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ENERGY EFFICIENT ENGINE
EXHAUST MIXER MODEL TECHNOLOGY REPORT

by:

H. Kozlowski and M. Larkin

UNITED TECHNOLOGIES CORPORATION
Pratt & Whitney Aircraft Group
Commercial Products Division

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UNITED TECHNOLOGIES
PRATT&WHITNEY
AIRCRAFT

400 Main Street
East Hartford, Connecticut 06108

Commercial Products Division

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Enclosures:	Twenty copies of the subject report

In accordance with the requirements of references (a) and (b), we are pleased to submit twenty copies of the subject report, which includes all revisions to the draft accompanying the reference (b) letter.

Distribution is being made in accordance with the reference (b) letter.

Sincerely yours,

UNITED TECHNOLOGIES CORPORATION
Pratt & Whitney Aircraft Group
Commercial Products Division

W B Gardner

W.B. Gardner
Program Manager

cc: Administrative Contracting Officer
Air Force Plant Representative Office
Pratt & Whitney Aircraft Group
East Hartford, Connecticut 06108

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16. ABSTRACT

An exhaust mixer test program was conducted to define the technology required for the Energy Efficient Engine Program. A total of 44 model configurations of 1/10 scale were tested in two phases. Phase I was generally parametric exploring a variety of mixer design options, the impact of residual low pressure turbine swirl and integration of the mixer with the structural pylon of the nacelle. Phase II was more restricted in scope, concentrating on improving the mixer itself by extrapolating the Phase I trends. Nozzle performance characteristics were obtained along with exit profiles and oil smear photographs.

Phase I established the sensitivity of nozzle performance to tailpipe length, lobe number and mixer penetration as well as mixer modifications like scalloping and cutbacks. The best practical configuration yielded a 2.1 percent reduction of thrust specific fuel consumption, with approximately 60 percent mixing. Residual turbine swirl was found to be detrimental to exhaust system performance and the low pressure turbine system for Energy Efficient Engine was designed so that no swirl would enter the mixer.

Phase II expanded upon the Phase I results. The impact of mixer/plug gap was established, along with importance of scalloping, cutbacks, hoods and plug angles on high penetration mixers. The best configuration tested in Phase II provided a reduction of 2.7 percent in thrust specific fuel consumption with approximately 85 percent mixing. This configuration was selected for adaptation to the Intergrated Core/Low Spool.

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FOREWORD

The Energy Efficient Engine Component Development and Integration Program is being conducted under parallel National Aeronautics and Space Administration (NASA) contracts to Pratt & Whitney Aircraft Group and General Electric Company. The overall project is under the direction of Mr. C. C. Ciepluch. Mr. John W. Schaefer is the NASA Project Manager for the Pratt & Whitney Aircraft effort under National Aeronautics and Space Administration Contract NAS3-20646, and Mr. Gerald Kraft is the Project Engineer responsible for the portion of the project described in this report. Mr. William B. Gardner is Manager of the Energy Efficient Engine Project at Pratt & Whitney Aircraft Group. The authors H. Kozlowski and M. Larkin wish to thank L. Davis for his technical contribution to this report.

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1.0 SUMMARY

An exhaust mixer test program was conducted to define the technology required for the Energy Efficient Engine Program. A total of 44 model configurations of 1/10 scale were tested, in two phases simulating a 6.5 bypass ratio engine. Phase I was generally parametric exploring a variety of mixer design options, the impact of residual low pressure turbine swirl and integration of the mixer with the structural pylon of the nacelle. Phase II was more restricted in scope, concentrating on improving the mixer itself by extrapolating the Phase I trends. Nozzle performance characteristics were obtained along with exit profiles and oil smear photographs.

Phase I established the sensitivity of nozzle performance to tailpipe length, lobe number and mixer penetration as well as mixer modifications like scalloping and cut-backs. The best practical forced mixed configuration yielded a 2.1 percent reduction of thrust specific fuel consumption, with approximately 60 percent mixing. A free mixer, by comparison, provided 0.5 percent reduction in thrust specific fuel consumption with about 20 percent mixing. Residual turbine swirl was found to be detrimental to exhaust system performance and the low pressure turbine system for the Energy Efficient Engine was designed so that no swirl would enter the mixer. In addition, tests of representative pylon fairings integrated with the mixer indicated only a very small impact on mixer performance.

Phase II confirmed the Phase I trend that high penetration mixers were effective. The impact of mixer/plug gap was established, along with this importance of scalloping, cutbacks, hoods and plug angles on high penetration mixers. The best configuration tested in Phase II provided a reduction of 2.7 percent in thrust specific fuel consumption with approximately 85 percent mixing. Additional gains are felt possible with continued development.

The best mixer configuration from Phase II was selected for adaptation to the Integrated Core/Low Spool.

2.0 INTRODUCTION

The objective of the National Aeronautics and Space Administration Energy Efficient Engine Component Development and Integration Project is to develop, evaluate, and demonstrate the technology for achieving lower installed fuel consumption and lower operating costs in future commercial turbofan engines. National Aeronautics and Space Administration has set minimum goals of a 12 percent reduction in thrust specific fuel consumption, a 5 percent reduction in direct operating cost, and a 50 percent reduction in performance degradation for the Energy Efficient Engine (flight propulsion system) relative to the JT9D-7A reference engine. In addition, environmental goals on emissions (meet the proposed Environmental Protection Agency 1981 regulation) and noise (meet Federal Aviation Regulations 36-1978 standards) have been established.

The Pratt & Whitney Aircraft program effort is based on an engine concept defined under the National Aeronautics and Space Administration-sponsored Energy Efficient Engine Preliminary Design and Integration Study Program, Contract NAS3-20628. This program was completed under an earlier contract effort, and is discussed in detail in NASA Report CR-135396. The Pratt & Whitney Aircraft engine is a twin-spool, direct drive, mixed-flow exhaust configuration, utilizing an integrated engine-nacelle structure. A short, stiff, high rotor and a single stage high-pressure turbine are among the major features in providing for both performance retention and major reductions in maintenance and direct operating costs. Improved active clearance control in the high pressure compressor and turbines, advanced single crystal materials in turbine blades and vanes, and shroudless fan blades are among the major features providing performance improvement. The present propulsion system, with the exhaust mixer, is shown in Figure 1. The exhaust mixer is a scalloped design for reduced pressure loss, increased efficiency and light weight.

To meet the program objectives, four technical tasks were established by the Pratt & Whitney Aircraft Project Team:

Task 1	Propulsion System Analysis, Design and Integration
Task 2	Component Analysis, Design and Development
Task 3	Core Design, Fabrication and Test
Task 4	Integrated Core/Low Spool Design, Fabrication and Test

The work described in this report is a technology program conducted as part of the exhaust mixer system effort in Task 2. This activity was aimed at establishing the basic technology required to define a high performance mixed flow exhaust system for high bypass ratio engines. The performance objective was to demonstrate overall mixed flow exhaust system performance which is equivalent to a reduction of 3.3 percent thrust specific fuel consumption, over an optimized separate flow exhaust system equivalent to the Preliminary Design baseline engine of September, 1978. This technology would directly support the design of the Energy Efficient Engine Flight Propulsion System and the experimental integrated core/low spool engine. The interaction between the mixer technology program, the engine component program and the complete engine design is illustrated in Figure 2.

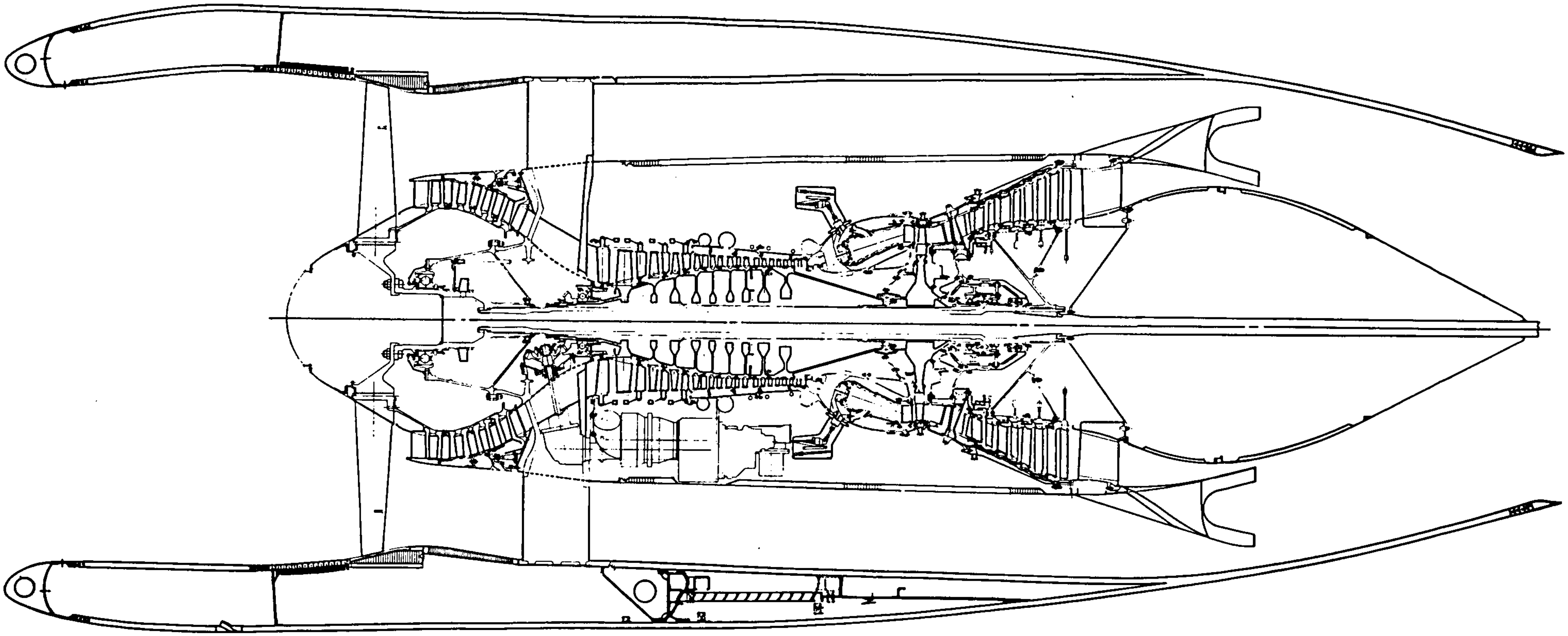
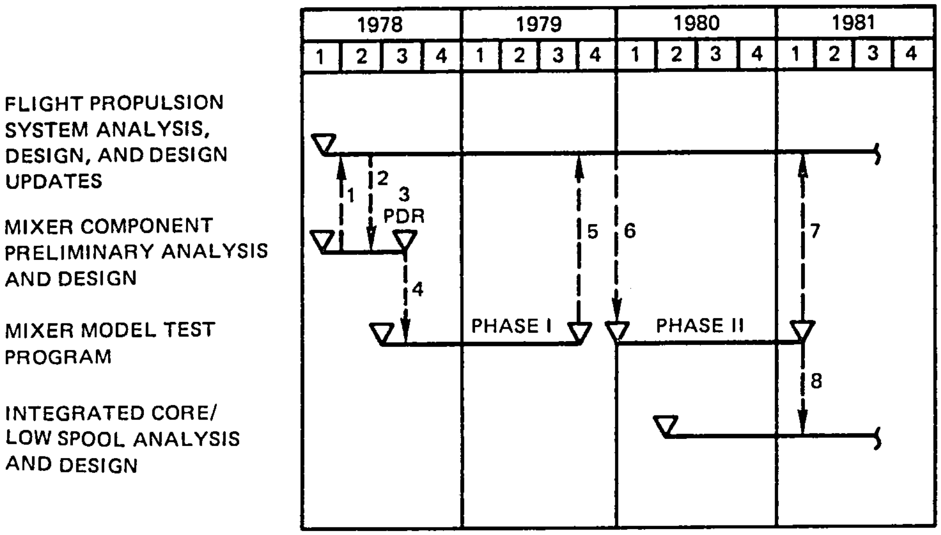


Figure 1 Propulsion System with Exhaust Mixer



1 – PRELIMINARY MIXER LAYOUT DEFINED FOR INCORPORATION INTO FLIGHT PROPULSION SYSTEM NACELLE DESIGN.
2 – EVALUATION OF PRELIMINARY NACELLE DESIGN COMPLETED, COMPONENT DESIGN REFINEMENT CONTINUES.
3 – COMPONENT PRELIMINARY DESIGN COMPLETED
4 – COMPONENT DESIGN DETAILS PROVIDED TO MODEL PROGRAM TO ESTABLISH BASELINE MODEL DESIGN
5 – PHASE I MODEL TEST RESULTS UTILIZED TO UPDATE FLIGHT PROPULSION SYSTEM MIXER DESIGN
6 – UPDATED FLIGHT PROPULSION SYSTEM MIXER DESIGN DETAILS PROVIDED TO MODEL PROGRAM TO ESTABLISH BASELINE DESIGN FOR PHASE II TESTS
7 – PHASE II MODEL TEST RESULTS UTILIZED TO REFINE FLIGHT PROPULSION SYSTEM MIXER DESIGNS
8 – PHASE II MODEL TEST RESULTS PROVIDED TO INTEGRATED CORE/ LOW SPOOL ANALYSIS AND DESIGN TASK FOR COMPLETION OF EXHAUST/ MIXER COMPONENT DESIGN

Figure 2 Exhaust/Mixer Program Logic Diagram

During the detail design of the mixed flow flight propulsion system, the engine became longer and its flow path was modified. The optimized separate flow exhaust system used for comparative purposes, in the mixer technology test program, was unchanged. This resulted in the performance benefit for the mixed flow configuration being reduced to 3.1 percent. The data presented in this report is in the context of the 3.1 percent benefit.

The mixer technology test program itself consisted of two phases spanning approximately 2 1/2 years (Figure 2). The first phase employed 28 test configurations covering a wide range of design variables such as tailpipe length, mixer lobe details, turbine swirl and integration of the structural pylon. After coordinating the results from Phase I with the updated engine design requirements, Phase II was conducted employing 16 configurations evaluating additional mixer refinements. This resulted in an improved mixed flow exhaust system which was subsequently adopted for the integrated core/low spool design.

The testing was conducted in the Channel 11 static thrust facility at Fluidyne Engineering Corporation, Minneapolis, Minnesota. Nozzle gross thrust and flow coefficients were measured at both "hot" and "cold" conditions. The "hot" conditions simulated the Energy Efficient Engine flow conditions with a fan/primary total pressure ratio (P_{T7}/P_{T8}) of approximately 1.1 and primary/fan total temperature ratio (TRAT) of approximately 2.5. The "cold" conditions used uniform flow conditions (i.e., $P_{T7}/P_{T8} = 1.0$ and TRAT = 1.0). This allowed mixing levels to be calculated and total pressure loss characteristics to be defined for each test configuration, providing important diagnostic information. In addition, total pressure and temperature traverses were taken at the exit of the tailpipe on many of the test configurations, along with oil smear photographs providing flow visualization in interesting regions of the exhaust system.

This report contains a complete description of the mixer model aeromechanical design, a description of the test facility and test program, and an in-depth discussion of the test results. Major conclusions and concluding remarks are also included. Finally, a complete tabulation of the measured data, the exit traverses and flow visualization photographs are presented in the Appendixes.

The mixer model aeromechanical design (Section 3.0) contains the requirements and criteria used in the model design, definition of the test configurations for Phase I and II and mixer model fabrication techniques.

The test facility and test program description (Section 4.0) includes detailed test conditions, data acquisition techniques and data reduction methods and data repeatability characteristics.

Phase I and II test results (Section 5.0) are discussed in detail and include correlation of mixer geometry with performance. Also included are test summaries which identify the more significant geometric variables for all configurations tested.

3.0 MIXER MODEL AEROMECHANICAL DESIGN

3.1 List of Symbols

A	Cross Sectional Area
A_{GAP}	Mixer/Plug Gap Area
A_{MIX}	Mixing Plane Area
A_{PEN}	Penetration Area
BPR	Bypass Ratio - Ratio of Measured Fan to Primary Flow
Cf	Skin Friction Coefficient
$C_{D_{MIX}}$	Mixed Model Flow Coefficient
C_V^{r}	Full Scale Model Thrust Coefficient
C_V''	Overall Gross Thrust Coefficient
$C_{V_{MIX}}$	Mixed Model Thrust Coefficient
$C_{V_{EXIT}}$	Exit Plane Thrust Coefficient
2r	Equivalent Duct Diameter
dl	Incremental Duct Length
D	Tailpipe Diameter at the Mixing Plane
Fg	Gross Thrust
h	Enthalpy
H_2	Forced Balance Axial Thrust Component
L	Tailpipe Length Measured From Mixing Plane to Exit
MIXP	Ideal Nozzle Performance Gain Available From Mixing
Mn	Mach Number
Mn_{FAN}	Mixing Plane Fan Stream Mach Number
Mn_{PRI}	Mixing Plane Primary Stream Mach Number
P	Static Pressure
PAM	Ambinent Pressure
PRAT	Ratio of Mixing Plane Fan to Primary Stream Total Pressure
P_T	Total Pressure
PTEPAM	Mixing Plane Primary Stream Total to Ambient Nozzle Pressure Ratio
PTFPAM	Mixing Plane Fan Stream Total to Ambient Nozzle Pressure Ratio
PTMPA	Fully Mixed Total to Ambient Nozzle Pressure Ratio
PT7PAM	Charging Station Fan Stream Total to Ambient Nozzle Pressure Ratio
PT8PAM	Charging Station Primary Stream Total to Ambient Nozzle Pressure Ratio
R	1/2 Diameter at Mixing Plane
T	Static Temperature
To	Balance Temperature
TRAT	Ratio of Primary to Fan Stream Total Temperature
T_T	Total Temperature
$T_{T_{MIX}}$	Full Mixed Total Temperature
T_{T_7}	Charging Station Fan Stream Total Temperature
T_{T_8}	Charging Station Primary Stream Total Temperature
V	Velocity
Wa_{FAN}	Fan Stream Flow
Wa_{PRI}	Primary Stream Flow

GREEK LETTERS

α	Angle Between Engine Lobe Peak and Mixer Side Wall
β	Average Swirl Angle
γ	Ratio of Specific Heats
η_m	Mixer Efficiency
θ	Angle Between Engine Lobe Peak and Fan Valley
ρ	Density
ψ	Mixer Cutback Angle
Δ	Difference in Levels

SUBSCRIPTS

C-D	Convergent Divergent Nozzle Effect
F	Fan Stream
M-FS	Model Full Scale Correction
P	Primary Stream
7	Fan Stream Charging Station
8	Primary Stream Charging Station
j	Jet

3.2 Design Requirements and Criteria

The requirements and criteria used in the model design for Phases I and II consist of simulated geometric flow paths and power conditions obtained from the Energy Efficient Engine Flight Propulsion System.

The test configurations were designed as one-tenth scale simulations of the mixed flow exhaust system with the fan duct flow path simulated downstream of the fan case and the primary flow path simulated downstream of the turbine exit. The following areas were simulated from the Flight Propulsion System design (except for some specific model variations noted in the discussion).

Mixing Plane Area (A_{MIX}) = 269.35 cm^2 (41.75 $in.^2$)
At mixing plane -- Primary Stream Area (A_P) = 68.84 cm^2 (10.67 $in.^2$)
At mixing plane -- Fan Stream Area (A_F) = 200.52 cm^2 (31.08 $in.^2$)
Jet Area (A_j) = 214.58 cm^2 (33.26 $in.^2$)

In addition, the model configurations were designed using the Flight Propulsion System 100 percent maximum cruise power conditions, which are defined as:

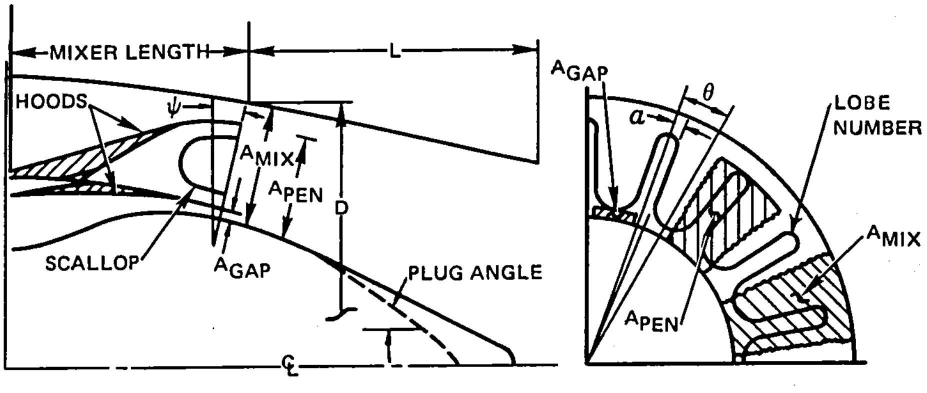
Primary Nozzle Pressure Ratio (P_{T8}/P_{AM}) = 2.35
Fan to Primary Total Pressure Ratio (P_{T7}/P_{T8}) = 1.1
Primary to Fan Total Temperature Ratio (TRAT) = 2.5

After the mixer model test program began, the Flight Propulsion System was lengthened and scaled down which effectively increased the model scale to 1/9.38.

The exhaust system design requirements dictate that the exhaust system be compatible with the Flight Propulsion System nacelle envelope and that it incorporate the shortest, smallest and most efficient mixing system. The Phase I program was constructed with these guidelines, employing variations of tailpipe length, mixer lobe number, scalloping, penetration and cutback.

The requirements of the Phase II program were to capitalize on the trends established during Phase I, evaluating parameters which would further improve overall performance. These trends were applied to the best Phase I model configuration. It consisted of 18 lobes and a tailpipe length to diameter ratio of 0.61. These parameters were held constant while the penetration level was increased to 0.75, based on Phase I performance trends. With these parameters defined, the mixer length and diameter were varied.

In addition, mixer/plug gap, scalloping, cutback, mixer hoods, and plug angle were evaluated. A sketch defining the major design variables is shown in Figure 3.



CUTBACK ANGLE = ψ
PENETRATION = A_{PEN}/A_{MIX}
TAILPIPE LENGTH/DIAMETER = L/D
MIXER/PLUG GAP = A_{GAP}/A_P

PRIMARY STREAM
CROSS-SECTIONAL AREA AT
MIXING PLANE = A_P

Figure 3 Test Variables

3.3 Mixer Model Test Configurations

Definition of the test configurations for Phases I and II is contained in Sections 3.2.1 and 3.2.2, respectively. The test configurations included are a free mixer in addition to 43 forced mixers. Major design variables are outlined and variations from the baseline design requirements are identified.

3.3.1 Phase I Configurations

Twenty-eight configurations were evaluated in the Phase I program. Four of the twenty-eight involved a free mixer (i.e., one having a simple splitter between the primary and fan streams). A description of each model configuration and its purpose is provided below.

A summary table identifying significant characteristics of the configurations tested in Phase I is presented in Table I.

TABLE I

PHASE I DESIGN VARIABLES

Configuration Type	No.	No. of Lobes	Tailpipe Length/ Diameter	Special Features	Penetration	Gap	α/θ **
Free Mixer	1	--	0.50		---		
	21	--	0.50	15° Swirl	---		
	22	--	0.50	36° Swirl	---		
	2	--	1.00		---		
Blue	19	12	0.50		0.50	0.06	0.56
Green	3	12	0.50	Mixer Scarf Angle 0°	0.65	0.12	0.36
	4	12	0.75		0.65	0.12	0.36
	5	12	1.00		0.65	0.12	0.36
	8	18	0.50		0.65	0.12	0.36
	6	12	0.50	Modified Tailpipe	0.65	0.12	0.36
	7	12	0.50	Modified Mixer Lobes*	0.65	0.12	0.36
	27	12	0.50	Mixer Hoods*	0.65	0.12	0.36
	23	12	0.50	15° Swirl	0.65	0.13	0.36
	24	12	0.50	36° Swirl	0.65	0.12	0.36
	9	12	0.50	Mixer Scarf Angle -5°	0.63	0.12	0.38
	10	12	0.50	Mixer Scarf Angle-10°	0.61	0.13	0.39
	11	12	0.50	Mixer Scarf Angle-15°	0.58	0.14	0.41
Red	13	12	0.50		0.57	0.11	0.44
	30	12	0.50	Scalloped Mixer	0.57	0.11	0.44
	14	12	1.00		0.57	0.11	0.44
	15	18	0.50		0.57	0.11	0.44
	16	18	0.50	Scalloped Mixer	0.57	0.11	0.44
	29	18	0.61	Cutback Mixer	0.51	0.22	0.50
	28	18	1.00	Scalloped Mixer	0.57	0.11	0.44
Orange	17	18	0.50		0.49	0.09	0.57
	18	18	1.00		0.49	0.09	0.57
Green	25	12	0.50	Short Pylon	0.58	0.14	0.41
Green	26	12	0.50	Long Pylon	0.58	0.14	0.41

* - constant lobe width
** - at mixer exit, defined in figure 3
Note - Configurations 12, 20, 31, 32 were not tested.

3.3.1.1 Free Mixer Nozzle

The free mixer shown in Figure 4 consists of a conical splitter between the fan and primary streams, and was designed with two tailpipe lengths (configurations 1 and 2). These tailpipe lengths correspond to the extremes of those used with the forced mixer configurations. Establishing the performance level of the free mixer nozzle provided a method for evaluating the accuracy and repeatability of the test facility. In addition to tailpipe length, the free mixer was tested with 15 degrees and 36 degrees of turbine discharge swirl. These are configurations 21 and 22. It should be noted that the free mixer was designed with the following areas at the mixing plane.

Mixing Plane Area (A_{MIX}) = 332.19 cm^2 (51.49 $in.^2$)
Primary Stream Area (A_P) = 97.42 cm^2 (15.10 $in.^2$)
Fan Stream Area (A_F) = 234.77 cm^2 (36.39 $in.^2$)

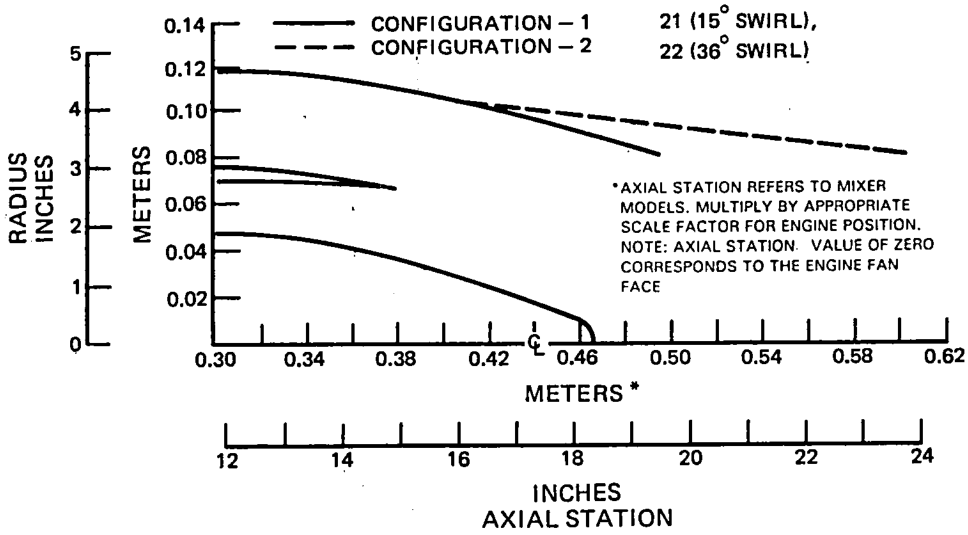


Figure 4 Free Mixer Configurations 1, 2, 21 and 22

The large mixing area was necessary in order to obtain free mixer and plug wall angles that minimize the possibility of separation within the nozzle length restrictions defined by the forced mixers designs.

3.3.1.2 Forced Mixer Configurations

Three basic mixer design families were chosen for Phase I representing different degrees of flow turning through the mixer as shown in Figure 5. The "blue" configuration represented the shortest, steepest design. It had a high degree of primary flow turning along with a steep fan valley angle and therefore had the lowest penetration of Phase I. The "green" and "red" series relaxed the amount of flow turning in stages and therefore were progressively longer and generally allowed a higher level of mixer penetration. An additional mixer design, the "orange" series, evaluated an enlarged mixing plane area. It had the same mixer length as the "red" series. These mixer designs were evaluated with an assortment of basic design variables such as tailpipe length, mixer lobe number, scalloping, etc.

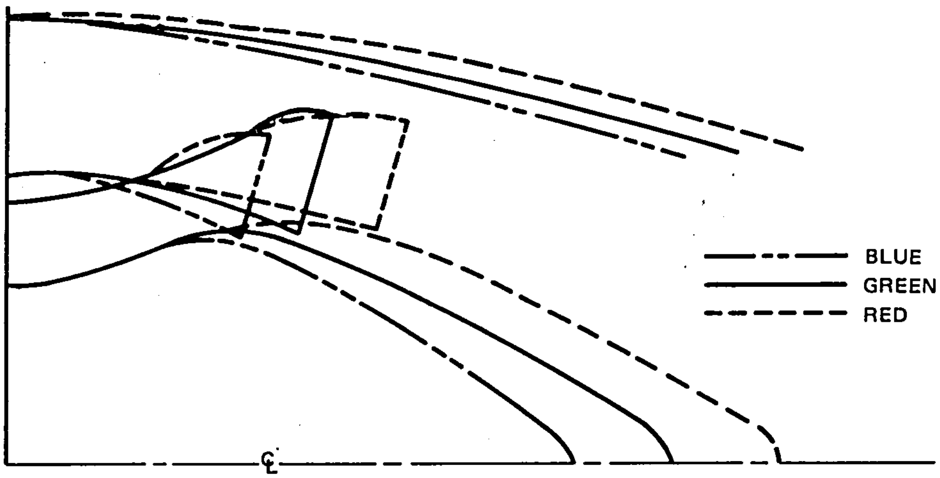


Figure 5 Phase I Mixer: Basic Forced Mixer Design

The "blue" configuration was confined to one mixer designed with 12 lobes and evaluated with a tailpipe length ratio (L/D) of 0.5. This was configuration 19 (see Figure 6).

The "green" series comprised a large number of configurations. Configurations 3, 4, and 5 varied tailpipe length using a 12 lobe mixer. Configuration 8 investigated the impact of increasing the mixer lobe number to 18 (see Figures 7 and 8). Configuration 6 had a modified tailpipe with a significantly larger flow area relative to configuration 3 (see Figure 9). Configuration 7 was designed with the same axial cross-section as configuration 3, but with constant width lobes ($\alpha / \Theta = K$) (see Figure 10). Mixer lobe hoods were evaluated with configuration 27. Hoods were attached to each lobe (fan and primary side), of the configuration 7 mixer and faired into the cylindrical section of the mixer (see Figure 11). This hooded mixer was also evaluated with 15 degrees and 36 degrees of turbine discharge swirl (configurations 23 and 24, respectively). The effects of mixer cutback was determined with configurations 9, 10, and 11. The mixer for configuration 3 was cutback in 5 degree increments to form the cutback matrix (see Figure 12).

The "red" series, which employed mixers somewhat longer than used with the "green" series, also investigated tailpipe length, scalloping, lobe number, and mixer cutback. Configurations 13 and 14 varied tailpipe length using a 12 lobe mixer (see Figures 13 and 14). Configuration 15 evaluated the importance of lobe number (i.e., 18). The mixers in this series were designed to allow scalloping of the mixer side walls, which was done with 12 (configuration 30) and 18 (configuration 16) lobes. The effects of scalloping with increased tailpipe length were investigated with configuration 28. Finally, a severe mixer cutback was investigated with configuration 29. This cutback reduced the amount of flow turning in the core, or primary stream, and increased the mixer/plug gap (see Figure 15).

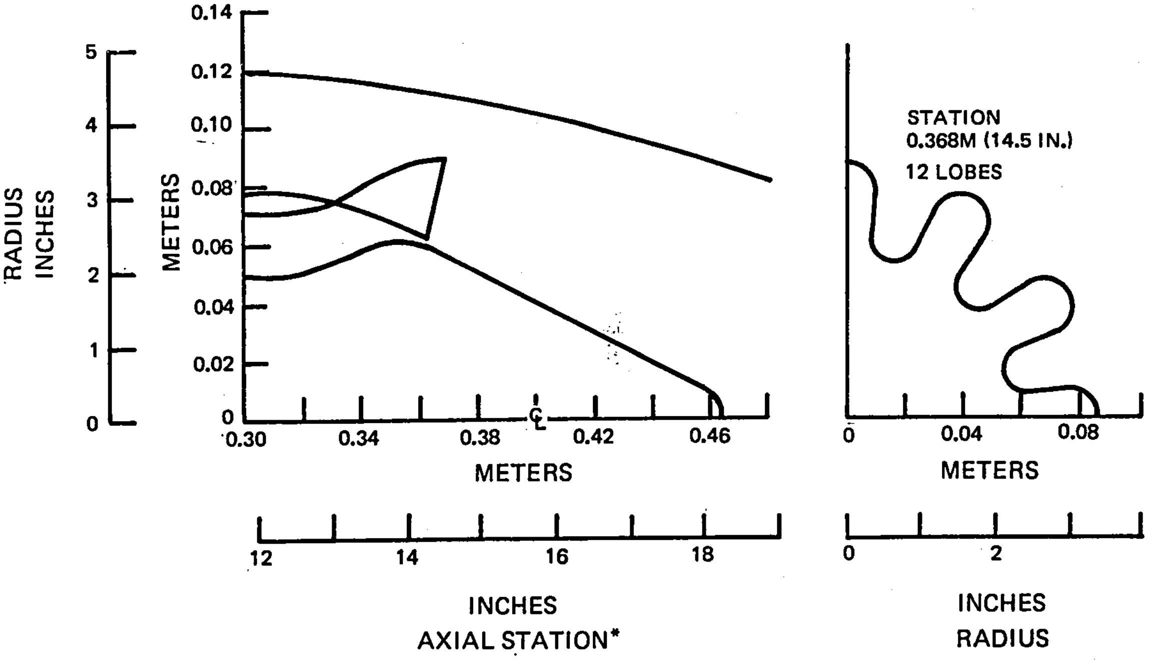
The "orange" series, which had the same mixer length as the red series, was designed to study the interaction of increased mixing plane area and tailpipe length (configurations 17 and 18) (see Figures 16 and 17). This series was designed with the following areas in the mixing plane:

Mixing Plane Area (A_{MIX}) = 320.64 cm^2 (49.70 in.^{2})
Primary Stream Area (A_P) = 89.68 cm^2 (13.90 in.^{2})
Fan Stream Area (A_F) = 230.97 cm^2 (35.80 in.^{2})

Two approaches to integrating the mixer with the structural pylon were evaluated with configurations 25 and 26 (see Figures 18 and 19). Configuration 25 had a short pylon which ended at the mixer exit; configuration 26 was tested with a longer, larger design which extended over the mixer and ended in the tailpipe. The mixer used in this test was the same as the one in configuration 11. A lower bifurcator ending upstream of the mixer was also simulated in these tests and is shown in Figure 20.

3.3.2 Phase II Configurations

The Phase II configurations varied mixer lengths and diameter while penetration level (0.75), tailpipe length to diameter ratio 0.61 and lobe number (18) were held constant. In addition, mixer/plug gap, scalloping, cutback, mixer hoods, and plug angle were evaluated in order to round out the data base for high penetration mixers.



*AXIAL STATION REFERS TO MIXER MODELS.
MULTIPLY BY APPROPRIATE SCALE FACTOR
FOR ENGINE POSITION

Figure 6 Configuration 19

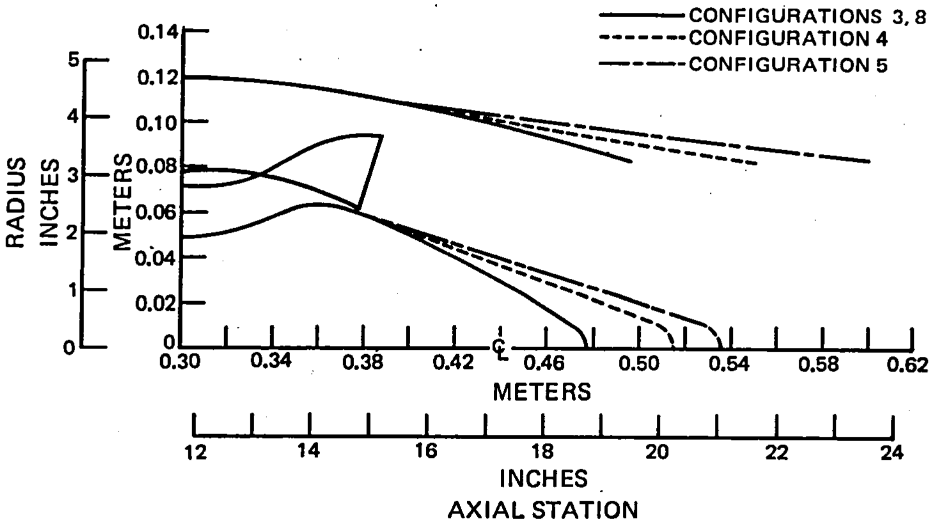


Figure 7 Configurations 3, 4, 5, and 8

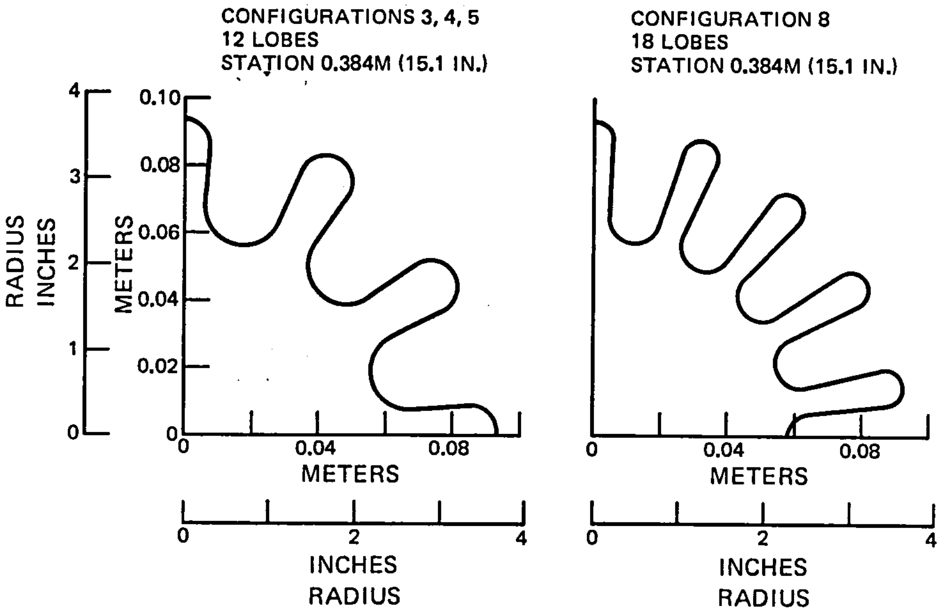


Figure 8 Configurations 3, 4, 5, and 8

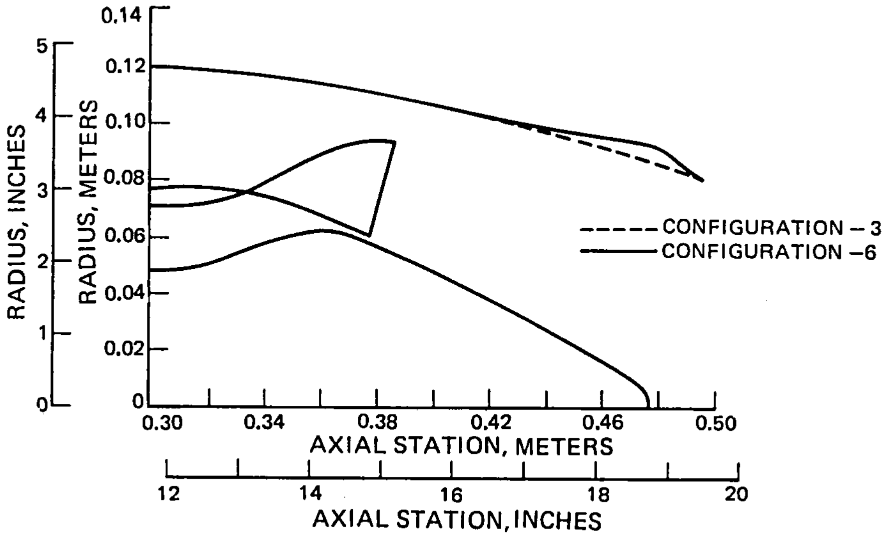


Figure 9 Configurations 3 and 6

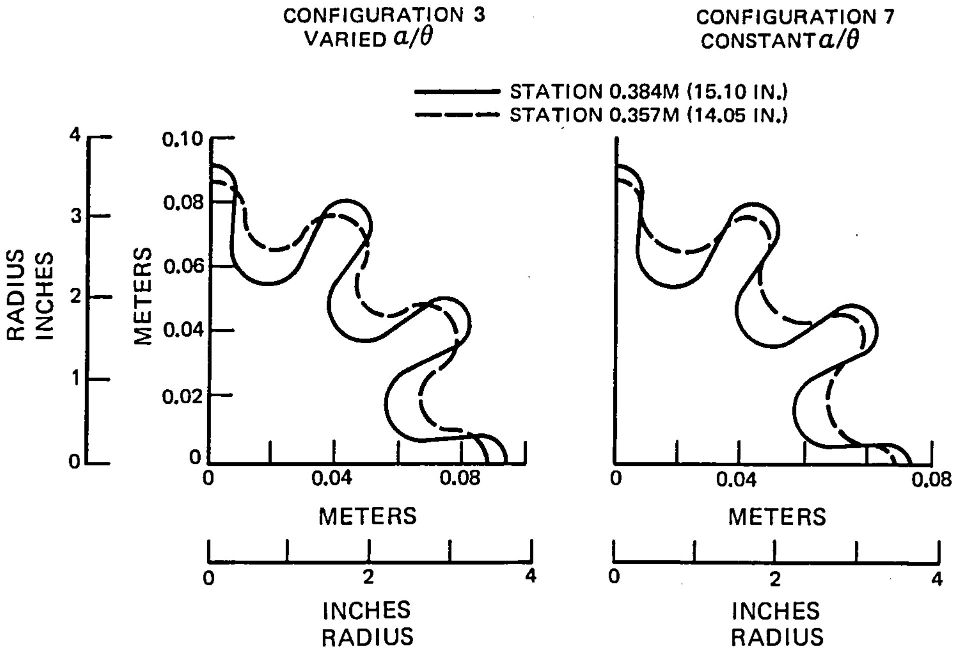


Figure 10 Configurations 3 and 7

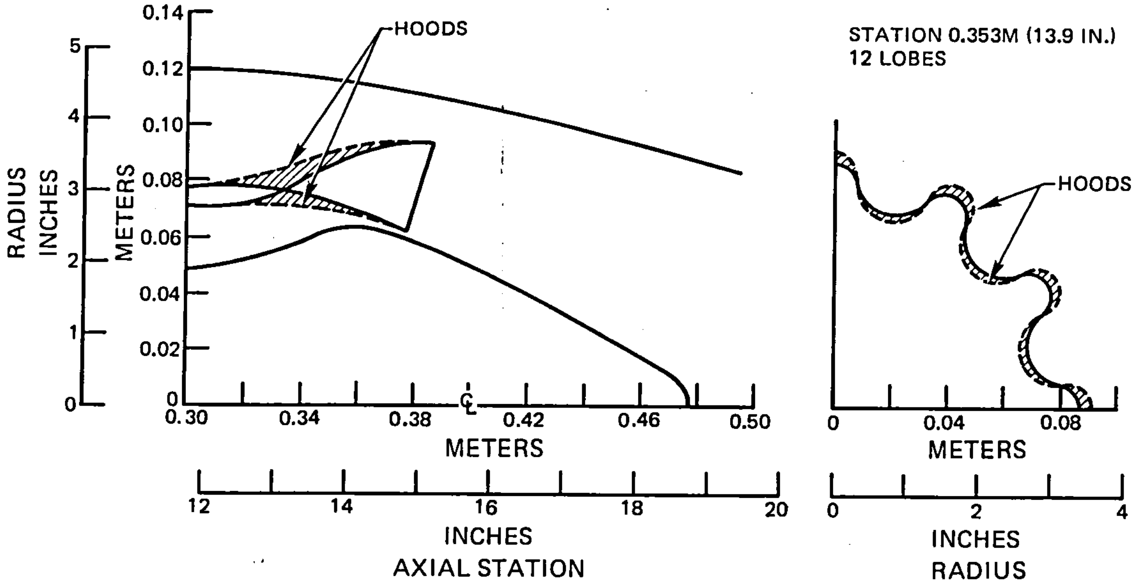


Figure 11 Configuration 27, 23 (15 degree Swirl), 24 (36 degree Swirl)

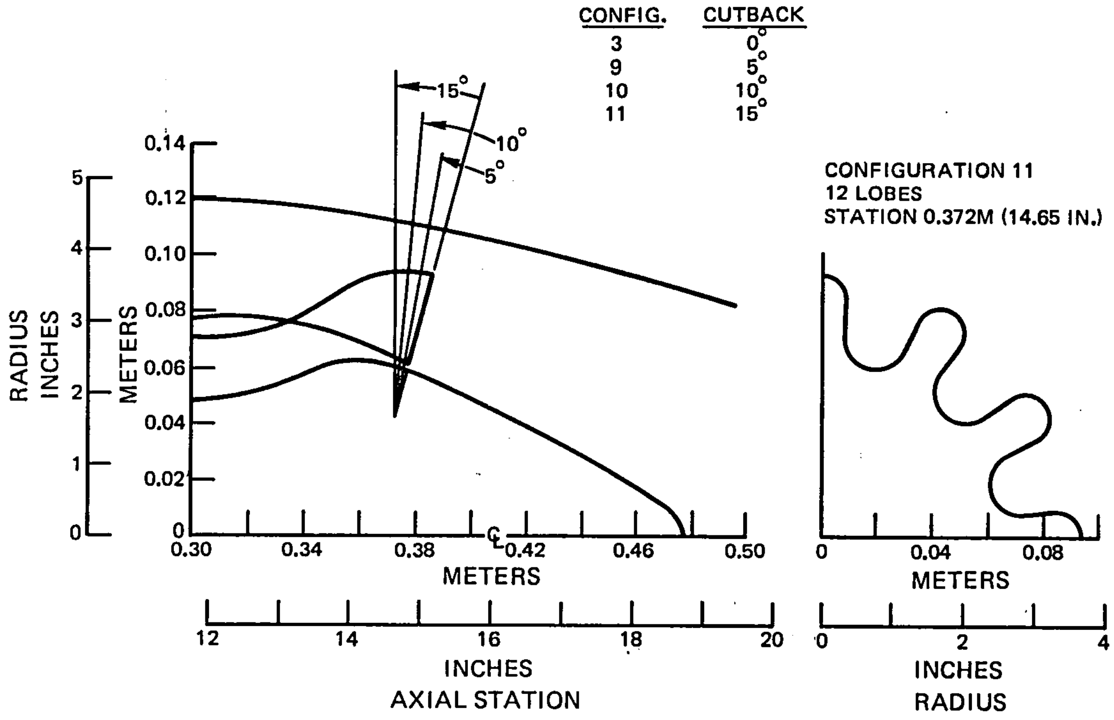


Figure 12 Configurations 3, 9, 10 and 11

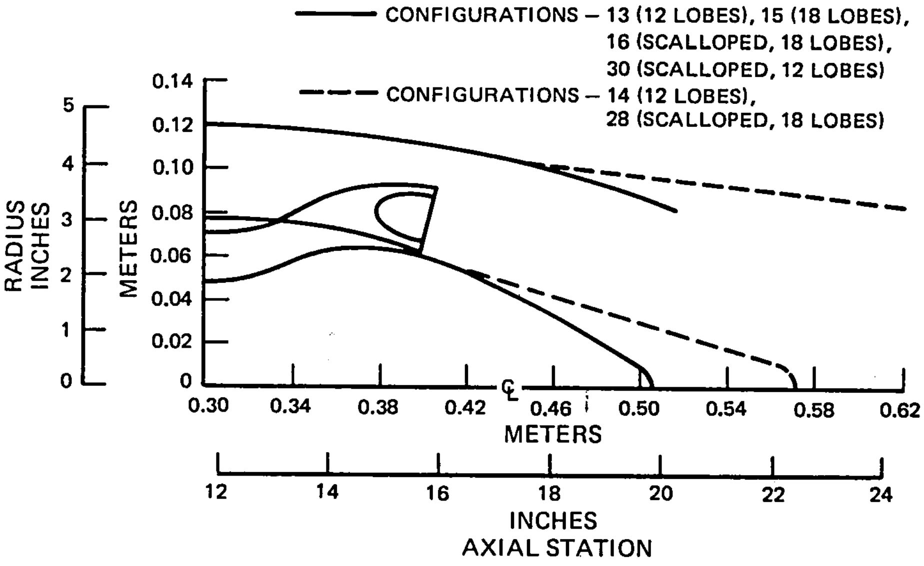


Figure 13 Configurations 13, 14, 15, 16, 28 and 30

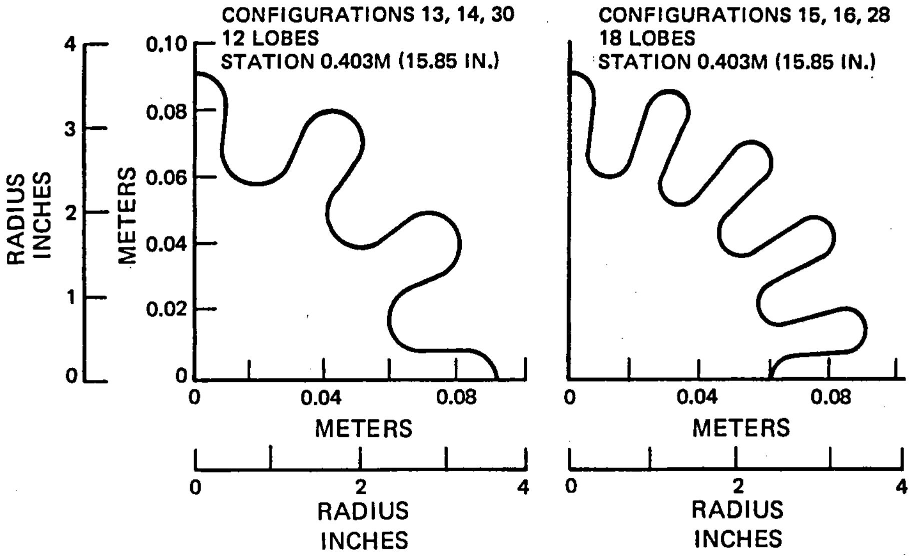


Figure 14 Configurations 13, 14, 15, 16, 28 and 30

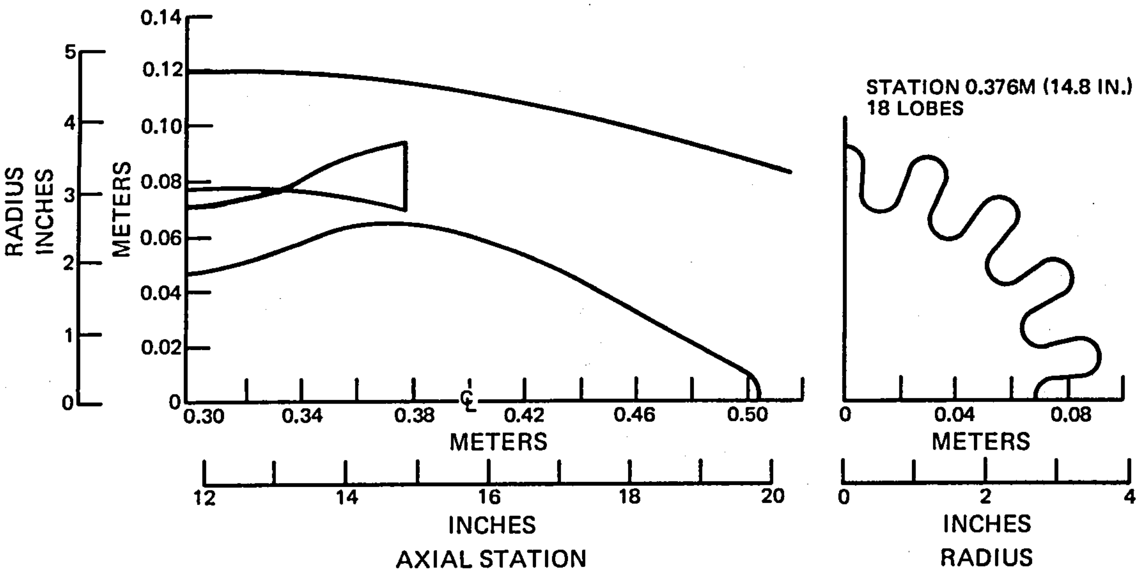


Figure 15 Configuration 29

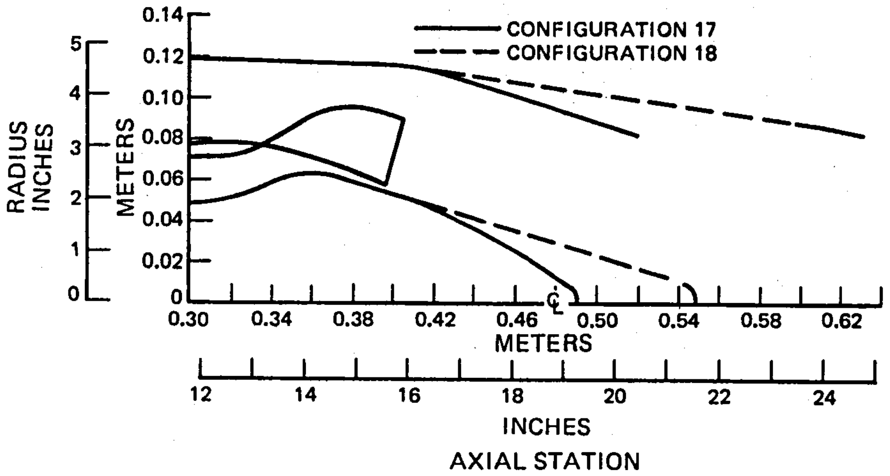


Figure 16 Configurations 17 and 18

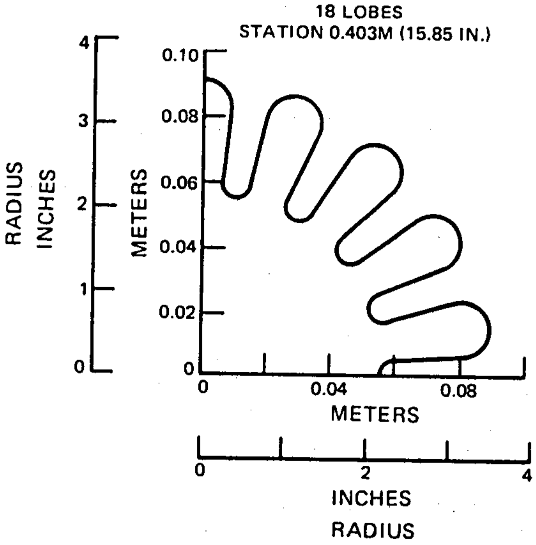


Figure 17 Configurations 17 and 18

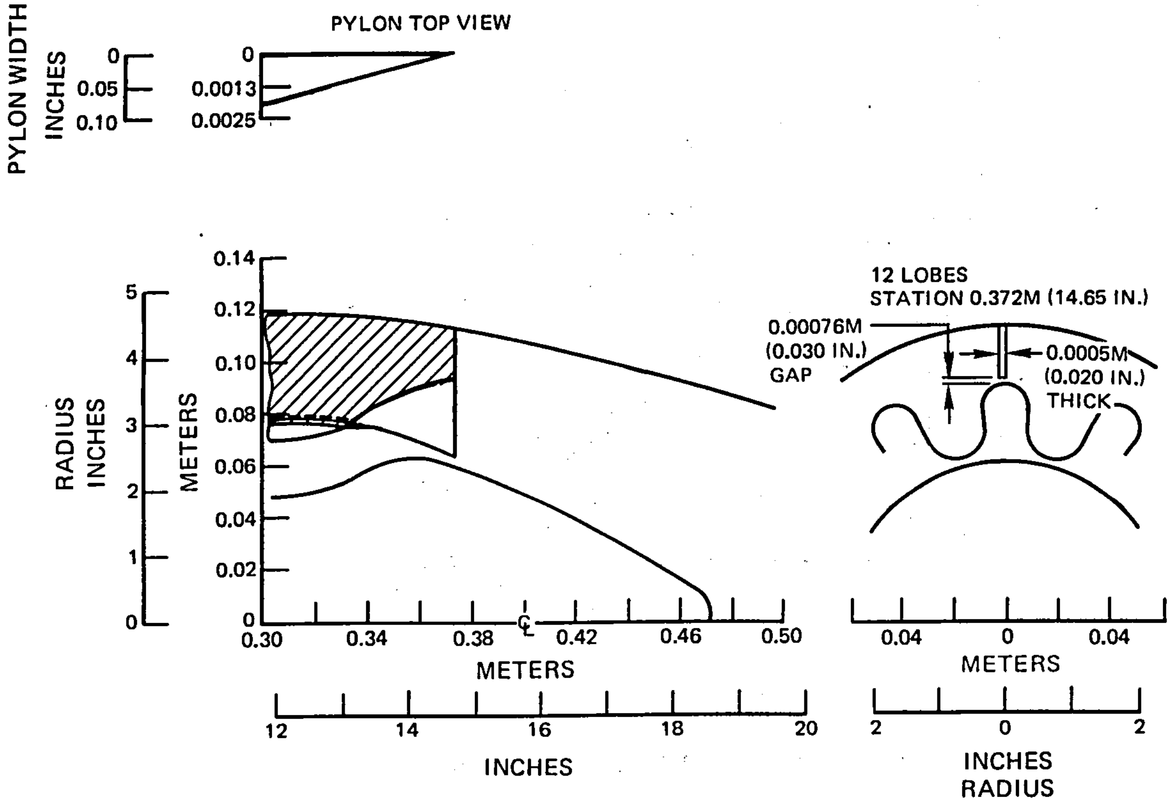


Figure 18 Configuration 25

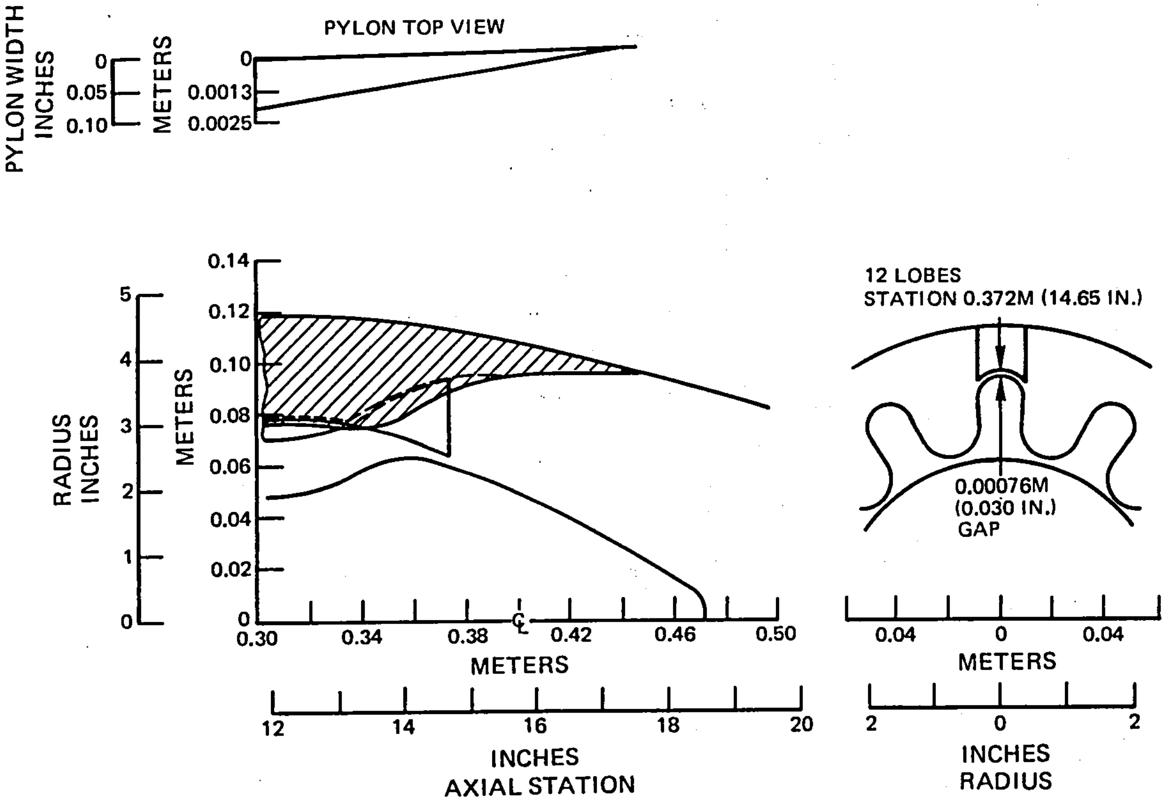


Figure 19 Configuration 26

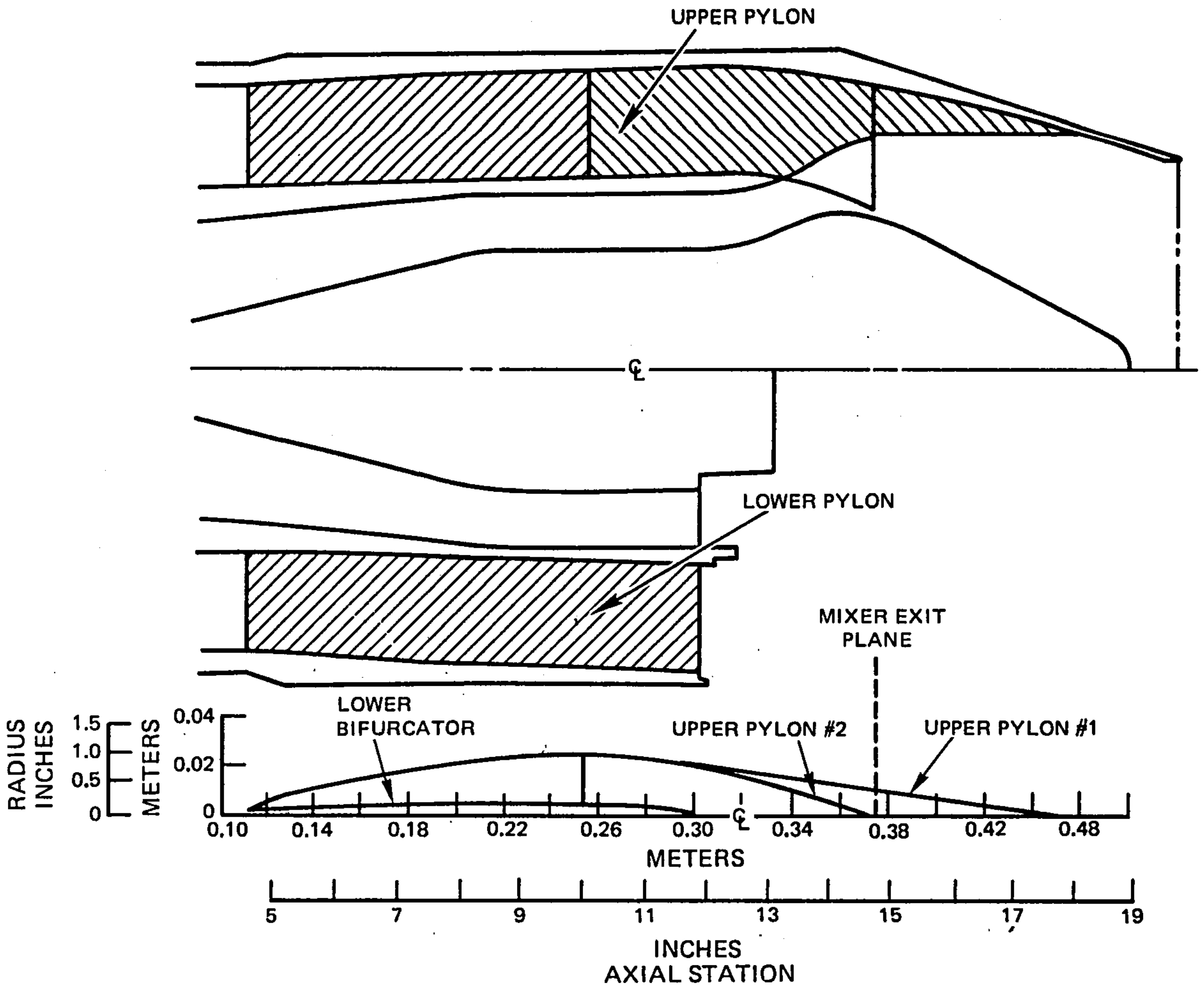


Figure 20 Lower Bifurcator Ending Upstream of the Mixer Simulated in these Tests

Eighteen mixer configurations were tested in the Phase II program. Sixteen were new configurations. The remaining two configurations consisted of the free mixer nozzle (configuration 1) and configuration 29 from the Phase I program. Retest of these configurations provided monitoring of data repeatability and improved accuracy. A summary of significant design variables and special features is shown in Table II.

Four basic series, which evaluated mixer size (length and diameter), were designed with variations in mixer/plug gap, scalloping, cutbacks, mixer hoods, and plug angle. These were the black, purple, brown and yellow series, beginning with configurations 33, 34, 35 and 36, respectively, as summarized in Table II. These designs are illustrated in Figures 21 through 25.

Mixer length variations included 2 short (configurations 33 and 34) and 2 long mixers (configurations 35 and 36). The short mixers were the same length as the best performing mixer from Phase I (configuration 29). The longer mixers +0.152m (+6 in) full scale provided an improved flowpath, with less severe turning through the mixer.

Mixer/plug gap variations were designed into configurations 37 and 38 which have 12 percent and 32 percent gaps, respectively. These two configurations use the mixer from configuration 36.

TABLE II

PHASE II DESIGN VARIABLES

Configuration Type	No.	No. of Lobes	Tailpipe length/ Diameter	Special Features	Penetration	Gap	α/θ **
Black	33	18	0.61		0.75	0.22	0.25*
	41	18	0.61	Scalloped Mixer	0.75	0.22	0.25*
	42	18	0.61	Scalloped Mixer, Modified Tailpipe	0.75	0.22	0.25*
	45	18	0.61	Scalloped and Cutback Mixer	0.75	0.35	0.25*
Purple	34	18	0.61		0.75	0.22	0.26*
Brown	35	18	0.61		0.75	0.22	0.27*
	40	18	0.61	33° Plug	0.75	0.22	0.27*
	46	18	0.61	Scalloped and Cutback Mixer, 33° Plug	0.75	0.37	0.27*
	47	18	0.61	Scalloped and Cutback Mixer, 39° Plug	0.75	0.37	0.27*
Yellow	36	18	0.61		0.75	0.22	0.26*
	37	18	0.61		0.75	0.12	0.26*
	38	18	0.61		0.75	0.32	0.26*
	39	18	0.61	Mixer Hoods	0.72	0.26	0.26*
	43	18	0.61	Mixer Hoods, Scallop 1 Mixer	0.72	0.26	0.26*
	48	18	0.61	Mixer Hoods, Scallop 1 Mixer, 37° Plug	0.72	0.26	0.26*
	49	18	0.61	Mixer Hoods, Scallop 2 Mixer	0.72	0.26	0.26*

* - constant lobe width
** - at mixer exit, defined in figure 3
Note - Configuration 44 was not tested.

A scalloping modification was designed for configuration 33 producing configuration 41. Since it was felt that scalloping might shift the bypass ratio of the system for this particular design, an insert was designed for the tailpipe (see configuration 42) which would correct the bypass ratio back to its original level. A cutback of the inner lobe of configuration 41 was selected (see configuration 45) to determine if this produced the same gap effect that changing plug diameter had on other configurations.

Modifications were also designed for configuration 36. These included mixer hoods (see configuration 39), scallops (see configuration 43 and 49) and a steeper plug (configuration 48) which changed the tailpipe flow area distribution.

Design modifications were also selected for configuration 35 to investigate steep plug angles (see configurations 40 and 47) along with scallops and cutbacks (see configuration 46).

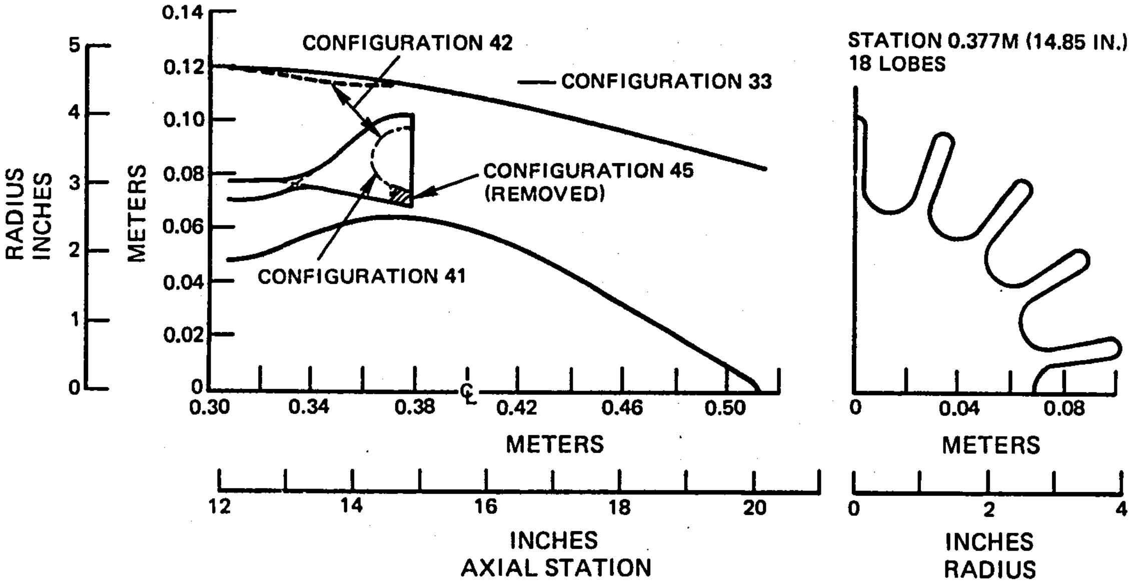


Figure 21 Configurations 33, 41, 42 and 45

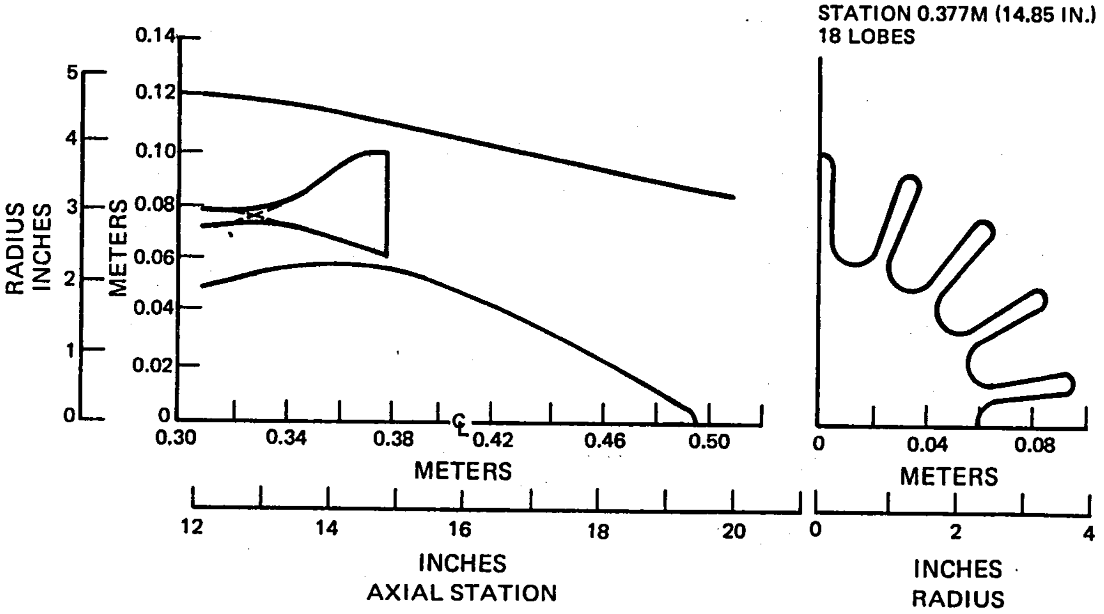


Figure 22 Configuration 34

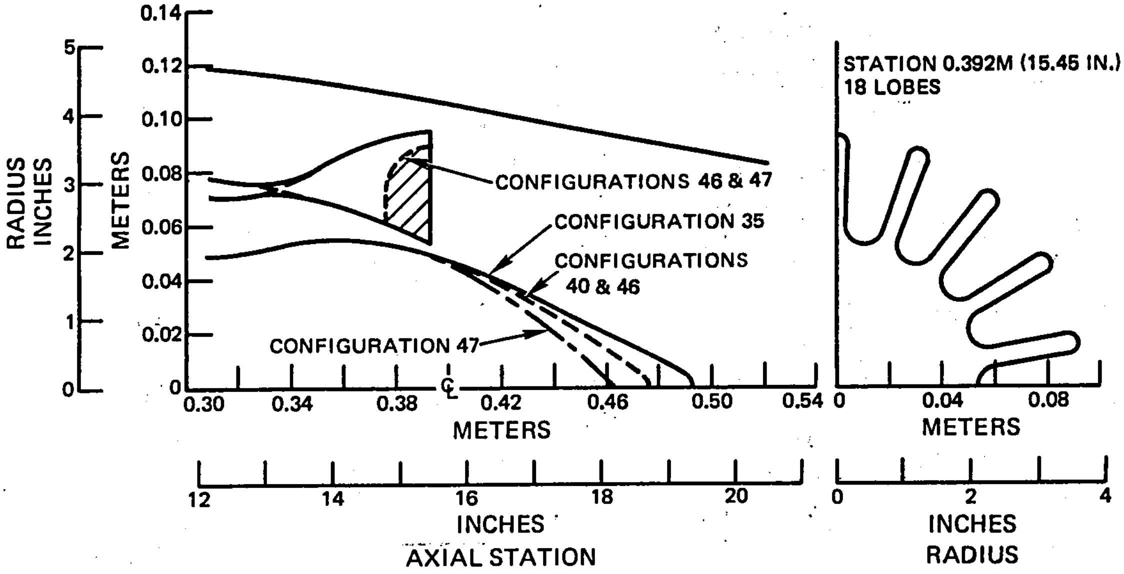


Figure 23 Configurations 35, 40, 46 and 47

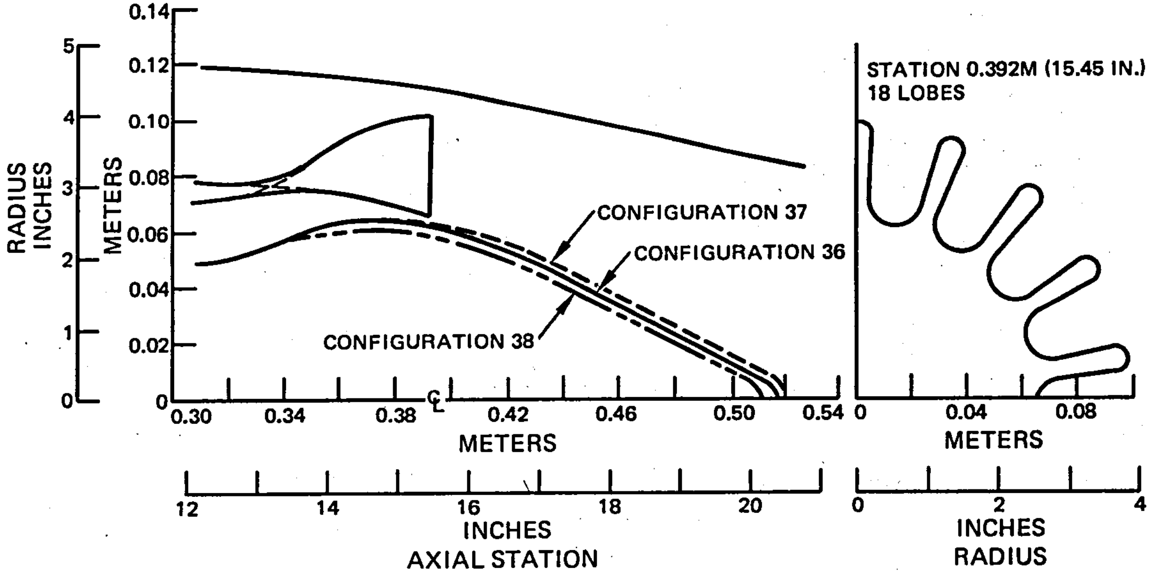


Figure 24 Configurations 36, 37 and 38

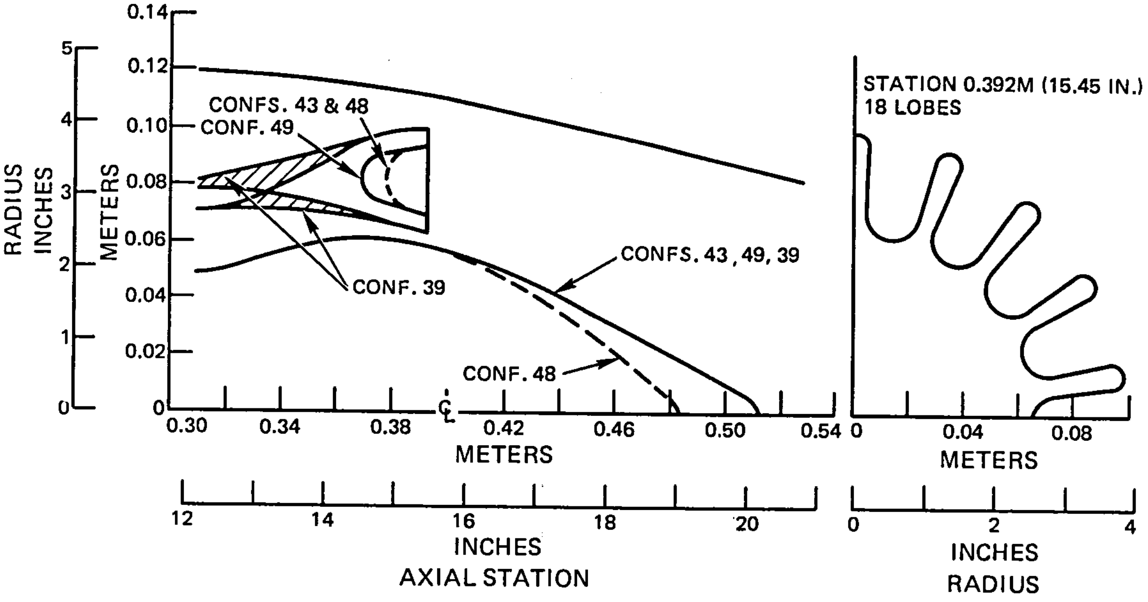


Figure 25 Configurations 39, 43, 48 and 49

3.4 Model Fabrication

Model hardware for both test phases was fabricated at FluiDyne Engineering Corporation. The mixers and plugs were fabricated from 416 stainless steel, tailpipes from mild steel, and bifurcators from aluminum. The mixers were machined from solid steel blanks to 0.00086m (0.034 in) wall thickness. The trailing edge of the mixers was handworked to 0.00025m (0.010 in).

Several Phase I configurations were obtained by modifying the original mixers. Mixer number 3 was modified by adding hoods (fairings) on both inner and outer surfaces. The hoods were stamped out on a pre-determined pattern and silver soldered in place. Mixer numbers 5 and 6 were modified by machining scallops in the trailing edge, and mixer 6 was further modified by shortening the length (cutback). Mixer 2 was progressively cut back to change the length and exit angle.

For Phase II, mixer number 9 was modified twice (scallops, cutback); mixer number 11 was modified once (scallops and cutback) and mixer number 12 was modified three times (lobe fairings, scallops, modified scallops).

The mixer, tailpipe and plug components, identified by number, for each test configuration are summarized in Table III. This table, when used with Figures 4 through 25, identifies the tailpipe and plug used with each mixer modification.

TABLE III

TEST CONFIGURATION COMPONENTS

	Configuration	Mixer	Tailpipe	Plug	Mixer Modification
PHASE I	1	1	1	1	
	2	1	2	1	
	3	2	1	2	
	4	2	3	3	
	5	2	2	4	
	6	2	4	2	
	7	3	1	1	
	8	4	1	1	
	9	2	1	1	Cut Back 5° Scarf Angle
	10	2	1	1	Cut Back 10° Scarf Angle
	11	2	1	1	Cut Back 15° Scarf Angle
	13	5	5	5	
	14	5	6	6	
	15	6	5	5	Scalloped
	16	6	5	5	
	17	7	7	7	
	18	7	8	8	
	19	8	9	9	
	21	1	1	1	
	22	1	1	1	
	23	3	1	2	Hooded
	24	3	1	2	Hooded
	25	2	1	2	
	26	2	1	2	
	27	3	1	2	Hooded
	28	6	6	6	Scalloped
	29	6	5	5	Cutback
	30	5	5	5	Scalloped
PHASE II	33	9	10	10	
	34	10	11	11	
	35	11	12	12	
	36	12	13	13	
	37	12	13	14	
	38	12	13	15	
	39	12	13	15	Hooded
	40	11	12	16	
	41	9	10	10	Scalloped
	42	9	14	10	Scalloped
	43	12	13	15	Hooded and Scalloped (#1)
	45	9	10	10	Scalloped and Cutback
	46	11	12	16	Scalloped and Cutback
	47	11	12	17	Scalloped and Cutback
	48	12	13	18	Hooded and Scalloped (#1)
	49	12	13	15	Hooded and Scalloped (#2)

4.0 TEST FACILITY AND TEST PROGRAM

4.1 Test Facility

The test facility used in this program was the Channel 11 static thrust stand at the Medicine Lake Laboratory of FluiDyne Engineering Corporation, Minneapolis, Minnesota. The facility, shown schematically in Figure 26, is capable of supplying two streams with different properties to the test nozzle. The airflow for each stream is obtained from a high pressure, dry air, storage system. The airflow for the hot stream is passed through a regenerative storage heater, and mixed with unheated bypass air to achieve the desired temperature. In both streams the airflow is throttled and metered through a long-radius ASME nozzle and then ducted to the nozzle assembly. A three component force balance is used to establish nozzle thrust.

