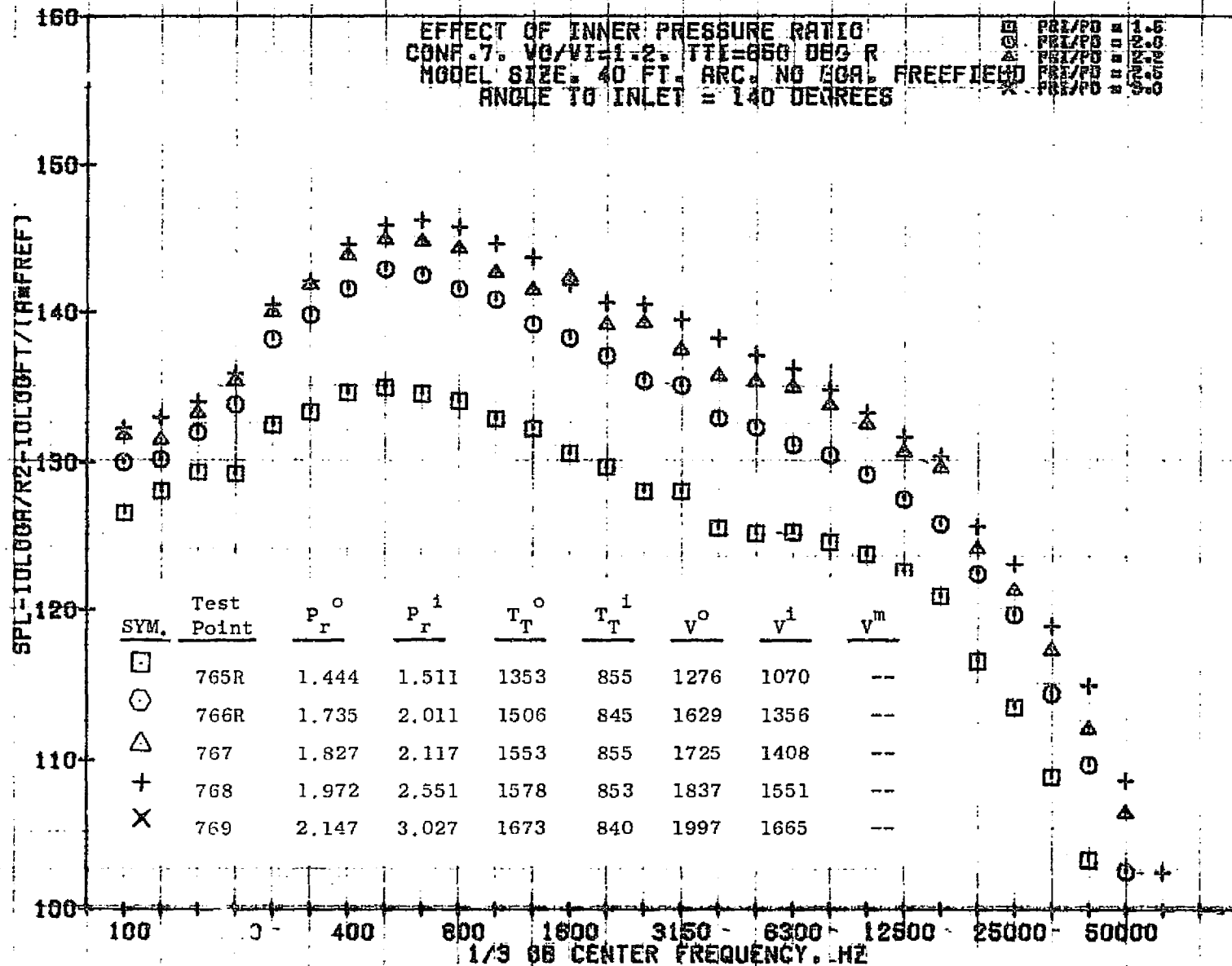


8911



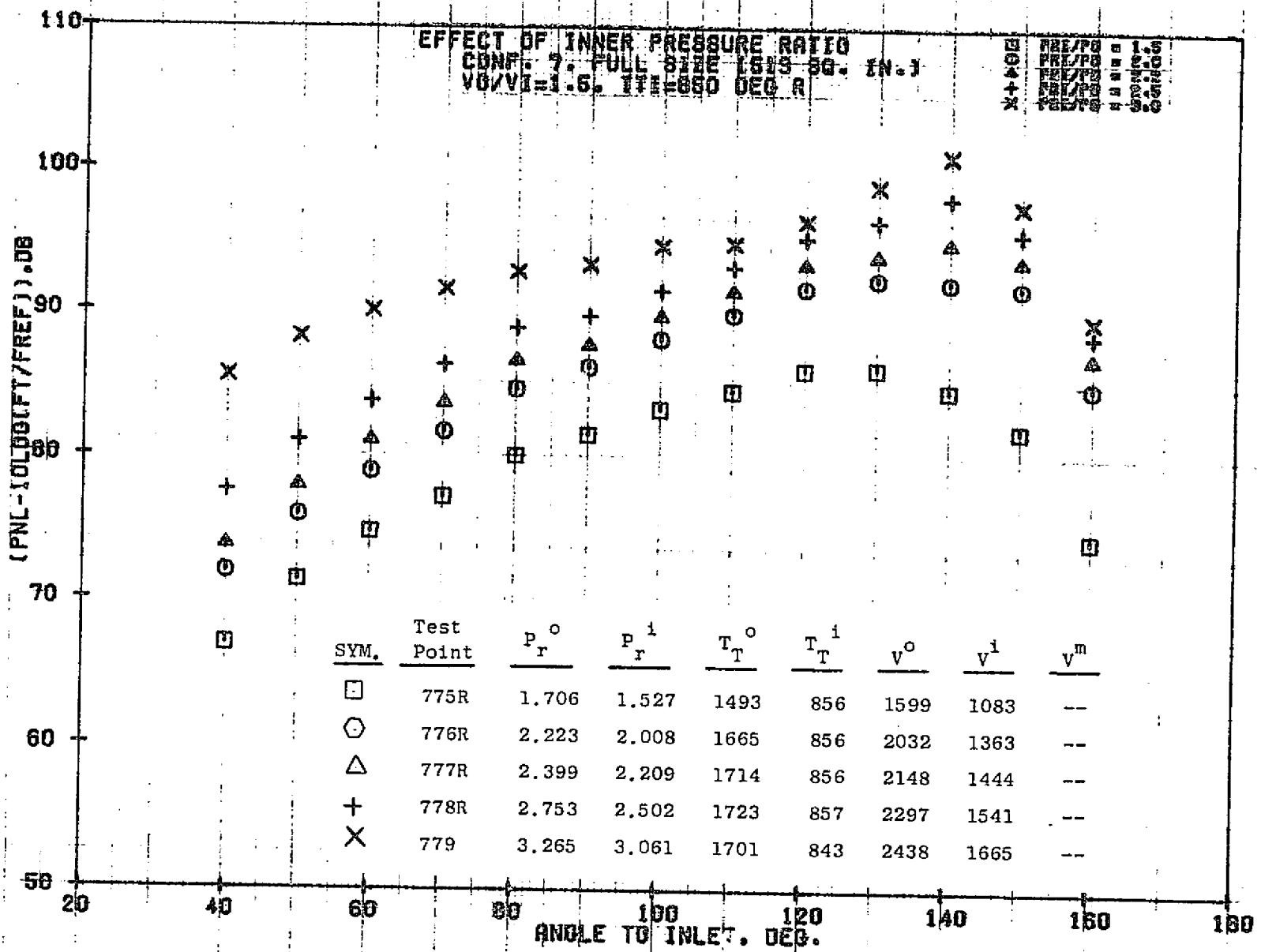
11/09/76
 1R376-001

79 AIRCH 8.

6911
116911/09/76
18346-001

79 BURCH A.

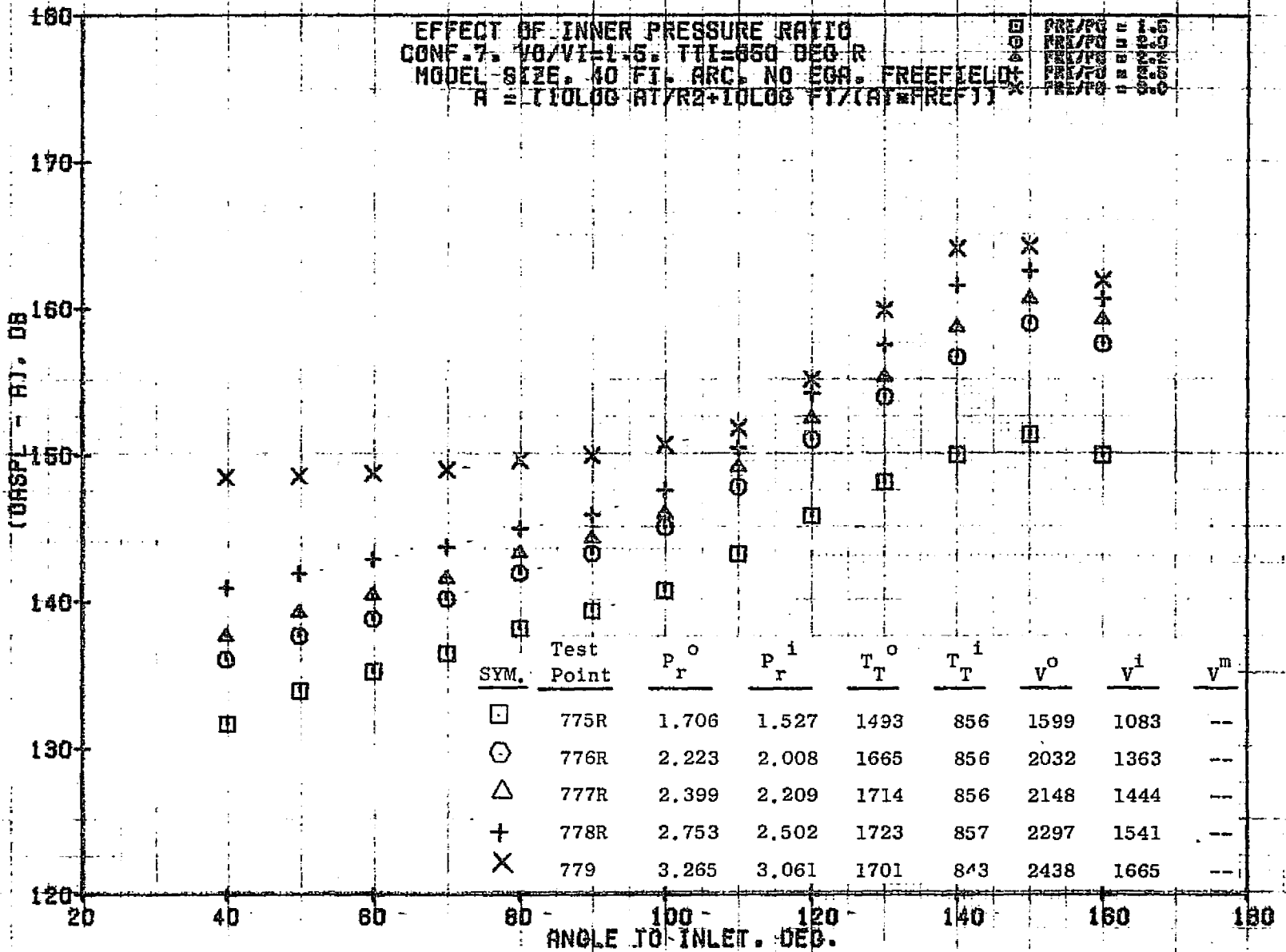
1170



11/04/76
18680-001

79 BURCH A.

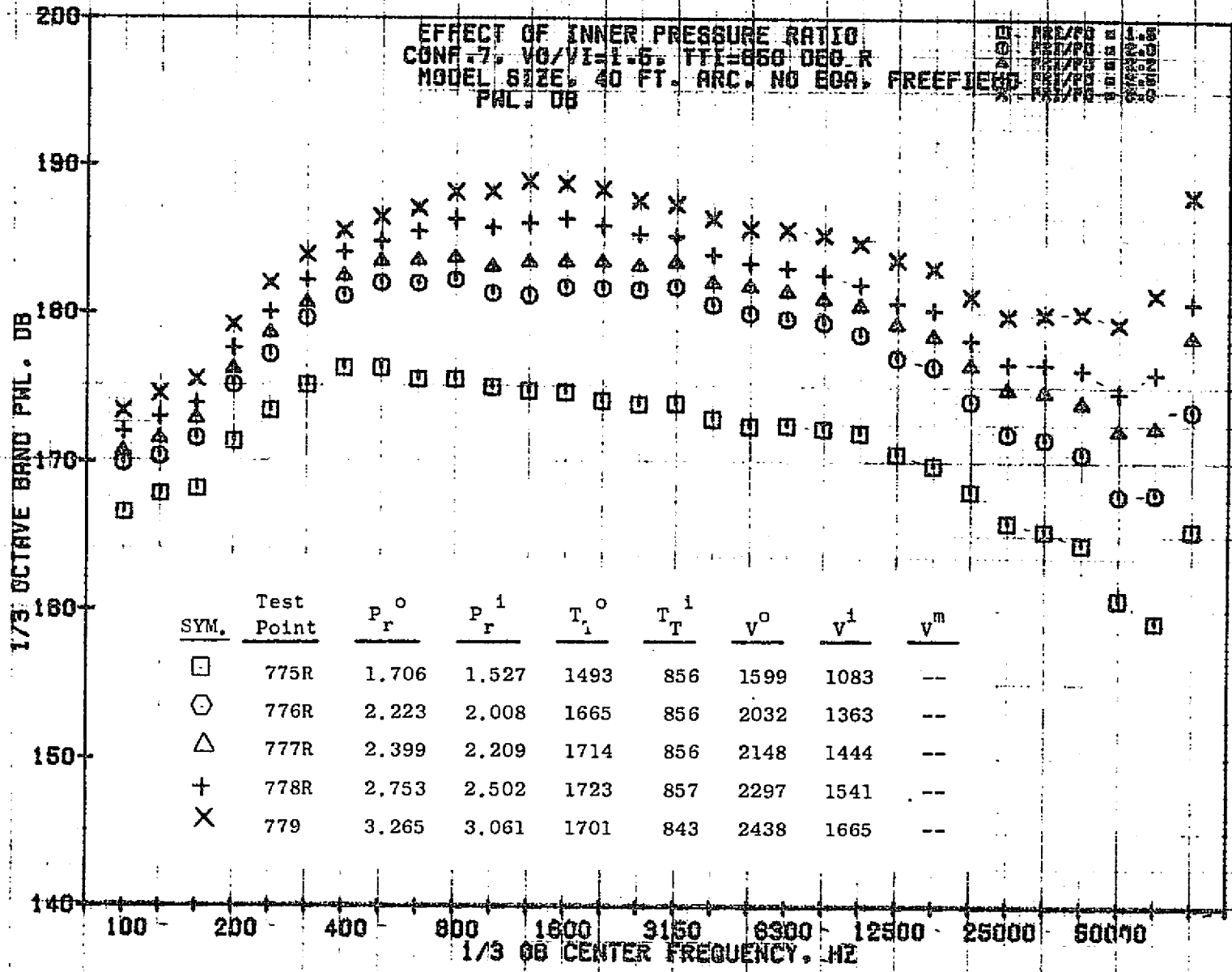
1171



11/09/76
 1R336-001

79 BIRCH A.

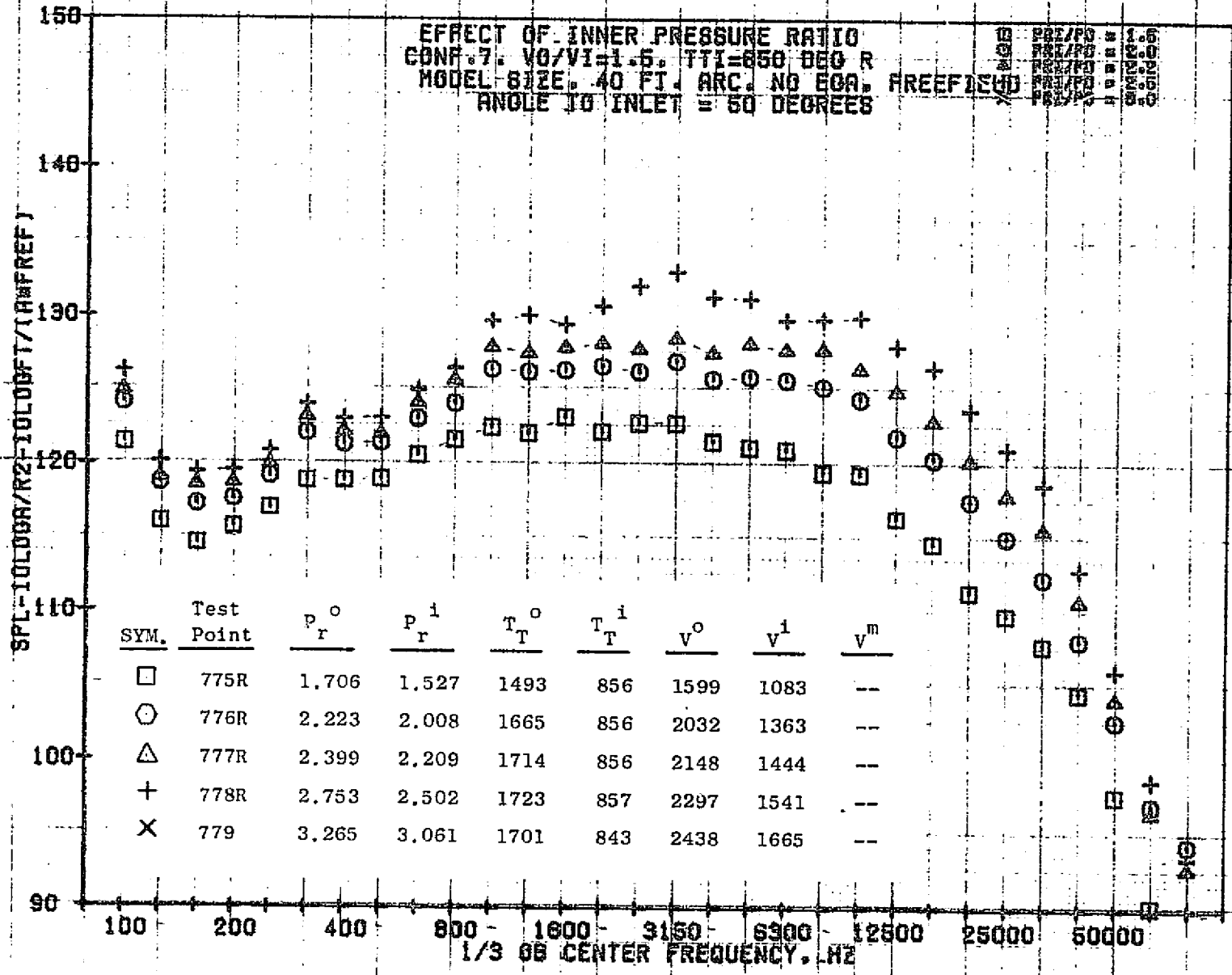
1172



11/09/76 -
 1A336-001

79 AIRCH A.

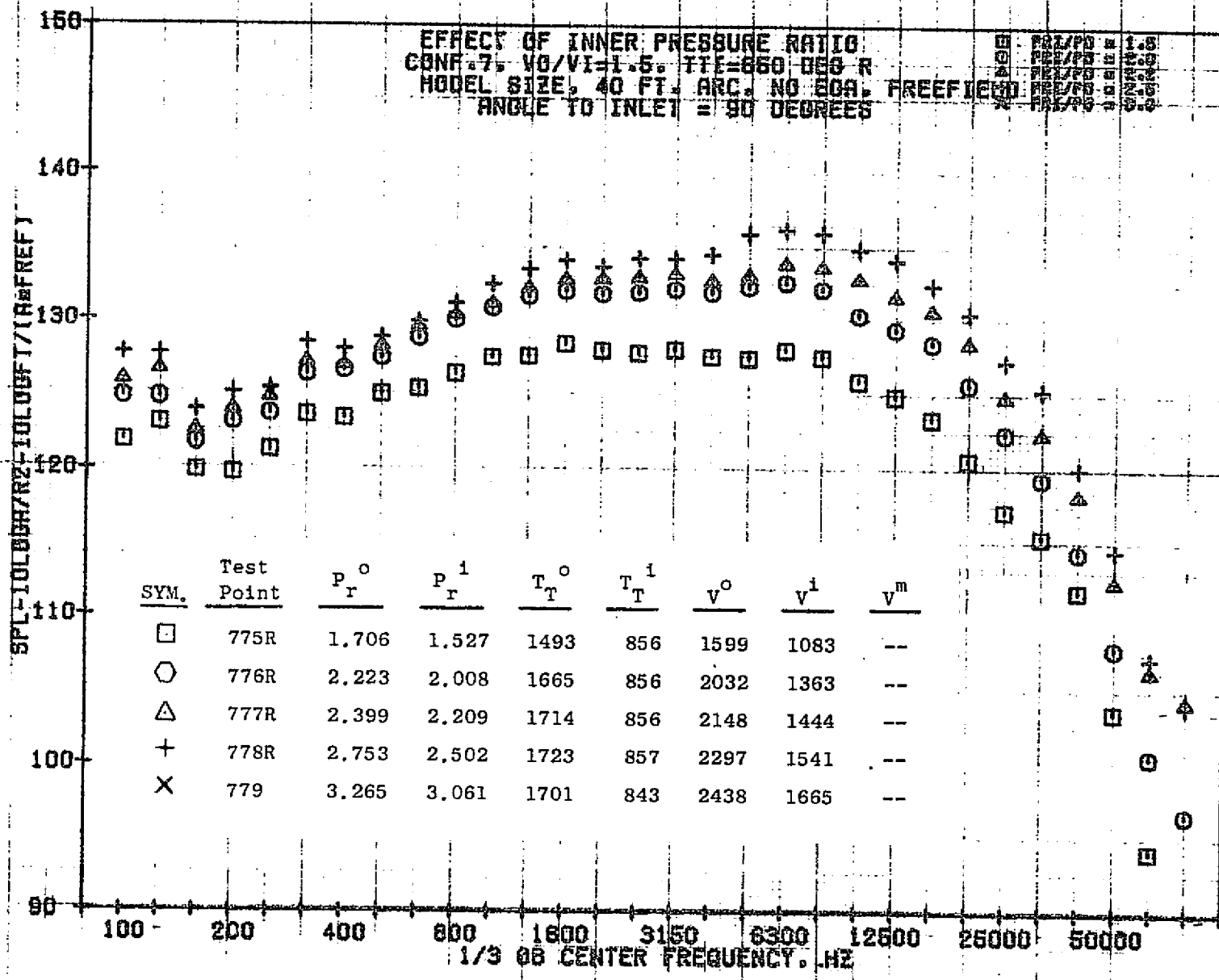
1173



11/09/76
 18336-001

79 BURCH A.

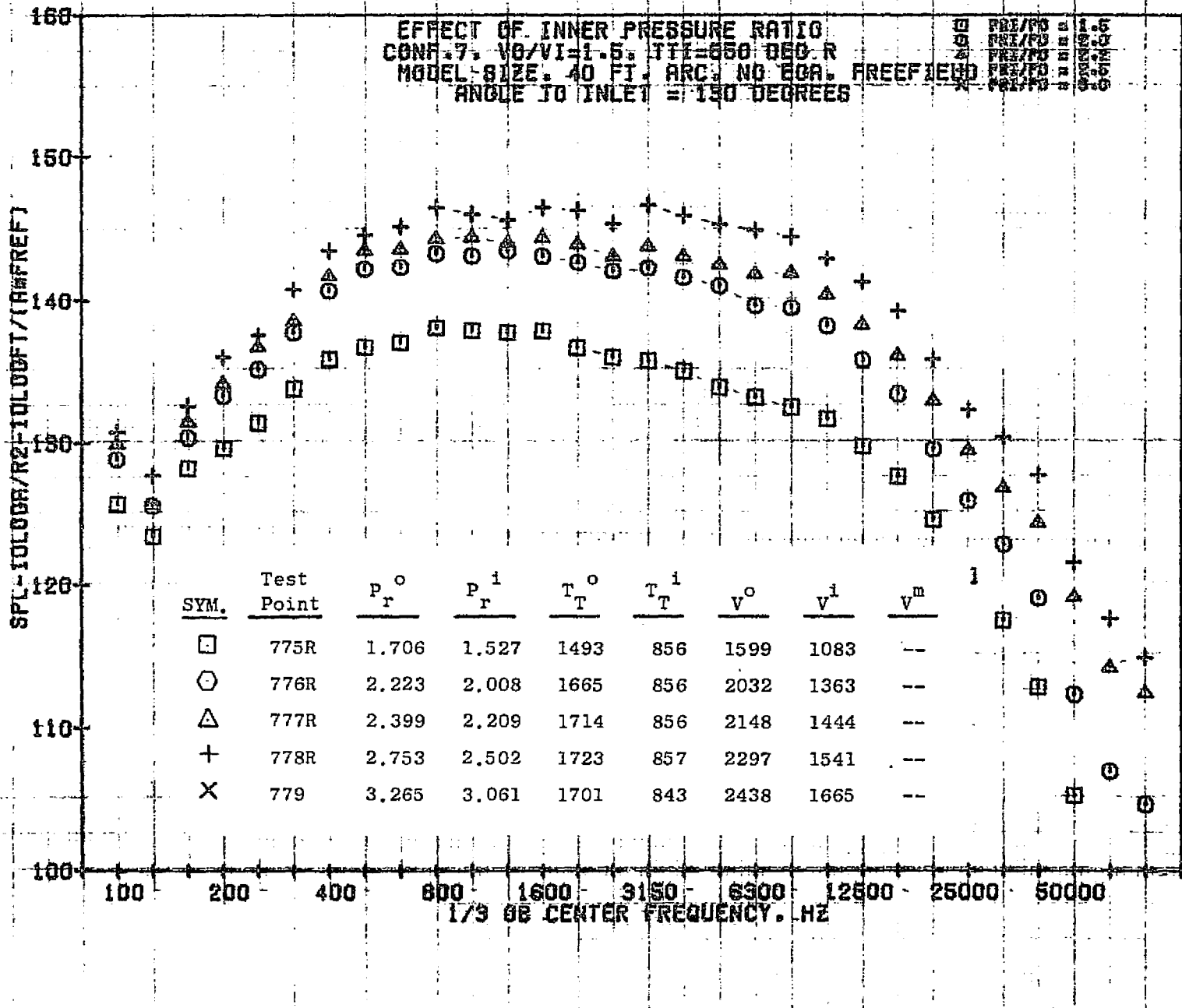
1174



11/09/76
 1R33R-001

79 AIRCH A.

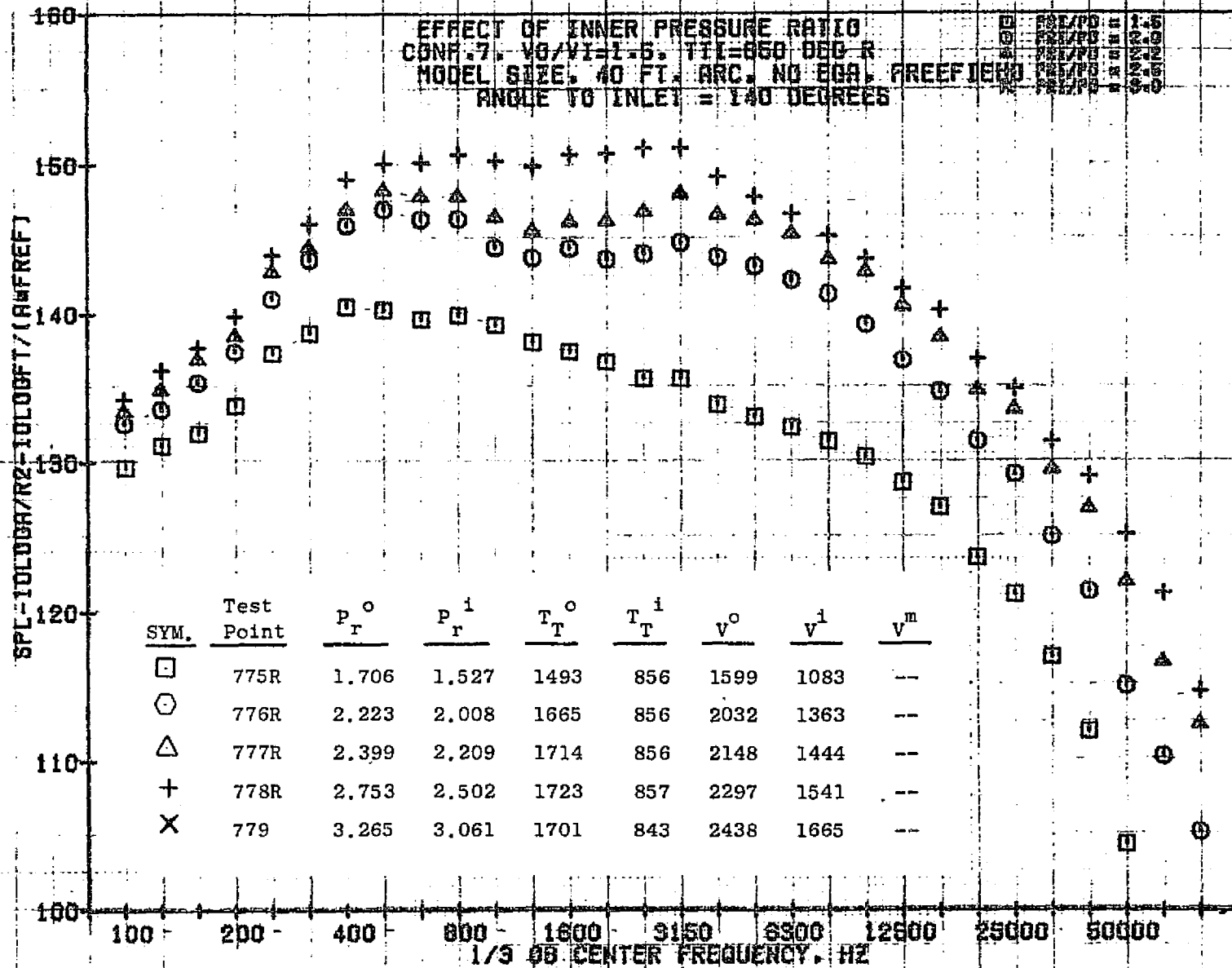
1375



11/09/78
 18336-001

79 AIRCH A.

1176



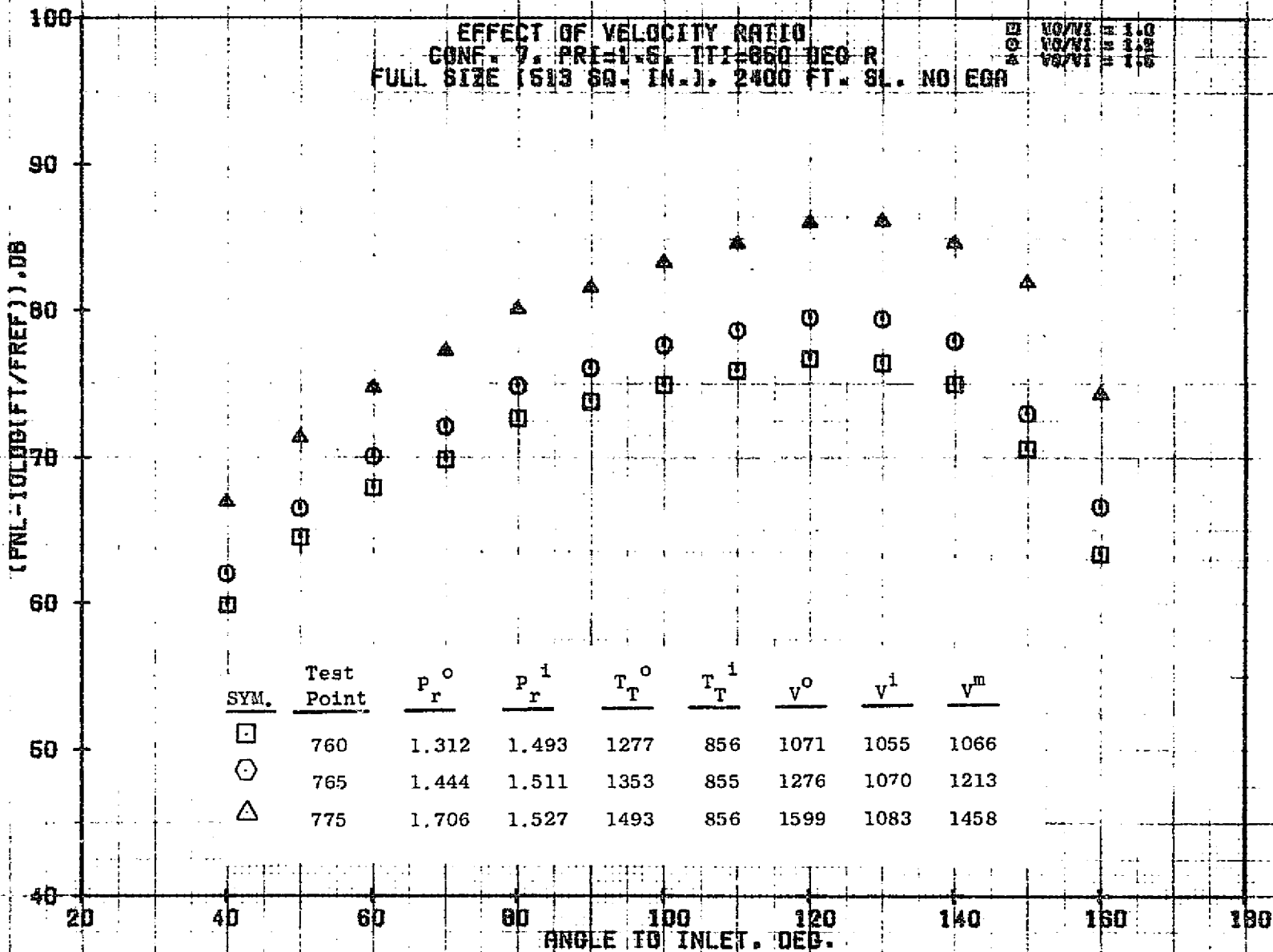
11/09/76 -
 1A998-001

7A AIRCH 2.

7.4.6 Effect of Velocity Ratio at Constant Inner Pressure Ratio

This section presents comparisons showing the influence of velocity ratio for a series of tests for Configuration 7 where the inner pressure ratio was held constant at different levels.

1178



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 18421-001

79 BURCH A.

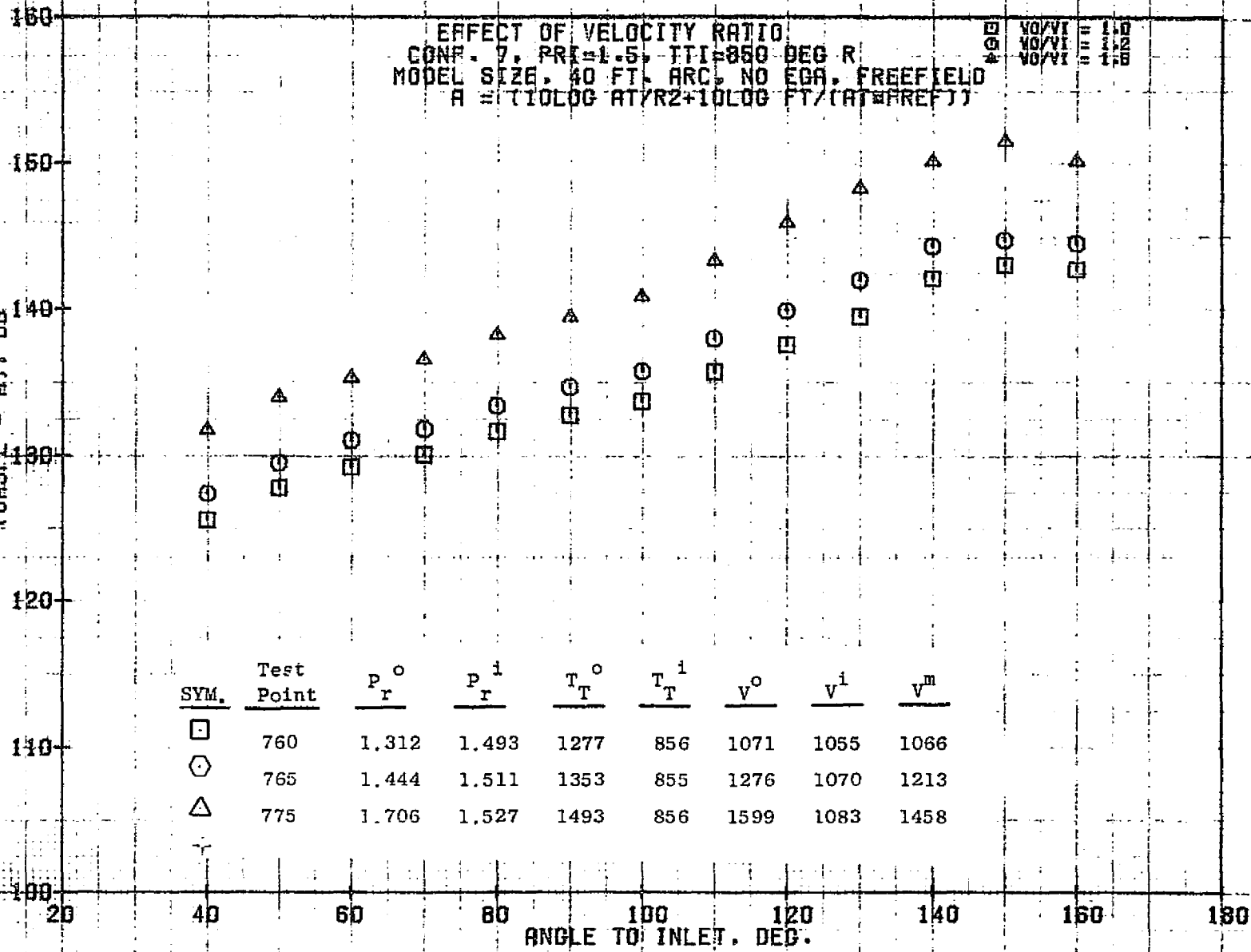
57

621E

(CURSP - H), DB

EFFECT OF VELOCITY RATIO
 CONF. 7, PRE=1.5, TTI=850 DEG R
 MODEL SIZE, 40 FT. ARC, NO EGA, FREEFIELD
 $A = (10 \log \frac{AT}{R^2} + 10 \log \frac{FT}{(AT \cdot PRE)})$

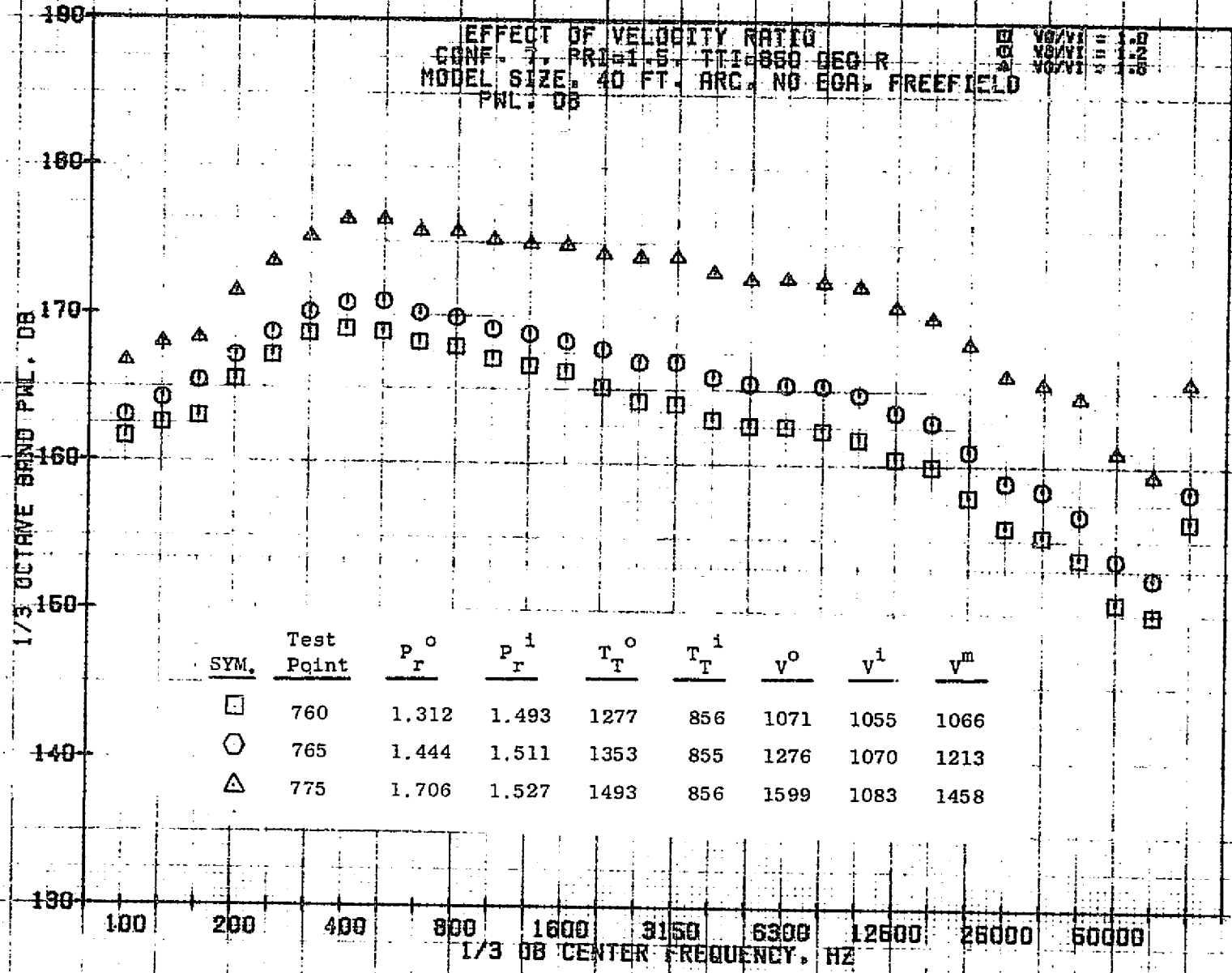
\square $\frac{V^o}{V^i} = 1.0$
 \circ $\frac{V^o}{V^i} = 1.2$
 \triangle $\frac{V^o}{V^i} = 1.5$



