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CAVITATION IN LIQUID CRYOGENS

III - Ogives

by J. Hord

Prepared by
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Boulder, Colo. 80302
for Lewis Research Center

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION • WASHINGTON, D. C. • MAY 1973

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
NASA CR-2242		

4. Title and Subtitle
CAVITATION IN LIQUID CRYOGENS
III - OGIVES

5. Report Date
May 1973

6. Performing Organization Code

7. Author(s)
J. Hord

8. Performing Organization Report No.
None

9. Performing Organization Name and Address
National Bureau of Standards
Boulder, Colorado 80302

10. Work Unit No.

11. Contract or Grant No.
C-39004B

12. Sponsoring Agency Name and Address
National Aeronautics and Space Administration
Washington, D.C. 20546

13. Type of Report and Period Covered
Contractor Report

14. Sponsoring Agency Code

15. Supplementary Notes
Project Manager, Werner R. Britsch, Fluid System Components Division, NASA Lewis Research Center, Cleveland, Ohio

16. Abstract
This document constitutes the third of four volumes to be issued on the results of continuing cavitation studies. Experimental results for three, scaled, quarter-caliber ogives are given. Both desinent and developed cavity data, using liquid hydrogen and liquid nitrogen, are reported. The desinent data do not exhibit a consistent ogive size effect, but the developed cavity data were consistently influenced by ogive size; B-factor increases with increasing ogive diameter. The developed cavity data indicated that stable thermodynamic equilibrium exists throughout the vaporous cavities. These data were correlated by using the extended theory derived in NASA CR-2156 (volume II of this report series). The new correlating parameter, MTWO, improves data correlation for the ogives, hydrofoil, and venturi and appears attractive for future predictive applications. The cavitation coefficient $K_{c,min}$ and equipment size effects are shown to vary with specific equipment-fluid combinations. A method of estimating $K_{c,min}$ from knowledge of the noncavitating pressure coefficient is suggested.

17. Key Words (Suggested by Author(s))
Cavitation, Cryogenics, Hydrofoil, Nucleation, Ogives, Pumps, Venturi

18. Distribution Statement
Unclassified - unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price*
Unclassified	Unclassified	244	$3.00

* For sale by the National Technical Information Service, Springfield, Virginia 22151

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CAVITATION IN LIQUID CRYOGENS

III - OGIVES

J. Hord

1. SUMMARY

This document constitutes the third of four volumes to be issued on the results of continuing cavitation studies. The first volume dealt with venturi experiments, and the second volume treated 0.5-caliber hydrofoil experiments and extended the theory for correlating developed cavitation data. This third volume documents experimental results for three, scaled, quarter-caliber ogives.

Details of the ogive-tunnel configurations, cavity instrumentation, data analysis, and correlative techniques are discussed.

Experimental data resulting from this study are presented in their entirety in tabular form. Selected data are also presented in graphical form. Both desinent and developed cavity data were acquired, using liquid hydrogen and liquid nitrogen test fluids. A mathematical technique was used to correlate the ogive desinent cavity data. The desinent data tend toward a narrow range of K_{iv} values, at the maximum fluid velocities, irrespective of fluid or fluid temperature. Similar results were previously obtained with the venturi and hydrofoil. Comparison of our desinent data with that of others--for higher boiling-point liquids --shows that cryogenic liquids require less subcooling to avoid cavitation, i.e., less Net Positive Suction Pressure (NPSP) is required for the cryogens.

Our ogive desinent data do not reflect a consistent size effect, although the ogive diameters varied by a factor of two. For hydrogen, K_{iv} increases with ogive diameter, but an opposite trend is noted for nitrogen. Use of the Weber and Reynolds numbers, as correlating

parameters, does not improve correlation of these desinent data. It is also apparent from these data that correlation of desinent cavity data, to account for variation of K_{iv} with fluid temperature, will require development of new correlating parameters. New parameters for correlating size effects in desinent cavity data may also be required.

Developed cavity data, consisting of pressure and temperature measurements within fully developed hydrogen and nitrogen cavities, indicated that stable thermodynamic equilibrium prevails throughout the vaporous cavities. These data were correlated using the extended theory derived in Volume II of this report series and the new correlating parameter, MTWO; MTWO is a liquid phase velocity ratio, derived from two-phase flow considerations. These correlative expressions are also suitable for predicting the cavitating performance of a particular piece of equipment from one fluid to another. In certain instances, data correlation is improved by using liquid kinematic viscosity as a correlating parameter. Maximum benefit, in data correlation, is obtained by using the new MTWO parameter. When MTWO is used it appears that only two other correlating parameters, cavity length and equipment size, are required. Use of MTWO, to correlate or predict the performance of cavitating equipment, is recommended in all future work. It is significant that the parameters which satisfactorily correlated the venturi and hydrofoil data also work quite well for these ogive data. Thus, these correlating parameters are proven applicable to a variety of body geometries (two-dimensional and axisymmetric) that encompass internal and external cavitating flows.

The developed-cavity data obtained with the ogives exhibited a consistently strong size effect. The cavity pressure-depressions increased with increasing ogive diameter; consequently, B-factor increased with increasing ogive diameter. For these data, we found that B-factor increases almost linearly with increasing ogive diameter--if the cavity length-to-ogive-diameter ratio is held constant. Comparison of our data with those of others indicates that size effects vary with specific equipment and equipment-fluid combinations.

This study demonstrates that $K_{c,min}$ can vary widely with fluid, flow conditions, and equipment size, although the equipment geometry is fixed. $K_{c,min}$, of course, varies widely with equipment geometry and our ogive data show that $K_{c,min}$ increases with increasing ogive size. This information, coupled with that of others, indicates that current predictive techniques must be used with prudence, i.e., the techniques that rely upon constant $K_{c,min}$ admit an additional source of error for some equipment geometries. This study also indicates that $K_{c,min}$, for a specific piece of equipment, is not currently predictable prior to testing of that equipment. It is suggested that extensive experimental data relating the cavitating pressure coefficient, $K_{c,min}$, to the noncavitating pressure coefficient, C_p, may alleviate this situation.

Photographic studies, performed during this experiment, indicate that the cavities formed on the ogives have an elliptical shape. The front halves of these cavities are adequately represented by a simple algebraic expression of parabolic form.

2. INTRODUCTION

Vaporous cavitation is the formation of the vapor phase within a flowing liquid, due to a reduction in pressure. Since the formation and collapse of vapor cavities alters flow patterns, cavitation may reduce the efficiency of pumping machinery [1][1] and reduce the precision of flow measuring devices. Collapse of these vapor cavities can also cause serious erosion damage [2] to fluid-handling equipment. While the noncavitating performance of hydraulic equipment may be predicted from established similarity laws, cavitating performance is much more

[1] Numbers in brackets indicate references at the end of this paper.

difficult to predict from fluid-to-fluid. Recent advances in this area have been made by NASA-LeRC personnel [3-6] and others [7-9], but additional work is required to improve the current technique for predicting cavitating performance of equipment from fluid-to-fluid. The effects of fluid properties on cavitation performance are well recognized [10-19] and require more understanding to develop improved similarity relations [19] for equipment behavior. Much more knowledge is needed to extend this predictive capability from one piece of equipment to another, i. e., a more general predictive technique, applicable to equipment design, must include the effects of equipment geometry and size in addition to fluid properties.

NASA has undertaken a program [1] to determine the cavitation characteristics of various hydrodynamic bodies and the thermodynamic behavior of different fluids, in an effort to obtain improved design criteria to aid in the prediction of cavitating pump performance. The study described herein was conducted in support of this program.

Liquid hydrogen and liquid nitrogen were chosen as test fluids for this study for the following reasons: (1) the ultimate goal of this program is to acquire sufficient knowledge to permit intelligent design of pumps for near-boiling liquids, and (2) predictive analyses indicated [1] that the physical properties of hydrogen and nitrogen make them particularly desirable test fluids. The objectives of this study were 1) to experimentally determine the flow and thermodynamic conditions required to induce desinent (or incipient) and developed cavitation on various hydrodynamic bodies, 2) to improve existing correlative expressions for the prediction of cavitating performance of hydraulic equipment, and 3) to establish, if possible, a technique for predicting the fluid-handling capability of different cavitating equipment using different fluids. The latter two items are extensions of the state-of-the-art and the last objective is highly optimistic, i. e., accounting for the effects of equipment geometry and size in the predictive expressions.

This report covers the work performed on three cylindrical bodies with quarter-caliber rounded heads. Such bodies are commonly called 'ogives' and 'quarter-caliber' indicates that the curve that is tangent to the cylinder nose and the cylindrical body has a radius that is 1/4 of the diameter of the cylindrical body. The three quarter-caliber ogives had diameters of 0.210-inch (0.533 cm), 0.357-inch (0.907 cm), and 0.420-inch (1.067 cm). This two-to-one variation in size was provided to permit the study of size effects. Cavitation data, pertaining to a transparent plastic venturi and a half-caliber hydrofoil, were presented in Volumes I and II of this report series [20, 21].

Both desinent and incipient cavitation data were acquired with hydrogen and nitrogen test fluids. In this report, desinence (or incipience) refers to barely visible cavities. Preliminary tests indicated that the incipient data were not repeatable; consequently, very little effort was expended in acquiring incipient data--only two incipient data points are reported in the tabulated data given in appendix A. In the desinent cavity studies, the range of attainable test section inlet velocities varied with the size of the ogives as follows: For the 0.210-inch ogive, the velocity varied from 120 to 255 ft/s (36.6 to 77.7 m/s) with hydrogen, and from 30 to 90 ft/s (9.1 to 27.4 m/s) with nitrogen; for the 0.357-inch ogive, the velocity varied from 113 to 230 ft/s (34.4 to 70.1 m/s) with hydrogen, and from 25 to 83 ft/s (7.6 to 25.3 m/s) with nitrogen; for the 0.420-inch ogive, the velocity varied from 110 to 158 ft/s (33.5 to 48.2 m/s) with hydrogen, and from 27 to 70 ft/s (8.2 to 21.3 m/s) with nitrogen. Inlet fluid temperatures were varied from approximately 37 to 42 R (20.56 to 23.33 K) with hydrogen, and from 138 to 166 R (76.67 to 92.22 K) with nitrogen.

Pressure and temperature profiles, within fully developed cavities, were measured and are referred to herein as developed cavitation data. The bulkstream vapor pressure exceeds the measured cavity pressure and the saturation pressure corresponding to the measured cavity temperature; therefore, the measured pressure depressions, and the pressure depressions corresponding to the measured temperature depressions, within the cavity, are called "pressure depressions." Alternatively, the pressure depression may be expressed in terms of its equivalent equilibrium "temperature depression." Contrary to the venturi tests [20, 22], no thermodynamic metastability was detected within the vaporous hydrogen or nitrogen cavities developed on the hydrofoil [21] or the ogives; i.e., measured temperatures and pressures within the cavitated regions appeared to be in thermodynamic equilibrium.

Test section inlet velocity range, inlet liquid temperatures, and cavity lengths varied with ogive size; fluid velocities and temperatures were approximately the same as those listed for the desinent data. Slightly higher velocities were required to develop long cavities on the ogives, and maximum inlet velocities were attained with the 0.210-inch ogive. Maximum inlet velocities were:

1) <u>0.210-inch ogive</u>-- 304 ft/s (92.7 m/s) with hydrogen and 111.6 ft/s (34.0 m/s) with nitrogen,

2) <u>0.357-inch ogive</u>-- 263.3 ft/s (80.3 m/s) with hydrogen and 90.6 ft/s (27.6 m/s) with nitrogen,

3) <u>0.420-inch ogive</u>-- 169.1 ft/s (51.5 m/s) with hydrogen and 72.0 ft/s (21.9 m/s) with nitrogen.

Cavity lengths varied as follows:

1) <u>0.210-inch ogive</u>--0.22 to 0.96 inches (0.56 to 2.44 cm) with hydrogen and from 0.20 to 1.52 inches (0.51 to 3.86 cm) with nitrogen,

2) <u>0.357-inch ogive</u>-- 0.40 to 1.50 inches (1.02 to 3.81 cm) with hydrogen and from 0.40 to 1.75 inches (1.02 to 4.45 cm) with nitrogen,

3) <u>0.420-inch ogive</u>-- 0.44 to 1.48 inches (1.12 to 3.76 cm) with hydrogen and from 0.32 to 1.80 inches (0.81 to 4.57 cm) with nitrogen.

A similarity equation, based upon the B-factor concept of Stahl and Stepanoff [11], has been developed [19] for correlating cavitation data for a particular test item from fluid-to-fluid; this correlation is also useful in extending the velocity and temperature range of data for any given fluid. Thermal boundary layer considerations and two-phase mass flux limiting concepts were used [21] to improve this correlative expression. A new correlating parameter, MTWO, was developed [21] and has proven to be a valuable correlating parameter for our venturi, hydrofoil [21], and ogive data. The MTWO parameter is the ratio of V_o/V_ℓ --where V_ℓ is proportional to the two-phase liquid-vapor sonic velocity across the cavity interface, see reference [21]. The correlative expressions [21] developed in the course of this study are used to correlate the experimental data for the ogives. A comparison of the correlative results for the venturi, hydrofoil, and ogives is also provided.

The developed cavitation number, $K_{c,min}$, is a vital parameter in current formulations for predicting [3-5] the cavitating performance of liquid pumps. $K_{c,min}$, for a specific piece of equipment, is currently obtained from experimental performance tests. To apply existing predictive techniques, $K_{c,min}$ must remain essentially constant, thus requiring the use of similar or identical equipment. Existing predictive techniques could be generalized, and possibly materially improved, if $K_{c,min}$ were predictable from one piece of equipment to another. This study indicates that it may be possible to predict $K_{c,min}$ from known fluid flow and equipment geometry considerations. It will be shown that $K_{c,min}$ can be related to the non-cavitating minimum pressure coefficient for cavitating bodies, such as the venturi [20], hydrofoil [21], and ogives used in this study. A similar approach may be possible with rotating machinery such as liquid pumps and inducers.

3. EXPERIMENTAL APPARATUS

The experimental apparatus used in this study was explained in detail in the first volume [20] of this report series. The experimental facility, instrumentation, error statements, visual and photographic aids, and test procedures are fully described in that document [20]. One additional error statement--concerning uncertainty in pressure measurement for nitrogen test fluid--was needed and given in section 5.2 of Volume II [21]. Only the test section (tunnel) and ogive details need to be discussed here. The tunnel was located between the supply and receiver dewars of a blowdown flow system, see reference [20].

3.1 Ogives, Tunnels, and Sting-Mount Assembly

The quarter-caliber ogives, used in this experiment, were chosen so that developed cavitation test data could be obtained for external flow over axisymmetric bodies. These data may ultimately be correlated with similar data for external flow over a hydrofoil [21] and for internal flow through a venturi [20]. Also, the ogives offer an opportunity to study the effects of cavity shape on the correlative formulae, i.e., the cavity thickness, as a function of length, velocity, etc., may be determined.

The three ogives used in this experiment consisted of cylindrical bodies with quarter-caliber rounded noses. The diameters of the cylindrical bodies were 0.210-inch (0.533 cm), 0.357-inch (0.907 cm) and 0.420-inch (1.067 cm). The length-to-diameter ratio of the ogives is 8:1, and the ogives are instrumented with pressure and temperature sensors over a length of ~ 3.5 diameters.

Transparent plastic tunnels, and rigid metallic sting-mounts, were designed to experimentally complement the quarter-caliber ogives. The ogives were designed to mate directly with the sting-mount used in the hydrofoil tests [21]--this sting design was fully described in the hydrofoil report [21] and will not be discussed herein. Initially, the tunnels were designed so that the internal passages were constant-diameter cylindrical ducts; however, difficulties were encountered with tunnel cavitation, and it was necessary to enlarge the tunnel diameters downstream of the ogive noses.

A photograph of the 0.210-inch and 0.420-inch ogives, ready for installation in the test facility, is shown on figure 3.1. Optical distortion photographs of the three plastic tunnels, as fabricated, are shown on figures 3.2 through 3.4. A sketch of an instrumented ogive and sting assembly is given on figure 3.5, and figures 3.6 through 3.8 show photographs of the ogives as viewed during tests. Details concerning the ogives and tunnels are given below and on figures 3.9 through 3.14.

3.1.1 Design Considerations

The ogives were initially designed to be situated within constant-diameter cylindrical tunnels. A tunnel blockage factor, $(D_m/D_o)^2$, of approximately 10 percent was selected to cause the ogives to cavitate readily; however, preliminary tests indicated that cavities, developed on the ogives, were sufficiently thick to cause tunnel cavitation. The tunnel (test section) cavitation is attributed to the pressure reduction that accompanies the acceleration of liquid between the cavity and tunnel walls. Machining a bell-contoured diffuser into the plastic tunnel alleviates this Bernoulli effect in the vicinity of the cavity, but simultaneously decreases the ogive cavitation number, K_{iv}--resulting in lower magnitudes of subcooling, $P_o - P_v$, in the tunnel inlet liquid and therefore enhancing cavitation in the inlet of the tunnel. Thus, to perform experiments within the pressure and flow limitations of the existing facility, it was necessary to machine bell-contoured diffusers into each of the plastic tunnels, see figures 3.12 to 3.14. These contours provided sufficient relief to avoid tunnel cavitation, without detachment of the cavity on the ogive, i.e., the cavity developed on the ogive adhered to the ogive--all tests were monitored via remote closed-circuit TV and motion picture cameras.

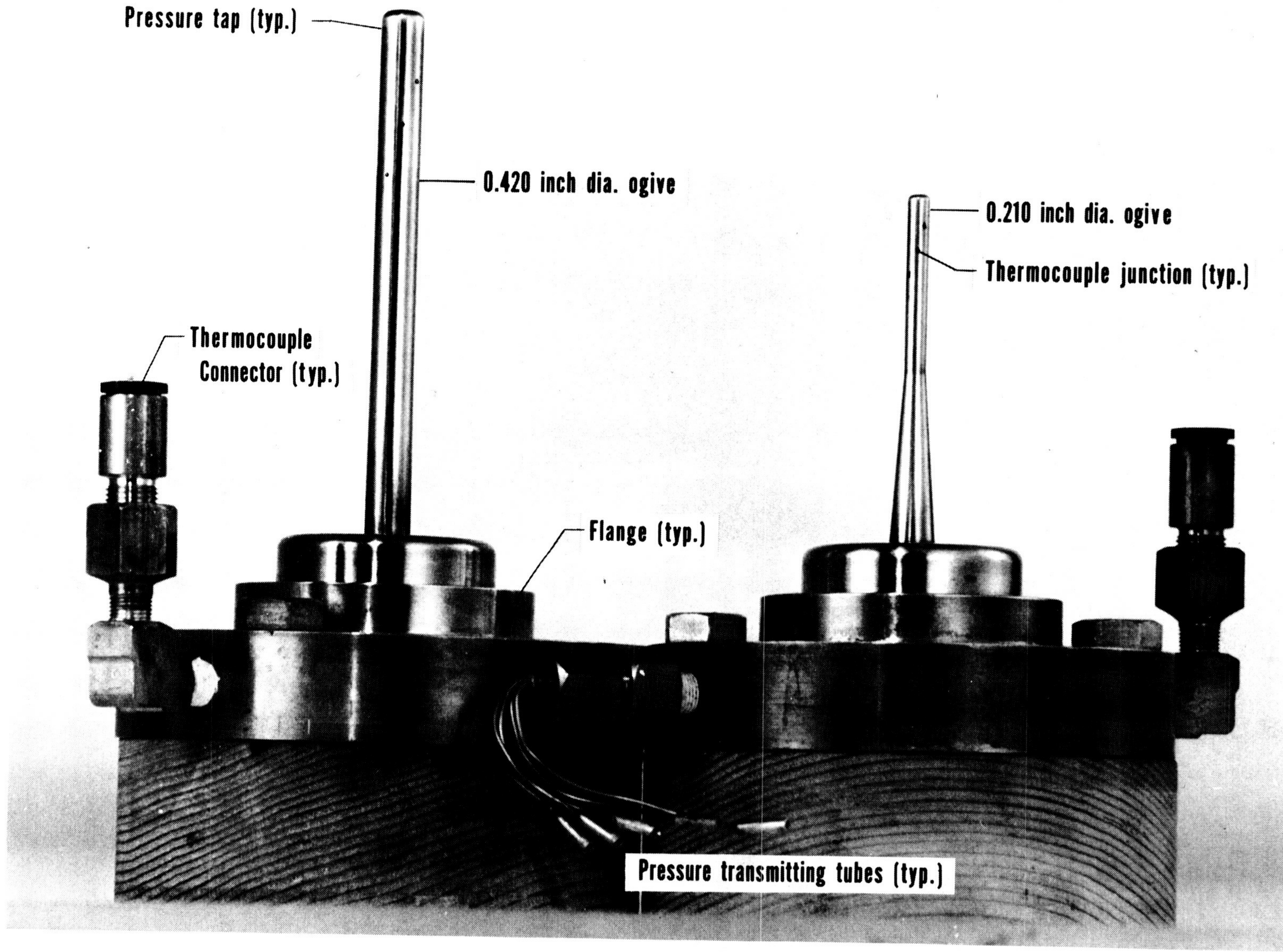

Figure 3.1 Photograph of 0.420-inch and 0.210-inch diameter ogives ready for installation in test facility.

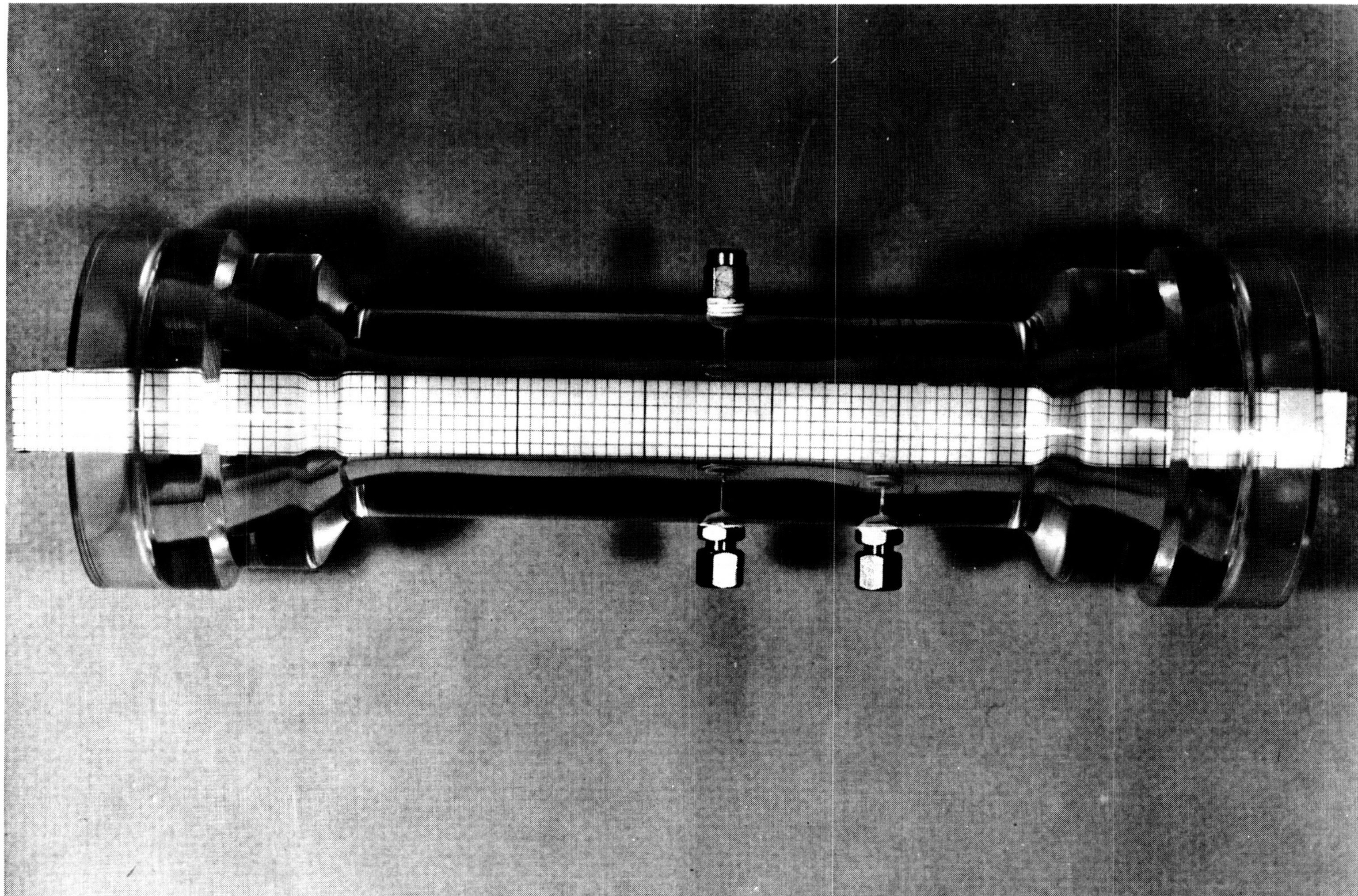

Figure 3.2 Photograph showing optical distortion attributable to plastic tunnel, as fabricated, for the 0.210-inch ogive.

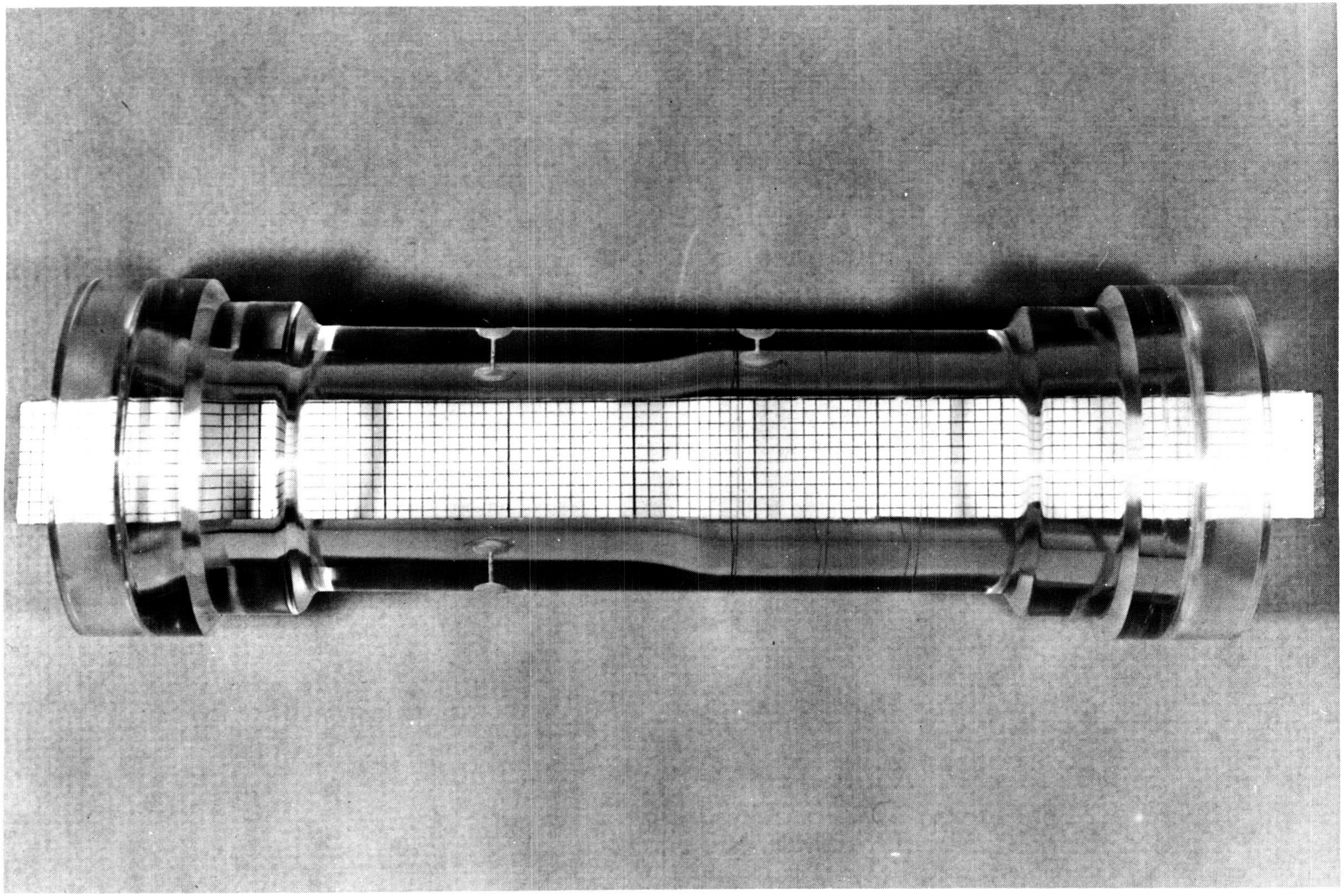

Figure 3.3 Photograph showing optical distortion attributable to plastic tunnel, as fabricated, for the 0.357-inch ogive.

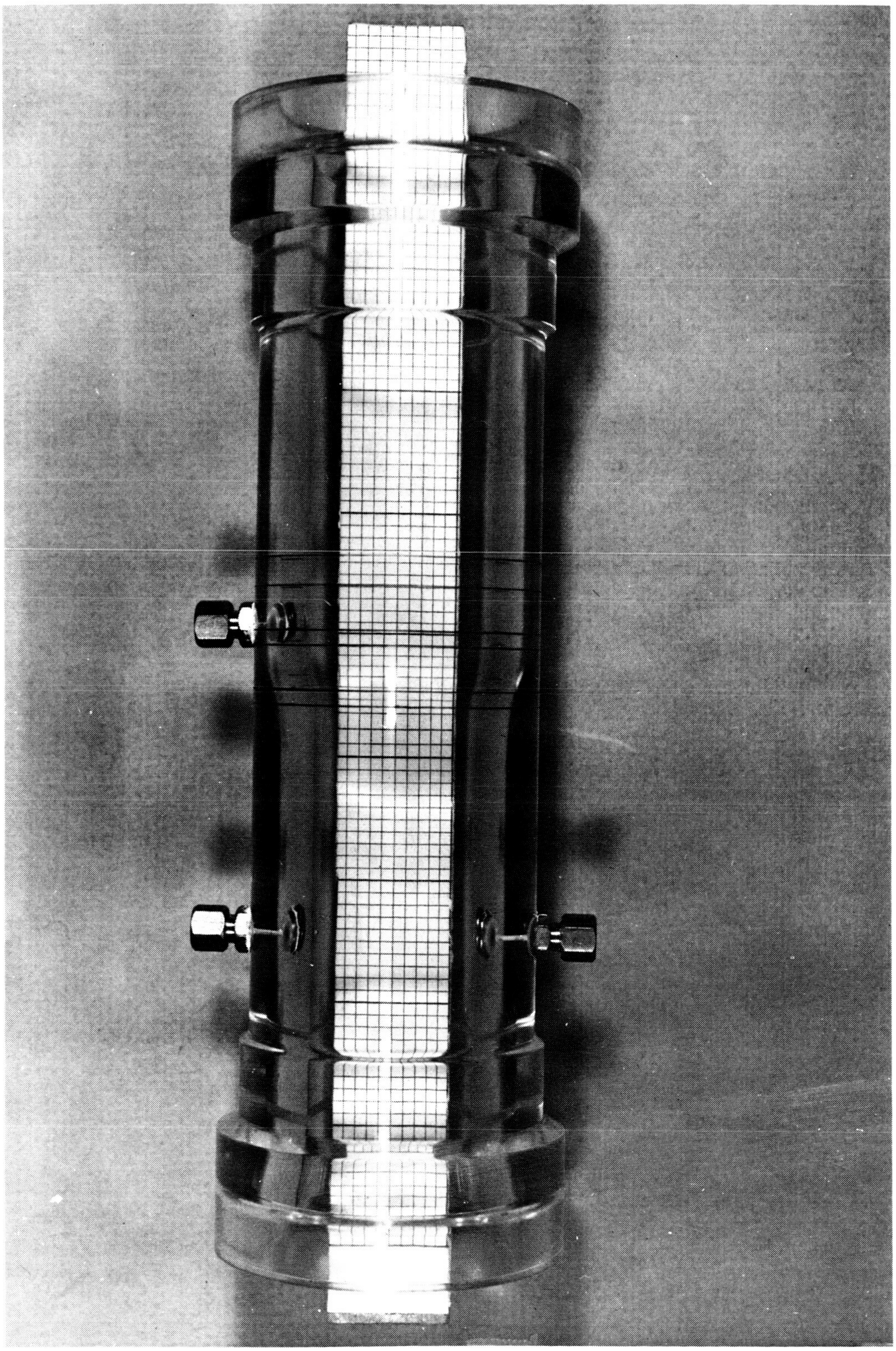

Figure 3.4 Photograph showing optical distortion attributable to plastic tunnel, as fabricated, for the 0.420-inch ogive.

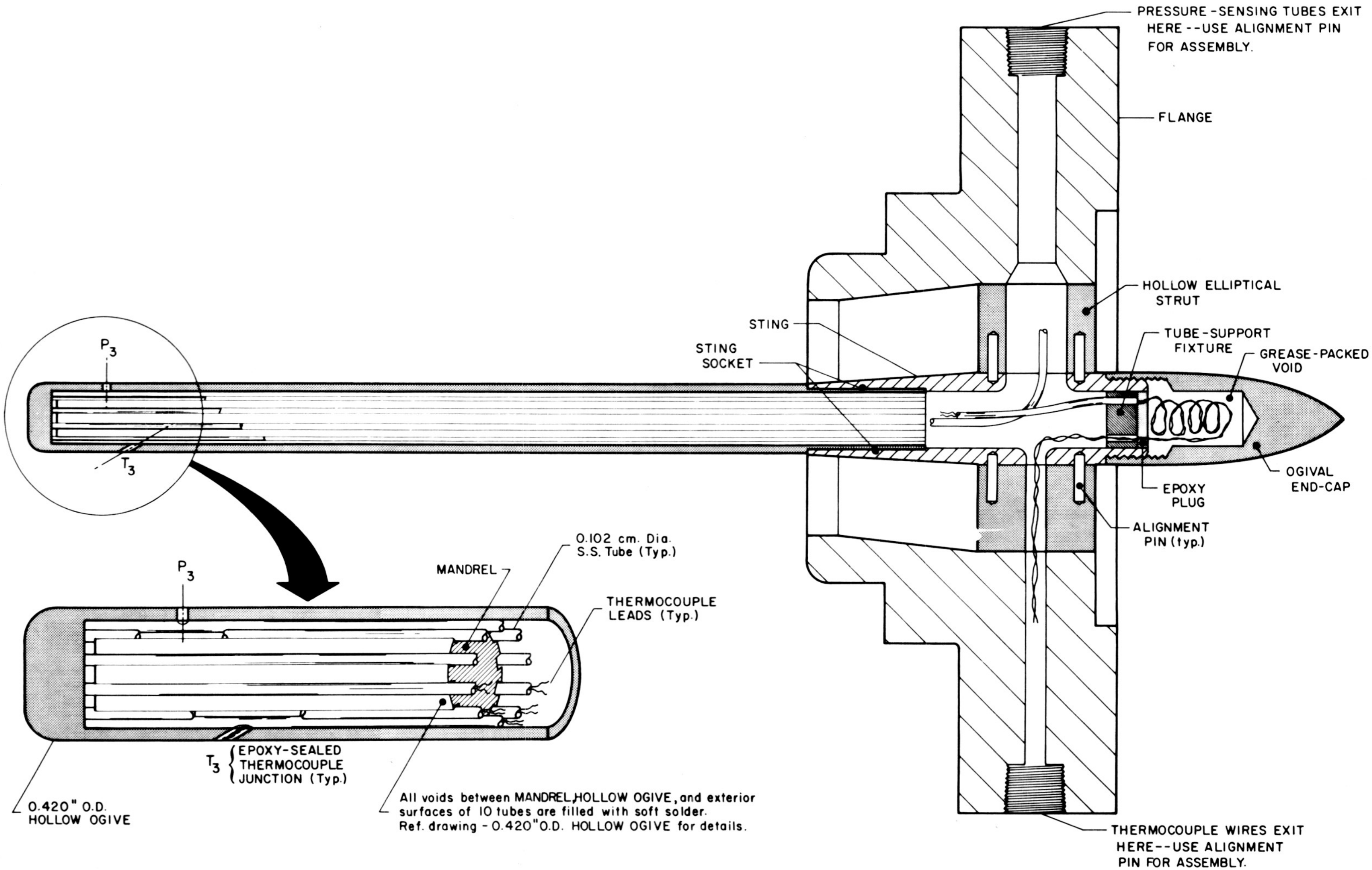

Figure 3.5 Sketch of instrumented ogive and sting assembly.

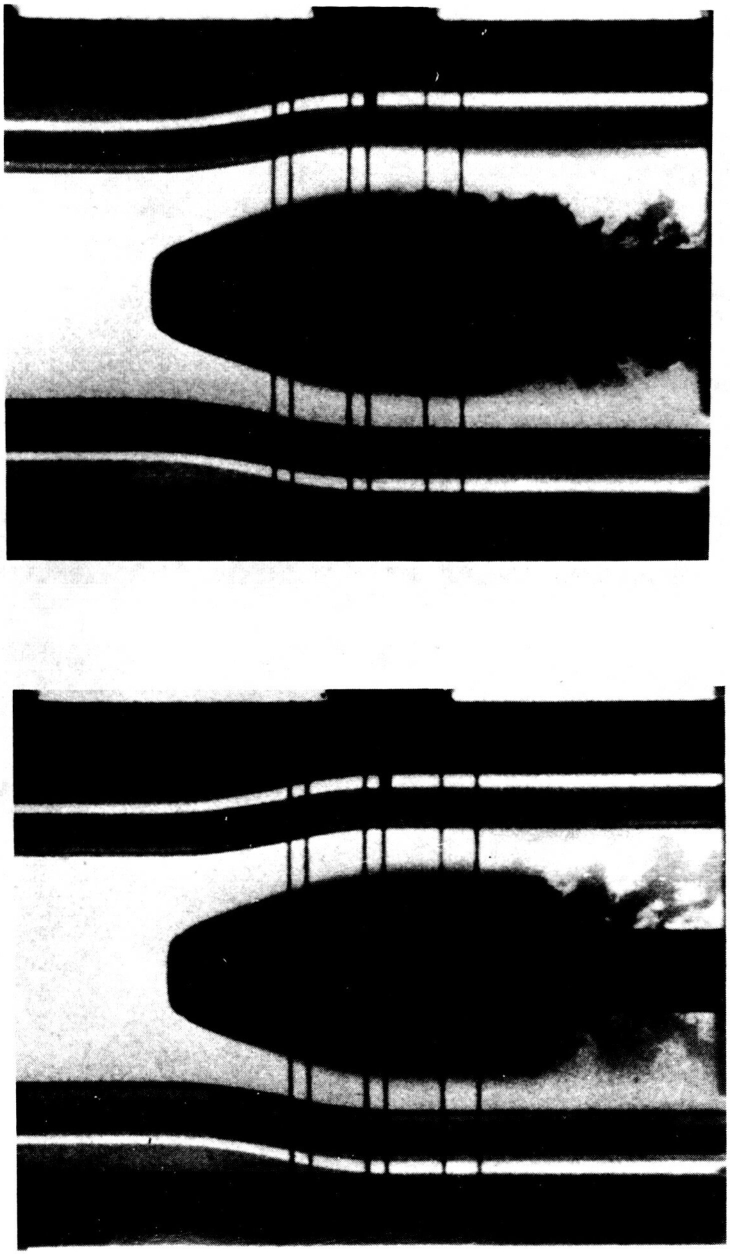

Figure 3.6 Photographs showing typical appearance of vaporous hydrogen cavities on the 0.210-inch ogive.

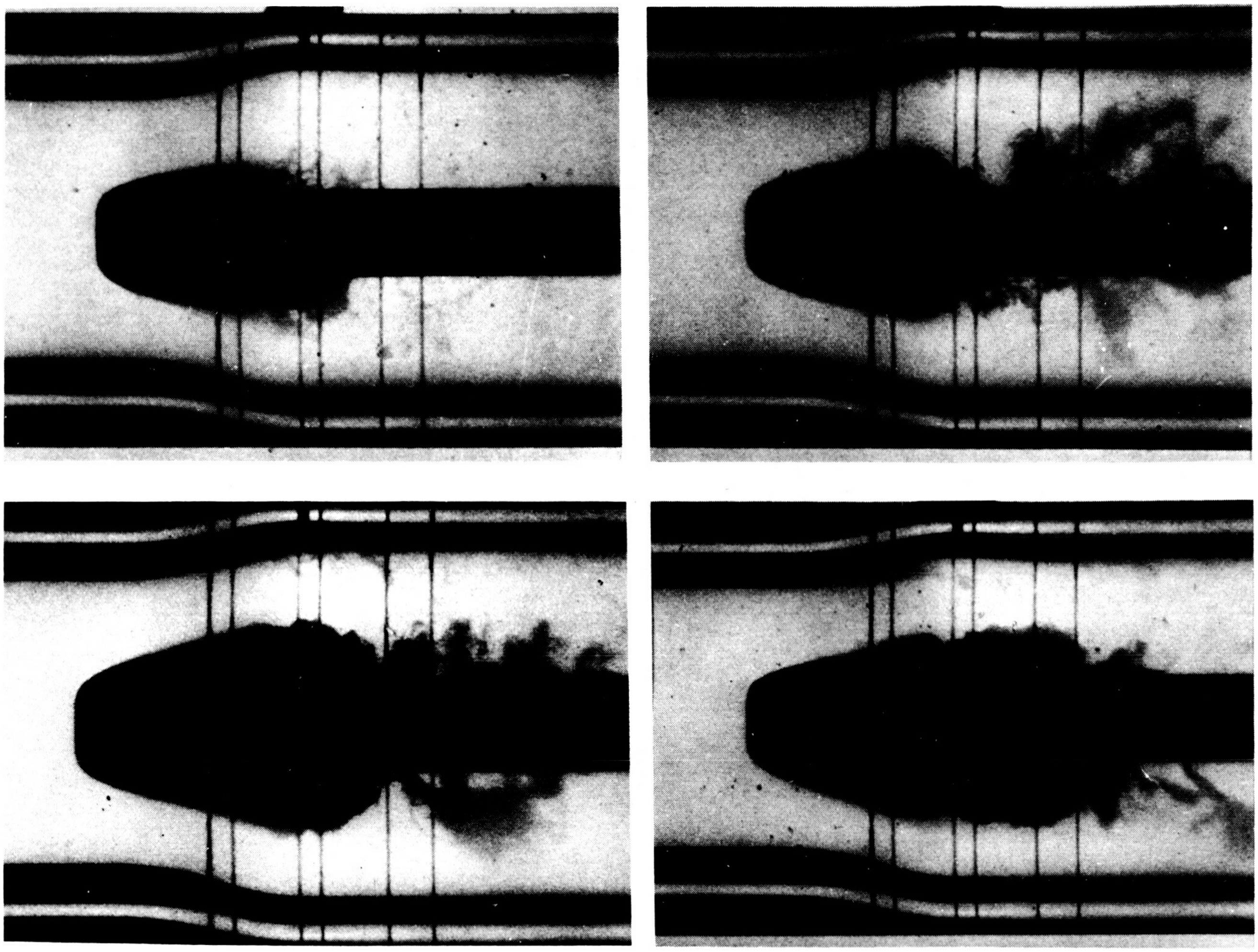

Figure 3.7 Photographs showing typical appearance of vaporous hydrogen cavities on the 0.357-inch ogive.

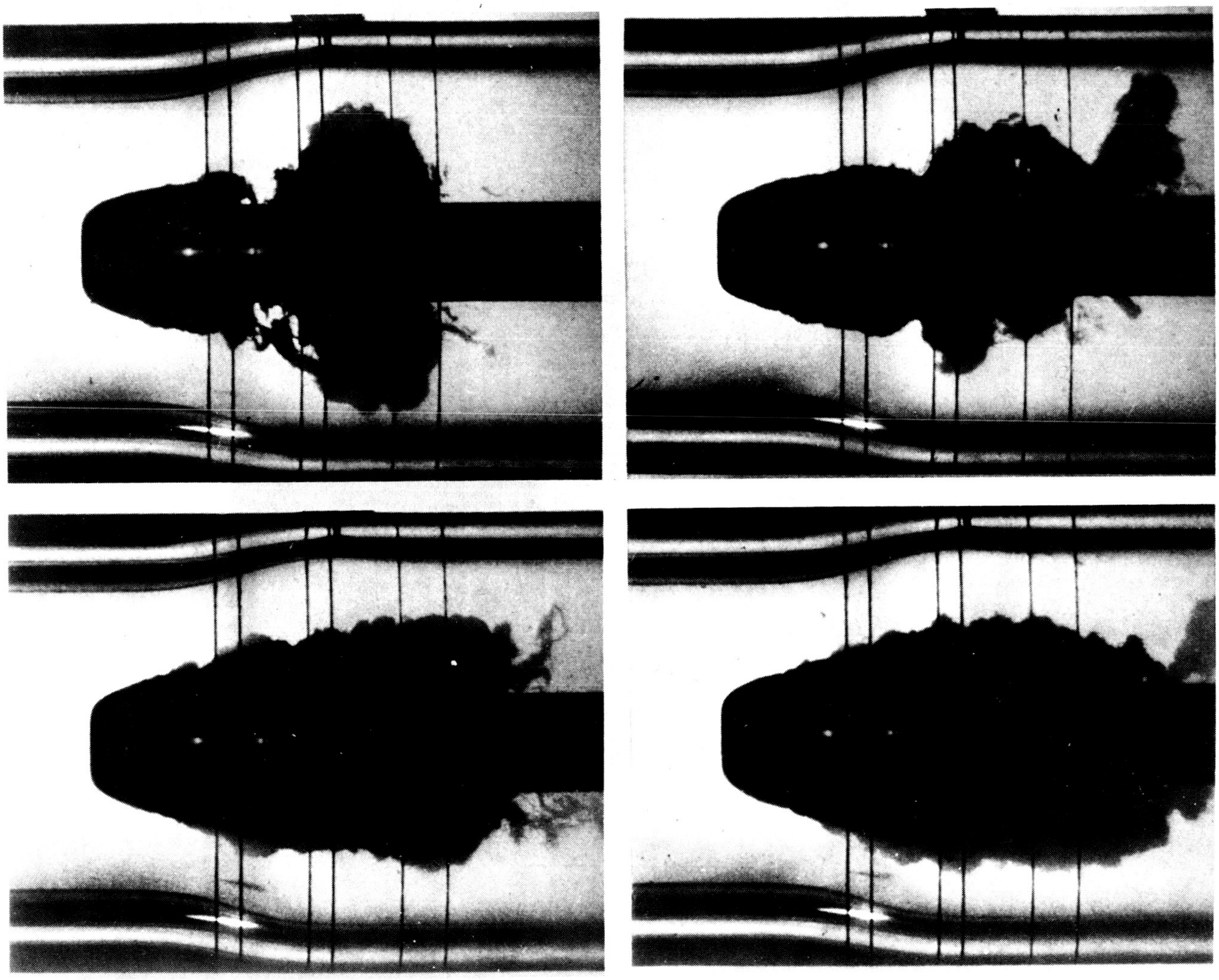

Figure 3.8 Photographs showing vaporous hydrogen cavities on the 0.420-inch ogive --bottom two photographs show typical appearance.

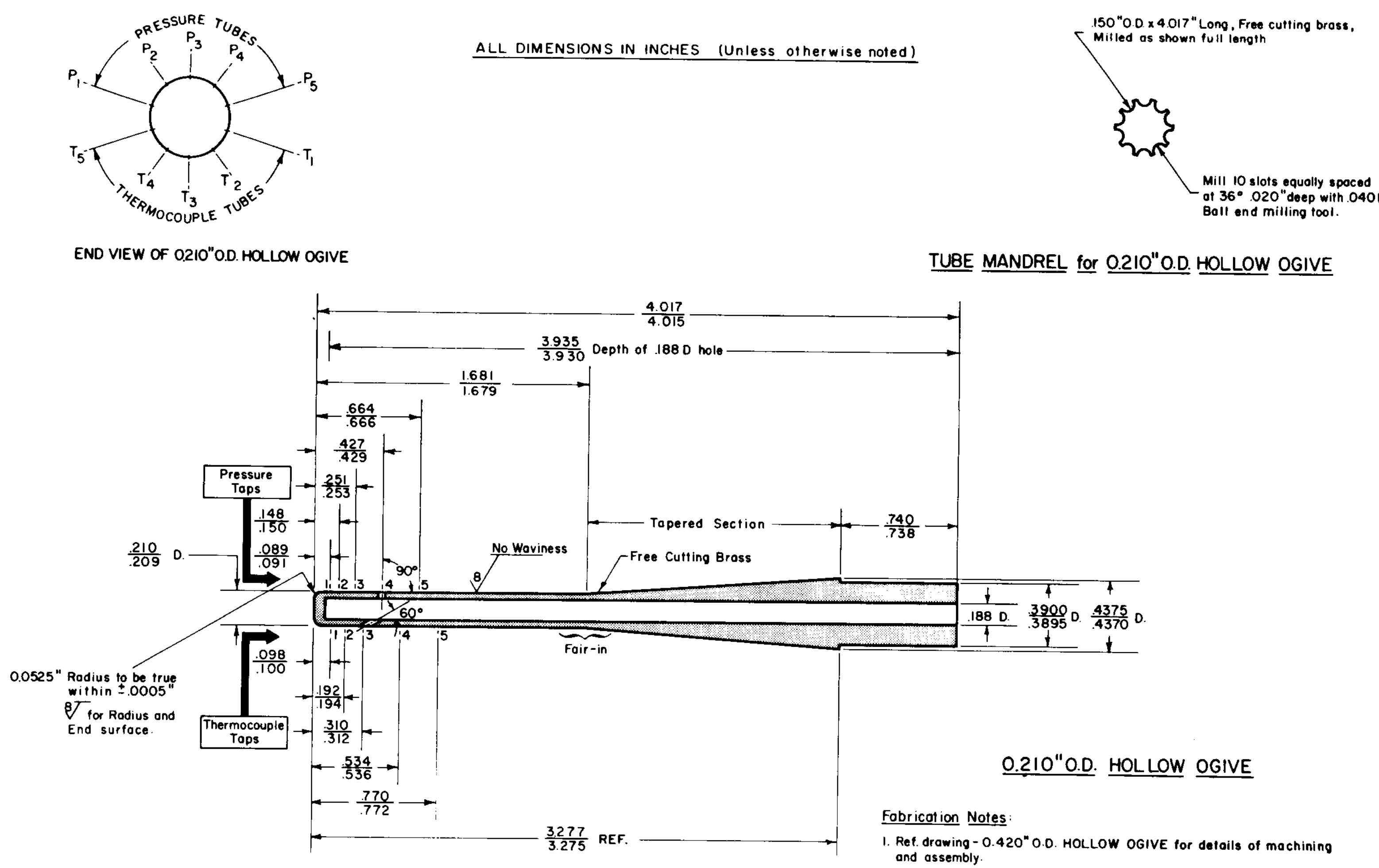

Figure 3.9 Details of 0.210-inch diameter ogive.

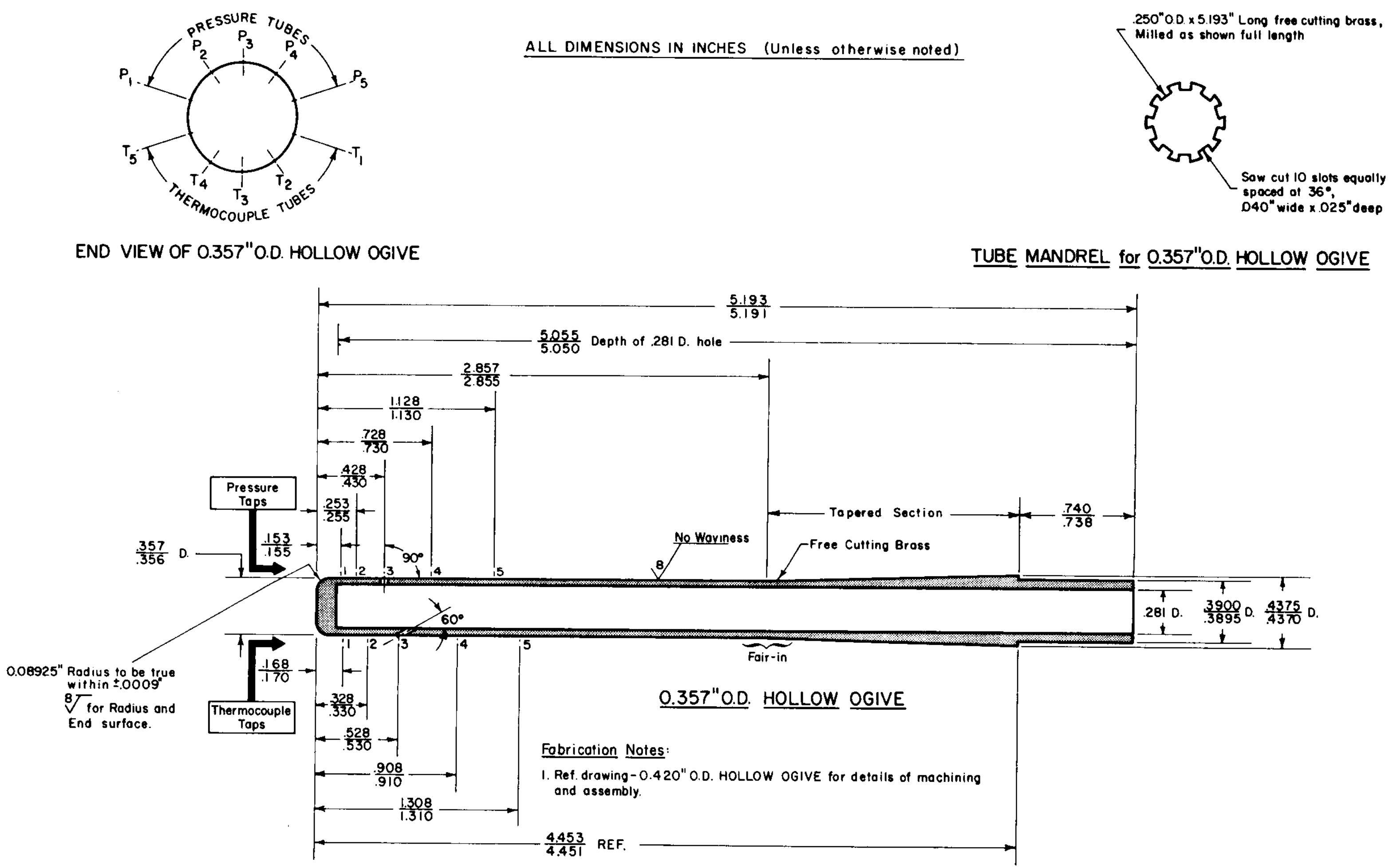

Figure 3. 10 Details of 0. 357-inch diameter ogive.

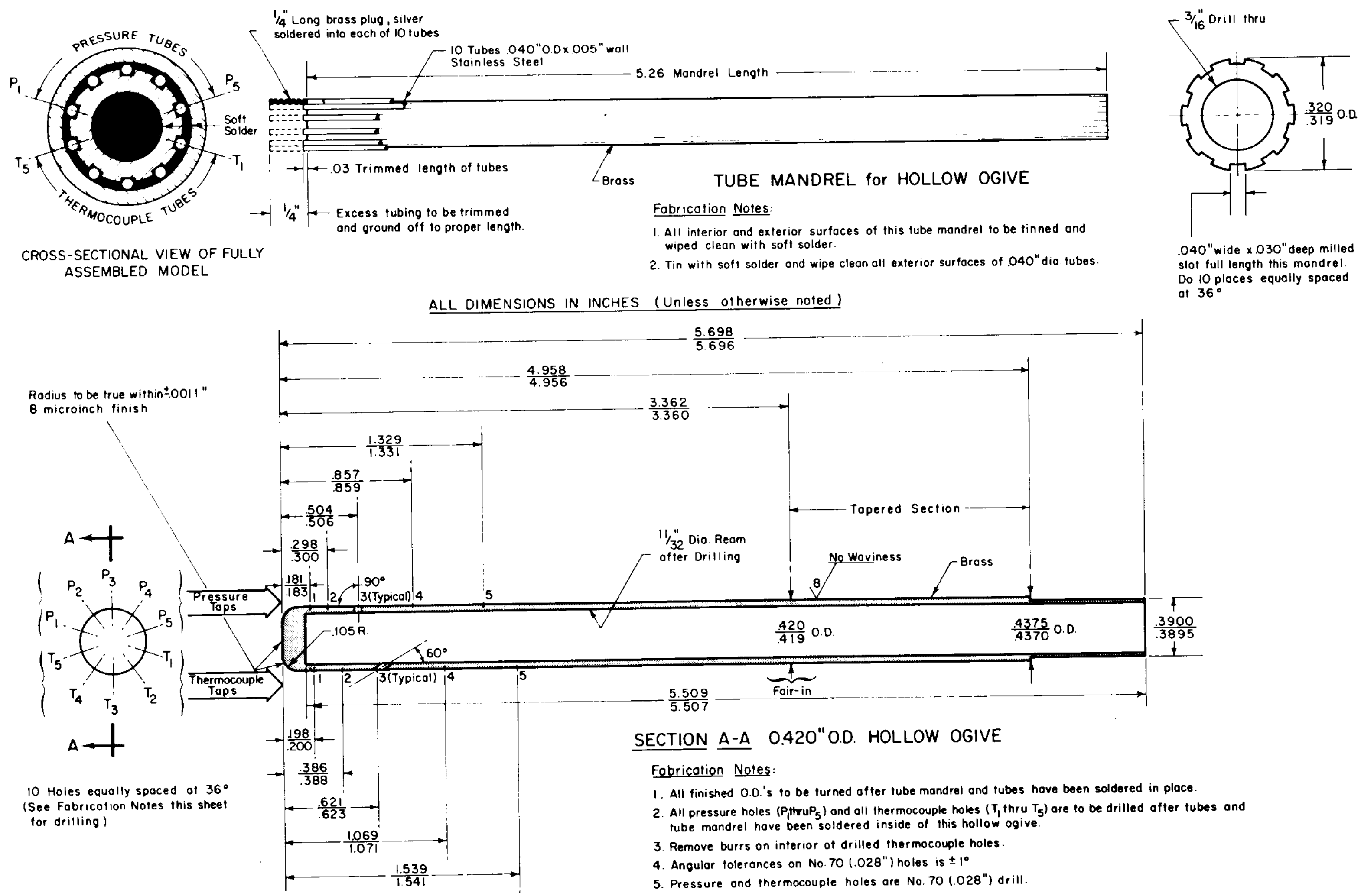

Figure 3.11 Details of 0.420-inch diameter ogive.