The air heater used for the hot stream contains alumina pebbles which are preheated to approximately 537 C (1000°F). The heater capacity is nominally 18 kg (40 lbs/sec) at 537 C (1000°F).

The airflow for the two streams is oriented in a concentric fashion as illustrated in Figure 27 to supply the test nozzle. Facility measurements provide mass flow rates in each stream and the overall nozzle thrust. Instrumentation at the model charging stations (7 and 8) allows the desired conditions to be set.

Static and total pressures were measured with multiple-tube mercury manometers and recorded with Polaroid cameras. The Polaroid pictures were read and input into a WANG computer system, along with the total temperatures and force balance measurements obtained using a digital data acquisition system. The total temperature probes were shielded chromel/alumel thermocouples.

4.2 Test Instrumentation

The charging station instrumentation is housed in the model adapter section, illustrated in Figure 28, which provides the transition from the facility plumbing to the test nozzle models. The fan passage includes an upstream choke plate and two screens, followed by a bellmouth contraction to the fan duct charging station. Downstream of the charging station is the common fan shroud adapter, simulating the fan duct of the engine, and the tailpipe. Adapters for the core passage consists of an insulated duct, 2 choke plates, two screens, a center-body and a common core shroud adapter. During selected tests, swirl was introduced in the core stream by means of a swirl vane assembly just upstream of the model connection plane. The test configurations described in Section 3.2 were attached to the adapting hardware at the model connection plane.

Instrumentation in the fan passage which is illustrated in Figure 29, includes four 12-tube, area-weighted total pressure rakes, two 5-probe, total temperature thermocouple rakes and four static taps on the inner as well as the outer wall. Instrumentation in the primary passage, illustrated in Figure 30, includes four 7-tube, area-weighted total pressure rakes, and two area-weighted total temperature rakes, one having 4 probes and the other having 3. There are four static taps each on both the inner and outer walls.

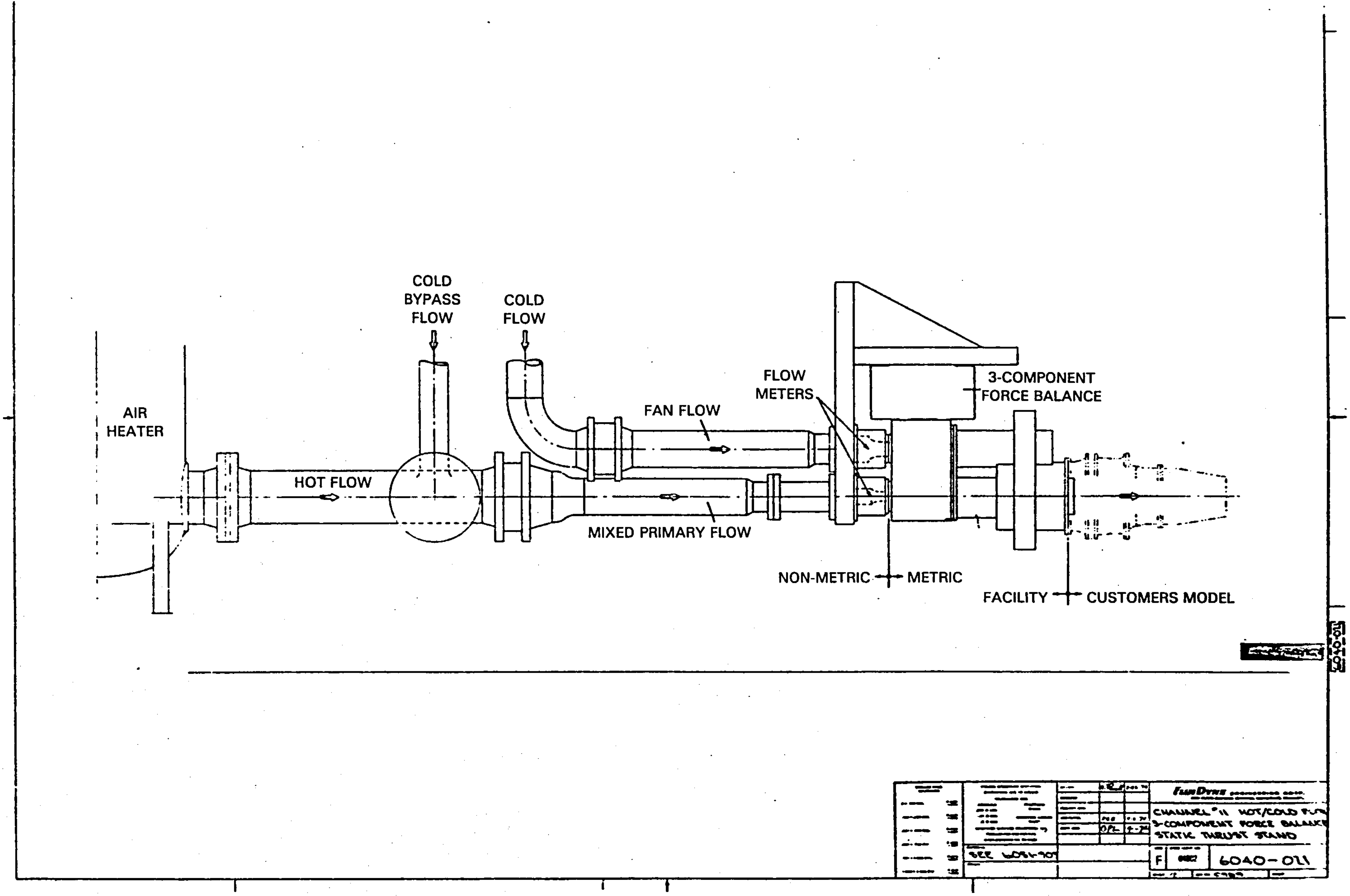
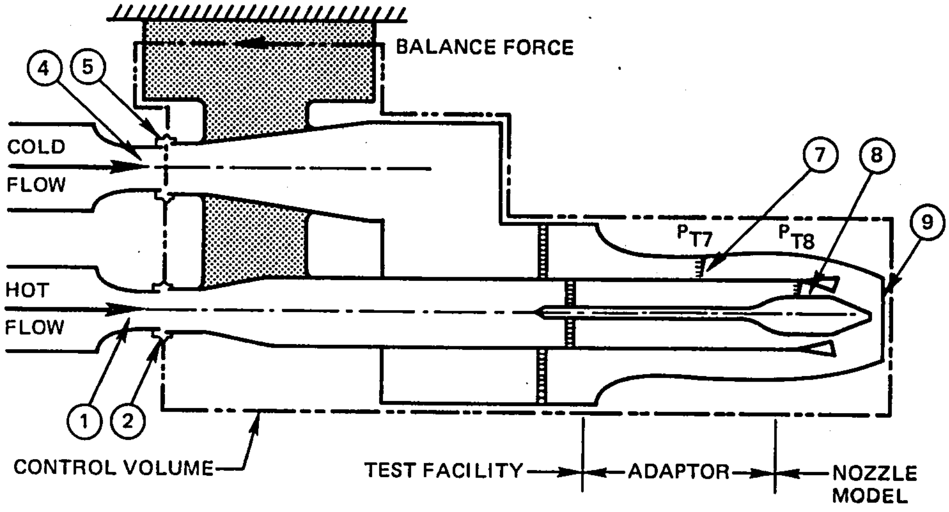


Figure 26 Channel 11 Facility Layout



STATION	DESCRIPTION
1	ASME METER THROAT (CORE FLOW)
2	FLEXIBLE SEAL (CORE FLOW)
4	ASME METER THROAT (FAN FLOW)
5	FLEXIBLE SEAL (FAN FLOW)
7	FAN NOZZLE
8	CORE NOZZLE
9	FINAL NOZZLE EXIT

Figure 27 Airflow for the Two Streams Oriented in a Concentric Fashion to Supply the Test Nozzle

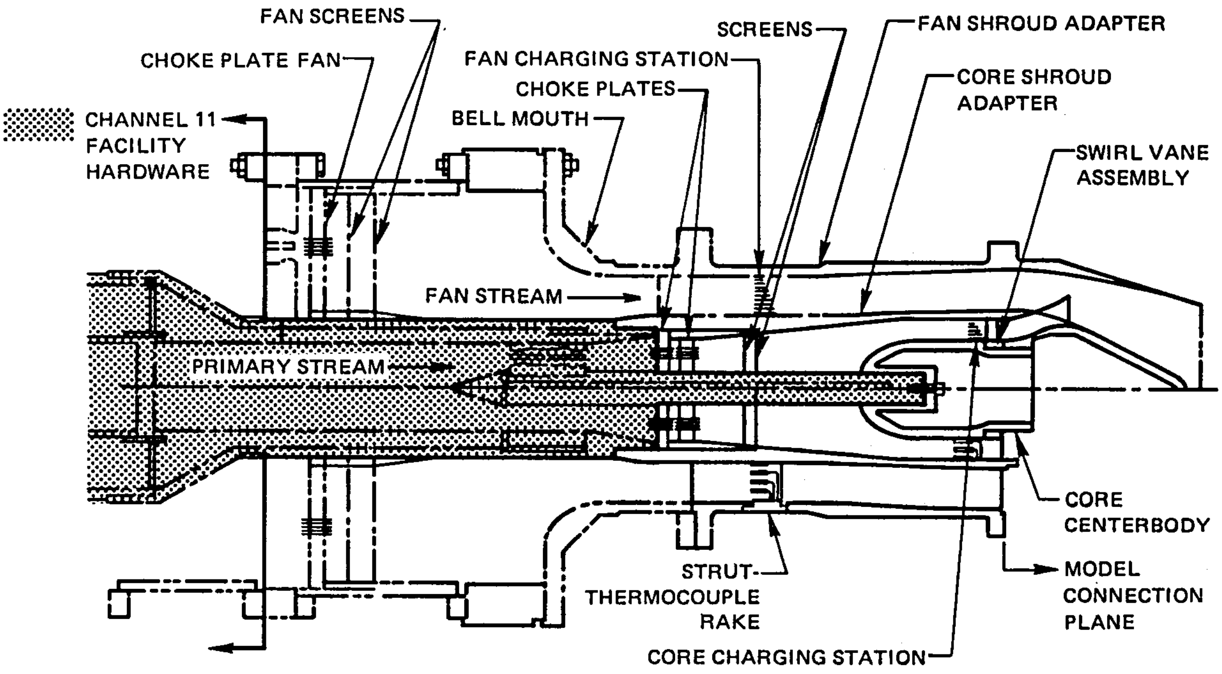
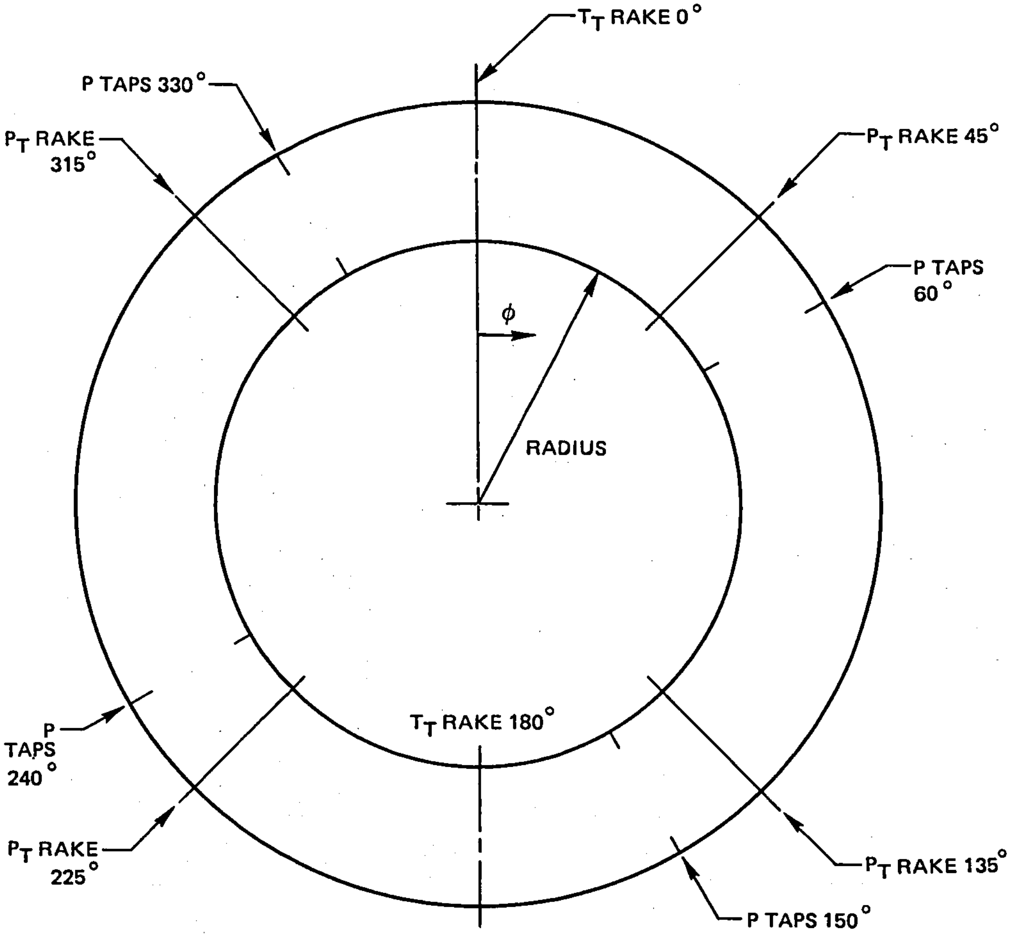


Figure 28 Charging Station Instrumentation Housed in the Model Adapter Section

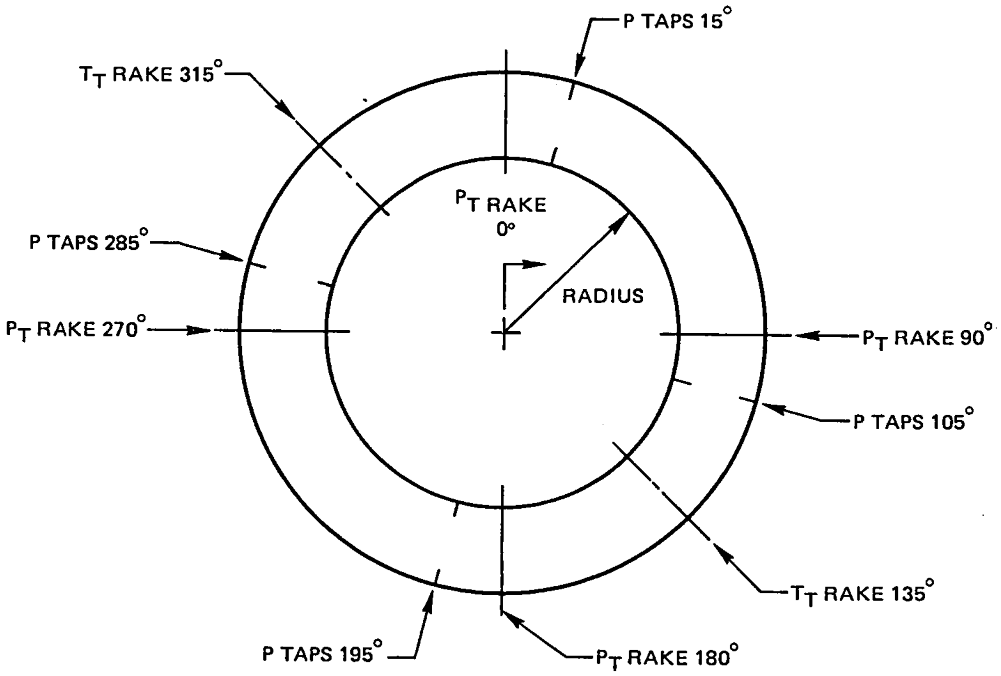


TOTAL PRESSURE RAKE LOCATIONS					
ϕ				RADIUS	
45°	135°	225°	315°	METERS	INCHES
PROBE NUMBER					
37	49	61	73	0.0737	2.903
38	50	62	74	0.0788	3.104
39	51	63	75	0.0825	3.249
40	52	64	76	0.0861	3.388
41	53	65	77	0.0895	3.523
42	54	66	78	0.0928	3.652
43	55	67	79	0.0959	3.776
44	56	68	80	0.0990	3.897
45	57	69	81	0.1020	4.014
46	58	70	82	0.1049	4.128
47	59	71	83	0.1077	4.239
48	60	72	84	0.1109	4.368

TOTAL TEMPERATURE RAKE LOCATIONS			
ϕ		RADIUS	
0	180	METERS	INCHES
PROBE NUMBER			
7	12	0.0742	2.920
8		0.0816	3.213
	13	0.0869	3.422
9		0.0919	3.620
	14	0.0967	3.807
10		0.1012	3.985
	15	0.1056	4.156
11	16	0.1105	4.350

STATIC PRESSURE TAP LOCATIONS		
RADIUS = 0.1191M (4.69 IN.)	RADIUS = 0.0775M (3.05 IN.)	ϕ
TAP NUMBER	TAP NUMBER	
85	89	60°
86	90	150°
87	91	240°
88	92	330°

Figure 29 Fan Stream Charging Station Instrumentation



TOTAL PRESSURE RAKE LOCATIONS					
φ				RADIUS	
0°	90°	180°	270°	METERS	INCHES
PROBE NUMBER					
1	8	15	22	0.0491	1.933
2	9	16	23	0.0540	2.126
3	10	17	24	0.0573	2.254
4	11	18	25	0.0605	2.381
5	12	19	26	0.0635	2.501
6	13	20	27	0.0664	2.616
7	14	21	28	0.0698	2.748

TOTAL TEMPERATURE RAKE LOCATIONS			
φ		RADIUS	
135°	315°	METERS	INCHES
PROBE NUMBER			
	4	0.0495	1.950
1		0.0559	2.201
	5	0.0605	2.381
2		0.0647	2.548
3	6	0.0693	2.730

STATIC PRESSURE TAP LOCATIONS		
RADIUS = 0.0706M (2.78 IN.)	RADIUS = 0.0483M (1.9 IN.)	φ
TAP NUMBER	TAP NUMBER	
29	33	15°
30	34	105°
31	35	195°
32	36	285°

Figure 30 Primary Stream Charging Station Instrumentation

The final charging station total pressures in each stream were determined as mass-momentum averaged values from the individual probe readings. Charging station total temperatures were determined as area-weighted averages of the individual thermocouple readings.

Special instrumentation was employed to survey the nozzle exit for selected test configurations. The traverse rake illustrated in Figure 31 consists of a temperature rake with thirteen probes and a pressure rake with 12 probes. For Phase I, the temperature and pressure was separated by a 30 degrees angle and during each test, data were acquired at 5 degrees angular intervals covering a 60 degrees segment of the nozzle exit. This resulted in a total of 169 temperature and 156 pressure data points per test. In Phase II, the temperature and pressure rakes were separated by a 40 degrees angle and data were acquired at 2.5 degrees angular intervals covering a 40 degrees segment of the nozzle exit for a total of 225 temperature and 204 pressure data points per test. The actual installation of the traverse probes is shown in Figure 32.

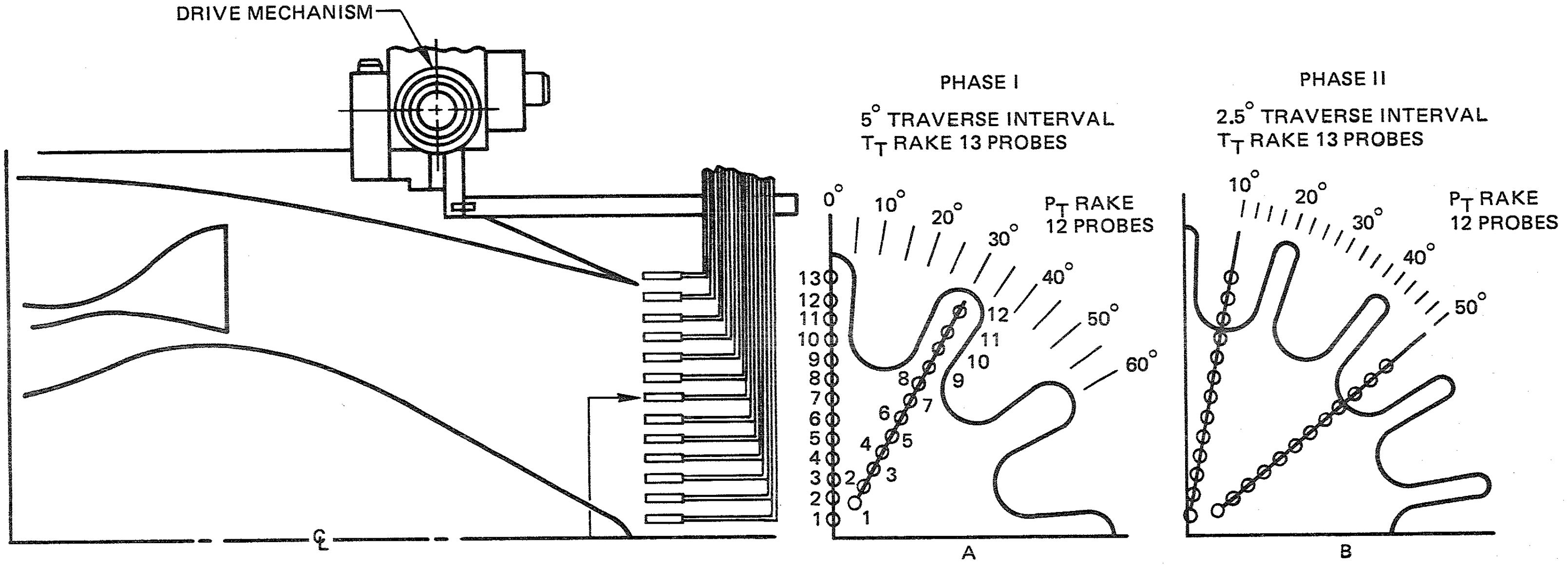
In addition, a flow visualization technique was also applied to selected configurations. The surface of the model was first spray painted white and then a mixture of lampblack and glycerine was applied in an array of spots covering the region of interest. A cold flow test run was then made to establish the airflow pattern on the surface of the models; the model was then disassembled and photographed.

4.3 Test Program

This section consists of the actual test conditions, data acquisition and reduction, and an evaluation of the data repeatability. The test conditions were based on simulation of Flight Propulsion System flow conditions. The data acquisition and reduction section describes the aerodynamic performance parameters acquired, the exit plane traverse measurements which were made, and the flow visualization information which was obtained. Finally, data repeatability is evaluated with a statistical evaluation of the free mixer test data, which represents the largest sampling of data available.

4.3.1 Test Conditions

The test conditions covered in the Phase I program simulated a range of cruise power settings for the Flight Propulsion System, at Mach 0.8, 10,668 m (35,000 feet). The Phase II program concentrated only on the maximum cruise power setting. The appropriate pressure ratios in each stream were simulated, as was the total temperature ratio between the two streams.



TRAVERSE RAKE PROBE LOCATIONS PHASE I AND II											
T_T	P_T	RADIUS		T_T	P_T	RADIUS		T_T	P_T	RADIUS	
PROBE #	PROBE #	METERS	INCHES	PROBE #	PROBE #	METERS	INCHES	PROBE #	PROBE #	METERS	INCHES
1		0.0066	0.26	5	4	0.0330	1.30	9	8	0.0594	2.34
2	1	0.0137	0.54	6	5	0.0396	1.56	10	9	0.0660	2.60
3	2	0.0198	0.78	7	6	0.0462	1.82	11	10	0.0726	2.86
4	3	0.0264	1.04	8	7	0.0528	2.08	12	11	0.0792	3.12
								13	12	0.0859	3.38

Figure 31 Traverse Rake Assembly

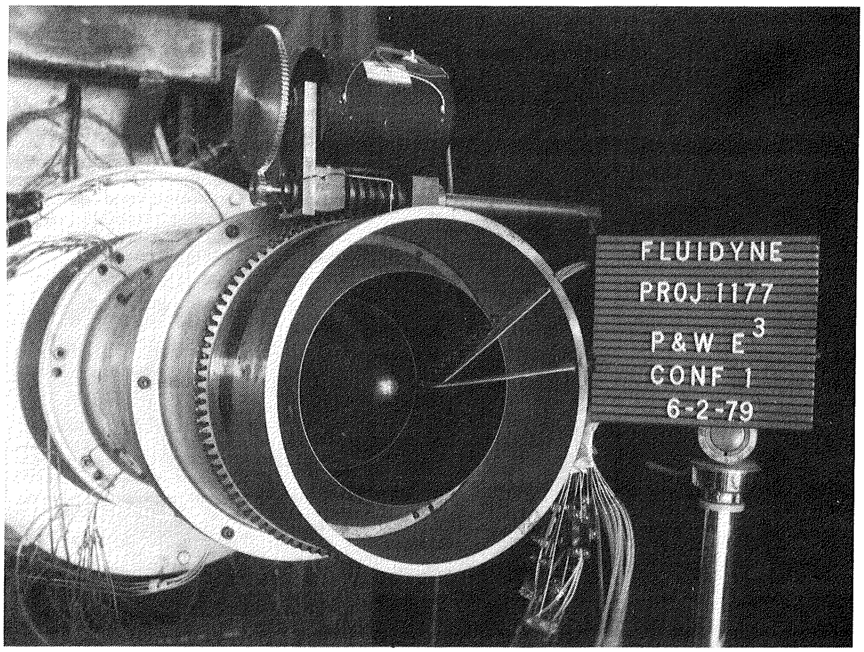


Figure 32 Actual Installation of the Traverse Probes

Phase I

The test matrix for each configuration in Phase I is presented in Table IV which covers a range of cruise power settings from approximately 55 percent to 110 percent. Each hot flow test point is defined by a primary stream pressure ratio (PT8PAM), a fan to primary stream total pressure ratio (P_{T7}/P_{T8}) and a primary to fan stream total temperature ratio (TRAT). The cold flow tests consisted of a range of pressure ratios which duplicated the range of mixed pressure ratios associated with the engine power setting variation. This facilitated calculation of the level of mixing and the amount of excess pressure loss exhibited by the test configuration.

The nozzle exit traverses were made at a high power setting, near maximum cruise operation; the flow visualization tests were conducted at a comparable cold flow condition.

Phase II

The tests of each Phase II configuration were conducted at a single power setting which represented the maximum cruise condition. Each point was repeated five times to improve data reliability. A hot flow point consisted of setting the primary stream total pressure ratio (PT8PAM) at 2.35, the fan to primary total pressure ratio (P_{T7}/P_{T8}) at 1.1 and the primary to fan total temperature ratio (TRAT) at 2.5. The cold flow primary stream pressure ratio was 2.5 and the fan to primary total pressure and total temperature ratio were both held at 1.0.

The nozzle exit traverses were made at the hot flow condition, and the flow visualization tests were conducted at the cold flow test condition.

TABLE IV

PHASE I TEST MATRIX

Hot Flow Tests

Condition Number	Primary Stream Pressure Ratio (PT8PAM)	Fan to Primary Stream Pressure Ratio (PT7/PT8)	Fan to Primary Stream Temperature Ratio (TRAT)
1	1.8	1.16	2.33
2	2.0	1.14	2.38
3	2.1	1.13	2.44
4	2.2	1.11	2.44
5	2.3	1.10	2.50
6	2.4	1.09	2.56

Cold Flow Tests:

Condition Number	Primary Stream Pressure Ratio (PT8PAM)	Fan to Primary Stream Pressure Ratio (PT7/PT8)	Fan to Primary Stream Temperature Ratio (TRAT)
1	2.0	1.00	1.00
2	2.2	1.00	1.00
3	2.3	1.00	1.00
4	2.4	1.00	1.00
5	2.5	1.00	1.00
6	2.6	1.00	1.00

Nozzle Exit Traverse: (see condition 5 of the hot flow test series)

Flow Visualization:

PT8PAM = PT7PAM = 2.5
TRAT = 1.0

4.3.2 Data Acquisition and Reduction

The experimental data produced during the program are described in this section. This includes the major aerodynamic performance parameters (i.e., thrust and flow coefficients), exit plane traverse measurements, and flow visualization information.

4.3.2.1 Thrust and Flow Coefficient

The determination of overall gross thrust coefficient and its equivalent change in thrust specific fuel consumption was the primary objective for the various configurations tested. Exhaust system performance was assessed through the use of mixed thrust and flow coefficients that were non-dimensionalized by fully mixed ideal thrust and flow terms in order to reflect the thrust gain avail- able from the mixing process. The basic model thrust coefficient was then corrected for model to full scale differences. Finally, the full scale model data were adjusted to reflect the adaptation of a convergent-divergent nozzle, in place of the convergent nozzle tested in the scale models. The general procedure used to calculate the coefficients and the equivalent change in thrust specific fuel consumption is outlined in Figure 33.

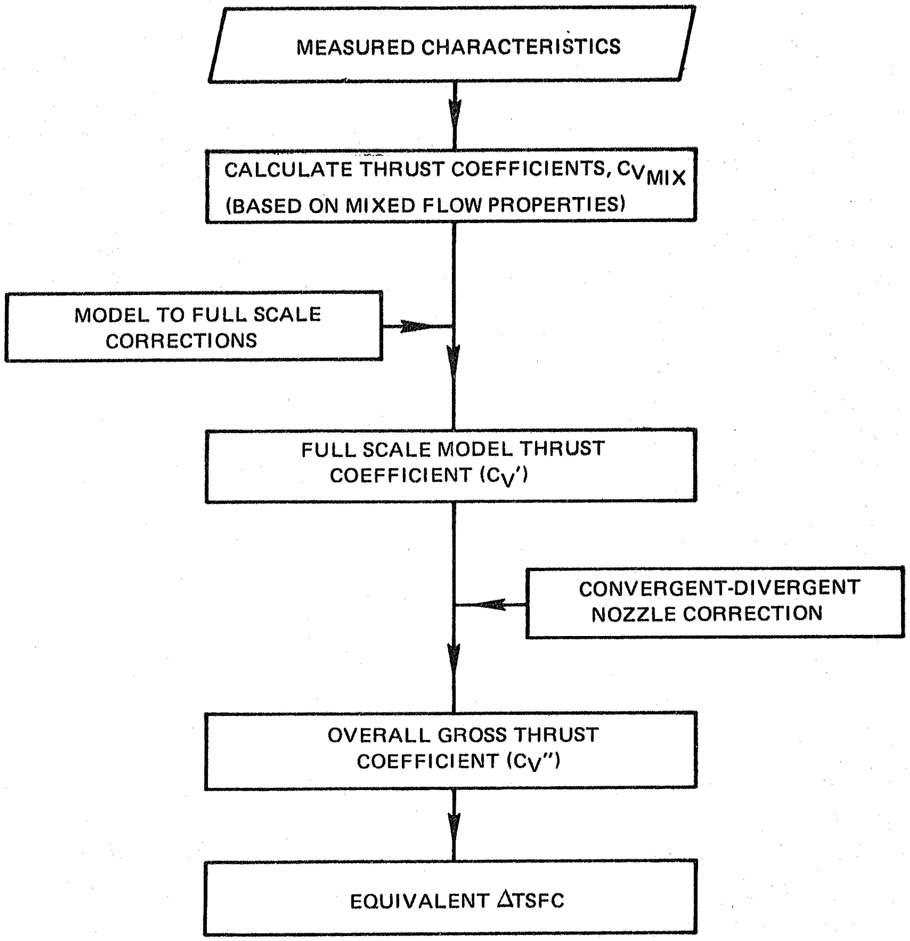


Figure 33 Data Processing Procedure

The procedure begins with the measured thrust and the airflow through each stream, along with the charging station pressures and temperatures. Since the most meaningful thrust coefficient ($C_{V\ MIX}$) is based on mixed flow properties at the exit plane of the mixer, it is necessary to estimate the stream properties at the mixing plane. This can best be done by accounting for the total pressure loss in each stream, from the charging station to mixing plane. This one dimensional calculation is defined as:

$$\frac{\Delta PT}{PT} = \int_{\text{CHARGING STATION}}^{\text{MIXING PLANE}} -4\ C_f\ \frac{dl}{2r}\ \frac{\gamma\ Mn_{local}^{2}}{2}$$

where

Cf is skin friction coefficient
Mn_{local} is the local Mach number
dl is incremental duct length
2r is equivalent duct diameter

Once the charging station pressures have been adjusted, the fully mixed values of pressure ($P_{T\ MIX}$) temperature ($T_{T\ MIX}$), used in the calculation of ideal thrust and flow, can be determined. The procedure used to calculate the fully mixed conditions is discussed in detail in Appendix A.

The mixed model thrust coefficient is defined as:

$$C_{V_{MIX}} = \frac{Fg_{\text{ measured}}}{\left.Fg\ \begin{matrix}\text{fully}\\ \text{mixed}\end{matrix}\right)_{\text{ideal}}}$$

$$\text{where } \left.Fg\ \begin{matrix}\text{fully}\\ \text{mixed}\end{matrix}\right)_{\text{ideal}} = \Big[Wa_{fan} + Wa_{pri}\Big]_{\text{measured}} \Big(\text{Velocity ideal}\Big)$$

$$\text{and Velocity} \sim f\ (P_{T_{MIX}}, T_{T_{MIX}})$$

In addition, the mixed model flow coefficient is defined as:

$$C_{V_{MIX}} = \frac{\Big[Wa_{fan} + Wa_{pri}\Big]\ \text{measured}}{\left.Wa\ \begin{matrix}\text{fully}\\ \text{mixed}\end{matrix}\right)_{\text{ideal}}}$$

$$\text{where } \left.Wa\ \begin{matrix}\text{fully}\\ \text{mixed}\end{matrix}\right)_{\text{ideal}} = \Big(\rho\ \text{exit}\Big)\Big(Aj_{\text{measured}}\Big)\Big(\text{Velocity}_{\text{ ideal}}\Big)$$

The full scale model thrust coefficient (C_V') is obtained by correcting the mixed model thrust coefficient ($C_{V\ MIX}$) to account for model-to-full scale differences.

$$C_V' = C_{V\ MIX} + \Delta C_{V\ M\text{-}FS}$$

where $\Delta C_{V_{M\text{-}FS}}$ = model to full scale corrections

The model to full scale corrections consist of pressure loss differences which include a Reynolds number correction for size and surface roughness and a full scale acoustic treatment loss estimate. The model-to-full scale correction is defined as:

$$\Delta C_{V_{M\text{-}FS}} = \left[\left.\frac{\Delta P_T}{P_T}\right)_{\text{model}} - \left.\frac{\Delta P_T}{P_T}\right)_{\begin{matrix}\text{full}\\ \text{scale}\end{matrix}}\right] \frac{\Delta C_V}{\Delta P_T/P_T}$$

where $\frac{\Delta P_T}{P_T}$ = Total Pressure Loss (Skin Friction)

$$\frac{\Delta C_V}{\Delta P_T/P_T} = \begin{array}{l}\text{Thrust Coefficient Sensitivity} \\ \text{with Total Pressure Loss}\end{array} \sim f\left[\begin{array}{c}\text{Nozzle Pressure} \\ \text{Ratio}\end{array}\right]$$

e.g. at PTMPA = 2.5, $\frac{\Delta C_V}{\Delta P_T/P_T} = 0.48$

A tabulation of $\Delta C_{V_{M-FS}}$ for Phase I and II "HOT" data are presented in Table V.

TABLE V

CORRECTIONS TO "HOT" DATA AT PTMPA = 2.5

CONFIGURATION	$\Delta C_{V_{MODEL-FULL\ SCALE}}$
1	-0.0005
2	-0.0006
3	-0.0008
4	-0.0009
5	-0.0009
6	-0.0008
7	-0.0008
8	-0.0008
9	-0.0008
10	-0.0008
11	-0.0008
13	-0.0008
14	-0.0010
15	-0.0008
16	-0.0008
17	-0.0008
18	-0.0009
19	-0.0008
21	-0.0005
22	-0.0005
23	-0.0008
24	-0.0008
25	-0.0008
26	-0.0008
27	-0.0008
28	-0.0010
29	-0.0008
30	-0.0008
33	-0.0008
34	-0.0008
35	-0.0008
36	-0.0008
37	-0.0008
38	-0.0008
39	-0.0008
40	-0.0007
41	-0.0008
42	-0.0008
43	-0.0008
45	-0.0008
46	-0.0007
48	-0.0008
49	-0.0008

For the majority of the configurations the $\Delta C_{V_{M-FS}}$ correction was 0.0008.

The final correction made to the data accounts for the fact that the flight propulsion system would have a convergent-divergent nozzle, rather than a convergent nozzle as tested on the models. This convergent-divergent effect is defined as:

$$\Delta C_{V_{C-D}} = C_{V_{\substack{\text{convergent}\\ \text{divergent}\\ \text{nozzle}}}} - C_{V_{\substack{\text{convergent}\\ \text{nozzle}}}}$$

The assumed convergent-divergent nozzle was selected to have an area ratio of 1.02. At a mixed pressure ratio of 2.5, the correction $\Delta C_{V_{C-D}} = +0.001$. The overall gross thrust coefficient is therefore defined as:

$$C_V'' = C_V' + \Delta C_{V_{C-D}}$$

The equivalent change in thrust specific fuel consumption, ΔTSFC, is established in Figure 34. The base level of overall thrust coefficient (i.e., at TSFC = 0) is the analytically established level selected for an optimized separate flow exhaust system.

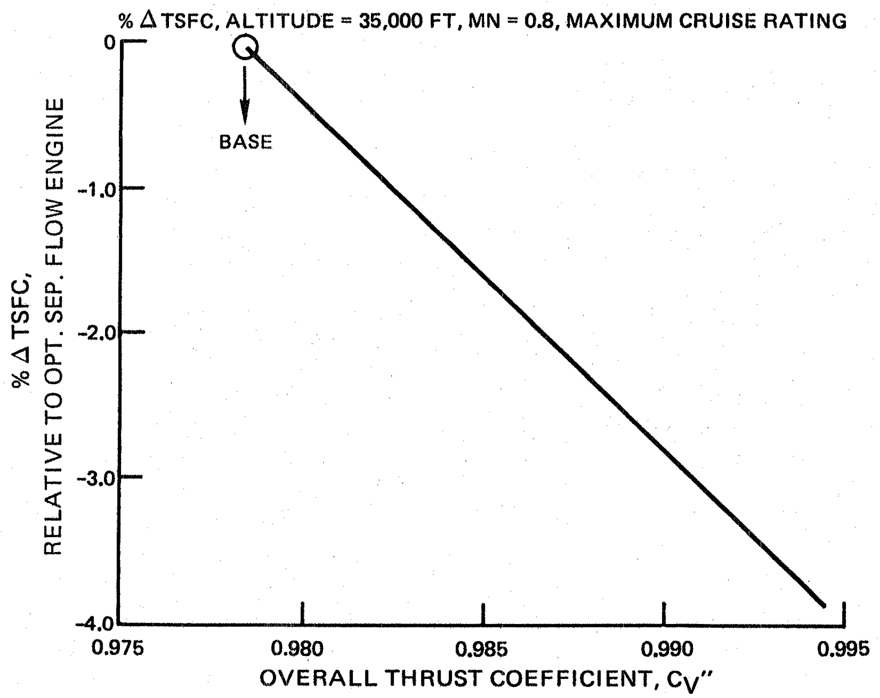


Figure 34 Equivalent Change in Thrust Specific Fuel Consumption Relative to the Optimized Separate Flow Exhaust System

To support the overall change in thrust specific fuel consumption evaluations, two other indicators, mixing efficiency (η_m) and the excess pressure loss ($\Delta P_T/P_T$), were also calculated. The amount of mixing coupled with the total pressure loss incurred in achieving that mixing determines the overall system performance. Mixing efficiency relates the actual nozzle performance gain to the ideal nozzle performance gain available from mixing. The fundamental definition is:

$$m = \frac{\text{actual nozzle performance gain}}{\text{ideal nozzle performance gain}} = \frac{\left[C_{V_{MIX_{Hot}}} - C_{V_{MIX_{Unmixed}}}\right] \text{actual}}{\left[\dfrac{F_{g_{\substack{\text{fully}\\ \text{mixed}}}} - F_{g_{\text{unmixed}}}}{F_{g_{\substack{\text{fully}\\ \text{mixed}}}}}\right]}$$

where $C_{V_{MIX_{Hot}}} = \dfrac{F_{g_{\text{actual}}}}{\left.F_{g_{\substack{\text{fully}\\ \text{mixed}}}}\right)_{\text{ideal}}}$ $\Bigg\}$ at fan to primary pressure ratio $P_{T_7}/P_{T_8} = K1$ and temperature ratio (TRAT) = K2

where $C_{V_{MIX_{Unmixed}}} = \dfrac{\left[F_{g_{\text{primary}}} + F_{g_{\text{fan}}}\right] \text{actual}}{\left.F_{g_{\substack{\text{fully}\\ \text{mixed}}}}\right)_{\text{ideal}}}$ $\Bigg\}$ at $P_{T_7}/P_{T_8} = K1$ and TRAT = K2 (requires no mixing between fan and primary stream)

and

$$\left[\frac{F_{g_{\substack{\text{fully}\\ \text{mixed}}}} - F_{g_{\text{unmixed}}}}{F_{g_{\text{fully mixed}}}}\right]_{\text{ideal}} = \text{ideal nozzle performance gain} \Bigg\} \text{ at } P_{T_7}/P_{T_8} = K1 \text{ and TRAT} = K2$$

where $\left.Fg_{\substack{\text{fully}\\ \text{mixed}}}\right)_{\text{ideal}} = f\,(P_{T_{MIX}}, T_{T_{MIX}})$

and $\left.Fg_{\text{unmixed}}\right)_{\text{ideal}} = \left.Fg_{\text{primary}}\right)_{\text{ideal}} + \left.Fg_{\text{fan}}\right)_{\text{ideal}}$

The fully mixed flow properties ($P_{T\ MIX} + T_{T\ MIX}$) are obtained from the mixing calculation procedure outlined in Appendix A.

Since the $C_{V\ MIX\ \text{unmixed}}$ cannot be measured (because it requires that no mixing take place between the fan and primary streams) it must be calculated by subtracting the ideal nozzle performance gain from the fully mixed performance.

$$C_{V_{MIX_{unmixed}}} = C_{V_{MIX_{\substack{fully\\mixed}}}} - \text{ideal nozzle performance gain}$$

$$\left.\text{where } C_{V_{MIX_{\substack{fully\\mixed}}}} = C_{V_{MIX_{Cold}}} = \frac{F_{g_{measured}}}{\left(F_{g_{\substack{fully\\mixed}}}\right)_{ideal}}\right\} \quad \begin{array}{l}\text{at } P_{T_7}/P_{T_8} = 1.0\\ \text{and TRAT} = 1.0\end{array}$$

The definition of mixing then becomes:

$$\eta_m = \frac{C_{V_{MIX_{Hot}}} - (C_{V_{MIX_{Cold}}} - \text{ideal nozzle performance gain})}{\text{ideal nozzle performance gain}}$$

$$\eta_m = 1 - \frac{\left[C_{V_{MIX_{Cold}}} - C_{V_{MIX_{Hot}}}\right] \text{actual}}{\text{ideal nozzle performance gain}}$$

The definition was used in the data reduction and its calculation requires separate tests of the exhaust system; (1) with both streams at the same temperature (cold flow, TRAT = 1.0) and pressure ($P_{T\ 7}/P_{T\ 8} = 1.0$), and (2) with both streams at simulated engine operating temperatures (hot flow, TRAT = K2) and pressure ($P_{T\ 7}/P_{T\ 8}$ = K1). With both streams at the same level of temperature and pressure, a uniform flow field will exist in the mixing region since the velocity difference between the two streams is zero. This simulates fully mixed flow ($C_{V\ MIX\ Cold}$). Since the cold stream Mach numbers approximate those of the desired operating conditions, the pressure losses for hot and cold flow tests are approximately equal. Therefore, the difference in thrust coefficient levels between the hot ($C_{V\ MIX\ Hot}$) and cold ($C_{V\ MIX\ Cold}$) flow tests is a measure of the nozzle performance change due to the mixing process between the two streams. The calculation of mixing efficiency is graphically illustrated in Figure 35 where the actual nozzle performance gain is obtained from relating the measured hot data and the unmixed performance level. The latter is derived by subtracting the ideal nozzle performance gain from the fully mixed performance level.

In addition to the mixing level, that portion of the exhaust system total pressure loss which is in excess of skin friction loss was selected as a meaningful parameter in evaluating mixer performance. The procedure used to calculate pressure loss in excess of skin friction is outlined in Figure 36.

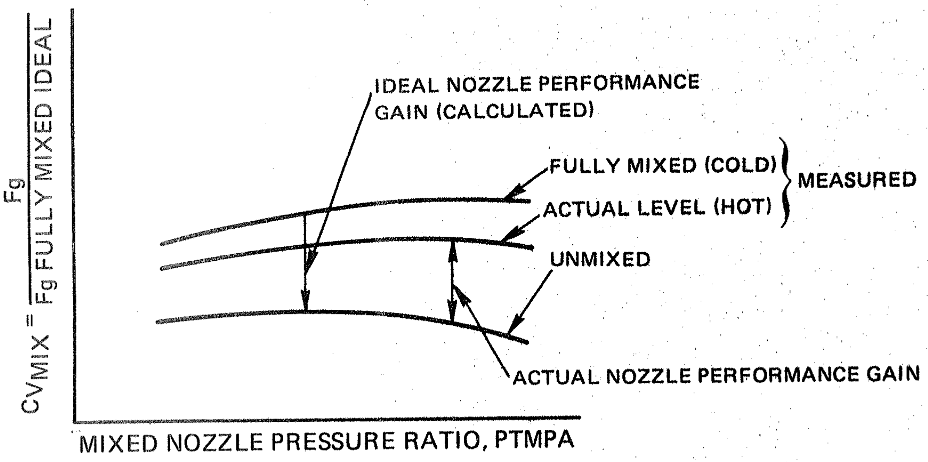


Figure 35 Calculation of Mixing Efficiency

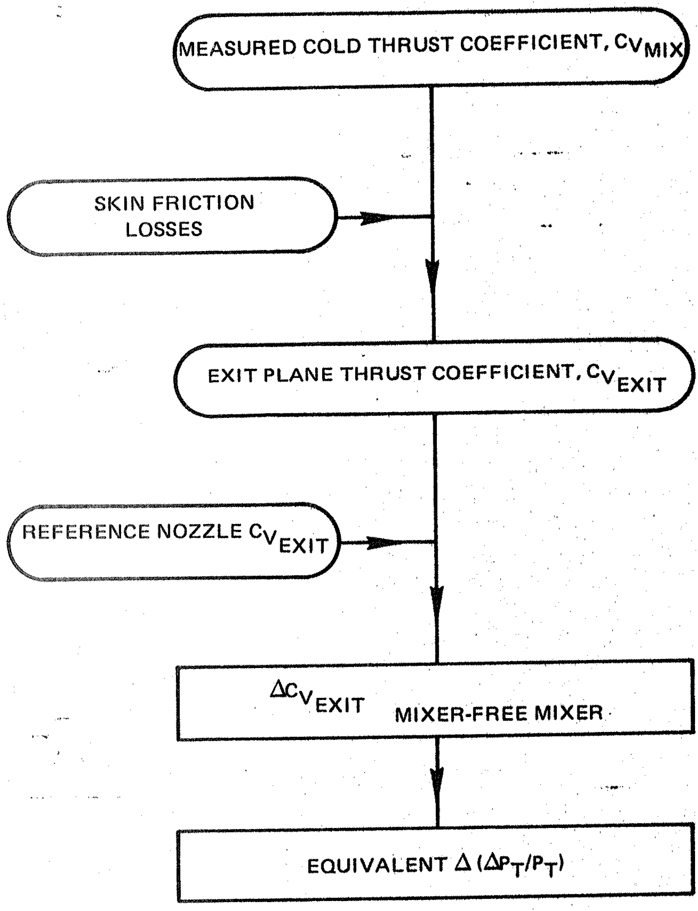


Figure 36 Procedure Used to Calculate Pressure Loss in Excess of Skin Friction

The procedure begins with the measured cold flow thrust coefficient ($C_{V\ MIX}$), for the mixer configuration of interest, which is adjusted to the exit plane of the tailpipe by adding in the equivalent change in thrust coefficient due to the skin friction losses of the tailpipe.

$$C_{V_{EXIT}} = C_{V_{MIX_{Cold}}} + \Delta C_{V_{Tailpipe}}$$

where $$\Delta C_{V_{Tailpipe}} = \left.\frac{\Delta P_T}{P_T}\right)_{\substack{\text{tailpipe}\\ \text{skin friction}}} \left(\frac{\Delta C_V}{\Delta P_{T/P_T}}\right)$$

and $$\frac{\Delta C_V}{\Delta P_{T/P_T}} = \text{Sensitivity factor}$$

Once the exit plane thrust coefficient is calculated for the mixer configurations, it is compared to the exit plane thrust coefficient of the free mixer. The free mixer is assumed to have skin friction losses only, therefore, the difference between the two can be attributed to pressure losses above skin friction with forced mixer configuration. The total pressure loss in excess of skin friction is, therefore, defined as:

$$\Delta\left(\frac{\Delta P_T}{P_T}\right)_{\substack{\text{excess of}\\ \text{skin friction}}} = \left[C_{V_{\substack{\text{exit free}\\ \text{mixer}}}} - C_{V_{\substack{\text{forced}\\ \text{mixer}}}}\right] \frac{1}{\frac{\Delta C_V}{\Delta P_{T/P_T}}}$$

where $$\frac{\Delta C_V}{\Delta P_{T/P_T}} = \text{Sensitivity factor}$$

4.3.2.2 Nozzle Exit Plane Traverses

Traverse plots were obtained by surveying the nozzle exit plane of selected configurations in Phase I and all the configurations in Phase II. At a single simulated engine operating point, total pressure and total temperature were measured and non-dimensionalized relative to the corresponding ideal mixed property. A sample of the resultant plots is shown in Figures 37 and 38. The charging station conditions for each stream (fan stream = station 7 and primary stream = station 8) are identified. The absolute level of the fully mixed reference is also identified. A complete presentation of all the traverse plots is made in Appendix B. The location of the primary lobe peaks are indicated by arrows.

4.3.2.3 Flow Visualization Photographs

Flow visualization tests were made for selected configurations in Phase I and for all of the Phase II configurations. These tests were conducted with uniform cold flow at a nozzle pressure ratio of 2.5 to provide a general indication of the flow field through the exhaust system. A sample photograph is presented in Figure 39. The streaks result from placing an array of dots (using a lampblack/glycerine mixture) on the painted surface of the model prior to a test run. A complete set of photographs is presented in Appendix C.

$P_T/P_{T\ MIX}$

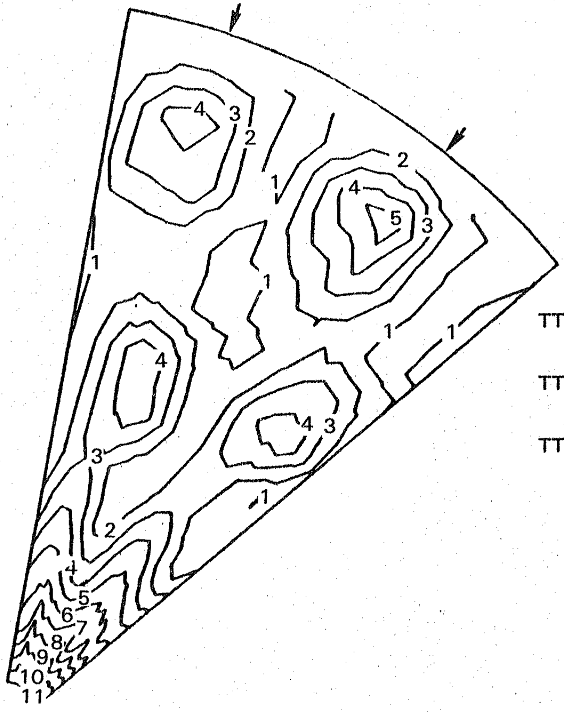
CURVE LABEL	CURVE VALUE
1	0.940000E+00
2	0.950000E+00
3	0.960000E+00
4	0.970000E+00
5	0.980000E+00
6	0.990000E+00
7	0.100000E+01
8	0.101000E+01
9	0.102000E+01
10	0.103000E+01

PT7/PTMIX = 1.0360

PT8/PTMIX = 0.9430

PTMIX = 2.468 X 10^5 N/M^2
(35.790 PSIA)

Figure 37 Resultant Plot Sample



TT/TT_{MIX}

CURVE LABEL	CURVE VALUE
1	0.850000E+00
2	0.950000E+00
3	0.105000E+01
4	0.115000E+01
5	0.125000E+01
6	0.135000E+01
7	0.145000E+01
8	0.155000E+01
9	0.165000E+01
10	0.175000E+01
11	0.184999E+01

TT7/TTMIX=0.8324

TT8/TTMIX = 2.0692

TTMIX = 348.20°K (627.36°R)

Figure 38 Resultant Plot Sample

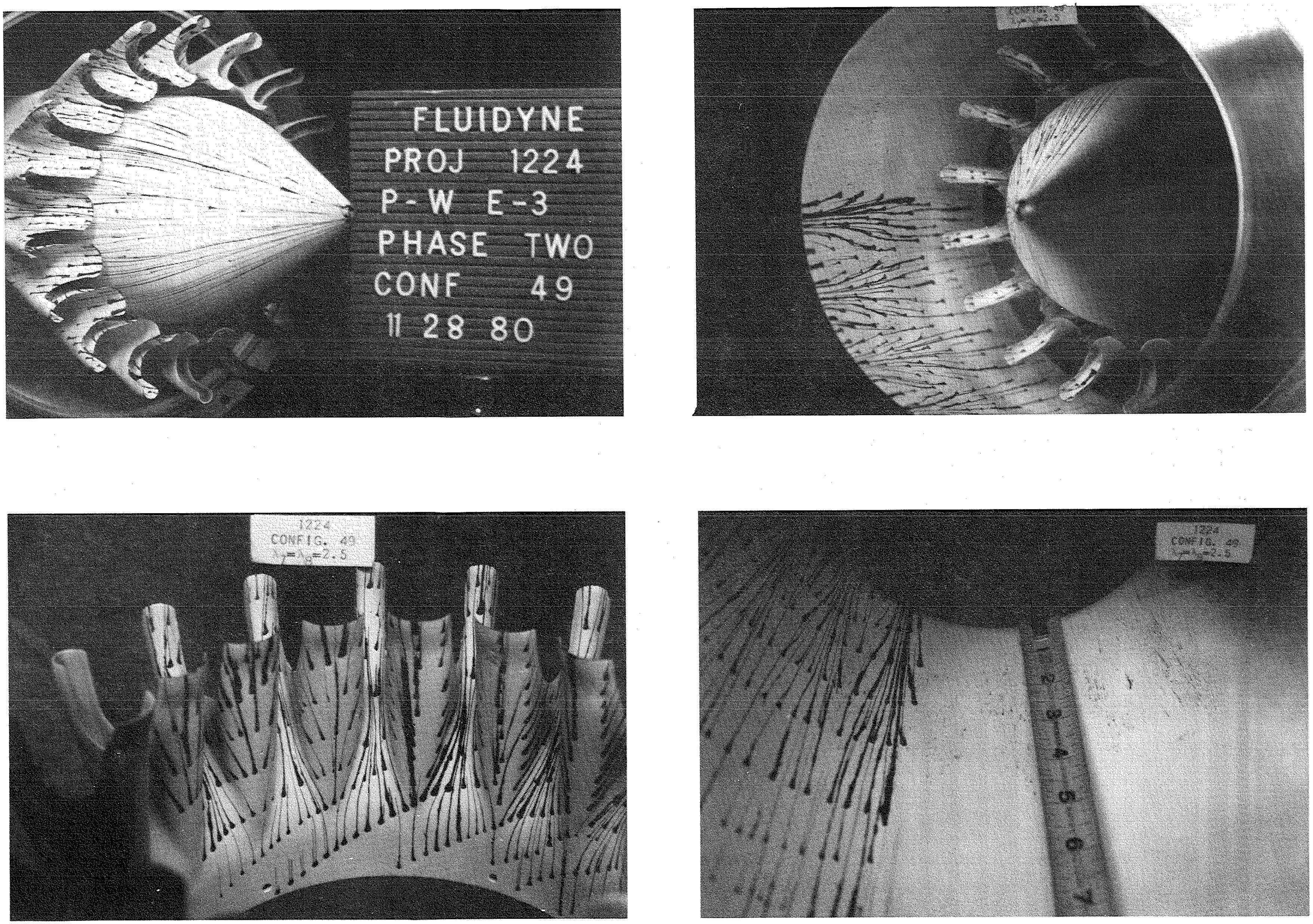


Figure 39 Flow Visualization Photographs, Configuration 49

4.3.3 Data Repeatability

The free mixer configuration was tested at the beginning, several times during, and at the end of Phase I and Phase II test programs to establish data repeatability. The repeatability of the thrust coefficient ($C_{V\ MIX}$) data was analyzed at relatively high nozzle pressure ratio, spanning the key pressure ratio (2.5) used in the parametric evaluations.

The cold data from Phase I, illustrated in Figure 40, had a standard deviation equal to ±0.0004. The Phase I "hot" flow data (Figure 40) are stratified into two groups according to total pressure split. The higher thrust coefficient reflects the desired pressure split schedule and has a standard deviation equal to ±0.0008. The lower "hot" flow line reflects an early set of test points conducted with a total pressure split schedule approximately 2 percent less than desired and has a standard deviation equal to ±0.0005. The difference in thrust coefficient level between these two lines can be traced to the difference in the potential thrust gain available from mixing because of the differences in pressure split. This level shift or stratification tends to collapse, around the higher thrust coefficient level, when the early data are corrected for the pressure split difference.

	COLD DATA				HOT DATA		
SYMBOL	RUN NO.	PTMPA	PRAT	SYMBOL	RUN NO.	PTMPA	PRAT
○	4	2.374	0.994	⬡	10.3	2.370	1.115
○	5	2.481	0.992	⬡	11.3	2.454	1.102
○	6	2.575	0.992	⬡	12.3	2.546	1.093
□	4.1	2.376	0.991	⌂	240	2.366	1.111
□	5.1	2.475	0.991	⌂	241	2.454	1.099
□	6.1	2.574	0.991	⌂	242	2.537	1.089
◇	4.11	2.391	1.005	⌓	10.1	2.343	1.095
◇	5.11	2.486	1.004	⌓	11.1	2.436	1.086
◇	6.11	2.585	1.003	⌓	12.1	2.522	1.078
△	4.4	2.395	1.003	⊿	10	2.346	1.093
△	5.4	2.488	1.002	⊿	11	2.436	1.086
△	6.4	2.584	1.003	⊿	12	2.521	1.078

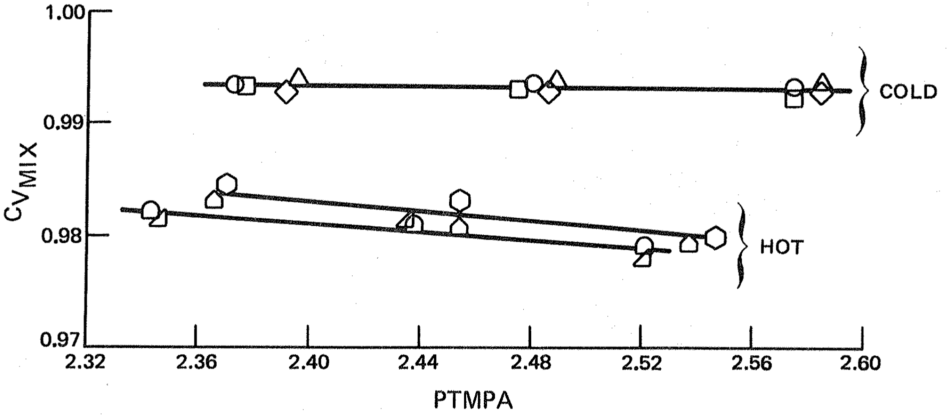


Figure 40 Phase I Free Mixer Data Configuration 1

It should be noted that the stratification of thrust coefficient due to pressure split variations essentially disappears with forced mixer configurations since they have mixing levels several times higher than the free mixer nozzle.

During Phase II, the "cold" flow tests had a standard deviation equal to ±0.0006 as illustrated in Figure 41. The "hot" flow tests had a standard deviation equal to ±0.0004. In general, the repeatability for each phase is somewhat better than that achieved with previous experimental programs in Channel 11 at Fluidyne Engineering Corporation.

Although the amount of available data is relatively small, an indication of the amount of data bias between Phase I and Phase II testing is provided by comparing the mean hot and cold thrust coefficient levels of the free mixer configuration. At a mixed nozzle pressure ratio of 2.5, the cold flow bias shift is 0.0012 and the hot flow bias shift is 0.0010. In general, the trends from each phase of the program were used independently. Therefore, this bias is not particularly troublesome.

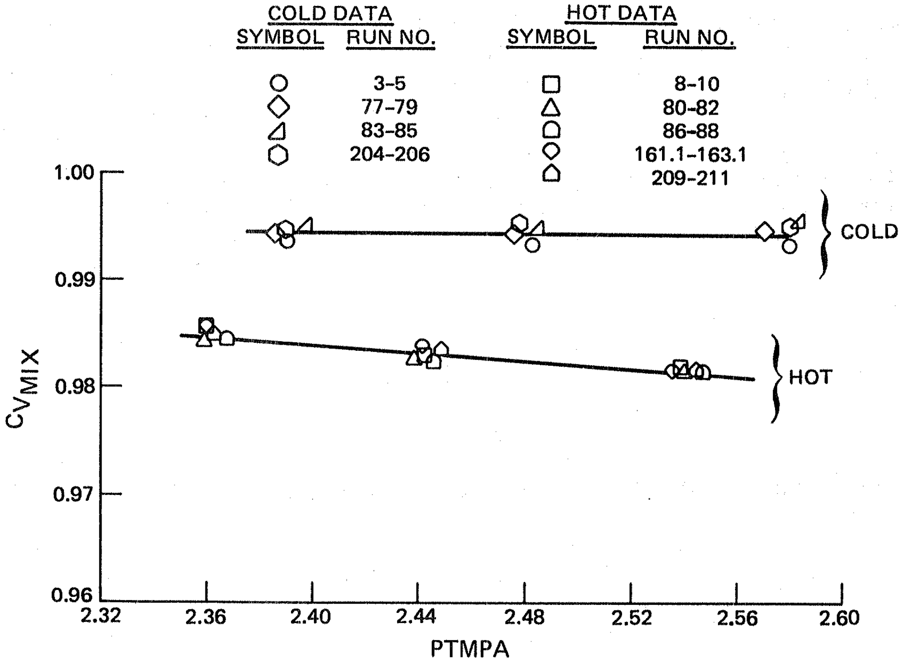


Figure 41 Phase II Free Mixer Data Configuration 1

5.0 TEST RESULTS

5.1 Phase I Results

The data from the Phase I mixer model test program were analyzed and correlated to determine the effects of mixer geometery on performance. The exhaust system variables evaluated were (1) tailpipe length, (2) number of mixer lobes, (3) scalloping, (4) penetration, (5) cutback, (6) turbine swirl, and (7) pylon integration. Each of these variables is discussed in the following paragraphs. The best measure of overall performance is the equivalent change in thrust specific fuel consumption which is a function of the measured nozzle gross thrust coefficient. In addition, the results are presented in terms of "percent mixing" and "excess pressure loss" $\Delta(\Delta P_t/P_t)$ to provide diagnostic insight into mixer performance.

5.1.1 Tailpipe Length

An increase in tailpipe length resulted in a substantial improvement in thrust specific fuel consumption in four basic mixer designs (Figure 42). These performance gains resulted primarily from the improved mixing efficiency caused by the tailpipe lengthening, while the corresponding excess pressure loss was not changed, as shown in Figure 43. (Note: the lines in Figure 42, and subsequent summary curves were established by cross-correlation of the performance trends shown in Figures 42 through 52, which clarify the trends and provide consistency. It should be noted that experimental accuracy (i.e., one standard deviation) would yield a variation of 0.15 percent thrust specific fuel consumption, 7 percent in mixing level, and 0.001 in pressure loss. Additional discussions of data repeatability and accuracy can be found in Section 4.3.3.) The change in mixing, with increased tailpipe length, is further illustrated in Figure 44, which shows the temperature pattern measured at the tailpipe exit. The longer tailpipe exhibited a mixing level nearly twice that of the shorter tailpipe, which is evidenced by the reduced gradients. The shaded areas on the traverses define the region where an essentially mixed temperature exists:

$$\left(1.05 \geq \frac{T_T}{T_{T\ MIX}} \geq 0.95\right)$$

This provides a quick convenient guide to distinguish the primary from the fan stream.

A brief study of the overall propulsion system indicated that the internal performance gains generated by longer tailpipes would be virtually eliminated by the additional external skin friction drag. In addition, the extra weight and potential installation problems of a larger nacelle make the shorter system more desirable.

A design modification of the short tailpipe for the green series, providing increased flow area, was also evaluated in this segment of the program (configuration 6). As indicated in Figure 42, the overall performance was essentially equal to the original design. The corresponding mixing and excess pressure loss is illustrated in Figure 43. The increased mixing level, generally associated with reduced internal Mach number, tends to be offset by a large increase in excess pressure loss. The latter occurrence is currently not understood.

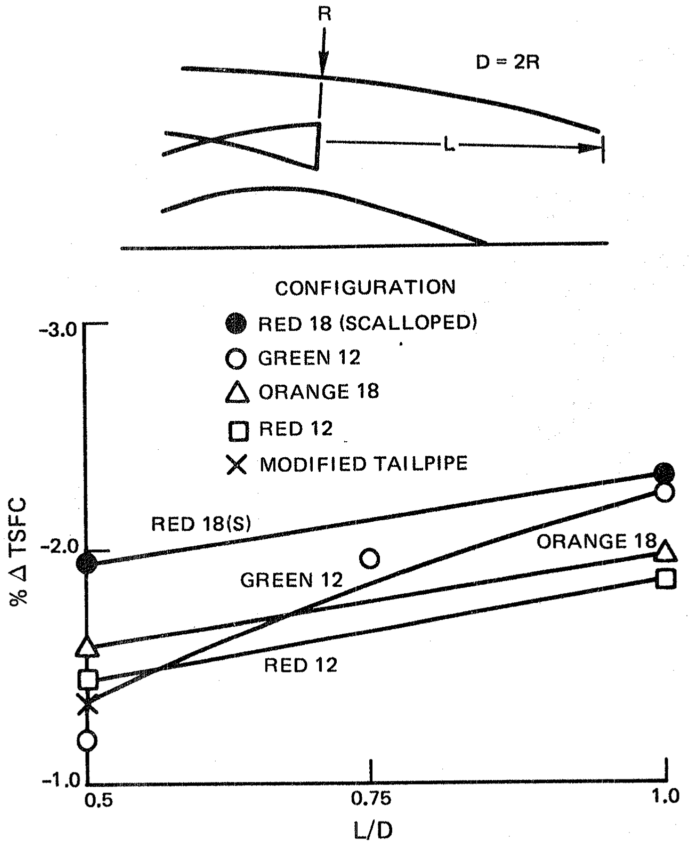


Figure 42 Thrust Specific Fuel Consumption Variation with Tailpipe Length

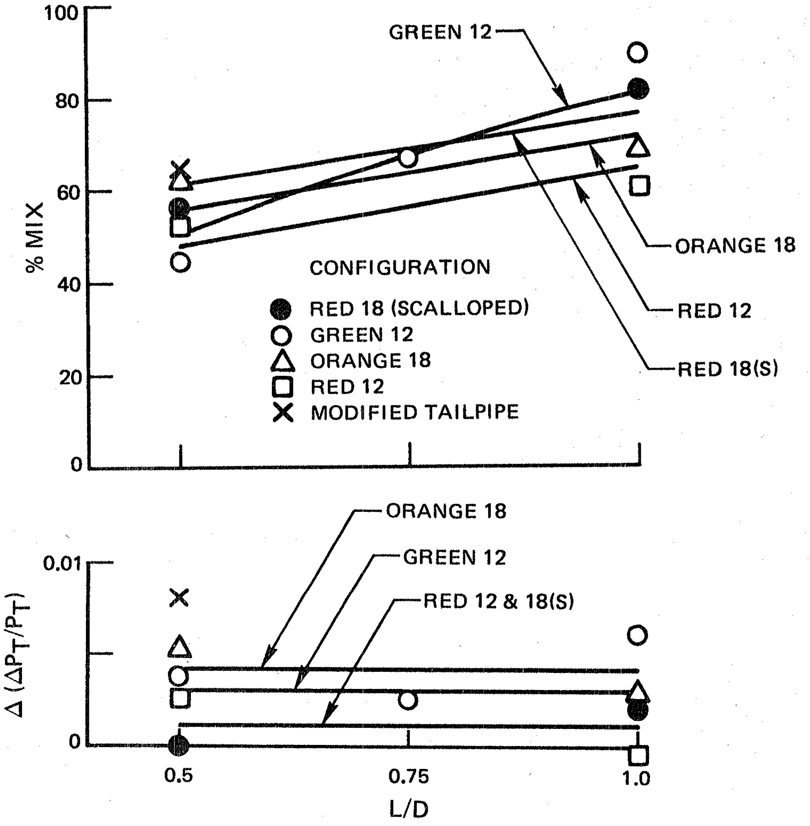
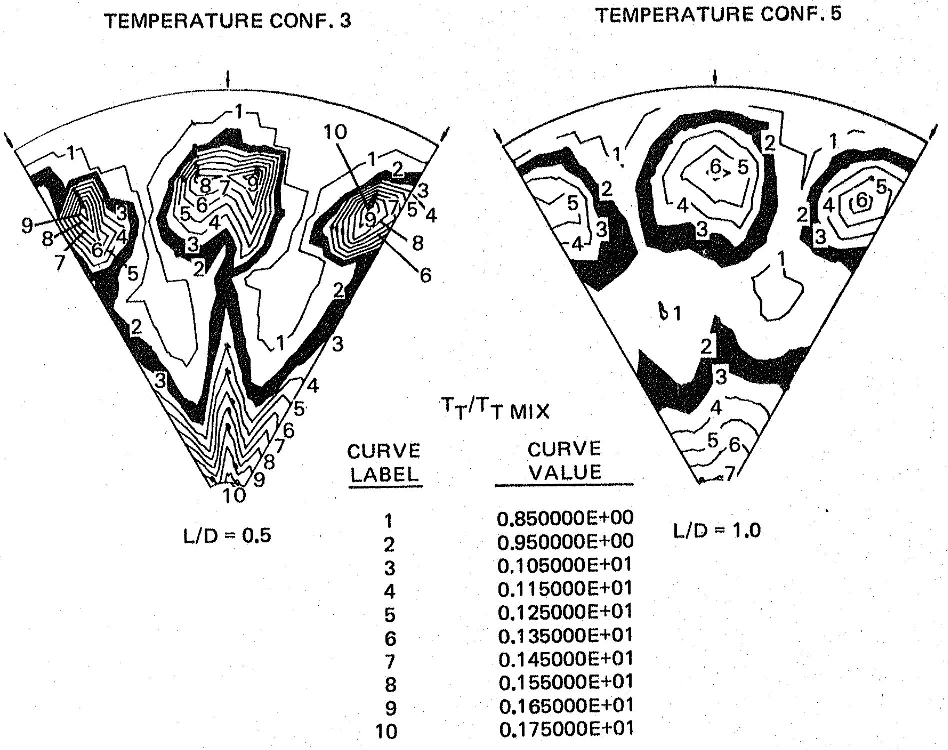


Figure 43 Percent Mixing and Excess Pressure Variation with Tailpipe Length



CURVE LABEL	CURVE VALUE
1	0.850000E+00
2	0.950000E+00
3	0.105000E+01
4	0.115000E+01
5	0.125000E+01
6	0.135000E+01
7	0.145000E+01
8	0.155000E+01
9	0.165000E+01
10	0.175000E+01

Figure 44 Temperature Pattern Measured at Tailpipe Exit

5.1.2 Lobe Variations

The results obtained from testing 12 and 18 lobe versions of two basic configurations indicated that the 18 lobe designs offered increased performance benefits. The influence of lobe number is presented in Figure 45. The overall performance gain is primarily due to an increase in the degree of mixing obtained even though it is partially offset by the increased pressure loss which also accompanies an increase in lobe number (see Figure 46). A comparison of the temperature traverses at the tailpipe exit is presented in Figure 47, showing the increased mixing. In many of the test configurations which were traversed, circulation patterns were noted aft of the primary lobes, inducing fan stream flow into the primary flow region and thus enhancing mixing between the two streams. This circulation, believed to be created by the secondary flow system within the tailpipe, tends to eliminate the initial character of the primary flow, especially behind the lower half of each lobe. This also creates a hoof print pattern.

The collection of primary flow near the centerline is also typical of the mixers tested, being the result of the gap between the mixer and the centerbody. This allows a portion of the primary flow to avoid the mixing process.

Most of the mixers were designed with lobes that were slightly converging in the axial direction, when viewed from the top (i.e., variable α / θ). This was done to provide additional control of the flow area distribution through the mixer. One mixer was designed with simplified constant width lobes (configuration 7). This modified green mixer configuration provided an improvement of approximately 0.4 percent thrust specific fuel consumption (as shown in

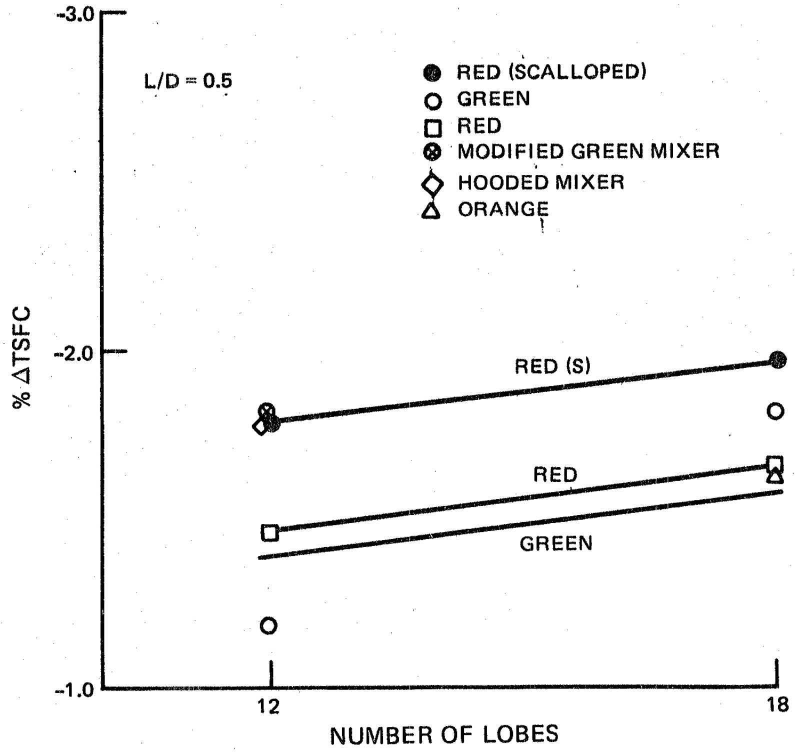


Figure 45 Thrust Specific Fuel Consumption Variation with Number of Lobes

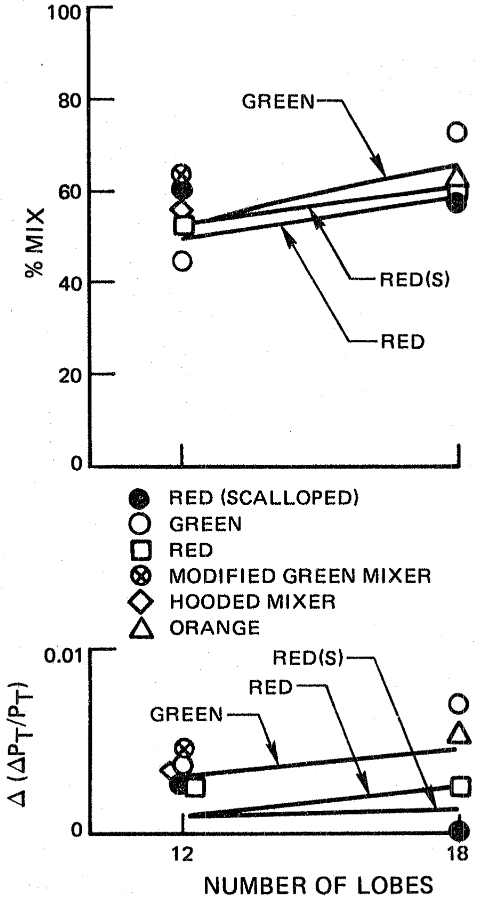
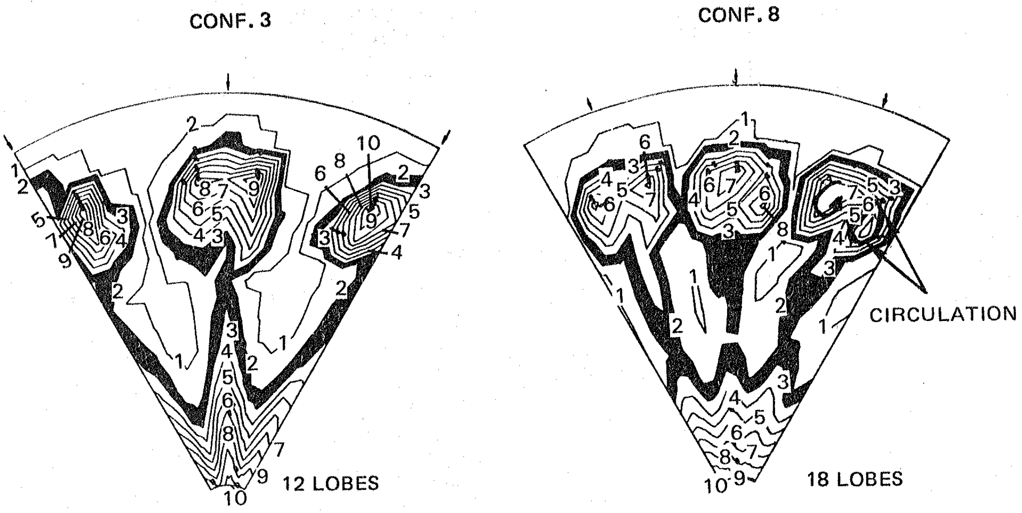


Figure 46 Percent Mixing and Excess Pressure Variation with Number of Lobes



TT/TT MIX

CURVE LABEL	CURVE VALUE
1	0.850000E+00
2	0.950000E+00
3	0.105000E+01
4	0.115000E+01
5	0.125000E+01
6	0.135000E+01
7	0.145000E+01
8	0.155000E+01
9	0.165000E+01
10	0.175000E+01

Figure 47 Comparison of Temperature Traverses at the Tailpipe Exit

Figure 45). The performance improvement was due to a substantial increase in the level of mixing as illustrated in Figure 46. A set of hoods or fairings was then added to this mixer to form configuration 27. The measured overall performance (shown in Figure 45) was essentially the same as the basic configuration. This may be somewhat pessimistic, since the cold flow test indicated the excess pressure loss was reduced. The flow visualization photographs also indicated the flow quality was improved.

In addition to the mixer lobe details described above, the importance of mixing plane area was also evaluated. The red and green series were designed with the same critical areas throughout the mixer. The orange series was designed with an increased mixing plane area (+19 percent A_{MIX}). The overall performance for the orange design, as illustrated in Figure 45, was essentially the same (within experimental accuracy) as the red and green series. It should be noted the orange series had a penetration of 0.49 while the red and green had 0.57 and 0.65 respectively. The penetration trends (in Section 5.1.3) suggest the orange series performance should have been significantly worse than the red and green but this effect was probably offset by the larger A_{MIX} (lower Mach number) and therefore the overall performance was essentially the same.

Scalloping the mixer produces a substantial performance improvement for both 12 and 18 lobe designs, as illustrated in Figure 45. This is a result of a combination of an increase in mixing and a decrease in excess pressure loss as illustrated in Figure 46.

5.1.3 Mixer Penetration

A correlation of the Phase I data indicated that increased mixer penetration could improve overall performance as shown in Figure 48. Increasing the penetration moves the primary stream radially outward and enhances the contact between the two streams. The mixing and pressure loss characteristics associated with increased penetration are illustrated in Figure 49. The data scatter about the performance curves is believed to be due to geometrical differences between the configurations such as mixer length and local angles. For example, configuration 19 had a short mixer with a high degree of primary flow turning. It showed signs of flow instability in the primary flow stream (as observed from the flow visualization photos) which could account for the high pressure loss seen in Figure 49.

The impact of increased mixer penetration on the temperature traverse pattern at the tailpipe exit is shown in Figure 50. In addition to the residual primary hot spot moving radially outward, the intensity of the primary flow region is diminished, reflecting the increased mixing.

Higher penetration mixer designs were subsequently evaluated in Phase II of the mixer technology program and are discussed in Section 5.2.

5.1.4 Cutback

The impact of mixer exit plane orientation (i.e., cutback) is shown in Figure 51. This illustrates the performance change for one excursion in exit plane geometry. It suggests that there may be an optimum exit plane orientation for a basic mixer design. The corresponding mixing and pressure loss characteristics are presented in Figure 52. Both diagnostic terms increase considerably with cutback.