11/10/76
 18048-001

79 BURCH A.

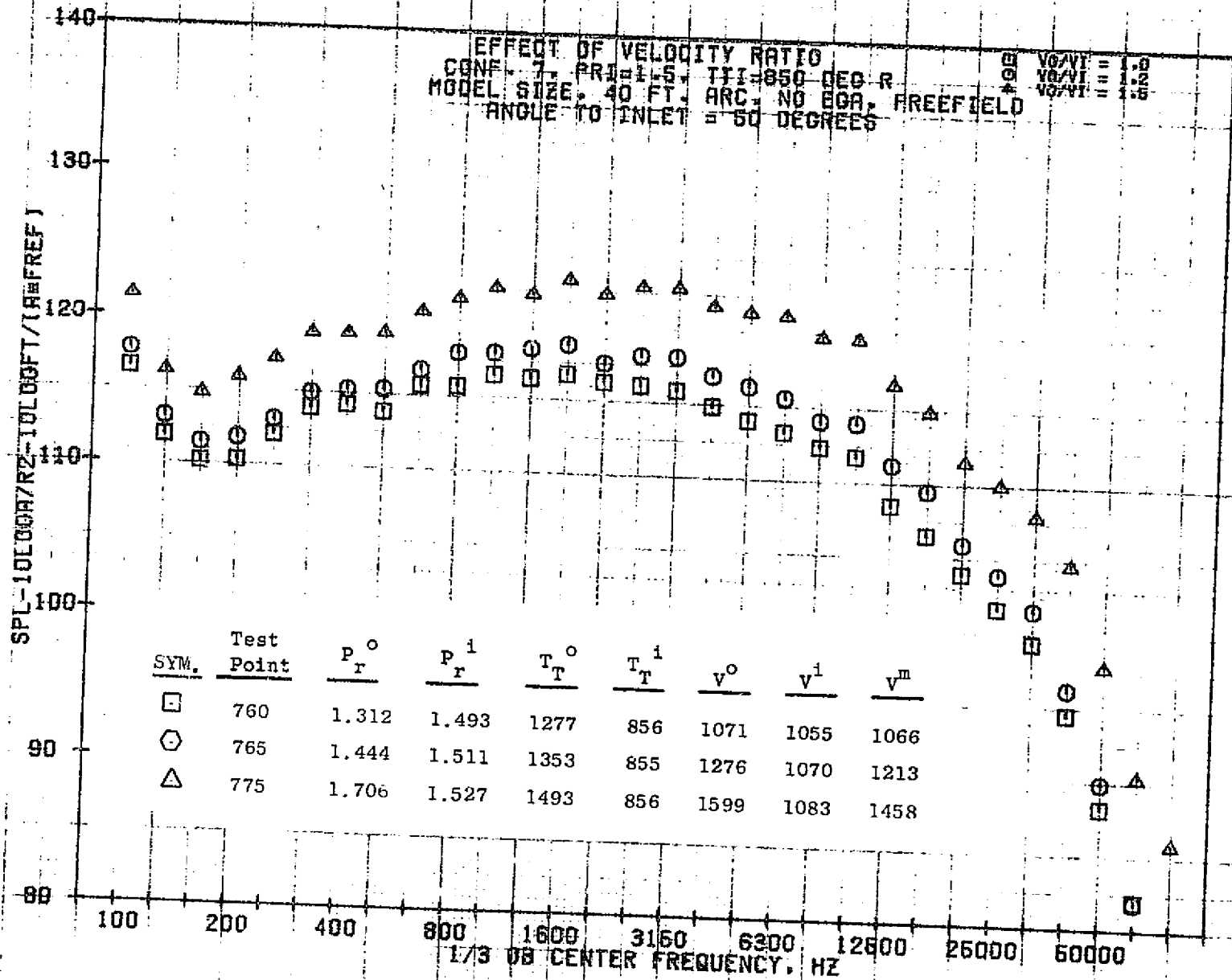
0811



11/10/76
 18048-001

79 BURCH A.

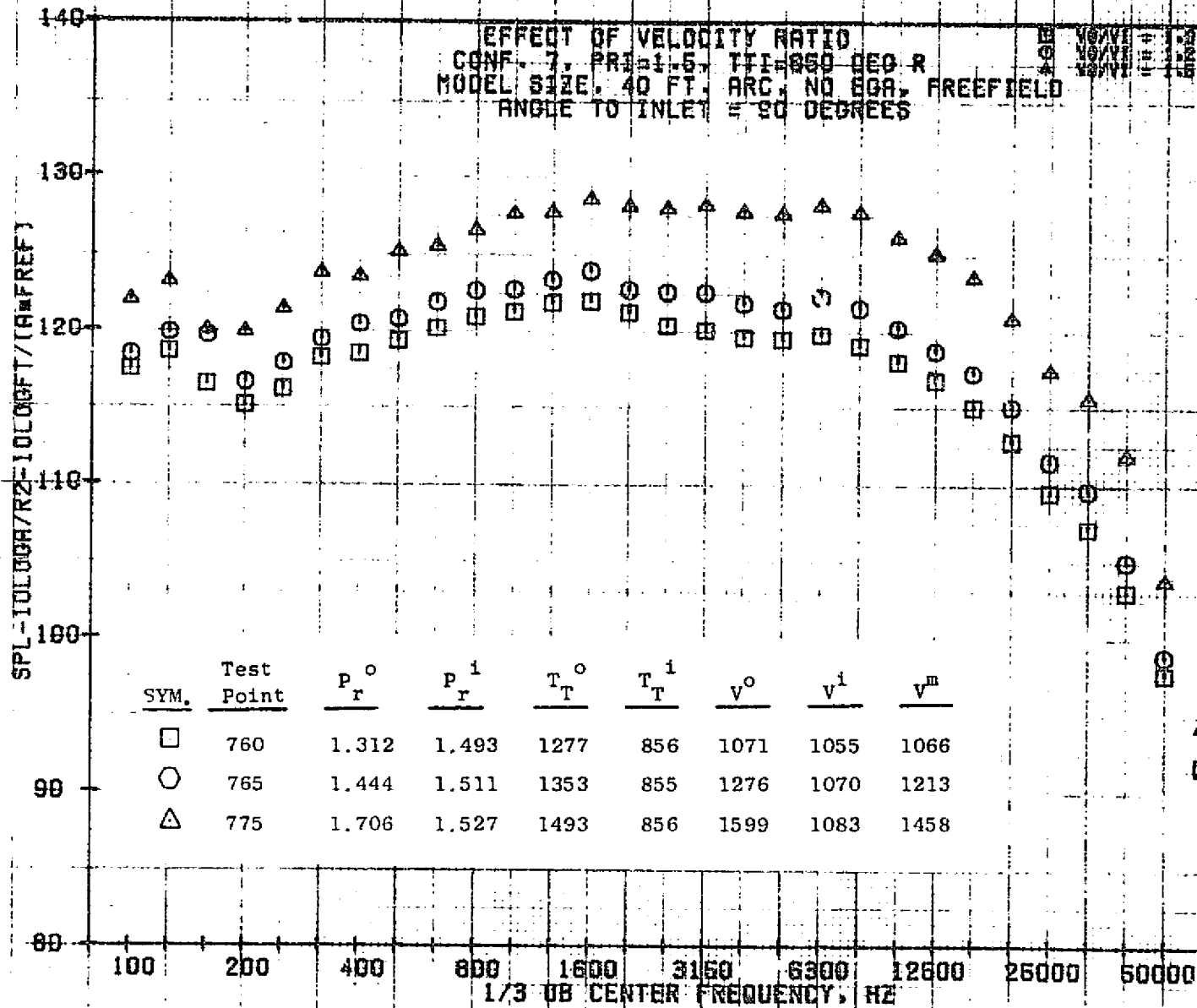
1811



11/10/76
 18048-001

79 BURCH A.

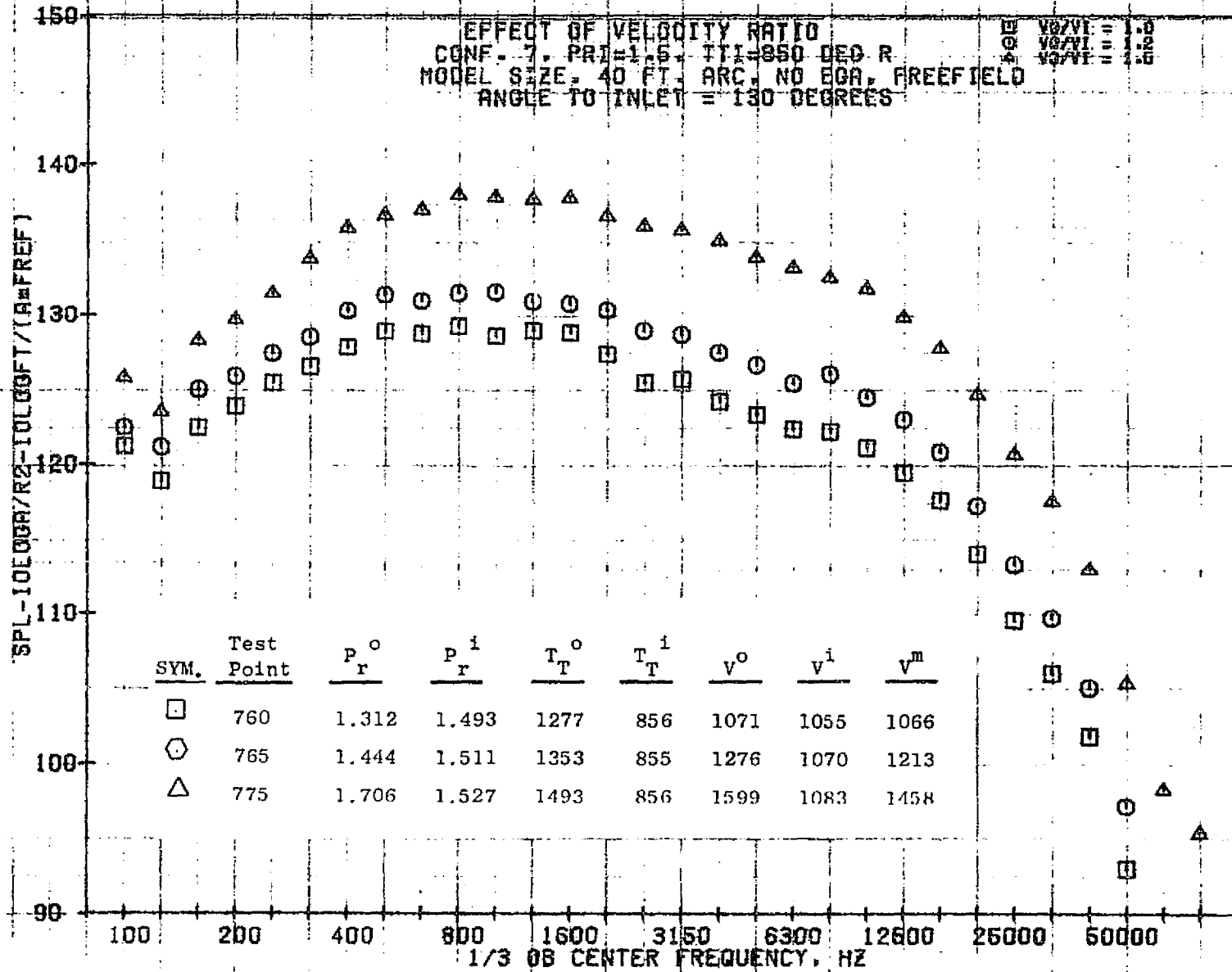
8871



11/10/76
 18048-001

79 BURCH A.

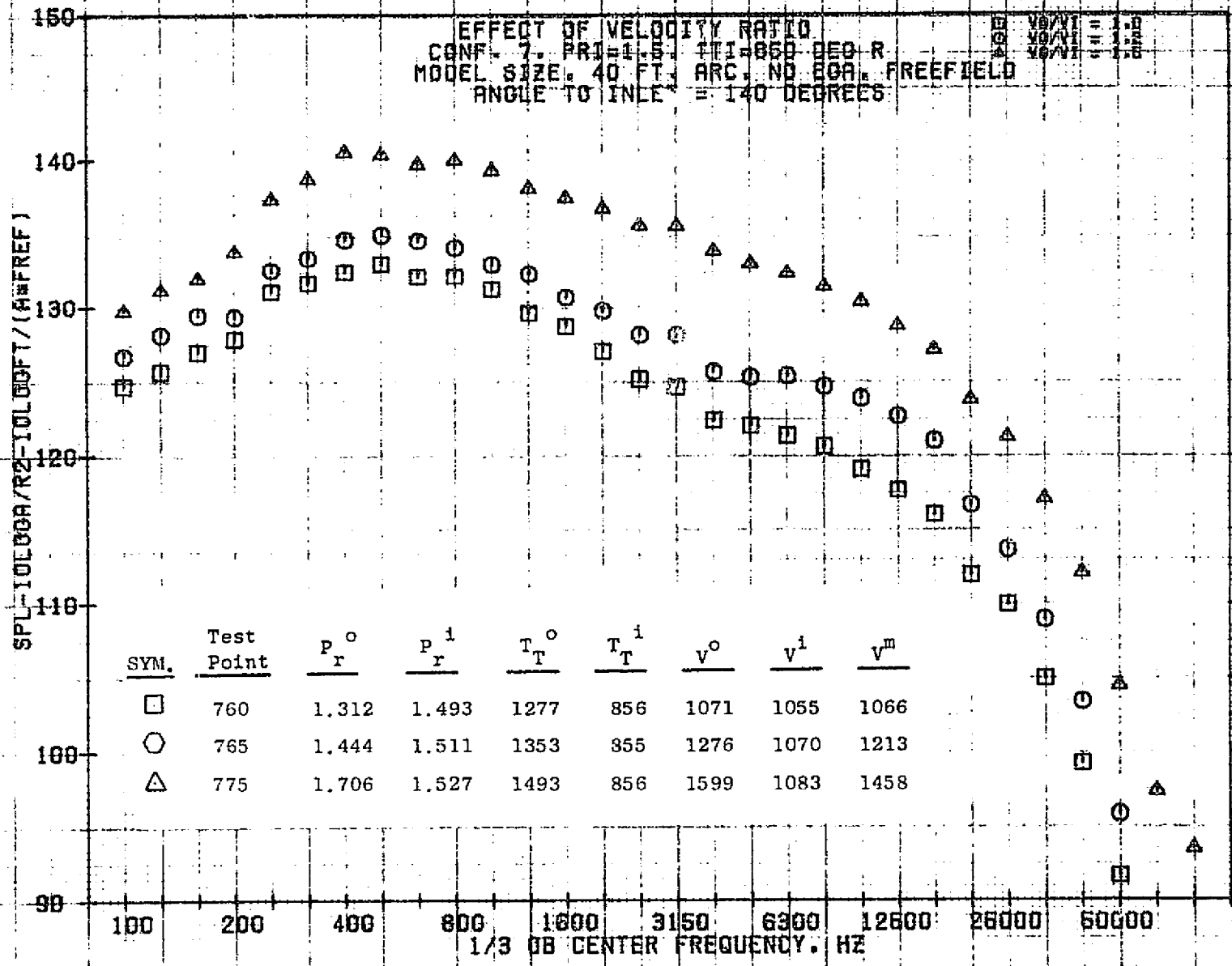
1183



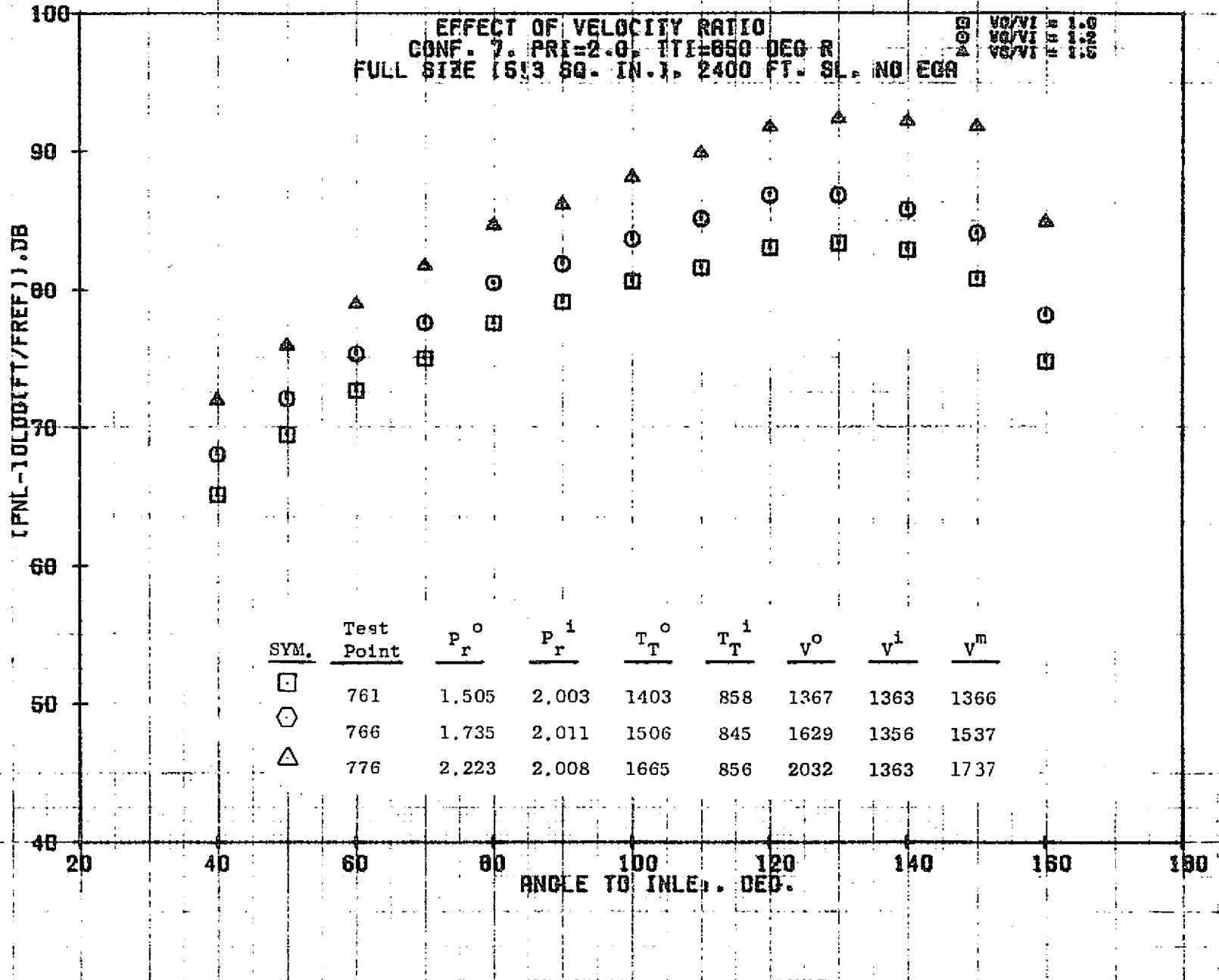
11/10/76
 18048-001

79 BURCH A.

1184



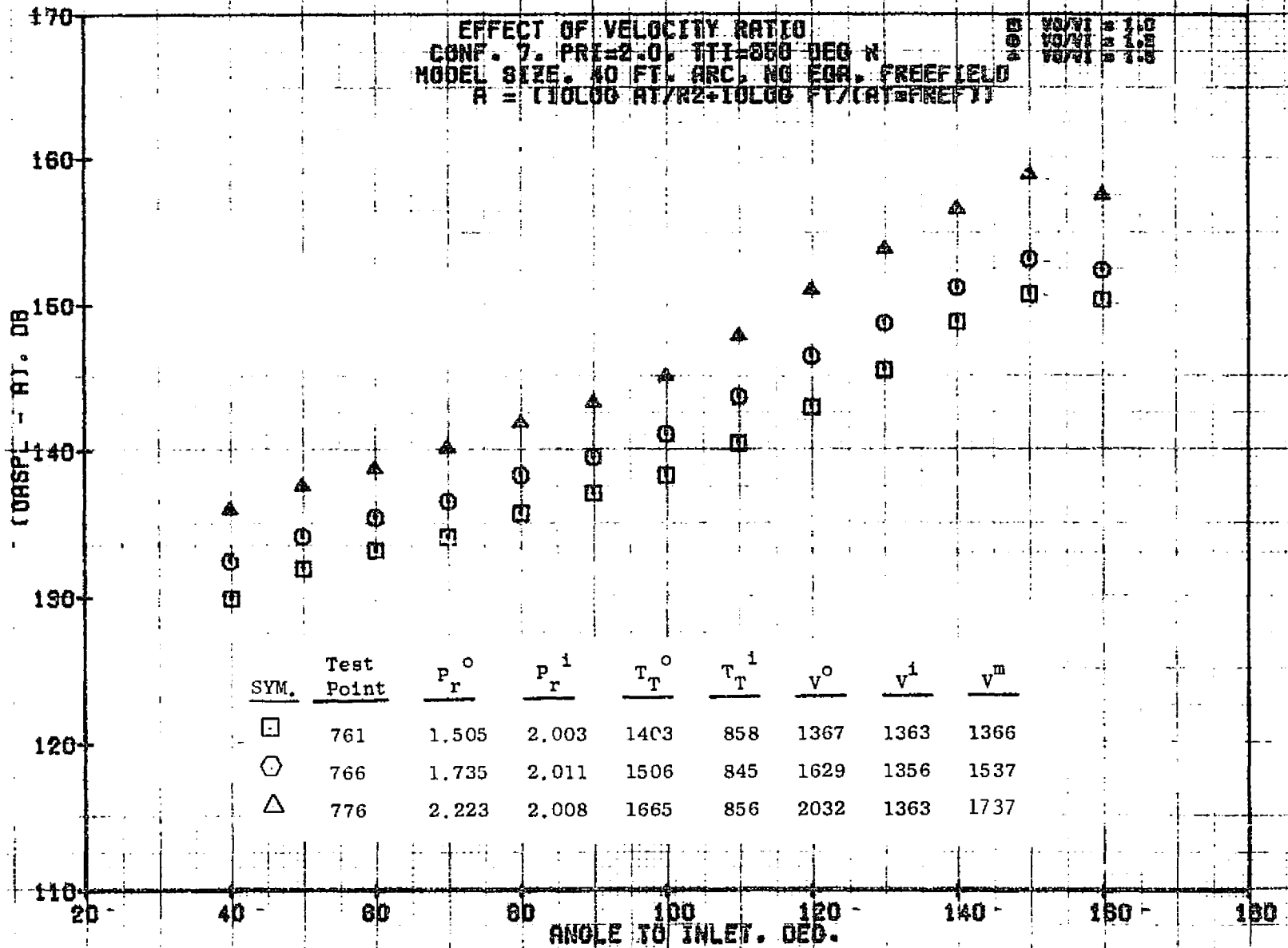
1185



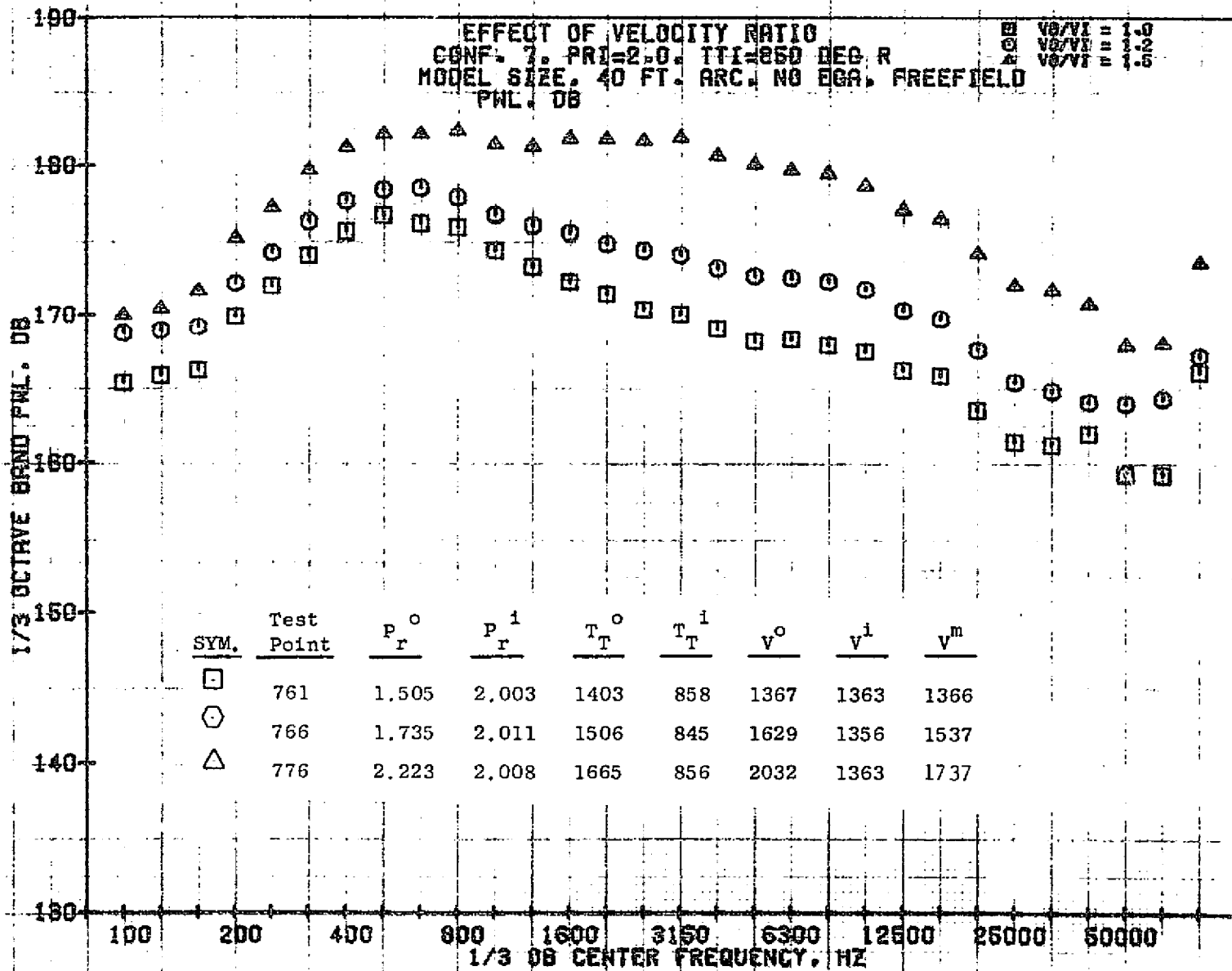
11/01/76
 18421-001

79 BURCH A.

1186



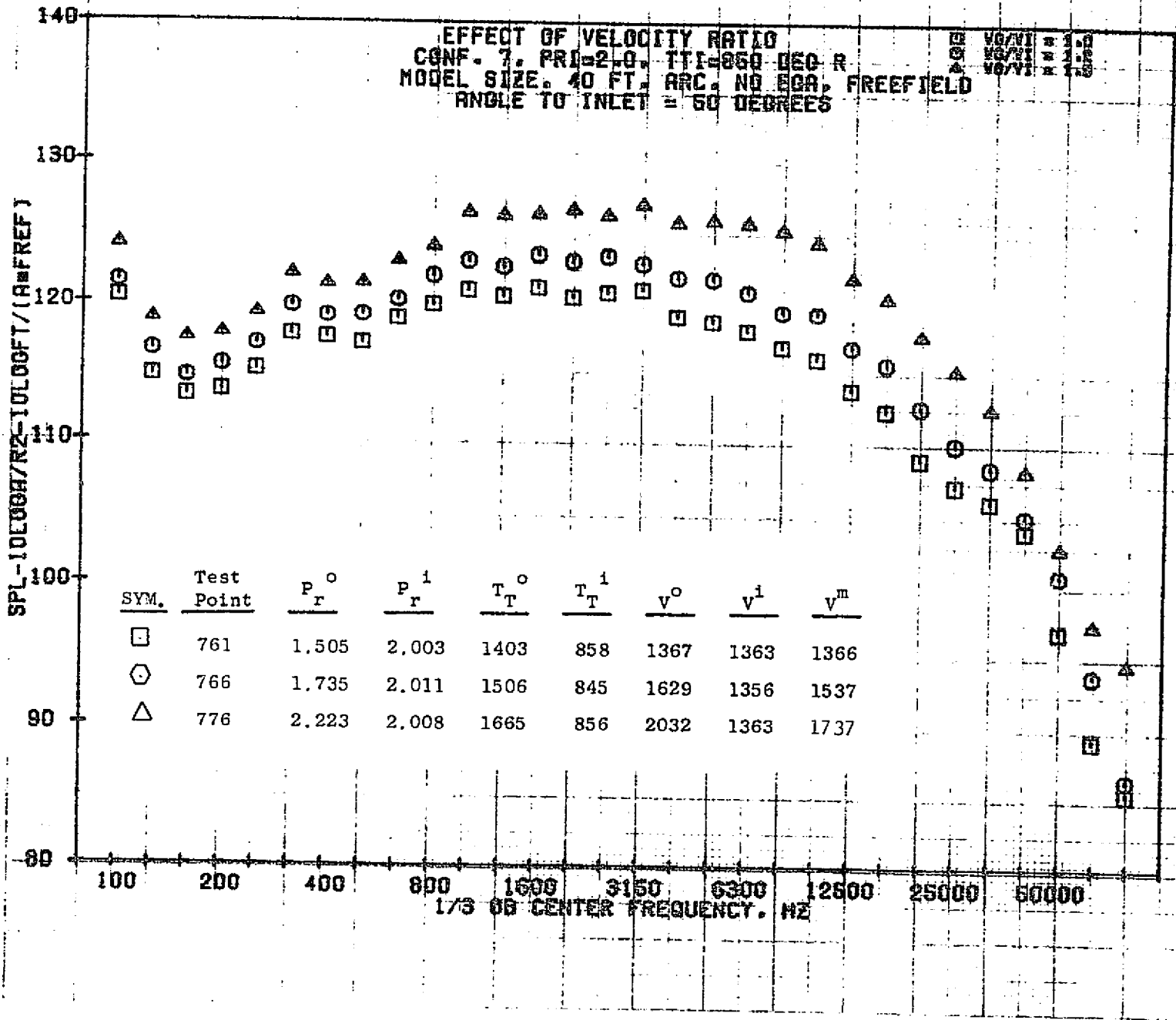
7811



11/03/76
 18575-001

79 BURCH A.

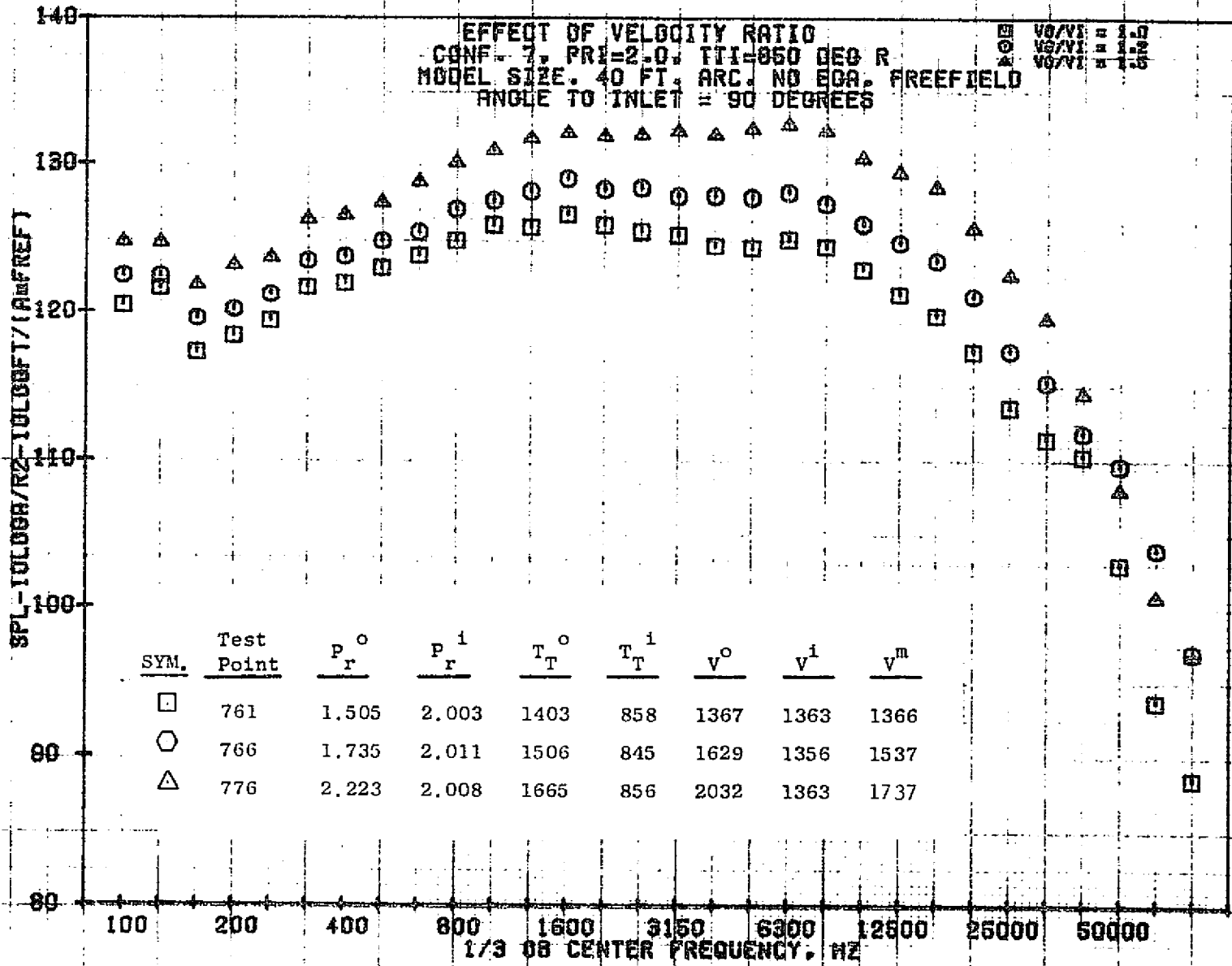
1188



11/03/76
 18575-001

79 BURCH A.

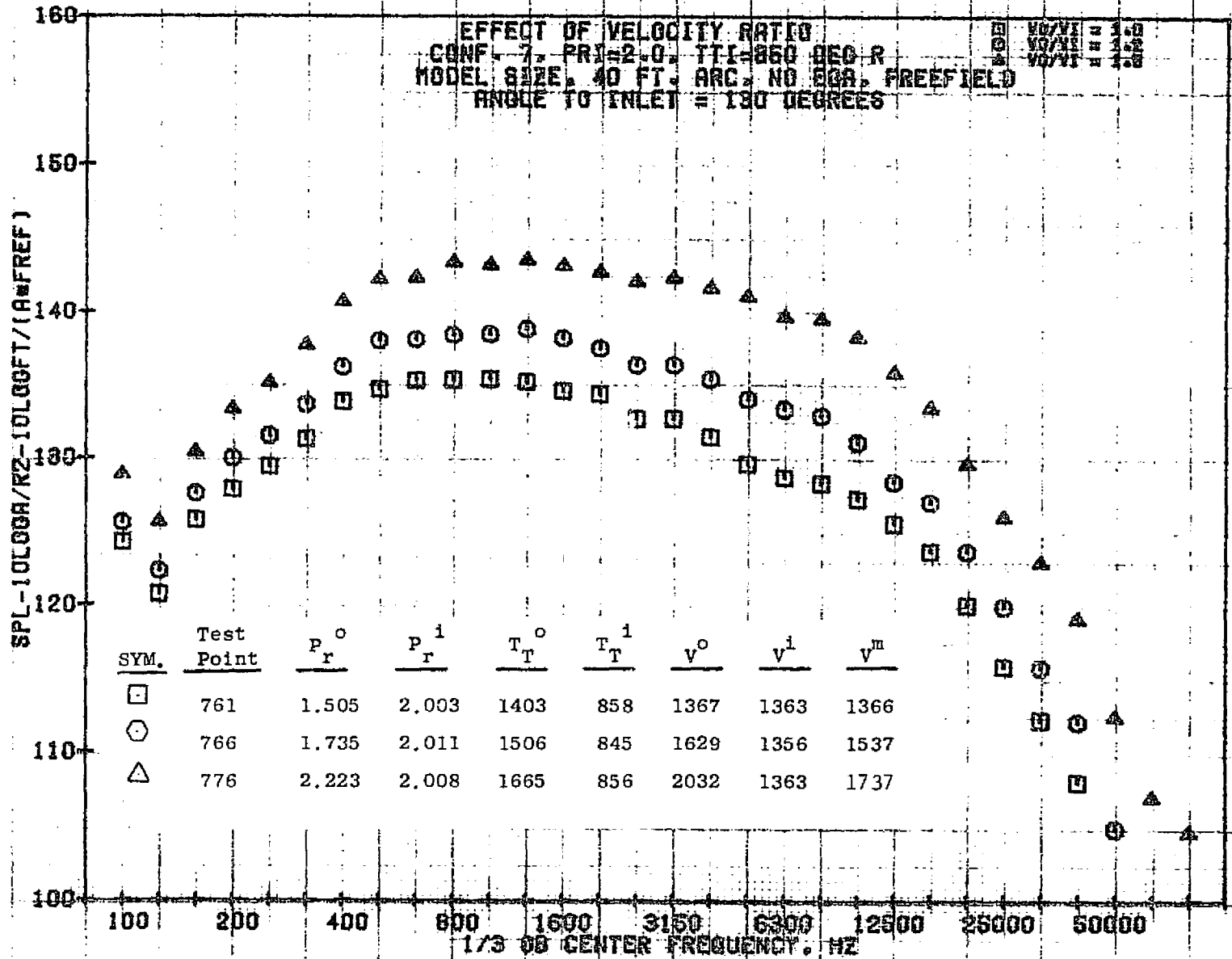