ALL DIMENSIONS IN INCHES (Unless otherwise noted)

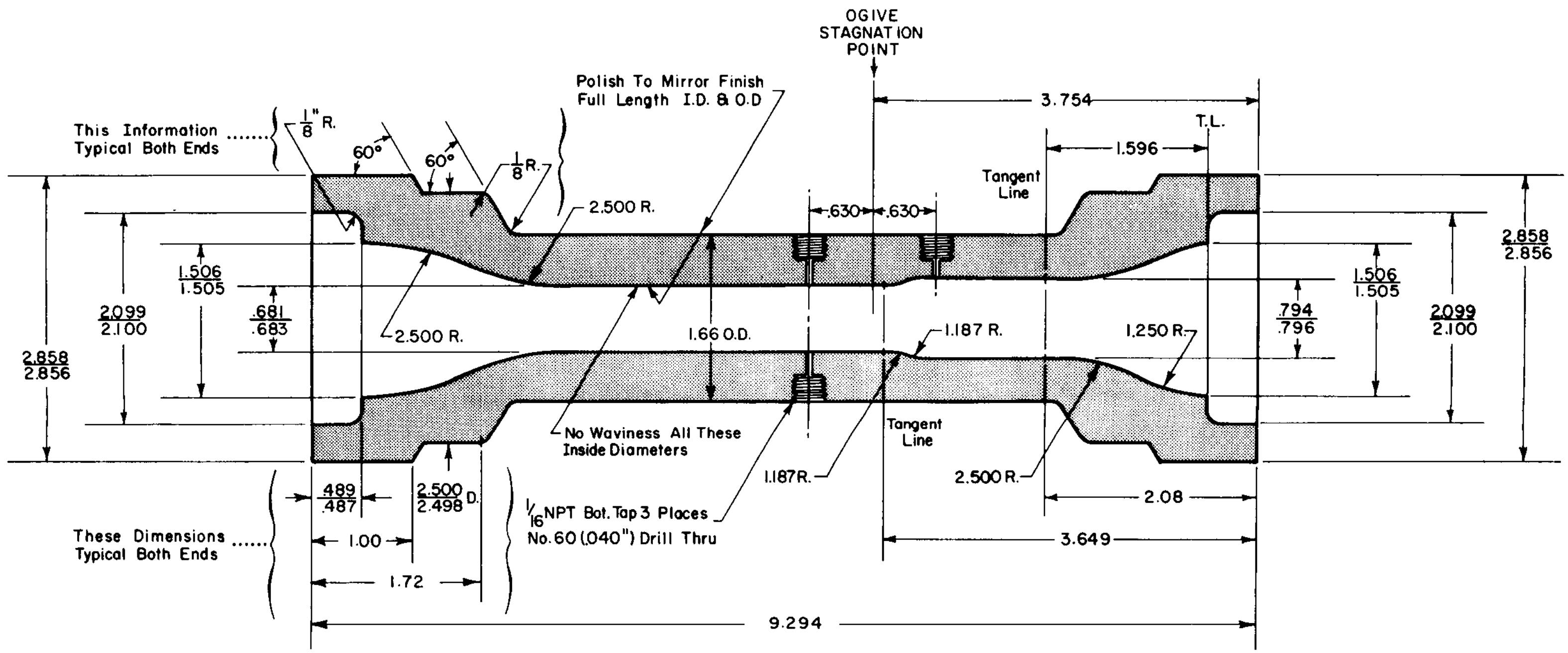

Figure 3.12 Details of plastic tunnel for 0.210-inch diameter ogive.

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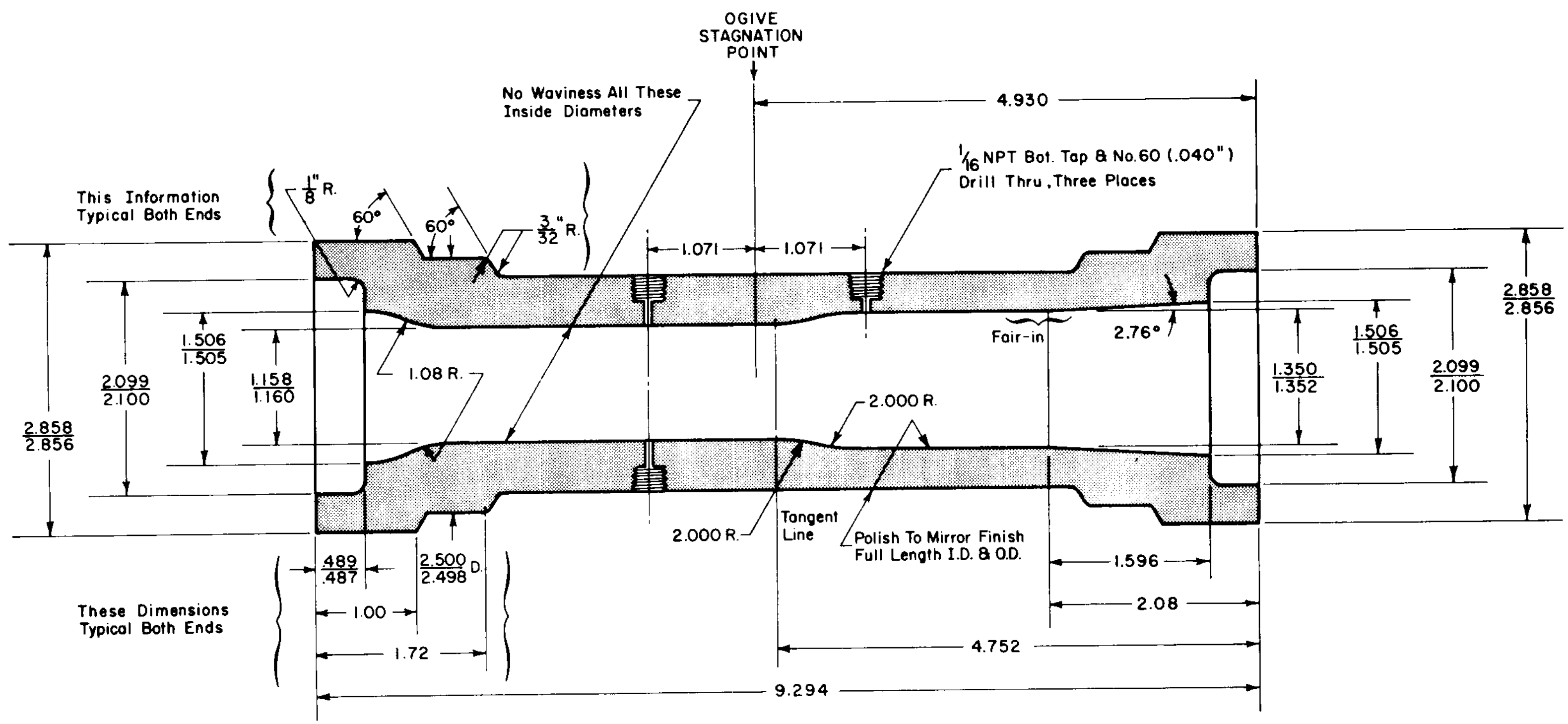


Figure 3.13 Details of plastic tunnel for 0.357-inch diameter ogive.

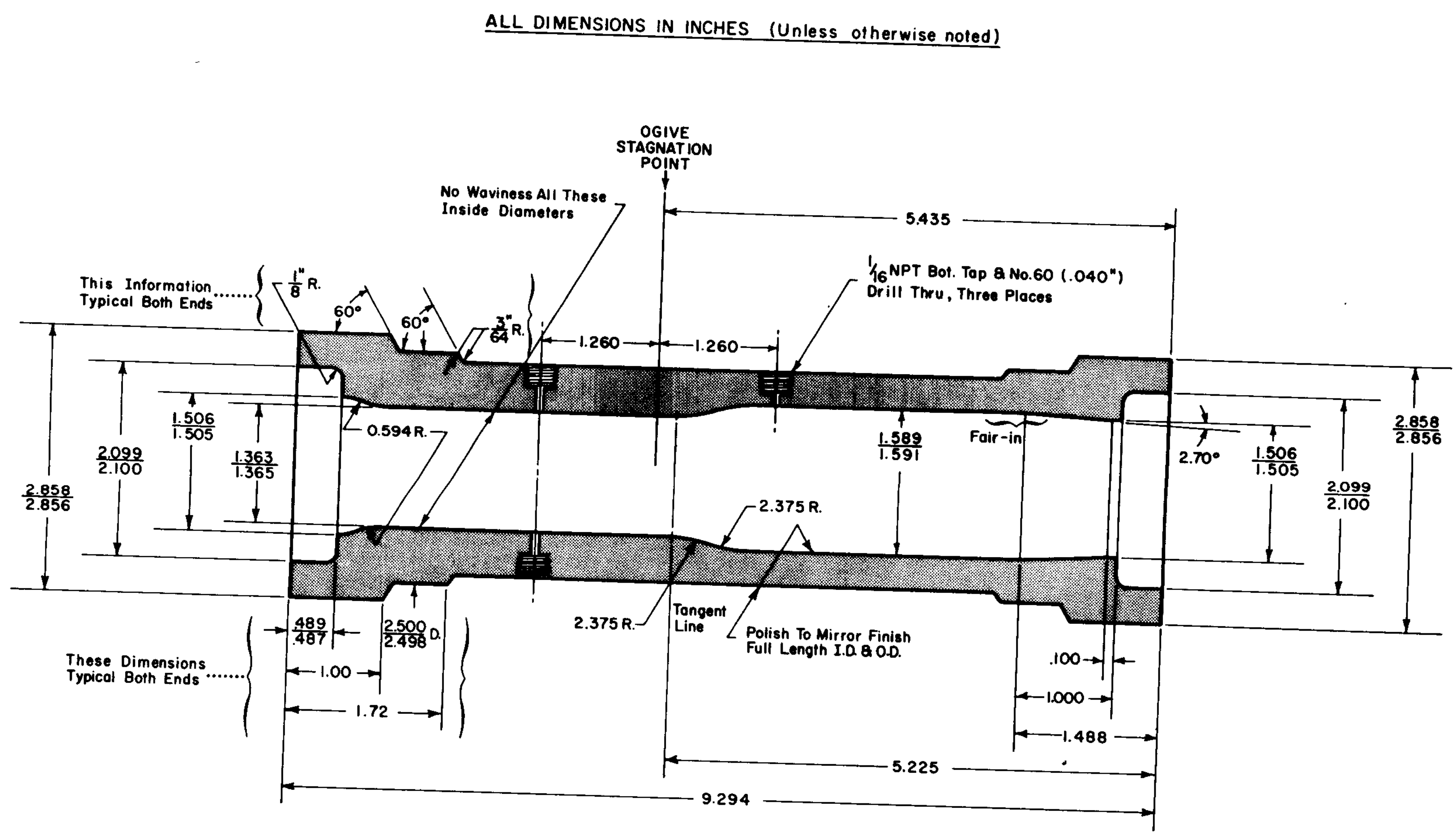


Figure 3.14 Details of plastic tunnel for 0.420-inch diameter ogive.

Several experiments were performed to determine the optimum configuration of the diffuser contour. Conical tapers of 3.5 degrees (half-angle taper) and 4.94 degrees were tested before the bell-contour was tried. Neither of these conical diffusers provided sufficient pressure recovery, far enough upstream, to avoid tunnel cavitation in the vicinity of the cavity attached to the ogive. Calculations indicated that conical diffusers with steeper half-angles would promote flow separation at the diffuser entrance, thus promoting cavitation at that point. Consequently, bell-contours were designed and the configuration indicated on figures 3.12 to 3.14 was finally selected. This contour was located so that the ogive cavitation number, K_{iv}, was not drastically lowered, and a blockage factor of 9.5 percent was found to be optimum. Thus, to avoid tunnel cavitation, the tunnel design was compromised by the addition of a bell-contour diffuser--simultaneously, this diffuser demanded the use of a 9.5 percent blockage factor and dictated the axial position of the ogive nose, relative to the diffuser. This axial position is clearly indicated on figures 3.12 to 3.14.

One of the primary objectives of this study was to experimentally determine cavity shapes, thicknesses, etc.; therefore, photographs were taken, using rectangular grid paper, to evaluate the optical distortion caused by the bell-contours. Figures 3.2 to 3.4 indicate the magnitude of this optical distortion--cavity dimensions, obtained from cavity photographs, were corrected to account for this tunnel induced optical distortion. The plastic tunnels were designed to provide noncavitating uniform flow at the ogive nose. Uniformity of static pressure at the wall of the tunnel inlet was experimentally verified by diametrically-opposed static pressure measurements in the tunnel inlet, see figures 3.12 to 3.14

The thermocouple junctions and pressure sensing ports, used to measure temperatures and pressures within the cavities developed on the ogives, were located as shown in figures 3.9 to 3.11. The pressure and temperature sensors were spaced to provide a well-defined continuous pressure profile, as obtained from the pressure and temperature measurements within the cavity. The cavities developed on the ogives appeared symmetrical in all tests, see figures 3. 6 to 3. 8.

The ogive test assembly was installed in the same space allocated for the plastic venturi [20] and the hydrofoil [21] in the experimental apparatus.

3. 1. 2 Details of Fabrication

The tunnels were constructed from annealed, cast acrylic rod; they were easily machined by conventional means. The bell-contours were cut by grinding special lathe tools with the exact contours as indicated on figures 3. 12 to 3. 14. The contours of the tool bits were verified by 50 X magnification on an optical comparator. After machining, the internal dimensions and contours of the tunnels were checked by using the tunnels as molds for dental plaster plugs; the plugs were then removed and measured. The internal passages of the tunnels were then carefully polished to a high lustre, using plastic polishing compound.

With the critical machining and polishing completed, the tunnel exteriors were machined and polished. Tunnel dimensions and the location of pressure taps are shown on figures 3. 12 to 3. 14. Maximum effort was devoted to polishing the interior and exterior surfaces of the tunnel walls, so that cavities on the ogives could be observed with maximum optical resolution. Scribe marks on the tunnel exteriors were used to estimate developed cavity lengths, see figures 3. 2 to 3. 4 and 3. 6 to 3. 8.

Construction of the ogives is quite intricate; therefore, one must carefully study figures 3. 9 to 3. 11 and figure 3. 5 to fully appreciate the finer details. The hollow ogives and ogive mandrels were easily machined by conventional means. The quarter-caliber ogival nose was lathe-cut by using a special tool that was shaped by grinding. The mandrel portion of each ogive was designed to accommodate ten stainless steel tubes [0.040-inch (0.102 cm) diameter with 0.005-inch (0.013 cm) wall thickness], see figures 3.9 to 3.11. Each tube was plugged with silver solder on the end nearest the leading edge of the ogive, see figure 3.11. With the tubes in place, the mandrel and tubes were tinned with soft solder. The hollow ogive, as shown on figure 3.11, was puddled full of soft solder. The mandrel and hollow ogive were then carefully assembled, while the solder was liquid.

Upon completion of this assembly, holes were drilled through the ogive into each of the ten small tubes as indicated on figures 3.5 and 3.11. Each of the holes, so drilled, are isolated from the others by the soft solder that fills all voids between the mandrel and hollow ogive. Five of these holes became pressure sensing stations, while the other five were used for thermocouples. This entire assembly was then attached, by soldering, to the sting socket using a special alignment fixture, see figure 3.5. The small tubes must be threaded through the sting, hollow strut, etc., to mate the ogive and sting. Also, the five tubes used as thermocouple conduits were extended through a tube support, at the rear of the sting, and soft soldered to this support. Later, during thermocouple fabrication, this support was epoxied to the sting.

Five pressure transmitting tubes were routed from the ogive, through the hollow sting, and up through one of the hollow elliptical struts. Then, the tubes pass through a slot in the flange and extend through a short length of 0.25-inch (0.64 cm) diameter tube that was located outside of the flange. The smaller tubes were collectively soldered inside this larger tube, to form a seal, and then the larger tube was sealed to the flange with a commercial compression fitting. Similar fittings were provided for the pressure sensing stations on the plastic tunnel. The small pressure transmitting tubes terminate outside of the flange, in the vacuum insulation space, see figures 3.1 and 3.5. These tubes were then solder-connected to larger tubes which penetrate the vacuum barrier and were attached to pressure transducers.

The other hollow elliptical strut was used to guide thermocouple wires into the vacuum space, see figures 3.1 and 3.5. Details of the thermocouple fabrication, installation, epoxy seals, etc., are given in appendix B of reference [21]. Following this installation, the thermocouple sensors extend through small mounds of epoxy on the ogives. These epoxy bumps must be removed so that 1) the bare thermocouple junction is flush with the surface of the ogive and 2) the thermocouple junction is surrounded by epoxy that electrically and thermally isolates the thermocouple while sealing it to the ogive. This installation technique assures rapid response of the thermocouples, while electrically and thermally isolating the junctions from the metal ogive. The epoxy bumps were finished flush with the ogive, by using Swiss files and then fine-grit sandpaper; during this hand-finishing operation, the entire ogive was tape-masked, exposing only the epoxy bumps. Following this finishing operation, the entire ogive was carefully polished, measured, and installed in the test apparatus.

A detailed description of assembly procedures and instrumentation techniques was provided for the hydrofoil [21]--identical procedures and techniques were used for the ogives and the reader is referred to the earlier work [21] for further details.

3.2 Ogive Contours and Pressure Distributions

The actual and theoretical contours of the 0.210-inch quarter-caliber ogive are shown on figure 3.15. This plot is typical for all of the ogives tested; i.e., the machined contours coincided almost perfectly with the theoretical contours. The actual contours were verified

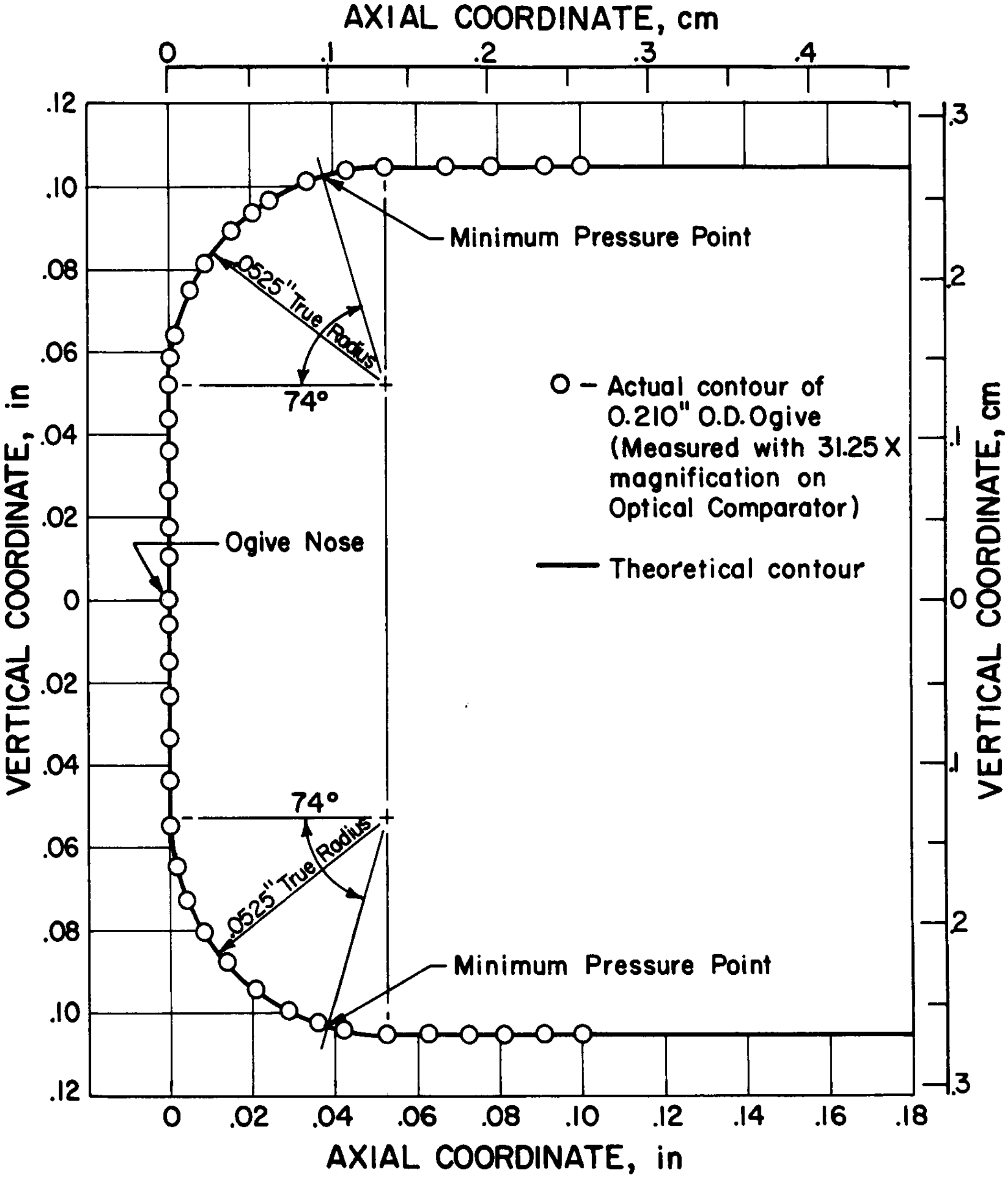


Figure 3.15 Contour of the quarter-caliber rounded nose of the 0.210-inch ogive.

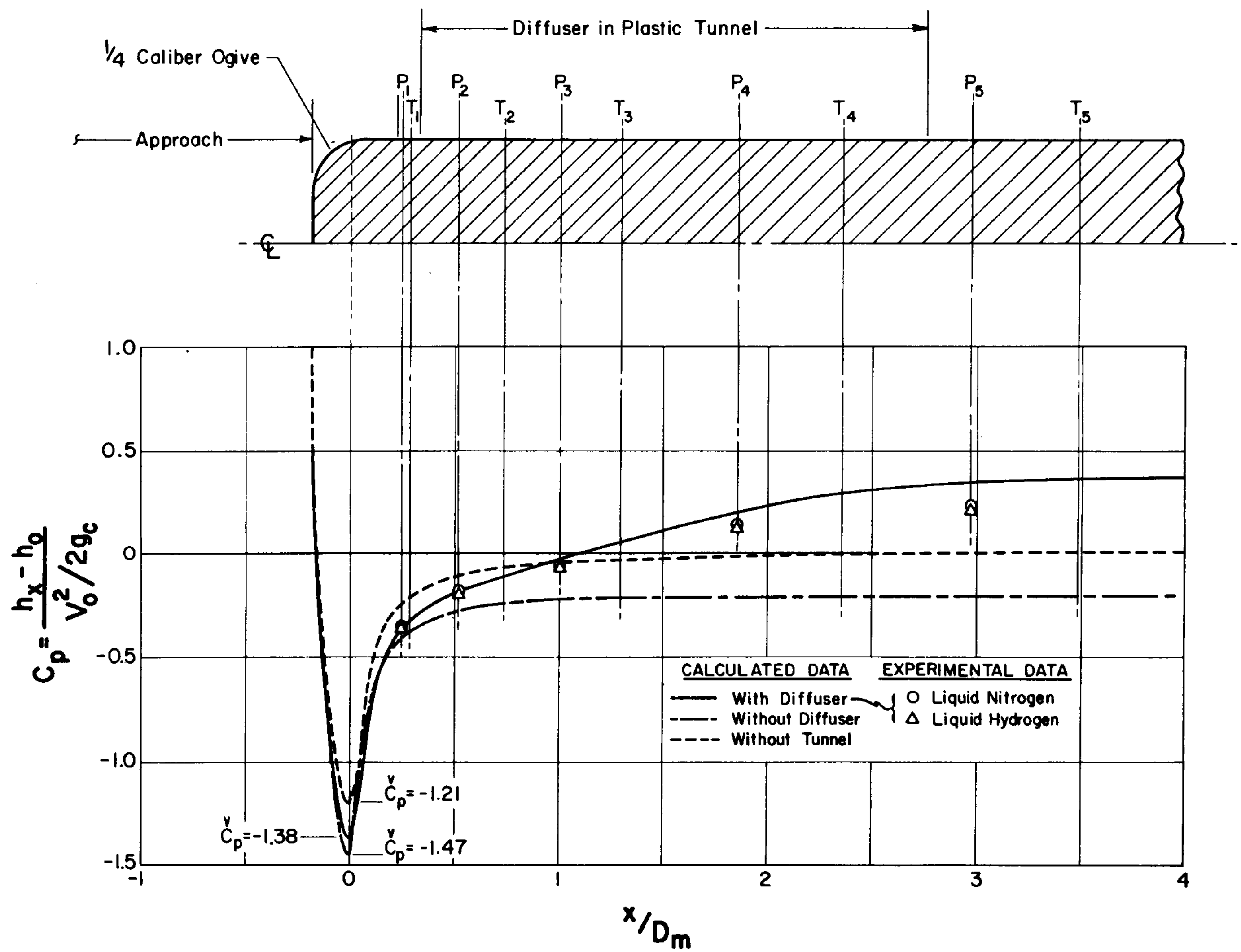


Figure 3.16 Pressure distributions on the quarter-caliber ogives, for noncavitating flow. Computed data supplied by Werner R. Britsch.

by using an optical comparator (shadowgraph) with 31.25X magnification. The theoretical noncavitating pressure profiles for these ogives, with and without bounding walls, are shown on figure 3.16; experimental data from this study are also plotted for comparison. The theoretical pressure profiles were computed using existing computer programs [23, 24]. Figure 3.16 indicates good agreement between experimental and calculate data upstream of the third pressure tap, P_3. Further downstream, the experimental data lie below the theoretical curve, suggesting that pressure recovery in the belled diffuser is less efficient than indicated by the idealized computations.

The calculated data on figure 3.16 are for the cases of 1) an infinite flow field (without tunnel [24]), 2) a constant-diameter cylindrical passage with 9.5 percent tunnel blockage (without diffuser), and 3) the 9.5 percent tunnel blockage ogive-tunnel configuration selected for this study (with diffuser). Figure 3.16 indicates that the minimum pressure point occurs at about 74 degrees of arc, measured from the stagnation point of the ogive. This minimum pressure location is indicated on the contour shown on figure 3.15. The value of 74 degrees corresponds favorably with the pressure coefficient data developed by Rouse and McNown [25], for cylindrical bodies with quarter-caliber rounded heads. Note from figure 3.16 that tunnel bounding wall configurations have negligible influence on the location of the minimum pressure point; however, the tunnel configuration does influence the minimum pressure coefficient, $\check{C}_p$, and the shape of the C_p curve downstream of the minimum pressure point.

It is comforting to note that the tunnel blockage correction factor, normally applied to pressure coefficients and cavitation numbers, agrees well with the calculated data shown on figure 3.16. This tunnel blockage correction factor [21] is simply $\left\{1 - (D_m/D_o)^2\right\}^2$. For our ogives $(D_m/D_o)^2 \approx 0.095$ and $\check{C}_p = -1.47$ for 9.5 percent constant tunnel blockage, see figure 3.16. Correcting for tunnel blockage, we estimate that $\check{C}_p$ for an unbounded ogive is $(1 - 0.095)^2 (-1.47) = -1.20$, in good agreement with the computerized solution plotted on figure 3.16. The bell-contour diffuser produces a minimum pressure coefficient ($\check{C}_p = -1.38$) intermediate to the unbounded ($\check{C}_p = -1.21$) and constant-diameter bounded ($\check{C}_p = -1.47$) ogives, as would be expected.

4. DATA ANALYSIS

The desinent (incipient) and developed cavitation data, for liquid hydrogen and liquid nitrogen, are given in complete detail in appendix A. These tabulated data are given in English and metric units and no attempt has been made to separate the desinent and developed cavity data; however, the desinent (or incipient) cavity data are clearly marked by the attachment of asterisks to the run numbers. The desinent and developed cavity data are correlated and discussed separately in this section.

4.1 Correlation of Desinent Cavitation Data

With the blow-down facility used in this experimental study, it was impossible to maintain a constant fluid temperature while varying the inlet velocities and pressures to obtain desinent cavities. Consequently, it was necessary to develop a mathematical technique for correlating the desinent data. This was accomplished by using a least-squares surface-fitting computer program. Once an equation is obtained, to fit the experimental surface (P_o, V_o, T_o coordinates), the conventional isotherm data for desinence are readily calculated. Complete details concerning this correlating technique, and the computer program, are given in appendix C of reference [21]. Polynomial expressions were derived to correlate the desinent hydrogen and nitrogen data for each of the three ogives.

These expressions were used to compute the desinent data presented in tables 4.1 to 4.6. These same data are plotted on figures 4.1 to 4.12. The algebraic expressions used to correlate the desinent data for the individual ogives are as follows:

Hydrogen (0.210-inch ogive); $P_o = 0.08720\, V_o$

$$-2.29920\, T_o + 0.00028\, V_o^2 + 0.06500\, T_o^2, \qquad (4\text{-}1)$$

Hydrogen (0.357-inch ogive); $P_o = 0.01427\, V_o$

$$-1.80390\, T_o + 0.00067\, V_o^2 + 0.05525\, T_o^2, \qquad (4\text{-}2)$$

Hydrogen (0.420-inch ogive); $P_o = -4.29106\, T_o$

$$+ 0.75224\, V_o - 0.01529\, T_o V_o + 0.11418\, T_o^2, \qquad (4\text{-}3)$$

Nitrogen (0.210-inch ogive); $P_o = -0.02306\, V_o$

$$+ 1.96230\, T_o + 0.00634\, V_o^2 - 0.03268\, T_o^2 + 0.0001393\, T_o^3, \qquad (4\text{-}4)$$

Nitrogen (0.357-inch ogive); $P_o = -1.31363\, T_o$

$$+ 0.98429\, V_o - 0.00778\, T_o V_o + 0.01022\, T_o^2 + 0.00802\, V_o^2, \qquad (4\text{-}5)$$

Nitrogen (0.420-inch ogive); $P_o = 0.39412\, V_o$

$$+ 2.14806\, T_o + 0.00168\, V_o^2 - 0.03482\, T_o^2 + 0.0001418\, T_o^3. \qquad (4\text{-}6)$$

Table 4.1 Temperature-compensated desinent data (Hydrogen: 0.210-inch (0.533 cm) ogive).

TO DEG R	VO FT/SEC	PO PSIA	KIV	PO N/CM/CM	VO M/SEC	TO DEG K
37.50	120.0	19.69	0.35	13.58	36.6	20.83
37.50	140.0	22.89	0.60	15.79	42.7	20.83
37.50	160.0	26.32	0.74	18.15	48.8	20.83
37.50	180.0	29.97	0.83	20.67	54.9	20.83
37.50	200.0	33.85	0.87	23.34	61.0	20.83
37.50	220.0	37.95	0.90	26.17	67.1	20.83
37.50	240.0	42.28	0.91	29.15	73.2	20.83
37.50	260.0	46.83	0.92	32.29	79.2	20.83
39.50	140.0	28.31	0.54	19.52	42.7	21.94
39.50	160.0	31.73	0.70	21.88	48.8	21.94
39.50	180.0	35.39	0.80	24.40	54.9	21.94
39.50	200.0	39.26	0.86	27.07	61.0	21.94
39.50	220.0	43.36	0.89	29.90	67.1	21.94
39.50	240.0	47.69	0.91	32.88	73.2	21.94
39.50	260.0	52.24	0.92	36.02	79.2	21.94
41.50	160.0	37.67	0.59	25.97	48.8	23.06
41.50	180.0	41.32	0.71	28.49	54.9	23.06
41.50	200.0	45.19	0.79	31.16	61.0	23.06
41.50	220.0	49.29	0.84	33.99	67.1	23.06
41.50	240.0	53.62	0.87	36.97	73.2	23.06
41.50	260.0	58.17	0.89	40.11	79.2	23.06

Table 4.2 Temperature-compensated desinent data (Hydrogen: 0.357-inch (0.907 cm) ogive).

TO DEG R	VO FT/SEC	PO PSIA	KIV	PO N/CM/CM	VO M/SEC	TO DEG K
37.00	110.0	18.52	0.44	12.77	33.5	20.56
37.00	130.0	22.00	0.75	15.17	39.6	20.56
37.00	150.0	26.02	0.94	17.94	45.7	20.56
37.00	170.0	30.56	1.06	21.07	51.8	20.56
37.00	190.0	35.64	1.14	24.57	57.9	20.56
37.00	210.0	41.26	1.20	28.44	64.0	20.56
37.00	230.0	47.40	1.25	32.68	70.1	20.56
39.00	130.0	26.79	0.64	18.47	39.6	21.67
39.00	150.0	30.81	0.87	21.24	45.7	21.67
39.00	170.0	35.35	1.01	24.38	51.8	21.67
39.00	190.0	40.43	1.11	27.88	57.9	21.67
39.00	210.0	46.05	1.18	31.75	64.0	21.67
39.00	230.0	52.19	1.23	35.98	70.1	21.67
41.00	130.0	32.02	0.42	22.08	39.6	22.78
41.00	150.0	36.04	0.70	24.85	45.7	22.78
41.00	170.0	40.59	0.89	27.98	51.8	22.78
41.00	190.0	45.67	1.02	31.49	57.9	22.78
41.00	210.0	51.28	1.11	35.35	64.0	22.78
41.00	230.0	57.42	1.18	39.59	70.1	22.78

Table 4.3 Temperature-compensated desinent data (Hydrogen: 0.420-inch (1.067 cm) ogive).

TO DEG R	VO FT/SEC	PO PSIA	KIV	PO N/CM/CM	VO M/SEC	TO DEG K
37.50	110.0	19.32	0.35	13.32	33.5	20.83
37.50	120.0	21.11	0.56	14.55	36.6	20.83
37.50	130.0	22.90	0.70	15.79	39.6	20.83
37.50	140.0	24.68	0.80	17.02	42.7	20.83
37.50	150.0	26.47	0.86	18.25	45.7	20.83
37.50	160.0	28.26	0.90	19.49	48.8	20.83
39.25	110.0	24.20	0.30	16.69	33.5	21.81
39.25	120.0	25.72	0.48	17.74	36.6	21.81
39.25	130.0	27.24	0.60	18.78	39.6	21.81
39.25	140.0	28.76	0.68	19.83	42.7	21.81
39.25	150.0	30.29	0.74	20.88	45.7	21.81
39.25	160.0	31.81	0.78	21.93	48.8	21.81
41.00	110.0	29.79	0.18	20.54	33.5	22.78
41.00	120.0	31.04	0.34	21.40	36.6	22.78
41.00	130.0	32.29	0.45	22.26	39.6	22.78
41.00	140.0	33.54	0.53	23.13	42.7	22.78
41.00	150.0	34.80	0.58	23.99	45.7	22.78
41.00	160.0	36.05	0.62	24.86	48.8	22.78

Table 4.4 Temperature-compensated desinent data (Nitrogen: 0.210-inch (0.533 cm) ogive).

TO DEG R	VO FT/SEC	PO PSIA	KIV	PO N/CM/CM	VO M/SEC	TO DEG K
141.00	30.0	22.56	1.26	15.56	9.1	78.33
141.00	40.0	26.77	1.19	18.46	12.2	78.33
141.00	50.0	32.24	1.17	22.23	15.2	78.33
141.00	60.0	38.99	1.16	26.88	18.3	78.33
141.00	70.0	46.99	1.15	32.40	21.3	78.33
141.00	80.0	56.27	1.15	38.80	24.4	78.33
141.00	90.0	66.82	1.15	46.07	27.4	78.33
151.00	30.0	35.89	1.31	24.75	9.1	83.89
151.00	40.0	40.10	1.24	27.65	12.2	83.89
151.00	50.0	45.57	1.21	31.42	15.2	83.89
151.00	60.0	52.31	1.20	36.07	18.3	83.89
151.00	70.0	60.32	1.19	41.59	21.3	83.89
151.00	80.0	69.60	1.19	47.99	24.4	83.89
151.00	90.0	80.15	1.19	55.26	27.4	83.89
161.00	30.0	55.31	1.23	38.13	9.1	89.44
161.00	40.0	59.51	1.21	41.03	12.2	89.44
161.00	50.0	64.99	1.21	44.81	15.2	89.44
161.00	60.0	71.73	1.21	49.46	18.3	89.44
161.00	70.0	79.74	1.21	54.98	21.3	89.44
161.00	80.0	89.02	1.22	61.37	24.4	89.44
161.00	90.0	99.56	1.22	68.64	27.4	89.44
166.00	40.0	71.76	1.13	49.48	12.2	92.22
166.00	50.0	77.24	1.16	53.25	15.2	92.22
166.00	60.0	83.98	1.19	57.90	18.3	92.22
166.00	70.0	91.99	1.20	63.42	21.3	92.22
166.00	80.0	101.27	1.21	69.82	24.4	92.22

Table 4.5 Temperature-compensated desinent data (Nitrogen: 0.357-inch (0.907 cm) ogive).

TO DEG R	VO FT/SEC	PO PSIA	KIV	PO N/CM/CM	VO M/SEC	TO DEG K
140.00	25.0	18.83	1.00	12.98	7.6	77.78
140.00	35.0	22.59	1.08	15.58	10.7	77.78
140.00	45.0	27.97	1.14	19.28	13.7	77.78
140.00	55.0	34.94	1.19	24.09	16.8	77.78
140.00	65.0	43.52	1.22	30.01	19.8	77.78
140.00	75.0	53.71	1.25	37.03	22.9	77.78
140.00	85.0	65.49	1.28	45.16	25.9	77.78
150.00	35.0	36.38	1.28	25.08	10.7	83.33
150.00	45.0	40.97	1.21	28.25	13.7	83.33
150.00	55.0	47.17	1.20	32.52	16.8	83.33
150.00	65.0	54.97	1.21	37.90	19.8	83.33
150.00	75.0	64.38	1.23	44.39	22.9	83.33
150.00	85.0	75.39	1.24	51.98	25.9	83.33
160.00	35.0	52.20	0.78	35.99	10.7	88.89
160.00	45.0	56.02	0.84	38.62	13.7	88.89
160.00	55.0	61.44	0.92	42.36	16.8	88.89
160.00	65.0	68.47	0.98	47.21	19.8	88.89
160.00	75.0	77.09	1.04	53.15	22.9	88.89
160.00	85.0	87.33	1.09	60.21	25.9	88.89

Table 4.6 Temperature-compensated desinent data (Nitrogen: 0.420-inch (1.067 cm) ogive).

TO DEG R	VO FT/SEC	PO PSIA	KIV	PO N/CM/CM	VO M/SEC	TO DEG K
140.00	25.0	18.11	0.79	12.49	7.6	77.78
140.00	30.0	20.55	1.05	14.17	9.1	77.78
140.00	35.0	23.06	1.15	15.90	10.7	77.78
140.00	40.0	25.66	1.18	17.69	12.2	77.78
140.00	45.0	28.34	1.18	19.54	13.7	77.78
140.00	50.0	31.11	1.16	21.45	15.2	77.78
140.00	55.0	33.96	1.13	23.42	16.8	77.78
140.00	60.0	36.90	1.10	25.44	18.3	77.78
140.00	65.0	39.92	1.07	27.52	19.8	77.78
140.00	70.0	43.02	1.04	29.66	21.3	77.78
150.00	35.0	33.01	0.76	22.76	10.7	83.33
150.00	40.0	35.61	0.89	24.55	12.2	83.33
150.00	45.0	38.29	0.96	26.40	13.7	83.33
150.00	50.0	41.06	0.99	28.31	15.2	83.33
150.00	55.0	43.91	0.99	30.28	16.8	83.33
150.00	60.0	46.85	0.99	32.30	18.3	83.33
150.00	65.0	49.87	0.98	34.38	19.8	83.33
150.00	70.0	52.97	0.97	36.52	21.3	83.33
160.50	40.0	52.31	0.46	36.07	12.2	89.17
160.50	45.0	54.99	0.63	37.92	13.7	89.17
160.50	50.0	57.76	0.73	39.82	15.2	89.17
160.50	55.0	60.61	0.79	41.79	16.8	89.17
160.50	60.0	63.55	0.82	43.81	18.3	89.17
160.50	65.0	66.57	0.84	45.90	19.8	89.17
160.50	70.0	69.67	0.85	48.03	21.3	89.17
165.50	45.0	65.47	0.40	45.14	13.7	91.94
165.50	50.0	68.24	0.55	47.05	15.2	91.94
165.50	55.0	71.09	0.65	49.02	16.8	91.94
165.50	60.0	74.03	0.71	51.04	18.3	91.94
165.50	65.0	77.05	0.75	53.12	19.8	91.94
165.50	70.0	80.15	0.77	55.26	21.3	91.94

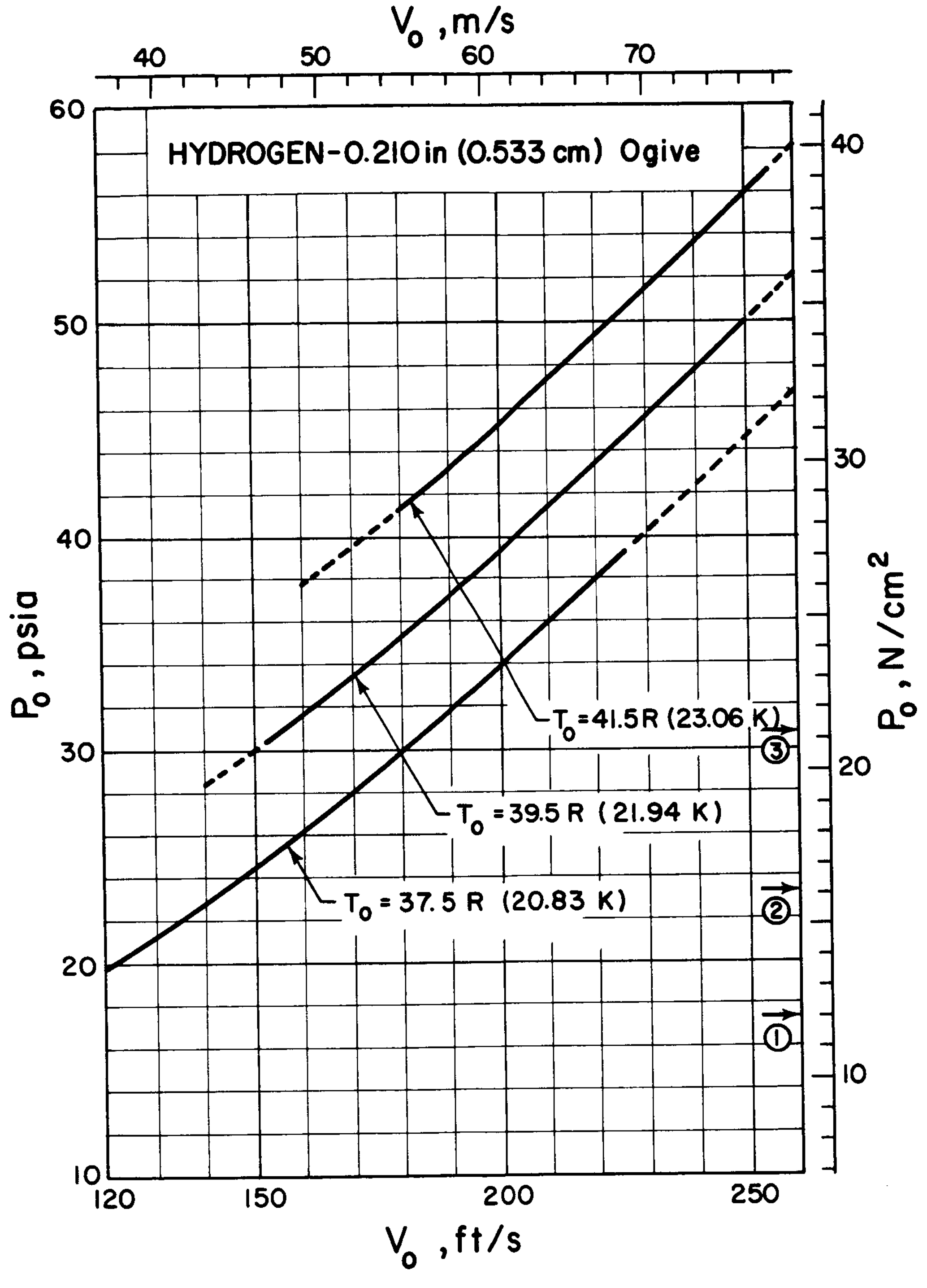


Figure 4. 1 Effects of tunnel inlet velocity and liquid temperature on required inlet pressure for desinent cavitation in liquid hydrogen--0. 210-inch ogive: ① = P_v @ 37. 5 R; ② = P_v @ 39. 5 R; ③ = P_v @ 41. 5 R.

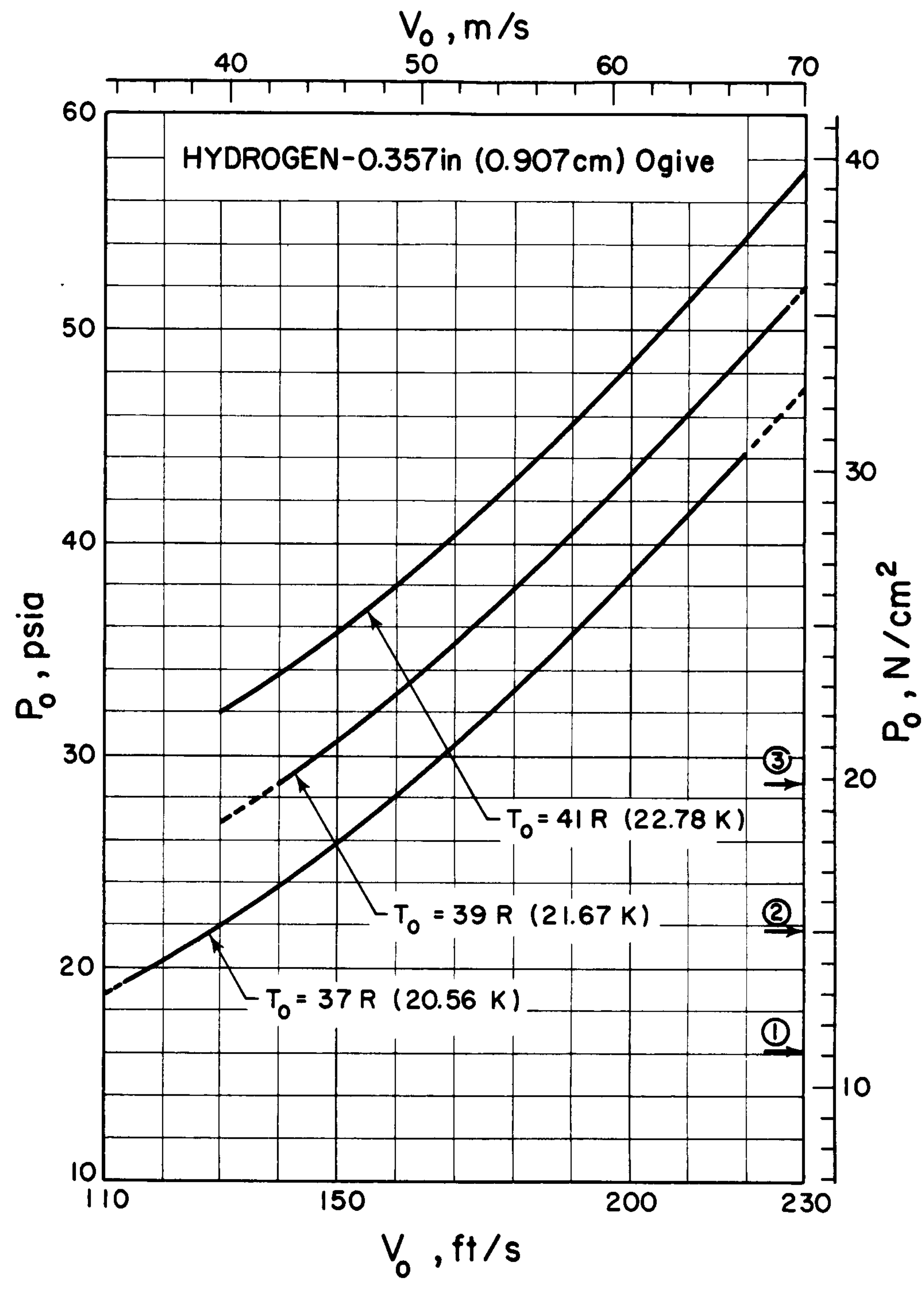


Figure 4.2 Effects of tunnel inlet velocity and liquid temperature on required inlet pressure for desinent cavitation in liquid hydrogen--0.357-inch ogive: ① = P_v @ 37 R; ② = P_v @ 39R; ③ = P_v @ 41 R.

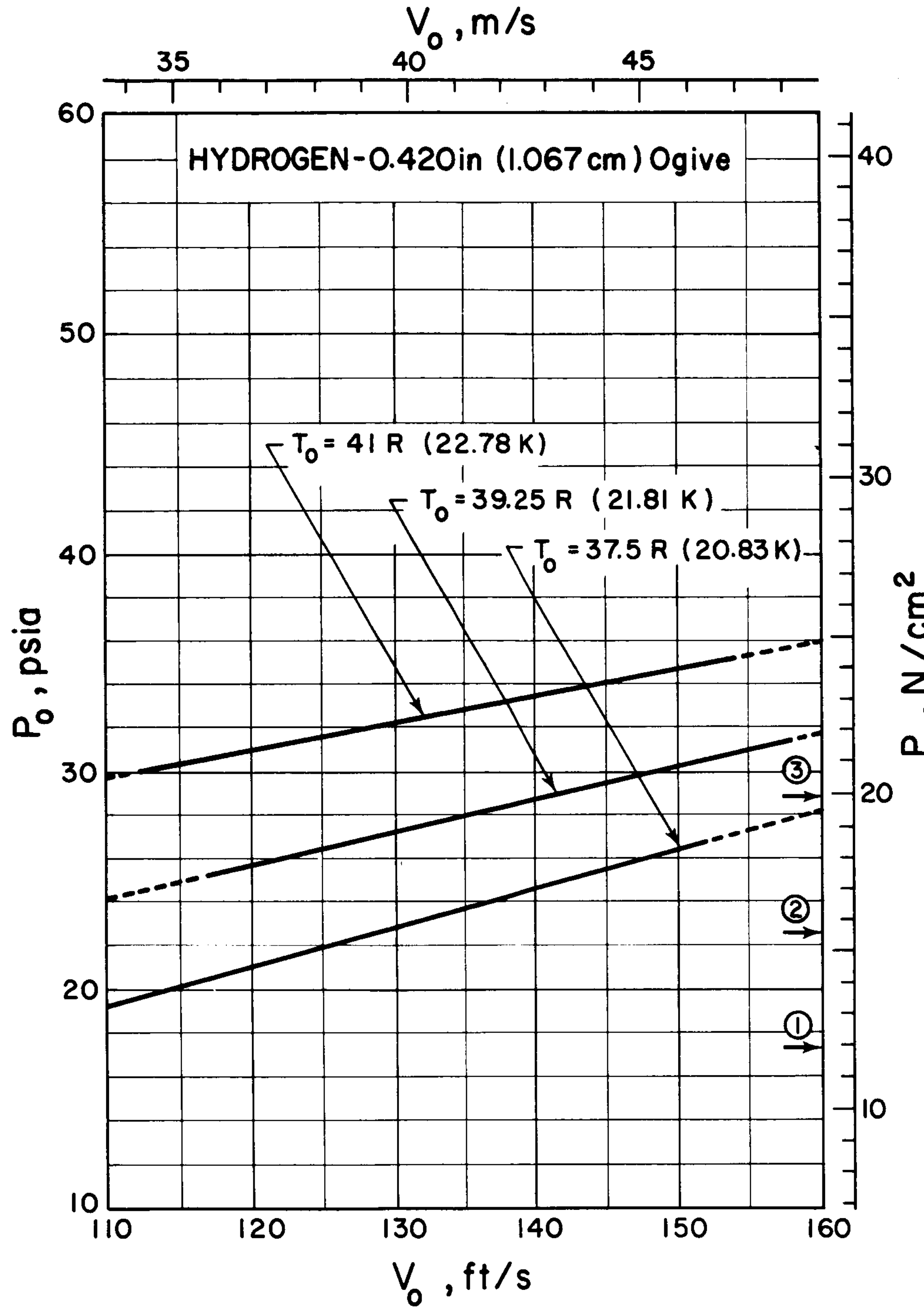


Figure 4.3 Effects of tunnel inlet velocity and liquid temperature on required inlet pressure for desinent cavitation in liquid hydrogen--0.420-inch ogive: ① = P_v @ 37.5 R; ② = P_v @ 39.25 R; ③ = P_v @ 41 R.

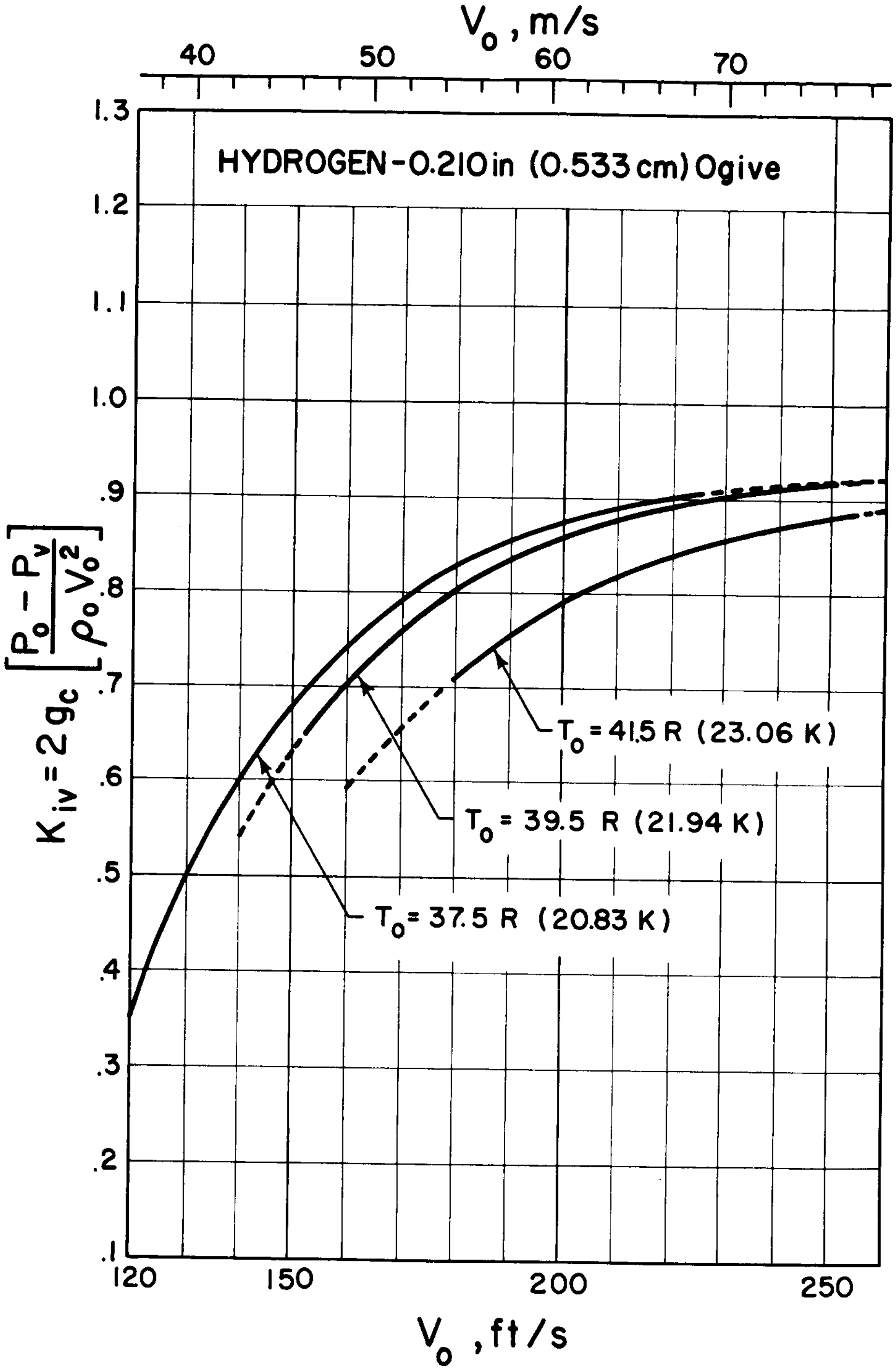


Figure 4.4 Desinent cavitation parameter for liquid hydrogen as a function of tunnel inlet velocity and liquid temperature--0.210-inch ogive.

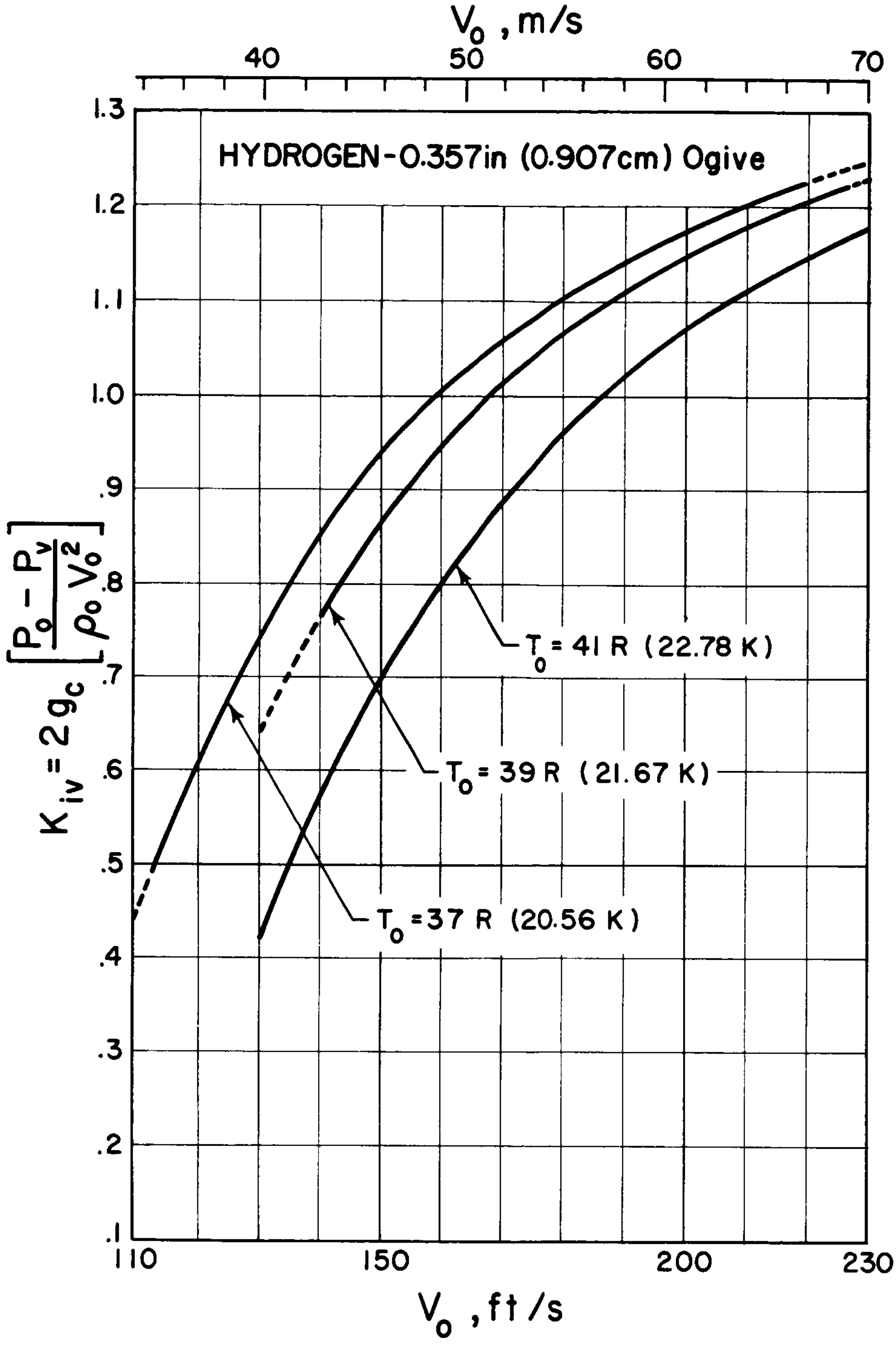


Figure 4. 5 Desinent cavitation parameter for liquid hydrogen as a function of tunnel inlet velocity and liquid temperature-- 0. 357-inch ogive.