5.1.5 Turbine Swirl

Simulated turbine discharge swirl was introduced into the mixer in order to support the study of simplified turbine system designs, offering improved turbine performance. The goal was to have no additional loss in the mixer. The importance of turbine discharge swirl on nozzle performance was established for the free mixer configurations (i.e., one having a simple splitter between the primary and fan streams) and a forced mixer configuration, as illustrated in Figure 53. As expected, the free mixer experienced severe performance losses as swirl angle increased. The forced mixer greatly reduces the performance losses associated with swirl, but still exhibits significant losses. The flow patterns developed on both configurations, for 36 degrees of swirls are shown in Figure 54. As illustrated, the mixer has a considerable amount of swirling flow remaining along the centerbody. Since turbine swirl produced a performance loss in the mixer which was much larger than the anticipated gains associated with a simplified turbine, it was decided to proceed by eliminating swirl exiting the turbine.

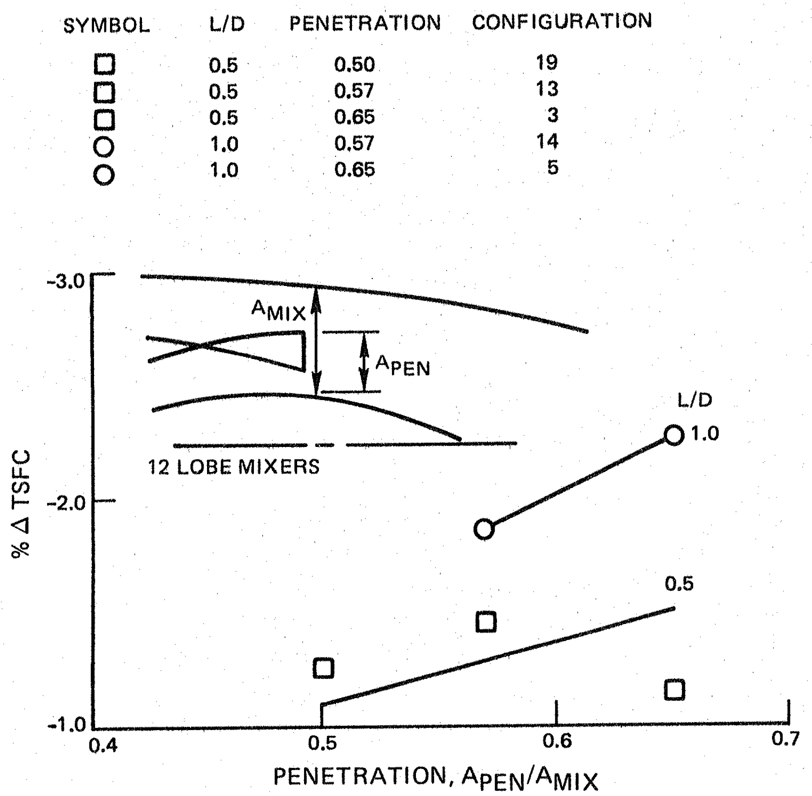


Figure 48 Thrust Specific Fuel Consumption Variation with Penetration

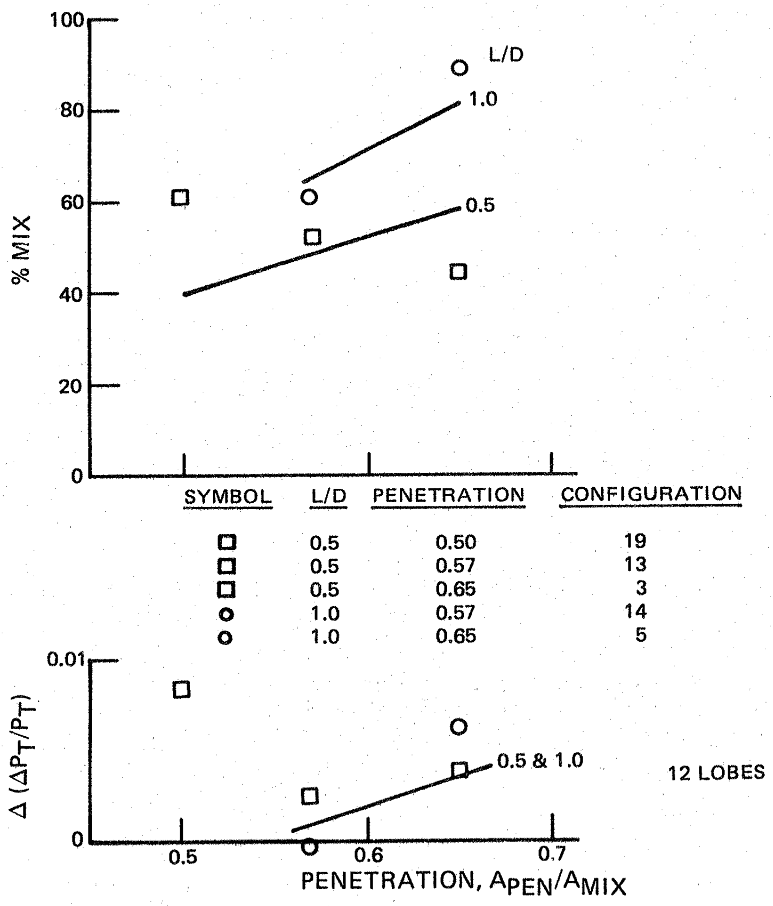
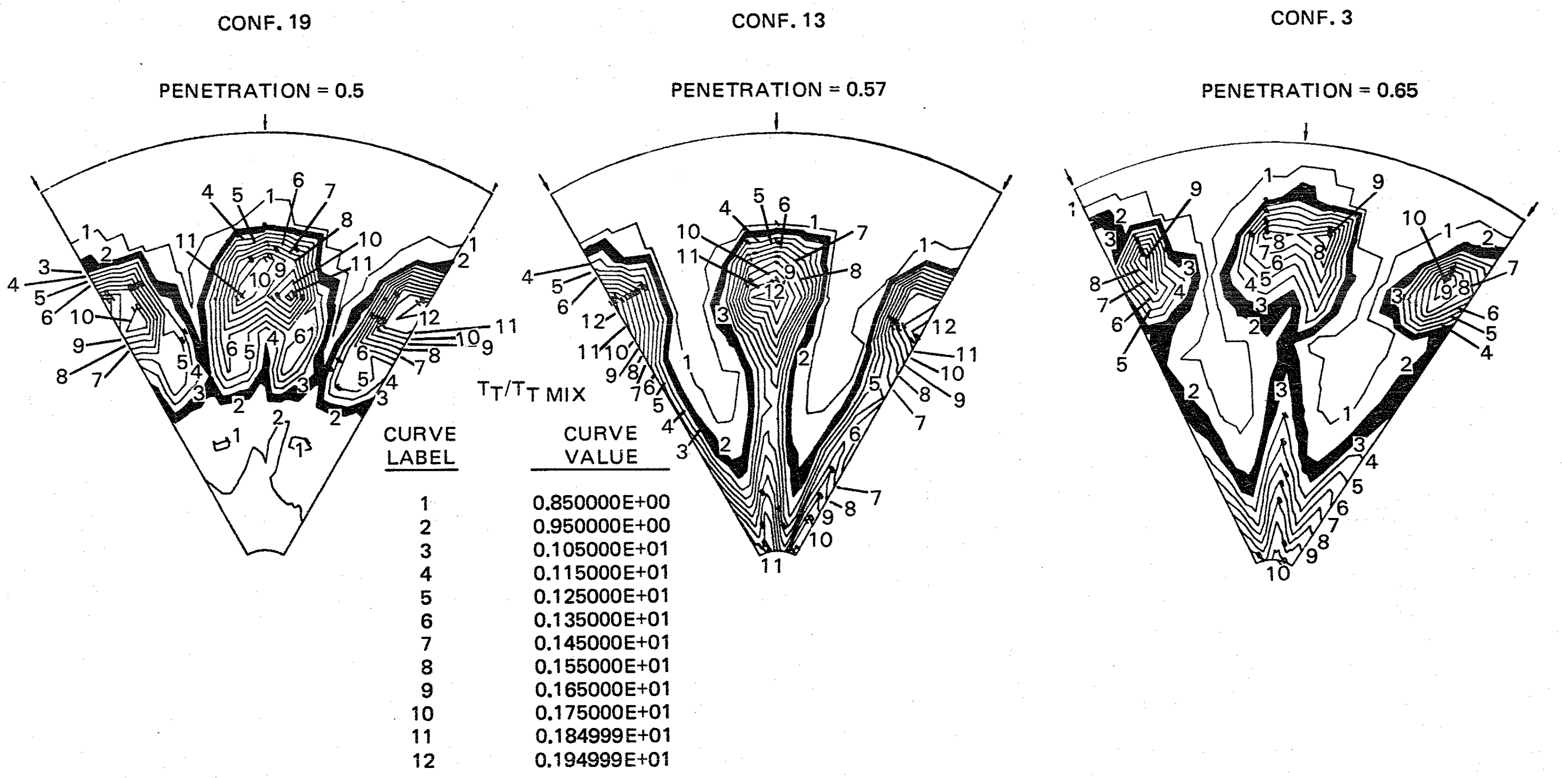


Figure 49 Percent Mixing and Excess Pressure Loss Variation with Penetration



CURVE LABEL	CURVE VALUE
1	0.850000E+00
2	0.950000E+00
3	0.105000E+01
4	0.115000E+01
5	0.125000E+01
6	0.135000E+01
7	0.145000E+01
8	0.155000E+01
9	0.165000E+01
10	0.175000E+01
11	0.184999E+01
12	0.194999E+01

Figure 50 Impact of Increased Mixer Penetration on the Temperature Traverse Pattern at the Tailpipe Exit

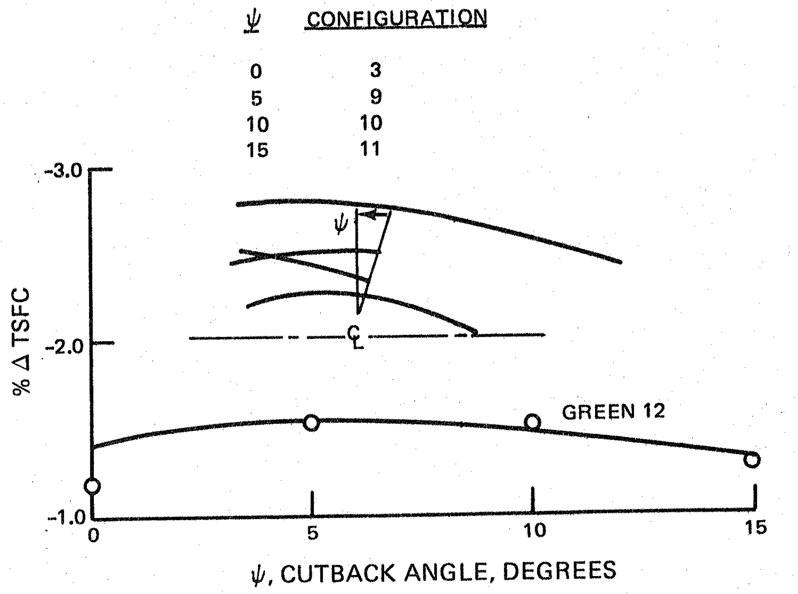


Figure 51 Thrust Specific Fuel Consumption Variation with Cutback Angle

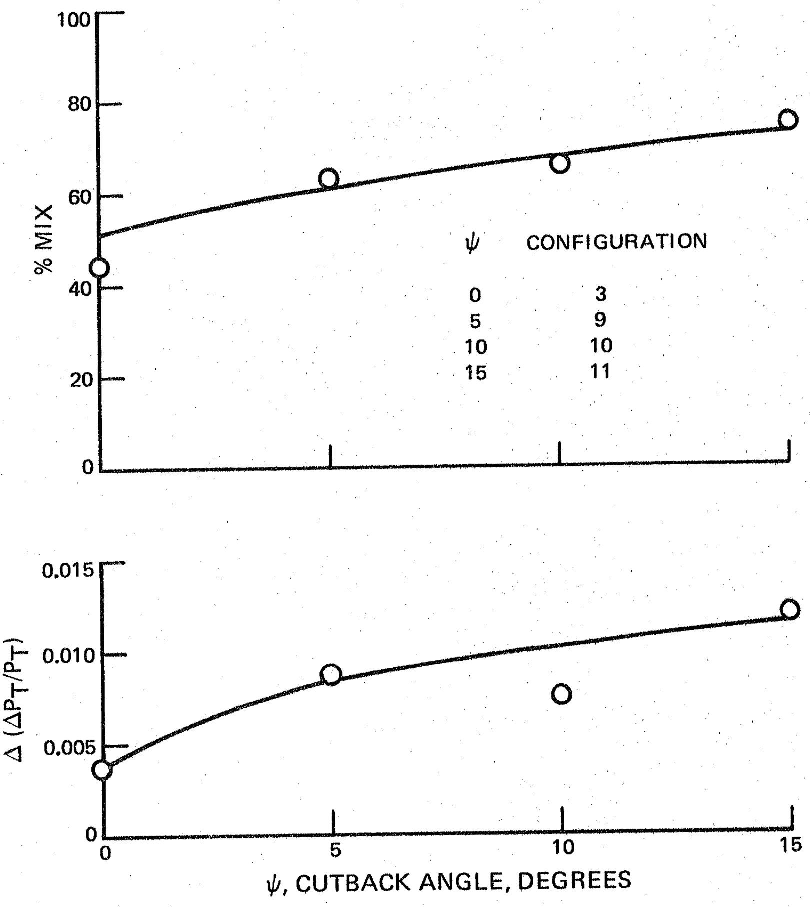


Figure 52 Energy Efficient Engine Phase I Mixer Performance Diagnostic Information

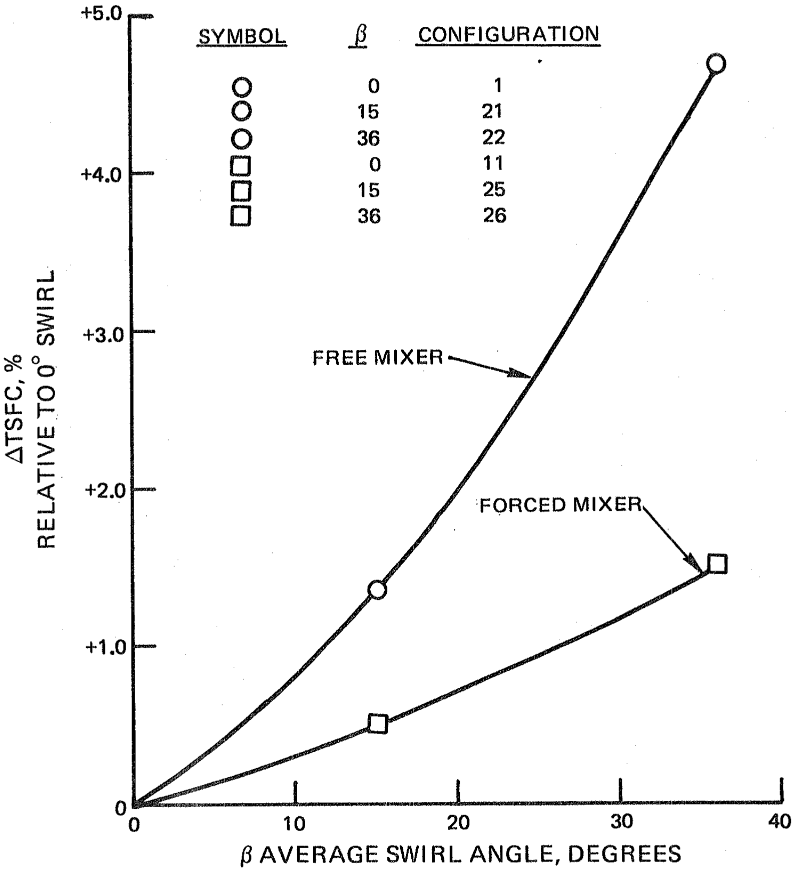
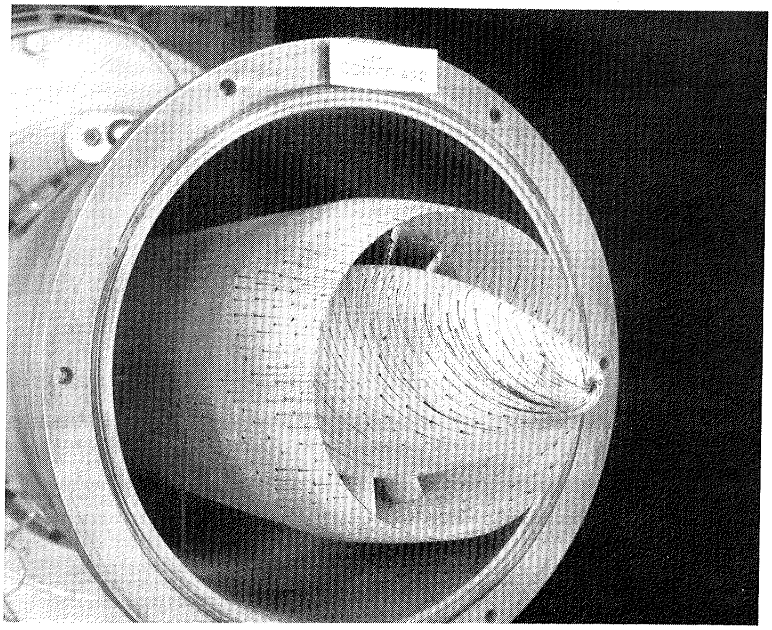


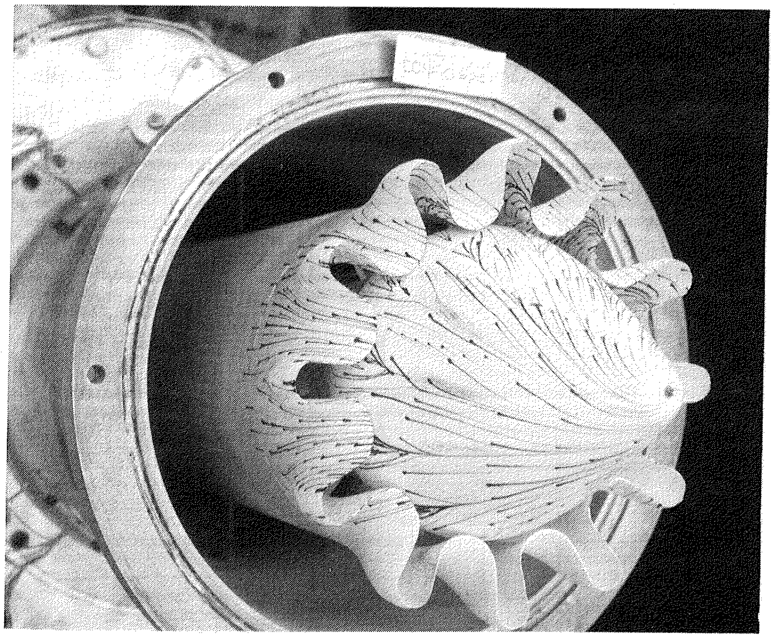
Figure 53 Impact of Turbine Discharge Swirl on Nozzle Performance

5.1.6 Pylon Integration

Integration of one of the mixers with two potential pylon fairings was also evaluated in the test matrix. A short pylon, ending at the mixer exit, was tested along with a longer design which extended over the mixer and ended well down the tailpipe. The flow visualization pictures obtained on both configurations are shown in Figure 55. The longer pylon appears to provide an improved flow field, relative to short design in the region where the pylon integrates into the lobe. However, the thrust measurements indicated both designs were essentially equal with the mixing efficiency and pressure loss being the same. A small loss in performance (a thrust specific fuel consumption change of approximately 0.1 percent) was noted for both, relative to the mixer configuration without a pylon simulation. This was a result of the mixing efficiency and pressure loss increasing by approximately 4 percent and 0.002, respectively, relative to the no pylon configuration.

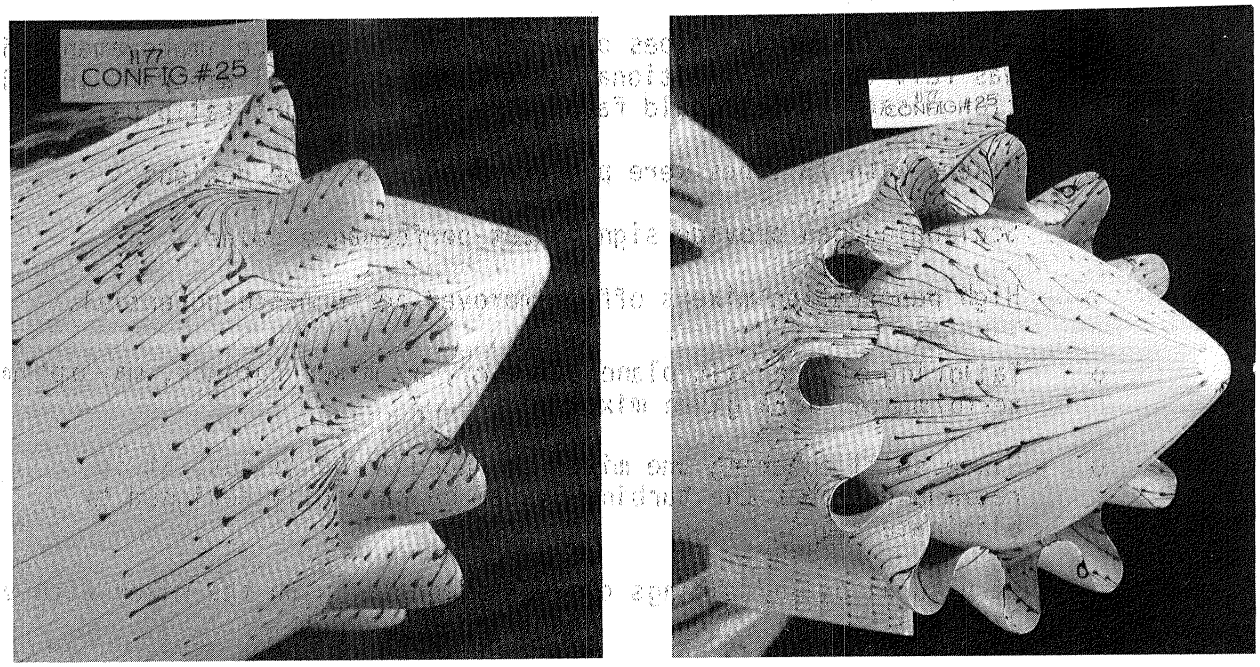


A) FREE MIXER

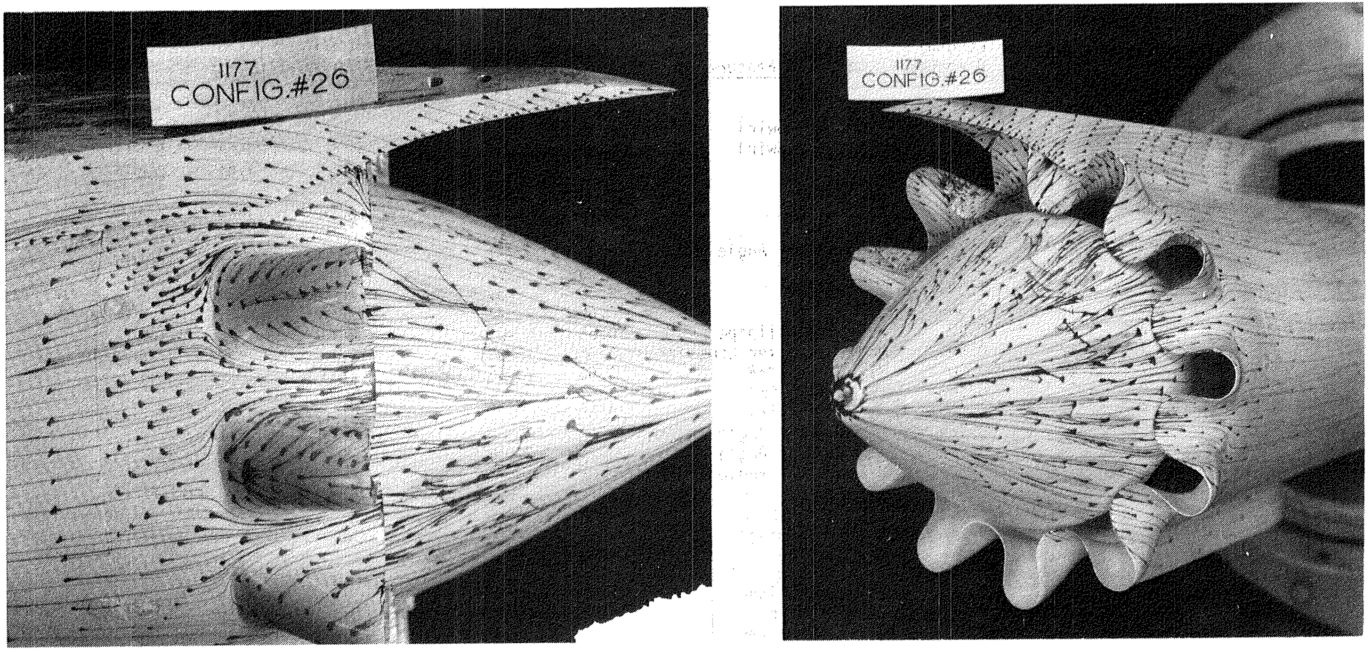


B) FORCED MIXER

Figure 54 Flow Patterns Developed on Free and Forced Mixers for 36 Degrees of Swirl



A) SHORT PYLON



B) LONG PYLON

Figure 55 Flow Visualization Pictures Obtained on Short and Long Pylon Configurations

5.1.7 Phase I Test Summary

A complete summary of the performance characteristics of the configurations tested in Phase I is presented in Table VI. The major conclusions drawn from Phase I were:

- Although longer tailpipes offered some performance improvement, it was felt that the additional weight and potential aircraft installation disadvantages would favor a relatively short tailpipe.
- Mixers with 18 lobes were preferred over 12 lobe designs.
- Scalloping can provide significant performance gains.
- High penetration mixers offer improved performance potential.
- Tailoring of the exit plane geometry, by mixer cutback, may optimize performance for a given mixer.
- Since swirl entering the mixer produced large losses, it is recommended that the turbine system be carefully designed to eliminate swirl.
- Structural pylon/fairings can be integrated with the mixer with very little loss.

TABLE VI

PHASE I TEST SUMMARY

Configuration Type/No.		Lobe No.	Tailpipe Length/ Diameter	Special Features	Penetration	% Mixing	Δ(ΔPT/PT)*	CV'	Thrust Specific Fuel Consump.** percent
Free Mixer	1	--	0.50		--	19.5	0.0001	0.9795	-0.55
	21	--	0.50	15° Swirl	--	--	---	0.9739	+0.81
	22	--	0.50	36° Swirl	--	--	---	0.9602	+4.13
	2	--	1.00		--	23.5	-.0002	0.9791	-0.45
Blue	19	12	0.50		0.5	61.5	0.0084	0.9825	-1.27
Green	3	12	0.50	Mixer Scarf Angle-0°	0.65	44.7	0.0038	0.9821	-1.18
	4	12	0.75		0.65	67.8	0.0026	0.9854	-1.98
	5	12	1.00		0.65	89.4	0.0062	0.9866	-2.27
	8	18	0.50		0.65	73	0.0070	0.9848	-1.82
	6	12	0.50	Modified Tailpipe	0.65	63.1	0.0081	0.9831	-1.42
	7	12	0.50	Modified Mixer Lobes***	0.65	63	0.0045	0.9848	-1.82
	27	12	0.50	Mixer Hoods***	0.65	55.4	0.0034	0.9846	-1.78
	23	12	0.50	15°Swirl	0.65	--	---	0.9826	-1.29
	24	12	0.50	36°Swirl	0.65	--	---	0.9784	-0.28
	9	12	0.50	Mixer Scarf Angle - 5°	0.63	64	0.0088	0.9836	-1.53
	10	12	0.50	Mixer Scarf Angle -10°	0.61	66.3	0.0076	0.9835	-1.51
	11	12	0.50	Mixer Scarf Angle -15°	0.58	74.7	0.0118	0.9826	-1.28
Red	13	12	0.50		0.57	52.6	0.0025	0.9833	-1.47
	30	12	0.50	Scalloped Mixer	0.57	60.5	0.0025	0.9847	-1.80
	14	12	1.00		0.57	60.7	-0.0003	0.9850	-1.88
	15	18	0.50		0.57	58.8	0.0025	0.9841	-1.67
	16	18	0.50	Scalloped Mixer	0.57	57.5	0	0.9854	-1.98
	29	18	0.61	Cutback Mixer	0.51	58.5	-0.0007	0.9859[1]	-2.11
	28	18	1.00	Scalloped Mixer	0.57	80.7	0.0024	0.9868	-2.32
Orange	17	18	0.50		0.49	61.6	0.0054	0.9839	-1.62
	18	18	1.00		0.49	68.4	0.0030	0.9854	-1.98
Green	25	12	0.50	Short Pylon	0.58	78.1	0.0139	0.9821	-1.18
Green	26	12	0.50	Long Pylon	0.58	78.4	0.0136	0.9822	-1.20

* In excess of skin friction losses.

** Relative to optimized separate flow exhaust system.

*** Constant lobe width.

[1] Avg. of Phase I and II

5.2 Phase II Results

Phase II testing was based on applying the significant Phase I performance trends to the best model in Phase I which was Configuration 29. It consisted of 18 lobes and a tailpipe length to diameter ratio of 0.6. These parameters were held constant for Phase II. It was decided to expand the Phase I trends and evaluate high penetration mixer designs; therefore, 0.75 penetration was selected and held constant. The Phase II portion of the program was developed with four basic mixer designs as shown in Figure 56. In addition to the basic matrix, variations of the promising configurations were tested to establish the impact of mixer/plug gap, scalloping, cut back, mixer hoods, and plug angles. The variations tested with each of the basic mixers are described separately below.

5.2.1 Mixer Length and Diameter Variations

The results of testing the four basic mixers are summarized in Figure 57. The longer mixer configurations (configurations 35 and 36) have considerably higher overall performance than the shorter pair of mixers (configurations 33 and 34). Although the latter pair exhibit more mixing, they also have higher pressure losses. The changes in mixing are believed due to slight differences in mixer exit plane geometry. The shorter configurations discharge the primary flow nearly horizontally, while the longer mixers are canted slightly toward the model centerline tending to reduce the amount of mixing achieved. The temperature traverses measured for the four basic mixers, shown in Figure 58, indicate a small reduction in penetration with configurations 35 and 36. The excess pressure loss appears to be a function of both mixer length and the degree of turning within the mixer. The two longer configurations (i.e., 35 and 36) have lower losses than the two shorter configurations (i.e., 33 and 34). In addition the configurations with more turning in a given length have higher losses then the configurations with relatively less turning (i.e., 33 versus 34 and 36 versus 35). This indicates that these two aspects of mixer geometry must be balanced to arrive at an optimum configuration.

5.2.2 Mixer/Plug Gap

The importance of mixer/plug gap was established using the configuration 36 mixer in combination with two additional plugs. This resulted in gaps ranging from 12 percent of primary flow area to 32 percent. As the gap is increased, so did the primary area and as a result the mixing plane Mach number decreases, however, these incremental changes were not enough to significantly change the mixing potential for the configurations being evaluated. A slight performance advantage appears to exist with a 22 percent gap, as shown in Figure 59. In general, as the gap is increased the amount of mixing which is achieved decreases, along with the excess pressure loss. The loss in mixing is evidenced in the tailpipe exit surveys (Figure 60) which show the growth in the unmixed flow surrounding the model centerline as the gap is increased. The pressure loss reduction is associated with reduced flow disturbance and Mach number on the plug near the mixer, as illustrated in Figure 61.

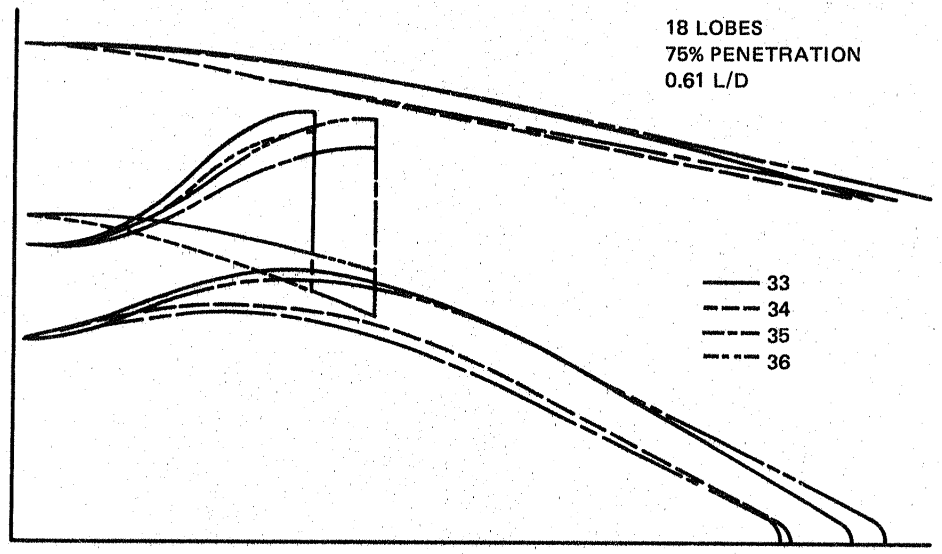


Figure 56 Four Basic Forced Mixer Designs

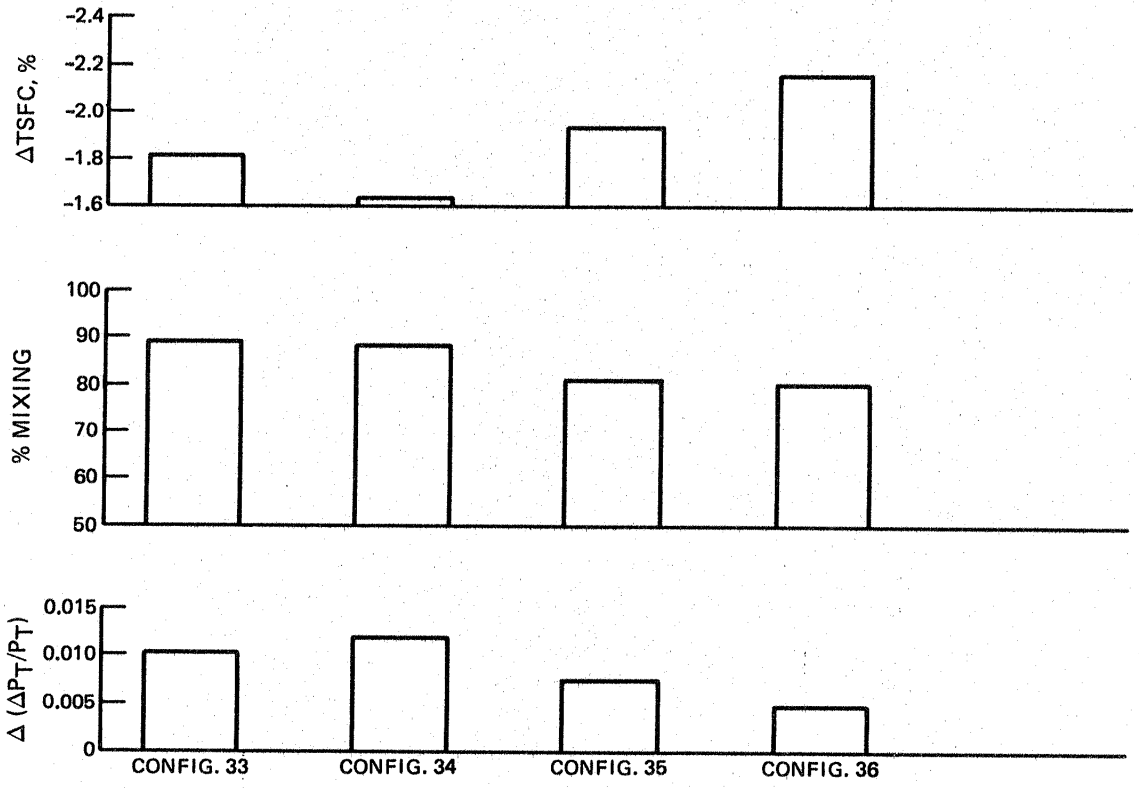
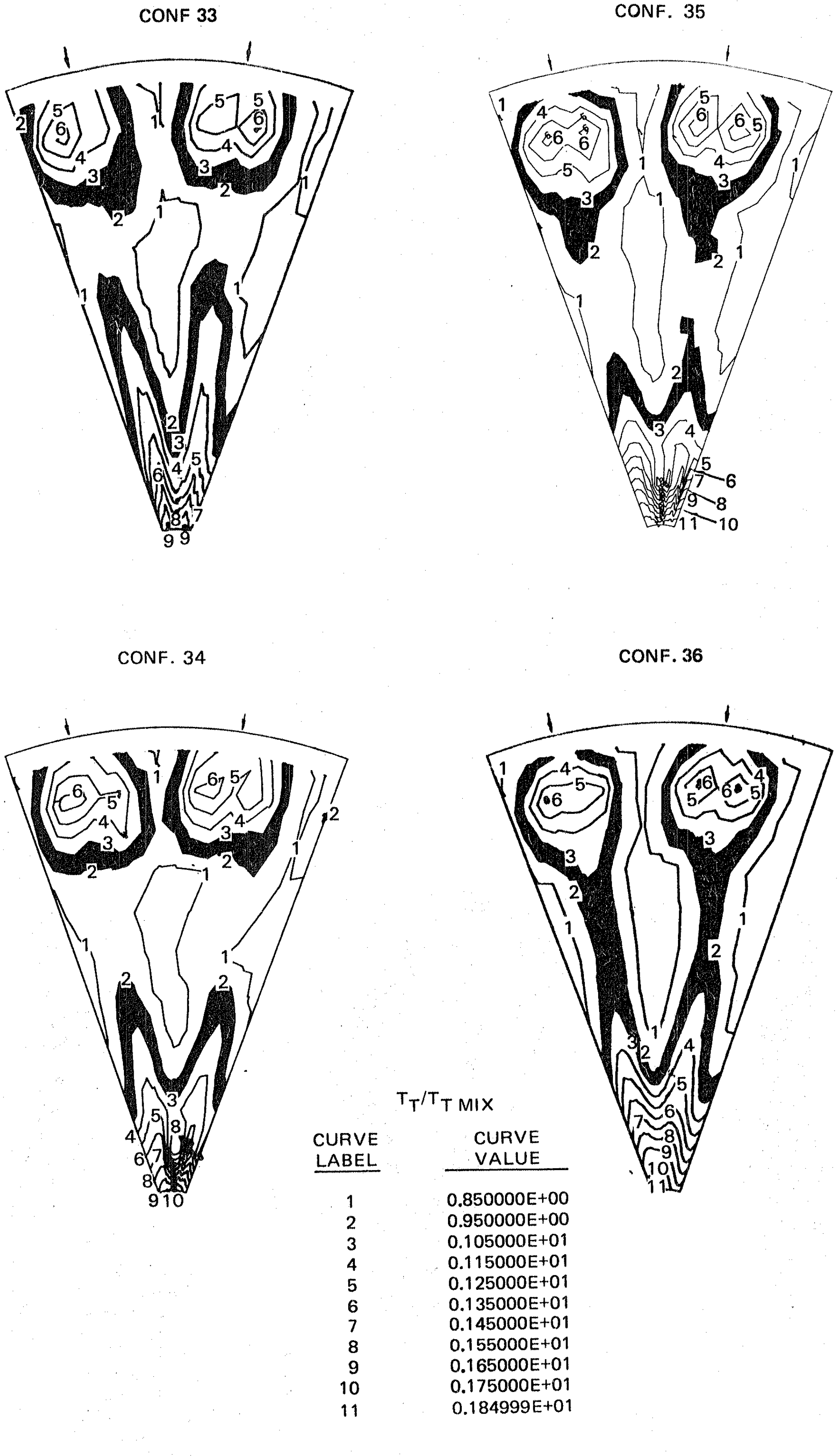


Figure 57 Results of Testing the Four Basic Mixers -- Mixer Size



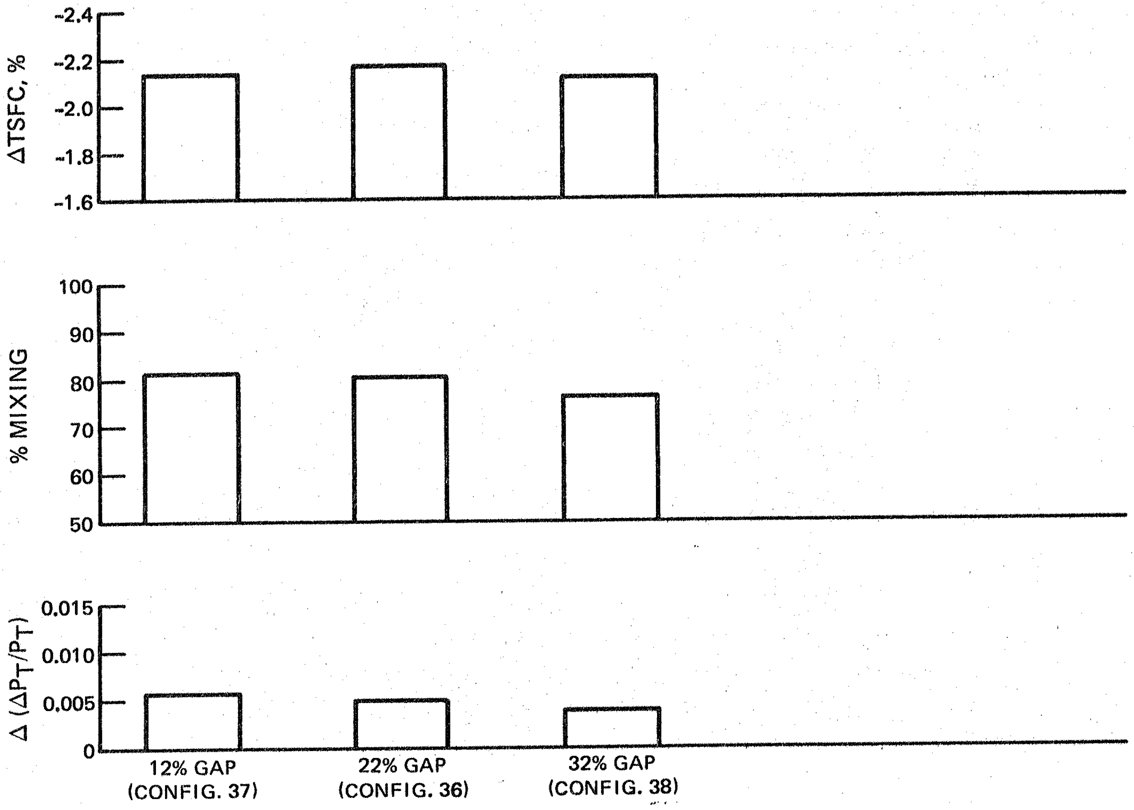
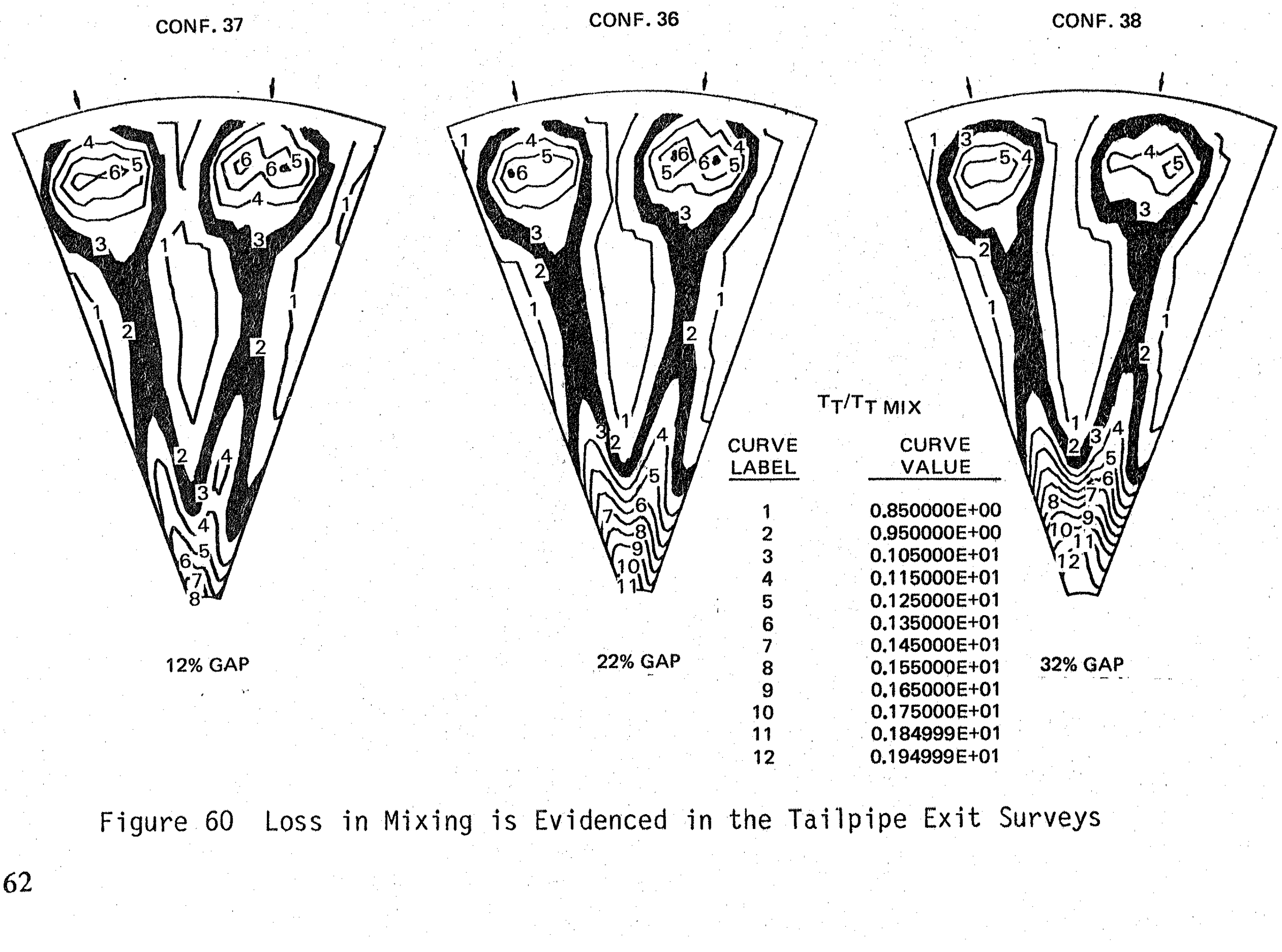
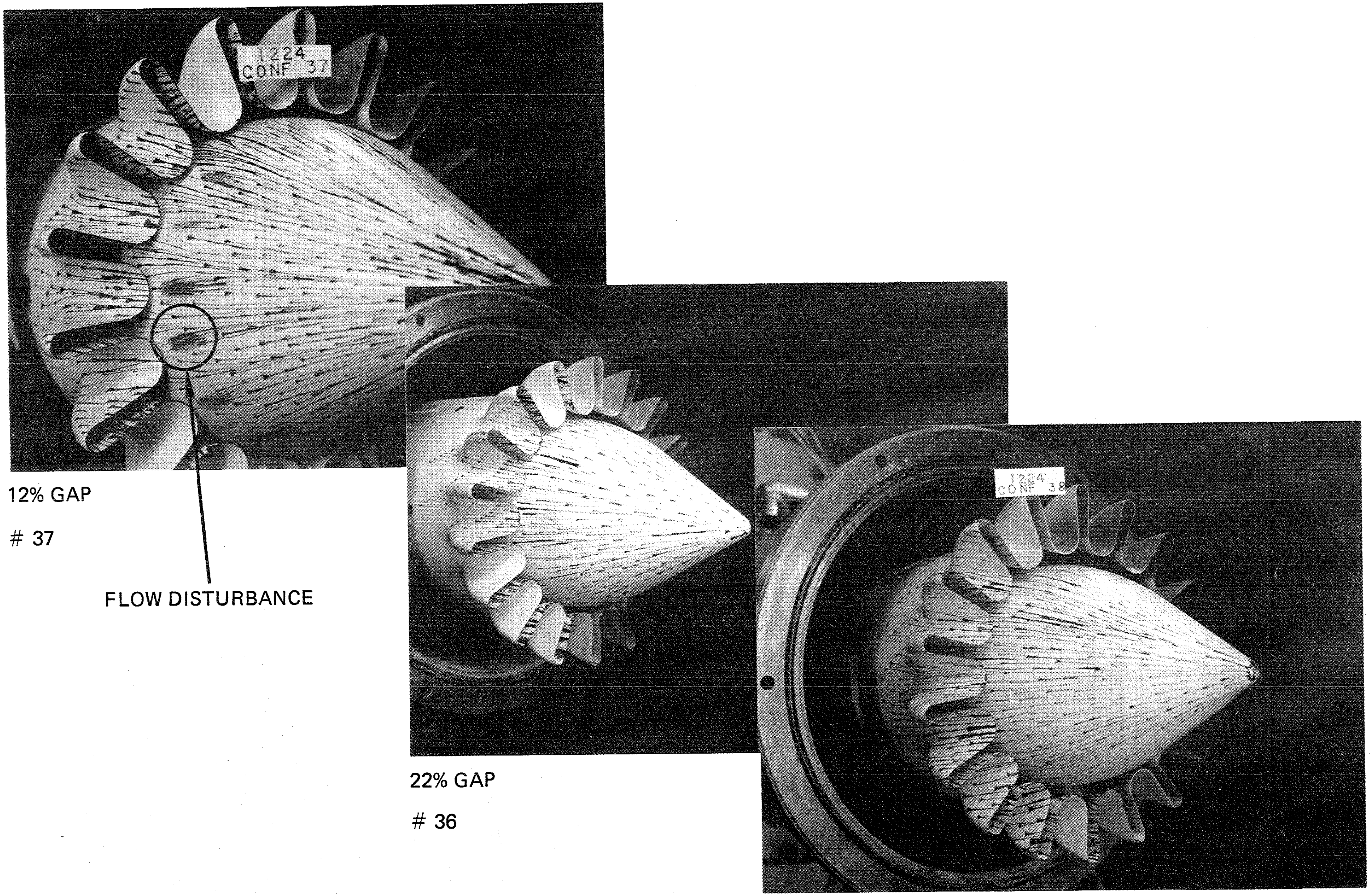


Figure 59 Results of Testing the Four Basic Mixers -- Mixer/Plug Gap



CURVE LABEL	CURVE VALUE
1	0.850000E+00
2	0.950000E+00
3	0.105000E+01
4	0.115000E+01
5	0.125000E+01
6	0.135000E+01
7	0.145000E+01
8	0.155000E+01
9	0.165000E+01
10	0.175000E+01
11	0.184999E+01
12	0.194999E+01

Figure 60 Loss in Mixing is Evidenced in the Tailpipe Exit Surveys



12% GAP

37

FLOW DISTURBANCE

22% GAP

36

32% GAP
38

Figure 61 Pressure Loss Reduction is Associated with Reduced Flow Disturbance on the Plug Near the Mixer

5.2.3 Exhaust System Modifications

5.2.3.1 Series 33

Several modifications were made sequentially to configuration 33. The mixer was first scalloped, producing a large performance improvement (0.39 percent in thrust specific fuel consumption) as illustrated in Figure 62. The performance improvement is a combination of more mixing and less pressure loss. Since scalloping the mixer produced an increase of approximately 6 percent in the bypass ratio of the exhaust system, an insert was added to the tailpipe (configuration 42) to reduce the bypass ratio back to its original level. The insert produced this desired effect, but also reduced overall performance because of a change in the amount of mixing obtained. An analysis of this configuration indicated the tailpipe insert changed the local flow field and reduced the local Mach number near the outer portion of the mixer, increasing the local static pressure which essentially suppressed the mixer. It should be noted that this shift in bypass ratio with scalloping in not necessarily a general case. If a scalloped configuration is selected as a baseline, the areas in each stream can be designed to achieve the required bypass ratio (without inserts, etc.).

The next configuration (i.e., 45) consisted of cutting back the inner portion of mixer used in configuration 41 in order to increase the mixed/plug gap (to 35 percent) and thereby reduce total pressure loss. As indicated in Figure 62, the pressure loss was reduced, but the amount of mixing also decreased such that the overall performance did not change. The increments in both the pressure loss and mixing levels are consistent with the mixer/plug gap performance trends discussed earlier.

The temperature patterns measured at the tailpipe exit for this series of tests are presented in Figure 63. A dramatic change in the pattern is created by introducing scallops (configuration 33 versus configuration 41). This is believed due to increased circulation created in the tailpipe. The impact of cutback is also illustrated, by comparing configuration 45 to 41, where the increase in unmixed primary flow is evident.

5.2.3.2 Series 36

Modifications were also made sequentially to configuration 36. These included hoods, scallops and plug changes which constituted configurations 39, 43, 48, and 49.

The first modification consisted of adding hoods or fairings to both the primary and fan side of the mixer (configuration 39) in order to reduce the excess pressure loss. Unfortunately in the brazing process the mixer lobes shrunk inward reducing the penetration from 0.75 to 0.72. This necessitated an adjustment to the subsequent test data. An increment of 5 percent (taken from Phase I trends) was added to the measured mixing level to reflect the original design. No adjustment was made to pressure loss because the shrinkage was near the end of the mixer and it was felt that it would not change the basic pressure loss characteristic. The final overall level of performance for the hooded configurations was 0.14 percent thrust specific fuel consumption better than the baseline design as shown in Figure 64. The tailpipe traverses, presented in Figure 65 confirm the loss in penetration. The general improvement in the flow field around the mixer is shown in Figure 66.

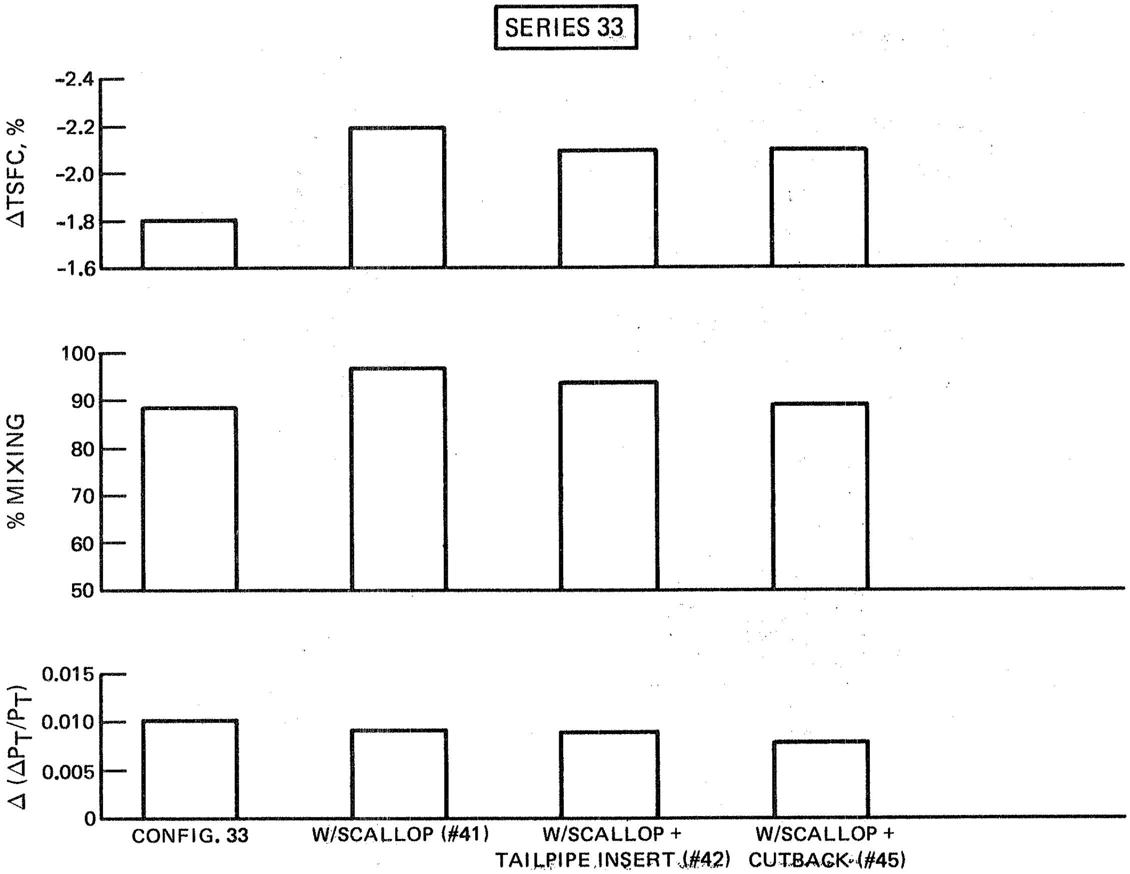
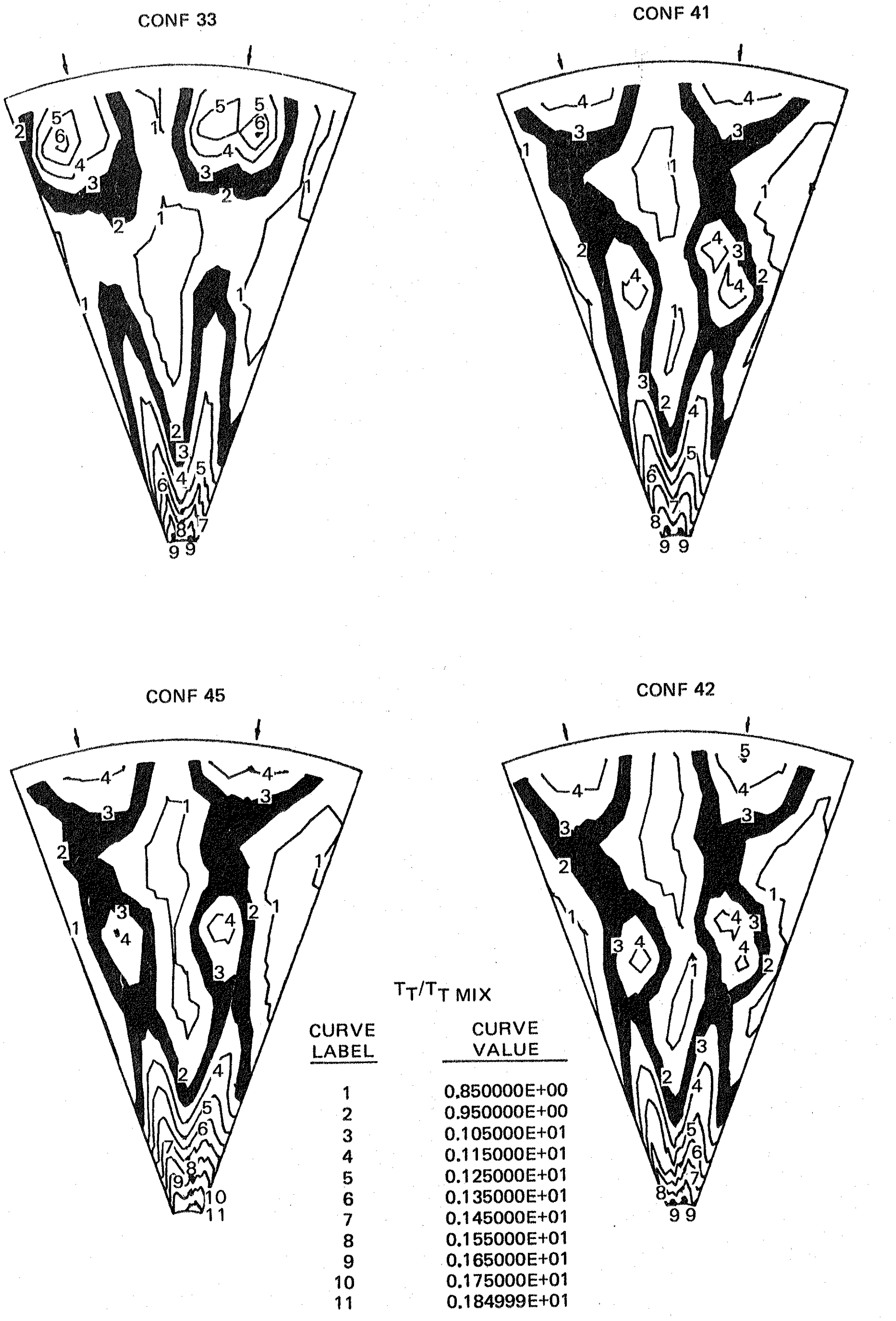


Figure 62 Scalloped Mixer Produces a Large Performance Improvement

Scallops were then added to configuration 39, producing configuration 43. As experienced earlier, the mixing level improved and the total pressure losses decreased to yield an overall performance increment of 0.22 percent thrust specific fuel consumption (configuration 43 versus configuration 39).

An alternate plug design was introduced in configuration 48 to vary the tailpipe area distribution. A performance loss of 0.12 percent thrust specific fuel consumption was observed with this mixer. The original plug was replaced and the mixer scallops were extended upstream resulting in configuration 49. This configuration produced the highest performance measured during the test program; 2.67 percent change in thrust specific fuel consumption relative to the optimized separate flow exhaust system.

The impact of scalloping on tailpipe temperature traverses is illustrated in Figure 67. Scalloping increases the circulation within the tailpipe thereby weakening the primary flow hot spots and increasing the overall mixing level.



$T_T/T_{T\ MIX}$

CURVE LABEL	CURVE VALUE
1	0.850000E+00
2	0.950000E+00
3	0.105000E+01
4	0.115000E+01
5	0.125000E+01
6	0.135000E+01
7	0.145000E+01
8	0.155000E+01
9	0.165000E+01
10	0.175000E+01
11	0.184999E+01

Figure 63 Temperature Patterns Measured at the Tailpipe Exit

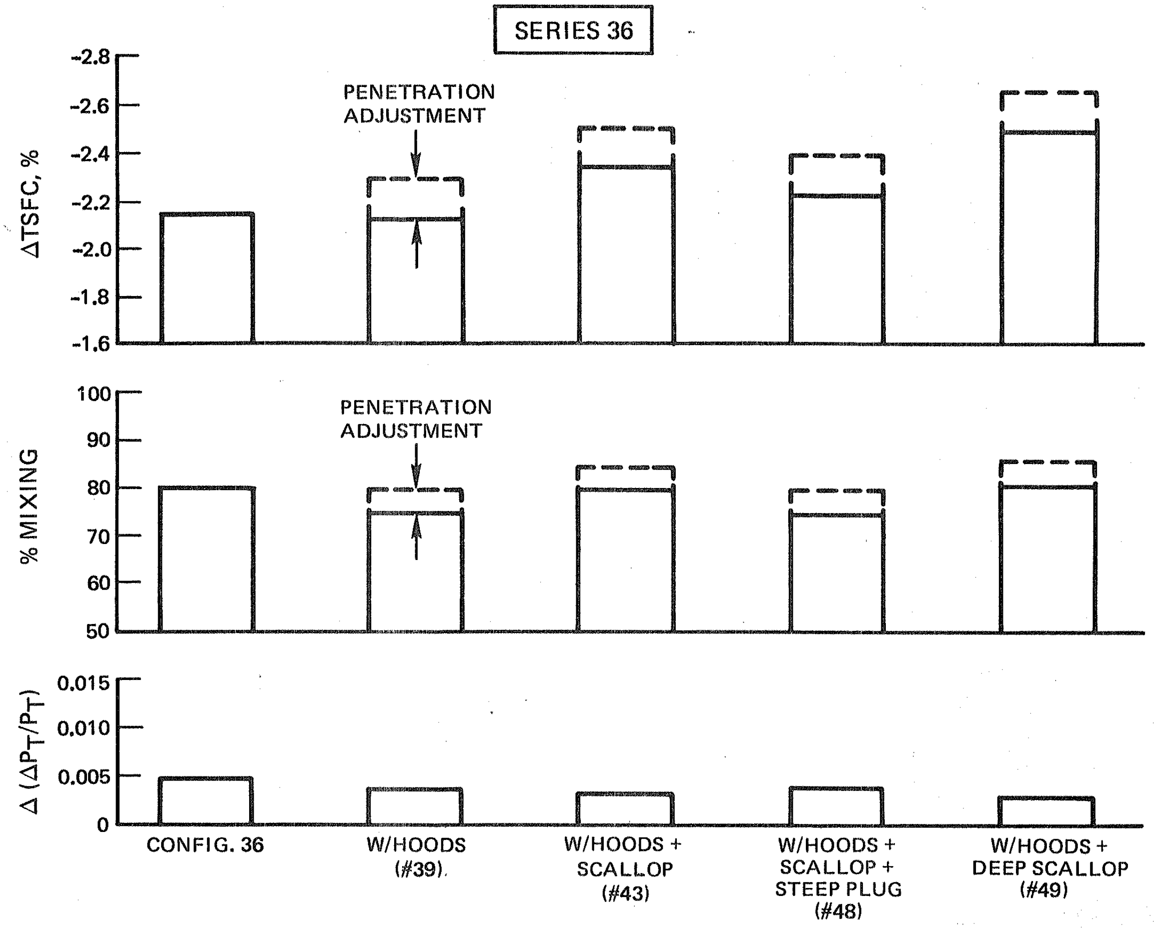


Figure 64 Modified Lobes Yield Thrust Specific Fuel Consumption Improvements

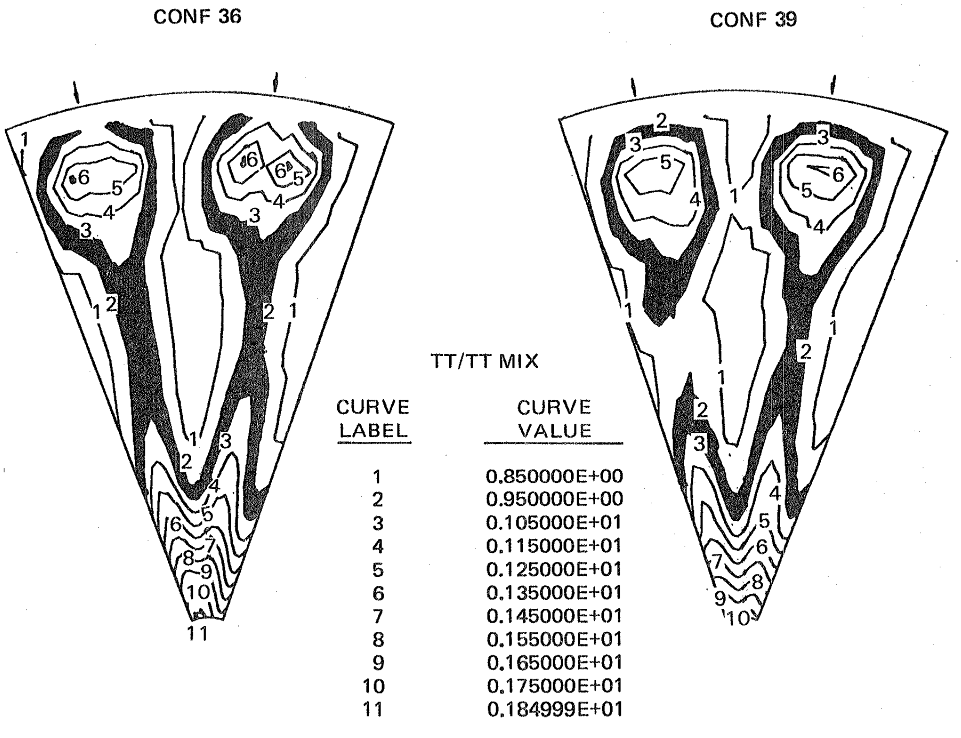


Figure 65 Tailpipe Traverses Confirm the Loss in Penetration

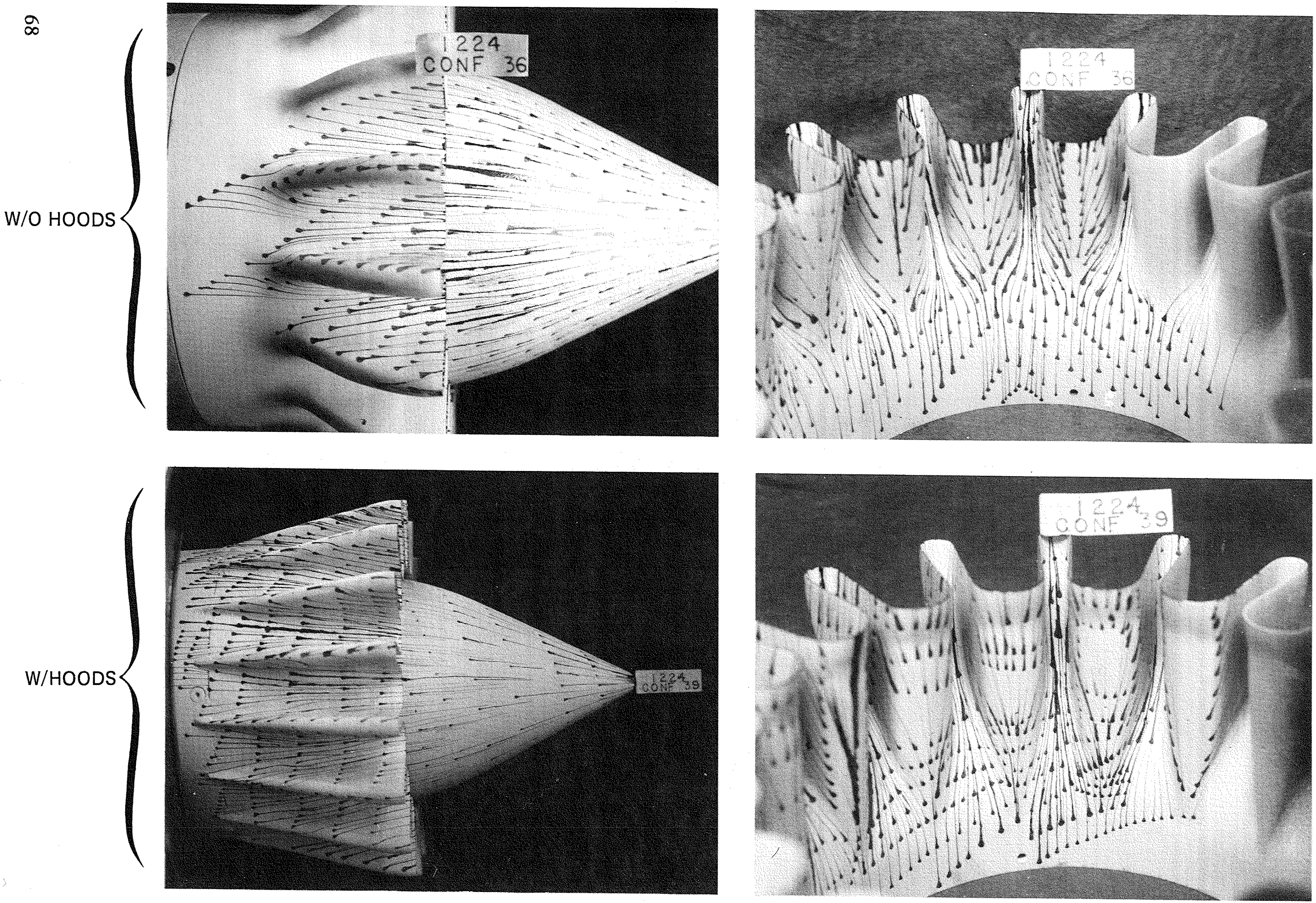
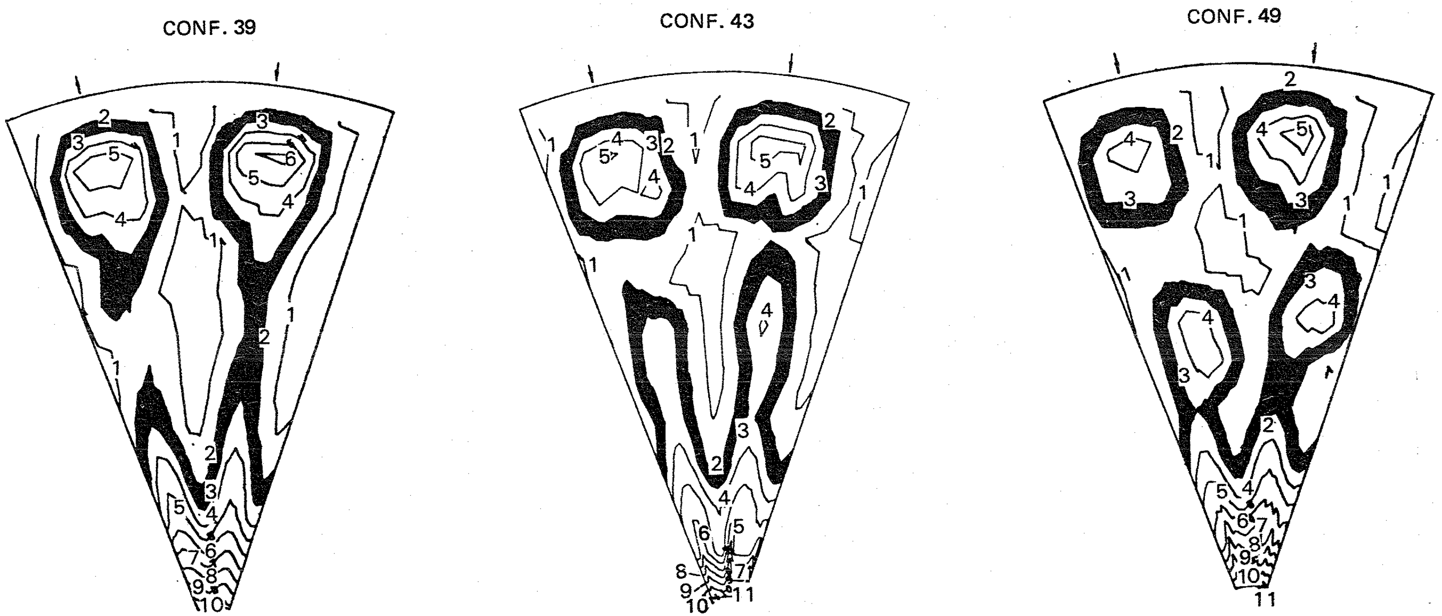


Figure 66 General Improvement in the Flow Field Around the Mixer Due to Hoods



$T_T/T_{T\ MIX}$

CURVE LABEL	CURVE VALUE
1	0.850000E+00
2	0.950000E+00
3	0.105000E+01
4	0.115000E+01
5	0.125000E+01
6	0.135000E+01
7	0.145000E+01
8	0.155000E+01
9	0.165000E+01
10	0.175000E+01
11	0.184999E+01

Figure 67 Impact of Scalloping on Tailpipe Temperature Traverses

5.2.3.3 Series 35

Configuration 35 was also modified sequentially to explore its performance potential. A steeper plug was first introduced (i.e., configuration 40), producing an improvement of 0.17 percent thrust specific fuel consumption (Figure 68). This was observed to be due to a pressure loss reduction. This configuration was then scalloped and cutback at the same time (configuration 46) which resulted in virtually no performance change (-0.05 percent change in thrust specific fuel consumption). The positive benefit of scalloping appears to have been eliminated by cutting back the mixer and producing a larger mixer/plug gap (37 percent). The next configuration incorporated an even steeper plug (configuration 47). The cold flow test of configuration 47 indicated the excess pressure loss had not changed (configuration 46), as noticed in the earlier tests with steep plugs, and so the hot tests of this configuration were not conducted.

A subsequent analysis of the plug variations in Series 35 and 36 indicated that the performance increments were probably due to the local diffusion taking place along the surface of the plug. A very rapid change in the radial profiles is believed to take place in the region between the end of the plug and the tailpipe exit. Series 35 showed a performance improvement and Series 36 did not. This is felt to be associated with the geometry differences between the two configurations. Series 35 had smaller shorter plugs, providing a much different flow area distribution through the tailpipe relative to Series 36 which had a very rapid acceleration region near the end of the tailpipe as illustrated in Figure 69.

5.2.4 Phase II Test Summary

A complete summary of the performance characteristics of the configurations tested in Phase II is presented in Table VII. The major conclusions drawn from Phase II were:

- High penetration mixers offer improved performance.
- Relatively long mixers are required for low internal losses.
- As mixer/plug gap is increased, the amount of mixing which is achieved decreases, along with the excess pressure loss.
- Scalloping improves the performance of high penetration mixers.
- Mixer hoods improved the flow field around the mixer and result in improved performance.
- Varying tailpipe area distribution through modified plug design can reduce pressure loss.

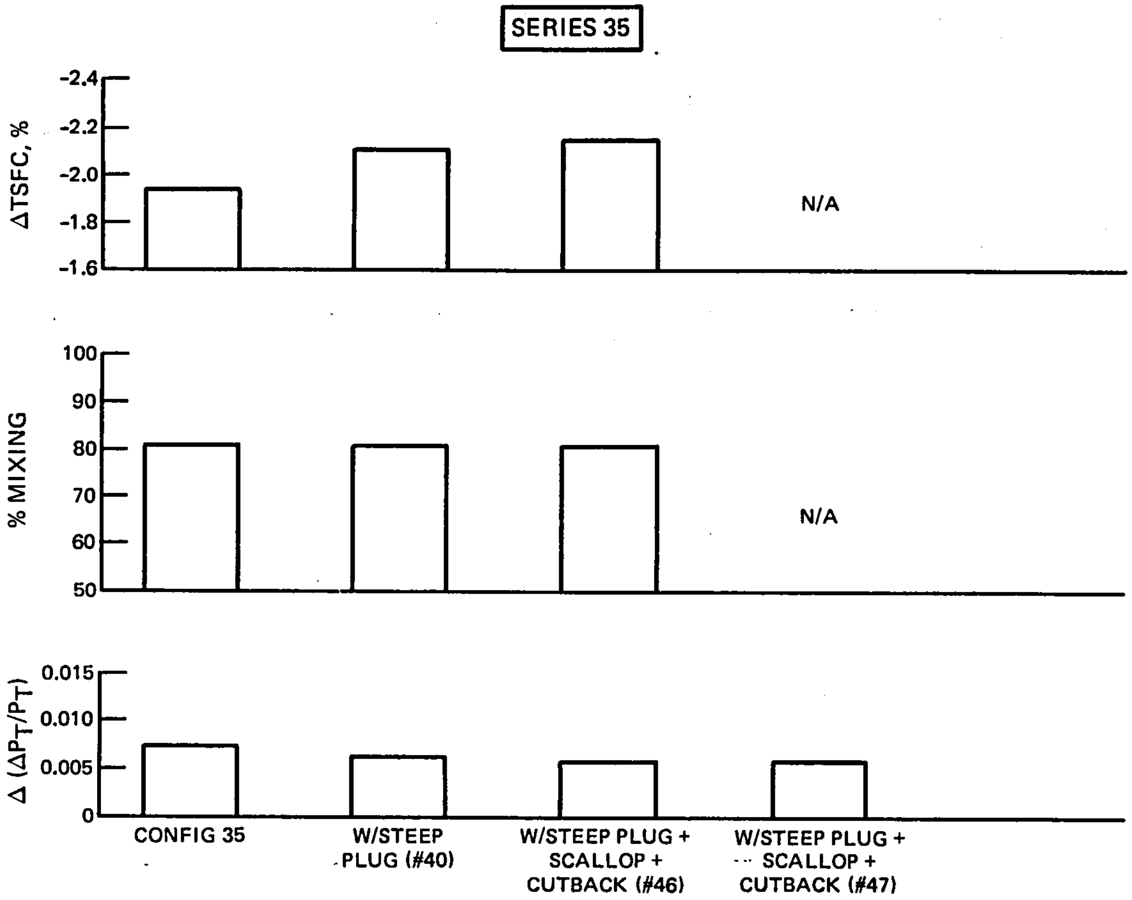


Figure 68 Steeper Plug Produces an Improvement in Thrust Specific Fuel Consumption

TABLE VII

PHASE II TEST SUMMARY

Lobe No. = 18
Tailpipe L/D = .61
Penetration = .75

Config. Type	No.	Special Features	% Mixing	$\Delta(\Delta PT/PT)$*	CV'	Thrust Specific Fuel Consumption**, percent
Black	33		89.5	0.0106	0.9847	-1.82
	41	Scalloped	97.8	0.0097	0.9863	-2.21
	42	Scalloped and Modified Tailpipe	94.4	0.0095	0.9859	-2.11
	45	Scalloped and Cutback	90.0	0.0083	0.9859	-2.11
Purple	34		88.8	0.0122	0.9839	-1.63
Brown	35		81.3	0.0078	0.9852	-1.94
	40	33° Plug	81.3	0.0067	0.9859	-2.11
	46	33° Plug and Scalloped and Cutback	81.3	0.0063	0.9861	-2.16
	47	39° Plug and Scalloped and Cutback	---	0.0063	---	---
Yellow	36		80.7	0.0051	0.9861	-2.16
	37	12 percent Gap	81.5	0.0060	0.9860	-2.13
	38	32 percent Gap	76.2	0.0039	0.9859	-2.11
	39	Hoods	79.9	0.0039	0.9867	-2.30
	43	Hoods and Scalloped (#1)	85.0	0.0037	0.9876	-2.52
	48	Hoods and Scalloped (#1) and 37° Plug	79.9	0.0039	0.9871	-2.40
	49	Hoods and Scalloped (#2)	86.0	0.0029	0.9882	-2.67

* In excess of skin friction losses.
** Relative to optimized separate flow exhaust system.