6811



11/03/76
 18575-001

79 BURCH A.

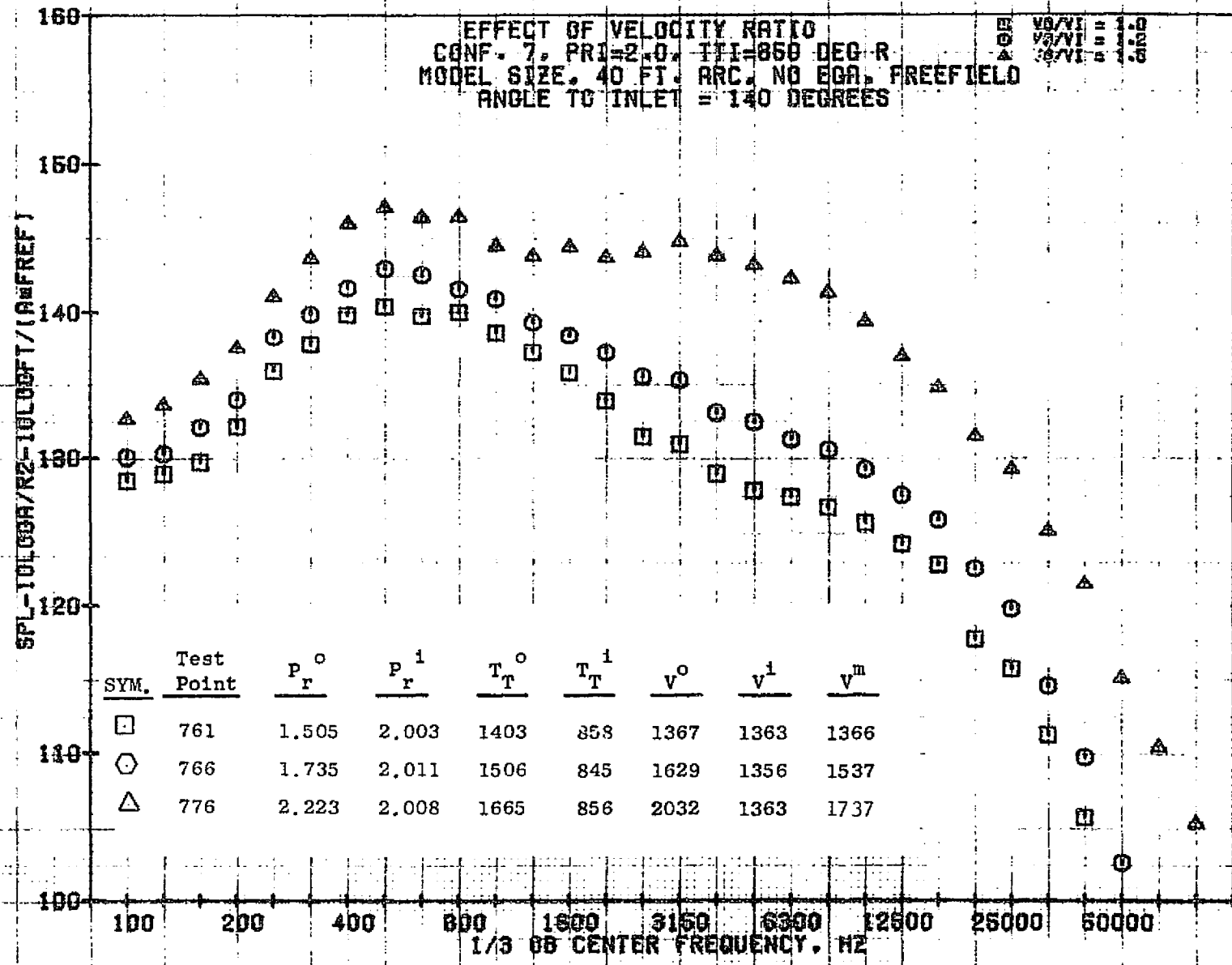
0611 1190



11/03/76
 18675-001

79 BURCH A.

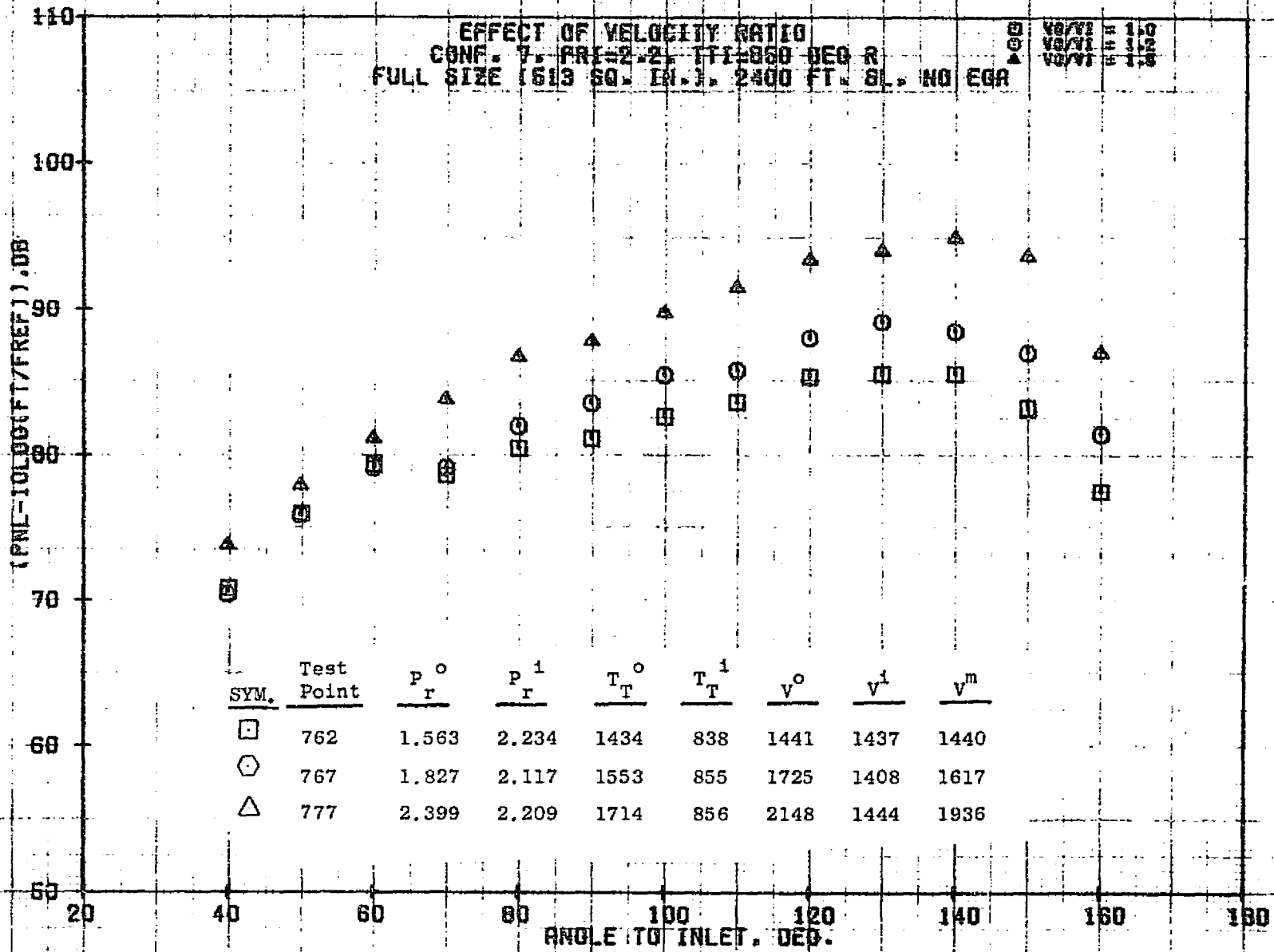
1611



11/03/76
 18575-001

79 BURCH A.

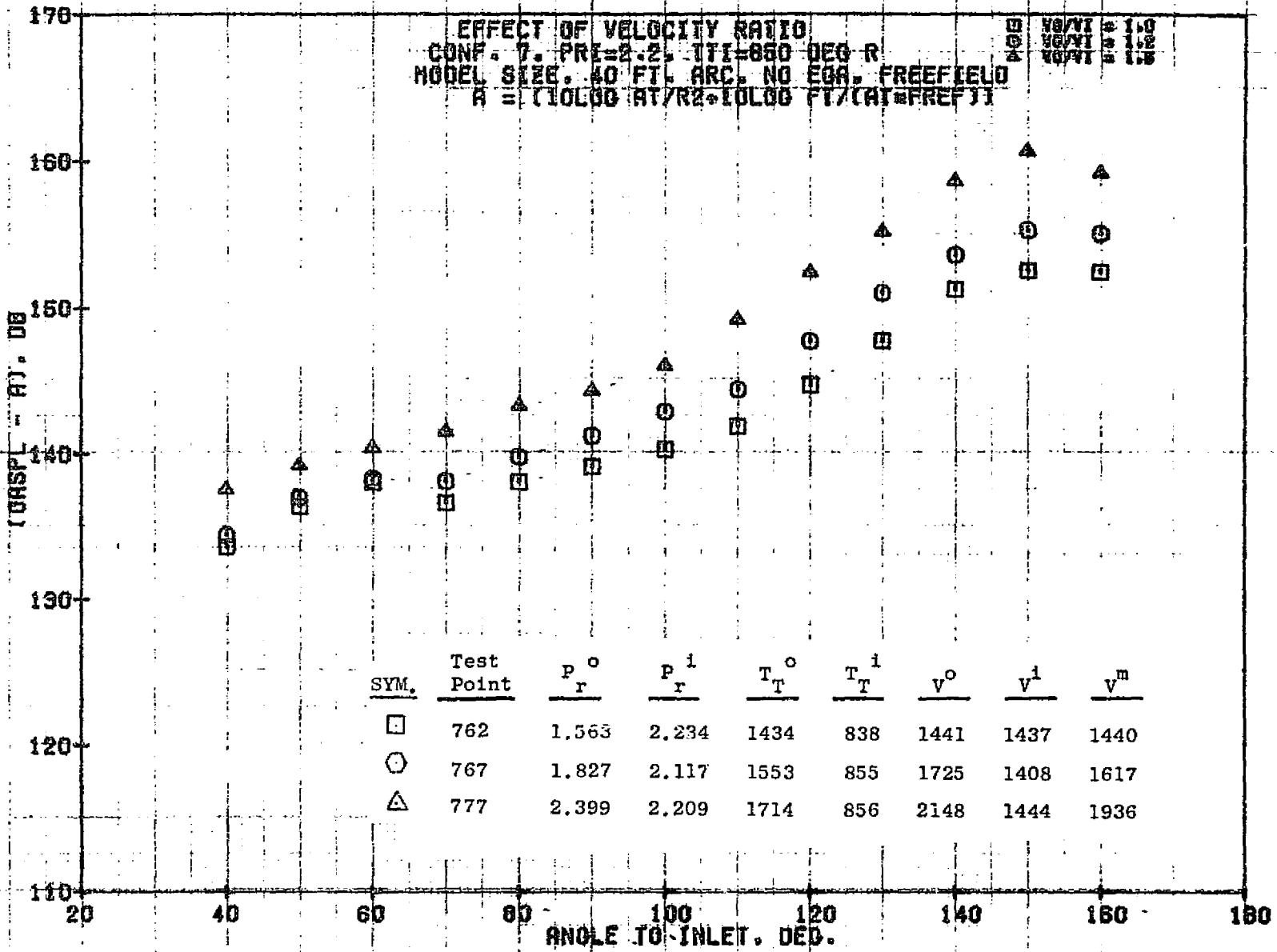
1192



11/01/76
 18421-001

79 BURCH A.

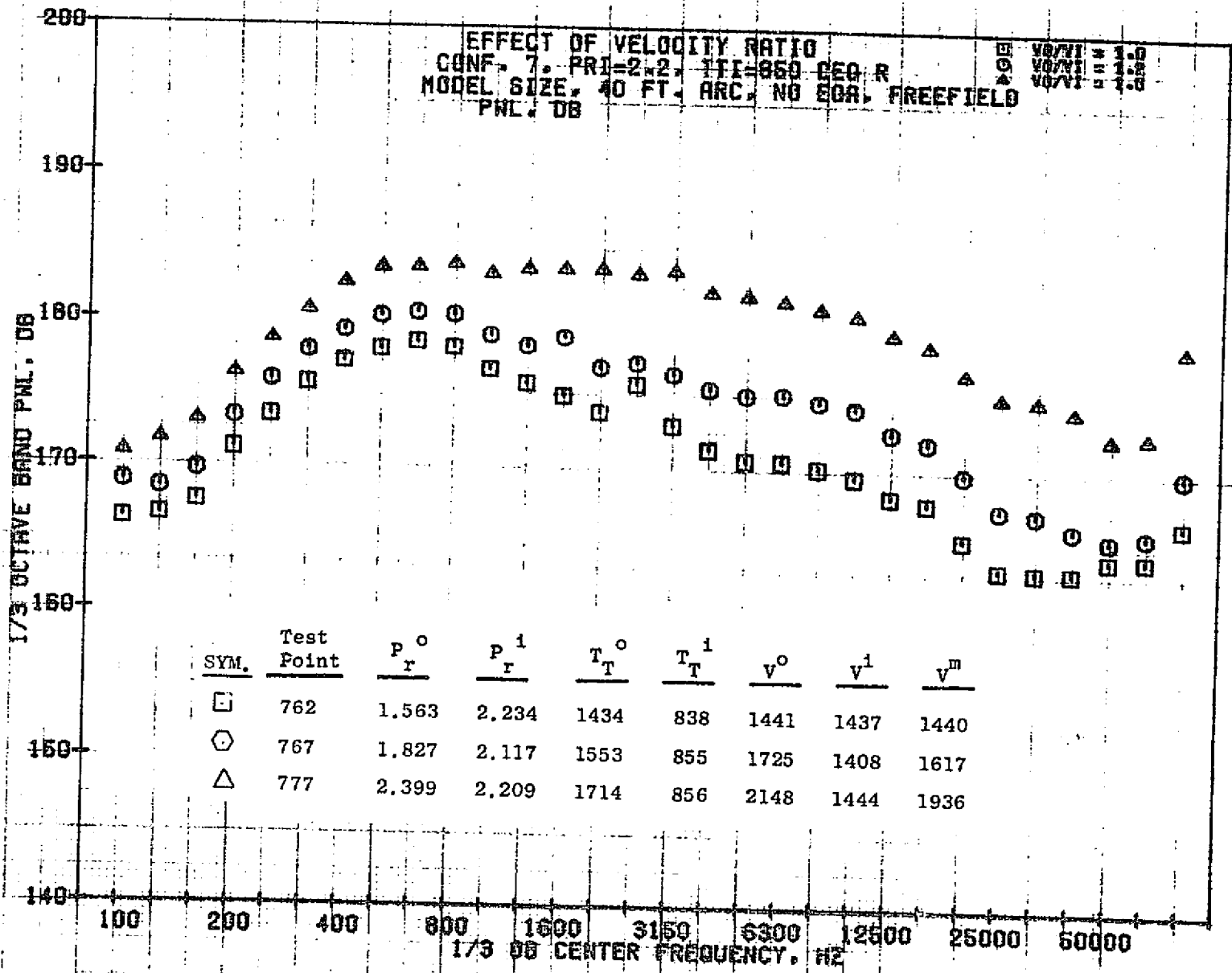
1193



11/09/76
18338-001

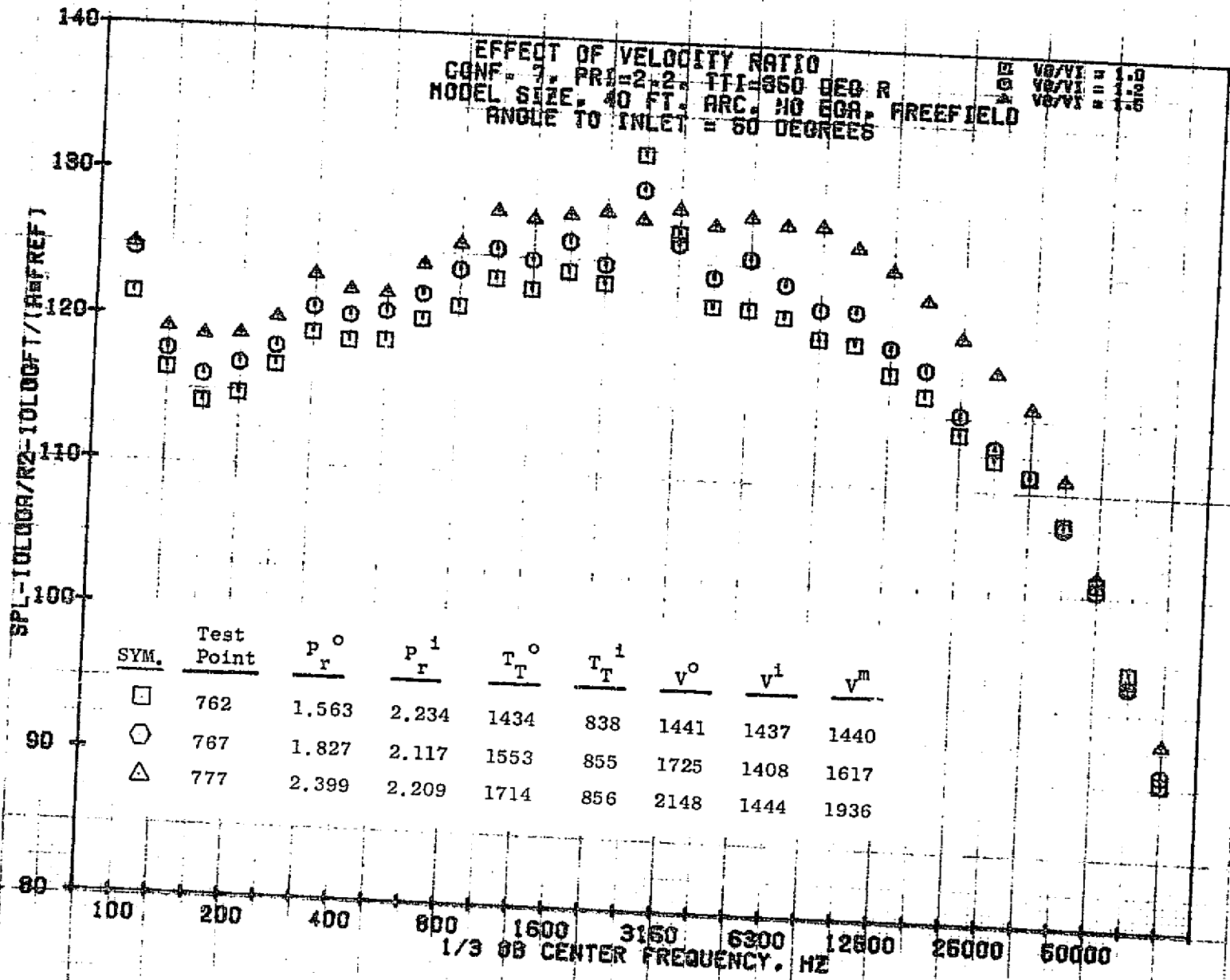
79 AIRCH 9.

1194



11/03/76
 18575-001

79 BURCH A.

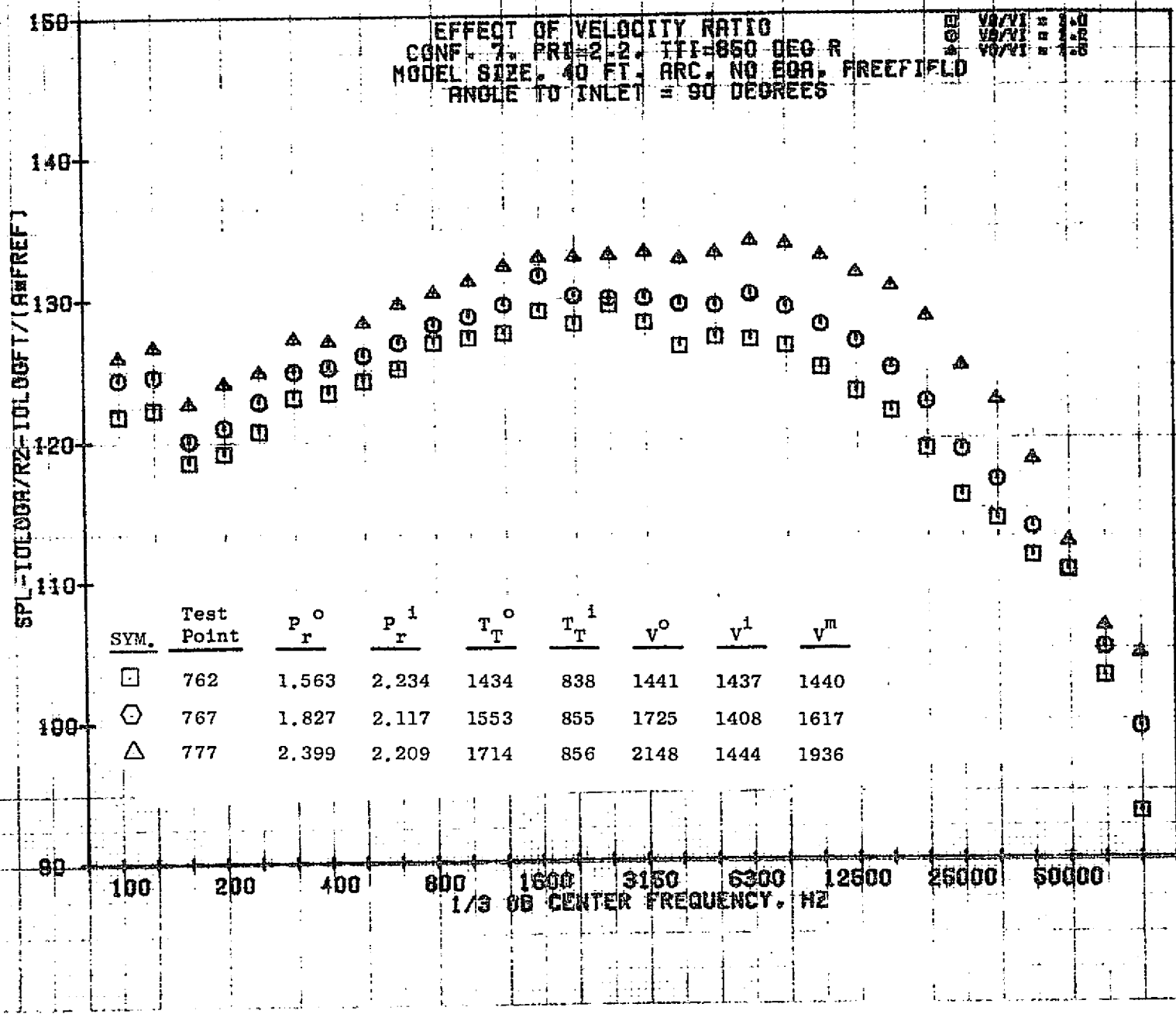


1195

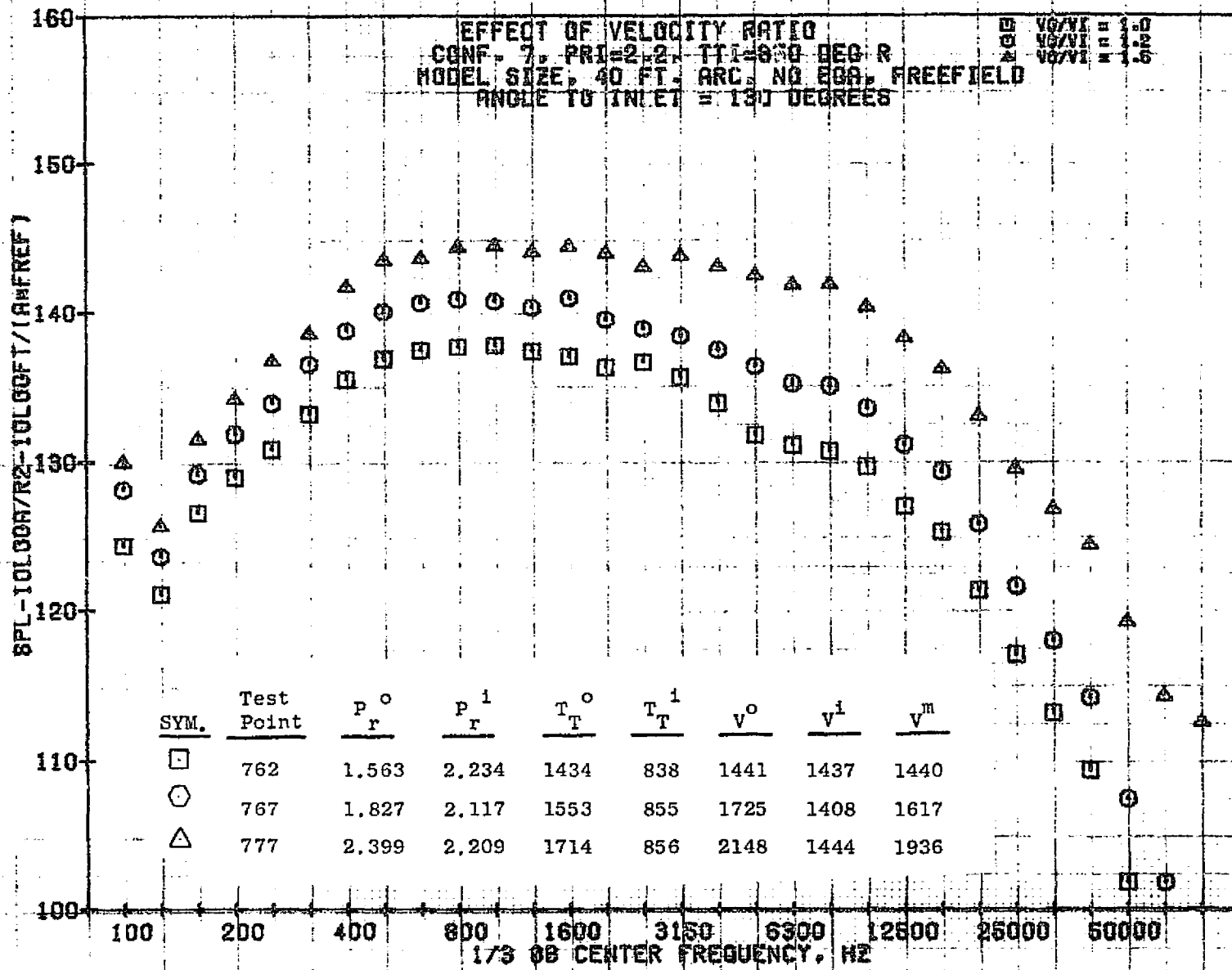
11/03/76
 18576-001

79 BURCH A.

9511



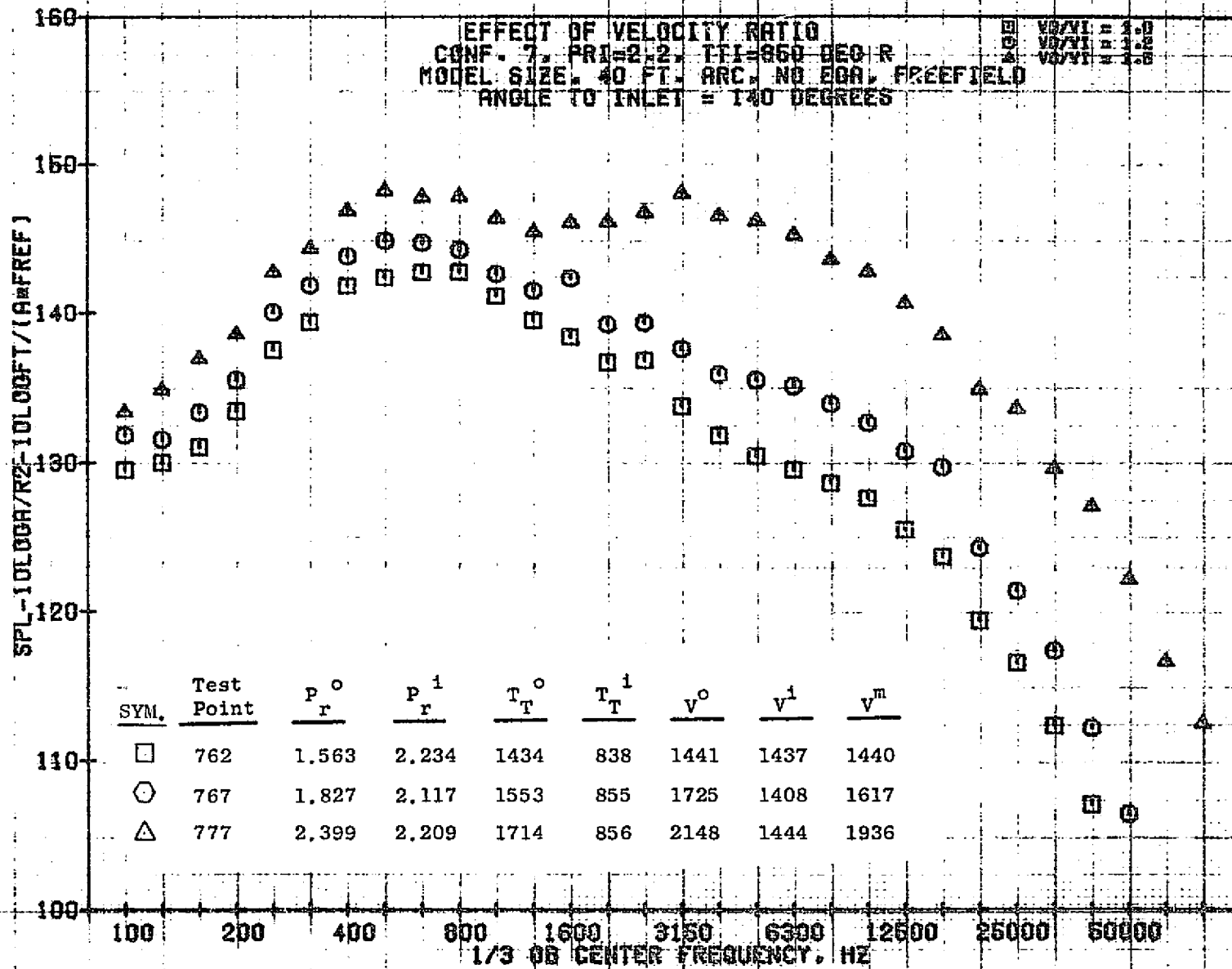
2611



11/03/76
18575-001

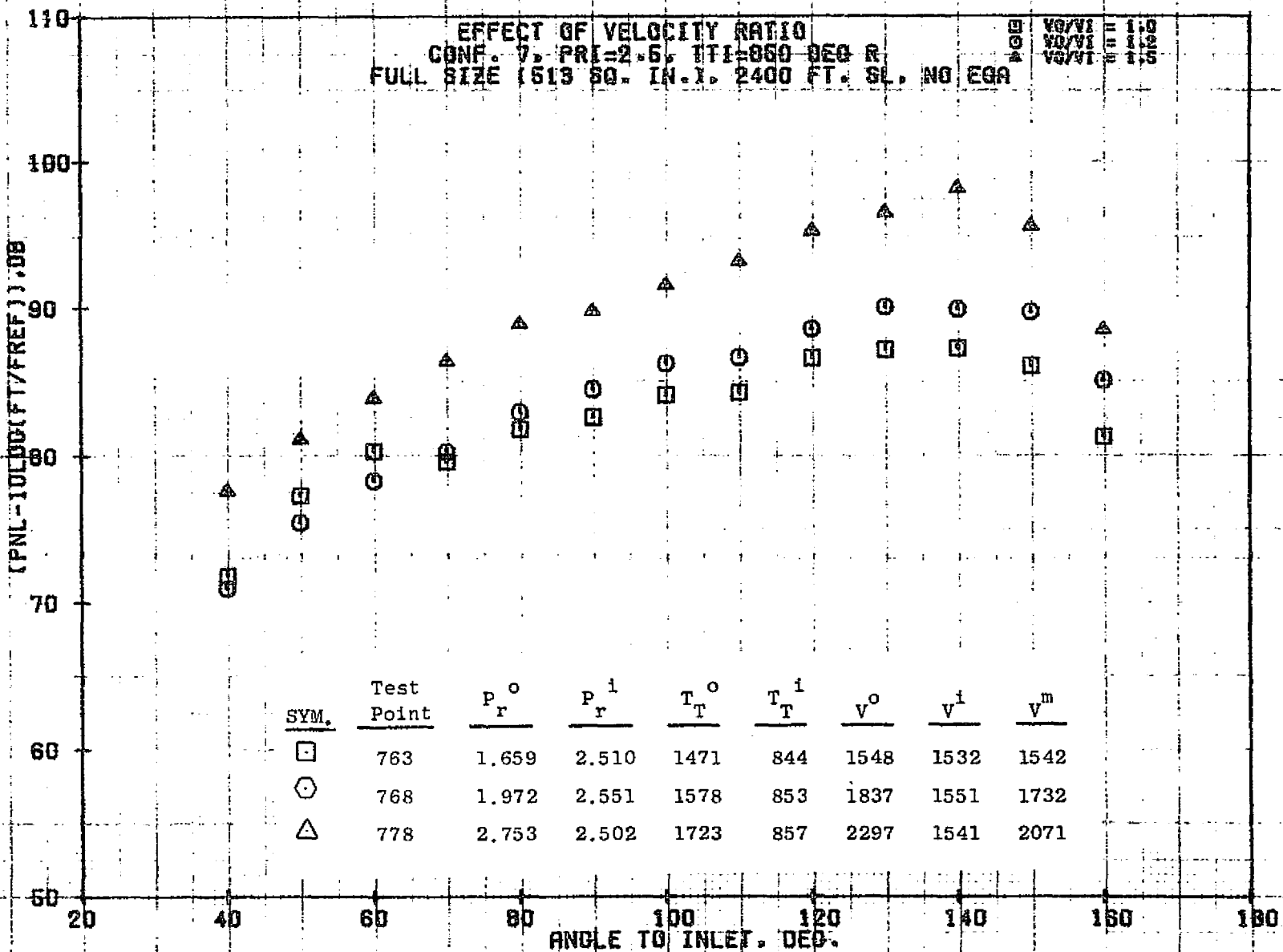
79 BURCH A.