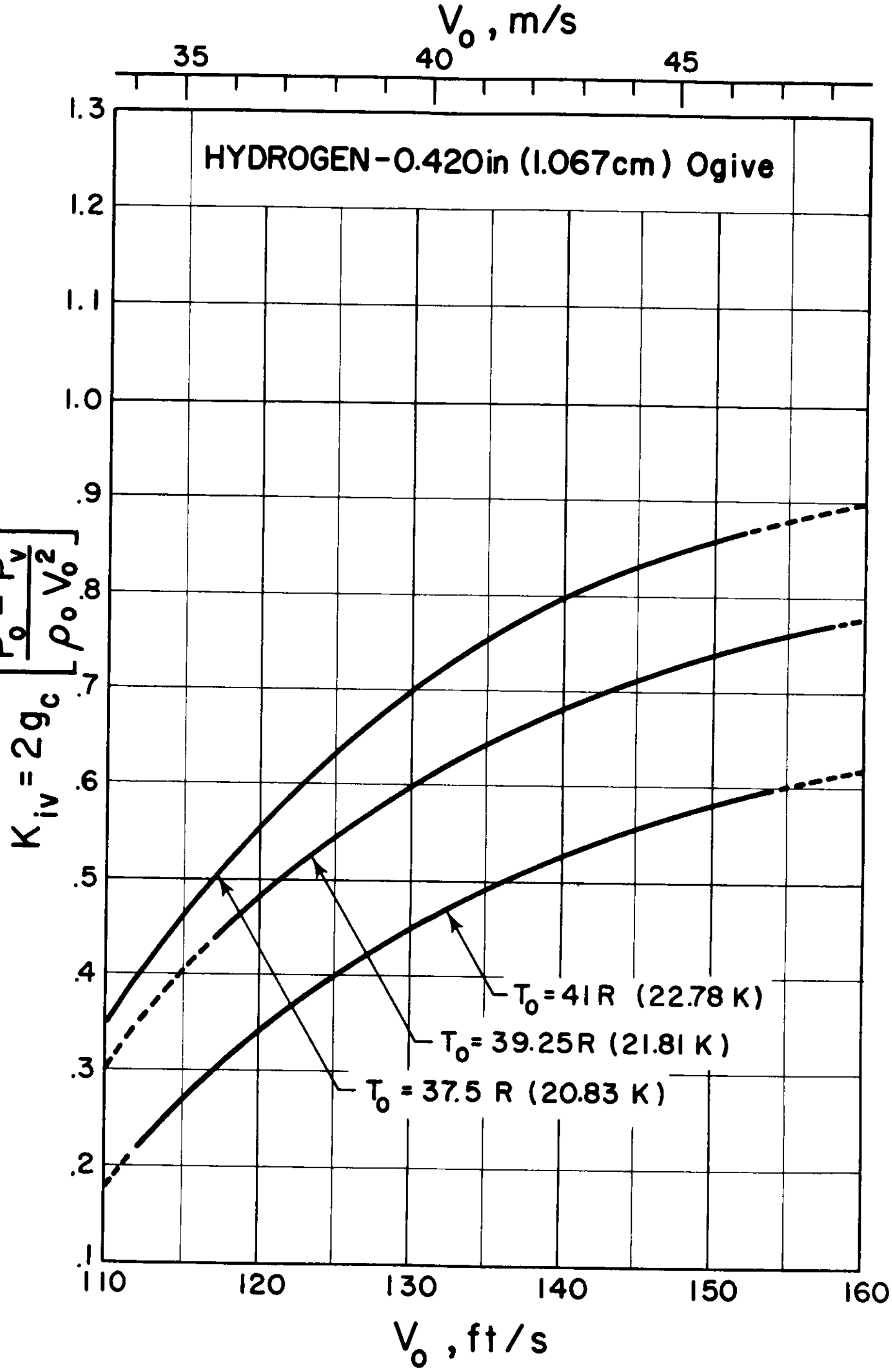


Figure 4. 6 Desinent cavitation parameter for liquid hydrogen as a function of tunnel inlet velocity and liquid temperature-- 0. 420-inch ogive.

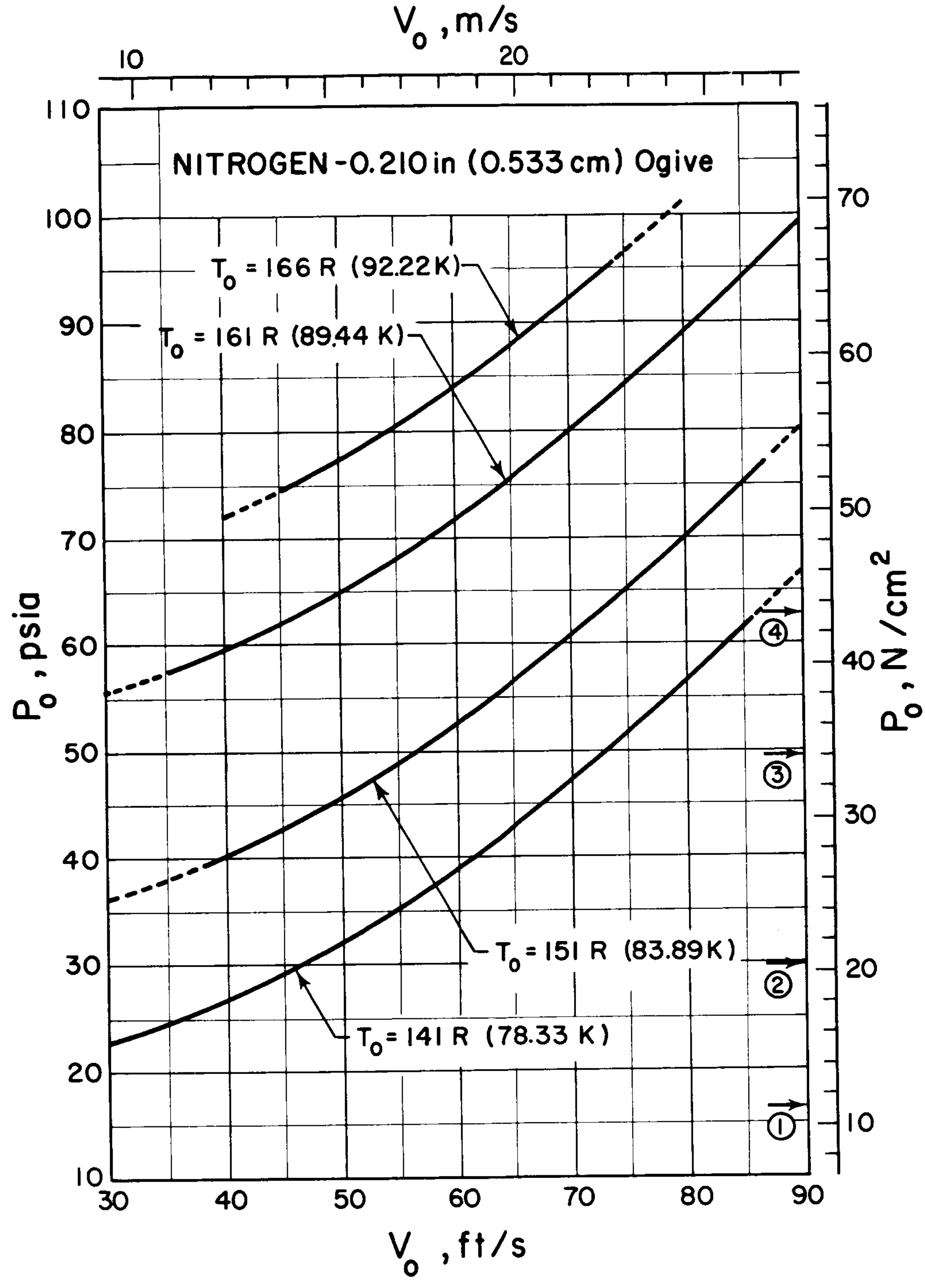


Figure 4.7 Effects of tunnel inlet velocity and liquid temperature on required inlet pressure for desinent cavitation in liquid nitrogen--0.210-inch ogive: ① = P_v @ 141 R; ② = P_v @ 151 R; ③ = P_v @ 161 R; ④ = P_v @ 166 R.

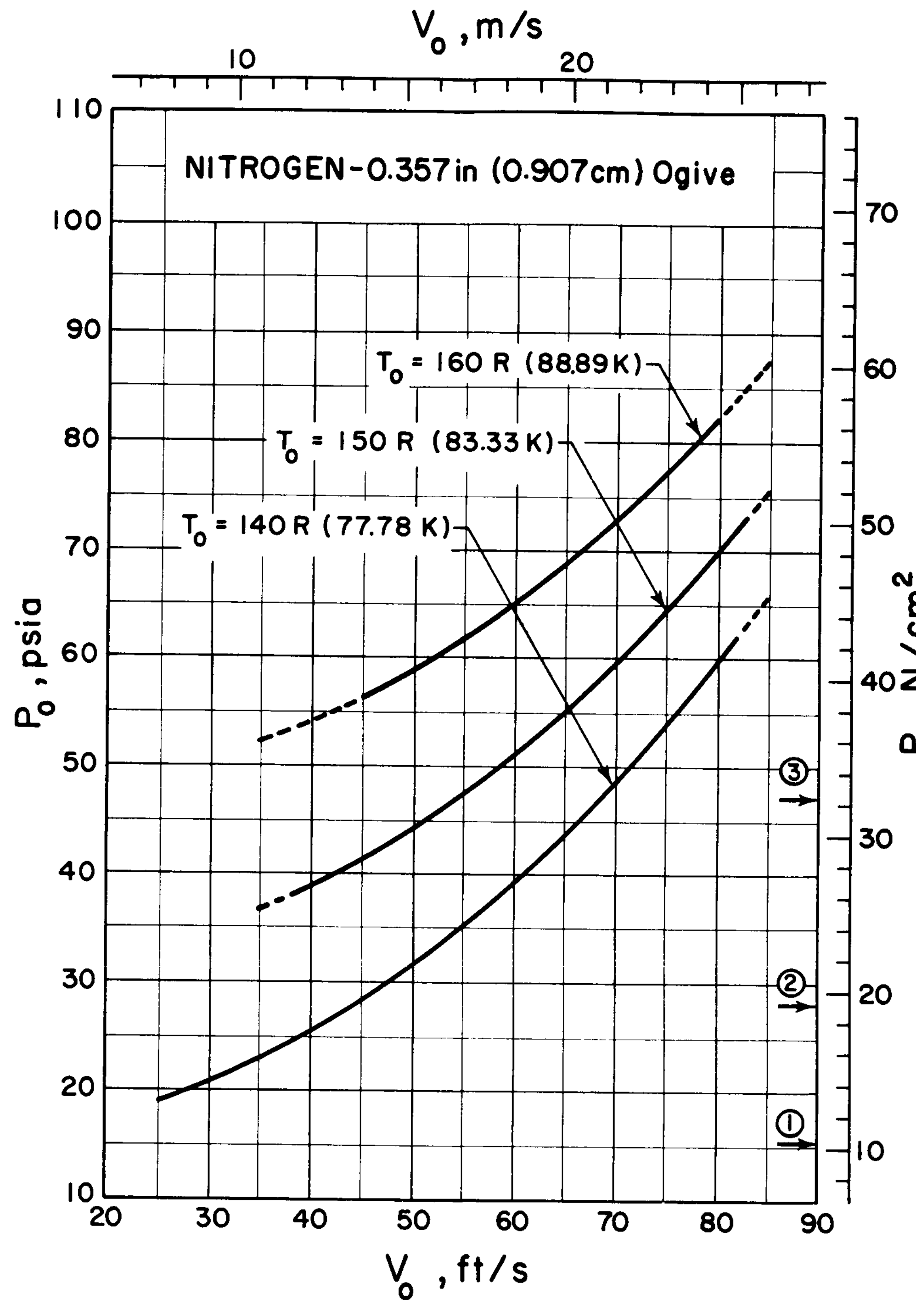


Figure 4.8 Effects of tunnel inlet velocity and liquid temperature on required inlet pressure for desinent cavitation in liquid nitrogen--0.357-inch ogive; ① = P_v @ 140 R; ② = P_v @ 150 R; ③ = P_v @ 160 R.

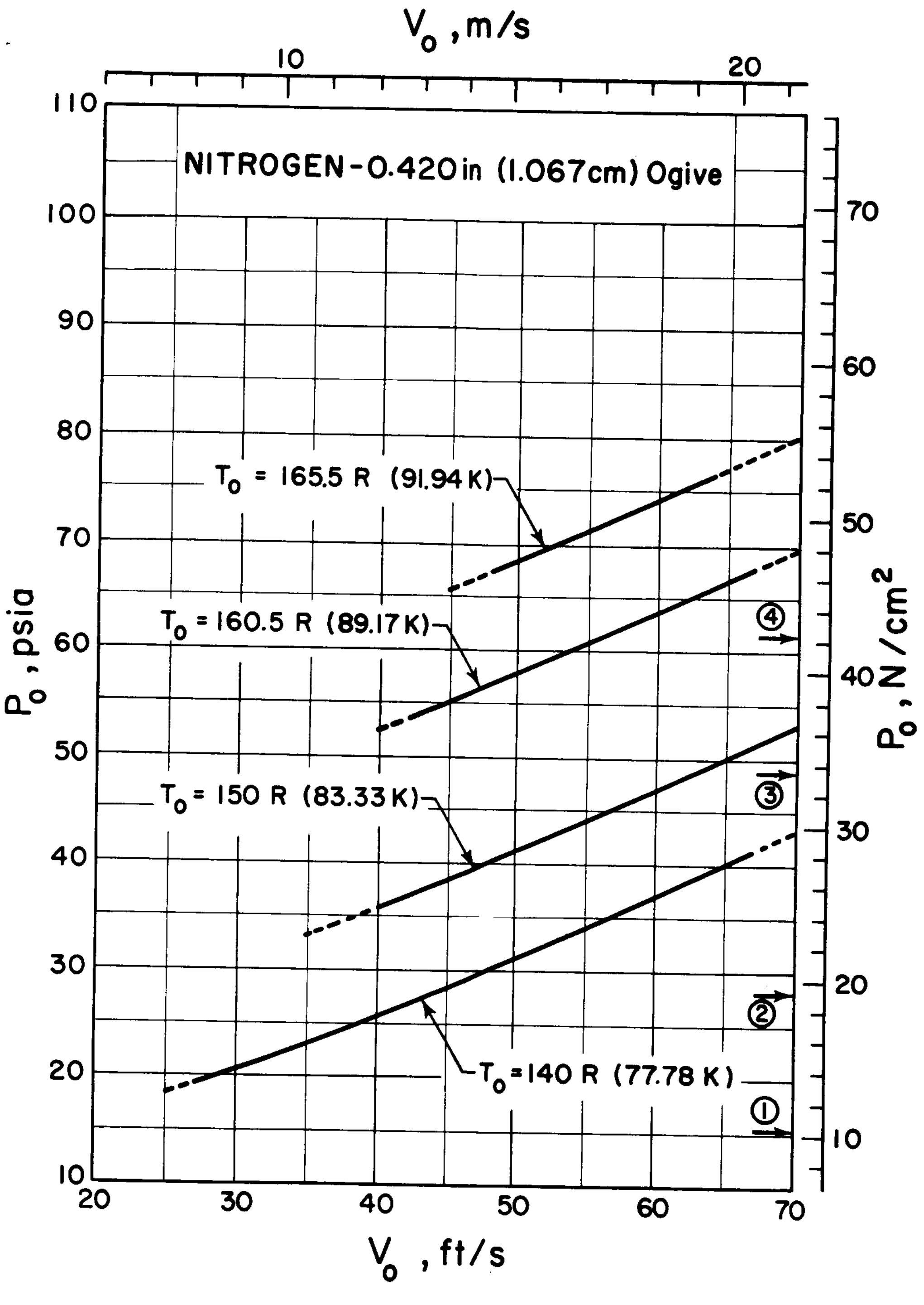


Figure 4.9 Effects of tunnel inlet velocity and liquid temperature on required inlet pressure for desinent cavitation in liquid nitrogen--0.420-inch ogive; ① = P_v @ 140 R; ② = P_v @ 150 R; ③ = P_v @ 160.5 R; ④ = P_v @ 165.5 R.

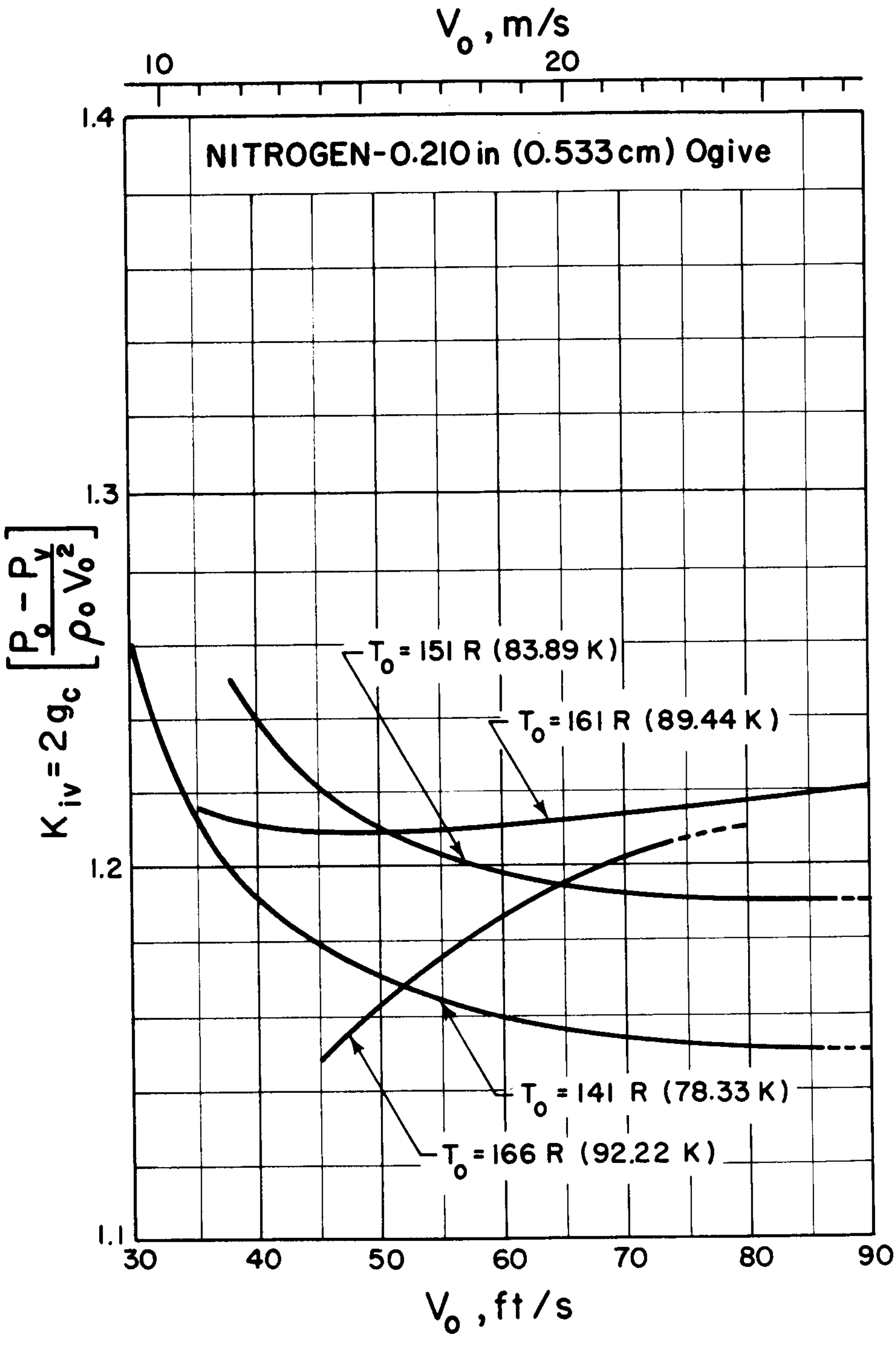


Figure 4.10 Desinent cavitation parameter for liquid nitrogen as a function of tunnel inlet velocity and liquid temperature--0.210-inch ogive.

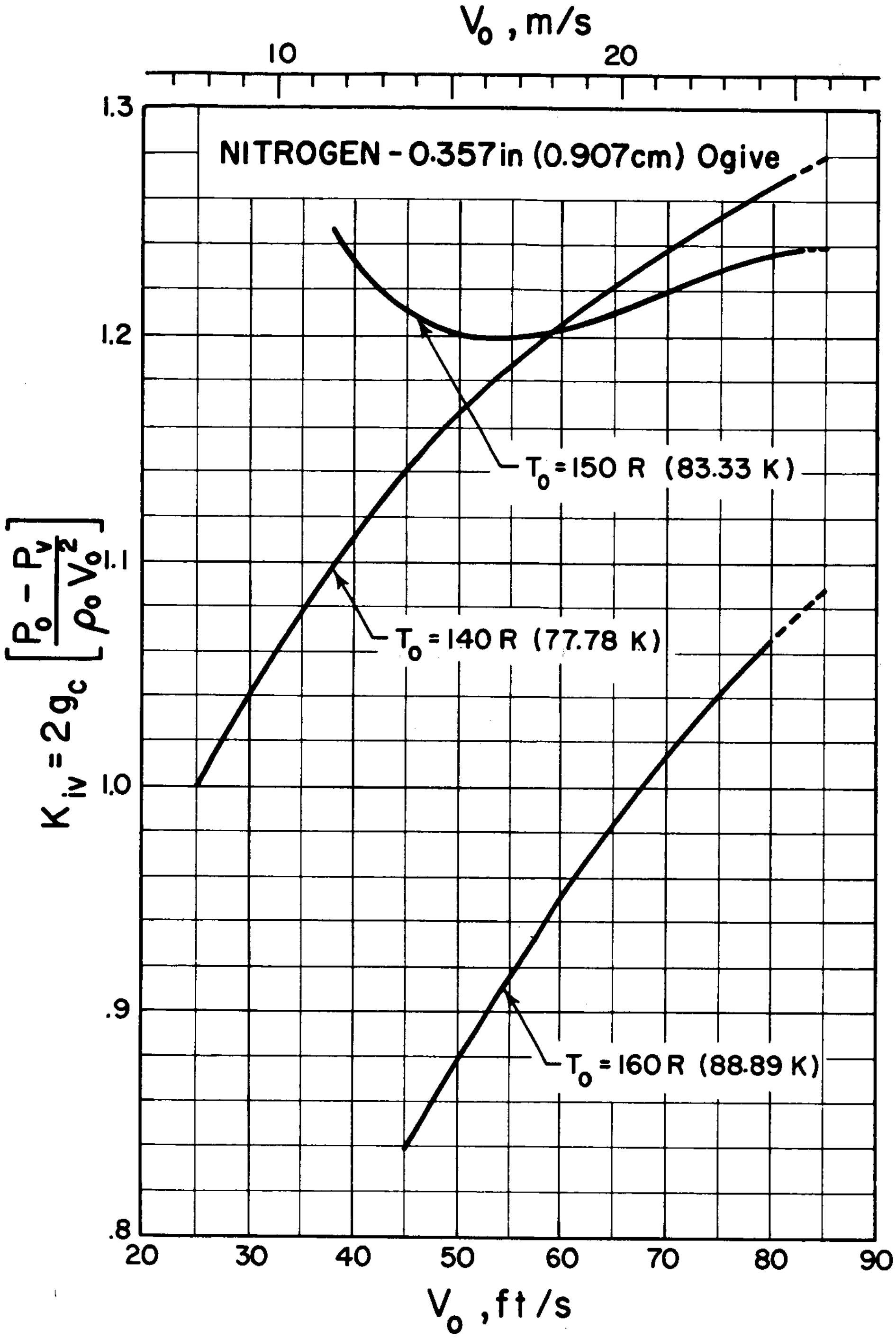


Figure 4.11 Desinent cavitation parameter for liquid nitrogen as a function of tunnel inlet velocity and liquid temperature-- 0.357-inch ogive.

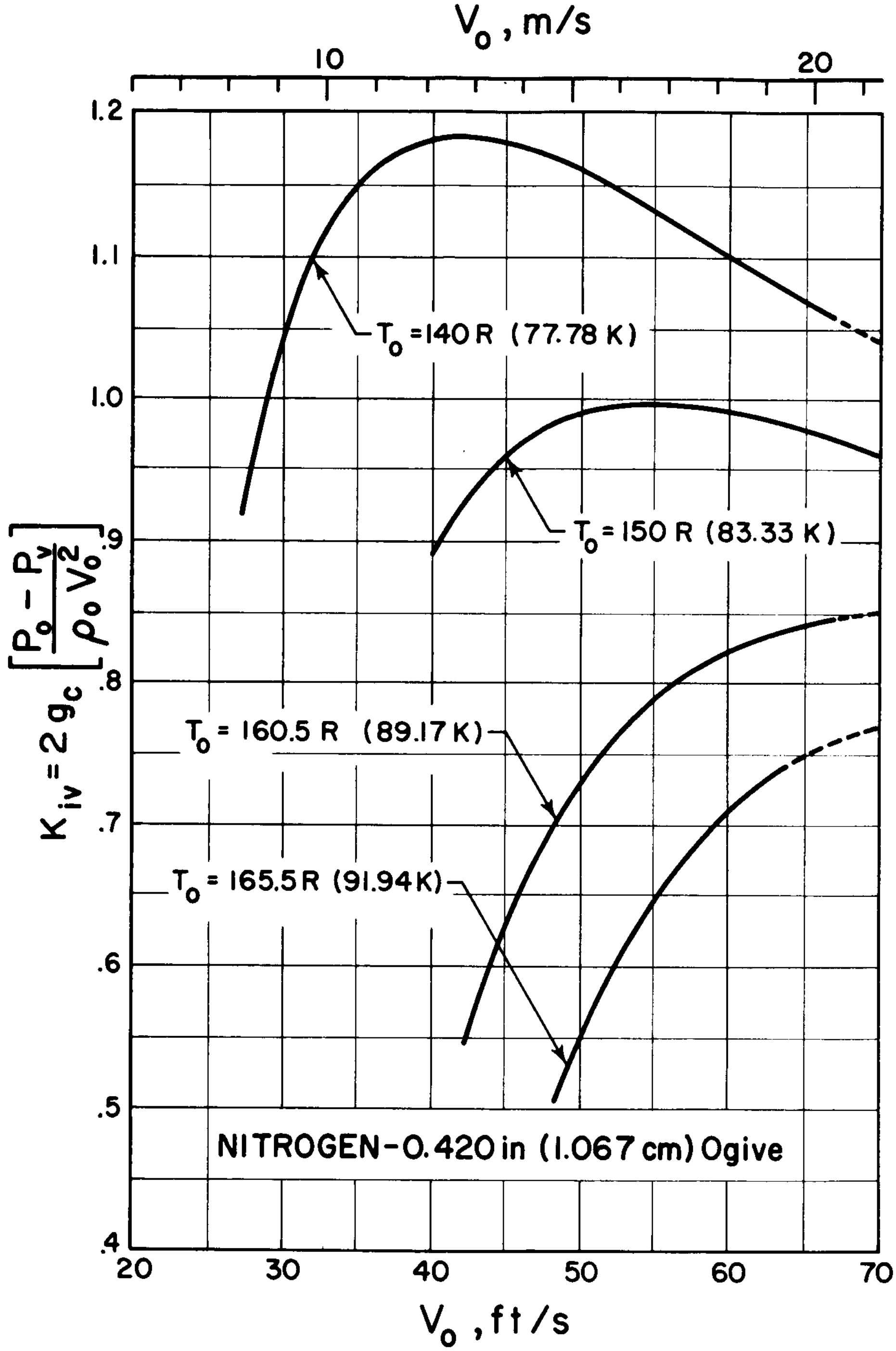


Figure 4.12 Desinent cavitation parameter for liquid nitrogen as a function of tunnel inlet velocity and liquid temperature--0.420-inch ogive.

In the foregoing expressions, the units of P_o, V_o, and T_o are psia, ft/s, and degrees Rankine, respectively.

The experimental values of K_{iv} are tabulated under the heading, KV, in appendix A, along with the experimental values of K_v for developed cavities. The K_{iv} parameter as given in appendix A, and used herein, is not corrected for tunnel blockage. Multiplying K_{iv} by the square of the appropriate area ratio, A_1/A_2, corrects for tunnel blockage, i.e.,

$$\text{corrected } K_{iv} = (\text{Experimental } K_{iv})\,(A_1/A_2)^2 , \qquad (4\text{-}7)$$

where A_1 = blocked cross sectional flow area and A_2 = unblocked (inlet) cross sectional flow area. This correction factor evolves from consideration of steady volumetric flow, C_p^v, and Bernoulli's equation, and is derived in detail elsewhere [26, 27]. This correction factor assures that the minimum static pressure is the same for blocked and unblocked flows, when the freestream static pressures are identical. Thus, tunnel constraint is easily accounted for, so that the results of this study may be readily compared with other experimental data. For the quarter-caliber ogives, the correction factor has a numerical value of 0.82.

4.2 Discussion of Desinent Cavitation Data

Figures 4.1 to 4.3 are conventional P_o, V_o, T_o plots for hydrogen test fluid, i.e., P_o increases with increasing V_o and T_o in a conventional manner. The incipient (desinent) cavitation parameter, K_{iv}, for hydrogen also behaves in a conventional manner, see figures 4.4 to 4.6. On all of these figures, the boundaries of the experimental data are indicated by the solid lines, i.e., the broken-line curves are extrapolations of the experimental data. Mathematical extrapolation, by correlative expressions, of experimentally-determined surfaces is rather risky; therefore, the broken-line extrapolations must be used with great caution. Only within the boundaries of the experimental data are the mathematically derived data--as presented in tables 4.1 to 4.6 and on figures 4.1 to 4.12--considered totally valid.

Due to test facility limitations it was impossible to obtain desinent hydrogen data at very low values of V_o with the 0.210-inch ogive, and at very high values of V_o with the 0.420-inch ogive. Flow control instabilities were experienced with the smaller body only at the lowest velocities and test duration was too short with the larger body only at the highest velocities. Referring to figures 4.4 and 4.6, we see that the inlet velocities for the 0.210-inch and the 0.420-inch ogives barely overlap, except for the 37.5 R isotherm; however, use of the 0.357-inch ogive data, figure 4.5, permits a reasonably good comparison of K_{iv} - V_o - T_o data with both the 0.210-inch and the 0.420-inch ogives.

Similar comments may be made about the nitrogen data shown on figures 4.7 to 4.12, except that the K_{iv} data on figures 4.10 and 4.11 do not consistently show conventional temperature dependency. Similar nitrogen K_{iv} data were obtained with the hydrofoil [21] and were attributed to 1) a relatively weak temperature dependence with nitrogen fluid, 2) amplification of instrument error in the K_{iv} parameter, and 3) mathematical correlation of the experimental data. Nonconventional behavior of the hydrogen K_{iv} data was not encountered because of a stronger temperature dependence and lower instrument error [21].

The ogive desinent cavity data are quite similar to the data obtained for the venturi [20] and hydrofoil [21]. For those two bodies, the hydrogen and nitrogen data tended toward a single-valued K_{iv}, for each fluid, at the maximum velocities. The ogive data presented herein display similar tendencies. The water data of Rouse and McNown [25] indicate a maximum value of $K_{iv} \approx 1.3$ for quarter-caliber ogives. To compare these data with our data, we must first multiply our K_{iv} data by 0.82 to correct for tunnel blockage. The maximum value of K_{iv} on figures

4.4 to 4.6 and 4.10 to 4.12 does not exceed 1.3; therefore, it is apparent that our K_{iv} data is at least 20 percent lower than that of Rouse and McNown. Similar results were noted upon comparison [21] of our hydrofoil and venturi data with the data of others for non-cryogenic fluids. Thus, as previously concluded [21], it is apparent that these cryogens require less subcooling--relative to higher boiling-point liquids--for desinent cavitation to occur.

The data plotted on figures 4.1 to 4.12 were derived to represent the experimental data at the nominal experimental isotherms (for each ogive). In order to compare the desinent data for the scaled ogives, we must derive K_{iv} - V_o - T_o data at identical isotherms. Using the expressions given in eqs (4-1) to (4-6), the data plotted on figures 4.13 to 4.16 were generated. These graphs provide a direct comparison of ogive size effect at a specified fluid temperature.

Referring to figure 4.13, we note that K_{iv} for the 0.210-inch ogive is generally lower than K_{iv} for the larger ogives at the lower values of V_o in hydrogen; however, at the highest values of V_o this trend is reversed for the 0.210-inch and 0.420-inch ogives. These hydrogen data indicate that K_{iv} for the 0.357-inch ogive is consistently larger than K_{iv} for the 0.210-inch and 0.420-inch ogives. Interpretation of these data could imply that the 0.357-inch ogive has a less streamlined contour and consequently a higher K_{iv}. Such is not the case, because all three ogives were carefully machined to fabrication tolerances as verified by measurements. Also, the K_{iv} data for nitrogen behave differently, see figure 4.15.

With nitrogen, the K_{iv} for the 0.210-inch ogive is larger than K_{iv} for the 0.420-inch ogive. The K_{iv} data for the two smaller ogives do not differ much at the lower temperatures but vary appreciably at the highest temperature (T_o = 160 R). From figure 4.15, it appears that

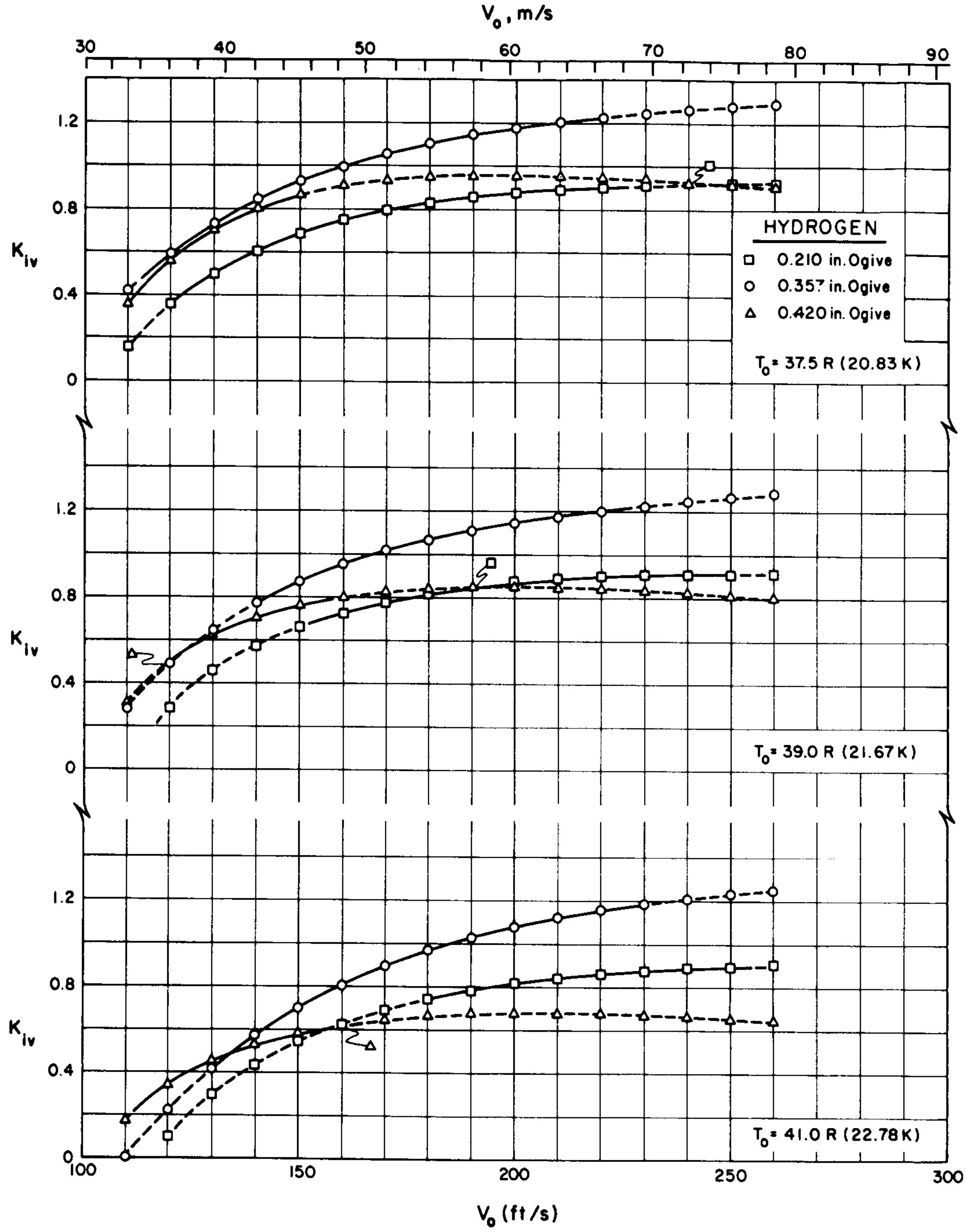


Figure 4.13 Desinent cavitation parameter for liquid hydrogen as a function of V_o, T_o, and D_m.

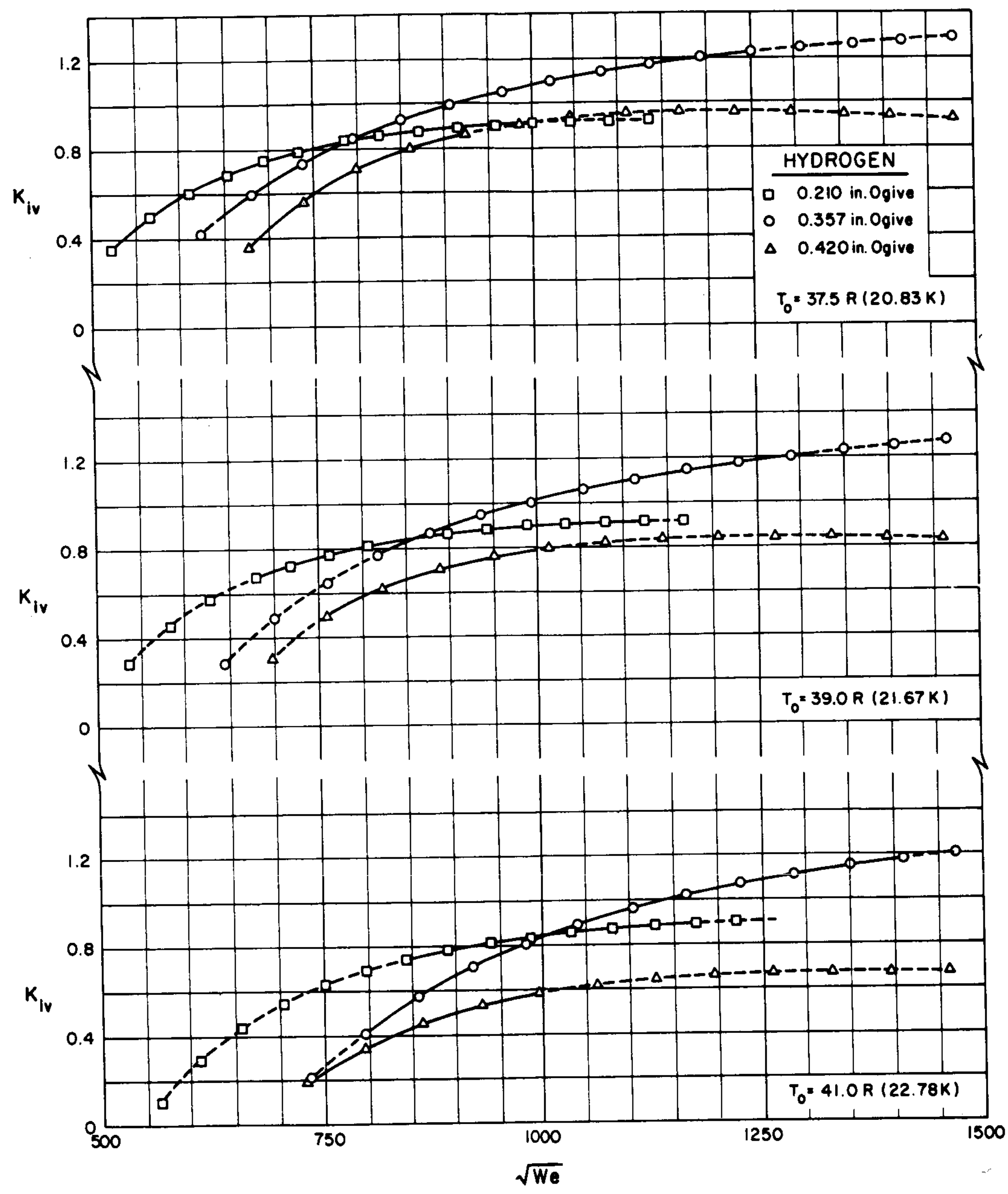


Figure 4.14 Desinent cavitation parameter for liquid hydrogen as a function of $(We)^{0.5}$, T_o and D_m.

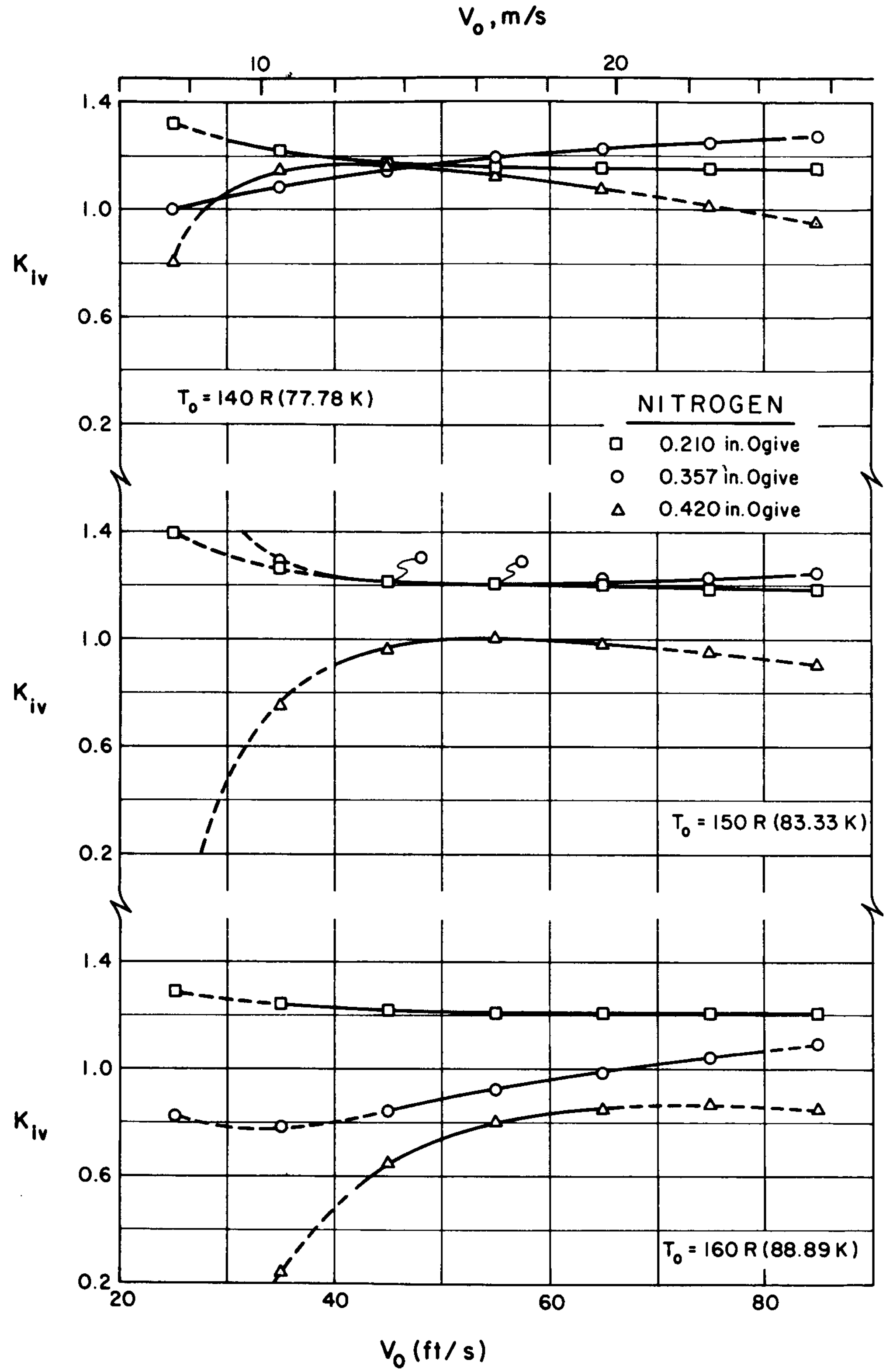


Figure 4.15 Desinent cavitation parameter for liquid nitrogen as a function of V_o, T_o, and D_m.

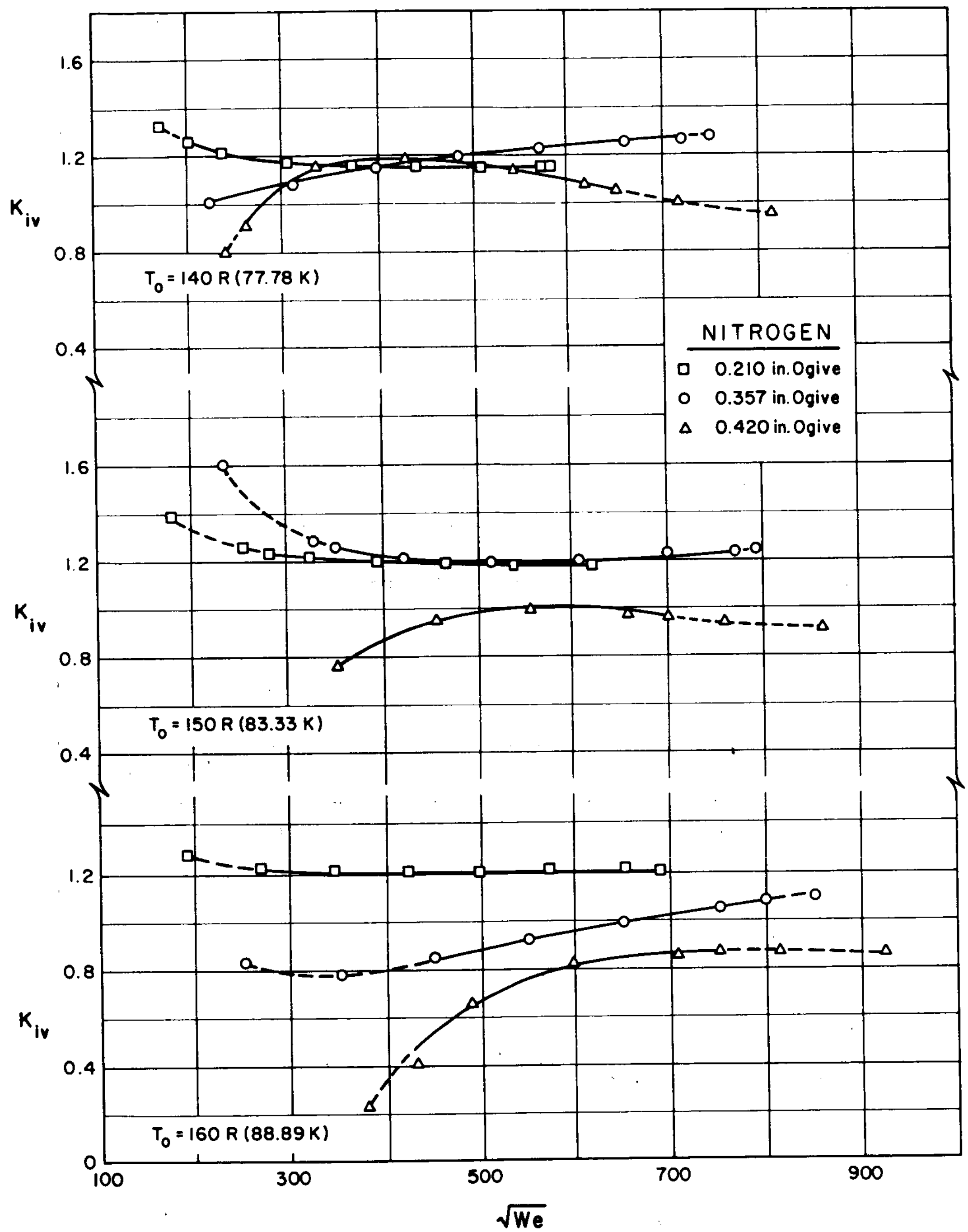


Figure 4. 16 Desinent cavitation parameter for liquid nitrogen as a function of $(We)^{0.5}$, T_o and D_m.

size effect is more pronounced at the higher nitrogen temperatures. No such effect is apparent in the hydrogen data shown on figure 4.13. For the nitrogen data, it appears that K_{iv} generally decreases with increasing size. No such conclusion can yet be drawn from the hydrogen data.

To shed some light on this topic, a desinent data correlating technique was sought. An attempt was made to use the method suggested by Parkin and Holl [26]. This technique employs a K_{iv} - $(We)^{0.5}$ plot, where $(We)^{0.5}$ is the essential part of the Weber number. $(We)^{0.5} = V_o\sqrt{(\rho_o D_m)/\sigma}$ is plotted against K_{iv} on figures 4.14 and 4.16. Because ρ_o/σ does not vary much in the hydrogen or nitrogen tests (less than 30 percent) the $(We)^{0.5}$ parameter reduces to $\approx V_o\sqrt{D_m}$. Then the data, for the larger ogives, on figure 4.13 are merely shifted to the right of the 0.210-inch ogive data on figure 4.14 without any substantial change in the shapes of the curves. Similar comments apply to the nitrogen data on figures 4.15 and 4.16. Considering only the 0.210-inch and 0.420-inch ogive data on figure 4.14, we would conclude that K_{iv} decreases slightly with increasing size--a result consistent with the nitrogen K_{iv} data. This result is in direct contrast with those found by Parkin and Holl [26] for 0.5-caliber and 1.5-caliber ogives tested in water. Therefore, the K_{iv} - $V_o\sqrt{D_m}$ plot improved the Parkin-Holl scaled-model data [26], but is of little or no value for our data.

The apparent inconsistency of the hydrogen K_{iv} data, as shown on figures 4.13 and 4.14, may be partially explained by the following observations. Recall 1) that the experimental data are mathematically extrapolated in the regions where the dashed-line curves appear on these figures, 2) that extrapolation of experimental data in this fashion [21] is risky and, 3) that the highest velocity data for the 0.420-inch ogive may reflect slight additional imprecision due to shorter available test duration. Re-examining figure 4.13, with this background information, reveals that the 0.357-inch and 0.420-inch ogive experimental data (solid-line curves) do not differ appreciably. Also, the K_{iv} data (solid-line curves) for the 0.210-inch ogive lie well below those for the two larger ogives--a result consistent with those of Parkin and Holl [26]. This result is also consistent with physical reasoning that the larger bodies should cavitate more readily, thereby identifying with larger values of K_{iv}. While this argument establishes the credibility of the hydrogen K_{iv} data, it does not explain why the hydrogen and nitrogen data display slightly different size effects. As previously explained, the latter is partially attributable to amplification of instrument error in K_{iv} and mathematical correlation of the experimental data.

Considering only the solid-curve data on figures 4.13 and 4.15, we conclude that 1) the hydrogen K_{iv} increases with increasing ogive size and 2) the nitrogen K_{iv} decreases with increasing ogive size. Also, perusal of figures 4.14 and 4.16 reveals that the Weber parameter 1) overcompensates for size effects with these hydrogen data and 2) has little effect on the apparent size dependency of the nitrogen data. Because there are more high quality hydrogen data for the 0.210-inch and 0.357-inch ogives, than for the 0.420-inch ogive, the size trends reflected by the two smaller ogives in figure 4.13 are favored.

Comparison of the Parkin and Holl water data [26] for 0.5-caliber ogives with the data presented herein reveals some interesting trends. As previously explained, the size effects with water and hydrogen are similar but with water and nitrogen they are directly opposed; however, K_{iv} tends to increase with decreasing V_o, at the lower values of V_o, for some of the water and nitrogen data. None of the hydrogen data exhibit this latter characteristic. Similar trends in K_{iv} - V_o data were observed in our hydrofoil-nitrogen data [21]. This effect was most pronounced for the smaller ogives (< 0.50 inch dia.) in the water data [26].

It was suggested [26] that use of $(We)^{0.5}$ may account for temperature effects in desinent cavity data, while correlating size effects. Our data, figures 4.14 and 4.16, indicate that temperature effects still prevail in the K_{iv} - $(We)^{0.5}$ plots. It appears as though a more universal correlating parameter is needed for desinent cavity data. This parameter should simultaneously account for the effects of fluid velocity, temperature and size. This criteria suggests use of the Reynolds number ($Re = \rho_o V_o D_m/\mu$)--a parameter of limited value in the data correlated by Parkin and Holl [26]. Use of the Reynolds number would not improve the correlation of our data because we would merely be replacing V_o or $V_o\sqrt{D_m}$, in figures 4.13 to 4.16, with $V_o D_m$. Such a simple substitution results because ρ_o/μ does not vary by more than 35 percent in any of our data; consequently, the $V_o D_m$ product dominates the magnitude of the Reynolds number. Use of the Reynolds number would effectively shift the K_{iv} curves, for the larger diameter ogives, farther to the right in figures 4.14 and 4.16. Because desinent cavity data are of limited interest, relative to developed cavity data, no further effort was expended in this direction.

4.3 Correlation of Developed Cavitation Data

The existence of thermodynamic equilibrium within developed cavities was verified by direct measurement of pressure and temperature within the vaporous cavities. Also, fully developed cavity data are correlated [20] by using these experimental values of cavity pressure and temperature to obtain cavity pressure depressions. The pressure depression in the cavitated region is determined by subtracting the measured cavity pressure, in one case, and the saturation pressure associated with the measured cavity temperature, in the other case, from the vapor pressure of the liquid entering the test section. In the hydrogen data reported here, the measured cavity pressure, P_1, was less than bulkstream vapor pressure by as much as 13.77 psi (9.50 N/cm^2); these pressure-depressions are obtained by subtracting P_1 from P_v in the tabulated data of appendix A. For the nitrogen data, P_v exceeded P_1 by as much as 12.89 psi (8.89 N/cm^2).

Typical profiles of measured pressure depression, for liquid hydrogen, are given on figures 4.17 to 4.21; similar profiles, for liquid nitrogen, are plotted on figures 4.22 to 4.26. Similar plots for the venturi and hydrofoil were presented in previous reports [20, 21]. From most of these figures, it can be observed that, within data accuracy, stable thermodynamic equilibrium exists throughout the vaporous cavity. This topic is discussed in greater detail in section 4.4 of this report. Temperature derived data (P_v - $P_{n, T}$) are not shown on figures 4.17 and 4.20--temperature data were omitted on these graphs because cavity temperature measurements were not obtained at the higher velocities with the 0.420-inch ogive. The time interval, during high velocity liquid hydrogen tests with the 0.420-inch ogive, was too short to obtain steady state cavity temperature data; therefore, cavity temperature data for these conditions are not reported for the 0.420-inch ogive. Thus, to avoid confusion, all cavity temperature data are omitted from these two graphs. In appendices A-6a and A-6b--tabulated hydrogen data for the 0.420-inch ogive--the cavity temperature data, T_1 through T_5, are held constant at T_o for these higher velocity tests. In this way the reader is instantly alerted that no cavity temperature data were acquired for these specific tests. No such difficulties were encountered with liquid nitrogen and all of the tabulated nitrogen data include cavity temperature data.

It should also be noted that some of the values of P_4, tabulated in appendix A, are in error. The P_4 data help establish the vaporous cavity pressure profile, but are not directly used to correlate the developed

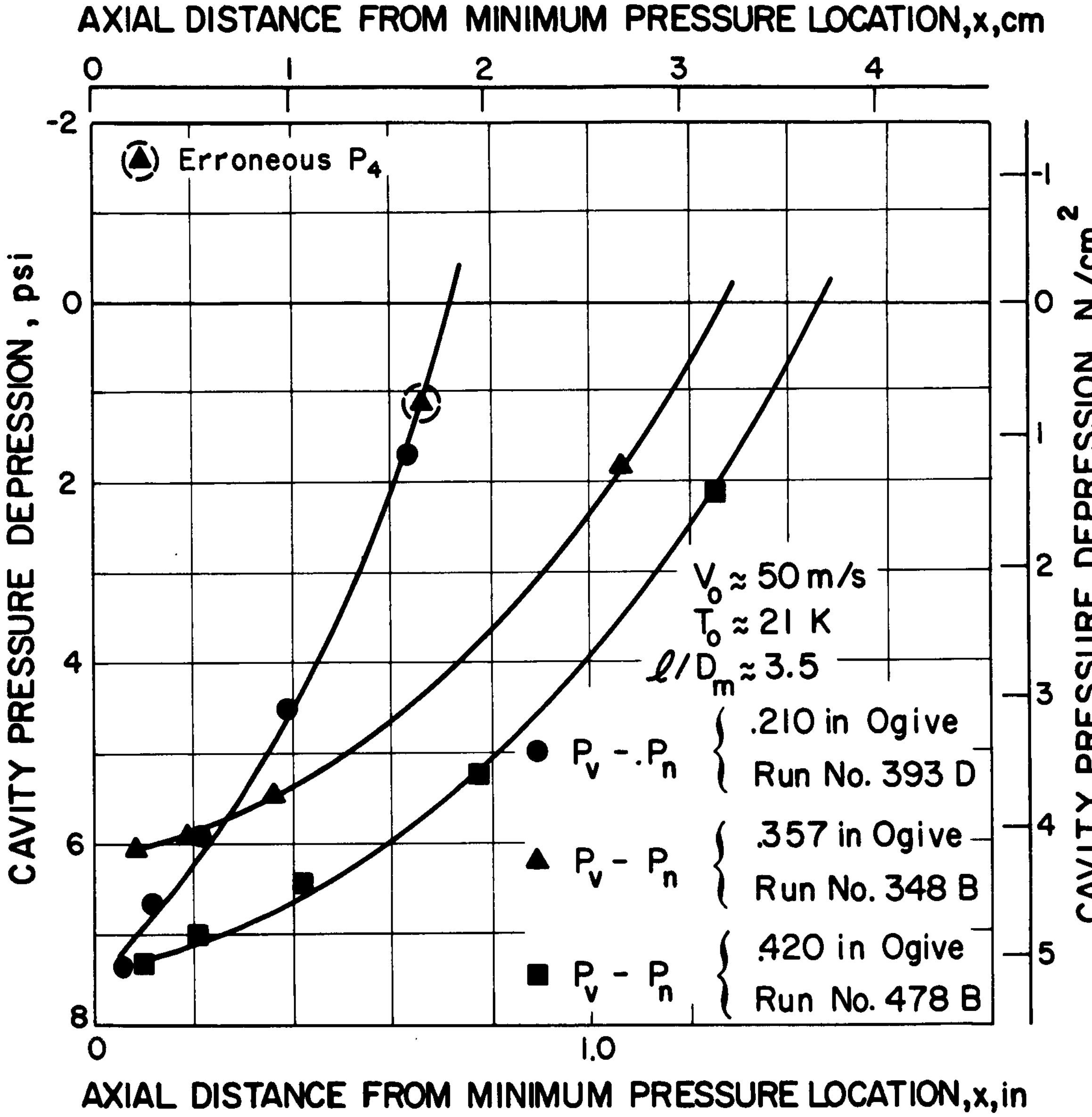


Figure 4. 17 Pressure depressions within cavities in liquid hydrogen.

