Calspan

Technical Report

(NASA-CR-144090) AN EXPERIMENTAL INVESTIGATION OF THE NASA SPACE SHUTTLE EXTERNAL TANK AT HYPERSONIC MACH NUMBERS (Calspan Corp., Buffalo, N.Y.) 98 p HC $5.00 CSCL 01A G3/02

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Section 1
FOREWORD

The experimental investigation of pressure and heat-transfer on the NASA Space Shuttle External Tank (ET) was conducted by Calspan Corporation for the George C. Marshall Space Flight Center (MSFC) of the National Aeronautics and Space Administration (NASA) under Contract NAS8-31398. This wind tunnel test program to support ET disposal was conducted during the period 9 June 1975 to 24 June 1975 in the Calsapn 48-inch Hypersonic Shock Tunnel (HST). The program was monitored by Mr. Homer Wilson, Mr. John Warmbrod and Mr. Ira Jones of NASA. NASA has designated this test as TH2F.

The test model was Rockwell International Corporation (RIC) space shuttle external tank model 37-T which was loaned for this program. Additional model parts and all instrumentation were fabricated and installed by Calspan.

The model and the results of the test program are unclassified.

Section 2

NOMENCLATURE AND SYMBOLS

a_∞	Free-stream speed of sound (ft/sec)
c	Specific heat of Pyrex substrate (BTU/lb-°R)
c_p	Specific heat at constant pressure of test gas (ft^2/sec^2-°R)
C_H	Stanton number, $778\ \dot{q}_w/\rho_\infty U_\infty\ (rH_o-H_w)$
C_p	Pressure coefficient,
h	Heat transfer coefficient, $778 \times 32.17\ \dot{q}_w/(rH_o-H_w)$, ($lb_m/ft^2$-sec)
h_D	Enthalpy in dissociation (ft^2/sec^2)
H_w	Gas enthalpy at wall temperature T_w (ft^2/sec^2)
H_o	Test gas stagnation enthalpy (ft^2/sec^2)
H_1	Gas enthalpy at initial temperature T_1 (ft^2/sec^2)
H_4	Theoretical enthalpy behind reflected shock wave in shock tube (ft^2/sec^2)
H1, 2, etc.	Model heat-transfer gauge location and identification, see Table I
k	Thermal conductivity of Pyrex substrate (BTU/sec-ft-°R)
L	Length of external tank model (inches)
M_i	Incident shock wave Mach number
M_∞	Free-stream Mach number
p	Model surface pressure (psia)
p_o	Test gas reservoir pressure (psia)
p_o'	Total pressure behind normal shock wave in free stream (psia)
p_1	Initial driven tube pressure (psia)
p_4	Theoretical pressure behind reflected shock wave in shock tube (psia)
p_∞	Free-stream static pressure (psia)
p_{t_5}	Initial pressure in test section before run (psia)
Pr_w	Prandtl number at wall temperature T_w
$\dot{q}$	Model surface heat-transfer rate (BTU/ft^2-sec)
$\dot{q}_w$	Model surface heat-transfer rate corrected to initial wall temperature T_w, (BTU/ft^2-sec)
$\dot{q}_o$	Theoretical stagnation line heat-transfer rate for 3.24-inch diameter cylinder (BTU/ft^2-sec)
q_∞	Free-stream dynamic pressure, $1/2\ \rho_\infty U_\infty^2$, (psia)

r	Enthalpy recovery factor
R	Model radius (in.); Gas constant (ft^2/sec^2-°R)
Re/ft	Free-stream Reynolds number per foot, $\rho_\infty U_\infty/\mu_\infty$, (ft^{-1})
$Re_{\infty L}$	Reynolds number based on free stream conditions and model length,
Re_s	Reynolds number based on conditions behind normal shockwave in test section and model radius,
t	Time during test (sec.)
T	Model surface temperature (°R)
T_w	Model initial wall temperature (°R)
T_o	Gas reservoir temperature (°R)
T_o'	Total temperature behind a normal shock wave in free stream (°R)
T_1	Initial gas temperature in shock tube (°R)
T_4	Theoretical temperature behind reflected shock wave in shock tube (°R)
T_∞	Free-stream static temperature (°R)
U_i	Incident shock wave velocity (ft/sec)
U_∞	Free-stream velocity (ft/sec)
x	Longitudinal distance along model axis (in.)
y	Distance normal to model surface (in.)
α	Angle of attack (deg.)
γ	Specific heat ratio
θ	Azimuthal angle around model (deg.)
μ_w	Absolute viscosity at wall temperature T_W (slugs/ft-sec)
μ_o'	Absolute viscosity at temperature T_O' (slugs/ft-sec)
μ_∞	Absolute viscosity at temperature T_∞ (slugs/ft-sec)
ρ	Density of Pyrex substrate (lb/ft^3)
ρ_w	Density at wall temperature T_W ($slugs/ft^3$)
ρ_o'	Density at temperature T_O' ($slugs/ft^3$)
ρ_∞	Free-stream density ($slugs/ft^3$)
ϕ	Angle of roll (deg.)
ψ	Angle of yaw (deg.)

Section 3
INTRODUCTION

The objective of this program was to conduct pressure and heat transfer tests simulating flight conditions which the space shuttle external tank will experience prior to break-up. This series of tests (TH2F) for NASA/MSFC utilized a 0.010-scale model (37-T) built for the Rockwell International Corporation. The tests were conducted in the Calspan 48-inch Hypersonic Shock Tunnel and simulated entry conditions for nominal, abort-once-around (AOA) and return to launch site (RTLS) launch occurrences.

Surface pressure and heat-transfer-rate distributions were obtained with and without various proturberences (or exterior hardware) on the model at Mach numbers from 15.2 to 17.7 at angles of attack from -15° to -180° and at several roll angles. The tests were conducted over a Reynolds number range from 0.013×10^6 to 0.58×10^6, based on model length.

Section 4
TEST EQUIPMENT

SHOCK TUNNEL

The basic components of the 48-inch Hypersonic Shock Tunnel (HST) are shown in Figure 1 and are described in Reference 1. This HST employs a constant-area shock tube with an 8-inch inner diameter. The driver tube is 20-feet long and is externally heated by an electrical resistance heater to temperatures of 1460°R. The driven tube is 50 feet long and contains instrumentation ports for the measurement of incident shock wave speed and pressure behind the reflected shock wave. For the present test program, the driver gas was either a mixture of helium and air or pure helium, while the driven (test) gas was air. The tailored-interface mode of operation[2] was used to provide the longest possible steady state reservoir conditions for the nozzle.

Although $M_\infty = 8$ and $M_\infty = 16$ contoured nozzles are available for the 48" HST, a 10.5° semi-angle conical nozzle having a 48-inch exit diameter was used in this program. The lowest Reynolds number test condition dictated the selection of this nozzle. This nozzle (designated as the "E" nozzle) can be operated with throat diameters ranging from 1.125" to 0.20". It has been calibrated for test section Mach numbers (M_∞) from 11 to 23 and unit Reynolds numbers from 4.5×10^3 to 2×10^6 per foot using pitot-pressure survey rakes.

The test section is equipped with 16-inch diameter windows allowing schlieren or shadowgraph flow visualization.

MODEL

The RIC Model 37-T is a 0.010 scale model of the space shuttle external tank (Figure 2) and was used in previous shock tunnel test programs.[3,4] This model was designed and fabricated by Grumman Aerospace Corporation. The model diameter is 3.24 inches and the model reference length is 18.65 inches. The tank is an ogive cylinder with an elliptical base. For this program, the original sphere-ogive nose configuration[3] was used rather than the hemisphere cylinder nose vent cap.[4] The model was tested with and without the various external fuel lines, pressure lines, electrical conduits and forward and rearward attachment struts for mating to the orbiter. For angles of attack greater than 90°, a new nose section, base plug and sting were required. These parts were designed and fabricated by Calspan as part of the present program. The model is shown in Figure 3 in this configuration.

For all tests the model was sting-mounted through either the base ($|\alpha| \leq 90°$) or the nose ($|\alpha| > 90°$) and could be rolled about its longitudinal axis. Because the pitch sector of the 48" HST has a maximum angle of attack of 53.5°, a 45° adapter was used on all tests to allow the model axis to be set at angles from 0° to 90°. Typical installation photographs of the model are shown in Figure 4. The ceiling-mounted pitot probe visible in Figure 4a was utilized throughout the test program. During the tests a second pitot probe and a stagnation heat transfer probe were added. These are visible in Figures 4c and 4d and are also shown in Figure 5.

INSTRUMENTATION

Heat Transfer

The model is instrumented with a total of 80 heat-transfer gauges of which as many as 42 were utilized for the present tests. A sketch of the model showing the heat-transfer and pressure gauge locations is shown in Figure 6. Table I gives the axial and peripheral location of each gauge. During the test program a cylindrical probe instrumented to measure stagnation line heat transfer rate was mounted in the test section.

The measurement of heat-transfer rates relies on sensing the transient surface temperature of the model by means of thin-film resistance thermometers.[5,6] These gauges are fabricated either on small Pyrex buttons or on contoured strips of Pyrex glass. The sensing element is a thin platinum strip painted on the Pyrex. After painting, the gauge is heated in an oven at controlled conditions resulting in a thin metal film fused to the Pyrex substrate. Typically, the element is 0.1 micron thick, 0.20-inch long and 0.02-inch wide. Because the heat capacity of the gauge is negligible, the film temperature is equal to the instantaneous surface temperature of the Pyrex substrate. The surface temperature is sensed by using the gauge as a resistance thermometer. The measured surface temperature is related to the heat-transfer rate to the model by the theory outlined in Section 7 of this report and discussed in detail in Reference 6.

Pressure

The model was instrumented with a maximum of 13 pressure transducers along the top and bottom centerline ($\theta = 180°$ and $0°$, respectively) and on the base, Figure 6. Table II gives the axial and peripheral location of each gauge. One or two pitot pressure probes were mounted in the test section also to monitor the air flow.

The pressure gauges installed in the model and in the pitot probes were Calspan-developed miniature transducers[7,8] employing lead-zirconium-titanate piezoelectric ceramics as pressure sensitive energy sources and field effects transistors as power amplifiers. The complete unit is about 0.37-inch in diameter and 0.21-inch thick. These transducers have sensitivities of approximately 1.5 V/psi and can be used up to 3 psi pressure. To provide acceleration compensation, an additional diaphragm-ceramic unit is wired in opposition to the active unit; this design reduces acceleration sensitivity to approximately 10^{-4} psi/g. A heat shield minimizes temperature effects.

Pressure behind the reflected shock wave in the shock tube (the nozzle reservoir pressure, p_o) was measured on each run using four Calspan-developed strain gauge pressure transducers.

Shock Wave Speed Measurement

Measurement of the speed of the incident shock wave in the driven tube is fundamental to determining the test conditions in a hypersonic shock tunnel. Three thin-film heat-transfer gauges were used to detect the passage of the incident shock wave. These gauges were spaced 5 feet apart with the last one located 2.5 feet from the end of the driven tube. The electrical signal generated by the passage of the shock wave is used to start and/or stop digital counters having a resolution of 1 microsecond. Thus, two wave speed measurements are obtained each test run with an error of less than 1%.

DATA ACQUISITION

The electrical output of the heat-transfer gauges, one of the pitot probes, and the reservoir pressures were recorded on a Navigation Computer Corporation MCL-100 data acquisition system (NAVCOR). Outputs from the model and the second pitot probe pressure transducers were recorded on Tektronix Corporation Type 502 dual-beam oscilloscopes where the trace generated on the cathode ray tube was photographed on Polaroid film using conventional oscilloscope cameras.

The 48-channel NAVCOR system simultaneously samples the electrical inputs to each channel at 50 microsecond intervals and records the information in digital form on a magnetic storage drum. The available recording time is 15 milliseconds. The readout cycle after a test run involves transferring the data to a digital-to-analog converter at a speed compatible with a direct-writing, strip chart recorder. The output from each heat-transfer gauge, as recorded on the NAVCOR, was additionally processed by a "$\dot{q}$-meter", a passive electric analog network that converts transient temperature history into a heat-transfer rate, and reproduced on the strip recorder simultaneously with the temperature history.

FLOW VISUALIZATION

A double-pass, collimated-light schlieren system was used to obtain flow field photographs. A single photograph was taken each run with a spark light source having a duration of 0.6 microsecond.

Section 5
TEST PROCEDURE

CALIBRATION

The heat-transfer gauges were calibrated prior to installation in the model to determine the change in resistance of the thin metal film with temperature. The resistance was measured at three temperatures up to 150°F during the calibration and the calibrated sensitivity (ohms/°F) is linear over this range which exceeds the surface temperature changes encountered in the present tests.

All pressure transducers were calibrated on a dead weight tester both before and after the test program.

TEST PROGRAM

Because the external tank is expected to undergo tumbling during entry, the test program included angles of attack from -15° to -180° and roll angles from 0° to 90°. Tests both with and without the external hardware were included. The program was conducted at three nominal test conditions: $M_\infty = 15.3$ and $Re/ft = 3.7 \times 10^5$; $M_\infty = 15.2$ and $Re/ft = 4.6 \times 10^4$; $M_\infty = 17.7$ and $Re/ft = 8.7 \times 10^3$. Although the tests were conducted in a conical nozzle, no source flow corrections were applied to the data. The complete run schedule is presented in Table III which lists the model configuration tested, the nominal values of free-stream Mach number and Reynolds number, the angle of attack, and the roll angle.

Section 6
TEST CONDITIONS

Normally the values of free-stream Mach number in the test section are determined from correlations of M_∞ with M_i and p_o based on previous air-flow calibrations. It became evident early in the test program that the pitot pressure predicted by this procedure was different from that measured by the ceiling-mounted pitot probe. Because this probe was located 13-1/4 inches above the tunnel centerline to clear the model at the large angles of attack, a second pitot probe was mounted along side the model about 6 inches from the tunnel centerline (Figure 5). This second pitot probe, as well as heat transfer measurements on the stagnation line of a 1-inch diameter cylinder (Figure 5), provided additional information for evaluating the test conditions.

The free-stream conditions have been determined using an average value of p_o'/p_o obtained from both pitot probes and model pressures along the cylindrical portion of the model at 90° angle of attack. At the lowest Reynolds number test condition, the ceiling-mounted pitot probe was outside the core of uniform flow. At that Reynolds number, only measurements made with the side pitot probe and with the model at $\alpha = -90°$ were used to obtain an average value of p_o'/p_o. The average values of p_o'/p_o for each of the three nominal test conditions are as follows:

M_∞	Re/ft	p_o'/p_o
15.3	3.7×10^5	3.22×10^{-4}
15.2	4.6×10^4	2.24×10^{-4}
17.7	8.7×10^3	1.195×10^{-4}

The free-stream test conditions of pressure, temperature, Reynolds number, etc. were computed assuming isentropic expansion of the test gas from conditions behind the reflected shock wave to the test section Mach number as determined from the average value of p_o'/p_o. The flow is expanded sufficiently so that the air in the test section is cool enough to obey the perfect gas law but still remains above the temperature for oxygen liquification.

The stagnation enthalpy and temperature of the air behind the reflected shock wave were determined from

$$H_o = H_1 \, (H_4/H_1) \tag{1}$$

and $$T_o = T_1 \, (T_4/T_1), \text{ respectively} \tag{2}$$

where H_4/H_1 and T_4/T_1 are functions of U_i, the incident shock wave velocity, and p_1, the initial pressure in the driven tube (References 9-11). U_i was obtained by measuring the time taken by the shock wave to pass between two stations in the shock tube. H_1 was taken from Reference 12. Free-stream static temperature was obtained from

$$T_\infty = \frac{H_o}{c_{p_\infty}} \left(1 + \frac{\gamma_\infty - 1}{2} M_\infty^2\right)^{-1} \tag{3}$$

with c_{p_∞} = 6005 ft^2/sec^2 °R and γ_∞ = 1.40. Free-stream static pressure was calculated using

$$p_\infty = \left(\frac{P}{P_p}\right) p_o \left(1 + \frac{\gamma_\infty - 1}{2} M_\infty^2\right)^{\frac{-\gamma_\infty}{\gamma_\infty - 1}} \tag{4}$$

where $$\frac{P}{P_p} = \frac{(p_\infty/p_o)_{real}}{(p_\infty/p_o)_{perf}}$$

is the real-gas correction to the ideal gas static-to-total pressure ratio as described in Reference 13. The sources for the real gas data used in this technique were References 12 and 14.

The free-stream velocity U_∞ was determined by

$$U_\infty = M_\infty a_\infty \tag{5}$$

where $a_\infty = 49.01 \sqrt{T_\infty}$, the speed of sound.

Free-stream dynamic pressure was calculated from

$$q_\infty = \frac{\gamma_\infty}{2} p_\infty M_\infty^2 \tag{6}$$

and free-stream density was based on the ideal gas equation of state

$$\rho_\infty = p_\infty / R T_\infty \tag{7}$$

where R = 1716 ft^2/sec^2-°R. Values for absolute viscosity μ used to compute Reynolds number were obtained from Reference 15 for temperatures below 500°R and from Reference 16 for temperatures above 500°R.

The reference temperature T^* was taken as $1/2\,(T_o' + T_w)$ where T_o' is the total temperature behind a normal shock wave in the test section and T_w equals the initial temperature T_1. The Chapman-Rubesin viscosity constant C^* was then calculated from

$$C^* = \frac{\mu^*}{\mu_\infty} \frac{T_\infty}{T^*} \tag{8}$$

The stagnation conditions behind a normal shock wave in the test section are based on the data of Reference 14.

In addition to the test section conditions, a theoretical stagnation line heat-transfer rate for a 3.24-inch diameter cylinder normal to the flow was calculated for each run by the method of Fay and Riddell.[17] This theoretical heat-transfer rate has been adopted as the reference value in normalizing the heat-transfer data. The stagnation line heat-transfer rate is given by

$$\dot{q}_o = \frac{0.76}{778\sqrt{2}} Pr_w^{-0.6} (\rho_w \mu_w)^{0.1} (\rho_o' \mu_o')^{0.4} \left\{1 + (Le^{0.52} - 1)\frac{h_D}{H_o}\right\} (H_o - H_w) \sqrt{(dU_e/dx)_o} \tag{9}$$

where $\left(\frac{dU_e}{dx}\right)_o = \frac{1}{R}\sqrt{\frac{2 \times 144\,(p_o' - p_\infty)}{\rho_o'}}$ and the Lewis number is Le = 1.4.

The test conditions for each run are given in Table IV. A discussion of the consistency of these test conditions with pressure and heat transfer measurements is included in Section 9 with the presentation of the data.

Section 7
DATA REDUCTION

HEAT TRANSFER

The "thin film" heat-transfer gauge is a resistance thermometer which reacts to the local surface temperature of the model. The theory of heat conduction is used to relate the surface temperature history to the rate of heat transfer. Because the resistance element has negligible heat capacity and, hence, negligible effect on the Pyrex substrate surface temperature, the substrate can be characterized as being homogeneous and isotropic. In addition, because of the short duration of a shock tunnel test (typically less than 10 milliseconds), the substrate can be treated as a semi-infinite body. The general heat conduction equation is

$$\rho c(T) \frac{\partial T}{\partial t} = \frac{\partial}{\partial y}\left[k(T) \frac{\partial T}{\partial y}\right] \tag{10}$$

where ρ , c and k are substrate density, specific heat and thermal conductivity, respectively, and y is the distance normal to the substrate surface.

If the substrate properties are independent of temperature, i.e., if the temperature rise is less than 100°F, a closed-form solution is obtained for the heat-transfer rate,

$$\dot{q}(t) = \frac{1}{2}\sqrt{\frac{\pi \rho c k}{t}}\left[T(t) + \frac{1}{\pi}\int_0^t \frac{\tau^{1/2}\, T(t) - t^{1/2}\, T(\tau)}{(t-\tau)^{3/2}}\, d\tau\right] \tag{11}$$

Two approaches are used at Calspan for obtaining heat-transfer rates from the temperature-time records; a numerical integration procedure and an analog electrical network. The analog network approach was used in the present work.

ANALOG $\dot{q}$-METER

In cases where the surface temperature change is nominally less than 100°F, Equation (10) may be solved directly by use of $\dot{q}$-meters, which are passive electrical analog networks, in conjunction with the heat-transfer gauge. The analog is based on the fact that the equation for heat conduction in a semi-infinite solid is identical to that for a semi-infinite electrical transmission line with distributed series resistance and shunt capacitance. In practice, it has been found feasible to construct the analog of a finite number of circuit elements consisting of parallel resistor-capacitor elements in a series arrangement.[18] For temperatures greater than 100°F, the variation of substrate properties with temperature causes a drop of the $\dot{q}$-meter output which is corrected by a time and heat transfer rate dependent factor. In the present tests the temperature change was such that this correction was not necessary.

However, because the heat-transfer rate is a function of the instantaneous wall temperature, the following correction for the wall temperature is applied to obtain the equivalent, cold wall, heat-transfer rate based on the initial wall temperature.

$$\dot{q}_w = \left[\frac{\dot{q}(t)}{rH_o - H_w(t)}\right](rH_o - H_w) \tag{12}$$

The recovery factor r varies from 1.0 for a stagnation point to typically 0.85 for a laminar boundary layer flow well removed from the stagnation point. Rather than attempt to evaluate r at all local conditions, the value of 1 has been used in correcting the measured heat-transfer rates to the initial cold wall temperature. This yields a correction that is sufficiently accurate in the present tests because of the relatively small wall temperature during the run.

HEAT TRANSFER COEFFICIENTS

The heat-transfer data were normalized in terms of a heat-transfer coefficient h and a Stanton number C_H based on free-stream conditions. The relations used are

$$h = 778(32.17)\frac{\dot{q}_w}{(rH_o - H_w)} \tag{13}$$

$$C_H = \frac{778\ \dot{q}_w}{\rho_\infty U_\infty (r H_o - H_w)} \tag{14}$$

where the wall conditions are based on the initial model surface temperature $T_w = T_1$. These coefficients have been calculated for values of $r = 1.0$ and 0.85.

PRESSURE

The pressure transducers measure the difference between the local model surface pressure and the initial test-section pressure p_{ts}. Thus, the initial pressure p_{ts} was added to the indicated pressure to obtain the absolute model surface pressure p. This pressure was converted to a pressure coefficient C_p using the values of dynamic pressure q_∞ and static pressure p_∞ given in Table IV. The model pressures were also normalized by the pitot pressure p_o'.

Section 8
PRECISION OF DATA

TEST CONDITIONS

The basic measurements used to determine the test conditions were the speed of the incident shock wave (M_i), the pressure behind the reflected shock wave (p_o), and pitot pressures (p_o') in the test section. The shock wave speed (U_i) was measured to within ± 1.0 percent. Based on the agreement of the four pressure transducers used, the pressure behind the reflected shock (the nozzle reservoir pressure) is considered accurate to within $\pm 3\%$. The pitot pressure measurements have a probable error of $\pm 3.2\%$. The resulting probable error in free-stream Mach number (M_∞) is $\pm 1.6\%$. The stagnation enthalpy (H_o) was calculated from the measured initial pressure in the driven tube and the incident shock Mach number using the equilibrium thermodynamic properties of real air. The uncertainty resulting from this calculation is about 0.4 percent. Another source of uncertainty in the stagnation enthalpy results from the fact that the measured pressure behind the reflected shock wave may not agree exactly with the theoretical pressure (e.g., the interface may not be ideally tailored). Based on a comparison of measured and theoretical pressures for the present tests, this results in an overall uncertainty in H_o of about $\pm 2\%$.

MODEL DATA

Calibrations to determine the heat-transfer gauge temperature-resistance characteristics indicate a potential uncertainty of $\pm 1\%$. Far more significant than this is the repeatability of the heat transfer gauge during testing. A series of shock tunnel tests designed to determine repeatability of heat transfer data has shown an RMS deviation of $\pm 3\%$. A combination of these errors indicates that the overall uncertainty in the heat transfer data is about ± 3.2 percent. At heat transfer rates below 1 BTU/ft^2-sec, greater inaccuracies occur because of lower signal-to-noise ratios. These are manifest as greater scatter in the data.

The model pressure transducers have a precision of $\pm 1\%$; the overall accuracy of the pressure measurement in the shock tunnel is generally $\pm 5\%$ or better. However, at very low pressures such as were encountered on the leeside of the model in the present tests signal-to-noise ratios are low and greater data scatter is evident.

Section 9
PRESENTATION OF DATA

PRESSURE DATA

The model pressure data are given in Table V, which lists the absolute pressure p (psia), the pressure coefficient C_p and the ratio of model pressure to pitot pressure p_o' (taken from Table IV). The variation of p/p_o' along the windward side at α = -15°, -45°, -90°, -135° and -180° is shown in Figure 7. To implify this figure, only data at $Re_{\infty_L} \simeq 7.1 \times 10^4$ are included. Note that for some runs, the tank was "clean" whereas for other runs the exterior protuberances were mounted on the model Also included in Figure 7 are runs at α = -180° with and without the side-mounted pitot probe and the additional 1-inch diameter heat-transfer cylinder (Figure 5). The external protuberances affected the pressures only in the region of the rear attachment strut. The presence of the additional probes had no effect on the pressures. The fact that the pressure at x/L = 1.0 exceeds the pitot pressure at α = -180° is a result of the axial gradients which exist in the conical nozzle. At α = -180° data are shown for both the top and bottom pressures and are in good agreement.

Another comparison of pressures with and without the external protuberances on the tank is shown in Figure 8. Here data at $Re_{\infty_L} \simeq 1.3 \times 10^4$ and α = -45° and -90° are compared. The agreement is good except near the forward attachment strut at α = -45° and on the base at α = -90°.

In the following table the measured pitot pressures from ceiling-mounted and side-mounted probes and the average of model pressures P9 through P12 at α = -90° are compared with the pitot pressure calculated for each run using the average values of p_o'/p_o given in Section 6. Because the measurements reported in this table were those used to obtain the average values of p_o'/p_o, the table serves to illustrate the consistency of the probe and model measurements and the repeatability from run to run. The runs are grouped by test condition rather than by sequential run number.

Run	p_o	(P_o') calc.	(p_o') ceiling	(p_o') side	Avg. p(P9-P12)
Test Condition 1: $M_\infty = 15.3$ Re/ft = 3.7×10^5					
6	3928	1.270	1.289		
9	3761	1.210	-		1.212
11	3470	1.280	1.259		1.268
15	3642	1.170	1.099		
26	4067	1.310	1.312	1.338	
Test Condition 2: $M_\infty = 15.2$ Re/ft = 4.6×10^4					
7	1590	.3560	.3582		
10	1701	.3810	.3731		.3715
16	1507	.3380	-		
19	1690	.3790	.3663	.3546	
21	1626	.3640	.3685	.3475	
25	1685	.3770	.3948	.3652	
28	1596	.3575	.3628		
Test Condition 3: $M_\infty = 17.7$ Re/ft = 8.7×10^3					
5	491.0	.04998	.05986*		
8	519.5	.05288	.06686		
12	434.5	.04428	.05857		.04191
13	509.2	.05188	.06430		.05080
14	513.0	.05228	.06804		
17	555.9	.05657	.06753		
18	535.0	.05448	.07377		
20	537.2	.05467	.06154		
23	526.4	.05358	.07762	.05878	
24	508.6	.05178	.07297	.05172	
27	540.9	.05510	.06714	.05441	

*At this Test Condition the ceiling-mounted pitot probe was outside the core of uniform flow.

HEAT TRANSFER DATA

The model heat transfer data are given in Table VI which lists the heat-transfer rate corrected to the initial cold-wall temperature $\dot{q}_w$ (BTU/ft^2-sec), the ratio of this rate to the theoretical stagnation-line value for a 3.24-inch diameter cylinder $\dot{q}_o$, the heat-transfer coefficient h and the Stanton number C_H for recovery factors of 1.0 and 0.85. The theoretical stagnation-line heat-transfer rate has been calculated using the analysis of Fay and Riddell.[17]

The variation of $\dot{q}_w/\dot{q}_o$ along the windward side at $Re_{\infty_L} \simeq 7.1 \times 10^4$ for $\alpha = -15°$, $-45°$, $-90°$ and $-180°$ is shown in Figure 9 for those runs with and without the side-mounted pitot probe and 1-inch diameter heat transfer cylinder. In both this figure and in Figure 7 it is apparent that these additional probes were not perturbing the flow about the model.

The effect of the external proturbances on the heat transfer is illustrated in Figure 10 for $\alpha = -45°$ and $-90°$ at $Re_{\infty_L} \simeq 1.3 \times 10^4$. At $\alpha = -45°$ there is a pronounced peak in the heat transfer rate near the forward attachment strut.

The circumferential variation of heat-transfer rate for $Re_{\infty_L} \simeq 7.1 \times 10^4$ is shown in Figure 11 at $x/L = 0.4$, 0.5 and 0.6 for $\alpha = -15°$, $-45°$ and $-90°$. This variation is essentially independent of x/L along the cylindrical portion of the model.

A comparison of the heat-transfer data from the cylindrical portion of the model at $\alpha = -90°$ and the 1-inch heat-transfer cylinder (Figure 5) with the laminar boundary layer theory of Fay and Riddell[17] and the low Reynolds number theory of Cheng[19] is shown in Figure 12. In this comparison the Stanton numbers are shown as a function of Cheng's parameter $K^2 = \rho_\infty U_\infty R/\mu_\infty \gamma_\infty M_\infty^2 C^*$. For the external tank model the data from $x/L = 0.35$ to $x/L = 0.80$ are averaged and shown as a single data point, while the total variation of these data are indicated by error bars. At the highest Reynolds number (Re/ft $\simeq$ 3.7×10^5), the external tank data lie above the Fay and Riddell theory. The corresponding 1-inch cylinder data for this Reynolds number (Run 26) are not included in Figure 12 because the heat transfer records show definite signs of particle-induced flow disturbances. Such effects are also present in some of the external tank data from Run 11 (the higher of the two data points at $K^2 \cong 285$) and the disturbance can be seen in the schlieren picture (Figure 18). At all lower values of K^2 (Re/ft = 8.7×10^3 and Re/ft $\simeq 4.6 \times 10^4$) the data are in better agreement with the laminar boundary layer theory of Fay and Riddell than with the low Reynolds number theory of Cheng.

The values of $\dot{q}_w/\dot{q}_o$ for the 1-inch diameter heat-transfer probe and the average model data (for $0.35 \leqslant x/L \leqslant 0.80$) at $\alpha = -90°$ are listed in the following table. For the 1-inch cylinder $\dot{q}_o$ has been calculated for that diameter rather than the value for 3.24 in. used elsewhere.

Run	$\dot{q}_w$ (H51)/$\dot{q}_o$	$\dot{q}_w$ (H52)/$\dot{q}_o$	$\dot{q}_w$ (Model)/$\dot{q}_o$
9			1.178
10			1.030
11			1.238
12			.9060
19	.985	.938	
20	.953		
21	.986		
23	1.006	.988	
24	.989	.992	
25	1.073	1.057	
27	1.005	.969	

H51, H52 are heat transfer gauges on the 1-in. diameter cylinder.

The data from the 1-inch diameter cylinder are in acceptable agreement with the Fay and Riddell theory. For the external tank model at α = -90°, the averaged stagnation-line heat-transfer rate at the highest Reynolds number (Re/ft $\cong$ 3.7 x 10^5, Runs 9 and 11) is 18 to 24 percent greater than the theory, is in very good agreement at the intermediate Reynolds number (Re/ft $\simeq$ 4.6 x 10^4, Run 10) and is about 9% low at the lowest Reynolds number (Re/ft $\simeq$ 8.7 x 10^3, Run 12).

SCHLIEREN PHOTOGRAPHS

Schlieren photographs of the flow field are presented in Figures 13-21. On many runs, flow field characteristics, i.e., shock waves, could not be discerned because of the low free-stream density. Attention is called to Figure 18 taken on Run 11 where a flow disturbance caused by a particle is clearly visible. Such flow disturbances result in enhanced heat-transfer rates.

Section 10
SUMMARY

Local heat-transfer rates and static wall pressures have been measured on a model of NASA Shuttle external tank at angles of attack from -15° to -180° and at several roll angles. The tests were conducted at three test conditions having the following nominal values of free-stream Mach number and Reynolds number based on model length.

Test Condition	Mach Number	Reynolds Number
1	15.3	5.77×10^5
2	15.2	7.12×10^4
3	17.7	1.36×10^4

The test program included runs with and without the external hardware associated with the attachment structure to the orbiter, LOX feed lines, pressures lines and electrical conduits. However, there were only three combinations of test condition and model angle of attack where runs were made with both the "clean" and "complete" configuration. Thus, only limited data was acquired relative to the influence of the external hardware on the local heat-transfer rates or static wall pressure.

The primary objective of this test program was to obtain data over a wider range of Reynolds numbers than available from previous external tank tests and, in particular, to test at lower Reynolds numbers corresponding to the higher altitudes of the tank reentry.

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TABLE I

Heat Transfer Instrumentation

Model Location No.	Gage No.	X/L	θ (deg.)	Remarks
H-2	106	.040	180	$0 \leq \lvert\alpha\rvert \leq 90°$ only
H-3	111	.040	0	" " "
H-4	107/107A	.080	180	Gages with suffix "A" are on the new nose for $90° < \lvert\alpha\rvert \leq 180°$. Other gages for $0 \leq \lvert\alpha\rvert \leq 90°$. Gauge 230 wired instead of 130
H-5	132/132A	.080	0	
H-6	108/108A	.150	180	
H-7	230/130A	.045/.150	180/0	
H-8	109/109A	.200	180	
H-9	151/151A	.200	270	
H-10	112	.250	180	
H-11	113	.350	180	
H-12	115	.400	180	
H-13	136	.400	221.5	
H-14	152	.400	270	
H-15	160	.400	0	
H-16	116	.425	180	
H-17	117	.450	180	
H-18	118	.475	180	
H-19	133	.475	199	
H-20	119	.500	180	
H-21	134	.500	199	
H-22	137	.500	221.5	
H-23	153	.500	270	
H-24	121	.550	180	
H-25	161	.600	0	

TABLE I (Cont'd)

Heat Transfer Instrumentation

Model Location No.	Gage No.	X/L	θ (deg.)	Remarks
H-26	123	.600	180	
H-27	138	.600	221.5	
H-28	154	.600	270	
H-29	158	.600	315	
H-30	124	.650	180	
H-31	125	.700	180	
H-32	155	.700	270	
H-33	162	.800	0	
H-34	126	.800	180	
H-35	140	.800	221.5	
H-36	156	.800	270	
H-37	159	.800	315	
H-38	127	.900	180	
H-39	135	.900	199	
H-40	142	.900	221.5	
H-41	150	.900	247.5	
H-42	157	.900	270	
H-43	148	.960	241	
H-44	239	1.000	0	On base plug, $\lvert\alpha\rvert > 90^\circ$ only

H51, H52 are heat transfer gauges on the 1-inch diameter cylinder probe.