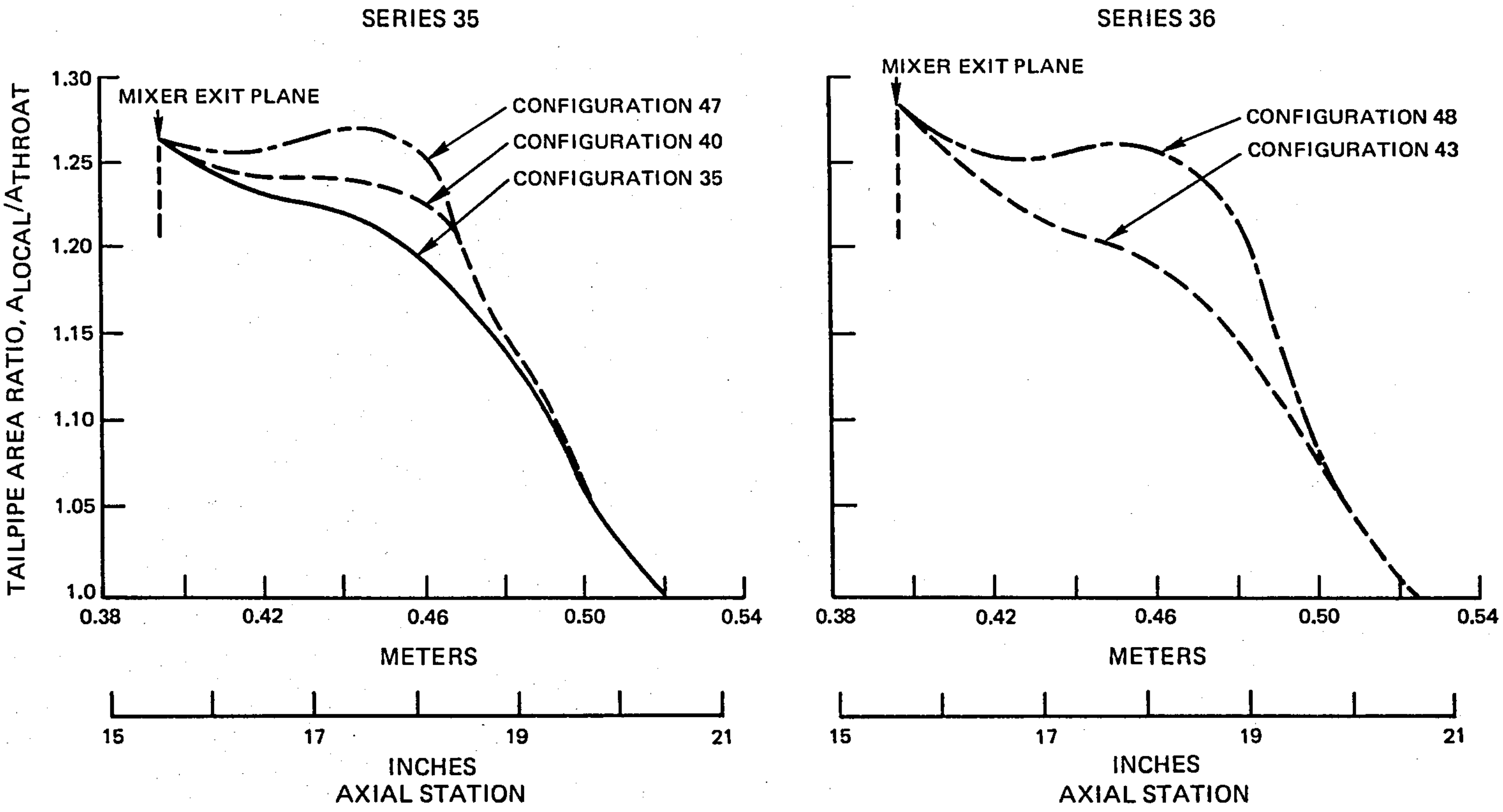


Figure 69 Geometry Differences Between in Series 35 and 36 are Evident

6.0 CONCLUSIONS AND CONCLUDING REMARKS

- This program has provided a substantial data base for high bypass ratio exhaust mixers.
- An improvement of 2.7 percent in thrust specific fuel consumption relative to an optimized separate flow exhaust system has been demonstrated. Additional performance gains are likely by extrapolation of the trends that have been identified.
- Scalloped high penetration mixer designs offer the most performance potential. Mixing levels as high as 98 percent have been demonstrated; however, high attendent pressure losses have lowered overall performance. It may be possible to reduce the internal losses while maintaining high mixing levels to improve overall performance. Careful attention to mixer contours, exit plane geometry and tailpipe area distribution is required to achieve the full potential.
- Residual swirl in the turbine discharge has been defined as generally detrimental with both free and forced mixer configurations. The turbine system should be selected to eliminate residual swirl.
- Integration of the mixer with the structural pylon in the nacelle has been shown to be only a minor problem, with very small overall penalties.

APPENDIX A

A tabulation of the key model test data are presented in this appendix. The data are grouped in order of the test configuration number, with a definition of the terms presented at the end of this section. The $C_{V\ MIX}$ and $C_{D\ MIX}$ data has been processed to reflect fully mixed flow properties for the reference ideal conditions. The procedure to calculate the fully mixed conditions is also presented in this section. Finally, this appendix includes a thrust balance temperature correction definition required for Phase I thrust coefficients. This correction compensates for the varying temperatures of the thrust balance.

The contents of this appendix consists of the following:

1. Definition of Symbols 75
2. Test Data Listing 76
3. Fully Mixed Conditions Calculation Procedure 106
4. Thrust Balance Temperature Correction 107

DEFINITION OF SYMBOLS

Defined At Model Mixing Plane

$C_{V\ MIX}$ -Mixed Model Thrust Coefficient = $\left.Fg_{MEASURED}/Fg_{\substack{FULLY\\MIXED}}\right)_{IDEAL}$

$C_{D\ MIX}$ -Mixed Model Flow Coefficient = $\left.(Wa_{FAN} + Wa_{PRI})_{MEASURED}/Wa_{\substack{FULLY\\MIXED}}\right)_{IDEAL}$

PTMPA - Fully Mixed Total to Ambient Nozzle Pressure Ratio

PTFPAM - Fan Stream Total to Ambient Nozzle Pressure Ratio

PTEPAM - Primary Stream Total to Ambient Nozzle Pressure Ratio

PRAT - Ratio of PTFPAM to PTEPAM

MIXP - Ideal Nozzle Performance Gain Available From Mixing = $\left[(Fg_{\substack{FULLY\\MIXED}} - Fg_{UNMIXED})/Fg_{\substack{FULLY\\MIXED}}\right]_{IDEAL}$

$F_G(3)$ - Fully Mixed Ideal Thrust = $\left.Fg_{\substack{FULLY\\MIXED}}\right)_{IDEAL}$ ~ LBS.