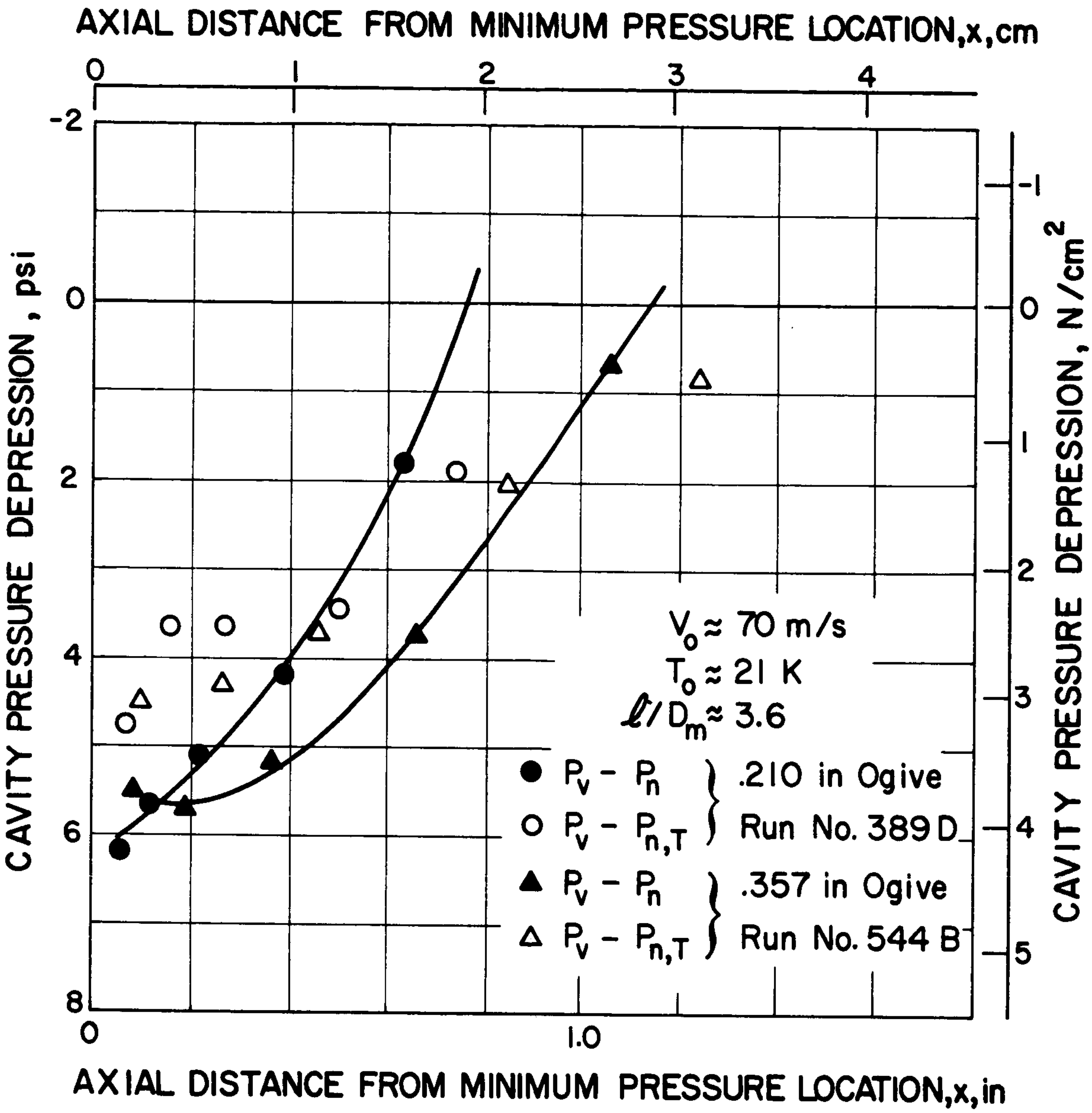


Figure 4.18 Pressure and temperature depressions within cavities in liquid hydrogen.

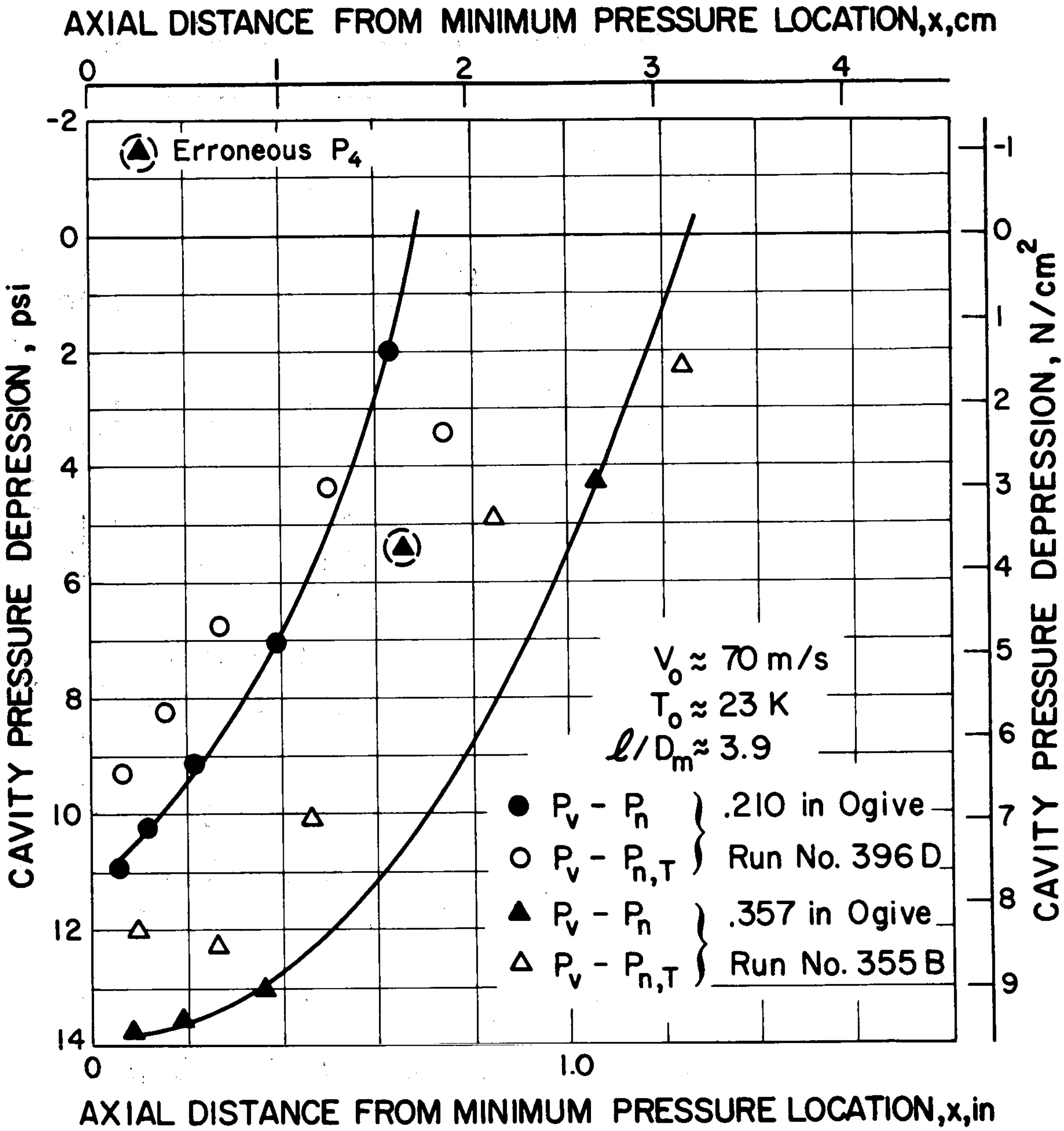


Figure 4.19 Pressure and temperature depressions within cavities in liquid hydrogen.

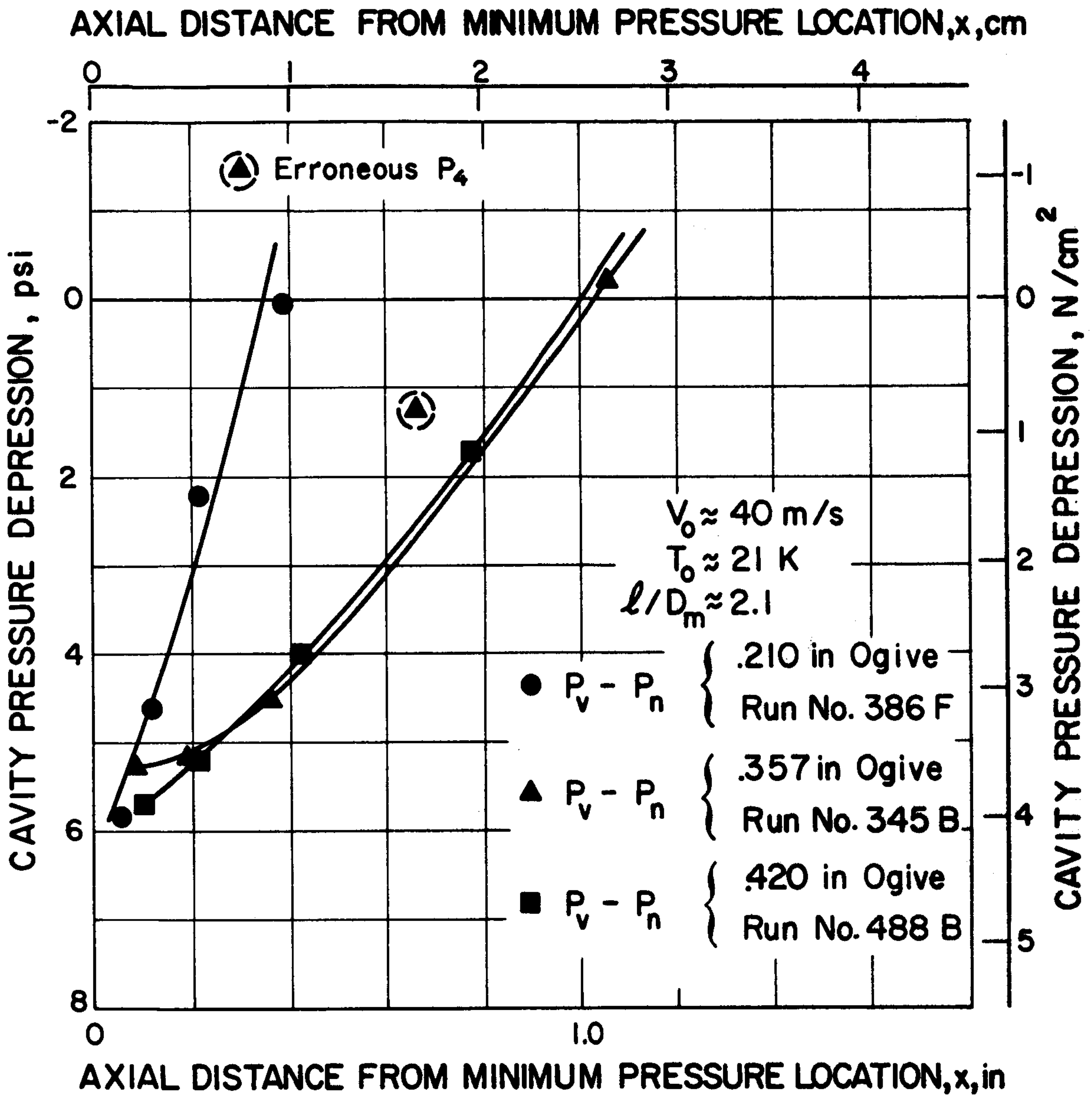


Figure 4.20 Pressure depressions within cavities in liquid hydrogen.

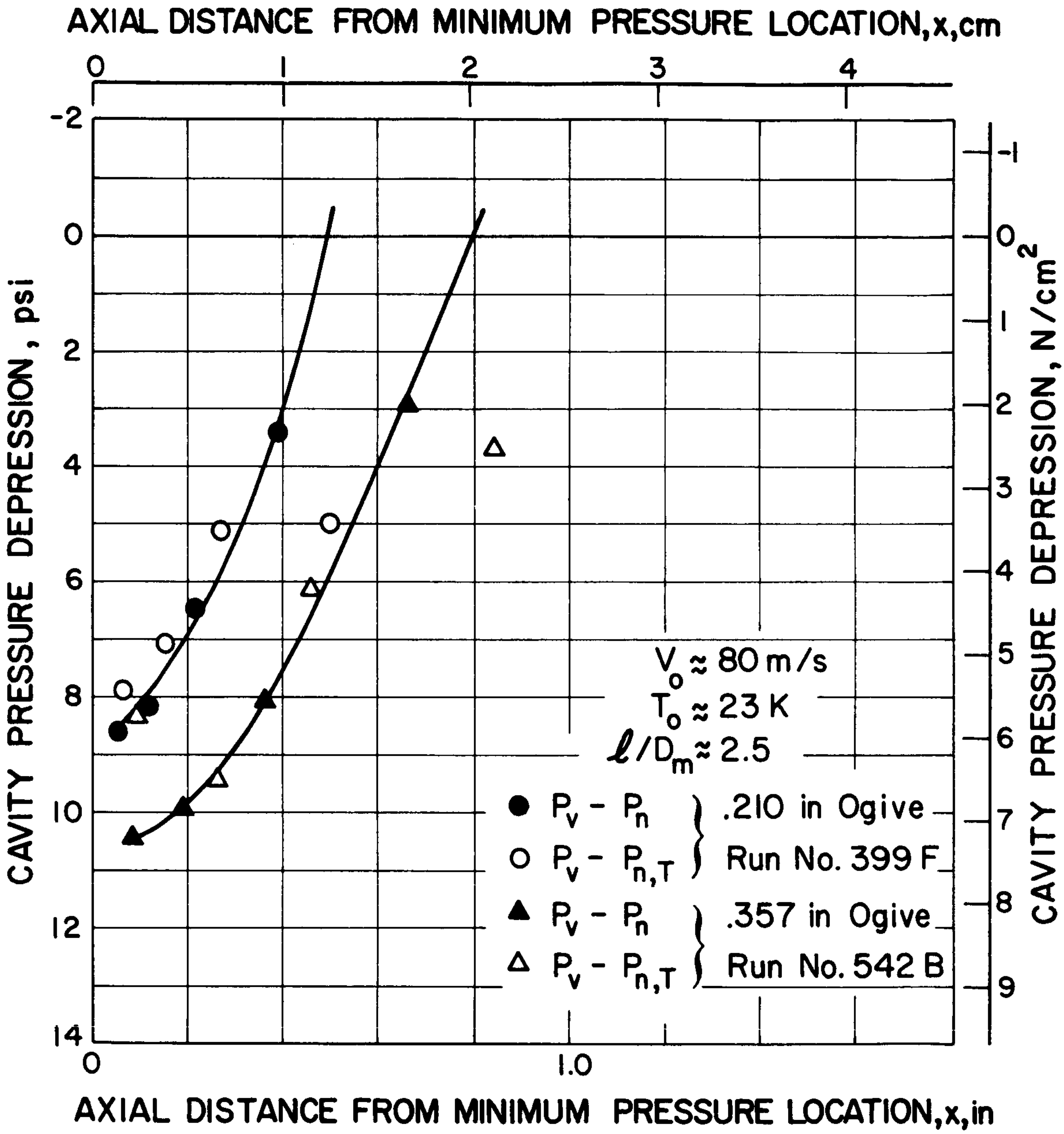


Figure 4.21 Pressure and temperature depressions within cavities in liquid hydrogen.

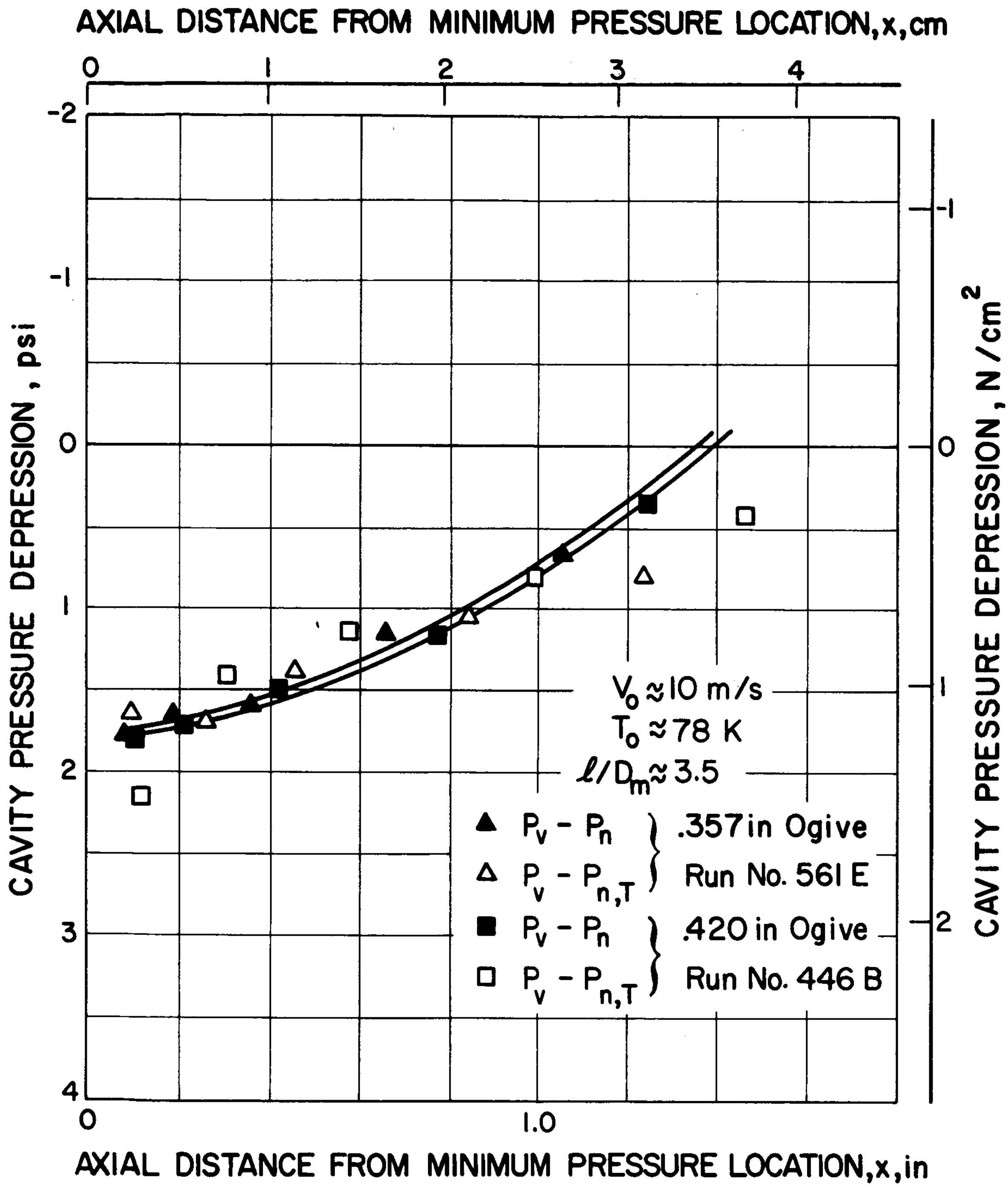


Figure 4.22 Pressure and temperature depressions within cavities in liquid nitrogen.

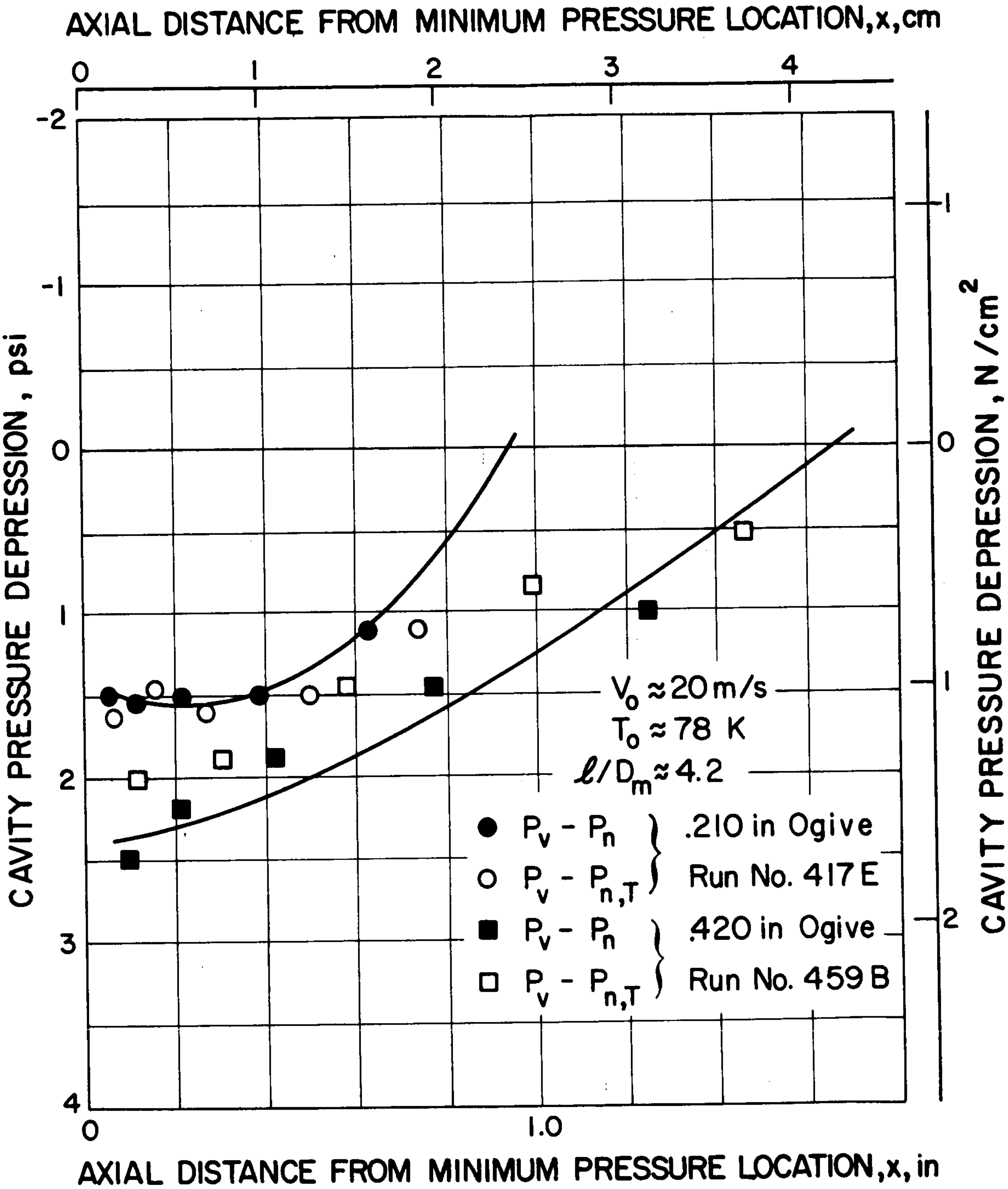


Figure 4.23 Pressure and temperature depressions within cavities in liquid nitrogen.

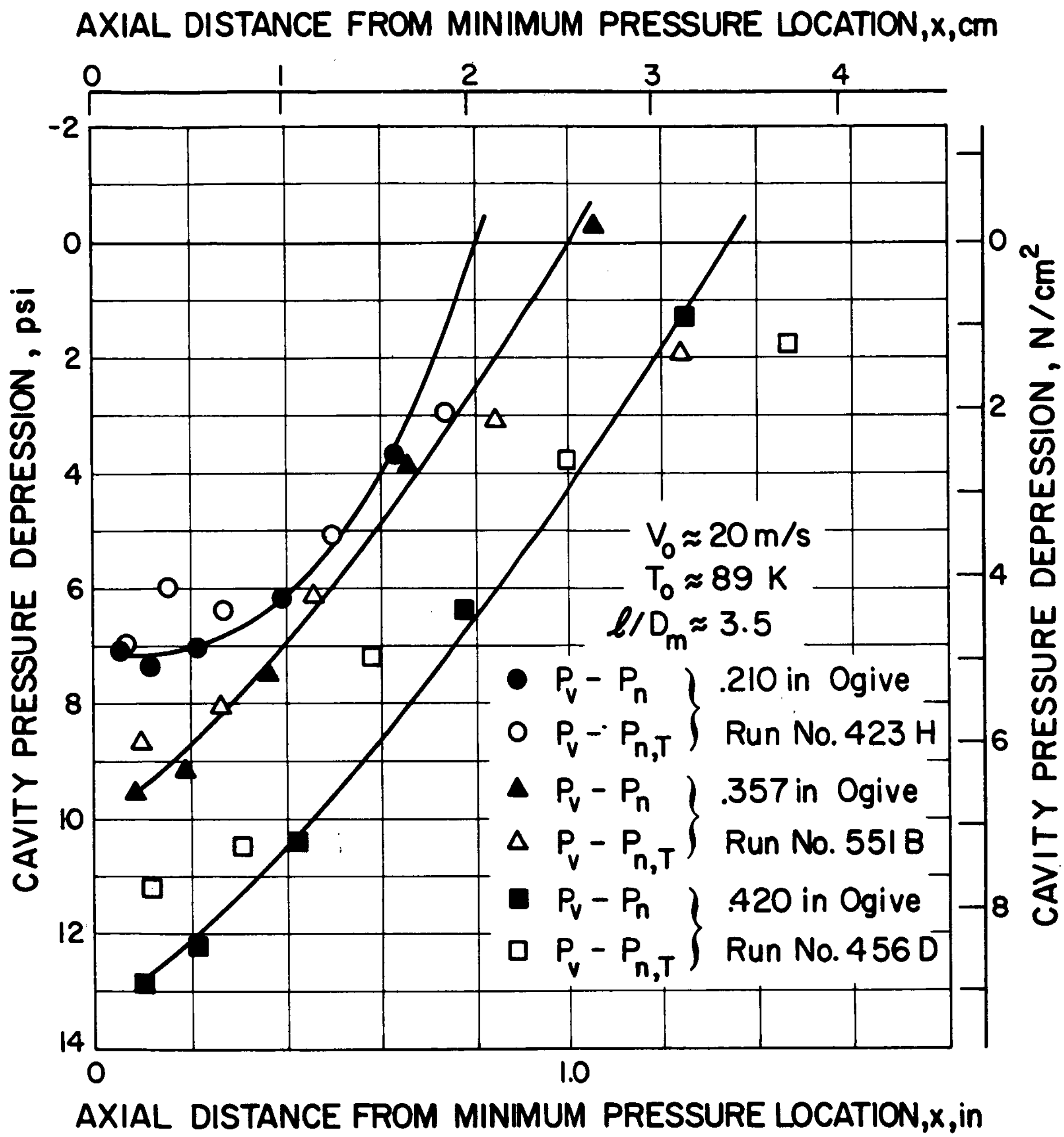


Figure 4.24 Pressure and temperature depressions within cavities in liquid nitrogen.

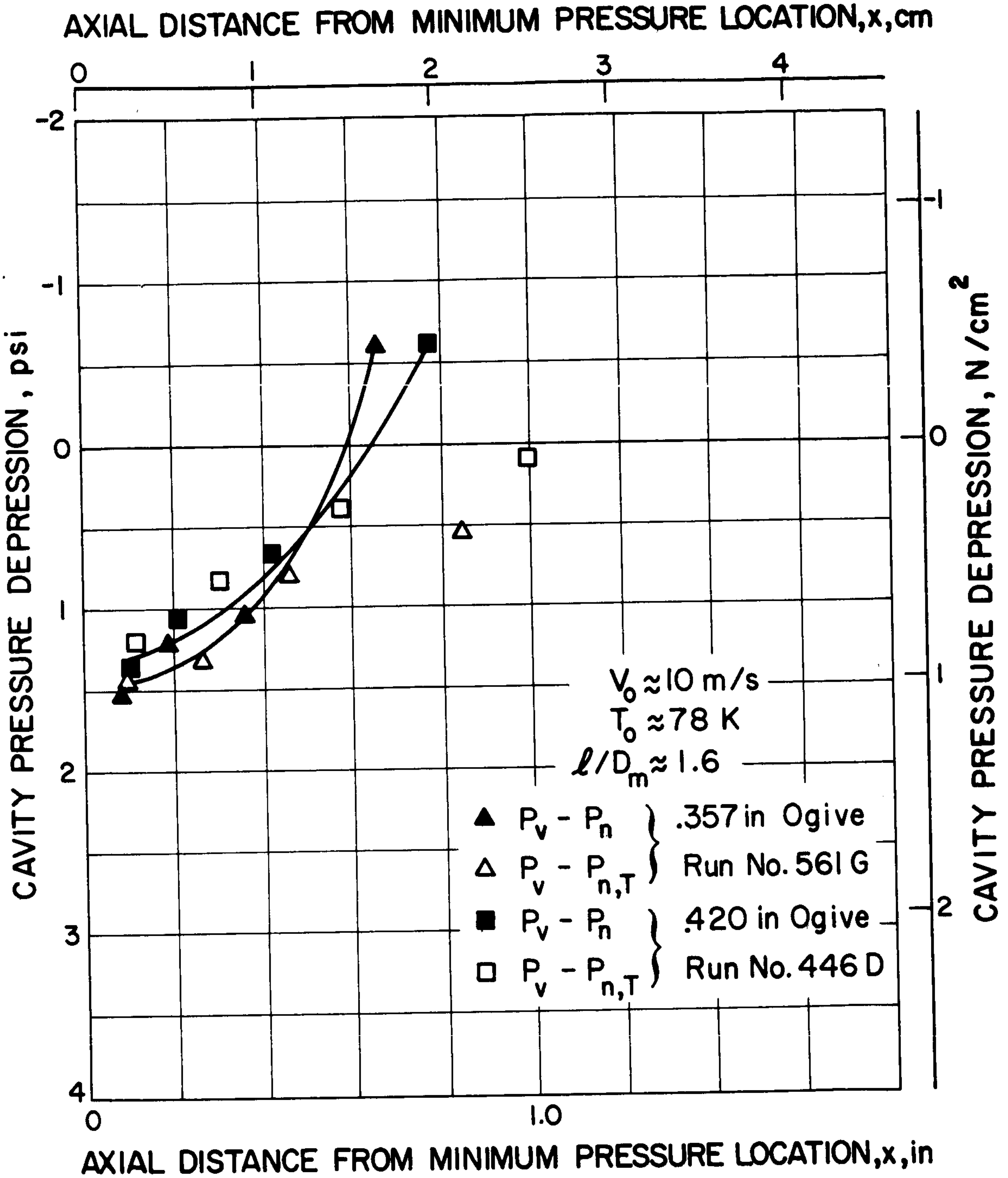


Figure 4.25 Pressure and temperature depressions within cavities in liquid nitrogen.

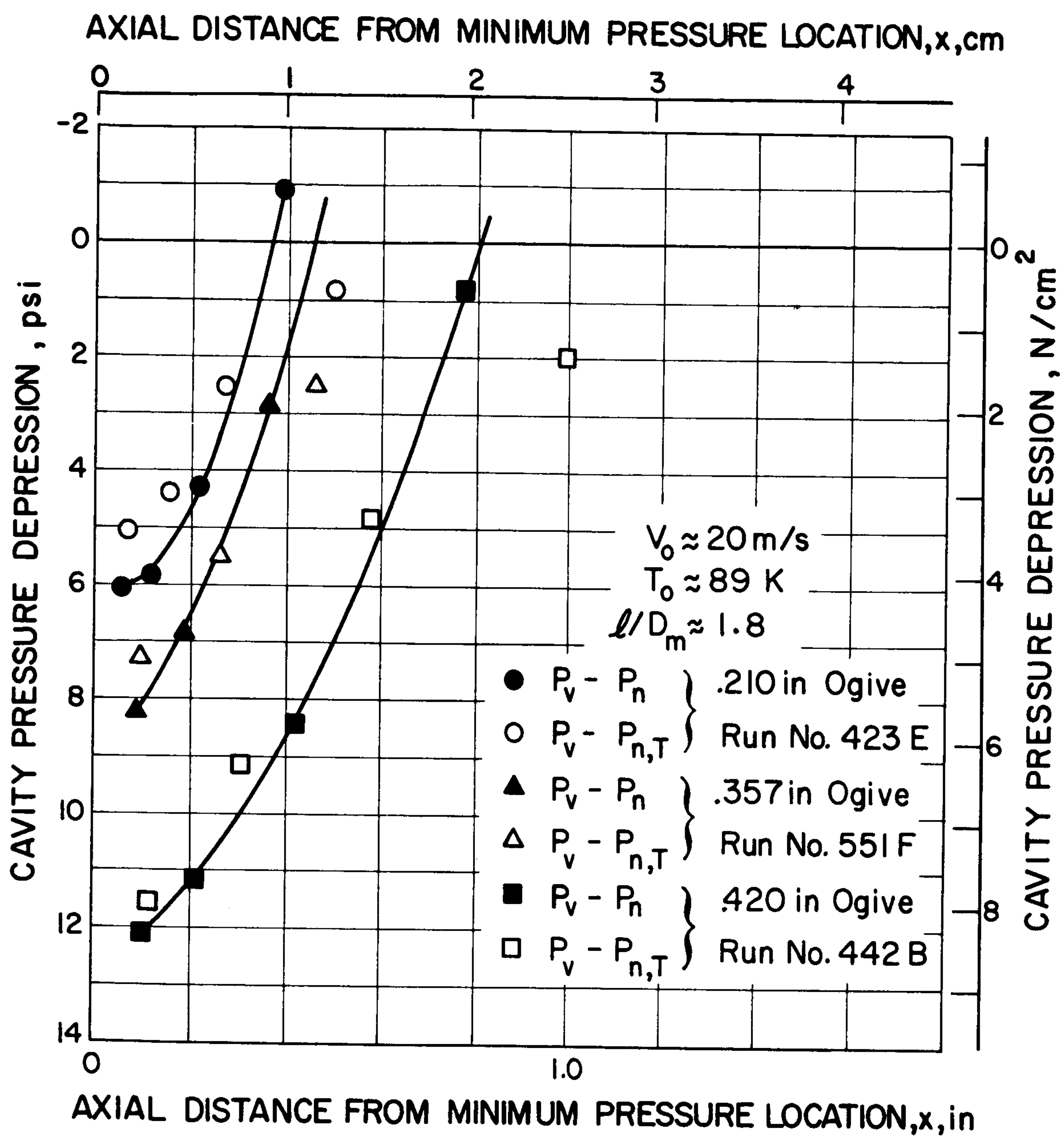


Figure 4.26 Pressure and temperature depressions within cavities in liquid nitrogen.

cavity data; thus, the erroneous values of P_4 have no effect on correlation of our developed cavity data. The developed cavity data are correlated using the minimum measured cavity pressure, P_1 (or $\overline{P}_1$). Thus, an erroneous P_4 merely distorts the 'pressure-depression' profile and complicates estimation of the instrumented cavity length--a minor inconvenience as revealed in the next paragraph. The erroneous data are restricted to the 0.357-inch ogive and Run number series 302 to 371. These P_4 data are in error because of a leak in the P_4 pressure transmitting tubing within the sting assembly. After careful analysis of the 0.357-inch ogive data, this leak was discovered and corrected and tests on the 0.357-inch ogive were repeated. The latter series of tests are recorded in appendix A as Run numbers 507 to 564. The pressure tubing leak caused P_4 to appear too high, resulting in a lower pressure depression at station 4, see figures 4.17, 4.19, and 4.20. Because the measurement of P_4 has no direct bearing on the correlation of developed cavity data, or desinent data, all of the data in Run series 302 to 371 were retained and tabulated in appendix A--thereby strengthening the statistical validity of the ogive data.

As indicated in previous reports [20, 21], the instrumented (actual) cavity length is estimated by extrapolating the pressure depression data to zero pressure depression. The actual length of the cavity, and the visual (as observed on film) length, differ because of the irregular trailing edges of the cavity and the difficulty in judging the visual length. Both actual and visual cavity lengths were used to correlate the data, and they produced essentially the same results. The visual cavity lengths, as tabulated in appendix A, were used in the final correlative data fits reported in tables 4.7 to 4.9.

The correlative expressions, developed in a previous report [21], were used to correlate the developed cavity data from this experiment. The two correlative equations are given as follows:

$$B = B_{ref}\left(\frac{\alpha_{ref}}{\alpha}\right)^{E1}\left(\frac{V_o}{V_{o,\,ref}}\right)^{E2}\left(\frac{x}{x_{ref}}\right)^{E3}\left(\frac{\nu_{ref}}{\nu}\right)^{E4}\left(\frac{\sigma_{ref}}{\sigma}\right)^{E5}\left(\frac{D_m}{D_{m,\,ref}}\right)^{E6}; \qquad (4\text{-}8)$$

$$B = B_{ref}\left(\frac{\alpha_{ref}}{\alpha}\right)^{E1}\left(\frac{MTWO}{MTWO_{ref}}\right)^{E2}\left(\frac{x}{x_{ref}}\right)^{E3}\left(\frac{\nu_{ref}}{\nu}\right)^{E4}\left(\frac{\sigma_{ref}}{\sigma}\right)^{E5}\left(\frac{D_m}{D_{m,\,ref}}\right)^{E6}. \qquad (4\text{-}9).$$

These expressions, along with the correlative technique developed by Gelder, et al. [19], the isentropic BFLASH theory [28], and two least-squares data-fitting computer programs [20] were used to correlate these ogive data. For convenience, we will refer to these correlative expressions as 'similarity' equations. The similarity equations are used to correlate developed cavitation data in similar test items, and to predict the cavitation performance of a test item from fluid-to-fluid, and from one temperature to another, when limited test data from a single fluid are available. Size effects, for the ogives, are shown to be important.

Complete and detailed descriptions of the correlative technique, computational steps, and computer programs are given in reference [20]. The correlative procedure, as previously described [20], can be followed directly when using eq (4-8). To use eq (4-9), simply substitute MTWO for V_o in the computer program. Briefly, this correlative procedure ensures that the B values calculated from eq (4-8), or eq (4-9), and the BFLASH values [28] for each data point, are as nearly identical as possible; because both B values, at each data point, are evaluated from

Table 4.7 Correlative results for developed cavity data using equation (4-8)--ogives.

Line No.	Ogive dia. (inches)	Fluids	Exponents*					Ref. Run No.	Standard † Deviation in B-Factor	$\bar{K}_{c,min}$
			E1	E2	E3	E4	E6			
1	0.210	H_2	0.47	-0.75	0.40	---	---	397B	0.2159	0.412
2	0.210	N_2	-2.48	0.66	0.46	---	---	429B	0.1633	0.419
3	0.357	H_2	-0.32	-0.28	0.43	---	---	338B	0.1943	0.608
4	0.357	N_2	-1.08	0.10	0.28	---	---	557E	0.2111	0.537
5	0.420	H_2	-3.94	0.41	0.32	---	---	469B	0.1670	0.632
6	0.420	N_2	-1.88	0.67	0.37	---	---	450C	0.1878	0.525
7	0.210	H_2 & N_2	0.07	0.19	0.45	-0.97	---	397B	0.2686	0.415
8	0.357	H_2 & N_2	-0.22	-0.03	0.35	---	---	338B	0.2198	0.568
9	0.420	H_2 & N_2	0.88	0.50	0.39	-1.05	---	450C	0.2308	0.567
10	0.210 & 0.357	H_2	-0.21	-0.39	0.43	---	0.15	397B	0.2114	0.531
11	0.210 & 0.357	N_2	-1.90	0.23	0.29	---	0.61	317B	0.2312	0.501
12	0.357 & 0.420	H_2	-0.92	-0.13	0.43	---	0.28	515B	0.2126	0.617
13	0.357 & 0.420	N_2	-1.86	0.37	0.36	---	1.13	450C	0.2402	0.532
14	0.210 & 0.420	H_2	-2.83	-0.13	0.40	---	0.14	469B	0.2397	0.516
15	0.210 & 0.420	N_2	-2.05	0.68	0.39	---	0.93	450C	0.1821	0.485
16	0.210 & 0.357 & 0.420	H_2	-0.75	-0.22	0.43	---	0.17	515B	0.2239	0.557
17	0.210 & 0.357 & 0.420	N_2	-2.08	0.41	0.39	---	0.88	450C	0.2381	0.509
18	0.210 & 0.357	H_2 & N_2	-0.30	-0.05	0.38	---	0.39	338B	0.2491	0.516
19	0.357 & 0.420	H_2 & N_2	0.43	0.27	0.32	-0.90	1.08	317B	0.2527	0.568
20	0.210 & 0.420	H_2 & N_2	0.88	0.50	0.40	-1.10	0.79	450C	0.2597	0.499
21	0.210 & 0.357 & 0.420	H_2 & N_2	0.32	0.21	0.34	-0.84	0.60	338B	0.2620	0.531

$$* \quad B = B_{ref}\left(\frac{\alpha_{ref}}{\alpha}\right)^{E1}\left(\frac{V_o}{V_{o,ref}}\right)^{E2}\left(\frac{x}{x_{ref}}\right)^{E3}\left(\frac{\nu_{ref}}{\nu}\right)^{E4}\left(\frac{\sigma_{ref}}{\sigma}\right)^{E5}\left(\frac{D_m}{D_{m,ref}}\right)^{E6} \text{ --- eq (4-8).}$$

† Standard Deviation $\equiv \sqrt{\left[\sum(B-B_t)^2\right] / (NPTS-1)}$, where NPTS = number of data points (including "ref" data point).

B_t = BFLASH and is computed from isentropic-flashing theory [28], and B is computed from eq (4-8).

Table 4.8 Correlative results for developed cavity data using equation (4-9)--ogives.

Line No.	Ogive dia. (inches)	Fluids	Exponents **				Ref. Run No.	Standard † Deviation in B-Factor	$\overline{K}_{c, min}$
			E1	E2	E3	E6			
1	0.210	H_2	-0.48	0.39	0.35	---	397B	0.2638	0.412
2	0.210	N_2	1.14	0.51	0.35	---	429B	0.1213	0.419
3	0.357	H_2	-0.83	-0.03	0.44	---	338B	0.2130	0.608
4	0.357	N_2	-0.53	0.18	0.23	---	557E	0.1974	0.537
5	0.420	H_2	-1.41	0.53	0.22	---	469B	0.1274	0.632
6	0.420	N_2	0.74	0.55	0.30	---	450C	0.1538	0.525
7	0.210	H_2 & N_2	-0.28	0.41	0.34	---	397B	0.2129	0.415
8	0.357	H_2 & N_2	-0.06	0.18	0.31	---	338B	0.2094	0.568
9	0.420	H_2 & N_2	0.05	0.55	0.29	---	450C	0.1694	0.567
10	0.210 & 0.357	H_2	-0.79	0.14	0.38	0.26	397B	0.2347	0.531
11	0.210 & 0.357	N_2	-0.45	0.36	0.23	0.67	317B	0.2001	0.501
12	0.357 & 0.420	H_2	-0.83	0.30	0.30	0.70	515B	0.2017	0.617
13	0.357 & 0.420	N_2	-0.12	0.43	0.30	0.82	450C	0.1994	0.532
14	0.210 & 0.420	H_2	-1.06	0.51	0.27	0.52	469B	0.2084	0.516
15	0.210 & 0.420	N_2	0.84	0.52	0.31	0.69	450C	0.1375	0.485
16	0.210 & 0.357 & 0.420	H_2	-1.07	0.27	0.31	0.42	515B	0.2237	0.557
17	0.210 & 0.357 & 0.420	N_2	0.10	0.43	0.31	0.71	450C	0.1903	0.509
18	0.210 & 0.357	H_2 & N_2	-0.09	0.36	0.28	0.53	338B	0.2228	0.516
19	0.357 & 0.420	H_2 & N_2	0.01	0.39	0.23	0.87	317B	0.2081	0.568
20	0.210 & 0.420	H_2 & N_2	-0.09	0.52	0.29	0.61	450C	0.1915	0.499
21	0.210 & 0.357 & 0.420	H_2 & N_2	-0.05	0.43	0.25	0.59	338B	0.2126	0.531

** $$B = B_{ref}\left(\frac{\alpha_{ref}}{\alpha}\right)^{E1}\left(\frac{MTWO}{MTWO_{ref}}\right)^{E2}\left(\frac{x}{x_{ref}}\right)^{E3}\left(\frac{\nu_{ref}}{\nu}\right)^{E4}\left(\frac{\sigma_{ref}}{\sigma}\right)^{E5}\left(\frac{D_m}{D_{m,ref}}\right)^{E6} \text{ ---eq (4-9).}$$

† Standard Deviation = $\sqrt{\left[\sum(B-B_t)^2\right]/(NPTS-1)}$, where NPTS = number of data points (including "ref" data point), B_t = BFLASH and is computed from isentropic-flashing theory [28], and B is computed from eq (4-9).

Table 4.9 Summary of correlative results for developed cavity data--ogives, hydrofoil, and venturi.

Line No.	Model	Fluids	Correlative Equation	Source of Data	Exponents					Reference Run No.	Standard † Deviation in B-Factor	$\overline{K}_{c,min}$
					E1	E2	E3	E4	E6			
1	Ogives	H_2 & N_2	(4-8)*	This Study	0.32	0.21	0.34	-0.84	0.60	338B	0.2620	0.531
2	Hydrofoil	H_2 & N_2	(4-8)	Reference [21]	0.80	0.64	0.45	-1.00	---	255B	0.3717	1.833
3	Venturi	H_2	(4-8)	Reference [20]	-1.92	0.74	0.31	---	---	071C	0.3466	2.459
4	Venturi	H_2 & F-114	(4-8)	Reference [3]	1.0	0.8	0.3	---	-0.10	---	---	2.47
5	Ogives	H_2 & N_2	(4-9)**	This Study	(-0.05)	0.43	0.25	---	0.59	338B	0.2126	0.531
6	Hydrofoil	H_2 & N_2	(4-9)	Reference [21]	(-0.13)	0.59	0.27	---	---	255B	0.2565	1.833
7	Venturi	H_2	(4-9)	Reference [20]	(0.10)	0.59	0.18	---	---	071C	0.2234	2.459

* $B = B_{ref}\left(\frac{\alpha_{ref}}{\alpha}\right)^{E1}\left(\frac{V_o}{V_{o,ref}}\right)^{E2}\left(\frac{x}{x_{ref}}\right)^{E3}\left(\frac{\nu_{ref}}{\nu}\right)^{E4}\left(\frac{\sigma_{ref}}{\sigma}\right)^{E5}\left(\frac{D_m}{D_{m,ref}}\right)^{E6}$ ---eq (4-8).

** $B = B_{ref}\left(\frac{\alpha_{ref}}{\alpha}\right)^{E1}\left(\frac{MTWO}{MTWO_{ref}}\right)^{E2}\left(\frac{x}{x_{ref}}\right)^{E3}\left(\frac{\nu_{ref}}{\nu}\right)^{E4}\left(\frac{\sigma_{ref}}{\sigma}\right)^{E5}\left(\frac{D_m}{D_{m,ref}}\right)^{E6}$ ---eq (4-9).

† Standard Deviation $\equiv\sqrt{\left[\sum(B-B_t)^2\right]/(NPTS-1)}$, where NPTS = number of data points (including "ref" data point),

B_t = BFLASH and is computed from isentropic-flashing theory [28], and B is computed from eq (4-8) or eq (4-9).

experimental data, this correlative procedure produces the best possible agreement between experiment, the isentropic flashing theory [28], and the correlative expression--eq (4-8) or eq (4-9). This 'best-fit,' of the experimental data, is obtained by selecting appropriate exponents for each of the correlative parameters in the correlative expression--eq (4-8) or eq (4-9). The exponent selecting process is quite complex and is treated in appropriate detail in reference [20]. Exponents for eq (4-8) and eq (4-9) were derived to evaluate the suitability of MTWO as a correlating parameter for the ogive data. Recall that the hydrofoil and venturi data correlations were significantly improved [21] by use of the MTWO parameter; similar improvement was obtained with the ogive data.

In eq (4-8) and eq (4-9) the cavity lengths were evaluated at the visually observed lengths. BFLASH was obtained, for each experimental data point, as follows: 1) the average measured cavity pressure depression ($P_v - \overline{P}_1$), T_o and the calculation method outlined in reference [28] were used, excepting the hydrogen data for the 0.357-inch and 0.420-inch ogives; 2) for the latter two batches of data we used $P_v - P_1$, T_o, and the calculation method of reference [28]. The average minimum cavity pressure, $\overline{P}_1 = (P_1 + P_{1,T})/2$, was used for most of the ogive data because the temperature measurements are considered just as accurate as the pressure measurements; however, the pressure measurements are considered slightly superior with the hydrogen data for the 0.357-inch and 0.420-inch ogives. The minimum cavity pressure, P_1, was used in those specific cases because test duration was shorter and the response characteristics of the pressure sensors hold a slight advantage over those of the temperature sensors.

In eq (4-8) and eq (4-9), the fluid physical properties are evaluated at P_o and T_o, with the exception that MTWO is evaluated at the minimum measured cavity pressure P_1 (or $\overline{P}_1$). The standard deviation in B is computed for each set of exponents; the individual exponents may be held constant or chosen by the computer. The standard deviation in B factor is minimized in the computer programs when one or more of the exponents is selected by the computer; the absolute minimum standard deviation is obtained when all of the exponents are selected by the computer--as in this report. In those cases where the exponents are held constant the standard deviation cannot be minimized and is merely computed. The set of exponents that produces minimum standard deviation in B is selected as the best correlative solution for any particular batch of data; i.e., the standard deviation is a measure of the validity of the similarity and isentropic-flashing theories, as both are evaluated from experimental data.

Because MTWO proved to be a valuable correlating parameter for the hydrofoil and venturi data [21], the ogive data were correlated with and without the MTWO parameter to further evaluate its influence. Correlating the ogive data with eq (4-8), and then eq (4-9), provides direct evaluation of MTWO as a correlating parameter--identical comparisons were prepared for the hydrofoil and venturi data [21]. Correlation of the ogive data, using eq (4-8), is summarized in table 4.7; similarly, table 4.8 was prepared using eq (4-9). Table 4.9 summarizes the correlative results for developed cavitation on all geometries (bodies) tested in this study, i.e., venturi, hydrofoil, and ogives. The results given in tables 4.7 to 4.9 are discussed in the following section of this report.

4.4 Discussion of Developed Cavitation Data

4.4.1 Cavity Visualization and Appearance

Photographs of fully developed vaporous cavities, in liquid hydrogen, are shown on figures 3.6 to 3.8. Inlet velocity and liquid temperature were observed to have very little effect on the appearance of cavitating hydrogen; i.e., the cavities were somewhat ragged but uniformly developed. Only at the highest temperature, and lowest velocities, did the hydrogen cavities exhibit a slightly porous, non-uniform character. Similar, though more pronounced, features were observed in the nitrogen cavities. If a cavity is sufficiently porous, i.e., if it visually resembles vapor streams, erratic developed cavity data may result. This occurs because the pressure and temperature sensing ports are not continuously covered with vapor during a test, but may be intermittently covered with vapor and then liquid. This results in non-steady data that are readily spotted during data analysis and no such data are reported herein.

The photographs in figures 3.6 to 3.8 indicate that the cavity profiles are fairly smooth except in the vicinity of the belled diffusers. Figure 3.6 shows two long cavities with trailing clouds of condensing vapors--scribe lines on the plastic tunnel, used to detect cavity length, are visible in both of these photographs. Figure 3.7 shows hydrogen cavities on the 0.357-inch ogive in various stages of development. Two very interesting photographs are shown in the top half of figure 3.8--these cavities were filmed in the rare act of tearing apart with the rear portion of the cavity collapsing. More typical photographs, for the 0.420-inch ogive, are shown in the bottom half of this figure.

By comparing figures 3.6, 3.7, and 3.8, it becomes apparent that cavity profile irregularities are accentuated with increasing size of the ogives. All of the photographs in these figures were acquired with a three microsecond stroboscopic flash exposure. Thus, these photographs are not representative of what one sees when viewing a test. At much slower exposure rates, that can be accommodated by the eye, the cavity profile irregularities are smeared into a nice smooth continuous elliptical shape.

4.4.2 Graphical Display of Typical Developed Cavity Data

In figures 4.17 to 4.26, the data points representing cavity pressure measurements have been connected with a smooth curve--this facilitates comparison with the data points obtained from the cavity temperature measurements, where the latter are plotted. The pressure depressions obtained from the cavity temperature measurements are, for the most part, in good agreement with those derived from the measured pressures, i.e., within the allowances of instrument error, the cavity vapor is in stable thermodynamic equilibrium. Plots similar to figures 4.18 to 4.26, of all the ogive data, reveal that stable thermodynamic equilibrium exists within the cavity vapor--within data accuracy. Similar results were obtained with the hydrofoil [21] while evidence of metastable vapor was presented in the venturi study [20].

In figures 4.18 to 4.26, the only significant differences in the measured pressure and temperature profiles occur near the trailing edges of the cavities. Similar characteristics were observed in the hydrofoil and venturi studies. The trailing edges of a cavity are normally irregular and are characterized by randomly-spaced clouds of condensing vapor. It was previously shown [21] that it is inadvisable to attempt to interpret the cavity data in this ill-defined region. Also, an explanation was offered [21] for the apparent discrepancy, in pressure and temperature measurements, near the aft end of the cavities.

Figures 4.17 to 4.26 were selected to demonstrate the functional dependency of cavity pressure depression upon various correlating parameters. The primary parameters, as differentiated from derived parameters, at our disposal are cavity length (ℓ), fluid temperature (T_o) and velocity (V_o), and ogive diameter (D_m). Comparing figures 4.17 and 4.18, we note that ℓ/D_m and T_o are almost constant but V_o varies. Comparing these hydrogen data for the same size ogives, we see that the maximum pressure depression decreases slightly with increasing values of V_o--this conclusion applies only to the 0.210-inch and 0.357-inch ogives. This result differs from the venturi [3, 20], hydrofoil [21], and zero-caliber ogive [29] tests; however, similar results were obtained in pump inducer performance tests [6] using liquid hydrogen.

The effect of hydrogen temperature upon $P_v - P_n$ is made apparent by comparing figures 4.18 and 4.19--here ℓ/D_m and V_o are nearly constant and T_o varies. Cavity pressure depression increases markedly with increasing hydrogen temperature. Similarly, by comparing figures 4.17 and 4.20 and then figures 4.19 and 4.21, we find that hydrogen cavity pressure depression increases with increasing cavity length. Upon comparison of figures 4.20 and 4.21, we find that increasing V_o, ℓ/D_m, and T_o increases the hydrogen cavity pressure depression. Figures 4.17, 4.18, and 4.20 reveal little size effect at the lower hydrogen temperatures; however, figures 4.19 and 4.21 indicate a definite size effect exists at higher hydrogen temperatures. The cavity pressure depressions increase with increasing values of D_m.

Similar comparisons and comments apply to the nitrogen data plotted on figures 4.22 to 4.26. Comparison of figures 4.22 and 4.23 reveals that $P_v - P_n$ increases with increasing V_o. Comparing figures 4.23 and 4.24, we note that $P_v - P_n$ increases markedly with increasing T_o. Pairing figures 4.22 and 4.25, and then figures 4.24 and 4.26, we find that $P_v - P_n$ for nitrogen increases with increasing cavity length. For nitrogen, as with hydrogen, the combined effects of increasing V_o, T_o, and ℓ/D_m results in larger values of $P_v - P_n$ (pair figures 4.25 and 4.26 or figures 4.24 and 4.25). Again, we see a definite ogive size effect at the higher velocities and temperatures with nitrogen test fluid-- $P_v - P_n$ increases with increasing ogive size.

The foregoing discussions of figures 4.17 to 4.26 show that cavity pressure depressions generally increase with increasing cavity length, ogive diameter, fluid temperature, and velocity for these tests; however, the pressure depressions decrease with increasing velocity for the 0.210-inch and 0.357-inch ogives in liquid hydrogen.

4.4.3 Mathematical Correlative Results

The foregoing cavity parameter functional dependencies are also shown by simply observing the characteristics of the experimentally derived exponents in table 4.7. In reference [28], it is shown that the pressure depression increases with increasing T_o and B. Referring to line 10 of table 4.7, we observe that B increases with increasing x and D_m, and B decreases with increasing V_o. Then, for hydrogen cavities on the 0.210-inch and 0.357-inch ogives, $P_v - P_1$ must increase with increasing T_o, x, and D_m, and $P_v - P_1$ must decrease with increasing V_o. By inspecting tables 4.7 to 4.9, similar deductions may be drawn for any body-fluid combination.

The 'similarity' equations were fitted with numerical exponents derived from the ogive experimental data. These equations were derived in the course of this study [21] and represent extensions of the work of Gelder, et al. [19]. The exponents given in tables 4. 7 to 4. 9 were obtained with a least-squares fitting technique and a digital computer; the suitability of the various exponents to the experimental data is indicated by the standard deviation in B-factor as explained previously. In the ogive experiments, the value of B varies with the diameter of the ogive as follows: 1) 0. 210-inch ogive--B ranges from 0. 7 to 2. 0 for hydrogen and from 0. 5 to 2. 3 for nitrogen, 2) 0. 357-inch ogive--B ranges from 1. 2 to 2. 6 for hydrogen and from 1. 1 to 2. 5 for nitrogen, 3) 0. 420-inch ogive--B ranges from 1. 1 to 2. 8 for hydrogen and from 1. 1 to 3. 0 for nitrogen. In the hydrogen venturi study, the value of B ranges from 2. 0 to 5. 0; in the hydrofoil experiments, the value of B ranges from 1. 0 to 5. 0, for both hydrogen and nitrogen test fluids.

The correlative expressions, used to correlate the experimental data, are given at the bottom of tables 4. 7 to 4. 9. The mathematical technique, used to derive the exponents, can easily pick an extraneous value for any of the exponents if there does not exist significant variation in the corresponding physical parameter. The lack of variation in α explains why E1 frequently tends toward a negative number in tables 4. 7 to 4. 9; this is particularly true when correlating with single fluids as explained in a previous report [21]. For the ogive data, α varied by less than 8 percent with hydrogen and by only 16 percent with nitrogen--the variation in α for hydrogen-nitrogen correlation was about 2: 1. Thus, sufficient variation in α exists, for the hydrogen-nitrogen correlations, to provide reliable exponents. There was over 400 percent change in α in the hydrogen-refrigerant 114 data correlated by Moore and Ruggeri [3], and thus the value for E1 reported in line 4 of table 4. 9 is to be preferred when correlating with eq (4-8). It is apparent that the combined fluid correlations, for any hydrodynamic model or correlative expression, are to be preferred because of the greater variation in physical parameters. We shall soon demonstrate that the α term is insignificant when correlating with the MTWO term--eq (4-9).

In all of our ogive, hydrofoil, and venturi data, use of the ν and σ terms improved the correlations; however, it is felt that use of these additional correlating parameters is not justified, unless they substantially improve the correlative fit. None of the data were materially improved by the use of σ; therefore, values for E5 are not included in tables 4.7 to 4.9. Similarly, the ν term was of value only for some of the combined fluid correlations using eq (4-8)--see values for E4 in tables 4.7 and 4.9. Correlation of the hydrogen-refrigerant 114 data (line 4 of table 4.9) would most likely be improved by using one or both of these terms.

Exponents for the ogive data, using eq (4-8), are given in table 4.7. Again, the viscosity and surface tension terms had little influence on the data correlation for single fluids (lines 1 to 6 and 10 to 17) and were not used; however, the viscosity term significantly improved some of the combined fluid correlations (lines 7, 9, and 19 to 21), and the corresponding exponent, E4, was determined. For these combined fluids, inclusion of the viscosity term reduced the standard deviation by 7 to 25 percent--a substantial reduction.

Inspection of the 0.210-inch ogive data reveals typical variations in α, ν, and σ. In the hydrogen data (line 1 of table 4.7), α varied by only 8 percent, ν varied by 12 percent, and σ varied by 17 percent. In the nitrogen data (line 2), α varied by 16 percent, ν varied by 35 percent, and σ varied by 29 percent. Thus, it is not surprising that the ν and σ terms were of little benefit in the single fluid correlations, nor that the exponent on the α term is somewhat unsteady. In the combined fluid data (line 7), α varied by almost 100 percent, ν varied by 35 percent, and σ varied more than 300 percent. Then the α exponent, E1, should be quite meaningful, the ν exponent, E4, (though beneficial) is suspect, and the σ exponent, E5, should be beneficial. Because the σ term was of negligible value in the correlative fit, even though it varied by a factor of three, we must conclude that σ is not an important correlating parameter for the cryogens tested; however, it may yet prove to be a valuable correlating parameter for other fluid combinations--with smaller or larger variations in σ. Although the ν term improved the combined fluid correlation, the numerical value of E4 is suspect because of the relatively small variation in ν for these data. Again, ν may be an excellent correlating parameter for other fluid combinations and is of considerable value for the hydrogen-nitrogen combination.

Inspection of the hydrogen data in table 4.7 (lines 1, 3, and 5) indicates that E2 tends toward negative values with decreasing ogive size. This result has already been illustrated graphically, i.e., B decreases with increasing V_o for the 0.210-inch and 0.357-inch ogives. All of the nitrogen data (lines 2, 4, and 6) produced positive values of E2, but these values appear somewhat inconsistent. The foregoing comments are reflected throughout the remainder of the E2 data in table 4.7 (lines 7 to 21). The cavity length exponent, E3, is observed to be relatively constant for all ogive model-fluid combinations (lines 1 to 21 of table 4.7). The viscosity exponent, E4, is also observed to be relatively constant for those model-fluid combinations where ν was found to be beneficial (lines 7, 9, and 19 to 21).