TABLE II

Pressure Instrumentation

Model Location No.	Gage No.	X/L	θ (deg)	Remarks
P-1	PZT 37-21	.165	0	On both noses
P-2		.233	0	
P-3		.350	0	
P-4		.559	0	
P-5		.767	0	
P-6		.933	0	
P-7		1.000	0	On base plug, $\|\alpha\| > 90°$ only
P-8		.982	180	
P-9		.858	180	
P-10		.751	180	
P-11		.523	180	
P-12		.295	180	
P-13		.114	180	On both noses

TABLE III

TEST TH2F RUN SCHEDULE

Run No.	Configuration	α	ϕ	Test Condition	Remarks
1	Clean	-45°	0°	1	Incomplete data
2		-45°	0°	1	Repeat of Run 1
3		-45°	0°	2	No useful data
4		-45°	0°	3	
5		-45°	0°	2	Repeat of Run 3
6		-15°	0°	1	
7		-15°	0°	3	
8		-15°	0°	2	
9		-90°	0°	1	Incomplete data
10		-90°	0°	3	
11		-90°	0°	1	Repeat of Run 9
12		-90°	0°	2	
13	Complete	-90°	0°	2	
14		-90°	90°	2	
15		-30°	0°	1	
16		-45°	0°	3	
17		-45°	0°	2	
18		-45°	45°	2	
19		-135°	0°	3	Additional p_o' and $\dot{q}_o$ probes added for this and following runs
20		-135°	0°	2	
21		-180°	0°	3	
22		-135°	45°	2	No heat transfer data
23		-135°	45°	2	Repeat of Run 22
24		-135°	90°	2	
25	Clean	-180°	0°	3	
26		-180°	0°	1	
27		-180°	0°	2	
28		-180°	0°	3	Repeat of Run 25 without additional probes

Table IV

TEST CONDITIONS

RUN NO.	1	2	4	5	6	7	8	9
α	−4.500E+01	−4.500E+01	−4.500E+01	−4.500E+01	−1.500E+01	−1.500E+01	−1.500E+01	−9.000E+01
ψ	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ϕ	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
M_i	3.973E+00	3.988E+00	5.500E+00	5.552E+00	4.069E+00	5.454E+00	5.472E+00	4.030E+00
p_o	3.850E+03	3.823E+03	1.688E+03	4.910E+02	3.938E+03	1.590E+03	5.195E+02	3.761E+03
H_o	2.454E+07	2.444E+07	4.381E+07	4.446E+07	2.578E+07	4.393E+07	4.389E+07	2.512E+07
T_o	3.619E+03	3.603E+03	5.815E+03	5.822E+03	3.777E+03	5.839E+03	5.776E+03	3.691E+03
M_∞	1.537E+01	1.525E+01	1.519E+01	1.773E+01	1.529E+01	1.517E+01	1.778E+01	1.533E+01
U_∞	6.923E+03	6.908E+03	9.248E+03	9.343E+03	7.096E+03	9.261E+03	9.283E+03	7.004E+03
T_∞	8.441E+01	8.533E+01	1.542E+02	1.154E+02	8.960E+01	1.549E+02	1.133E+02	8.680E+01
p_∞	4.022E−03	4.216E−03	1.240E−03	1.202E−04	4.159E−03	1.169E−03	1.265E−04	3.941E−03
q_∞	6.655E−01	6.871E−01	2.003E−01	2.648E−02	6.810E−01	1.887E−01	2.802E−02	6.491E−01
ρ_∞	3.999E−06	4.146E−06	6.746E−07	8.737E−08	3.895E−06	6.336E−07	9.365E−08	3.811E−06
μ_∞	7.100E−08	7.178E−08	1.292E−07	9.708E−08	7.537E−08	1.298E−07	9.532E−08	7.302E−08
RE/FT.	3.899E+05	3.990E+05	4.828E+04	8.409E+03	3.667E+05	4.521E+04	9.121E+03	3.656E+05
p'_o	1.240E+00	1.280E+00	3.780E−01	4.998E−02	1.270E+00	3.560E−01	5.288E−02	1.210E+00
T^*	2.077E+03	2.067E+03	2.733E+03	2.559E+03	2.155E+03	2.764E+03	2.571E+03	2.112E+03
μ^*	9.442E−07	9.417E−07	1.106E−06	1.066E−06	9.649E−07	1.113E−06	1.069E−06	9.535E−07
$\sqrt{C^*}$	7.352E−01	7.358E−01	6.950E−01	7.037E−01	7.295E−01	6.934E−01	7.029E−01	7.326E−01
H_w	3.207E+06	3.189E+06	3.195E+06	3.207E+06	3.219E+06	3.225E+06	3.228E+06	3.204E+06
T_w	5.340E+02	5.310E+02	5.320E+02	5.340E+02	5.360E+02	5.370E+02	5.375E+02	5.335E+02
P_{ts}	1.934E−04	9.670E−05	7.736E−05	5.802E−05	7.736E−05	7.736E−05	5.802E−05	1.160E−04
Re_s	2.887E+03	2.994E+03	5.494E+02	7.481E+01	2.816E+03	5.136E+02	7.948E+01	2.754E+03
p_o/p_4	1.073E+00	1.055E+00	1.051E+00	1.014E+00	1.030E+00	1.011E+00	1.112E+00	1.009E+00
$\dot{q}_o$	1.879E+01	1.901E+01	2.099E+01	7.727E+00	2.018E+01	2.052E+01	7.844E+00	1.908E+01
h_o	2.204E−02	2.239E−02	1.294E−02	4.688E−03	2.238E−02	1.262E−02	4.829E−03	2.179E−02
C_{H_o}	2.475E−02	2.430E−02	6.445E−02	1.785E−01	2.517E−02	6.684E−02	1.726E−01	2.537E−02

Table IV

TEST CONDITIONS (Cont.)

RUN NO.	10	11	12	13	14	15	16	17
α	−9.000E+01	−9.000E+01	−9.000E+01	−9.000E+01	−9.000E+01	−3.000E+01	−4.500E+01	−4.500E+01
ψ	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Φ	0.0	0.0	0.0	0.0	9.000E+01	0.0	0.0	0.0
M_i	5.493E+00	4.074E+00	5.378E+00	5.549E+00	5.394E+00	4.028E+00	5.442E+00	5.570E+00
p_o	1.701E+03	3.970E+03	4.345E+02	5.092E+02	5.130E+02	3.642E+03	1.507E+03	5.559E+02
H_o	4.433E+07	2.589E+07	4.280E+07	4.472E+07	4.273E+07	2.523E+07	4.391E+07	4.565E+07
T_o	5.879E+03	3.791E+03	5.673E+03	5.853E+03	5.661E+03	3.707E+03	5.840E+03	5.954E+03
M_∞	1.515E+01	1.528E+01	1.786E+01	1.771E+01	1.787E+01	1.532E+01	1.516E+01	1.764E+01
U_∞	9.303E+03	7.111E+03	9.168E+03	9.370E+03	9.161E+03	7.020E+03	9.259E+03	9.467E+03
T_∞	1.568E+02	9.004E+01	1.096E+02	1.164E+02	1.093E+02	8.726E+01	1.550E+02	1.197E+02
p_∞	1.255E−03	4.194E−03	1.051E−04	1.250E−04	1.239E−04	3.814E−03	1.112E−03	1.373E−04
q_∞	2.019E−01	6.863E−01	2.348E−02	2.748E−02	2.772E−02	6.276E−01	1.791E−01	2.996E−02
ρ_∞	6.718E−07	3.909E−06	8.046E−08	9.014E−08	9.514E−08	3.668E−06	6.018E−07	9.627E−08
μ_∞	1.313E−07	7.575E−08	9.221E−08	9.789E−08	9.194E−08	7.340E−08	1.299E−07	1.006E−07
RE/FT.	4.759E+04	3.670E+05	8.000E+03	8.629E+03	9.480E+03	3.508E+05	4.290E+04	9.056E+03
p'_o	3.810E−01	1.280E+00	4.428E−02	5.188E−02	5.228E−02	1.170E+00	3.380E−01	5.657E−02
T^*	2.766E+03	2.162E+03	2.573E+03	2.574E+03	2.559E+03	2.120E+03	2.770E+03	2.610E+03
μ^*	1.114E−06	9.668E−07	1.069E−06	1.069E−06	1.066E−06	9.558E−07	1.115E−06	1.078E−06
$\sqrt{C^*}$	6.934E−01	7.290E−01	7.028E−01	7.028E−01	7.036E−01	7.320E−01	6.931E−01	7.008E−01
H_w	3.219E+06	3.222E+06	3.237E+06	3.219E+06	3.225E+06	3.213E+06	3.231E+06	3.243E+06
T_w	5.360E+02	5.365E+02	5.390E+02	5.360E+02	5.370E+02	5.350E+02	5.380E+02	5.400E+02
P_{ts}	7.736E−05	9.670E−05	7.736E−05	9.670E−05	9.670E−05	1.160E−04	1.160E−04	7.736E−05
Re_s	5.467E+02	2.827E+03	6.743E+01	7.716E+01	7.991E+01	2.650E+03	4.872E+02	8.258E+01
p_o/p_4	1.062E+00	1.035E+00	9.718E−01	1.053E+00	1.139E+00	9.788E−01	9.631E−01	1.138E+00
$\dot{q}_o$	2.143E+01	2.036E+01	7.013E+00	7.924E+00	7.581E+00	1.885E+01	2.004E+01	8.497E+00
h_o	1.304E−02	2.248E−02	4.436E−03	4.778E−03	4.802E−03	2.143E−02	1.233E−02	5.015E−03
C_{H_o}	6.488E−02	2.514E−02	1.869E−01	1.759E−01	1.713E−01	2.587E−02	6.879E−02	1.711E−01

Table IV
TEST CONDITIONS (Cont.)

RUN NO.	18	19	20	21	23	24	25	26
α	−4.500E+01	−1.350E+02	−1.350E+02	−1.800E+02	−1.350E+02	−1.350E+02	−1.800E+02	−1.800E+02
ψ	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Φ	4.500E+01	0.0	0.0	0.0	4.500E+01	9.000E+01	0.0	0.0
M_i	5.565E+00	5.502E+00	5.542E+00	5.448E+00	5.567E+00	5.543E+00	5.497E+00	4.095E+00
P_o	5.350E+02	1.690E+03	5.372E+02	1.626E+03	5.264E+02	5.086E+02	1.685E+03	4.067E+03
H_o	4.573E+07	4.461E+07	4.525E+07	4.445E+07	4.592E+07	4.589E+07	4.470E+07	2.655E+07
T_o	5.965E+03	5.910E+03	5.916E+03	5.903E+03	5.985E+03	5.988E+03	5.921E+03	3.878E+03
M_∞	1.763E+01	1.513E+01	1.767E+01	1.514E+01	1.762E+01	1.762E+01	1.51[illegible]E+01	1.525E+01
U_∞	9.475E+03	9.332E+03	9.426E+03	9.315E+03	9.494E+03	9.491E+03	9.341E+03	7.200E+03
T_∞	1.201E+02	1.583E+02	1.183E+02	1.574E+02	1.207E+02	1.207E+02	1.585E+02	9.276E+01
P_∞	1.324E−04	1.252E−03	1.323E−04	1.201E−03	1.304E−04	1.260E−04	1.245E−03	4.310E−03
q_∞	2.884E−02	2.008E−01	2.896E−02	1.929E−01	2.837E−02	2.741E−02	1.997E−01	7.020E−01
ρ_∞	9.253E−08	6.640E−07	9.387E−08	6.400E−07	9.063E−08	8.764E−08	6.592E−07	3.900E−06
μ_∞	1.009E−07	1.325E−07	9.944E−08	1.318E−07	1.015E−07	1.015E−07	1.328E−07	7.804E−08
RE/FT.	8.685E+03	4.675E+04	8.898E+03	4.522E+04	8.476E+03	8.199E+03	4.638E+04	3.598E+05
p'_o	5.448E−02	3.790E−01	5.467E−02	3.640E−01	5.358E−02	5.178E−02	3.770E−01	1.310E+00
T^*	2.617E+03	2.777E+03	2.604E+03	2.797E+03	2.625E+03	2.635E+03	2.784E+03	2.207E+03
μ^*	1.079E−06	1.116E−06	1.076E−06	1.121E−06	1.081E−06	1.084E−06	1.118E−06	9.784E−07
$\sqrt{C^*}$	7.004E−01	6.929E−01	7.011E−01	6.918E−01	7.000E−01	6.994E−01	6.925E−01	7.259E−01
H_w	3.249E+06	3.225E+06	3.243E+06	3.249E+06	3.255E+06	3.267E+06	3.231E+06	3.249E+06
T_w	5.410E+02	5.370E+02	5.400E+02	5.410E+02	5.420E+02	5.440E+02	5.380E+02	5.410E+02
P_{ts}	1.160E−04	1.354E−04	5.802E−05	7.736E−05	5.802E−05	1.354E−04	1.354E−04	7.736E−05
Re_s	7.933E+01	5.408E+02	8.030E+01	5.185E+02	7.772E+01	7.498E+01	5.367E+02	2.821E+03
P_o/P_4	1.098E+00	1.051E+00	1.114E+00	1.037E+00	1.079E+00	1.054E+00	1.050E+00	1.046E+00
$\dot{q}_o$	8.368E+00	2.157E+01	8.279E+00	2.109E+01	8.345E+00	8.219E+00	2.155E+01	2.121E+01
h_o	4.929E−03	1.304E−02	4.932E−03	1.281E−02	4.896E−03	4.826E−03	1.301E−02	2.278E−02
C_{H_o}	1.748E−01	6.543E−02	1.733E−01	6.680E−02	1.769E−01	1.804E−01	6.568E−02	2.522E−02

Table IV

TEST CONDITIONS (Concl.)

RUN NO.	27	28
α	-1.800E+02	-1.800E+02
ψ	0.0	0.0
ϕ	0.0	0.0
M_i	5.487E+00	5.451E+00
p_o	5.409E+02	1.596E+03
H_o	4.510E+07	4.482E+07
T_o	5.912E+03	5.945E+03
M_∞	1.768E+01	1.511E+01
U_∞	9.409E+03	9.353E+03
T_∞	1.177E+02	1.593E+02
p_∞	1.332E-04	1.183E-03
q_∞	2.918E-02	1.894E-01
ρ_∞	9.493E-08	6.234E-07
μ_∞	9.899E-08	1.334E-07
RE/FT.	9.024E+03	4.372E+04
p'_o	5.510E-02	3.575E-01
T^*	2.624E+03	2.815E+03
μ^*	1.081E-06	1.125E-06
$\sqrt{C^*}$	7.000E-01	6.909E-01
H_w	3.267E+06	3.261E+06
T_w	5.440E+02	5.430E+02
P_{ts}	7.736E-05	5.802E-05
Re_s	8.073E+01	5.052E+02
p_o/p_4	1.150E+00	1.016E+00
$\dot{q}_o$	8.297E+00	2.113E+01
h_o	4.964E-03	1.272E-02
C_{H_o}	1.728E-01	6.783E-02

Table V
PRESSURE DATA

RUN	GAGE	p	C_p	p_o/p'_o
1	1	5.286E-03	1.899E-03	4.263E-03
1	2	7.464E-03	5.172E-03	6.020E-03
1	3	4.145E-03	1.855E-04	3.343E-03
1	4	5.684E-03	2.497E-03	4.584E-03
1	5	5.445E-03	2.138E-03	4.391E-03
1	6	4.761E-03	1.110E-03	3.839E-03
1	8	1.133E-02	1.099E-02	9.140E-03
1	9	4.643E-01	6.916E-01	3.744E-01
1	10	5.444E-01	8.119E-01	4.390E-01
1	11	5.029E-01	7.496E-01	4.056E-01
1	12	5.099E-01	7.602E-01	4.113E-01
2	1	5.649E-03	2.085E-03	4.413E-03
2	2	3.799E-03	-6.071E-04	2.968E-03
2	3	6.875E-03	3.870E-03	5.371E-03
2	4	6.923E-03	3.940E-03	5.409E-03
2	5	3.786E-03	-6.264E-04	2.958E-03
2	6	2.342E-03	-2.727E-03	1.830E-03
2	9	5.282E-01	7.627E-01	4.127E-01
2	10	5.727E-01	8.274E-01	4.474E-01
2	11	5.874E-01	8.488E-01	4.589E-01
2	12	6.302E-01	9.111E-01	4.923E-01
2	13	8.294E-01	1.201E+00	6.480E-01
4	1	1.469E-03	1.144E-03	3.886E-03
4	2	2.706E-03	7.320E-03	7.159E-03
4	3	3.344E-03	1.050E-02	8.846E-03
4	4	2.571E-03	6.644E-03	6.801E-03
4	5	2.280E-03	5.194E-03	6.033E-03
4	6	1.325E-03	4.283E-04	3.507E-03
4	8	5.899E-03	2.326E-02	1.561E-02
4	9	1.587E-01	7.859E-01	4.198E-01
4	10	1.609E-01	7.967E-01	4.256E-01
4	11	1.786E-01	8.851E-01	4.724E-01
4	12	1.759E-01	8.720E-01	4.655E-01
4	13	2.698E-01	1.340E+00	7.137E-01
5	1	1.859E-04	2.481E-03	3.720E-03
5	2	1.678E-04	1.798E-03	3.357E-03
5	3	2.191E-04	3.735E-03	4.384E-03
5	5	1.205E-04	1.177E-05	2.411E-03
5	8	7.730E-04	2.465E-02	1.547E-02
5	9	2.385E-02	8.960E-01	4.772E-01
5	10	2.300E-02	8.640E-01	4.602E-01
5	11	2.402E-02	9.025E-01	4.806E-01
5	12	2.551E-02	9.589E-01	5.105E-01
5	13	4.251E-02	1.601E+00	8.505E-01
6	1	1.250E-02	1.226E-02	9.846E-03
6	2	7.055E-03	4.252E-03	5.555E-03
6	3	8.412E-03	6.246E-03	6.624E-03
6	4	7.207E-03	4.477E-03	5.675E-03
6	5	5.326E-03	1.715E-03	4.194E-03
6	6	3.647E-03	-7.519E-04	2.871E-03
6	8	1.692E-03	-3.623E-03	1.332E-03
6	9	2.340E-02	2.826E-02	1.843E-02
6	10	2.338E-02	2.822E-02	1.841E-02
6	11	2.424E-02	2.948E-02	1.908E-02
6	12	3.838E-02	5.026E-02	3.022E-02
6	13	3.733E-01	5.421E-01	2.940E-01
7	1	4.617E-03	1.827E-02	1.297E-02
7	2	1.488E-03	1.686E-03	4.179E-03
7	3	2.321E-03	6.102E-03	6.519E-03
7	4	1.999E-03	4.398E-03	5.616E-03
7	5	1.437E-03	1.417E-03	4.036E-03
7	6	6.980E-04	-2.498E-03	1.961E-03
7	8	2.597E-04	-4.622E-03	7.295E-04
7	9	1.279E-02	6.158E-02	3.592E-02

Table V

PRESSURE DATA (Cont.)

RUN	GAGE	p	C_p	p_o/p'_o
7	10	1.300E-02	6.272E-02	3.653E-02
7	11	1.521E-02	7.440E-02	4.272E-02
7	12	2.239E-02	1.125E-01	6.289E-02
7	13	1.062E-01	5.565E-01	2.982E-01
8	1	1.273E-03	4.090E-02	2.407E-02
8	3	4.173E-04	1.038E-02	7.893E-03
8	5	2.446E-04	4.214E-03	4.625E-03
8	9	1.937E-03	6.459E-02	3.663E-02
8	10	1.908E-03	6.357E-02	3.608E-02
8	11	2.389E-03	8.075E-02	4.519E-02
8	12	3.340E-03	1.147E-01	6.318E-02
8	13	1.767E-02	6.260E-01	3.342E-01
9	1	1.436E-02	1.605E-02	1.187E-02
9	2	1.202E-02	1.244E-02	9.933E-03
9	3	1.527E-02	1.745E-02	1.262E-02
9	4	1.144E-02	1.156E-02	9.457E-03
9	5	7.332E-03	5.223E-03	6.059E-03
9	6	5.275E-03	2.055E-03	4.360E-03
9	8	5.756E-01	8.807E-01	4.757E-01
9	9	1.183E+00	1.817E+00	9.779E-01
9	10	1.213E+00	1.863E+00	1.003E+00
9	11	1.196E+00	1.836E+00	9.884E-01
9	12	1.254E+00	1.926E+00	1.037E+00
9	13	9.129E-01	1.400E+00	7.545E-01
10	4	4.647E-03	1.680E-02	1.220E-02
10	6	3.017E-03	8.727E-03	7.919E-03
10	8	1.725E-01	8.484E-01	4.528E-01
10	9	3.652E-01	1.803E+00	9.587E-01
10	10	3.632E-01	1.793E+00	9.533E-01
10	11	3.802E-01	1.877E+00	9.980E-01
10	12	3.774E-01	1.863E+00	9.905E-01
10	13	2.302E-01	1.134E+00	6.044E-01
11	1	1.653E-02	1.797E-02	1.291E-02
11	2	1.811E-02	2.028E-02	1.415E-02
11	3	1.775E-02	1.976E-02	1.387E-02
11	4	1.801E-02	2.013E-02	1.407E-02
11	5	1.312E-02	1.300E-02	1.025E-02
11	6	9.781E-03	8.142E-03	7.642E-03
11	8	6.157E-01	8.911E-01	4.811E-01
11	9	1.270E+00	1.844E+00	9.921E-01
11	10	1.292E+00	1.876E+00	1.009E+00
11	11	1.242E+00	1.803E+00	9.700E-01
11	12	1.379E+00	2.003E+00	1.077E+00
11	13	9.651E-01	1.400E+00	7.540E-01
12	2	3.991E-04	1.252E-02	9.013E-03
12	3	3.895E-04	1.211E-02	8.795E-03
12	5	3.556E-04	1.067E-02	8.031E-03
12	6	3.390E-04	9.960E-03	7.656E-03
12	8	1.660E-02	7.025E-01	3.749E-01
12	9	4.345E-02	1.846E+00	9.813E-01
12	10	3.707E-02	1.574E+00	8.371E-01
12	11	4.158E-02	1.766E+00	9.390E-01
12	12	4.553E-02	1.934E+00	1.028E+00
12	13	4.076E-02	1.731E+00	9.205E-01
13	1	4.449E-04	1.164E-02	8.575E-03
13	2	4.232E-04	1.085E-02	8.158E-03
13	3	4.428E-04	1.156E-02	8.535E-03
13	4	4.664E-04	1.242E-02	8.990E-03
13	5	4.070E-04	1.026E-02	7.846E-03
13	6	4.167E-04	1.061E-02	8.032E-03
13	8	1.294E-02	4.662E-01	2.494E-01
13	9	5.179E-02	1.880E+00	9.982E-01
13	10	5.045E-02	1.831E+00	9.725E-01
13	11	5.005E-02	1.817E+00	9.649E-01

Table V

PRESSURE DATA (Cont.)

RUN	GAGE	p	C_p	p_o/p'_o
13	12	5.089E-02	1.847E+00	9.810E-01
13	13	4.891E-02	1.775E+00	9.428E-01
14	1	3.203E-03	1.111E-01	6.128E-02
14	2	3.514E-03	1.223E-01	6.721E-02
14	4	3.871E-03	1.351E-01	7.404E-02
14	5	3.729E-03	1.300E-01	7.133E-02
14	6	2.513E-03	8.618E-02	4.808E-02
14	8	6.976E-03	2.471E-01	1.334E-01
14	9	4.223E-03	1.478E-01	8.077E-02
14	10	5.037E-03	1.772E-01	9.634E-02
14	11	4.287E-03	1.501E-01	8.199E-02
14	12	4.280E-03	1.499E-01	8.187E-02
14	13	3.232E-03	1.121E-01	6.181E-02
15	1	8.130E-03	6.876E-03	6.949E-03
15	2	5.228E-03	2.253E-03	4.466E-03
15	3	5.337E-03	2.427E-03	4.562E-03
15	4	4.171E-03	5.686E-04	3.565E-03
15	5	5.196E-03	2.201E-03	4.441E-03
15	6	3.615E-03	-3.163E-04	3.090E-03
15	8	2.335E-02	3.112E-02	1.996E-02
15	9	3.784E-01	5.968E-01	3.234E-01
15	10	2.531E-01	3.972E-01	2.164E-01
15	11	2.376E-01	3.726E-01	2.031E-01
15	12	2.565E-01	4.026E-01	2.193E-01
15	13	6.295E-01	9.969E-01	5.381E-01
16	1	2.601E-03	6.317E-03	7.697E-03
16	2	1.981E-03	4.854E-03	5.862E-03
16	3	2.574E-03	8.166E-03	7.617E-03
16	4	2.184E-03	5.986E-03	6.461E-03
16	5	2.367E-03	7.007E-03	7.002E-03
16	6	1.971E-03	4.800E-03	5.833E-03
16	8	9.860E-03	4.684E-02	2.917E-02
16	9	1.517E-01	8.404E-01	4.487E-01
16	10	1.582E-01	8.772E-01	4.682E-01
16	11	1.462E-01	8.102E-01	4.327E-01
16	12	1.635E-01	9.064E-01	4.837E-01
16	13	2.505E-01	1.392E+00	7.412E-01
17	3	2.635E-04	4.214E-03	4.658E-03
17	5	1.699E-04	1.088E-03	3.003E-03
17	6	1.655E-04	9.425E-04	2.926E-03
17	8	1.027E-03	2.971E-02	1.816E-02
17	9	2.408E-02	7.993E-01	4.256E-01
17	10	2.351E-02	7.802E-01	4.156E-01
17	11	2.022E-02	6.705E-01	3.575E-01
17	12	2.611E-02	8.670E-01	4.615E-01
17	13	4.225E-02	1.406E+00	7.468E-01
18	3	2.960E-04	5.673E-03	5.434E-03
18	5	2.402E-04	3.736E-03	4.408E-03
18	8	8.609E-04	2.525E-02	1.580E-02
18	9	1.615E-02	5.555E-01	2.965E-01
18	10	1.677E-02	5.767E-01	3.078E-01
18	11	1.542E-02	5.301E-01	2.831E-01
18	12	1.564E-02	5.378E-01	2.872E-01
18	13	2.890E-02	9.973E-01	5.305E-01
19	1	2.129E-03	4.365E-03	5.616E-03
19	2	1.951E-03	3.482E-03	5.149E-03
19	3	2.118E-03	4.315E-03	5.590E-03
19	4	2.028E-03	3.863E-03	5.351E-03
19	5	2.572E-03	6.576E-03	6.788E-03
19	6	1.303E-03	2.555E-04	3.439E-03
19	7	2.025E-01	1.003E+00	5.344E-01
19	8	3.640E-01	1.607E+00	9.605E-01
19	9	1.683E-01	8.322E-01	4.442E-01
19	10	1.688E-01	8.343E-01	4.453E-01

Table V
PRESSURE DATA (Cont.)

RUN	GAGE	p	C_p	p_o/p'_o
19	11	1.911E-01	9.455E-01	5.042E-01
19	12	8.890E-02	4.366E-01	2.346E-01
19	13	5.567E-02	2.710E-01	1.469E-01
20	7	2.579E-02	8.859E-01	4.716E-01
20	8	5.476E-02	1.886E+00	1.002E+00
20	9	2.742E-02	9.424E-01	5.016E-01
20	10	3.105E-02	1.068E+00	5.680E-01
20	11	2.366E-02	8.124E-01	4.327E-01
20	12	2.144E-02	7.358E-01	3.921E-01
20	13	8.421E-03	2.862E-01	1.540E-01
21	1	2.293E-03	5.664E-03	6.300E-03
21	2	3.586E-03	1.237E-02	9.852E-03
21	3	4.761E-03	1.846E-02	1.308E-02
21	4	6.170E-03	2.577E-02	1.695E-02
21	5	3.433E-03	1.157E-02	9.431E-03
21	6	1.083E-02	4.993E-02	2.976E-02
21	7	3.395E-01	1.754E+00	9.327E-01
21	8	2.510E-01	1.295E+00	6.896E-01
21	9	1.779E-02	8.603E-02	4.888E-02
21	10	7.347E-03	3.187E-02	2.018E-02
21	11	5.693E-03	2.329E-02	1.564E-02
21	12	3.922E-03	1.411E-02	1.078E-02
21	13	1.822E-03	3.220E-03	5.004E-03
23	2	1.755E-04	1.591E-03	3.276E-03
23	5	4.341E-04	1.071E-02	8.103E-03
23	6	1.382E-04	2.744E-04	2.579E-03
23	7	2.863E-02	1.005E+00	5.344E-01
23	8	4.272E-02	1.501E+00	7.973E-01
23	9	1.713E-02	5.992E-01	3.197E-01
23	10	1.911E-02	6.693E-01	3.568E-01
23	11	1.710E-02	5.981E-01	3.191E-01
23	12	1.461E-02	5.105E-01	2.727E-01
23	13	4.243E-03	1.450E-01	7.920E-02
24	1	1.166E-03	3.794E-02	2.252E-02
24	2	1.913E-03	6.519E-02	3.695E-02
24	3	2.105E-03	7.219E-02	4.066E-02
24	4	1.764E-03	5.977E-02	3.408E-02
24	5	1.691E-03	5.710E-02	3.266E-02
24	6	2.994E-03	1.046E-01	5.783E-02
24	7	2.579E-02	9.361E-01	4.981E-01
24	8	1.705E-02	6.172E-01	3.292E-01
24	9	2.548E-03	8.834E-02	4.921E-02
24	10	1.869E-03	6.358E-02	3.610E-02
24	11	2.278E-03	7.851E-02	4.400E-02
24	12	2.180E-03	7.493E-02	4.211E-02
24	13	1.153E-03	3.748E-02	2.228E-02
25	1	2.009E-03	3.822E-03	5.328E-03
25	2	3.178E-03	9.675E-03	8.429E-03
25	3	4.249E-03	1.504E-02	1.127E-02
25	4	5.417E-03	2.089E-02	1.437E-02
25	5	1.001E-02	4.386E-02	2.654E-02
25	6	9.412E-03	4.089E-02	2.497E-02
25	7	4.162E-01	2.078E+00	1.104E+00
25	8	2.281E-01	1.136E+00	6.052E-01
25	9	1.404E-02	6.406E-02	3.724E-02
25	10	9.533E-03	4.150E-02	2.529E-02
25	11	5.683E-03	2.222E-02	1.507E-02
25	12	3.918E-03	1.338E-02	1.039E-02
25	13	1.839E-03	2.972E-03	4.878E-03
26	1	8.200E-03	5.540E-03	6.260E-03
26	2	1.348E-02	1.307E-02	1.029E-02
26	3	1.779E-02	1.920E-02	1.358E-02
26	4	2.238E-02	2.574E-02	1.708E-02
26	5	3.484E-02	4.349E-02	2.660E-02

Table V
PRESSURE DATA (Concl.)

RUN	GAGE	p	C_p	p_o/p'_o
26	6	6.899E-02	9.214E-02	5.267E-02
26	7	1.461E+00	2.076E+00	1.116E+00
26	8	9.069E-01	1.286E+00	6.923E-01
26	9	4.613E-02	5.957E-02	3.522E-02
26	10	3.468E-02	4.326E-02	2.647E-02
26	11	2.115E-02	2.398E-02	1.614E-02
26	12	1.469E-02	1.478E-02	1.121E-02
26	13	6.010E-03	2.421E-03	4.588E-03
27	2	3.184E-04	6.348E-03	5.779E-03
27	3	4.290E-04	1.014E-02	7.786E-03
27	4	5.071E-04	1.281E-02	9.203E-03
27	5	9.850E-04	2.919E-02	1.788E-02
27	6	3.876E-03	1.282E-01	7.034E-02
27	7	4.089E-02	1.396E+00	7.421E-01
27	8	3.649E-02	1.246E+00	6.623E-01
27	9	1.402E-03	4.348E-02	2.545E-02
27	10	1.603E-03	5.035E-02	2.909E-02
28	1	2.062E-03	4.639E-03	5.767E-03
28	2	3.262E-03	1.097E-02	9.124E-03
28	3	4.557E-03	1.782E-02	1.275E-02
28	4	5.475E-03	2.266E-02	1.532E-02
28	7	3.765E-01	1.982E+00	1.053E+00
28	8	2.513E-01	1.321E+00	7.029E-01
28	9	1.309E-02	6.287E-02	3.661E-02
28	10	9.417E-03	4.348E-02	2.634E-02
28	11	4.702E-03	1.858E-02	1.315E-02
28	12	3.604E-03	1.278E-02	1.008E-02
28	13	1.670E-03	2.568E-03	4.671E-03

Table VI
HEAT TRANSFER DATA

RUN	GAGE	$\dot{q}_w$	$\dot{q}_w/\dot{q}_o$	$h_{r=1.0}$	$C_{H_{r=1.0}}$	$h_{r=.85}$	$C_{H_{r=.85}}$
1	2	3.635E+01	1.935E+00	4.265E−02	4.789E−02	5.155E−02	5.788E−02
1	3	1.763E+00	9.386E−02	2.069E−03	2.323E−03	2.500E−03	2.807E−03
1	6	2.217E+01	1.180E+00	2.601E−02	2.921E−02	3.144E−02	3.530E−02
1	8	1.571E+01	8.361E−01	1.843E−02	2.069E−02	2.227E−02	2.501E−02
1	10	1.484E+01	7.899E−01	1.741E−02	1.955E−02	2.104E−02	2.363E−02
1	11	1.522E+01	8.101E−01	1.786E−02	2.005E−02	2.158E−02	2.423E−02
1	12	1.544E+01	8.220E−01	1.812E−02	2.034E−02	2.190E−02	2.459E−02
1	13	9.397E+00	5.002E−01	1.103E−02	1.238E−02	1.332E−02	1.496E−02
1	14	1.611E+00	8.578E−02	1.891E−03	2.123E−03	2.285E−03	2.566E−03
1	16	1.472E+01	7.833E−01	1.727E−02	1.939E−02	2.087E−02	2.343E−02
1	17	1.546E+01	8.228E−01	1.814E−02	2.036E−02	2.192E−02	2.461E−02
1	18	1.388E+01	7.389E−01	1.629E−02	1.829E−02	1.968E−02	2.210E−02
1	20	1.471E+01	7.833E−01	1.726E−02	1.938E−02	2.086E−02	2.343E−02
1	21	1.314E+01	6.993E−01	1.541E−02	1.731E−02	1.863E−02	2.092E−02
1	22	9.256E+00	4.927E−01	1.086E−02	1.219E−02	1.312E−02	1.474E−02
1	23	1.853E+00	9.863E−02	2.174E−03	2.441E−03	2.627E−03	2.950E−03
1	24	1.305E+01	6.949E−01	1.532E−02	1.720E−02	1.851E−02	2.078E−02
1	26	1.271E+01	6.766E−01	1.491E−02	1.674E−02	1.802E−02	2.024E−02
1	27	8.635E+00	4.597E−01	1.013E−02	1.138E−02	1.224E−02	1.375E−02
1	28	1.737E+00	9.247E−02	2.038E−03	2.288E−03	2.463E−03	2.766E−03
1	29	1.991E−01	1.060E−02	2.336E−04	2.623E−04	2.824E−04	3.170E−04
1	30	1.299E+01	6.916E−01	1.524E−02	1.711E−02	1.842E−02	2.068E−02
1	31	1.292E+01	6.876E−01	1.516E−02	1.702E−02	1.832E−02	2.057E−02
1	32	1.674E+00	8.911E−02	1.964E−03	2.205E−03	2.374E−03	2.665E−03
1	34	1.443E+01	7.679E−01	1.693E−02	1.900E−02	2.046E−02	2.297E−02
1	36	1.571E+00	8.365E−02	1.844E−03	2.070E−03	2.228E−03	2.502E−03
1	39	1.028E+01	5.471E−01	1.206E−02	1.354E−02	1.457E−02	1.636E−02
1	40	8.081E+00	4.302E−01	9.481E−03	1.065E−02	1.146E−02	1.287E−02
1	41	4.257E+00	2.266E−01	4.994E−03	5.608E−03	6.036E−03	6.777E−03
1	42	1.436E+00	7.645E−02	1.685E−03	1.892E−03	2.036E−03	2.286E−03
1	43	1.507E+00	8.020E−02	1.768E−03	1.985E−03	2.136E−03	2.399E−03
2	2	4.296E+01	2.260E+00	5.060E−02	5.492E−02	6.115E−02	6.636E−02
2	3	1.806E+00	9.502E−02	2.127E−03	2.309E−03	2.571E−03	2.790E−03

Table VI

HEAT TRANSFER DATA (Cont.)