8611



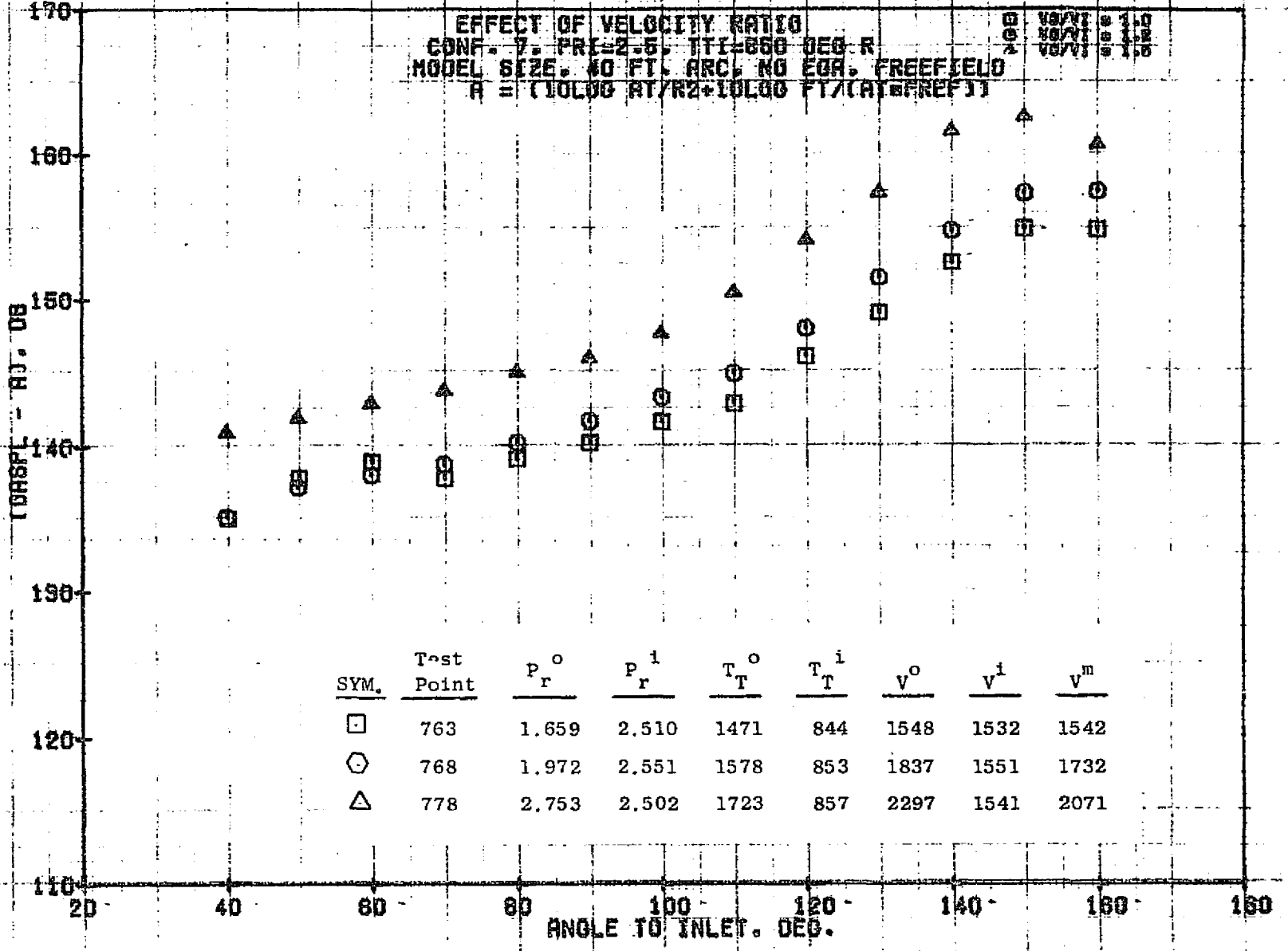
11/03/76
 18575-001

79 BURCH P.



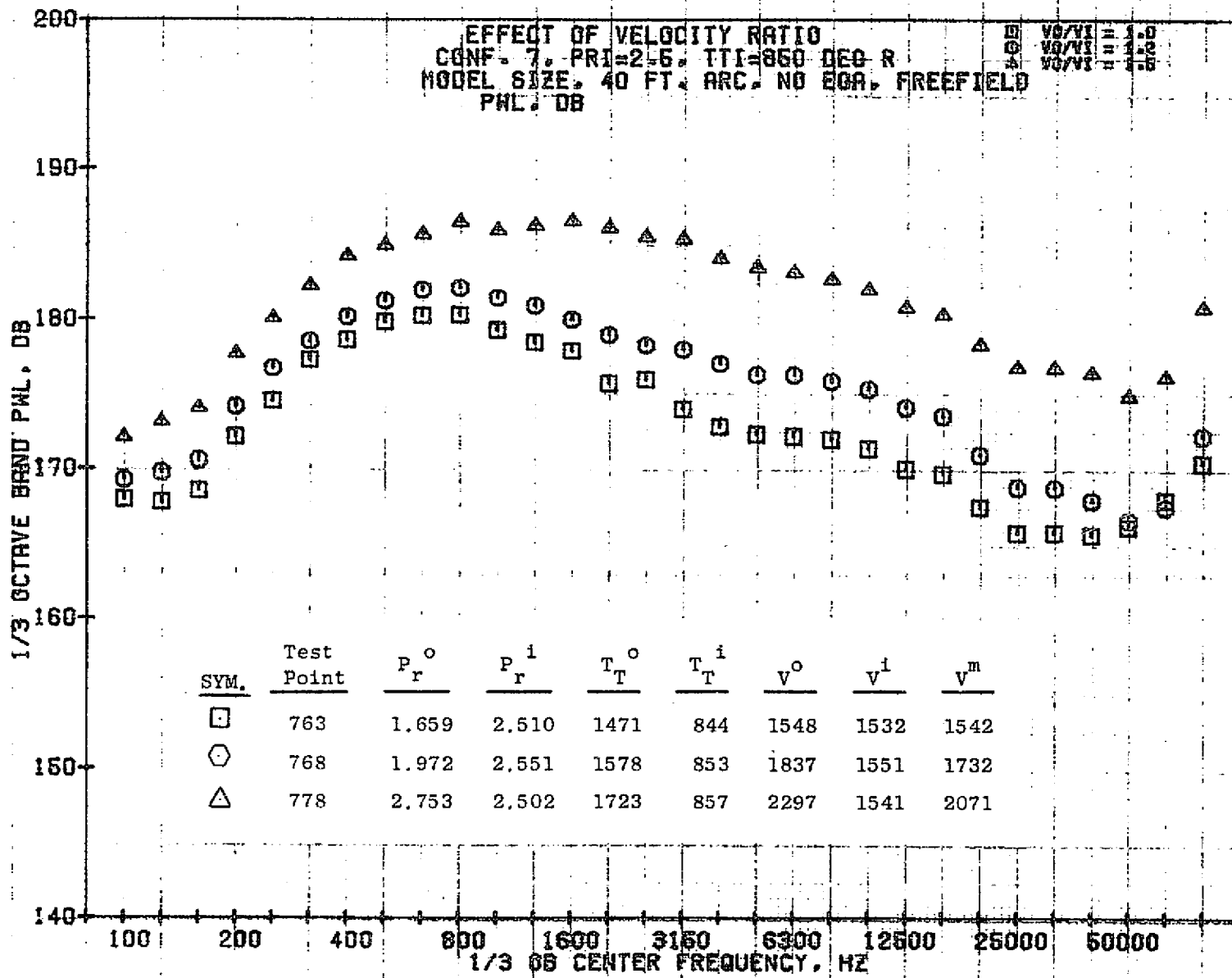
11/01/76
 18421-001

79 BURCH A.



1200

1201



11/03/76
 18675-001

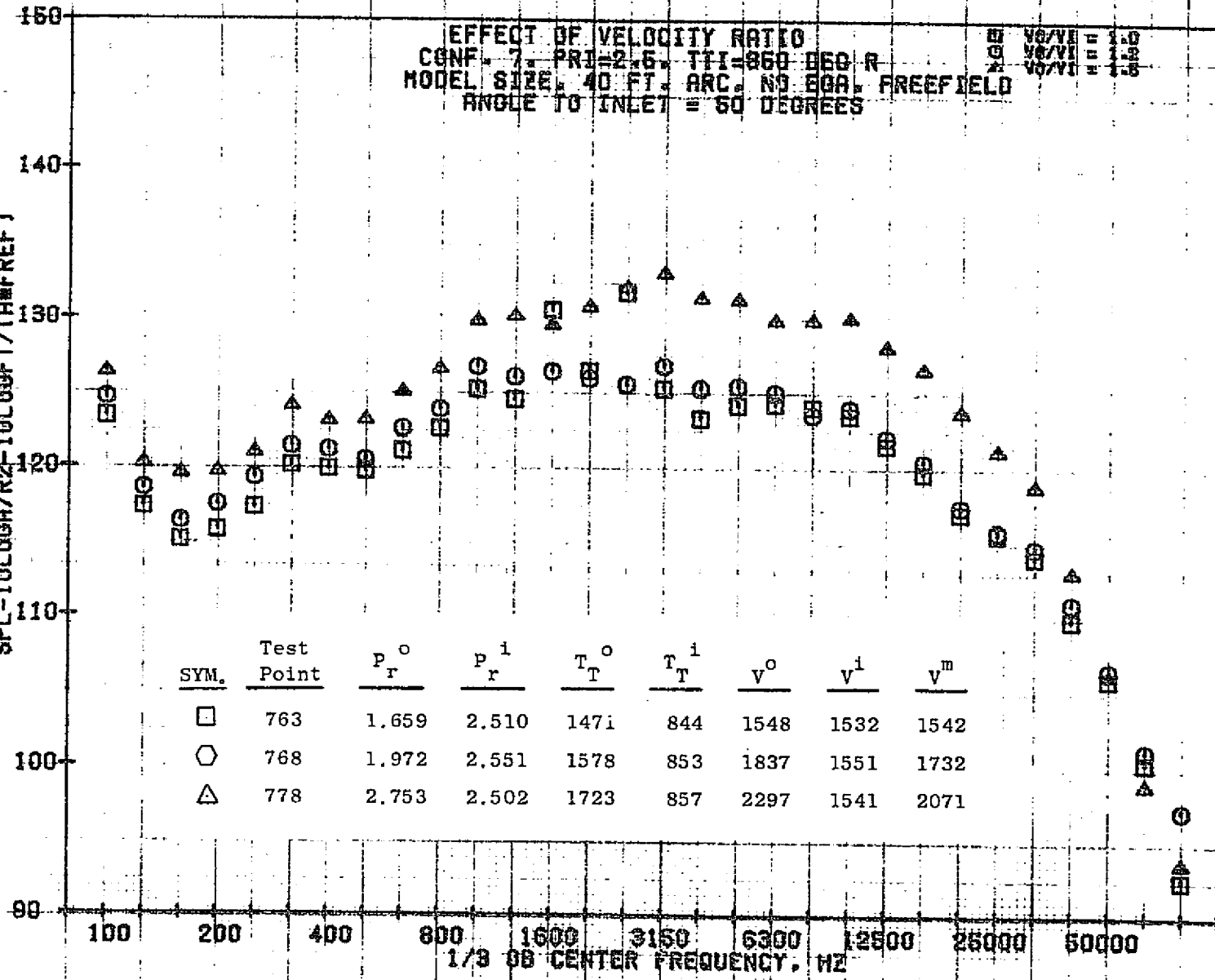
79 BURCH A.

150FT

SPL - 10 LOG (P/PREF) - 10 LOG (R/RREF)

EFFECT OF VELOCITY RATIO
 CONF. 7, PRI=2.6, TTI=860 DEG R
 MODEL SIZE 40 FT. ARC, NO. 80A, FREEFIELD
 ANGLE TO INLET = 60 DEGREES

□ V₀/V₁ = 1.0
 ○ V₀/V₁ = 1.5
 △ V₀/V₁ = 2.0

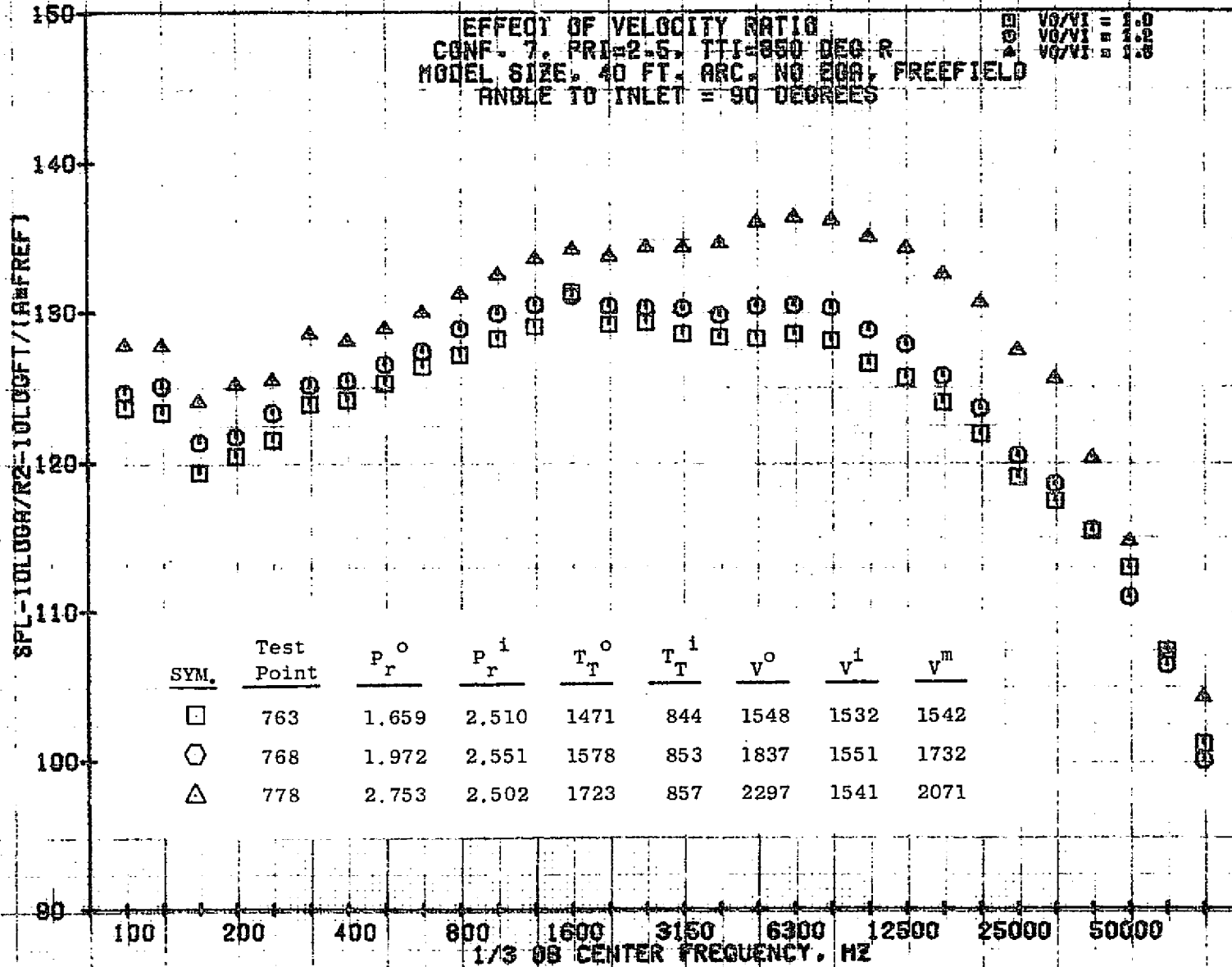


SYM.	Test Point	P _r ^o	P _r ⁱ	T _T ^o	T _T ⁱ	V ^o	V ⁱ	V ^m
□	763	1.659	2.510	147i	844	1548	1532	1542
○	768	1.972	2.551	1578	853	1837	1551	1732
△	778	2.753	2.502	1723	857	2297	1541	2071

11/03/76
 18575-001

79 BURCH A.

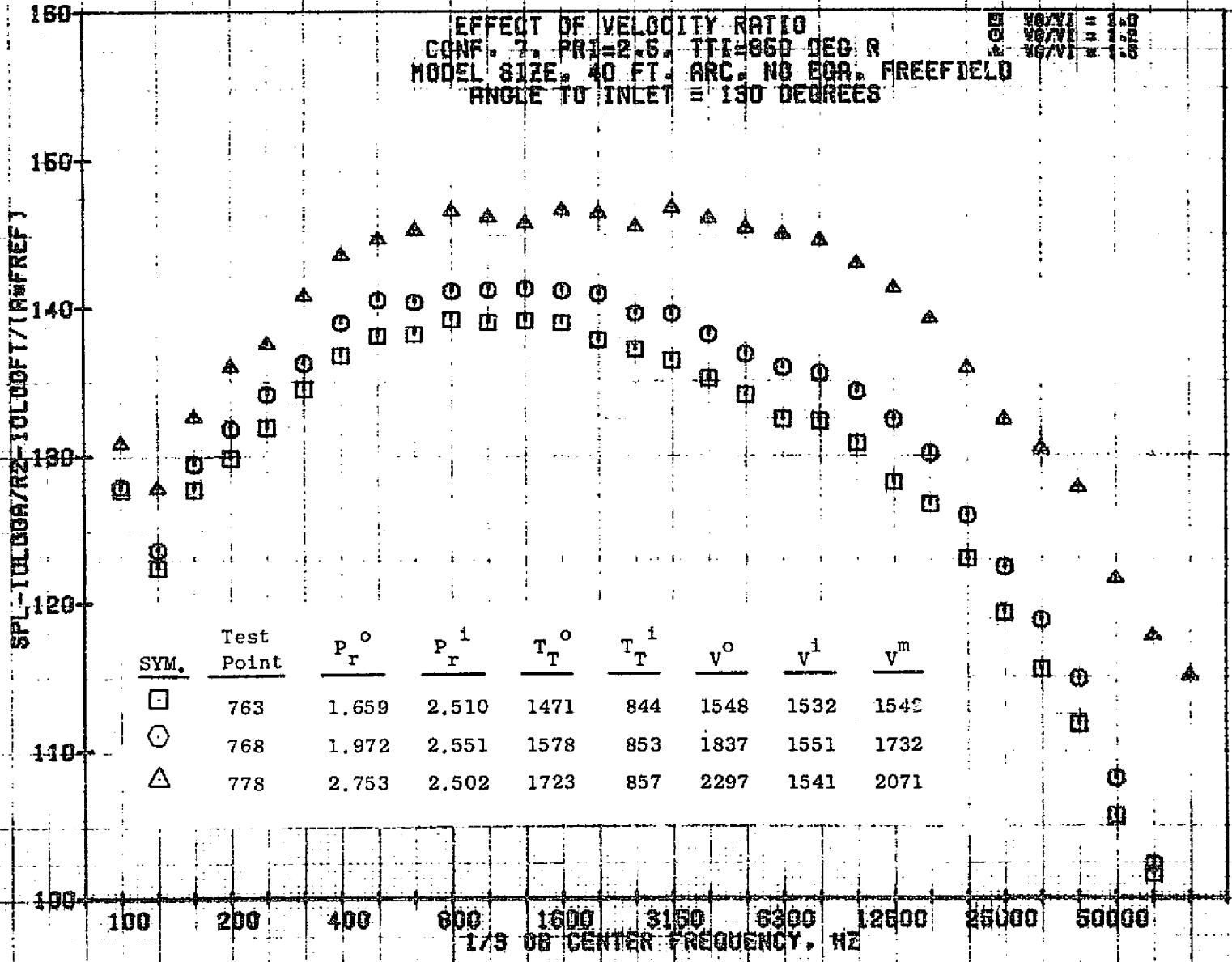
1208



11/03/76
 18575-001

79 BURCH A.

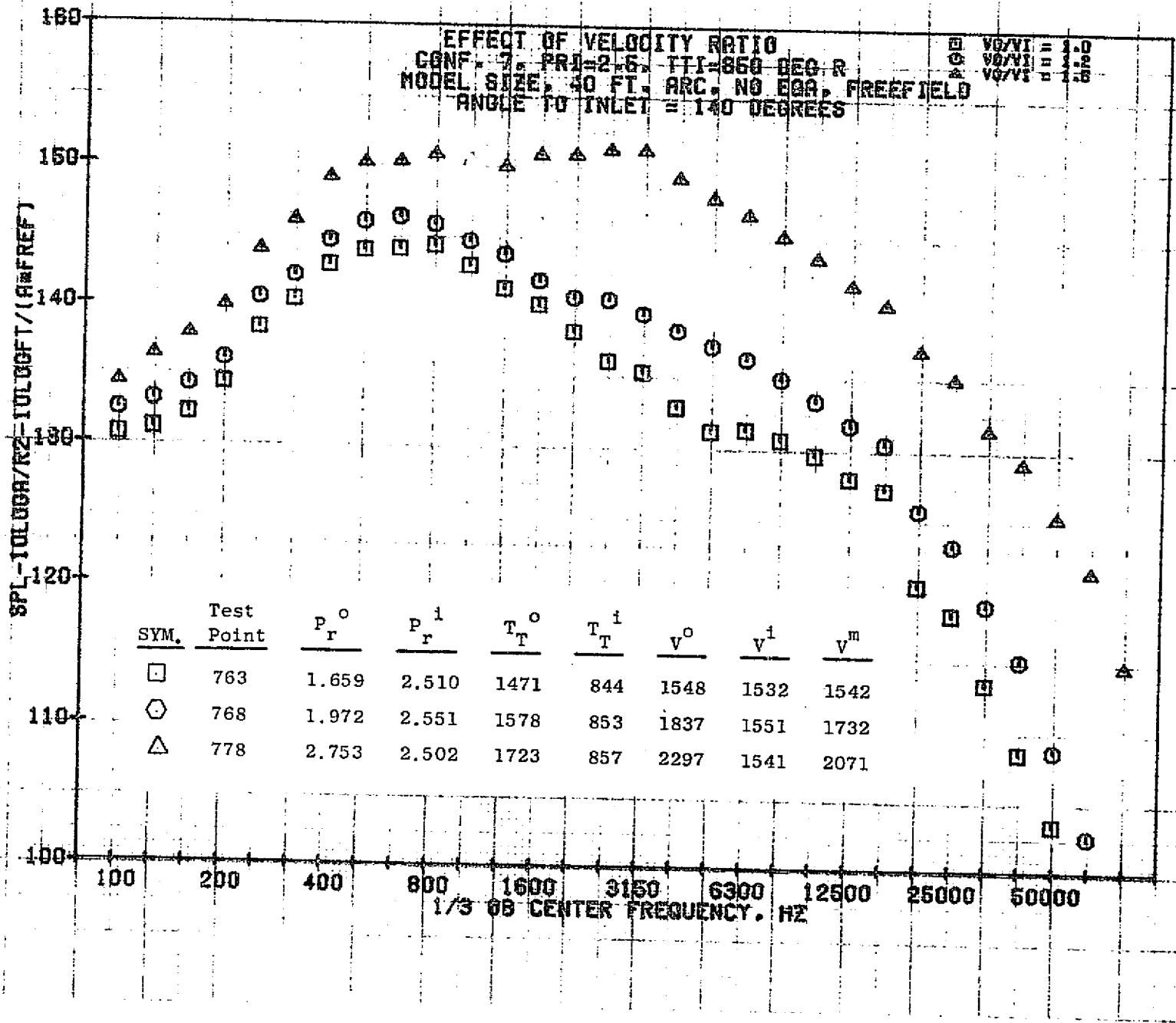
1204



11/03/76
 18576-001

79 BURCH A.

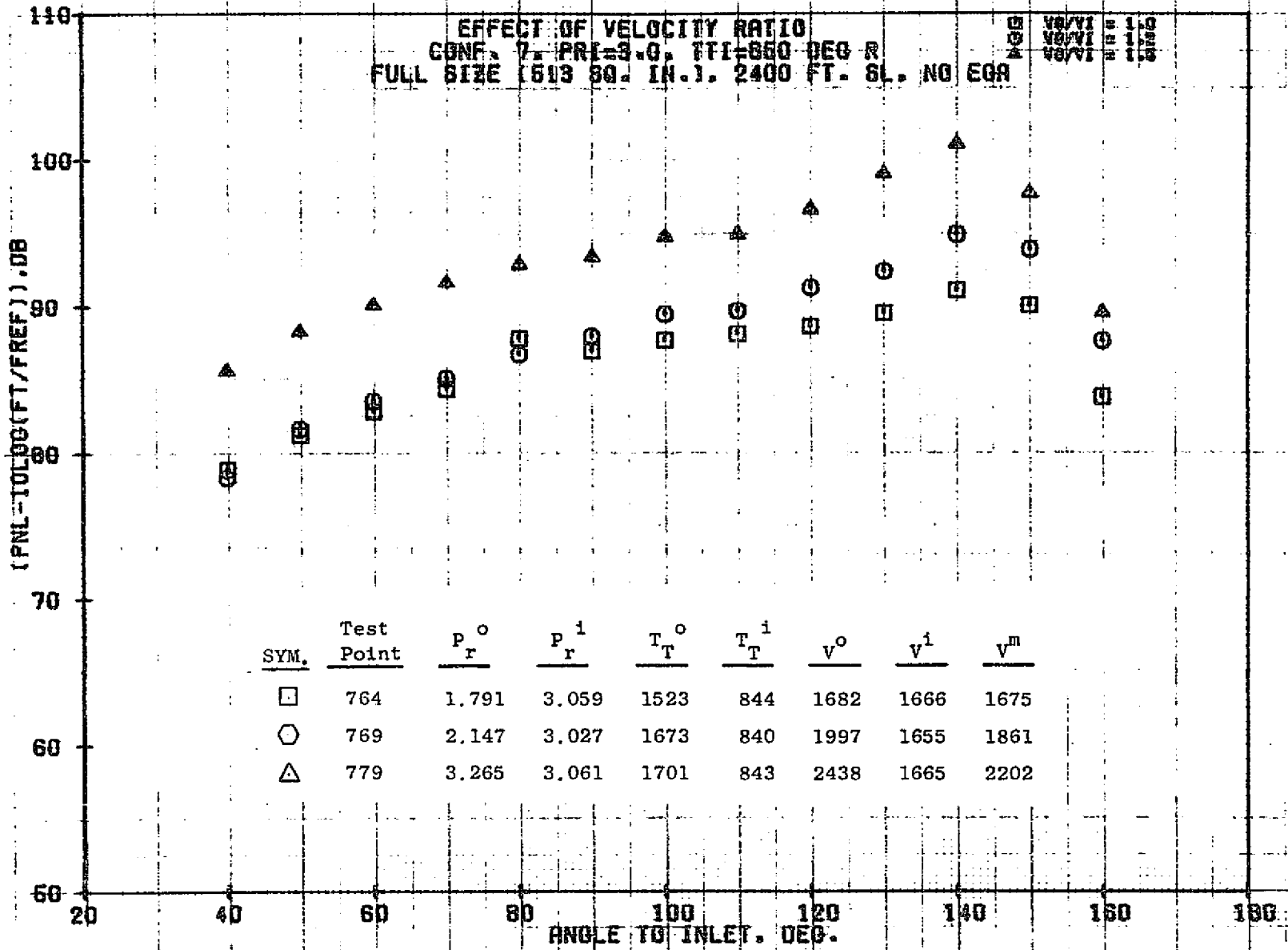
1205



11/03/76
 1B575-001

79 BURCH A.

1P08



11/01/76
 18421-001

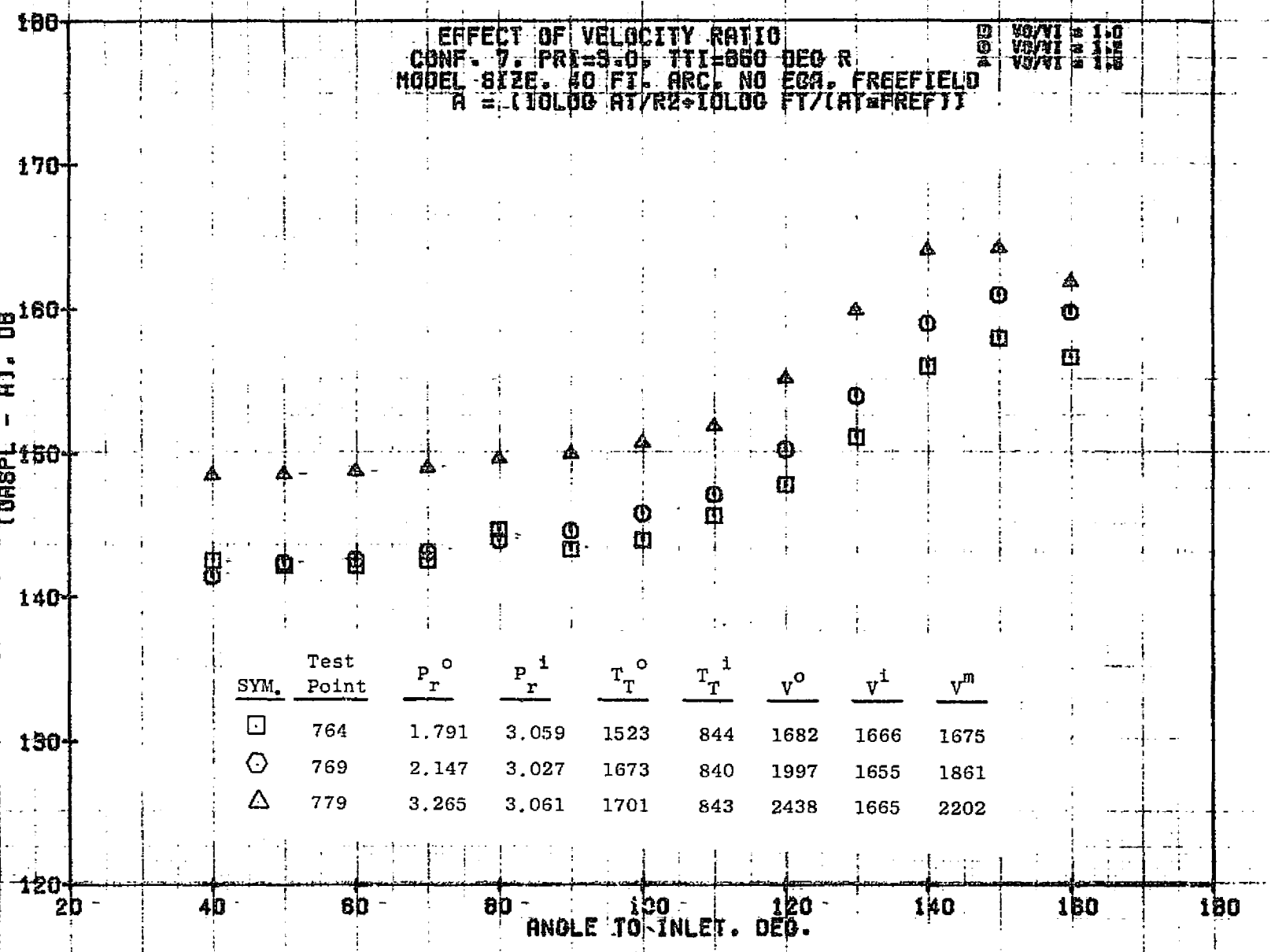
79 BURCH A.