Lines 10 to 21 on table 4.7 were selected to establish the size effect for the ogives, i.e., the value of E6. Perusal of this data indicates considerable variation in E6, depending upon the model-fluid combination. The best set of exponents, using eq (4-8), is considered to be those given in line 21 of table 4.7. These exponents are derived using all of the available ogive data and are consequently representative of the maximum variation in each of the correlating parameters. The data on line 21 is repeated on line 1 of table 4.9.

Comparison of these best experimental exponents (line 21 of table 4.7) for the ogives, with the exponents predicted from heat transfer considerations [21], is somewhat gratifying. The predicted [21] values of E1, E2, and E3 bracketed the experimental data, but the predicted value of E4 did not. These ogive tests do not reveal that a particular flow mode, and technique for evaluating the thermal boundary layer thickness, are to be preferred. Similar results were obtained in the hydrofoil tests [21].

The ogive data were also correlated using eq (4-9); this was accomplished by substituting MTWO for V_o in the computer program. These results are shown in table 4.8. It is apparent from the foregoing discussion, and the results shown in table 4.8, that the ν and σ terms did not materially improve the correlation. That eq (4-9) is quite superior to eq (4-8), as a correlative expression, is readily shown by a line-to-line comparison of the results given in tables 4.7 and 4.8. A substantial reduction (up to 1/4) in standard deviation in B-factor is achieved, in all but three cases (lines 1, 3, and 10), by substituting MTWO for V_o. In those three cases where MTWO does not improve the correlation, the 0.210-inch and 0.357-inch ogives and hydrogen fluid are involved. For these three cases, it was found that the standard deviations listed in table 4.7 could be reduced by 10 to 20 percent by using eq (4-9) and evaluating MTWO in a different manner--the homogeneous thermal equilibrium two-phase mass flux limiting model [30] was used to derive an expression for MTWO. All of the data presented in table 4.8

were derived using the expression for MTWO that was developed in a previous report [21]. The fact that a different expression for MTWO works better in some cases implies that we have not yet developed the optimum formulation for evaluating MTWO; however, the use of MTWO, as currently evaluated, is clearly superior to the use of V_o as a correlating parameter.

In addition to reducing the standard deviation in B-factor, the use of MTWO results in far more consistent values of the exponents E2, E3, and E4 for the various model-fluid combinations (lines 1 to 21 of table 4.8). Careful study of these same data (and comparison with the data in table 4.7) will also show that the importance of the α and x terms is generally lessened when eq (4-9) is used, i.e., the numerical values of E1 and E3 are reduced. In the combined model-fluid correlations (lines 18 to 21 of table 4.8), the numerical value of E1 is so small that the α term could be neglected. The α term is undoubtedly diluted somewhat, because of the many thermophysical and thermodynamic fluid properties embodied in the MTWO parameter. It is believed that the slight correlative improvement offered by the ν and σ terms, when using eq (4-9), can be attributed to the very strong influence of the MTWO parameter. While the ν term was of considerable benefit (lines 7, 9, and 19 - 21 of table 4.7), when using eq (4-8), it has little effect when the standard deviation is reduced to a much lower value (lines 7, 9, and 19 - 21 of table 4.8), by use of the MTWO parameter. The predominant influence of the MTWO term may also be responsible for the slight reductions in E3, when using eq (4-9). The importance of MTWO, as a correlating parameter, emphasizes that mass transfer plays an important role in the cavitation process. Again, line 21 of table 4.8 represents the best set of exponents for the ogive data using eq (4-9). These data are repeated on line 5 of table 4.9.

Table 4.9 lists the best experimental exponents for the hydrodynamic bodies and fluids used in this study. The best correlative results using eq (4-8) and eq (4-9) are presented. The first four data lines indicate that the exponents, using eq (4-8), vary appreciably with the model-fluid combination--only E3 and E4 show reasonable constancy. Lines 5 to 7 of table 4.9 indicate that all of the exponents, using eq (4-9), are reasonably constant for the model-fluid combinations available to us. Certainly, it is not expected that the exponents derived from eq (4-8) or eq (4-9), for different bodies, should be the same. Our tests coupled with recent tests [29], on zero-caliber ogives, indicate that the exponents derived from eq (4-8) may vary widely from one hydrodynamic body to another. Yet it is remarkable that the variation in the exponents, using eq (4-9), is so small (lines 5 to 7 of table 4.9). It is apparent that the α term is negligible in lines 5 to 7; thus, it appears that the α term could be eliminated in eq (4-9). Then, only the MTWO, x and D_m terms remain as vital correlating parameters.

The importance of MTWO, as a correlating parameter, is readily demonstrated by comparing the standard deviation in B-factor for lines 1 and 5, 2 and 6, 3 and 7 in table 4.9. A significant improvement in data correlation is obtained, in each case, by using eq (4-9).

The diameter (size) terms in eq (4-8) and eq (4-9) produced almost identical values for E6 (lines 1 and 5 of table 4.9). Moore and Ruggeri [3] obtained an exponent value of -0.1 for the diameter term--E6 = -0.1 in eq (4-8)--based on tests using refrigerant 114 in two different venturi sizes. Those tests were performed with a venturi identical to the one used in our study [20], and with a larger (1.414:1) geometrically similar venturi. Billet [29] used water and refrigerant-113 to test 0.24-inch and 0.50-inch diameter zero-caliber ogives. He obtained values of E1 = 0.60, E2 = 0.30, E3 = 0.58, and E6 = -0.25 for these tests--as derived from a formulation similar to eq (4-8). Thus, it appears that size effects vary with equipment geometry.

It is instructive to consider another aspect of size effect. The ℓ/D_m ratio is used in a wide variety of geometric scaling problems and has special 'similarity' significance [3]. Substitution of ℓ/D_m for x in eq (4-8) and eq (4-9) requires that

$$\left(\frac{x}{x_{ref}}\right)^{E3}\left(\frac{D_m}{D_{m,ref}}\right)^{E6} = \left(\frac{\ell/D_m}{(\ell/D_m)_{ref}}\right)^{E3}\left(\frac{D_m}{D_{m,ref}}\right)^{E7} . \quad (4\text{-}10)$$

The true 'size effect' is then indicated by the value of the new exponent, E7, i.e., for the same cavity length-to-diameter ratio, ℓ/D_m, the size effect is functionally represented by $(D_m/D_{m,ref})^{E7}$. Using the E3 and E6 data in lines 1, 4, and 5 of table 4.9 and Billets' data [29], we obtain values of E7 as follows: The Moore and Ruggeri data [3] produce the lowest value of 0.20 (from line 4), Billets' data [29] yields a value of 0.33 and our ogive data requires that E7 = 0.84 (line 5) or 0.94 (line 1). Our ogive data indicate that B increases almost linearly with increasing equipment (body) size--for the same ℓ/D_m. From these limited available data, it appears that size effect must be individually determined for specific equipment-fluid combinations.

The results obtained herein indicate that eq (4-9), rather than eq (4-8), should be used for predictive calculations [4, 5].

4.4.4 Variation of $K_{c,min}$ With Geometry, Fluid, Size, Etc.

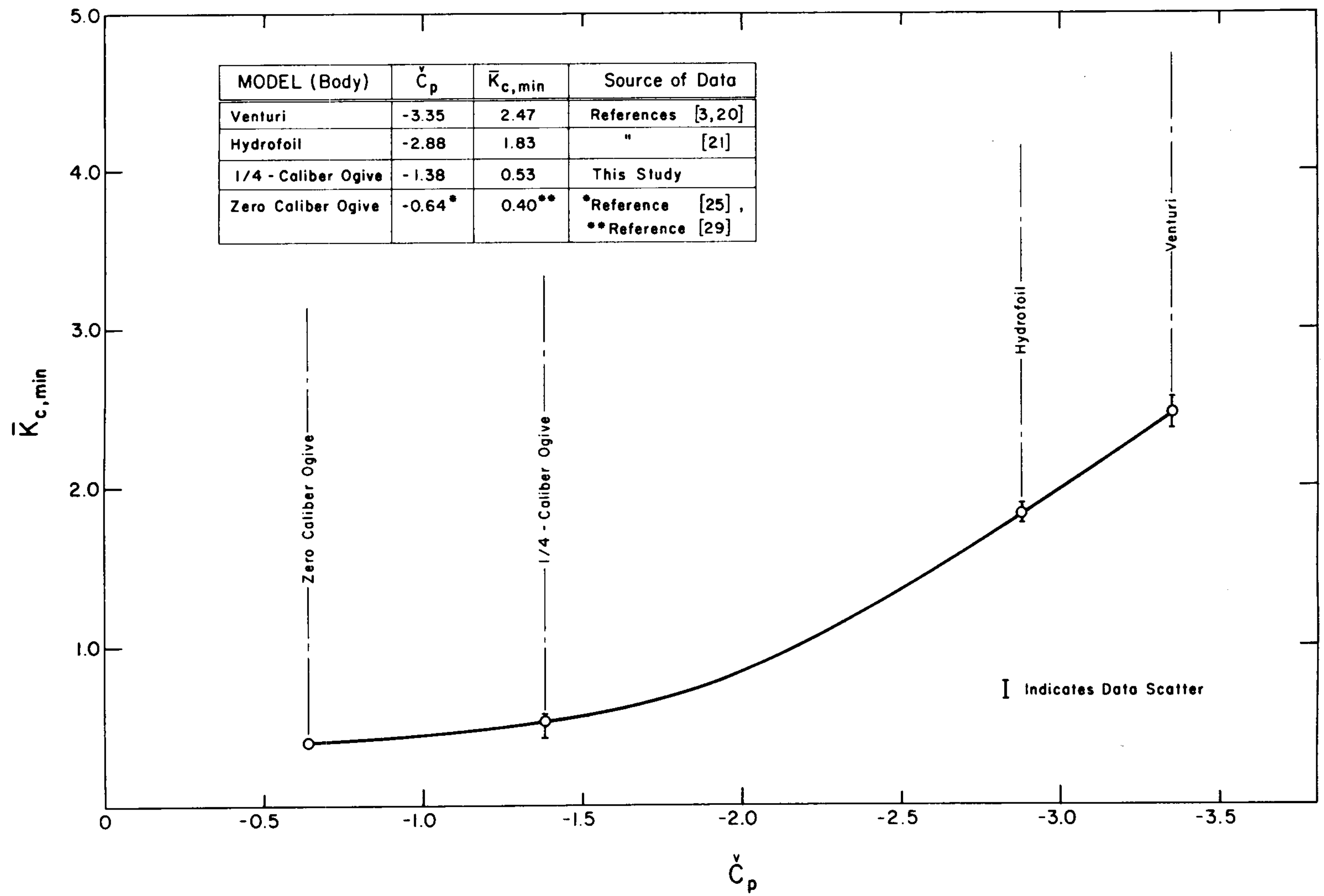
The arithmetic mean value of the developed cavitation parameter, $\overline{K}_{c,min}$, does not vary appreciably for the venturi data presented in table 4.9. This parameter was also relatively constant for the hydrofoil data [21]; this is an important result, because constant $\overline{K}_{c,min}$, eq (4-8), and the isentropic flashing theory [28] are used to predict [4, 5] the cavitating performance of a particular piece of equipment. The fact that $\overline{K}_{c,min}$ is different, for different models, curtails the current predictive techniques [4, 5] to a particular piece of equipment, i.e., the geometry (shape) of the cavitating equipment must be identical or similar. Actually, it was anticipated [20] that $\overline{K}_{c,min}$, for many cavitating bodies, would not remain constant--as with the venturi--for all fluids, cavity lengths, velocities, temperatures, etc. Then, it was neither surprising that $\overline{K}_{c,min}$ for the hydrofoil varied slightly [21] nor that $\overline{K}_{c,min}$ varied appreciably with ogive model-fluid combinations, see table 4.7 or 4.8. For the ogive data, $\overline{K}_{c,min}$ varied by a factor of 1.5:1.

Also, $K_{c,min}$ varied more for the ogives and the hydrofoil than for the venturi; $K_{c,min}$ was within 7 percent of $\overline{K}_{c,min}$ for the venturi and showed 15 percent deviation for the hydrofoil. $K_{c,min}$ for the ogives varied as follows: 1) <u>0.210-inch ogive</u>--$K_{c,min}$ varied from 0.33 to 0.51 with hydrogen and from 0.36 to 0.63 with nitrogen, 2) <u>0.357-inch ogive</u>--$K_{c,min}$ varied from 0.50 to 0.77 with hydrogen and from 0.43 to 0.71 with nitrogen, 3) <u>0.420-inch</u> ogive--$K_{c,min}$ varied from 0.53 to 0.71 with hydrogen and from 0.45 to 0.63 with nitrogen. From these data and the $\overline{K}_{c,min}$ data given in table 4.7, it is apparent that $K_{c,min}$ increases with increasing ogive size. We note that the 0.24-inch diameter zero-caliber ogive data of Billet [29], for water and refrigerant-113, show similar large variations in $K_{c,min}$ (0.32 to 0.52). Also, significant variations in $K_{c,min}$ have been observed in pump [4] and pump inducer [5,6] performance tests. Then, for a specific piece of equipment $K_{c,min}$ can vary appreciably with fluid and flow conditions, and $K_{c,min}$ for similar equipment can be expected to vary with size.

An attempt was made to determine the functional dependency of $K_{c,min}$ upon x, V_o, and T_o; however, these results were somewhat discouraging. It was determined that the hydrofoil $K_{c,min}$ is nearly independent of cavity length and velocity and increases very slightly with increasing temperature. With the ogives, $K_{c,min}$ was also found to increase with increasing temperature and is almost independent of cavity length and velocity. Billet obtained different results for zero-caliber ogives [29]--$K_{c,min}$ was nearly independent of T_o, and increased slightly with increasing V_o, and decreased with increasing cavity length. For the venturi [20], $K_{c,min}$ was nearly independent of x, V_o, and T_o. Consequently, the behavior of $K_{c,min}$ for different equipment is not currently predictable prior to testing.

Where $K_{c,min}$ does not vary appreciably, it is convenient to use $\overline{K}_{c,min}$ for predictive purposes. With large variations in $K_{c,min}$, as in our ogive data, this practice will produce relatively crude predictive results; however, in practical applications similar flow conditions can usually be selected [4-6], so that predictions can be made at identical values of $\overline{K}_{c,min}$. Data presented herein shows that $K_{c,min}$, and consequently $\overline{K}_{c,min}$, varies widely with body or equipment geometry, as does the pressure coefficient, C_p. Thus, it is quite obvious that prediction of cavitation performance, from one piece of equipment to another, will require significant advances in the 'state-of-the art.'

As a preliminary step, we can supply, from this study and others, data that relates $\overline{K}_{v\,c,min}$ to the noncavitating minimum pressure coefficient, C_p. The definitions of these two parameters are nearly identical, except that $\overline{K}_{c,min}$ is based upon minimum cavity pressure in cavitating flow and C_{p_v} is based upon minimum pressure in noncavitating flow--also, C_p has a negative numerical value, see nomenclature. Experimental data from this study and others are plotted on figure 4.27; neither $\overline{K}_{c,min}$ or C_p are corrected for blockage in this plot. If a designer can estimate values of C_p from idealized fluid flow solutions, or from model scale-up tests in wind tunnels, a corresponding value of $\overline{K}_{c,min}$ can be picked from figure 4.27.



MODEL (Body)	$\check{C}_p$	$\bar{K}_{c,min}$	Source of Data
Venturi	-3.35	2.47	References [3,20]
Hydrofoil	-2.88	1.83	" [21]
1/4 - Caliber Ogive	-1.38	0.53	This Study
Zero Caliber Ogive	-0.64*	0.40**	*Reference [25], **Reference [29]

Figure 4.27 Minimum cavitation parameter, $\bar{K}_{c,min}$, as a function of minimum noncavitating pressure coefficient, $\check{C}_p$, for various hydrodynamic bodies.

It may then be possible to apply the predictive techniques of Ruggeri and Moore [4-6] to estimate cavitation performance from one piece of equipment to another. More data on this topic will be supplied in Volume IV of this report series.

The conventional cavitation parameter for developed cavitation, K_v, also varies with flow conditions for any particular geometry, e.g., see table A-1a and Rouse and McNown [25].

4.5 Developed Cavity Shapes

One of the main objectives of the hydrofoil and ogive experiments was to obtain cavity volume-thickness data, in an effort to improve the correlative theory. The hydrofoil-tunnel and ogive-tunnel configurations were designed to provide optimum photographs of the developed cavities. Enlarged photographs of the cavities, for each experimental data point, were carefully studied to determine cavity shape, thickness, and volume. Ogive tunnel distortion, figures 3.2 to 3.4, was taken into consideration in this cavity shape analysis. All of the cavities were elliptically shaped, and the photographed cavities were easily fit with a transparent-plastic elliptical-template. By recording appropriate data from the template, e.g., major and minor axes dimensions, maximum cavity thickness, and angle of projection, it was possible to compute cavity volumes, shapes, etc. We found that cavity thickness and volume increased with increasing cavity length, and were nearly independent of V_o and T_o. Because we are primarily interested in the shape of cavities near their leading edge, we restricted our attention to cavity volumes in the front-half of the cavity; in this way, the ill-defined trailing regions of the cavity are avoided. The shapes, of all of the cavities, were adequately represented by a simple algebraic expression of the form $\delta_v = C_o x^p$. Table 4.10 summarizes the cavity shape data.

Table 4.10 Summary of developed cavity shape data.

Model	Fluid	C_o	p
Hydrofoil	H_2	0.77	0.37
Hydrofoil.	N_2	0.44	0.63
0.210-inch ogive	H_2	0.41	0.86
0.210-inch ogive	N_2	0.43	0.73
0.357-inch ogive	H_2	0.49	0.69
0.357-inch ogive	N_2	0.50	0.69
0.420-inch ogive	H_2	0.34	0.79
0.420-inch ogive	N_2	0.29	0.78
$\delta_v = C_o x^p$, where δ_v and x are in millimeters and x cannot exceed the cavity half-length.			

The expressions for the ogive cavity shapes are observed to be reasonably consistent in the exponent p. These cavity data and shape analyses substantiate the assumption of the existence of parabolic-shaped cavities in a previous analysis [21]. These data also support the selection of a mean value for $p \approx 0.65$ in that analysis [21].

Because of its application in the pumping machinery field, pressure-head has been included in the data tabulated in appendix A. Mathematical conversion of pressure to pressure-head merely requires evaluation of the liquid density at the point of measurement; however, selection of the appropriate liquid density can be a bit perplexing. Figures 4.17 to 4.26 indicate that the measured pressures and temperatures, within the cavities, are not in perfect agreement. Also, due to the thermal expansivity of liquid hydrogen, the bulkstream temperature does not remain perfectly constant as the liquid flows over the ogives. The following methods were used to calculate pressure head from the cavity measurements: (1) Head (h_n) was calculated from measured cavity pressure by using the saturation density at the measured pressure. (2) Head ($h_{n,T}$) was calculated from measured cavity temperature by using the saturation density at the measured temperature. Both values of head are given in the tabulated data in appendix A.

5. CONCLUDING REMARKS

Desinent cavity data, for three quarter-caliber ogives, were acquired for vaporous hydrogen and nitrogen cavities; the results for these scaled ogives are given in appendix A and on figures 4. 1 to 4. 16. Correlation of the desinent data is treated in appendix C of reference [21]. The desinent data tend toward a narrow range of K_{iv} values, at the maximum velocities, irrespective of fluid or fluid temperature. The hydrogen data indicate that K_{iv} increases slightly with increasing body size, while the nitrogen data imply an opposite trend. Neither the Weber or Reynolds numbers appear attractive as correlating parameters for these ogive desinent cavity data. These ogive data, for cryogenic liquids, substantiate a previous observation [21] that these liquids require less subcooling--relative to higher boiling-point liquids--for desinent cavitation to occur.

Pressure and temperature profiles were measured within fully developed, vaporous hydrogen and nitrogen cavities; these results, for the ogives, are given in appendix A and on figures 4. 17 to 4. 26. Within data accuracy, these pressure and temperature depressions were in stable thermodynamic equilibrium. These data were correlated using a previously described [20] technique, and the extended theory developed in a previous report [21]. Using the conventional correlating technique, eq (4-8), it was found that α, V_o, x, and ν, were valuable correlating parameters for combined fluids, see table 4.7. Using the new MTWO parameter, only MTWO and x were of value, see table 4.8. If the MTWO correlation is not used, the results may be degraded by approximately 25 to 50 percent (as based on standard deviation in B), see table 4.9. Because MTWO is such an influential parameter, its use is highly recommended in future work, for both correlative and predictive purposes.

The ogive developed cavity data revealed a strong size dependency--for the same ℓ/D_m ratio the B-factor increases almost linearly with increasing size (diameter). Thus, for liquids that possess nearly linear relationships between B and pressure-depression, such as water [28], the pressure-depression will increase almost linearly with increasing body (ogive) size. The ogive size effect is clearly indicated in tables 4.7 to 4.9 and through the use of eq (4-10). Comparison of our data with those of others [3, 29] indicates that size effects vary with specific equipment-fluid combinations.

The parameters used in this study to correlate ogive, hydrofoil, and venturi data are obviously suitable for a variety of body geometries (and sizes) with two-dimensional and axisymmetric cavitating flows (internal and external). Correlation of developed cavitation data from one cavitating body to another (of different geometry) requires further development.

$K_{c,min}$ was found to vary by a factor of approximately two for the ogives; however, relatively small deviations in $K_{c,min}$ were experienced with the venturi and hydrofoil tests [21]. Variations, in $K_{c,min}$, of 1.65:1 were found in tests on zero-caliber ogives [29] in water. Our data also show that $K_{c,min}$ increases with increasing ogive size. It is quite apparent that $K_{c,min}$ will vary with equipment geometry, size, fluid, velocities, temperatures, etc. Then, the current predictive technique [4, 5], which relies on constant $K_{c,min}$ (or $\overline{K}_{c,min}$), must be used with appropriate caution.

It appears that the behavior of $K_{c,min}$ for different equipment is not currently predictable prior to testing of that equipment. With sufficient experimental data, it may be possible to estimate a range of values for $\overline{K}_{v\ c,min}$ from knowledge of the noncavitating pressure coefficient, C_p. Such knowledge may permit us to predict cavitating performance, from one piece of equipment to another, under certain limiting conditions. A typical $\overline{K}_{c,min} - \overset{v}{C}_p$ plot is shown on figure 4.27. The final volume of this report series will cover this subject in detail.

The cavity-shape data, acquired during this study, indicate that the cavities can be described by a simple expression of the form $\delta_v = C_o x^p$; this expression is valid only in the frontal regions of the cavity.

6. NOMENCLATURE

B	=	ratio of vapor to liquid volume associated with the sustenance of a fixed cavity in a liquid
BFLASH	=	B derived from isentropic flashing theory (Ref. [28])
B_t	≡	BFLASH
C_o	=	constant or numerical coefficient in various algebraic expressions

C_p = pressure coefficient [$\equiv (h_x - h_o)/(V_o^2/2g_c)$]

$\check{C}_p$ = minimum pressure coefficient [$\equiv (\check{h} - h_o)/(V_o^2/2g_c)$]

D_m = diameter of axisymmetric model (body)--in this study, the diameter of the cylindrical body with a quarter-caliber rounded nose (ogive)

D_o = test section (tunnel) inlet diameter

g_c = conversion factor in Newton's law of motion (gravitational acceleration)

h_n = (n = 1, 2, 3, 4, or 5): head corresponding to cavity pressure, measured at a particular instrument port on the ogive

$h_{n,T}$ = (n = 1, 2, 3, 4, or 5): head corresponding to the saturation pressure at the cavity temperature, measured at a particular instrument port on the ogive

h_o = tunnel inlet head corresponding to absolute inlet pressure

h_v = head corresponding to saturation or vapor pressure at the tunnel inlet temperature

h_x = head corresponding to absolute pressure, measured on the ogive at distance x, downstream of the minimum pressure point--for noncavitating flow

$\check{h}$ = head corresponding to the minimum absolute pressure on the leading edge of the ogive, computed from expression for $\check{C}_p$

$K_{c,min}$	=	developed cavitation parameter, based on minimum measured cavity pressure $[\equiv (P_o - P_1)/(\rho_o V_o^2/2g_c)]$
$\overline{K}_{c,min}$	=	arithmetic mean value of $K_{c,min}$ for a complete set of data points for a particular hydrodynamic body-fluid combination
K_{iv}	=	cavitation parameter, K_v, evaluated at incipient (desinent) conditions $[\equiv (P_o - P_v)/(\rho_o V_o^2/2g_c)]$
K_v	=	developed cavitation parameter $[\equiv (P_o - P_v)/(\rho_o V_o^2/2g_c)]$
ℓ	=	length of cavities developed on ogives, used interchangeably with x in eq's (4-8), (4-9), and (4-10)
MTWO	=	liquid phase velocity ratio $[\equiv V_o/V_\ell]$, see reference [21]
P_n	=	(n = 1, 2, 3, 4, or 5): absolute cavity pressure, measured at a particular station or instrument port on the ogive
$P_{n,T}$	=	(n = 1, 2, 3, 4, or 5): saturation pressure corresponding to the measured cavity temperature at a particular station or instrument port on the ogive
P_o	=	tunnel absolute inlet pressure
P_v	=	saturation or vapor pressure at tunnel inlet temperature
Re	=	Reynolds number $[\equiv \rho_o V_o D_m/\mu]$
T_n	=	(n = 1, 2, 3, 4, or 5): measured cavity temperature at a particular station or instrument port on the ogive

T_o = bulkstream temperature in degrees Rankine (Kelvin), of liquid entering the tunnel

V_ℓ = characteristic liquid velocity component, normal to cavity liquid-vapor interface, see reference [21]

V_o = velocity of test liquid at inlet to tunnel

We = Weber number [$\equiv \rho_o V_o^2 D_m/\sigma$]

x = axial distance measured from minimum pressure point on ogive--used interchangeably with cavity length, ℓ, in eq's (4-8), (4-9), and (4-10)

Greek

α = thermal diffusivity of liquid, evaluated at tunnel inlet

δ_v = thickness of the developed vaporous cavity

μ = absolute viscosity of liquid, evaluated at tunnel inlet

ν = kinematic viscosity of liquid, evaluated at tunnel inlet [$\equiv \mu/\rho_o$]

ρ_o = density of liquid, evaluated at tunnel inlet

σ = surface tension of liquid in contact with its vapor, evaluated at tunnel inlet

Subscripts

o = denotes tunnel inlet location

ref = reference run (data point), or test conditions, to which a computation is being referenced when attempting to correlate cavitation performance via eq (4-8) or eq (4-9)

Superscripts

E1 = exponent on thermal diffusivity ratio in eq (4-8) and eq (4-9)

E2 = exponent on tunnel inlet velocity ratio in eq (4-8) and also used as an exponent on the MTWO ratio in eq (4-9)

E3 = exponent on cavity length ratio in eq (4-8) and eq (4-9)

E4 = exponent on kinematic viscosity ratio in eq (4-8) and eq (4-9)

E5 = exponent on surface tension ratio in eq (4-8) and eq (4-9)

E6 = exponent on (characteristic dimension) cavitating body diameter (or thickness) ratio in eq (4-8) and eq (4-9)

E7 = exponent on cavitating body diameter ratio in eq (4-10)--used to determine true size effect for the same ℓ/D_m ratio

p = exponent in algebraic expression for cavity shape ($\delta_v = C_o x^p$)

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APPENDIX A: Experimental cavitation data--nitrogen and hydrogen--for ogives.

Table A-1a. Experimental cavitation data for 0.210-inch ogive using liquid nitrogen (English Units).

RUN NO.	CAVITY INCHES	TO DEG R	VO FT/SEC	PO PSIA	PV PSIA	HO FT	HV FT	KV	T 1 DEG R	T 2 DEG R	T 3 DEG R	T 4 DEG R	T 5 DEG R
415A**		140.87	27.9	21.48	16.31	61.7	46.8	1.22					
415H**		141.19	28.0	21.82	16.65	62.7	47.9	1.22					
416A	1.00	141.05	49.0	20.75	16.50	59.6	47.4	0.33	139.86	140.04	139.84	139.75	140.11
416D**		141.17	38.5	26.83	16.63	77.1	47.8	1.27					
416E	1.17	141.19	49.6	20.67	16.65	59.4	47.9	0.30	140.08	140.22	139.97	140.09	140.26
416F	0.60	141.21	48.7	21.03	16.67	60.5	47.9	0.34	140.36	140.47	140.45	140.62	140.85
416G**		141.23	41.3	26.53	16.69	76.3	48.0	1.07					
416H**		141.19	40.2	26.52	16.65	76.2	47.9	1.13					
417A	1.03	140.87	68.0	24.59	16.31	70.6	46.8	0.33	139.36	139.63	139.48	139.32	139.95
417E	0.95	140.90	69.1	24.59	16.35	70.6	46.9	0.32	139.27	139.45	139.30	139.41	139.81
417F**		140.94	55.4	36.66	16.38	105.3	47.1	1.22					
418B**		140.74	71.2	47.40	16.18	136.0	46.4	1.14					
418C**		140.80	70.8	48.04	16.23	137.8	46.6	1.17					
418D	0.86	140.83	86.8	29.86	16.27	85.7	46.7	0.33	139.03	139.30	139.34	139.66	140.06
419A	0.59	150.75	48.9	32.20	29.32	95.6	87.0	0.23	149.20	149.45	149.51	150.23	150.16
419B**		150.91	38.3	38.88	29.58	115.4	87.8	1.21					
419C	0.28	150.97	47.1	33.49	29.67	99.5	88.1	0.33	150.10	150.30	150.68	150.97	150.97
419D**		151.04	39.5	38.70	29.78	115.0	88.5	1.09					
419E	0.46	151.02	48.3	32.94	29.75	97.9	88.4	0.26	149.80	149.98	150.19	150.57	150.75
419F**		151.16	39.1	38.84	29.99	115.4	89.1	1.11					
419G	0.61	151.18	48.9	32.63	30.02	97.0	89.2	0.21	149.67	149.89	149.92	150.26	150.64
419H	0.62	151.20	48.0	32.70	30.05	97.2	89.3	0.22	149.71	149.87	150.03	150.39	150.71
419J	0.57	151.40	49.0	32.95	30.38	98.0	90.4	0.21	149.90	150.10	150.21	150.62	150.93
420A**		151.15	54.8	49.44	29.96	146.9	89.0	1.24					
420B	0.25	151.07	67.3	38.82	29.84	115.3	88.7	0.38	150.21	150.46	150.84	150.75	151.02
420C**		151.07	55.0	49.30	29.84	146.4	88.7	1.23					
420D	1.20	151.11	71.1	36.06	29.90	107.1	88.9	0.23	148.86	149.06	148.79	149.00	149.60
420E	0.66	151.15	70.5	36.80	29.96	109.4	89.0	0.26	149.27	149.44	149.53	149.92	150.46
420F**		151.18	56.1	48.68	30.02	144.6	89.2	1.13					
420G	0.22	151.18	68.2	39.58	30.02	117.6	89.2	0.39	150.32	150.48	150.97	151.15	151.16

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-1a. (cont'd)

RUN NO.	CAVITY INCHES	TO DEG R	VO FT/SEC	PO PSIA	PV PSIA	HO FT	HV FT	KV	T 1 DEG R	T 2 DEG R	T 3 DEG R	T 4 DEG R	T 5 DEG R
421A	1.10	150.73	88.9	41.12	29.29	122.0	86.9	0.29	148.57	148.82	148.55	148.68	149.53
421D**		150.80	68.3	60.65	29.40	179.9	87.3	1.28					
422A**		161.69	35.5	59.84	51.42	184.8	158.9	1.33					
422C**		161.71	36.7	59.54	51.47	183.9	159.0	1.19					
422D	0.49	161.71	49.9	51.55	51.47	159.3	159.0	0.01	159.53	160.04	160.56	161.39	161.53
422E	0.22	161.71	47.4	53.78	51.47	166.2	159.0	0.20	160.51	160.96	161.51	161.78	161.77
422F**		161.73	37.5	59.64	51.51	184.2	159.2	1.14					
422G	0.52	161.77	51.1	51.43	51.60	159.0	159.5	-0.01	159.55	159.88	160.29	161.03	161.32
422H**		161.75	35.9	60.72	51.56	187.6	159.3	1.41					
422I	0.34	161.73	50.2	52.54	51.51	162.4	159.2	0.08	159.89	160.25	160.92	161.46	161.53
422J	0.42	161.73	51.1	52.03	51.51	160.8	159.2	0.04	159.53	159.89	160.49	161.08	161.30
422K**		161.78	36.7	59.97	51.64	185.3	159.6	1.22					
423A	0.21	161.75	70.8	60.07	51.56	185.6	159.3	0.34	159.98	160.94	161.78	162.05	161.91
423B**		161.77	56.6	71.73	51.60	221.5	159.5	1.24					
423C	1.02	161.75	76.5	54.82	51.56	169.4	159.3	0.11	158.69	158.94	158.80	159.26	160.25
423D**		161.73	57.2	71.85	51.51	221.9	159.2	1.23					
423E	0.38	161.73	73.7	57.12	51.51	176.5	159.2	0.20	159.59	159.88	160.69	161.39	161.53
423F**		161.77	56.6	71.90	51.60	222.1	159.5	1.26					
423G**		161.80	57.2	71.22	51.69	220.0	159.8	1.19					
423H	0.81	161.82	75.9	55.48	51.73	171.5	159.9	0.13	158.83	159.28	159.10	159.68	160.60
423I**		161.86	59.2	70.77	51.82	218.7	160.2	1.07					
424A**		161.41	73.4	83.14	50.72	256.3	156.5	1.19					
424B	0.35	161.39	93.4	62.51	50.68	192.8	156.4	0.27	159.32	159.71	160.33	160.92	161.06
424C**		161.35	74.6	82.43	50.59	254.1	156.1	1.13					
424D	0.47	161.39	93.5	61.76	50.68	190.5	156.4	0.25	159.10	159.89	160.56	161.41	161.51
424E	0.73	161.37	95.0	60.48	50.63	186.6	156.2	0.22	158.44	158.60	158.71	159.35	160.31
425A**		165.53	44.7	72.91	61.50	228.6	192.9	1.15					
426A**		165.42	72.5	91.25	61.19	285.8	191.9	1.15					
426B	0.37	165.44	90.7	72.18	61.24	226.3	192.1	0.27	162.58	163.10	163.85	164.97	165.29
426C**		165.47	69.8	93.58	61.34	293.1	192.4	1.33					

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-1a. (cont'd)

RUN NO.	CAVITY INCHES	TO DEG R	VO FT/SEC	PO PSIA	PV PSIA	HO FT	HV FT	KV	T 1 DEG R	T 2 DEG R	T 3 DEG R	T 4 DEG R	T 5 DEG R
426D	0.44	165.42	91.4	71.56	61.19	224.3	191.9	0.25	158.40	162.50	163.01	164.03	164.70
426E**		165.42	74.0	90.58	61.19	283.7	191.9	1.08					
426G	0.52	165.42	91.6	70.35	61.19	220.5	191.9	0.22	161.91	162.40	162.79	163.76	164.61
427A**		165.31	46.6	74.07	60.89	232.0	190.9	1.22					
427C	0.20	165.35	56.6	66.56	60.99	208.6	191.2	0.35	163.33	163.94	164.84	165.37	165.33
427D	0.20	165.40	57.6	66.82	61.14	209.5	191.7	0.34	163.19	163.73	164.74	165.22	165.24
427E**		165.33	45.6	74.55	60.94	233.6	191.0	1.31					
428A**		161.50	88.6	97.81	50.94	301.5	157.3	1.18					
428B	0.52	161.50	108.8	69.38	50.94	214.1	157.3	0.31	159.07	159.26	159.70	160.36	161.14
428D	1.06	161.57	111.0	66.72	51.11	205.9	157.9	0.25	157.48	157.91	157.45	157.86	159.28
428E**		161.55	87.2	99.17	51.07	305.7	157.7	1.25					
428F	1.01	161.60	111.6	66.56	51.20	205.5	158.1	0.24	157.34	157.72	157.32	157.61	159.10
428H	0.45	161.78	109.0	69.67	51.64	215.2	159.6	0.30	159.28	159.55	160.11	160.74	161.28
428I	0.15	161.77	104.2	77.03	51.60	237.9	159.5	0.46	160.29	160.79	161.59	161.71	161.64
428J**		161.91	86.1	98.04	51.96	302.7	160.7	1.23					
429A**		150.50	86.8	76.02	28.91	225.2	85.7	1.19					
429B	0.72	150.77	106.3	48.75	29.34	144.6	87.1	0.33	148.23	148.54	148.57	148.34	149.45
429D	1.41	150.80	107.1	47.20	29.40	140.1	87.3	0.30	147.33	147.62	147.17	147.44	148.23
429E**		150.95	85.9	76.78	29.64	227.8	88.0	1.22					
429F	0.98	150.93	106.9	48.53	29.61	144.1	87.9	0.32	149.11	148.54	148.41	148.73	149.60
430A**		140.60	85.7	61.65	16.03	176.7	46.0	1.14					
430B**		140.54	85.4	62.37	15.97	178.7	45.8	1.17					
430C	0.98	140.54	103.3	36.30	15.97	104.1	45.8	0.35	138.47	138.67	138.78	139.09	139.50
430D**		140.56	86.5	61.72	15.99	176.9	45.9	1.13					
430E	1.52	140.67	104.0	35.88	16.10	102.9	46.2	0.34	138.35	138.64	138.26	138.38	138.87
430F**		141.16	86.0	62.50	16.61	179.5	47.7	1.15					

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-1a. (cont'd)

RUN NO.	P 1 PSIA	P 2 PSIA	P 3 PSIA	P 4 PSIA	P 5 PSIA	P 1,T PSIA	P 2,T PSIA	P 3,T PSIA	P 4,T PSIA	P 5,T PSIA
416A	15.72	15.62	15.52	15.39	15.70	15.29	15.46	15.27	15.18	15.54
416E	15.70	15.51	15.38	15.24	15.43	15.50	15.65	15.39	15.52	15.68
416F	16.12	16.02	15.89	15.87	16.73	15.79	15.90	15.88	16.05	16.29
417A	14.98	14.90	14.98	14.92	15.40	14.79	15.06	14.92	14.76	15.38
417E	14.86	14.80	14.83	14.77	15.22	14.71	14.88	14.74	14.85	15.23
418D	14.58	14.72	14.92	14.88	15.78	14.48	14.74	14.78	15.09	15.48
419A	27.27	27.21	27.15	27.65	30.22	26.89	27.27	27.36	28.48	28.37
419C	28.30	28.28	28.99	32.84	40.65	28.28	28.59	29.20	29.67	29.67
419E	28.10	27.98	28.05	29.08	33.13	27.80	28.08	28.42	29.02	29.32
419G	27.79	27.70	27.67	28.19	30.30	27.61	27.94	28.00	28.54	29.14
419H	27.92	27.85	27.77	28.25	30.37	27.66	27.91	28.17	28.74	29.26
419J	28.19	28.12	28.06	28.67	31.57	27.97	28.28	28.45	29.11	29.61
420B	28.16	28.30	29.48	36.62	48.82	28.45	28.85	29.46	29.32	29.75
420D	26.36	26.27	26.17	26.13	26.76	26.37	26.67	26.27	26.59	27.49
420E	26.86	26.90	27.18	27.58	29.72	27.00	27.24	27.38	28.00	28.85
420G	28.48	28.63	30.60	40.46	49.58	28.62	28.88	29.67	29.96	29.99
421A	25.87	25.85	25.75	25.69	26.62	25.94	26.32	25.92	26.10	27.38
422D	45.67	45.53	46.55	49.77	55.25	46.31	47.47	48.69	50.68	51.03
422E	47.10	47.83	51.97	55.20	62.78	48.56	49.63	50.98	51.64	51.60
422G	45.27	45.33	46.17	49.07	54.32	46.36	47.10	48.06	49.81	50.50
422I	46.10	46.40	48.68	53.30	62.10	47.14	47.97	49.55	50.85	51.03
422J	45.75	45.86	47.13	50.95	57.26	46.31	47.14	48.52	49.94	50.46
423A	46.40	47.79	55.00	63.42	70.07	47.35	49.59	51.64	52.31	51.96
423C	43.87	43.67	43.75	44.37	46.20	44.42	44.98	44.66	45.70	47.97
423E	45.44	45.66	47.22	52.44	67.12	46.44	47.10	48.99	50.68	51.03
423H	44.62	44.37	44.67	45.55	48.05	44.74	45.74	45.34	46.64	48.78
424B	45.40	45.48	47.03	52.93	72.51	45.83	46.73	48.14	49.55	49.89
424D	44.86	45.04	46.00	49.04	61.96	45.34	47.14	48.69	50.72	50.98
424E	43.76	43.80	44.03	45.05	48.43	43.87	44.22	44.46	45.91	48.10

Table A-1a. (cont'd)

RUN NO.	P 1 PSIA	P 2 PSIA	P 3 PSIA	P 4 PSIA	P 5 PSIA	P 1,T PSIA	P 2,T PSIA	P 3,T PSIA	P 4,T PSIA	P 5,T PSIA
426B	55.80	55.81	57.66	62.77	82.18	53.62	54.96	56.93	59.95	60.84
426D	55.32	55.35	56.55	59.97	73.42	43.79	53.44	54.73	57.41	59.21
426G	54.52	54.42	55.42	57.94	65.81	51.96	53.17	54.17	56.70	58.96
427C	57.68	58.75	63.23	68.15	76.56	55.56	57.17	59.60	61.04	60.94
427D	57.85	59.01	63.48	68.63	76.82	55.19	56.60	59.31	60.64	60.69
428B	46.05	46.25	46.95	48.72	56.82	45.26	45.70	46.68	48.23	50.07
428D	43.21	43.01	43.06	43.40	44.71	41.82	42.74	41.74	42.62	45.74
428F	43.03	42.80	42.85	43.21	44.61	41.52	42.31	41.48	42.08	45.34
428H	46.93	47.09	47.95	50.53	62.63	45.74	46.36	47.64	49.12	50.41
428I	48.53	50.51	65.63	77.03	87.03	48.06	49.25	51.16	51.47	51.29
429B	25.90	26.30	26.50	26.95	29.68	25.44	25.89	25.94	25.60	27.27
429D	24.36	24.29	24.27	24.09	24.62	24.16	24.56	23.93	24.31	25.44
429F	26.01	26.09	26.19	26.12	27.23	26.75	25.89	25.71	26.18	27.49
430C	13.92	14.38	14.66	14.38	15.41	13.96	14.14	14.24	14.53	14.93
430E	14.04	14.20	14.08	13.78	13.98	13.84	14.11	13.76	13.88	14.33

Table A-1a. (cont'd)

RUN NO.	H 1 FT	H 2 FT	H 3 FT	H 4 FT	H 5 FT	H 1,T FT	H 2,T FT	H 3,T FT	H 4,T FT	H 5,T FT
416A	45.1	44.8	44.5	44.1	45.0	43.8	44.3	43.7	43.4	44.5
416E	45.0	44.4	44.0	43.6	44.2	44.4	44.8	44.1	44.5	44.9
416F	46.3	46.0	45.6	45.5	48.1	45.3	45.6	45.5	46.0	46.8
417A	42.8	42.6	42.8	42.7	44.1	42.3	43.1	42.6	42.2	44.0
417E	42.5	42.3	42.4	42.2	43.6	42.0	42.5	42.1	42.4	43.6
418D	41.6	42.1	42.7	42.5	45.2	41.3	42.1	42.2	43.2	44.3
419A	80.6	80.4	80.2	81.8	89.9	79.4	80.6	80.8	84.4	84.0
419C	83.8	83.7	86.0	98.2	123.4	83.7	84.7	86.6	88.1	88.1
419E	83.2	82.8	83.0	86.3	99.1	82.2	83.1	84.2	86.1	87.0
419G	82.2	81.9	81.8	83.5	90.1	81.6	82.7	82.9	84.6	86.5
419H	82.6	82.4	82.1	83.7	90.3	81.8	82.6	83.4	85.2	86.8
419J	83.5	83.2	83.1	85.0	94.1	82.8	83.7	84.3	86.4	87.9
420B	83.4	83.8	87.5	110.3	150.2	84.3	85.5	87.5	87.0	88.4
420D	77.7	77.4	77.1	77.0	79.0	77.8	78.7	77.4	78.4	81.3
420E	79.3	79.4	80.3	81.5	88.3	79.7	80.5	80.9	82.9	85.5
420G	84.4	84.8	91.1	122.7	152.7	84.8	85.6	88.1	89.0	89.1
421A	76.2	76.1	75.8	75.6	78.5	76.4	77.6	76.3	76.9	80.9
422D	139.8	139.3	142.7	153.4	171.7	141.9	145.7	149.8	156.4	157.6
422E	144.5	146.9	160.7	171.6	197.3	149.4	152.9	157.4	159.6	159.5
422G	138.5	138.7	141.4	151.0	168.6	142.1	144.5	147.7	153.5	155.8
422I	141.2	142.2	149.8	165.2	195.0	144.6	147.4	152.6	157.0	157.6
422J	140.1	140.4	144.6	157.3	178.5	141.9	144.6	149.2	153.9	155.7
423A	142.2	146.8	170.9	199.5	222.5	145.3	152.8	159.6	161.9	160.7
423C	133.9	133.2	133.5	135.5	141.5	135.7	137.5	136.5	139.9	147.4
423E	139.0	139.8	144.9	162.3	212.2	142.3	144.5	150.8	156.4	157.6
423H	136.3	135.5	136.5	139.4	147.7	136.7	140.0	138.7	143.0	150.1
424B	138.9	139.2	144.3	163.9	231.0	140.3	143.3	148.0	152.6	153.8
424D	137.1	137.7	140.9	150.9	194.5	138.7	144.6	149.8	156.5	157.4
424E	133.5	133.6	134.4	137.8	148.9	133.9	135.0	135.8	140.6	147.8

Table A-1a. (cont'd)

RUN NO.	H 1 FT	H 2 FT	H 3 FT	H 4 FT	H 5 FT	H 1,T FT	H 2,T FT	H 3,T FT	H 4,T FT	H 5,T FT
426B	173.6	173.6	179.9	197.3	265.1	166.3	170.7	177.4	187.6	190.7
426D	172.0	172.1	176.1	187.7	234.2	133.6	165.6	170.0	179.0	185.1
426G	169.3	168.9	172.3	180.8	207.7	160.7	164.7	168.1	176.6	184.3
427C	179.9	183.6	198.9	215.8	245.2	172.8	178.2	186.5	191.4	191.0
427D	180.5	184.4	199.7	217.5	246.1	171.5	176.3	185.5	190.0	190.2
428B	141.0	141.7	144.0	149.9	177.0	138.4	139.9	143.1	148.2	154.4
428D	131.7	131.1	131.2	132.3	136.6	127.2	130.2	126.9	129.8	140.0
428F	131.1	130.4	130.5	131.7	136.3	126.2	128.8	126.0	128.0	138.7
428H	144.0	144.5	147.3	155.9	196.8	140.0	142.1	146.3	151.2	155.5
428I	149.3	155.8	207.1	246.8	282.4	147.7	151.6	158.0	159.0	158.4
429B	76.3	77.5	78.2	79.6	88.2	74.9	76.3	76.4	75.4	80.6
429D	71.5	71.3	71.2	70.7	72.3	70.9	72.1	70.2	71.3	74.9
429F	76.6	76.9	77.2	77.0	80.4	79.0	76.3	75.7	77.2	81.3
430C	39.7	41.0	41.9	41.0	44.1	39.8	40.3	40.6	41.5	42.7
430E	40.0	40.5	40.1	39.2	39.8	39.4	40.2	39.2	39.5	40.9

Table A-1b. Experimental cavitation data for 0.210-inch ogive using liquid nitrogen (SI Units).

RUN NO.	CAVITY CM	TO DEG K	VO M/SEC	PO N/CM/CM	PV N/CM/CM	HO M	HV M	KV	T 1 DEG K	T 2 DEG K	T 3 DEG K	T 4 DEG K	T 5 DEG K
415A**		78.26	8.5	14.81	11.24	18.8	14.3	1.22					
415H**		78.44	8.5	15.04	11.48	19.1	14.6	1.22					
416A	2.54	78.36	14.9	14.31	11.37	18.2	14.4	0.33	77.70	77.80	77.69	77.64	77.84
416D**		78.43	11.7	18.50	11.47	23.5	14.6	1.27					
416E	2.97	78.44	15.1	14.25	11.48	18.1	14.6	0.30	77.82	77.90	77.76	77.83	77.92
416F	1.52	78.45	14.8	14.50	11.49	18.4	14.6	0.34	77.98	78.04	78.03	78.12	78.25
416G**		78.46	12.6	18.29	11.51	23.2	14.6	1.07					
416H**		78.44	12.3	18.28	11.48	23.2	14.6	1.13					
417A	2.61	78.26	20.7	16.95	11.24	21.5	14.3	0.33	77.42	77.57	77.49	77.40	77.75
417E	2.41	78.28	21.1	16.95	11.27	21.5	14.3	0.32	77.37	77.47	77.39	77.45	77.67
417F**		78.30	16.9	25.28	11.30	32.1	14.3	1.22					
418B**		78.19	21.7	32.68	11.15	41.4	14.2	1.14					
418C**		78.22	21.6	33.12	11.19	42.0	14.2	1.17					
418D	2.18	78.24	26.5	20.59	11.22	26.1	14.2	0.33	77.24	77.39	77.41	77.59	77.81
419A	1.49	83.75	14.9	22.20	20.21	29.1	26.5	0.23	82.89	83.03	83.06	83.46	83.42
419B**		83.84	11.7	26.81	20.39	35.2	26.8	1.21					
419C	0.71	83.87	14.4	23.09	20.45	30.3	26.9	0.33	83.39	83.50	83.71	83.87	83.87
419D**		83.91	12.0	26.68	20.54	35.0	27.0	1.09					
419E	1.16	83.90	14.7	22.71	20.52	29.8	26.9	0.26	83.22	83.32	83.44	83.65	83.75
419F**		83.98	11.9	26.78	20.68	35.2	27.2	1.11					
419G	1.54	83.99	14.9	22.50	20.70	29.6	27.2	0.21	83.15	83.27	83.29	83.48	83.69
419H	1.57	84.00	14.6	22.55	20.72	29.6	27.2	0.22	83.17	83.26	83.35	83.55	83.73
419J	1.44	84.11	14.9	22.72	20.95	29.9	27.5	0.21	83.28	83.39	83.45	83.68	83.85
420A**		83.97	16.7	34.09	20.66	44.8	27.1	1.24					
420B	0.63	83.93	20.5	26.77	20.58	35.1	27.0	0.38	83.45	83.59	83.80	83.75	83.90
420C**		83.93	16.8	33.99	20.58	44.6	27.0	1.23					
420D	3.04	83.95	21.7	24.86	20.62	32.7	27.1	0.23	82.70	82.81	82.66	82.78	83.11
420E	1.67	83.97	21.5	25.37	20.66	33.3	27.1	0.26	82.93	83.02	83.07	83.29	83.59
420F**		83.99	17.1	33.56	20.70	44.1	27.2	1.13					
420G	0.55	83.99	20.8	27.29	20.70	35.9	27.2	0.39	83.51	83.60	83.87	83.97	83.98

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-1b. (cont'd)

RUN NO.	CAVITY CM	TO DEG K	VO M/SEC	PO N/CM/CM	PV N/CM/CM	HO M	HV M	KV	T 1 DEG K	T 2 DEG K	T 3 DEG K	T 4 DEG K	T 5 DEG K
421A	2.79	83.74	27.1	28.35	20.19	37.2	26.5	0.29	82.54	82.68	82.53	82.60	83.07
421D**		83.78	20.8	41.82	20.27	54.8	26.6	1.28					
422A**		89.83	10.8	41.26	35.45	56.3	48.4	1.33					
422C**		89.84	11.2	41.05	35.49	56.1	48.5	1.19					
422D	1.24	89.84	15.2	35.54	35.49	48.6	48.5	0.01	88.63	88.91	89.20	89.66	89.74
422E	0.55	89.84	14.5	37.08	35.49	50.6	48.5	0.20	89.17	89.42	89.73	89.88	89.87
422F**		89.85	11.4	41.12	35.52	56.2	48.5	1.14					
422G	1.32	89.87	15.6	35.46	35.58	48.4	48.6	-0.01	88.64	88.82	89.05	89.46	89.62
422H**		89.86	10.9	41.86	35.55	57.2	48.6	1.41					
422I	0.86	89.85	15.3	36.23	35.52	49.5	48.5	0.08	88.83	89.03	89.40	89.70	89.74
422J	1.06	89.85	15.6	35.87	35.52	49.0	48.5	0.04	88.63	88.83	89.16	89.49	89.61
422K**		89.88	11.2	41.35	35.61	56.5	48.7	1.22					
423A	0.53	89.86	21.6	41.42	35.55	56.6	48.6	0.34	88.88	89.41	89.88	90.03	89.95
423B**		89.87	17.3	49.46	35.58	67.5	48.6	1.24					
423C	2.59	89.86	23.3	37.80	35.55	51.6	48.6	0.11	88.16	88.30	88.22	88.48	89.03
423D**		89.85	17.4	49.54	35.52	67.6	48.5	1.23					
423E	0.96	89.85	22.5	39.38	35.52	53.8	48.5	0.20	88.66	88.82	89.27	89.66	89.74
423F**		89.87	17.3	49.57	35.58	67.7	48.6	1.26					
423G**		89.89	17.4	49.10	35.64	67.1	48.7	1.19					
423H	2.05	89.90	23.1	38.25	35.67	52.3	48.7	0.13	88.24	88.49	88.39	88.71	89.22
423I**		89.92	18.1	48.79	35.73	66.6	48.8	1.07					
424A**		89.67	22.4	57.32	34.97	78.1	47.7	1.19					
424B	0.88	89.66	28.5	43.10	34.94	58.8	47.7	0.27	88.51	88.73	89.07	89.40	89.48
424C**		89.64	22.7	56.83	34.88	77.4	47.6	1.13					
424D	1.19	89.66	28.5	42.58	34.94	58.1	47.7	0.25	88.39	88.83	89.20	89.67	89.73
424E	1.85	89.65	28.9	41.70	34.91	56.9	47.6	0.22	88.02	88.11	88.17	88.53	89.06
425A**		91.96	13.6	50.27	42.40	69.7	58.8	1.15					
426A**		91.90	22.1	62.91	42.19	87.1	58.5	1.15					
426B	0.94	91.91	27.7	49.77	42.23	69.0	58.5	0.27	90.32	90.61	91.03	91.65	91.83
426C**		91.93	21.3	64.52	42.30	89.3	58.6	1.33					

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-1b. (cont'd)

RUN NO.	CAVITY CM	TO DEG K	VO M/SEC	PO N/CM/CM	PV N/CM/CM	HO M	HV M	KV	T 1 DEG K	T 2 DEG K	T 3 DEG K	T 4 DEG K	T 5 DEG K
426D	1.11	91.90	27.9	49.34	42.19	68.4	58.5	0.25	88.00	90.28	90.56	91.13	91.50
426E**		91.90	22.5	62.45	42.19	86.5	58.5	1.08					
426G	1.32	91.90	27.9	48.50	42.19	67.2	58.5	0.22	89.95	90.22	90.44	90.98	91.45
427A**		91.84	14.2	51.07	41.98	70.7	58.2	1.22					
427C	0.50	91.86	17.2	45.89	42.05	63.6	58.3	0.35	90.74	91.08	91.58	91.87	91.85
427D	0.50	91.89	17.6	46.07	42.16	63.8	58.4	0.34	90.66	90.96	91.52	91.79	91.80
427E**		91.85	13.9	51.40	42.02	71.2	58.2	1.31					
428A**		89.72	27.0	67.44	35.12	91.9	47.9	1.18					
428B	1.32	89.72	33.2	47.84	35.12	65.2	47.9	0.31	88.37	88.48	88.72	89.09	89.52
428D	2.69	89.76	33.8	46.00	35.24	62.8	48.1	0.25	87.49	87.73	87.47	87.70	88.49
428E**		89.75	26.6	68.38	35.21	93.2	48.1	1.25					
428F	2.56	89.78	34.0	45.89	35.30	62.6	48.2	0.24	87.41	87.62	87.40	87.56	88.39
428H	1.14	89.88	33.2	48.04	35.61	65.6	48.7	0.30	88.49	88.64	88.95	89.30	89.60
428I	0.38	89.87	31.8	53.11	35.58	72.5	48.6	0.46	89.05	89.33	89.77	89.84	89.80
428J**		89.95	26.2	67.60	35.82	92.3	49.0	1.23					
429A**		83.61	26.4	52.41	19.93	68.6	26.1	1.19					
429B	1.82	83.76	32.4	33.61	20.23	44.1	26.5	0.33	82.35	82.52	82.54	82.41	83.03
429D	3.58	83.78	32.7	32.54	20.27	42.7	26.6	0.30	81.85	82.01	81.76	81.91	82.35
429E**		83.86	26.2	52.94	20.43	69.4	26.8	1.22					
429F	2.48	83.85	32.6	33.46	20.41	43.9	26.8	0.32	82.84	82.52	82.45	82.63	83.11
430A**		78.11	26.1	42.51	11.05	53.9	14.0	1.14					
430B**		78.08	26.0	43.00	11.01	54.5	14.0	1.17					
430C	2.48	78.08	31.5	25.03	11.01	31.7	14.0	0.35	76.93	77.04	77.10	77.27	77.50
430D**		78.09	26.4	42.55	11.03	53.9	14.0	1.13					
430E	3.86	78.15	31.7	24.74	11.10	31.4	14.1	0.34	76.86	77.02	76.81	76.88	77.15
430F**		78.42	26.2	43.09	11.45	54.7	14.6	1.15					

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-1b. (cont'd)

RUN NO.	P 1 N/CM/CM	P 2 N/CM/CM	P 3 N/CM/CM	P 4 N/CM/CM	P 5 N/CM/CM	P 1,T N/CM/CM	P 2,T N/CM/CM	P 3,T N/CM/CM	P 4,T N/CM/CM	P 5,T N/CM/CM
416A	10.84	10.77	10.70	10.61	10.82	10.54	10.66	10.53	10.47	10.71
416E	10.82	10.69	10.60	10.51	10.64	10.69	10.79	10.61	10.70	10.81
416F	11.11	11.05	10.96	10.94	11.53	10.89	10.96	10.95	11.07	11.23
417A	10.33	10.27	10.33	10.29	10.62	10.20	10.38	10.28	10.18	10.60
417E	10.25	10.20	10.22	10.18	10.49	10.14	10.26	10.16	10.24	10.50
418D	10.05	10.15	10.29	10.26	10.88	9.99	10.16	10.19	10.40	10.68
419A	18.80	18.76	18.72	19.06	20.84	18.54	18.80	18.86	19.64	19.56
419C	19.51	19.50	19.99	22.64	28.03	19.50	19.71	20.13	20.45	20.45
419E	19.37	19.29	19.34	20.05	22.84	19.17	19.36	19.60	20.01	20.21
419G	19.16	19.10	19.08	19.44	20.89	19.03	19.26	19.30	19.67	20.09
419H	19.25	19.20	19.15	19.48	20.94	19.07	19.25	19.42	19.81	20.17
419J	19.44	19.39	19.35	19.77	21.77	19.28	19.50	19.62	20.07	20.41
420B	19.42	19.51	20.33	25.25	33.66	19.62	19.89	20.31	20.21	20.52
420D	18.17	18.11	18.04	18.02	18.45	18.18	18.39	18.11	18.33	18.96
420E	18.52	18.55	18.74	19.02	20.49	18.61	18.78	18.88	19.30	19.89
420G	19.64	19.74	21.10	27.90	34.18	19.73	19.91	20.45	20.66	20.68
421A	17.84	17.82	17.75	17.71	18.35	17.89	18.15	17.87	18.00	18.88
422D	31.49	31.39	32.10	34.32	38.09	31.93	32.73	33.57	34.94	35.18
422E	32.47	32.98	35.83	38.06	43.29	33.48	34.22	35.15	35.61	35.58
422G	31.21	31.25	31.83	33.83	37.45	31.96	32.47	33.13	34.34	34.82
422I	31.78	31.99	33.56	36.75	42.82	32.50	33.08	34.16	35.06	35.18
422J	31.54	31.62	32.49	35.13	39.48	31.93	32.50	33.45	34.43	34.79
423A	31.99	32.95	37.92	43.73	48.31	32.64	34.19	35.61	36.07	35.82
423C	30.25	30.11	30.16	30.59	31.85	30.63	31.01	30.79	31.51	33.08
423E	31.33	31.48	32.56	36.16	46.28	32.02	32.47	33.78	34.94	35.18
423H	30.76	30.59	30.80	31.41	33.13	30.85	31.54	31.26	32.16	33.63
424B	31.30	31.36	32.43	36.49	49.99	31.60	32.22	33.19	34.16	34.40
424D	30.93	31.05	31.72	33.81	42.72	31.26	32.50	33.57	34.97	35.15
424E	30.17	30.20	30.36	31.06	33.39	30.24	30.49	30.65	31.65	33.16

Table A-1b. (cont'd)

RUN NO.	P 1 N/CM/CM	P 2 N/CM/CM	P 3 N/CM/CM	P 4 N/CM/CM	P 5 N/CM/CM	P 1,T N/CM/CM	P 2,T N/CM/CM	P 3,T N/CM/CM	P 4,T N/CM/CM	P 5,T N/CM/CM
426B	38.47	38.48	39.76	43.28	56.66	36.97	37.89	39.26	41.33	41.95
426D	38.14	38.16	38.99	41.35	50.62	30.19	36.85	37.73	39.58	40.82
426G	37.59	37.52	38.21	39.95	45.37	35.82	36.66	37.35	39.09	40.65
427C	39.77	40.51	43.60	46.99	52.79	38.31	39.42	41.09	42.09	42.02
427D	39.89	40.69	43.77	47.32	52.97	38.05	39.03	40.89	41.81	41.85
428B	31.75	31.89	32.37	33.59	39.18	31.20	31.51	32.19	33.25	34.52
428D	29.79	29.65	29.69	29.92	30.83	28.83	29.47	28.78	29.39	31.54
428F	29.67	29.51	29.54	29.79	30.76	28.62	29.17	28.60	29.02	31.26
428H	32.36	32.47	33.06	34.84	43.18	31.54	31.96	32.85	33.87	34.76
428I	33.46	34.83	45.25	53.11	60.01	33.13	33.95	35.27	35.49	35.36
429B	17.86	18.13	18.27	18.58	20.46	17.54	17.85	17.89	17.65	18.80
429D	16.80	16.75	16.73	16.61	16.97	16.66	16.94	16.50	16.76	17.54
429F	17.93	17.99	18.06	18.01	18.77	18.44	17.85	17.72	18.05	18.96
430C	9.60	9.91	10.11	9.91	10.62	9.62	9.75	9.82	10.02	10.30
430E	9.68	9.79	9.71	9.50	9.64	9.54	9.73	9.49	9.57	9.88

Table A-1b. (cont'd)

RUN NO.	H 1 M	H 2 M	H 3 M	H 4 M	H 5 M	H 1,T M	H 2,T M	H 3,T M	H 4,T M	H 5,T M
416A	13.7	13.6	13.6	13.4	13.7	13.3	13.5	13.3	13.2	13.6
416E	13.7	13.5	13.4	13.3	13.5	13.5	13.7	13.4	13.5	13.7
416F	14.1	14.0	13.9	13.9	14.7	13.8	13.9	13.9	14.0	14.3
417A	13.1	13.0	13.1	13.0	13.4	12.9	13.1	13.0	12.9	13.4
417E	12.9	12.9	12.9	12.9	13.3	12.8	13.0	12.8	12.9	13.3
418D	12.7	12.8	13.0	13.0	13.8	12.6	12.8	12.9	13.2	13.5
419A	24.6	24.5	24.4	24.9	27.4	24.2	24.6	24.6	25.7	25.6
419C	25.5	25.5	26.2	29.9	37.6	25.5	25.8	26.4	26.9	26.9
419E	25.4	25.2	25.3	26.3	30.2	25.1	25.3	25.7	26.2	26.5
419G	25.1	25.0	24.9	25.4	27.5	24.9	25.2	25.3	25.8	26.4
419H	25.2	25.1	25.0	25.5	27.5	24.9	25.2	25.4	26.0	26.5
419J	25.4	25.4	25.3	25.9	28.7	25.2	25.5	25.7	26.3	26.8
420B	25.4	25.5	26.7	33.6	45.8	25.7	26.1	26.7	26.5	26.9
420D	23.7	23.6	23.5	23.5	24.1	23.7	24.0	23.6	23.9	24.8
420E	24.2	24.2	24.5	24.9	26.9	24.3	24.5	24.7	25.3	26.1
420G	25.7	25.9	27.8	37.4	46.6	25.9	26.1	26.9	27.1	27.2
421A	23.2	23.2	23.1	23.1	23.9	23.3	23.7	23.3	23.4	24.7
422D	42.6	42.5	43.5	46.7	52.3	43.3	44.4	45.7	47.7	48.0
422E	44.0	44.8	49.0	52.3	60.1	45.5	46.6	48.0	48.7	48.6
422G	42.2	42.3	43.1	46.0	51.4	43.3	44.0	45.0	46.8	47.5
422I	43.0	43.3	45.6	50.3	59.4	44.1	44.9	46.5	47.8	48.0
422J	42.7	42.8	44.1	47.9	54.4	43.3	44.1	45.5	46.9	47.4
423A	43.3	44.7	52.1	60.8	67.8	44.3	46.6	48.7	49.3	49.0
423C	40.8	40.6	40.7	41.3	43.1	41.4	41.9	41.6	42.6	44.9
423E	42.4	42.6	44.2	49.5	64.7	43.4	44.0	46.0	47.7	48.0
423H	41.6	41.3	41.6	42.5	45.0	41.7	42.7	42.3	43.6	45.7
424B	42.3	42.4	44.0	50.0	70.4	42.8	43.7	45.1	46.5	46.9
424D	41.8	42.0	42.9	46.0	59.3	42.3	44.1	45.7	47.7	48.0
424E	40.7	40.7	41.0	42.0	45.4	40.8	41.2	41.4	42.8	45.1

Table A-1b. (cont'd)

RUN NO.	H 1 M	H 2 M	H 3 M	H 4 M	H 5 M	H 1,T M	H 2,T M	H 3,T M	H 4,T M	H 5,T M
426B	52.9	52.9	54.8	60.1	80.8	50.7	52.0	54.1	57.2	58.1
426D	52.4	52.4	53.7	57.2	71.4	40.7	50.5	51.8	54.6	56.4
426G	51.6	51.5	52.5	55.1	63.3	49.0	50.2	51.2	53.8	56.2
427C	54.8	56.0	60.6	65.8	74.7	52.7	54.3	56.8	58.3	58.2
427D	55.0	56.2	60.9	66.3	75.0	52.3	53.7	56.5	57.9	58.0
428B	43.0	43.2	43.9	45.7	54.0	42.2	42.6	43.6	45.2	47.0
428D	40.1	39.9	40.0	40.3	41.6	38.8	39.7	38.7	39.6	42.7
428F	40.0	39.7	39.8	40.1	41.5	38.5	39.3	38.4	39.0	42.3
428H	43.9	44.0	44.9	47.5	60.0	42.7	43.3	44.6	46.1	47.4
428I	45.5	47.5	63.1	75.2	86.1	45.0	46.2	48.2	48.5	48.3
429B	23.3	23.6	23.8	24.3	26.9	22.8	23.2	23.3	23.0	24.6
429D	21.8	21.7	21.7	21.5	22.0	21.6	22.0	21.4	21.7	22.8
429F	23.4	23.4	23.5	23.5	24.5	24.1	23.2	23.1	23.5	24.8
430C	12.1	12.5	12.8	12.5	13.5	12.1	12.3	12.4	12.6	13.0
430E	12.2	12.3	12.2	12.0	12.1	12.0	12.3	11.9	12.1	12.5

Table A-2a. Experimental cavitation data for 0.210-inch ogive using liquid hydrogen (English Units).