RUN	GAGE	$\dot{q}_w$	$\dot{q}_w/\dot{q}_o$	$h_{r=1.0}$	$C_{H_{r=1.0}}$	$h_{r=.85}$	$C_{H_{r=.85}}$
2	4	2.912E+01	1.532E+00	3.430E-02	3.722E-02	4.145E-02	4.498E-02
2	5	1.646E+00	8.661E-02	1.939E-03	2.104E-03	2.343E-03	2.543E-03
2	6	2.402E+01	1.264E+00	2.829E-02	3.071E-02	3.419E-02	3.711E-02
2	8	1.989E+01	1.047E+00	2.343E-02	2.543E-02	2.832E-02	3.073E-02
2	9	2.107E+00	1.109E-01	2.482E-03	2.694E-03	3.000E-03	3.255E-03
2	10	1.550E+01	8.155E-01	1.826E-02	1.981E-02	2.207E-02	2.395E-02
2	11	1.639E+01	8.624E-01	1.931E-02	2.095E-02	2.333E-02	2.532E-02
2	12	1.607E+01	8.451E-01	1.892E-02	2.054E-02	2.287E-02	2.482E-02
2	13	1.060E+01	5.575E-01	1.248E-02	1.355E-02	1.508E-02	1.637E-02
2	14	1.676E+00	8.816E-02	1.974E-03	2.142E-03	2.385E-03	2.589E-03
2	15	5.038E-01	2.650E-02	5.934E-04	6.439E-04	7.171E-04	7.782E-04
2	16	1.612E+01	8.479E-01	1.898E-02	2.060E-02	2.294E-02	2.490E-02
2	17	1.615E+01	8.495E-01	1.902E-02	2.064E-02	2.299E-02	2.495E-02
2	18	1.561E+01	8.211E-01	1.839E-02	1.995E-02	2.222E-02	2.411E-02
2	19	1.505E+01	7.916E-01	1.772E-02	1.923E-02	2.142E-02	2.324E-02
2	20	1.593E+01	8.379E-01	1.876E-02	2.036E-02	2.267E-02	2.460E-02
2	21	1.419E+01	7.466E-01	1.672E-02	1.814E-02	2.020E-02	2.192E-02
2	22	1.053E+01	5.537E-01	1.240E-02	1.345E-02	1.498E-02	1.626E-02
2	23	1.681E+00	8.841E-02	1.980E-03	2.148E-03	2.392E-03	2.596E-03
2	24	1.537E+01	8.086E-01	1.810E-02	1.965E-02	2.188E-02	2.374E-02
2	25	4.690E-01	2.467E-02	5.524E-04	5.994E-04	6.675E-04	7.244E-04
2	26	1.438E+01	7.563E-01	1.693E-02	1.838E-02	2.046E-02	2.221E-02
2	27	9.263E+00	4.873E-01	1.091E-02	1.184E-02	1.319E-02	1.431E-02
2	28	1.574E+00	8.278E-02	1.853E-03	2.011E-03	2.240E-03	2.431E-03
2	29	1.707E-01	8.979E-03	2.010E-04	2.182E-04	2.429E-04	2.637E-04
2	30	1.703E+01	8.956E-01	2.005E-02	2.176E-02	2.423E-02	2.630E-02
2	31	1.456E+01	7.662E-01	1.715E-02	1.862E-02	2.073E-02	2.250E-02
2	32	1.684E+00	8.859E-02	1.984E-03	2.153E-03	2.397E-03	2.601E-03
2	33	6.163E-01	3.242E-02	7.260E-04	7.878E-04	8.773E-04	9.521E-04
2	34	1.483E+01	7.803E-01	1.747E-02	1.896E-02	2.111E-02	2.291E-02
2	35	9.770E+00	5.139E-01	1.151E-02	1.249E-02	1.391E-02	1.509E-02
2	36	1.559E+00	8.203E-02	1.837E-03	1.993E-03	2.219E-03	2.409E-03
2	38	1.599E+01	8.412E-01	1.884E-02	2.044E-02	2.276E-02	2.470E-02
2	39	1.202E+01	6.322E-01	1.416E-02	1.536E-02	1.711E-02	1.856E-02
2	40	8.880E+00	4.671E-01	1.046E-02	1.135E-02	1.264E-02	1.372E-02

Table VI

HEAT TRANSFER DATA (Cont.)

RUN	GAGE	$\dot{q}_w$	$\dot{q}_w/\dot{q}_o$	$h_{r=1.0}$	$C_{H_{r=1.0}}$	$h_{r=.85}$	$C_{H_{r=.85}}$
2	41	4.149E+00	2.183E-01	4.887E-03	5.303E-03	5.906E-03	6.409E-03
2	42	1.061E+00	5.583E-02	1.250E-03	1.357E-03	1.511E-03	1.639E-03
2	43	1.193E+00	6.276E-02	1.405E-03	1.525E-03	1.698E-03	1.843E-03
4	2	3.436E+01	1.637E+00	2.117E-02	1.055E-01	2.526E-02	1.259E-01
4	3	1.695E+00	8.076E-02	1.045E-03	5.205E-03	1.246E-03	6.210E-03
4	4	2.974E+01	1.417E+00	1.833E-02	9.131E-02	2.186E-02	1.089E-01
4	5	8.797E-01	4.191E-02	5.422E-04	2.701E-03	6.468E-04	3.223E-03
4	6	2.323E+01	1.107E+00	1.432E-02	7.133E-02	1.708E-02	8.510E-02
4	7	3.606E+01	1.718E+00	2.223E-02	1.107E-01	2.652E-02	1.321E-01
4	8	1.581E+01	7.531E-01	9.742E-03	4.854E-02	1.162E-02	5.791E-02
4	9	2.412E+00	1.149E-01	1.487E-03	7.408E-03	1.774E-03	8.838E-03
4	10	1.521E+01	7.244E-01	9.371E-03	4.669E-02	1.118E-02	5.570E-02
4	11	1.485E+01	7.077E-01	9.154E-03	4.561E-02	1.092E-02	5.441E-02
4	12	1.455E+01	6.931E-01	8.966E-03	4.467E-02	1.070E-02	5.330E-02
4	13	9.344E+00	4.452E-01	5.759E-03	2.869E-02	6.870E-03	3.423E-02
4	14	1.726E+00	8.225E-02	1.064E-03	5.301E-03	1.269E-03	6.325E-03
4	15	1.984E-01	9.454E-03	1.223E-04	6.093E-04	1.459E-04	7.269E-04
4	16	1.563E+01	7.447E-01	9.633E-03	4.800E-02	1.149E-02	5.726E-02
4	17	1.522E+01	7.250E-01	9.378E-03	4.672E-02	1.119E-02	5.574E-02
4	18	1.459E+01	6.949E-01	8.989E-03	4.479E-02	1.072E-02	5.343E-02
4	19	1.463E+01	6.970E-01	9.016E-03	4.492E-02	1.076E-02	5.359E-02
4	20	1.493E+01	7.114E-01	9.202E-03	4.585E-02	1.098E-02	5.470E-02
4	21	1.325E+01	6.312E-01	8.164E-03	4.068E-02	9.740E-03	4.853E-02
4	22	9.198E+00	4.382E-01	5.669E-03	2.824E-02	6.763E-03	3.370E-02
4	23	1.839E+00	8.763E-02	1.134E-03	5.648E-03	1.352E-03	6.738E-03
4	24	1.482E+01	7.062E-01	9.136E-03	4.552E-02	1.090E-02	5.431E-02
4	25	1.936E-01	9.222E-03	1.193E-04	5.944E-04	1.423E-04	7.091E-04
4	26	1.303E+01	6.208E-01	8.030E-03	4.001E-02	9.580E-03	4.773E-02
4	27	8.830E+00	4.207E-01	5.442E-03	2.711E-02	6.492E-03	3.235E-02
4	28	1.944E+00	9.261E-02	1.198E-03	5.969E-03	1.429E-03	7.121E-03
4	29	1.236E-01	5.887E-03	7.615E-05	3.794E-04	9.085E-05	4.526E-04
4	30	1.408E+01	6.710E-01	8.680E-03	4.325E-02	1.036E-02	5.160E-02
4	31	1.270E+01	6.050E-01	7.826E-03	3.899E-02	9.337E-03	4.652E-02
4	32	1.760E+00	8.387E-02	1.085E-03	5.405E-03	1.294E-03	6.449E-03

Table VI

HEAT TRANSFER DATA (Cont.)

RUN	GAGE	$\dot{q}_w$	$\dot{q}_w/\dot{q}_o$	$h_{r=1.0}$	$C_{H_{r=1.0}}$	$h_{r=.85}$	$C_{H_{r=.85}}$
4	33	1.096E-01	5.220E-03	6.752E-05	3.364E-04	8.056E-05	4.014E-04
4	34	1.405E+01	6.694E-01	8.659E-03	4.314E-02	1.033E-02	5.147E-02
4	35	8.164E+00	3.690E-01	5.031E-03	2.507E-02	6.003E-03	2.991E-02
4	36	1.685E+00	8.028E-02	1.039E-03	5.174E-03	1.239E-03	6.173E-03
4	37	2.148E-01	1.024E-02	1.324E-04	6.597E-04	1.580E-04	7.870E-04
4	38	1.369E+01	6.522E-01	8.437E-03	4.204E-02	1.007E-02	5.015E-02
4	39	1.103E+01	5.257E-01	6.801E-03	3.388E-02	8.113E-03	4.043E-02
4	40	8.074E+00	3.847E-01	4.976E-03	2.479E-02	5.937E-03	2.958E-02
4	41	3.980E+00	1.896E-01	2.453E-03	1.222E-02	2.926E-03	1.458E-02
4	42	1.618E+00	7.711E-02	9.975E-04	4.970E-03	1.190E-03	5.929E-03
4	43	1.384E+00	6.594E-02	8.529E-04	4.250E-03	1.018E-03	5.070E-03
5	2	1.215E+01	1.573E+00	7.373E-03	2.808E-01	8.795E-03	3.349E-01
5	3	3.693E-01	4.780E-02	2.241E-04	8.533E-03	2.673E-04	1.018E-02
5	4	1.006E+01	1.303E+00	6.107E-03	2.325E-01	7.284E-03	2.774E-01
5	5	2.526E-01	3.269E-02	1.533E-04	5.836E-03	1.828E-04	6.961E-03
5	6	7.741E+00	1.002E+00	4.697E-03	1.788E-01	5.602E-03	2.133E-01
5	7	1.196E+01	1.548E+00	7.259E-03	2.764E-01	8.659E-03	3.297E-01
5	8	5.567E+00	7.205E-01	3.378E-03	1.286E-01	4.029E-03	1.534E-01
5	9	7.211E-01	9.333E-02	4.375E-04	1.666E-02	5.219E-04	1.987E-02
5	10	4.838E+00	6.261E-01	2.935E-03	1.118E-01	3.501E-03	1.333E-01
5	11	4.931E+00	6.382E-01	2.992E-03	1.139E-01	3.569E-03	1.359E-01
5	13	3.056E+00	3.955E-01	1.854E-03	7.061E-02	2.212E-03	8.423E-02
5	14	6.147E-01	7.956E-02	3.730E-04	1.420E-02	4.449E-04	1.694E-02
5	15	6.112E-02	7.910E-03	3.708E-05	1.412E-03	4.423E-05	1.684E-03
5	16	4.343E+00	5.621E-01	2.635E-03	1.003E-01	3.143E-03	1.197E-01
5	17	4.701E+00	6.084E-01	2.852E-03	1.086E-01	3.402E-03	1.296E-01
5	18	3.826E+00	4.952E-01	2.322E-03	8.840E-02	2.769E-03	1.054E-01
5	19	4.311E+00	5.580E-01	2.616E-03	9.961E-02	3.120E-03	1.188E-01
5	20	4.450E+00	5.759E-01	2.700E-03	1.028E-01	3.221E-03	1.226E-01
5	21	3.816E+00	4.939E-01	2.315E-03	8.817E-02	2.762E-03	1.052E-01
5	22	2.857E+00	3.697E-01	1.733E-03	6.601E-02	2.068E-03	7.874E-02
5	24	4.331E+00	5.605E-01	2.628E-03	1.001E-01	3.134E-03	1.194E-01
5	26	4.191E+00	5.424E-01	2.543E-03	9.684E-02	3.034E-03	1.155E-01
5	27	2.745E+00	3.553E-01	1.666E-03	6.343E-02	1.987E-03	7.566E-02

Table VI
HEAT TRANSFER DATA (Cont.)

RUN	GAGE	$\dot{q}_w$	$\dot{q}_w/\dot{q}_o$	$h_{r=1.0}$	$C_{H_{r=1.0}}$	$h_{r=.85}$	$C_{H_{r=.85}}$
5	28	5.933E-01	7.679E-02	3.600E-04	1.371E-02	4.294E-04	1.635E-02
5	30	4.183E+00	5.413E-01	2.538E-03	9.664E-02	3.027E-03	1.153E-01
5	31	4.135E+00	5.351E-01	2.509E-03	9.553E-02	2.993E-03	1.140E-01
5	34	4.345E+00	5.623E-01	2.636E-03	1.004E-01	3.145E-03	1.198E-01
5	35	2.630E+00	3.403E-01	1.596E-03	6.076E-02	1.903E-03	7.248E-02
5	36	5.641E-01	7.301E-02	3.423E-04	1.303E-02	4.083E-04	1.555E-02
5	38	4.529E+00	5.861E-01	2.748E-03	1.046E-01	3.278E-03	1.248E-01
5	39	3.824E+00	4.949E-01	2.320E-03	8.834E-02	2.767E-03	1.054E-01
5	40	2.727E+00	3.529E-01	1.654E-03	6.300E-02	1.973E-03	7.515E-02
6	2	3.262E+01	1.616E+00	3.618E-02	4.069E-02	4.366E-02	4.911E-02
6	4	2.087E+01	1.034E+00	2.315E-02	2.603E-02	2.793E-02	3.142E-02
6	5	3.519E+00	1.744E-01	3.903E-03	4.390E-03	4.711E-03	5.298E-03
6	6	1.195E+01	5.923E-01	1.326E-02	1.491E-02	1.600E-02	1.800E-02
6	7	3.311E+01	1.641E+00	3.673E-02	4.131E-02	4.432E-02	4.985E-02
6	8	7.033E+00	3.485E-01	7.802E-03	8.774E-03	9.415E-03	1.059E-02
6	9	1.963E+00	9.730E-02	2.178E-03	2.449E-03	2.629E-03	2.956E-03
6	10	4.808E+00	2.383E-01	5.333E-03	5.998E-03	6.437E-03	7.239E-03
6	11	3.676E+00	1.821E-01	4.077E-03	4.586E-03	4.921E-03	5.534E-03
6	12	4.185E+00	2.074E-01	4.643E-03	5.222E-03	5.603E-03	6.302E-03
6	13	2.633E+00	1.305E-01	2.921E-03	3.285E-03	3.525E-03	3.965E-03
6	14	7.088E-01	3.513E-02	7.863E-04	8.843E-04	9.489E-04	1.067E-03
6	16	4.677E+00	2.318E-01	5.188E-03	5.835E-03	6.261E-03	7.041E-03
6	17	4.324E+00	2.143E-01	4.796E-03	5.394E-03	5.788E-03	6.510E-03
6	18	3.956E+00	1.960E-01	4.388E-03	4.936E-03	5.296E-03	5.956E-03
6	19	3.412E+00	1.691E-01	3.785E-03	4.257E-03	4.568E-03	5.138E-03
6	20	4.148E+00	2.055E-01	4.601E-03	5.175E-03	5.553E-03	6.245E-03
6	21	3.237E+00	1.604E-01	3.591E-03	4.038E-03	4.334E-03	4.874E-03
6	22	2.583E+00	1.280E-01	2.865E-03	3.222E-03	3.457E-03	3.888E-03
6	23	9.400E-01	4.658E-02	1.043E-03	1.173E-03	1.258E-03	1.415E-03
6	24	4.107E+00	2.035E-01	4.556E-03	5.124E-03	5.499E-03	6.184E-03
6	25	3.975E-01	1.970E-02	4.409E-04	4.959E-04	5.321E-04	5.985E-04
6	26	3.611E+00	1.790E-01	4.006E-03	4.505E-03	4.834E-03	5.437E-03
6	27	2.412E+00	1.195E-01	2.675E-03	3.009E-03	3.229E-03	3.631E-03
6	28	7.482E-01	3.708E-02	8.299E-04	9.334E-04	1.002E-03	1.126E-03

Table VI

HEAT TRANSFER DATA (Cont.)

RUN	GAGE	$\dot{q}_w$	$\dot{q}_w/\dot{q}_o$	$h_{r=1.0}$	$C_{H_{r=1.0}}$	$h_{r=.85}$	$C_{H_{r=.85}}$
6	29	3.419E-01	1.694E-02	3.793E-04	4.266E-04	4.578E-04	5.148E-04
6	30	4.028E+00	1.996E-01	4.468E-03	5.025E-03	5.393E-03	6.065E-03
6	31	3.729E+00	1.848E-01	4.137E-03	4.653E-03	4.993E-03	5.615E-03
6	32	7.435E-01	3.685E-02	8.248E-04	9.276E-04	9.954E-04	1.119E-03
6	33	5.995E-01	2.971E-02	6.650E-04	7.479E-04	8.025E-04	9.026E-04
6	34	4.094E+00	2.029E-01	4.542E-03	5.108E-03	5.481E-03	6.164E-03
6	35	2.235E+00	1.107E-01	2.479E-03	2.788E-03	2.991E-03	3.364E-03
6	36	8.963E-01	4.442E-02	9.942E-04	1.118E-03	1.200E-03	1.349E-03
6	38	4.613E+00	2.286E-01	5.117E-03	5.755E-03	6.175E-03	6.945E-03
6	39	3.376E+00	1.673E-01	3.745E-03	4.212E-03	4.520E-03	5.083E-03
6	40	3.050E+00	1.512E-01	3.384E-03	3.805E-03	4.084E-03	4.593E-03
6	41	1.677E+00	8.308E-02	1.860E-03	2.092E-03	2.244E-03	2.524E-03
6	42	5.251E-01	2.602E-02	5.824E-04	6.551E-04	7.029E-04	7.906E-04
6	43	5.648E-01	2.799E-02	6.265E-04	7.046E-04	7.561E-04	8.504E-04
7	2	2.572E+01	1.254E+00	1.582E-02	8.380E-02	1.887E-02	9.998E-02
7	3	7.599E+00	3.704E-01	4.673E-03	2.476E-02	5.575E-03	2.954E-02
7	4	1.726E+01	8.414E-01	1.062E-02	5.624E-02	1.267E-02	6.710E-02
7	5	3.759E+00	1.832E-01	2.311E-03	1.225E-02	2.758E-03	1.461E-02
7	6	9.100E+00	4.435E-01	5.595E-03	2.964E-02	6.676E-03	3.537E-02
7	7	2.529E+01	1.232E+00	1.555E-02	8.238E-02	1.855E-02	9.830E-02
7	8	4.146E+00	2.021E-01	2.549E-03	1.351E-02	3.042E-03	1.612E-02
7	9	1.820E+00	8.871E-02	1.119E-03	5.930E-03	1.335E-03	7.075E-03
7	10	3.285E+00	1.601E-01	2.020E-03	1.070E-02	2.410E-03	1.277E-02
7	11	2.827E+00	1.378E-01	1.738E-03	9.209E-03	2.074E-03	1.099E-02
7	12	2.632E+00	1.283E-01	1.618E-03	8.573E-03	1.931E-03	1.023E-02
7	13	2.038E+00	9.934E-02	1.253E-03	6.640E-03	1.495E-03	7.923E-03
7	14	8.386E-01	4.087E-02	5.156E-04	2.732E-03	6.152E-04	3.260E-03
7	15	2.828E-01	1.378E-02	1.739E-04	9.211E-04	2.075E-04	1.099E-03
7	16	2.770E+00	1.350E-01	1.703E-03	9.024E-03	2.032E-03	1.077E-02
7	17	2.713E+00	1.322E-01	1.668E-03	8.837E-03	1.990E-03	1.054E-02
7	18	2.458E+00	1.198E-01	1.512E-03	8.008E-03	1.804E-03	9.555E-03
7	19	2.582E+00	1.259E-01	1.588E-03	8.412E-03	1.895E-03	1.004E-02
7	20	2.631E+00	1.282E-01	1.618E-03	8.570E-03	1.930E-03	1.023E-02
7	21	2.513E+00	1.225E-01	1.545E-03	8.187E-03	1.844E-03	9.768E-03

Table VI

HEAT TRANSFER DATA (Cont.)

RUN	GAGE	$\dot{q}_w$	$\dot{q}_w/\dot{q}_o$	$h_{r=1.0}$	$C_{H_{r=1.0}}$	$h_{r=.85}$	$C_{H_{r=.85}}$
7	22	1.755E+00	8.552E-02	1.079E-03	5.717E-03	1.287E-03	6.821E-03
7	23	6.527E-01	3.181E-02	4.014E-04	2.126E-03	4.789E-04	2.537E-03
7	24	2.937E+00	1.432E-01	1.806E-03	9.569E-03	2.155E-03	1.142E-02
7	25	1.597E-01	7.786E-03	9.823E-05	5.204E-04	1.172E-04	6.209E-04
7	26	2.539E+00	1.238E-01	1.561E-03	8.272E-03	1.863E-03	9.870E-03
7	27	1.749E+00	8.525E-02	1.076E-03	5.699E-03	1.283E-03	6.799E-03
7	28	6.673E-01	3.252E-02	4.103E-04	2.174E-03	4.896E-04	2.594E-03
7	29	2.308E-01	1.125E-02	1.419E-04	7.520E-04	1.694E-04	8.972E-04
7	30	2.716E+00	1.324E-01	1.670E-03	8.847E-03	1.992E-03	1.056E-02
7	31	2.427E+00	1.183E-01	1.492E-03	7.905E-03	1.780E-03	9.432E-03
7	32	6.412E-01	3.125E-02	3.942E-04	2.089E-03	4.704E-04	2.492E-03
7	33	1.861E-01	9.070E-03	1.144E-04	6.063E-04	1.365E-04	7.234E-04
7	34	2.619E+00	1.276E-01	1.610E-03	8.531E-03	1.921E-03	1.018E-02
7	35	1.712E+00	8.345E-02	1.053E-03	5.578E-03	1.256E-03	6.656E-03
7	36	5.566E-01	2.713E-02	3.422E-04	1.813E-03	4.083E-04	2.163E-03
7	37	1.794E-01	8.743E-03	1.103E-04	5.844E-04	1.316E-04	6.973E-04
7	38	2.626E+00	1.280E-01	1.615E-03	8.556E-03	1.927E-03	1.021E-02
7	39	2.113E+00	1.030E-01	1.299E-03	6.884E-03	1.550E-03	8.214E-03
7	40	1.763E+00	8.593E-02	1.084E-03	5.744E-03	1.294E-03	6.853E-03
7	41	1.081E+00	5.269E-02	6.647E-04	3.522E-03	7.931E-04	4.202E-03
7	42	5.669E-01	2.763E-02	3.486E-04	1.847E-03	4.159E-04	2.204E-03
7	43	3.749E-01	1.827E-02	2.305E-04	1.221E-03	2.751E-04	1.457E-03
8	2	8.956E+00	1.142E+00	5.513E-03	1.971E-01	6.578E-03	2.352E-01
8	3	2.866E+00	3.654E-01	1.764E-03	6.308E-02	2.105E-03	7.527E-02
8	4	5.834E+00	7.437E-01	3.591E-03	1.284E-01	4.285E-03	1.532E-01
8	5	1.343E+00	1.712E-01	8.267E-04	2.956E-02	9.864E-04	3.527E-02
8	6	3.045E+00	3.882E-01	1.874E-03	6.702E-02	2.236E-03	7.996E-02
8	7	8.593E+00	1.095E+00	5.290E-03	1.891E-01	6.312E-03	2.257E-01
8	8	1.459E+00	1.860E-01	8.980E-04	3.211E-02	1.071E-03	3.831E-02
8	9	6.831E-01	8.708E-02	4.205E-04	1.503E-02	5.017E-04	1.794E-02
8	10	1.208E+00	1.540E-01	7.435E-04	2.658E-02	8.871E-04	3.172E-02
8	11	8.956E-01	1.142E-01	5.513E-04	1.971E-02	6.578E-04	2.352E-02
8	12	9.006E-01	1.148E-01	5.544E-04	1.982E-02	6.615E-04	2.365E-02
8	13	7.408E-01	9.444E-02	4.560E-04	1.631E-02	5.441E-04	1.946E-02

Table VI
HEAT TRANSFER DATA (Cont.)

RUN	GAGE	$\dot{q}_w$	$\dot{q}_w/\dot{q}_o$	$h_{r=1.0}$	$C_{H_{r=1.0}}$	$h_{r=.85}$	$C_{H_{r=.85}}$
8	14	3.291E-01	4.195E-02	2.026E-04	7.243E-03	2.417E-04	8.642E-03
8	15	1.970E-01	2.512E-02	1.213E-04	4.337E-03	1.447E-04	5.175E-03
8	16	8.104E-01	1.033E-01	4.988E-04	1.784E-02	5.952E-04	2.128E-02
8	17	7.941E-01	1.012E-01	4.888E-04	1.748E-02	5.832E-04	2.085E-02
8	18	8.372E-01	1.067E-01	5.154E-04	1.843E-02	6.149E-04	2.199E-02
8	19	9.006E-01	1.148E-01	5.544E-04	1.982E-02	6.615E-04	2.365E-02
8	20	8.160E-01	1.040E-01	5.023E-04	1.796E-02	5.993E-04	2.143E-02
8	21	7.703E-01	9.820E-02	4.742E-04	1.695E-02	5.658E-04	2.023E-02
8	22	6.385E-01	8.140E-02	3.931E-04	1.405E-02	4.690E-04	1.677E-02
8	23	2.350E-01	2.995E-02	1.446E-04	5.171E-03	1.726E-04	6.170E-03
8	24	8.926E-01	1.138E-01	5.495E-04	1.965E-02	6.556E-04	2.344E-02
8	25	9.993E-02	1.274E-02	6.152E-05	2.199E-03	7.340E-05	2.624E-03
8	26	7.609E-01	9.700E-02	4.684E-04	1.675E-02	5.589E-04	1.998E-02
8	27	5.601E-01	7.140E-02	3.448E-04	1.233E-02	4.114E-04	1.471E-02
8	28	2.400E-01	3.060E-02	1.477E-04	5.282E-03	1.763E-04	6.302E-03
8	30	8.213E-01	1.047E-01	5.056E-04	1.808E-02	6.033E-04	2.157E-02
8	31	7.786E-01	9.926E-02	4.793E-04	1.714E-02	5.719E-04	2.045E-02
8	32	2.518E-01	3.209E-02	1.550E-04	5.541E-03	1.849E-04	6.611E-03
8	33	8.795E-02	1.121E-02	5.414E-05	1.936E-03	6.460E-05	2.310E-03
8	34	7.980E-01	1.017E-01	4.912E-04	1.756E-02	5.861E-04	2.096E-02
8	35	5.129E-01	6.538E-02	3.157E-04	1.129E-02	3.767E-04	1.347E-02
8	36	2.005E-01	2.556E-02	1.234E-04	4.412E-03	1.473E-04	5.265E-03
8	38	7.994E-01	1.019E-01	4.921E-04	1.759E-02	5.871E-04	2.099E-02
8	39	6.562E-01	8.366E-02	4.039E-04	1.444E-02	4.820E-04	1.723E-02
8	40	5.594E-01	7.131E-02	3.443E-04	1.231E-02	4.109E-04	1.469E-02
8	41	3.050E-01	3.888E-02	1.877E-04	6.712E-03	2.240E-04	8.008E-03
8	42	1.900E-01	2.423E-02	1.170E-04	4.182E-03	1.396E-04	4.990E-03
8	43	6.759E-02	8.616E-03	4.160E-05	1.488E-03	4.964E-05	1.775E-03
9	2	2.068E+01	1.084E+00	2.362E-02	2.751E-02	2.852E-02	3.322E-02
9	4	2.244E+01	1.176E+00	2.563E-02	2.985E-02	3.095E-02	3.604E-02
9	6	2.479E+01	1.300E+00	2.831E-02	3.297E-02	3.419E-02	3.982E-02
9	7	2.136E+01	1.120E+00	2.440E-02	2.841E-02	2.946E-02	3.431E-02
9	8	2.879E+01	1.509E+00	3.289E-02	3.830E-02	3.971E-02	4.625E-02
9	9	2.543E+00	1.333E-01	2.904E-03	3.382E-03	3.507E-03	4.084E-03

Table VI

HEAT TRANSFER DATA (Cont.)

RUN	GAGE	$\dot{q}_w$	$\dot{q}_w/\dot{q}_o$	$h_{r=1.0}$	$C_{H_{r=1.0}}$	$h_{r=.85}$	$C_{H_{r=.85}}$
9	10	2.435E+01	1.277E+00	2.782E-02	3.239E-02	3.359E-02	3.912E-02
9	11	2.278E+01	1.194E+00	2.601E-02	3.030E-02	3.142E-02	3.659E-02
9	12	1.981E+01	1.039E+00	2.263E-02	2.635E-02	2.733E-02	3.182E-02
9	13	1.520E+01	7.970E-01	1.736E-02	2.022E-02	2.097E-02	2.442E-02
9	14	2.419E+00	1.268E-01	2.762E-03	3.217E-03	3.336E-03	3.885E-03
9	16	2.037E+01	1.068E+00	2.327E-02	2.710E-02	2.810E-02	3.273E-02
9	17	2.257E+01	1.183E+00	2.576E-02	3.002E-02	3.113E-02	3.626E-02
9	18	2.091E+01	1.096E+00	2.388E-02	2.782E-02	2.884E-02	3.359E-02
9	19	1.975E+01	1.035E+00	2.255E-02	2.626E-02	2.723E-02	3.172E-02
9	20	2.235E+01	1.171E+00	2.552E-02	2.972E-02	3.082E-02	3.589E-02
9	21	2.019E+01	1.059E+00	2.306E-02	2.686E-02	2.785E-02	3.244E-02
9	22	1.359E+01	7.127E-01	1.553E-02	1.808E-02	1.875E-02	2.184E-02
9	23	2.546E+00	1.335E-01	2.908E-03	3.387E-03	3.512E-03	4.090E-03
9	24	2.357E+01	1.235E+00	2.692E-02	3.135E-02	3.251E-02	3.786E-02
9	26	2.337E+01	1.225E+00	2.669E-02	3.108E-02	3.223E-02	3.754E-02
9	27	1.498E+01	7.856E-01	1.711E-02	1.993E-02	2.067E-02	2.407E-02
9	28	2.528E+00	1.325E-01	2.887E-03	3.363E-03	3.487E-03	4.061E-03
9	30	2.523E+01	1.323E+00	2.882E-02	3.356E-02	3.480E-02	4.053E-02
9	31	2.268E+01	1.189E+00	2.591E-02	3.017E-02	3.129E-02	3.644E-02
9	32	2.200E+00	1.153E-01	2.513E-03	2.927E-03	3.035E-03	3.534E-03
9	34	2.353E+01	1.233E+00	2.687E-02	3.129E-02	3.245E-02	3.779E-02
9	36	2.361E+00	1.237E-01	2.696E-03	3.140E-03	3.256E-03	3.792E-03
9	38	2.548E+01	1.336E+00	2.910E-02	3.390E-02	3.515E-02	4.093E-02
9	39	2.005E+01	1.051E+00	2.290E-02	2.667E-02	2.765E-02	3.220E-02
9	40	1.479E+01	7.754E-01	1.689E-02	1.967E-02	2.040E-02	2.376E-02
9	42	2.157E+00	1.131E-01	2.463E-03	2.869E-03	2.975E-03	3.464E-03
9	43	7.988E+00	4.187E-01	9.123E-03	1.062E-02	1.102E-02	1.283E-02
10	2	1.963E+01	9.159E-01	1.195E-02	5.943E-02	1.425E-02	7.089E-02
10	4	2.478E+01	1.156E+00	1.509E-02	7.503E-02	1.800E-02	8.951E-02
10	5	3.675E-01	1.715E-02	2.237E-04	1.113E-03	2.668E-04	1.327E-03
10	6	2.500E+01	1.167E+00	1.522E-02	7.569E-02	1.815E-02	9.029E-02
10	7	2.296E+01	1.071E+00	1.398E-02	6.952E-02	1.667E-02	8.293E-02
10	8	2.526E+01	1.179E+00	1.537E-02	7.647E-02	1.834E-02	9.123E-02
10	9	2.804E+00	1.309E-01	1.707E-03	8.491E-03	2.037E-03	1.013E-02

Table VI

HEAT TRANSFER DATA (Cont.)