1207

(CONSPL - RJ. DB

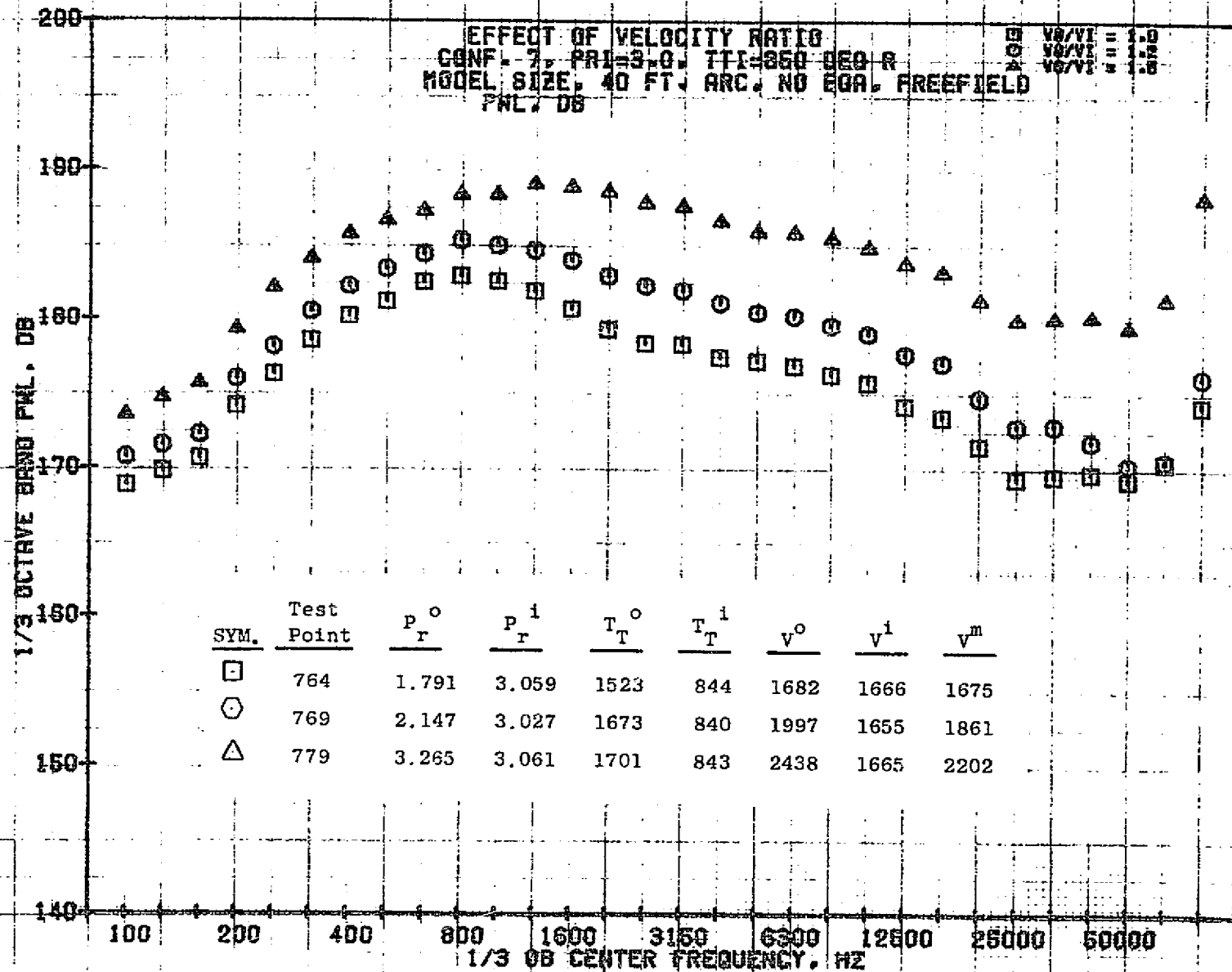
EFFECT OF VELOCITY RATIO
 CONF. 7. $P_r^i = 3.0$, $T_T^i = 850$ DEG R
 MODEL SIZE. 40 FI. ARC. NO EGR. FREEFIELD
 $A = (10 \log AT/2 + 10 \log FT/(AT - PREF))$

$V_0/V_1 = 1.0$
 $V_0/V_1 = 1.5$
 $V_0/V_1 = 1.8$



11/09/76
 18736-001

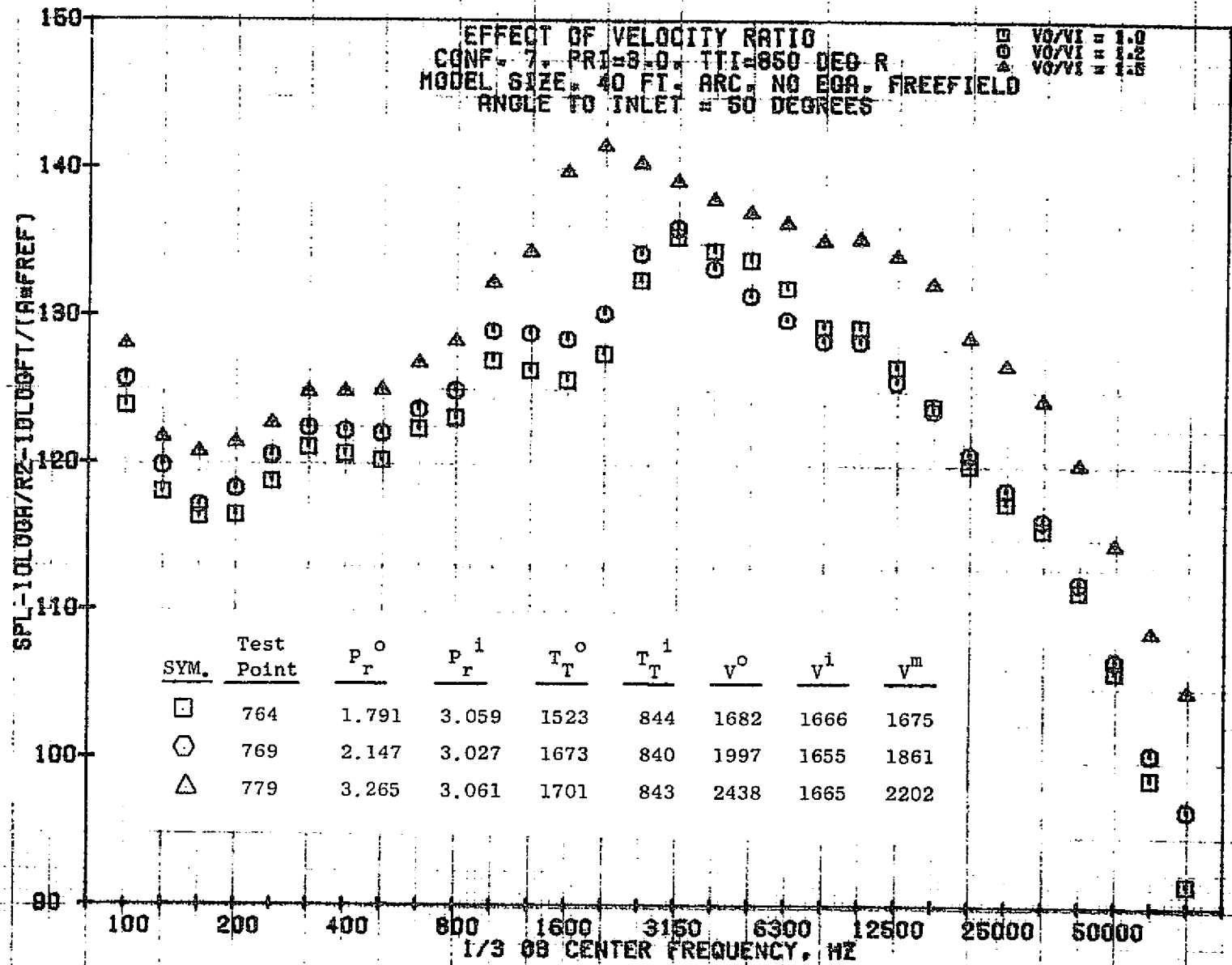
79 AIRCH A.



11/03/76
 16575-001

79 BURCH A.

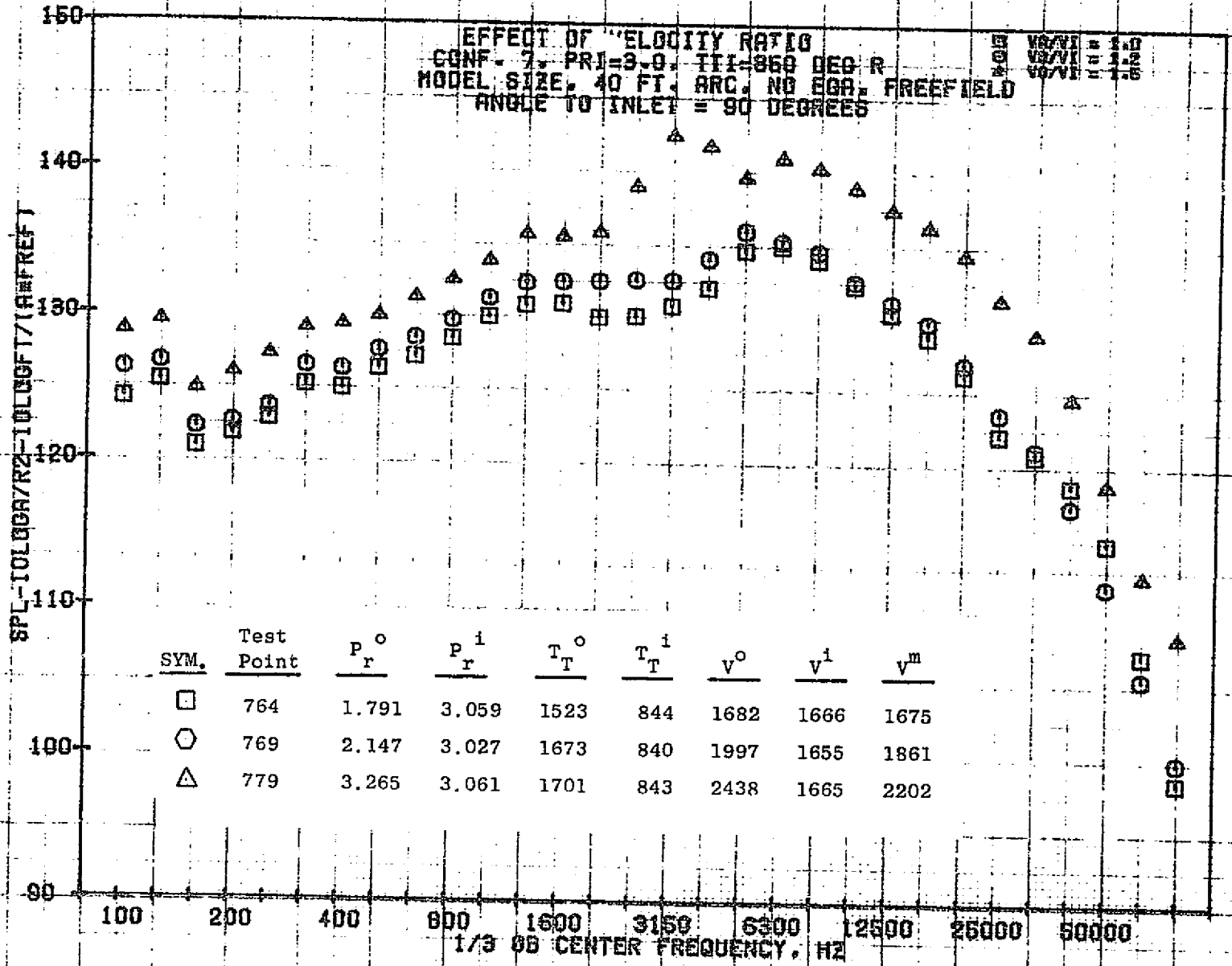
1209



11/03/76
 18575-001

79 BURCH A.

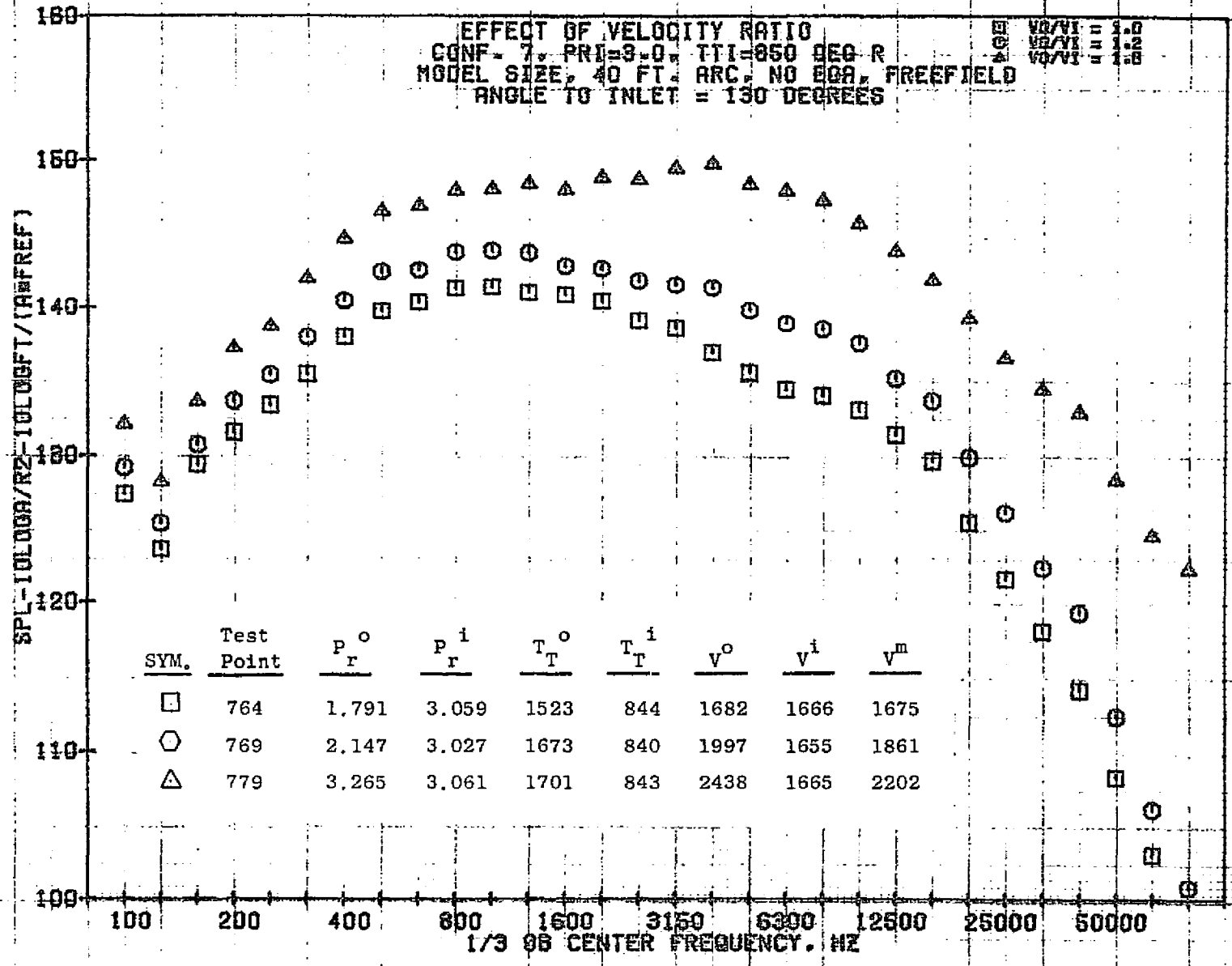
1210



11/03/76
 18575-001

79 BURCH A.

1211



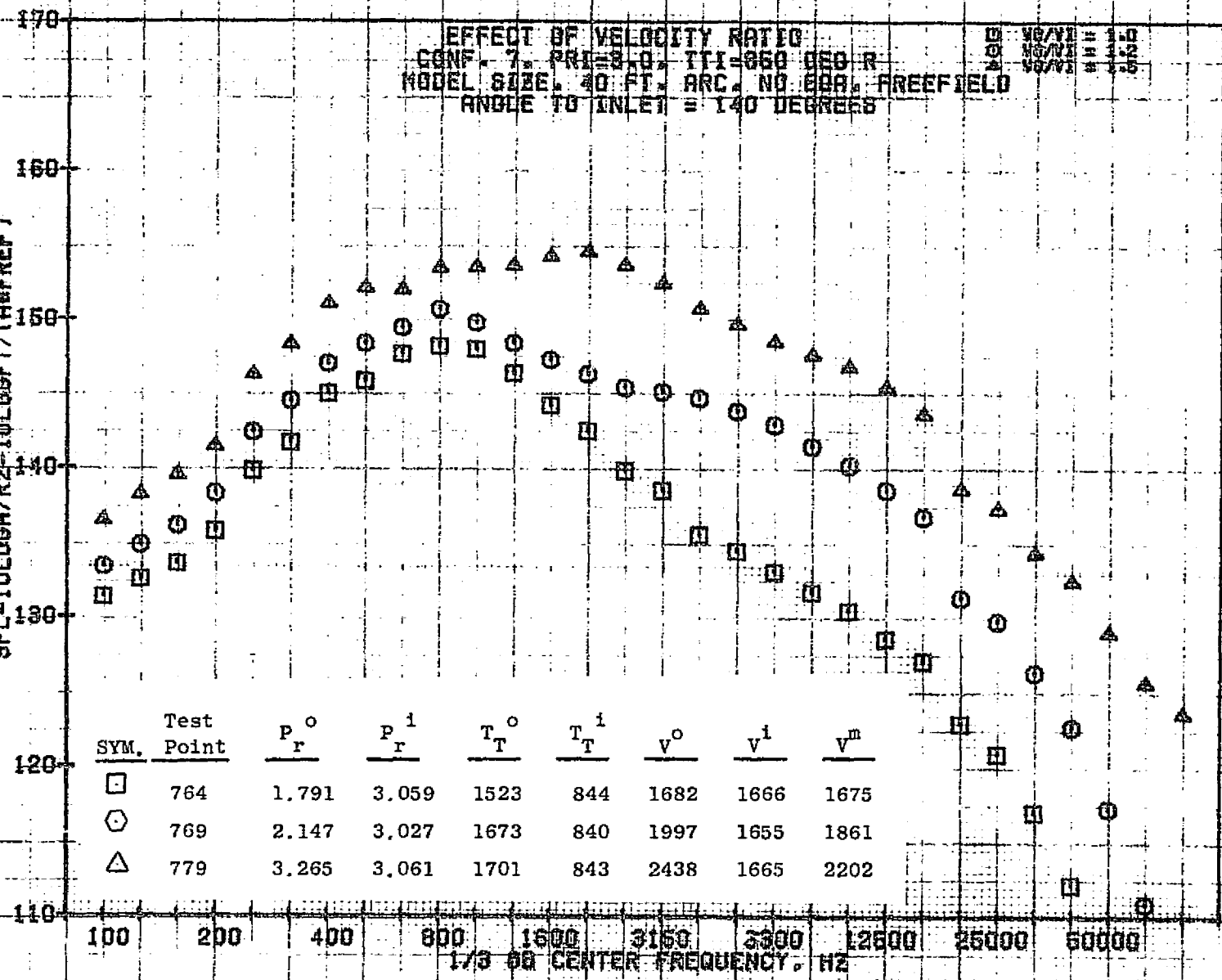
11/03/76
 18575-001

79 BURCH A.

1212

EFFECT OF VELOCITY RATIO
 CONF. 7, P_r¹ = 3.0, T_T¹ = 850 DEG R
 MODEL SIZE: 40 FT. ARC, NO EDB, FREEFIELD
 ANGLE TO INLET = 140 DEGREES

SPL - 10 LOG (P_r⁰ / P_r¹) - 10 LOG (T_T⁰ / T_T¹) (dB REF)



SYM.	Test Point	P _r ⁰	P _r ¹	T _T ⁰	T _T ¹	V ⁰	V ¹	V ^m
□	764	1.791	3.059	1523	844	1682	1666	1675
○	769	2.147	3.027	1673	840	1997	1655	1861
△	779	3.265	3.061	1701	843	2438	1665	2202

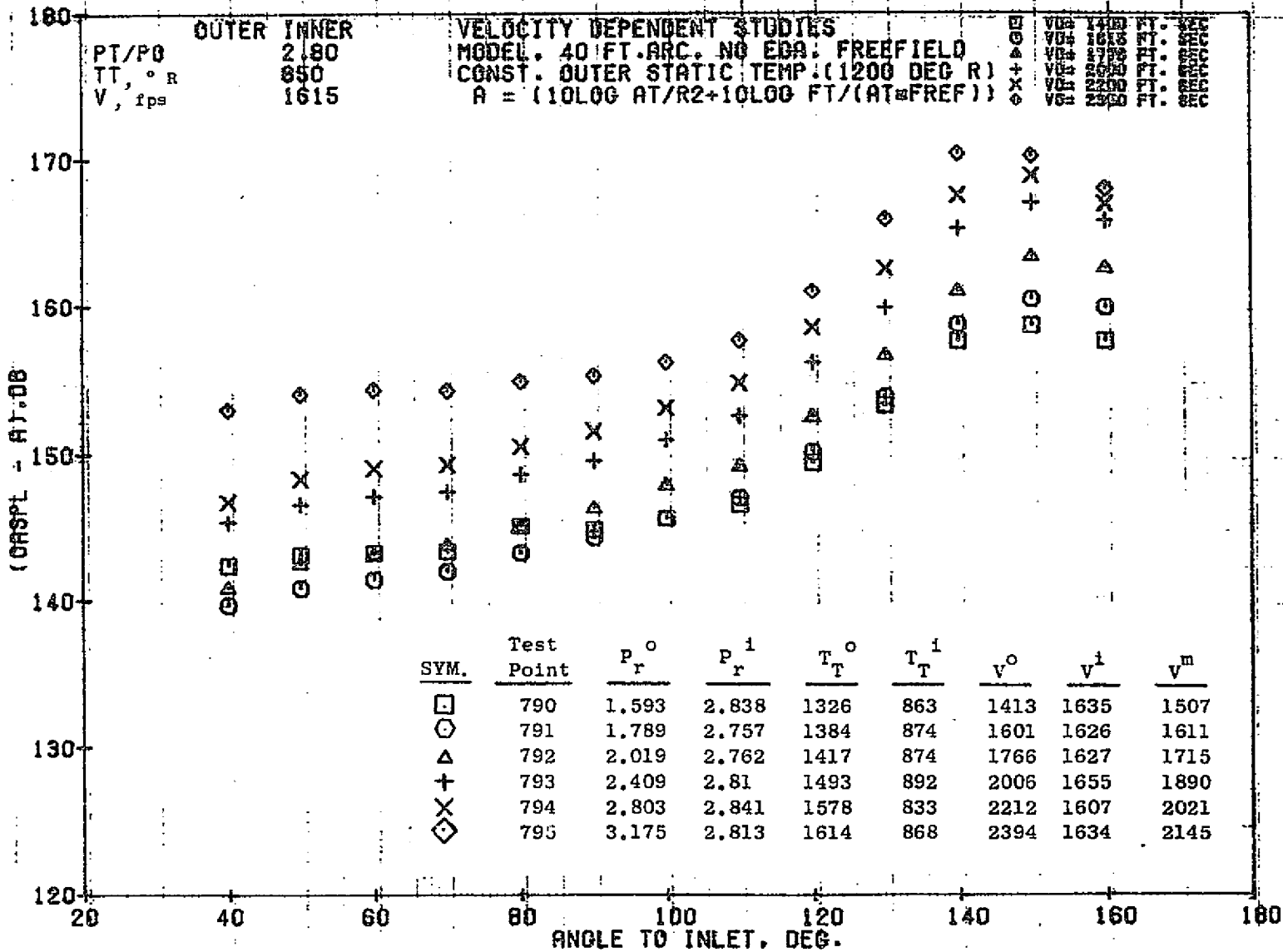
11/03/76
 18575-001

79 BURCH A.

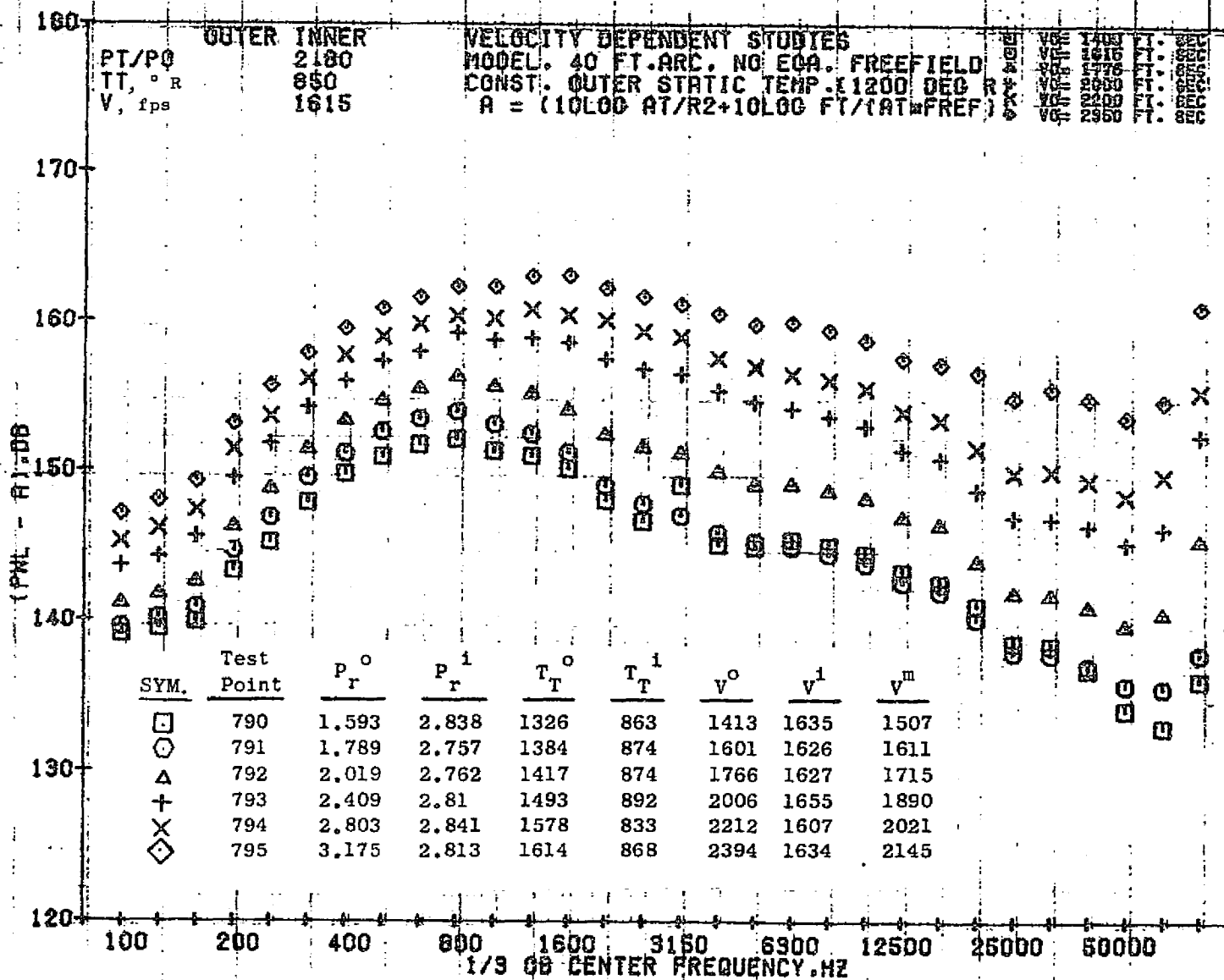
7.4.7 Velocity Dependence Study

For Configuration 7, a series of tests was run to examine the velocity dependence of a high inner flow annular nozzle. Seven test points were taken at constant inner flow conditions and constant outer stream static temperature. The outer stream velocity was varied from point to point. The results are presented in this section.