RUN NO.	CAVITY INCHES	TO DEG R	VO FT/SEC	PO PSIA	PV PSIA	HO FT	HV FT	KV	T 1 DEG R	T 2 DEG R	T 3 DEG R	T 4 DEG R	T 5 DEG R
386A**		37.84	120.4	19.84	18.23	654.3	601.4	0.23					
386B	0.29	37.75	137.8	17.45	17.98	575.2	592.6	-0.06	36.79	36.97	37.51	37.76	37.76
386C**		37.78	116.3	20.44	18.08	673.7	596.1	0.37					
386F	0.32	37.76	140.1	17.47	18.03	576.0	594.4	-0.06	36.92	37.26	37.76	37.84	38.07
387B	0.35	37.89	186.7	19.88	18.38	656.0	606.8	0.09	36.76	37.15	37.64	3[illegible].87	37.76
387C**		37.91	157.5	26.52	18.43	874.4	608.6	0.69					
387D	0.72	37.89	192.6	18.92	18.38	624.4	606.8	0.03	36.20	36.47	36.83	37.06	37.58
387E**		37.89	156.4	26.93	18.38	887.7	606.8	0.74					
388B	0.62	37.73	184.8	18.43	17.93	607.3	590.9	0.03	36.36	36.59	36.90	37.24	37.62
388C**		37.75	151.1	25.90	17.98	852.7	592.6	0.73					
388D	0.50	37.78	182.2	18.88	18.08	622.4	596.1	0.05	36.65	36.86	37.28	37.71	37.80
388E**		37.69	154.2	25.53	17.83	840.1	587.4	0.68					
388F	0.56	37.80	184.8	18.78	18.13	619.3	597.9	0.04	36.92	36.94	37.55	37.80	38.16
388G**		37.58	152.9	25.78	17.53	847.4	577.0	0.74					
389B	0.60	37.73	222.8	21.73	17.93	715.7	590.9	0.16	35.87	36.14	36.56	36.50	36.97
389D	0.76	37.73	223.5	21.54	17.93	709.5	590.9	0.15	35.82	36.31	36.31	36.40	37.03
389E**		37.73	188.0	32.68	17.93	1074.7	590.9	0.88					
389F	0.33	37.80	225.0	23.21	18.13	764.8	597.9	0.21	35.91	36.22	36.92	36.85	36.86
390A**		39.40	175.4	34.20	23.03	1143.6	771.7	0.78					
390B	0.63	39.37	216.5	24.00	22.92	803.5	767.4	0.05	36.70	37.04	37.66	37.71	38.36
390C**		39.37	178.9	33.79	22.92	1129.5	767.4	0.73					
390D	0.70	39.38	217.2	23.96	22.97	802.4	769.6	0.04	36.59	36.81	37.31	37.37	38.05
390F	0.34	39.42	214.9	25.61	23.09	857.7	773.9	0.12	37.57	37.73	38.54	38.61	38.70
390G**		39.56	175.4	34.94	23.58	1170.2	791.2	0.79					
391B	0.67	39.42	192.4	22.40	23.09	750.6	773.9	-0.04	37.39	37.58	38.03	38.29	38.86
391D	0.60	39.42	191.6	22.61	23.09	757.6	773.9	-0.03	37.42	37.71	38.21	38.61	38.90
391E**		39.46	154.5	30.68	23.22	1027.0	778.2	0.67					
391F	0.34	39.42	188.0	24.23	23.09	811.7	773.9	0.07	37.78	38.16	38.92	39.04	39.08
391G**		39.56	155.6	30.68	23.58	1028.2	791.2	0.63					

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-2a. (cont'd)

RUN NO.	CAVITY INCHES	TO DEG R	VO FT/SEC	PO PSIA	PV PSIA	HO FT	HV FT	KV	T 1 DEG R	T 2 DEG R	T 3 DEG R	T 4 DEG R	T 5 DEG R
392C**		39.42	152.3	31.87	23.09	1066.3	773.9	0.81					
393B	0.45	37.60	167.2	17.32	17.58	570.1	578.7	-0.02	36.07	36.40	36.88	37.26	37.49
393C**		37.66	138.8	23.22	17.73	764.1	583.9	0.60					
393D	0.72	37.71	169.3	16.98	17.88	559.6	589.1	-0.07	36.05	36.31	36.49	36.83	37.39
393E**		37.75	137.7	22.87	17.98	753.3	592.6	0.54					
395A**		41.26	184.4	41.40	29.83	1411.4	1019.0	0.74					
395B	0.34	41.29	224.0	31.84	29.97	1087.9	1024.3	0.08	38.88	39.38	40.36	40.16	40.32
395C**		41.31	186.2	41.86	30.04	1427.8	1027.0	0.74					
395D	0.70	41.33	229.3	30.07	30.12	1028.2	1029.7	-0.00	38.36	38.57	39.02	38.99	39.92
395E**		41.31	189.8	40.69	30.04	1388.2	1027.0	0.65					
396A**		41.22	181.6	39.72	29.68	1354.0	1013.7	0.66					
396B	0.75	41.22	225.5	29.33	29.68	1001.8	1013.7	-0.02	38.05	38.45	38.88	39.46	39.82
396C**		41.22	186.2	39.60	29.68	1349.9	1013.7	0.62					
396D	0.72	41.18	226.9	29.43	29.54	1004.7	1008.4	-0.00	38.52	38.86	39.33	40.03	40.28
397A**		41.26	203.2	45.23	29.83	1540.8	1019.0	0.81					
397B	0.69	41.33	252.3	32.43	30.12	1108.4	1029.7	0.08	38.90	39.37	39.78	40.34	40.50
397D	0.39	41.27	248.7	33.60	29.90	1147.4	1021.7	0.13	38.66	38.93	39.85	39.91	40.10
397E**		41.27	205.6	45.77	29.90	1559.4	1021.7	0.82					
397F	0.28	41.35	246.1	34.68	30.19	1185.0	1032.4	0.16	39.20	39.58	40.54	40.52	40.59
398B	0.42	41.29	278.8	36.93	29.97	1260.6	1024.3	0.20	39.56	39.87	40.46	40.73	40.91
398D	0.88	41.22	283.9	35.63	29.68	1215.5	1013.7	0.16	39.17	39.44	39.56	39.69	40.55
398E**		41.27	234.4	52.67	29.90	1792.2	1021.7	0.90					
398F	0.33	41.36	279.3	38.00	30.26	1297.9	1035.1	0.22	39.65	39.82	40.59	40.73	40.70
398G**		41.78	237.1	51.90	31.97	1776.7	1098.7	0.78					
399B	0.96	41.35	277.7	35.42	30.19	1210.2	1032.4	0.15	39.02	39.62	39.65	39.51	40.41
399D	0.36	41.33	272.0	37.67	30.12	1286.2	1029.7	0.22	39.47	40.41	40.82	40.82	40.64
399F	0.50	41.53	274.8	36.80	30.92	1259.7	1059.6	0.17	39.40	39.64	40.19	40.23	40.57
399G**		41.72	225.5	52.28	31.74	1788.5	1090.2	0.88					

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-2a. (cont'd)

RUN NO.	CAVITY INCHES	TO DEG R	VO FT/SEC	PO PSIA	PV PSIA	HO FT	HV FT	KV	T 1 DEG R	T 2 DEG R	T 3 DEG R	T 4 DEG R	T 5 DEG R
400B	0.91	41.24	304.0	38.77	29.75	1322.1	1016.3	0.21	39.06	39.51	39.69	39.53	40.45
400D	0.37	41.38	296.4	40.73	30.33	1390.8	1037.8	0.26	39.71	40.16	40.86	40.82	40.93
401A**		41.13	253.9	56.30	29.32	1911.3	1000.5	0.91					
401B	0.51	41.27	299.1	40.60	29.90	1384.6	1021.7	0.26	39.53	39.91	40.43	40.57	40.66
401D	0.32	41.42	298.1	41.83	30.48	1428.6	1043.2	0.28	39.78	39.98	40.64	40.66	40.66
401E**		41.67	251.3	56.87	31.52	1942.5	1081.8	0.88					
402A**		37.85	222.6	38.87	18.28	1278.6	603.2	0.88					
402B	0.71	37.89	260.5	25.78	18.38	850.0	606.8	0.23	36.68	36.90	37.06	37.35	37.57
402C**		37.84	226.2	38.68	18.23	1272.2	601.4	0.84					
402D	0.51	37.85	260.4	26.03	18.28	857.9	603.2	0.24	35.77	36.14	36.74	36.74	36.63
402E**		37.84	222.6	39.25	18.23	1290.8	601.4	0.90					
403B	0.78	39.44	266.8	29.47	23.15	986.5	776.0	0.19	37.73	38.09	38.21	38.45	38.81
403D	0.26	39.44	262.4	31.90	23.15	1067.5	776.0	0.27	38.36	38.74	39.35	39.37	39.28
403E**		39.44	223.5	44.50	23.15	1486.0	776.0	0.91					
403F	0.48	39.53	266.3	30.77	23.46	1030.8	786.9	0.22	38.03	38.25	38.66	38.86	39.06
403G**		39.62	222.2	45.20	23.76	1512.1	797.8	0.93					
404B	0.64	39.46	261.7	29.52	23.22	988.4	778.2	0.20	37.66	38.25	38.45	38.56	38.92
404F	0.53	39.58	266.3	30.40	23.64	1019.1	793.4	0.20	37.76	38.02	38.41	38.66	38.90
404G**		39.67	220.8	45.40	23.95	1519.6	804.5	0.94					
405A**		39.49	248.4	49.90	23.34	1665.9	782.5	0.92					
405B	0.35	39.53	290.4	34.83	23.46	1166.1	786.9	0.29	37.91	38.61	39.22	39.04	38.95
405E**		39.65	251.3	49.35	23.89	1650.4	802.3	0.86					
405F	0.91	39.83	296.6	33.50	24.51	1125.5	824.6	0.22	38.00	37.96	38.00	38.09	38.81
405G**		40.21	244.6	50.10	25.85	1685.4	873.2	0.87					
406B	0.30	37.75	259.5	29.53	17.98	971.7	592.6	0.36	36.22	36.76	37.31	36.97	36.97
406D	0.22	37.84	258.4	30.15	18.23	992.9	601.4	0.38	36.49	36.92	37.44	37.31	37.08
406E	0.45	37.82	262.1	28.50	18.18	938.6	599.7	0.32	36.67	36.97	37.24	37.31	37.42

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-2a. (cont'd)

RUN NO.	CAVITY INCHES	TO DEG R	VO FT/SEC	PO PSIA	PV PSIA	HO FT	HV FT	KV	T 1 DEG R	T 2 DEG R	T 3 DEG R	T 4 DEG R	T 5 DEG R
407B	0.44	37.84	284.8	30.70	18.23	1010.9	601.4	0.32	36.52	36.85	37.10	37.21	37.30
407D	0.22	37.69	280.3	32.27	17.83	1060.9	587.4	0.39	36.63	36.86	37.48	37.39	37.35
408A**		39.33	187.7	37.73	22.80	1259.9	763.2	0.91					
408C**		39.33	194.5	36.85	22.80	1230.7	763.2	0.80					
408D	0.90	39.38	230.4	26.68	22.97	893.0	769.6	0.15	37.26	37.53	37.78	37.49	38.16
408E**		39.33	193.7	37.35	22.80	1247.3	763.2	0.83					
409B	0.30	41.24	248.0	36.10	29.75	1231.7	1016.3	0.23	39.64	40.12	40.90	40.79	40.72
409C**		41.22	209.6	47.70	29.68	1623.6	1013.7	0.89					
409D	0.72	41.27	256.2	33.70	29.90	1150.8	1021.7	0.13	38.48	38.95	39.26	39.26	39.98
409E**		41.26	212.0	47.20	29.83	1607.4	1019.0	0.84					
409F	0.39	41.31	254.8	35.13	30.04	1199.8	1027.0	0.17	39.46	39.73	40.45	40.54	40.72
409G**		41.45	209.0	48.12	30.63	1642.2	1048.7	0.87					

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-2a. (cont'd)

RUN NO.	P 1 PSIA	P 2 PSIA	P 3 PSIA	P 4 PSIA	P 5 PSIA	P 1,T PSIA	P 2,T PSIA	P 3,T PSIA	P 4,T PSIA	P 5,T PSIA
386B	12.42	13.75	16.07	18.03	21.35	15.46	15.91	17.33	18.03	18.03
386F	12.17	13.42	15.82	17.97	21.67	15.77	16.66	18.03	18.23	18.90
387B	11.45	12.78	15.25	19.91	30.08	15.37	16.37	17.68	18.33	18.03
387D	11.15	11.95	12.75	14.35	17.82	14.02	14.66	15.55	16.14	17.53
388B	11.53	11.90	12.75	14.60	18.15	14.40	14.97	15.73	16.61	17.63
388D	11.70	12.18	13.36	16.18	21.72	15.10	15.64	16.70	17.88	18.13
388F	11.35	11.95	13.01	15.01	19.78	15.77	15.82	17.43	18.13	19.16
389B	12.13	12.66	13.23	14.63	18.73	13.28	13.89	14.88	14.75	15.91
389D	11.74	12.27	12.81	13.74	16.14	13.16	14.27	14.27	14.49	16.05
389F	12.63	13.57	15.09	22.35	46.31	13.36	14.06	15.77	15.59	15.64
390B	14.34	15.28	16.18	18.28	22.92	15.23	16.09	17.73	17.88	19.74
390D	13.96	14.96	15.73	17.38	21.41	14.97	15.50	16.80	16.94	18.84
390F	14.73	16.15	19.13	25.87	46.81	17.48	17.93	20.28	20.50	20.78
391B	14.10	14.97	15.83	18.27	21.97	16.99	17.53	18.79	19.53	21.29
391D	14.48	15.38	16.48	19.23	24.06	17.09	17.88	19.31	20.50	21.40
391F	15.66	16.96	20.23	24.76	36.93	18.08	19.16	21.46	21.86	21.97
393B	11.15	11.92	13.02	15.95	20.75	13.73	14.49	15.68	16.66	17.28
393D	10.51	11.21	11.95	13.35	16.18	13.68	14.27	14.70	15.55	16.99
395B	19.31	21.37	25.77	32.21	54.84	21.34	22.97	26.37	25.65	26.24
395D	19.39	20.24	21.22	23.32	27.97	19.74	20.39	21.80	21.68	24.82
396B	18.48	19.13	20.28	22.53	27.63	18.84	20.01	21.34	23.22	24.44
396D	18.58	19.30	20.40	22.50	27.53	20.23	21.29	22.80	25.20	26.11
397B	20.30	20.70	21.83	23.70	28.96	21.40	22.92	24.32	26.31	26.91
397D	20.17	21.55	23.90	30.57	56.70	20.67	21.51	24.57	24.76	25.46
397F	20.48	22.23	26.60	34.83	85.28	22.38	23.64	27.04	26.97	27.24
398B	21.70	22.60	24.46	29.33	48.53	23.58	24.63	26.77	27.79	28.48
398D	20.70	20.93	21.83	22.36	24.93	22.26	23.15	23.58	24.01	27.11
398F	21.73	23.03	25.87	34.47	104.90	23.89	24.44	27.24	27.79	27.65

Table A-2a. (cont'd)

RUN NO.	P 1 PSIA	P 2 PSIA	P 3 PSIA	P 4 PSIA	P 5 PSIA	P 1,T PSIA	P 2,T PSIA	P 3,T PSIA	P 4,T PSIA	P 5,T PSIA
399B	21.22	21.36	22.06	22.14	23.52	21.80	23.76	23.89	23.40	26.57
399D	23.24	23.67	25.94	33.04	71.77	23.28	26.57	28.13	28.13	27.45
399F	22.30	22.73	24.47	27.50	36.47	23.03	23.82	25.78	25.91	27.17
400B	21.84	22.17	22.84	22.81	23.94	21.92	23.40	24.01	23.46	26.70
400D	24.00	24.63	26.20	31.40	55.33	24.07	25.65	28.27	28.13	28.55
401B	23.40	24.23	25.70	28.05	40.00	23.46	24.76	26.64	27.17	27.51
401D	24.40	25.03	27.26	35.73	119.13	24.32	25.01	27.45	27.51	27.51
402B	12.83	13.50	14.13	14.73	17.28	15.19	15.73	16.14	16.90	17.48
402D	12.90	13.73	14.60	16.05	22.28	13.04	13.89	15.32	15.32	15.05
403B	16.00	16.70	17.54	18.17	20.94	17.93	18.95	19.31	20.01	21.12
403D	16.75	18.32	21.73	30.50	81.00	19.74	20.89	22.86	22.92	22.62
403F	17.40	17.87	19.10	21.80	30.60	18.79	19.42	20.67	21.29	21.92
404B	16.88	17.32	18.16	19.02	23.18	17.73	19.42	20.01	20.34	21.46
404F	16.63	17.47	18.80	20.63	27.37	18.03	18.74	19.90	20.67	21.40
405B	18.55	19.23	20.73	25.53	45.23	18.43	20.50	22.44	21.86	21.57
405F	17.23	17.87	18.53	18.70	20.20	18.69	18.59	18.69	18.95	21.12
406P	15.58	15.83	16.78	25.10	69.93	14.06	15.37	16.80	15.91	15.91
406D	15.80	15.95	18.10	29.45	94.15	14.70	15.77	17.14	16.80	16.19
406E	14.25	14.95	15.85	17.20	25.20	15.14	15.91	16.61	16.80	17.09
407B	14.07	15.00	16.20	17.37	27.20	14.79	15.59	16.23	16.52	16.75
407D	15.34	15.77	18.00	29.57	52.27	15.05	15.64	17.23	16.99	16.90
408D	17.03	17.23	17.33	17.45	18.95	16.66	17.38	18.08	17.28	19.16
409B	22.77	23.82	26.85	35.82	83.60	23.82	25.52	28.41	27.99	27.72
409D	21.67	21.83	22.43	23.43	27.43	20.12	21.57	22.56	22.56	25.01
409F	22.70	23.00	24.73	30.66	51.63	23.22	24.13	26.70	27.04	27.72

Table A-2a. (cont'd)

RUN NO.	H 1 FT	H 2 FT	H 3 FT	H 4 FT	H 5 FT	H 1,T FT	H 2,T FT	H 3,T FT	H 4,T FT	H 5,T FT
386B	401.3	446.5	526.3	594.5	711.6	505.1	520.8	570.1	594.4	594.4
386F	392.8	435.3	517.7	592.4	723.0	516.0	546.7	594.4	601.4	624.8
387B	368.5	413.5	498.0	660.6	1028.4	502.0	536.8	582.1	605.0	594.4
387D	358.4	385.3	412.5	467.1	587.2	455.7	477.7	508.2	528.8	577.0
388B	371.2	383.7	412.5	475.6	598.7	468.8	488.2	514.4	545.0	580.4
388D	376.9	393.1	433.2	530.1	724.7	492.8	511.3	548.3	589.1	597.9
388F	365.1	385.3	421.3	489.7	656.0	516.0	517.6	573.5	597.9	634.0
389B	391.4	409.4	428.8	476.7	619.0	430.4	451.4	485.2	480.7	520.8
389D	378.3	396.2	414.5	446.2	528.7	426.2	464.4	464.4	471.7	525.6
389F	408.4	440.4	492.5	747.2	1650.9	433.1	457.1	516.0	509.7	511.3
390B	466.7	499.0	530.1	603.2	767.6	497.4	527.2	583.9	589.1	654.6
390D	453.7	488.0	514.6	571.8	713.7	488.2	506.6	551.6	556.6	623.0
390F	480.1	529.1	633.1	874.0	1670.8	575.3	590.9	673.7	681.5	691.3
391B	458.5	488.4	518.0	602.9	733.6	558.3	577.0	621.2	647.0	709.3
391D	471.5	502.5	540.5	636.6	808.5	561.7	589.1	639.6	681.5	713.3
391F	512.1	557.2	671.9	833.8	1285.8	596.1	634.0	715.3	729.6	733.8
393B	358.4	384.3	421.6	522.2	690.3	445.7	471.7	512.9	546.7	568.4
393D	336.9	360.4	385.3	432.9	530.1	444.3	464.4	479.2	508.2	558.3
395B	639.4	712.3	870.4	1107.6	1995.8	711.3	769.6	892.3	866.1	887.5
395D	642.2	672.2	706.9	781.9	950.6	654.6	677.6	727.6	723.5	836.0
396B	610.3	633.1	673.6	753.6	938.2	623.0	664.1	711.3	778.2	822.4
396D	613.8	639.1	677.9	752.6	934.5	671.8	709.3	763.2	849.8	882.7
397B	674.3	688.5	728.7	795.6	987.0	713.3	767.4	817.9	889.9	911.7
397D	669.7	718.7	802.8	1046.5	2072.7	687.4	717.4	826.9	833.7	859.1
397F	680.7	742.9	900.6	1206.1	3337.4	748.3	793.4	916.6	914.2	924.0
398B	724.0	756.1	823.0	1000.7	1739.5	791.2	829.2	906.8	943.9	969.3
398D	688.5	696.7	728.7	747.6	839.9	744.2	776.0	791.2	806.7	919.1
398F	725.1	771.5	874.0	1192.5	4313.3	802.3	822.4	924.0	943.9	938.9

Table A-2a. (cont'd)

RUN NO.	H 1 FT	H 2 FT	H 3 FT	H 4 FT	H 5 FT	H 1,T FT	H 2,T FT	H 3,T FT	H 4,T FT	H 5,T FT
399B	706.9	711.9	736.9	739.7	789.1	727.6	797.8	802.3	784.7	899.5
399D	779.1	794.5	876.6	1138.7	2719.1	780.3	899.5	956.6	956.6	931.4
399F	745.4	760.8	823.3	933.4	1268.3	771.7	800.0	870.9	875.6	921.5
400B	729.0	740.8	764.7	763.7	804.2	731.7	784.7	806.7	786.9	904.4
400D	806.4	829.1	886.0	1077.4	2016.0	808.9	866.1	961.6	956.6	971.9
401B	784.8	814.7	867.8	953.6	1403.7	786.9	833.7	902.0	921.5	933.9
401D	820.8	843.6	924.7	1240.2	5093.4	817.9	842.9	931.4	933.9	933.9
402B	415.2	438.0	459.5	480.1	568.3	495.8	514.4	528.8	555.0	575.3
402D	417.6	445.8	475.6	525.6	744.7	422.2	451.4	500.4	500.4	491.2
403B	523.9	548.2	577.4	599.4	697.0	590.9	626.7	639.6	664.1	703.3
403D	549.9	604.6	725.1	1044.0	3137.3	654.6	695.3	765.3	767.4	756.8
403F	572.5	588.9	632.0	727.6	1047.7	621.2	643.3	687.4	709.3	731.7
404B	554.4	569.7	599.0	629.2	776.9	583.9	643.3	664.1	675.7	715.3
404F	545.7	574.9	621.5	686.0	928.7	594.4	619.4	660.3	687.4	713.3
405B	612.7	636.6	689.6	8[illegible]1.7	1608.1	608.6	681.5	750.4	729.6	719.4
405F	566.6	588.9	612.0	618.0	670.8	617.6	613.9	617.6	626.7	703.3
406B	509.4	518.0	550.9	846.1	2637.9	457.1	502.0	551.6	520.8	520.8
406D	517.0	522.2	596.9	1005.1	3766.0	479.2	516.0	563.4	551.6	530.4
406E	463.6	487.7	518.7	565.5	849.7	494.3	520.8	545.0	551.6	561.7
407B	457.5	489.4	530.8	571.5	922.5	482.2	509.7	532.0	541.7	550.0
407D	501.1	515.9	593.5	1009.5	1890.6	491.2	511.3	566.7	558.3	555.0
408D	559.6	566.6	570.1	574.3	626.7	546.7	571.8	596.1	568.4	634.0
409B	762.2	799.9	909.7	1243.6	3258.3	800.0	861.5	966.7	951.5	941.4
409D	723.0	728.7	750.1	785.9	930.9	667.9	719.4	754.7	754.7	842.9
409F	759.7	770.5	832.7	1049.9	1864.6	778.2	811.2	904.4	916.6	941.4

Table A-2b. Experimental cavitation data for 0.210-inch ogive using liquid hydrogen (SI Units).

RUN NO.	CAVITY CM	TO DEG K	VO M/SEC	PO N/CM/CM	PV N/CM/CM	HO M	HV M	KV	T 1 DEG K	T 2 DEG K	T 3 DEG K	T 4 DEG K	T 5 DEG K
386A**		21.02	36.7	13.68	12.57	199.4	183.3	0.23					
386B	0.73	20.97	42.0	12.03	12.39	175.3	180.6	-0.06	20.44	20.54	20.84	20.98	20.98
386C**		20.99	35.4	14.09	12.46	205.3	181.7	0.37					
386F	0.81	20.98	42.7	12.05	12.43	175.6	181.2	-0.06	20.51	20.70	20.98	21.02	21.15
387B	0.88	21.05	56.9	13.71	12.67	200.0	184.9	0.09	20.42	20.64	20.91	21.04	20.98
387C**		21.06	48.0	18.28	12.71	266.5	185.5	0.69					
387D	1.82	21.05	58.7	13.04	12.67	190.3	184.9	0.03	20.11	20.26	20.46	20.59	20.88
387E**		21.05	47.7	18.57	12.67	270.6	184.9	0.74					
388B	1.57	20.96	56.3	12.71	12.36	185.1	180.1	0.03	20.20	20.33	20.50	20.69	20.90
388C**		20.97	46.1	17.86	12.39	259.9	180.6	0.73					
388D	1.27	20.99	55.5	13.02	12.46	189.7	181.7	0.05	20.36	20.48	20.71	20.95	21.00
388E**		20.94	47.0	17.60	12.29	256.1	179.0	0.68					
388F	1.42	21.00	56.3	12.95	12.50	188.8	182.2	0.04	20.51	20.52	20.86	21.00	21.20
388G**		20.88	46.6	17.77	12.09	258.3	175.9	0.74					
389B	1.52	20.96	67.9	14.98	12.36	218.2	180.1	0.16	19.93	20.08	20.31	20.28	20.54
389D	1.93	20.96	68.1	14.85	12.36	216.2	180.1	0.15	19.90	20.17	20.17	20.22	20.57
389E**		20.96	57.3	22.53	12.36	327.6	180.1	0.88					
389F	0.83	21.00	68.6	16.00	12.50	233.1	182.2	0.21	19.95	20.12	20.51	20.47	20.48
390A**		21.89	53.4	23.58	15.88	348.6	235.2	0.78					
390B	1.60	21.87	66.0	16.55	15.80	244.9	233.9	0.05	20.39	20.58	20.92	20.95	21.31
390C**		21.87	54.5	23.30	15.80	344.3	233.9	0.73					
390D	1.77	21.88	66.2	16.52	15.84	244.6	234.6	0.04	20.33	20.45	20.73	20.76	21.14
390F	0.86	21.90	65.5	17.66	15.92	261.4	235.9	0.12	20.87	20.96	21.41	21.45	21.50
390G**		21.98	53.5	24.09	16.26	356.7	241.2	0.79					
391B	1.70	21.90	58.7	15.44	15.92	228.8	235.9	-0.04	20.77	20.88	21.13	21.27	21.59
391D	1.52	21.90	58.4	15.59	15.92	230.9	235.9	-0.03	20.79	20.95	21.23	21.45	21.61
391E**		21.92	47.1	21.15	16.01	313.0	237.2	0.67					
391F	0.86	21.90	57.3	16.71	15.92	247.4	235.9	0.07	20.99	21.20	21.62	21.69	21.71
391G**		21.98	47.4	21.15	16.26	313.4	241.2	0.63					

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-2b. (cont'd)

RUN NO.	CAVITY CM	TO DEG K	VO M/SEC	PO N/CM/CM	PV N/CM/CM	HO M	HV M	KV	T 1 DEG K	T 2 DEG K	T 3 DEG K	T 4 DEG K	T 5 DEG K
392C**		21.90	46.4	21.97	15.92	325.0	235.9	0.81					
393B	1.14	20.89	51.0	11.94	12.12	173.8	176.4	-0.02	20.04	20.22	20.49	20.70	20.83
393C**		20.92	42.3	16.01	12.22	232.9	178.0	0.60					
393D	1.82	20.95	51.6	11.71	12.32	170.6	179.6	-0.07	20.03	20.17	20.27	20.46	20.77
393E**		20.97	42.0	15.77	12.39	229.6	180.6	0.54					
395A**		22.92	56.2	28.54	20.56	430.2	310.6	0.74					
395B	0.86	22.94	68.3	21.95	20.66	331.6	312.2	0.08	21.60	21.88	22.42	22.31	22.40
395C**		22.95	56.8	28.86	20.71	435.2	313.0	0.74					
395D	1.77	22.96	69.9	20.73	20.76	313.4	313.9	-0.00	21.31	21.43	21.68	21.66	22.18
395E**		22.95	57.9	28.05	20.71	423.1	313.0	0.65					
396A**		22.90	55.4	27.39	20.47	412.7	309.0	0.66					
396B	1.90	22.90	68.7	20.22	20.47	305.3	309.0	-0.02	21.14	21.36	21.60	21.92	22.12
396C**		22.90	56.7	27.30	20.47	411.4	309.0	0.62					
396D	1.82	22.88	69.1	20.29	20.37	306.2	307.4	-0.00	21.40	21.59	21.85	22.24	22.38
397A**		22.92	61.9	31.18	20.56	469.6	310.6	0.81					
397B	1.75	22.96	76.9	22.36	20.76	337.8	313.9	0.08	21.61	21.87	22.10	22.41	22.50
397D	0.99	22.93	75.8	23.17	20.61	349.7	311.4	0.13	21.48	21.63	22.14	22.17	22.28
397E**		22.93	62.7	31.56	20.61	475.3	311.4	0.82					
397F	0.71	22.97	75.0	23.91	20.81	361.2	314.7	0.16	21.78	21.99	22.52	22.51	22.55
398B	1.06	22.94	85.0	25.46	20.66	384.2	312.2	0.20	21.98	22.15	22.48	22.63	22.73
398D	2.23	22.90	86.5	24.57	20.47	370.5	309.0	0.16	21.76	21.91	21.98	22.05	22.53
398E**		22.93	71.4	36.31	20.61	546.3	311.4	0.90					
398F	0.83	22.98	85.1	26.20	20.86	395.6	315.5	0.22	22.03	22.12	22.55	22.63	22.61
398G**		23.21	72.3	35.78	22.04	541.5	334.9	0.78					
399B	2.43	22.97	84.6	24.42	20.81	368.9	314.7	0.15	21.68	22.01	22.03	21.95	22.45
399D	0.91	22.96	82.9	25.97	20.76	392.0	313.9	0.22	21.93	22.45	22.68	22.68	22.58
399F	1.27	23.07	83.8	25.37	21.32	384.0	323.0	0.17	21.89	22.02	22.33	22.35	22.54
399G**		23.18	68.7	36.05	21.89	545.1	332.3	0.88					

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-2b. (cont'd)

RUN NO.	CAVITY CM	TO DEG K	VO M/SEC	PO N/CM/CM	PV N/CM/CM	HO M	HV M	KV	T 1 DEG K	T 2 DEG K	T 3 DEG K	T 4 DEG K	T 5 DEG K
400B	2.31	22.91	92.6	26.73	20.51	403.0	309.8	0.21	21.70	21.95	22.05	21.96	22.47
400D	0.94	22.99	90.3	28.08	20.91	423.9	316.3	0.26	22.06	22.31	22.70	22.68	22.74
401A**		22.85	77.4	38.82	20.22	582.6	304.9	0.91					
401B	1.29	22.93	91.2	27.99	20.61	422.0	311.4	0.26	21.96	22.17	22.46	22.54	22.59
401D	0.81	23.01	90.9	28.84	21.02	435.4	318.0	0.28	22.10	22.21	22.58	22.59	22.59
401E**		23.15	76.6	39.21	21.73	592.1	329.7	0.88					
402A**		21.03	67.9	26.80	12.60	389.7	183.9	0.88					
402B	1.80	21.05	79.4	17.77	12.67	259.1	184.9	0.23	20.38	20.50	20.59	20.75	20.87
402C**		21.02	68.9	26.67	12.57	387.8	183.3	0.84					
402D	1.29	21.03	79.4	17.95	12.60	261.5	183.9	0.24	19.87	20.08	20.41	20.41	20.35
402E**		21.02	67.8	27.06	12.57	393.4	183.3	0.90					
403B	1.98	21.91	81.3	20.32	15.96	300.7	236.5	0.19	20.96	21.16	21.23	21.36	21.56
403D	0.66	21.91	80.0	21.99	15.96	325.4	236.5	0.27	21.31	21.52	21.86	21.87	21.82
403E**		21.91	68.1	30.68	15.96	452.9	236.5	0.91					
403F	1.21	21.96	81.2	21.22	16.17	314.2	239.8	0.22	21.13	21.25	21.48	21.59	21.70
403G**		22.01	67.7	31.16	16.38	460.9	243.2	0.93					
404B	1.62	21.92	79.8	20.35	16.01	301.3	237.2	0.20	20.92	21.25	21.36	21.42	21.62
404F	1.34	21.99	81.2	20.96	16.30	310.6	241.8	0.20	20.98	21.12	21.34	21.48	21.61
404G**		22.04	67.3	31.30	16.51	463.2	245.2	0.94					
405A**		21.94	75.7	34.40	16.09	507.8	238.5	0.92					
405B	0.88	21.96	88.5	24.01	16.17	355.4	239.8	0.29	21.06	21.45	21.79	21.69	21.64
405E**		22.03	76.6	34.03	16.47	503.1	244.5	0.86					
405F	2.31	22.13	90.4	23.10	16.90	343.0	251.4	0.22	21.11	21.09	21.11	21.16	21.56
405G**		22.34	74.5	34.54	17.82	513.7	266.2	0.87					
406B	0.76	20.97	79.1	20.36	12.39	296.2	180.6	0.36	20.12	20.42	20.73	20.54	20.54
406D	0.55	21.02	78.8	20.79	12.57	302.6	183.3	0.38	20.27	20.51	20.80	20.73	20.60
406E	1.14	21.01	79.9	19.65	12.53	286.1	182.8	0.32	20.37	20.54	20.69	20.73	20.79

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-2b. (cont'd)

RUN NO.	CAVITY CM	TO DEG K	VO M/SEC	PO N/CM/CM	PV N/CM/CM	HO M	HV M	KV	T 1 DEG K	T 2 DEG K	T 3 DEG K	T 4 DEG K	T 5 DEG K
407B	1.11	21.02	86.8	21.17	12.57	308.1	183.3	0.32	20.29	20.47	20.61	20.67	20.72
407D	0.55	20.94	85.4	22.25	12.29	323.4	179.0	0.39	20.35	20.48	20.82	20.77	20.75
408A**		21.85	57.2	26.01	15.72	384.0	232.6	0.91					
408C**		21.85	59.3	25.41	15.72	375.1	232.6	0.80					
408D	2.28	21.88	70.2	18.40	15.84	272.2	234.6	0.15	20.70	20.85	20.99	20.83	21.20
408E**		21.85	59.0	25.75	15.72	380.2	232.6	0.83					
409B	0.76	22.91	75.6	24.89	20.51	375.4	309.8	0.23	22.02	22.29	22.72	22.66	22.62
409C**		22.90	63.9	32.89	20.47	494.9	309.0	0.89					
409D	1.82	22.93	78.1	23.24	20.61	350.8	311.4	0.13	21.38	21.64	21.81	21.81	22.21
409E**		22.92	64.6	32.54	20.56	489.9	310.6	0.84					
409F	0.99	22.95	77.7	24.22	20.71	365.7	313.0	0.17	21.92	22.07	22.47	22.52	22.62
409G**		23.03	63.7	33.18	21.12	500.5	319.6	0.87					

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-2b. (cont'd)

RUN NO.	P 1 N/CM/CM	P 2 N/CM/CM	P 3 N/CM/CM	P 4 N/CM/CM	P 5 N/CM/CM	P 1,T N/CM/CM	P 2,T N/CM/CM	P 3,T N/CM/CM	P 4,T N/CM/CM	P 5,T N/CM/CM
386B	8.56	9.48	11.08	12.43	14.72	10.66	10.97	11.95	12.43	12.43
386F	8.39	9.25	10.91	12.39	14.94	10.87	11.48	12.43	12.57	13.03
387B	7.89	8.81	10.51	13.73	20.74	10.59	11.29	12.19	12.64	12.43
387D	7.69	8.24	8.79	9.89	12.29	9.67	10.11	10.72	11.13	12.09
388B	7.95	8.20	8.79	10.07	12.51	9.93	10.32	10.84	11.45	12.15
388D	8.07	8.40	9.21	11.16	14.98	10.41	10.78	11.52	12.32	12.50
388F	7.83	8.24	8.97	10.35	13.64	10.87	10.91	12.02	12.50	13.21
389B	8.36	8.73	9.12	10.09	12.91	9.15	9.58	10.26	10.17	10.97
389D	8.09	8.46	8.83	9.47	11.13	9.07	9.84	9.84	9.99	11.06
389F	8.71	9.36	10.40	15.41	31.93	9.21	9.69	10.87	10.75	10.78
390B	9.89	10.54	11.16	12.60	15.80	10.50	11.10	12.22	12.32	13.61
390D	9.63	10.31	10.85	11.98	14.76	10.32	10.69	11.58	11.68	12.99
390F	10.16	11.14	13.19	17.84	32.27	12.05	12.36	13.98	14.14	14.33
391B	9.72	10.32	10.91	12.60	15.15	11.72	12.09	12.96	13.46	14.68
391D	9.98	10.60	11.36	13.26	16.59	11.78	12.32	13.32	14.14	14.75
391F	10.80	11.69	13.95	17.07	25.46	12.46	13.21	14.79	15.07	15.15
393B	7.69	8.22	8.98	11.00	14.31	9.46	9.99	10.81	11.48	11.92
393D	7.25	7.73	8.24	9.20	11.16	9.44	9.84	10.14	10.72	11.72
395B	13.31	14.73	17.77	22.21	37.81	14.71	15.84	18.18	17.69	18.09
395D	13.37	13.95	14.63	16.08	19.28	13.61	14.06	15.03	14.95	17.11
396B	12.74	13.19	13.98	15.53	19.05	12.99	13.80	14.71	16.01	16.85
396D	12.81	13.31	14.07	15.51	18.98	13.95	14.68	15.72	17.38	18.00
397B	14.00	14.27	15.05	16.34	19.97	14.75	15.80	16.77	18.14	18.55
397D	13.91	14.86	16.48	21.08	39.09	14.25	14.83	16.94	17.07	17.55
397F	14.12	15.33	18.34	24.01	58.80	15.43	16.30	18.64	18.60	18.78
398B	14.96	15.58	16.86	20.22	33.46	16.26	16.98	18.46	19.16	19.64
398D	14.27	14.43	15.05	15.42	17.19	15.35	15.96	16.26	16.55	18.69
398F	14.98	15.88	17.84	23.77	72.33	16.47	16.85	18.78	19.16	19.06

Table A-2b. (cont'd)

RUN NO.	P 1 N/CM/CM	P 2 N/CM/CM	P 3 N/CM/CM	P 4 N/CM/CM	P 5 N/CM/CM	P 1,T N/CM/CM	P 2,T N/CM/CM	P 3,T N/CM/CM	P 4,T N/CM/CM	P 5,T N/CM/CM
399B	14.63	14.73	15.21	15.26	16.22	15.03	16.38	16.47	16.13	18.32
399D	16.02	16.32	17.89	22.78	49.48	16.05	18.32	19.40	19.40	18.92
399F	15.38	15.67	16.87	18.96	25.15	15.88	16.43	17.78	17.87	18.74
400B	15.06	15.29	15.75	15.73	16.51	15.11	16.13	16.55	16.17	18.41
400D	16.55	16.98	18.06	21.65	38.15	16.60	17.69	19.49	19.40	19.68
401B	16.13	16.71	17.72	19.34	27.58	16.17	17.07	18.37	18.74	18.97
401D	16.82	17.26	18.80	24.63	82.14	16.77	17.24	18.92	18.97	18.97
402B	8.85	9.31	9.74	10.16	11.91	10.47	10.84	11.13	11.65	12.05
402D	8.89	9.47	10.07	11.07	15.36	8.99	9.58	10.56	10.56	10.38
403B	11.03	11.51	12.09	12.53	14.44	12.36	13.06	13.32	13.80	14.56
403D	11.55	12.63	14.98	21.03	55.85	13.61	14.40	15.76	15.80	15.59
403F	12.00	12.32	13.17	15.03	21.10	12.96	13.39	14.25	14.68	15.11
404B	11.64	11.94	12.52	13.11	15.98	12.22	13.39	13.80	14.02	14.79
404F	11.47	12.05	12.96	14.22	18.87	12.43	12.92	13.72	14.25	14.75
405B	12.79	13.26	14.29	17.60	31.18	12.71	14.14	15.47	15.07	14.87
405F	11.88	12.32	12.78	12.89	13.93	12.89	12.81	12.89	13.06	14.56
406B	10.74	10.91	11.57	17.31	48.22	9.69	10.59	11.58	10.97	10.97
406D	10.89	11.00	12.48	20.31	64.91	10.14	10.87	11.82	11.58	11.16
406E	9.83	10.31	10.93	11.86	17.37	10.44	10.97	11.45	11.58	11.78
407B	9.70	10.34	11.17	11.98	18.75	10.20	10.75	11.19	11.39	11.55
407D	10.58	10.87	12.41	20.39	36.04	10.38	10.78	11.88	11.72	11.65
408D	11.74	11.88	11.95	12.03	13.07	11.48	11.98	12.46	11.92	13.21
409B	15.70	16.42	18.51	24.70	57.64	16.43	17.60	19.59	19.30	19.11
409D	14.94	15.05	15.46	16.15	18.91	13.87	14.87	15.55	15.55	17.24
409F	15.65	15.86	17.05	21.14	35.60	16.01	16.64	18.41	18.64	19.11

Table A-2b. (cont'd)

RUN NO.	H 1 M	H 2 M	H 3 M	H 4 M	H 5 M	H 1,T M	H 2,T M	H 3,T M	H 4,T M	H 5,T M
386B	122.3	136.1	160.4	181.2	216.9	153.9	158.7	173.8	181.2	181.2
386F	119.7	132.7	157.8	180.6	220.4	157.3	166.6	181.2	183.3	190.4
387B	112.3	126.0	151.8	201.3	313.5	153.0	163.6	177.4	184.4	181.2
387D	109.2	117.5	125.7	142.4	179.0	138.9	145.6	154.9	161.2	175.9
388B	113.1	116.9	125.7	145.0	182.5	142.9	148.8	156.8	166.1	176.9
388D	114.9	119.8	132.0	161.6	220.9	150.2	155.8	167.1	179.6	182.2
388F	111.3	117.5	128.4	149.3	199.9	157.3	157.8	174.8	182.2	193.2
389B	119.3	124.8	130.7	145.3	188.7	131.2	137.6	147.9	146.5	158.7
389D	115.3	120.8	126.3	136.0	161.2	129.9	141.5	141.5	143.8	160.2
389F	124.5	134.2	150.1	227.7	503.2	132.0	139.3	157.3	155.4	155.8
390B	142.3	152.1	161.6	183.9	234.0	151.6	160.7	178.0	179.6	199.5
390D	138.3	148.7	156.8	174.3	217.5	148.8	154.4	168.1	169.7	189.9
390F	146.3	161.3	193.0	266.4	509.3	175.3	180.1	205.4	207.7	210.7
391B	139.8	148.9	157.9	183.8	223.6	170.2	175.9	189.3	197.2	216.2
391D	143.7	153.2	164.8	194.0	246.4	171.2	179.6	194.9	207.7	217.4
391F	156.1	169.8	204.8	254.1	391.9	181.7	193.2	218.0	222.4	223.7
393B	109.2	117.1	128.5	159.2	210.4	135.9	143.8	156.3	166.6	173.3
393D	102.7	109.8	117.5	131.9	161.6	135.4	141.5	146.1	154.9	170.2
395B	194.9	217.1	265.3	337.6	608.3	216.8	234.6	272.0	264.0	270.5
395D	195.7	204.9	215.5	238.3	289.8	199.5	206.5	221.8	220.5	254.8
396B	186.0	193.0	205.3	229.7	286.0	189.9	202.4	216.8	237.2	250.7
396D	187.1	194.8	206.6	229.4	284.8	204.8	216.2	232.6	259.0	269.1
397B	205.5	209.9	222.1	242.5	300.8	217.4	233.9	249.3	271.2	277.9
397D	204.1	219.1	244.7	319.0	631.8	209.5	218.7	252.0	254.1	261.9
397F	207.5	226.4	274.5	367.6	1017.2	228.1	241.8	279.4	278.6	281.6
398B	220.7	230.5	250.8	305.0	530.2	241.2	252.7	276.4	287.7	295.4
398D	209.9	212.3	222.1	227.9	256.0	226.8	236.5	241.2	245.9	280.1
398F	221.0	235.2	266.4	363.5	1314.7	244.5	250.7	281.6	287.7	286.2

Table A-2b. (cont'd)

RUN NO.	H 1 M	H 2 M	H 3 M	H 4 M	H 5 M	H 1,T M	H 2,T M	H 3,T M	H 4,T M	H 5,T M
399B	215.5	217.0	224.6	225.5	240.5	221.8	243.2	244.5	239.2	274.2
399D	237.5	242.2	267.2	347.1	828.8	237.8	274.2	291.6	291.6	283.9
399F	227.2	231.9	250.9	284.5	386.6	235.2	243.9	265.4	266.9	280.9
400B	222.2	225.8	233.1	232.8	245.1	223.0	239.2	245.9	239.8	275.7
400D	245.8	252.7	270.1	328.4	614.5	246.6	264.0	293.1	291.6	296.2
401B	239.2	248.3	264.5	290.7	427.9	239.8	254.1	274.9	280.9	284.7
401D	250.2	257.1	281.8	378.0	1552.5	249.3	256.9	283.9	284.7	284.7
402B	126.5	133.5	140.1	146.3	173.2	151.1	156.8	161.2	169.2	175.3
402D	127.3	135.9	145.0	160.2	227.0	128.7	137.6	152.5	152.5	149.7
403B	159.7	167.1	176.0	182.7	212.4	180.1	191.0	194.9	202.4	214.4
403D	167.6	184.3	221.0	318.2	956.2	199.5	211.9	233.3	233.9	230.7
403F	174.5	179.5	192.6	221.8	319.3	189.3	196.1	209.5	216.2	223.0
404B	169.0	173.7	182.6	191.8	236.8	178.0	196.1	202.4	205.9	218.0
404F	166.3	175.2	189.4	209.1	283.1	181.2	188.8	201.3	209.5	217.4
405B	186.8	194.0	210.2	262.6	490.2	185.5	207.7	228.7	222.4	219.3
405F	172.7	179.5	186.5	188.4	204.5	188.2	187.1	188.2	191.0	214.4
406B	155.3	157.9	167.9	257.9	804.0	139.3	153.0	168.1	158.7	158.7
406D	157.6	159.2	182.0	306.4	1147.9	146.1	157.3	171.7	168.1	161.7
406E	141.3	148.6	158.1	172.4	259.0	150.7	158.7	166.1	168.1	171.2
407B	139.4	149.2	161.8	174.2	281.2	147.0	155.4	162.1	165.1	167.6
407D	152.7	157.3	180.9	307.7	576.3	149.7	155.8	172.7	170.2	169.2
408D	170.6	172.7	173.8	175.0	191.0	166.6	174.3	181.7	173.3	193.2
409B	232.3	243.8	277.3	379.0	993.1	243.9	262.6	294.7	290.0	286.9
409D	220.4	222.1	228.6	239.5	283.7	203.6	219.3	230.0	230.0	256.9
409F	231.6	234.8	253.8	320.0	568.3	237.2	247.2	275.7	279.4	286.9

Table A-3a. Experimental cavitation data for 0.357-inch ogive using liquid nitrogen (English Units).