RUN	GAGE	$\dot{q}_w$	$\dot{q}_w/\dot{q}_o$	$h_{r=1.0}$	$C_{H_{r=1.0}}$	$h_{r=.85}$	$C_{H_{r=.85}}$
10	10	2.385E+01	1.113E+00	1.452E-02	7.222E-02	1.732E-02	8.616E-02
10	11	2.396E+01	1.118E+00	1.458E-02	7.254E-02	1.740E-02	8.653E-02
10	12	2.097E+01	9.785E-01	1.276E-02	6.349E-02	1.523E-02	7.574E-02
10	13	1.615E+01	7.538E-01	9.832E-03	4.891E-02	1.173E-02	5.834E-02
10	14	2.642E+00	1.233E-01	1.608E-03	7.998E-03	1.918E-03	9.542E-03
10	16	1.902E+01	8.876E-01	1.158E-02	5.759E-02	1.381E-02	6.871E-02
10	17	2.206E+01	1.029E+00	1.343E-02	6.679E-02	1.602E-02	7.967E-02
10	18	2.327E+01	1.086E+00	1.416E-02	7.045E-02	1.690E-02	8.404E-02
10	19	2.211E+01	1.032E+00	1.346E-02	6.695E-02	1.606E-02	7.987E-02
10	20	2.437E+01	1.137E+00	1.483E-02	7.379E-02	1.770E-02	8.803E-02
10	21	2.147E+01	1.002E+00	1.307E-02	6.502E-02	1.559E-02	7.756E-02
10	22	1.354E+01	6.321E-01	8.245E-03	4.101E-02	9.836E-03	4.892E-02
10	23	2.645E+00	1.234E-01	1.610E-03	8.008E-03	1.921E-03	9.554E-03
10	24	2.204E+01	1.028E+00	1.341E-02	6.672E-02	1.600E-02	7.960E-02
10	25	4.088E-01	1.908E-02	2.489E-04	1.238E-03	2.969E-04	1.477E-03
10	26	2.225E+01	1.038E+00	1.355E-02	6.738E-02	1.616E-02	8.038E-02
10	27	1.335E+01	6.229E-01	8.125E-03	4.041E-02	9.693E-03	4.821E-02
10	28	2.590E+00	1.209E-01	1.577E-03	7.842E-03	1.881E-03	9.356E-03
10	30	2.175E+01	1.015E+00	1.324E-02	6.587E-02	1.580E-02	7.858E-02
10	31	2.144E+01	1.000E+00	1.305E-02	6.491E-02	1.557E-02	7.744E-02
10	32	2.826E+00	1.319E-01	1.720E-03	8.556E-03	2.052E-03	1.021E-02
10	33	8.226E-01	3.839E-02	5.008E-04	2.491E-03	5.974E-04	2.971E-03
10	34	2.178E+01	1.017E+00	1.326E-02	6.596E-02	1.582E-02	7.868E-02
10	35	1.341E+01	6.258E-01	8.162E-03	4.060E-02	9.737E-03	4.843E-02
10	36	2.718E+00	1.268E-01	1.655E-03	8.230E-03	1.974E-03	9.818E-03
10	37	4.306E-01	2.010E-02	2.621E-04	1.304E-03	3.127E-04	1.555E-03
10	38	2.413E+01	1.126E+00	1.469E-02	7.306E-02	1.752E-02	8.716E-02
10	39	1.881E+01	8.778E-01	1.145E-02	5.695E-02	1.366E-02	6.794E-02
10	40	1.394E+01	6.506E-01	8.487E-03	4.221E-02	1.012E-02	5.036E-02
10	41	6.655E+00	3.106E-01	4.051E-03	2.015E-02	4.833E-03	2.404E-02
10	42	1.975E+00	9.219E-02	1.203E-03	5.982E-03	1.435E-03	7.136E-03
10	43	7.135E+00	3.330E-01	4.343E-03	2.160E-02	5.181E-03	2.577E-02
11	2	2.375E+01	1.167E+00	2.623E-02	2.933E-02	3.165E-02	3.539E-02
11	4	2.577E+01	1.266E+00	2.846E-02	3.182E-02	3.434E-02	3.840E-02

Table VI

HEAT TRANSFER DATA (Cont.)

RUN	GAGE	$\dot{q}_w$	$\dot{q}_w/\dot{q}_o$	$h_{r=1.0}$	$C_{H_{r=1.0}}$	$h_{r=.85}$	$C_{H_{r=.85}}$
11	6	2.901E+01	1.425E+00	3.203E-02	3.582E-02	3.865E-02	4.322E-02
11	7	2.282E+01	1.121E+00	2.519E-02	2.817E-02	3.040E-02	3.400E-02
11	9	2.534E+00	1.245E-01	2.797E-03	3.128E-03	3.376E-03	3.775E-03
11	10	2.810E+01	1.380E+00	3.103E-02	3.470E-02	3.744E-02	4.187E-02
11	11	2.372E+01	1.165E+00	2.619E-02	2.929E-02	3.160E-02	3.535E-02
11	12	2.604E+01	1.279E+00	2.874E-02	3.215E-02	3.469E-02	3.879E-02
11	13	1.693E+01	8.314E-01	1.869E-02	2.090E-02	2.255E-02	2.522E-02
11	14	2.527E+00	1.241E-01	2.790E-03	3.120E-03	3.367E-03	3.765E-03
11	16	2.518E+01	1.237E+00	2.780E-02	3.109E-02	3.355E-02	3.752E-02
11	17	2.517E+01	1.236E+00	2.779E-02	3.108E-02	3.354E-02	3.751E-02
11	18	2.627E+01	1.290E+00	2.900E-02	3.243E-02	3.500E-02	3.914E-02
11	19	2.442E+01	1.200E+00	2.696E-02	3.015E-02	3.254E-02	3.639E-02
11	20	2.480E+01	1.218E+00	2.738E-02	3.062E-02	3.304E-02	3.695E-02
11	21	2.768E+01	1.360E+00	3.056E-02	3.418E-02	3.688E-02	4.124E-02
11	22	1.561E+01	7.665E-01	1.723E-02	1.927E-02	2.079E-02	2.325E-02
11	23	2.754E+00	1.353E-01	3.040E-03	3.400E-03	3.669E-03	4.103E-03
11	24	2.368E+01	1.163E+00	2.615E-02	2.924E-02	3.155E-02	3.529E-02
11	26	3.027E+01	1.487E+00	3.342E-02	3.737E-02	4.032E-02	4.510E-02
11	27	1.571E+01	7.716E-01	1.734E-02	1.940E-02	2.093E-02	2.341E-02
11	28	3.013E+00	1.480E-01	3.326E-03	3.720E-03	4.014E-03	4.489E-03
11	30	2.175E+01	1.068E+00	2.402E-02	2.686E-02	2.898E-02	3.241E-02
11	31	2.441E+01	1.199E+00	2.695E-02	3.014E-02	3.253E-02	3.637E-02
11	32	2.861E+00	1.405E-01	3.158E-03	3.532E-03	3.811E-03	4.262E-03
11	33	7.246E-01	3.559E-02	7.999E-04	8.946E-04	9.653E-04	1.080E-03
11	34	2.604E+01	1.279E+00	2.875E-02	3.215E-02	3.469E-02	3.880E-02
11	35	1.678E+01	8.239E-01	1.852E-02	2.071E-02	2.235E-02	2.499E-02
11	36	2.543E+00	1.249E-01	2.808E-03	3.140E-03	3.388E-03	3.789E-03
11	38	2.741E+01	1.346E+00	3.026E-02	3.385E-02	3.652E-02	4.084E-02
11	39	2.267E+01	1.113E+00	2.503E-02	2.799E-02	3.020E-02	3.378E-02
11	40	1.764E+01	8.663E-01	1.947E-02	2.178E-02	2.350E-02	2.628E-02
11	41	7.995E+00	3.927E-01	8.827E-03	9.872E-03	1.065E-02	1.191E-02
11	42	2.449E+00	1.203E-01	2.704E-03	3.024E-03	3.263E-03	3.649E-03
11	43	7.969E+00	3.914E-01	8.799E-03	9.840E-03	1.062E-02	1.187E-02
12	2	6.088E+00	8.682E-01	3.851E-03	1.623E-01	4.597E-03	1.937E-01

Table VI

HEAT TRANSFER DATA (Cont.)

RUN	GAGE	$\dot{q}_w$	$\dot{q}_w/\dot{q}_o$	$h_{r=1.0}$	$C_{H_{r=1.0}}$	$h_{r=.85}$	$C_{H_{r=.85}}$
12	4	6.852E+00	9.770E-01	4.334E-03	1.826E-01	5.174E-03	2.180E-01
12	6	7.985E+00	1.139E+00	5.051E-03	2.128E-01	6.030E-03	2.541E-01
12	7	6.778E+00	9.666E-01	4.288E-03	1.807E-01	5.119E-03	2.157E-01
12	8	5.694E+00	8.119E-01	3.602E-03	1.518E-01	4.300E-03	1.812E-01
12	9	7.788E-01	1.111E-01	4.927E-04	2.076E-02	5.881E-04	2.478E-02
12	10	8.565E+00	1.221E+00	5.418E-03	2.283E-01	6.467E-03	2.725E-01
12	11	6.508E+00	9.280E-01	4.117E-03	1.735E-01	4.914E-03	2.071E-01
12	12	6.606E+00	9.419E-01	4.179E-03	1.761E-01	4.988E-03	2.102E-01
12	13	4.164E+00	5.937E-01	2.634E-03	1.110E-01	3.144E-03	1.325E-01
12	14	7.380E-01	1.052E-01	4.669E-04	1.967E-02	5.573E-04	2.348E-02
12	16	6.092E+00	8.688E-01	3.854E-03	1.624E-01	4.601E-03	1.939E-01
12	17	5.601E+00	7.986E-01	3.543E-03	1.493E-01	4.229E-03	1.782E-01
12	18	5.783E+00	8.246E-01	3.658E-03	1.541E-01	4.367E-03	1.840E-01
12	19	6.676E+00	9.520E-01	4.223E-03	1.780E-01	5.041E-03	2.124E-01
12	20	7.137E+00	1.018E+00	4.515E-03	1.902E-01	5.389E-03	2.271E-01
12	21	4.778E+00	6.813E-01	3.022E-03	1.274E-01	3.608E-03	1.520E-01
12	22	4.256E+00	6.069E-01	2.692E-03	1.135E-01	3.214E-03	1.354E-01
12	23	8.322E-01	1.187E-01	5.264E-04	2.218E-02	6.284E-04	2.648E-02
12	24	7.416E+00	1.057E+00	4.691E-03	1.977E-01	5.600E-03	2.360E-01
12	26	6.002E+00	8.558E-01	3.797E-03	1.600E-01	4.532E-03	1.910E-01
12	27	4.298E+00	6.128E-01	2.719E-03	1.146E-01	3.245E-03	1.367E-01
12	28	8.334E-01	1.188E-01	5.272E-04	2.222E-02	6.293E-04	2.652E-02
12	30	6.493E+00	9.259E-01	4.107E-03	1.731E-01	4.903E-03	2.066E-01
12	31	7.056E+00	1.006E+00	4.463E-03	1.881E-01	5.328E-03	2.245E-01
12	32	7.409E-01	1.056E-01	4.687E-04	1.975E-02	5.595E-04	2.357E-02
12	34	5.198E+00	7.412E-01	3.288E-03	1.386E-01	3.925E-03	1.654E-01
12	35	4.410E+00	6.288E-01	2.790E-03	1.175E-01	3.330E-03	1.403E-01
12	36	7.853E-01	1.120E-01	4.968E-04	2.093E-02	5.930E-04	2.499E-02
12	37	1.172E-01	1.671E-02	7.413E-05	3.124E-03	8.849E-05	3.729E-03
12	38	8.047E+00	1.147E+00	5.090E-03	2.145E-01	6.076E-03	2.560E-01
12	39	6.009E+00	8.569E-01	3.801E-03	1.602E-01	4.538E-03	1.912E-01
12	40	4.147E+00	5.913E-01	2.623E-03	1.105E-01	3.131E-03	1.320E-01
12	41	1.939E+00	2.765E-01	1.227E-03	5.169E-02	1.464E-03	6.170E-02
12	42	7.101E-01	1.013E-01	4.492E-04	1.893E-02	5.362E-04	2.260E-02
12	43	2.189E+00	3.121E-01	1.385E-03	5.835E-02	1.653E-03	6.965E-02

Table VI

HEAT TRANSFER DATA (Cont.)

RUN	GAGE	$\dot{q}_w$	$\dot{q}_w/\dot{q}_o$	$h_{r=1.0}$	$C_{H_{r=1.0}}$	$h_{r=.85}$	$C_{H_{r=.85}}$
13	2	6.332E+00	7.991E-01	3.818E-03	1.405E-01	4.555E-03	1.676E-01
13	4	7.531E+00	9.505E-01	4.542E-03	1.671E-01	5.418E-03	1.994E-01
13	6	8.140E+00	1.027E+00	4.909E-03	1.806E-01	5.855E-03	2.155E-01
13	7	7.818E+00	9.866E-01	4.715E-03	1.735E-01	5.623E-03	2.069E-01
13	8	9.588E+00	1.210E+00	5.782E-03	2.128E-01	6.897E-03	2.538E-01
13	10	7.827E+00	9.877E-01	4.720E-03	1.737E-01	5.630E-03	2.072E-01
13	11	7.008E+00	8.844E-01	4.226E-03	1.555E-01	5.041E-03	1.855E-01
13	12	7.236E+00	9.132E-01	4.364E-03	1.606E-01	5.205E-03	1.915E-01
13	13	4.534E+00	5.722E-01	2.734E-03	1.006E-01	3.261E-03	1.200E-01
13	14	9.356E-01	1.181E-01	5.642E-04	2.076E-02	6.730E-04	2.477E-02
13	15	9.781E-02	1.234E-02	5.899E-05	2.171E-03	7.036E-05	2.589E-03
13	16	5.355E+00	6.758E-01	3.229E-03	1.188E-01	3.852E-03	1.418E-01
13	17	5.297E+00	6.685E-01	3.195E-03	1.176E-01	3.811E-03	1.402E-01
13	18	7.001E+00	8.835E-01	4.222E-03	1.554E-01	5.036E-03	1.853E-01
13	19	4.006E+00	5.055E-01	2.416E-03	8.890E-02	2.881E-03	1.060E-01
13	20	7.021E+00	8.861E-01	4.234E-03	1.558E-01	5.050E-03	1.859E-01
13	21	3.262E+00	4.116E-01	1.967E-03	7.239E-02	2.346E-03	8.634E-02
13	22	3.536E+00	4.462E-01	2.132E-03	7.847E-02	2.543E-03	9.360E-02
13	23	1.008E+00	1.272E-01	6.079E-04	2.237E-02	7.251E-04	2.669E-02
13	24	6.728E+00	8.491E-01	4.057E-03	1.493E-01	4.840E-03	1.781E-01
13	25	7.264E-02	9.168E-03	4.381E-05	1.612E-03	5.226E-05	1.923E-03
13	26	6.092E+00	7.688E-01	3.674E-03	1.352E-01	4.382E-03	1.613E-01
13	27	3.352E+00	4.230E-01	2.021E-03	7.438E-02	2.411E-03	8.872E-02
13	28	9.410E-01	1.188E-01	5.675E-04	2.088E-02	6.769E-04	2.491E-02
13	29	9.138E-02	1.153E-02	5.511E-05	2.028E-03	6.573E-05	2.419E-03
13	30	6.720E+00	8.481E-01	4.053E-03	1.491E-01	4.834E-03	1.779E-01
13	31	6.838E+00	8.630E-01	4.124E-03	1.518E-01	4.919E-03	1.810E-01
13	32	1.027E+00	1.296E-01	6.194E-04	2.279E-02	7.388E-04	2.719E-02
13	33	1.108E-01	1.398E-02	6.682E-05	2.459E-03	7.970E-05	2.933E-03
13	34	6.228E+00	7.860E-01	3.756E-03	1.382E-01	4.480E-03	1.649E-01
13	35	3.314E+00	4.183E-01	1.999E-03	7.356E-02	2.384E-03	8.774E-02
13	36	9.036E-01	1.140E-01	5.449E-04	2.005E-02	6.500E-04	2.392E-02
13	37	8.163E-02	1.030E-02	4.923E-05	1.812E-03	5.872E-05	2.161E-03
13	38	8.453E+00	1.067E+00	5.098E-03	1.876E-01	6.081E-03	2.238E-01

Table VI
HEAT TRANSFER DATA (Cont.)

RUN	GAGE	$\dot{q}_w$	$\dot{q}_w/\dot{q}_o$	$h_{r=1.0}$	$C_{H_{r=1.0}}$	$h_{r=.85}$	$C_{H_{r=.85}}$
13	39	4.907E+00	6.192E-01	2.959E-03	1.089E-01	3.530E-03	1.299E-01
13	40	1.553E+00	1.960E-01	9.366E-04	3.447E-02	1.117E-03	4.111E-02
13	41	1.696E+00	2.141E-01	1.023E-03	3.765E-02	1.220E-03	4.491E-02
13	42	6.963E-01	8.787E-02	4.199E-04	1.545E-02	5.009E-04	1.843E-02
13	43	9.607E-01	1.212E-01	5.794E-04	2.132E-02	6.911E-04	2.543E-02
14	2	1.022E+00	1.348E-01	6.474E-04	2.309E-02	7.728E-04	2.756E-02
14	3	9.246E-01	1.220E-01	5.857E-04	2.089E-02	6.992E-04	2.494E-02
14	4	8.560E-01	1.129E-01	5.422E-04	1.934E-02	6.473E-04	2.308E-02
14	5	8.242E-01	1.087E-01	5.221E-04	1.862E-02	6.233E-04	2.223E-02
14	6	8.484E-01	1.119E-01	5.374E-04	1.917E-02	6.415E-04	2.288E-02
14	7	1.040E+00	1.372E-01	6.589E-04	2.350E-02	7.866E-04	2.805E-02
14	8	8.062E-01	1.063E-01	5.107E-04	1.821E-02	6.096E-04	2.174E-02
14	10	8.216E-01	1.084E-01	5.205E-04	1.856E-02	6.213E-04	2.216E-02
14	11	8.436E-01	1.113E-01	5.344E-04	1.906E-02	6.379E-04	2.275E-02
14	12	9.075E-01	1.197E-01	5.749E-04	2.050E-02	6.862E-04	2.447E-02
14	13	1.019E-01	1.345E-02	6.457E-05	2.303E-03	7.708E-05	2.749E-03
14	15	7.841E-01	1.034E-01	4.967E-04	1.771E-02	5.929E-04	2.115E-02
14	16	8.506E-01	1.122E-01	5.389E-04	1.922E-02	6.432E-04	2.294E-02
14	17	8.275E-01	1.092E-01	5.242E-04	1.869E-02	6.257E-04	2.232E-02
14	18	8.131E-01	1.073E-01	5.151E-04	1.837E-02	6.148E-04	2.193E-02
14	19	5.394E-01	7.115E-02	3.417E-04	1.219E-02	4.079E-04	1.455E-02
14	20	8.443E-01	1.114E-01	5.348E-04	1.907E-02	6.384E-04	2.277E-02
14	21	5.228E-01	6.897E-02	3.312E-04	1.181E-02	3.954E-04	1.410E-02
14	22	7.328E-02	9.667E-03	4.643E-05	1.656E-03	5.542E-05	1.976E-03
14	24	8.016E-01	1.057E-01	5.078E-04	1.811E-02	6.061E-04	2.162E-02
14	25	7.942E-01	1.048E-01	5.031E-04	1.794E-02	6.006E-04	2.142E-02
14	26	7.939E-01	1.047E-01	5.030E-04	1.794E-02	6.004E-04	2.141E-02
14	27	5.714E-02	7.537E-03	3.620E-05	1.291E-03	4.321E-05	1.541E-03
14	29	6.980E-02	9.208E-03	4.422E-05	1.577E-03	5.278E-05	1.882E-03
14	30	8.209E-01	1.083E-01	5.201E-04	1.855E-02	6.208E-04	2.214E-02
14	31	8.673E-01	1.144E-01	5.494E-04	1.960E-02	6.559E-04	2.339E-02
14	32	1.038E-01	1.369E-02	6.576E-05	2.345E-03	7.849E-05	2.799E-03
14	33	8.684E-01	1.146E-01	5.501E-04	1.962E-02	6.567E-04	2.342E-02
14	34	8.932E-01	1.178E-01	5.658E-04	2.018E-02	6.754E-04	2.409E-02

Table VI

HEAT TRANSFER DATA (Cont.)

RUN	GAGE	$\dot{q}_w$	$\dot{q}_w/\dot{q}_o$	$h_{r=1.0}$	$C_{H_{r=1.0}}$	$h_{r=.85}$	$C_{H_{r=.85}}$
14	35	5.612E-02	7.403E-03	3.555E-05	1.268E-03	4.244E-05	1.514E-03
14	37	8.369E-02	1.104E-02	5.302E-05	1.891E-03	6.329E-05	2.257E-03
14	38	7.619E-01	1.005E-01	4.826E-04	1.721E-02	5.761E-04	2.055E-02
14	39	4.088E-01	5.393E-02	2.590E-04	9.237E-03	3.092E-04	1.103E-02
14	40	8.913E-02	1.176E-02	5.646E-05	2.014E-03	6.740E-05	2.404E-03
15	2	3.015E+01	1.599E+00	3.427E-02	4.137E-02	4.138E-02	4.996E-02
15	3	2.347E+00	1.245E-01	2.668E-03	3.221E-03	3.222E-03	3.889E-03
15	4	2.322E+01	1.232E+00	2.640E-02	3.187E-02	3.188E-02	3.848E-02
15	5	8.977E-01	4.763E-02	1.020E-03	1.232E-03	1.232E-03	1.488E-03
15	6	1.446E+01	7.670E-01	1.644E-02	1.984E-02	1.985E-02	2.396E-02
15	7	2.924E+01	1.552E+00	3.324E-02	4.013E-02	4.014E-02	4.846E-02
15	8	9.761E+00	5.178E-01	1.110E-02	1.339E-02	1.340E-02	1.617E-02
15	9	1.917E+00	1.017E-01	2.180E-03	2.631E-03	2.632E-03	3.177E-03
15	10	8.955E+00	4.751E-01	1.018E-02	1.229E-02	1.229E-02	1.484E-02
15	11	8.010E+00	4.249E-01	9.105E-03	1.099E-02	1.099E-02	1.327E-02
15	12	3.047E+00	1.617E-01	3.464E-03	4.182E-03	4.183E-03	5.050E-03
15	13	6.995E+00	3.711E-01	7.952E-03	9.599E-03	9.602E-03	1.159E-02
15	14	1.043E+00	5.536E-02	1.186E-03	1.432E-03	1.432E-03	1.729E-03
15	16	4.590E+00	2.435E-01	5.218E-03	6.299E-03	6.301E-03	7.607E-03
15	18	1.062E+01	5.635E-01	1.207E-02	1.458E-02	1.458E-02	1.760E-02
15	19	1.066E+01	5.658E-01	1.212E-02	1.463E-02	1.464E-02	1.767E-02
15	20	1.119E+01	5.937E-01	1.272E-02	1.536E-02	1.536E-02	1.855E-02
15	21	1.182E+01	6.269E-01	1.343E-02	1.622E-02	1.622E-02	1.958E-02
15	22	3.536E+00	1.876E-01	4.020E-03	4.853E-03	4.854E-03	5.860E-03
15	23	1.050E+00	5.571E-02	1.194E-03	1.441E-03	1.441E-03	1.740E-03
15	24	7.841E+00	4.160E-01	8.913E-03	1.076E-02	1.076E-02	1.299E-02
15	26	7.479E+00	3.968E-01	8.501E-03	1.026E-02	1.027E-02	1.239E-02
15	27	1.797E+00	9.534E-02	2.043E-03	2.466E-03	2.467E-03	2.978E-03
15	28	1.421E+00	7.541E-02	1.616E-03	1.951E-03	1.951E-03	2.355E-03
15	30	7.498E+00	3.978E-01	8.524E-03	1.029E-02	1.029E-02	1.243E-02
15	31	7.050E+00	3.740E-01	8.014E-03	9.675E-03	9.678E-03	1.168E-02
15	32	1.243E+00	6.597E-02	1.413E-03	1.706E-03	1.707E-03	2.061E-03
15	34	5.454E+00	2.893E-01	6.200E-03	7.484E-03	7.487E-03	9.038E-03
15	35	1.341E+00	7.113E-02	1.524E-03	1.840E-03	1.840E-03	2.222E-03

Table VI

HEAT TRANSFER DATA (Cont.)

RUN	GAGE	$\dot{q}_w$	$\dot{q}_w/\dot{q}_o$	$h_{r=1.0}$	$C_{H_{r=1.0}}$	$h_{r=.85}$	$C_{H_{r=.85}}$
15	36	8.702E-01	4.617E-02	9.892E-04	1.194E-03	1.195E-03	1.442E-03
15	38	8.455E+00	4.486E-01	9.611E-03	1.160E-02	1.161E-02	1.401E-02
15	39	7.094E+00	3.764E-01	8.065E-03	9.736E-03	9.739E-03	1.176E-02
15	40	1.634E+00	8.671E-02	1.858E-03	2.243E-03	2.244E-03	2.709E-03
15	41	4.714E+00	2.501E-01	5.358E-03	6.468E-03	6.470E-03	7.811E-03
15	42	1.251E+00	6.635E-02	1.422E-03	1.716E-03	1.717E-03	2.072E-03
15	43	1.238E+00	6.568E-02	1.407E-03	1.699E-03	1.699E-03	2.051E-03
16	2	3.288E+01	1.640E+00	2.023E-02	1.128E-01	2.413E-02	1.346E-01
16	3	1.668E+00	8.324E-02	1.026E-03	5.726E-03	1.225E-03	6.833E-03
16	4	2.802E+01	1.398E+00	1.724E-02	9.618E-02	2.057E-02	1.148E-01
16	5	8.830E-01	4.406E-02	5.433E-04	3.031E-03	6.482E-04	3.616E-03
16	6	1.980E+01	9.881E-01	1.218E-02	6.797E-02	1.454E-02	8.110E-02
16	7	3.250E+01	1.621E+00	1.999E-02	1.115E-01	2.386E-02	1.331E-01
16	8	1.469E+01	7.330E-01	9.038E-03	5.042E-02	1.078E-02	6.017E-02
16	9	2.285E+00	1.140E-01	1.406E-03	7.843E-03	1.677E-03	9.358E-03
16	10	1.276E+01	6.365E-01	7.848E-03	4.378E-02	9.364E-03	5.224E-02
16	11	1.303E+01	6.502E-01	8.017E-03	4.473E-02	9.566E-03	5.337E-02
16	12	1.246E+01	6.215E-01	7.664E-03	4.276E-02	9.144E-03	5.102E-02
16	13	8.101E+00	4.042E-01	4.984E-03	2.780E-02	5.947E-03	3.318E-02
16	14	1.672E+00	8.344E-02	1.029E-03	5.740E-03	1.228E-03	6.849E-03
16	15	2.090E-01	1.043E-02	1.286E-04	7.174E-04	1.534E-04	8.560E-04
16	16	5.285E+00	2.637E-01	3.252E-03	1.814E-02	3.880E-03	2.165E-02
16	17	3.399E+01	1.696E+00	2.091E-02	1.167E-01	2.495E-02	1.392E-01
16	18	1.267E+01	6.324E-01	7.797E-03	4.350E-02	9.303E-03	5.190E-02
16	19	7.139E+00	3.562E-01	4.392E-03	2.450E-02	5.241E-03	2.924E-02
16	20	1.344E+01	6.704E-01	8.266E-03	4.612E-02	9.863E-03	5.503E-02
16	21	4.453E+00	2.222E-01	2.740E-03	1.529E-02	3.269E-03	1.824E-02
16	22	7.208E+00	3.597E-01	4.435E-03	2.474E-02	5.291E-03	2.952E-02
16	23	1.867E+00	9.316E-02	1.149E-03	6.408E-03	1.371E-03	7.647E-03
16	24	1.602E+01	7.991E-01	9.853E-03	5.497E-02	1.176E-02	6.559E-02
16	25	2.033E-01	1.014E-02	1.251E-04	6.979E-04	1.493E-04	8.327E-04
16	26	1.236E+01	6.166E-01	7.603E-03	4.242E-02	9.072E-03	5.061E-02
16	27	4.445E+00	2.218E-01	2.734E-03	1.526E-02	3.263E-03	1.820E-02
16	28	1.857E+00	9.267E-02	1.143E-03	6.375E-03	1.363E-03	7.607E-03

Table VI

HEAT TRANSFER DATA (Cont.)

RUN	GAGE	$\dot{q}_w$	$\dot{q}_w/\dot{q}_o$	$h_{r=1.0}$	$C_{H_{r=1.0}}$	$h_{r=.85}$	$C_{H_{r=.85}}$
16	29	1.831E-01	9.137E-03	1.127E-04	6.285E-04	1.344E-04	7.499E-04
16	30	1.006E+01	5.022E-01	6.192E-03	3.454E-02	7.388E-03	4.122E-02
16	31	8.728E+00	4.355E-01	5.370E-03	2.996E-02	6.407E-03	3.575E-02
16	32	1.831E+00	9.135E-02	1.126E-03	6.284E-03	1.344E-03	7.498E-03
16	34	9.477E+00	4.729E-01	5.831E-03	3.253E-02	6.957E-03	3.881E-02
16	35	3.130E+00	1.562E-01	1.926E-03	1.074E-02	2.298E-03	1.282E-02
16	36	1.571E+00	7.838E-02	9.664E-04	5.392E-03	1.153E-03	6.433E-03
16	37	1.733E-01	8.646E-03	1.066E-04	5.948E-04	1.272E-04	7.097E-04
16	38	3.972E+00	1.982E-01	2.444E-03	1.363E-02	2.916E-03	1.627E-02
16	39	4.117E+00	2.054E-01	2.533E-03	1.413E-02	3.022E-03	1.686E-02
16	40	1.009E+00	5.037E-02	6.210E-04	3.465E-03	7.410E-04	4.134E-03
16	41	1.893E+00	9.447E-02	1.165E-03	6.499E-03	1.390E-03	7.754E-03
16	42	1.159E+00	5.781E-02	7.128E-04	3.977E-03	8.506E-04	4.745E-03
16	43	9.729E-01	4.855E-02	5.986E-04	3.339E-03	7.142E-04	3.985E-03
17	2	1.130E+01	1.330E+00	6.671E-03	2.275E-01	7.955E-03	2.713E-01
17	3	4.424E-01	5.206E-02	2.611E-04	8.905E-03	3.114E-04	1.062E-02
17	4	1.029E+01	1.211E+00	6.072E-03	2.071E-01	7.242E-03	2.470E-01
17	5	2.205E-01	2.595E-02	1.302E-04	4.439E-03	1.552E-04	5.294E-03
17	6	7.358E+00	8.660E-01	4.343E-03	1.481E-01	5.179E-03	1.767E-01
17	7	1.201E+01	1.413E+00	7.087E-03	2.417E-01	8.452E-03	2.883E-01
17	8	5.368E+00	6.317E-01	3.168E-03	1.081E-01	3.778E-03	1.289E-01
17	9	8.336E-01	9.810E-02	4.920E-04	1.678E-02	5.867E-04	2.001E-02
17	10	4.916E+00	5.785E-01	2.901E-03	9.896E-02	3.460E-03	1.180E-01
17	11	5.036E+00	5.927E-01	2.972E-03	1.014E-01	3.545E-03	1.209E-01
17	12	4.867E+00	5.728E-01	2.873E-03	9.799E-02	3.426E-03	1.169E-01
17	13	2.916E+00	3.432E-01	1.721E-03	5.871E-02	2.053E-03	7.001E-02
17	14	6.145E-01	7.232E-02	3.627E-04	1.237E-02	4.325E-04	1.475E-02
17	15	5.806E-02	6.833E-03	3.427E-05	1.169E-03	4.086E-05	1.394E-03
17	16	4.385E+00	5.161E-01	2.588E-03	8.828E-02	3.087E-03	1.053E-01
17	17	7.450E+00	8.768E-01	4.397E-03	1.500E-01	5.244E-03	1.789E-01
17	18	3.690E+00	4.343E-01	2.178E-03	7.429E-02	2.597E-03	8.859E-02
17	19	1.688E+00	1.986E-01	9.962E-04	3.398E-02	1.188E-03	4.052E-02
17	20	3.989E+00	4.694E-01	2.354E-03	8.030E-02	2.807E-03	9.576E-02
17	21	1.497E+00	1.762E-01	8.835E-04	3.014E-02	1.054E-03	3.594E-02

Table VI

HEAT TRANSFER DATA (Cont.)