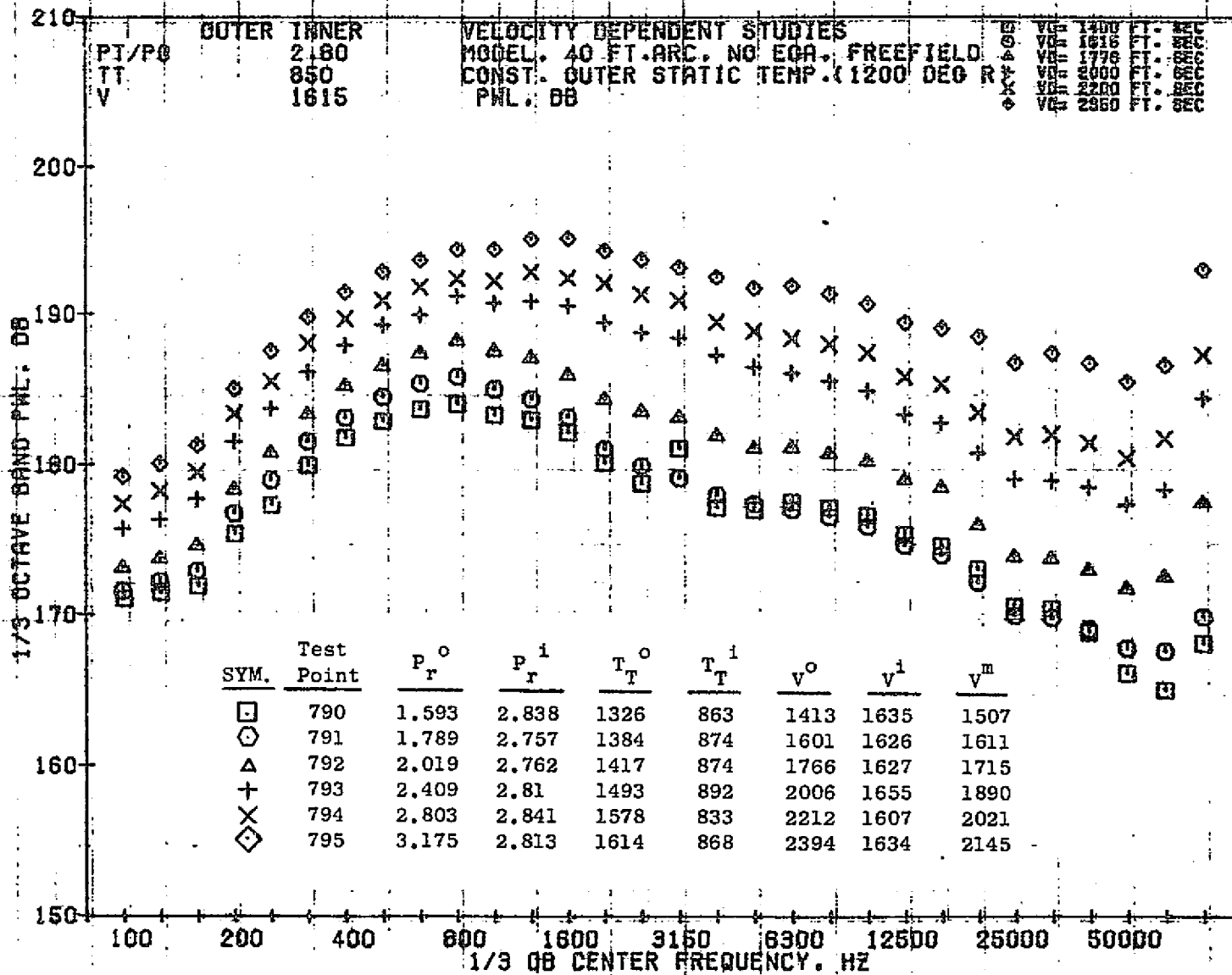
1214



1215

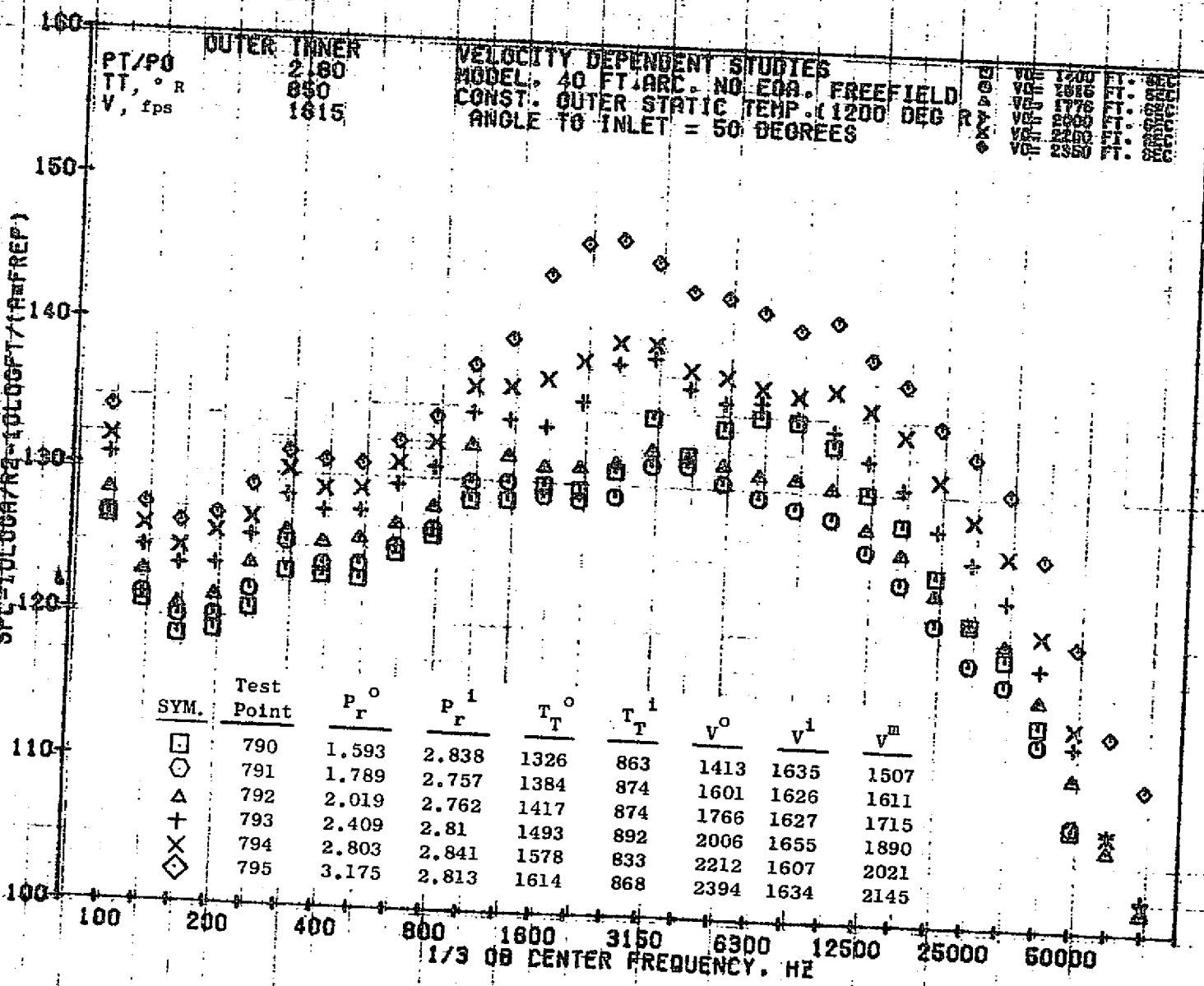


1216

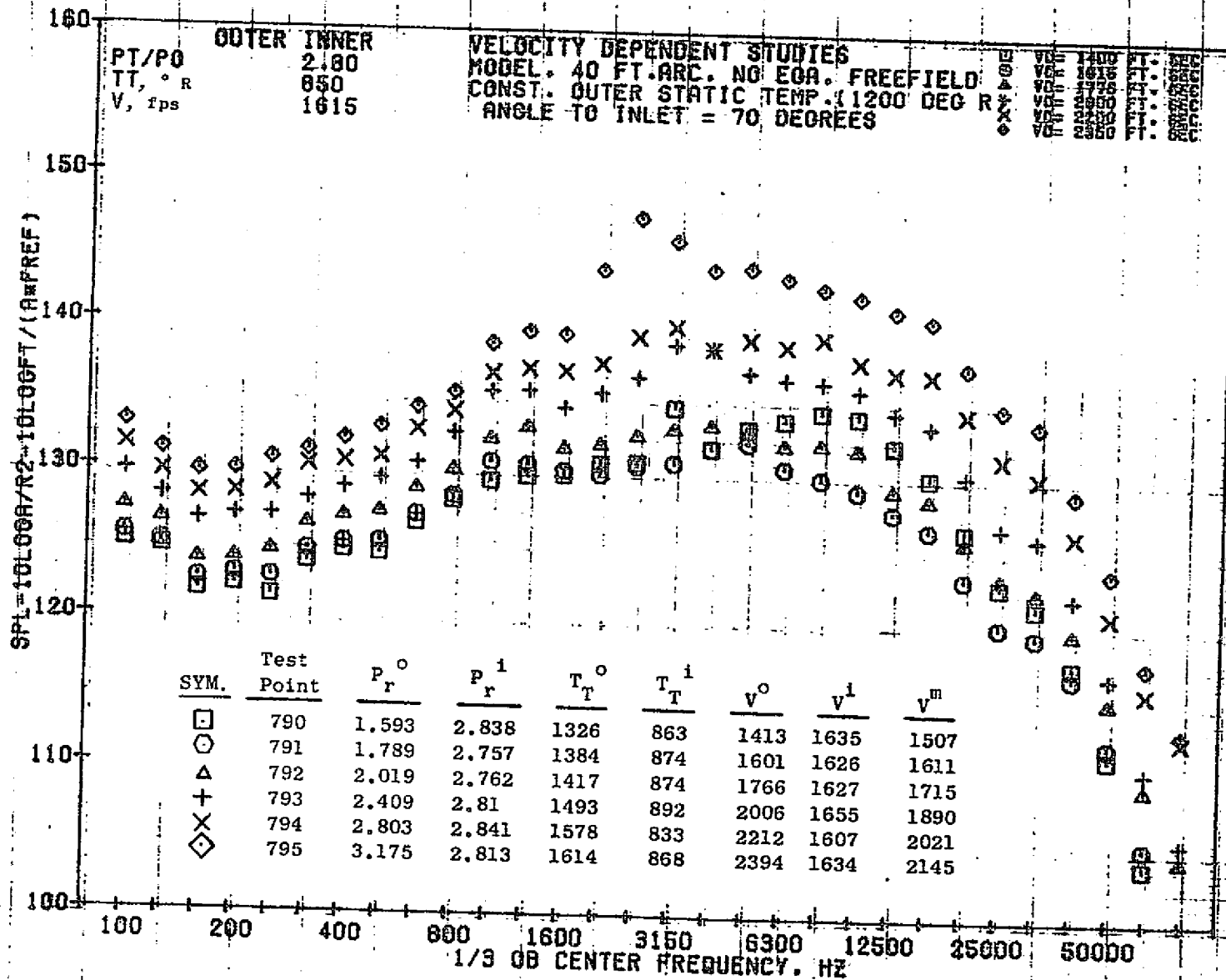


1217

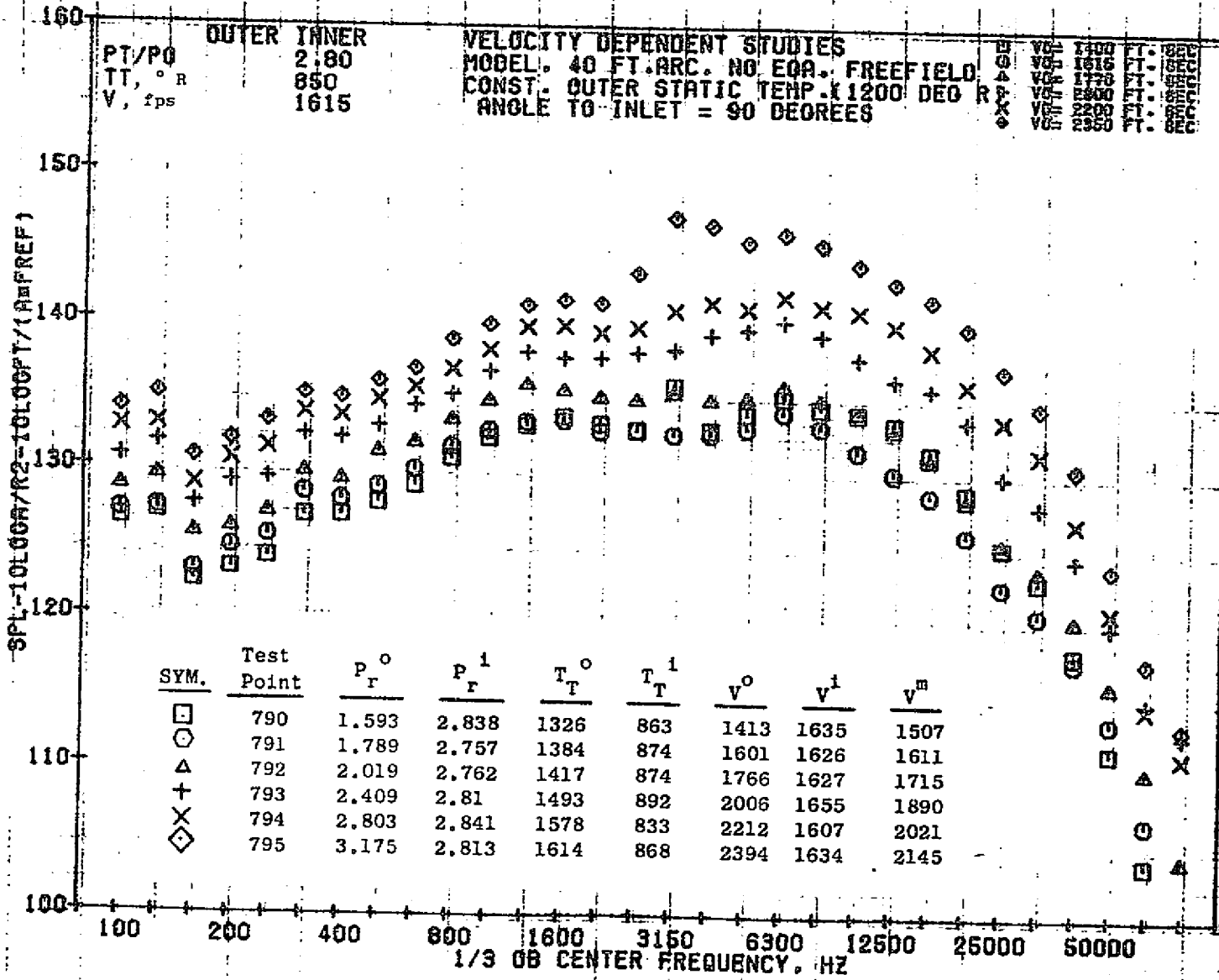
SPL = 10 * LOG (P_r^2 / (R^2 * P_0)) + 10 * LOG (P_r^2 / (R^2 * P_0))