RUN NO.	CAVITY INCHES	TO DEG R	VO FT/SEC	PO PSIA	PV PSIA	HO FT	HV FT	KV	T 1 DEG R	T 2 DEG R	T 3 DEG R	T 4 DEG R	T 5 DEG R
302A**		137.84	28.1	18.25	13.39	51.9	38.1	1.13					
302B	1.50	137.92	30.8	15.10	13.45	43.0	38.3	0.32	136.57	136.55	136.69	137.05	137.27
302D	0.60	137.93	31.1	15.63	13.47	44.5	38.3	0.41	136.78	136.93	137.38	137.61	137.63
302E**		138.06	28.0	17.83	13.58	50.7	38.7	0.99					
302F	0.80	137.93	29.7	15.30	13.47	43.5	38.3	0.38	137.00	136.96	137.23	137.65	137.77
302G**		137.84	27.1	17.80	13.39	50.6	38.1	1.10					
303A**		140.38	32.0	22.60	15.81	64.8	45.3	1.22					
303B	1.00	140.47	37.1	18.40	15.90	52.8	45.6	0.34	138.80	139.01	139.37	139.79	139.93
303C**		140.54	33.1	22.28	15.97	63.9	45.8	1.06					
304A**		140.42	32.8	22.47	15.85	64.4	45.4	1.14					
304D	0.50	140.58	35.3	19.30	16.01	55.4	45.9	0.49	139.63	139.86	140.35	140.42	140.45
304E**		140.62	32.4	22.45	16.05	64.4	46.0	1.13					
305A**		139.93	50.7	31.00	15.36	88.7	44.0	1.12					
305B	1.00	140.24	55.9	22.85	15.66	65.5	44.9	0.42	138.76	138.85	139.25	139.84	140.00
305D	0.60	140.09	54.6	23.85	15.52	68.3	44.5	0.51	138.46	138.65	139.36	139.54	139.54
305E**		140.15	50.8	30.85	15.57	88.4	44.6	1.09					
305F	0.90	139.99	55.0	22.60	15.41	64.7	44.1	0.44	138.20	138.31	138.74	139.27	139.52
305G**		140.17	49.8	31.95	15.59	91.5	44.7	1.21					
306A**		150.01	57.7	49.03	28.14	145.1	83.3	1.20					
306B	1.50	150.08	64.6	35.30	28.25	104.5	83.7	0.32	146.38	146.36	146.99	147.89	148.82
306D	0.45	150.10	62.4	37.86	28.28	112.1	83.7	0.47	147.31	147.98	149.22	149.29	149.33
306E**		150.01	56.3	49.10	28.14	145.3	83.3	1.26					
307A**		150.46	41.2	39.93	28.85	118.4	85.5	1.24					
307B	0.90	150.52	47.0	32.00	28.94	94.9	85.8	0.26	148.07	148.39	149.20	149.99	150.16
307C	0.45	150.41	45.6	33.26	28.77	98.6	85.3	0.41	148.10	148.79	149.67	149.87	149.83
307D**		150.52	41.4	39.35	28.94	116.7	85.8	1.16					
308A**		149.87	41.8	38.84	27.91	114.9	82.6	1.19					
308B	0.75	149.76	47.3	31.18	27.74	92.2	82.1	0.29	147.06	147.42	148.28	149.20	149.27

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-3a. (cont'd)

RUN NO.	CAVITY INCHES	TO DEG R	VO FT/SEC	PO PSIA	PV PSIA	HO FT	HV FT	KV	T 1 DEG R	T 2 DEG R	T 3 DEG R	T 4 DEG R	T 5 DEG R
308C	0.90	149.83	47.7	30.70	27.86	90.8	82.4	0.24	146.90	147.06	147.85	148.81	149.17
308D**		149.74	41.7	38.18	27.72	112.9	82.0	1.15					
309A**		159.30	55.6	62.95	45.78	192.6	140.2	1.09					
309B	1.50	159.26	63.1	48.60	45.70	148.8	139.9	0.14	154.37	154.69	155.93	157.50	158.24
309C	0.75	159.34	62.5	49.70	45.87	152.2	140.4	0.19	154.87	155.74	157.50	158.33	158.54
309D**		159.23	55.7	63.00	45.62	192.7	139.6	1.10					
309E	0.50	159.26	62.7	50.85	45.70	155.6	139.9	0.26	155.90	157.18	158.76	158.99	159.03
310A**		159.55	45.3	57.06	46.36	174.8	142.1	1.03					
310F**		159.71	46.3	57.58	46.73	176.5	143.3	1.00					
311A**		159.01	77.9	79.52	45.14	242.9	138.0	1.11					
311B	1.20	159.12	87.3	56.60	45.38	173.1	138.8	0.29	153.68	153.79	154.64	156.44	157.81
311C	0.60	159.21	86.4	58.56	45.58	179.1	139.5	0.34	154.49	155.25	157.16	158.02	158.45
311E**		159.05	76.4	80.21	45.22	245.1	138.3	1.18					
312B	0.90	149.40	83.4	43.70	27.19	129.0	80.3	0.45	146.65	146.97	147.85	148.84	148.99
312C	1.20	149.42	81.1	42.22	27.22	124.7	80.4	0.43	145.66	145.89	146.79	147.78	148.43
312D	0.60	149.40	77.2	41.70	27.19	123.1	80.3	0.46	146.52	147.04	148.23	148.79	148.82
312E**		149.53	65.8	55.95	27.38	165.2	80.9	1.25					
313A**		139.64	80.5	60.16	15.07	171.9	43.1	1.28					
315A**		137.77	26.9	17.87	13.32	50.8	37.9	1.15					
315B	1.50	137.75	29.7	14.75	13.31	41.9	37.8	0.30	136.35	136.33	136.48	136.80	137.09
315C	0.80	137.84	29.7	15.07	13.39	42.9	38.1	0.35	136.69	136.76	137.12	137.48	137.59
315D	0.50	137.83	29.0	15.42	13.37	43.9	38.0	0.45	136.89	137.05	137.47	137.63	137.65
315E**		137.79	25.9	17.62	13.34	50.1	37.9	1.17					
315I**		137.77	25.9	17.75	13.32	50.5	37.9	1.21					
316A**		140.53	31.4	23.92	15.96	68.6	45.8	1.49					
316B	1.00	140.71	36.8	18.62	16.14	53.4	46.3	0.34	139.12	139.25	139.66	140.18	140.24
316C	1.30	140.58	37.0	18.50	16.01	53.1	45.9	0.33	138.58	138.69	139.12	139.55	139.84
316D	1.50	140.69	37.0	18.40	16.12	52.8	46.3	0.31	138.62	138.67	139.07	139.43	139.82
316G**		140.80	31.6	24.60	16.23	70.6	46.6	1.55					

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-3a. (cont'd)

RUN NO.	CAVITY INCHES	TO DEG R	VO FT/SEC	PO PSIA	PV PSIA	HO FT	HV FT	KV	T 1 DEG R	T 2 DEG R	T 3 DEG R	T 4 DEG R	T 5 DEG R
317A**		149.90	57.3	49.57	27.97	146.6	82.8	1.25					
317B	1.50	150.62	64.8	36.10	29.11	107.1	86.4	0.32	147.44	147.55	148.16	149.18	149.87
317C	0.90	150.75	63.7	37.25	29.32	110.5	87.0	0.37	147.40	147.80	149.04	149.69	149.83
318A**		159.61	55.3	64.16	46.48	196.5	142.5	1.14					
318B	1.50	159.80	63.1	49.65	46.93	152.3	144.0	0.13	155.41	155.75	157.09	158.56	159.10
318D	1.20	159.64	62.5	49.65	46.56	152.2	142.7	0.16	154.80	155.34	156.76	158.04	158.31
318E**		159.75	54.7	64.15	46.81	196.6	143.5	1.14					
319B	1.20	159.44	63.5	49.55	46.11	151.8	141.2	0.17	155.23	155.70	157.07	158.51	158.90
319C	1.00	159.37	62.7	49.62	45.95	151.9	140.7	0.18	154.75	155.25	156.87	158.06	158.49
320A**		159.39	45.0	57.77	45.99	176.9	140.8	1.14					
320D**		159.68	44.7	57.62	46.64	176.6	143.0	1.08					
321A**		159.64	77.1	82.09	46.56	251.4	142.7	1.18					
321B	1.20	159.59	86.0	58.45	46.44	179.1	142.3	0.32	155.32	155.38	156.15	157.86	158.69
321F**		159.70	76.5	79.12	46.68	242.3	143.1	1.09					
322B	1.30	159.34	86.4	58.25	45.87	178.3	140.4	0.33	154.75	154.89	155.81	157.46	158.38
322E	0.40	159.41	84.6	62.22	46.03	190.5	141.0	0.44	155.50	156.69	158.36	158.13	158.31
323A**		149.58	79.0	69.72	27.47	205.9	81.2	1.29					
323D	0.50	149.81	86.4	47.89	27.83	141.6	82.3	0.51	147.15	147.64	148.81	148.81	148.88
323E**		149.90	78.1	65.85	27.97	194.7	82.8	1.18					
324A**		149.42	80.0	68.44	27.22	202.0	80.4	1.22					
325A**		150.08	58.6	50.98	28.25	150.9	83.7	1.26					
325B	1.30	150.12	65.6	36.28	28.31	107.4	83.8	0.35	146.92	147.10	147.92	148.81	149.49
325D	0.45	150.08	62.7	38.42	28.25	113.7	83.7	0.49	147.15	148.00	149.22	149.20	149.22
325F**		150.21	56.0	49.14	28.45	145.5	84.3	1.25					
326B**		150.55	42.3	39.28	29.00	116.5	86.0	1.10					
326C	1.50	150.61	48.1	31.57	29.08	93.6	86.3	0.21	147.67	147.73	148.52	149.49	149.96

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-3a. (cont'd)

RUN NO.	CAVITY INCHES	TO DEG R	VO FT/SEC	PO PSIA	PV PSIA	HO FT	HV FT	KV	T 1 DEG R	T 2 DEG R	T 3 DEG R	T 4 DEG R	T 5 DEG R
326D	1.00	150.68	47.6	31.92	29.20	94.7	86.6	0.23	147.71	147.91	148.79	149.67	150.03
326E	0.50	150.77	45.9	33.28	29.34	98.8	87.1	0.36	148.34	148.86	149.87	150.21	150.30
326F	0.75	150.86	46.2	32.59	29.49	96.8	87.6	0.28	148.10	148.46	149.56	150.14	150.26
326G	1.00	150.89	46.6	32.25	29.55	95.8	87.7	0.24	147.78	147.96	148.86	149.72	150.07
326H**		151.29	41.3	3?.42	30.20	117.2	89.8	1.03					
327E**		140.00	78.0	58.74	15.43	168.1	44.2	1.31					
328D**		140.00	77.1	58.76	15.43	168.1	44.2	1.34					
329A**		139.95	50.6	33.54	15.38	96.0	44.0	1.31					
329B	1.60	140.00	55.9	22.62	15.43	64.8	44.2	0.42	137.77	137.79	138.20	138.78	139.07
329D	1.30	140.06	55.4	22.55	15.48	64.6	44.3	0.42	137.32	137.45	138.11	138.51	138.87
329F	0.50	140.17	53.8	23.92	15.59	68.5	44.7	0.53	138.01	138.35	139.19	139.21	139.25
329G**		140.26	49.5	31.64	15.68	90.7	44.9	1.20					
330A**		139.86	50.6	32.32	15.29	92.5	43.8	1.23					
330D**		140.80	48.5	32.42	16.23	93.0	46.6	1.27					
547A**		140.63	32.7	21.68	16.07	62.2	46.1	0.97					
547B	1.75	140.63	36.3	17.42	16.07	50.0	46.1	0.19	138.82	138.64	138.96	139.09	139.23
547C	1.00	140.65	36.0	17.78	16.09	51.0	46.2	0.24	139.03	139.09	139.61	139.93	140.08
547D**		140.72	32.7	21.60	16.16	62.0	46.4	0.94					
547E	0.90	140.67	35.9	17.75	16.10	50.9	46.2	0.24	139.36	139.43	139.75	140.20	140.38
547F	1.10	140.71	35.2	17.68	16.14	50.7	46.3	0.23	139.19	139.27	139.70	140.06	140.27
547G**		140.69	31.8	21.47	16.12	61.6	46.3	0.98					
547H	0.50	140.71	34.4	18.25	16.14	52.4	46.3	0.33	139.70	139.91	140.31	140.53	140.56
548A**		140.74	48.0	29.27	16.18	84.0	46.4	1.05					
548B	0.90	140.80	51.7	21.35	16.23	61.3	46.6	0.35	138.98	139.12	139.75	140.09	140.17
548C	0.60	140.83	51.2	22.05	16.27	63.3	46.7	0.41	138.89	139.09	140.11	140.13	140.00
548D**		140.80	47.1	29.64	16.23	85.1	46.6	1.12					
548E	1.30	140.83	51.4	20.87	16.27	59.9	46.7	0.32	138.67	138.73	139.16	139.48	139.82
548F	0.50	140.81	49.8	22.32	16.25	64.1	46.7	0.45	139.00	139.34	140.08	140.02	140.00
548G**		140.89	46.8	28.70	16.33	82.4	46.9	1.04					

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-3a. (cont'd)

RUN NO.	CAVITY INCHES	TO DEG R	VO FT/SEC	PO PSIA	PV PSIA	HO FT	HV FT	KV	T 1 DEG R	T 2 DEG R	T 3 DEG R	T 4 DEG R	T 5 DEG R
549A**		150.80	39.2	37.98	29.40	112.7	87.3	1.06					
549B	1.10	150.97	44.5	30.17	29.67	89.6	88.1	0.05	148.37	148.50	149.18	149.94	150.37
549C	0.90	150.93	44.0	30.52	29.61	90.6	87.9	0.09	148.28	148.50	149.51	150.12	150.39
549D**		150.93	39.0	37.64	29.61	111.8	87.9	1.01					
549E	1.00	150.95	43.6	30.47	29.64	90.5	88.0	0.08	148.39	148.73	149.51	150.34	150.53
549F	0.50	150.98	42.5	31.52	29.70	93.6	88.2	0.19	148.79	149.42	150.37	150.64	150.68
549G**		151.00	38.5	36.95	29.73	109.7	88.3	0.93					
549H	0.60	151.06	42.5	31.34	29.81	93.1	88.6	0.16	148.95	149.54	150.37	150.86	150.84
550A**		150.68	56.4	45.60	29.20	135.2	86.6	0.98					
550B	0.90	150.70	61.4	34.64	29.23	102.8	86.7	0.27	147.92	148.36	149.24	149.90	150.03
550C	0.60	150.70	61.1	35.20	29.23	104.4	86.7	0.31	147.82	148.45	149.58	149.81	149.87
550D**		150.68	56.0	45.39	29.20	134.6	86.6	0.98					
550E	1.10	150.73	60.8	33.90	29.29	100.6	86.9	0.24	147.80	148.19	148.88	149.63	150.07
550F**		150.77	54.3	46.58	29.34	138.2	87.1	1.12					
551A**		160.58	57.5	65.62	48.73	201.8	149.9	1.01					
551B	1.30	160.74	64.9	50.62	49.12	155.8	151.2	0.07	156.82	157.10	158.02	159.41	159.91
551C	0.75	160.72	64.2	52.42	49.08	161.3	151.1	0.16	157.21	157.86	159.34	159.82	160.65
551D**		160.78	58.4	64.54	49.20	198.6	151.5	0.89					
551E	0.90	160.83	64.6	51.56	49.33	158.8	151.9	0.11	157.32	157.86	159.03	160.09	160.29
551F	0.60	160.87	63.9	52.92	49.42	163.0	152.2	0.17	157.63	158.45	159.80	160.25	160.29
552A**		161.12	46.4	58.10	50.02	179.1	154.2	0.74					
552C**		161.12	46.8	56.68	50.02	174.7	154.2	0.60					
552E**		161.19	45.7	57.85	50.20	178.3	154.8	0.73					
553A**		161.19	47.2	58.40	50.20	180.0	154.8	0.73					
553D**		161.10	46.8	58.54	49.98	180.4	154.1	0.77					
553G**		161.21	46.9	58.44	50.24	180.2	154.9	0.74					
554A**		161.03	72.9	75.23	49.81	231.6	153.5	0.95					
554B	1.30	161.01	80.5	55.68	49.76	171.6	153.3	0.18	157.23	157.37	158.26	159.53	160.11
554C	1.00	161.06	80.2	56.35	49.89	173.6	153.8	0.20	157.32	157.72	158.87	159.97	160.20

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-3a. (cont'd)

RUN NO.	CAVITY INCHES	TO DEG R	VO FT/SEC	PO PSIA	PV PSIA	HO FT	HV FT	KV	T 1 DEG R	T 2 DEG R	T 3 DEG R	T 4 DEG R	T 5 DEG R
554D	0.50	161.05	79.6	58.95	49.85	181.6	153.6	0.28	157.97	158.83	160.13	160.34	160.36
554F	0.90	161.08	80.4	56.73	49.94	174.8	153.9	0.21	157.99	158.38	159.32	160.29	161.01
554G**		161.15	73.3	76.54	50.11	235.8	154.5	0.97					
555A**		161.21	80.1	81.99	50.24	252.6	154.9	0.98					
555B	0.90	161.26	85.0	59.65	50.37	183.9	155.4	0.25	158.54	158.81	159.89	160.74	161.05
555C	1.10	161.21	83.9	58.07	50.24	179.0	154.9	0.22	157.79	158.04	159.05	159.91	160.63
555D**		161.06	73.8	76.80	49.89	236.5	153.8	0.98					
555E	1.00	161.15	79.8	56.23	50.11	173.3	154.5	0.19	157.82	158.13	159.05	160.07	160.65
555F	0.50	161.08	77.1	58.55	49.94	180.4	153.9	0.29	158.17	159.16	160.31	160.54	160.78
555G**		161.15	70.2	73.40	50.11	226.1	154.5	0.93					
556A**		161.30	79.5	80.59	50.46	248.4	155.7	0.94					
556B	1.00	161.30	85.8	59.36	50.46	183.1	155.7	0.24	158.00	158.08	158.94	159.95	160.72
556C	0.70	161.21	84.5	60.69	50.24	187.1	154.9	0.29	157.91	158.45	159.82	160.33	160.36
556D**		161.24	77.5	80.89	50.33	249.2	155.2	1.01					
556E	1.00	161.59	84.7	59.32	51.16	183.2	158.0	0.23	158.47	158.74	159.64	160.70	161.14
556F	0.50	161.66	83.2	62.12	51.33	191.8	158.6	0.31	158.90	159.75	161.05	161.26	161.21
556G**		161.73	76.1	81.06	51.51	250.2	159.2	1.01					
557A**		151.06	72.0	61.95	29.81	183.9	88.6	1.18					
557B	1.00	151.22	79.1	40.63	30.08	120.8	89.4	0.32	148.97	149.27	150.05	150.61	150.91
557C	0.60	151.11	78.3	42.01	29.90	124.8	88.9	0.38	148.82	149.36	150.34	150.50	150.52
557E	1.30	151.22	79.6	40.08	30.08	119.1	89.4	0.31	148.75	149.08	149.58	150.25	150.73
557F	0.50	151.31	77.8	42.23	30.23	125.5	89.9	0.38	149.22	149.90	150.80	150.93	150.89
558A**		151.04	82.1	72.01	29.78	213.7	88.5	1.19					
558B	1.30	151.06	90.1	45.60	29.81	135.4	88.6	0.37	148.99	149.00	149.54	150.10	150.68
558C	0.60	151.09	89.6	46.75	29.87	138.9	88.8	0.40	149.22	149.47	150.26	150.68	150.80
558E	0.75	151.20	89.7	46.45	30.05	138.0	89.3	0.39	149.40	149.74	150.32	150.93	151.00
558F	0.50	151.36	88.8	48.15	30.32	143.1	90.2	0.43	149.60	149.99	150.79	150.95	151.02
558G**		151.60	80.6	72.15	30.71	214.5	91.4	1.22					
559A**		150.88	82.5	72.23	29.52	214.2	87.7	1.20					
559B	1.30	150.97	90.6	45.43	29.67	134.9	88.1	0.37	148.90	148.95	149.62	150.14	150.62

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-3a. (cont'd)

RUN NO.	CAVITY INCHES	TO DEG R	VO FT/SEC	PO PSIA	PV PSIA	HO FT	HV FT	KV	T 1 DEG R	T 2 DEG R	T 3 DEG R	T 4 DEG R	T 5 DEG R
559C	0.70	150.93	90.0	46.60	29.61	138.3	87.9	0.40	148.90	149.15	150.05	150.46	150.53
559D**		151.00	82.3	70.36	29.73	208.8	88.3	1.14					
559E	0.60	151.15	89.9	46.69	29.96	138.7	89.0	0.40	149.44	149.76	150.43	150.89	150.91
560A**		150.75	40.2	36.85	29.32	109.3	87.0	0.89					
560B	0.75	150.91	44.6	30.30	29.58	90.0	87.8	0.07	148.48	148.82	149.76	150.44	150.62
560C	0.50	150.86	43.9	31.22	29.49	92.7	87.6	0.17	148.63	149.26	150.23	150.46	150.50
560D**		150.98	40.4	36.52	29.70	108.5	88.2	0.80					
560E	0.90	151.02	44.4	30.21	29.75	89.7	88.4	0.04	148.32	148.64	149.40	150.16	150.50
560F	0.60	151.16	43.9	30.99	29.99	92.1	89.1	0.10	148.64	149.20	150.21	150.61	150.71
560G	1.00	151.24	44.3	30.16	30.11	89.7	89.5	0.00	148.12	148.39	149.17	149.90	150.34
560H**		151.45	39.2	37.68	30.47	112.1	90.7	0.90					
561A**		140.56	33.7	22.00	15.99	63.1	45.9	0.97					
561B	0.90	140.63	37.0	17.72	16.07	50.8	46.1	0.22	139.05	139.05	139.66	140.00	140.13
561C	1.50	140.62	36.8	17.40	16.05	49.9	46.0	0.18	138.55	138.40	138.91	139.05	139.34
561D**		140.58	33.4	21.55	16.01	61.8	45.9	0.92					
561E	1.30	140.62	36.6	17.42	16.05	50.0	46.0	0.19	138.94	138.91	139.23	139.55	139.82
561F	0.90	140.63	36.2	17.64	16.07	50.6	46.1	0.22	139.00	139.05	139.52	139.90	140.04
561G	0.60	140.63	35.9	17.92	16.07	51.4	46.1	0.27	139.18	139.30	139.86	140.08	140.15
561H**		140.63	33.0	21.34	16.07	61.2	46.1	0.89					
561I	0.75	140.72	35.7	17.87	16.16	51.3	46.4	0.25	139.50	139.63	140.08	140.47	140.47
561J**		140.76	32.6	21.57	16.20	61.9	46.5	0.93					
562A**		140.35	66.8	45.70	15.77	130.9	45.2	1.24					
562C**		140.44	66.8	45.79	15.86	131.2	45.5	1.23					
563A**		139.90	82.0	61.10	15.32	174.8	43.9	1.25					
563E**		140.44	81.6	59.95	15.86	171.8	45.5	1.22					
564B**		140.06	80.8	62.50	15.48	178.8	44.3	1.32					

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-3a. (cont'd)

RUN NO.	P 1 PSIA	P 2 PSIA	P 3 PSIA	P 4 PSIA	P 5 PSIA	P 1,T PSIA	P 2,T PSIA	P 3,T PSIA	P 4,T PSIA	P 5,T PSIA
302B	12.35	12.40	12.25	13.75	12.90	12.28	12.26	12.39	12.69	12.88
302D	12.66	12.76	12.83	15.10	16.40	12.46	12.58	12.97	13.18	13.19
302F	12.44	12.50	12.44	14.20	14.77	12.65	12.62	12.85	13.21	13.32
303B	14.32	14.56	14.60	16.98	18.10	14.26	14.47	14.81	15.21	15.36
304D	14.57	15.14	16.07	19.80	20.73	15.06	15.29	15.77	15.85	15.88
305B	14.10	14.25	14.45	18.05	17.60	14.23	14.31	14.69	15.27	15.43
305D	14.25	14.75	15.55	23.85	27.65	13.94	14.13	14.79	14.97	14.97
305F	13.94	14.27	14.34	18.44	17.44	13.71	13.81	14.21	14.71	14.95
306B	23.74	23.70	23.80	28.34	27.50	22.85	22.83	23.68	24.95	26.32
306D	25.40	25.70	28.73	39.59	44.66	24.13	25.08	26.92	27.02	27.08
307B	25.28	25.78	26.35	31.25	33.90	25.21	25.68	26.89	28.11	28.37
307C	25.90	26.56	28.83	34.16	36.32	25.26	26.27	27.61	27.91	27.86
308B	24.36	24.80	25.28	29.82	32.06	23.78	24.28	25.52	26.89	27.00
308C	24.10	24.37	24.57	28.44	30.00	23.56	23.78	24.90	26.29	26.83
309B	36.55	36.78	37.60	44.83	46.38	35.62	36.23	38.65	41.86	43.44
309C	38.00	38.44	40.74	49.00	53.43	36.58	38.25	41.86	43.63	44.10
309E	38.95	39.40	43.75	52.05	56.90	38.58	41.18	44.58	45.10	45.18
311B	34.45	34.10	35.25	43.45	45.15	34.36	34.56	36.13	39.66	42.51
311C	37.16	37.40	39.76	53.29	69.22	35.86	37.30	41.14	42.97	43.91
312B	23.50	23.45	24.15	31.30	36.45	23.21	23.66	24.90	26.35	26.56
312C	22.52	22.62	23.07	28.97	28.47	21.90	22.20	23.41	24.79	25.73
312D	23.60	24.10	25.10	33.10	48.80	23.04	23.76	25.44	26.27	26.32
315B	12.18	12.38	12.40	13.82	13.03	12.10	12.09	12.20	12.48	12.72
315C	12.34	12.64	12.74	14.19	15.57	12.39	12.45	12.75	13.07	13.16
315D	12.56	12.84	13.24	15.50	16.18	12.55	12.69	13.05	13.19	13.21
316B	14.52	14.77	14.92	17.32	17.57	14.57	14.69	15.09	15.61	15.66
316C	14.40	14.65	14.77	16.82	16.50	14.06	14.16	14.57	14.99	15.27
316D	14.30	14.55	14.65	16.60	15.95	14.09	14.14	14.52	14.86	15.25

Table A-3a. (cont'd)

RUN NO.	P 1 PSIA	P 2 PSIA	P 3 PSIA	P 4 PSIA	P 5 PSIA	P 1,T PSIA	P 2,T PSIA	P 3,T PSIA	P 4,T PSIA	P 5,T PSIA
317B	24.62	24.60	25.07	28.78	28.35	24.31	24.46	25.34	26.86	27.91
317C	25.88	25.88	26.92	32.08	39.22	24.26	24.82	26.64	27.63	27.86
318B	38.42	38.18	39.58	46.58	49.02	37.62	38.29	40.99	44.14	45.34
318D	38.57	38.27	40.25	47.07	50.40	36.44	37.48	40.32	43.01	43.59
319B	38.22	38.08	39.88	47.62	50.28	37.27	38.18	40.95	44.02	44.90
319C	38.22	38.17	40.12	47.82	50.67	36.34	37.30	40.54	43.05	43.98
321B	37.60	37.60	38.50	46.20	47.95	37.44	37.55	39.08	42.62	44.42
322B	36.75	36.87	38.07	45.21	47.88	36.34	36.61	38.40	41.78	43.75
322E	38.82	40.02	47.72	65.02	70.92	37.79	40.17	43.71	43.20	43.59
323D	24.59	25.07	27.77	48.01	56.14	23.91	24.59	26.29	26.29	26.40
325B	24.45	24.28	24.98	29.85	30.68	23.58	23.83	25.00	26.29	27.33
325D	25.52	25.87	29.32	40.22	43.17	23.91	25.10	26.92	26.89	26.92
326C	24.87	25.22	25.65	29.97	30.22	24.64	24.72	25.87	27.33	28.05
326D	25.22	25.49	26.09	30.29	30.92	24.69	24.97	26.27	27.61	28.17
326E	26.02	26.68	28.52	34.11	35.61	25.60	26.37	27.91	28.45	28.59
326F	25.74	26.24	27.16	32.41	34.52	25.26	25.79	27.44	28.34	28.54
326G	25.72	26.02	26.58	30.65	32.62	24.79	25.05	26.37	27.69	28.22
329B	13.67	13.87	13.97	17.47	15.22	13.32	13.34	13.71	14.24	14.52
329D	13.89	14.02	14.08	17.02	15.98	12.93	13.04	13.63	13.99	14.33
329F	14.57	14.87	15.77	24.92	27.27	13.53	13.84	14.64	14.65	14.69
547B	14.12	14.29	14.34	14.87	14.72	14.28	14.11	14.41	14.53	14.67
547C	14.32	14.56	14.78	15.70	17.14	14.48	14.53	15.04	15.36	15.50
547E	14.38	14.58	14.85	15.58	16.72	14.79	14.86	15.18	15.63	15.81
547F	14.36	14.64	14.82	15.44	17.06	14.64	14.71	15.13	15.48	15.70
547H	14.80	15.10	15.62	18.43	19.25	15.13	15.34	15.74	15.96	15.99
548B	14.35	14.80	15.20	16.15	18.10	14.43	14.57	15.18	15.52	15.59
548C	14.65	15.20	15.87	20.42	23.95	14.35	14.53	15.54	15.56	15.43
548E	14.14	14.47	14.67	15.34	15.72	14.14	14.19	14.60	14.92	15.25
548F	14.77	15.24	16.57	24.00	24.32	14.45	14.78	15.50	15.45	15.43

Table A-3a. (cont'd)

RUN NO.	P 1 PSIA	P 2 PSIA	P 3 PSIA	P 4 PSIA	P 5 PSIA	P 1,T PSIA	P 2,T PSIA	P 3,T PSIA	P 4,T PSIA	P 5,T PSIA
549B	24.89	25.14	25.84	27.07	29.32	25.65	25.84	26.86	28.03	28.71
549C	25.30	25.62	26.50	28.58	31.12	25.52	25.84	27.36	28.31	28.74
549E	25.39	25.79	26.57	28.59	31.20	25.68	26.18	27.36	28.65	28.97
549F	26.00	26.62	28.94	32.28	33.08	26.27	27.22	28.71	29.14	29.20
549H	26.04	26.50	28.58	31.78	32.74	26.51	27.41	28.71	29.49	29.46
550B	25.00	25.36	26.68	29.30	35.82	25.00	25.63	26.94	27.97	28.17
550C	25.17	25.65	27.37	33.40	37.30	24.85	25.76	27.47	27.83	27.91
550E	24.86	25.28	26.04	27.58	29.90	24.82	25.39	26.40	27.55	28.22
551B	39.57	39.92	41.62	45.22	49.37	40.43	41.03	42.97	46.03	47.18
551C	40.72	42.07	45.57	52.72	54.52	41.25	42.62	45.87	46.97	48.90
551E	40.62	41.50	43.40	48.60	53.52	41.48	42.62	45.18	47.60	48.06
551F	41.18	42.58	46.56	54.12	54.96	42.12	43.91	46.93	47.97	48.06
554B	40.28	40.20	41.10	43.53	46.43	41.29	41.59	43.47	46.31	47.64
554C	40.30	40.87	42.30	45.45	54.40	41.48	42.31	44.82	47.30	47.85
554D	40.62	41.95	47.65	60.72	58.65	42.85	44.74	47.68	48.18	48.23
554F	41.10	41.68	42.98	46.58	55.88	42.89	43.75	45.83	48.06	49.76
555B	41.22	42.32	43.78	48.72	60.25	44.10	44.70	47.14	49.12	49.85
555C	40.94	41.37	42.60	45.67	51.97	42.47	43.01	45.22	47.18	48.86
555E	40.33	41.36	42.60	45.66	59.80	42.54	43.20	45.22	47.55	48.90
555F	40.55	42.45	49.20	61.70	63.55	43.28	45.46	48.10	48.65	49.20
556B	40.86	41.21	42.53	45.01	49.03	42.93	43.09	44.98	47.26	49.08
556C	42.04	42.86	45.34	54.29	61.04	42.74	43.91	46.97	48.14	48.23
556E	41.59	42.45	43.75	46.59	54.82	43.95	44.54	46.56	49.03	50.07
556F	42.45	43.72	48.59	65.15	59.15	44.90	46.81	49.85	50.37	50.24
557B	25.00	25.75	26.65	28.78	34.73	26.53	27.00	28.19	29.08	29.58
557C	25.46	26.36	28.08	38.08	42.19	26.32	27.13	28.65	28.91	28.94
557E	24.35	25.01	25.95	27.48	29.83	26.21	26.70	27.47	28.51	29.29
557F	25.15	26.00	28.85	43.11	41.53	26.92	27.97	29.40	29.61	29.55
558B	25.15	25.67	26.20	27.45	28.95	26.56	26.59	27.41	28.28	29.20
558C	25.47	26.51	27.85	32.25	48.21	26.92	27.30	28.54	29.20	29.40
558E	25.48	26.52	27.68	31.48	47.42	27.19	27.72	28.62	29.61	29.73
558F	26.42	27.38	29.35	44.35	42.70	27.49	28.11	29.37	29.64	29.75

Table A-3a. (cont'd)

RUN NO.	P 1 PSIA	P 2 PSIA	P 3 PSIA	P 4 PSIA	P 5 PSIA	P 1,T PSIA	P 2,T PSIA	P 3,T PSIA	P 4,T PSIA	P 5,T PSIA
559B	25.13	25.83	26.40	28.00	30.73	26.43	26.51	27.52	28.34	29.11
559C	25.52	26.56	27.88	33.02	47.60	26.43	26.81	28.19	28.85	28.97
559E	25.66	26.61	27.99	33.71	47.87	27.24	27.74	28.79	29.55	29.58
560B	24.60	25.22	26.16	28.92	31.30	25.81	26.32	27.74	28.82	29.11
560C	25.12	25.99	28.35	32.02	32.84	26.02	26.97	28.48	28.85	28.91
560E	24.58	25.23	26.03	28.08	35.04	25.57	26.05	27.19	28.37	28.91
560F	25.09	25.93	27.49	31.19	32.53	26.05	26.89	28.45	29.08	29.26
560G	24.64	25.14	25.84	27.52	30.00	25.29	25.68	26.83	27.97	28.65
561B	14.30	14.52	14.74	15.55	17.09	14.50	14.50	15.09	15.43	15.56
561C	14.22	14.32	14.40	14.86	15.14	14.03	13.89	14.36	14.50	14.78
561E	14.26	14.38	14.46	14.88	15.38	14.40	14.36	14.67	14.99	15.25
561F	14.42	14.60	14.78	15.48	17.16	14.45	14.50	14.95	15.32	15.46
561G	14.54	14.84	15.02	16.67	18.79	14.62	14.74	15.29	15.50	15.57
561I	14.32	14.79	15.10	16.37	18.57	14.93	15.06	15.50	15.90	15.90

Table A-3a. (cont'd)

RUN NO.	H 1 FT	H 2 FT	H 3 FT	H 4 FT	H 5 FT	H 1,T FT	H 2,T FT	H 3,T FT	H 4,T FT	H 5,T FT
302B	35.0	35.1	34.7	39.2	36.6	34.8	34.7	35.1	36.0	36.6
302D	35.9	36.2	36.4	43.2	47.1	35.3	35.7	36.8	37.5	37.5
302F	35.3	35.4	35.3	40.5	42.2	35.9	35.8	36.5	37.6	37.9
303B	40.9	41.6	41.7	48.9	52.3	40.7	41.3	42.3	43.5	44.0
304D	41.6	43.3	46.1	57.4	60.3	43.1	43.8	45.2	45.4	45.5
305B	40.2	40.7	41.2	52.1	50.7	40.6	40.8	42.0	43.7	44.2
305D	40.7	42.1	44.5	69.9	81.8	39.7	40.3	42.3	42.8	42.8
305F	39.7	40.7	40.9	53.3	50.3	39.0	39.3	40.5	42.0	42.7
306B	69.6	69.4	69.8	83.9	81.3	66.8	66.7	69.4	73.3	77.6
306D	74.7	75.7	85.2	119.9	136.5	70.8	73.7	79.5	79.8	80.0
307B	74.4	75.9	77.7	93.1	101.6	74.1	75.6	79.4	83.2	84.0
307C	76.3	78.4	85.5	102.4	109.3	74.3	77.4	81.6	82.6	82.4
308B	71.5	72.9	74.4	88.6	95.7	69.7	71.3	75.1	79.4	79.7
308C	70.7	71.5	72.1	84.2	89.2	69.0	69.7	73.2	77.5	79.2
309B	110.1	110.8	113.5	137.0	142.1	107.1	109.1	116.8	127.3	132.4
309C	114.8	116.2	123.6	150.8	165.6	110.2	115.6	127.3	133.1	134.6
309E	117.8	119.3	133.5	161.0	177.3	116.6	125.1	136.2	137.9	138.2
311B	103.3	102.2	105.9	132.5	138.1	103.0	103.7	108.7	120.1	129.4
311C	112.0	112.8	120.5	165.1	219.5	107.9	112.5	124.9	130.9	134.0
312B	68.8	68.7	70.8	93.3	109.8	67.9	69.3	73.2	77.7	78.4
312C	65.8	66.1	67.5	85.9	84.3	63.9	64.8	68.5	72.8	75.8
312D	69.1	70.7	73.8	99.0	150.1	67.4	69.6	74.9	77.4	77.6
315B	34.5	35.1	35.1	39.4	37.0	34.3	34.2	34.6	35.4	36.1
315C	35.0	35.9	36.2	40.5	44.6	35.1	35.3	36.2	37.1	37.4
315D	35.6	36.5	37.6	44.4	46.4	35.6	36.0	37.1	37.5	37.6
316B	41.5	42.2	42.7	49.9	50.6	41.6	42.0	43.2	44.7	44.9
316C	41.1	41.8	42.2	48.4	47.4	40.1	40.4	41.6	42.9	43.7
316D	40.8	41.5	41.8	47.7	45.8	40.2	40.3	41.4	42.5	43.6

Table A-3a. (cont'd)

RUN NO.	H 1 FT	H 2 FT	H 3 FT	H 4 FT	H 5 FT	H 1,T FT	H 2,T FT	H 3,T FT	H 4,T FT	H 5,T FT
317B	72.3	72.2	73.7	85.3	84.0	71.3	71.8	74.5	79.3	82.6
317C	76.2	76.2	79.5	95.8	118.7	71.2	72.9	78.6	81.7	82.4
318B	116.1	115.3	119.9	142.8	150.9	113.5	115.7	124.5	134.8	138.7
318D	116.6	115.6	122.0	144.4	155.5	109.7	113.1	122.3	131.0	133.0
319B	115.5	115.0	120.8	146.2	155.1	112.4	115.3	124.3	134.4	137.3
319C	115.5	115.3	121.6	146.9	156.4	109.4	112.5	123.0	131.2	134.3
321B	113.5	113.5	116.4	141.5	147.3	113.0	113.3	118.2	129.8	135.7
322B	110.7	111.1	115.0	138.3	147.1	109.4	110.3	116.0	127.0	133.5
322E	117.4	121.3	146.6	205.0	225.4	114.1	121.8	133.3	131.7	133.0
323D	72.2	73.7	82.1	147.5	174.7	70.1	72.2	77.5	77.5	77.8
325B	71.8	71.2	73.4	88.7	91.3	69.1	69.9	73.5	77.5	80.8
325D	75.1	76.2	87.0	122.0	131.6	70.1	73.8	79.5	79.4	79.5
326C	73.1	74.2	75.5	89.1	89.9	72.4	72.6	76.2	80.8	83.0
326D	74.2	75.0	76.9	90.1	92.1	72.5	73.4	77.4	81.6	83.4
326E	76.7	78.7	84.5	102.2	107.1	75.4	77.8	82.6	84.3	84.7
326F	75.8	77.3	80.2	96.8	103.6	74.3	75.9	81.1	83.9	84.6
326G	75.7	76.7	78.4	91.2	97.5	72.8	73.6	77.8	81.9	83.6
329B	38.9	39.5	39.8	50.3	43.6	37.9	37.9	39.0	40.6	41.4
329D	39.6	40.0	40.1	49.0	45.8	36.7	37.0	38.8	39.9	40.9
329F	41.6	42.5	45.2	73.2	80.6	38.5	39.4	41.8	41.9	42.0
547B	40.3	40.8	40.9	42.5	42.1	40.7	40.2	41.1	41.5	41.9
547C	40.9	41.6	42.2	45.0	49.3	41.3	41.5	43.0	44.0	44.4
547E	41.0	41.6	42.4	44.6	48.1	42.3	42.5	43.4	44.8	45.3
547F	41.0	41.8	42.4	44.2	49.1	41.8	42.0	43.3	44.3	45.0
547H	42.3	43.2	44.8	53.3	55.8	43.3	43.9	45.1	45.8	45.9
548B	41.0	42.3	43.5	46.4	52.3	41.2	41.6	43.4	44.5	44.7
548C	41.8	43.5	45.5	59.3	70.2	40.9	41.5	44.5	44.6	44.2
548E	40.3	41.3	41.9	43.9	45.1	40.3	40.5	41.7	42.6	43.6
548F	42.2	43.6	47.6	70.4	71.4	41.2	42.2	44.4	44.2	44.2

Table A-3a. (cont'd)

RUN NO.	H 1 FT	H 2 FT	H 3 FT	H 4 FT	H 5 FT	H 1,T FT	H 2,T FT	H 3,T FT	H 4,T FT	H 5,T FT
549B	73.1	73.9	76.1	79.9	87.0	75.5	76.1	79.3	82.9	85.1
549C	74.4	75.4	78.2	84.7	92.7	75.1	76.1	80.8	83.8	85.2
549E	74.7	75.9	78.4	84.7	93.0	75.6	77.2	80.8	84.9	85.9
549F	76.6	78.5	85.8	96.4	99.0	77.4	80.4	85.1	86.5	86.6
549H	76.7	78.2	84.7	94.8	97.9	78.2	81.0	85.1	87.6	87.5
550B	73.5	74.6	78.7	87.0	107.7	73.5	75.4	79.5	82.8	83.4
550C	74.0	75.5	80.9	100.0	112.5	73.0	75.8	81.2	82.3	82.6
550E	73.0	74.4	76.7	81.5	88.9	72.9	74.7	77.8	81.5	83.6
551B	119.8	121.0	126.5	138.3	152.0	122.6	124.6	130.9	141.0	144.8
551C	123.6	128.0	139.5	163.2	169.3	125.3	129.8	140.4	144.1	150.5
551E	123.3	126.1	132.3	149.5	165.9	126.0	129.8	138.2	146.2	147.7
551F	125.1	129.6	142.7	167.9	170.7	128.2	134.0	144.0	147.4	147.7
554B	122.1	121.9	124.8	132.8	142.3	125.4	126.4	132.6	141.9	146.3
554C	122.2	124.1	128.7	139.1	168.9	126.0	128.8	137.0	145.2	147.0
554D	123.3	127.6	146.3	190.3	183.2	130.5	136.7	146.4	148.1	148.2
554F	124.8	126.7	131.0	142.8	173.9	130.7	133.5	140.3	147.7	153.3
555B	125.2	128.8	133.6	149.9	188.7	134.6	136.6	144.6	151.2	153.6
555C	124.3	125.7	129.7	139.3	160.7	129.3	131.0	138.3	144.8	150.4
555E	122.3	125.7	129.7	139.3	187.1	129.5	131.7	138.3	146.0	150.5
555F	123.0	129.2	151.5	193.6	199.9	131.9	139.1	147.8	149.6	151.5
556B	124.0	125.2	129.5	137.6	150.9	130.8	131.3	137.5	145.1	151.1
556C	127.9	130.6	138.7	168.5	191.4	130.2	134.0	144.1	148.0	148.2
556E	126.4	129.2	133.5	142.8	170.3	134.1	136.1	142.7	150.9	154.4
556F	129.2	133.4	149.5	205.4	184.9	137.3	143.5	153.6	155.4	154.9
557B	73.5	75.8	78.6	85.3	104.2	78.3	79.7	83.5	86.3	87.8
557C	74.9	77.7	83.1	115.0	128.4	77.6	80.2	84.9	85.7	85.8
557E	71.5	73.5	76.4	81.2	88.6	77.3	78.8	81.2	84.5	86.9
557F	73.9	76.6	85.5	131.4	126.2	79.5	82.8	87.3	87.9	87.7
558B	73.9	75.6	77.2	81.1	85.9	78.4	78.4	81.0	83.7	86.6
558C	74.9	78.2	82.4	96.3	148.2	79.5	80.7	84.6	86.6	87.3
558E	75.0	78.2	81.9	93.9	145.6	80.3	82.0	84.8	87.9	88.3
558F	77.9	80.9	87.1	135.5	130.0	81.3	83.2	87.2	88.0	88.4

Table A-3a. (cont'd)

RUN NO.	H 1 FT	H 2 FT	H 3 FT	H 4 FT	H 5 FT	H 1,T FT	H 2,T FT	H 3,T FT	H 4,T FT	H 5,T FT
559B	73.9	76.1	77.9	82.9	91.5	77.9	78.2	81.4	83.9	86.4
559C	75.1	78.4	82.5	98.8	146.2	77.9	79.1	83.5	85.5	85.9
559E	75.5	78.5	82.8	101.0	147.1	80.5	82.1	85.4	87.7	87.8
560B	72.2	74.2	77.1	85.8	93.3	76.0	77.6	82.1	85.5	86.4
560C	73.9	76.6	84.0	95.6	98.2	76.7	79.6	84.4	85.5	85.7
560E	72.2	74.2	76.7	83.1	105.2	75.3	76.8	80.3	84.0	85.7
560F	73.8	76.4	81.3	92.9	97.2	76.8	79.4	84.3	86.3	86.8
560G	72.4	73.9	76.1	81.4	89.2	74.4	75.6	79.2	82.8	84.9
561B	40.8	41.5	42.1	44.5	49.2	41.4	41.4	43.2	44.2	44.6
561C	40.6	40.9	41.1	42.5	43.3	40.0	39.6	41.0	41.4	42.2
561E	40.7	41.0	41.3	42.5	44.0	41.1	41.0	41.9	42.9	43.6
561F	41.2	41.7	42.2	44.3	49.4	41.2	41.4	42.7	43.9	44.3
561G	41.5	42.4	43.0	47.9	54.4	41.8	42.1	43.8	44.4	44.6
561I	40.9	42.3	43.2	47.0	53.7	42.7	43.1	44.4	45.6	45.6

Table A-3b. Experimental cavitation data for 0.357-inch ogive using liquid nitrogen (SI Units).

RUN NO.	CAVITY CM	TO DEG K	VO M/SEC	PO N/CM/CM	PV N/CM/CM	HO M	HV M	KV	T 1 DEG K	T 2 DEG K	T 3 DEG K	T 4 DEG K	T 5 DEG K
302A**		76.58	8.6	12.58	9.23	15.8	11.6	1.13					
302B	3.81	76.62	9.4	10.41	9.27	13.1	11.7	0.32	75.87	75.86	75.94	76.14	76.26
302D	1.52	76.63	9.5	10.78	9.29	13.6	11.7	0.41	75.99	76.07	76.32	76.45	76.46
302E**		76.70	8.5	12.29	9.36	15.5	11.8	0.99					
302F	2.03	76.63	9.1	10.55	9.29	13.3	11.7	0.38	76.11	76.09	76.24	76.47	76.54
302G**		76.58	8.3	12.27	9.23	15.4	11.6	1.10					
303A**		77.99	9.8	15.58	10.90	19.7	13.8	1.22					
303B	2.54	78.04	11.3	12.69	10.96	16.1	13.9	0.34	77.11	77.23	77.43	77.66	77.74
303C**		78.08	10.1	15.36	11.01	19.5	14.0	1.06					
304A**		78.01	10.0	15.49	10.93	19.6	13.8	1.14					
304D	1.27	78.10	10.8	13.31	11.04	16.9	14.0	0.49	77.57	77.70	77.97	78.01	78.03
304E**		78.12	9.9	15.48	11.07	19.6	14.0	1.13					
305A**		77.74	15.5	21.37	10.59	27.0	13.4	1.12					
305B	2.54	77.91	17.0	15.75	10.80	20.0	13.7	0.42	77.09	77.14	77.36	77.69	77.78
305D	1.52	77.83	16.7	16.44	10.70	20.8	13.5	0.51	76.92	77.03	77.42	77.52	77.52
305E**		77.86	15.5	21.27	10.74	26.9	13.6	1.09					
305F	2.29	77.77	16.8	15.58	10.63	19.7	13.5	0.44	76.78	76.84	77.08	77.37	77.51
305G**		77.87	15.2	22.03	10.75	27.9	13.6	1.21					
306A**		83.34	17.6	33.80	19.40	44.2	25.4	1.20					
306B	3.81	83.38	19.7	24.34	19.48	31.9	25.5	0.32	81.32	81.31	81.66	82.16	82.68
306D	1.14	83.39	19.0	26.10	19.50	34.2	25.5	0.47	81.84	82.21	82.90	82.94	82.96
306E**		83.34	17.2	33.85	19.40	44.3	25.4	1.26					
307A**		83.59	12.6	27.53	19.89	36.1	26.1	1.24					
307B	2.29	83.62	14.3	22.06	19.95	28.9	26.2	0.26	82.26	82.44	82.89	83.33	83.42
307C	1.14	83.56	13.9	22.93	19.83	30.0	26.0	0.41	82.28	82.66	83.15	83.26	83.24
307D**		83.62	12.6	27.13	19.95	35.6	26.2	1.16					
308A**		83.26	12.7	26.78	19.25	35.0	25.2	1.19					
308B	1.90	83.20	14.4	21.50	19.13	28.1	25.0	0.29	81.70	81.90	82.38	82.89	82.93

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-3b. (cont'd)

RUN NO.	CAVITY CM	TO DEG K	VO M/SEC	PO N/CM/CM	PV N/CM/CM	HO M	HV M	KV	T 1 DEG K	T 2 DEG K	T 3 DEG K	T 4 DEG K	T 5 DEG K
308C	2.29	83.24	14.5	21.17	19.21	27.7	25.1	0.24	81.61	81.70	82.14	82.67	82.87
308D**		83.19	12.7	26.32	19.11	34.4	25.0	1.15					
309A**		88.50	17.0	43.40	31.57	58.7	42.7	1.09					
309B	3.81	88.48	19.2	33.51	31.51	45.3	42.6	0.14	85.76	85.94	86.63	87.50	87.91
309C	1.90	88.52	19.1	34.27	31.62	46.4	42.8	0.19	86.04	86.52	87.50	87.96	88.08
309D**		88.46	17.0	43.44	31.46	58.7	42.6	1.10					
309E	1.27	88.48	19.1	35.06	31.51	47.4	42.6	0.26	86.61	87.32	88.20	88.33	88.35
310A**		88.64	13.8	39.34	31.96	53.3	43.3	1.03					
310F**		88.73	14.1	39.70	32.22	53.8	43.7	1.00					
311A**		88.34	23.8	54.83	31.12	74.0	42.1	1.11					
311B	3.05	88.40	26.6	39.02	31.29	52.8	42.3	0.29	85.38	85.44	85.91	86.91	87.67
311C	1.52	88.45	26.3	40.38	31.43	54.6	42.5	0.34	85.83	86.25	87.31	87.79	88.03
311E**		88.36	23.3	55.30	31.18	74.7	42.2	1.18					
312B	2.29	83.00	25.4	30.13	18.75	39.3	24.5	0.45	81.47	81.65	82.14	82.69	82.77
312C	3.05	83.01	24.7	29.11	18.77	38.0	24.5	0.43	80.92	81.05	81.55	82.10	82.46
312D	1.52	83.00	23.5	28.75	18.75	37.5	24.5	0.46	81.40	81.69	82.35	82.66	82.68
312E**		83.07	20.1	38.58	18.88	50.4	24.7	1.25					
313A**		77.58	24.5	41.48	10.39	52.4	13.1	1.28					
315A**		76.54	8.2	12.32	9.19	15.5	11.5	1.15					
315B	3.81	76.53	9.0	10.17	9.17	12.8	11.5	0.30	75.75	75.74	75.82	76.00	76.16
315C	2.03	76.58	9.1	10.39	9.23	13.1	11.6	0.35	75.94	75.98	76.18	76.38	76.44
315D	1.27	76.57	8.8	10.63	9.22	13.4	11.6	0.45	76.05	76.14	76.37	76.46	76.47
315E**		76.55	7.9	12.15	9.20	15.3	11.6	1.17					
315I**		76.54	7.9	12.24	9.19	15.4	11.5	1.21					
316A**		78.07	9.6	16.49	11.00	20.9	14.0	1.49					
316B	2.54	78.17	11.2	12.84	11.13	16.3	14.1	0.34	77.29	77.36	77.59	77.88	77.91
316C	3.30	78.10	11.3	12.76	11.04	16.2	14.0	0.33	76.99	77.05	77.29	77.53	77.69
316D	3.81	78.16	11.3	12.69	11.12	16.1	14.1	0.31	77.01	77.04	77.26	77.46	77.68
316G**		78.22	9.6	16.96	11.19	21.5	14.2	1.55					

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-3b. (cont'd)

RUN NO.	CAVITY CM	TO DEG K	VO M/SEC	PO N/CM/CM	PV N/CM/CM	HO M	HV M	KV	T 1 DEG K	T 2 DEG K	T 3 DEG K	T 4 DEG K	T 5 DEG K
317A**		83.28	17.5	34.18	19.28	44.7	25.2	1.25					
317B	3.81	83.68	19.8	24.89	20.07	32.6	26.3	0.32	81.91	81.97	82.31	82.88	83.26
317C	2.29	83.75	19.4	25.68	20.21	33.7	26.5	0.37	81.89	82.11	82.80	83.16	83.24
318A**		88.67	16.9	44.24	32.05	59.9	43.4	1.14					
318B	3.81	88.78	19.2	34.23	32.36	46.4	43.9	0.13	86.34	86.53	87.27	88.09	88.39
318D	3.05	88.69	19.0	34.23	32.10	46.4	43.5	0.16	86.00	86.30	87.09	87.80	87.95
318E**		88.75	16.7	44.23	32.27	59.9	43.8	1.14					
319B	3.05	88.58	19.4	34.16	31.79	46.3	43.1	0.17	86.24	86.50	87.26	88.06	88.28
319C	2.54	88.54	19.1	34.21	31.68	46.3	42.9	0.18	85.97	86.25	87.15	87.81	88.05
320A**		88.55	13.7	39.83	31.71	53.9	42.9	1.14					
320D**		88.71	13.6	39.73	32.16	53.8	43.6	1.08					
321A**		88.69	23.5	56.60	32.10	76.6	43.5	1.18					
321B	3.05	88.66	26.2	40.30	32.02	54.6	43.4	0.32	86.29	86.32	86.75	87.70	88.16
321F**		88.72	23.3	54.55	32.19	73.9	43.6	1.09					
322B	3.30	88.52	26.3	40.16	31.62	54.3	42.8	0.33	85.97	86.05	86.56	87.48	87.99
322E	1.02	88.56	25.8	42.90	31.74	58.1	43.0	0.44	86.39	87.05	87.98	87.85	87.95
323A**		83.10	24.1	48.07	18.94	62.7	24.7	1.29					
323D	1.27	83.23	26.3	33.02	19.19	43.2	25.1	0.51	81.75	82.02	82.67	82.67	82.71
323E**		83.28	23.8	45.40	19.28	59.3	25.2	1.18					
324A**		83.01	24.4	47.19	18.77	61.6	24.5	1.22					
325A**		83.38	17.9	35.15	19.48	46.0	25.5	1.26					
325B	3.30	83.40	20.0	25.01	19.52	32.7	25.6	0.35	81.62	81.72	82.18	82.67	83.05
325D	1.14	83.38	19.1	26.49	19.48	34.7	25.5	0.49	81.75	82.22	82.90	82.89	82.90
325F**		83.45	17.1	33.88	19.62	44.3	25.7	1.25					
326B**		83.64	12.9	27.08	19.99	35.5	26.2	1.10					
326C	3.81	83.67	14.7	21.77	20.05	28.5	26.3	0.21	82.04	82.07	82.51	83.05	83.31

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-3b. (cont'd)

RUN NO.	CAVITY CM	TO DEG K	VO M/SEC	PO N/CM/CM	PV N/CM/CM	HO M	HV M	KV	T 1 DEG K	T 2 DEG K	T 3 DEG K	T 4 DEG K	T 5 DEG K
326D	2.54	83.71	14.5	22.01	20.13	28.9	26.4	0.23	82.06	82.17	82.66	83.15	83.35
326E	1.27	83.76	14.0	22.95	20.23	30.1	26.5	0.36	82.41	82.70	83.26	83.45	83.50
326F	1.90	83.81	14.1	22.47	20.33	29.5	26.7	0.28	82.28	82.48	83.09	83.41	83.48
326G	2.54	83.83	14.2	22.24	20.37	29.2	26.7	0.24	82.10	82.20	82.70	83.18	83.37
326H**		84.05	12.6	27.18	20.82	35.7	27.4	1.03					
327E**		77.78	23.8	40.50	10.64	51.2	13.5	1.31					
328D**		77.78	23.5	40.51	10.64	51.2	13.5	1.34					
329A**		77.75	15.4	23.13	10.60	29.3	13.4	1.31					
329B	4.06	77.78	17.0	15.60	10.64	19.7	13.5	0.42	76.54	76.55	76.78	77.10	77.26
329D	3.30	77.81	16.9	15.55	10.68	19.7	13.5	0.42	76.29	76.36	76.73	76.95	77.15
329F	1.27	77.87	16.4	16.49	10.75	20.9	13.6	0.53	76.67	76.86	77.33	77.34	77.36
329G**		77.92	15.1	21.82	10.81	27.6	13.7	1.20					
330A**		77.70	15.4	22.28	10.54	28.2	13.3	1.23					
330D**		78.22	14.8	22.35	11.19	28.4	14.2	1.27					
547A**		78.13	10.0	14.95	11.08	19.0	14.1	0.97					
547B	4.44	78.13	11.1	12.01	11.08	15.2	14.1	0.19	77.12	77.02	77.20	77.27	77.35
547C	2.54	78.14	11.0	12.26	11.09	15.6	14.1	0.24	77.24	77.27	77.56	77.74	77.82
547D**		78.18	10.0	14.89	11.14	18.9	14.1	0.94					
547E	2.29	78.15	10.9	12.24	11.10	15.5	14.1	0.24	77.42	77.46	77.64	77.89	77.99
547F	2.79	78.17	10.7	12.19	11.13	15.5	14.1	0.23	77.33	77.37	77.61	77.81	77.93
547G**		78.16	9.7	14.80	11.12	18.8	14.1	0.98					
547H	1.27	78.17	10.5	12.58	11.13	16.0	14.1	0.33	77.61	77.73	77.95	78.07	78.09
548A**		78.19	14.6	20.18	11.15	25.6	14.2	1.05					
548B	2.29	78.22	15.8	14.72	11.19	18.7	14.2	0.35	77.21	77.29	77.64	77.83	77.87
548C	1.52	78.24	15.6	15.20	11.22	19.3	14.2	0.41	77.16	77.27	77.84	77.85	77.78
548D**		78.22	14.3	20.44	11.19	25.9	14.2	1.12					
548E	3.30	78.24	15.7	14.39	11.22	18.3	14.2	0.32	77.04	77.07	77.31	77.49	77.68
548F	1.27	78.23	15.2	15.39	11.21	19.5	14.2	0.45	77.22	77.41	77.82	77.79	77.78
548G**		78.27	14.3	19.79	11.26	25.1	14.3	1.04					

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-3b. (cont'd)

RUN NO.	CAVITY CM	TO DEG K	VO M/SEC	PO N/CM/CM	PV N/CM/CM	HO M	HV M	KV	T 1 DEG K	T 2 DEG K	T 3 DEG K	T 4 DEG K	T 5 DEG K
549A**		83.78	12.0	26.19	20.27	34.4	26.6	1.06					
549B	2.79	83.87	13.6	20.80	20.45	27.3	26.9	0.05	82.43	82.50	82.88	83.30	83.54
549C	2.29	83.85	13.4	21.04	20.41	27.6	26.8	0.09	82.38	82.50	83.06	83.40	83.55
549D**		83.85	11.9	25.95	20.41	34.1	26.8	1.01					
549E	2.54	83.86	13.3	21.01	20.43	27.6	26.8	0.08	82.44	82.63	83.06	83.52	83.63
549F	1.27	83.88	13.0	21.73	20.47	28.5	26.9	0.19	82.66	83.01	83.54	83.69	83.71
549G**		83.89	11.7	25.48	20.49	33.4	26.9	0.93					
549H	1.52	83.92	13.0	21.61	20.56	28.4	27.0	0.16	82.75	83.08	83.54	83.81	83.80
550A**		83.71	17.2	31.44	20.13	41.2	26.4	0.98					
550B	2.29	83.72	18.7	23.88	20.15	31.3	26.4	0.27	82.18	82.42	82.91	83.28	83.35
550C	1.52	83.72	18.6	24.27	20.15	31.8	26.4	0.31	82.12	82.47	83.10	83.23	83.26
550D**		83.71	17.1	31.30	20.13	41.0	26.4	0.98					
550E	2.79	83.74	18.5	23.37	20.19	30.7	26.5	0.24	82.11	82.33	82.71	83.13	83.37
550F**		83.76	16.5	32.12	20.23	42.1	26.5	1.12					
551A**		89.21	17.5	45.24	33.60	61.5	45.7	1.01					
551B	3.30	89.30	19.8	34.90	33.87	47.5	46.1	0.07	87.12	87.28	87.79	88.56	88.84
551C	1.90	89.29	19.6	36.14	33.84	49.2	46.0	0.16	87.34	87.70	88.52	88.79	89.25
551D**		89.32	17.8	44.50	33.92	60.5	46.2	0.89					
551E	2.29	89.35	19.7	35.55	34.01	48.4	46.3	0.11	87.40	87.70	88.35	88.94	89.05
551F	1.52	89.37	19.5	36.49	34.07	49.7	46.4	0.17	87.57	88.03	88.78	89.03	89.05
552A**		89.51	14.2	40.06	34.49	54.6	47.0	0.74					
552C**		89.51	14.3	39.08	34.49	53.2	47.0	0.60					
552E**		89.55	13.9	39.89	34.61	54.4	47.2	0.73					
553A**		89.55	14.4	40.27	34.61	54.9	47.2	0.73					
553D**		89.50	14.3	40.36	34.46	55.0	47.0	0.77					
553G**		89.56	14.3	40.29	34.64	54.9	47.2	0.74					
554A**		89.46	22.2	51.87	34.34	70.6	46.8	0.95					
554B	3.30	89.45	24.5	38.39	34.31	52.3	46.7	0.18	87.35	87.43	87.92	88.63	88.95
554C	2.54	89.48	24.5	38.85	34.40	52.9	46.9	0.20	87.40	87.62	88.26	88.87	89.00

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-3b. (cont'd)