RUN	GAGE	$\dot{q}_w$	$\dot{q}_w/\dot{q}_o$	$h_{r=1.0}$	$C_{H_{r=1.0}}$	$h_{r=.85}$	$C_{H_{r=.85}}$
17	22	2.462E+00	2.897E-01	1.453E-03	4.956E-02	1.733E-03	5.910E-02
17	23	6.914E-01	8.136E-02	4.080E-04	1.392E-02	4.866E-04	1.660E-02
17	24	3.910E+00	4.602E-01	2.308E-03	7.871E-02	2.752E-03	9.387E-02
17	25	4.881E-02	5.745E-03	2.881E-05	9.827E-04	3.436E-05	1.172E-03
17	26	3.793E+00	4.464E-01	2.239E-03	7.635E-02	2.670E-03	9.106E-02
17	27	2.120E+00	2.495E-01	1.251E-03	4.269E-02	1.492E-03	5.091E-02
17	28	6.915E-01	8.138E-02	4.081E-04	1.392E-02	4.867E-04	1.660E-02
17	29	5.796E-02	6.822E-03	3.421E-05	1.167E-03	4.080E-05	1.392E-03
17	30	3.906E+00	4.596E-01	2.305E-03	7.863E-02	2.749E-03	9.377E-02
17	31	4.140E+00	4.872E-01	2.443E-03	8.334E-02	2.914E-03	9.939E-02
17	32	6.135E-01	7.221E-02	3.621E-04	1.235E-02	4.318E-04	1.473E-02
17	33	4.411E-02	5.191E-03	2.603E-05	8.880E-04	3.105E-05	1.059E-03
17	34	4.194E+00	4.936E-01	2.476E-03	8.444E-02	2.952E-03	1.007E-01
17	35	2.136E+00	2.514E-01	1.261E-03	4.300E-02	1.503E-03	5.128E-02
17	36	5.796E-01	6.822E-02	3.421E-04	1.167E-02	4.080E-04	1.392E-02
17	38	4.223E+00	4.970E-01	2.492E-03	8.501E-02	2.972E-03	1.014E-01
17	39	1.335E+00	1.571E-01	7.879E-04	2.688E-02	9.396E-04	3.205E-02
17	40	8.604E-01	1.013E-01	5.078E-04	1.732E-02	6.056E-04	2.066E-02
17	41	1.676E+00	1.972E-01	9.892E-04	3.374E-02	1.180E-03	4.024E-02
17	42	6.810E-01	8.015E-02	4.020E-04	1.371E-02	4.794E-04	1.635E-02
17	43	5.501E-01	6.474E-02	3.247E-04	1.107E-02	3.872E-04	1.321E-02
18	2	9.133E+00	1.092E+00	5.380E-03	1.908E-01	6.417E-03	2.275E-01
18	3	7.353E-01	8.788E-02	4.332E-04	1.536E-02	5.166E-04	1.832E-02
18	4	7.025E+00	8.395E-01	4.138E-03	1.467E-01	4.935E-03	1.750E-01
18	5	4.194E-01	5.013E-02	2.471E-04	8.761E-03	2.947E-04	1.045E-02
18	6	4.832E+00	5.775E-01	2.847E-03	1.009E-01	3.395E-03	1.204E-01
18	7	8.875E+00	1.061E+00	5.228E-03	1.854E-01	6.235E-03	2.211E-01
18	8	3.105E+00	3.711E-01	1.829E-03	6.486E-02	2.182E-03	7.735E-02
18	9	1.234E-01	1.475E-02	7.270E-05	2.578E-03	8.670E-05	3.074E-03
18	10	2.983E+00	3.565E-01	1.757E-03	6.231E-02	2.096E-03	7.431E-02
18	11	2.852E+00	3.408E-01	1.680E-03	5.957E-02	2.004E-03	7.104E-02
18	12	2.866E+00	3.425E-01	1.688E-03	5.985E-02	2.013E-03	7.138E-02
18	13	6.100E-01	7.290E-02	3.593E-04	1.274E-02	4.285E-04	1.519E-02
18	14	6.130E-02	7.325E-03	3.611E-05	1.280E-03	4.306E-05	1.527E-03

Table VI
HEAT TRANSFER DATA (Cont.)

RUN	GAGE	$\dot{q}_w$	$\dot{q}_w/\dot{q}_o$	$h_{r=1.0}$	$C_{H_{r=1.0}}$	$h_{r=.85}$	$C_{H_{r=.85}}$
18	15	4.249E-02	5.078E-03	2.503E-05	8.875E-04	2.985E-05	1.058E-03
18	16	3.140E+00	3.752E-01	1.850E-03	6.558E-02	2.206E-03	7.821E-02
18	17	4.355E+00	5.205E-01	2.566E-03	9.097E-02	3.060E-03	1.085E-01
18	18	2.238E+00	2.675E-01	1.319E-03	4.675E-02	1.573E-03	5.576E-02
18	19	1.948E+00	2.328E-01	1.148E-03	4.069E-02	1.369E-03	4.853E-02
18	20	2.382E+00	2.847E-01	1.404E-03	4.976E-02	1.674E-03	5.934E-02
18	21	1.527E+00	1.825E-01	8.997E-04	3.190E-02	1.073E-03	3.804E-02
18	22	4.091E-01	4.890E-02	2.410E-04	8.546E-03	2.874E-04	1.019E-02
18	23	5.916E-02	7.070E-03	3.485E-05	1.236E-03	4.156E-05	1.474E-03
18	24	2.836E+00	3.389E-01	1.671E-03	5.923E-02	1.992E-03	7.064E-02
18	25	4.600E-02	5.497E-03	2.710E-05	9.607E-04	3.231E-05	1.146E-03
18	26	2.728E+00	3.260E-01	1.607E-03	5.697E-02	1.916E-03	6.795E-02
18	27	3.835E-01	4.583E-02	2.259E-04	8.011E-03	2.694E-04	9.553E-03
18	28	9.234E-02	1.104E-02	5.440E-05	1.929E-03	6.487E-05	2.300E-03
18	29	3.896E-02	4.656E-03	2.295E-05	8.138E-04	2.737E-05	9.705E-04
18	30	2.637E+00	3.152E-01	1.553E-03	5.508E-02	1.853E-03	6.569E-02
18	31	2.615E+00	3.125E-01	1.540E-03	5.461E-02	1.837E-03	6.513E-02
18	32	5.424E-02	6.482E-03	3.195E-05	1.133E-03	3.811E-05	1.351E-03
18	33	8.006E-02	9.567E-03	4.716E-05	1.672E-03	5.624E-05	1.994E-03
18	34	2.797E+00	3.343E-01	1.648E-03	5.843E-02	1.965E-03	6.968E-02
18	35	4.098E-01	4.897E-02	2.414E-04	8.559E-03	2.879E-04	1.021E-02
18	36	6.879E-02	8.221E-03	4.053E-05	1.437E-03	4.833E-05	1.714E-03
18	37	9.187E-02	1.098E-02	5.412E-05	1.919E-03	6.455E-05	2.288E-03
18	38	2.872E+00	3.432E-01	1.692E-03	5.999E-02	2.018E-03	7.154E-02
18	39	1.031E+00	1.232E-01	6.074E-04	2.154E-02	7.244E-04	2.568E-02
18	40	2.540E-01	3.035E-02	1.496E-04	5.305E-03	1.784E-04	6.327E-03
18	41	1.998E-01	2.387E-02	1.177E-04	4.172E-03	1.403E-04	4.976E-03
18	42	6.888E-02	8.231E-03	4.058E-05	1.439E-03	4.839E-05	1.716E-03
18	43	4.824E-02	5.765E-03	2.842E-05	1.008E-03	3.389E-05	1.202E-03
19	4	3.775E+00	1.750E-01	2.283E-03	1.145E-02	2.723E-03	1.366E-02
19	5	1.666E-01	7.725E-03	1.007E-04	5.054E-04	1.202E-04	6.029E-04
19	6	9.301E+00	4.313E-01	5.625E-03	2.822E-02	6.709E-03	3.366E-02
19	7	1.793E-01	8.312E-03	1.084E-04	5.438E-04	1.293E-04	6.487E-04
19	8	1.263E+01	5.858E-01	7.640E-03	3.833E-02	9.114E-03	4.572E-02

Table VI

HEAT TRANSFER DATA (Cont.)

RUN	GAGE	$\dot{q}_w$	$\dot{q}_w/\dot{q}_o$	$h_{r=1.0}$	$C_{H_{r=1.0}}$	$h_{r=.85}$	$C_{H_{r=.85}}$
19	9	1.063E+00	4.930E-02	6.429E-04	3.226E-03	7.670E-04	3.848E-03
19	10	1.499E+01	6.951E-01	9.066E-03	4.548E-02	1.081E-02	5.425E-02
19	11	1.362E+01	6.317E-01	8.238E-03	4.133E-02	9.827E-03	4.930E-02
19	12	7.833E+00	3.632E-01	4.737E-03	2.376E-02	5.650E-03	2.835E-02
19	13	5.544E+00	2.570E-01	3.352E-03	1.682E-02	3.999E-03	2.006E-02
19	14	1.996E+00	9.256E-02	1.207E-03	6.056E-03	1.440E-03	7.224E-03
19	15	2.145E-01	9.946E-03	1.297E-04	6.507E-04	1.547E-04	7.762E-04
19	16	2.641E+01	1.224E+00	1.597E-02	8.011E-02	1.905E-02	9.557E-02
19	17	3.888E+00	1.803E-01	2.351E-03	1.179E-02	2.804E-03	1.407E-02
19	18	1.186E+01	5.498E-01	7.171E-03	3.597E-02	8.554E-03	4.291E-02
19	19	5.086E+00	2.358E-01	3.076E-03	1.543E-02	3.669E-03	1.841E-02
19	20	1.219E+01	5.652E-01	7.371E-03	3.698E-02	8.793E-03	4.411E-02
19	21	6.538E+00	3.031E-01	3.953E-03	1.983E-02	4.716E-03	2.366E-02
19	22	6.821E+00	3.163E-01	4.125E-03	2.069E-02	4.920E-03	2.468E-02
19	23	1.985E+00	9.204E-02	1.200E-03	6.022E-03	1.432E-03	7.183E-03
19	24	1.319E+01	6.117E-01	7.978E-03	4.002E-02	9.517E-03	4.774E-02
19	25	2.149E-01	9.964E-03	1.299E-04	6.519E-04	1.550E-04	7.777E-04
19	26	1.278E+01	5.924E-01	7.726E-03	3.876E-02	9.216E-03	4.623E-02
19	27	1.160E+01	5.378E-01	7.013E-03	3.518E-02	8.366E-03	4.197E-02
19	28	1.965E+00	9.113E-02	1.189E-03	5.963E-03	1.418E-03	7.113E-03
19	29	1.882E-01	8.726E-03	1.138E-04	5.709E-04	1.358E-04	6.810E-04
19	30	1.334E+01	6.186E-01	8.068E-03	4.047E-02	9.624E-03	4.828E-02
19	31	1.417E+01	6.571E-01	8.570E-03	4.299E-02	1.022E-02	5.129E-02
19	32	1.776E+00	8.234E-02	1.074E-03	5.387E-03	1.281E-03	6.427E-03
19	33	2.879E-01	1.335E-02	1.741E-04	8.735E-04	2.077E-04	1.042E-03
19	34	1.346E+01	6.242E-01	8.140E-03	4.084E-02	9.710E-03	4.871E-02
19	35	4.941E+00	2.291E-01	2.988E-03	1.499E-02	3.564E-03	1.788E-02
19	36	1.798E+00	8.336E-02	1.087E-03	5.454E-03	1.297E-03	6.506E-03
19	37	1.839E-01	8.525E-03	1.112E-04	5.578E-04	1.326E-04	6.654E-04
19	38	1.524E+01	7.064E-01	9.213E-03	4.622E-02	1.099E-02	5.513E-02
19	39	7.462E+00	3.460E-01	4.512E-03	2.264E-02	5.382E-03	2.700E-02
19	40	3.780E+00	1.753E-01	2.286E-03	1.147E-02	2.727E-03	1.368E-02
19	41	6.233E+00	2.890E-01	3.769E-03	1.891E-02	4.496E-03	2.256E-02
19	42	1.680E+00	7.792E-02	1.016E-03	5.098E-03	1.212E-03	6.081E-03
19	43	1.471E+01	6.822E-01	8.897E-03	4.463E-02	1.061E-02	5.324E-02

Table VI

HEAT TRANSFER DATA (Cont.)

RUN	GAGE	$\dot{q}_w$	$\dot{q}_w/\dot{q}_o$	$h_{r=1.0}$	$C_{H_{r=1.0}}$	$h_{r=.85}$	$C_{H_{r=.85}}$
19	44	1.618E+01	7.500E-01	9.781E-03	4.907E-02	1.167E-02	5.854E-02
19	51	3.824E+01	1.773E+00	2.313E-02	1.160E-01	2.759E-02	1.384E-01
19	52	3.642E+01	1.689E+00	2.202E-02	1.105E-01	2.627E-02	1.318E-01
20	4	1.404E+00	1.696E-01	8.365E-04	2.939E-02	9.977E-04	3.505E-02
20	5	4.641E-02	5.606E-03	2.765E-05	9.715E-04	3.298E-05	1.159E-03
20	6	3.089E+00	3.731E-01	1.840E-03	6.465E-02	2.195E-03	7.711E-02
20	7	3.080E-02	3.720E-03	1.835E-05	6.446E-04	2.188E-05	7.689E-04
20	8	4.248E+00	5.131E-01	2.531E-03	8.891E-02	3.018E-03	1.060E-01
20	9	5.139E-01	6.207E-02	3.062E-04	1.076E-02	3.652E-04	1.283E-02
20	10	4.303E+00	5.198E-01	2.564E-03	9.007E-02	3.058E-03	1.074E-01
20	11	3.575E+00	4.318E-01	2.130E-03	7.483E-02	2.540E-03	8.925E-02
20	12	3.985E+00	4.813E-01	2.374E-03	8.340E-02	2.831E-03	9.948E-02
20	13	2.602E+00	3.142E-01	1.550E-03	5.445E-02	1.849E-03	6.495E-02
20	14	6.282E-01	7.588E-02	3.743E-04	1.315E-02	4.464E-04	1.568E-02
20	15	4.777E-02	5.770E-03	2.846E-05	9.999E-04	3.395E-05	1.193E-03
20	16	5.627E+00	6.796E-01	3.352E-03	1.178E-01	3.998E-03	1.405E-01
20	17	4.033E+00	4.871E-01	2.403E-03	8.442E-02	2.866E-03	1.007E-01
20	18	4.039E+00	4.878E-01	2.406E-03	8.454E-02	2.870E-03	1.008E-01
20	19	2.260E+00	2.730E-01	1.347E-03	4.732E-02	1.606E-03	5.643E-02
20	20	4.219E+00	5.096E-01	2.513E-03	8.830E-02	2.998E-03	1.053E-01
20	21	2.444E+00	2.953E-01	1.456E-03	5.117E-02	1.737E-03	6.103E-02
20	22	2.181E+00	2.634E-01	1.299E-03	4.565E-02	1.550E-03	5.444E-02
20	23	6.386E-01	7.714E-02	3.805E-04	1.337E-02	4.538E-04	1.594E-02
20	24	4.776E+00	5.769E-01	2.845E-03	9.997E-02	3.394E-03	1.192E-01
20	25	4.612E-02	5.571E-03	2.748E-05	9.654E-04	3.277E-05	1.151E-03
20	26	4.391E+00	5.303E-01	2.616E-03	9.190E-02	3.120E-03	1.096E-01
20	27	2.465E+00	2.977E-01	1.468E-03	5.159E-02	1.751E-03	6.153E-02
20	28	6.512E-01	7.866E-02	3.880E-04	1.363E-02	4.627E-04	1.626E-02
20	29	5.818E-02	7.027E-03	3.466E-05	1.218E-03	4.134E-05	1.452E-03
20	30	4.696E+00	5.672E-01	2.798E-03	9.829E-02	3.337E-03	1.172E-01
20	31	4.873E+00	5.885E-01	2.903E-03	1.020E-01	3.462E-03	1.216E-01
20	32	6.269E-01	7.572E-02	3.735E-04	1.312E-02	4.455E-04	1.565E-02
20	33	8.133E-02	9.824E-03	4.845E-05	1.702E-03	5.779E-05	2.030E-03
20	34	5.700E+00	6.884E-01	3.396E-03	1.193E-01	4.050E-03	1.423E-01

Table VI

HEAT TRANSFER DATA (Cont.)

RUN	GAGE	$\dot{q}_w$	$\dot{q}_w/\dot{q}_o$	$h_{r=1.0}$	$C_{H_{r=1.0}}$	$h_{r=.85}$	$C_{H_{r=.85}}$
20	35	2.849E+00	3.441E-01	1.697E-03	5.963E-02	2.024E-03	7.112E-02
20	36	4.536E-01	5.479E-02	2.703E-04	9.495E-03	3.224E-04	1.133E-02
20	37	9.586E-02	1.158E-02	5.711E-05	2.006E-03	6.812E-05	2.393E-03
20	38	4.013E+00	4.847E-01	2.391E-03	8.399E-02	2.851E-03	1.002E-01
20	39	2.820E+00	3.406E-01	1.680E-03	5.902E-02	2.004E-03	7.039E-02
20	40	9.792E-01	1.183E-01	5.834E-04	2.050E-02	6.958E-04	2.445E-02
20	41	1.554E+00	1.877E-01	9.258E-04	3.253E-02	1.104E-03	3.879E-02
20	42	7.040E-01	8.503E-02	4.194E-04	1.474E-02	5.002E-04	1.757E-02
20	43	5.133E+00	6.200E-01	3.058E-03	1.074E-01	3.648E-03	1.282E-01
20	44	5.520E+00	6.668E-01	3.289E-03	1.156E-01	3.923E-03	1.378E-01
20	51	1.420E+01	1.715E+00	8.460E-03	2.972E-01	1.009E-02	3.545E-01
21	4	2.021E-01	9.580E-03	1.227E-04	6.399E-04	1.464E-04	7.635E-04
21	5	2.089E-01	9.904E-03	1.269E-04	6.616E-04	1.514E-04	7.893E-04
21	6	2.598E-01	1.232E-02	1.578E-04	8.227E-04	1.883E-04	9.816E-04
21	7	2.904E-01	1.377E-02	1.764E-04	9.196E-04	2.104E-04	1.097E-03
21	8	3.333E-01	1.580E-02	2.024E-04	1.055E-03	2.415E-04	1.259E-03
21	9	3.206E-01	1.520E-02	1.947E-04	1.015E-03	2.323E-04	1.211E-03
21	10	3.606E-01	1.710E-02	2.190E-04	1.142E-03	2.613E-04	1.363E-03
21	11	3.373E-01	1.599E-02	2.049E-04	1.068E-03	2.444E-04	1.274E-03
21	12	4.099E-01	1.943E-02	2.490E-04	1.298E-03	2.970E-04	1.549E-03
21	13	6.616E-01	3.136E-02	4.019E-04	2.095E-03	4.794E-04	2.500E-03
21	14	4.227E-01	2.004E-02	2.568E-04	1.339E-03	3.063E-04	1.597E-03
21	15	5.278E-01	2.502E-02	3.206E-04	1.671E-03	3.825E-04	1.994E-03
21	16	5.272E-01	2.499E-02	3.202E-04	1.670E-03	3.821E-04	1.992E-03
21	17	4.404E-01	2.088E-02	2.675E-04	1.395E-03	3.192E-04	1.664E-03
21	18	4.922E-01	2.334E-02	2.990E-04	1.559E-03	3.567E-04	1.860E-03
21	19	2.879E-01	1.365E-02	1.749E-04	9.116E-04	2.086E-04	1.088E-03
21	20	4.978E-01	2.360E-02	3.024E-04	1.577E-03	3.608E-04	1.881E-03
21	21	2.973E-01	1.409E-02	1.806E-04	9.414E-04	2.154E-04	1.123E-03
21	22	6.501E-01	3.082E-02	3.949E-04	2.059E-03	4.711E-04	2.456E-03
21	23	4.942E-01	2.343E-02	3.002E-04	1.565E-03	3.582E-04	1.867E-03
21	24	5.249E-01	2.488E-02	3.188E-04	1.662E-03	3.804E-04	1.983E-03
21	25	7.597E-01	3.602E-02	4.615E-04	2.406E-03	5.506E-04	2.870E-03
21	26	5.844E-01	2.771E-02	3.550E-04	1.851E-03	4.235E-04	2.208E-03

Table VI

HEAT TRANSFER DATA (Cont.)

RUN	GAGE	$\dot{q}_w$	$\dot{q}_w/\dot{q}_0$	$h_{r=1.0}$	$C_{H_{r=1.0}}$	$h_{r=.85}$	$C_{H_{r=.85}}$
21	27	8.522E-01	4.040E-02	5.177E-04	2.699E-03	6.176E-04	3.220E-03
21	28	6.509E-01	3.086E-02	3.954E-04	2.061E-03	4.717E-04	2.459E-03
21	29	6.611E-01	3.134E-02	4.016E-04	2.094E-03	4.791E-04	2.498E-03
21	30	7.118E-01	3.375E-02	4.324E-04	2.254E-03	5.159E-04	2.690E-03
21	31	6.974E-01	3.306E-02	4.236E-04	2.209E-03	5.054E-04	2.635E-03
21	32	7.547E-01	3.578E-02	4.585E-04	2.390E-03	5.470E-04	2.852E-03
21	33	2.482E+00	1.177E-01	1.507E-03	7.859E-03	1.799E-03	9.377E-03
21	34	1.344E+00	6.373E-02	8.165E-04	4.257E-03	9.741E-04	5.079E-03
21	35	1.157E+00	5.486E-02	7.029E-04	3.665E-03	8.386E-04	4.372E-03
21	36	9.622E-01	4.562E-02	5.845E-04	3.047E-03	6.974E-04	3.636E-03
21	37	1.287E+00	6.103E-02	7.820E-04	4.077E-03	9.329E-04	4.864E-03
21	38	3.127E+00	1.483E-01	1.900E-03	9.903E-03	2.266E-03	1.182E-02
21	39	3.500E+00	1.659E-01	2.126E-03	1.108E-02	2.536E-03	1.322E-02
21	40	1.851E+00	8.773E-02	1.124E-03	5.861E-03	1.341E-03	6.992E-03
21	41	1.302E+00	6.173E-02	7.910E-04	4.124E-03	9.437E-04	4.920E-03
21	42	1.192E+00	5.649E-02	7.238E-04	3.774E-03	8.636E-04	4.502E-03
21	43	1.070E+01	5.071E-01	6.497E-03	3.387E-02	7.751E-03	4.041E-02
21	44	3.044E+01	1.443E+00	1.849E-02	9.639E-02	2.206E-02	1.150E-01
21	51	3.742E+01	1.774E+00	2.273E-02	1.185E-01	2.712E-02	1.414E-01
23	4	8.901E-01	1.067E-01	5.222E-04	1.886E-02	6.227E-04	2.250E-02
23	5	2.071E-02	2.482E-03	1.215E-05	4.390E-04	1.449E-05	5.235E-04
23	6	1.741E+00	2.086E-01	1.021E-03	3.690E-02	1.218E-03	4.400E-02
23	8	2.074E+00	2.485E-01	1.216E-03	4.395E-02	1.451E-03	5.241E-02
23	10	2.855E+00	3.422E-01	1.675E-03	6.051E-02	1.998E-03	7.217E-02
23	11	2.745E+00	3.289E-01	1.610E-03	5.817E-02	1.920E-03	6.937E-02
23	12	2.317E+00	2.776E-01	1.359E-03	4.910E-02	1.621E-03	5.856E-02
23	13	5.268E-01	6.312E-02	3.090E-04	1.116E-02	3.685E-04	1.331E-02
23	14	7.011E-02	8.401E-03	4.113E-05	1.486E-03	4.905E-05	1.772E-03
23	15	5.819E-02	6.972E-03	3.413E-05	1.233E-03	4.071E-05	1.471E-03
23	16	3.683E+00	4.413E-01	2.160E-03	7.805E-02	2.576E-03	9.307E-02
23	17	2.980E+00	3.571E-01	1.748E-03	6.316E-02	2.085E-03	7.532E-02
23	18	2.810E+00	3.367E-01	1.648E-03	5.955E-02	1.966E-03	7.102E-02
23	19	1.395E+00	1.672E-01	8.185E-04	2.957E-02	9.761E-04	3.526E-02
23	20	2.835E+00	3.397E-01	1.663E-03	6.008E-02	1.983E-03	7.165E-02

Table VI

HEAT TRANSFER DATA (Cont.)

RUN	GAGE	$\dot{q}_w$	$\dot{q}_w/\dot{q}_o$	$h_{r=1.0}$	$C_{H_{r=1.0}}$	$h_{r=.85}$	$C_{H_{r=.85}}$
23	21	1.447E+00	1.734E-01	8.491E-04	3.068E-02	1.013E-03	3.658E-02
23	22	4.340E-01	5.200E-02	2.546E-04	9.197E-03	3.036E-04	1.097E-02
23	24	3.011E+00	3.608E-01	1.766E-03	6.381E-02	2.106E-03	7.609E-02
23	25	4.042E-02	4.844E-03	2.371E-05	8.567E-04	2.828E-05	1.022E-03
23	26	2.788E+00	3.341E-01	1.636E-03	5.909E-02	1.950E-03	7.046E-02
23	27	5.349E-01	6.409E-02	3.138E-04	1.134E-02	3.742E-04	1.352E-02
23	30	2.792E+00	3.346E-01	1.638E-03	5.917E-02	1.953E-03	7.057E-02
23	31	3.420E+00	4.098E-01	2.006E-03	7.249E-02	2.393E-03	8.644E-02
23	32	5.031E-02	6.029E-03	2.952E-05	1.066E-03	3.520E-05	1.272E-03
23	33	7.949E-02	9.526E-03	4.663E-05	1.685E-03	5.561E-05	2.009E-03
23	34	2.421E+00	2.901E-01	1.420E-03	5.130E-02	1.693E-03	6.118E-02
23	35	4.275E-01	5.122E-02	2.508E-04	9.059E-03	2.990E-04	1.080E-02
23	36	7.481E-02	8.964E-03	4.389E-05	1.585E-03	5.234E-05	1.891E-03
23	38	2.491E+00	2.985E-01	1.461E-03	5.279E-02	1.743E-03	6.296E-02
23	39	1.842E+00	2.207E-01	1.080E-03	3.903E-02	1.288E-03	4.655E-02
23	40	3.870E-01	4.637E-02	2.270E-04	8.202E-03	2.707E-04	9.781E-03
23	41	2.849E-01	3.414E-02	1.671E-04	6.038E-03	1.993E-04	7.201E-03
23	42	1.303E-01	1.562E-02	7.645E-05	2.762E-03	9.117E-05	3.294E-03
23	43	1.729E+00	2.072E-01	1.014E-03	3.665E-02	1.210E-03	4.371E-02
23	44	6.120E+00	7.333E-01	3.590E-03	1.297E-01	4.281E-03	1.547E-01
23	51	1.511E+01	1.810E+00	8.863E-03	3.202E-01	1.057E-02	3.818E-01
23	52	1.485E+01	1.779E+00	8.709E-03	3.146E-01	1.039E-02	3.752E-01
24	4	2.428E-01	2.954E-02	1.426E-04	5.328E-03	1.700E-04	6.354E-03
24	5	2.396E-01	2.915E-02	1.407E-04	5.258E-03	1.678E-04	6.271E-03
24	6	3.986E-01	4.850E-02	2.341E-04	8.748E-03	2.792E-04	1.043E-02
24	7	4.176E-01	5.082E-02	2.452E-04	9.165E-03	2.925E-04	1.093E-02
24	8	5.693E-01	6.927E-02	3.343E-04	1.249E-02	3.987E-04	1.490E-02
24	10	5.929E-01	7.214E-02	3.482E-04	1.301E-02	4.152E-04	1.552E-02
24	11	6.750E-01	8.212E-02	3.964E-04	1.481E-02	4.727E-04	1.766E-02
24	12	7.154E-01	8.705E-02	4.201E-04	1.570E-02	5.010E-04	1.872E-02
24	13	9.264E-02	1.127E-02	5.440E-05	2.033E-03	6.488E-05	2.424E-03
24	14	6.528E-02	7.943E-03	3.834E-05	1.433E-03	4.572E-05	1.709E-03
24	15	5.888E-01	7.164E-02	3.457E-04	1.292E-02	4.123E-04	1.541E-02
24	16	6.746E-01	8.208E-02	3.962E-04	1.480E-02	4.725E-04	1.766E-02

Table VI

HEAT TRANSFER DATA (Cont.)

RUN	GAGE	$\dot{q}_w$	$\dot{q}_w/\dot{q}_o$	$h_{r=1.0}$	$C_{H_{r=1.0}}$	$h_{r=.85}$	$C_{H_{r=.85}}$
24	17	8.622E-01	1.049E-01	5.063E-04	1.892E-02	6.038E-04	2.256E-02
24	18	7.015E-01	8.535E-02	4.119E-04	1.539E-02	4.913E-04	1.836E-02
24	19	4.492E-01	5.465E-02	2.638E-04	9.857E-03	3.146E-04	1.176E-02
24	20	6.853E-01	8.338E-02	4.024E-04	1.504E-02	4.800E-04	1.794E-02
24	21	4.657E-01	5.667E-02	2.735E-04	1.022E-02	3.262E-04	1.219E-02
24	22	4.842E-02	5.891E-03	2.843E-05	1.062E-03	3.391E-05	1.267E-03
24	23	6.469E-02	7.871E-03	3.799E-05	1.420E-03	4.531E-05	1.693E-03
24	24	6.739E-01	8.199E-02	3.957E-04	1.479E-02	4.719E-04	1.764E-02
24	25	5.643E-01	6.866E-02	3.314E-04	1.238E-02	3.952E-04	1.477E-02
24	26	6.520E-01	7.933E-02	3.829E-04	1.431E-02	4.566E-04	1.706E-02
24	27	8.831E-02	1.075E-02	5.186E-05	1.938E-03	6.185E-05	2.311E-03
24	28	7.708E-02	9.379E-03	4.526E-05	1.692E-03	5.398E-05	2.017E-03
24	29	8.131E-02	9.894E-03	4.775E-05	1.784E-03	5.695E-05	2.128E-03
24	30	7.137E-01	8.684E-02	4.191E-04	1.566E-02	4.998E-04	1.868E-02
24	31	7.195E-01	8.754E-02	4.225E-04	1.579E-02	5.039E-04	1.883E-02
24	33	6.452E-01	7.850E-02	3.789E-04	1.416E-02	4.518E-04	1.689E-02
24	34	6.245E-01	7.599E-02	3.667E-04	1.370E-02	4.374E-04	1.634E-02
24	35	4.727E-02	5.752E-03	2.776E-05	1.037E-03	3.311E-05	1.237E-03
24	37	1.429E-01	1.738E-02	8.389E-05	3.135E-03	1.000E-04	3.739E-03
24	38	7.267E-01	8.842E-02	4.267E-04	1.595E-02	5.089E-04	1.902E-02
24	39	3.726E-01	4.533E-02	2.188E-04	8.175E-03	2.609E-04	9.750E-03
24	40	9.401E-02	1.144E-02	5.520E-05	2.063E-03	6.584E-05	2.460E-03
24	43	5.930E-01	7.216E-02	3.482E-04	1.301E-02	4.153E-04	1.552E-02
24	44	6.152E+00	7.485E-01	3.612E-03	1.350E-01	4.308E-03	1.610E-01
24	51	1.463E+01	1.780E+00	8.589E-03	3.210E-01	1.024E-02	3.828E-01
24	52	1.467E+01	1.785E+00	8.615E-03	3.219E-01	1.027E-02	3.839E-01
25	4	1.956E-01	9.073E-03	1.180E-04	5.959E-04	1.408E-04	7.108E-04
25	5	2.384E-01	1.106E-02	1.439E-04	7.264E-04	1.717E-04	8.666E-04
25	6	3.112E-01	1.444E-02	1.878E-04	9.481E-04	2.240E-04	1.131E-03
25	7	3.501E-01	1.624E-02	2.113E-04	1.067E-03	2.520E-04	1.272E-03
25	8	5.182E-01	2.404E-02	3.128E-04	1.579E-03	3.731E-04	1.884E-03
25	9	4.428E-01	2.054E-02	2.672E-04	1.349E-03	3.188E-04	1.609E-03
25	10	5.182E-01	2.404E-02	3.128E-04	1.579E-03	3.731E-04	1.883E-03
25	11	5.501E-01	2.552E-02	3.320E-04	1.676E-03	3.961E-04	1.999E-03

Table VI

HEAT TRANSFER DATA (Cont.)

RUN	GAGE	$\dot{q}_w$	$\dot{q}_w/\dot{q}_o$	$h_{r=1.0}$	$C_{H_{r=1.0}}$	$h_{r=.85}$	$C_{H_{r=.85}}$
25	12	5.775E-01	2.679E-02	3.486E-04	1.760E-03	4.158E-04	2.099E-03
25	13	6.252E-01	2.901E-02	3.774E-04	1.905E-03	4.501E-04	2.272E-03
25	14	5.841E-01	2.710E-02	3.525E-04	1.780E-03	4.205E-04	2.123E-03
25	15	5.603E-01	2.599E-02	3.382E-04	1.707E-03	4.034E-04	2.037E-03
25	16	6.297E-01	2.922E-02	3.801E-04	1.919E-03	4.534E-04	2.289E-03
25	17	6.550E-01	3.039E-02	3.954E-04	1.996E-03	4.716E-04	2.381E-03
25	18	6.570E-01	3.048E-02	3.966E-04	2.002E-03	4.731E-04	2.388E-03
25	19	6.502E-01	3.016E-02	3.924E-04	1.981E-03	4.681E-04	2.363E-03
25	20	7.619E-01	3.535E-02	4.598E-04	2.321E-03	5.485E-04	2.769E-03
25	21	7.337E-01	3.404E-02	4.429E-04	2.236E-03	5.283E-04	2.667E-03
25	22	7.246E-01	3.362E-02	4.374E-04	2.208E-03	5.217E-04	2.634E-03
25	23	7.325E-01	3.399E-02	4.421E-04	2.232E-03	5.274E-04	2.663E-03
25	24	7.926E-01	3.677E-02	4.784E-04	2.415E-03	5.707E-04	2.881E-03
25	25	7.842E-01	3.638E-02	4.733E-04	2.389E-03	5.646E-04	2.850E-03
25	26	8.394E-01	3.894E-02	5.066E-04	2.558E-03	6.044E-04	3.051E-03
25	27	8.015E-01	3.718E-02	4.838E-04	2.442E-03	5.771E-04	2.913E-03
25	28	8.280E-01	3.841E-02	4.998E-04	2.523E-03	5.962E-04	3.010E-03
25	29	8.144E-01	3.779E-02	4.916E-04	2.482E-03	5.864E-04	2.960E-03
25	30	9.701E-01	4.501E-02	5.855E-04	2.956E-03	6.985E-04	3.526E-03
25	31	1.044E+00	4.843E-02	6.301E-04	3.181E-03	7.517E-04	3.795E-03
25	32	1.006E+00	4.669E-02	6.074E-04	3.066E-03	7.245E-04	3.658E-03
25	34	1.450E+00	6.727E-02	8.751E-04	4.418E-03	1.044E-03	5.270E-03
25	35	1.306E+00	6.059E-02	7.883E-04	3.980E-03	9.404E-04	4.747E-03
25	36	1.273E+00	5.908E-02	7.686E-04	3.880E-03	9.169E-04	4.629E-03
25	37	1.310E+00	6.077E-02	7.906E-04	3.991E-03	9.431E-04	4.761E-03
25	38	2.221E+00	1.030E-01	1.340E-03	6.767E-03	1.599E-03	8.072E-03
25	39	2.162E+00	1.003E-01	1.305E-03	6.589E-03	1.557E-03	7.860E-03
25	40	2.165E+00	1.004E-01	1.307E-03	6.596E-03	1.559E-03	7.869E-03
25	41	2.039E+00	9.458E-02	1.230E-03	6.212E-03	1.468E-03	7.410E-03
25	42	1.912E+00	8.869E-02	1.154E-03	5.825E-03	1.376E-03	6.948E-03
25	43	1.086E+01	5.036E-01	6.552E-03	3.308E-02	7.816E-03	3.946E-02
25	44	3.[illegible]E+01	1.480E+00	1.925E-02	9.719E-02	2.296E-02	1.159E-01
25	51	4.164E+01	1.932E+00	2.513E-02	1.269E-01	2.998E-02	1.513E-01
25	52	4.103E+01	1.903E+00	2.476E-02	1.250E-01	2.954E-02	1.491E-01
26	5	1.931E-01	9.108E-03	2.075E-04	2.297E-04	2.502E-04	2.770E-04

Table VI

HEAT TRANSFER DATA (Cont.)