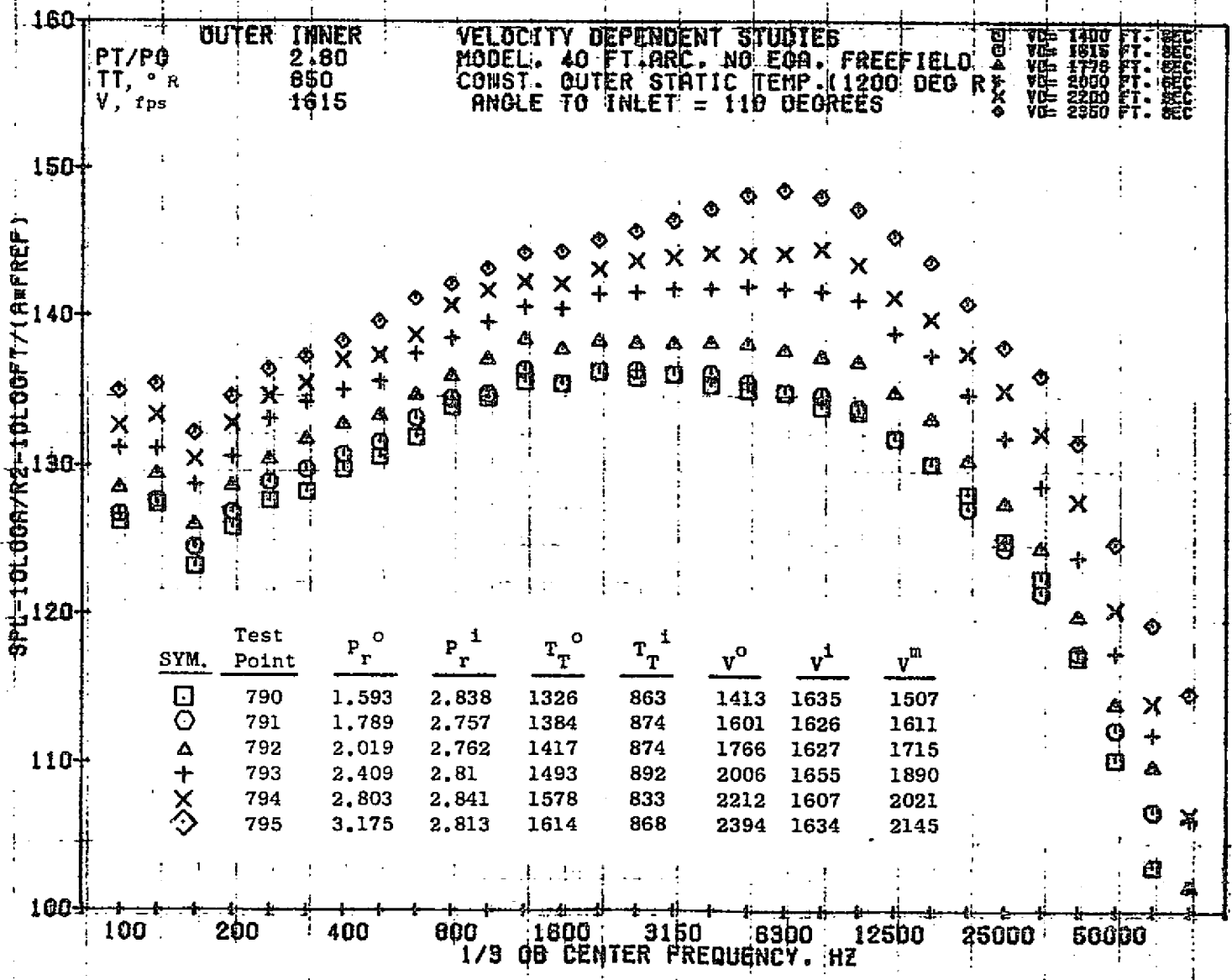
1218

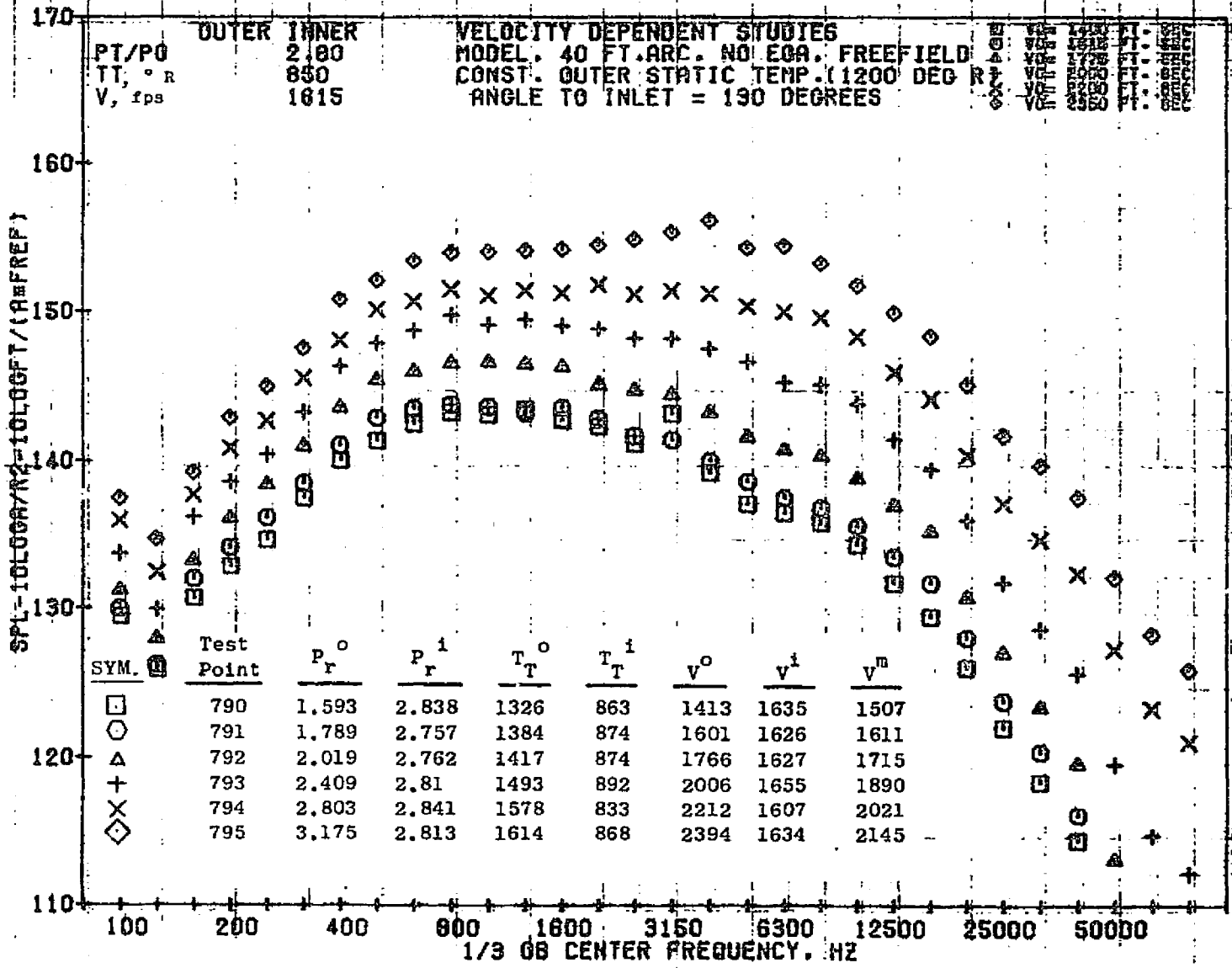


1219



1230

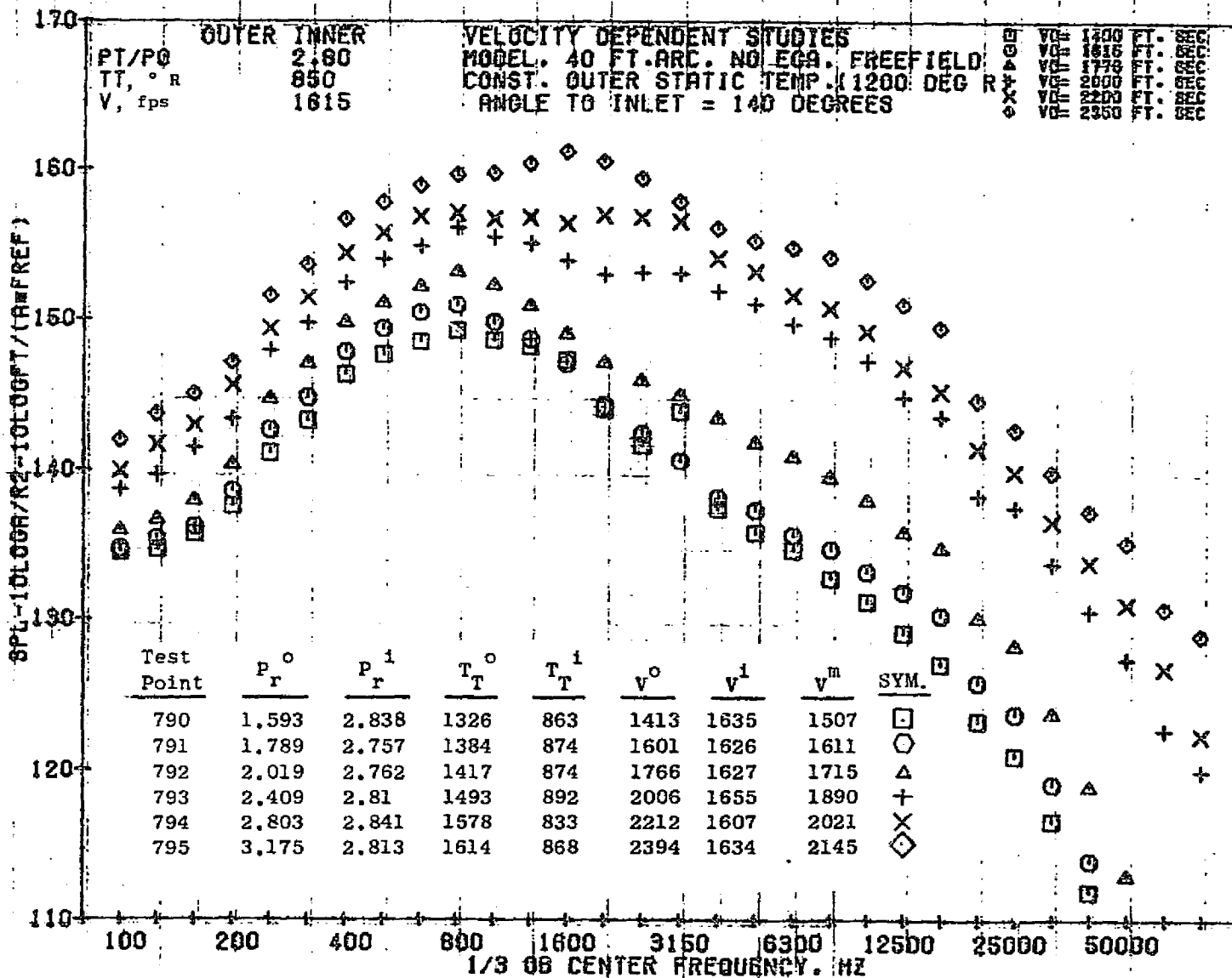




13221

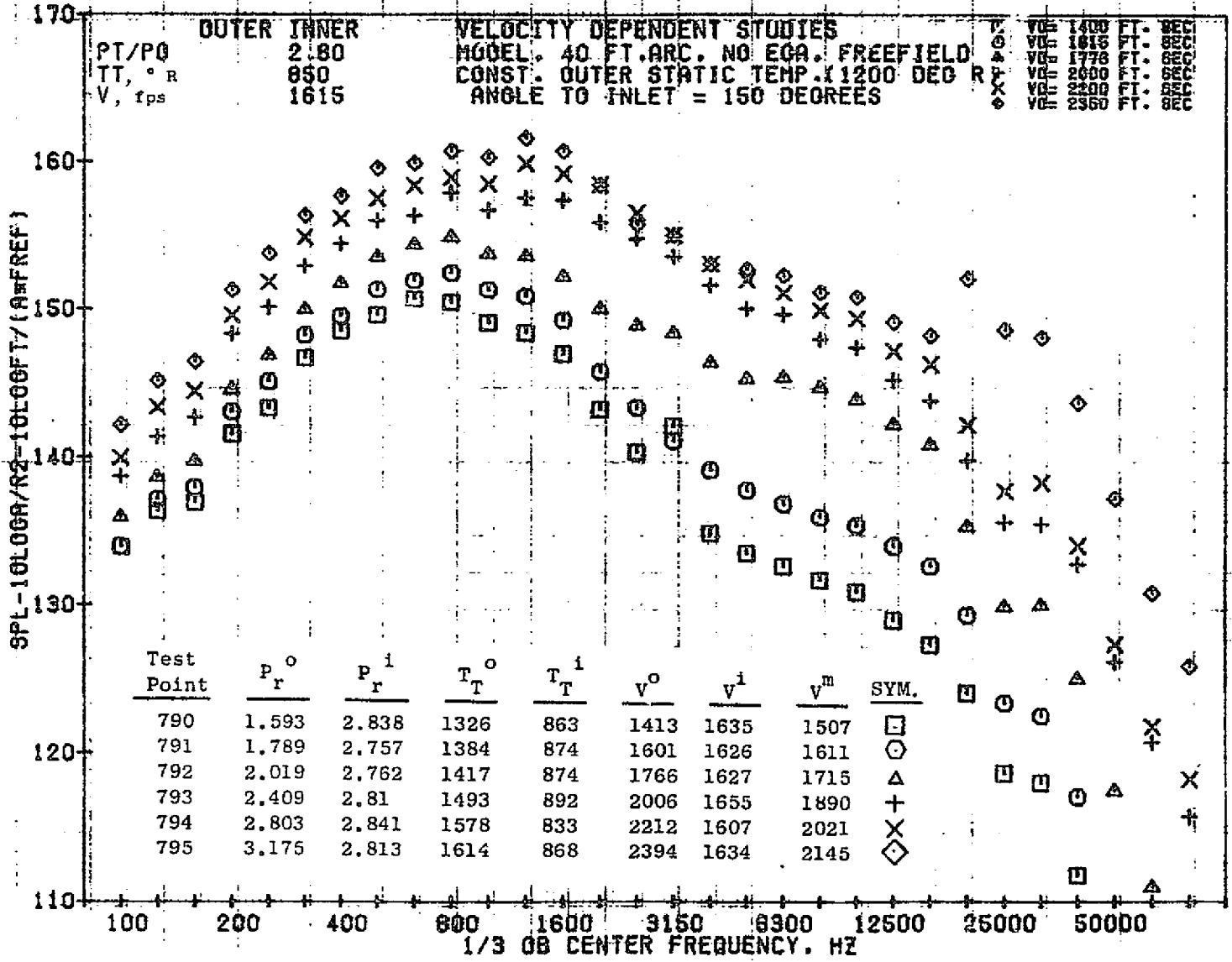
10/13/76
1X930-001

73KOLLSTEDT



10/13/76
1X930-001

73KOLLSTEDT

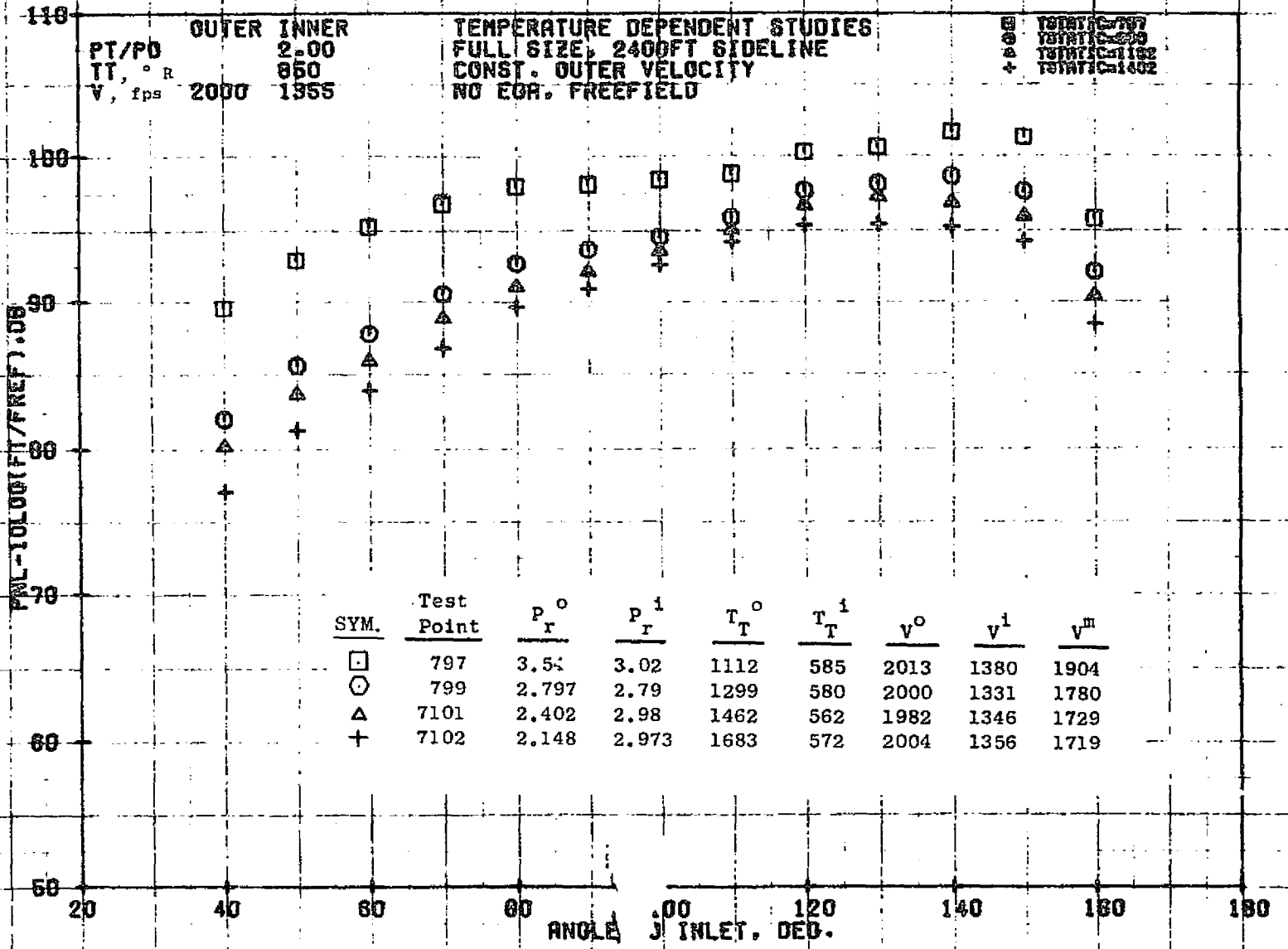


10/13/76
1X930-001

73KOLLSTEDT

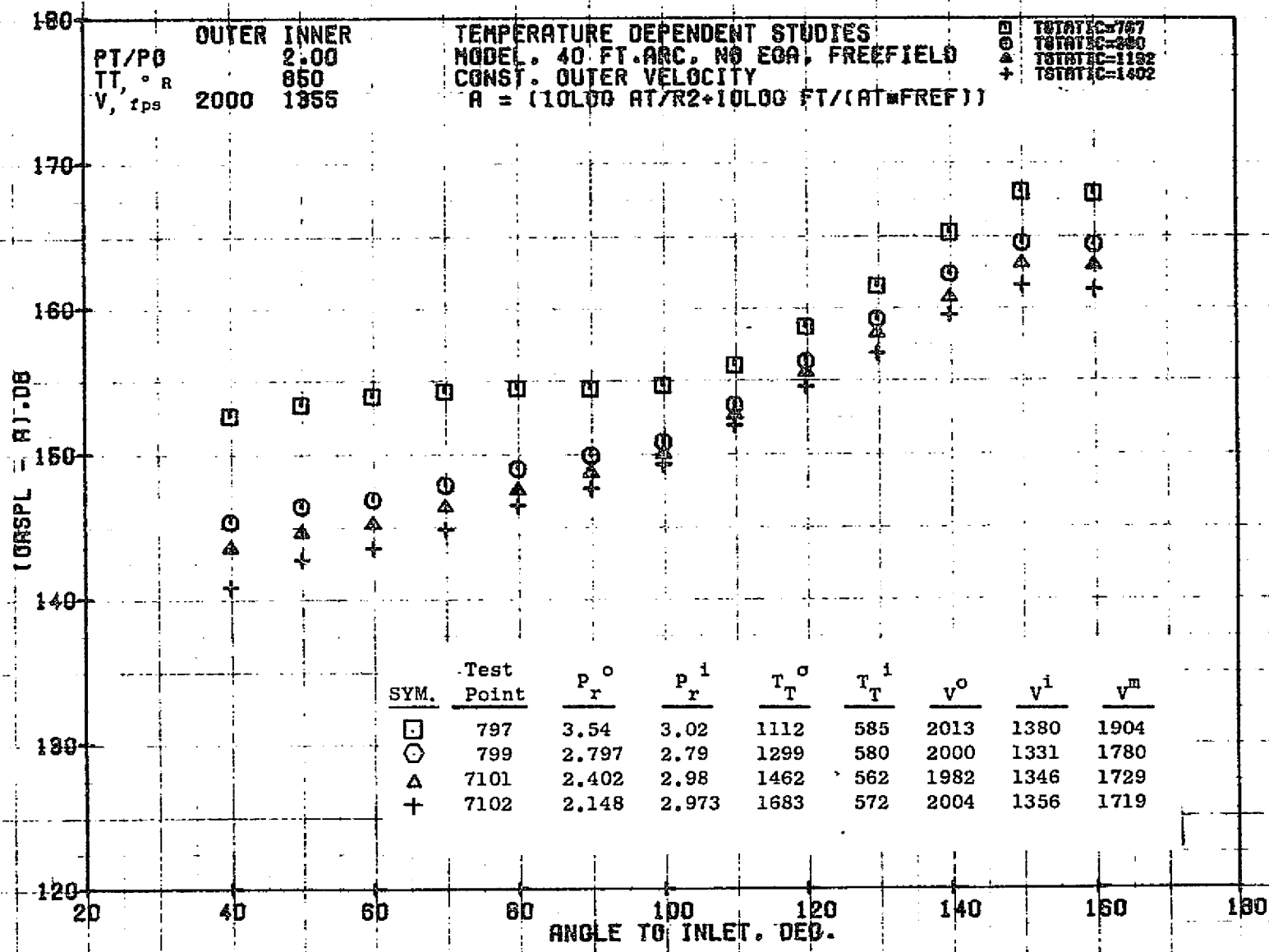
7.4.8 Temperature Dependence Study

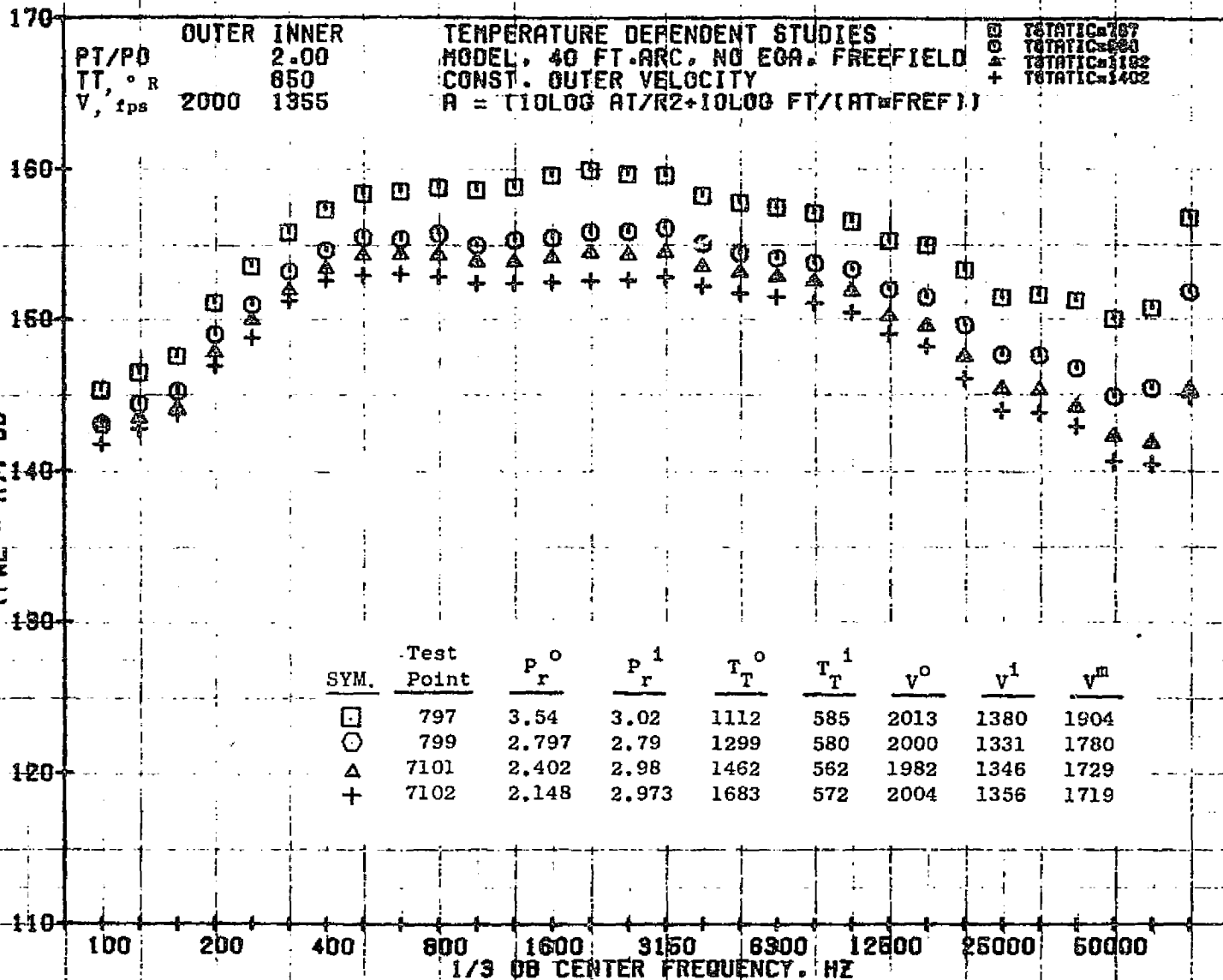
For Configuration 7, another series of tests was run to examine the temperature dependence of a high inner flow annular nozzle. For this study, the inner stream conditions were held constant, while the outer stream velocity was held constant and the static temperature of the outer stream was varied. The results are presented in this section.



10/25/76
1X898-001

73KOLLETEDT

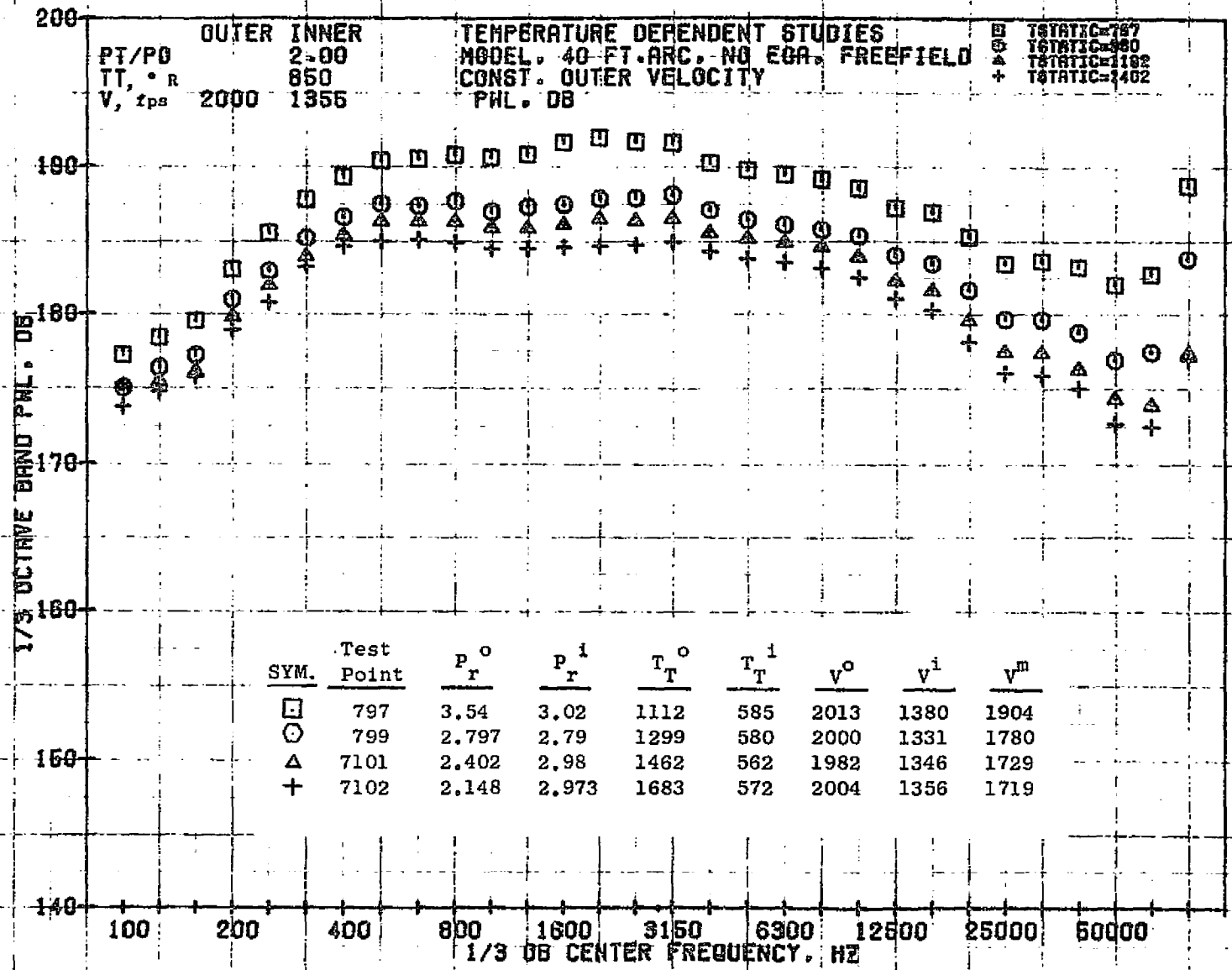


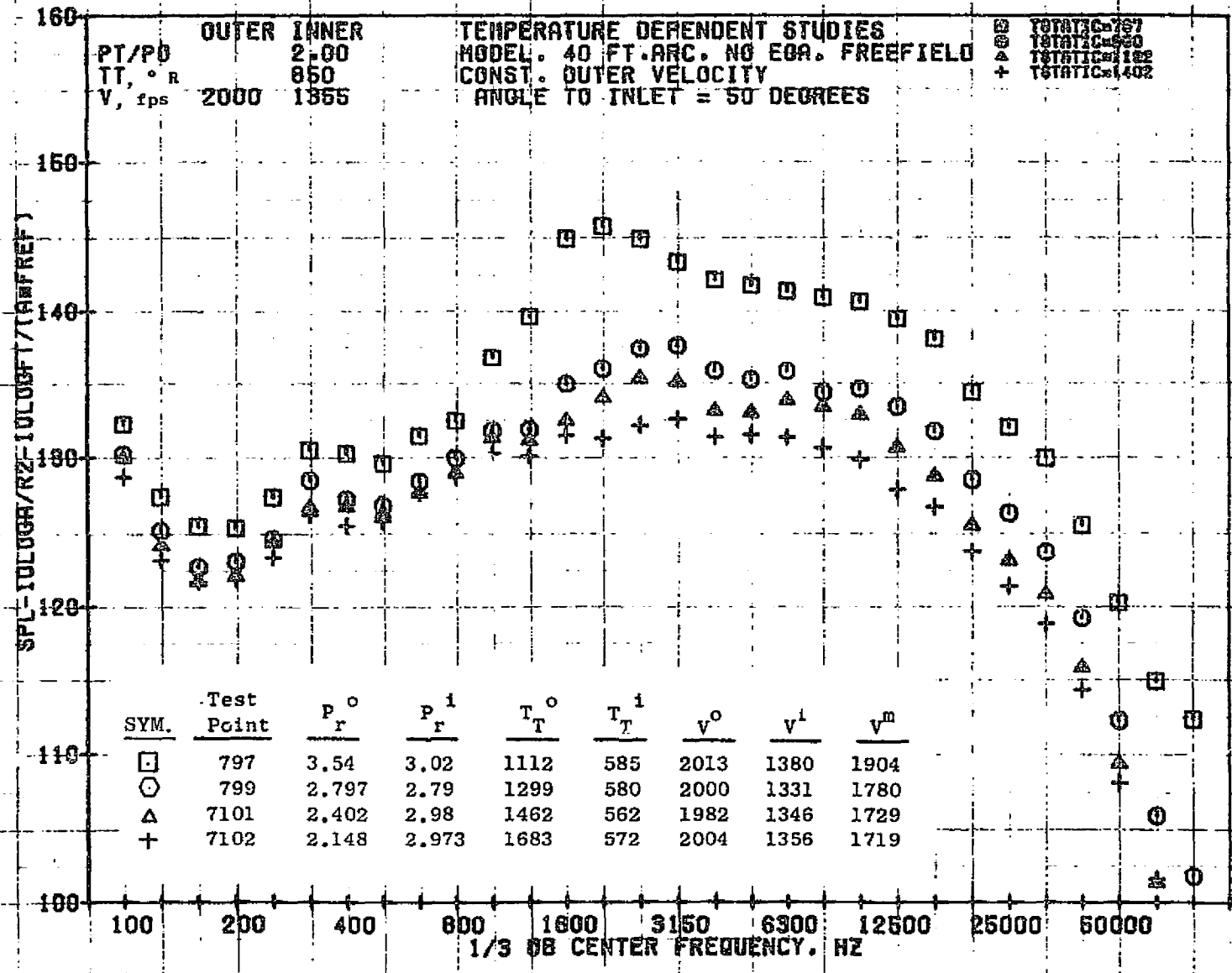


1227

10/25/76
1X946-001

73KOLLSTEDT





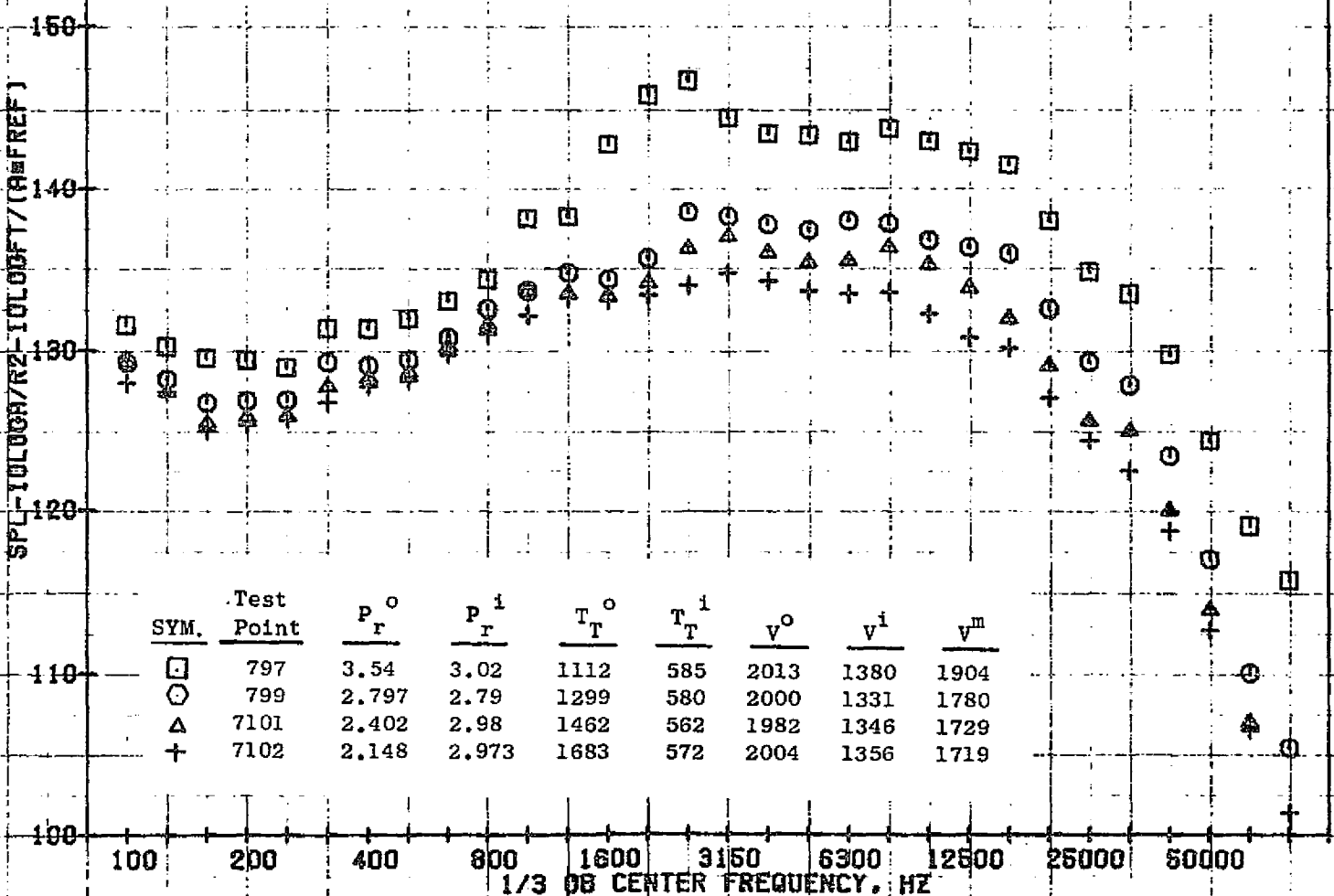
10/25/76
 1X945-001

73KOLLSTED

160
 PT/PD OUTER INNER TEMPERATURE DEPENDENT STUDIES
 TT, °R 2.00 MODEL. 40 FT. ARC. NO EGA. FREEFIELD
 V, fps 2000 1955 CONST. OUTER VELOCITY
 ANGLE TO INLET = 70 DEGREES

□ TSTATIC=787
 ○ TSTATIC=980
 △ TSTATIC=1182
 + TSTATIC=1402

SPL-10LOG(R/R2-10LOG(FT/REF))
 1230



SYM.	Test Point	P_r^o	P_r^i	T_T^o	T_T^i	V^o	V^i	V^m
□	797	3.54	3.02	1112	585	2013	1380	1904
○	799	2.797	2.79	1299	580	2000	1331	1780