MN_{FAN} - Fan Stream Mach Number

MN_{PRI} - Primary Stream Mach Number

Defined at Model Charging Station

PT7PAM - Fan Stream Total to Ambient Nozzle Pressure Ratio

PT8PAM - Primary Stream Total to Ambient Nozzle Pressure Ratio

TT7 - Fan Stream Total Temperature - ^{o}R

TT8 - Primary Stream Total Temperature - ^{o}R

TRAT - Ratio of TT8 to TT7

PAM - Ambient Pressure ~ LBS/IN^2

BPR - Bypass Ratio = $(Wa_{FAN}/Wa_{PRI})_{MEASURED}$

1) TEST DATA LISTING

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45	103
46	104
47	104
48	105
49	105

```
 E3 MIXER NO. 1 CONF 1 RUNS 1-6,COLD
CVMIX            1   .99572      .99534      .99498      .99498      .99412      .99431
CDMIX            2   .96027      .96678      .96884      .96979      .97003      .97137
PTMPA            3   1.9834      2.1807      2.2771      2.3736      2.4806      2.5748
PTFPAM           4   1.9777      2.1758      2.2708      2.3693      2.4741      2.5684
PTEPAM           5   1.9964      2.1917      2.2913      2.3834      2.4954      2.5896
PRAT             6   .99063      .99277      .99109      .99408      .99147      .99180
MIXP             7  -.84933E-05-.30135E-05-.12933E-04 .13182E-05-.69171E-05 .30325E-05
FG  (    3)      8   689.88      810.16      868.39      926.02      988.26      1046.6
MNFAN            9   .39970      .40424      .40445      .40654      .40530      .40619
MNPRI           10   .41671      .41727      .42046      .41717      .42059      .42088
PT7PAM          11   1.9872      2.1864      2.2819      2.3810      2.4862      2.5810
PT8PAM          12   2.0109      2.2080      2.3084      2.4012      2.5141      2.6089
TT7             13   510.66      511.51      508.25      514.99      522.09      518.19
TT8             14   513.75      514.18      511.10      516.87      522.22      519.39
TRAT            15   1.0061      1.0052      1.0056      1.0037      1.0002      1.0023
PAM             16   14.332      14.343      14.343      14.343      14.327      14.343
BPR             17   2.2567      2.2526      2.2498      2.2647      2.2445      2.2603
```

```
 E3 MIXER NO. 1 CONF 1 ,RUNS 4.1-5.1-6.1 COLD
CVMIX            1   .99369      .99341      .99288
CDMIX            2   .96858      .96933      .97033
PTMPA            3   2.3759      2.4746      2.5736
PTFPAM           4   2.3693      2.4679      2.5665
PTEPAM           5   2.3910      2.4902      2.5899
PRAT             6   .99092      .99102      .99095
MIXP             7  -.10780E-04-.78550E-05-.93184E-05
FG  (    3)      8   905.87      963.51      1021.8
MNFAN            9   .40425      .40473      .40522
MNPRI           10   .42058      .42084      .42145
PT7PAM          11   2.3810      2.4800      2.5791
PT8PAM          12   2.4088      2.5086      2.6091
TT7             13   515.83      518.90      522.14
TT8             14   520.07      522.66      525.65
TRAT            15   1.0082      1.0072      1.0067
PAM             16   14.028      14.028      14.028
BPR             17   2.2656      2.2741      2.2695
```

```
 E3 MIXER NO. 1 CONF 1 ,RUNS 4.11-5.11-6.11 COLD
CVMIX            1   .99397      .99388      .99387
CDMIX            2   .96750      .96910      .96957
PTMPA            3   2.3914      2.4861      2.5846
PTFPAM           4   2.3952      2.4893      2.5867
PTEPAM           5   2.3823      2.4786      2.5797
PRAT             6   1.0054      1.0043      1.0027
MIXP             7   .89201E-05 .22245E-05 .32667E-05
FG  (    3)      8   930.57      987.74      1046.3
MNFAN            9   .41151      .41174      .41110
MNPRI           10   .40175      .40397      .40622
PT7PAM          11   2.4073      2.5017      2.5997
PT8PAM          12   2.3989      2.4962      2.5976
TT7             13   524.97      522.58      527.67
TT8             14   526.88      525.12      528.90
TRAT            15   1.0036      1.0049      1.0023
PAM             16   14.286      14.286      14.286
BPR             17   2.3682      2.3502      2.3648
```

```
 E3 MIXER NO. 1 CONF 1 ,RUNS 4.4-5.6-6.4 COLD
CVMIX            1   .99331      .99327      .99293
CDMIX            2   .96783      .96948      .97025
PTMPA            3   2.3945      2.4882      2.5838
PTFPAM           4   2.3965      2.4894      2.5858
PTEPAM           5   2.3897      2.4854      2.5788
PRAT             6   1.0029      1.0016      1.0027
MIXP             7   .49545E-05 .10816E-04 .62750E-05
FG  (    3)      8   936.26      993.14      1050.5
MNFAN            9   .41024      .41043      .41142
MNPRI           10   .40508      .40751      .40655
PT7PAM          11   2.4086      2.5021      2.5990
PT8PAM          12   2.4059      2.5021      2.5962
TT7             13   510.31      513.16      516.50
TT8             14   515.20      518.18      521.58
TRAT            15   1.0096      1.0098      1.0098
PAM             16   14.340      14.340      14.340
BPR             17   2.4026      2.4123      2.4144
```

```
 E3 MIXER NO. 1 CONF 1 ,RUNS 7-12 HOT
CVMIX               1   .98932      .98582      .98484      .98240      .98217      .97897
CDMIX               2   .95915      .97104      .97368      .97850      .98217      .98597
PTMPA               3   1.9946      2.1806      2.2749      2.3458      2.4360      2.5213
PTFPAM              4   2.0636      2.2496      2.3469      2.4108      2.5012      2.5864
PTEPAM              5   1.8050      2.0117      2.1034      2.2067      2.3023      2.3986
PRAT                6   1.1432      1.1182      1.1158      1.0925      1.0864      1.0783
MIXP                7   .62198E-02  .10316E-01  .11755E-01  .13999E-01  .15512E-01  .17660E-01
FG  (    3)         8   694.76      812.08      869.64      915.94      973.03      1027.9
MNFAN               9   .49272      .47687      .47579      .46039      .45689      .45221
MNPRI              10   .21723      .25452      .25890      .28963      .29854      .31018
PT7PAM             11   2.0775      2.2641      2.3619      2.4254      2.5162      2.6015
PT8PAM             12   1.8093      2.0182      2.1104      2.2159      2.3123      2.4101
TT7                13   511.91      502.61      515.08      507.67      518.59      512.49
TT8                14   1172.1      1177.4      1233.8      1219.6      1271.1      1297.0
TRAT               15   2.2897      2.3427      2.3953      2.4023      2.4511      2.5308
PAM                16   14.315      14.315      14.315      14.315      14.315      14.315
BPR                17   7.6411      6.4599      6.3867      5.5821      5.4758      5.2566
```

```
 E3 MIXER NO. 1 CONF 1 ,RUNS 10.1-11.1-12.1 HOT
CVMIX               1   .98168      .98074      .97886
CDMIX               2   .97613      .98049      .98442
PTMPA               3   2.3426      2.4363      2.5221
PTFPAM              4   2.4081      2.5011      2.5850
PTEPAM              5   2.2003      2.3031      2.4034
PRAT                6   1.0945      1.0859      1.0755
MIXP                7   .13759E-01  .15490E-01  .17472E-01
FG  (    3)         8   894.41      952.97      1007.1
MNFAN               9   .46078      .45582      .44960
MNPRI              10   .28574      .29804      .31256
PT7PAM             11   2.4227      2.5160      2.6001
PT8PAM             12   2.2091      2.3131      2.4149
TT7                13   520.50      523.20      525.90
TT8                14   1245.2      1280.0      1317.4
TRAT               15   2.3923      2.4464      2.5051
PAM                16   14.042      14.042      14.042
BPR                17   5.6663      5.4775      5.2164
```

```
 E3 MIXER NO. 1 CONF 1 ,RUNS 10.3-11.3-12.3 HOT
CVMIX               1   .98366      .98188      .97954
CDMIX               2   .97621      .98035      .98473
PTMPA               3   2.3701      2.4539      2.5461
PTFPAM              4   2.4445      2.5268      2.6188
PTEPAM              5   2.1931      2.2923      2.3963
PRAT                6   1.1146      1.1023      1.0929
MIXP                7   .12182E-01  .14453E-01  .16393E-01
FG  (    3)         8   928.74      982.50      1042.1
MNFAN               9   .47558      .46747      .46212
MNPRI              10   .26156      .27825      .29215
PT7PAM             11   2.4602      2.5426      2.6347
PT8PAM             12   2.2005      2.3010      2.4065
TT7                13   524.50      527.25      530.05
TT8                14   1258.2      1297.8      1332.3
TRAT               15   2.3989      2.4615      2.5135
PAM                16   14.324      14.324      14.324
BPR                17   6.3788      5.9980      5.6716
```

```
 E3 MIXER NO. 1 CONF 1 ,RUNS 237-242 HOT
CVMIX               1   .99095      .98702      .98455      .98386      .98170      .97992
CDMIX               2   .95780      .96903      .97148      .97616      .98044      .98485
PTMPA               3   2.0154      2.2008      2.2905      2.3657      2.4537      2.5371
PTFPAM              4   2.0903      2.2768      2.3676      2.4399      2.5258      2.6075
PTEPAM              5   1.7965      2.0024      2.0995      2.1959      2.2976      2.3950
PRAT                6   1.1636      1.1370      1.1277      1.1111      1.0993      1.0887
MIXP                7   .38333E-02  .86938E-02  .10476E-01  .12554E-01  .14616E-01  .16706E-01
FG  (    3)         8   704.22      820.42      875.01      923.48      979.75      1034.0
MNFAN               9   .50944      .49102      .48465      .47375      .46575      .45914
MNPRI              10   .19408      .23163      .24425      .26698      .28242      .29698
PT7PAM             11   2.1052      2.2921      2.3831      2.4552      2.5413      2.6232
PT8PAM             12   1.7999      2.0078      2.1059      2.2039      2.3068      2.4055
TT7                13   504.63      512.67      507.49      515.88      510.84      519.39
TT8                14   1152.7      1202.6      1210.1      1235.5      1255.9      1309.1
TRAT               15   2.2842      2.3459      2.3846      2.3950      2.4585      2.5204
PAM                16   14.284      14.284      14.284      14.284      14.284      14.284
BPR                17   8.6754      7.2145      6.7739      6.0774      5.8154      5.5656
```

```
 E3 MIXER NO. 1 CONF 2 ,RUNS 14-19 COLD
CVMIX           1 .99325     .99310     .99288     .99278     .99249     .99206
CDMIX           2 .98544     .98798     .98836     .98877     .98877     .98890
PTMPA           3 1.9864     2.1790     2.2847     2.3812     2.4796     2.5762
PTFPAM          4 1.9825     2.1761     2.2807     2.3769     2.4731     2.5700
PTEPAM          5 1.9958     2.1858     2.2942     2.3916     2.4952     2.5911
PRAT            6 .99333     .99556     .99409     .99386     .99115     .99186
MIXP            7 .10365E-04 .38585E-05 .85443E-05 .13193E-04-.48701E-06 .50635E-05
FG  (    3)     8 706.61     822.55     885.77     943.74     1002.6     1060.7
MNFAN           9 .41447     .41699     .41640     .41650     .41514     .41556
MNPRI          10 .42612     .42467     .42680     .42731     .43068     .42987
PT7PAM         11 1.9929     2.1877     2.2928     2.3895     2.4862     2.5836
PT8PAM         12 2.0104     2.2017     2.3110     2.4091     2.5135     2.6102
TT7            13 515.43     520.14     517.30     521.78     519.17     524.27
TT8            14 524.53     530.07     526.49     531.64     528.94     537.44
TRAT           15 1.0177     1.0191     1.0178     1.0189     1.0188     1.0251
PAM            16 14.271     14.271     14.271     14.271     14.271     14.271
BPR            17 2.3543     2.3791     2.3685     2.3656     2.3551     2.3598

 E3 MIXER NO. 1 CONF 2 ,RUNS 20-25 HOT
CVMIX           1 .98880     .98599     .98397     .98285     .98131     .97972
CDMIX           2 .99534     .99970     1.0012     1.0032     1.0053     1.0076
PTMPA           3 1.9921     2.1808     2.2711     2.3480     2.4351     2.5235
PTFPAM          4 2.0573     2.2494     2.3394     2.4113     2.4983     2.5864
PTEPAM          5 1.8033     1.9995     2.1048     2.2070     2.3023     2.4006
PRAT            6 1.1409     1.1250     1.1115     1.0926     1.0851     1.0774
MIXP            7 .67386E-02 .95949E-02 .11998E-01 .13617E-01 .15365E-01 .17063E-01
FG  (    3)     8 717.97     834.87     890.15     938.88     993.35     1050.1
MNFAN           9 .49997     .49030     .48127     .46913     .46439     .45980
MNPRI          10 .23942     .26197     .27928     .30321     .31290     .32311
PT7PAM         11 2.0729     2.2657     2.3557     2.4273     2.5145     2.6028
PT8PAM         12 1.8077     2.0055     2.1121     2.2160     2.3123     2.4119
TT7            13 520.94     511.74     524.93     515.83     528.42     520.10
TT8            14 1192.6     1196.2     1255.6     1234.7     1295.9     1307.9
TRAT           15 2.2893     2.3374     2.3920     2.3936     2.4525     2.5147
PAM            16 14.289     14.296     14.289     14.296     14.289     14.296
BPR            17 7.8046     6.9900     6.4454     5.8012     5.6479     5.4510

 E3 MIXER NO. 2 CONF 3 ,RUNS 26-31 COLD
CVMIX           1 .99079     .99228     .99133     .99119     .99147     .99103
CDMIX           2 .94817     .95648     .95710     .95936     .96055     .96040
PTMPA           3 1.9776     2.1681     2.2760     2.3691     2.4754     2.5652
PTFPAM          4 1.9720     2.1614     2.2684     2.3607     2.4677     2.5553
PTEPAM          5 1.9953     2.1889     2.2992     2.3950     2.4991     2.5956
PRAT            6 .98829     .98744     .98663     .98568     .98744     .98447
MIXP            7 .36126E-06 .95661E-05-.31452E-05 .10733E-05-.62896E-05-.76211E-05
FG  (    3)     8 675.81     791.17     853.87     909.90     970.41     1025.1
MNFAN           9 .51585     .52224     .52248     .52400     .52556     .52446
MNPRI          10 .53278     .54018     .54155     .54435     .54338     .54649
PT7PAM         11 1.9857     2.1768     2.2846     2.3777     2.4854     2.5737
PT8PAM         12 2.0095     2.2048     2.3161     2.4127     2.5177     2.6150
TT7            13 505.07     498.51     508.83     501.44     521.07     513.12
TT8            14 514.14     506.96     517.17     509.89     526.63     521.31
TRAT           15 1.0180     1.0169     1.0164     1.0169     1.0107     1.0160
PAM            16 14.287     14.287     14.287     14.287     14.251     14.287
BPR            17 3.0929     3.0846     3.0661     3.0706     3.0534     3.0514

 E3 MIXER NO. 2 CONF 3 ,RUNS 32-37 HOT
CVMIX           1 .98711     .98605     .98545     .98518     .98426     .98373
CDMIX           2 .94897     .95730     .96110     .96281     .96433     .96749
PTMPA           3 1.9943     2.1791     2.2696     2.3435     2.4349     2.5190
PTFPAM          4 2.0566     2.2444     2.3333     2.4034     2.4957     2.5784
PTEPAM          5 1.8037     1.9963     2.1059     2.2020     2.3014     2.4023
PRAT            6 1.1403     1.1243     1.1080     1.0915     1.0844     1.0733
MIXP            7 .76962E-02 .96761E-02 .11457E-01 .12301E-01 .13757E-01 .14978E-01
FG  (    3)     8 683.04     794.84     850.18     894.45     948.93     1001.2
MNFAN           9 .56477     .56212     .55584     .54950     .54629     .54291
MNPRI          10 .35484     .37966     .39932     .41835     .42615     .44008
PT7PAM         11 2.0734     2.2624     2.3517     2.4220     2.5148     2.5977
PT8PAM         12 1.8112     2.0059     2.1170     2.2146     2.3152     2.4178
TT7            13 508.74     512.67     519.57     515.66     522.09     518.68
TT8            14 1173.5     1201.8     1248.8     1237.5     1287.3     1299.6
TRAT           15 2.3067     2.3441     2.4035     2.3998     2.4656     2.5056
PAM            16 14.228     14.228     14.228     14.228     14.228     14.228
BPR            17 7.8571     7.2787     6.9588     6.5259     6.4245     6.1652
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 E3 MIXER NO. 2 CONF 4 ,RUNS 39-44 COLD
CVMIX           1   .98814     .98995     .98998     .99000     .99041     .99026
CDMIX           2   .97328     .97717     .97834     .97787     .97881     .97892
PTMPA           3   1.9826     2.1773     2.2759     2.3822     2.4776     2.5742
PTFPAM          4   1.9760     2.1706     2.2686     2.3732     2.4691     2.5665
PTEPAM          5   2.0035     2.1982     2.2989     2.4106     2.5046     2.5985
PRAT            6   .98626     .98746     .98680     .98447     .98582     .98769
MIXP            7   .56822E-05 .22180E-04 .17574E-04 .13746E-04 .25171E-04 .28011E-04
FG  (    3)     8   687.45     803.54     861.32     923.54     979.65     1037.2
MNFAN           9   .53570     .53932     .54011     .53898     .54021     .54087
MNPRI          10   .55489     .55677     .55846     .56053     .55990     .55796
PT7PAM         11   1.9908     2.1871     2.2858     2.3912     2.4879     2.5861
PT8PAM         12   2.0184     2.2147     2.3163     2.4288     2.5234     2.6180
TT7            13   523.96     520.68     525.59     522.89     526.83     525.99
TT8            14   538.26     538.83     541.15     542.39     545.74     549.91
TRAT           15   1.0273     1.0349     1.0296     1.0373     1.0359     1.0455
PAM            16   14.100     14.110     14.100     14.110     14.100     14.110
BPR            17   3.1246     3.1432     3.1284     3.1380     3.1504     3.1704

 E3 MIXER NO. 2 CONF 4 ,RUNS 45-50 HOT
CVMIX           1   .98682     .98632     .98687     .98668     .98575     .98528
CDMIX           2   .97752     .98101     .98338     .98293     .98437     .98478
PTMPA           3   1.9910     2.1807     2.2717     2.3456     2.4347     2.5231
PTFPAM          4   2.0531     2.2462     2.3378     2.4074     2.4962     2.5843
PTEPAM          5   1.8071     2.0036     2.1013     2.2016     2.3020     2.4037
PRAT            6   1.1361     1.1211     1.1125     1.0934     1.0844     1.0751
MIXP            7   .80406E-02 .10083E-01 .11282E-01 .12220E-01 .13629E-01 .14989E-01
FG  (    3)     8   695.32     808.08     863.21     906.07     959.74     1011.5
MNFAN           9   .58098     .57602     .57282     .56428     .56008     .55541
MNPRI          10   .38702     .40541     .41524     .43462     .44394     .45294
PT7PAM         11   2.0709     2.2652     2.3574     2.4270     2.5163     2.6047
PT8PAM         12   1.8156     2.0142     2.1128     2.2149     2.3163     2.4194
TT7            13   528.38     529.44     529.66     531.20     531.07     532.66
TT8            14   1214.6     1245.9     1274.1     1272.7     1308.5     1340.9
TRAT           15   2.2988     2.3533     2.4054     2.3960     2.4639     2.5175
PAM            16   14.100     14.100     14.100     14.100     14.100     14.090
BPR            17   7.6001     7.1332     7.0417     6.5174     6.4423     6.2740

 E3 MIXER NO. 2 CONF 5 ,RUNS 51-56 COLD
CVMIX           1   .98917     .98983     .99026     .98943     .99023     .98946
CDMIX           2   .97912     .98301     .98320     .98237     .98388     .98286
PTMPA           3   1.9761     2.1712     2.2677     2.3706     2.4633     2.5661
PTFPAM          4   1.9691     2.1639     2.2610     2.3624     2.4545     2.5559
PTEPAM          5   1.9984     2.1946     2.2891     2.3966     2,4918     2.5987
PRAT            6   .98536     .98600     .98773     .98573     .98505     .98354
MIXP            7   .11716E-04 .14878E-04 .34042E-05 .68985E-05-.40018E-05-.47147E-05
FG  (    3)     8   687.66     804.09     860.61     920.15     976.12     1035.7
MNFAN           9   .54027     .54376     .54445     .54312     .54421     .54287
MNPRI          10   .56050     .56303     .56137     .56279     .56477     .56555
PT7PAM         11   1.9844     2.1809     2.2787     2.3809     2.4738     2.5759
PT8PAM         12   2.0128     2.2106     2.3057     2.4142     2.5099     2.6177
TT7            13   512.23     516.99     514.19     519.61     515.88     522.32
TT8            14   519.80     523.59     521.78     525.77     523.85     528.64
TRAT           15   1.0148     1.0128     1.0148     1.0119     1.0154     1.0121
PAM            16   14.100     14.100     14.100     14.100     14.100     14.100
BPR            17   3.1918     3.1839     3.2030     3.1712     3.1880     3.1658

 E3 MIXER NO. 2 CONF 5 ,RUNS 57-62 HOT
CVMIX           1   .98713     .98701     .98656     .98712     .98703     .98657
CDMIX           2   .98047     .98417     .98452     .98430     .98668     .98622
PTMPA           3   1.9913     2.1788     2.2701     2.3468     2.4352     2.5221
PTFPAM          4   2.0526     2.2424     2.3342     2.4065     2.4940     2.5818
PTEPAM          5   1.8036     2.0018     2.1030     2.2037     2.3034     2.4029
PRAT            6   1.1380     1.1202     1.1100     1.0920     1.0827     1.0744
MIXP            7   .77103E-02 .97896E-02 .11186E-01 .12000E-01 .12786E-01 .14727E-01
FG  (    3)     8   696.74     808.59     862.28     906.93     961.18     1012.0
MNFAN           9   .58321     .57720     .57201     .56413     .56146     .55586
MNPRI          10   .38694     .40846     .41822     .43668     .44795     .45460
PT7PAM         11   2.0709     2.2618     2.3541     2.4265     2.5146     2.6026
PT8PAM         12   1.8117     2.0119     2.1142     2.2164     2.3172     2.4180
TT7            13   523.16     530.19     526.04     532.92     527.80     536.01
TT8            14   1200.2     1242.2     1264.9     1274.9     1275.8     1346.9
TRAT           15   2.2942     2.3429     2.4046     2.3923     2.4171     2.5128
PAM            16   14.086     14.086     14.086     14.086     14.086     14.086
BPR            17   7.8290     7.3127     7.1301     6.6964     6.5383     6.4266
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 E3 MIXER NO. 2 CONF 6 ,RUNS 64-69 COLD
CVMIX              1  .99068     .99078     .99091     .99098     .99085     .99025
CDMIX              2  .90868     .91998     .92359     .92696     .92864     .93047
PTMPA              3  1.9773     2.1802     2.2779     2.3741     2.4723     2.5739
PTFPAM             4  1.9726     2.1746     2.2722     2.3677     2.4668     2.5658
PTEPAM             5  1.9919     2.1974     2.2957     2.3940     2.4896     2.5990
PRAT               6  .99029     .98964     .98977     .98902     .99085     .98724
MIXP               7  .12118E-04 .13734E-04 .11887E-04 .23908E-04 .25593E-04 .24565E-04
FG  (    3)        8  644.71     764.38     821.57     878.21     934.84     993.84
MNFAN              9  .48583     .49410     .49688     .49923     .50116     .50132
MNPRI             10  .50068     .50970     .51230     .51560     .51474     .52023
PT7PAM            11  1.9850     2.1887     2.2871     2.3834     2.4831     2.5829
PT8PAM            12  2.0046     2.2119     2.3110     2.4101     2.5063     2.6166
TT7               13  509.50     514.23     511.47     517.66     513.79     520.68
TT8               14  524.96     532.08     526.99     536.65     531.08     541.60
TRAT              15  1.0303     1.0347     1.0303     1.0367     1.0337     1.0402
PAM               16  14.232     14.232     14.232     14.232     14.232     14.232
BPR               17  3.1311     3.1300     3.1251     3.1337     3.1334     3.1269
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 E3 MIXER NO. 2 CONF 6 ,RUNS 70-75 HOT
CVMIX              1  .98776     .98758     .98640     .98630     .98606     .98490
CDMIX              2  .90492     .91820     .92348     .92813     .93153     .93611
PTMPA              3  2.0014     2.1865     2.2767     2.3498     2.4403     2.5252
PTFPAM             4  2.0605     2.2483     2.3392     2.4080     2.4974     2.5829
PTEPAM             5  1.8057     2.0013     2.1020     2.2029     2.3059     2.4040
PRAT               6  1.1411     1.1234     1.1128     1.0931     1.0831     1.0744
MIXP               7  .70912E-02 .94794E-02 .11043E-01 .12267E-01 .13523E-01 .15216E-01
FG  (    3)        8  654.76     765.97     820.32     865.21     919.18     971.61
MNFAN              9  .53817     .53618     .53348     .52667     .52324     .52141
MNPRI             10  .30994     .34250     .35881     .38528     .39859     .41159
PT7PAM            11  2.0759     2.2650     2.3564     2.4253     2.5153     2.6011
PT8PAM            12  1.8116     2.0091     2.1111     2.2137     2.3177     2.4176
TT7               13  519.34     523.47     521.43     526.08     523.96     528.33
TT8               14  1193.2     1229.0     1254.0     1263.9     1285.9     1331.2
TRAT              15  2.2976     2.3478     2.4048     2.4024     2.4543     2.5197
PAM               16  14.225     14.225     14.225     14.225     14.225     14.225
BPR               17  8.5500     7.7814     7.4380     6.8246     6.6823     6.3959
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 E3 MIXER NO. 3 CONF 7 ,RUNS 76-81 COLD
CVMIX             1   .99001      .99104      .99108      .99106      .99058      .99095
CDMIX             2   .94554      .95264      .95575      .95630      .95789      .95837
PTMPA             3   1.9883      2.1874      2.2861      2.3826      2.4697      2.5861
PTFPAM            4   1.9868      2.1857      2.2833      2.3797      2.4629      2.5822
PTEPAM            5   1.9931      2.1932      2.2949      2.3919      2.4920      2.5990
PRAT              6   .99686      .99657      .99497      .99492      .98832      .99354
MIXP              7   .23818E-04 .13206E-04 .14292E-04 .13950E-04 .55588E-05 .11142E-04
FG  (    3)       8   676.52      794.97      854.09      910.09      966.23      1029.9
MNFAN             9   .51702      .52260      .52455      .52499      .52417      .52623
MNPRI            10   .52157      .52739      .53175      .53225      .54078      .53540
PT7PAM           11   2.0008      2.2014      2.2998      2.3969      2.4807      2.6010
PT8PAM           12   2.0086      2.2105      2.3132      2.4110      2.5123      2.6200
TT7              13   509.95      512.05      513.83      515.97      516.01      517.66
TT8              14   515.24      516.67      518.11      519.80      523.20      521.05
TRAT             15   1.0104      1.0090      1.0083      1.0074      1.0139      1.0065
PAM              16   14.214      14.214      14.214      14.214      14.278      14.214
BPR              17   3.3412      3.3374      3.3242      3.3205      3.2889      3.3087

 E3 MIXER NO. 3 CONF 7 ,RUNS 79.1-80.1-81.1 COLD
CVMIX             1   .99054      .99085      .99061
CDMIX             2   .95697      .95853      .95912
PTMPA             3   2.3885      2.4853      2.5831
PTFPAM            4   2.3868      2.4846      2.5811
PTEPAM            5   2.3939      2.4875      2.5895
PRAT              6   .99705      .99885      .99677
MIXP              7   .17236E-04 .18243E-04 .19381E-04
FG  (    3)       8   906.54      963.53      1020.4
MNFAN             9   .52624      .52808      .52789
MNPRI            10   .53043      .52971      .53249
PT7PAM           11   2.4042      2.5028      2.6000
PT8PAM           12   2.4127      2.5071      2.6100
TT7              13   521.74      524.44      526.79
TT8              14   527.77      530.43      533.68
TRAT             15   1.0116      1.0114      1.0131
PAM              16   14.096      14.096      14.096
BPR              17   3.3673      3.3781      3.3698

 E3 MIXER NO. 3 CONF 7 ,RUNS 82-87 HOT
CVMIX             1   .98757      .98602      .98582      .98533      .98458      .98394
CDMIX             2   .94901      .95716      .96083      .96318      .96624      .96825
PTMPA             3   1.9978      2.1851      2.2737      2.3495      2.4327      2.5231
PTFPAM            4   2.0570      2.2465      2.3361      2.4079      2.4900      2.5814
PTEPAM            5   1.8042      2.0045      2.0974      2.2013      2.2994      2.3996
PRAT              6   1.1401      1.1207      1.1138      1.0939      1.0829      1.0758
MIXP              7   .72518E-02 .95786E-02 .10618E-01 .11876E-01 .13156E-01 .14607E-01
FG  (    3)       8   676.76      788.53      842.04      887.40      938.09      992.23
MNFAN             9   .56340      .55894      .55750      .55009      .54659      .54390
MNPRI            10   .35298      .38152      .39157      .41529      .42895      .43754
PT7PAM           11   2.0738      2.2645      2.3549      2.4267      2.5092      2.6010
PT8PAM           12   1.8127      2.0155      2.1094      2.2154      2.3150      2.4168
TT7              13   512.81      520.37      515.17      523.67      518.28      527.54
TT8              14   1176.2      1222.7      1235.3      1258.7      1274.0      1329.4
TRAT             15   2.2936      2.3497      2.3979      2.4036      2.4582      2.5201
PAM              16   14.056      14.056      14.056      14.056      14.056      14.056
BPR              17   8.3452      7.6889      7.5777      6.9943      6.8012      6.6406

 E3 MIXER NO. 3 CONF 7 ,RUNS 85.1-86.1-87.1 HOT
CVMIX             1   .98602      .98547      .98376
CDMIX             2   .95986      .96337      .96641
PTMPA             3   2.3641      2.4539      2.5411
PTFPAM            4   2.4258      2.5170      2.6033
PTEPAM            5   2.1965      2.2952      2.3995
PRAT              6   1.1044      1.0966      1.0849
MIXP              7   .11091E-01 .12645E-01 .14232E-01
FG  (    3)       8   893.79      948.62      1002.0
MNFAN             9   .55288      .55074      .54651
MNPRI            10   .40138      .41198      .42615
PT7PAM           11   2.4449      2.5366      2.6233
PT8PAM           12   2.2097      2.3099      2.4158
TT7              13   531.91      533.28      534.86
TT8              14   1262.5      1306.2      1346.9
TRAT             15   2.3735      2.4494      2.5183
PAM              16   14.074      14.074      14.074
BPR              17   7.2503      7.0868      6.8922
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 E3 MIXER NO. 4 CONF 8 ,RUNS 88-93 COLD
CVMIX          1   .99094     .99068     .99049     .99045     .98989     .99018
CDMIX          2   .94619     .95217     .95430     .95542     .95659     .95795
PTMPA          3   1.9854     2.1862     2.2844     2.3804     2.4682     2.5791
PTFPAM         4   1.9827     2.1840     2.2823     2.3764     2.4626     2.5743
PTEPAM         5   1.9938     2.1929     2.2911     2.3926     2.4862     2.5941
PRAT           6   .99445     .99595     .99612     .99323     .99050     .99237
MIXP           7   .64980E-05 .28252E-04 .20319E-04 .21480E-04 .15962E-04 .15455E-04
FG  (    3)    8   676.29     795.03     853.09     909.28     963.61     1026.8
MNFAN          9   .51640     .52167     .52343     .52336     .52343     .52513
MNPRI         10   .52443     .52747     .52899     .53304     .53707     .53601
PT7PAM        11   1.9973     2.2004     2.2994     2.3943     2.4813     2.5938
PT8PAM        12   2.0086     2.2095     2.3086     2.4111     2.5051     2.6142
TT7           13   495.04     497.79     500.85     504.85     518.28     510.04
TT8           14   503.02     505.38     508.11     511.77     525.21     516.02
TRAT          15   1.0161     1.0152     1.0145     1.0137     1.0134     1.0117
PAM           16   14.234     14.234     14.234     14.234     14.271     14.234
BPR           17   3.1989     3.1926     3.1931     3.1570     3.1840     3.1599


 E3 MIXER NO. 4 CONF 8 ,RUNS 94-99 HOT
CVMIX          1   .98740     .98633     .98654     .98679     .98603     .98514
CDMIX          2   .94486     .95320     .95615     .95926     .96166     .96355
PTMPA          3   1.9960     2.1844     2.2738     2.3475     2.4317     2.5230
PTFPAM         4   2.0569     2.2464     2.3383     2.4071     2.4907     2.5835
PTEPAM         5   1.8064     2.0123     2.1018     2.2031     2.3013     2.3988
PRAT           6   1.1387     1.1163     1.1125     1.0926     1.0823     1.0770
MIXP           7   .75637E-02 .99843E-02 .11056E-01 .12125E-01 .13606E-01 .14803E-01
FG  (    3)    8   672.61     784.66     837.71     882.41     932.80     987.06
MNFAN          9   .56123     .55520     .55476     .54747     .54347     .54163
MNPRI         10   .35249     .38397     .39019     .41411     .42625     .43294
PT7PAM        11   2.0743     2.2650     2.3575     2.4265     2.5105     2.6037
PT8PAM        12   1.8146     2.0231     2.1134     2.2166     2.3162     2.4151
TT7           13   533.63     535.74     535.43     537.50     537.28     539.09
TT8           14   1216.6     1249.4     1275.5     1280.8     1314.4     1345.7
TRAT          15   2.2798     2.3321     2.3822     2.3828     2.4463     2.4963
PAM           16   14.053     14.053     14.053     14.053     14.053     14.053
BPR           17   7.9069     7.2044     7.1178     6.6291     6.4509     6.3112


 E3 MIXER NO. 2 CONF 9 ,RUNS 101-106 COLD
CVMIX          1   .98857     .98917     .98954     .98970     .98968     .99046
CDMIX          2   .94421     .95159     .95370     .95550     .95637     .95861
PTMPA          3   1.9940     2.1901     2.2947     2.3956     2.4940     2.5880
PTFPAM         4   1.9933     2.1900     2.2960     2.3958     2.4935     2.5898
PTEPAM         5   1.9958     2.1903     2.2902     2.3948     2.4954     2.5823
PRAT           6   .99874     .99983     1.0025     1.0004     .99926     1.0029
MIXP           7   .18467E-04 .46336E-05 .18350E-04 .10186E-04 .16394E-04 .10010E-04
FG  (    3)    8   674.25     790.34     851.52     910.77     968.00     1024.4
MNFAN          9   .51633     .52257     .52519     .52590     .52620     .52928
MNPRI         10   .51816     .52278     .52156     .52531     .52723     .52514
PT7PAM        11   2.0071     2.2054     2.3123     2.4129     2.5113     2.6084
PT8PAM        12   2.0099     2.2061     2.3067     2.4122     2.5135     2.6013
TT7           13   517.43     522.09     519.08     524.00     521.16     525.95
TT8           14   520.34     524.31     521.70     525.63     523.34     527.14
TRAT          15   1.0056     1.0043     1.0050     1.0031     1.0042     1.0023
PAM           16   14.120     14.120     14.120     14.120     14.120     14.120
BPR           17   3.1036     3.1027     3.1266     3.1046     3.1096     3.1070


 E3 MIXER NO. 2 CONF 9 ,RUNS 104.4-105.5-106.4  COLD
CVMIX          1   .98896     .98928     .98982
CDMIX          2   .95483     .95669     .95822
PTMPA          3   2.3668     2.4636     2.5592
PTFPAM         4   2.3612     2.4578     2.5531
PTEPAM         5   2.3835     2.4808     2.5774
PRAT           6   .99066     .99073     .99055
MIXP           7   .40548E-05 .58434E-05 .95923E-06
FG  (    3)    8   903.15     960.95     1018.1
MNFAN          9   .52194     .52348     .52466
MNPRI         10   .53531     .53671     .53813
PT7PAM        11   2.3777     2.4751     2.5711
PT8PAM        12   2.4015     2.4996     2.5971
TT7           13   511.82     514.63     517.66
TT8           14   517.40     519.95     523.29
TRAT          15   1.0109     1.0103     1.0109
PAM           16   14.270     14.270     14.270
BPR           17   3.0093     3.0154     3.0162
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 E3 MIXER NO. 2 CONF 9 ,RUNS 107-112 HOT
CVMIX           1   .98677      .98668      .98549      .98539      .98441      .98379
CDMIX           2   .94692      .95467      .95794      .96034      .96154      .96402
PTMPA           3   2.0142      2.2046      2.2972      2.3681      2.4578      2.5438
PTFPAM          4   2.0831      2.2762      2.3702      2.4355      2.5281      2.6138
PTEPAM          5   1.8021      2.0035      2.1014      2.2054      2.2923      2.3926
PRAT            6   1.1559      1.1361      1.1279      1.1043      1.1028      1.0924
MIXP            7   .69631E-02 .93781E-02 .10679E-01 .12057E-01 .13063E-01 .14600E-01
FG  (    3)     8   679.18      791.33      846.27      888.54      940.64      992.15
MNFAN           9   .57308      .56727      .56453      .55466      .55379      .54965
MNPRI          10   .33899      .36655      .37732      .40385      .40545      .41758
PT7PAM         11   2.0999      2.2942      2.3889      2.4541      2.5473      2.6334
PT8PAM         12   1.8096      2.0132      2.1121      2.2182      2.3057      2.4075
TT7            13   516.68      520.76      517.79      523.03      521.07      525.02
TT8            14   1181.2      1217.7      1238.1      1250.7      1277.0      1317.3
TRAT           15   2.2862      2.3383      2.3911      2.3912      2.4507      2.5090
PAM            16   13.948      13.948      13.948      13.948      13.948      13.948
BPR            17   7.9525      7.3119      7.1451      6.5175      6.5803      6.3635

 E3 MIXER NO. 2 CONF 9 ,RUNS 110.2-111.2-112.2  HOT
CVMIX           1   .98512      .98511      .98389
CDMIX           2   .95892      .96176      .96364
PTMPA           3   2.3396      2.4303      2.5087
PTFPAM          4   2.4033      2.4944      2.5697
PTEPAM          5   2.1895      2.2903      2.3927
PRAT            6   1.0977      1.0891      1.0740
MIXP            7   .12314E-01 .13757E-01 .15430E-01
FG  (    3)     8   886.66      941.70      989.07
MNFAN           9   .55038      .54734      .54067
MNPRI          10   .40938      .41988      .43641
PT7PAM         11   2.4215      2.5130      2.5884
PT8PAM         12   2.2024      2.3046      2.4088
TT7            13   527.27      529.26      530.98
TT8            14   1260.8      1297.8      1332.1
TRAT           15   2.3911      2.4521      2.5087
PAM            16   14.198      14.198      14.198
BPR            17   6.4095      6.2660      5.9756

 E3 MIXER NO. 2 CONF 10,RUNS 113-118 COLD
CVMIX           1   .98718      .98807      .98819      .98875      .98829      .98813
CDMIX           2   .94370      .95031      .95276      .95425      .95535      .95517
PTMPA           3   1.9931      2.1879      2.2925      2.3903      2.4867      2.5856
PTFPAM          4   1.9944      2.1885      2.2926      2.3905      2.4890      2.5875
PTEPAM          5   1.9889      2.1856      2.2918      2.3894      2.4795      2.5796
PRAT            6   1.0028      1.0013      1.0004      1.0004      1.0038      1.0031
MIXP            7   .11894E-04 .80076E-05 .24000E-04 .17134E-04 .50418E-05 .10238E-04
FG  (    3)     8   677.38      792.70      854.49      911.90      968.47      1025.4
MNFAN           9   .51739      .52208      .52368      .52490      .52700      .52660
MNPRI          10   .51333      .52015      .52313      .52428      .52153      .52217
PT7PAM         11   2.0079      2.2036      2.3085      2.4071      2.5063      2.6056
PT8PAM         12   2.0037      2.2022      2.3092      2.4078      2.4986      2.5993
TT7            13   514.45      519.34      515.26      521.56      518.10      523.96
TT8            14   518.98      523.16      519.53      524.87      522.06      527.13
TRAT           15   1.0088      1.0074      1.0083      1.0063      1.0076      1.0060
PAM            16   14.204      14.204      14.204      14.204      14.204      14.204
BPR            17   3.0288      3.0182      3.0191      3.0096      3.0245      3.0323

 E3 MIXER NO. 2 CONF 10,RUNS 119-124 HOT
CVMIX           1   .98521      .98522      .98490      .98534      .98401      .98310
CDMIX           2   .94435      .95273      .95560      .95795      .95955      .96175
PTMPA           3   2.0135      2.1983      2.2909      2.3637      2.4554      2.5402
PTFPAM          4   2.0857      2.2731      2.3656      2.4351      2.5282      2.6123
PTEPAM          5   1.8026      1.9967      2.1023      2.1951      2.2924      2.3915
PRAT            6   1.1571      1.1384      1.1253      1.1093      1.1029      1.0923
MIXP            7   .72574E-02 .96603E-02 .11281E-01 .12364E-01 .13586E-01 .15195E-01
FG  (    3)     8   689.63      800.96      856.38      900.35      954.84      1006.2
MNFAN           9   .57383      .56836      .56278      .55600      .55317      .54840
MNPRI          10   .33815      .36428      .37947      .39748      .40478      .41641
PT7PAM         11   2.1020      2.2906      2.3835      2.4532      2.5468      2.6312
PT8PAM         12   1.8107      2.0070      2.1140      2.2083      2.3068      2.4075
TT7            13   529.84      534.16      532.13      535.74      534.11      537.37
TT8            14   1211.8      1249.9      1272.9      1286.4      1309.6      1351.7
TRAT           15   2.2872      2.3400      2.3920      2.4012      2.4519      2.5155
PAM            16   14.210      14.210      14.210      14.210      14.210      14.210
BPR            17   7.5644      7.0469      6.7466      6.3964      6.2768      6.1091
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 E3 MIXER NO. 2 CONF 11,RUNS 125-130 COLD
CVMIX           1   .98497      .98586      .98573      .98669      .98658      .98651
CDMIX           2   .94170      .94754      .95002      .95140      .95251      .95349
PTMPA           3   1.9953      2.1936      2.2913      2.3903      2.4892      2.5938
PTFPAM          4   1.9957      2.1947      2.2928      2.3909      2.4905      2.5956
PTEPAM          5   1.9940      2.1900      2.2866      2.3880      2.4853      2.5885
PRAT            6   1.0008      1.0021      1.0027      1.0012      1.0021      1.0027
MIXP            7   .16271E-04 .12342E-04 .86287E-05 .16159E-04 .15952E-04 .10477E-04
FG  (    3)     8   675.22      791.28      848.82      906.50      964.23      1025.3
MNFAN           9   .51311      .51820      .52036      .52090      .52209      .52311
MNPRI          10   .51197      .51508      .51639      .51911      .51908      .51915
PT7PAM         11   2.0089      2.2094      2.3083      2.4071      2.5074      2.6133
PT8PAM         12   2.0096      2.2073      2.3048      2.4071      2.5053      2.6091
TT7            13   511.87      518.23      513.65      520.23      515.79      522.72
TT8            14   515.97      521.58      517.48      523.09      519.72      525.25
TRAT           15   1.0080      1.0065      1.0075      1.0055      1.0076      1.0048
PAM            16   14.162      14.162      14.162      14.162      14.162      14.162
BPR            17   2.9308      2.9375      2.9382      2.9269      2.9324      2.9522

 E3 MIXER NO. 2 CONF 11,RUNS 131-136 HOT
CVMIX           1   .98473      .98427      .98418      .98411      .98330      .98332
CDMIX           2   .94276      .95110      .95407      .95508      .95808      .96141
PTMPA           3   2.0086      2.1977      2.2927      2.3647      2.4527      2.5382
PTFPAM          4   2.0813      2.2729      2.3704      2.4381      2.5251      2.6102
PTEPAM          5   1.8066      2.0054      2.1024      2.1967      2.2971      2.3977
PRAT            6   1.1521      1.1334      1.1275      1.1098      1.0993      1.0886
MIXP            7   .77069E-02 .10114E-01 .11459E-01 .12521E-01 .14011E-01 .15813E-01
FG  (    3)     8   683.62      796.77      853.46      895.49      948.89      1001.6
MNFAN           9   .56989      .56425      .56229      .55366      .54914      .54490
MNPRI          10   .34119      .36707      .37490      .39335      .40546      .41804
PT7PAM         11   2.0971      2.2898      2.3879      2.4557      2.5432      2.6286
PT8PAM         12   1.8155      2.0167      2.1148      2.2108      2.3124      2.4148
TT7            13   532.00      536.49      533.63      538.60      536.14      540.67
TT8            14   1215.2      1252.1      1276.1      1287.5      1314.9      1364.3
TRAT           15   2.2843      2.3338      2.3913      2.3904      2.4525      2.5234
PAM            16   14.167      14.167      14.167      14.167      14.167      14.167
BPR            17   7.1498      6.6528      6.5483      6.1568      6.0442      5.8632

 E3 MIXER NO. 5 CONF 13,RUNS 150-155 COLD
CVMIX           1   .99235      .99256      .99206      .99211      .99174      .99150
CDMIX           2   .94721      .95358      .95573      .95750      .95817      .95935
PTMPA           3   1.9743      2.1758      2.2734      2.3717      2.4702      2.5684
PTFPAM          4   1.9685      2.1711      2.2693      2.3662      2.4651      2.5634
PTEPAM          5   1.9906      2.1891      2.2848      2.3874      2.4849      2.5824
PRAT            6   .98890      .99180      .99322      .99110      .99203      .99264
MIXP            7   .10624E-04 .17412E-04 .81129E-05 .12743E-04 .20436E-05 .13222E-04
FG  (    3)     8   666.43      785.21      842.60      900.48      955.71      1015.5
MNFAN           9   .51429      .52040      .52263      .52328      .52421      .52533
MNPRI          10   .53027      .53216      .53233      .53602      .53563      .53585
PT7PAM         11   1.9822      2.1865      2.2855      2.3830      2.4828      2.5816
PT8PAM         12   2.0105      2.2112      2.3081      2.4120      2.5097      2.6092
TT7            13   507.00      510.26      509.01      513.21      524.13      517.17
TT8            14   514.54      518.24      517.21      520.82      529.49      525.60
TRAT           15   1.0149      1.0156      1.0161      1.0148      1.0102      1.0163
PAM            16   14.146      14.146      14.146      14.146      14.117      14.146
BPR            17   2.8417      2.8550      2.8585      2.8398      2.8831      2.8370

 E3 MIXER NO. 5 CONF 13,RUNS 156-161 HOT
CVMIX           1   .98774      .98575      .98550      .98467      .98345      .98291
CDMIX           2   .94381      .95397      .95819      .96123      .96446      .96789
PTMPA           3   1.9913      2.1790      2.2695      2.3450      2.4300      2.5170
PTFPAM          4   2.0594      2.2490      2.3411      2.4122      2.4958      2.5830
PTEPAM          5   1.7948      1.9973      2.0952      2.1972      2.2958      2.3961
PRAT            6   1.1474      1.1260      1.1173      1.0979      1.0871      1.0780
MIXP            7   .76753E-02 .10337E-01 .11730E-01 .13039E-01 .14200E-01 .15879E-01
FG  (    3)     8   668.78      781.58      836.38      882.05      933.79      987.28
MNFAN           9   .56721      .56183      .55974      .55202      .54829      .54520
MNPRI          10   .34560      .37662      .38893      .41147      .42454      .43574
PT7PAM         11   2.0762      2.2670      2.3596      2.4308      2.5148      2.6023
PT8PAM         12   1.8049      2.0107      2.1104      2.2150      2.3154      2.4179
TT7            13   532.70      535.87      533.98      537.68      535.88      539.22
TT8            14   1218.5      1258.1      1279.4      1292.7      1309.2      1353.6
TRAT           15   2.2874      2.3477      2.3960      2.4043      2.4430      2.5103
PAM            16   14.045      14.045      14.045      14.045      14.045      14.045
BPR            17   7.4232      6.7845      6.5377      6.0529      5.8906      5.7125
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 E3 MIXER NO. 5 CONF 14,RUNS 163-168 COLD
CVMIX            1   .98993      .99017      .99026      .99104      .99060      .99009
CDMIX            2   .97981      .98293      .98335      .98424      .98285      .98354
PTMPA            3   1.9796      2.1702      2.2698      2.3672      2.4670      2.5672
PTFPAM           4   1.9762      2.1661      2.2664      2.3625      2.4627      2.5618
PTEPAM           5   1.9895      2.1822      2.2795      2.3808      2.4794      2.5831
PRAT             6   .99333      .99261      .99429      .99231      .99326      .99175
MIXP             7   .16098E-04 .17823E-04 .17186E-04 .17177E-04 .25265E-04 .20951E-04
FG  (    3)      8   682.49      794.47      852.35      909.62      966.32      1025.5
MNFAN            9   .54244      .54483      .54576      .54583      .54501      .54505
MNPRI           10   .55173      .55504      .55364      .55646      .55434      .55646
PT7PAM          11   1.9915      2.1830      2.2841      2.3810      2.4821      2.5818
PT8PAM          12   2.0095      2.2045      2.3028      2.4053      2.5043      2.6097
TT7             13   524.53      526.21      527.89      529.88      533.54      531.91
TT8             14   536.95      537.67      539.00      541.61      544.79      545.48
TRAT            15   1.0237      1.0218      1.0210      1.0221      1.0211      1.0255
PAM             16   13.944      13.944      13.944      13.944      13.944      13.944
BPR             17   2.9869      2.9686      2.9709      2.9581      2.9995      2.9587


 E3 MIXER NO. 5 CONF 14,RUNS 169-174 HOT
CVMIX            1   .98699      .98589      .98640      .98562      .98563      .98509
CDMIX            2   .98551      .98991      .99135      .99117      .99291      .99328
PTMPA            3   1.9853      2.1754      2.2657      2.3367      2.4263      2.5160
PTFPAM           4   2.0528      2.2444      2.3355      2.4022      2.4912      2.5812
PTEPAM           5   1.7977      2.0036      2.0998      2.1962      2.2964      2.3982
PRAT             6   1.1419      1.1202      1.1122      1.0938      1.0848      1.0763
MIXP             7   .80661E-02 .10408E-01 .11610E-01 .12700E-01 .13790E-01 .15250E-01
FG  (    3)      8   690.44      803.90      857.71      899.01      953.15      1006.2
MNFAN            9   .59043      .58264      .57905      .57053      .56690      .56229
MNPRI           10   .39107      .41598      .42399      .44204      .45153      .45936
PT7PAM          11   2.0712      2.2639      2.3556      2.4223      2.5118      2.6021
PT8PAM          12   1.8097      2.0189      2.1163      2.2152      2.3169      2.4208
TT7             13   518.90      524.41      521.12      527.05      523.20      529.13
TT8             14   1189.8      1228.6      1248.2      1263.2      1277.4      1321.5
TRAT            15   2.2930      2.3428      2.3953      2.3968      2.4415      2.4974
PAM             16   13.958      13.958      13.958      13.958      13.958      13.958
BPR             17   7.1103      6.5627      6.4792      6.0365      5.9382      5.7724


 E3 MIXER NO. 6 CONF 15,RUNS 175-180 COLD
CVMIX            1   .99239      .99191      .99206      .99175      .99157      .99176
CDMIX            2   .94564      .95203      .95429      .95513      .95548      .95824
PTMPA            3   1.9760      2.1758      2.2723      2.3729      2.4657      2.5651
PTFPAM           4   1.9716      2.1721      2.2682      2.3664      2.4613      2.5600
PTEPAM           5   1.9880      2.1860      2.2837      2.3909      2.4782      2.5792
PRAT             6   .99176      .99365      .99322      .98975      .99319      .99254
MIXP             7   .12459E-04 .87201E-05 .14520E-04 .54317E-05 .84601E-05 .86806E-05
FG  (    3)      8   666.27      783.92      840.71      898.94      952.31      1012.5
MNFAN            9   .51400      .51979      .52143      .52084      .52241      .52433
MNPRI           10   .52598      .52891      .53117      .53553      .53218      .53510
PT7PAM          11   1.9857      2.1879      2.2847      2.3837      2.4795      2.5788
PT8PAM          12   2.0112      2.2119      2.3109      2.4198      2.5071      2.6106
TT7             13   508.12      509.68      512.36      514.50      518.23      516.90
TT8             14   514.21      515.13      517.53      519.31      524.70      522.00
TRAT            15   1.0120      1.0107      1.0101      1.0093      1.0125      1.0099
PAM             16   14.146      14.146      14.146      14.146      14.144      14.146
BPR             17   2.7892      2.7900      2.7886      2.7645      2.8319      2.7706


 E3 MIXER NO. 6 CONF 15,RUNS 181-186 HOT
CVMIX            1   .98761      .98675      .98605      .98553      .98463      .98452
CDMIX            2   .94124      .95167      .95437      .95745      .96217      .96475
PTMPA            3   1.9873      2.1745      2.2658      2.3366      2.4238      2.5107
PTFPAM           4   2.0563      2.2455      2.3373      2.4032      2.4921      2.5770
PTEPAM           5   1.7981      1.9984      2.0976      2.1961      2.2881      2.3928
PRAT             6   1.1436      1.1236      1.1143      1.0943      1.0892      1.0769
MIXP             7   .79721E-02 .10593E-01 .11908E-01 .13263E-01 .14559E-01 .16137E-01
FG  (    3)      8   661.09      772.95      826.46      869.11      922.97      975.08
MNFAN            9   .56502      .56026      .55651      .54841      .54807      .54286
MNPRI           10   .34900      .37827      .38938      .41234      .42067      .43432
PT7PAM          11   2.0733      2.2637      2.3561      2.4220      2.5115      2.5966
PT8PAM          12   1.8106      2.0146      2.1156      2.2172      2.3110      2.4184
TT7             13   515.48      521.56      517.79      523.91      520.45      526.17
TT8             14   1178.6      1223.6      1239.4      1258.2      1282.3      1324.3
TRAT            15   2.2864      2.3460      2.3936      2.4017      2.4639      2.5169
PAM             16   13.968      13.968      13.968      13.968      13.968      13.968
BPR             17   7.0009      6.4626      6.2923      5.8151      5.7518      5.5557
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 E3 MIXER NO. 6 CONF 16,RUNS 187-192 COLD
CVMIX          1   .99044      .99123      .99114      .99143      .99104      .99165
CDMIX          2   .94320      .94982      .95113      .95254      .95383      .95535
PTMPA          3   1.9871      2.1900      2.2896      2.3883      2.4856      2.5825
PTFPAM         4   1.9907      2.1938      2.2951      2.3942      2.4906      2.5884
PTEPAM         5   1.9773      2.1799      2.2750      2.3725      2.4720      2.5665
PRAT           6   1.0067      1.0064      1.0088      1.0091      1.0075      1.0085
MIXP           7   .11233E-04 .49219E-05 .91747E-05 .93973E-05 .85889E-05 .15021E-04
FG  (    3)    8   673.76      793.65      851.53      909.29      966.46      1023.9
MNFAN          9   .51795      .52301      .52501      .52625      .52665      .52824
MNPRI         10   .50812      .51375      .51229      .51308      .51578      .51603
PT7PAM        11   2.0044      2.2092      2.3112      2.4111      2.5083      2.6068
PT8PAM        12   2.0023      2.2078      2.3042      2.4027      2.5040      2.5998
TT7           13   530.63      533.45      531.91      535.57      533.23      537.33
TT8           14   532.47      535.03      533.34      536.74      534.65      538.49
TRAT          15   1.0035      1.0030      1.0027      1.0022      1.0027      1.0022
PAM           16   14.209      14.209      14.209      14.209      14.209      14.209
BPR           17   2.6882      2.6900      2.7002      2.7167      2.6901      2.6990


 E3 MIXER NO. 6 CONF 16,RUNS 193-198 HOT
CVMIX          1   .99014      .98851      .98814      .98763      .98685      .98568
CDMIX          2   .93964      .94912      .95174      .95402      .95772      .96076
PTMPA          3   2.0028      2.1935      2.2871      2.3605      2.4459      2.5364
PTFPAM         4   2.0769      2.2713      2.3661      2.4353      2.5197      2.6116
PTEPAM         5   1.7973      1.9964      2.0976      2.1951      2.2951      2.3921
PRAT           6   1.1556      1.1377      1.1280      1.1094      1.0978      1.0917
MIXP           7   .75002E-02 .10087E-01 .11573E-01 .12824E-01 .14386E-01 .15909E-01
FG  (    3)    8   677.62      792.15      847.53      891.42      943.90      999.14
MNFAN          9   .57134      .56677      .56269      .55431      .54989      .54762
MNPRI         10   .33691      .36321      .37452      .39503      .40887      .41646
PT7PAM        11   2.0941      2.2897      2.3851      2.4543      2.5390      2.6315
PT8PAM        12   1.8094      2.0121      2.1153      2.2156      2.3180      2.4168
TT7           13   531.91      537.72      534.16      539.88      536.23      542.42
TT8           14   1213.6      1257.9      1277.2      1292.4      1314.9      1365.8
TRAT          15   2.2817      2.3393      2.3911      2.3938      2.4521      2.5180
PAM           16   14.159      14.159      14.159      14.159      14.159      14.159
BPR           17   7.1627      6.6258      6.4081      5.9670      5.7759      5.7163

 E3 MIXER NO. 7 CONF 17,RUNS 199-204 COLD
CVMIX          1   .99194      .99283      .99195      .99152      .99184      .99164
CDMIX          2   .94914      .95666      .95748      .95847      .96012      .96084
PTMPA          3   1.9855      2.1872      2.2839      2.3841      2.4791      2.5825
PTFPAM         4   1.9839      2.1865      2.2844      2.3830      2.4773      2.5788
PTEPAM         5   1.9897      2.1890      2.2826      2.3870      2.4839      2.5923
PRAT           6   .99710      .99888      1.0008      .99834      .99736      .99480
MIXP           7   .10458E-04 .18365E-05 .65765E-05 .14181E-04 .37794E-05 .49790E-05
FG  (    3)    8   677.03      797.65      853.83      912.42      968.96      1029.7
MNFAN          9   .41301      .41796      .41931      .41871      .41917      .41838
MNPRI         10   .41813      .41993      .41792      .42162      .42380      .42751
PT7PAM        11   1.9969      2.2011      2.2997      2.3990      2.4940      2.5961
PT8PAM        12   2.0075      2.2088      2.3032      2.4088      2.5067      2.6165
TT7           13   506.15      508.70      511.29      513.74      516.63      519.12
TT8           14   510.74      512.96      515.25      517.10      519.32      521.14
TRAT          15   1.0091      1.0084      1.0077      1.0065      1.0052      1.0039
PAM           16   14.202      14.202      14.202      14.202      14.202      14.202
BPR           17   2.7390      2.7463      2.7610      2.7368      2.7358      2.7028


 E3 MIXER NO. 7 CONF 17,RUNS 205-210 HOT
CVMIX          1   .99134      .98802      .98784      .98668      .98502      .98381
CDMIX          2   .94548      .95495      .95829      .96088      .96407      .96839
PTMPA          3   2.0074      2.1959      2.2890      2.3637      2.4480      2.5321
PTFPAM         4   2.0709      2.2617      2.3564      2.4288      2.5120      2.5940
PTEPAM         5   1.8062      2.0084      2.1033      2.1973      2.2938      2.3960
PRAT           6   1.1465      1.1261      1.1203      1.1054      1.0951      1.0827
MIXP           7   .52699E-02 .90190E-02 .10449E-01 .11951E-01 .13830E-01 .15902E-01
FG  (    3)    8   689.26      803.97      860.49      906.11      958.17      1011.7
MNFAN          9   .49595      .48388      .48056      .47123      .46491      .45798
MNPRI         10   .21441      .24694      .25594      .27677      .29096      .30903
PT7PAM        11   2.0887      2.2804      2.3756      2.4479      2.5314      2.6135
PT8PAM        12   1.8123      2.0173      2.1132      2.2094      2.3076      2.4121
TT7           13   507.49      518.63      510.31      513.03      515.79      526.34
TT8           14   1158.0      1214.4      1222.5      1227.1      1265.3      1319.8
TRAT          15   2.2818      2.3416      2.3955      2.3918      2.4531      2.5076
PAM           16   14.253      14.252      14.253      14.253      14.253      14.253
BPR           17   8.8443      7.6283      7.4250      6.7291      6.4483      6.0611
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 E3 MIXER NO. 7 CONF 18,RUNS 212-217 COLD
CVMIX           1  .99201      .99201      .99210      .99194      .99151      .99222
CDMIX           2  .97128      .97605      .97710      .97759      .97705      .97946
PTMPA           3  1.9853      2.1880      2.2844      2.3800      2.4808      2.5811
PTFPAM          4  1.9842      2.1867      2.2824      2.3782      2.4796      2.5779
PTEPAM          5  1.9883      2.1916      2.2898      2.3852      2.4840      2.5901
PRAT            6  .99794      .99776      .99680      .99704      .99820      .99530
MIXP            7  .13736E-04 .14682E-04 .92376E-05 .39428E-05 .74159E-06 .12794E-04
FG  (    3)     8  693.16      814.83      872.16      928.80      987.63      1049.5
MNFAN           9  .42564      .42823      .42839      .42878      .42899      .42903
MNPRI          10  .42920      .43208      .43391      .43385      .43208      .43726
PT7PAM         11  1.9985      2.2025      2.2989      2.3953      2.4974      2.5966
PT8PAM         12  2.0055      2.2110      2.3102      2.4066      2.5065      2.6135
TT7            13  503.95      506.24      508.48      511.82      514.72      517.88
TT8            14  509.11      510.97      513.08      515.84      518.06      520.42
TRAT           15  1.0102      1.0093      1.0090      1.0079      1.0065      1.0049
PAM            16  14.211      14.211      14.211      14.211      14.211      14.211
BPR            17  2.8835      2.8657      2.8501      2.8423      2.8267      2.8285


 E3 MIXER NO. 7 CONF 18,RUNS 218-223 HOT
CVMIX           1  .99081      .98934      .98882      .98819      .98692      .98637
CDMIX           2  .97250      .97847      .97982      .98062      .98241      .98446
PTMPA           3  2.0052      2.1996      2.2896      2.3631      2.4488      2.5375
PTFPAM          4  2.0678      2.2641      2.3549      2.4253      2.5087      2.5968
PTEPAM          5  1.7966      2.0058      2.1034      2.1995      2.3028      2.4034
PRAT            6  1.1509      1.1287      1.1196      1.1027      1.0894      1.0805
MIXP            7  .54337E-02 .87514E-02 .10438E-01 .12060E-01 .13927E-01 .15766E-01
FG  (    3)     8  707.84      826.24      880.47      924.60      977.15      1032.0
MNFAN           9  .50640      .49284      .48690      .47614      .46786      .46255
MNPRI          10  .22524      .25735      .26946      .29137      .30855      .32063
PT7PAM         11  2.0874      2.2845      2.3757      2.4458      2.5293      2.6177
PT8PAM         12  1.8026      2.0144      2.1133      2.2115      2.3168      2.4192
TT7            13  514.50      519.79      516.86      522.72      519.70      525.59
TT8            14  1186.2      1218.2      1238.5      1253.6      1275.4      1324.4
TRAT           15  2.3055      2.3436      2.3963      2.3983      2.4541      2.5198
PAM            16  14.257      14.257      14.257      14.257      14.257      14.257
BPR            17  9.2807      8.0155      7.6369      6.9121      6.5372      6.3020


 E3 MIXER NO. 8 CONF 19,RUNS 224-229 COLD
CVMIX           1  .98991      .98979      .98990      .98922      .99069      .99016
CDMIX           2  .94297      .94984      .95149      .95313      .95329      .95635
PTMPA           3  1.9905      2.1840      2.2895      2.3872      2.4849      2.5805
PTFPAM          4  1.9892      2.1822      2.2872      2.3839      2.4817      2.5761
PTEPAM          5  1.9944      2.1894      2.2963      2.3971      2.4944      2.5935
PRAT            6  .99737      .99671      .99601      .99450      .99490      .99330
MIXP            7  .26039E-04 .17003E-04 .13194E-04 .69888E-05 .65792E-05 .11454E-04
FG  (    3)     8  675.06      789.70      851.18      908.26      964.80      1023.1
MNFAN           9  .50387      .50886      .50988      .51059      .51088      .51267
MNPRI          10  .50780      .51371      .51572      .51865      .51831      .52244
PT7PAM         11  2.0014      2.1958      2.3015      2.3989      2.4974      2.5925
PT8PAM         12  2.0077      2.2043      2.3121      2.4137      2.5114      2.6115
TT7            13  501.93      504.00      506.28      509.46      512.67      516.19
TT8            14  507.48      509.32      511.42      512.47      512.67      519.91
TRAT           15  1.0111      1.0106      1.0102      1.0059      1.0000      1.0072
PAM            16  14.195      14.195      14.195      14.190      14.195      14.195
BPR            17  2.9939      2.9877      2.9781      2.9596      2.9731      2.9669

 E3 MIXER NO. 8 CONF 19,RUNS 230-235 HOT
CVMIX           1  .98529      .98505      .98408      .98452      .98247      .98242
CDMIX           2  .94481      .95431      .95780      .95962      .96302      .96617
PTMPA           3  2.0075      2.2025      2.2895      2.3652      2.4497      2.5408
PTFPAM          4  2.0762      2.2732      2.3611      2.4334      2.5160      2.6097
PTEPAM          5  1.8014      2.0106      2.1012      2.2000      2.3026      2.3982
PRAT            6  1.1525      1.1306      1.1237      1.1061      1.0927      1.0882
MIXP            7  .73303E-02 .99106E-02 .11031E-01 .12188E-01 .13782E-01 .15256E-01
FG  (    3)     8  687.86      806.13      859.14      904.45      956.76      1013.1
MNFAN           9  .56232      .55594      .55362      .54595      .54058      .53955
MNPRI          10  .32779      .35935      .36866      .38895      .40499      .41167
PT7PAM         11  2.0913      2.2894      2.3779      2.4503      2.5332      2.6273
PT8PAM         12  1.8082      2.0197      2.1110      2.2114      2.3154      2.4124
TT7            13  524.57      530.10      526.65      531.73      528.82      533.54
TT8            14  1206.7      1241.9      1259.4      1271.3      1296.1      1342.3
TRAT           15  2.3003      2.3427      2.3913      2.3908      2.4510      2.5158
PAM            16  14.235      14.235      14.235      14.235      14.235      14.235
BPR            17  7.8082      7.0691      7.0025      6.4932      6.2654      6.1455
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 E3 MIXER NO. 1 CONF 21,RUNS 243-248 COLD
CVMIX           1   .97741      .97949      .98012      .98098      .98089      .98121
CDMIX           2   .94004      .94656      .94815      .95012      .95072      .95106
PTMPA           3   1.9884      2.1833      2.2862      2.3827      2.4799      2.5770
PTFPAM          4   1.9967      2.1937      2.2968      2.3942      2.4911      2.5887
PTEPAM          5   1.9683      2.1577      2.2604      2.3542      2.4525      2.5483
PRAT            6   1.0144      1.0167      1.0161      1.0170      1.0157      1.0158
MIXP            7  -.42996E-04-.62029E-04-.48468E-04-.54829E-04-.43010E-04-.44221E-04
FG  (    3)     8   675.71      791.12      851.27      908.37      964.98      1021.4
MNFAN           9   .40237      .40702      .40751      .40900      .40858      .40881
MNPRI          10   .37546      .37593      .37753      .37741      .37941      .37944
PT7PAM         11   2.0064      2.2046      2.3083      2.4063      2.5037      2.6017
PT8PAM         12   2.0043      2.1976      2.3027      2.3979      2.4988      2.5961
TT7            13   514.59      521.25      516.72      524.75      519.48      527.05
TT8            14   519.25      524.50      520.77      527.52      523.17      529.47
TRAT           15   1.0091      1.0062      1.0078      1.0053      1.0071      1.0046
PAM            16   14.279      14.279      14.279      14.279      14.279      14.279
BPR            17   2.5567      2.5691      2.5592      2.5765      2.5572      2.5615


 E3 MIXER NO. 1 CONF 21,RUNS 249-254 HOT
CVMIX           1   .98645      .98265      .97996      .97825      .97621      .97388
CDMIX           2   .95237      .96123      .96301      .96662      .96871      .97211
PTMPA           3   2.0206      2.2033      2.2936      2.3651      2.4544      2.5370
PTFPAM          4   2.0962      2.2806      2.3708      2.4396      2.5270      2.6095
PTEPAM          5   1.7954      1.9950      2.0953      2.1866      2.2887      2.3814
PRAT            6   1.1675      1.1432      1.1315      1.1157      1.1041      1.0958
MIXP            7   .34113E-02 .80220E-02 .10052E-01 .12064E-01 .13883E-01 .15954E-01
FG  (    3)     8   702.86      814.84      868.69      913.60      967.93      1020.0
MNFAN           9   .51114      .49328      .48420      .47305      .46426      .45893
MNPRI          10   .18561      .21885      .23311      .25411      .26824      .27983
PT7PAM         11   2.1111      2.2960      2.3864      2.4550      2.5426      2.6252
PT8PAM         12   1.8050      2.0095      2.1125      2.2077      2.3128      2.4088
TT7            13   524.84      530.14      527.36      532.57      530.36      534.33
TT8            14   1200.5      1244.3      1258.8      1278.2      1297.2      1344.2
TRAT           15   2.2874      2.3472      2.3870      2.4000      2.4460      2.5157
PAM            16   14.277      14.277      14.277      14.277      14.277      14.277
BPR            17   9.0787      7.6442      7.1473      6.4625      6.1661      5.9250


 E3 MIXER NO. 1 CONF 22,RUNS 255-260 COLD
CVMIX           1   .93767      .94598      .94768      .95082      .95196      .95396
CDMIX           2   .89110      .90081      .90178      .90399      .90397      .90505
PTMPA           3   1.9865      2.1840      2.2828      2.3806      2.4863      2.5830
PTFPAM          4   1.9937      2.1924      2.2916      2.3906      2.4954      2.5930
PTEPAM          5   1.9652      2.1592      2.2571      2.3512      2.4596      2.5535
PRAT            6   1.0145      1.0154      1.0153      1.0168      1.0146      1.0155
MIXP            7  -.54703E-04-.44165E-04-.46031E-04-.56115E-04-.40903E-04-.40381E-04
FG  (    3)     8   638.21      751.80      806.18      861.45      919.19      973.39
MNFAN           9   .37745      .38257      .38304      .38489      .38369      .38468
MNPRI          10   .34829      .35210      .35282      .35179      .35498      .35419
PT7PAM         11   2.0034      2.2034      2.3030      2.4026      2.5079      2.6061
PT8PAM         12   2.0083      2.2069      2.3079      2.4033      2.5149      2.6103
TT7            13   522.05      526.79      523.51      528.64      525.28      530.32
TT8            14   524.33      528.19      525.48      529.36      527.00      530.55
TRAT           15   1.0044      1.0027      1.0038      1.0014      1.0033      1.0004
PAM            16   14.251      14.251      14.251      14.251      14.251      14.251
BPR            17   3.0553      3.0883      3.0590      3.0956      3.0658      3.0893


 E3 MIXER NO. 1 CONF 22,RUNS 261-266 HOT
CVMIX           1   .97609      .96893      .96767      .96287      .96138      .95828
CDMIX           2   .93345      .93552      .93715      .93349      .93583      .93502
PTMPA           3   2.0227      2.2082      2.2977      2.3761      2.4623      2.5478
PTFPAM          4   2.0916      2.2787      2.3687      2.4404      2.5290      2.6136
PTEPAM          5   1.7939      1.9923      2.0869      2.1937      2.2823      2.3788
PRAT            6   1.1660      1.1438      1.1350      1.1125      1.1081      1.0987
MIXP            7   .22785E-02 .64096E-02 .82535E-02 .10542E-01 .11997E-01 .13988E-01
FG  (    3)     8   690.58      796.46      848.39      889.30      940.37      988.08
MNFAN           9   .50231      .48310      .47564      .45460      .45222      .44392
MNPRI          10   .16618      .19320      .20398      .22767      .23578      .24673
PT7PAM         11   2.1067      2.2942      2.3845      2.4559      2.5448      2.6295
PT8PAM         12   1.8071      2.0115      2.1088      2.2200      2.3124      2.4125
TT7            13   515.34      522.58      517.70      525.19      520.72      528.11
TT8            14   1175.5      1219.1      1236.5      1257.6      1273.6      1327.2
TRAT           15   2.2810      2.3328      2.3885      2.3945      2.4458      2.5132
PAM            16   14.288      14.288      14.288      14.288      14.288      14.288
BPR            17   10.457      8.9561      8.5772      7.7498      7.4127      7.1363
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 E3 MIXER NO. 3 CONF 23,RUNS 267-272 COLD
CVMIX           1   .98653     .98793     .98784     .98821     .98800     .98869
CDMIX           2   .94371     .95100     .95327     .95384     .95518     .95737
PTMPA           3   1.9903     2.1941     2.2927     2.3927     2.4895     2.5873
PTFPAM          4   1.9964     2.2017     2.2997     2.4001     2.4961     2.5949
PTEPAM          5   1.9696     2.1684     2.2687     2.3675     2.4668     2.5612
PRAT            6   1.0136     1.0153     1.0137     1.0138     1.0119     1.0132
MIXP            7   .65271E-05-.43058E-05 .85981E-06 .26845E-05 .98541E-05 .52409E-05
FG  (    3)     8   673.28     793.81     851.84     909.44     966.25     1024.8
MNFAN           9   .52127     .52759     .52881     .52929     .52971     .53191
MNPRI          10   .50144     .50548     .50907     .50952     .51267     .51306
PT7PAM         11   2.0106     2.2177     2.3166     2.4177     2.5145     2.6141
PT8PAM         12   1.9986     2.2007     2.3025     2.4028     2.5039     2.6000
TT7            13   520.63     525.55     522.45     527.58     524.31     529.92
TT8            14   527.17     531.50     528.82     533.52     531.56     537.39
TRAT           15   1.0126     1.0113     1.0122     1.0113     1.0138     1.0141
PAM            16   14.150     14.150     14.150     14.150     14.150     14.150
BPR            17   3.4924     3.5062     3.5108     3.5082     3.5003     3.4997


 E3 MIXER NO. 3 CONF 23,RUNS 273-278 HOT
CVMIX           1   .98745     .98684     .98551     .98486     .98394     .98248
CDMIX           2   .94832     .95598     .95804     .96032     .96266     .96512
PTMPA           3   2.0205     2.2081     2.3014     2.3739     2.4647     2.5482
PTFPAM          4   2.0865     2.2780     2.3722     2.4427     2.5340     2.6184
PTEPAM          5   1.7931     1.9869     2.0896     2.1814     2.2814     2.3771
PRAT            6   1.1636     1.1466     1.1352     1.1198     1.1107     1.1015
MIXP            7   .59396E-02 .82606E-02 .96772E-02 .10808E-01 .12029E-01 .13637E-01
FG  (    3)     8   694.04     806.47     861.58     905.29     960.00     1010.9
MNFAN           9   .57564     .57140     .56668     .56060     .55713     .55376
MNPRI          10   .32841     .35396     .36733     .38568     .39681     .40805
PT7PAM         11   2.1040     2.2968     2.3914     2.4620     2.5539     2.6386
PT8PAM         12   1.8073     2.0051     2.1103     2.2050     2.3074     2.4062
TT7            13   514.19     522.66     517.19     525.43     520.09     528.45
TT8            14   1169.0     1218.7     1233.2     1258.8     1272.9     1327.4
TRAT           15   2.2735     2.3317     2.3845     2.3958     2.4475     2.5119
PAM            16   14.159     14.159     14.159     14.159     14.159     14.159
BPR            17   8.9278     8.2697     7.9434     7.4913     7.3087     7.0508


 E3 MIXER NO. 3 CONF 24,RUNS 279-284 COLD
CVMIX           1   .97589     .97783     .97871     .97901     .98004     .98039
CDMIX           2   .93110     .93725     .93931     .94081     .94210     .94410
PTMPA           3   1.9901     2.1889     2.2868     2.3861     2.4841     2.5887
PTFPAM          4   1.9979     2.1991     2.2963     2.3969     2.4947     2.5989
PTEPAM          5   1.9624     2.1526     2.2533     2.3479     2.4463     2.5522
PRAT            6   1.0181     1.0216     1.0191     1.0209     1.0198     1.0183
MIXP            7  -.25462E-04-.35848E-04-.13192E-04-.23321E-04-.18576E-04-.12359E-04
FG  (    3)     8   661.59     776.38     832.82     889.85     946.27     1007.5
MNFAN           9   .51293     .51886     .51956     .52137     .52196     .52301
MNPRI          10   .48603     .48700     .49156     .49067     .49298     .49632
PT7PAM         11   2.0121     2.2150     2.3129     2.4143     2.5129     2.6179
PT8PAM         12   2.0043     2.1987     2.3022     2.3987     2.4995     2.6080
TT7            13   510.80     517.21     512.85     519.97     514.94     522.98
TT8            14   517.72     523.63     519.36     525.86     521.61     528.94
TRAT           15   1.0135     1.0124     1.0127     1.0113     1.0130     1.0114
PAM            16   14.095     14.095     14.095     14.095     14.095     14.095
BPR            17   3.6830     3.7170     3.6885     3.7063     3.7034     3.6924


 E3 MIXER NO. 3 CONF 24,RUNS 285-290 HOT
CVMIX           1   .98249     .98143     .98091     .98013     .97907     .97666
CDMIX           2   .94148     .94770     .95052     .95153     .95248     .95400
PTMPA           3   2.0263     2.2158     2.3055     2.3783     2.4657     2.5494
PTFPAM          4   2.0930     2.2859     2.3780     2.4481     2.5349     2.6183
PTEPAM          5   1.7871     1.9839     2.0736     2.1703     2.2701     2.3717
PRAT            6   1.1712     1.1522     1.1468     1.1280     1.1166     1.1040
MIXP            7   .55464E-02 .78727E-02 .90104E-02 .10264E-01 .11399E-01 .13255E-01
FG  (    3)     8   690.11     801.29     854.45     896.72     947.40     996.82
MNFAN           9   .57502     .56852     .56700     .55828     .55295     .54698
MNPRI          10   .31248     .33881     .34675     .36792     .38057     .39469
PT7PAM         11   2.1105     2.3046     2.3974     2.4676     2.5547     2.6383
PT8PAM         12   1.8073     2.0099     2.1020     2.2033     2.3068     2.4130
TT7            13   526.05     530.65     528.17     533.04     530.71     535.06
TT8            14   1200.9     1238.7     1261.9     1276.7     1289.7     1342.5
TRAT           15   2.2828     2.3344     2.3893     2.3951     2.4301     2.5090
PAM            16   14.115     14.115     14.115     14.115     14.115     14.115
BPR            17   9.4637     8.7140     8.5765     7.9619     7.6840     7.3908
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 E3 MIXER NO. 2 CONF 25,RUNS 291-296 COLD
CVMIX           1   .98372      .98540      .98540      .98639      .98574      .98582
CDMIX           2   .93914      .94585      .94802      .94946      .95028      .95056
PTMPA           3   1.9882      2.1865      2.2816      2.3784      2.4824      2.5788
PTFPAM          4   1.9887      2.1869      2.2820      2.3784      2.4832      2.5797
PTEPAM          5   1.9868      2.1851      2.2803      2.3780      2.4800      2.5758
PRAT            6   1.0009      1.0008      1.0007      1.0002      1.0013      1.0015
MIXP            7   .21534E-04 .19871E-04 .11705E-04 .15787E-04 .95293E-05 .16356E-04
FG  (    3)     8   680.24      798.61      855.16      912.40      973.55      1029.9
MNFAN           9   .51118      .51641      .51805      .51898      .52003      .52034
MNPRI          10   .50981      .51508      .51694      .51870      .51812      .51814
PT7PAM         11   2.0040      2.2042      2.3000      2.3973      2.5030      2.6002
PT8PAM         12   2.0019      2.2021      2.2980      2.3966      2.4995      2.5961
TT7            13   512.76      518.86      514.41      520.90      516.28      523.25
TT8            14   517.38      522.68      518.50      524.42      520.53      526.89
TRAT           15   1.0090      1.0074      1.0080      1.0068      1.0082      1.0070
PAM            16   14.391      14.391      14.391      14.391      14.391      14.391
BPR            17   2.9594      2.9564      2.9663      2.9537      2.9556      2.9536
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 E3 MIXER NO. 2 CONF 25,RUNS 297-302 HOT
CVMIX           1   .98503      .98407      .98434      .98317      .98291      .98300
CDMIX           2   .94323      .95135      .95476      .95725      .95877      .96324
PTMPA           3   2.0026      2.1874      2.2812      2.3579      2.4392      2.5253
PTFPAM          4   2.0764      2.2634      2.3565      2.4299      2.5100      2.5955
PTEPAM          5   1.7954      1.9928      2.0911      2.1959      2.2886      2.3884
PRAT            6   1.1565      1.1358      1.1279      1.1065      1.0967      1.0867
MIXP            7   .73108E-02 .99143E-02 .11322E-01 .12785E-01 .13941E-01 .15647E-01
FG  (    3)     8   691.90      804.25      861.56      908.43      957.50      1012.6
MNFAN           9   .57279      .56593      .56294      .55326      .54849      .54524
MNPRI          10   .33718      .36504      .37482      .39821      .40846      .42135
PT7PAM         11   2.0950      2.2832      2.3790      2.4505      2.5311      2.6172
PT8PAM         12   1.8040      2.0040      2.1033      2.2103      2.3040      2.4054
TT7            13   508.16      516.13      511.17      520.11      513.83      523.64
TT8            14   1163.3      1207.9      1227.4      1253.4      1261.9      1322.0
TRAT           15   2.2892      2.3402      2.4011      2.4098      2.4560      2.5246
PAM            16   14.401      14.401      14.401      14.401      14.401      14.401
BPR            17   7.2580      6.6671      6.5794      6.1025      6.0024      5.8736
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 E3 MIXER NO. 2 CONF 26,RUNS 303-308 COLD
CVMIX           1   .98473      .98571      .98585      .98618      .98612      .98712
CDMIX           2   .94114      .94732      .95010      .95067      .95284      .95274
PTMPA           3   1.9881      2.1892      2.2832      2.3824      2.4825      2.5795
PTFPAM          4   1.9890      2.1895      2.2838      2.3824      2.4823      2.5808
PTEPAM          5   1.9850      2.1881      2.2811      2.3824      2.4830      2.5755
PRAT            6   1.0020      1.0007      1.0012      1.0000      .99972      1.0021
MIXP            7   .25793E-04 .22852E-04 .19069E-04 .22928E-04 .26013E-04 .30975E-04
FG  (    3)     8   681.50      801.25      857.81      915.76      976.06      1032.5
MNFAN           9   .52394      .52846      .53092      .53096      .53264      .53342
MNPRI          10   .52107      .52753      .52926      .53098      .53307      .53051
PT7PAM         11   2.0043      2.2065      2.3018      2.4011      2.5019      2.6013
PT8PAM         12   2.0008      2.2059      2.2997      2.4018      2.5033      2.5964
TT7            13   524.84      530.23      526.57      532.66      529.04      536.01
TT8            14   538.01      543.85      539.14      546.62      543.38      552.95
TRAT           15   1.0251      1.0257      1.0239      1.0262      1.0271      1.0316
PAM            16   14.389      14.389      14.389      14.389      14.389      14.389
BPR            17   2.9263      2.9127      2.9255      2.9204      2.9241      2.9466
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 E3 MIXER NO. 2 CONF 26,RUNS 309-314 HOT
CVMIX           1   .98460      .98394      .98355      .98373      .98316      .98290
CDMIX           2   .94258      .95187      .95437      .95626      .95937      .96257
PTMPA           3   2.0009      2.1860      2.2805      2.3560      2.4372      2.5276
PTFPAM          4   2.0779      2.2655      2.3620      2.4307      2.5109      2.6013
PTEPAM          5   1.7918      1.9878      2.0848      2.1906      2.2869      2.3889
PRAT            6   1.1597      1.1397      1.1330      1.1096      1.0980      1.0889
MIXP            7   .75554E-02 .10012E-01 .11481E-01 .12741E-01 .14275E-01 .15852E-01
FG  (    3)     8   690.25      803.68      860.54      906.14      956.61      1013.0
MNFAN           9   .58304      .57761      .57463      .56353      .55896      .55544
MNPRI          10   .34837      .37599      .38347      .40740      .42068      .43116
PT7PAM         11   2.0961      2.2850      2.3823      2.4510      2.5316      2.6226
PT8PAM         12   1.8009      1.9996      2.0975      2.2052      2.3031      2.4066
TT7            13   525.64      528.97      527.52      531.62      529.72      533.81
TT8            14   1204.1      1236.2      1268.0      1278.2      1303.8      1349.3
TRAT           15   2.2906      2.3370      2.4037      2.4043      2.4612      2.5277
PAM            16   14.398      14.398      14.398      14.398      14.398      14.398
BPR            17   7.0333      6.5050      6.4589      6.0321      5.8383      5.7474
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 E3 MIXER NO. 3 CONF 27,RUNS 315-320 COLD
CVMIX           1   .98838      .98936      .98926      .98953      .99029      .98960
CDMIX           2   .94553      .95197      .95372      .95513      .95719      .95675
PTMPA           3   2.0001      2.1987      2.2963      2.3965      2.4996      2.5988
PTFPAM          4   2.0031      2.2025      2.2998      2.3999      2.5028      2.6029
PTEPAM          5   1.9897      2.1856      2.2842      2.3850      2.4886      2.5846
PRAT            6   1.0067      1.0077      1.0068      1.0062      1.0057      1.0071
MIXP            7   .26883E-04 .22016E-04 .23684E-04 .22965E-04 .23274E-04 .20101E-04
FG  (    3)     8   681.12      798.44      855.58      914.26      975.55      1032.4
MNFAN           9   .52037      .52578      .52685      .52778      .52924      .52936
MNPRI          10   .51049      .51465      .51709      .51887      .52113      .51922
PT7PAM         11   2.0174      2.2185      2.3165      2.4174      2.5212      2.6221
PT8PAM         12   2.0047      2.2022      2.3017      2.4033      2.5078      2.6044
TT7            13   532.75      536.09      534.42      537.50      535.83      539.00
TT8            14   544.84      548.92      547.48      551.06      552.56      556.52
TRAT           15   1.0227      1.0239      1.0244      1.0252      1.0312      1.0325
PAM            16   14.172      14.172      14.172      14.172      14.172      14.172
BPR            17   3.4584      3.4653      3.4646      3.4639      3.4741      3.4844
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 E3 MIXER NO. 3 CONF 27,RUNS 315.2-318.1-320.1  COLD
CVMIX           1   .98944      .99020      .99109
CDMIX           2   .94712      .95732      .95852
PTMPA           3   1.9995      2.3948      2.5944
PTFPAM          4   2.0022      2.3973      2.5967
PTEPAM          5   1.9903      2.3860      2.5863
PRAT            6   1.0060      1.0047      1.0040
MIXP            7   .20618E-04 .12174E-04 .27913E-04
FG  (    3)     8   686.77      922.47      1040.8
MNFAN           9   .52132      .52902      .52975
MNPRI          10   .51267      .52227      .52404
PT7PAM         11   2.0165      2.4149      2.6159
PT8PAM         12   2.0053      2.4044      2.6061
TT7            13   519.30      520.10      540.23
TT8            14   525.49      527.90      560.04
TRAT           15   1.0119      1.0150      1.0367
PAM            16   14.272      14.282      14.297
BPR            17   3.4384      3.4451      3.4940
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 E3 MIXER NO. 3 CONF 27,RUNS 318.2-319.4-320.2  COLD
CVMIX           1   .99084      .99068      .99056
CDMIX           2   .95660      .95823      .95893
PTMPA           3   2.3977      2.4929      2.5934
PTFPAM          4   2.4004      2.4956      2.5964
PTEPAM          5   2.3885      2.4838      2.5829
PRAT            6   1.0050      1.0047      1.0052
MIXP            7   .11111E-04 .14205E-04 .19974E-04
FG  (    3)     8   922.83      979.68      1038.9
MNFAN           9   .52854      .52976      .53051
MNPRI          10   .52140      .52298      .52303
PT7PAM         11   2.4180      2.5140      2.6156
PT8PAM         12   2.4068      2.5028      2.6030
TT7            13   526.43      523.16      528.95
TT8            14   532.08      529.15      535.32
TRAT           15   1.0107      1.0114      1.0120
PAM            16   14.272      14.272      14.272
BPR            17   3.4437      3.4528      3.4320
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 E3 MIXER NO. 3 CONF 27,RUNS 321-326 HOT
CVMIX           1   .98739      .98607      .98573      .98554      .98339      .98234
CDMIX           2   .94623      .95490      .95760      .96010      .96255      .96543
PTMPA           3   2.0228      2.2121      2.3093      2.3758      2.4679      2.5516
PTFPAM          4   2.0886      2.2815      2.3810      2.4431      2.5371      2.6208
PTEPAM          5   1.7995      1.9988      2.0967      2.1928      2.2896      2.3881
PRAT            6   1.1607      1.1414      1.1356      1.1142      1.1081      1.0974
MIXP            7   .63577E-02 .87901E-02 .99332E-02 .11174E-01 .12520E-01 .14015E-01
FG  (    3)     8   694.33      808.41      866.36      906.85      962.39      1013.9
MNFAN           9   .57282      .56824      .56645      .55777      .55571      .55189
MNPRI          10   .32958      .35865      .36663      .39169      .39948      .41258
PT7PAM         11   2.1059      2.2999      2.4001      2.4622      2.5568      2.6408
PT8PAM         12   1.8073      2.0092      2.1080      2.2061      2.3042      2.4044
TT7            13   532.37      535.48      534.03      536.99      535.82      538.59
TT8            14   1216.3      1253.5      1277.8      1285.7      1318.4      1356.2
TRAT           15   2.2847      2.3408      2.3927      2.3943      2.4605      2.5180
PAM            16   14.170      14.170      14.170      14.170      14.170      14.170
BPR            17   8.8300      8.0538      7.9427      7.3106      7.1966      6.9474
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 E3 MIXER NO. 3 CONF 27,RUNS 321.1-324.1-326.1  HOT
CVMIX           1   .98809      .98670      .98470
CDMIX           2   .94836      .96178      .96651
PTMPA           3   2.0215      2.3789      2.5463
PTFPAM          4   2.0877      2.4462      2.6120
PTEPAM          5   1.7909      2.1914      2.3895
PRAT            6   1.1657      1.1163      1.0931
MIXP            7   .61029E-02 .10975E-01 .13547E-01
FG  (    3)     8   701.63      918.85      1021.5
MNFAN           9   .57617      .55957      .55094
MNPRI          10   .32551      .39056      .41840
PT7PAM         11   2.1053      2.4657      2.6321
PT8PAM         12   1.7983      2.2043      2.4056
TT7            13   538.74      537.73      541.49
TT8            14   1234.5      1287.5      1343.3
TRAT           15   2.2915      2.3943      2.4808
PAM            16   14.302      14.304      14.304
BPR            17   9.1467      7.4792      6.9285

 E3 MIXER NO. 3 CONF 27,RUNS 324.2-325.2-326.2  HOT
CVMIX           1   .98636      .98541      .98386
CDMIX           2   .96117      .96373      .96628
PTMPA           3   2.3757      2.4621      2.5506
PTFPAM          4   2.4435      2.5287      2.6188
PTEPAM          5   2.1845      2.2895      2.3862
PRAT            6   1.1185      1.1045      1.0975
MIXP            7   .10807E-01 .12405E-01 .13777E-01
FG  (    3)     8   913.50      966.27      1020.6
MNFAN           9   .56021      .55462      .55236
MNPRI          10   .38767      .40393      .41304
PT7PAM         11   2.4630      2.5486      2.6390
PT8PAM         12   2.1972      2.3038      2.4020
TT7            13   532.14      528.22      535.70
TT8            14   1273.7      1297.5      1346.6
TRAT           15   2.3935      2.4563      2.5137
PAM            16   14.259      14.259      14.259
BPR            17   7.5435      7.2411      7.0580

 E3 MIXER NO. 6 CONF 28,RUNS 327-329 COLD
CVMIX           1   .98935      .98935      .98912
CDMIX           2   .98107      .98156      .98178
PTMPA           3   2.3898      2.4964      2.5948
PTFPAM          4   2.3952      2.5023      2.6011
PTEPAM          5   2.3745      2.4797      2.5770
PRAT            6   1.0087      1.0091      1.0094
MIXP            7   .94048E-05 .10520E-04 .60090E-05
FG  (    3)     8   934.52      997.90      1056.4
MNFAN           9   .54903      .54961      .54990
MNPRI          10   .53695      .53692      .53689
PT7PAM         11   2.4141      2.5221      2.6216
PT8PAM         12   2.4042      2.5108      2.6096
TT7            13   524.49      527.05      529.48
TT8            14   526.56      528.42      530.34
TRAT           15   1.0039      1.0026      1.0016
PAM            16   14.167      14.167      14.167
BPR            17   2.8533      2.8545      2.8373

 E3 MIXER NO. 6 CONF 28,RUNS 327.1-328.1-329.1 COLD
CVMIX           1   .98960      .98951      .98985
CDMIX           2   .98209      .98178      .98261
PTMPA           3   2.3929      2.4885      2.5852
PTFPAM          4   2.3986      2.4950      2.5928
PTEPAM          5   2.3765      2.4698      2.5635
PRAT            6   1.0093      1.0102      1.0114
MIXP            7   .24502E-04 .19225E-04 .15404E-04
FG  (    3)     8   946.57      1003.2      1061.9
MNFAN           9   .55008      .55018      .55131
MNPRI          10   .53723      .53598      .53554
PT7PAM         11   2.4177      2.5149      2.6134
PT8PAM         12   2.4058      2.5002      2.5952
TT7            13   532.17      534.24      535.87
TT8            14   543.08      546.85      552.63
TRAT           15   1.0205      1.0236      1.0313
PAM            16   14.307      14.307      14.307
BPR            17   2.9047      2.9166      2.9241
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 E3 MIXER NO. 6 CONF 28,RUNS 330-332 HOT
CVMIX           1  .98600     .98635     .98624
CDMIX           2  .98315     .98578     .99036
PTMPA           3  2.3629     2.4487     2.5293
PTFPAM          4  2.4436     2.5312     2.6106
PTEPAM          5  2.1859     2.2759     2.3754
PRAT            6  1.1179     1.1121     1.0990
MIXP            7  .12497E-01 .13757E-01 .15679E-01
FG  (    3)     8  921.10     974.32     1026.9
MNFAN           9  .57799     .57590     .57117
MNPRI          10  .41361     .42037     .43548
PT7PAM         11  2.4640     2.5522     2.6319
PT8PAM         12  2.2080     2.2997     2.4019
TT7            13  530.58     532.47     534.03
TT8            14  1272.9     1307.7     1352.4
TRAT           15  2.3991     2.4559     2.5324
PAM            16  14.176     14.176     14.176
BPR            17  5.9696     5.9155     5.7283
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 E3 MIXER NO. 6 CONF 28,RUNS 330.1-331.1-332.1 HOT
CVMIX           1  .98780     .98713     .98694
CDMIX           2  .98694     .98795     .99096
PTMPA           3  2.3606     2.4435     2.5266
PTFPAM          4  2.4403     2.5224     2.6045
PTEPAM          5  2.1836     2.2802     2.3801
PRAT            6  1.1175     1.1062     1.0943
MIXP            7  .12315E-01 .13880E-01 .15504E-01
FG  (    3)     8  932.35     982.93     1035.9
MNFAN           9  .58012     .57411     .56941
MNPRI          10  .41712     .42746     .44051
PT7PAM         11  2.4611     2.5435     2.6259
PT8PAM         12  2.2054     2.3039     2.4066
TT7            13  527.85     530.64     533.35
TT8            14  1265.1     1304.6     1342.2
TRAT           15  2.3967     2.4584     2.5165
PAM            16  14.315     14.315     14.315
BPR            17  6.0423     5.9096     5.7038
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     E3 MIXER NO. 6 CONF 29,RUNS 333-338,COLD
CVMIX           1  .99000     .99246     .99262     .99192     .99267     .99224
CDMIX           2  .94227     .94644     .94795     .94944     .95304     .95225
PTMPA           3  1.9965     2.1900     2.2944     2.3949     2.4866     2.5867
PTFPAM          4  1.9970     2.1932     2.2969     2.3978     2.4895     2.5898
PTEPAM          5  1.9947     2.1805     2.2867     2.3862     2.4778     2.5774
PRAT            6  1.0012     1.0058     1.0044     1.0048     1.0047     1.0048
MIXP            7  .16120E-04 .16287E-04 .13415E-04 .74766E-05 .22132E-04 .15677E-04
FG  (    3)     8  681.54     794.48     855.33     914.32     970.74     1027.8
MNFAN           9  .48512     .48989     .49041     .49163     .49412     .49362
MNPRI          10  .48331     .48094     .48361     .48423     .48698     .48629
PT7PAM         11  2.0091     2.2067     2.3110     2.4126     2.5051     2.6060
PT8PAM         12  2.0091     2.1961     2.3033     2.4035     2.4960     2.5961
TT7            13  516.77     521.56     518.68     524.35     520.37     527.36
TT8            14  523.80     528.30     525.54     530.89     528.37     535.06
TRAT           15  1.0136     1.0129     1.0132     1.0125     1.0154     1.0146
PAM            16  14.275     14.275     14.275     14.275     14.275     14.275
BFR            17  2.9717     3.0072     2.9928     3.0026     3.0058     3.0080
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     E3 MIXER NO. 6 CONF 29,RUNS 339-344,HOT
CVMIX           1  .98992     .99025     .98862     .98904     .98685     .98562
CDMIX           2  .94061     .94960     .95191     .95187     .95591     .95691
PTMPA           3  2.0116     2.2072     2.2942     2.3689     2.4539     2.5456
PTFPAM          4  2.0834     2.2821     2.3706     2.4414     2.5251     2.6174
PTEPAM          5  1.7940     1.9998     2.0906     2.1879     2.2880     2.3897
PRAT            6  1.1614     1.1412     1.1339     1.1159     1.1036     1.0953
MIXP            7  .64812E-02 .93142E-02 .10720E-01 .12024E-01 .13632E-01 .15256E-01
FG  (    3)     8  688.74     806.74     858.54     901.39     954.36     1008.5
MNFAN           9  .55249     .54486     .54133     .53093     .52576     .52106
MNPRI          10  .29204     .32134     .33038     .34941     .36511     .37423
PT7PAM         11  2.0985     2.2982     2.3872     2.4580     2.5420     2.6345
PT8PAM         12  1.8007     2.0088     2.1006     2.1994     2.3010     2.4040
TT7            13  523.43     528.45     526.03     530.77     528.37     533.82
TT8            14  1199.1     1237.3     1261.1     1273.5     1297.2     1343.5
TRAT           15  2.2908     2.3415     2.3974     2.3994     2.4550     2.5168
PAM            16  14.272     14.272     14.272     14.272     14.272     14.272
BFR            17  8.0429     7.2805     7.1168     6.6329     6.3831     6.2135
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 E3 MIXER NO. 5 CONF 30,RUNS 345-347 COLD
CVMIX             1   .99112      .99123      .99097
CDMIX             2   .95387      .95538      .95540
PTMPA             3   2.3892      2.4866      2.5917
PTFPAM            4   2.3952      2.4926      2.6006
PTEPAM            5   2.3730      2.4706      2.5679
PRAT              6   1.0094      1.0089      1.0127
MIXP              7   .53775E-05 .12139E-04 .19752E-04
FG  (    3)       8   908.01      965.41      1025.9
MNFAN             9   .52735      .52840      .52998
MNPRI            10   .51402      .51565      .51171
PT7PAM           11   2.4114      2.5095      2.6183
PT8PAM           12   2.4001      2.4989      2.5971
TT7              13   528.47      531.51      534.86
TT8              14   540.31      543.75      550.24
TRAT             15   1.0224      1.0230      1.0288
PAM              16   14.162      14.162      14.162
BPR              17   2.7245      2.7263      2.7545
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 E3 MIXER NO. 5 CONF 30,RUNS 348-350 HOT
CVMIX             1   .98617      .98569      .98424
CDMIX             2   .95771      .96007      .96373
PTMPA             3   2.3578      2.4460      2.5313
PTFPAM            4   2.4376      2.5282      2.6141
PTEPAM            5   2.1867      2.2770      2.3760
PRAT              6   1.1148      1.1103      1.1002
MIXP              7   .12874E-01 .14152E-01 .15999E-01
FG  (    3)       8   893.38      946.34      999.39
MNFAN             9   .56059      .55889      .55497
MNPRI            10   .39460      .40004      .41217
PT7PAM           11   2.4555      2.5466      2.6328
PT8PAM           12   2.2062      2.2980      2.3997
TT7              13   530.27      533.48      535.02
TT8              14   1270.2      1308.1      1348.1
TRAT             15   2.3954      2.4520      2.5196
PAM              16   14.160      14.160      14.160
BFR              17   5.7661      5.7223      5.5120
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     E3 MIXER NO. 1 CONF 1 ,RUNS 1-5,COLD
CVMIX             1   .99347      .99267      .99375      .99317      .99316
CDMIX             2   .96594      .96793      .96927      .97112      .97062
PTMPA             3   2.1803      2.2691      2.3907      2.4818      2.5787
PTFPAM            4   2.1749      2.2629      2.3878      2.4779      2.5758
PTEPAM            5   2.1926      2.2834      2.3975      2.4907      2.5855
PRAT              6   .99193      .99103      .99595      .99485      .99622
MIXP              7  -.10941E-04-.91203E-05-.15771E-05-.34735E-05 .10558E-04
FG  (    3)       8   803.35      856.61      928.80      984.01      1040.5
MNFAN             9   .40339      .40400      .40731      .40773      .40817
MNPRI            10   .41796      .42012      .41459      .41686      .41493
PT7PAM           11   2.1855      2.2740      2.3997      2.4903      2.5887
PT8PAM           12   2.2087      2.3000      2.4145      2.5086      2.6041
TT7              13   520.24      517.27      522.44      519.72      523.95
TT8              14   521.13      518.59      522.43      520.50      522.79
TRAT             15   1.0017      1.0026      .99998      1.0015      .99779
PAM              16   14.239      14.239      14.239      14.239      14.239
BPR              17   2.2627      2.2759      2.3229      2.3139      2.3090
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     E3 MIXER NO. 1 CONF 1 ,RUNS 77-79,COLD
CVMIX             1   .99410      .99407      .99447
CDMIX             2   .96906      .97018      .97167
PTMPA             3   2.3857      2.4760      2.5699
PTFPAM            4   2.3851      2.4757      2.5684
PTEPAM            5   2.3871      2.4768      2.5734
PRAT              6   .99914      .99954      .99805
MIXP              7   .99988E-05 .77073E-05 .79904E-05
FG  (    3)       8   927.85      981.97      1038.8
MNFAN             9   .40888      .40969      .40968
MNPRI            10   .41043      .41051      .41316
PT7PAM           11   2.3970      2.4881      2.5813
PT8PAM           12   2.4040      2.4944      2.5918
TT7              13   510.19      513.54      517.43
TT8              14   512.99      515.78      518.86
TRAT             15   1.0055      1.0044      1.0028
PAM              16   14.272      14.272      14.272
BPR              17   2.3376      2.3366      2.3272
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     E3 MIXER NO. 1 CONF 1 ,RUNS 83-85,COLD
CVMIX            1   .99465     .99447     .99529
CDMIX            2   .96728     .96856     .97120
PTMPA            3   2.3964     2.4835     2.5814
PTFPAM           4   2.3957     2.4846     2.5794
PTEPAM           5   2.3980     2.4807     2.5859
PRAT             6   .99902     1.0016     .99748
MIXP             7   .19375E-04 .30158E-05 .92348E-05
FG  (    3)      8   919.85     971.44     1031.0
MNFAN            9   .40785     .40996     .40913
MNPRI           10   .40978     .40707     .41367
PT7PAM          11   2.4077     2.4972     2.5923
PT8PAM          12   2.4148     2.4979     2.6044
TT7             13   521.25     523.83     525.83
TT8             14   527.20     529.44     532.13
TRAT            15   1.0114     1.0107     1.0120
PAM             16   14.080     14.080     14.080
BPR             17   2.3559     2.3736     2.3354

     E3 MIXER NO. 1 CONF 1 ,RUNS 202-206,COLD
CVMIX            1   .99460     .99524     .99421     .99470     .99491
CDMIX            2   .96639     .96854     .96919     .97083     .97203
PTMPA            3   2.1780     2.2692     2.3892     2.4772     2.5795
PTFPAM           4   2.1770     2.2679     2.3899     2.4801     2.5835
PTEPAM           5   2.1802     2.2720     2.3874     2.4706     2.5702
PRAT             6   .99853     .99820     1.0010     1.0038     1.0051
MIXP             7   .15716E-04 .59409E-05 .19341E-04 .14831E-05 .46525E-06
FG  (    3)      8   807.78     862.99     934.11     987.67     1049.5
MNFAN            9   .40715     .40810     .41000     .41239     .41375
MNPRI           10   .40981     .41132     .40810     .40547     .40449
PT7PAM          11   2.1877     2.2790     2.4018     2.4925     2.5964
PT8PAM          12   2.1960     2.2888     2.4046     2.4883     2.5888
TT7             13   519.93     516.70     521.84     519.66     524.32
TT8             14   521.89     519.09     523.47     521.57     525.42
TRAT            15   1.0038     1.0046     1.0031     1.0037     1.0021
PAM             16   14.335     14.335     14.335     14.335     14.335
BPR             17   2.2924     2.2788     2.3193     2.3356     2.3359

     E3 MIXER NO. 1 CONF 1 ,RUNS 6-10,HOT
CVMIX            1   .98763     .98577     .98531     .98269     .98179
CDMIX            2   .96850     .97214     .97599     .98064     .98471
PTMPA            3   2.1927     2.2838     2.3593     2.4410     2.5381
PTFPAM           4   2.2666     2.3561     2.4309     2.5093     2.6059
PTEPAM           5   1.9975     2.1018     2.1890     2.2907     2.4002
PRAT             6   1.1347     1.1210     1.1105     1.0954     1.0857
MIXP             7   .88656E-02 .10958E-01 .12415E-01 .14864E-01 .16873E-01
FG  (    3)      8   807.82     863.72     911.23     963.53     1025.0
MNFAN            9   .48846     .47831     .47188     .46181     .45625
MNPRI           10   .23266     .25013     .26544     .28573     .29967
PT7PAM          11   2.2819     2.3716     2.4465     2.5249     2.6217
PT8PAM          12   2.0028     2.1081     2.1964     2.2995     2.4105
TT7             13   529.50     530.06     530.83     530.81     531.97
TT8             14   1240.3     1262.6     1272.7     1307.6     1341.5
TRAT            15   2.3425     2.3821     2.3976     2.4634     2.5218
PAM             16   14.155     14.155     14.155     14.155     14.155
BPR             17   7.2651     6.8054     6.3446     5.9260     5.6236

     E3 MIXER NO. 1 CONF 1 ,RUNS 80-82,HOT
CVMIX            1   .98415     .98238     .98156
CDMIX            2   .97603     .98109     .98474
PTMPA            3   2.3583     2.4376     2.5382
PTFPAM           4   2.4299     2.5057     2.6056
PTEPAM           5   2.1882     2.2891     2.3976
PRAT             6   1.1104     1.0946     1.0868
MIXP             7   .12418E-01 .14844E-01 .16036E-01
FG  (    3)      8   916.87     968.51     1032.1
MNFAN            9   .47185     .46174     .45717
MNPRI           10   .26562     .28722     .29849
PT7PAM          11   2.4454     2.5212     2.6216
PT8PAM          12   2.1956     2.2981     2.4075
TT7             13   526.14     529.31     531.89
TT8             14   1262.2     1299.7     1320.3
TRAT            15   2.3990     2.4555     2.4824
PAM             16   14.251     14.251     14.251
BPR             17   6.3355     5.8495     5.6684
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     E3 MIXER NO. 1 CONF 1 ,RUNS 86-88,HOT
CVMIX              1    .98418       .98236       .98132
CDMIX              2    .97398       .97978       .98340
PTMPA              3    2.3668       2.4462       2.5462
PTFPAM             4    2.4393       2.5141       2.6141
PTEPAM             5    2.1908       2.2977       2.4079
PRAT               6    1.1134       1.0942       1.0856
MIXP               7    .12022E-01  .14874E-01  .16850E-01
FG  (    3)        8    908.45       960.19       1022.5
MNFAN              9    .47321       .46075       .45566
MNPRI             10    .26032       .28664       .29895
PT7PAM            11    2.4551       2.5297       2.6299
PT8PAM            12    2.1978       2.3065       2.4181
TT7               13    527.51       531.48       534.10
TT8               14    1263.0       1305.6       1345.0
TRAT              15    2.3943       2.4566       2.5183
PAM               16    14.073       14.073       14.073
BPR               17    6.5020       5.8795       5.6296

     E3 MIXER NO. 1 CONF 1 ,RUNS 160-163.1,HOT
CVMIX              1    .98608       .98531       .98355       .98155
CDMIX              2    .97273       .97545       .97983       .98475
PTMPA              3    2.2785       2.3599       2.4416       2.5356
PTFPAM             4    2.3514       2.4340       2.5115       2.6069
PTEPAM             5    2.0963       2.1806       2.2884       2.3873
PRAT               6    1.1217       1.1162       1.0975       1.0920
MIXP               7    .10986E-01  .11975E-01  .14664E-01  .16232E-01
FG  (    3)        8    865.73       915.91       968.22       1028.7
MNFAN              9    .47932       .47617       .46360       .46122
MNPRI             10    .25012       .25859       .28335       .29269
PT7PAM            11    2.3668       2.4498       2.5271       2.6228
PT8PAM            12    2.1026       2.1876       2.2973       2.3972
TT7               13    526.43       526.90       527.60       527.67
TT8               14    1256.7       1265.1       1295.0       1324.5
TRAT              15    2.3872       2.4009       2.4545       2.5101
PAM               16    14.230       14.230       14.230       14.225
BPR               17    6.7734       6.5196       5.8858       5.7232

     E3 MIXER NO. 1 CONF 1 ,RUNS 207-211,HOT
CVMIX              1    .98855       .98649       .98479       .98318       .98139
CDMIX              2    .97087       .97425       .97692       .98184       .98496
PTMPA              3    2.1923       2.2839       2.3606       2.4476       2.5441
PTFPAM             4    2.2660       2.3591       2.4329       2.5186       2.6151
PTEPAM             5    1.9981       2.0960       2.1902       2.2938       2.3985
PRAT               6    1.1341       1.1255       1.1108       1.0980       1.0903
MIXP               7    .88299E-02  .10586E-01  .12264E-01  .14587E-01  .16340E-01
FG  (    3)        8    821.35       878.23       926.09       982.71       1043.8
MNFAN              9    .48868       .48335       .47304       .46522       .46035
MNPRI             10    .23495       .24771       .26645       .28469       .29523
PT7PAM            11    2.2813       2.3747       2.4485       2.5341       2.6309
PT8PAM            12    2.0035       2.1024       2.1978       2.3029       2.4088
TT7               13    520.15       521.09       518.51       520.28       522.96
TT8               14    1217.2       1238.0       1238.2       1273.4       1310.0
TRAT              15    2.3401       2.3758       2.3881       2.4475       2.5050
PAM               16    14.360       14.360       14.360       14.360       14.360
BPR               17    7.2202       6.7818       6.2390       5.7995       5.6161

     E3 MIXER NO. 6 CONF 29,RUNS 89-92,HOT
CVMIX              1    .98718       .98745       .98668       .98655
CDMIX              2    .95887       .95784       .95754       .95732
PTMPA              3    2.4912       2.4914       2.4922       2.4912
PTFPAM             4    2.5629       2.5621       2.5628       2.5607
PTEPAM             5    2.3311       2.3320       2.3320       2.3342
PRAT               6    1.0994       1.0987       1.0990       1.0970
MIXP               7    .14668E-01  .14534E-01  .14360E-01  .14437E-01
FG  (    3)        8    965.65       964.73       964.91       964.14
MNFAN              9    .52463       .52353       .52363       .52235
MNPRI             10    .37154       .37129       .37083       .37250
PT7PAM            11    2.5799       2.5792       2.5799       2.5778
PT8PAM            12    2.3448       2.3455       2.3455       2.3476
TT7               13    533.37       529.13       524.80       521.13
TT8               14    1333.2       1321.1       1305.9       1298.8
TRAT              15    2.4997       2.4967       2.4885       2.4923
PAM               16    14.078       14.078       14.078       14.078
BPR               17    6.3033       6.3430       6.3464       6.3432
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      E3 MIXER NO. 9 CONF 33,RUNS 44-48,COLD
 CVMIX             1    .98608      .98678      .98709      .98706      .98789
 CDMIX             2    .95549      .95594      .95616      .95513      .95614
 PTMPA             3    2.4814      2.4810      2.4793      2.4802      2.4768
 PTFPAM            4    2.4816      2.4810      2.4781      2.4795      2.4759
 PTEPAM            5    2.4805      2.4811      2.4826      2.4821      2.4792
 PRAT              6    1.0005      .99996      .99819      .99897      .99867
 MIXP              7    .25711E-04  .22141E-04  .18084E-04  .10194E-04  .11224E-04
 FG  (    3)       8    959.06      959.31      958.52      957.99      957.07
 MNFAN             9    .52864      .52882      .52837      .52783      .52854
 MNPRI            10    .52798      .52887      .53092      .52930      .53044
 PT7PAM           11    2.4995      2.4988      2.4959      2.4973      2.4938
 PT8PAM           12    2.5009      2.5016      2.5030      2.5023      2.4995
 TT7              13    509.87      504.16      501.24      516.77      515.21
 TT8              14    519.90      512.31      509.22      522.39      519.92
 TRAT             15    1.0197      1.0162      1.0159      1.0109      1.0091
 PAM              16    14.103      14.103      14.103      14.103      14.103
 BPR              17    3.0388      3.0216      3.0259      3.0329      3.0317


      E3 MIXER NO. 9 CONF 33,RUNS 49-53,HOT
 CVMIX             1    .98591      .98558      .98542      .98559      .98488
 CDMIX             2    .96519      .96448      .96372      .96402      .96281
 PTMPA             3    2.4787      2.4781      2.4804      2.4795      2.4805
 PTFPAM            4    2.5506      2.5499      2.5520      2.5520      2.5527
 PTEPAM            5    2.3263      2.3251      2.3266      2.3237      2.3246
 PRAT              6    1.0964      1.0967      1.0969      1.0983      1.0981
 MIXP              7    .14421E-01  .14357E-01  .14281E-01  .14212E-01  .14215E-01
 FG  (    3)       8    968.28      967.24      967.81      967.63      967.01
 MNFAN             9    .55548      .55510      .55468      .55574      .55477
 MNPRI            10    .41865      .41761      .41670      .41578      .41464
 PT7PAM           11    2.5699      2.5692      2.5713      2.5713      2.5721
 PT8PAM           12    2.3433      2.3419      2.3433      2.3405      2.3412
 TT7              13    523.22      519.64      516.03      516.15      512.64
 TT8              14    1305.5      1297.2      1287.5      1285.7      1279.0
 TRAT             15    2.4951      2.4963      2.4950      2.4910      2.4949
 PAM              16    14.121      14.121      14.121      14.121      14.121
 BPR              17    6.1692      6.2007      6.2274      6.2070      6.2406

      E3 MIXER NO.10 CONF 34,RUNS 55-59,COLD
 CVMIX             1    .98613      .98633      .98637      .98617      .98669
 CDMIX             2    .96870      .96847      .96868      .96896      .96894
 PTMPA             3    2.4754      2.4758      2.4761      2.4768      2.4777
 PTFPAM            4    2.4763      2.4756      2.4756      2.4780      2.4781
 PTEPAM            5    2.4724      2.4759      2.4772      2.4728      2.4761
 PRAT              6    1.0016      .99991      .99935      1.0021      1.0008
 MIXP              7    .15025E-04  .16779E-04  .20776E-04  .21289E-04  .19777E-04
 FG  (    3)       8    974.91      974.90      975.32      974.75      975.25
 MNFAN             9    .53893      .53814      .53811      .53931      .53885
 MNPRI            10    .53672      .53827      .53903      .53638      .53770
 PT7PAM           11    2.4949      2.4942      2.4942      2.4966      2.4966
 PT8PAM           12    2.4942      2.4977      2.4991      2.4945      2.4981
 TT7              13    510.47      504.76      498.88      504.53      499.83
 TT8              14    517.70      512.19      507.07      513.23      507.33
 TRAT             15    1.0142      1.0147      1.0164      1.0172      1.0150
 PAM              16    14.197      14.197      14.197      14.179      14.179
 BPR              17    3.0163      3.0070      3.0073      3.0282      3.0032

      E3 MIXER NO.10 CONF 34,RUNS 60-64,HOT
 CVMIX             1    .98539      .98461      .98444      .98449      .98466
 CDMIX             2    .97943      .97842      .97821      .97793      .97787
 PTMPA             3    2.4824      2.4833      2.4844      2.4747      2.4736
 PTFPAM            4    2.5560      2.5568      2.5581      2.5450      2.5443
 PTEPAM            5    2.3298      2.3306      2.3294      2.3324      2.3297
 PRAT              6    1.0971      1.0970      1.0982      1.0911      1.0921
 MIXP              7    .14317E-01  .14308E-01  .14182E-01  .14483E-01  .14405E-01
 FG  (    3)       8    988.24      987.77      988.19      982.20      981.52
 MNFAN             9    .56513      .56439      .56478      .56122      .56171
 MNPRI            10    .43004      .42910      .42768      .43439      .43327
 PT7PAM           11    2.5762      2.5769      2.5783      2.5649      2.5642
 PT8PAM           12    2.3483      2.3490      2.3476      2.3512      2.3483
 TT7              13    515.27      510.30      505.32      508.71      504.77
 TT8              14    1283.4      1272.4      1260.0      1267.9      1258.2
 TRAT             15    2.4907      2.4934      2.4935      2.4925      2.4926
 PAM              16    14.176      14.176      14.176      14.176      14.176
 BPR              17    6.0668      6.0810      6.1269      5.9946      6.0145
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     E3 MIXER NO.11 CONF 35,RUNS 66-70,COLD
CVMIX           1   .98912      .98895      .98857      .98811      .98851
CDMIX           2   .97628      .97638      .97566      .97626      .97640
PTMPA           3   2.4656      2.4659      2.4681      2.4661      2.4660
PTFPAM          4   2.4655      2.4669      2.4690      2.4669      2.4669
PTEPAM          5   2.4657      2.4629      2.4650      2.4637      2.4630
PRAT            6   .99993      1.0016      1.0016      1.0013      1.0016
MIXP            7   .19204E-04  .15458E-04  .82232E-05  .20943E-04  .29170E-04
FG  (    3)     8   978.91      979.21      979.74      979.21      979.25
MNFAN           9   .54215      .54264      .54225      .54261      .54282
MNPRI          10   .54231      .54060      .53994      .54081      .54064
PT7PAM         11   2.4859      2.4873      2.4895      2.4873      2.4873
PT8PAM         12   2.4923      2.4895      2.4916      2.4902      2.4895
TT7            13   514.69      509.88      504.23      500.86      497.40
TT8            14   521.13      516.02      511.03      508.04      504.24
TRAT           15   1.0125      1.0120      1.0135      1.0143      1.0138
PAM            16   14.228      14.228      14.228      14.228      14.228
BPR            17   2.9412      2.9480      2.9446      2.9556      2.9550
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     E3 MIXER NO.11 CONF 35,RUNS 71-75,HOT
CVMIX           1   .98683      .98585      .98511      .98633      .98575
CDMIX           2   .98679      .98586      .98465      .98640      .98541
PTMPA           3   2.4746      2.4765      2.4787      2.4750      2.4758
PTFPAM          4   2.5517      2.5524      2.5545      2.5509      2.5509
PTEPAM          5   2.3166      2.3210      2.3220      2.3183      2.3207
PRAT            6   1.1015      1.0997      1.1001      1.1004      1.0992
MIXP            7   .14471E-01  .14534E-01  .14380E-01  .14317E-01  .14376E-01
FG  (    3)     8   996.66      996.85      997.00      996.50      996.02
MNFAN           9   .57037      .56868      .56809      .56960      .56814
MNPRI          10   .43029      .43089      .42939      .43099      .43085
PT7PAM         11   2.5740      2.5747      2.5768      2.5733      2.5733
PT8PAM         12   2.3390      2.3432      2.3439      2.3404      2.3425
TT7            13   533.49      531.14      528.80      533.09      529.65
TT8            14   1328.8      1325.6      1316.7      1323.1      1318.7
TRAT           15   2.4907      2.4958      2.4900      2.4819      2.4899
PAM            16   14.258      14.258      14.258      14.258      14.258
BPR            17   5.9912      6.0167      6.0508      6.0130      6.0545
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     E3 MIXER NO.12 CONF 36,RUNS 11-15,COLD
CVMIX           1   .98973      .98979      .98971      .99015      .98936
CDMIX           2   .96787      .96815      .96886      .96846      .96824
PTMPA           3   2.4754      2.4759      2.4745      2.4731      2.4744
PTFPAM          4   2.4767      2.4774      2.4759      2.4745      2.4766
PTEPAM          5   2.4715      2.4715      2.4702      2.4688      2.4675
PRAT            6   1.0021      1.0024      1.0023      1.0023      1.0037
MIXP            7   .15437E-04  .13934E-04  .18664E-04  .18189E-04  .19674E-04
FG  (    3)     8   980.57      981.15      981.05      979.83      980.33
MNFAN           9   .53666      .53697      .53753      .53721      .53755
MNPRI          10   .53370      .53366      .53427      .53395      .53231
PT7PAM         11   2.4963      2.4970      2.4956      2.4942      2.4963
PT8PAM         12   2.4984      2.4984      2.4970      2.4956      2.4942
TT7            13   521.04      516.94      512.17      519.48      516.50
TT8            14   525.73      521.28      517.10      523.12      519.79
TRAT           15   1.0090      1.0084      1.0096      1.0070      1.0064
PAM            16   14.301      14.301      14.301      14.301      14.301
BPR            17   2.9238      2.9284      2.9346      2.9301      2.9346
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     E3 MIXER NO.12 CONF 36,RUNS 18-20,16.1,17.1,HOT
CVMIX           1   .98691      .98668      .98715      .98684      .98691
CDMIX           2   .97687      .97594      .97633      .97686      .97708
PTMPA           3   2.4784      2.4786      2.4763      2.4726      2.4720
PTFPAM          4   2.5543      2.5537      2.5513      2.5484      2.5476
PTEPAM          5   2.3205      2.3232      2.3205      2.3182      2.3171
PRAT            6   1.1008      1.0992      1.0995      1.0993      1.0995
MIXP            7   .14419E-01  .14456E-01  .14360E-01  .14645E-01  .14560E-01
FG  (    3)     8   980.89      980.08      980.04      975.50      975.42
MNFAN           9   .56379      .56246      .56288      .56310      .56333
MNPRI          10   .42243      .42314      .42321      .42412      .42397
PT7PAM         11   2.5758      2.5751      2.5727      2.5696      2.5689
PT8PAM         12   2.3426      2.3454      2.3426      2.3409      2.3394
TT7            13   517.67      515.79      513.13      525.23      521.44
TT8            14   1292.3      1286.5      1278.6      1311.3      1301.9
TRAT           15   2.4964      2.4943      2.4918      2.4966      2.4967
PAM            16   14.151      14.151      14.164      14.123      14.123
BPR            17   6.0412      6.0107      6.0262      5.9501      5.9857
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     E3 MIXER NO.12 CONF 37,RUNS 22-26,COLD
CVMIX             1   .98913      .98969      .98908      .98909      .98942
CDMIX             2   .96555      .96685      .96589      .96594      .96612
PTMPA             3   2.4731      2.4695      2.4728      2.4710      2.4737
PTFPAM            4   2.4734      2.4712      2.4741      2.4713      2.4734
PTEPAM            5   2.4718      2.4634      2.4682      2.4698      2.4744
PRAT              6   1.0007      1.0032      1.0024      1.0006      .99960
MIXP              7   .16981E-04  .18744E-04  .11235E-04  .23993E-04  .11226E-04
FG  (     3)      8   977.67      976.86      977.84      976.85      978.62
MNFAN             9   .55504      .55701      .55590      .55536      .55520
MNPRI            10   .55416      .55265      .55263      .55452      .55572
PT7PAM           11   2.4942      2.4921      2.4949      2.4921      2.4942
PT8PAM           12   2.4991      2.4907      2.4956      2.4970      2.5019
TT7              13   520.17      517.01      513.42      514.84      511.25
TT8              14   524.12      520.83      517.75      518.96      515.60
TRAT             15   1.0076      1.0074      1.0084      1.0080      1.0085
PAM              16   14.313      14.313      14.313      14.313      14.313
BPR              17   3.2454      3.2545      3.2452      3.2543      3.2359


     E3 MIXER NO.12 CONF 37,RUNS 27-31,HOT
CVMIX             1   .98638      .98696      .98689      .98683      .98688
CDMIX             2   .97474      .97385      .97338      .97314      .97215
PTMPA             3   2.4807      2.4802      2.4800      2.4809      2.4816
PTFPAM            4   2.5523      2.5517      2.5503      2.5517      2.5524
PTEPAM            5   2.3214      2.3208      2.3243      2.3230      2.3231
PRAT              6   1.0995      1.0995      1.0972      1.0984      1.0987
MIXP              7   .13560E-01  .13517E-01  .13575E-01  .13471E-01  .13438E-01
FG  (     3)      8   979.69      978.54      977.98      978.26      977.72
MNFAN             9   .57790      .57726      .57585      .57631      .57578
MNPRI            10   .44300      .44212      .44374      .44242      .44110
PT7PAM           11   2.5748      2.5741      2.5726      2.5741      2.5748
PT8PAM           12   2.3443      2.3436      2.3471      2.3457      2.3457
TT7              13   518.90      515.25      511.65      512.14      509.33
TT8              14   1294.4      1285.1      1277.4      1276.0      1268.9
TRAT             15   2.4944      2.4942      2.4966      2.4916      2.4914
PAM              16   14.145      14.145      14.145      14.145      14.145
BPR              17   6.5698      6.5817      6.5721      6.5831      6.5950


     E3 MIXER NO.12 CONF 38,RUNS 33-37,COLD
CVMIX             1   .99064      .99035      .99026      .99080      .98988
CDMIX             2   .97143      .97217      .97194      .97287      .97188
PTMPA             3   2.4752      2.4757      2.4743      2.4717      2.4736
PTFPAM            4   2.4768      2.4775      2.4761      2.4733      2.4761
PTEPAM            5   2.4709      2.4707      2.4695      2.4674      2.4668
PRAT              6   1.0024      1.0028      1.0027      1.0024      1.0037
MIXP              7   .20812E-04  .18563E-04  .16105E-04  .12644E-04  .10412E-04
FG  (     3)      8   985.37      986.39      985.37      984.74      984.85
MNFAN             9   .51625      .51697      .51676      .51738      .51715
MNPRI            10   .51281      .51294      .51286      .51377      .51169
PT7PAM           11   2.4951      2.4958      2.4944      2.4916      2.4944
PT8PAM           12   2.4972      2.4972      2.4958      2.4937      2.4930
TT7              13   522.30      518.59      514.33      516.42      513.40
TT8              14   523.40      520.43      517.15      519.46      516.37
TRAT             15   1.0021      1.0035      1.0055      1.0059      1.0058
PAM              16   14.320      14.320      14.320      14.320      14.320
BPR              17   2.5837      2.5808      2.5928      2.5916      2.5997

     E3 MIXER NO.12 CONF 38,RUNS 38-42,HOT
CVMIX             1   .98686      .98659      .98613      .98690      .98705
CDMIX             2   .98151      .98210      .98142      .98236      .98212
PTMPA             3   2.4774      2.4767      2.4771      2.4769      2.4778
PTFPAM            4   2.5588      2.5573      2.5579      2.5572      2.5585
PTEPAM            5   2.3258      2.3259      2.3241      2.3254      2.3242
PRAT              6   1.1002      1.0995      1.1006      1.0997      1.1008
MIXP              7   .15689E-01  .15652E-01  .15483E-01  .15468E-01  .15340E-01
FG  (     3)      8   983.14      983.34      982.90      983.72      984.04
MNFAN             9   .54916      .54902      .54924      .54934      .54989
MNPRI            10   .40396      .40495      .40323      .40491      .40360
PT7PAM           11   2.5789      2.5775      2.5782      2.5775      2.5789
PT8PAM           12   2.3474      2.3474      2.3453      2.3467      2.3453
TT7              13   526.87      523.92      519.49      518.85      516.25
TT8              14   1314.4      1307.7      1295.4      1292.8      1284.8
TRAT             15   2.4948      2.4960      2.4936      2.4916      2.4887
PAM              16   14.126      14.126      14.126      14.126      14.126
BPR              17   5.3593      5.3871      5.4243      5.4098      5.4342
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     E3 MIXER NO.12 CONF 39,RUNS 149-153,COLD
CVMIX            1   .99008        .99048        .99072        .99044        .99029
CDMIX            2   .96961        .97086        .97054        .96959        .97012
PTMPA            3   2.4723        2.4719        2.4726        2.4707        2.4700
PTFPAM           4   2.4717        2.4709        2.4731        2.4695        2.4695
PTEPAM           5   2.4738        2.4744        2.4709        2.4740        2.4711
PRAT             6   .99914        .99858        1.0009        .99819        .99935
MIXP             7   .17711E-04 .10868E-04 .15921E-04 .14183E-04 .15700E-04
FG  (    3)      8   964.93        965.93        966.05        963.99        964.10
MNFAN            9   .51276        .51351        .51410        .51242        .51324
MNPRI           10   .51404        .51557        .51276        .51505        .51416
PT7PAM          11   2.4918        2.4911        2.4932        2.4897        2.4897
PT8PAM          12   2.4982        2.4989        2.4954        2.4982        2.4954
TT7             13   516.35        513.75        511.64        518.45        517.48
TT8             14   519.20        516.24        514.00        519.27        518.46
TRAT            15   1.0055        1.0048        1.0046        1.0016        1.0019
PAM             16   14.074        14.074        14.074        14.074        14.074
BPR             17   3.0582        3.0537        3.0555        3.0616        3.0621


     E3 MIXER NO.12 CONF 39,RUNS 154-158,HOT
CVMIX            1   .98754        .98680        .98666        .98647        .98636
CDMIX            2   .97841        .97724        .97746        .97700        .97644
PTMPA            3   2.4790        2.4806        2.4803        2.4806        2.4810
PTFPAM           4   2.5497        2.5518        2.5511        2.5518        2.5525
PTEPAM           5   2.3231        2.3226        2.3234        2.3226        2.3214
PRAT             6   1.0976        1.0987        1.0980        1.0987        1.0996
MIXP             7   .14365E-01 .14311E-01 .14354E-01 .14370E-01 .14279E-01
FG  (    3)      8   988.64        988.45        988.52        988.18        987.89
MNFAN            9   .54222        .54212        .54177        .54190        .54198
MNPRI           10   .39914        .39692        .39765        .39664        .39525
PT7PAM          11   2.5716        2.5738        2.5731        2.5738        2.5745
PT8PAM          12   2.3434        2.3427        2.3434        2.3427        2.3412
TT7             13   529.53        528.22        527.29        528.18        527.09
TT8             14   1320.2        1316.9        1316.7        1319.1        1315.6
TRAT            15   2.4932        2.4932        2.4972        2.4974        2.4961
PAM             16   14.236        14.236        14.236        14.236        14.236
BPR             17   6.3058        6.3335        6.3535        6.3402        6.3714


     E3 MIXER NO.11 CONF 40,RUNS 93-97,COLD
CVMIX            1   .98956        .98907        .98905        .98952        .98939
CDMIX            2   .97639        .97615        .97566        .97638        .97606
PTMPA            3   2.4775        2.4773        2.4798        2.4764        2.4764
PTFPAM           4   2.4776        2.4783        2.4804        2.4767        2.4774
PTEPAM           5   2.4769        2.4741        2.4775        2.4752        2.4731
PRAT             6   1.0003        1.0017        1.0012        1.0006        1.0017
MIXP             7   .16428E-04 .14690E-04 .14427E-04 .22663E-04 .18435E-04
FG  (    3)      8   980.87        980.53        981.49        980.30        979.99
MNFAN            9   .54239        .54269        .54209        .54251        .54264
MNPRI           10   .54204        .54032        .54044        .54165        .54021
PT7PAM          11   2.4982        2.4989        2.5011        2.4974        2.4981
PT8PAM          12   2.5032        2.5004        2.5039        2.5016        2.4995
TT7             13   524.30        521.19        516.19        525.04        522.97
TT8             14   532.85        527.79        522.59        531.65        527.87
TRAT            15   1.0163        1.0127        1.0124        1.0126        1.0094
PAM             16   14.154        14.154        14.154        14.155        14.155
BPR             17   2.9762        2.9724        2.9633        2.9626        2.9622


     E3 MIXER NO.11 CONF 40,RUNS 98-102,HOT
CVMIX            1   .98746        .98662        .98599        .98658        .98637
CDMIX            2   .98643        .98504        .98501        .98549        .98498
PTMPA            3   2.4766        2.4773        2.4779        2.4773        2.4795
PTFPAM           4   2.5527        2.5534        2.5540        2.5534        2.5556
PTEPAM           5   2.3214        2.3202        2.3203        2.3215        2.3242
PRAT             6   1.0996        1.1005        1.1007        1.0999        1.0995
MIXP             7   .14505E-01 .14356E-01 .14368E-01 .14537E-01 .14583E-01
FG  (    3)      8   989.31        988.31        988.67        988.74        989.51
MNFAN            9   .56914        .56868        .56868        .56854        .56803
MNPRI           10   .43147        .42943        .42909        .43028        .43018
PT7PAM          11   2.5750        2.5757        2.5764        2.5757        2.5778
PT8PAM          12   2.3437        2.3423        2.3423        2.3437        2.3465
TT7             13   524.48        523.34        522.88        525.38        525.01
TT8             14   1309.5        1303.4        1304.0        1313.2        1312.9
TRAT            15   2.4968        2.4906        2.4938        2.4995        2.5006
PAM             16   14.140        14.140        14.140        14.140        14.140
BPR             17   6.0019        6.0280        6.0529        6.0184        6.0034
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     E3 MIXER NO. 9 CONF 41,RUNS 106-110,COLD
CVMIX          1  .98734     .98732     .98767     .98751     .98737
CDMIX          2  .95642     .95658     .95590     .95660     .95559
PTMPA          3  2.4799     2.4816     2.4808     2.4806     2.4826
PTFPAM         4  2.4776     2.4783     2.4777     2.4769     2.4798
PTEPAM         5  2.4869     2.4918     2.4904     2.4918     2.4911
PRAT           6  .99628     .99461     .99489     .99405     .99546
MIXP           7  .20554E-04 .16474E-04 .23599E-04 .22063E-04 .18257E-04
FG  (    3)    8  962.13     963.28     962.12     962.69     962.84
MNFAN          9  .52797     .52753     .52706     .52735     .52700
MNPRI         10  .53327     .53520     .53435     .53582     .53347
PT7PAM        11  2.4952     2.4959     2.4952     2.4945     2.4973
PT8PAM        12  2.5037     2.5087     2.5072     2.5087     2.5080
TT7           13  514.06     509.11     502.76     503.93     499.47
TT8           14  523.78     517.83     512.65     512.59     507.58
TRAT          15  1.0189     1.0171     1.0197     1.0172     1.0162
PAM           16  14.147     14.147     14.147     14.147     14.147
BPR           17  3.1694     3.1580     3.1625     3.1545     3.1588


     E3 MIXER NO. 9 CONF 41,RUNS 111-115,HOT
CVMIX          1  .98774     .98775     .98737     .98661     .98603
CDMIX          2  .96385     .96287     .96168     .96245     .96074
PTMPA          3  2.4862     2.4867     2.4886     2.4853     2.4891
PTFPAM         4  2.5561     2.5569     2.5583     2.5532     2.5553
PTEPAM         5  2.3272     2.3266     2.3288     2.3313     2.3392
PRAT           6  1.0984     1.0990     1.0985     1.0952     1.0924
MIXP           7  .13945E-01 .13918E-01 .13896E-01 .13941E-01 .13931E-01
FG  (    3)    8  979.37     978.69     978.58     967.95     968.45
MNFAN          9  .55455     .55418     .55307     .55203     .54949
MNPRI         10  .41429     .41279     .41205     .41592     .41706
PT7PAM        11  2.5753     2.5760     2.5774     2.5723     2.5745
PT8PAM        12  2.3408     2.3401     2.3422     2.3447     2.3525
TT7           13  528.56     528.37     528.05     513.67     507.20
TT8           14  1320.2     1319.6     1319.4     1285.8     1269.5
TRAT          15  2.4978     2.4976     2.4986     2.5031     2.5030
PAM           16  14.239     14.239     14.239     14.100     14.100
BPR           17  6.5861     6.6027     6.6353     6.6018     6.6090

     E3 MIXER NO. 9 CONF 42,RUNS 116-120,COLD
CVMIX          1  .98750     .98712     .98708     .98787     .98796
CDMIX          2  .95602     .95559     .95551     .95535     .95628
PTMPA          3  2.4774     2.4790     2.4796     2.4787     2.4777
PTFPAM         4  2.4756     2.4777     2.4770     2.4756     2.4748
PTEPAM         5  2.4828     2.4828     2.4871     2.4878     2.4864
PRAT           6  .99709     .99796     .99596     .99508     .99535
MIXP           7  .12689E-04 .20188E-04 .15009E-04 .19680E-04 .17342E-04
FG  (    3)    8  942.76     943.27     943.47     942.81     943.20
MNFAN          9  .52844     .52839     .52763     .52720     .52808
MNPRI         10  .53257     .53129     .53336     .53419     .53459
PT7PAM        11  2.4941     2.4962     2.4955     2.4941     2.4933
PT8PAM        12  2.5005     2.5005     2.5049     2.5056     2.5041
TT7           13  518.95     517.91     517.41     518.49     518.48
TT8           14  528.34     523.53     521.71     524.63     522.33
TRAT          15  1.0181     1.0109     1.0083     1.0118     1.0074
PAM           16  13.889     13.889     13.889     13.889     13.889
BPR           17  3.0709     3.0617     3.0499     3.0559     3.0520

     E3 MIXER NO. 9 CONF 42,RUNS 121-125,HOT
CVMIX          1  .98684     .98635     .98608     .98746     .98668
CDMIX          2  .96275     .96126     .96035     .96016     .96080
PTMPA          3  2.4858     2.4872     2.4884     2.4950     2.4875
PTFPAM         4  2.5572     2.5586     2.5608     2.5653     2.5586
PTEPAM         5  2.3320     2.3321     2.3294     2.3434     2.3329
PRAT           6  1.0966     1.0971     1.0993     1.0947     1.0968
MIXP           7  .14302E-01 .14238E-01 .14152E-01 .14356E-01 .14206E-01
FG  (    3)    8  965.62     964.95     964.71     963.69     964.71
MNFAN          9  .55422     .55345     .55392     .55140     .55300
MNPRI         10  .41667     .41469     .41166     .41609     .41447
PT7PAM        11  2.5772     2.5786     2.5807     2.5852     2.5786
PT8PAM        12  2.3467     2.3467     2.3439     2.3579     2.3474
TT7           13  521.42     519.03     516.66     524.54     507.78
TT8           14  1300.6     1294.9     1289.6     1308.0     1269.0
TRAT          15  2.4943     2.4947     2.4960     2.4937     2.4992
PAM           16  14.058     14.058     14.058     13.991     14.058
BPR           17  6.2504     6.2863     6.3270     6.2768     6.2956
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     E3 MIXER NO.12 CONF 43,RUNS 169-173,COLD
CVMIX            1  .99067       .99035       .98973       .99089       .99105
CDMIX            2  .97129       .97077       .97020       .97108       .97123
PTMPA            3  2.4786       2.4802       2.4826       2.4795       2.4792
PTFPAM           4  2.4791       2.4805       2.4833       2.4791       2.4798
PTEPAM           5  2.4769       2.4790       2.4803       2.4804       2.4769
PRAT             6  1.0009       1.0006       1.0012       .99948       1.0012
MIXP             7  .19677E-04 .81134E-05 .17686E-04 .17458E-04 .22130E-04
FG  (   3)       8  992.61       993.01       993.88       992.89       992.87
MNFAN            9  .51466       .51419       .51396       .51401       .51472
MNPRI           10  .51341       .51325       .51216       .51475       .51301
PT7PAM          11  2.4990       2.5003       2.5031       2.4990       2.4997
PT8PAM          12  2.4983       2.5003       2.5017       2.5017       2.4983
TT7             13  523.20       521.58       520.33       521.38       520.45
TT8             14  528.99       525.28       523.57       525.83       523.54
TRAT            15  1.0111       1.0071       1.0062       1.0085       1.0059
PAM             16  14.398       14.398       14.398       14.398       14.398
BPR             17  3.1565       3.1481       3.1382       3.1477       3.1469

     E3 MIXER NO.12 CONF 43,RUNS 174-178,HOT
CVMIX            1  .98839       .98769       .98702       .98789       .98763
CDMIX            2  .97813       .97731       .97660       .97699       .97658
PTMPA            3  2.4888       2.4895       2.4903       2.4894       2.4897
PTFPAM           4  2.5596       2.5596       2.5610       2.5596       2.5596
PTEPAM           5  2.3262       2.3277       2.3264       2.3277       2.3278
PRAT             6  1.1003       1.0996       1.1008       1.0997       1.0995
MIXP             7  .14071E-01 .14002E-01 .13931E-01 .14019E-01 .13902E-01
FG  (   3)       8  993.22       992.79       992.60       992.42       992.22
MNFAN            9  .54289       .54205       .54225       .54193       .54160
MNPRI           10  .39528       .39525       .39338       .39498       .39467
PT7PAM          11  2.5812       2.5812       2.5826       2.5812       2.5812
PT8PAM          12  2.3436       2.3450       2.3436       2.3450       2.3450
TT7             13  528.86       525.35       523.02       524.20       522.89
TT8             14  1321.5       1310.6       1305.2       1308.1       1302.6
TRAT            15  2.4987       2.4947       2.4955       2.4955       2.4911
PAM             16  14.222       14.222       14.222       14.222       14.222
BPR             17  6.5619       6.5719       6.5952       6.5547       6.5850

     E3 MIXER NO. 9 CONF 45,RUNS 127-131,COLD
CVMIX            1  .98809       .98736       .98753       .98872       .98866
CDMIX            2  .95683       .95617       .95637       .95667       .95680
PTMPA            3  2.4766       2.4766       2.4773       2.4822       2.4822
PTFPAM           4  2.4740       2.4754       2.4760       2.4792       2.4813
PTEPAM           5  2.4844       2.4803       2.4810       2.4912       2.4849
PRAT             6  .99580       .99800       .99799       .99518       .99853
MIXP             7  .17969E-04 .16461E-04 .15438E-04 .14058E-04 .23844E-04
FG  (   3)       8  964.67       964.05       964.64       972.52       972.70
MNFAN            9  .52815       .52837       .52852       .52781       .52906
MNPRI           10  .53411       .53120       .53137       .53463       .53112
PT7PAM          11  2.4910       2.4924       2.4931       2.4963       2.4984
PT8PAM          12  2.5009       2.4967       2.4974       2.5075       2.5012
TT7             13  526.87       526.54       526.36       517.03       515.58
TT8             14  526.66       526.23       526.18       518.73       517.39
TRAT            15  .99960       .99941       .99966       1.0033       1.0035
PAM             16  14.207       14.207       14.207       14.277       14.277
BPR             17  3.0806       3.0965       3.0988       3.1024       3.1128

     E3 MIXER NO. 9 CONF 45,RUNS 132-136,HOT
CVMIX            1  .98714       .98646       .98653       .98723       .98624
CDMIX            2  .96379       .96205       .96268       .96216       .96208
PTMPA            3  2.4883       2.4906       2.4883       2.4883       2.4891
PTFPAM           4  2.5574       2.5596       2.5581       2.5581       2.5595
PTEPAM           5  2.3330       2.3351       2.3290       2.3283       2.3283
PRAT             6  1.0962       1.0961       1.0984       1.0987       1.0993
MIXP             7  .14071E-01 .14034E-01 .13869E-01 .13797E-01 .13919E-01
FG  (   3)       8  981.06       980.60       979.93       979.39       979.79
MNFAN            9  .55334       .55226       .55380       .55363       .55381
MNPRI           10  .41646       .41494       .41321       .41257       .41168
PT7PAM          11  2.5762       2.5783       2.5769       2.5769       2.5783
PT8PAM          12  2.3459       2.3480       2.3417       2.3410       2.3410
TT7             13  526.04       524.76       523.91       525.11       524.70
TT8             14  1316.5       1311.5       1307.8       1308.2       1312.0
TRAT            15  2.5026       2.4992       2.4963       2.4912       2.5005
PAM             16  14.246       14.246       14.246       14.246       14.246
BPR             17  6.5597       6.5519       6.6026       6.6047       6.6110
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     E3 MIXER NO.11 CONF 46,RUNS 138-142,COLD
 CVMIX           1   .98951      .98942      .98957      .98990      .98901
 CDMIX           2   .97750      .97726      .97695      .97744      .97691
 PTMPA           3   2.4777      2.4789      2.4784      2.4760      2.4776
 PTFPAM          4   2.4792      2.4813      2.4814      2.4772      2.4793
 PTEPAM          5   2.4729      2.4716      2.4694      2.4721      2.4722
 PRAT            6   1.0025      1.0039      1.0049      1.0020      1.0029
 MIXP            7   .18326E-04 .12872E-04 .14614E-04 .17355E-04 .17348E-04
 FG  (    3)     8   985.81      986.30      985.67      984,73      985.13
 MNFAN           9   .54411      .54441      .54450      .54389      .54374
 MNPRI          10   .54062      .53894      .53770      .54103      .53973
 PT7PAM         11   2.4988      2.5009      2.5009      2.4967      2.4988
 PT8PAM         12   2.4960      2.4945      2.4924      2.4952      2.4952
 TT7            13   519.07      516.87      515.69      515.99      515.89
 TT8            14   527.33      522.47      520.05      521.51      519.59
 TRAT.          15   1.0159      1.0108      1.0085      1.0107      1.0072
 PAM            16   14.207      14.207      14.207      14.207      14.207
 BPR            17   2.9748      2.9746      2.9622      2.9578      2.9554
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     E3 MIXER NO.11 CONF 46,RUNS 143-145,146.1,147.1,HOT
 CVMIX           1   .98852      .98817      .98717      .98660      .98634
 CDMIX           2   .98868      .98779      .98745      .98821      .98775
 PTMPA           3   2.4788      2.4794      2.4798      2.4771      2.4786
 PTFPAM          4   2.5535      2.5542      2.5542      2.5514      2.5527
 PTEPAM          5   2.3235      2.3242      2.3256      2.3256      2.3258
 PRAT            6   1.0990      1.0990      1.0983      1.0971      1.0976
 MIXP            7   .14368E-01 .14397E-01 .14506E-01 .14539E-01 .14443E-01
 FG  (    3)     8   1005.1      1004.6      1004.4      996.64      997.06
 MNFAN           9   .56998      .56943      .56867      .56883      .56876
 MNPRI          10   .43381      .43299      .43314      .43510      .43419
 PT7PAM         11   2.5749      2.5756      2.5756      2.5726      2.5740
 PT8PAM         12   2.3423      2.3430      2.3444      2.3447      2.3447
 TT7            13   533.95      533.03      532.27      524.47      523.03
 TT8            14   1331.3      1329.3      1331.9      1312.4      1307.3
 TRAT           15   2.4932      2.4939      2.5022      2.5024      2.4995
 PAM            16   14.315      14.315      14.315      14.215      14.215
 BPR            17   6.1251      6.1110      6.1309      6.0579      6.0904
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```
     E3 MIXER NO.11 CONF 46,RUNS 143.1,144.1,145.1,HOT
 CVMIX           1   .98618      .98581      .98536
 CDMIX           2   .98768      .98706      .98666
 PTMPA           3   2.4777      2.4796      2.4796
 PTFPAM          4   2.5516      2.5544      2.5537
 PTEPAM          5   2.3255      2.3242      2.3257
 PRAT            6   1.0972      1.0990      1.0980
 MIXP            7   .14410E-01 .14358E-01 .14294E-01
 FG  (    3)     8   997,43      997.94      997.58
 MNFAN           9   .56863      .56905      .56832
 MNPRI          10   .43457      .43225      .43284
 PT7PAM         11   2.5729      2.5757      2.5750
 PT8PAM         12   2.3445      2.3431      2.3445
 TT7            13   523.10      521.59      520.63
 TT8            14   1305.3      1302.4      1297.9
 TRAT           15   2.4953      2.4971      2.4930
 PAM            16   14.229      14.229      14.229
 BPR            17   6.0717      6.1029      6.1061
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     E3 MIXER NO.11 CONF 47,RUNS 164-168,COLD
 CVMIX           1   .98975      .98935      .98930      .99018      .98958
 CDMIX           2   .97800      .97756      .97700      .97849      .97737
 PTMPA           3   2.4732      2.4748      2.4759      2.4723      2.4748
 PTFPAM          4   2.4740      2.4761      2.4769      2.4740      2.4762
 PTEPAM          5   2.4707      2.4707      2.4728      2.4670      2.4707
 PRAT            6   1.0013      1.0022      1.0017      1.0028      1.0022
 MIXP            7   .20927E-04 .11088E-04 .13103E-04 .15886E-04 .11594E-04
 FG  (    3)     8   968.30      968.79      968.87      968.23      968.60
 MNFAN           9   .54410      .54406      .54339      .54506      .54391
 MNPRI          10   .54230      .54096      .54107      .54110      .54079
 PT7PAM         11   2.4934      2.4955      2.4962      2.4934      2.4955
 PT8PAM         12   2.4941      2.4941      2.4962      2.4905      2.4941
 TT7            13   519.23      518.16      517.49      518.75      518.91
 TT8            14   522.38      520.62      519.57      521.53      520.52
 TRAT           15   1.0061      1.0047      1.0040      1.0054      1.0031
 PAM            16   13.985      13.985      13.985      13.985      13.985
 BPR            17   2.9297      2.9273      2.9200      2.9234      2.9223
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      E3 MIXER NO.12 CONF 48,RUNS 180-184,COLD
CVMIX          1  .99092      .99050      .99041      .99058      .99051
CDMIX          2  .97430      .97369      .97308      .97367      .97323
PTMPA          3  2.4777      2.4791      2.4790      2.4784      2.4804
PTFPAM         4  2.4760      2.4781      2.4782      2.4768      2.4789
PTEPAM         5  2.4827      2.4820      2.4814      2.4833      2.4847
PRAT           6  .99730      .99843      .99870      .99737      .99766
MIXP           7  .11851E-04 .15551E-04 .15315E-04 .19509E-04 .14806E-04
FG  (    3)    8  988.84      989.08      988.39      988.64      989.34
MNFAN          9  .51570      .51562      .51523      .51524      .51501
MNPRI         10  .51960      .51789      .51722      .51906      .51841
PT7PAM        11  2.4960      2.4981      2.4981      2.4967      2.4988
PT8PAM        12  2.5044      2.5037      2.5030      2.5051      2.5065
TT7           13  520.71      518.74      517.62      520.75      520.21
TT8           14  521.47      520.00      519.20      521.14      520.76
TRAT          15  1.0015      1.0024      1.0031      1.0007      1.0011
PAM           16  14.307      14.307      14.307      14.307      14.307
BPR           17  3.1198      3.1233      3.1263      3.1084      3.1085


      E3 MIXER NO.12 CONF 48,RUNS 186-189,185.1,HOT
CVMIX          1  .98746      .98693      .98715      .98597      .98786
CDMIX          2  .98070      .98066      .98109      .97924      .98051
PTMPA          3  2.4886      2.4878      2.4889      2.4940      2.4815
PTFPAM         4  2.5591      2.5590      2.5591      2.5647      2.5506
PTEPAM         5  2.3263      2.3222      2.3282      2.3306      2.3241
PRAT           6  1.1001      1.1020      1.0992      1.1005      1.0975
MIXP           7  .13963E-01 .13818E-01 .13998E-01 .13947E-01 .14086E-01
FG  (    3)    8  997.45      996.99      998.03      999.17      987.97
MNFAN          9  .54440      .54541      .54431      .54371      .54294
MNPRI         10  .39773      .39575      .39905      .39602      .40023
PT7PAM        11  2.5809      2.5809      2.5809      2.5865      2.5723
PT8PAM        12  2.3437      2.3394      2.3458      2.3479      2.3416
TT7           13  528.46      525.92      526.10      525.38      529.54
TT8           14  1317.6      1309.5      1310.8      1310.2      1320.5
TRAT          15  2.4932      2.4899      2.4915      2.4939      2.4937
PAM           16  14.247      14.247      14.247      14.247      14.174
BPR           17  6.5686      6.6030      6.5255      6.5791      6.5243

      E3 MIXER NO.12 CONF 49,RUNS 191-195,COLD
CVMIX          1  .99056      .99068      .99090      .99109      .99123
CDMIX          2  .97065      .97108      .97102      .97100      .97082
PTMPA          3  2.4748      2.4744      2.4746      2.4753      2.4753
PTFPAM         4  2.4732      2.4725      2.4725      2.4726      2.4726
PTEPAM         5  2.4796      2.4802      2.4809      2.4835      2.4836
PRAT           6  .99741      .99691      .99664      .99560      .99557
MIXP           7  .19949E-04 .61559E-05 .15266E-04 .39381E-05 .15263E-04
FG  (    3)    8  991.28      991.49      991.53      991.90      991.72
MNFAN          9  .51296      .51312      .51297      .51260      .51246
MNPRI         10  .51675      .51761      .51788      .51901      .51891
PT7PAM        11  2.4929      2.4922      2.4922      2.4922      2.4922
PT8PAM        12  2.4998      2.5005      2.5012      2.5040      2.5040
TT7           13  516.91      515.36      514.78      517.38      517.15
TT8           14  520.27      518.45      517.58      519.19      518.72
TRAT          15  1.0065      1.0060      1.0054      1.0035      1.0030
PAM           16  14.421      14.421      14.421      14.421      14.421
BPR           17  3.1763      3.1651      3.1636      3.1455      3.1508

      E3 MIXER NO.12 CONF 49,RUNS 196-200,HOT
CVMIX          1  .98929      .98807      .98757      .98901      .98754
CDMIX          2  .97661      .97533      .97529      .97659      .97491
PTMPA          3  2.4845      2.4870      2.4875      2.4851      2.4885
PTFPAM         4  2.5521      2.5541      2.5556      2.5535      2.5563
PTEPAM         5  2.3262      2.3285      2.3271      2.3242      2.3285
PRAT           6  1.0971      1.0969      1.0982      1.0987      1.0978
MIXP           7  .13756E-01 .13699E-01 .13684E-01 .13674E-01 .13703E-01
FG  (    3)    8  1001.9      1002.0      1002.3      1002.2      1002.5
MNFAN          9  .54014      .53916      .53991      .54103      .53946
MNPRI         10  .39695      .39587      .39458      .39534      .39462
PT7PAM        11  2.5736      2.5757      2.5771      2.5750      2.5778
PT8PAM        12  2.3424      2.3445      2.3431      2.3403      2.3445
TT7           13  523.09      519.38      517.14      519.39      518.37
TT8           14  1299.9      1291.3      1286.1      1290.4      1289.0
TRAT          15  2.4850      2.4862      2.4870      2.4845      2.4867
PAM           16  14.404      14.404      14.404      14.404      14.404
BPR           17  6.6580      6.7021      6.6842      6.6622      6.6887
```

2) Procedure to Calculate Fully Mixed Conditions

Establishing the fully mixed properties required to calculate nozzle coefficients involves solving a set of 4 equations iteratively in velocity using the following assumptions:

- o one dimensional flow
- o fan and primary flow has equal static pressure at mixing plan
- o flow becomes fully mixed
- o mixing duct is constant area

The equations involved are:

Continuity

$$\dot{m}_p + \dot{m}_f = \rho_M A_M V_M \tag{1}$$

Momentum

$$p_1 A_M - p_M A_M = \rho_M A_M V_M^2 - \dot{m}_p V_{1p} - \dot{m}_f V_{1f}$$

Energy

$$\dot{m}_M \left(h_M + \frac{V_M^2}{2}\right) = \dot{m}_p \left(h_{1_p} + \frac{V_{1p}^2}{2}\right) + \dot{m}_f \left(h_{1_f} + \frac{V_{1f}^2}{2}\right) \tag{3}$$

Equation of State

$$p_M \sim f(\rho_M, h_M) \tag{4}$$

where

1 is the point at which both streams come together (mixing plane) for first time.

f is fan duct at mixing plane.

p is primary duct at mixing plane.