RUN	GAGE	$\dot{q}_w$	$\dot{q}_w/\dot{q}_o$	$h_{r=1.0}$	$C_{H_{r=1.0}}$	$h_{r=.85}$	$C_{H_{r=.85}}$
26	8	4.857E-01	2.291E-02	5.217E-04	5.776E-04	6.293E-04	6.966E-04
26	10	5.517E-01	2.602E-02	5.926E-04	6.560E-04	7.148E-04	7.913E-04
26	11	6.258E-01	2.951E-02	6.722E-04	7.442E-04	8.108E-04	8.976E-04
26	12	6.273E-01	2.958E-02	6.738E-04	7.459E-04	8.127E-04	8.996E-04
26	13	7.064E-01	3.331E-02	7.587E-04	8.400E-04	9.152E-04	1.013E-03
26	15	5.453E-01	2.572E-02	5.858E-04	6.485E-04	7.065E-04	7.821E-04
26	16	5.484E-01	2.586E-02	5.890E-04	6.520E-04	7.104E-04	7.864E-04
26	17	6.656E-01	3.139E-02	7.149E-04	7.914E-04	8.623E-04	9.545E-04
26	18	6.847E-01	3.229E-02	7.354E-04	8.141E-04	8.870E-04	9.820E-04
26	19	6.914E-01	3.260E-02	7.426E-04	8.221E-04	8.957E-04	9.916E-04
26	20	7.604E-01	3.586E-02	8.168E-04	9.042E-04	9.851E-04	1.091E-03
26	21	7.243E-01	3.415E-02	7.779E-04	8.612E-04	9.383E-04	1.039E-03
26	22	7.101E-01	3.349E-02	7.627E-04	8.444E-04	9.200E-04	1.018E-03
26	23	7.871E-01	3.712E-02	8.455E-04	9.360E-04	1.020E-03	1.129E-03
26	24	7.858E-01	3.706E-02	8.441E-04	9.344E-04	1.018E-03	1.127E-03
26	25	9.230E-01	4.353E-02	9.914E-04	1.098E-03	1.196E-03	1.324E-03
26	26	8.005E-01	3.775E-02	8.598E-04	9.519E-04	1.037E-03	1.148E-03
26	27	8.132E-01	3.835E-02	8.735E-04	9.670E-04	1.054E-03	1.166E-03
26	28	8.566E-01	4.040E-02	9.201E-04	1.019E-03	1.110E-03	1.229E-03
26	29	7.350E-01	3.466E-02	7.895E-04	8.740E-04	9.523E-04	1.054E-03
26	30	1.051E+00	4.954E-02	1.128E-03	1.249E-03	1.361E-03	1.507E-03
26	31	1.098E+00	5.179E-02	1.180E-03	1.306E-03	1.423E-03	1.575E-03
26	32	1.097E+00	5.173E-02	1.178E-03	1.304E-03	1.421E-03	1.573E-03
26	33	1.259E+00	5.937E-02	1.352E-03	1.497E-03	1.631E-03	1.806E-03
26	34	1.401E+00	6.608E-02	1.505E-03	1.666E-03	1.816E-03	2.010E-03
26	35	1.761E+00	8.305E-02	1.892E-03	2.094E-03	2.282E-03	2.526E-03
26	36	1.371E+00	6.465E-02	1.473E-03	1.630E-03	1.776E-03	1.966E-03
26	37	1.434E+00	6.764E-02	1.541E-03	1.706E-03	1.858E-03	2.057E-03
26	38	2.537E+00	1.196E-01	2.725E-03	3.017E-03	3.287E-03	3.639E-03
26	39	2.023E+00	9.540E-02	2.173E-03	2.406E-03	2.621E-03	2.901E-03
26	40	1.861E+00	8.777E-02	1.999E-03	2.213E-03	2.411E-03	2.669E-03
26	42	1.902E+00	8.968E-02	2.043E-03	2.261E-03	2.464E-03	2.728E-03
26	43	1.400E+01	6.604E-01	1.504E-02	1.665E-02	1.814E-02	2.008E-02
26	44	3.801E+01	1.792E+00	4.082E-02	4.519E-02	4.924E-02	5.451E-02
26	51	6.563E+01	3.095E+00	7.050E-02	7.804E-02	8.503E-02	9.413E-02

Table VI

HEAT TRANSFER DATA (Cont.)

RUN	GAGE	$\dot{q}_w$	$\dot{q}_w/\dot{q}_o$	$h_{r=1.0}$	$C_{H_{r=1.0}}$	$h_{r=.85}$	$C_{H_{r=.85}}$
26	52	4.831E+01	2.278E+00	5.189E-02	5.744E-02	6.258E-02	6.928E-02
27	4	5.851E-02	7.052E-03	3.501E-05	1.218E-03	4.176E-05	1.453E-03
27	5	6.621E-02	7.980E-03	3.962E-05	1.379E-03	4.726E-05	1.645E-03
27	6	1.403E-01	1.691E-02	8.393E-05	2.921E-03	1.001E-04	3.484E-03
27	7	1.207E-01	1.455E-02	7.224E-05	2.514E-03	8.617E-05	2.999E-03
27	8	1.676E-01	2.021E-02	1.003E-04	3.490E-03	1.197E-04	4.164E-03
27	9	1.437E-01	1.732E-02	8.597E-05	2.992E-03	1.026E-04	3.569E-03
27	10	1.820E-01	2.194E-02	1.089E-04	3.790E-03	1.299E-04	4.522E-03
27	11	2.321E-01	2.797E-02	1.389E-04	4.833E-03	1.657E-04	5.765E-03
27	12	2.165E-01	2.610E-02	1.295E-04	4.508E-03	1.545E-04	5.378E-03
27	13	2.218E-01	2.673E-02	1.327E-04	4.618E-03	1.583E-04	5.509E-03
27	14	2.100E-01	2.531E-02	1.257E-04	4.373E-03	1.499E-04	5.216E-03
27	15	2.291E-01	2.761E-02	1.371E-04	4.770E-03	1.635E-04	5.691E-03
27	16	1.929E-01	2.325E-02	1.154E-04	4.016E-03	1.377E-04	4.791E-03
27	17	2.456E-01	2.961E-02	1.470E-04	5.115E-03	1.753E-04	6.101E-03
27	18	2.427E-01	2.925E-02	1.452E-04	5.053E-03	1.732E-04	6.028E-03
27	19	2.604E-01	3.139E-02	1.558E-04	5.422E-03	1.859E-04	6.468E-03
27	20	2.635E-01	3.176E-02	1.577E-04	5.487E-03	1.881E-04	6.546E-03
27	21	2.408E-01	2.903E-02	1.441E-04	5.015E-03	1.719E-04	5.982E-03
27	22	2.351E-01	2.845E-02	1.413E-04	4.916E-03	1.685E-04	5.864E-03
27	23	2.329E-01	2.807E-02	1.394E-04	4.849E-03	1.662E-04	5.785E-03
27	24	2.546E-01	3.068E-02	1.523E-04	5.300E-03	1.817E-04	6.323E-03
27	25	2.812E-01	3.389E-02	1.683E-04	5.855E-03	2.007E-04	6.985E-03
27	26	2.983E-01	3.595E-02	1.785E-04	6.211E-03	2.129E-04	7.409E-03
27	27	2.697E-01	3.251E-02	1.614E-04	5.616E-03	1.925E-04	6.700E-03
27	28	3.197E-01	3.854E-02	1.913E-04	6.657E-03	2.282E-04	7.941E-03
27	29	2.666E-01	3.213E-02	1.595E-04	5.550E-03	1.903E-04	6.621E-03
27	30	3.338E-01	4.023E-02	1.997E-04	6.950E-03	2.382E-04	8.291E-03
27	31	3.154E-01	3.802E-02	1.887E-04	6.568E-03	2.252E-04	7.835E-03
27	32	3.682E-01	4.438E-02	2.203E-04	7.667E-03	2.628E-04	9.146E-03
27	33	5.300E-01	6.388E-02	3.171E-04	1.104E-02	3.783E-04	1.316E-02
27	34	4.503E-01	5.427E-02	2.694E-04	9.376E-03	3.214E-04	1.118E-02
27	35	4.444E-01	5.356E-02	2.659E-04	9.253E-03	3.172E-04	1.104E-02
27	36	4.580E-01	5.520E-02	2.740E-04	9.536E-03	3.269E-04	1.138E-02

Table VI

HEAT TRANSFER DATA (Cont.)

RUN	GAGE	$\dot{q}_w$	$\dot{q}_w/\dot{q}_o$	$h_{r=1.0}$	$C_{H_{r=1.0}}$	$h_{r=.85}$	$C_{H_{r=.85}}$
27	37	5.376E-01	6.480E-02	3.217E-04	1.119E-02	3.837E-04	1.335E-02
27	38	7.418E-01	8.941E-02	4.439E-04	1.545E-02	5.295E-04	1.843E-02
27	39	6.864E-01	8.274E-02	4.107E-04	1.429E-02	4.900E-04	1.705E-02
27	40	6.766E-01	8.155E-02	4.048E-04	1.409E-02	4.830E-04	1.681E-02
27	41	7.023E-01	8.465E-02	4.202E-04	1.462E-02	5.013E-04	1.744E-02
27	42	7.171E-01	8.643E-02	4.291E-04	1.493E-02	5.118E-04	1.781E-02
27	43	3.683E+00	4.439E-01	2.204E-03	7.669E-02	2.629E-03	9.149E-02
27	44	1.180E+01	1.422E+00	7.059E-03	2.456E-01	8.420E-03	2.930E-01
27	51	1.501E+01	1.809E+00	8.982E-03	3.126E-01	1.071E-02	3.729E-01
27	52	1.442E+01	1.737E+00	8.625E-03	3.002E-01	1.029E-02	3.581E-01
28	4	2.098E-01	9.931E-03	1.264E-04	6.736E-04	1.507E-04	8.036E-04
28	5	1.965E-01	9.300E-03	1.183E-04	6.308E-04	1.412E-04	7.525E-04
28	6	3.629E-01	1.718E-02	2.186E-04	1.165E-03	2.608E-04	1.390E-03
28	7	3.352E-01	1.587E-02	2.019E-04	1.076E-03	2.408E-04	1.284E-03
28	8	4.635E-01	2.194E-02	2.792E-04	1.488E-03	3.331E-04	1.776E-03
28	9	4.082E-01	1.932E-02	2.459E-04	1.311E-03	2.933E-04	1.564E-03
28	10	4.719E-01	2.234E-02	2.842E-04	1.515E-03	3.391E-04	1.808E-03
28	11	5.803E-01	2.747E-02	3.495E-04	1.863E-03	4.170E-04	2.223E-03
28	12	5.646E-01	2.673E-02	3.400E-04	1.813E-03	4.057E-04	2.163E-03
28	13	6.188E-01	2.929E-02	3.727E-04	1.987E-03	4.446E-04	2.370E-03
28	14	5.661E-01	2.680E-02	3.410E-04	1.818E-03	4.068E-04	2.168E-03
28	15	5.784E-01	2.738E-02	3.484E-04	1.857E-03	4.156E-04	2.216E-03
28	16	5.935E-01	2.810E-02	3.575E-04	1.906E-03	4.265E-04	2.274E-03
28	17	6.326E-01	2.994E-02	3.810E-04	2.031E-03	4.545E-04	2.423E-03
28	18	6.880E-01	3.257E-02	4.144E-04	2.209E-03	4.944E-04	2.635E-03
28	19	6.780E-01	3.210E-02	4.084E-04	2.177E-03	4.872E-04	2.597E-03
28	20	6.696E-01	3.170E-02	4.033E-04	2.150E-03	4.811E-04	2.565E-03
28	21	6.774E-01	3.207E-02	4.080E-04	2.175E-03	4.867E-04	2.595E-03
28	22	6.360E-01	3.010E-02	3.830E-04	2.042E-03	4.570E-04	2.436E-03
28	23	6.398E-01	3.029E-02	3.854E-04	2.054E-03	4.597E-04	2.451E-03
28	24	7.604E-01	3.600E-02	4.580E-04	2.442E-03	5.464E-04	2.913E-03
28	25	8.515E-01	4.031E-02	5.129E-04	2.734E-03	6.119E-04	3.262E-03
28	26	7.865E-01	3.723E-02	4.737E-04	2.525E-03	5.651E-04	3.013E-03
28	27	7.876E-01	3.728E-02	4.744E-04	2.529E-03	5.659E-04	3.017E-03

Table VI
HEAT TRANSFER DATA (Concl.)

28	28	7.770E-01	3.678E-02	4.680E-04	2.495E-03	5.583E-04	2.976E-03
28	29	7.721E-01	3.655E-02	4.650E-04	2.479E-03	5.548E-04	2.958E-03
28	30	9.352E-01	4.427E-02	5.633E-04	3.003E-03	6.720E-04	3.582E-03
28	31	1.035E+00	4.898E-02	6.233E-04	3.323E-03	7.435E-04	3.964E-03
28	32	9.712E-01	4.598E-02	5.850E-04	3.118E-03	6.979E-04	3.720E-03
28	33	1.236E+00	5.849E-02	7.442E-04	3.967E-03	8.879E-04	4.733E-03
28	34	1.311E+00	6.207E-02	7.897E-04	4.210E-03	9.422E-04	5.023E-03
28	35	1.227E+00	5.809E-02	7.392E-04	3.940E-03	8.818E-04	4.701E-03
28	36	1.258E+00	5.956E-02	7.578E-04	4.040E-03	9.040E-04	4.819E-03
28	37	1.322E+00	6.258E-02	7.962E-04	4.245E-03	9.499E-04	5.064E-03
28	38	2.227E+00	1.054E-01	1.341E-03	7.150E-03	1.600E-03	8.530E-03
28	39	2.005E+00	9.492E-02	1.208E-03	6.438E-03	1.441E-03	7.681E-03
28	40	1.958E+00	9.271E-02	1.180E-03	6.288E-03	1.407E-03	7.502E-03
28	41	1.945E+00	9.208E-02	1.172E-03	6.245E-03	1.398E-03	7.451E-03
28	42	1.876E+00	8.882E-02	1.130E-03	6.024E-03	1.348E-03	7.187E-03
28	43	1.077E+01	5.097E-01	6.486E-03	3.458E-02	7.737E-03	4.125E-02
28	44	3.044E+01	1.441E+00	1.833E-02	9.774E-02	2.187E-02	1.166E-01