△	7101	2.402	2.98	1462	562	1982	1346	1729
+	7102	2.148	2.973	1683	572	2004	1356	1719

PT/PO OUTER INNER
 TT, °R 2.00 850
 V, fps 2000 1365

TEMPERATURE DEPENDENT STUDIES
 MODEL, 40 FT-ARC, NO EGA, FREEFIELD
 CONST. OUTER VELOCITY
 ANGLE TO INLET = 90 DEGREES

□ TOSTATIC=787
 ○ TOSTATIC=799
 △ TOSTATIC=1182
 + TOSTATIC=1402

1331

SPL - 10LOG(R/R2) - 10LOG(F/T) (REF REF)

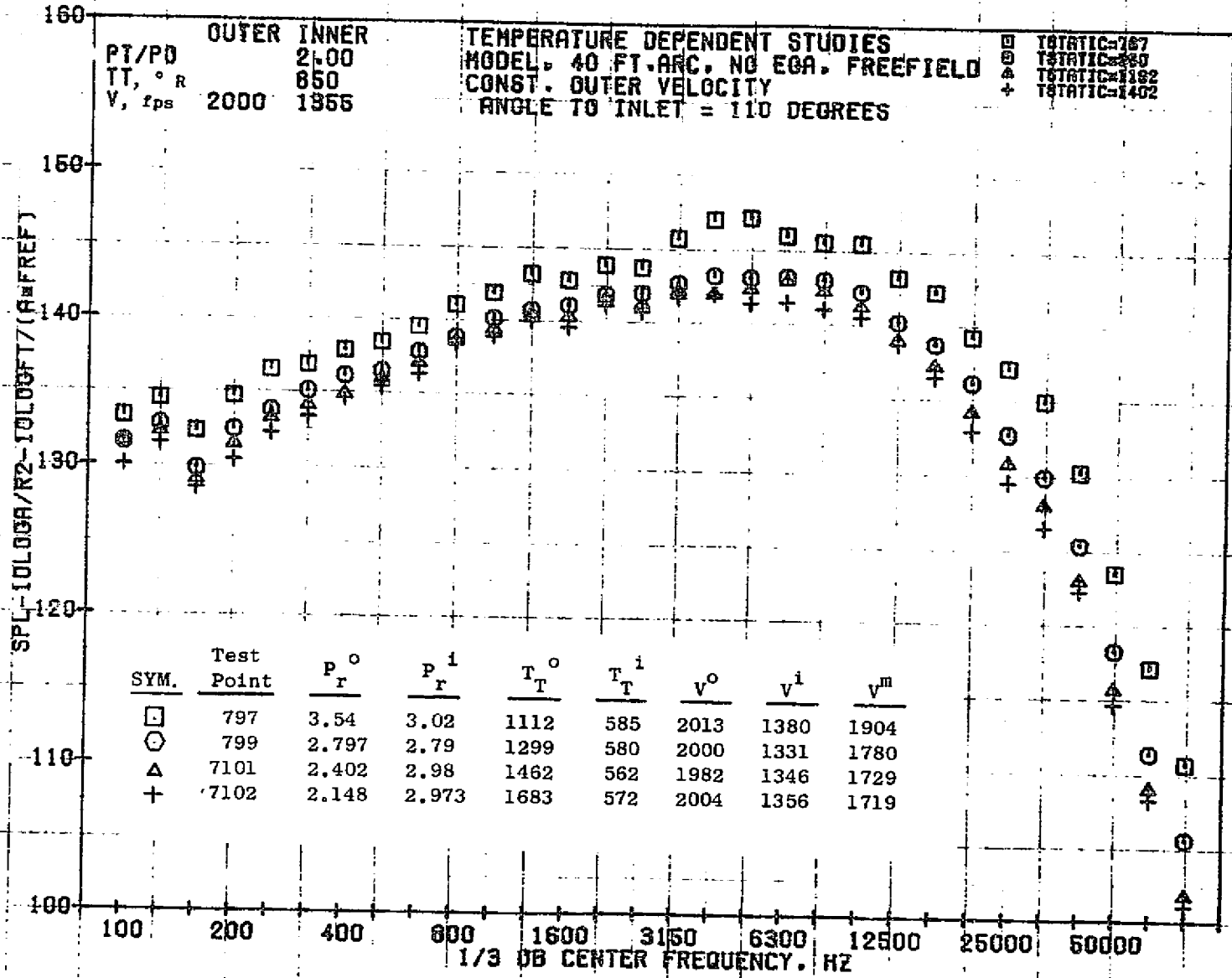
SYM.	Test Point	P_r^o	P_r^i	T_T^o	T_T^i	V^o	V^i	V^m
□	797	3.54	3.02	1112	585	2013	1380	1904
○	799	2.797	2.79	1299	580	2000	1331	1780
△	7101	2.402	2.98	1462	562	1982	1346	1729
+	7102	2.148	2.973	1683	572	2004	1356	1719

100 200 400 800 1600 3150 6300 12500 25000 50000
 1/3 OB CENTER FREQUENCY, HZ

10/25/76
 1X945-001

79KOLLSTES

1232



10/25/76

PT/PD OUTER INNER
 TT, ° R 2.00 860
 V, fps 2000 1365

TEMPERATURE DEPENDENT STUDIES
 MODEL, 40 FT-ARC, NO EOA, FREEFIELD
 CONST. OUTER VELOCITY
 ANGLE TO INLET = 130 DEGREES

□ TSTATIC=787
 ○ TSTATIC=890
 △ TSTATIC=1102
 + TSTATIC=1402

SPL 10LOGA/RZ - 10LOGFT/(RMREF)

1233

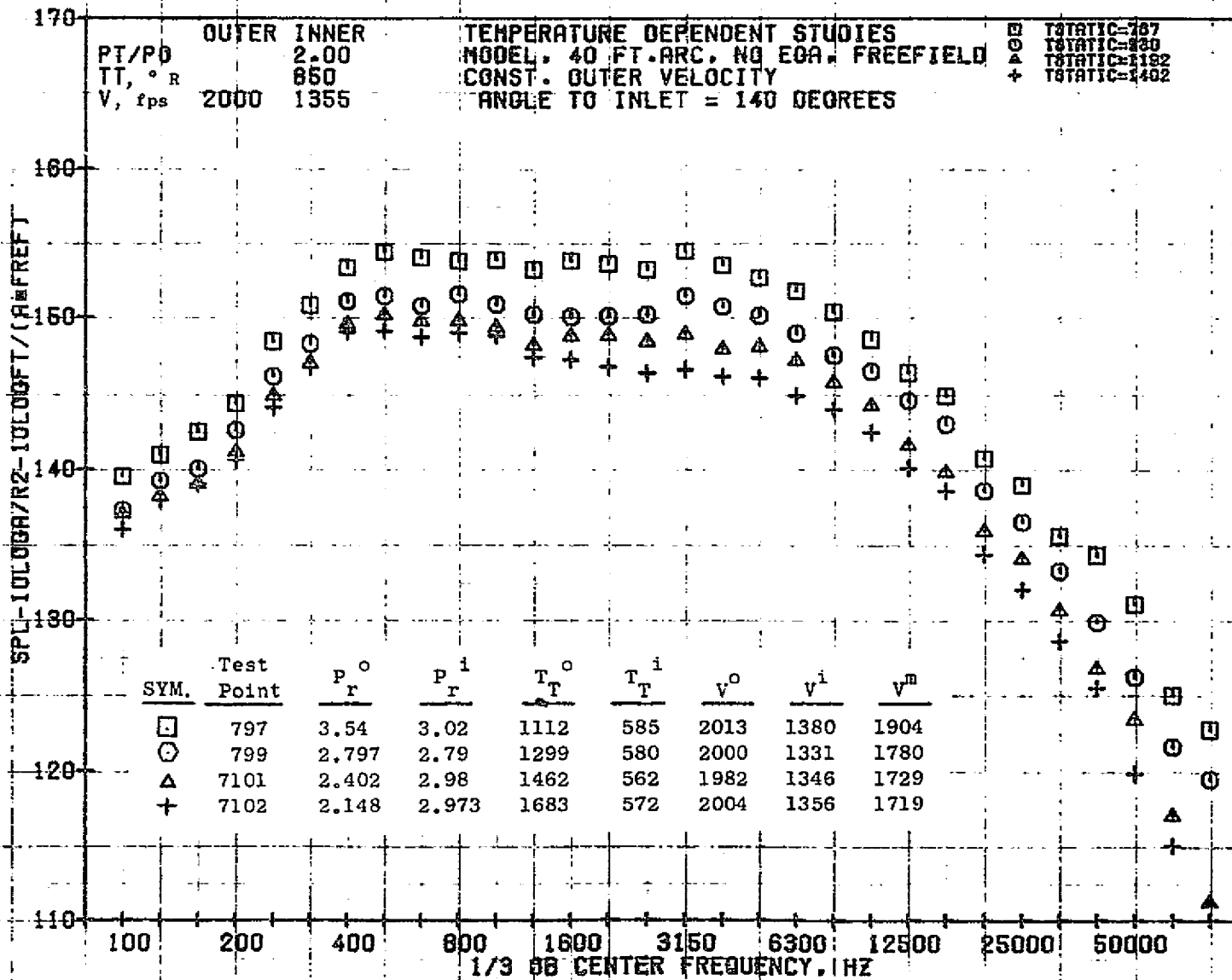
SYM.	Test Point	P_r^o	P_r^i	T_T^o	T_T^i	V^o	V^i	V^m
□	797	3.54	3.02	1112	585	2013	1380	1904
○	799	2.797	2.79	1299	580	2000	1331	1780
△	7101	2.402	2.98	1462	562	1982	1346	1729
+	7102	2.148	2.973	1683	572	2004	1356	1719

100 200 400 800 1600 3150 6300 12500 25000 50000

1/3 OB CENTER FREQUENCY, HZ

10/25/76
1X945-001

79KOLLSTDT



10/25/76