M is the point at which both flows are fully mixed.

$\dot{m}$ is mass flow.

The known quantities are:

$\dot{m}p$, $\dot{m}f$, p1,
V_{1p}, V_{1f}, h_{1p}, h_{1f},
A_M assumed to be mixing plane area.

The unknown quantities are:

ρ_M, P_M, h_M, and V_M

where ρ is density and h is enthalpy.

Equation (1) through (4) represent a proper set of 4 equations and 4 unknowns. The equations are solved iteractively in velocity. The Gas Tables are used in place of equation (4). Once solved, fully mixed Mach number, total pressure and temperature can be calculated.

$$M_{n_M} = f(V_M, T_M)$$
$$P_{T_{MIX}} = f(p_M, Mn_M)$$
$$T_{T_{MIX}} = f(T_M, Mn_M)$$

The ideal thrust and flow used in the model thrust ($C_{V_{MIX}}$) and flow ($C_{D_{MIX}}$) coefficients are calculated with these conditions.

3) <u>Thrust Balance Temperature Correction</u>: $\Delta C_{V_{TEMP}}$

At the completion of Phase I model testing, it was determined that a correction to the measured thrust was necessary because the measured thrust was observed to be a function of balance temperature. Since balance temperature was not measured during Phase I testing it was assumed to be essentially equal to ambient temperature which was obtained from the National Weather Bureau and the Minneapolis Tribune, as a function of date and time of day. The temperature correction is defined as:

$$\Delta C_{V_{TEMP}} = \frac{\Delta \text{CORRECTED AXIAL THRUST}}{F_G(3)} = \frac{H2\ (.0001513(TO) - .01053)}{F_G(3)}$$

where:
H2 - UNCORRECTED AXIAL BALANCE FORCE POUNDS
TO - BALANCE TEMPERATURE ^oF
$F_G(3)$ - 100% MIXED IDEAL THRUST POUNDS

This correction was added to the original thrust coefficient to estimate the real model thrust coefficient for Phase I, where

$$C_V')_{corrected} = C_V' + \Delta C_{V_{TEMP}}$$

A tabulation of this correction, averaging approximately +0.0004 C_V, is presented in Table I for a cruise PTMPA = 2.5. In genral this correction significantly improves the consistency of the Phase I data. The ambient temperature history for all of Phase I is presented in Table II.

During the Phase II testing the thrust balance temperature was measured directly and incorporated into the basic data reduction.

TABLE A-1

CRUISE CONDITION PTMPA = 2.5

CONFIGURATION	HOT C_{VTEMP}	COLD C_{VTEMP}
1	-0.0001	-0.0005
2	-0.0005	-0.0004
3	-0.0010	-0.0005
4	0.0010	0.0010
5	0.0009	-0.0008
6	-0.0011	-0.0013
7	0.0011	0.0002
8	0.0006	-0.0005
9	0.0003	-0.0001
10	0.0008	0.0011
11	0	0.0006
13	0.0011	-0.0002
14	0.0008	0.0019
15	0.0003	-0.0003
16	0.0002	0.0013
17	0.0003	-0.0010
18	-0.0002	-0.0006
19	0.0006	-0.0011
21	-0.0006	-0.0010
22	0.0008	0
23	0	0.0014
24	0.0012	0.0003
25	0	0.0003
26	0	0.0004
27	0.0012	0.0012
28	0.0011	0.0013
29	0.0002	0.0004
30	0.0005	0.0005

TABLE A-2

AMBIENT TEMPERATURE LOG

CONFIG.	RUN NO.	DATE	TIME	T_{AMB}
1	2, 3, 4, 6	5/24/79	8:12	55°F
1	1	5/24	12:45	64°F
1	5	5/24	13:30	63°F
1	4.1-6.1	6/7	10:16	64°F
1	4.11-6.11	6/22	10:20	59°F
1	6.4, 5.6, 4.4	7/18	10:15	75°F
1	7-12	5/25	8:20	57°F
1	10.1-12.3	7/18	10:15	75°F
1	237-242	6/22	12:45	60°F
1	10.3-12.3	7/18	12:38	81°F
2	14-19	5/25	2:30	66°F
2	21, 23, 25	5/25	11:50	64°F
2	20, 22, 24	5/25	12:55	64°F
3	26, 27, 28, 29, 31	6/1	7:55	48°F
3	30	6/1	14:09	70°F
3	32, 33, 35, 37	5/31	4:00	58°F
3	34.1, 36.1	5/31	4:31	60°F
4	40, 42, 44	5/29	1:00	81°F
4	39, 41, 43	5/29	1:30	81°F
4	45-50	5/29	2:30	81°F
5	51-56	5/30	8:45	61°F
5	57-62	5/29	4:30	81°F
6	64-69	5/31	12:50	56°F
6	70-75	5/31	12:00	56°F
7	76-79, 81	6/9	12:11	64°F
7	80	6/8	13:40	56°F
7	79.1-81.1	6/14	11:00	84°F
7	82-87	6/7	14:50	75°F
7	85.1, 87.1	6/14	14:17	91°F
8	92	6/8	16:36	64°F
8	93, 91-88	6/9	11:10	66°F
8	94-99	6/7	16:10	77°F
9	101- 06	6/19	13:17	79°F
9	104.4, 105.5, 106.4	6/22	8:12	59°F
9	107-112	6/20	11:09	74°F
9	110.2-112.2	6/21	15:00	74°F
10	113-118	6/29	10:42	82°F
10	119-124	6/29	14:00	80°F
11	125-130	7/3	10:40	76°F
11	131-136	7/3	14:22	71°F
13	150-155	6/5	7:22	61°F
13	156-161	6/4	16:47	83°F
14	163-168	6/6	13:50	85°F

TABLE A-2 (Cont'd)

14	167	6/6	15:54	95°F
14	169-174	6/6	12:35	80°F
15	175-180	6/5	8:05	64°F
15	179	6/5	10:35	70°F
15	181-186	6/6	10:38	74°F
16	187-192	7/2	14:20	84°F
16	193-198	7/3	15:34	72°F
17	199-204	6/9	14:44	60°F
17	205-210	6/12	10:39	74°F
18	212-217	6/9	13:45	64°F
18	218-223	6/19	9:07	68°F
19	224-229	6/9	16:23	58°F
19	230-235	6/12	15:51	77°F
21	243-248	6/22	9:13	60°F
21	249-254	6/22	15:30	63°F
22	255-260	6/26	16:08	70°F
22	261-266	6/27	13:41	80°F
23	267-272	7/12	13:00	85°F
23	273-278	7/14	8:30	71°F
24	279-284	7/13	9:17	78°F
24	285-290	7/13	16:11	85°F
25	291-296	7/16	16:30	73°F
25	297-302	7/17	10:27	71°F
26	303-308	7/17	12:44	74°F
26	309-314	7/17	11:45	71°F
27	315-320	7/11	16:30	89°F
27	320.1	7/18	16:45	80°F
27	318.1	7/19	10:25	77°F
27	315.2,319.4,318.2,320.2	7/19	14:18	82°F
27	321-326	7/11	15:30	89°F
27	321.1-326.1	7/18	16:13	80°F
27	324.2-326.2	7/19	16:45	83°F
28	328-329	7/10	12:45	85°F
28	328.1, 329.1	7/18	15:39	81°F
28	331-332	7/11	13:00	80°F
28	330.1, 332.1	7/18	14:40	84°F
29	333-338	7/20	9:13	74°F
29	339-344	7/20	11:08	73°F
30	345-347	7/4	10:15	75°F
30	340-350	7/14	9:25	76°F

Appendix B

Nozzle Exit Plane Traverses

Traverse plots were obtained by surverying the nozzle exit plane of selected configurations in Phase I and all the configurations in Phase II. At a single simulated engine operating point, total pressure and total temperature were measured and non-dimensionalized relative to the corresponding ideal mixed property The charging station conditions for each stream (fan stream = station 7 and primary stream = station 8) are identified along with the absolute level of the fully mixed reference. The location of the primary lobe peaks is indicated by an arrow.

Exit Survey

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Pressure Traverse

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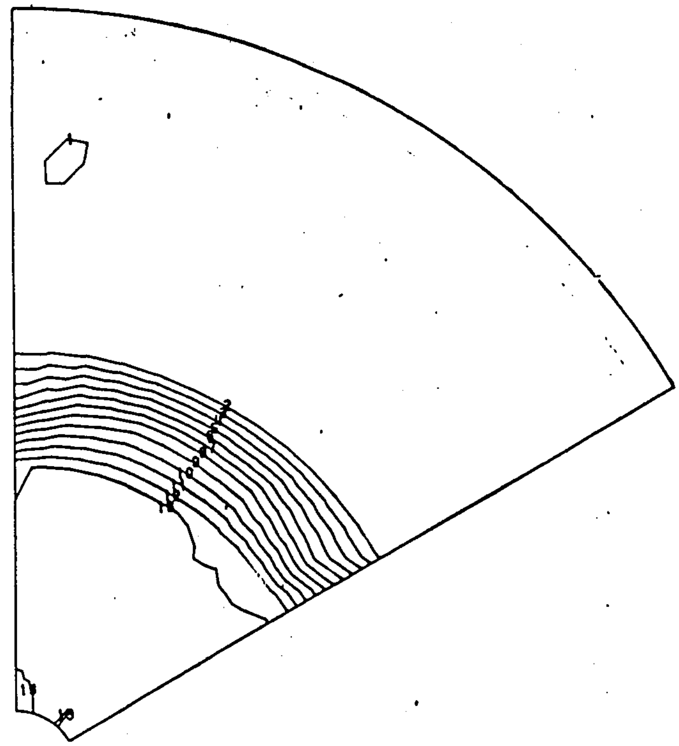
TEMPERATURE CONF 1



T_T/T_{TMIX}

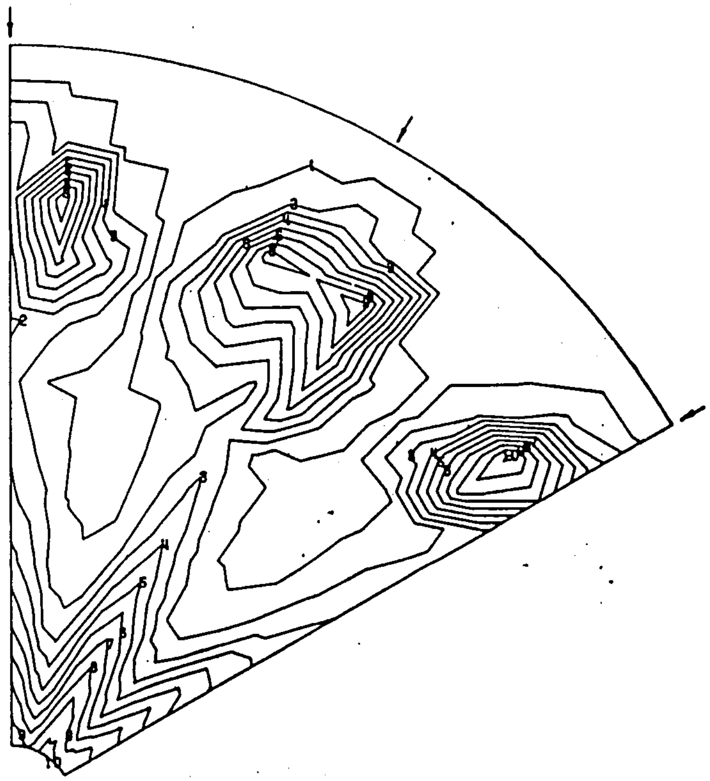
CURVE LABEL	CURVE VALUE
1	0.800000E+00
2	0.900000E+00
3	0.100000E+01
4	0.110000E+01
5	0.120000E+01
6	0.130000E+01
7	0.140000E+01
8	0.150000E+01
9	0.160000E+01
10	0.170000E+01
11	0.180000E+01
12	0.189999E+01
13	0.199999E+01

TT7/TTMIX=0.81

TT8/TTMIX=2.00

TTMIX = 355.99°K (641.38°R)

TEMPERATURE CONF 3



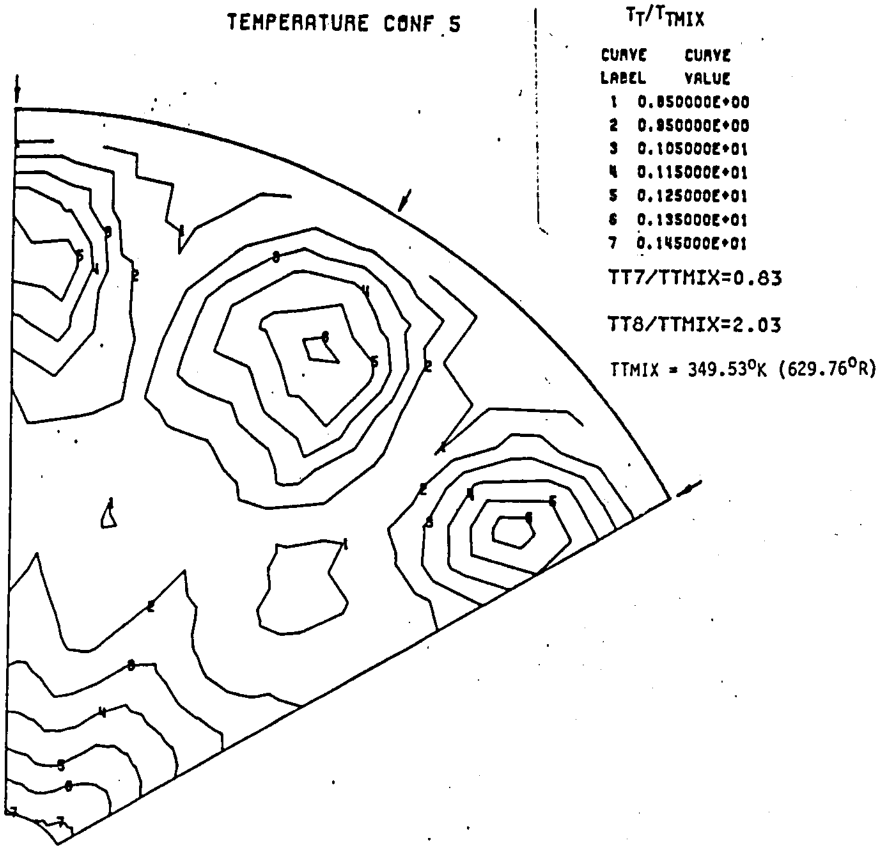
T_T/T_{TMIX}

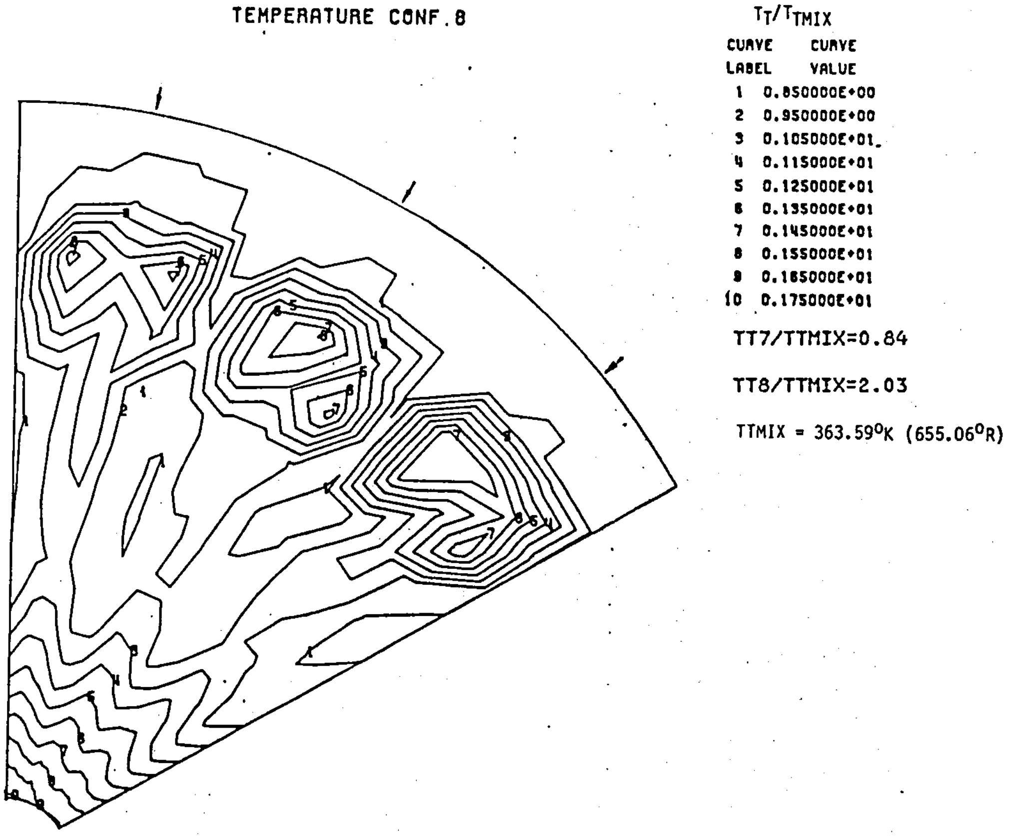
CURVE LABEL	CURVE VALUE
1	0.850000E+00
2	0.950000E+00
3	0.105000E+01
4	0.115000E+01
5	0.125000E+01
6	0.135000E+01
7	0.145000E+01
8	0.155000E+01
9	0.165000E+01
10	0.175000E+01

TT7/TTMIX=0.83

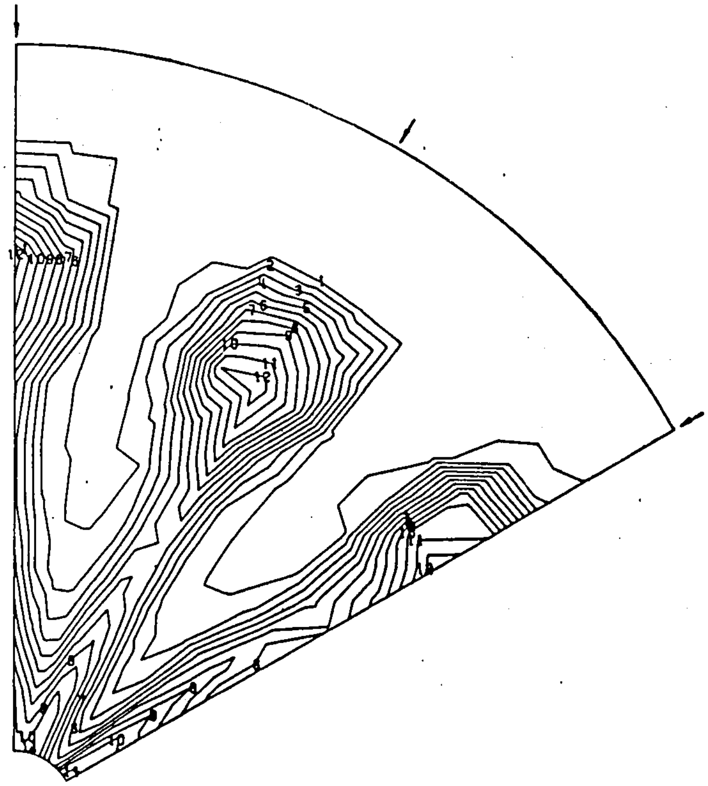
TT8/TTMIX=2.05

TTMIX = 347.14°K (625.45°R)


TEMPERATURE CONF.5


TEMPERATURE CONF.8

TEMPERATURE CONF 13



T_T/T_{TMIX}

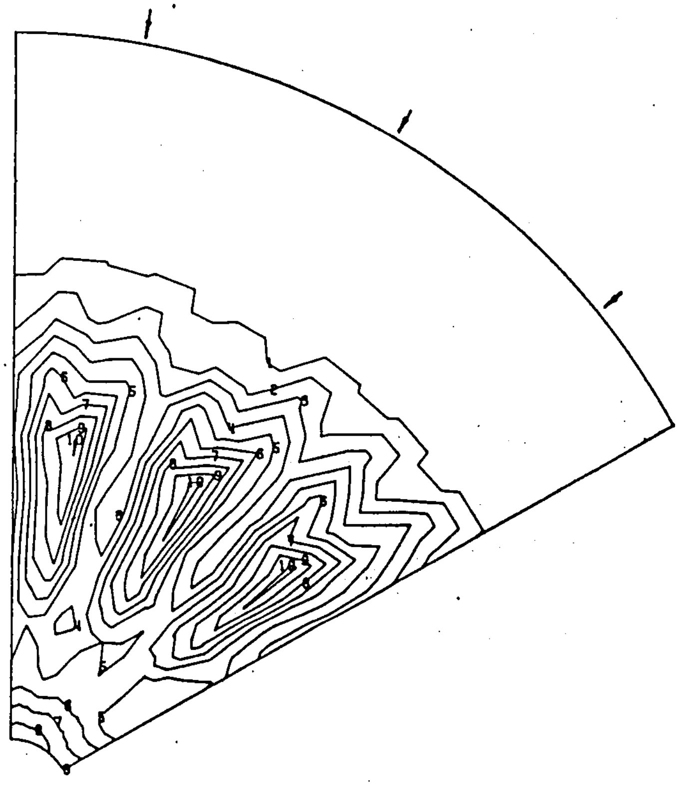
CURVE LABEL	CURVE VALUE
1	0.850000E+00
2	0.950000E+00
3	0.105000E+01
4	0.115000E+01
5	0.125000E+01
6	0.135000E+01
7	0.145000E+01
8	0.155000E+01
9	0.165000E+01
10	0.175000E+01
11	0.184999E+01
12	0.184999E+01

TT7/TTMIX=0.82

TT8/TTMIX=2.02

TTMIX = 357.92°K (644.83°R)

TEMPERATURE CONF 17



T_T/T_{TMIX}

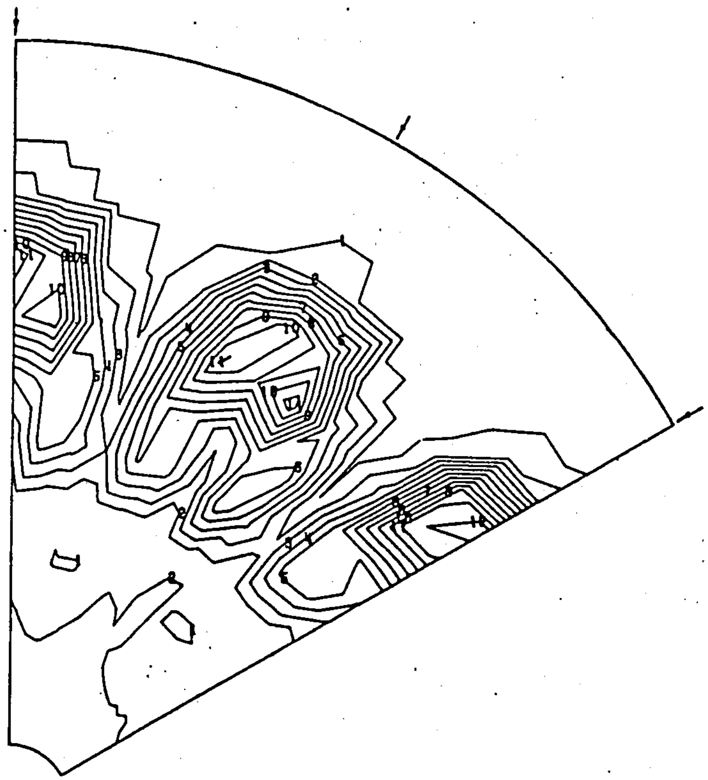
CURVE LABEL	CURVE VALUE
1	0.850000E+00
2	0.950000E+00
3	0.105000E+01
4	0.115000E+01
5	0.125000E+01
6	0.135000E+01
7	0.145000E+01
8	0.155000E+01
9	0.165000E+01
10	0.175000E+01

TT7/TTMIX=0.83

TT8/TTMIX=2.05

TTMIX = 349.61°K (629.89°R)

TEMPERATURE CONF 19



T_T/T_{TMIX}

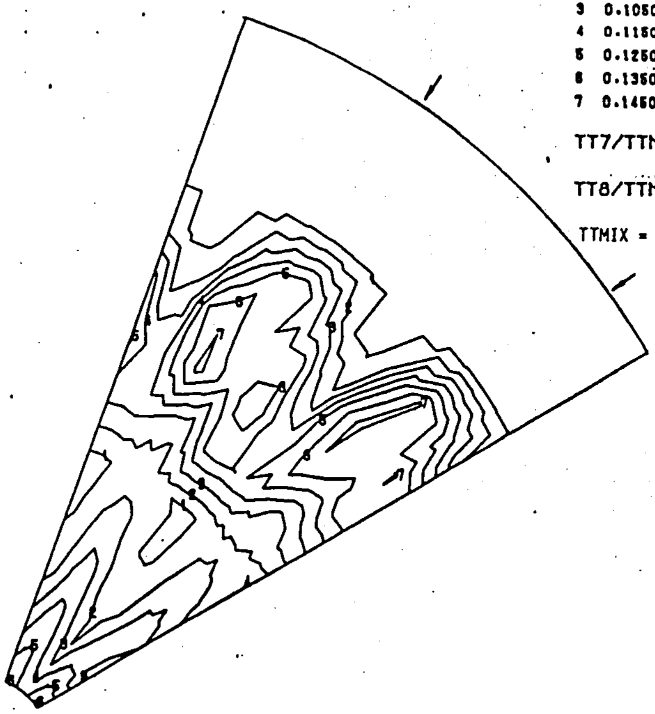
CURVE LABEL	CURVE VALUE
1	0.850000E+00
2	0.950000E+00
3	0.105000E+01
4	0.115000E+01
5	0.125000E+01
6	0.135000E+01
7	0.145000E+01
8	0.155000E+01
9	0.165000E+01
10	0.175000E+01
11	0.184999E+01
12	0.184999E+01

TT7/TTMIX=0.83

TT8/TTMIX=2.04

TTMIX = 348.57°K (628.03°R)

TEMPERATURE CONF 29



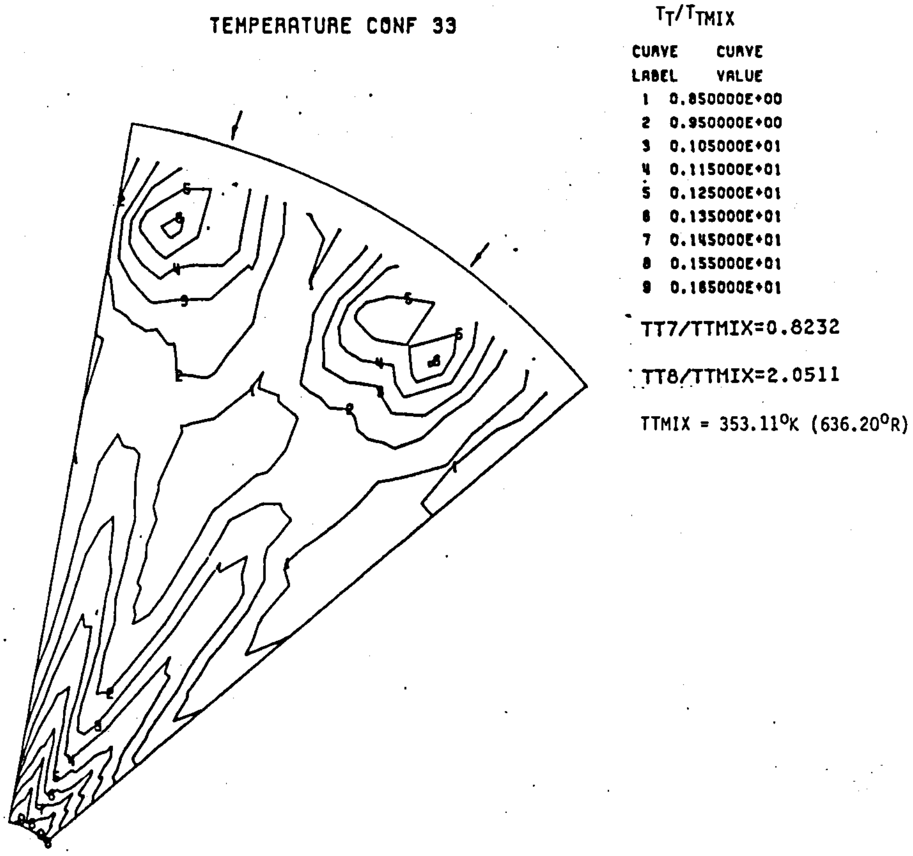
T_T/T_{TMIX}

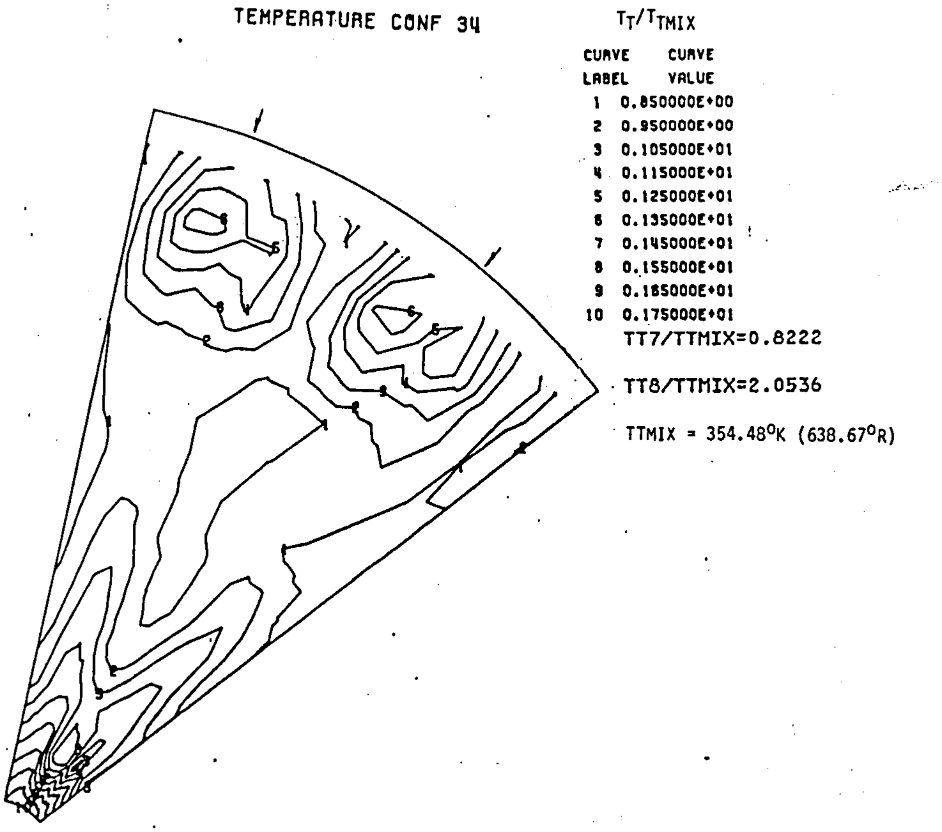
CURVE LABEL	CURVE VALUE
1	0.850000E+00
2	0.950000E+00
3	0.105000E+01
4	0.115000E+01
5	0.125000E+01
6	0.135000E+01
7	0.145000E+01

TT7/TTMIX=0.8262

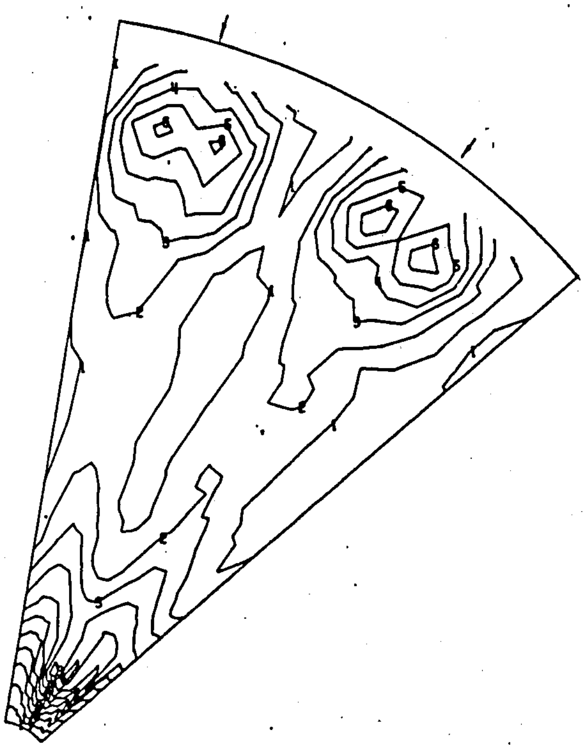
TT8/TTMIX=2.0637

TTMIX = 357.82°K (644.68°R)


TEMPERATURE CONF 33
T_T/T_{TMIX}
CURVE LABEL
CURVE VALUE
1 0.850000E+00
2 0.950000E+00
3 0.105000E+01
4 0.115000E+01
5 0.125000E+01
6 0.135000E+01
7 0.145000E+01
8 0.155000E+01
9 0.165000E+01
TT7/TTMIX=0.8232
TT8/TTMIX=2.0511
TTMIX = 353.11°K (636.20°R)


TEMPERATURE CONF 34
T_T/T_{TMIX}
CURVE LABEL
CURVE VALUE
1 0.850000E+00
2 0.950000E+00
3 0.105000E+01
4 0.115000E+01
5 0.125000E+01
6 0.135000E+01
7 0.145000E+01
8 0.155000E+01
9 0.165000E+01
10 0.175000E+01
TT7/TTMIX=0.8222
TT8/TTMIX=2.0536
TTMIX = 354.48°K (638.67°R)

TEMPERATURE CONF 35



T_T/T_{TMIX}

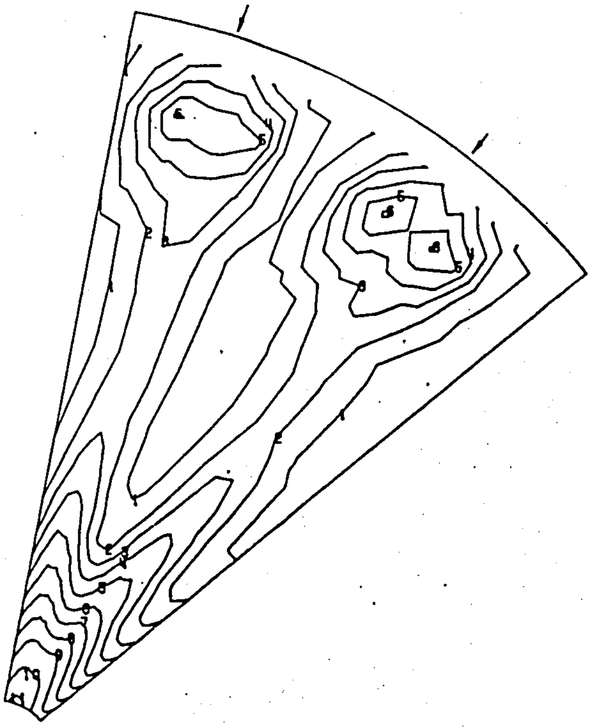
CURVE LABEL	CURVE VALUE
1	0.850000E+00
2	0.950000E+00
3	0.105000E+01
4	0.115000E+01
5	0.125000E+01
6	0.135000E+01
7	0.145000E+01
8	0.155000E+01
9	0.165000E+01
10	0.175000E+01
11	0.184999E+01

TT7/TTMIX=0.8197

TT8/TTMIX=2.0467

TTMIX = 358.07°K (645.13°R)

TEMPERATURE CONF 36



T_T/T_{TMIX}

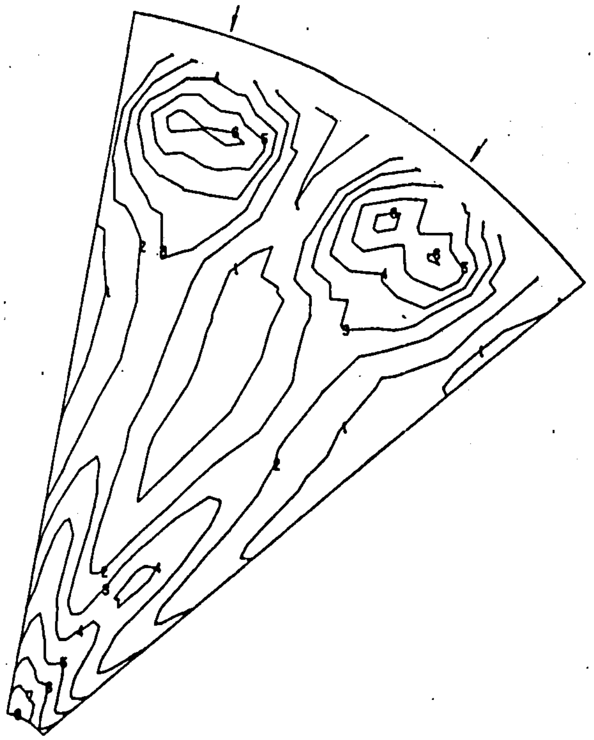
CURVE LABEL	CURVE VALUE
1	0.850000E+00
2	0.950000E+00
3	0.105000E+01
4	0.115000E+01
5	0.125000E+01
6	0.135000E+01
7	0.145000E+01
8	0.155000E+01
9	0.165000E+01
10	0.175000E+01
11	0.184999E+01

TT7/TTMIX=0.8124

TT8/TTMIX=2.0284

TTMIX = 355.18°K (639.92°R)

TEMPERATURE CONF 37



T_T/T_{TMIX}

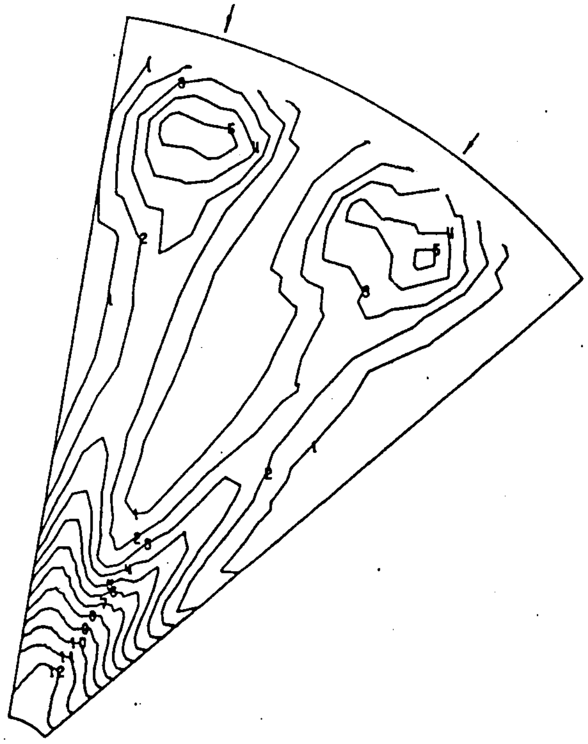
CURVE LABEL	CURVE VALUE
1	0.850000E+00
2	0.950000E+00
3	0.105000E+01
4	0.115000E+01
5	0.125000E+01
6	0.135000E+01
7	0.145000E+01
8	0.155000E+01

TT7/TTMIX=0.8316

TT8/TTMIX=2.0726

TTMIX = 347.75°K (626.55°R)

TEMPERATURE CONF 38



T_T/T_{TMIX}

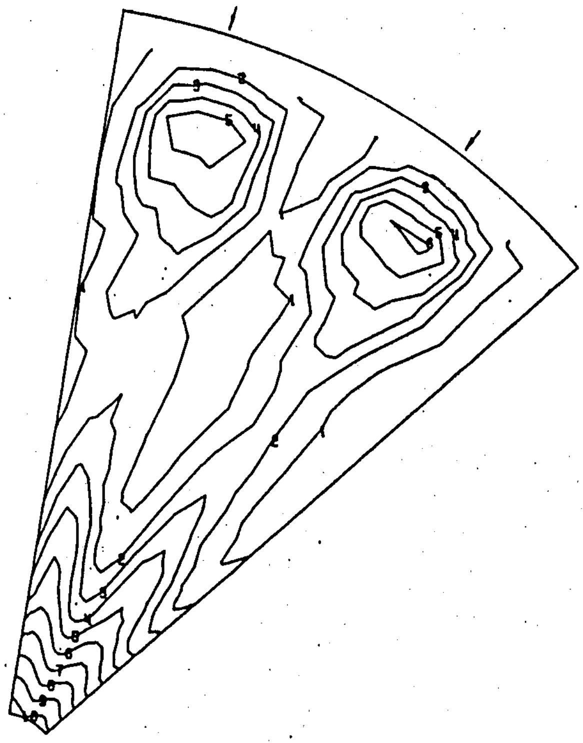
CURVE LABEL	CURVE VALUE
1	0.850000E+00
2	0.950000E+00
3	0.105000E+01
4	0.115000E+01
5	0.125000E+01
6	0.135000E+01
7	0.145000E+01
8	0.155000E+01
9	0.165000E+01
10	0.175000E+01
11	0.184999E+01
12	0.194999E+01

TT7/TTMIX=0.8062

TT8/TTMIX=2.0103

TTMIX = 366.68°K (660.62°R)

TEMPERATURE CONF 39



T_T/T_{TMIX}

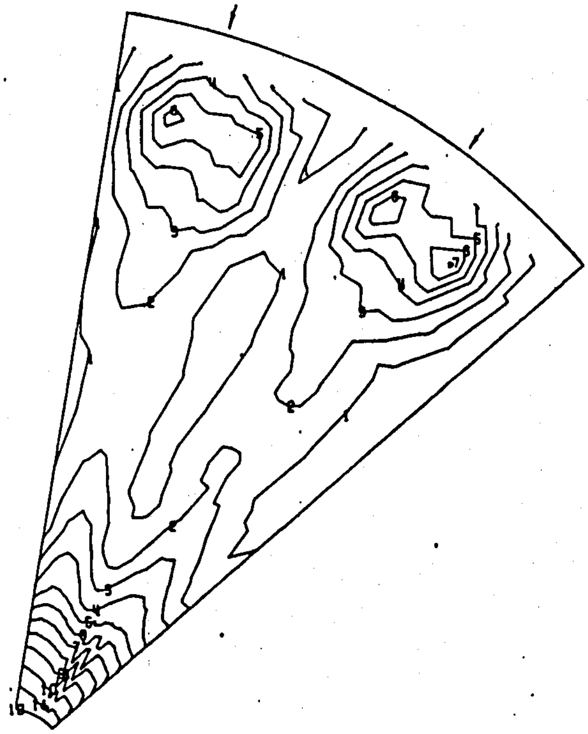
CURVE LABEL	CURVE VALUE
1	0.850000E+00
2	0.950000E+00
3	0.105000E+01
4	0.115000E+01
5	0.125000E+01
6	0.135000E+01
7	0.145000E+01
8	0.155000E+01
9	0.165000E+01
10	0.175000E+01

TT7/TTMIX=0.8262

TT8/TTMIX=2.0628

TTMIX = 355.89°K (641.20°R)

TEMPERATURE CONF 40



T_T/T_{TMIX}

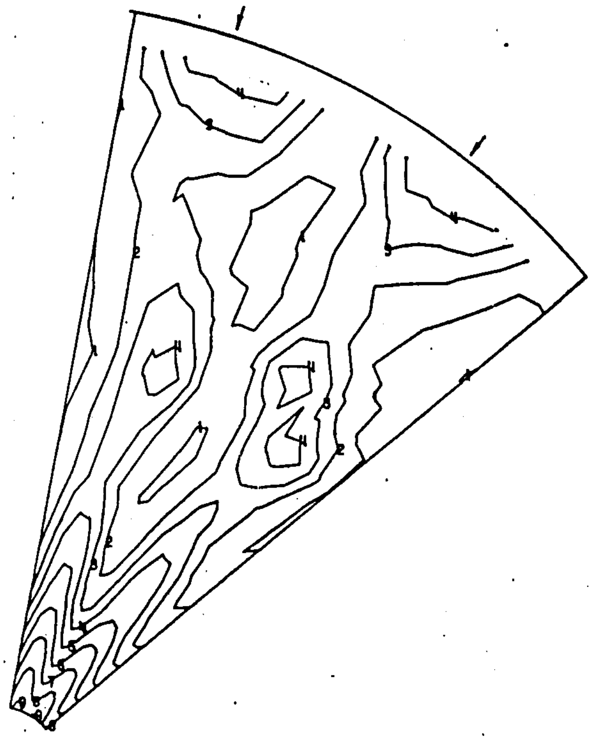
CURVE LABEL	CURVE VALUE
1	0.850000E+00
2	0.950000E+00
3	0.105000E+01
4	0.115000E+01
5	0.125000E+01
6	0.135000E+01
7	0.145000E+01
8	0.155000E+01
9	0.165000E+01
10	0.175000E+01
11	0.184999E+01
12	0.194999E+01

TT7/TTMIX=0.8213

TT8/TTMIX=2.0490

TTMIX = 356.43°K (642.17°R)

TEMPERATURE CONF 41



T_T/T_{TMIX}

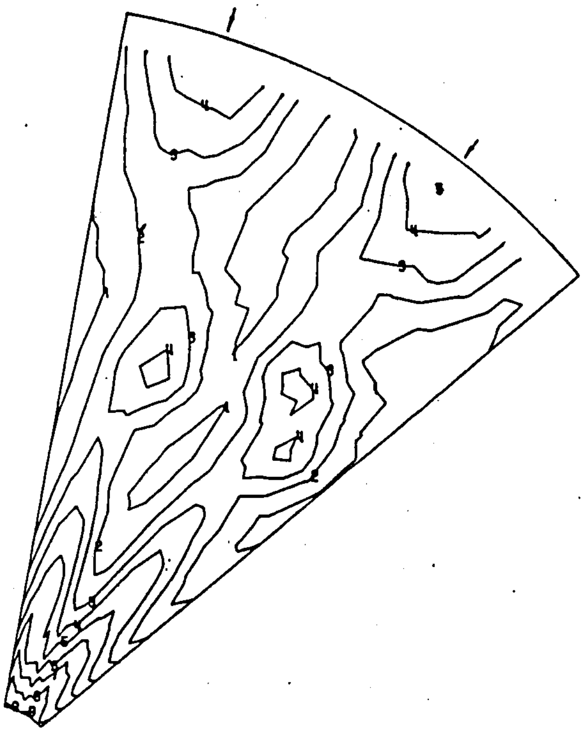
CURVE LABEL	CURVE VALUE
1	0.850000E+00
2	0.950000E+00
3	0.105000E+01
4	0.115000E+01
5	0.125000E+01
6	0.135000E+01
7	0.145000E+01
8	0.155000E+01
9	0.165000E+01

TT7/TTMIX=0.8311

TT8/TTMIX=2.0744

TTMIX = 351.12°K (632.61°R)

TEMPERATURE CONF 42



T_T/T_{TMIX}

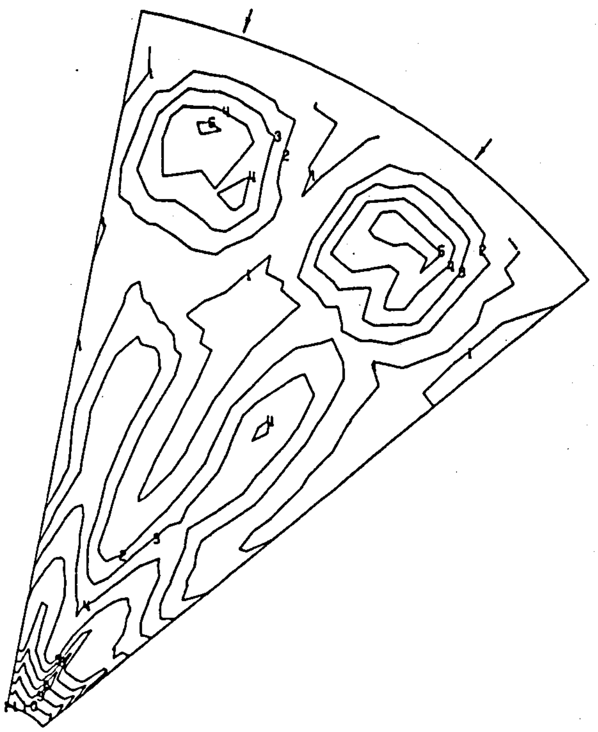
CURVE LABEL	CURVE VALUE
1	0.850000E+00
2	0.950000E+00
3	0.105000E+01
4	0.115000E+01
5	0.125000E+01
6	0.135000E+01
7	0.145000E+01
8	0.155000E+01
9	0.165000E+01

TT7/TTMIX=0.8238

TT8/TTMIX=2.0543

TTMIX = 355.98°K (641.37°R)

TEMPERATURE CONF 43



T_T/T_{TMIX}

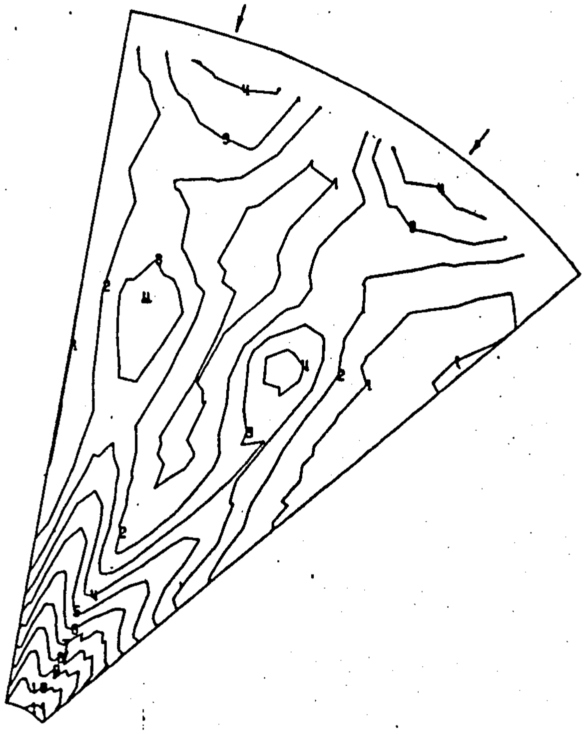
CURVE LABEL	CURVE VALUE
1	0.850000E+00
2	0.950000E+00
3	0.105000E+01
4	0.115000E+01
5	0.125000E+01
6	0.135000E+01
7	0.145000E+01
8	0.155000E+01
9	0.165000E+01
10	0.175000E+01
11	0.184999E+01

TT7/TTMIX=0.8292

TT8/TTMIX=2.0707

TTMIX = 354.44°K (638.60°R)

TEMPERATURE CONF 45



T_T/T_{TMIX}

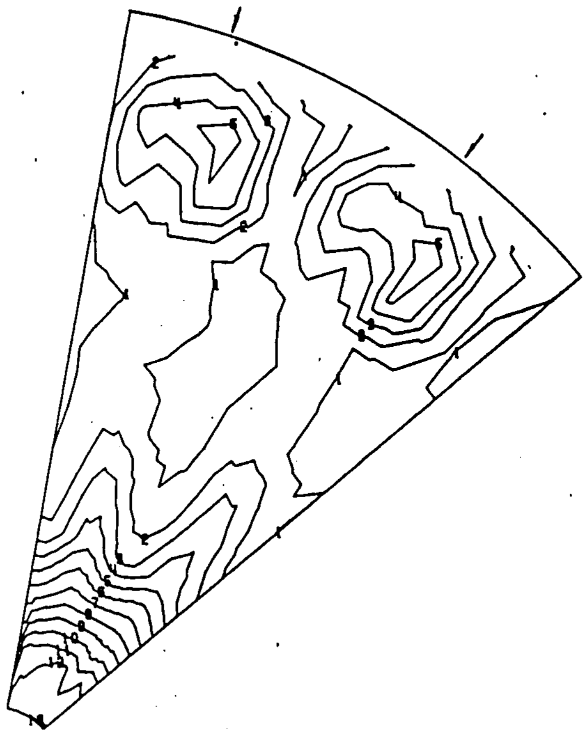
CURVE LABEL	CURVE VALUE
1	0.850000E+00
2	0.950000E+00
3	0.105000E+01
4	0.115000E+01
5	0.125000E+01
6	0.135000E+01
7	0.145000E+01
8	0.155000E+01
9	0.165000E+01
10	0.175000E+01
11	0.184999E+01

TT7/TTMIX=0.8301

TT8/TTMIX=2.0715

TTMIX = 347.99°K (626.99°R)

TEMPERATURE CONF 46



T_T/T_{TMIX}

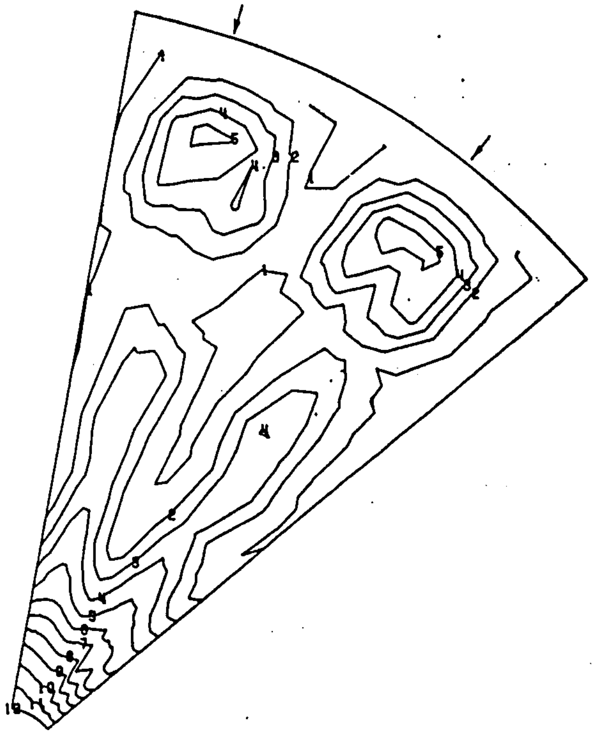
CURVE LABEL	CURVE VALUE
1	0.850000E+00
2	0.950000E+00
3	0.105000E+01
4	0.115000E+01
5	0.125000E+01
6	0.135000E+01
7	0.145000E+01
8	0.155000E+01
9	0.185000E+01
10	0.175000E+01
11	0.184999E+01
12	0.194999E+01
13	0.204999E+01

TT7/TTMIX=0.8202

TT8/TTMIX=2.0488

TTMIX = 350.16°K (630.89°R)

TEMPERATURE CONF 48



T_T/T_{TMIX}

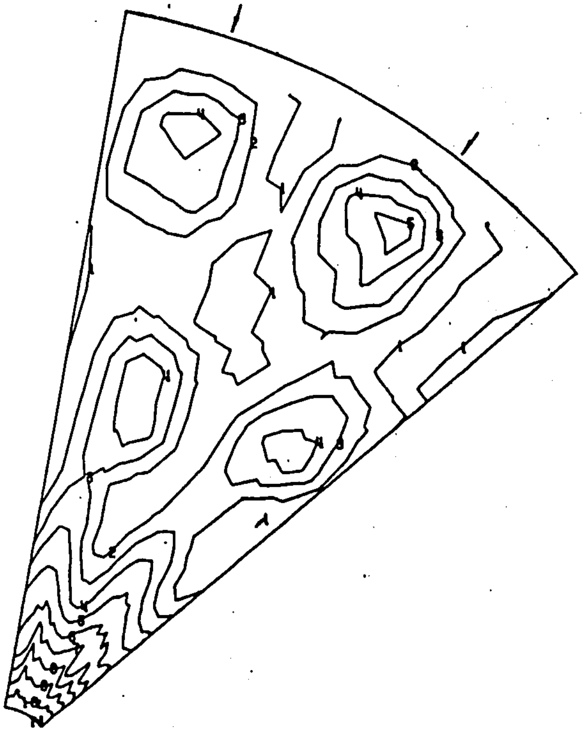
CURVE LABEL	CURVE VALUE
1	0.850000E+00
2	0.950000E+00
3	0.105000E+01
4	0.115000E+01
5	0.125000E+01
6	0.135000E+01
7	0.145000E+01
8	0.155000E+01
9	0.165000E+01
10	0.175000E+01
11	0.184999E+01
12	0.194999E+01

TT7/TTMIX=0.8299

TT8/TTMIX=2.0688

TTMIX = 351.54°K (633.38°R)

TEMPERATURE CONF 49



T_T/T_{TMIX}

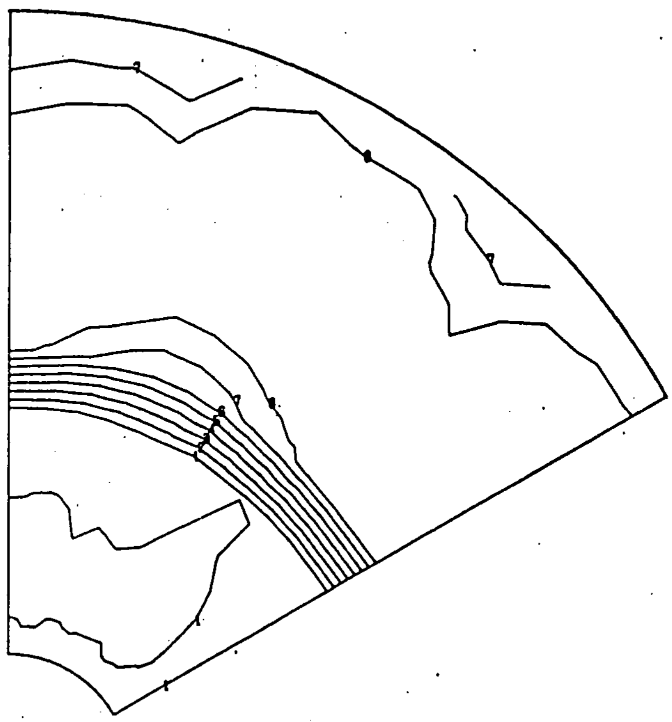
CURVE LABEL	CURVE VALUE
1	0.850000E+00
2	0.950000E+00
3	0.105000E+01
4	0.115000E+01
5	0.125000E+01
6	0.135000E+01
7	0.145000E+01
8	0.155000E+01
9	0.165000E+01
10	0.175000E+01
11	0.184999E+01

TT7/TTMIX=0.8324

TT8/TTMIX=2.0692

TTMIX = 348.20°K (627.36°R)

PRESSURE CONF 1



P_T/P_{TMIX}

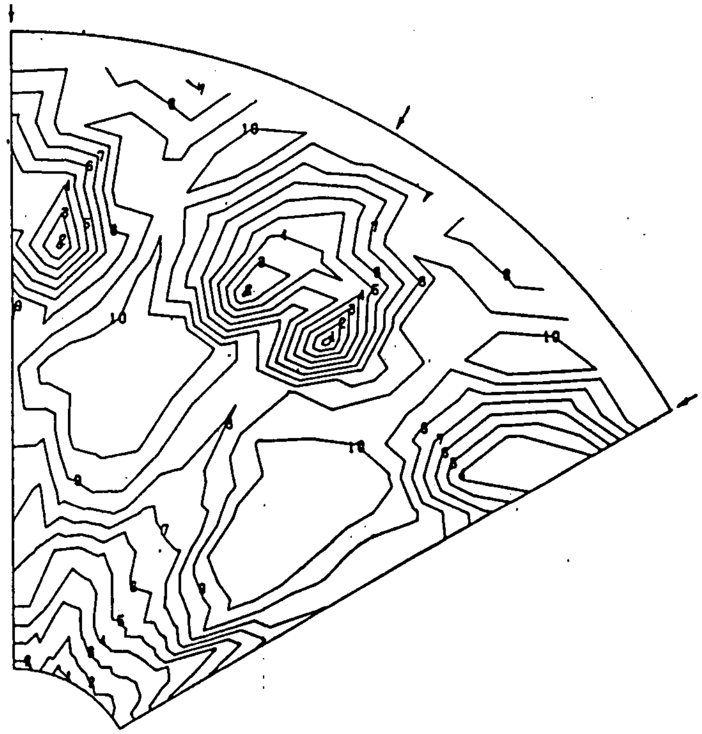
CURVE LABEL	CURVE VALUE
1	0.950000E+00
2	0.960000E+00
3	0.970000E+00
4	0.980000E+00
5	0.990000E+00
6	0.100000E+01
7	0.101000E+01
8	0.102000E+01

PT7/PTMIX=1.03

PT8/PTMIX=0.95

PTMIX = $2.385 \times 10^5 N/m^2$ (34.59 PSIA)

PRESSURE CONF 3



P_T/P_{TMIX}

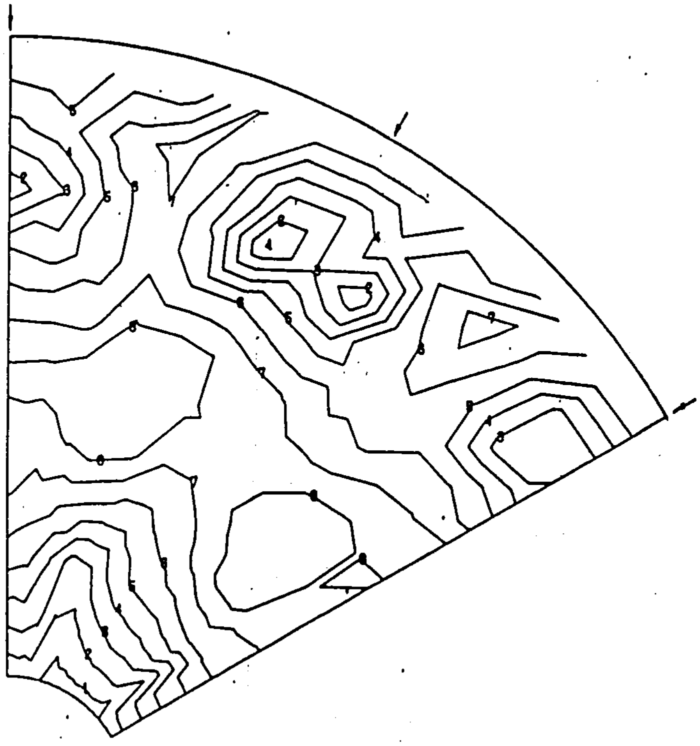
CURVE LABEL	CURVE VALUE
1	0.930000E+00
2	0.940000E+00
3	0.950000E+00
4	0.960000E+00
5	0.970000E+00
6	0.980000E+00
7	0.990000E+00
8	0.100000E+01
9	0.101000E+01
10	0.102000E+01

PT7/PTMIX=1.03

PT8/PTMIX=0.95

PTMIX = $2.358 \times 10^5 N/m^2$ (34.20 PSIA)

PRESSURE CONF 5



P_T/P_{TMIX}

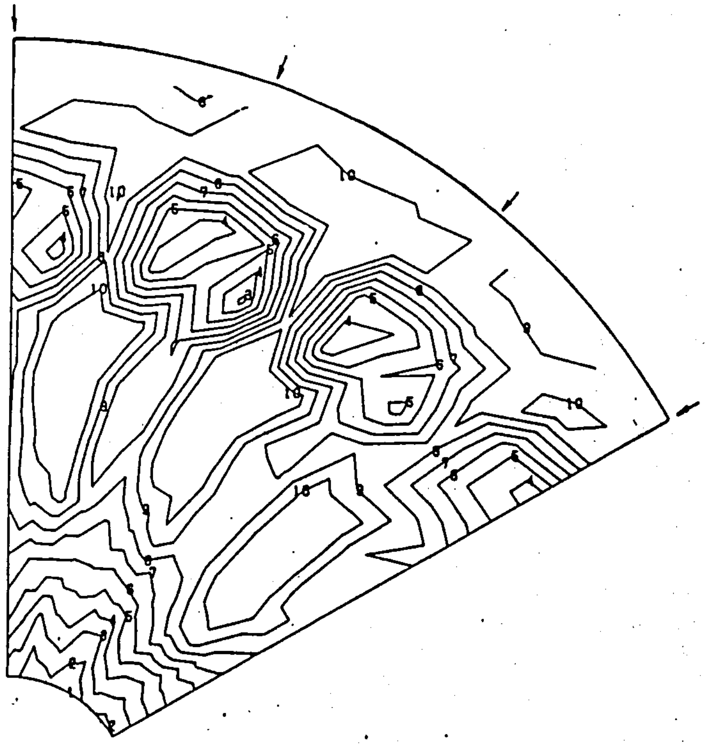
CURVE LABEL	CURVE VALUE
1	0.950000E+00
2	0.960000E+00
3	0.970000E+00
4	0.980000E+00
5	0.990000E+00
6	0.100000E+01
7	0.101000E+01
8	0.102000E+01

PT7/PTMIX=1.03

PT8/PTMIX=0.95

PTMIX = 2.356×10^5 N/m^2 (34.17 PSIA)

PRESSURE CONF 8



P_T/P_{TMIX}

CURVE LABEL	CURVE VALUE
1	0.930000E+00
2	0.940000E+00
3	0.950000E+00
4	0.960000E+00
5	0.970000E+00
6	0.980000E+00
7	0.990000E+00
8	0.100000E+01
9	0.101000E+01
10	0.102000E+01

PT7/PTMIX=1.03

PT8/PTMIX=0.95

PTMIX = 2.355×10^5 N/m^2 (32.41 PSIA)

PRESSURE CONF 13

P_T/P_{TMIX}

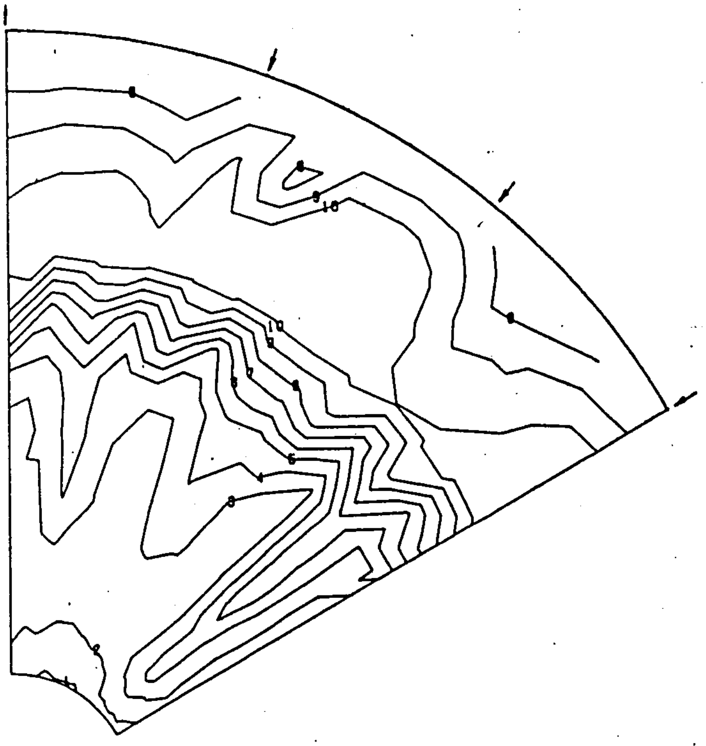
CURVE LABEL	CURVE VALUE
1	0.920000E+00
2	0.930000E+00
3	0.940000E+00
4	0.950000E+00
5	0.960000E+00
6	0.970000E+00
7	0.980000E+00
8	0.990000E+00
9	0.100000E+01
10	0.101000E+01
11	0.102000E+01
12	0.103000E+01

PT7/PTMIX=1.04

PT8/PTMIX=0.95

PTMIX = $2.395\times10^5 N/m^2$ (34.74 PSIA)

PRESSURE CONF 17



P_T/P_{TMIX}

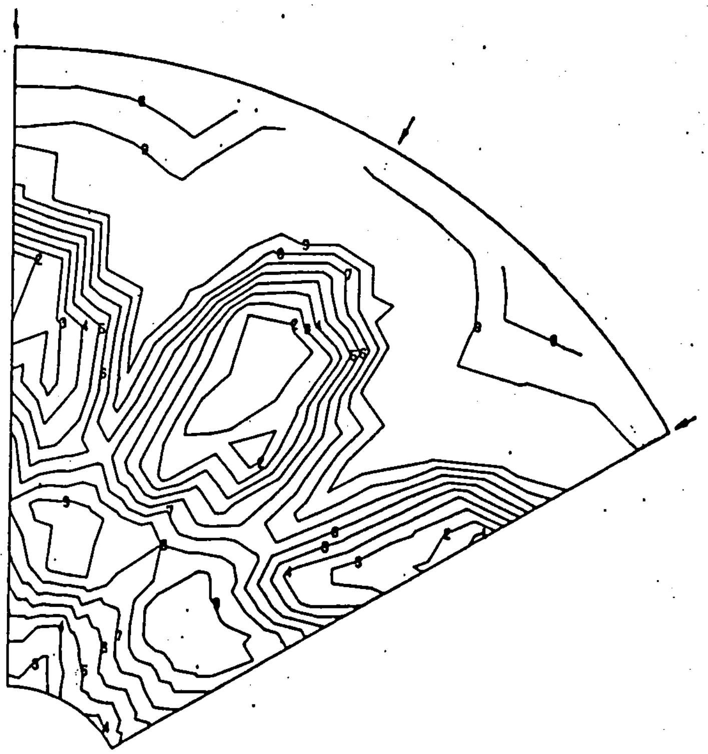
CURVE LABEL	CURVE VALUE
1	0.940000E+00
2	0.950000E+00
3	0.960000E+00
4	0.970000E+00
5	0.980000E+00
6	0.990000E+00
7	0.100000E+01
8	0.101000E+01
9	0.102000E+01
10	0.103000E+01

PT7/PTMIX=1.03

PT8/PTMIX=0.94

PTMIX = $2.405\times10^5 N/m^2$ (34.88 PSIA)

PRESSURE CONF 19



P_T/P_{TMIX}

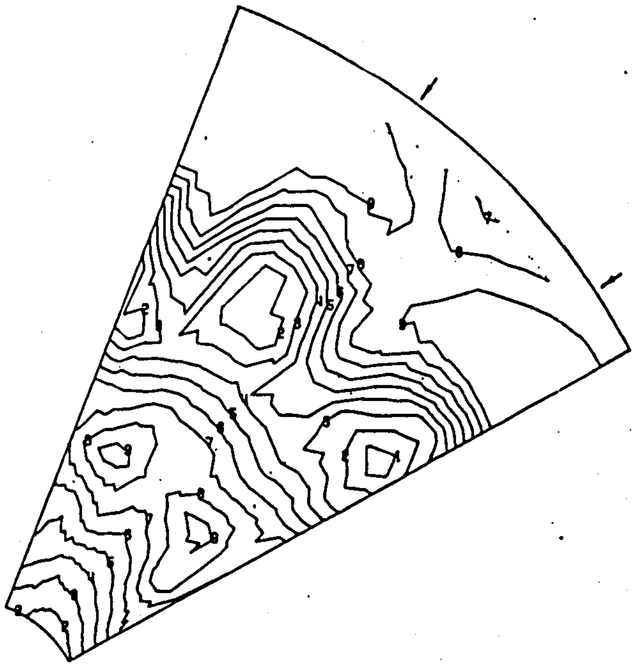
CURVE LABEL	CURVE VALUE
1	0.940000E+00
2	0.950000E+00
3	0.960000E+00
4	0.970000E+00
5	0.980000E+00
6	0.990000E+00
7	0.100000E+01
8	0.101000E+01
9	0.102000E+01

PT7/PTMIX=1.03

PT8/PTMIX=0.94

PTMIX = $2.403\times10^5 N/m^2$ (34.85 PSIA)

PRESSURE CONF 29



P_T/P_{TMIX}

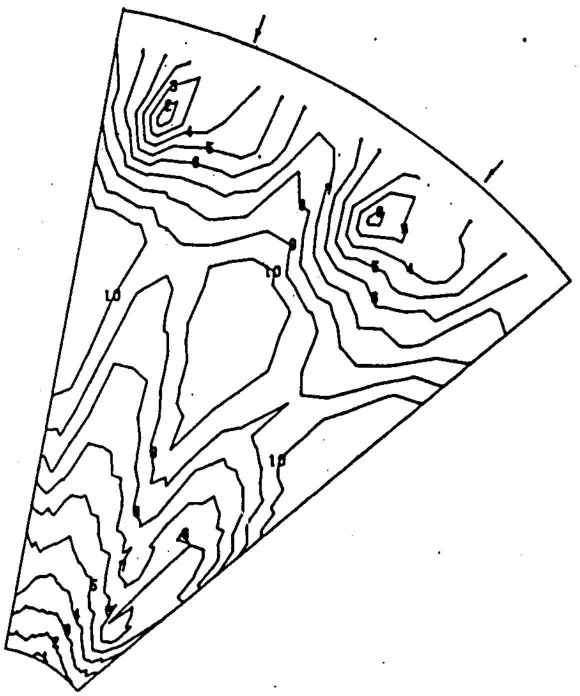
CURVE LABEL	CURVE VALUE
1	0.950000E+00
2	0.960000E+00
3	0.970000E+00
4	0.980000E+00
5	0.990000E+00
6	0.100000E+01
7	0.101000E+01
8	0.102000E+01
9	0.103000E+01

PT7/PTMIX=1.0358

PT8/PTMIX=0.9406

PTMIX = $2.355\times10^5 N/m^2$ (32.41 PSIA)

PRESSURE CONF 33



P_T/P_{TMIX}

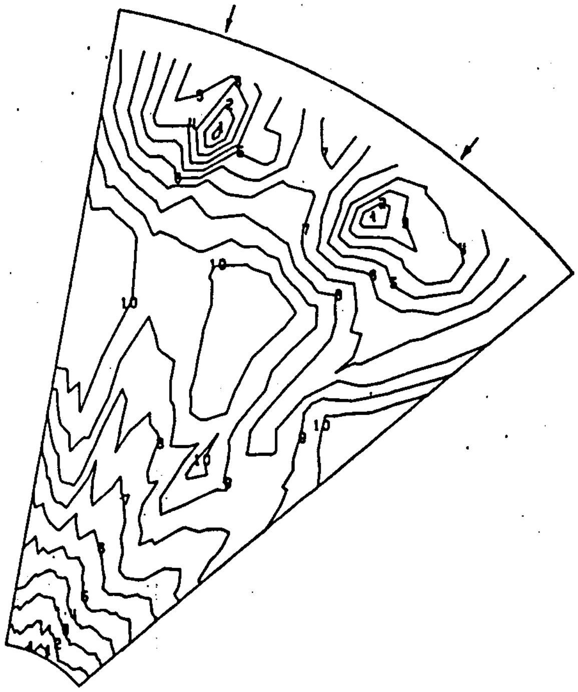
CURVE LABEL	CURVE VALUE
1	0.940000E+00
2	0.950000E+00
3	0.960000E+00
4	0.970000E+00
5	0.980000E+00
6	0.990000E+00
7	0.100000E+01
8	0.101000E+01
9	0.102000E+01
10	0.103000E+01

PT7/PTMIX=1.0369

PT8/PTMIX=0.9449

PTMIX = $2.412 \times 10^5 N/m^2$ (34.97 PSIA)

PRESSURE CONF 34



P_T/P_{TMIX}

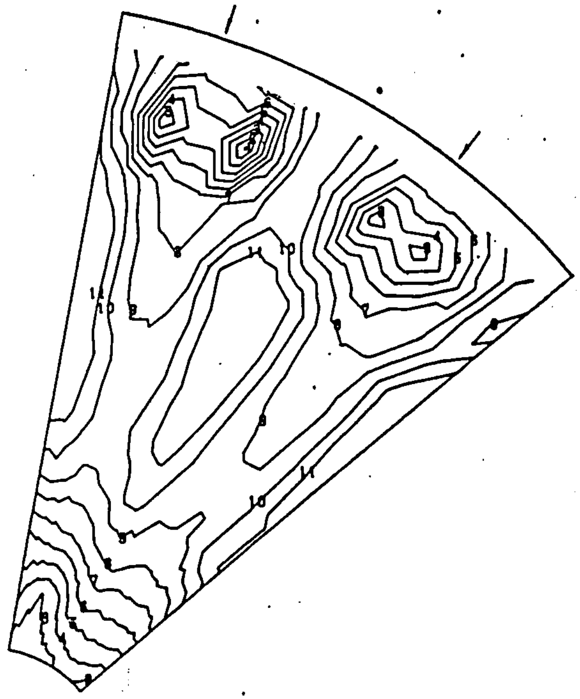
CURVE LABEL	CURVE VALUE
1	0.940000E+00
2	0.950000E+00
3	0.960000E+00
4	0.970000E+00
5	0.980000E+00
6	0.990000E+00
7	0.100000E+01
8	0.101000E+01
9	0.102000E+01
10	0.103000E+01

PT7/PTMIX=1.0382

PT8/PTMIX=0.9446

PTMIX = $2.436 \times 10^5 N/m^2$ (35.33 PSIA)

PRESSURE CONF 35



P_T/P_{TMIX}

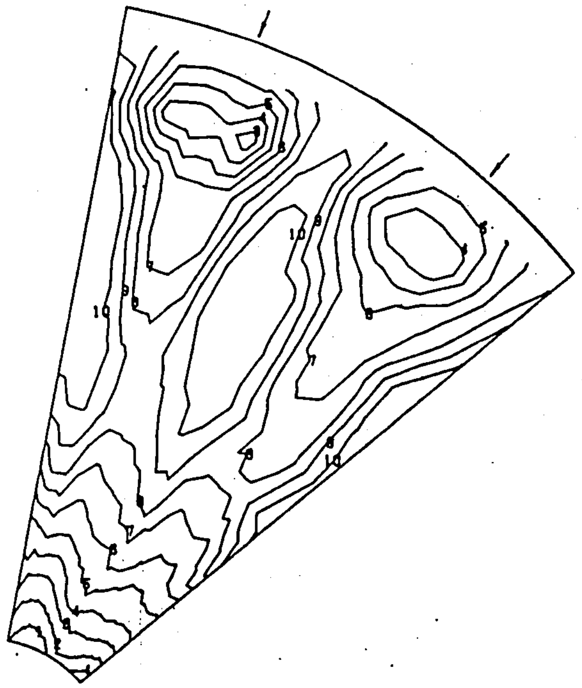
CURVE LABEL	CURVE VALUE
1	0.930000E+00
2	0.940000E+00
3	0.950000E+00
4	0.960000E+00
5	0.970000E+00
6	0.980000E+00
7	0.990000E+00
8	0.100000E+01
9	0.101000E+01
10	0.102000E+01
11	0.103000E+01

PT7/PTMIX=1.0400

PT8/PTMIX=0.9454

PTMIX = 2.432x10^5N/m^2 (35.28 PSIA)

PRESSURE CONF 36



P_T/P_{TMIX}

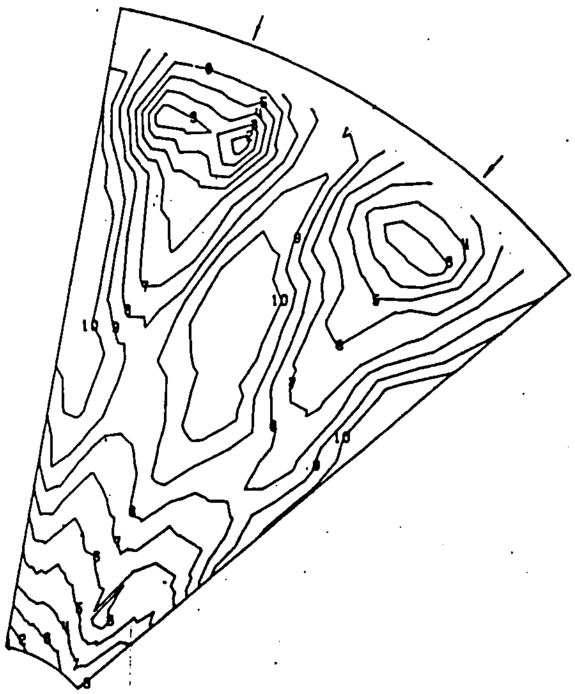
CURVE LABEL	CURVE VALUE
1	0.940000E+00
2	0.950000E+00
3	0.960000E+00
4	0.970000E+00
5	0.980000E+00
6	0.990000E+00
7	0.100000E+01
8	0.101000E+01
9	0.102000E+01
10	0.103000E+01

PT7/PTMIX=1.0390

PT8/PTMIX=0.9470

PTMIX = 2.418x10^5N/m^2 (35.07 PSIA)

PRESSURE CONF 37



P_T/P_{TMIX}

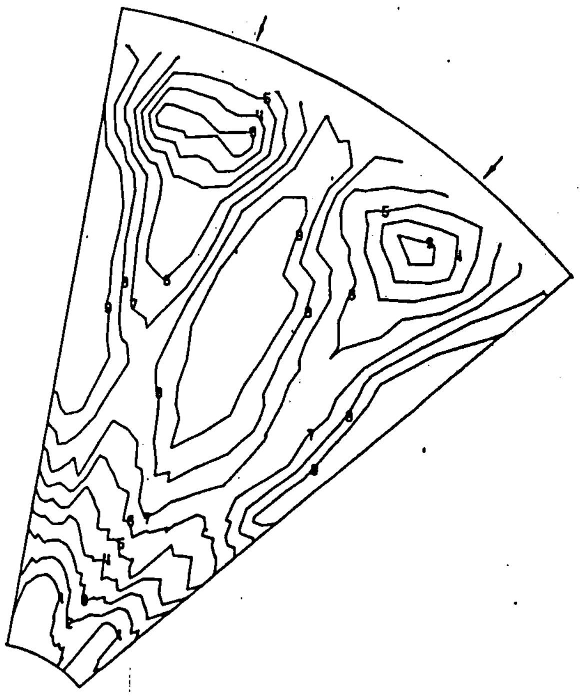
CURVE LABEL	CURVE VALUE
1	0.940000E+00
2	0.950000E+00
3	0.960000E+00
4	0.970000E+00
5	0.980000E+00
6	0.990000E+00
7	0.100000E+01
8	0.101000E+01
9	0.102000E+01
10	0.103000E+01

PT7/PTMIX=1.0379

PT8/PTMIX=0.9446

PTMIX = $2.417\times10^5 N/m^2$ (35.05 PSIA)