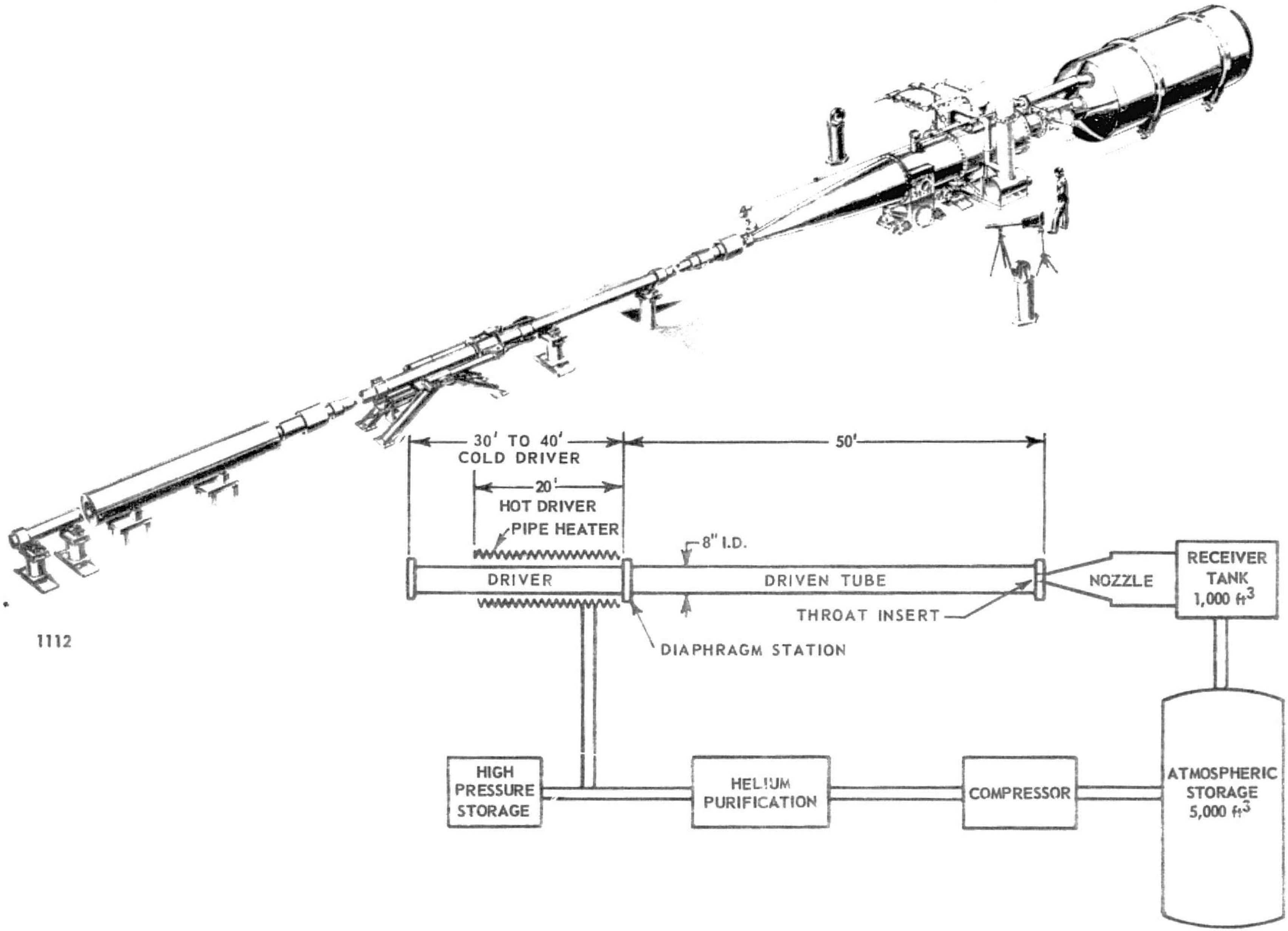


Figure 1 BASIC COMPONENTS OF THE CALSPAN HYPERSONIC SHOCK TUNNEL - 48″ LEG

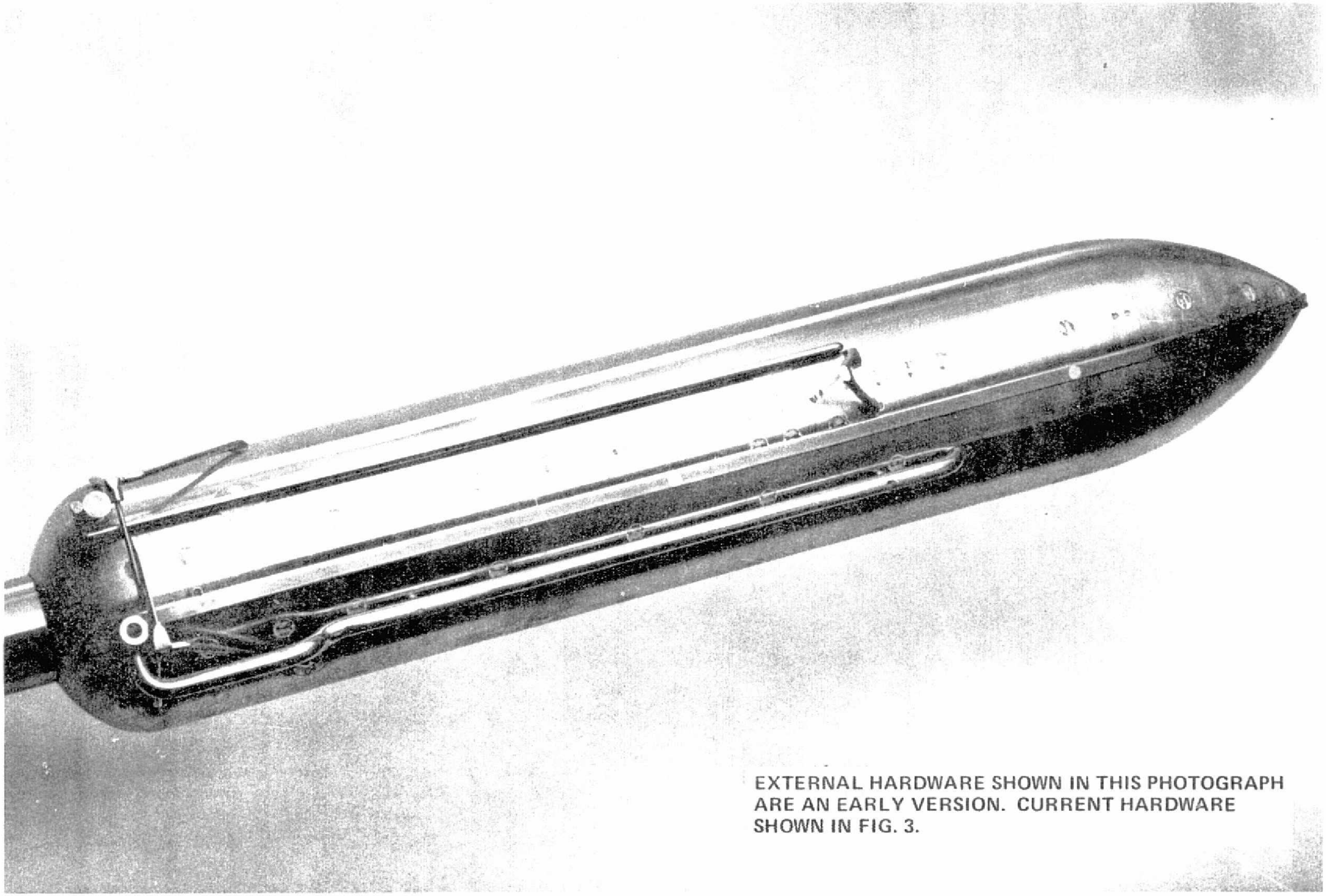


Figure 2 EXTERNAL TANK MODEL 37-T – CONFIGURATION USED FOR ANGLES OF ATTACK UP TO 90 DEGREES

Figure 3 EXTERNAL TANK MODEL 37-T – CONFIGURATION USED FOR ANGLES OF ATTACK GREATER THAN 90 DEGREES

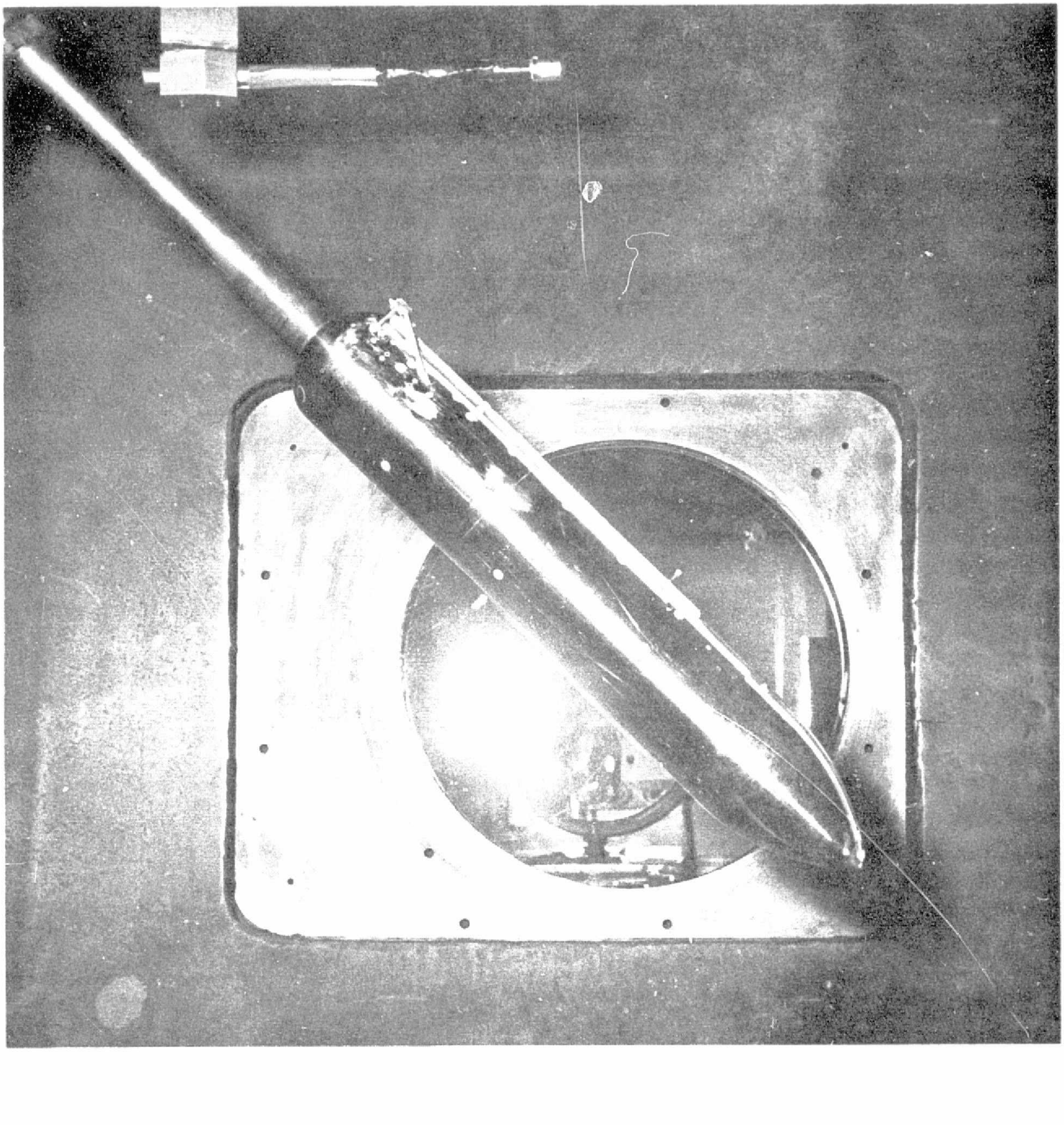


Figure 4a TYPICAL MODEL INSTALLATION PHOTOGRAPH, $\alpha = -45^{\circ}$

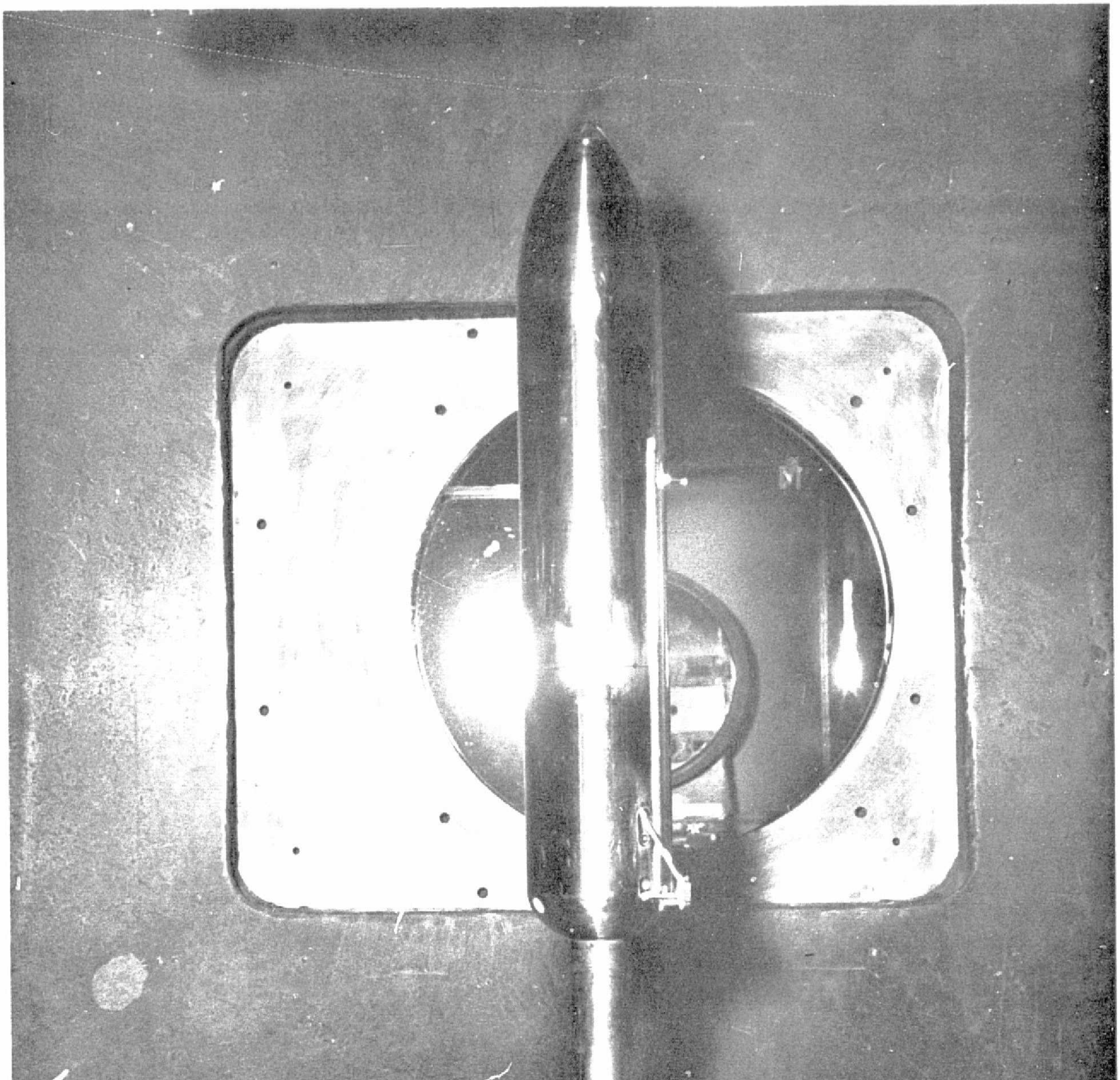


Figure 4b TYPICAL MODEL INSTALLATION PHOTOGRAPH, $\alpha = -90^{\circ}$

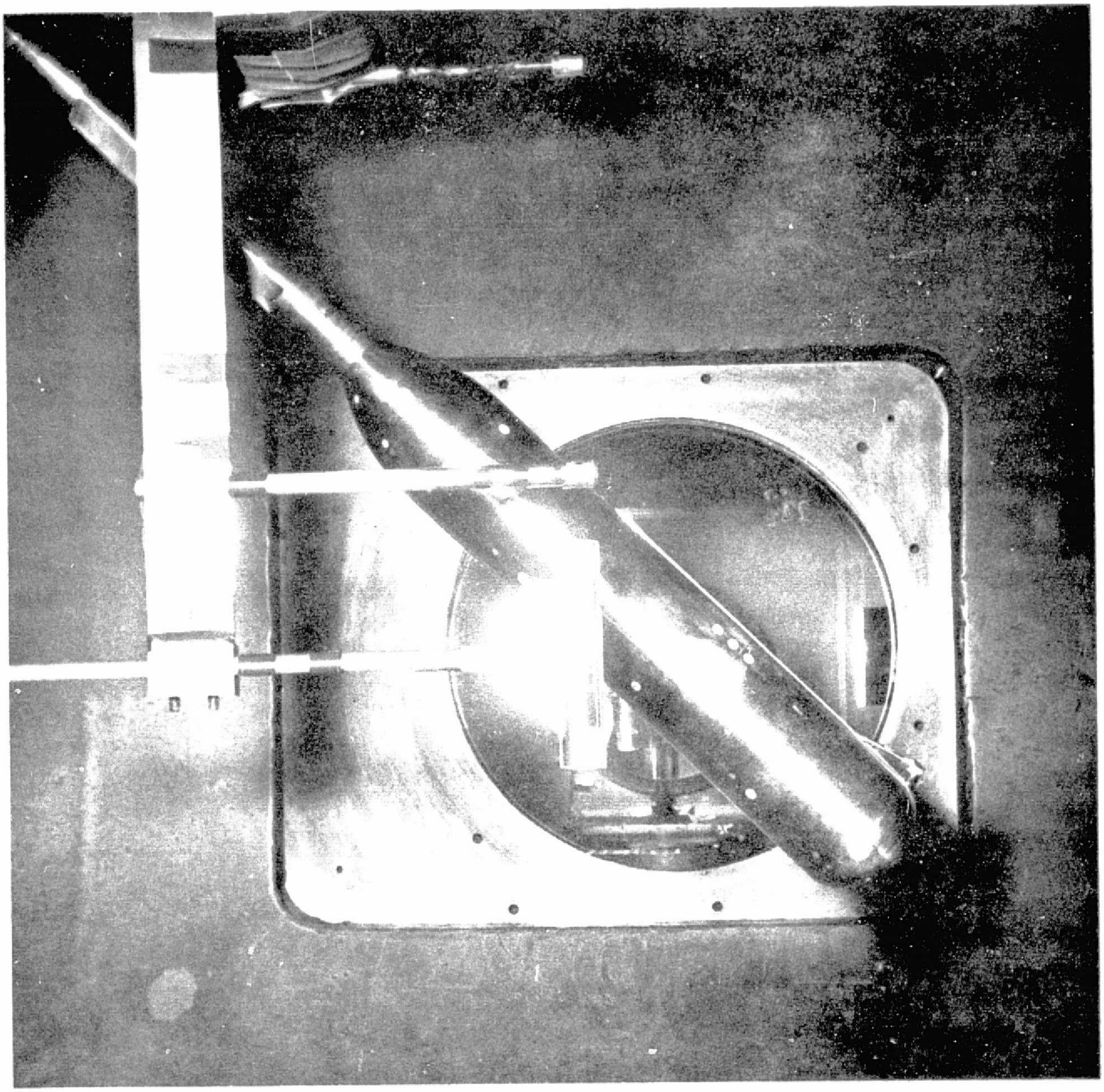


Figure 4c TYPICAL MODEL INSTALLATION PHOTOGRAPH, $\alpha = -135^{o}$

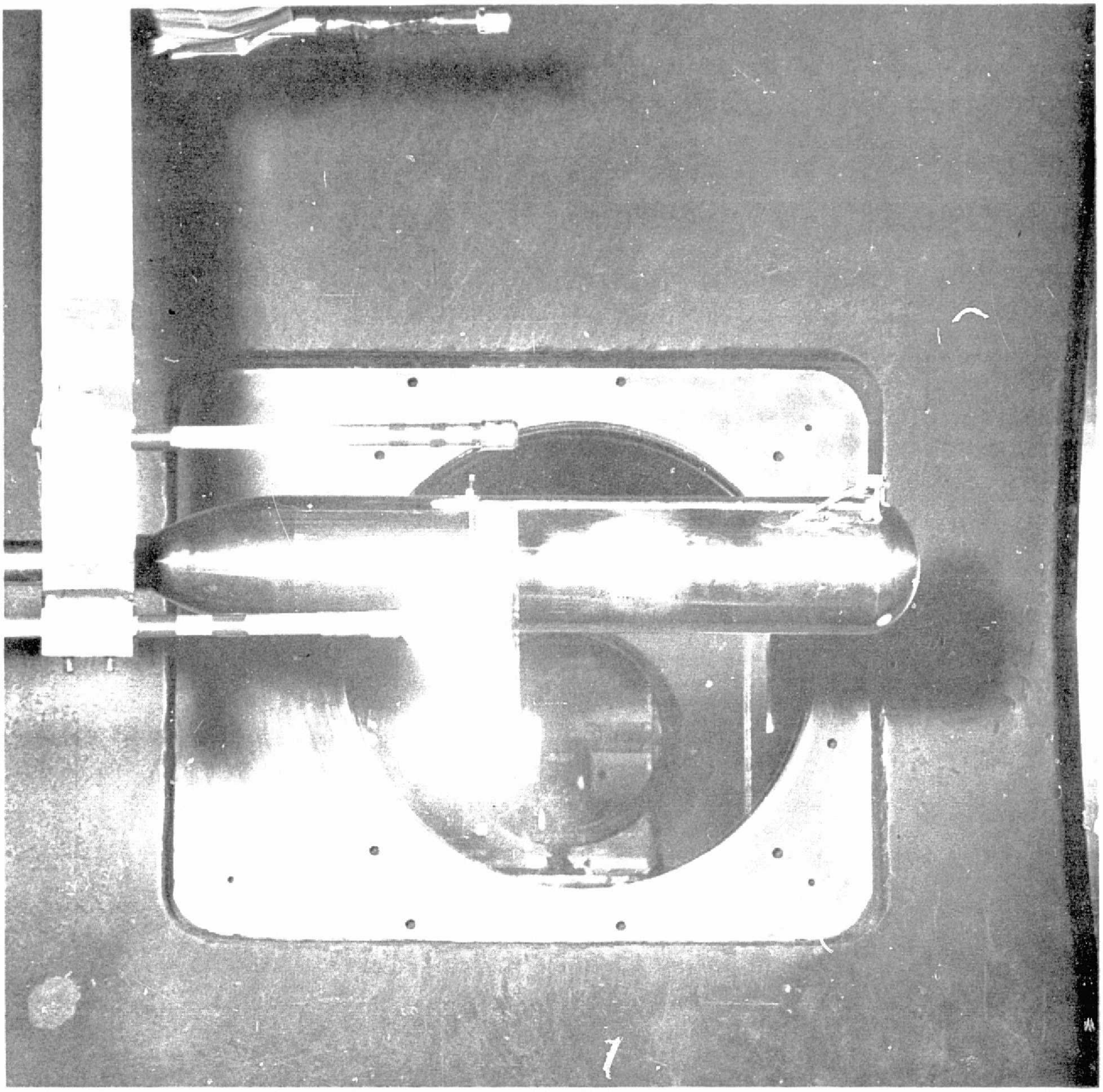


Figure 4d TYPICAL MODEL INSTALLATION PHOTOGRAPH, $\alpha = -180^{\circ}$

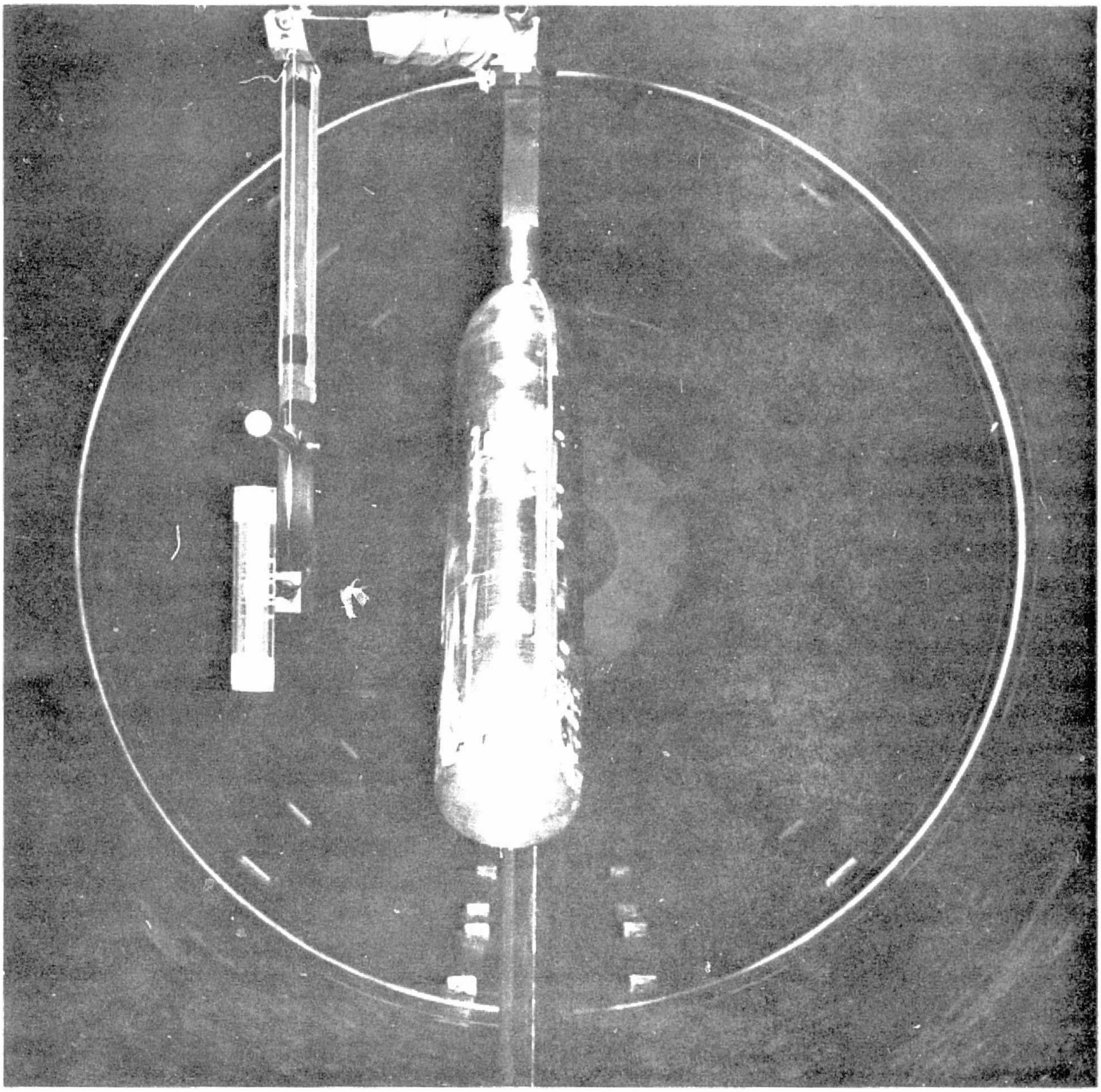


Figure 5 MODEL INSTALLATION SHOWING RELATIVE POSITION OF SIDE-MOUNTED PITOT PROBE AND 1"-DIA. HEAT-TRANSFER CYLINDER

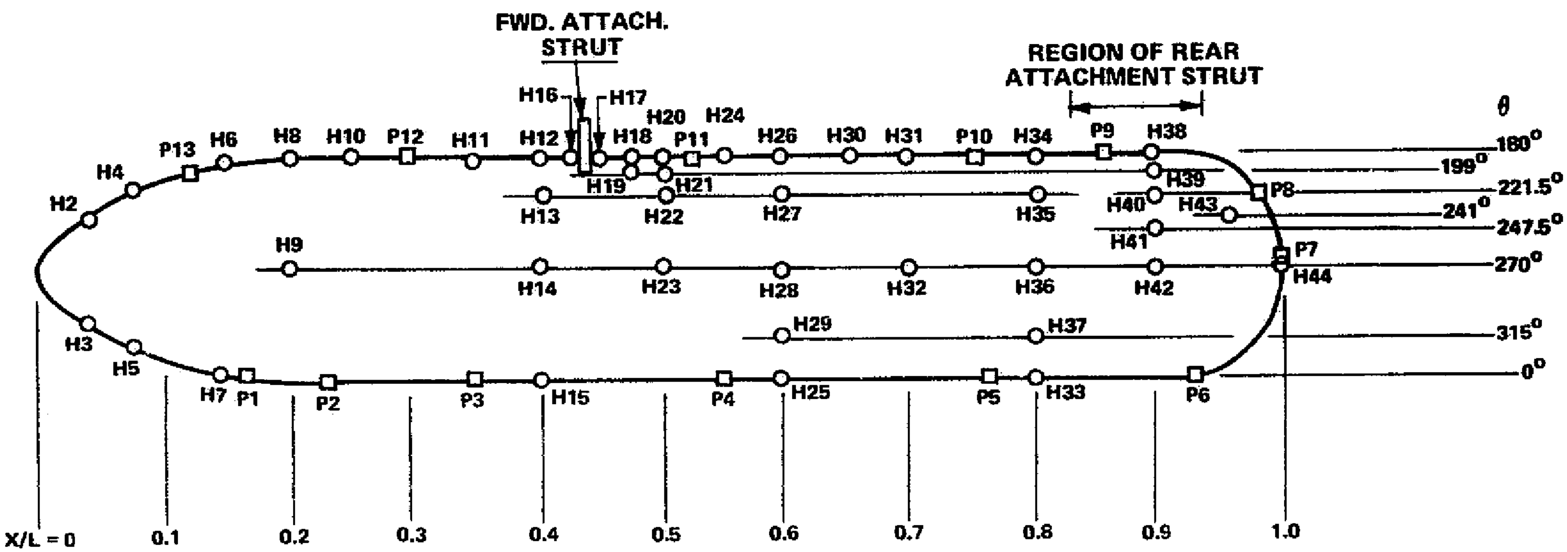


Figure 6 SKETCH ILLUSTRATING HEAT TRANSFER AND PRESSURE GAUGE LOCATIONS

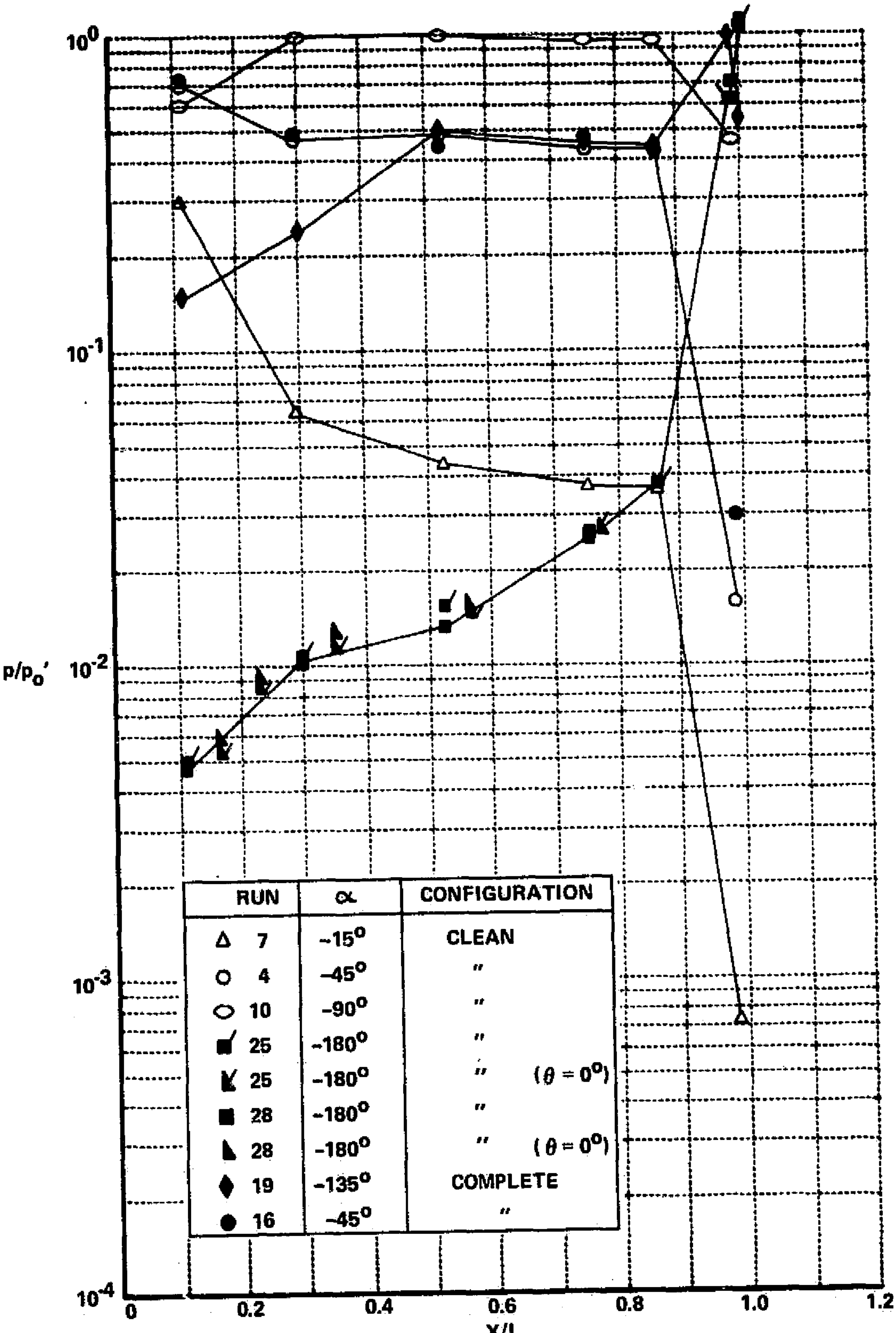


Figure 7 PRESSURE DISTRIBUTION ALONG WINDWARD SIDE (θ = 180°) AT $Re_{\infty L} \simeq 7.1 \times 10^4$

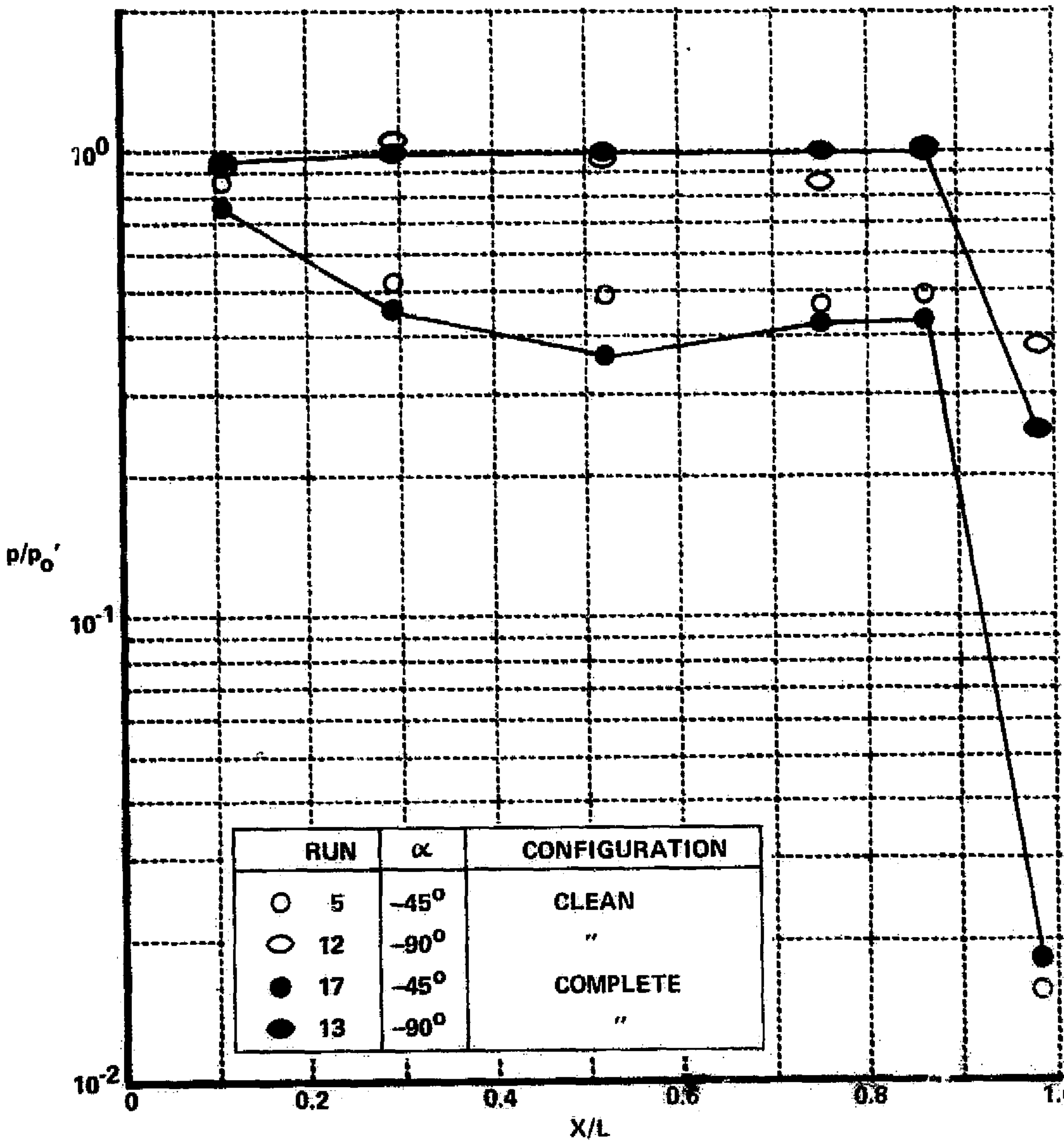


Figure 8 COMPARISON OF PRESSURE DISTRIBUTION WITH AND WITHOUT EXTERNAL HARDWARE AT $Re_{\infty L} \simeq 1.3 \times 10^4$

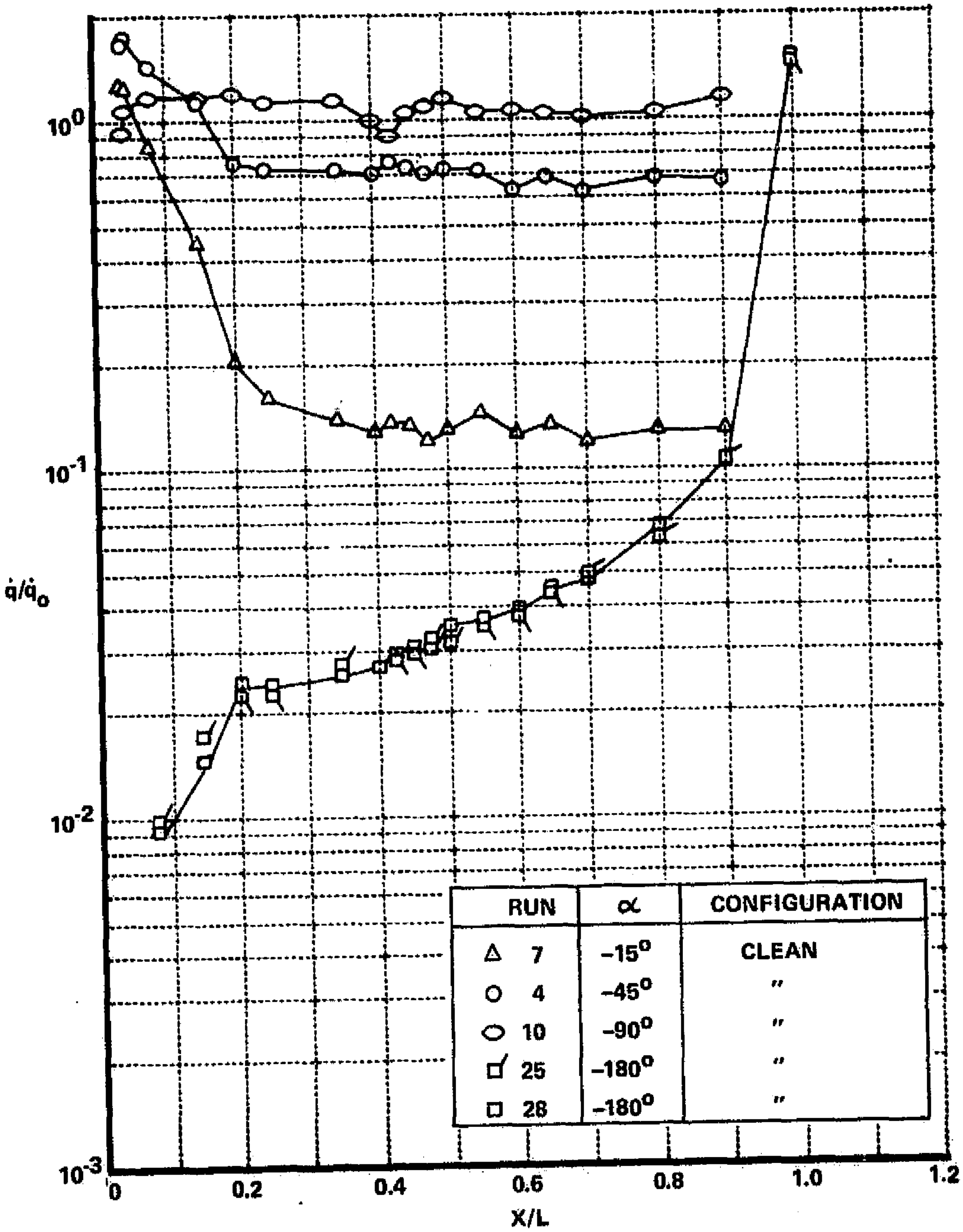
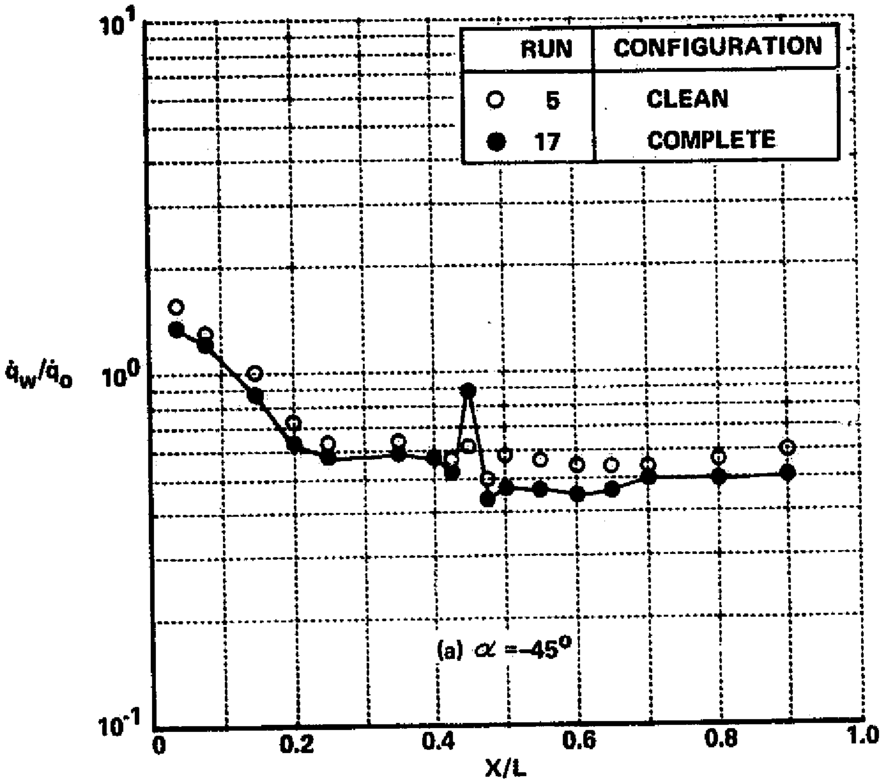


Figure 9 HEAT TRANSFER DISTRIBUTION ALONG WINDWARD SIDE (θ = 180°) AT $Re_{\infty L} \simeq 7.1 \times 10^4$



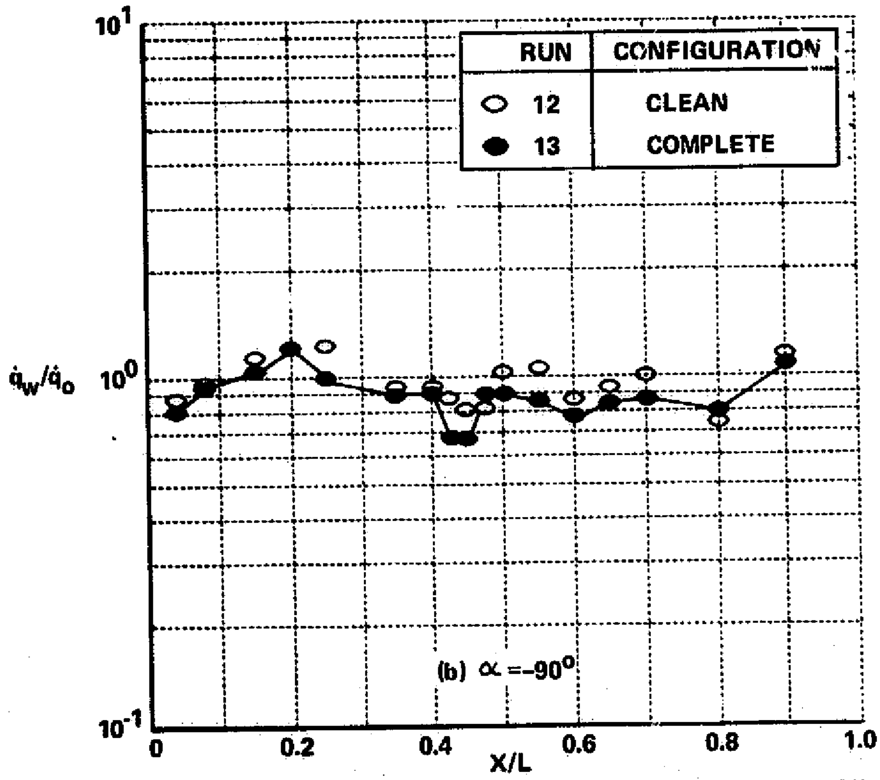


Figure 10 COMPARISON OF HEAT TRANSFER DISTRIBUTION WITH AND WITHOUT EXTERNAL HARDWARE AT $Re_{\infty L} \simeq 1.3 \times 10^4$

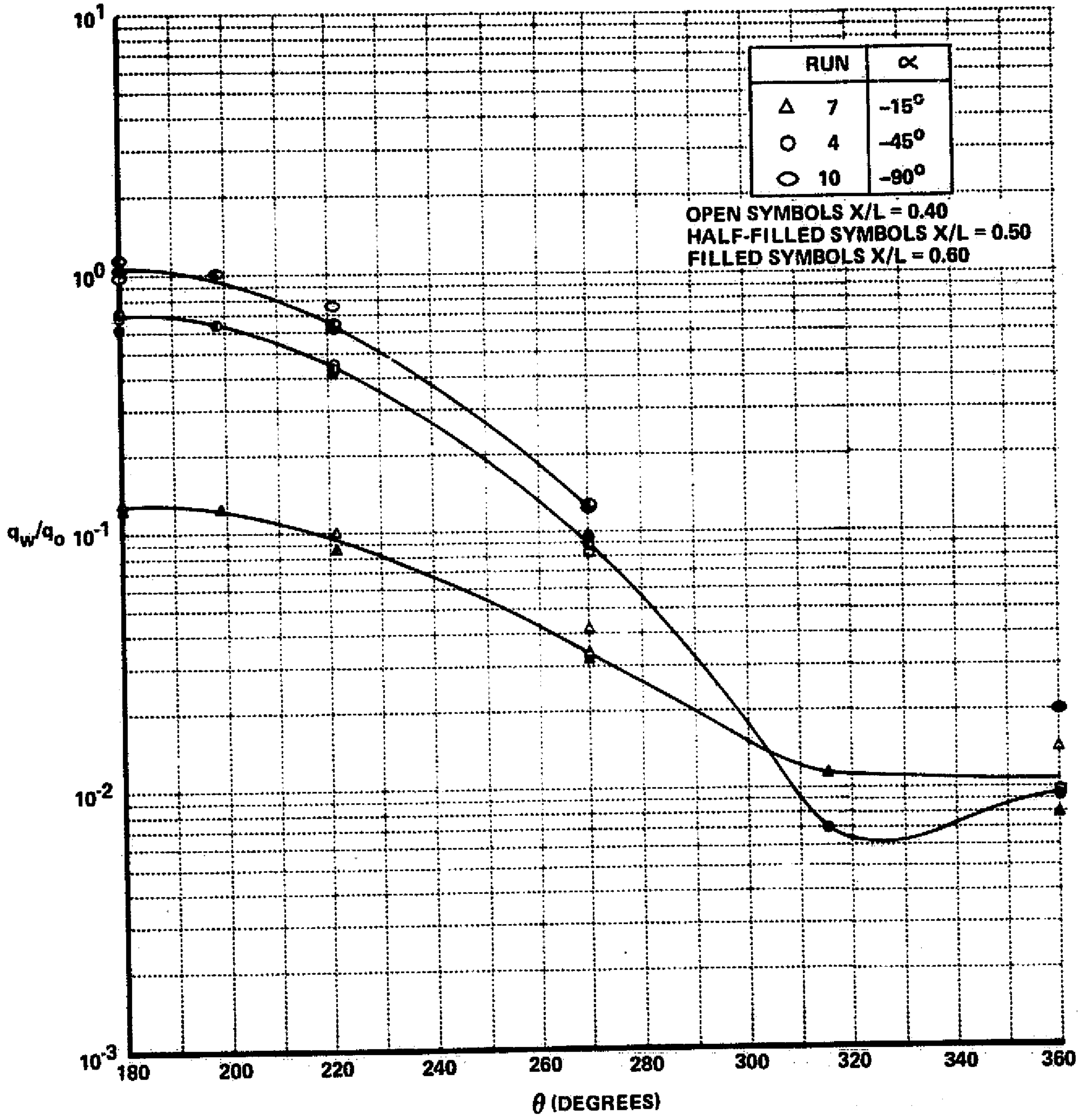


Figure 11 CIRCUMFERENTIAL HEAT TRANSFER DISTRIBUTION AT $Re_{\infty L} \simeq 7.1 \times 10^4$

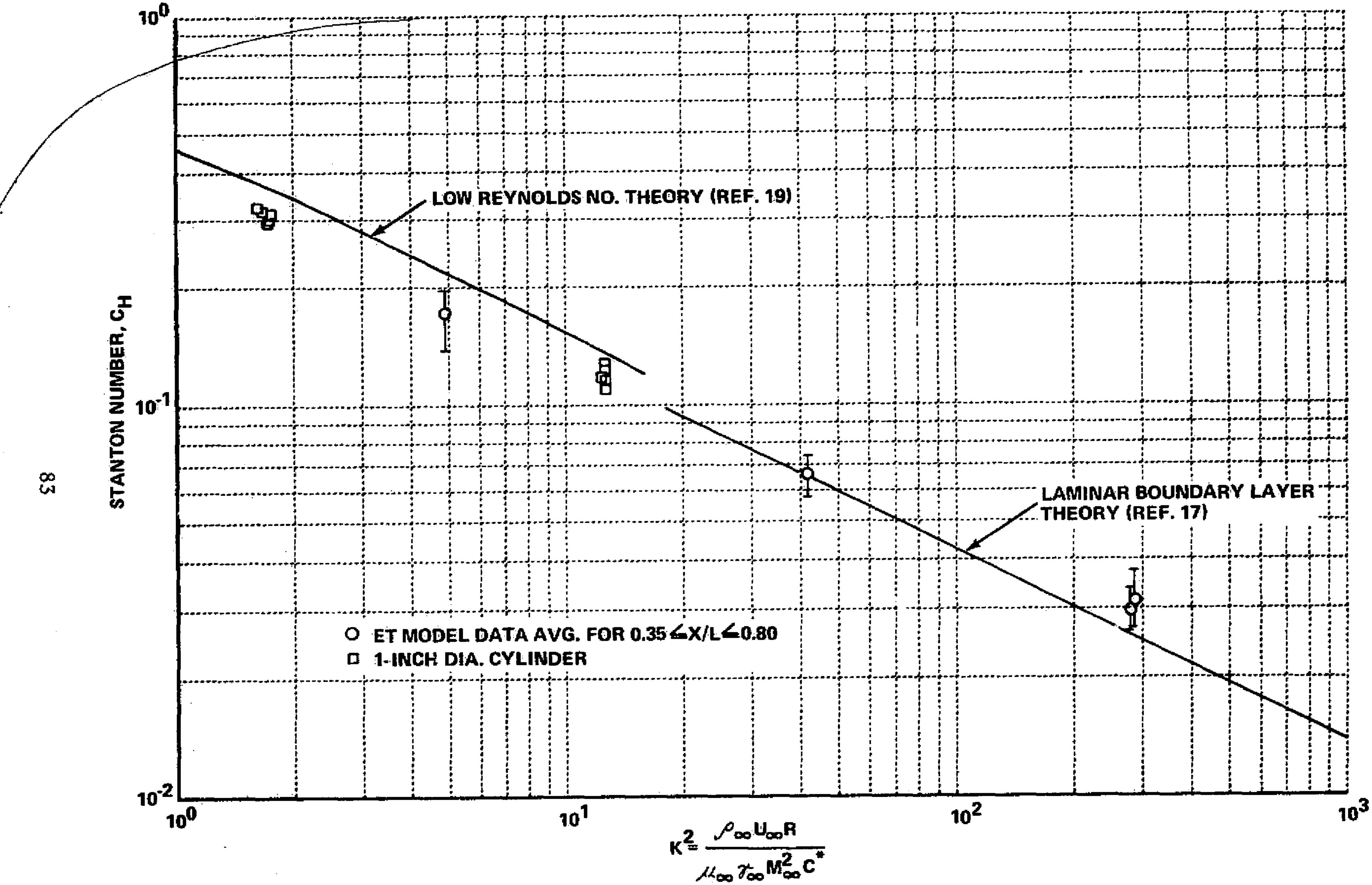


Figure 12 STAGNATION LINE HEAT TRANSFER FOR CYLINDER NORMAL TO AIRFLOW

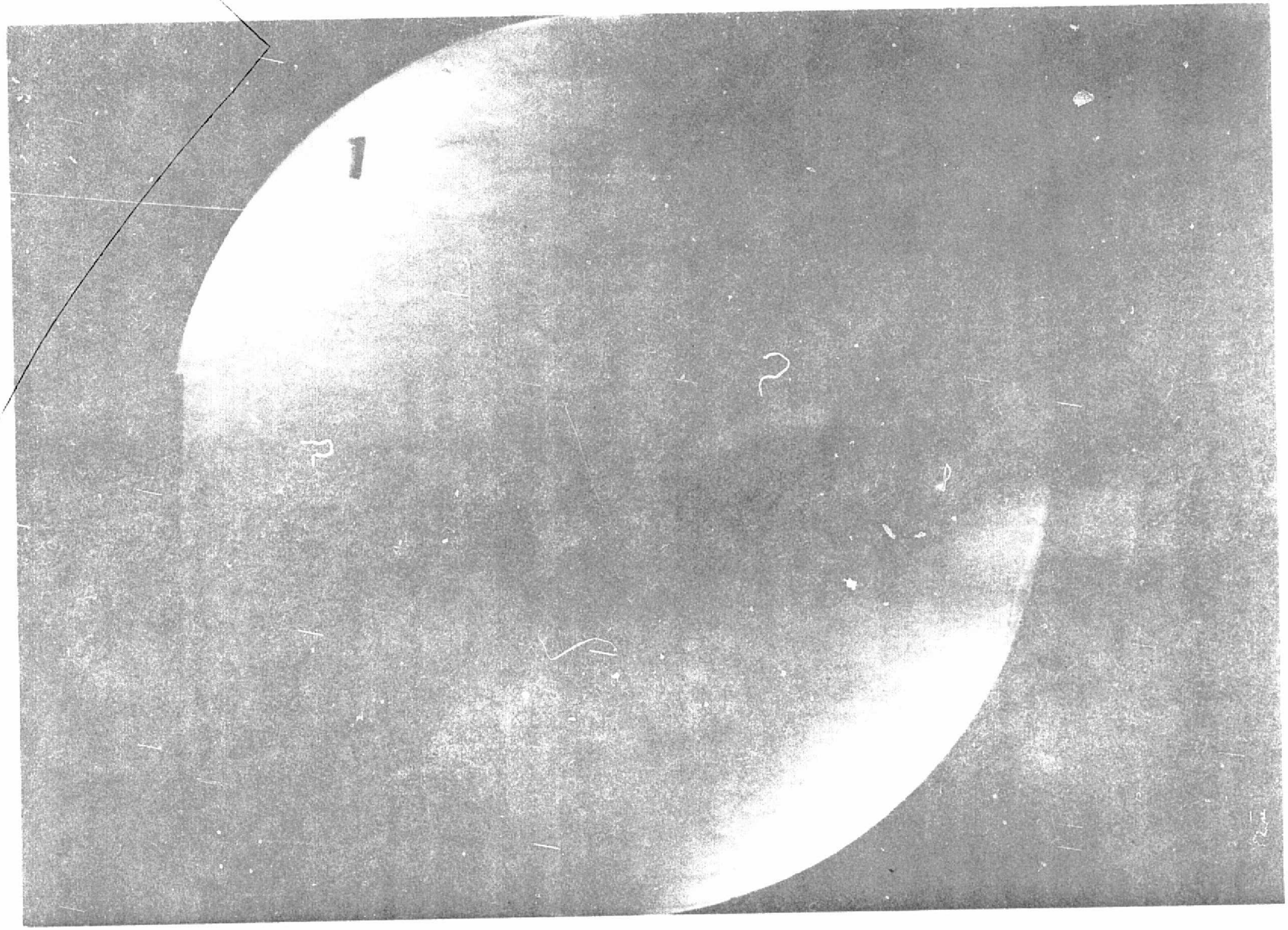


Figure 13 SCHLIEREN PHOTOGRAPH, RUN 1, $\alpha = -45^{o}$

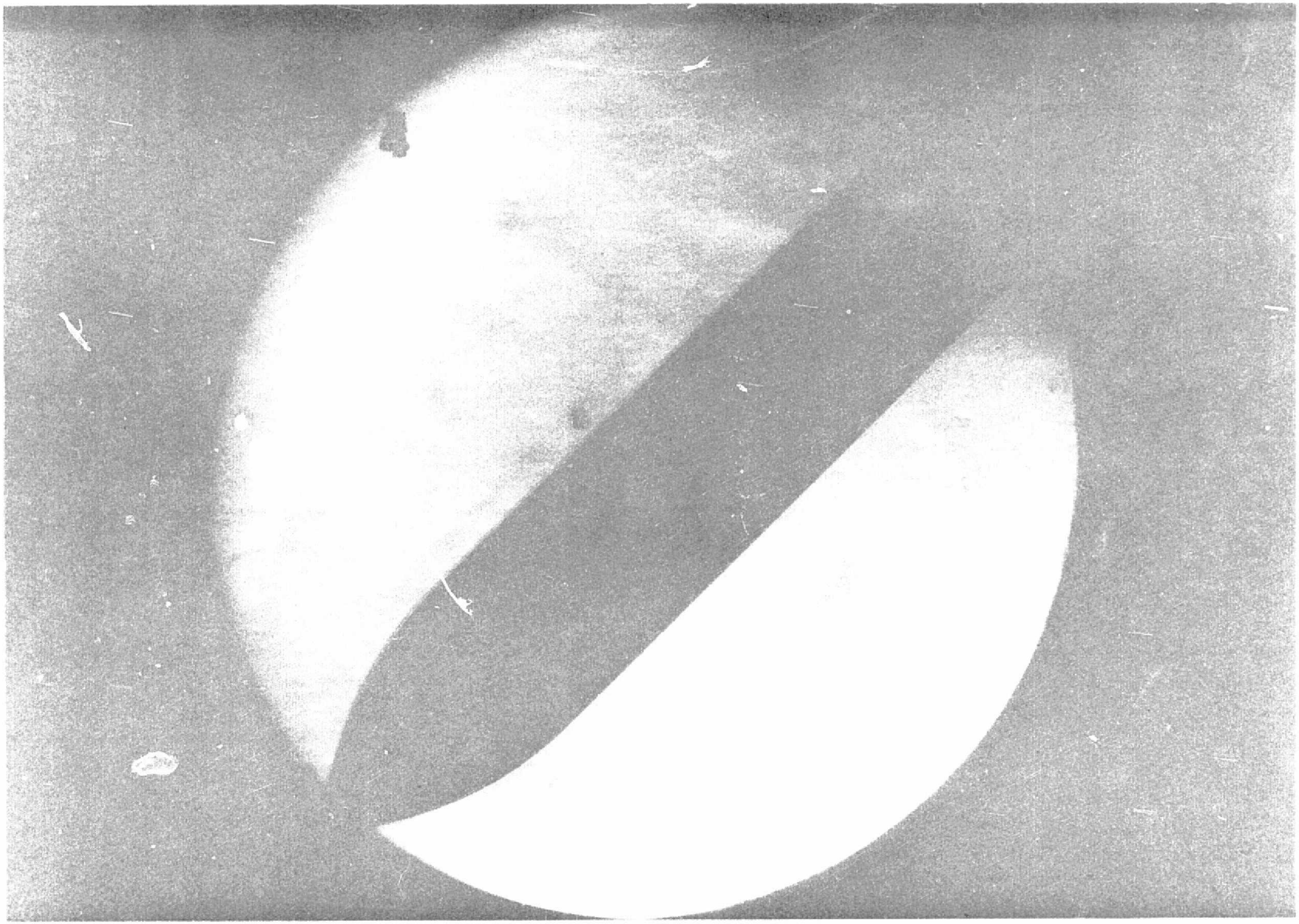


Figure 14 SCHLIEREN PHOTOGRAPH, RUN 4, $\alpha = -45^{\circ}$

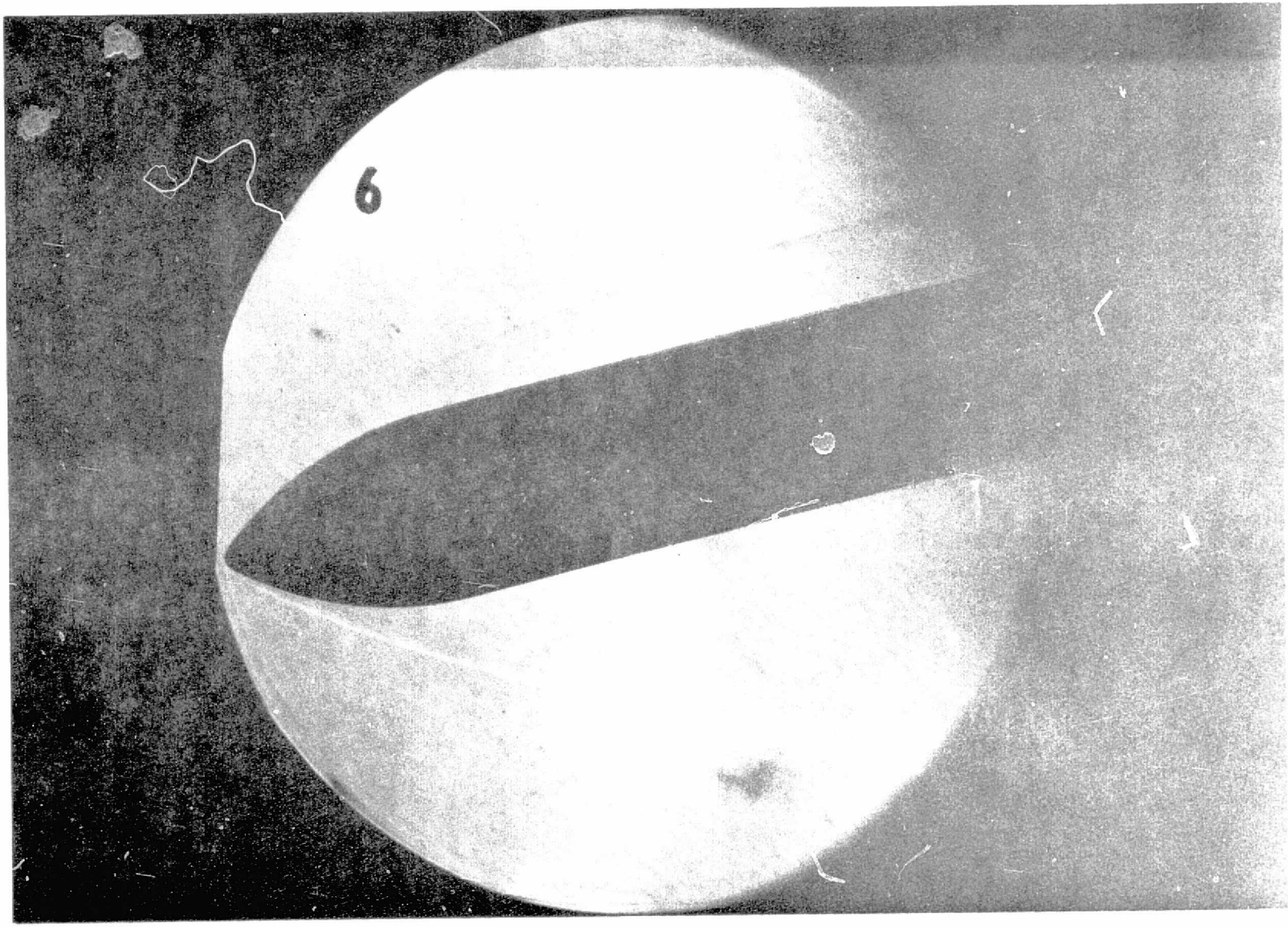


Figure 15 SCHLIEREN PHOTOGRAPH, RUN 6, $\alpha = -15^{o}$

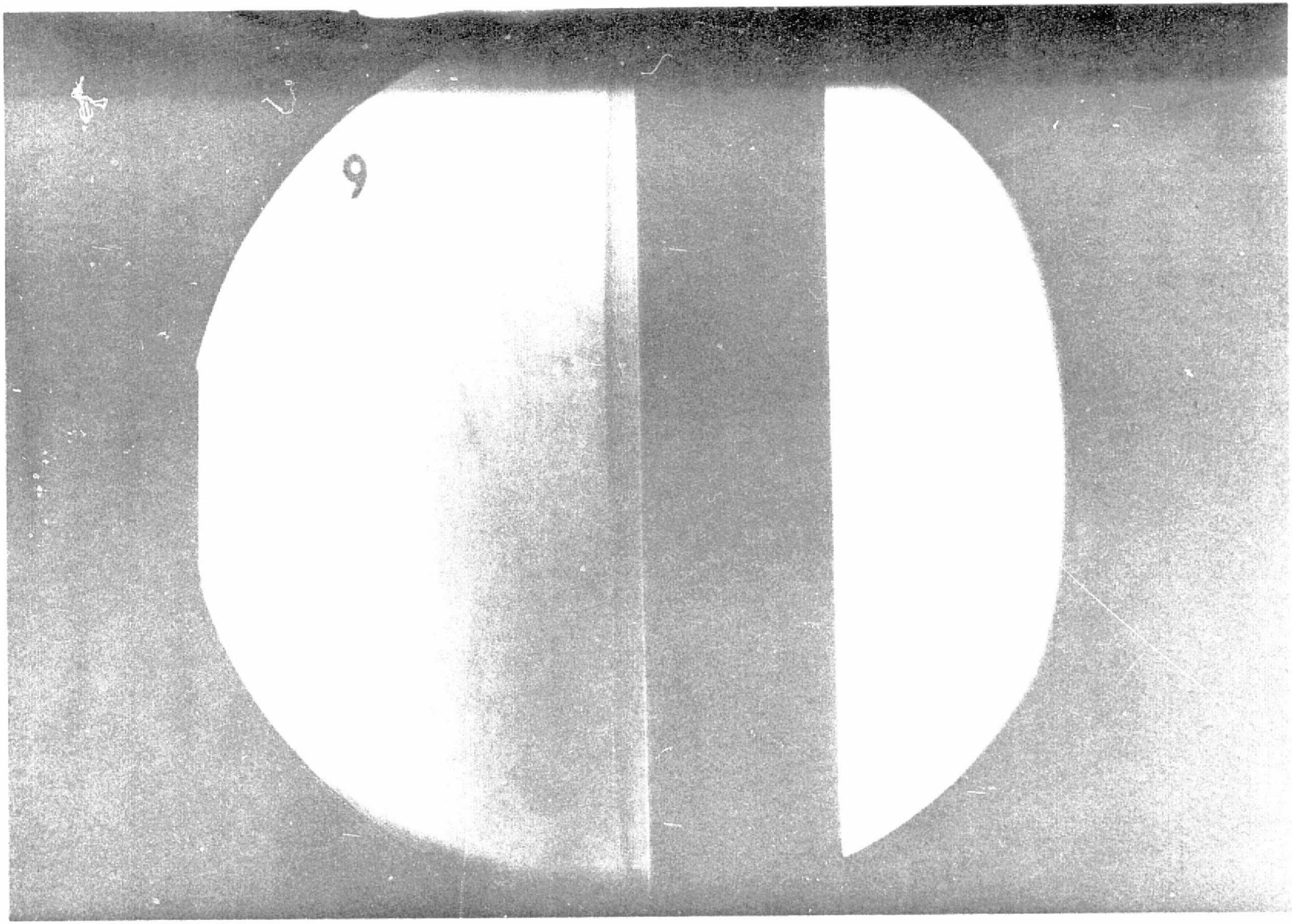


Figure 16 SCHLIEREN PHOTOGRAPH, RUN 9, $\alpha = -90^{o}$

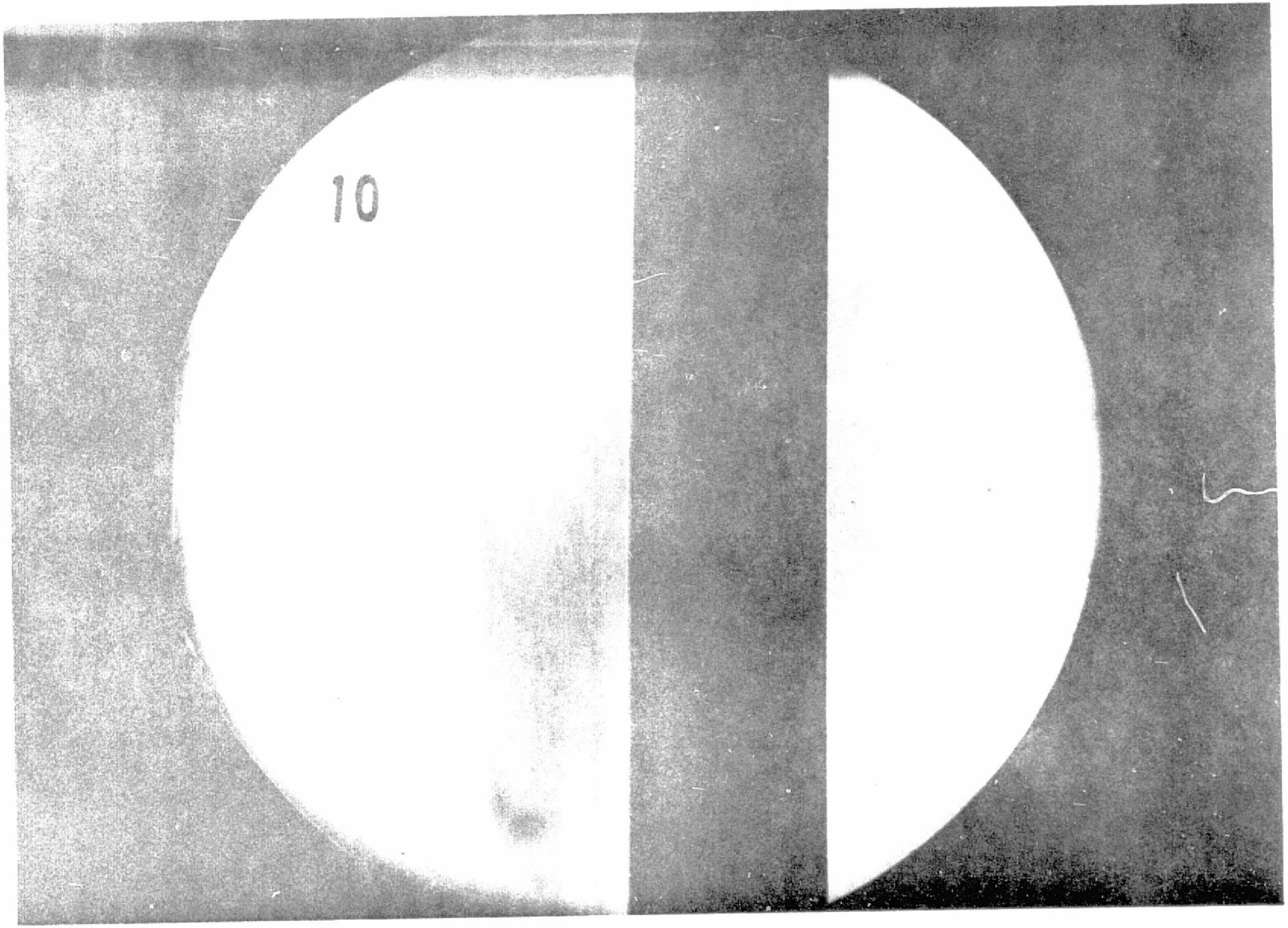


Figure 17 SCHLIEREN PHOTOGRAPH, RUN 10, $\alpha = -90^{o}$

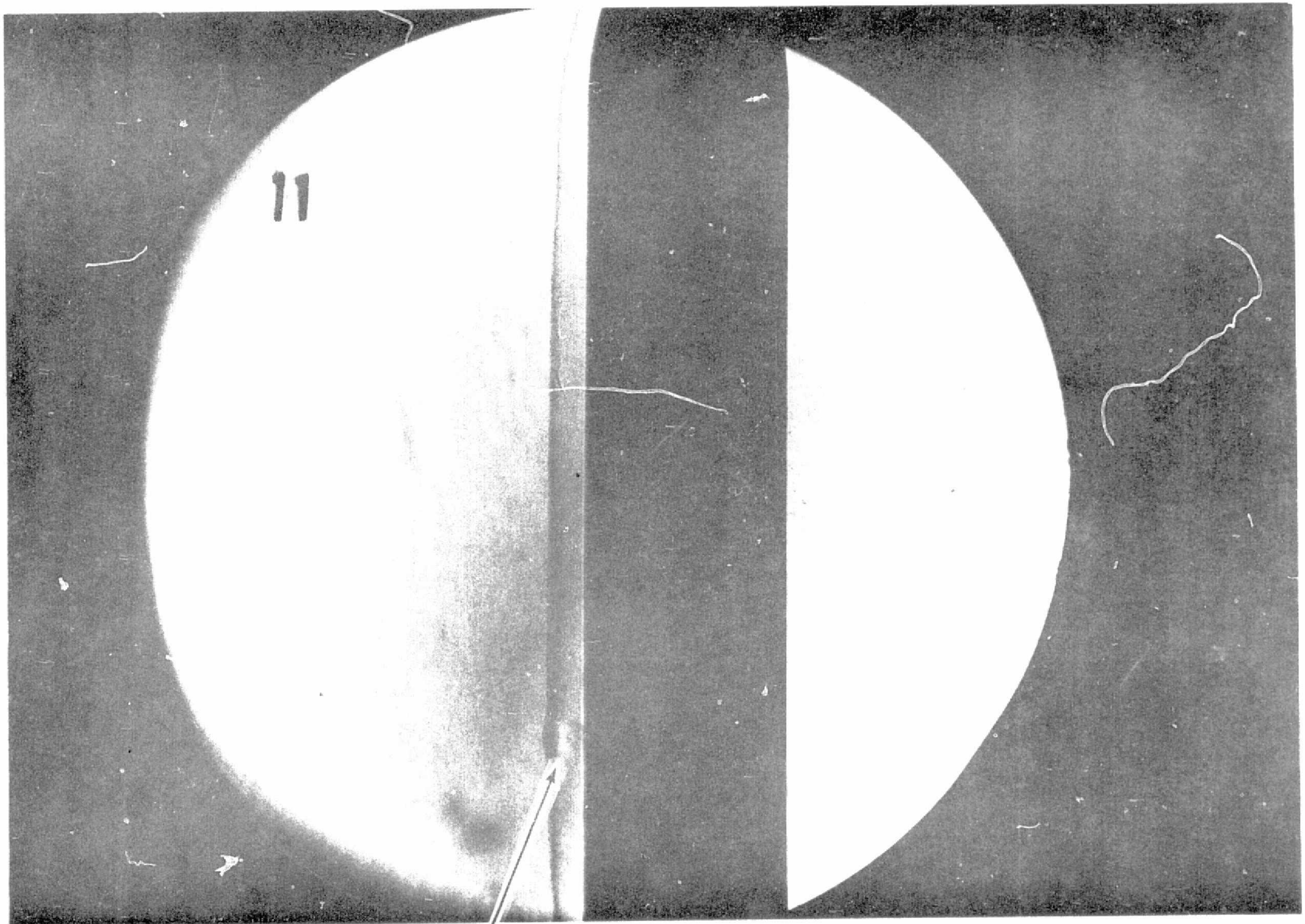


Figure 18 SCHLIEREN PHOTOGRAPH, RUN 11, $\alpha = -90^o$

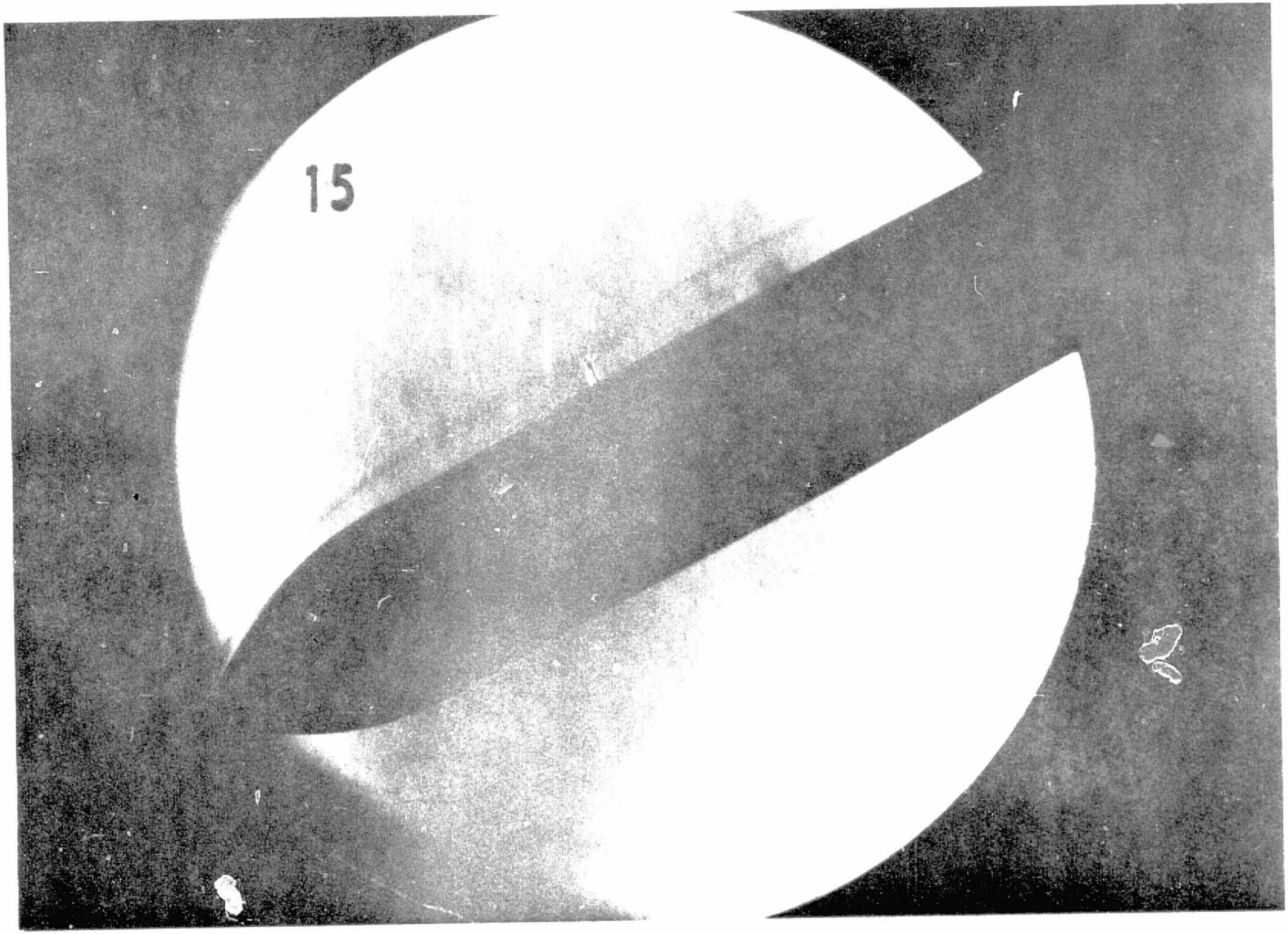


Figure 19 SCHLIEREN PHOTOGRAPH, RUN 15, $\alpha = -30^{o}$

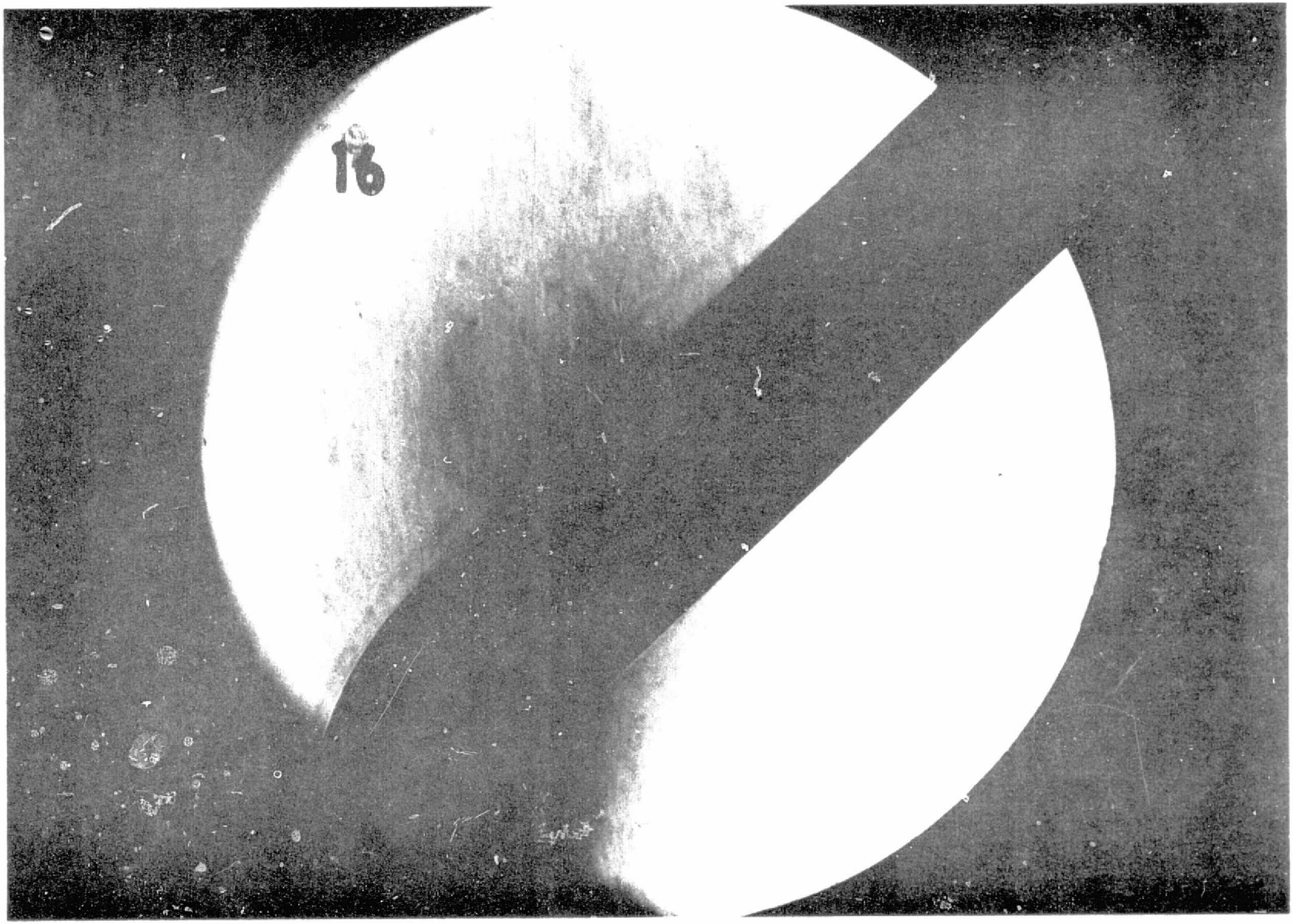


Figure 20 SCHLIEREN PHOTOGRAPH, RUN 16, $\alpha = -45^{o}$

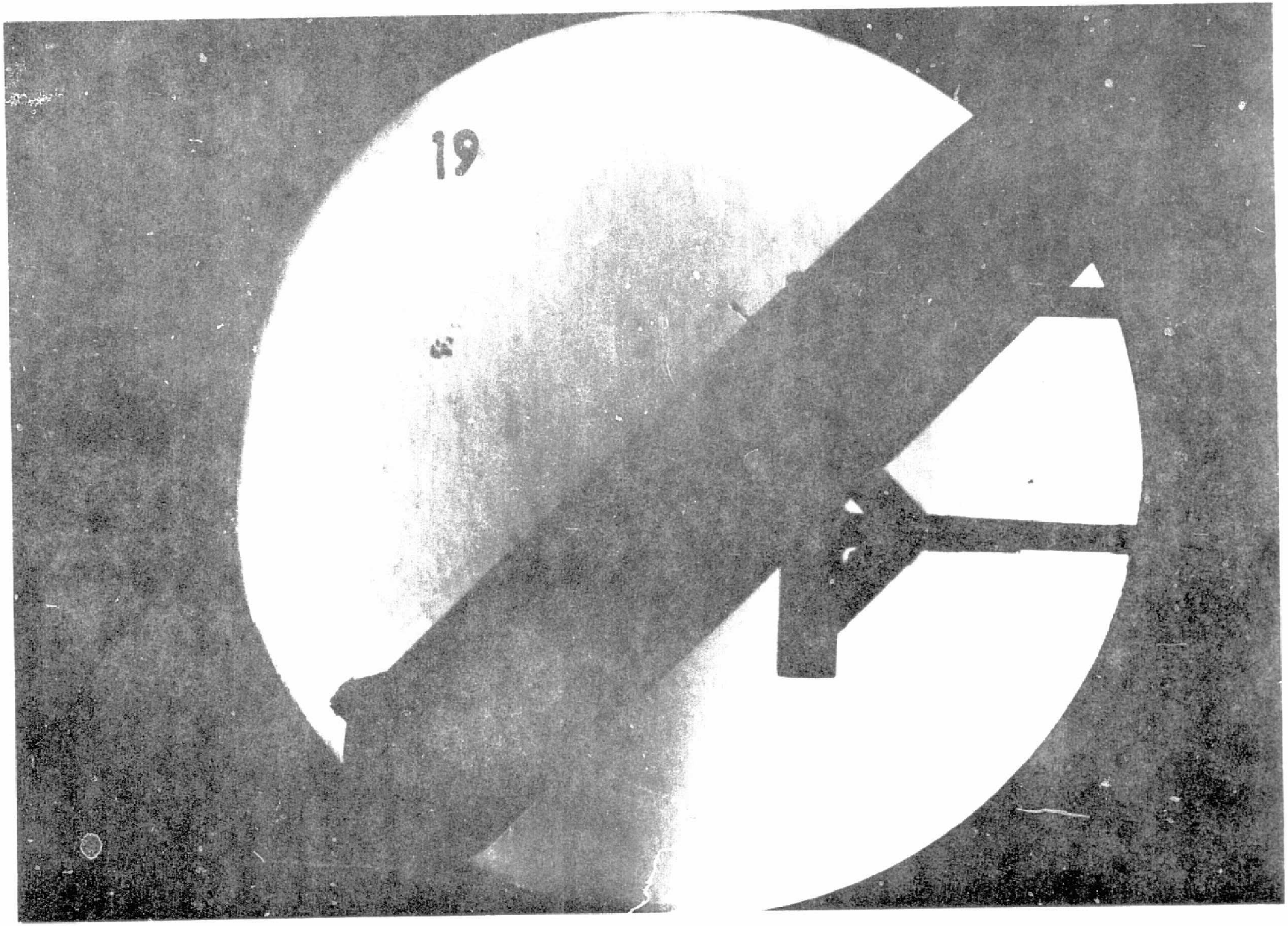


Figure 21 SCHLIEREN PHOTOGRAPH, RUN 19, $\alpha = -135^{o}$