PRESSURE CONF 38



P_T/P_{TMIX}

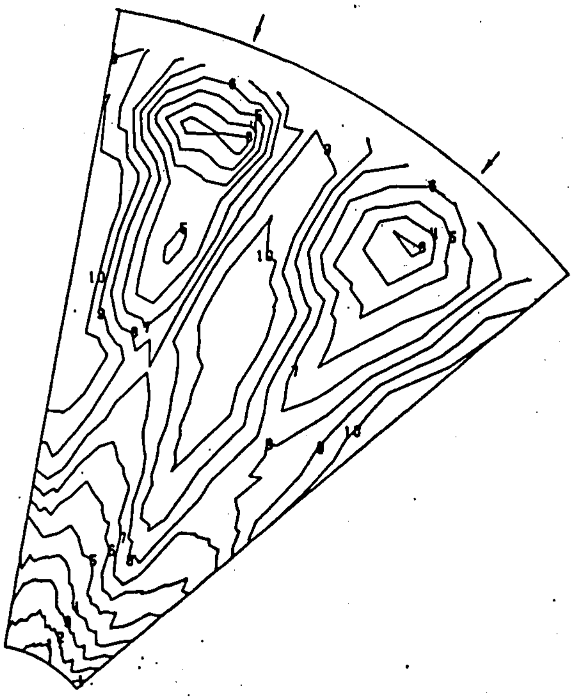
CURVE LABEL	CURVE VALUE
1	0.950000E+00
2	0.960000E+00
3	0.970000E+00
4	0.980000E+00
5	0.990000E+00
6	0.100000E+01
7	0.101000E+01
8	0.102000E+01
9	0.103000E+01

PT7/PTMIX=1.0412

PT8/PTMIX=0.9478

PTMIX = $2.410\times10^5 N/m^2$ (34.96 PSIA)

PRESSURE CONF 39



P_T/P_{TMIX}

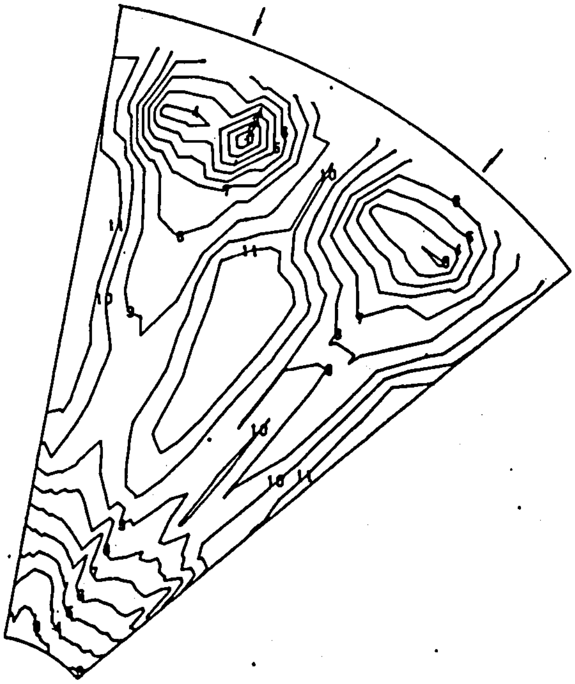
CURVE LABEL	CURVE VALUE
1	0.940000E+00
2	0.950000E+00
3	0.960000E+00
4	0.970000E+00
5	0.980000E+00
6	0.990000E+00
7	0.100000E+01
8	0.101000E+01
9	0.102000E+01
10	0.103000E+01

PT7/PTMIX=1.0373

PT8/PTMIX=0.9448

PTMIX = $2.436\times10^5 N/m^2$ (35.33 PSIA)

PRESSURE CONF 40



P_T/P_{TMIX}

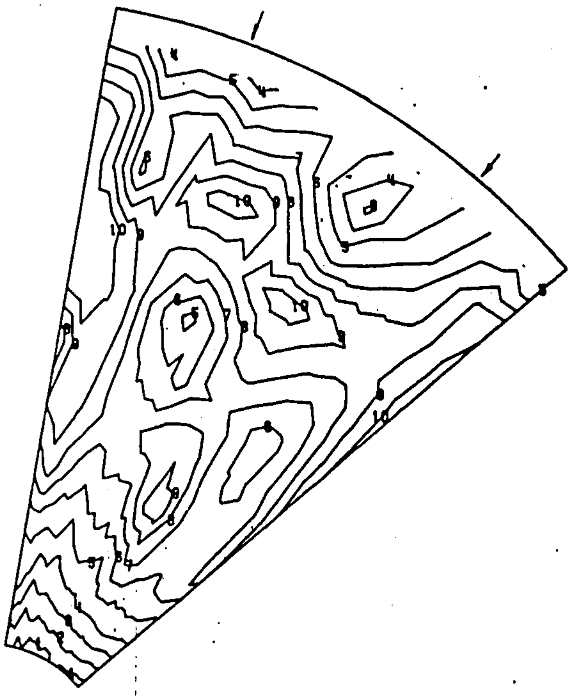
CURVE LABEL	CURVE VALUE
1	0.930000E+00
2	0.940000E+00
3	0.950000E+00
4	0.960000E+00
5	0.970000E+00
6	0.980000E+00
7	0.990000E+00
8	0.100000E+01
9	0.101000E+01
10	0.102000E+01
11	0.103000E+01

PT7/PTMIX=1.0394

PT8/PTMIX=0.9454

PTMIX = $2.413\times10^5 N/m^2$ (34.99 PSIA)

PRESSURE CONF 41



P_T/P_{TMIX}

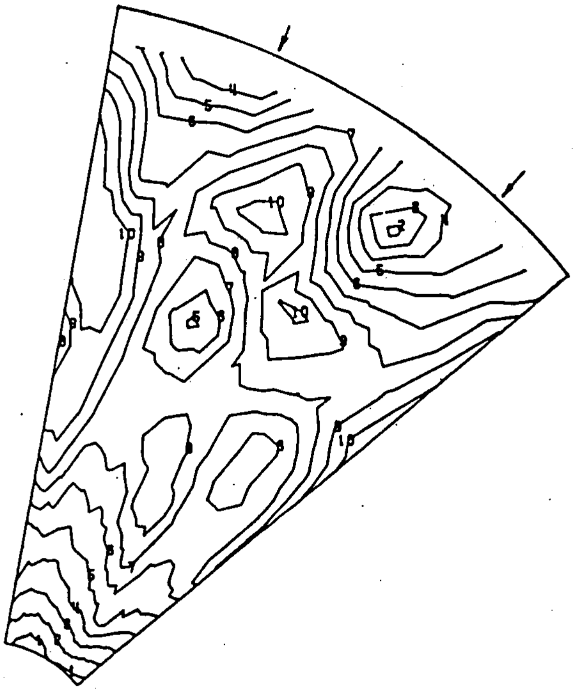
CURVE LABEL	CURVE VALUE
1	0.940000E+00
2	0.950000E+00
3	0.960000E+00
4	0.970000E+00
5	0.980000E+00
6	0.990000E+00
7	0.100000E+01
8	0.101000E+01
9	0.102000E+01
10	0.103000E+01

PT7/PTMIX=1.0360

PT8/PTMIX=0.9413

PTMIX = 2.441x10^5N/m^2 (35.41 PSIA)

PRESSURE CONF 42



P_T/P_{TMIX}

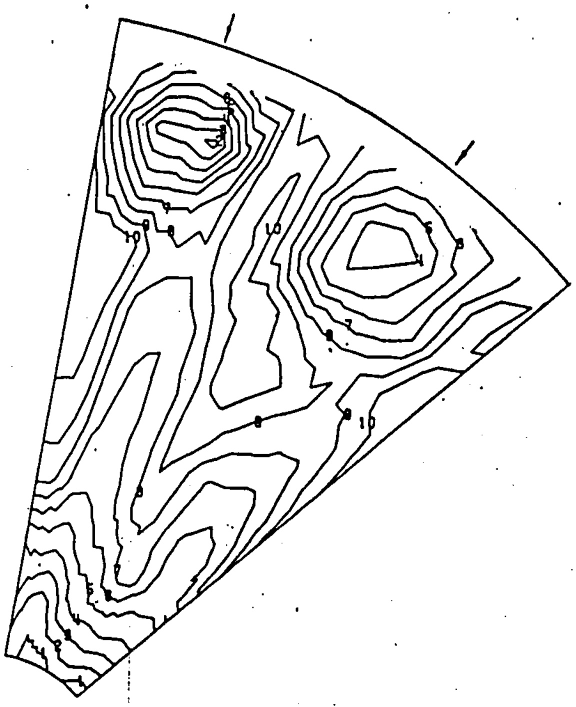
CURVE LABEL	CURVE VALUE
1	0.940000E+00
2	0.950000E+00
3	0.960000E+00
4	0.970000E+00
5	0.980000E+00
6	0.990000E+00
7	0.100000E+01
8	0.101000E+01
9	0.102000E+01
10	0.103000E+01

PT7/PTMIX=1.0377

PT8/PTMIX=0.9428

PTMIX = 2.441x10^5N/m^2 (35.41 PSIA)

PRESSURE CONF 43



P_T/P_{TMIX}

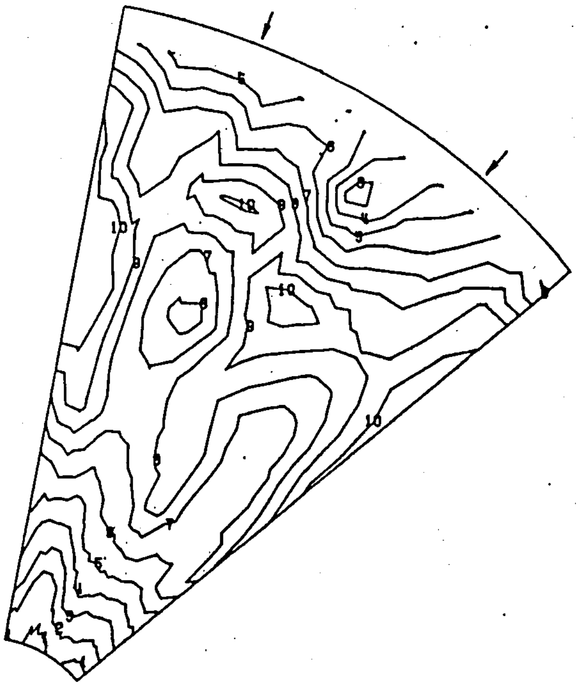
CURVE LABEL	CURVE VALUE
1	0.940000E+00
2	0.950000E+00
3	0.960000E+00
4	0.970000E+00
5	0.980000E+00
6	0.990000E+00
7	0.100000E+01
8	0.101000E+01
9	0.102000E+01
10	0.103000E+01

PT7/PTMIX=1.0364

PT8/PTMIX=0.9441

PTMIX = $2.436 \times 10^5 N/m^2$ (35.32 PSIA)

PRESSURE CONF 45



P_T/P_{TMIX}

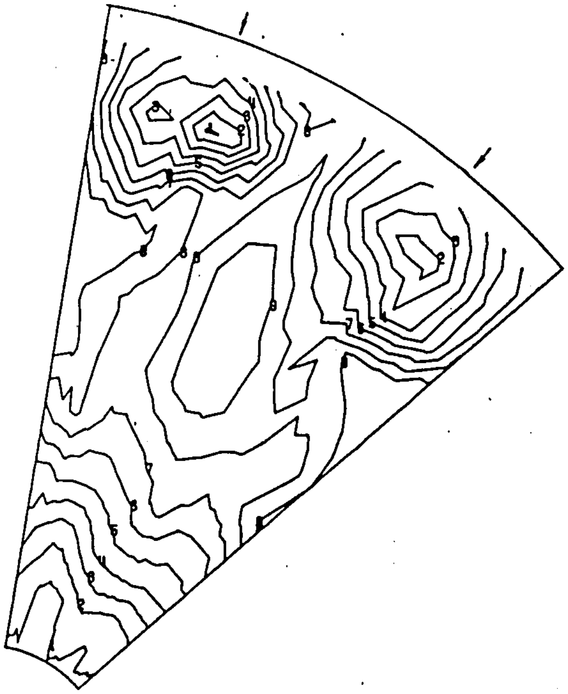
CURVE LABEL	CURVE VALUE
1	0.940000E+00
2	0.950000E+00
3	0.960000E+00
4	0.970000E+00
5	0.980000E+00
6	0.990000E+00
7	0.100000E+01
8	0.101000E+01
9	0.102000E+01
10	0.103000E+01

PT7/PTMIX=1.0349

PT8/PTMIX=0.9440

PTMIX = $2.457 \times 10^5 N/m^2$ (35.64 PSIA)

PRESSURE CONF 46



P_T/P_{TMIX}

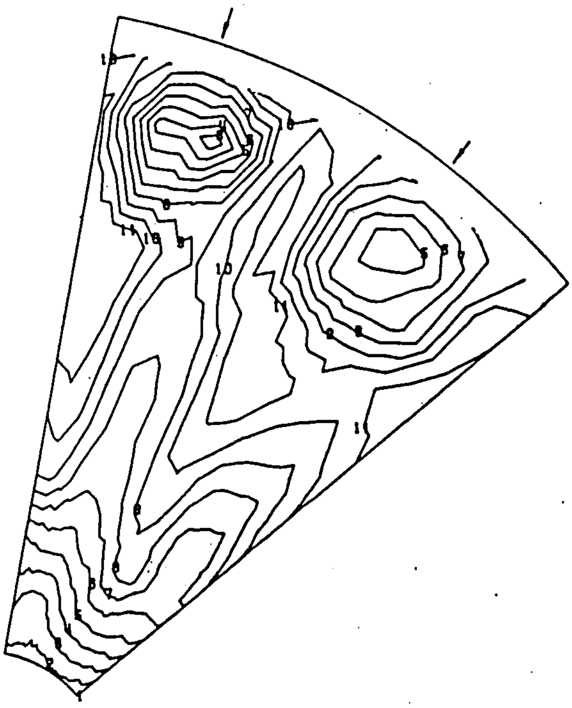
CURVE LABEL	CURVE VALUE
1	0.950000E+00
2	0.960000E+00
3	0.970000E+00
4	0.980000E+00
5	0.990000E+00
6	0.100000E+01
7	0.101000E+01
8	0.102000E+01
9	0.103000E+01

PT7/PTMIX=1.0387

PT8/PTMIX=0.9462

PTMIX = 2.446x10^{5}N/m^2 (35.48 PSIA)

PRESSURE CONF 48



P_T/P_{TMIX}

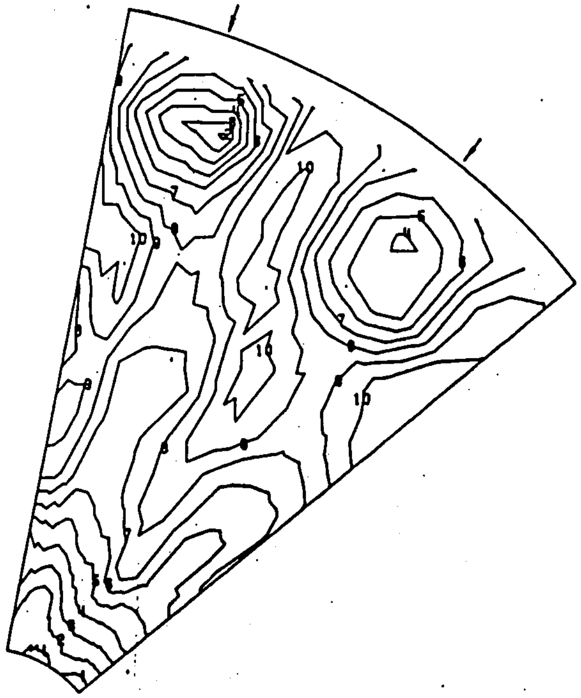
CURVE LABEL	CURVE VALUE
1	0.930000E+00
2	0.940000E+00
3	0.950000E+00
4	0.960000E+00
5	0.970000E+00
6	0.980000E+00
7	0.990000E+00
8	0.100000E+01
9	0.101000E+01
10	0.102000E+01
11	0.103000E+01

PT7/PTMIX=1.0371

PT8/PTMIX=0.9424

PTMIX = 2.446x10^{5}N/m^2 (35.47 PSIA)

PRESSURE CONF 49



P_T/P_{TMIX}

CURVE LABEL	CURVE VALUE
1	0.940000E+00
2	0.950000E+00
3	0.960000E+00
4	0.970000E+00
5	0.980000E+00
6	0.990000E+00
7	0.100000E+01
8	0.101000E+01
9	0.102000E+01
10	0.103000E+01

PT7/PTMIX=1.0360

PT8/PTMIX=0.9430

PTMIX = 2.448x10^{5}N/m^2 (35.79 PSIA)

Appendix C

Flow Visualization Photographs

Flow visualization tests were made for selected configurations in Phase I and for all of the Phase II configurations. These tests were conducted with uniform cold flow at a nozzle pressure ratio of 2.5 to provide a general indication of the flow field through the exhaust system. The streaks result from placing an array of dots (using a lamplack/glycerine mixture) on the painted surface of the model prior to a test run.

Flow Visualization

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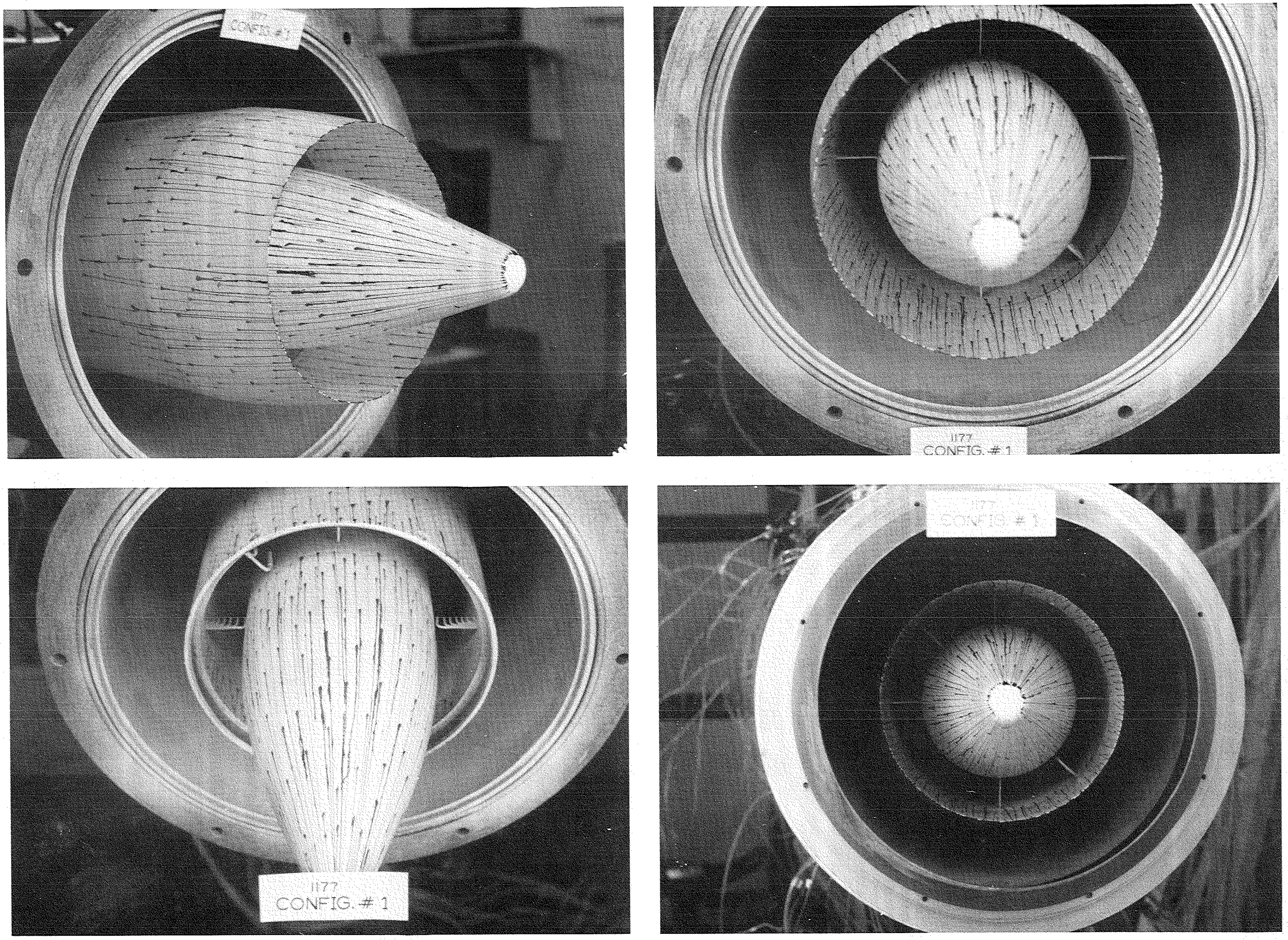
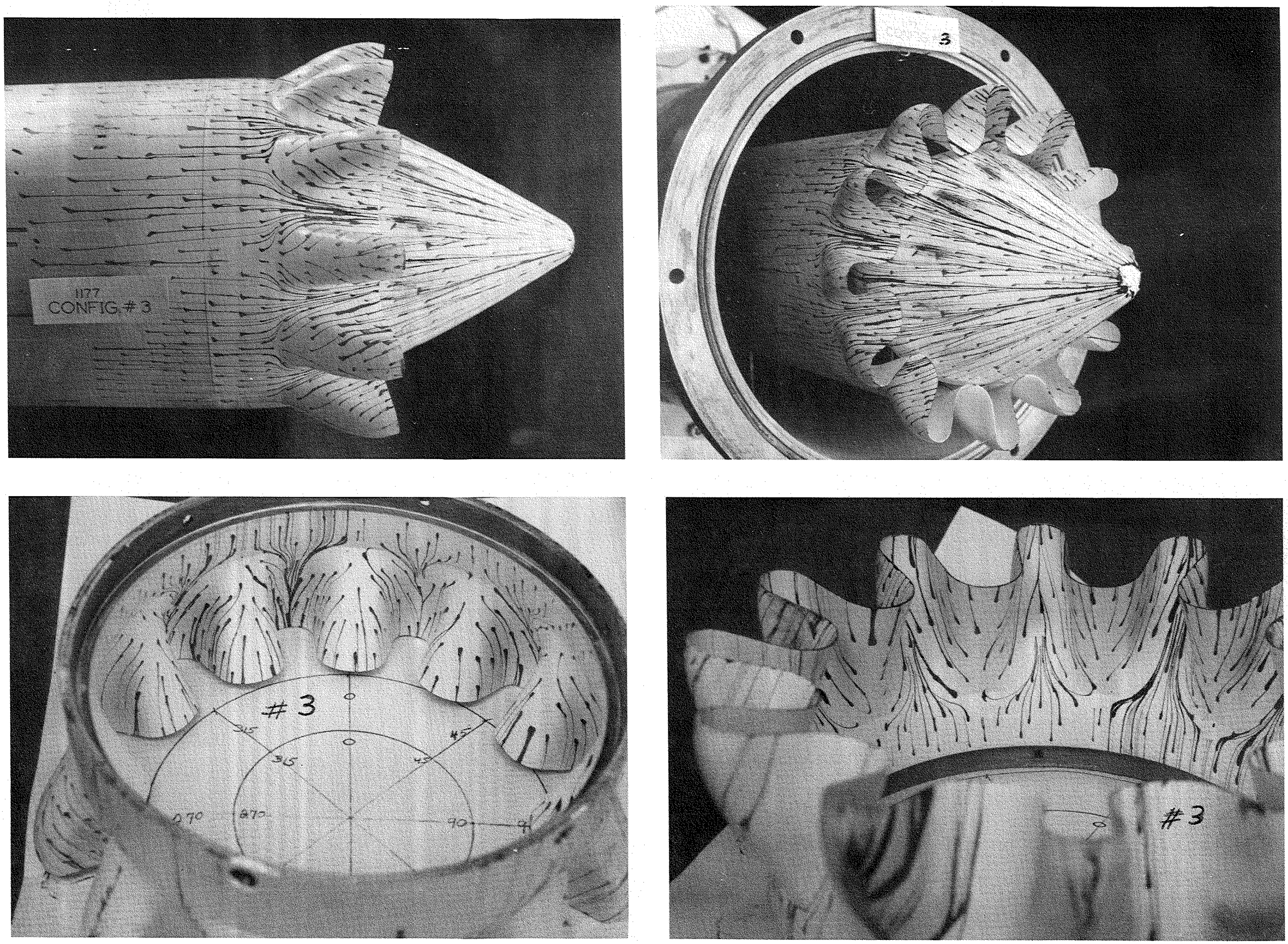
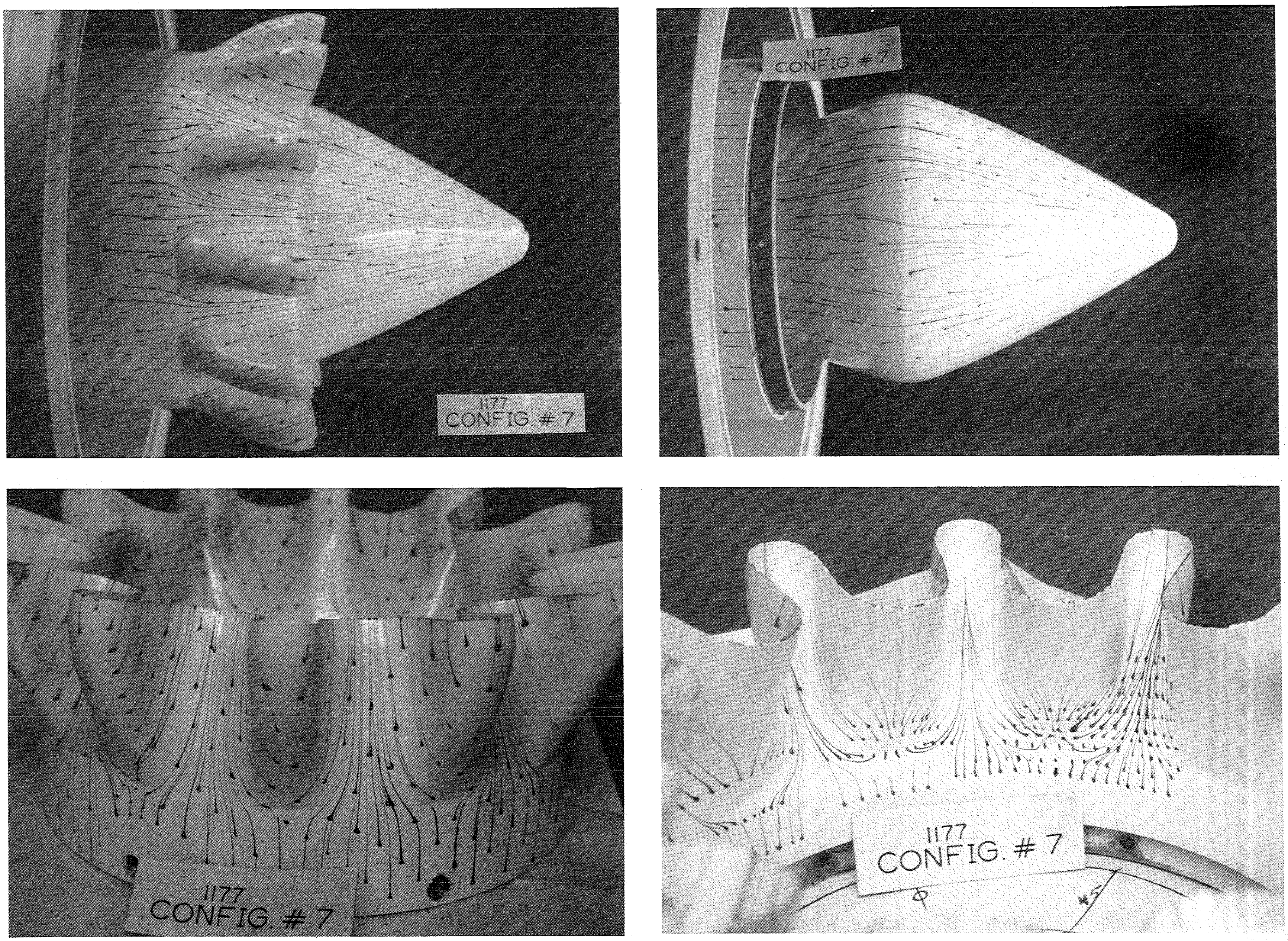


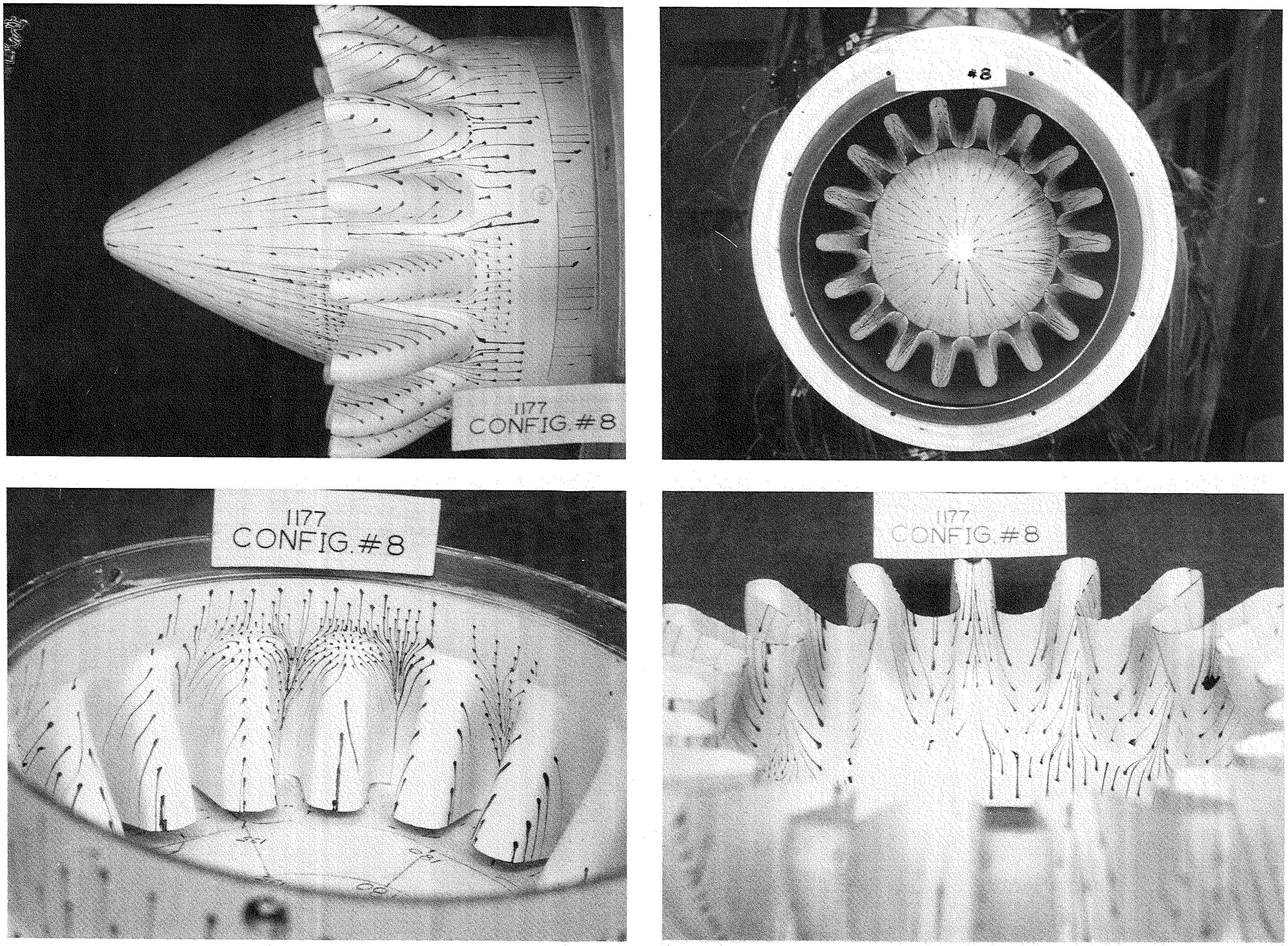
Flow Visualization Photographs, Configuration 1



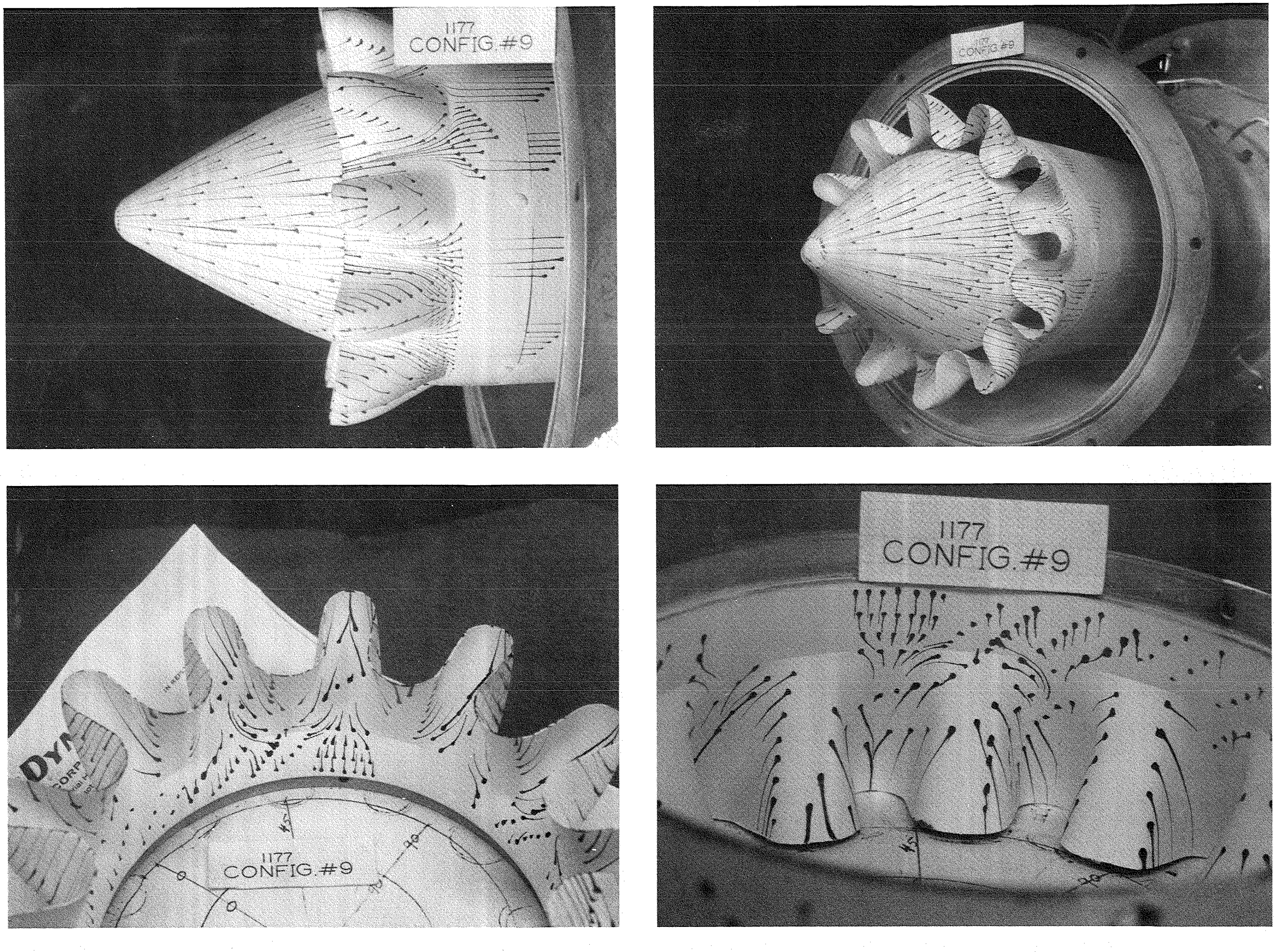
Flow Visualization Photographs, Configuration 3



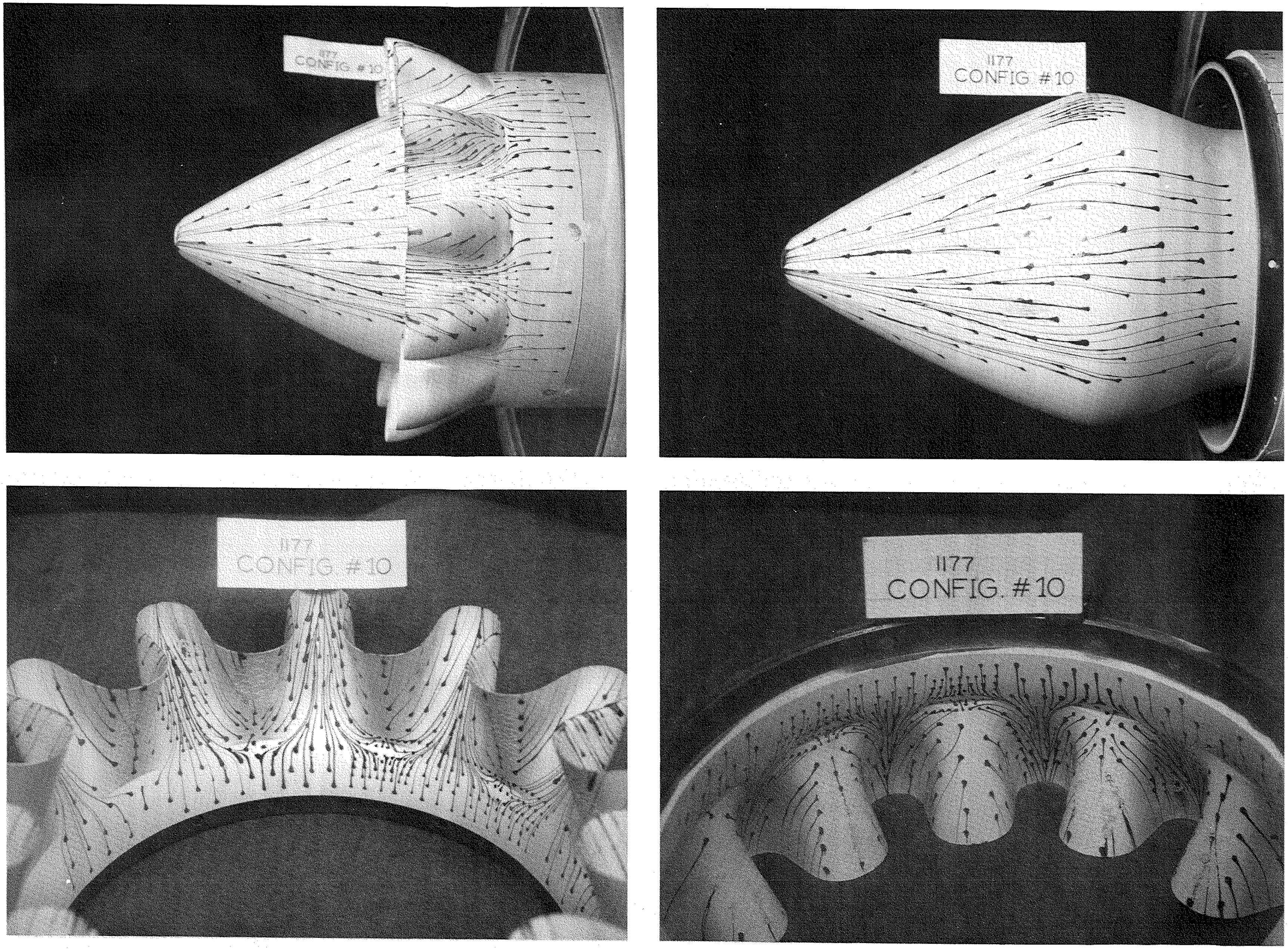
Flow Visualization Photographs, Configuration 7



Flow Visualization Photographs, Configuration 8



Flow Visualization Photographs, Configuration 9



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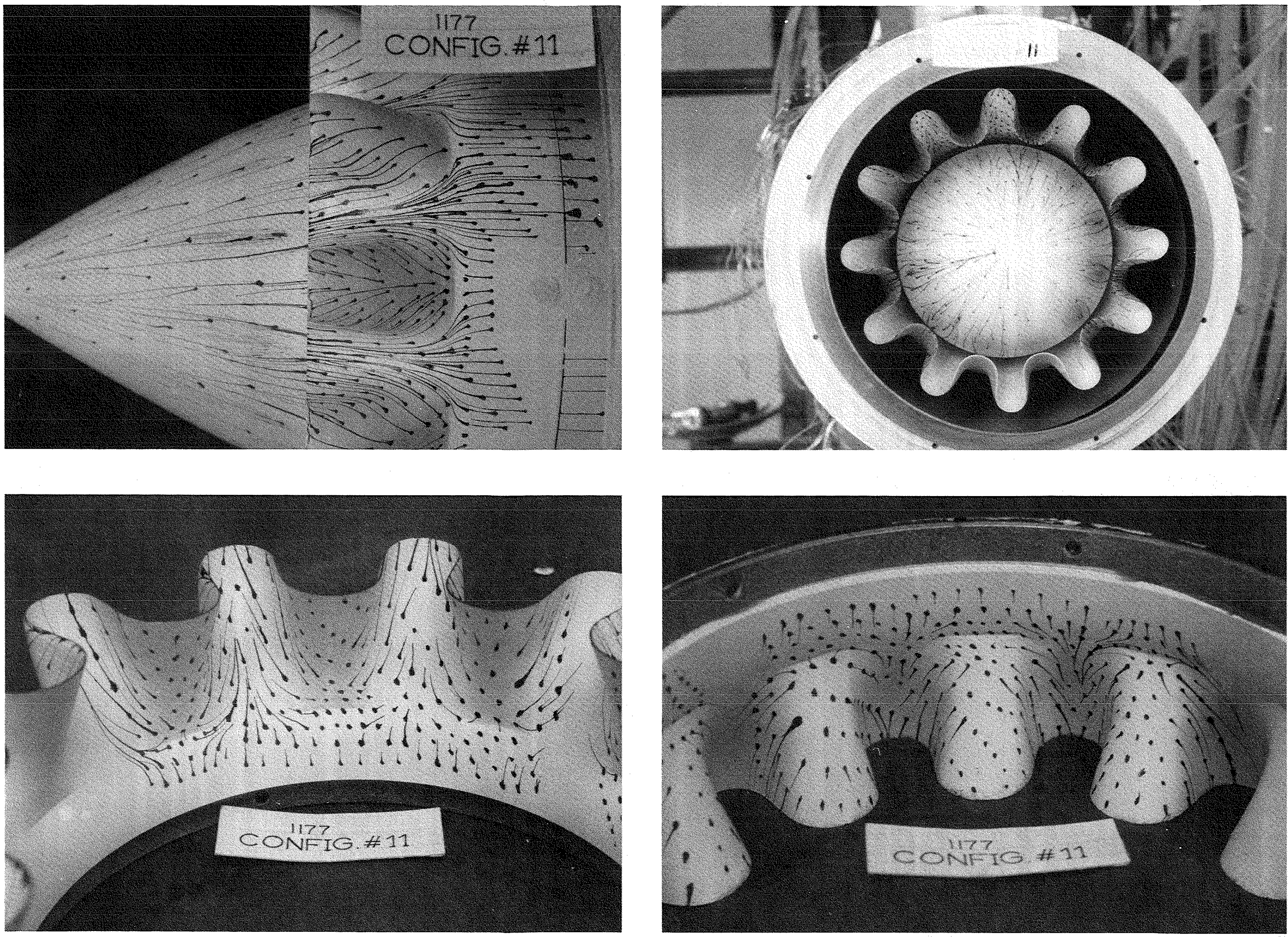

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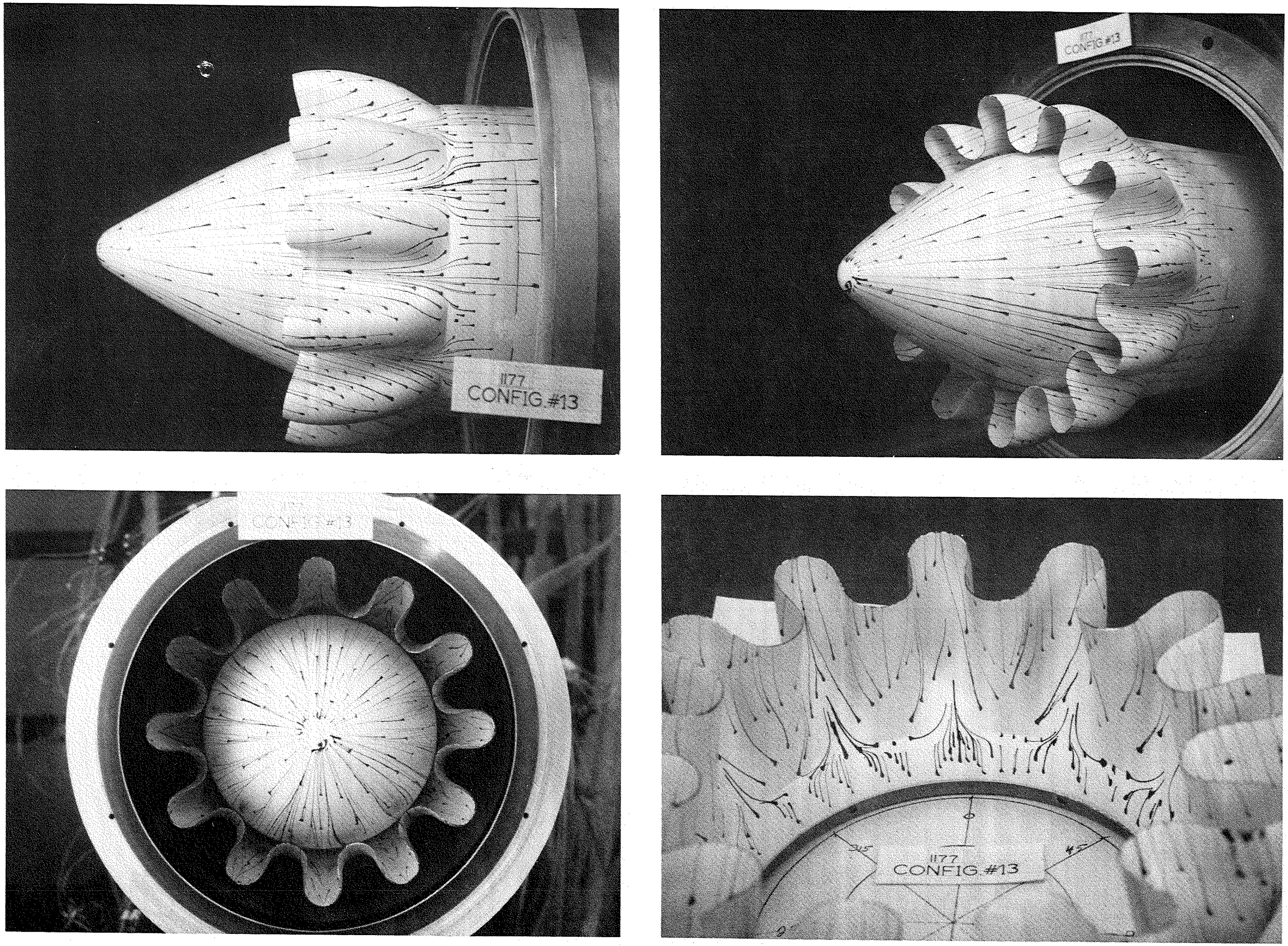

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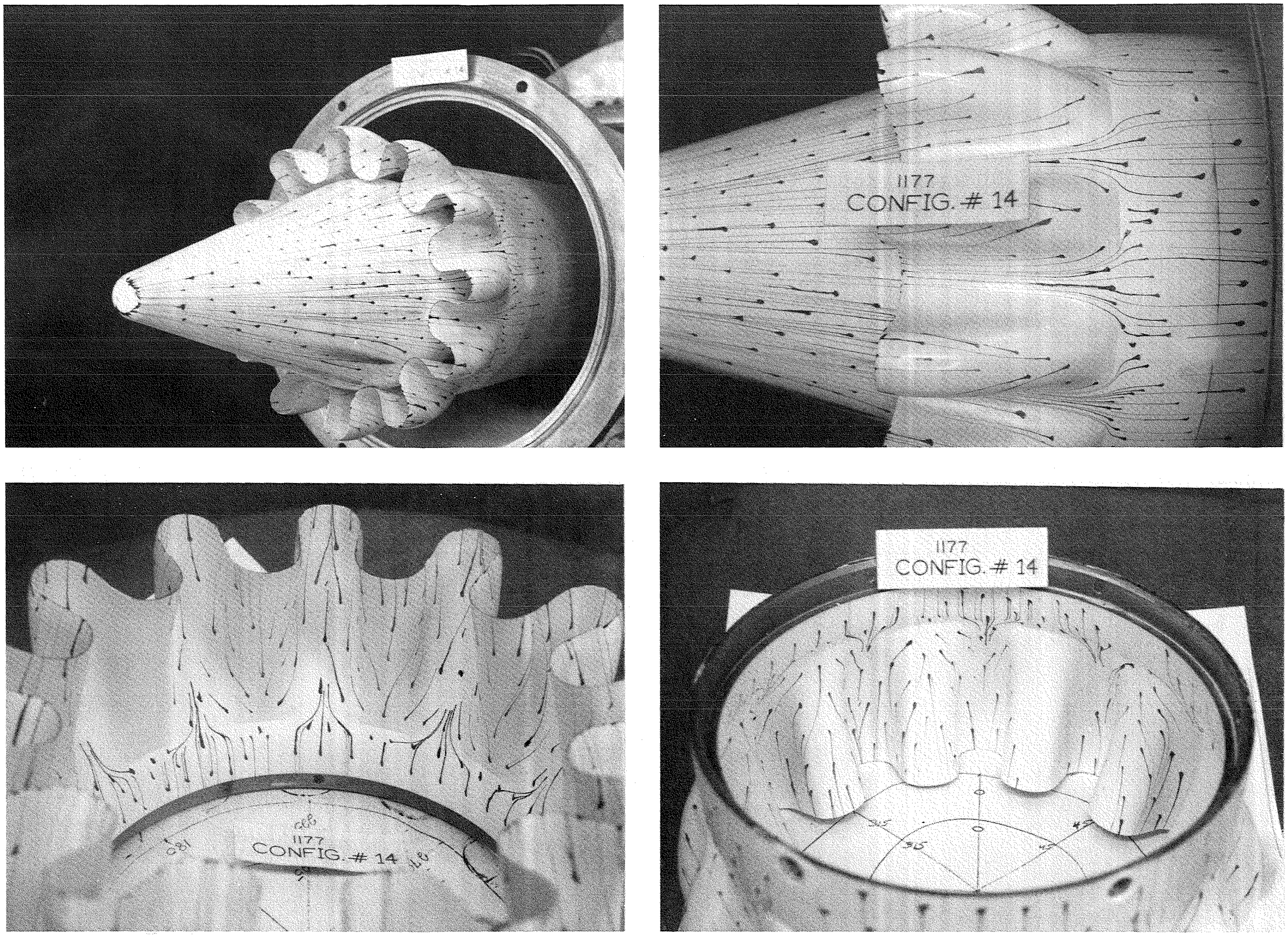

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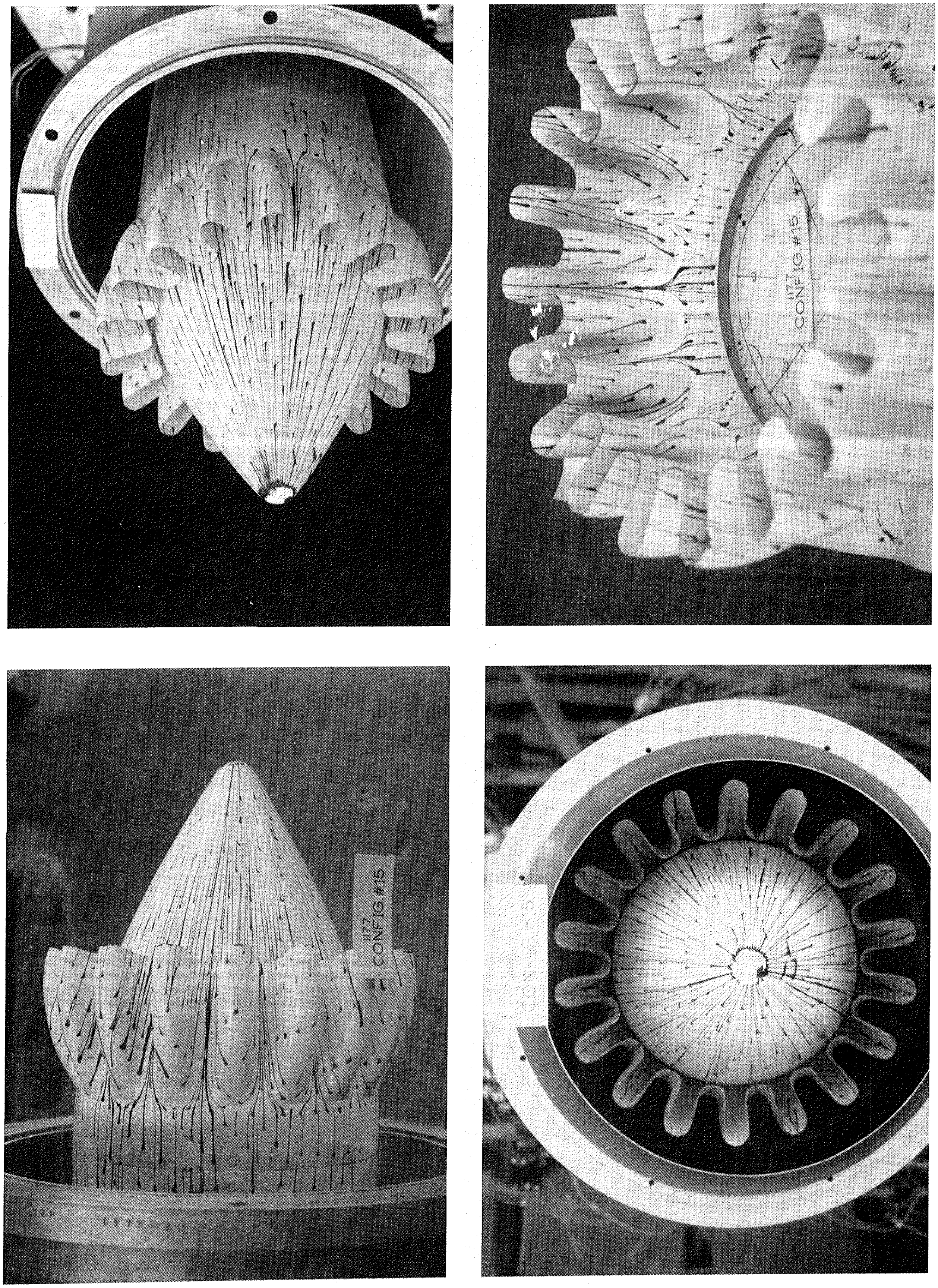

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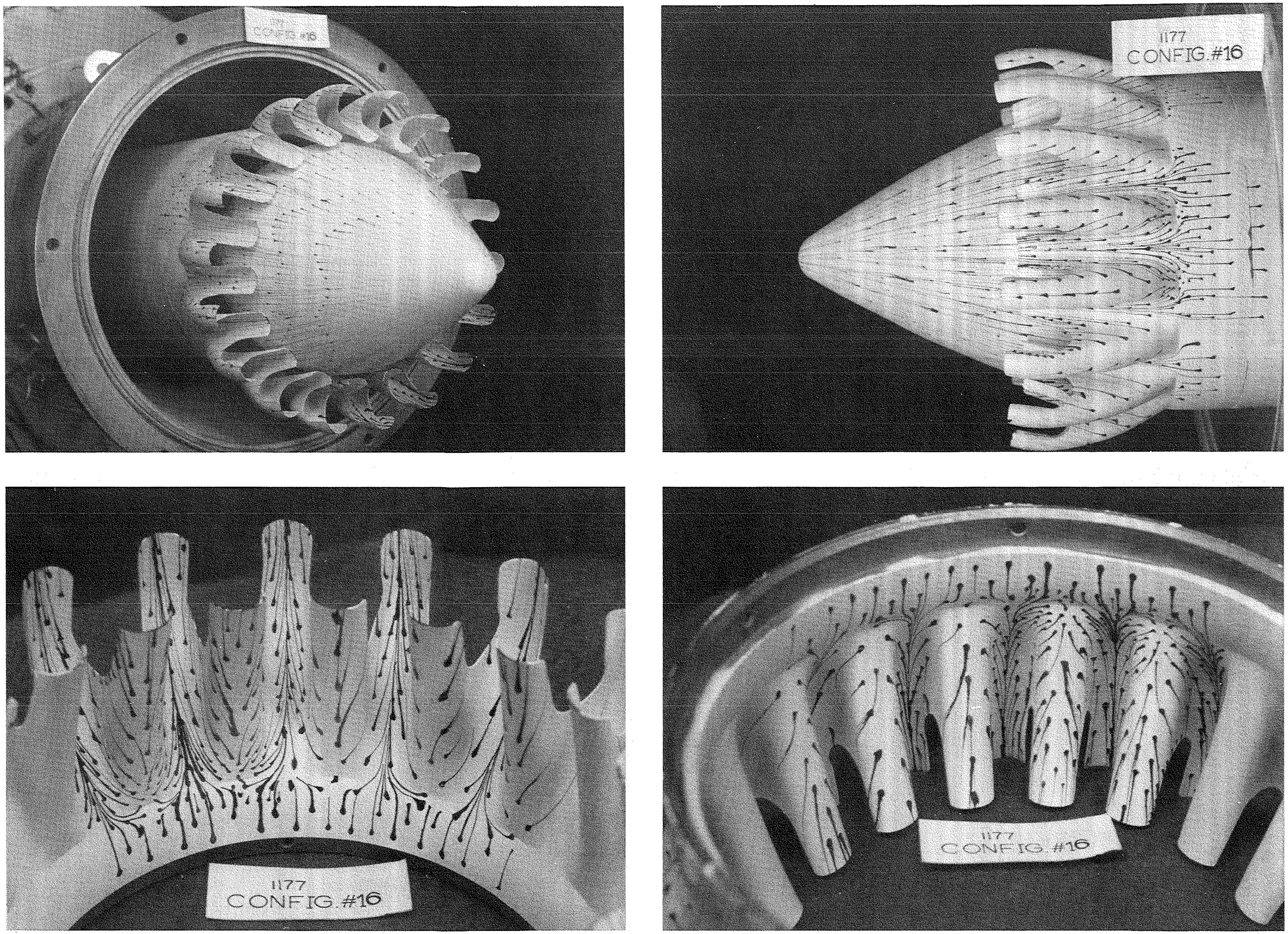

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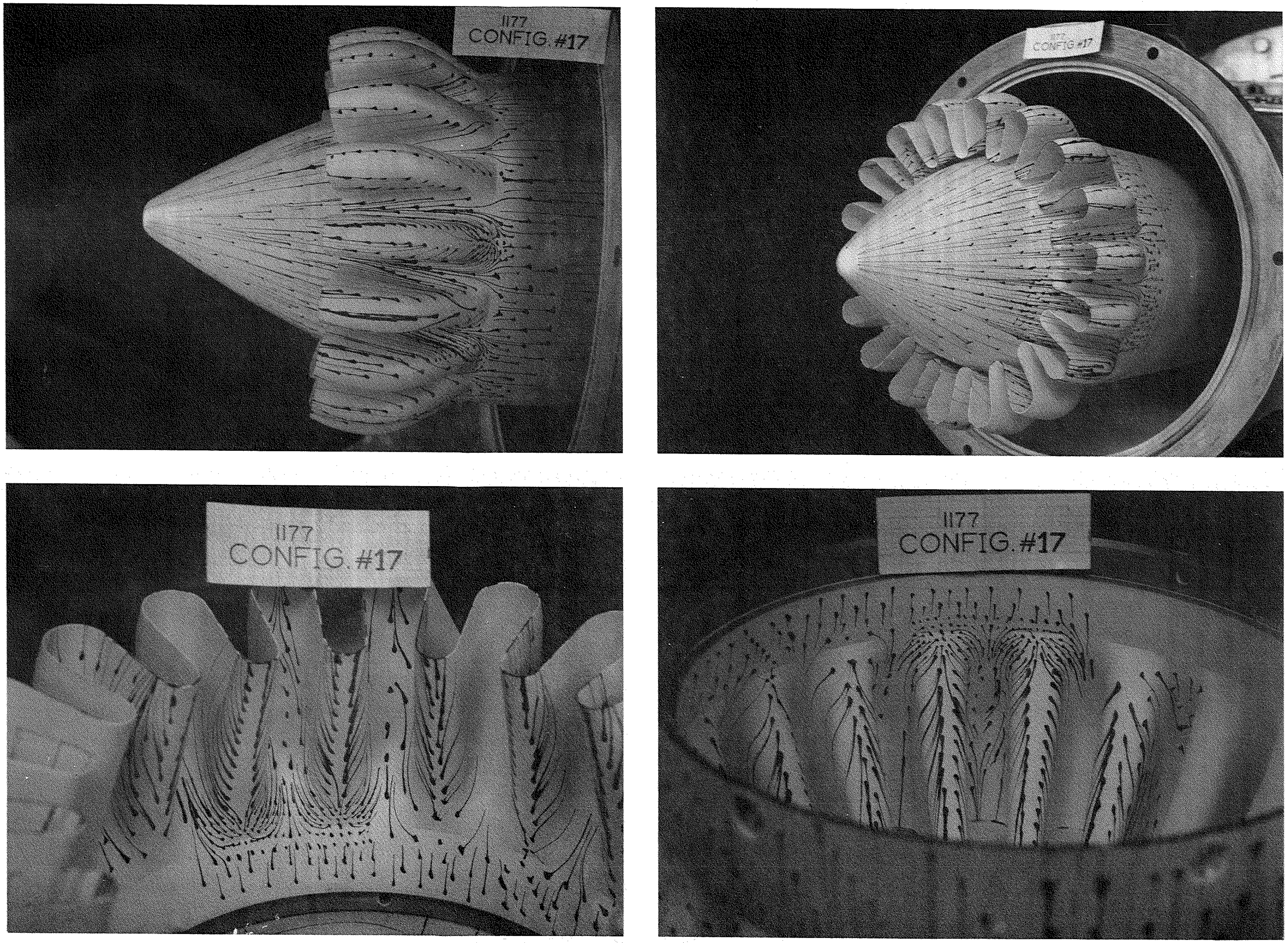

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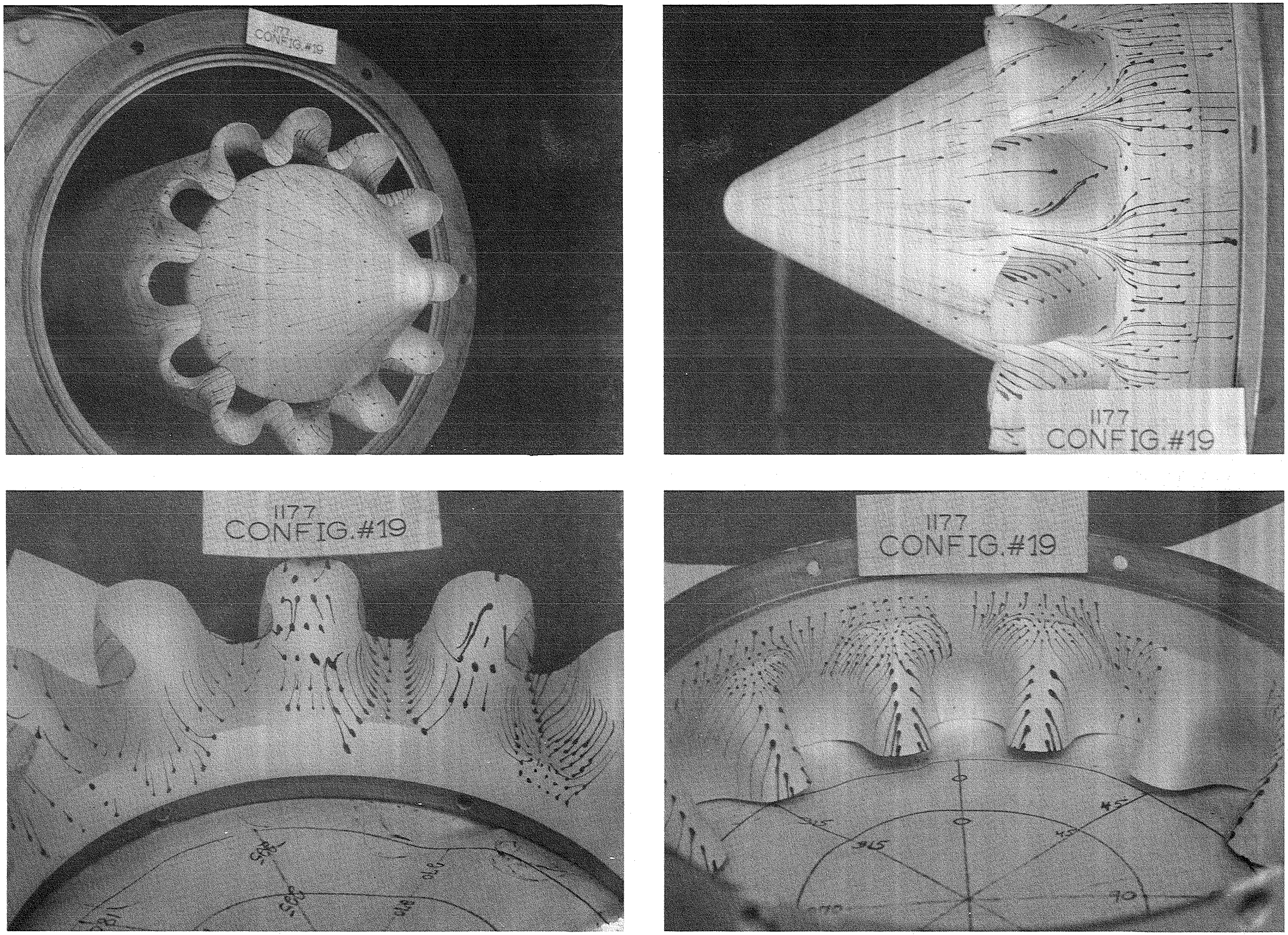

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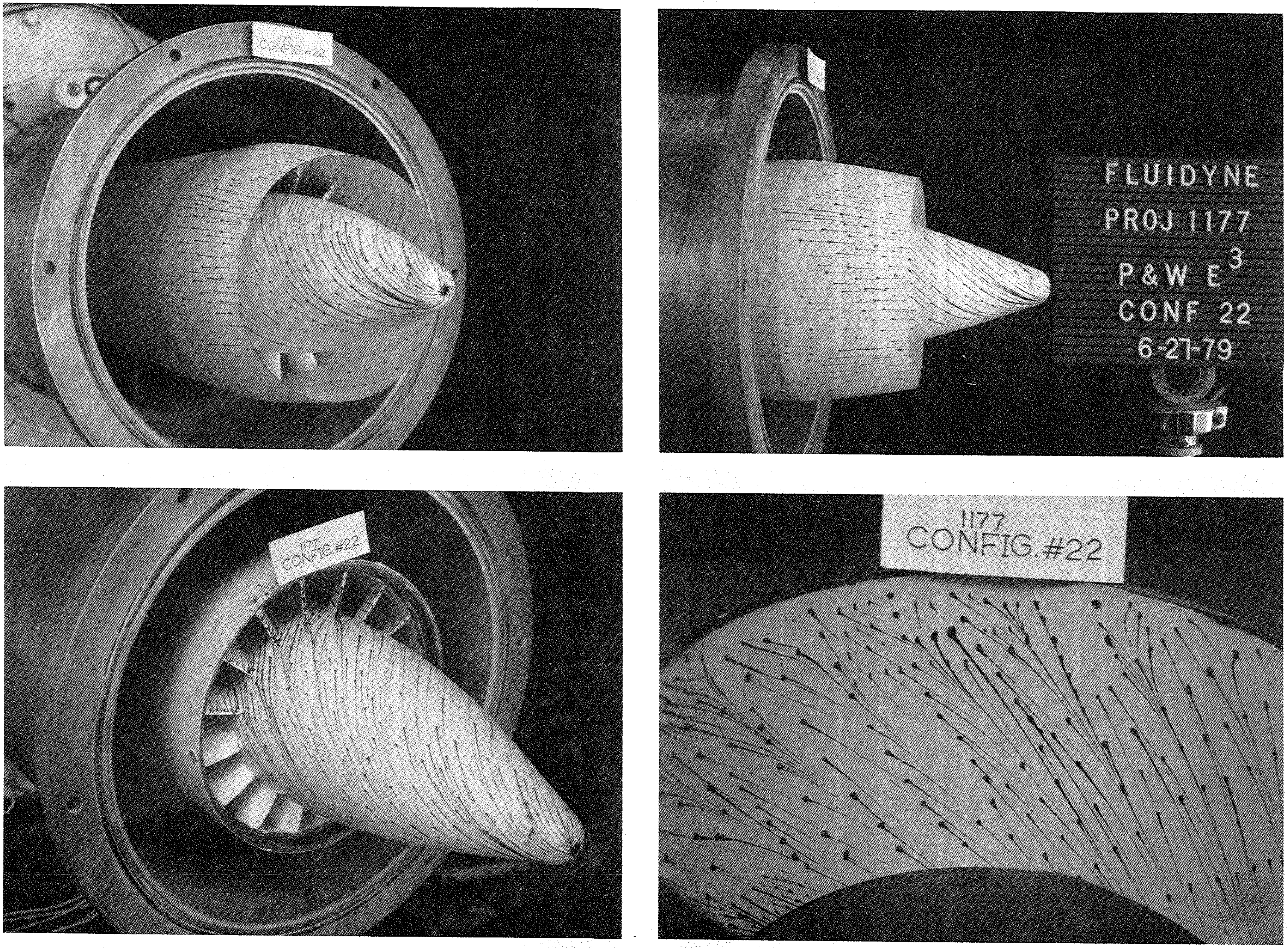

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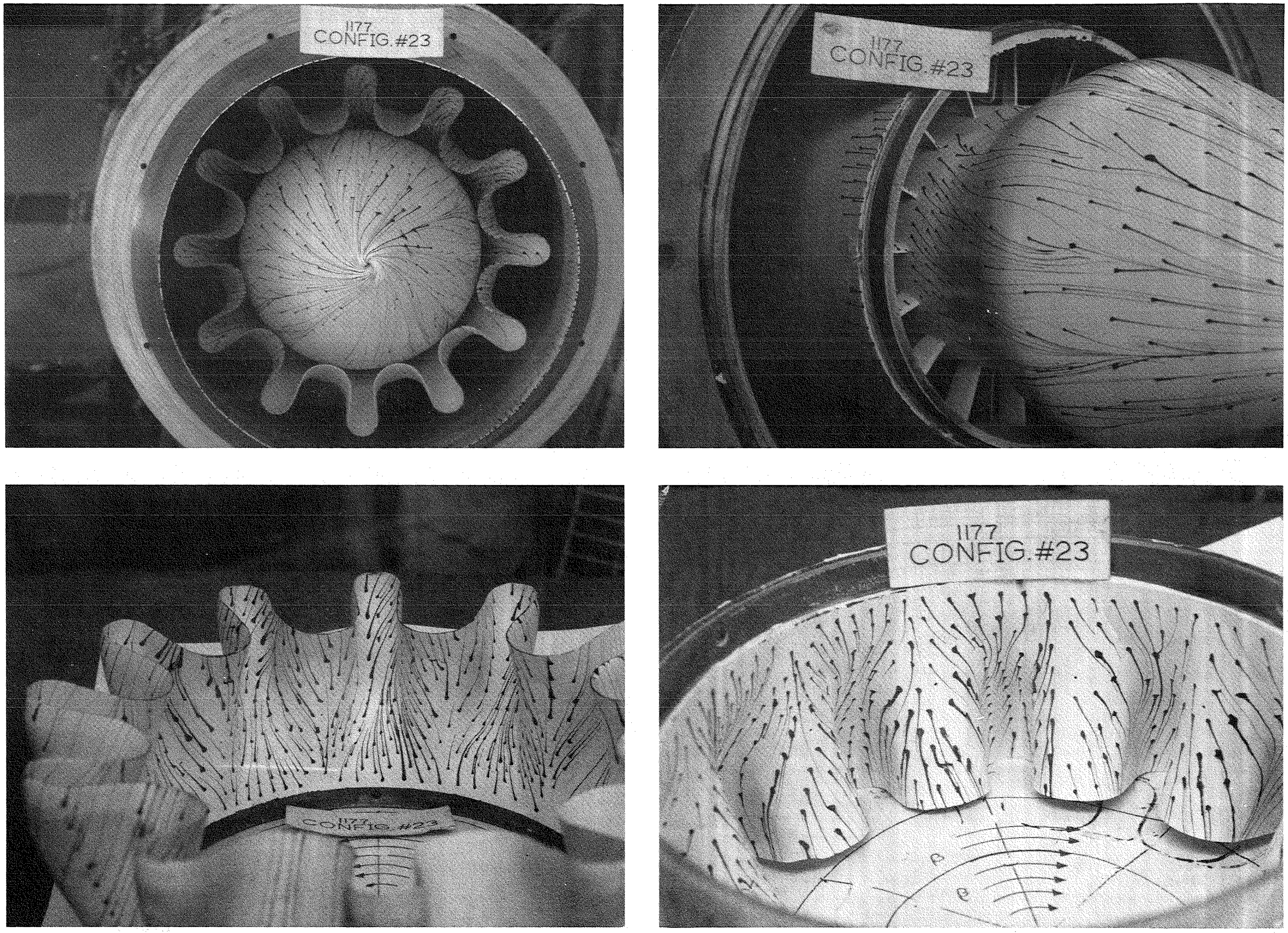

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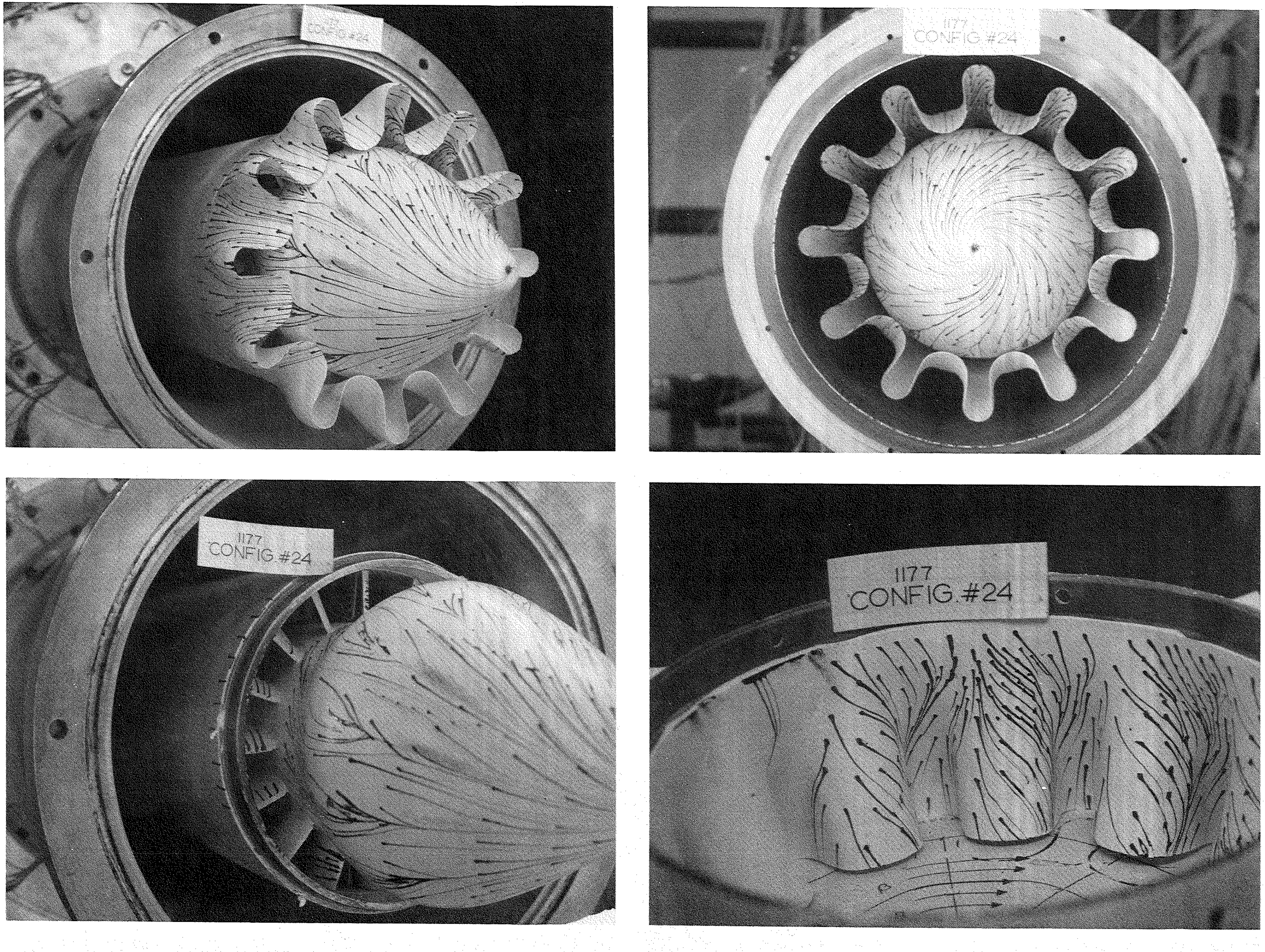

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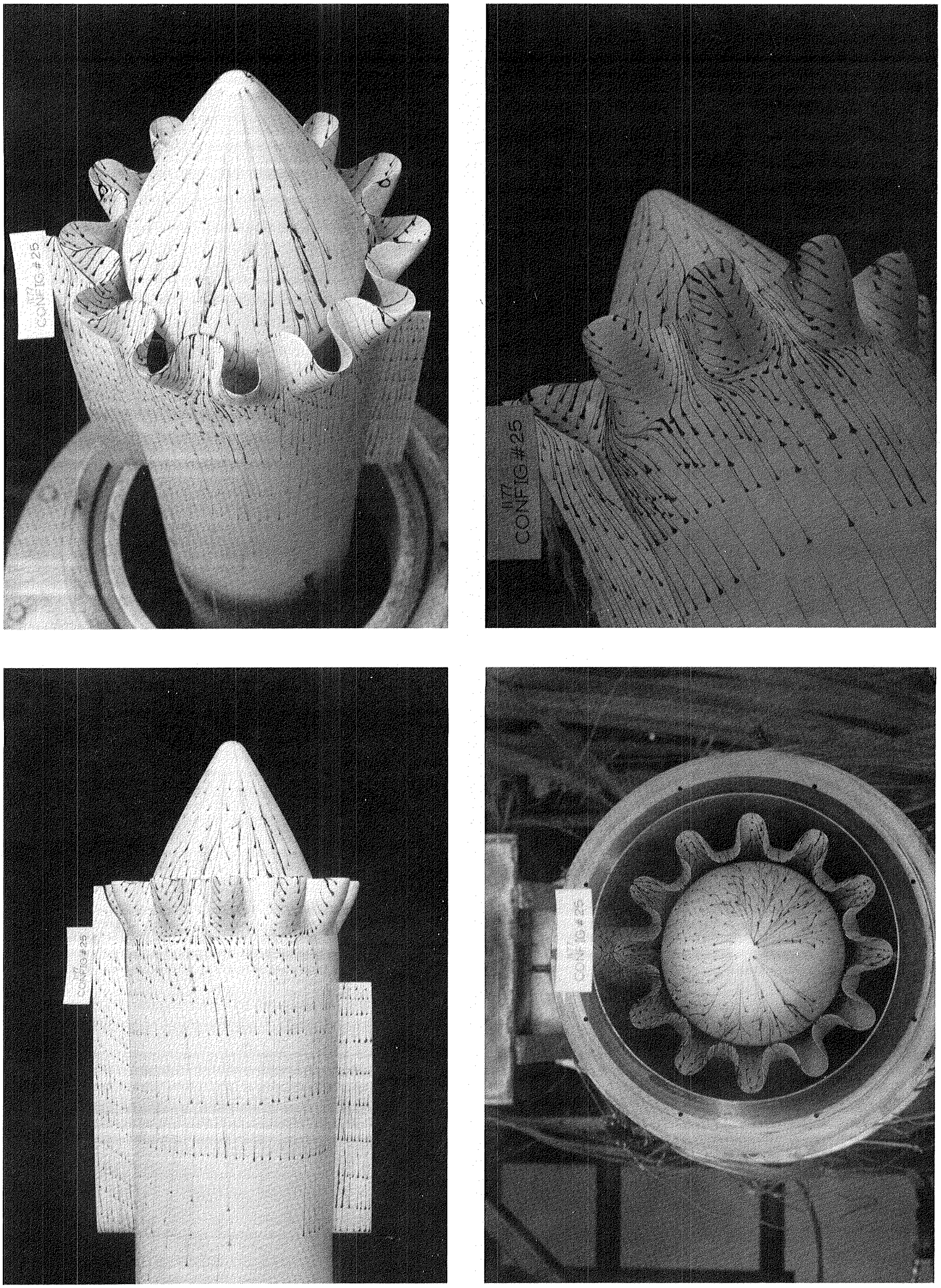

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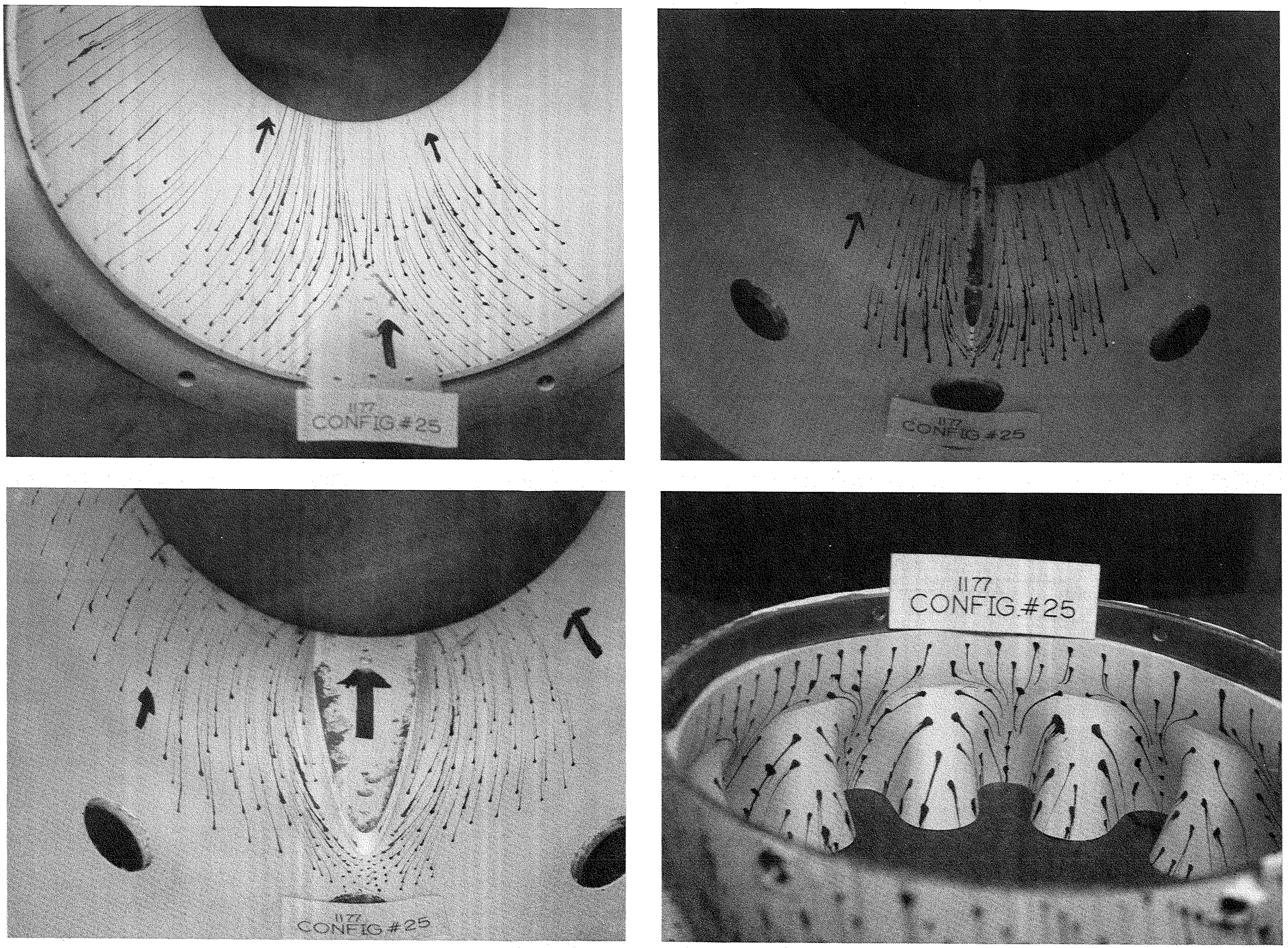

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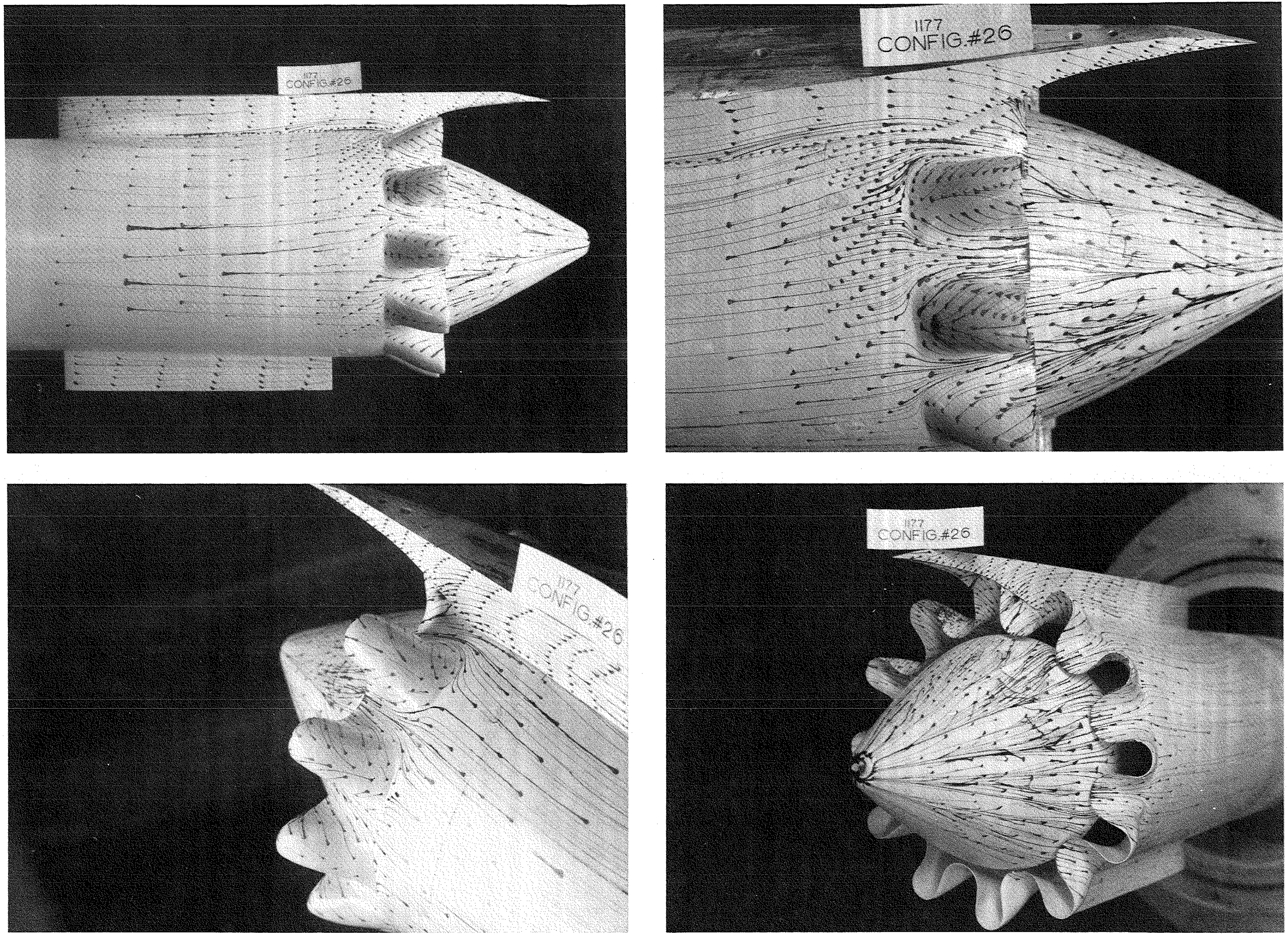

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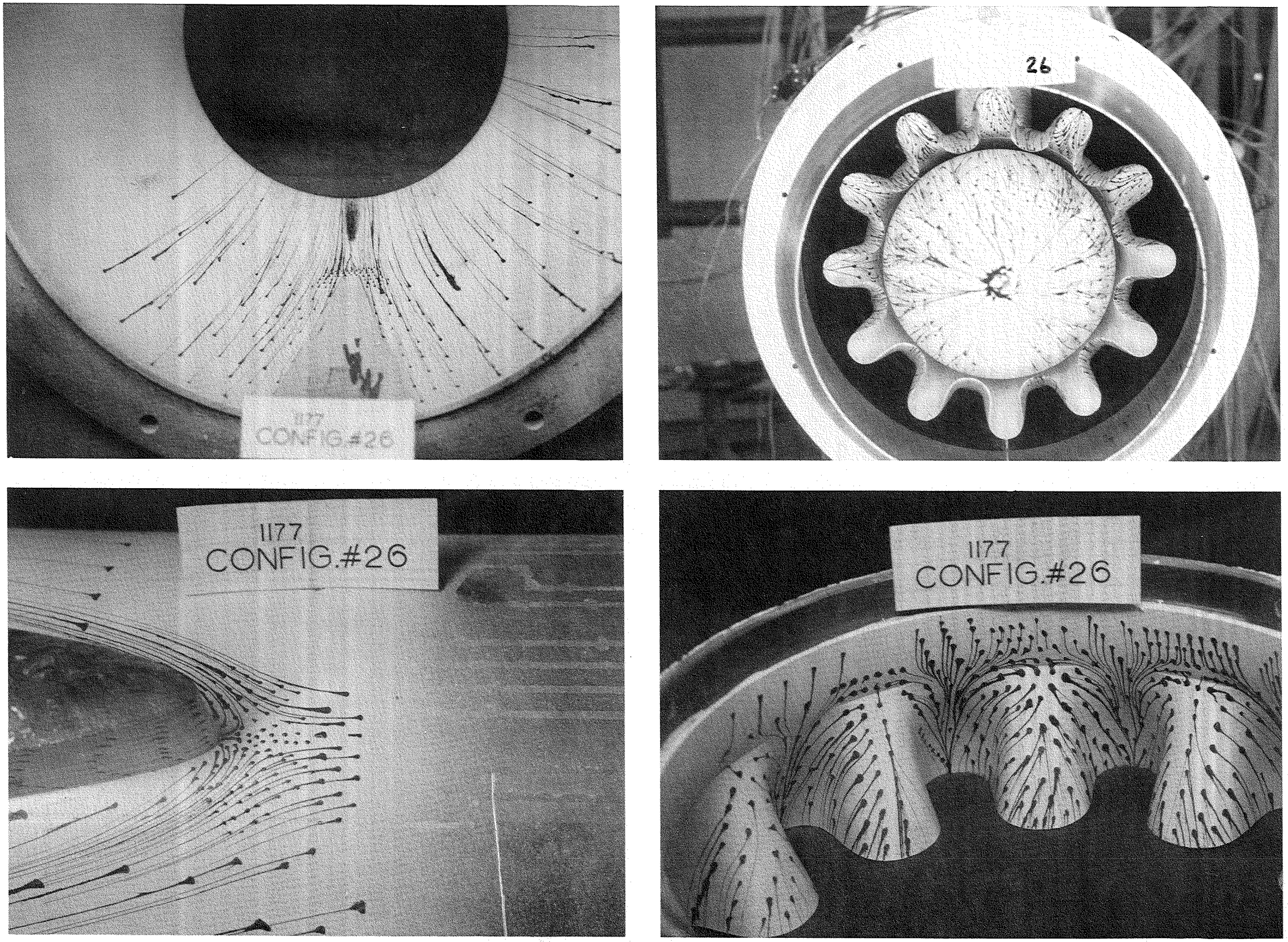

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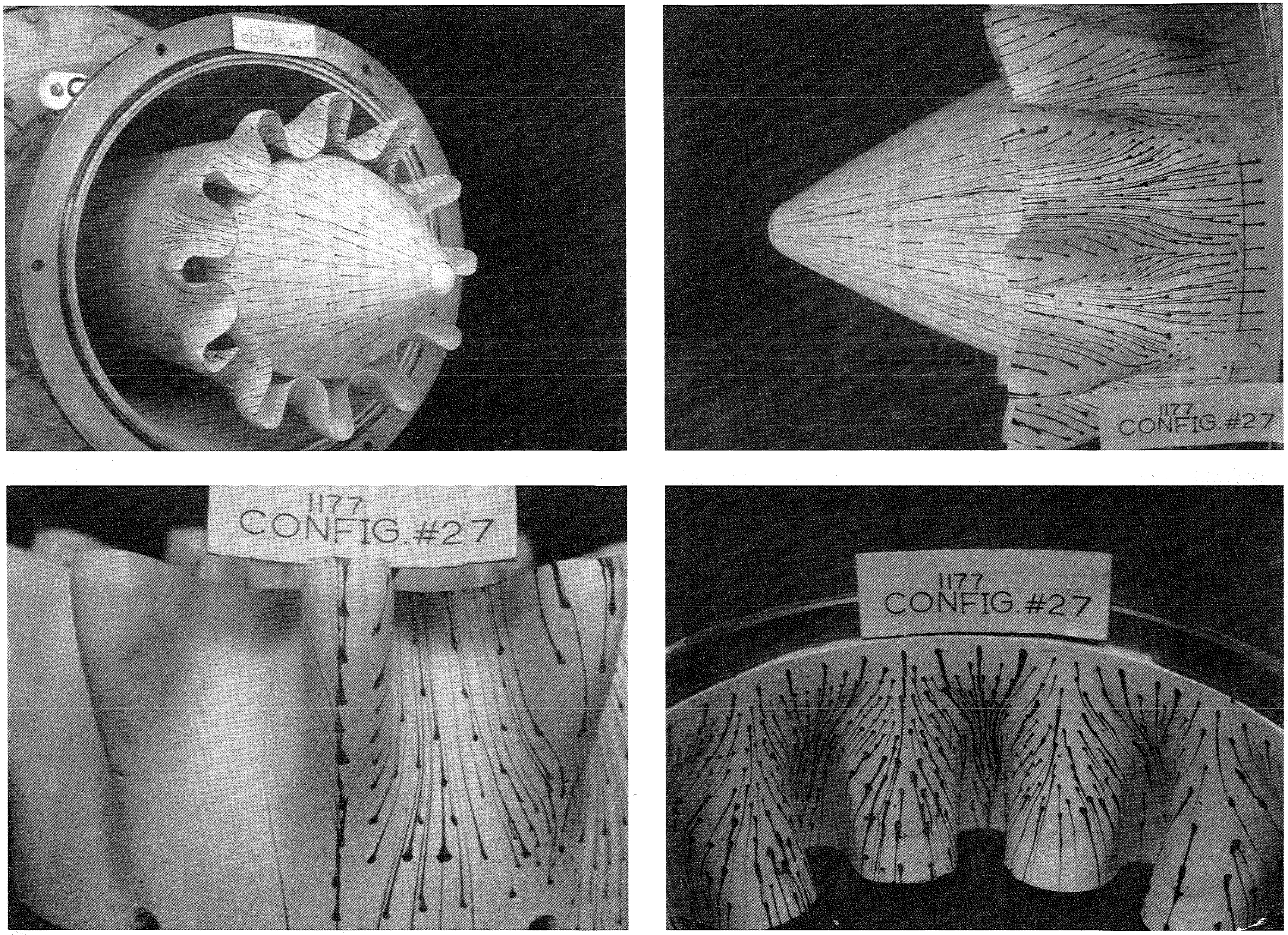

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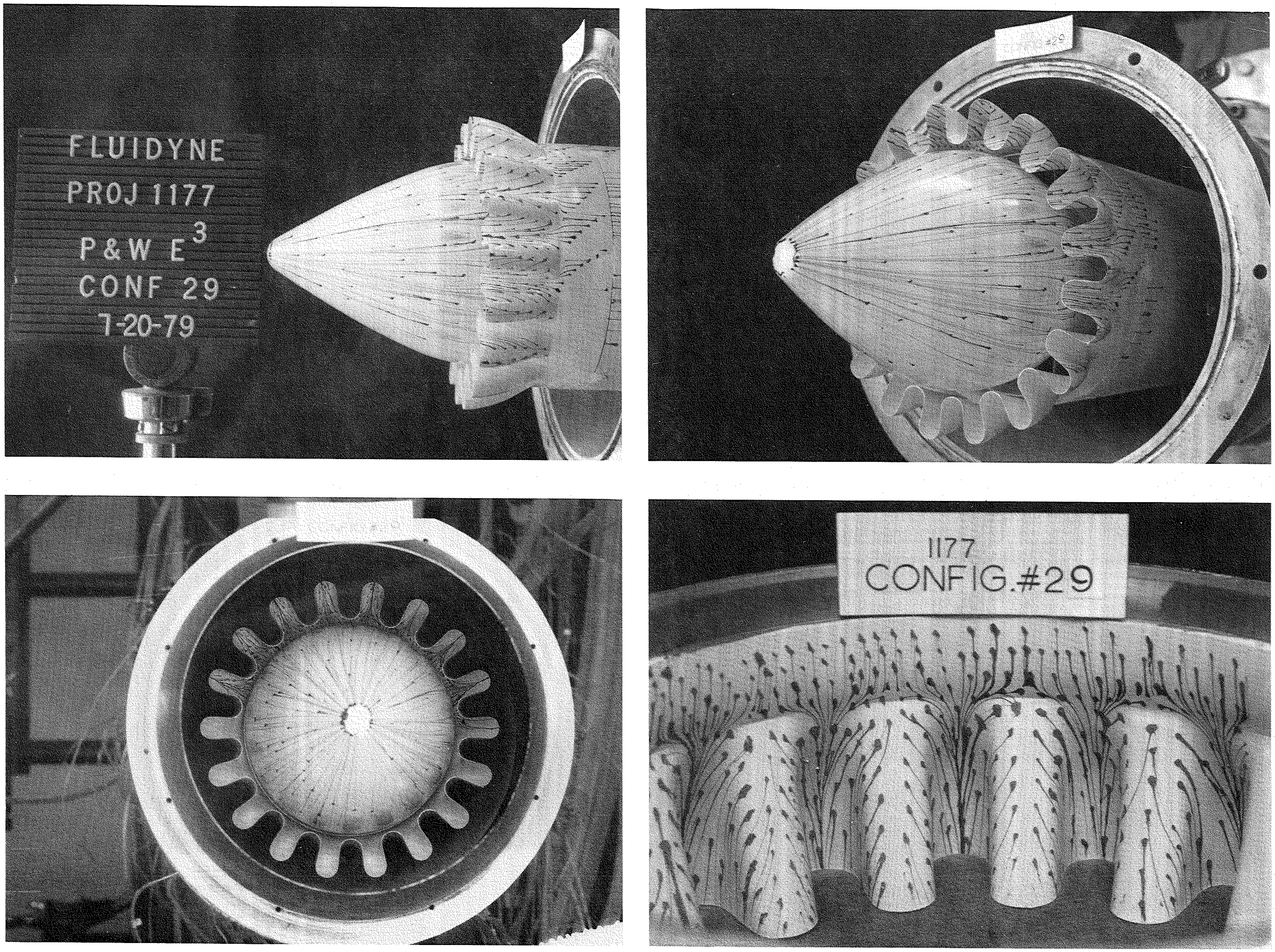

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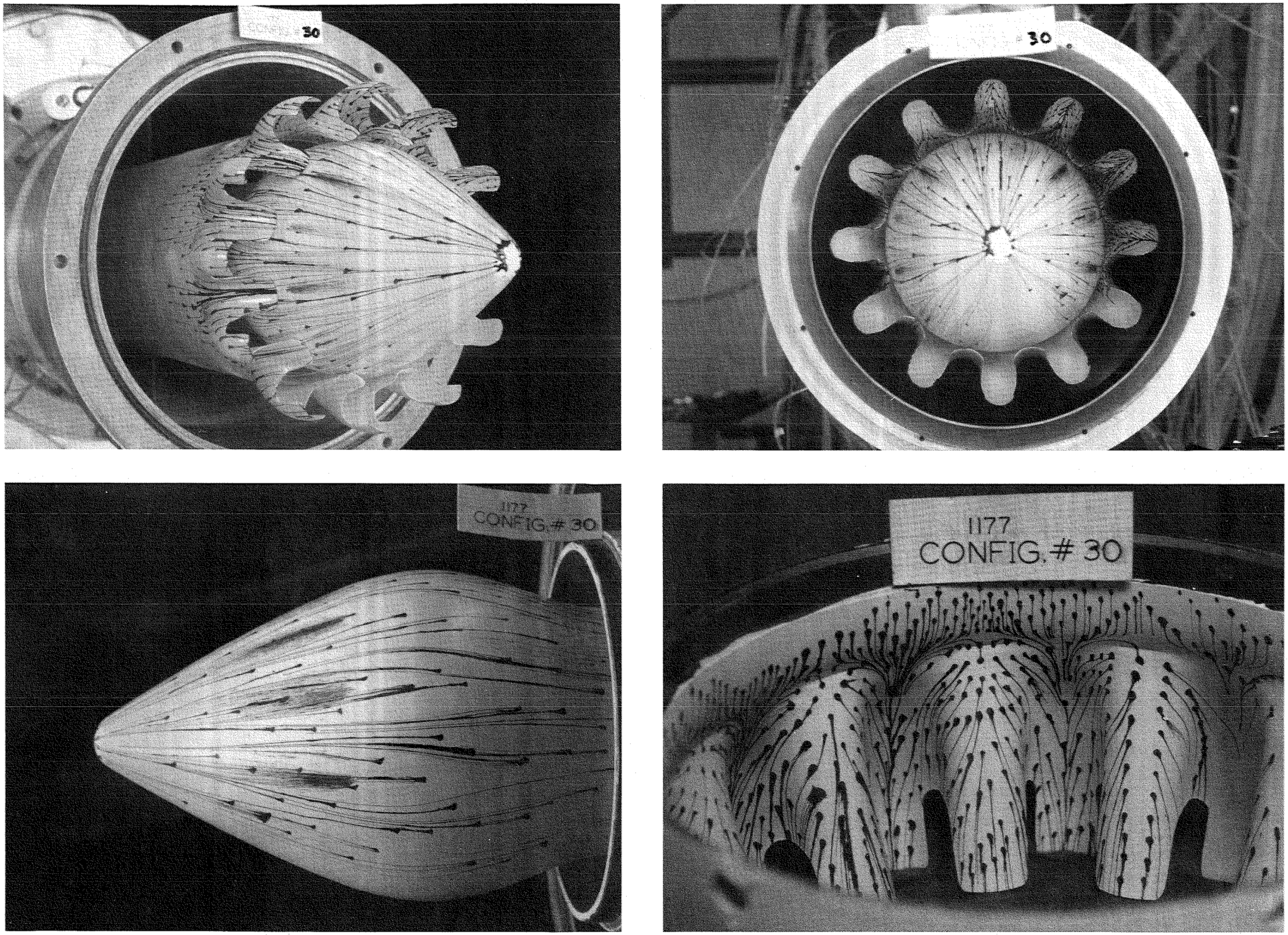

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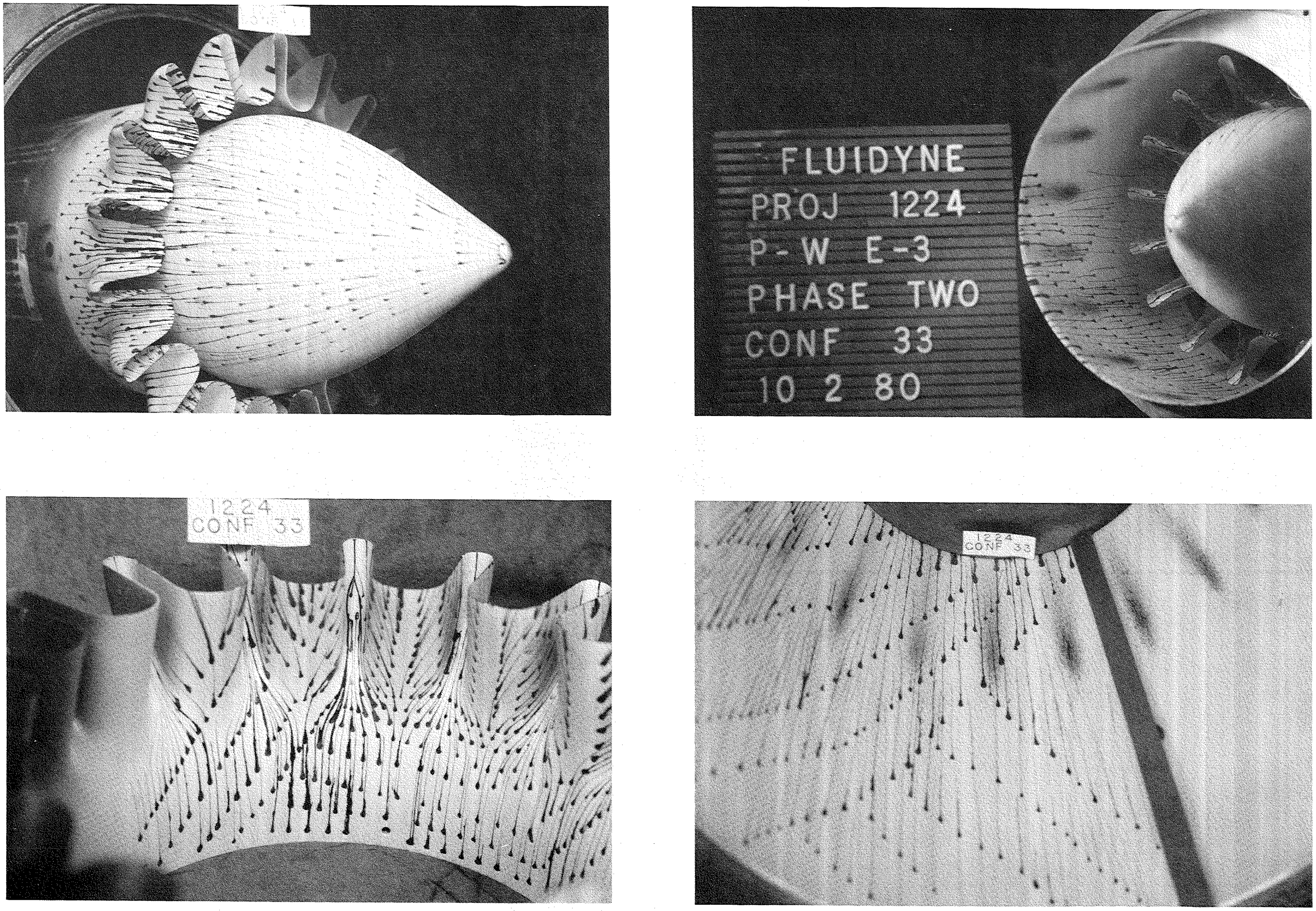

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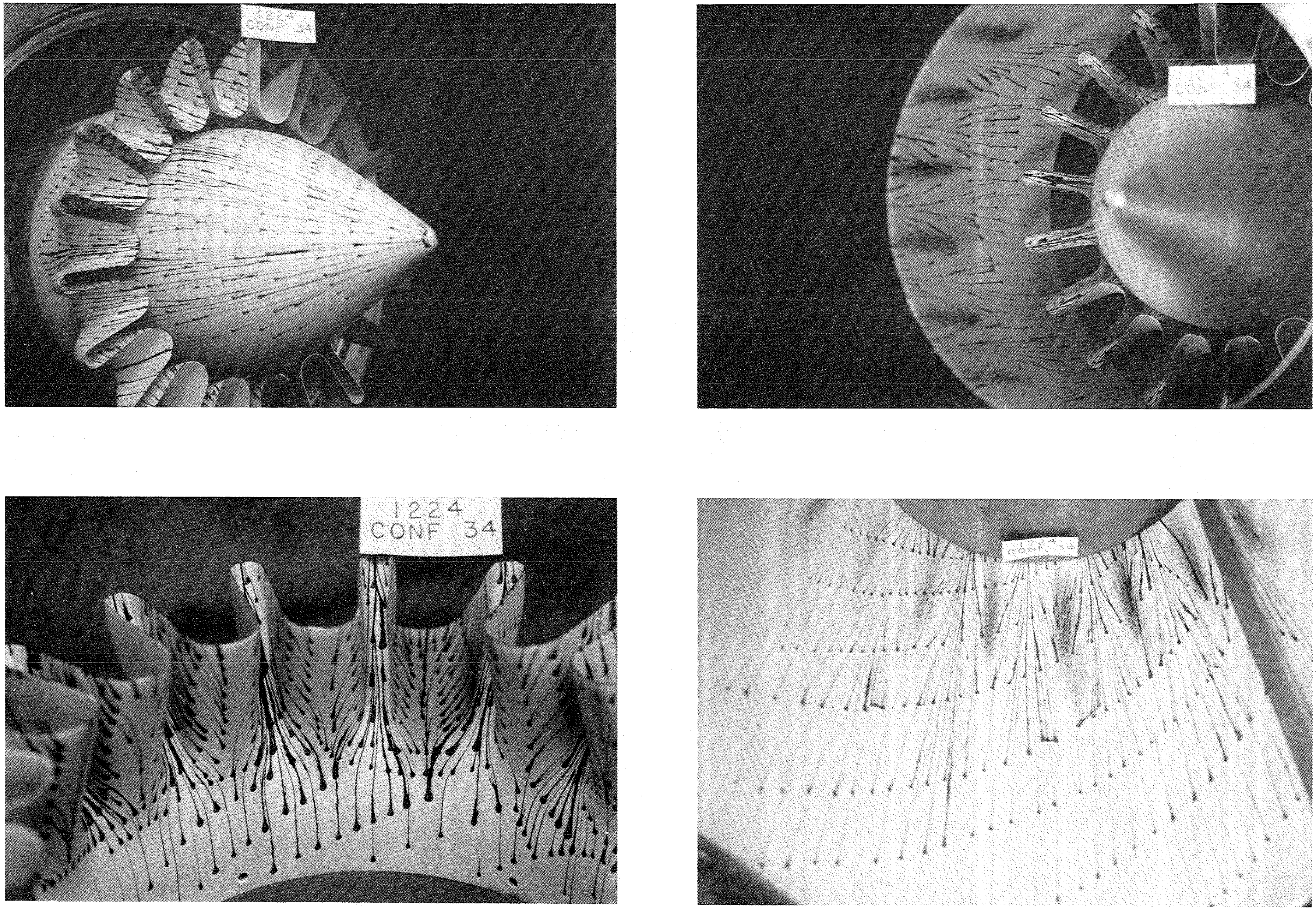

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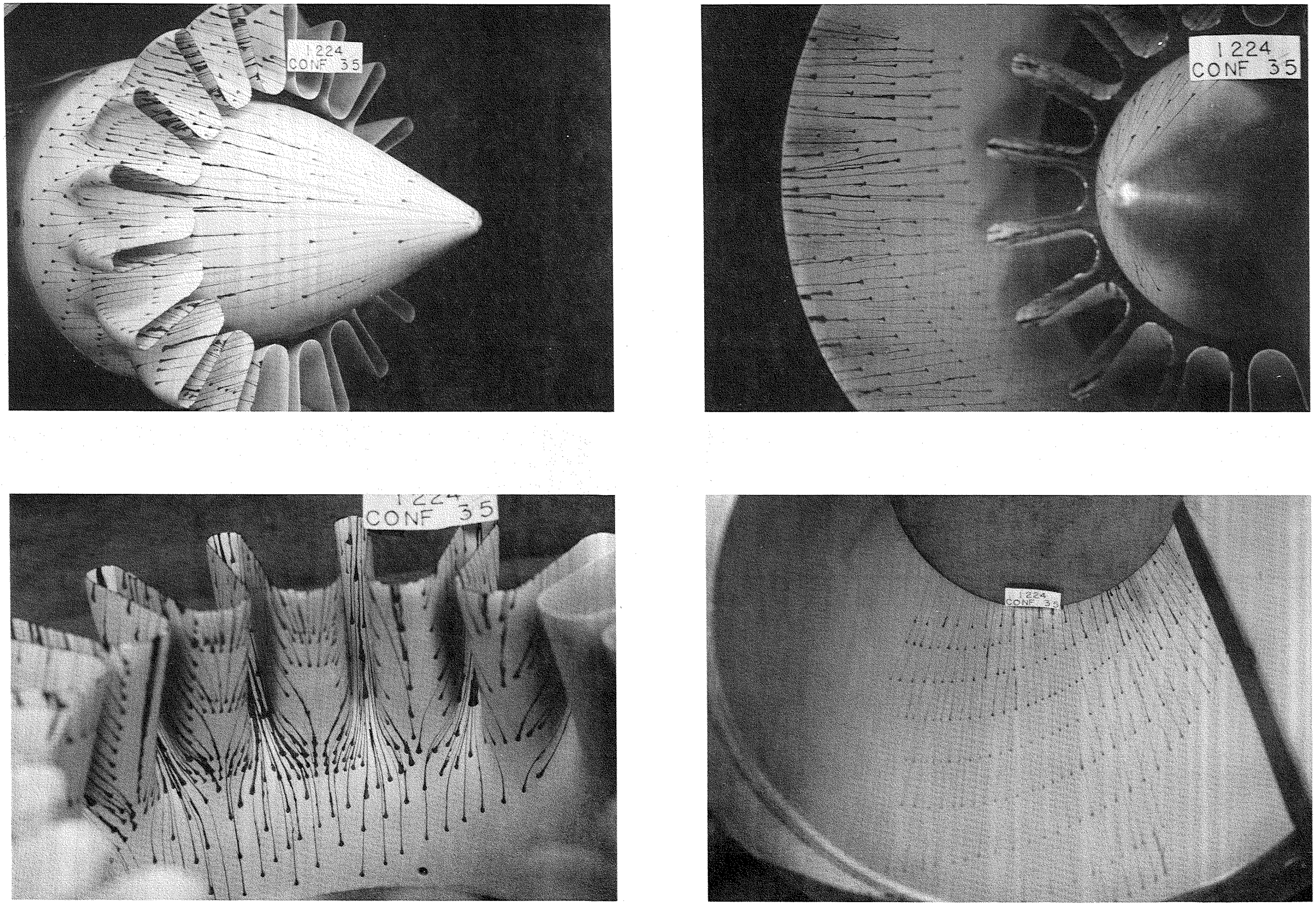

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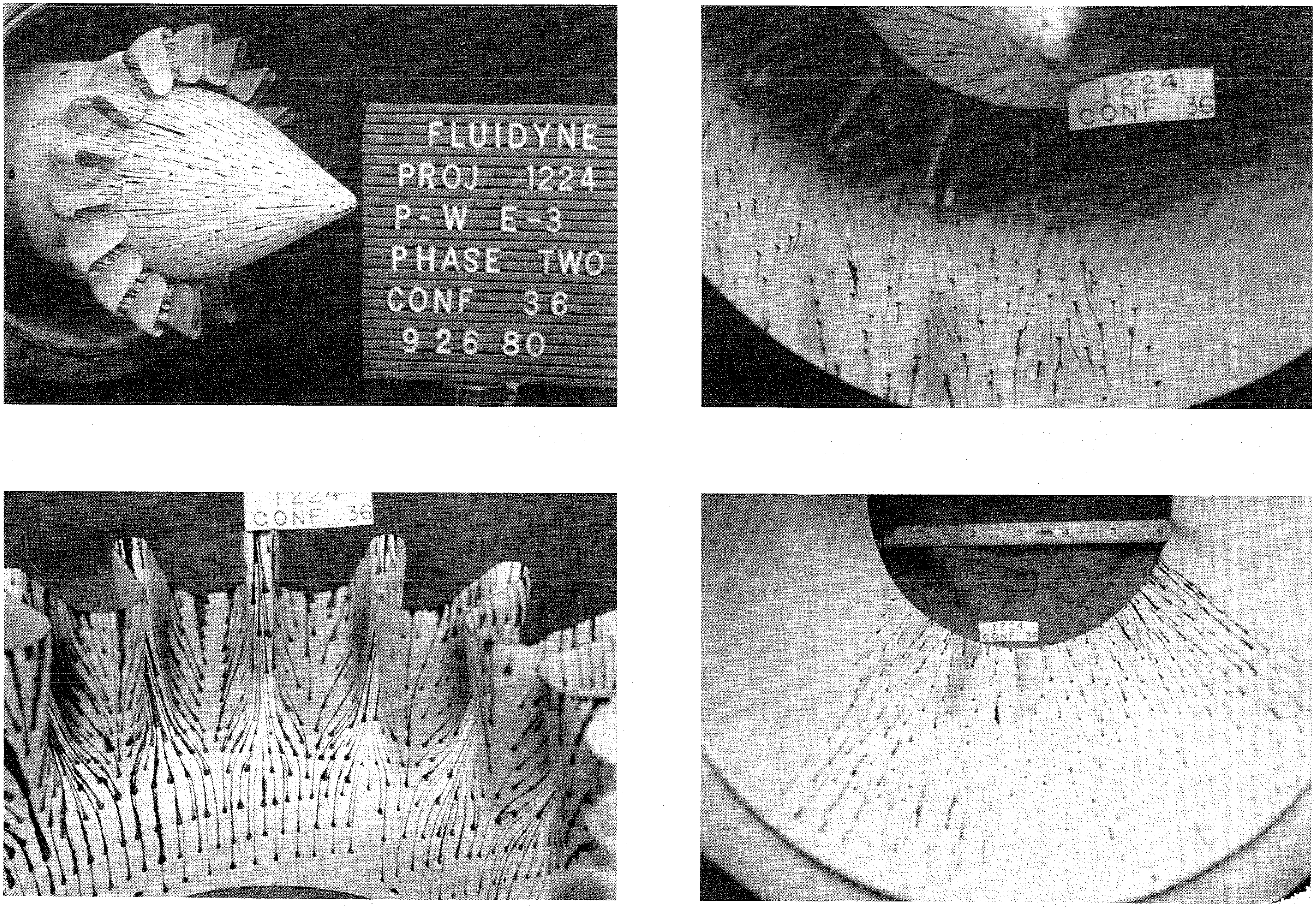

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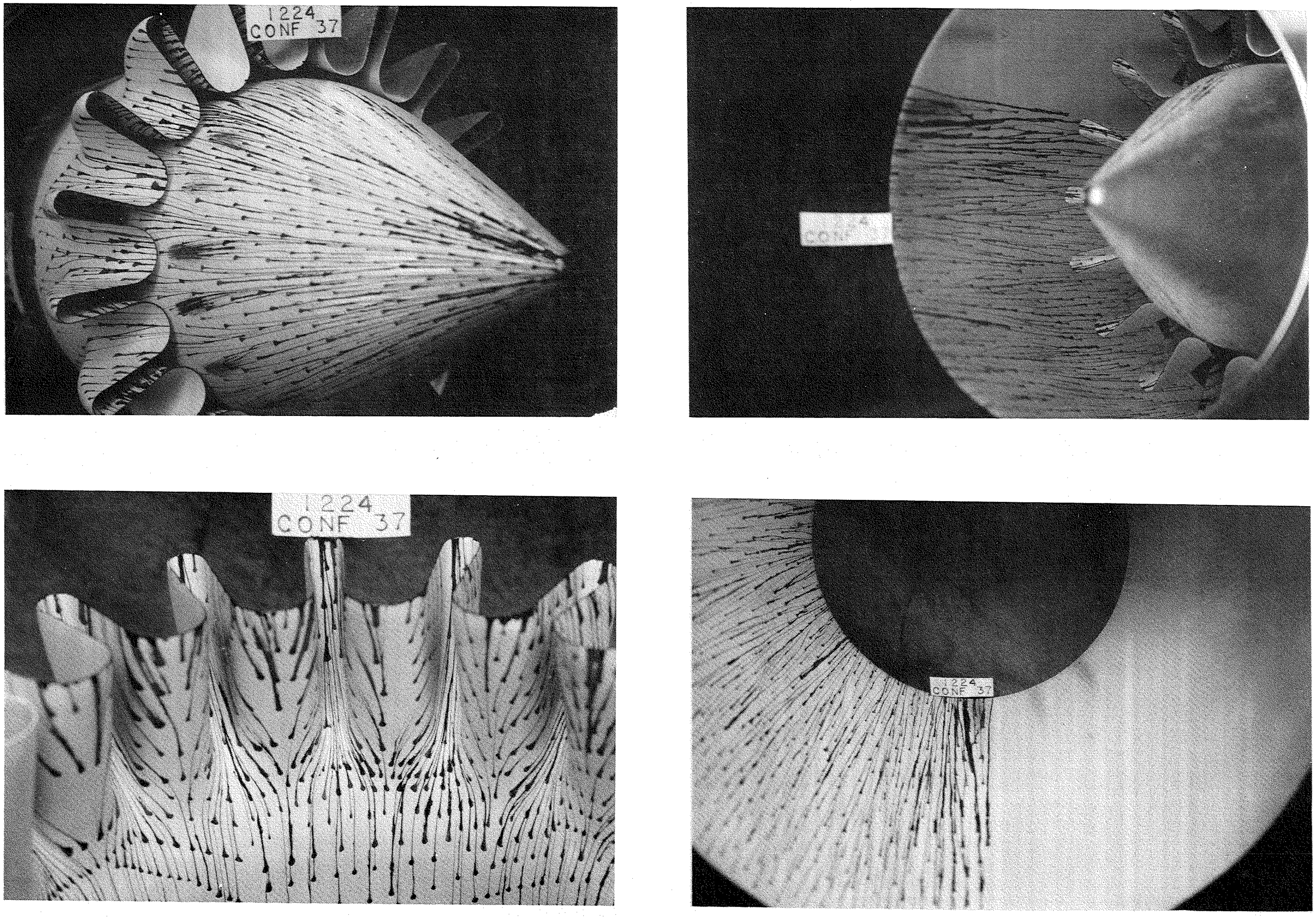

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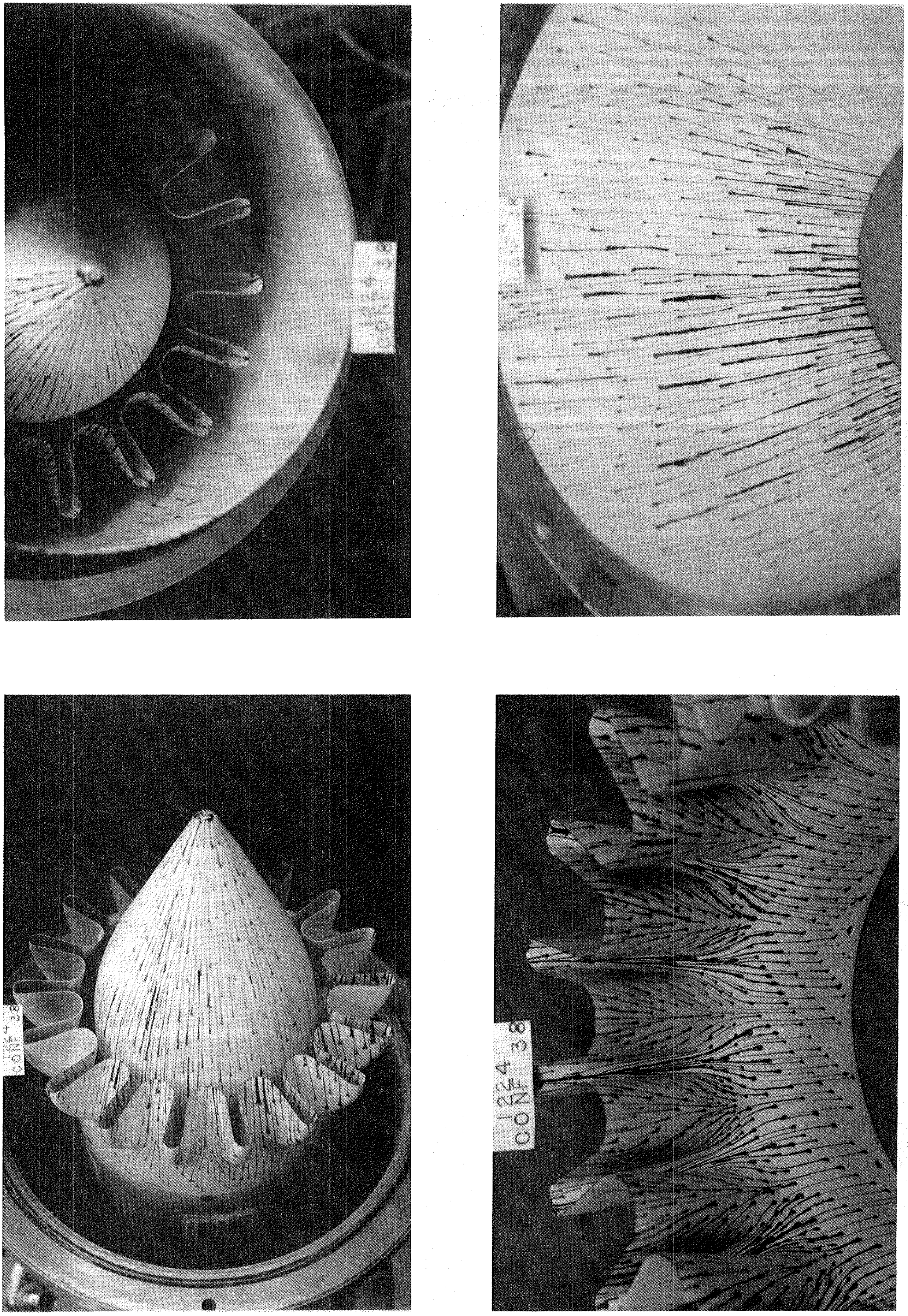

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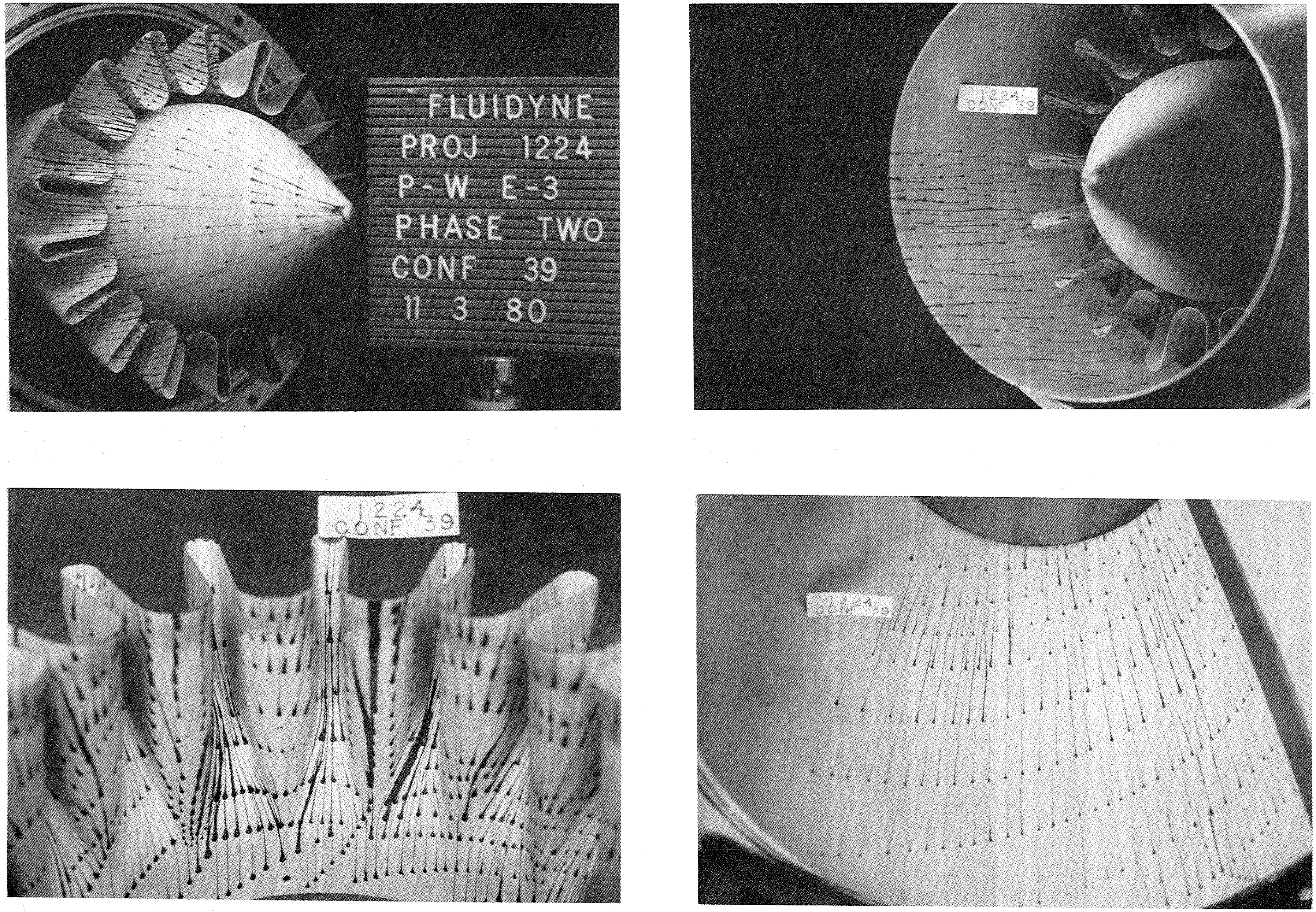

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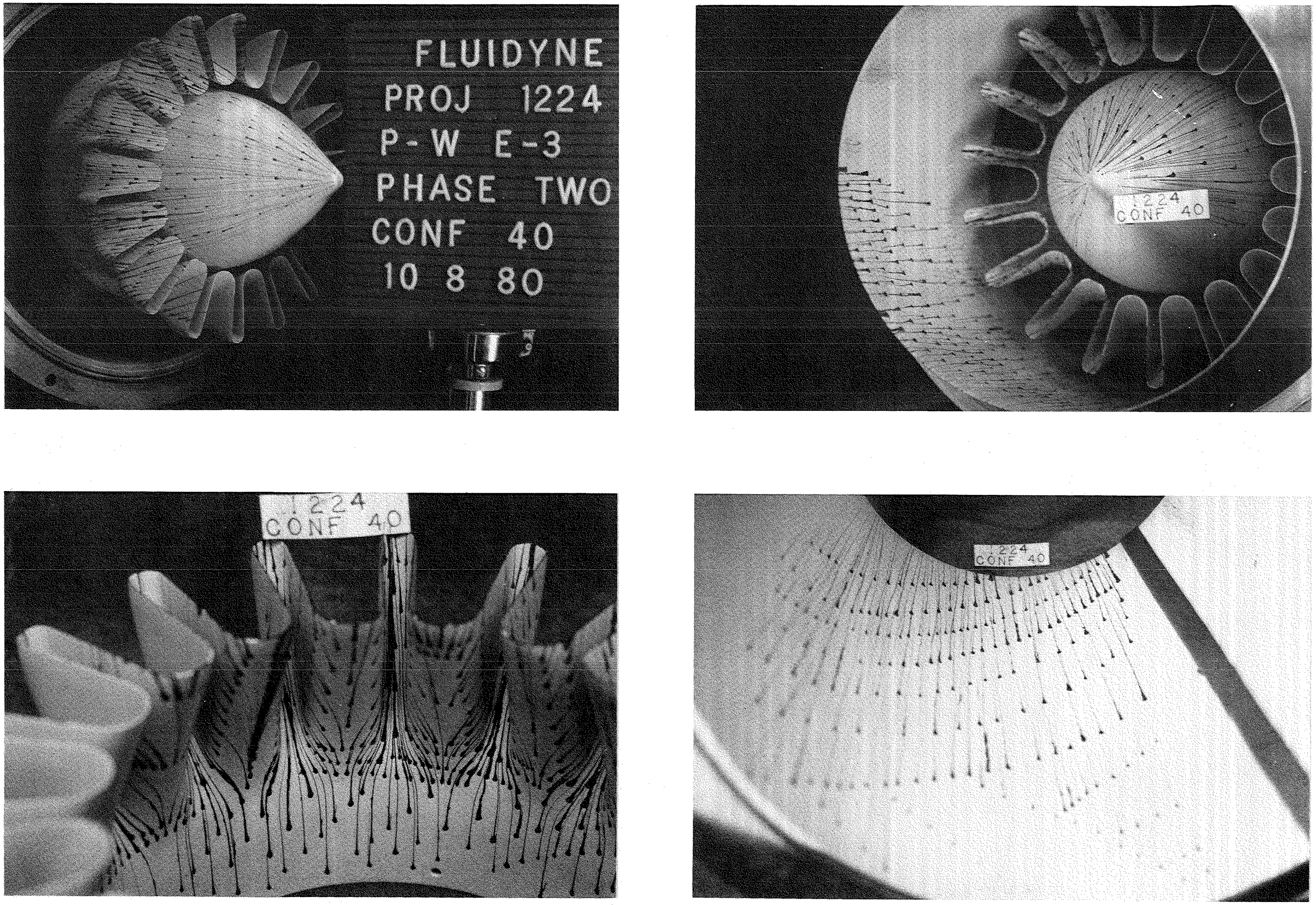

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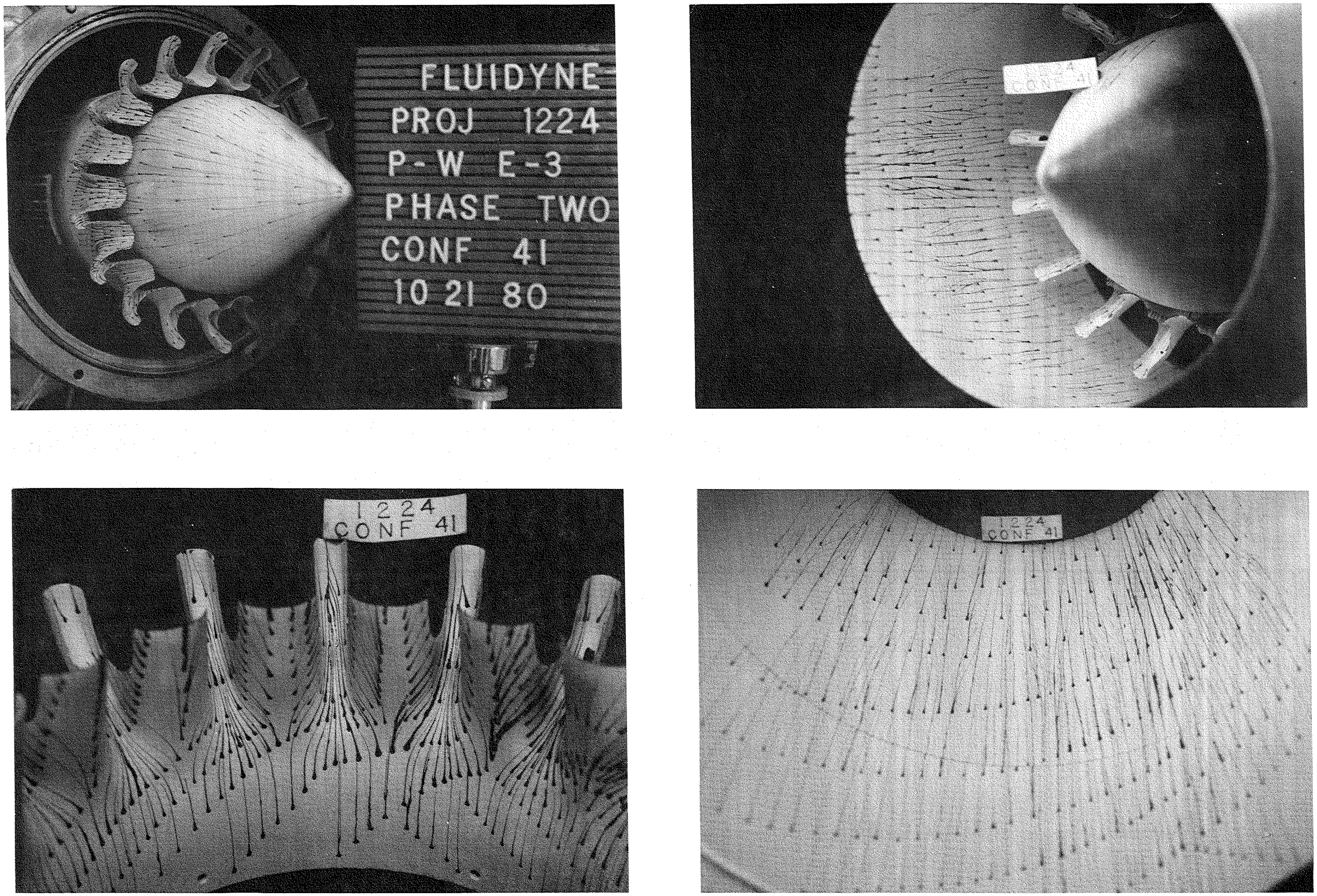

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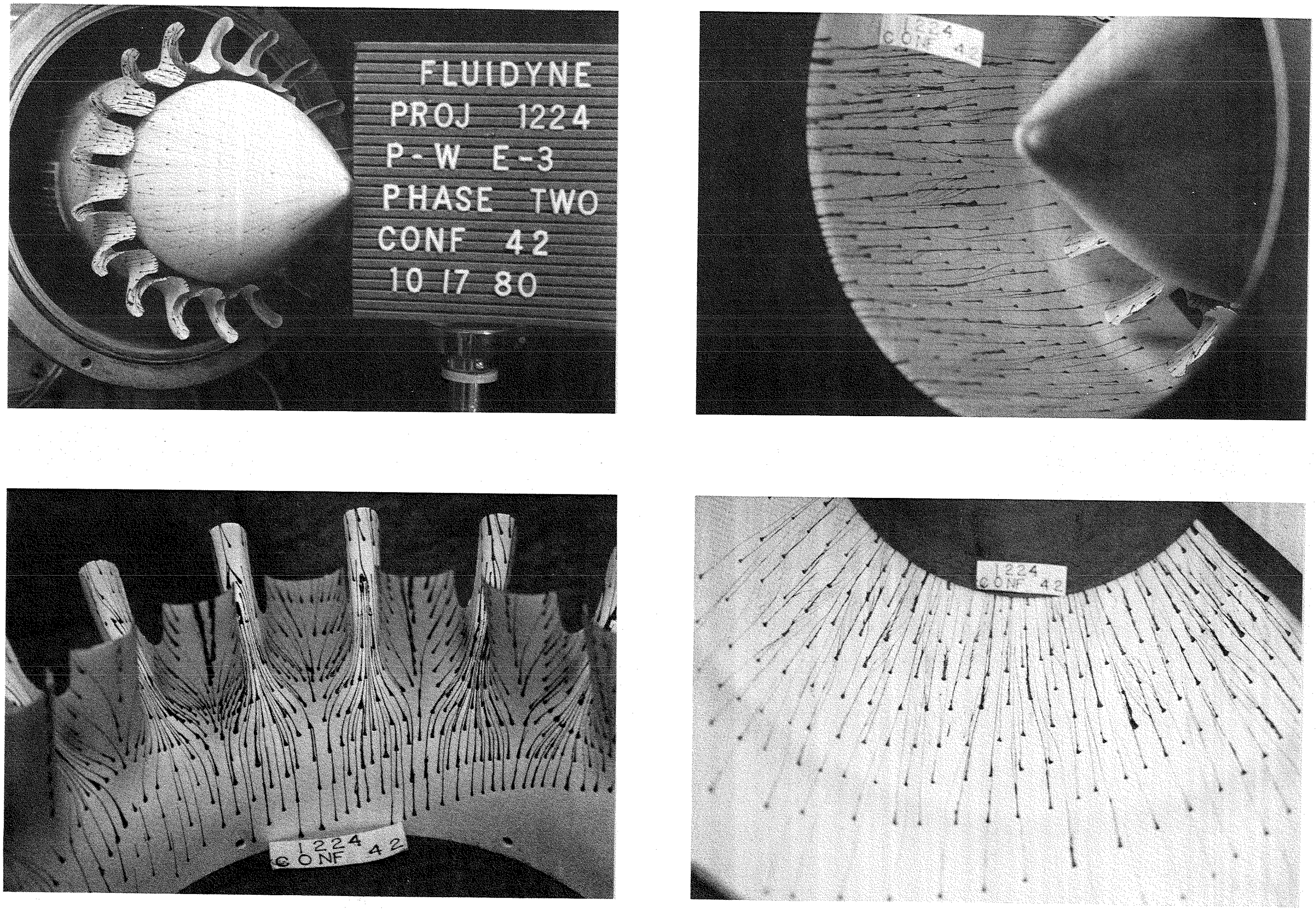

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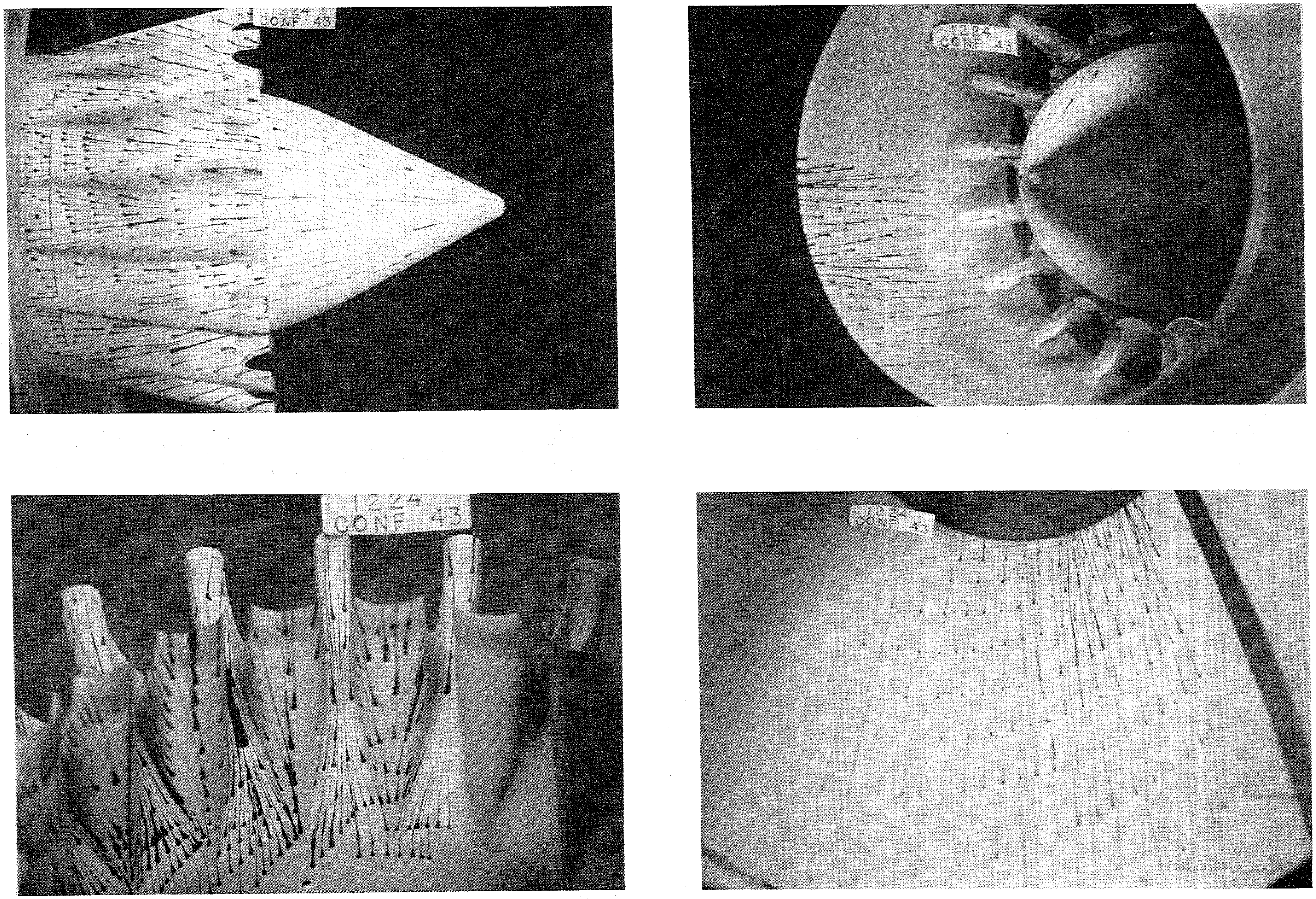

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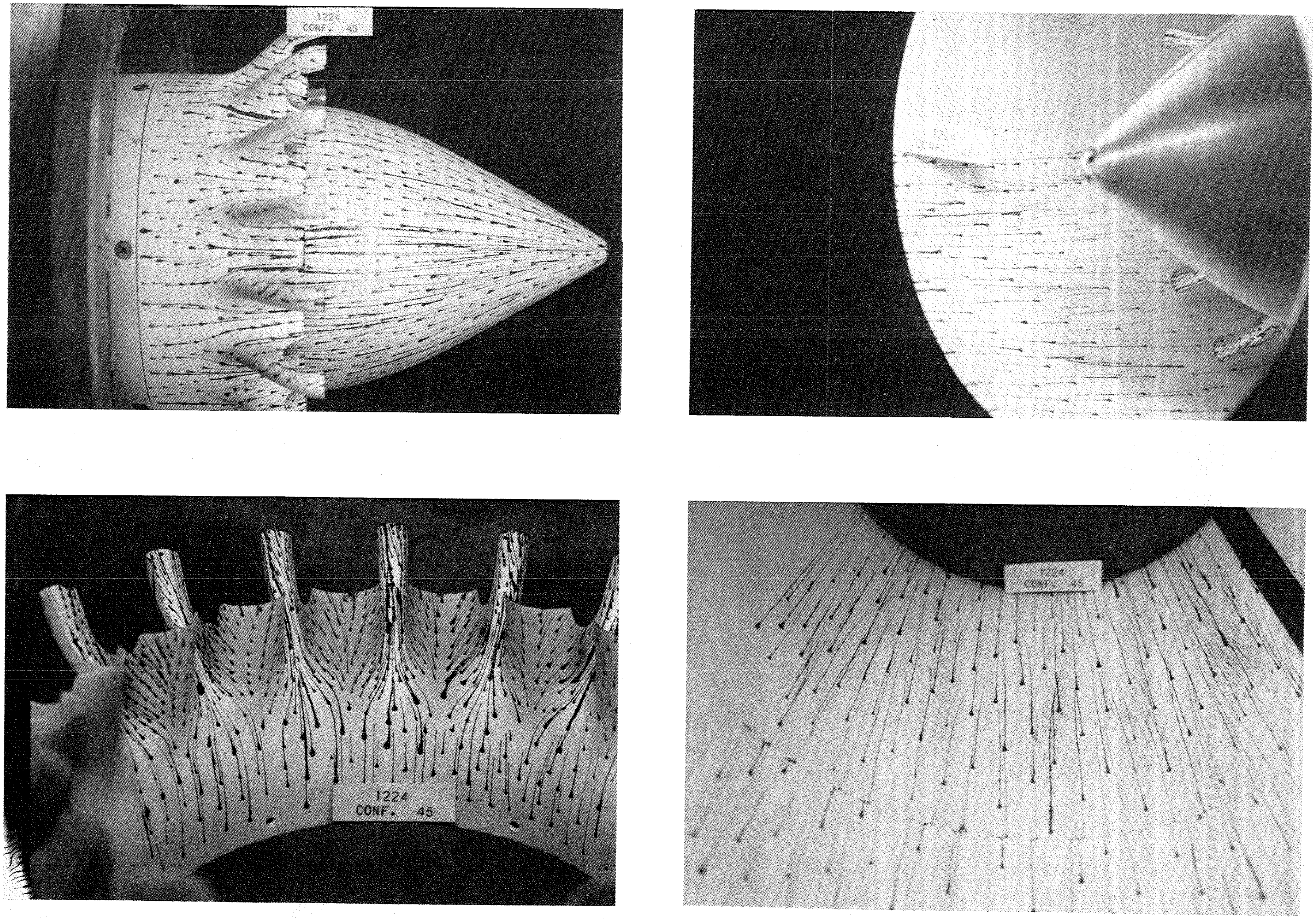

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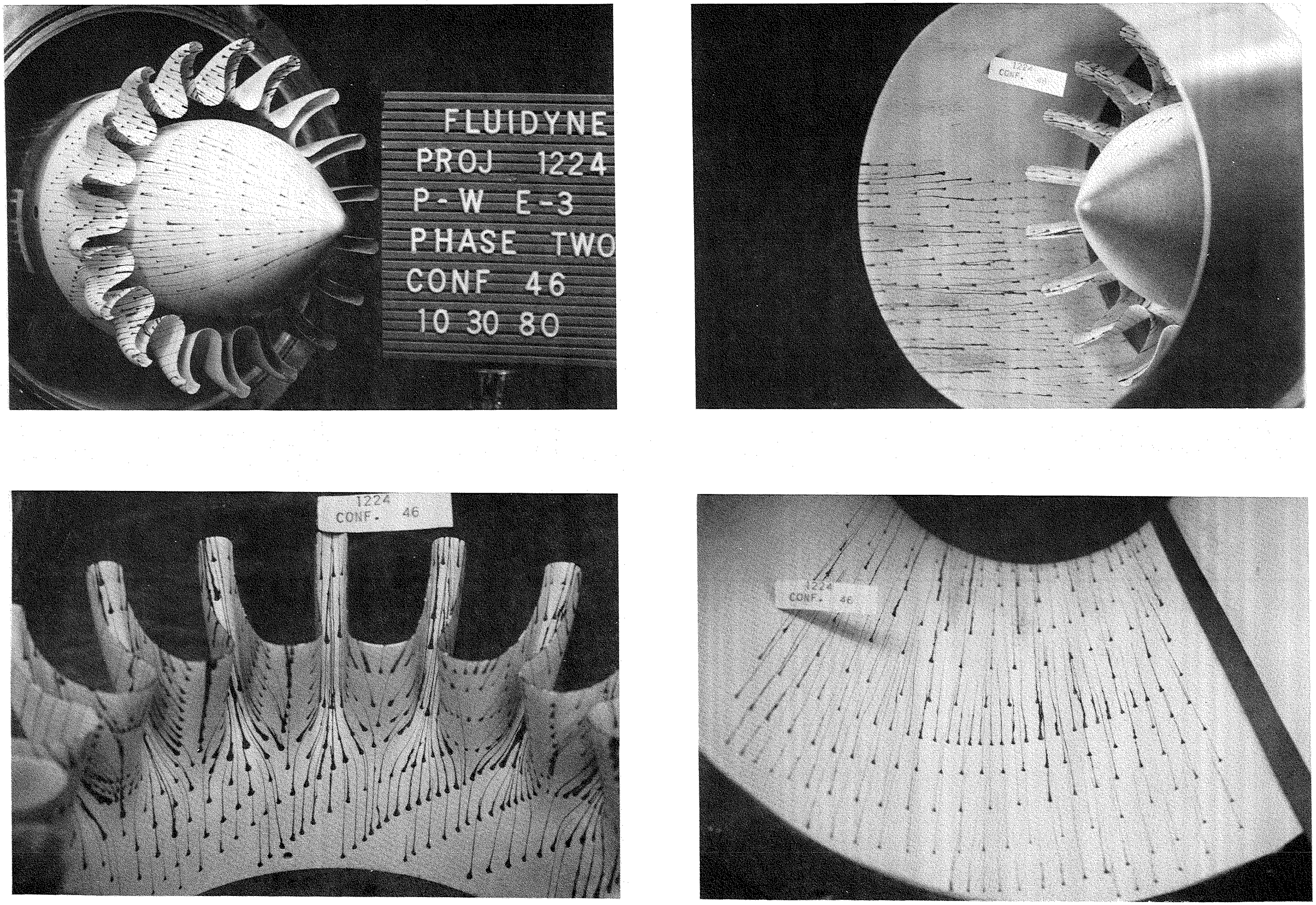

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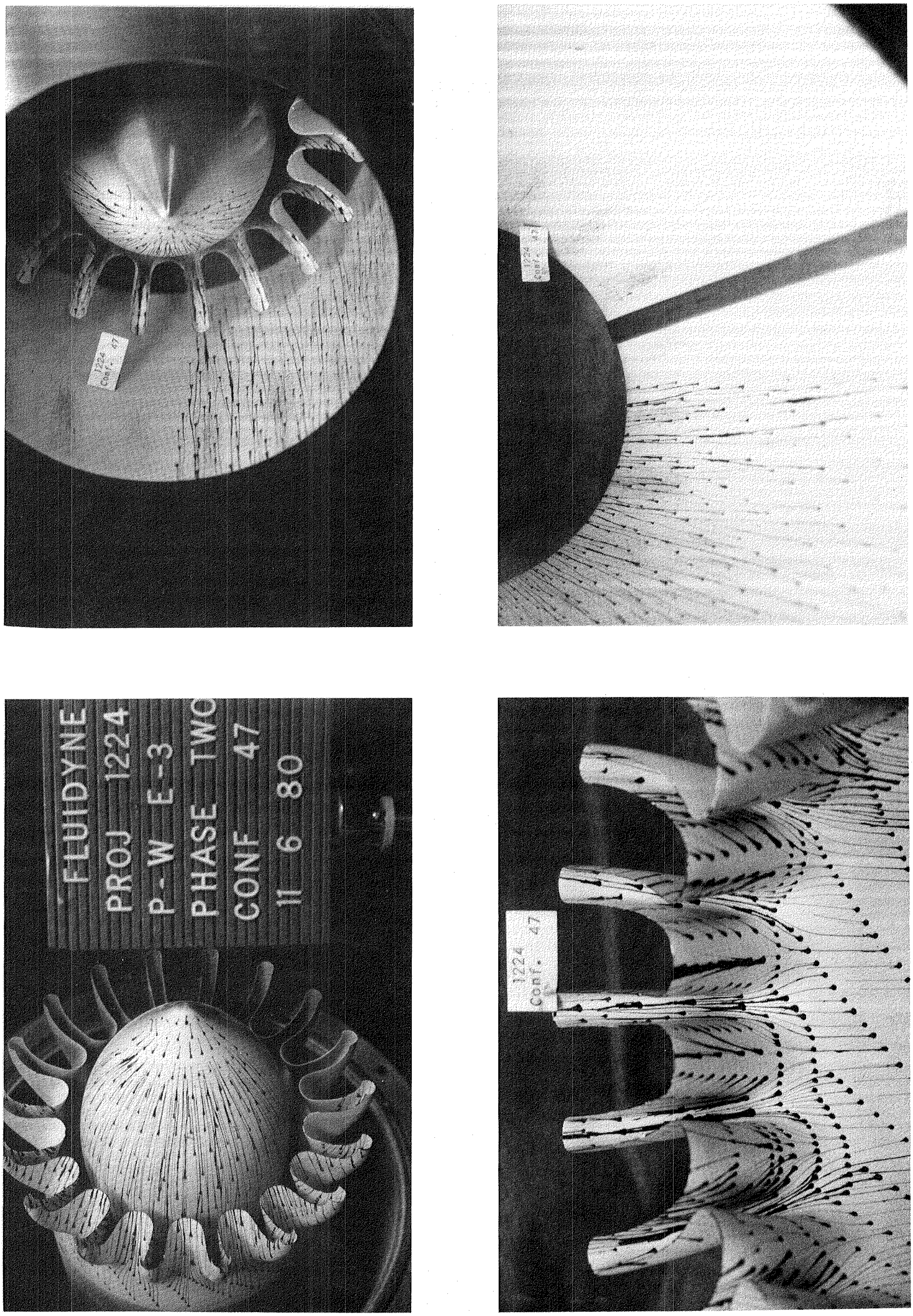

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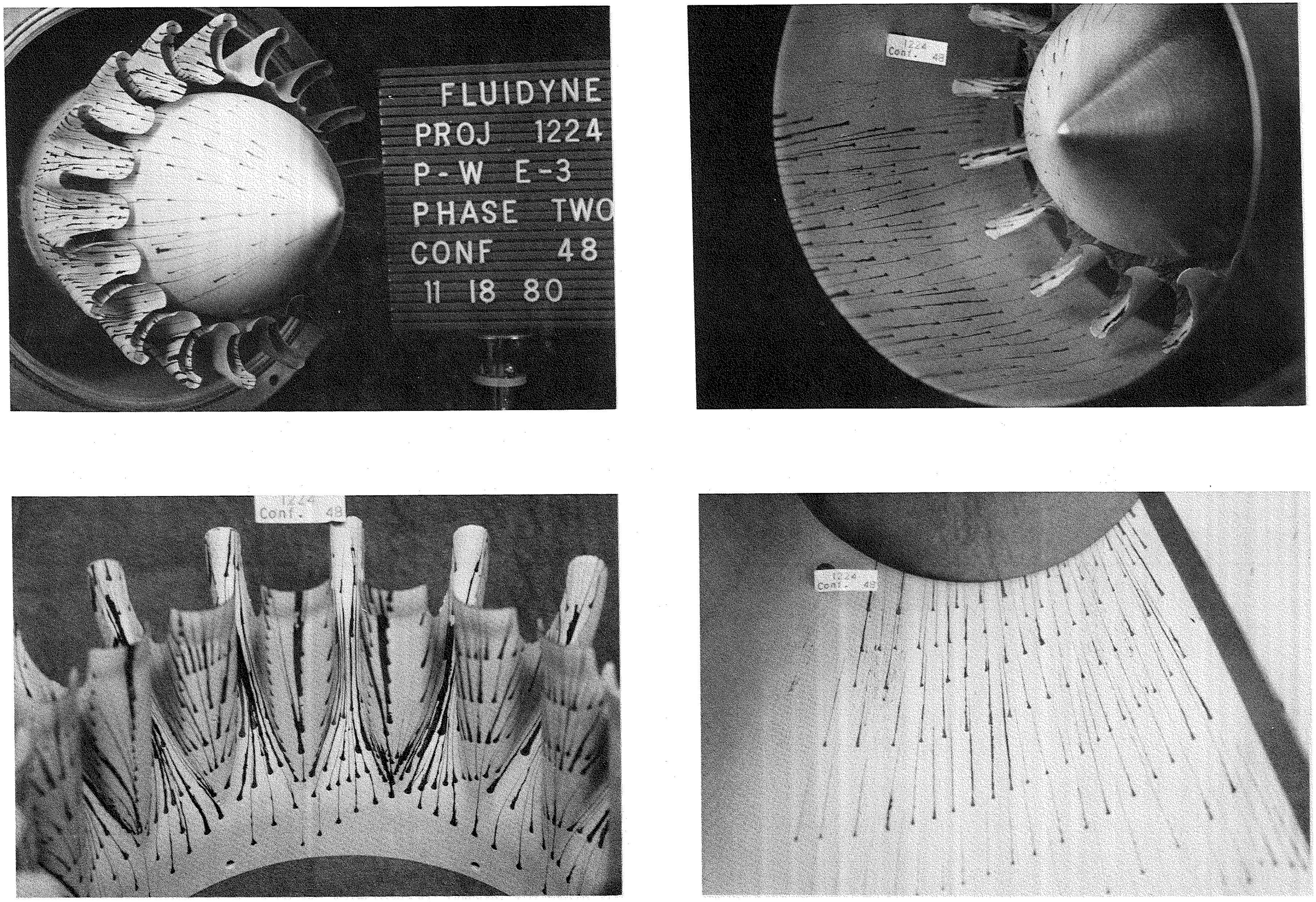

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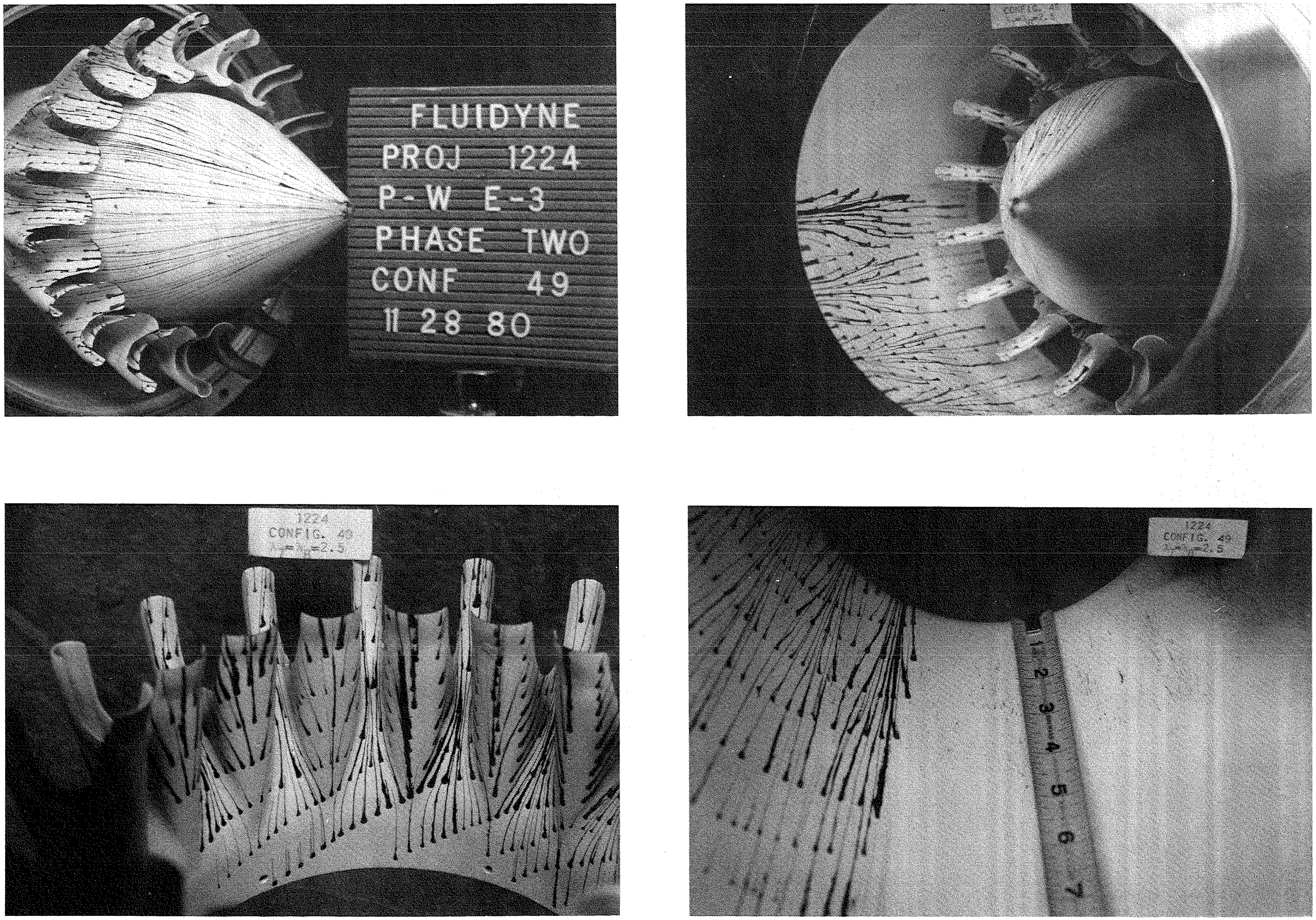

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