RUN NO.	CAVITY CM	TO DEG K	VO M/SEC	PO N/CM/CM	PV N/CM/CM	HO M	HV M	KV	T 1 DEG K	T 2 DEG K	T 3 DEG K	T 4 DEG K	T 5 DEG K
554D	1.27	89.47	24.3	40.64	34.37	55.4	46.8	0.28	87.76	88.24	88.96	89.08	89.09
554F	2.29	89.49	24.5	39.11	34.43	53.3	46.9	0.21	87.77	87.99	88.51	89.05	89.45
554G**		89.53	22.3	52.77	34.55	71.9	47.1	0.97					
555A**		89.56	24.4	56.53	34.64	77.0	47.2	0.98					
555B	2.29	89.59	25.9	41.13	34.73	56.1	47.4	0.25	88.08	88.23	88.83	89.30	89.47
555C	2.79	89.56	25.6	40.04	34.64	54.6	47.2	0.22	87.66	87.80	88.36	88.84	89.24
555D**		89.48	22.5	52.95	34.40	72.1	46.9	0.98					
555E	2.54	89.53	24.3	38.77	34.55	52.8	47.1	0.19	87.68	87.85	88.36	88.93	89.25
555F	1.27	89.49	23.5	40.37	34.43	55.0	46.9	0.29	87.87	88.42	89.06	89.19	89.32
555G**		89.53	21.4	50.61	34.55	68.9	47.1	0.93					
556A**		89.61	24.2	55.56	34.79	75.7	47.4	0.94					
556B	2.54	89.61	26.2	40.93	34.79	55.8	47.4	0.24	87.78	87.82	88.30	88.86	89.29
556C	1.78	89.56	25.7	41.84	34.64	57.0	47.2	0.29	87.73	88.03	88.79	89.07	89.09
556D**		89.58	23.6	55.77	34.70	76.0	47.3	1.01					
556E	2.54	89.77	25.8	40.90	35.27	55.8	48.2	0.23	88.04	88.19	88.69	89.28	89.52
556F	1.27	89.81	25.4	42.83	35.39	58.5	48.3	0.31	88.28	88.75	89.47	89.59	89.56
556G**		89.85	23.2	55.89	35.52	76.3	48.5	1.01					
557A**		83.92	21.9	42.71	20.56	56.1	27.0	1.18					
557B	2.54	84.01	24.1	28.01	20.74	36.8	27.3	0.32	82.76	82.93	83.36	83.67	83.84
557C	1.52	83.95	23.9	28.96	20.62	38.0	27.1	0.38	82.68	82.98	83.52	83.61	83.62
557E	3.30	84.01	24.0	27.63	20.74	36.3	27.3	0.31	82.64	82.82	83.10	83.47	83.74
557F	1.27	84.06	23.7	29.12	20.84	38.3	27.4	0.38	82.90	83.28	83.78	83.85	83.83
558A**		83.91	25.0	49.65	20.54	65.1	27.0	1.19					
558B	3.30	83.92	27.5	31.44	20.56	41.3	27.0	0.37	82.77	82.78	83.08	83.39	83.71
558C	1.52	83.94	27.3	32.23	20.60	42.3	27.1	0.40	82.90	83.04	83.48	83.71	83.78
558E	1.90	84.00	27.3	32.03	20.72	42.1	27.2	0.39	83.00	83.19	83.51	83.85	83.89
558F	1.27	84.09	27.1	33.20	20.90	43.6	27.5	0.43	83.11	83.33	83.77	83.86	83.90
558G**		84.22	24.6	49.75	21.17	65.4	27.9	1.22					
559A**		83.82	25.1	49.80	20.35	65.3	26.7	1.20					
559B	3.30	83.87	27.6	31.32	20.45	41.1	26.9	0.37	82.72	82.75	83.12	83.41	83.68

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-3b. (cont'd)

RUN NO.	CAVITY CM	TO DEG K	VO M/SEC	PO N/CM/CM	PV N/CM/CM	HO M	HV M	KV	T 1 DEG K	T 2 DEG K	T 3 DEG K	T 4 DEG K	T 5 DEG K
559C	1.78	83.85	27.4	32.13	20.41	42.2	26.8	0.40	82.72	82.86	83.36	83.59	83.63
559D**		83.89	25.1	48.51	20.49	63.6	26.9	1.14					
559E	1.52	83.97	27.4	32.19	20.66	42.3	27.1	0.40	83.02	83.20	83.57	83.83	83.84
560A**		83.75	12.3	25.41	20.21	33.3	26.5	0.89					
560B	1.90	83.84	13.6	20.89	20.39	27.4	26.8	0.07	82.49	82.68	83.20	83.58	83.68
560C	1.27	83.81	13.4	21.53	20.33	28.3	26.7	0.17	82.57	82.92	83.46	83.59	83.61
560D**		83.88	12.3	25.18	20.47	33.1	26.9	0.80					
560E	2.29	83.90	13.5	20.83	20.52	27.4	26.9	0.04	82.40	82.58	83.00	83.42	83.61
560F	1.52	83.98	13.4	21.37	20.68	28.1	27.2	0.10	82.58	82.89	83.45	83.67	83.73
560G	2.54	84.02	13.5	20.79	20.76	27.3	27.3	0.00	82.29	82.44	82.87	83.28	83.52
560H**		84.14	12.0	25.98	21.01	34.2	27.6	0.90					
561A**		78.09	10.3	15.17	11.03	19.2	14.0	0.97					
561B	2.29	78.13	11.3	12.22	11.08	15.5	14.1	0.22	77.25	77.25	77.59	77.78	77.85
561C	3.81	78.12	11.2	12.00	11.07	15.2	14.0	0.18	76.97	76.89	77.17	77.25	77.41
561D**		78.10	10.2	14.86	11.04	18.8	14.0	0.92					
561E	3.30	78.12	11.1	12.01	11.07	15.2	14.0	0.19	77.19	77.17	77.35	77.53	77.68
561F	2.29	78.13	11.0	12.16	11.08	15.4	14.1	0.22	77.22	77.25	77.51	77.72	77.80
561G	1.52	78.13	10.9	12.36	11.08	15.7	14.1	0.27	77.32	77.39	77.70	77.82	77.86
561H**		78.13	10.1	14.71	11.08	18.7	14.1	0.89					
561I	1.90	78.18	10.9	12.32	11.14	15.6	14.1	0.25	77.50	77.57	77.82	78.04	78.04
561J**		78.20	9.9	14.87	11.17	18.9	14.2	0.93					
562A**		77.97	20.4	31.51	10.88	39.9	13.8	1.24					
562C**		78.02	20.4	31.57	10.94	40.0	13.9	1.23					
563A**		77.72	25.0	42.13	10.56	53.3	13.4	1.25					
563E**		78.02	24.9	41.33	10.94	52.4	13.9	1.22					
564B**		77.81	24.6	43.09	10.68	54.5	13.5	1.32					

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-3b. (cont'd)

RUN NO.	P 1 N/CM/CM	P 2 N/CM/CM	P 3 N/CM/CM	P 4 N/CM/CM	P 5 N/CM/CM	P 1,T N/CM/CM	P 2,T N/CM/CM	P 3,T N/CM/CM	P 4,T N/CM/CM	P 5,T N/CM/CM
302B	8.52	8.55	8.45	9.48	8.89	8.47	8.46	8.54	8.75	8.88
302D	8.73	8.80	8.85	10.41	11.31	8.59	8.68	8.94	9.09	9.10
302F	8.58	8.62	8.58	9.79	10.18	8.72	8.70	8.86	9.11	9.19
303B	9.87	10.04	10.07	11.71	12.48	9.83	9.97	10.21	10.49	10.59
304D	10.05	10.44	11.08	13.65	14.29	10.38	10.54	10.88	10.93	10.95
305B	9.72	9.83	9.96	12.45	12.13	9.81	9.87	10.13	10.53	10.64
305D	9.83	10.17	10.72	16.44	19.06	9.61	9.74	10.20	10.32	10.32
305F	9.61	9.84	9.89	12.71	12.02	9.45	9.52	9.80	10.14	10.31
306B	16.37	16.34	16.41	19.54	18.96	15.75	15.74	16.33	17.20	18.15
306D	17.51	17.72	19.81	27.30	30.79	16.64	17.29	18.56	18.63	18.67
307B	17.43	17.77	18.17	21.55	23.37	17.38	17.71	18.54	19.38	19.56
307C	17.86	18.31	19.88	23.55	25.04	17.42	18.11	19.03	19.25	19.21
308B	16.80	17.10	17.43	20.56	22.10	16.40	16.74	17.60	18.54	18.61
308C	16.62	16.80	16.94	19.61	20.68	16.24	16.40	17.17	18.13	18.50
309B	25.20	25.36	25.92	30.91	31.98	24.56	24.98	26.65	28.86	29.95
309C	26.20	26.50	28.09	33.78	36.84	25.22	26.38	28.86	30.08	30.41
309E	26.86	27.17	30.16	35.89	39.23	26.60	28.39	30.74	31.09	31.15
311B	23.75	23.51	24.30	29.96	31.13	23.69	23.83	24.91	27.34	29.31
311C	25.62	25.79	27.41	36.74	47.73	24.72	25.72	28.36	29.63	30.27
312B	16.20	16.17	16.65	21.58	25.13	16.01	16.31	17.17	18.16	18.31
312C	15.53	15.60	15.91	19.97	19.63	15.10	15.31	16.14	17.10	17.74
312D	16.27	16.62	17.31	22.82	33.65	15.89	16.38	17.54	18.11	18.15
315B	8.40	8.54	8.55	9.53	8.98	8.34	8.33	8.41	8.60	8.77
315C	8.51	8.71	8.78	9.78	10.74	8.54	8.58	8.79	9.01	9.08
315D	8.66	8.85	9.13	10.69	11.16	8.66	8.75	9.00	9.10	9.11
316B	10.01	10.18	10.29	11.94	12.11	10.04	10.13	10.40	10.76	10.80
316C	9.93	10.10	10.18	11.60	11.38	9.69	9.76	10.04	10.33	10.53
316D	9.86	10.03	10.10	11.45	11.00	9.72	9.75	10.01	10.25	10.51

Table A-3b. (cont'd)

RUN NO.	P 1 N/CM/CM	P 2 N/CM/CM	P 3 N/CM/CM	P 4 N/CM/CM	P 5 N/CM/CM	P 1,T N/CM/CM	P 2,T N/CM/CM	P 3,T N/CM/CM	P 4,T N/CM/CM	P 5,T N/CM/CM
317B	16.97	16.96	17.29	19.84	19.55	16.76	16.87	17.47	18.52	19.25
317C	17.84	17.84	18.56	22.12	27.04	16.73	17.11	18.37	19.05	19.21
318B	26.49	26.32	27.29	32.12	33.80	25.94	26.40	28.26	30.44	31.26
318D	26.59	26.39	27.75	32.45	34.75	25.12	25.84	27.80	29.65	30.06
319B	26.35	26.26	27.50	32.83	34.67	25.70	26.33	28.24	30.35	30.96
319C	26.35	26.32	27.66	32.97	34.94	25.05	25.72	27.95	29.68	30.33
321B	25.92	25.92	26.54	31.85	33.06	25.82	25.89	26.94	29.39	30.63
322B	25.34	25.42	26.25	31.17	33.01	25.05	25.24	26.47	28.81	30.16
322E	26.77	27.59	32.90	44.83	48.90	26.06	27.70	30.14	29.79	30.06
323D	16.95	17.29	19.15	33.10	38.71	16.48	16.95	18.13	18.13	18.20
325B	16.86	16.74	17.22	20.58	21.15	16.26	16.43	17.24	18.13	18.84
325D	17.60	17.84	20.22	27.73	29.76	16.48	17.31	18.56	18.54	18.56
326C	17.15	17.39	17.69	20.66	20.84	16.99	17.04	17.83	18.84	19.34
326D	17.39	17.57	17.99	20.88	21.32	17.02	17.22	18.11	19.03	19.42
326E	17.94	18.40	19.66	23.52	24.55	17.65	18.18	19.25	19.62	19.71
326F	17.75	18.09	18.73	22.35	23.80	17.42	17.78	18.92	19.54	19.67
326G	17.73	17.94	18.33	21.13	22.49	17.10	17.27	18.18	19.09	19.46
329B	9.43	9.56	9.63	12.05	10.49	9.19	9.20	9.45	9.82	10.01
329D	9.58	9.67	9.71	11.73	11.02	8.91	8.99	9.40	9.65	9.88
329F	10.05	10.25	10.87	17.18	18.80	9.33	9.54	10.09	10.10	10.13
547B	9.74	9.85	9.89	10.25	10.15	9.84	9.73	9.94	10.02	10.12
547C	9.87	10.04	10.19	10.82	11.82	9.99	10.02	10.37	10.59	10.69
547E	9.91	10.05	10.24	10.74	11.53	10.20	10.25	10.47	10.77	10.90
547F	9.90	10.09	10.22	10.65	11.76	10.09	10.14	10.43	10.68	10.82
547H	10.20	10.41	10.77	12.71	13.27	10.43	10.58	10.85	11.00	11.03
548B	9.89	10.20	10.48	11.14	12.48	9.95	10.04	10.47	10.70	10.75
548C	10.10	10.48	10.94	14.08	16.51	9.89	10.02	10.71	10.72	10.64
548E	9.75	9.98	10.11	10.58	10.84	9.75	9.79	10.07	10.28	10.51
548F	10.18	10.51	11.42	16.55	16.77	9.96	10.19	10.69	10.65	10.64

Table A-3b. (cont'd)

RUN NO.	P 1 N/CM/CM	P 2 N/CM/CM	P 3 N/CM/CM	P 4 N/CM/CM	P 5 N/CM/CM	P 1,T N/CM/CM	P 2,T N/CM/CM	P 3,T N/CM/CM	P 4,T N/CM/CM	P 5,T N/CM/CM
549B	17.16	17.33	17.82	18.66	20.22	17.69	17.82	18.52	19.32	19.79
549C	17.44	17.66	18.27	19.71	21.46	17.60	17.82	18.86	19.52	19.81
549E	17.51	17.78	18.32	19.71	21.51	17.71	18.05	18.86	19.75	19.97
549F	17.93	18.35	19.95	22.26	22.81	18.11	18.77	19.79	20.09	20.13
549H	17.95	18.27	19.71	21.91	22.57	18.28	18.90	19.79	20.33	20.31
550B	17.24	17.49	18.40	20.20	24.70	17.24	17.67	18.58	19.28	19.42
550C	17.35	17.69	18.87	23.03	25.72	17.13	17.76	18.94	19.19	19.25
550E	17.14	17.43	17.95	19.02	20.62	17.11	17.51	18.20	18.99	19.46
551B	27.28	27.52	28.70	31.18	34.04	27.88	28.29	29.63	31.74	32.53
551C	28.08	29.01	31.42	36.35	37.59	28.44	29.39	31.62	32.39	33.72
551E	28.01	28.61	29.92	33.51	36.90	28.60	29.39	31.15	32.82	33.13
551F	28.39	29.36	32.10	37.31	37.89	29.04	30.27	32.36	33.08	33.13
554B	27.77	27.72	28.34	30.01	32.01	28.47	28.68	29.97	31.93	32.85
554C	27.79	28.18	29.16	31.34	37.51	28.60	29.17	30.90	32.62	32.99
554D	28.01	28.92	32.85	41.86	40.44	29.55	30.85	32.87	33.22	33.25
554F	28.34	28.74	29.63	32.12	38.53	29.57	30.16	31.60	33.13	34.31
555B	28.42	29.18	30.19	33.59	41.54	30.41	30.82	32.50	33.87	34.37
555C	28.23	28.52	29.37	31.49	35.83	29.28	29.65	31.18	32.53	33.69
555E	27.81	28.52	29.37	31.48	41.23	29.33	29.79	31.18	32.79	33.72
555F	27.96	29.27	33.92	42.54	43.82	29.84	31.34	33.16	33.54	33.92
556B	28.17	28.41	29.32	31.03	33.80	29.60	29.71	31.01	32.59	33.84
556C	28.99	29.55	31.26	37.43	42.09	29.47	30.27	32.39	33.19	33.25
556E	28.68	29.27	30.16	32.12	37.80	30.30	30.71	32.10	33.81	34.52
556F	29.27	30.14	33.50	44.92	40.78	30.96	32.27	34.37	34.73	34.64
557B	17.24	17.75	18.37	19.84	23.95	18.30	18.61	19.44	20.05	20.39
557C	17.55	18.17	19.36	26.26	29.09	18.15	18.71	19.75	19.93	19.95
557E	16.79	17.24	17.89	18.95	20.57	18.07	18.41	18.94	19.66	20.19
557F	17.34	17.93	19.89	29.72	28.63	18.56	19.28	20.27	20.41	20.37
558B	17.34	17.70	18.06	18.93	19.96	18.31	18.33	18.90	19.50	20.13
558C	17.56	18.28	19.20	22.24	33.24	18.56	18.82	19.67	20.13	20.27
558E	17.57	18.28	19.08	21.70	32.69	18.75	19.11	19.73	20.41	20.49
558F	18.22	18.88	20.24	3(.58	29.44	18.96	19.38	20.25	20.43	20.52

Table A-3b. (cont'd)

RUN NO.	P 1 N/CM/CM	P 2 N/CM/CM	P 3 N/CM/CM	P 4 N/CM/CM	P 5 N/CM/CM	P 1,T N/CM/CM	P 2,T N/CM/CM	P 3,T N/CM/CM	P 4,T N/CM/CM	P 5,T N/CM/CM
559B	17.33	17.81	18.20	19.31	21.19	18.22	18.28	18.98	19.54	20.07
559C	17.60	18.31	19.22	22.77	32.82	18.22	18.48	19.44	19.89	19.97
559E	17.69	18.35	19.30	23.24	33.01	18.78	19.13	19.85	20.37	20.39
560B	16.96	17.39	18.04	19.94	21.58	17.80	18.15	19.13	19.87	20.07
560C	17.32	17.92	19.55	22.08	22.64	17.94	18.60	19.64	19.89	19.93
560E	16.95	17.40	17.95	19.36	24.16	17.63	17.96	18.75	19.56	19.93
560F	17.30	17.88	18.95	21.50	22.43	17.96	18.54	19.62	20.05	20.17
560G	16.99	17.33	17.82	18.97	20.68	17.43	17.71	18.50	19.28	19.75
561B	9.86	10.01	10.16	10.72	11.78	10.00	10.00	10.40	10.64	10.72
561C	9.80	9.87	9.93	10.25	10.44	9.67	9.58	9.90	10.00	10.19
561E	9.83	9.91	9.97	10.26	10.60	9.93	9.90	10.12	10.33	10.51
561F	9.94	10.07	10.19	10.67	11.83	9.96	10.00	10.31	10.56	10.66
561G	10.02	10.23	10.36	11.49	12.96	10.08	10.16	10.54	10.69	10.74
561I	9.87	10.20	10.41	11.29	12.80	10.30	10.38	10.69	10.96	10.96

Table A-3b. (cont'd)

RUN NO.	H 1 M	H 2 M	H 3 M	H 4 M	H 5 M	H 1,T M	H 2,T M	H 3,T M	H 4,T M	H 5,T M
302B	10.7	10.7	10.6	11.9	11.2	10.6	10.6	10.7	11.0	11.1
302D	10.9	11.0	11.1	13.2	14.4	10.8	10.9	11.2	11.4	11.4
302F	10.7	10.8	10.7	12.3	12.9	10.9	10.9	11.1	11.4	11.5
303B	12.5	12.7	12.7	14.9	15.9	12.4	12.6	12.9	13.3	13.4
304D	12.7	13.2	14.1	17.5	18.4	13.1	13.3	13.8	13.8	13.9
305B	12.3	12.4	12.6	15.9	15.5	12.4	12.4	12.8	13.3	13.5
305D	12.4	12.8	13.6	21.3	24.9	12.1	12.3	12.9	13.0	13.0
305F	12.1	12.4	12.5	16.2	15.3	11.9	12.0	12.4	12.8	13.0
306B	21.2	21.2	21.3	25.6	24.8	20.4	20.3	21.1	22.3	23.7
306D	22.8	23.1	26.0	36.5	41.6	21.6	22.5	24.2	24.3	24.4
307B	22.7	23.1	23.7	28.4	31.0	22.6	23.0	24.2	25.4	25.6
307C	23.3	23.9	26.1	31.2	33.3	22.6	23.6	24.9	25.2	25.1
308B	21.8	22.2	22.7	27.0	29.2	21.2	21.7	22.9	24.2	24.3
308C	21.5	21.8	22.0	25.7	27.2	21.0	21.2	22.3	23.6	24.1
309B	33.6	33.8	34.6	41.8	43.3	32.6	33.2	35.6	38.8	40.4
309C	35.0	35.4	37.7	46.0	50.5	33.6	35.2	38.8	40.6	41.0
309E	35.9	36.4	40.7	49.1	54.0	35.5	38.1	41.5	42.0	42.1
311B	31.5	31.2	32.3	40.4	42.1	31.4	31.6	33.1	36.6	39.4
311C	34.2	34.4	36.7	50.3	66.9	32.9	34.3	38.1	39.9	40.8
312B	21.0	20.9	21.6	28.4	33.5	20.7	21.1	22.3	23.7	23.9
312C	20.1	20.1	20.6	26.2	25.7	19.5	19.8	20.9	22.2	23.1
312D	21.1	21.5	22.5	30.2	45.8	20.5	21.2	22.8	23.6	23.7
315B	10.5	10.7	10.7	12.0	11.3	10.4	10.4	10.5	10.8	11.0
315C	10.7	10.9	11.0	12.3	13.6	10.7	10.8	11.0	11.3	11.4
315D	10.9	11.1	11.5	13.5	14.2	10.9	11.0	11.3	11.4	11.4
316B	12.6	12.9	13.0	15.2	15.4	12.7	12.8	13.2	13.6	13.7
316C	12.5	12.8	12.9	14.7	14.5	12.2	12.3	12.7	13.1	13.3
316D	12.4	12.7	12.8	14.5	13.9	12.2	12.3	12.6	12.9	13.3

Table A-3b. (cont'd)

RUN NO.	H 1 M	H 2 M	H 3 M	H 4 M	H 5 M	H 1,T M	H 2,T M	H 3,T M	H 4,T M	H 5,T M
317B	22.0	22.0	22.5	26.0	25.6	21.7	21.9	22.7	24.2	25.2
317C	23.2	23.2	24.2	29.2	36.2	21.7	22.2	24.0	24.9	25.1
318B	35.4	35.2	36.5	43.5	46.0	34.6	35.3	37.9	41.1	42.3
318D	35.5	35.2	37.2	44.0	47.4	33.4	34.5	37.3	39.9	40.5
319B	35.2	35.1	36.8	44.6	47.3	34.3	35.2	37.9	41.0	41.8
319C	35.2	35.1	37.1	44.8	47.7	33.3	34.3	37.5	40.0	40.9
321B	34.6	34.6	35.5	43.1	44.9	34.4	34.5	36.0	39.6	41.4
322B	33.7	33.9	35.0	42.1	44.8	33.3	33.6	35.4	38.7	40.7
322E	35.8	37.0	44.7	62.5	68.7	34.8	37.1	40.6	40.1	40.5
323D	22.0	22.5	25.0	45.0	53.3	21.4	22.0	23.6	23.6	23.7
325B	21.9	21.7	22.4	27.0	27.8	21.1	21.3	22.4	23.6	24.6
325D	22.9	23.2	26.5	37.2	40.1	21.4	22.5	24.2	24.2	24.2
326C	22.3	22.6	23.0	27.2	27.4	22.1	22.1	23.2	24.6	25.3
326D	22.6	22.9	23.4	27.5	28.1	22.1	22.4	23.6	24.9	25.4
326E	23.4	24.0	25.8	31.2	32.6	23.0	23.7	25.2	25.7	25.8
326F	23.1	23.6	24.5	29.5	31.6	22.6	23.1	24.7	25.6	25.8
326G	23.1	23.4	23.9	27.8	29.7	22.2	22.4	23.7	25.0	25.5
329B	11.9	12.0	12.1	15.3	13.3	11.5	11.6	11.9	12.4	12.6
329D	12.1	12.2	12.2	14.9	14.0	11.2	11.3	11.8	12.2	12.5
329F	12.7	13.0	13.8	22.3	24.6	11.7	12.0	12.7	12.8	12.8
547B	12.3	12.4	12.5	13.0	12.8	12.4	12.3	12.5	12.6	12.8
547C	12.5	12.7	12.9	13.7	15.0	12.6	12.6	13.1	13.4	13.5
547E	12.5	12.7	12.9	13.6	14.7	12.9	12.9	13.2	13.6	13.8
547F	12.5	12.7	12.9	13.5	15.0	12.7	12.8	13.2	13.5	13.7
547H	12.9	13.2	13.6	16.2	17.0	13.2	13.4	13.7	14.0	14.0
548B	12.5	12.9	13.3	14.1	15.9	12.6	12.7	13.2	13.5	13.6
548C	12.8	13.3	13.9	18.1	21.4	12.5	12.6	13.6	13.6	13.5
548E	12.3	12.6	12.8	13.4	13.7	12.3	12.3	12.7	13.0	13.3
548F	12.9	13.3	14.5	21.4	21.8	12.6	12.9	13.5	13.5	13.5

Table A-3b. (cont'd)

RUN NO.	H 1 M	H 2 M	H 3 M	H 4 M	H 5 M	H 1,T M	H 2,T M	H 3,T M	H 4,T M	H 5,T M
549B	22.3	22.5	23.2	24.4	26.5	23.0	23.2	24.2	25.3	25.9
549C	22.7	23.0	23.8	25.8	28.3	22.9	23.2	24.6	25.6	26.0
549E	22.8	23.1	23.9	25.8	28.3	23.0	23.5	24.6	25.9	26.2
549F	23.3	23.9	26.2	29.4	30.2	23.6	24.5	25.9	26.4	26.4
549H	23.4	23.8	25.8	28.9	29.8	23.8	24.7	25.9	26.7	26.7
550B	22.4	22.7	24.0	26.5	32.8	22.4	23.0	24.2	25.2	25.4
550C	22.6	23.0	24.7	30.5	34.3	22.3	23.1	24.7	25.1	25.2
550E	22.3	22.7	23.4	24.9	27.1	22.2	22.8	23.7	24.8	25.5
551B	36.5	36.9	38.6	42.2	46.3	37.4	38.0	39.9	43.0	44.1
551C	37.7	39.0	42.5	49.8	51.6	38.2	39.6	42.8	43.9	45.9
551E	37.6	38.4	40.3	45.6	50.6	38.4	39.6	42.1	44.5	45.0
551F	38.1	39.5	43.5	51.2	52.0	39.1	40.8	43.9	44.9	45.0
554B	37.2	37.2	38.0	40.5	43.4	38.2	38.5	40.4	43.3	44.6
554C	37.3	37.8	39.2	42.4	51.5	38.4	39.3	41.8	44.3	44.8
554D	37.6	38.9	44.6	58.0	55.8	39.8	41.7	44.6	45.1	45.2
554F	38.0	38.6	39.9	43.5	53.0	39.8	40.7	42.8	45.0	46.7
555B	38.2	39.3	40.7	45.7	57.5	41.0	41.6	44.1	46.1	46.8
555C	37.9	38.3	39.5	42.6	49.0	39.4	39.9	42.2	44.1	45.8
555E	37.3	38.3	39.5	42.6	57.0	39.5	40.1	42.2	44.5	45.9
555F	37.5	39.4	46.2	59.0	60.9	40.2	42.4	45.1	45.6	46.2
556B	37.8	38.2	39.5	41.9	46.0	39.9	40.0	41.9	44.2	46.0
556C	39.0	39.8	42.3	51.4	58.3	39.7	40.8	43.9	45.1	45.2
556E	38.5	39.4	40.7	43.5	51.9	40.9	41.5	43.5	46.0	47.0
556F	39.4	40.7	45.6	62.6	56.4	41.8	43.8	46.8	47.4	47.2
557B	22.4	23.1	24.0	26.0	31.8	23.9	24.3	25.4	26.3	26.8
557C	22.8	23.7	25.3	35.1	39.1	23.7	24.4	25.9	26.1	26.2
557E	21.8	22.4	23.3	24.8	27.0	23.5	24.0	24.7	25.7	26.5
557F	22.5	23.3	26.1	40.0	38.5	24.2	25.2	26.6	26.8	26.7
558B	22.5	23.0	23.5	24.7	26.2	23.9	23.9	24.7	25.5	26.4
558C	22.8	23.8	25.1	29.4	45.2	24.2	24.6	25.8	26.4	26.6
558E	22.9	23.8	25.0	28.6	44.4	24.5	25.0	25.9	26.8	26.9
558F	23.7	24.7	26.6	41.3	39.6	24.8	25.4	26.6	26.8	26.9

Table A-3b. (cont'd)

RUN NO.	H 1 M	H 2 M	H 3 M	H 4 M	H 5 M	H 1,T M	H 2,T M	H 3,T M	H 4,T M	H 5,T M
559B	22.5	23.2	23.7	25.3	27.9	23.8	23.8	24.8	25.6	26.3
559C	22.9	23.9	25.1	30.1	44.6	23.8	24.1	25.4	26.1	26.2
559E	23.0	23.9	25.2	30.8	44.8	24.5	25.0	26.0	26.7	26.8
560B	22.0	22.6	23.5	26.1	28.4	23.2	23.7	25.0	26.0	26.3
560C	22.5	23.3	25.6	29.1	29.9	23.4	24.3	25.7	26.1	26.1
560E	22.0	22.6	23.4	25.3	32.1	22.9	23.4	24.5	25.6	26.1
560F	22.5	23.3	24.8	28.3	29.6	23.4	24.2	25.7	26.3	26.5
560G	22.1	22.5	23.2	24.8	27.2	22.7	23.0	24.1	25.2	25.9
561B	12.4	12.6	12.8	13.6	15.0	12.6	12.6	13.2	13.5	13.6
561C	12.4	12.5	12.5	12.9	13.2	12.2	12.1	12.5	12.6	12.9
561E	12.4	12.5	12.6	13.0	13.4	12.5	12.5	12.8	13.1	13.3
561F	12.5	12.7	12.9	13.5	15.1	12.6	12.6	13.0	13.4	13.5
561G	12.7	12.9	13.1	14.6	16.6	12.7	12.8	13.3	13.5	13.6
561I	12.5	12.9	13.2	14.3	16.4	13.0	13.1	13.5	13.9	13.9

Table A-4a. Experimental cavitation data for 0.357-inch ogive using liquid hydrogen (English Units).

RUN NO.	CAVITY INCHES	TO DEG R	VO FT/SEC	PO PSIA	PV PSIA	HO FT	HV FT	KV	T 1 DEG R	T 2 DEG R	T 3 DEG R	T 4 DEG R	T 5 DEG R
331A**		36.58	113.7	19.75	14.92	643.6	486.7	0.78					
331B	1.50	36.74	129.9	14.11	15.32	460.9	500.4	-0.15	34.56	34.45	35.19	35.59	35.78
331C	1.00	36.63	129.2	14.26	15.05	465.3	491.2	-0.10	34.09	34.11	35.15	35.46	35.66
331D**		36.94	113.2	20.76	15.82	678.7	517.6	0.81					
332A**		38.48	195.9	39.06	20.12	1292.8	667.9	1.05					
332B	1.00	38.54	216.9	26.36	20.28	874.6	673.7	0.27	37.01	36.54	36.97	38.05	38.39
333A*		41.36	128.8	31.81	30.26	1087.8	1035.1	0.20					
334A**		37.71	173.1	31.71	17.88	1042.7	589.1	0.97					
334B	1.30	37.78	191.3	21.77	18.08	717.4	596.1	0.21	34.81	34.54	35.03	35.75	36.36
334D**		38.09	169.2	34.11	18.95	1125.4	626.7	1.12					
335B	1.20	40.01	213.8	28.71	25.14	967.2	847.5	0.17	38.14	37.49	37.94	39.33	39.74
336A*		41.33	130.8	31.21	30.12	1067.0	1029.7	0.14					
336B**		41.35	130.3	31.71	30.19	1084.2	1032.4	0.20					
337A	1.50	37.64	240.9	27.76	17.68	912.7	582.1	0.37	35.32	34.70	34.92	35.89	36.04
338A**		41.20	182.2	44.81	29.61	1525.7	1011.0	1.00					
338B	1.30	41.27	207.8	30.64	29.90	1046.9	1021.7	0.04	38.34	37.91	38.86	39.96	40.37
339A**		41.36	153.1	36.31	30.26	1240.6	1035.1	0.56					
340A**		39.64	179.8	37.61	23.82	1260.0	800.0	0.92					
341B	0.90	39.91	244.9	33.01	24.76	1110.0	833.7	0.30	38.11	37.57	38.34	39.40	39.60
342B	1.30	41.56	251.5	35.71	31.07	1223.2	1065.1	0.16	39.08	38.48	39.19	40.79	41.29
344B	1.30	36.49	125.9	13.86	14.70	451.7	479.2	-0.11	34.33	34.33	35.03	35.50	35.78

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-4a. (cont'd)

RUN NO.	CAVITY INCHES	TO DEG R	VO FT/SEC	PO PSIA	PV PSIA	HO FT	HV FT	KV	T 1 DEG R	T 2 DEG R	T 3 DEG R	T 4 DEG R	T 5 DEG R
345A**		36.41	124.0	19.26	14.53	626.8	473.2	0.64					
345B	C.90	36.50	138.1	14.51	14.75	472.9	480.7	-0.03	33.86	33.77	34.72	35.15	35.33
345C**		36.63	124.7	20.46	15.05	667.0	491.2	0.73					
346A**		36.45	124.6	20.66	14.62	672.4	476.2	0.81					
346B	0.50	36.43	131.8	15.64	14.57	509.3	474.7	0.13	35.42	35.69	36.23	36.18	36.20
346C**		36.45	119.7	19.96	14.62	649.7	476.2	0.78					
347A**		36.83	159.5	29.03	15.55	947.0	508.2	1.11					
347B	C.50	36.92	174.1	20.91	15.77	683.5	516.0	0.36	36.25	36.27	36.92	37.03	36.97
347C**		36.95	158.0	28.46	15.86	929.6	519.2	1.06					
348B	1.30	36.99	179.0	18.86	15.96	617.1	522.4	0.19	34.94	34.65	35.19	35.80	36.38
348C	1.00	37.12	178.7	19.26	16.28	630.9	533.6	0.20	34.78	34.49	35.35	35.91	36.23
349A**		38.34	192.2	39.33	19.69	1299.8	652.7	1.13					
349B	0.60	38.39	209.8	27.63	19.85	915.3	658.4	0.38	37.51	37.33	38.16	38.43	38.32
349C**		38.45	189.9	40.33	20.01	1334.1	664.1	1.20					
350A**		39.64	139.9	29.03	23.82	973.9	800.0	0.57					
351A**		38.25	189.5	40.11	19.42	1324.3	643.3	1.22					
351B	1.00	38.36	212.5	25.61	19.74	848.3	654.6	0.28	36.90	36.52	36.95	38.18	38.41
351C	1.30	38.36	212.6	25.01	19.74	828.5	654.6	0.25	35.64	35.30	35.86	36.56	37.37
351D**		38.41	189.7	37.11	19.90	1227.7	660.3	1.01					
352A**		39.78	152.2	33.46	24.32	1123.5	817.9	0.85					
352B	1.20	39.91	172.9	24.59	24.76	828.0	833.7	-0.01	37.66	37.28	38.18	38.95	39.40
352C**		40.05	155.5	34.41	25.27	1158.6	852.1	0.82					
353A**		39.53	157.0	32.79	23.46	1098.1	786.9	0.81					
353B	0.50	39.55	172.7	25.29	23.52	848.2	789.1	0.13	38.61	38.68	39.53	39.46	39.58
354B	1.20	38.43	241.2	29.09	19.96	963.8	662.2	0.33	36.38	36.38	36.95	38.20	38.41

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-4a. (cont'd)

RUN NO.	CAVITY INCHES	TO DEG R	VO FT/SEC	PO PSIA	PV PSIA	HO FT	HV FT	KV	T 1 DEG R	T 2 DEG R	T 3 DEG R	T 4 DEG R	T 5 DEG R
355A**		41.27	211.1	51.13	29.90	1740.3	1021.7	1.04					
355B	1.50	41.38	237.9	33.36	30.33	1140.7	1037.8	0.12	37.85	37.76	38.52	40.10	40.81
355C	1.00	41.31	231.4	35.39	30.04	1208.6	1027.0	0.22	38.86	39.11	40.43	41.04	41.17
356A**		41.44	207.2	51.93	30.55	1770.6	1045.9	1.09					
357B	0.70	38.39	240.9	31.99	19.85	1059.0	658.4	0.44	35.41	35.46	36.40	37.62	37.89
358B	1.30	41.38	200.7	31.29	30.33	1070.4	1037.8	0.05	38.39	38.45	39.38	40.61	40.88
359A**		41.35	179.6	43.73	30.19	1491.7	1032.4	0.92					
359B	0.60	41.38	199.7	34.03	30.33	1163.5	1037.8	0.20	39.82	40.10	41.26	41.36	41.36
360A**		41.36	143.8	35.16	30.26	1201.6	1035.1	0.52					
361A**		41.29	145.3	36.79	29.97	1255.8	1024.3	0.71					
362A**		41.49	155.8	38.63	30.77	1321.3	1054.1	0.71					
362C**		41.72	157.9	38.01	31.74	1303.9	1090.2	0.55					
363B	0.60	41.35	179.0	31.46	30.19	1075.7	1032.4	0.09	39.85	39.94	40.86	40.97	41.02
364A**		39.76	212.6	48.09	24.26	1610.5	815.6	1.13					
364B	1.30	40.14	237.6	32.86	25.59	1107.8	863.8	0.28	37.64	37.12	38.07	39.40	40.23
365B	0.70	39.73	236.2	34.03	24.13	1141.8	811.2	0.38	38.83	38.43	39.37	39.83	39.96
366B	0.60	39.64	188.6	27.46	23.82	921.5	800.0	0.22	38.57	38.41	39.38	39.62	39.65
367B	1.00	39.94	217.2	30.01	24.88	1010.0	838.3	0.23	38.20	37.80	38.20	39.78	39.96
367C	1.50	40.27	218.3	29.76	26.04	1005.2	880.3	0.17	37.37	37.04	37.55	39.04	39.78
368A**		39.74	199.8	43.83	24.19	1468.6	813.4	1.06					
368B	0.60	39.83	219.4	32.16	24.51	1080.7	824.6	0.34	38.32	38.07	39.10	39.47	39.44

* DENOTES AN INCIPIENT PUN
** DENOTES A DESINENT RUN

Table A-4a. (cont'd)

RUN NO.	CAVITY INCHES	TO DEG R	VO FT/SEC	PO PSIA	PV PSIA	HO FT	HV FT	KV	T 1 DEG R	T 2 DEG R	T 3 DEG R	T 4 DEG R	T 5 DEG R
369A**		39.89	175.4	39.59	24.70	1329.5	831.5	1.04					
369B	1.20	39.94	195.3	26.99	24.88	908.8	838.3	0.12	37.55	37.17	37.84	38.97	39.53
369C**		39.96	172.6	40.11	24.95	1347.9	840.6	1.10					
370A**		39.64	212.9	48.71	23.82	1628.9	800.0	1.18					
370B	1.30	39.65	239.0	31.71	23.89	1063.6	802.3	0.29	37.26	36.90	37.35	38.70	39.33
370C**		39.85	207.7	49.91	24.57	1672.5	826.9	1.26					
371A**		39.51	173.3	37.66	23.40	1260.0	784.7	1.02					
371B	1.00	39.62	193.4	26.59	23.76	892.3	797.8	0.16	37.49	37.21	38.00	38.92	39.11
371C**		39.94	169.7	39.51	24.88	1327.6	838.3	1.09					
507A**		37.42	116.3	19.67	17.09	646.1	561.7	0.40					
508A**		37.64	137.6	23.76	17.68	781.7	582.1	0.68					
508B	0.60	37.67	151.5	17.39	17.78	572.8	585.6	-0.04	35.93	35.86	37.08	37.30	37.19
508C	0.40	37.69	149.2	18.46	17.83	608.1	587.4	0.06	36.27	36.47	37.42	37.22	37.06
508D**		37.67	137.5	23.94	17.78	787.8	585.6	0.69					
509A**		37.71	134.9	22.74	17.88	748.7	589.1	0.56					
509B	0.90	37.73	148.2	16.94	17.93	558.3	590.9	-0.10	35.95	35.73	36.95	37.33	37.33
509C	0.40	37.67	144.9	18.39	17.78	605.7	585.6	0.06	36.13	36.31	37.28	37.10	36.90
509D**		37.78	134.7	22.86	18.08	753.2	596.1	0.56					
510A**		37.71	167.3	30.16	17.88	992.0	589.1	0.93					
510B	0.90	37.76	185.1	20.61	18.03	679.2	594.4	0.16	36.05	35.89	37.31	37.85	37.62
510C	0.60	37.78	183.1	21.06	18.08	694.1	596.1	0.19	36.18	36.05	37.67	37.78	37.62
511A**		37.64	166.3	29.53	17.68	970.7	582.1	0.90					
511B	1.00	37.66	183.2	20.19	17.73	664.7	583.9	0.15	35.60	35.48	36.65	37.03	36.77
511C	0.50	37.67	181.0	21.56	17.78	709.8	585.6	0.24	35.66	35.73	37.12	36.76	37.06
511D**		37.71	164.8	29.16	17.88	959.2	589.1	0.88					
512A**		37.66	190.4	37.16	17.73	1220.3	583.9	1.13					
512B	0.75	37.73	211.9	23.93	17.93	787.9	590.9	0.28	36.40	36.43	36.79	37.48	37.39

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-4a. (cont'd)

RUN NO.	CAVITY INCHES	T0 DEG R	V0 FT/SEC	P0 PSIA	PV PSIA	H0 FT	HV FT	KV	T 1 DEG R	T 2 DEG R	T 3 DEG R	T 4 DEG R	T 5 DEG R
513A**		37.62	182.3	37.26	17.63	1223.2	580.4	1.24					
513B	0.75	37.69	205.2	23.49	17.83	773.2	587.4	0.28	35.89	36.00	37.30	37.37	37.22
514A**		39.28	148.0	32.34	22.62	1080.3	756.8	0.95					
514B	1.00	39.40	169.6	22.83	23.03	764.8	771.7	-0.02	37.12	37.19	38.23	38.93	38.83
514C	0.60	39.44	167.0	23.99	23.15	803.8	776.0	0.06	37.10	37.35	38.93	38.84	38.57
514D**		39.53	148.2	32.76	23.46	1097.1	786.9	0.91					
515A**		41.09	191.8	48.26	29.18	1640.1	995.2	1.13					
515B	1.00	41.18	218.9	31.26	29.54	1066.8	1008.4	0.08	38.54	38.63	39.76	40.72	40.72
515C	0.40	41.22	213.0	34.96	29.68	1192.8	1013.7	0.25	39.49	40.28	41.22	41.00	40.68
516A**		41.22	140.8	36.11	29.68	1231.7	1013.7	0.71					
517A**		39.42	170.6	35.69	23.09	1193.3	773.9	0.93					
517B	0.60	39.46	190.5	25.46	23.22	853.0	778.2	0.13	38.21	38.09	38.90	39.44	39.17
517C**		39.42	172.5	34.83	23.09	1164.7	773.9	0.84					
518A**		41.09	165.3	38.84	29.18	1322.2	995.2	0.77					
518B	0.75	41.15	184.8	28.96	29.40	988.3	1003.1	-0.03	39.46	39.15	40.46	40.99	40.82
518C	0.50	41.17	182.7	30.66	29.47	1046.2	1005.7	0.08	39.82	39.85	40.99	40.81	40.68
518D**		41.15	164.4	39.26	29.40	1337.3	1003.1	0.80					
519A**		41.18	143.4	36.06	29.54	1229.5	1008.4	0.69					
520A**		41.18	163.8	40.09	29.54	1365.9	1008.4	0.86					
520B	0.60	41.22	185.4	29.76	29.68	1016.4	1013.7	0.01	39.56	39.83	40.59	41.08	40.90
521A	0.90	37.80	252.3	28.19	18.13	928.3	597.9	0.33	36.50	36.23	36.74	37.48	37.46
522A	0.50	39.42	249.5	33.13	23.09	1108.2	773.9	0.35	37.84	38.21	39.10	39.22	39.01
522B**		39.60	223.2	50.31	23.70	1681.3	795.6	1.14					
523A**		41.11	228.1	56.53	29.25	1918.6	997.8	1.14					
523B	0.75	41.24	259.3	36.23	29.75	1236.1	1016.3	0.21	39.40	38.92	39.89	40.57	40.64

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-4a. (cont'd)

RUN NO.	CAVITY INCHES	TO DEG R	VO FT/SEC	PO PSIA	PV PSIA	HO FT	HV FT	KV	T 1 DEG R	T 2 DEG R	T 3 DEG R	T 4 DEG R	T 5 DEG R
524A**		41.04	194.9	47.99	28.97	1630.0	987.4	1.09					
524B	0.60	41.11	219.9	33.16	29.25	1130.3	997.8	0.18	39.26	39.87	40.27	40.84	40.75
526A**		41.20	223.4	56.96	29.61	1935.1	1011.0	1.19					
526B	0.60	41.63	252.4	37.81	31.37	1295.7	1076.2	0.22	39.40	39.20	40.01	40.64	40.77
528A**		37.60	127.6	23.20	17.58	763.0	578.7	0.73					
528B	0.80	37.62	140.6	17.55	17.63	577.8	580.4	-0.01	36.36	36.13	37.17	37.37	37.12
528C	0.40	37.58	139.1	18.77	17.53	617.6	577.0	0.14	36.52	36.67	37.48	37.26	37.10
528D**		37.62	128.8	23.25	17.63	764.8	580.4	0.72					
529A**		39.24	149.1	31.22	22.50	1042.6	752.6	0.84					
529B	1.00	39.26	167.8	22.62	22.56	756.6	754.7	0.00	37.85	37.48	38.59	39.10	39.08
529C	0.40	39.31	165.0	24.87	22.74	832.1	761.0	0.17	38.36	38.45	39.31	39.13	38.92
529D**		39.38	152.8	31.25	22.97	1045.2	769.6	0.76					
530A**		41.36	225.4	58.72	30.26	1997.9	1035.1	1.22					
530B	0.90	41.58	255.3	37.02	31.14	1268.0	1067.9	0.20	38.70	37.71	39.62	39.69	40.32
531A**		37.57	191.8	38.95	17.48	1277.7	575.3	1.23					
531B	1.30	37.57	216.3	23.62	17.48	776.5	575.3	0.28	36.18	35.89	36.81	37.39	37.44
531C**		37.64	192.0	39.39	17.68	1292.9	582.1	1.24					
532A**		37.55	219.8	45.49	17.43	1490.6	573.5	1.22					
532B	1.00	37.64	244.8	27.89	17.68	917.0	582.1	0.36	35.46	35.35	35.78	36.45	36.59
532C**		37.69	220.5	46.19	17.83	1515.5	587.4	1.23					
533A**		37.44	218.3	44.79	17.14	1466.3	563.4	1.22					
533B	0.90	37.58	245.3	28.07	17.53	922.4	577.0	0.37	35.75	36.43	36.36	36.97	37.01
533C**		37.64	220.1	45.47	17.68	1491.2	582.1	1.21					
534A**		40.79	146.8	34.60	27.99	1174.6	951.5	0.67					
534C**		41.02	145.1	36.12	28.90	1229.2	984.8	0.75					

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-4a. (cont'd)

RUN NO.	CAVITY INCHES	TO DEG R	VO FT/SEC	PO PSIA	PV PSIA	HO FT	HV FT	KV	T 1 DEG R	T 2 DEG R	T 3 DEG R	T 4 DEG R	T 5 DEG R
535A**		40.93	144.3	35.37	28.55	1202.6	971.9	0.71					
535C**		41.18	143.9	37.12	29.54	1265.4	1008.4	0.80					
536A**		37.49	165.2	30.92	17.28	1014.8	568.4	1.05					
536B	1.00	37.53	184.5	20.75	17.38	682.2	571.8	0.21	36.41	36.04	37.01	37.55	37.57
536C	0.60	37.58	182.5	21.85	17.53	718.7	577.0	0.27	36.52	36.07	37.30	37.31	37.15
537A**		39.01	172.7	36.25	21.74	1206.7	725.5	1.04					
537B	0.90	39.13	195.9	25.12	22.15	838.8	740.0	0.17	37.94	37.64	38.54	39.20	39.13
537C	0.50	39.17	194.1	27.22	22.26	909.0	744.2	0.28	38.18	38.02	39.19	38.86	38.77
538A**		40.88	168.5	40.49	28.34	1374.6	964.2	0.93					
538B	1.00	40.93	194.4	28.52	28.55	970.9	971.9	-0.00	38.95	38.90	39.69	40.93	40.50
538C	0.60	40.97	193.0	30.45	28.69	1036.7	977.0	0.10	39.01	39.19	40.32	40.63	40.07
539A**		39.04	196.9	40.99	21.86	1364.0	729.6	1.05					
539B	0.90	39.13	217.9	27.83	22.15	928.9	740.0	0.26	38.14	37.96	38.52	39.46	39.28
540A**		41.13	195.5	48.75	29.32	1657.3	1000.5	1.11					
540B	0.90	41.27	224.3	32.62	29.90	1114.1	1021.7	0.12	39.46	39.06	39.89	40.97	40.75
541A**		37.55	136.2	24.52	17.43	805.9	573.5	0.81					
541B	0.90	37.60	153.9	18.22	17.58	599.7	578.7	0.06	36.14	36.18	36.58	37.28	37.12
541C	0.60	37.53	152.8	18.85	17.38	619.9	571.8	0.13	35.98	36.09	36.85	36.97	36.67
541D**		37.51	138.0	25.62	17.33	841.6	570.1	0.92					
542A**		41.31	233.4	58.12	30.04	1976.5	1027.0	1.12					
542B	0.90	41.38	263.3	38.32	30.33	1309.1	1037.8	0.25	39.08	38.74	39.74	40.43	40.41
543A**		41.13	227.9	57.87	29.32	1964.0	1000.5	1.19					
543B	1.00	41.26	259.1	37.17	29.83	1268.2	1019.0	0.24	39.53	39.73	40.52	41.24	41.40
543C**		41.27	227.9	57.72	29.90	1962.2	1021.7	1.17					
544A**		37.31	218.3	42.92	16.80	1403.8	551.6	1.15					
544B	1.30	37.48	241.6	26.95	17.23	884.8	566.7	0.35	35.64	35.71	35.98	36.68	37.15

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-4a. (cont'd)

RUN NO.	CAVITY INCHES	TO DEG R	VO FT/SEC	PO PSIA	PV PSIA	HO FT	HV FT	KV	T 1 DEG R	T 2 DEG R	T 3 DEG R	T 4 DEG R	T 5 DEG R
545A**		38.92	220.2	48.09	21.46	1596.4	715.3	1.17					
545B	1.00	39.13	247.0	30.72	22.15	1024.9	740.0	0.30	35.77	35.39	36.31	37.06	36.90
546A**		39.11	227.0	51.27	22.09	1704.6	737.9	1.21					

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-4a. (cont'd)

RUN NO.	P 1 PSIA	P 2 PSIA	P 3 PSIA	P 4 PSIA	P 5 PSIA	P 1,T PSIA	P 2,T PSIA	P 3,T PSIA	P 4,T PSIA	P 5,T PSIA
331B	9.81	10.61	9.91	12.94	12.84	10.55	10.35	11.80	12.64	13.08
331C	9.83	10.74	10.46	13.68	14.36	9.69	9.72	11.73	12.37	12.80
332B	13.01	13.16	13.61	20.61	22.01	16.00	14.83	15.91	18.84	19.85
334B	11.30	11.30	11.74	16.61	15.81	11.04	10.52	11.47	13.00	14.40
335B	15.38	15.45	15.88	23.15	24.98	19.10	17.28	18.53	22.80	24.19
337A	11.16	11.31	11.61	19.76	16.11	12.06	10.83	11.26	13.32	13.64
338B	17.97	18.24	19.11	26.67	28.81	19.69	18.43	21.29	24.95	26.44
341B	16.61	16.36	17.11	25.91	29.91	19.00	17.48	19.69	23.03	23.70
342B	18.16	17.96	18.41	27.46	29.61	21.97	20.12	22.32	27.99	29.97
344B	9.44	9.44	10.26	13.21	13.43	10.12	10.12	11.47	12.45	13.08
345B	9.46	9.56	10.21	13.51	14.96	9.28	9.12	10.87	11.73	12.10
346B	10.14	11.01	14.06	16.77	17.44	12.29	12.88	14.10	13.98	14.02
347B	11.28	11.81	14.78	22.61	23.94	14.14	14.19	15.77	16.05	15.91
348B	9.89	10.03	10.49	14.83	14.13	11.29	10.73	11.80	13.12	14.44
348C	10.46	10.81	11.31	15.96	17.86	10.97	10.42	12.14	13.36	14.10
349B	14.03	14.83	17.26	28.93	31.50	17.33	16.85	19.16	19.96	19.63
351B	12.61	12.81	13.41	19.61	20.81	15.73	14.79	15.86	19.21	19.90
351C	11.71	11.81	12.26	18.71	15.91	12.76	12.03	13.24	14.88	16.94
352B	15.86	15.96	16.82	21.79	24.69	17.73	16.70	19.21	21.57	23.03
353B	16.16	17.19	21.49	26.99	28.25	20.50	20.72	23.46	23.22	23.64
354B	12.89	13.06	13.36	21.59	21.79	14.44	14.44	15.86	19.26	19.90

Table A-4a. (cont'd)

RUN NO.	P 1 PSIA	P 2 PSIA	P 3 PSIA	P 4 PSIA	P 5 PSIA	P 1,T PSIA	P 2,T PSIA	P 3,T PSIA	P 4,T PSIA	P 5,T PSIA
355B	16.56	16.76	17.31	24.91	26.06	18.28	18.03	20.23	25.46	28.06
355C	20.02	20.59	22.06	33.19	37.96	21.29	22.09	26.64	28.97	29.47
357B	14.14	14.69	16.09	28.64	34.84	12.25	12.37	14.49	17.63	18.38
358B	18.22	18.52	19.42	26.06	28.59	19.85	20.01	22.97	27.31	28.34
359B	21.00	22.23	26.66	35.40	37.00	24.44	25.46	29.83	30.26	30.26
363B	20.33	22.19	27.06	32.66	33.96	24.57	24.88	28.27	28.69	28.90
364B	15.46	15.81	16.41	24.11	26.51	17.68	16.28	18.90	23.03	25.91
365B	16.93	17.66	19.53	32.43	37.36	21.17	19.96	22.92	24.51	24.95
366B	16.56	17.16	19.21	27.96	29.96	20.39	19.90	22.97	23.76	23.89
367B	15.56	15.86	16.46	23.01	25.56	19.26	18.13	19.26	24.32	24.95
367C	14.61	14.86	15.26	21.86	22.76	16.94	16.09	17.43	21.86	24.32
368B	17.01	17.82	20.21	32.91	35.61	19.63	18.90	22.03	23.28	23.15
369B	15.29	15.56	16.02	21.39	23.69	17.43	16.42	18.23	21.63	23.46
370B	14.46	14.66	15.21	22.81	23.61	16.66	15.73	16.90	20.78	22.80
371B	15.22	15.56	16.42	22.69	26.32	17.28	16.52	18.69	21.46	22.09
508B	11.12	11.79	13.79	16.72	19.22	13.40	13.24	16.19	16.75	16.47
508C	11.81	13.76	17.26	19.51	20.71	14.19	14.66	17.09	16.56	16.14
509B	11.19	11.71	12.61	15.19	17.97	13.44	12.96	15.86	16.85	16.85
509C	12.02	13.69	17.09	19.39	20.56	13.85	14.27	16.70	16.23	15.73
510B	12.18	12.71	13.41	15.86	21.26	13.68	13.32	16.80	18.28	17.63
510C	12.39	13.09	14.91	21.56	24.56	13.98	13.68	17.78	18.08	17.63
511B	11.79	12.16	12.92	15.22	20.52	12.68	12.41	15.10	16.05	15.41
511C	12.26	13.26	16.91	23.21	25.06	12.80	12.96	16.28	15.37	16.14

Table A-4a. (cont'd)

RUN NO.	P 1 PSIA	P 2 PSIA	P 3 PSIA	P 4 PSIA	P 5 PSIA	P 1,T PSIA	P 2,T PSIA	P 3,T PSIA	P 4,T PSIA	P 5,T PSIA
512B	12.83	13.20	13.90	17.33	25.63	14.49	14.57	15.46	17.23	16.99
513B	12.89	13.26	14.06	17.59	25.16	13.32	13.56	16.75	16.94	16.56
514B	15.30	15.66	16.40	19.20	23.36	16.28	16.47	19.37	21.51	21.17
514C	16.36	17.06	19.02	24.16	26.69	16.23	16.90	21.51	21.23	20.39
515B	18.66	18.96	20.11	24.16	31.46	20.28	20.56	24.26	27.72	27.72
515C	21.06	24.61	32.76	38.21	40.36	23.34	26.11	29.68	28.83	27.58
517B	15.91	16.61	18.71	25.26	28.86	19.31	18.95	21.40	23.15	22.26
518B	19.36	20.31	22.41	28.11	31.46	23.22	22.21	26.77	28.76	28.13
518C	20.66	23.13	28.49	32.83	34.39	24.44	24.57	28.76	28.06	27.58
520B	20.56	21.56	25.01	30.76	32.96	23.58	24.51	27.24	29.11	28.41
521A	13.09	13.26	13.86	17.29	28.39	14.75	14.10	15.32	17.23	17.19
522A	16.63	17.43	22.33	35.73	40.46	18.23	19.31	22.03	22.44	21.74
523B	20.13	20.76	22.33	28.10	39.90	23.03	21.46	24.70	27.17	27.45
524B	20.36	21.09	24.49	33.46	37.53	22.56	24.63	26.04	28.20	27.86
526B	21.34	21.66	23.91	32.51	41.81	23.03	22.38	25.14	27.45	27.92
528B	12.15	12.32	13.15	15.85	18.48	14.40	13.85	16.42	16.94	16.28
528C	12.67	13.54	16.62	19.50	20.27	14.79	15.14	17.23	16.66	16.23
529B	14.82	14.95	15.85	18.39	22.62	18.28	17.23	20.45	22.03	21.97
529C	16.22	17.52	21.87	25.87	26.77	19.74	20.01	22.74	22.15	21.46
530B	19.72	20.02	21.07	25.52	36.17	20.78	17.88	23.76	24.01	26.24
531B	11.29	11.25	11.65	12.95	14.99	13.98	13.32	15.50	16.99	17.14
532B	12.06	12.09	12.76	14.66	20.09	12.37	12.14	13.08	14.62	14.97

Table A-4a. (cont'd)

RUN NO.	P 1 PSIA	P 2 PSIA	P 3 PSIA	P 4 PSIA	P 5 PSIA	P 1,T PSIA	P 2,T PSIA	P 3,T PSIA	P 4,T PSIA	P 5,T PSIA
533B	12.37	12.72	13.47	15.92	24.67	13.00	14.57	14.40	15.91	16.00
536B	11.58	11.75	12.55	14.52	18.95	14.53	13.64	16.00	17.43	17.48
536C	12.75	12.98	14.42	20.18	23.65	14.79	13.73	16.75	16.80	16.37
537B	15.07	15.32	16.32	19.62	25.72	18.53	17.68	20.28	22.38	22.15
537C	16.02	16.92	20.79	28.25	29.32	19.21	18.74	22.32	21.29	21.00
538B	17.52	18.17	19.77	24.07	28.87	21.57	21.40	24.01	28.55	26.91
538C	19.42	20.52	24.22	30.78	32.52	21.74	22.32	26.24	27.38	25.33
539B	15.06	15.53	16.43	19.70	27.70	19.10	18.59	20.23	23.22	22.62
540B	18.79	19.29	20.69	25.05	33.09	23.22	21.92	24.70	28.69	27.86
541B	12.15	12.45	12.99	14.99	18.42	13.89	13.98	14.92	16.70	16.28
541C	12.35	12.88	14.38	19.51	20.42	13.52	13.77	15.59	15.91	15.14
542B	19.87	20.37	22.22	27.37	38.62	21.97	20.89	24.19	26.64	26.57
543B	19.47	19.72	21.17	25.62	36.67	23.46	24.13	26.97	29.75	30.41
544B	11.72	11.52	12.05	13.48	16.55	12.76	12.92	13.52	15.19	16.37
545B	14.89	15.12	15.65	17.95	25.39	13.04	12.22	14.27	16.14	15.73

Table A-4a. (cont'd)

RUN NO.	H 1 FT	H 2 FT	H 3 FT	H 4 FT	H 5 FT	H 1,T FT	H 2,T FT	H 3,T FT	H 4,T FT	H 5,T FT
331B	313.5	340.2	316.8	418.9	415.5	338.4	331.5	380.4	408.7	423.5
331C	314.1	344.6	335.2	444.1	467.4	309.5	310.6	377.9	399.5	414.1
332B	421.3	426.4	441.7	685.3	735.1	524.0	483.7	520.8	623.0	658.4
334B	363.4	363.4	378.3	545.0	517.3	354.7	337.2	369.2	420.8	468.8
335B	502.5	504.9	519.7	775.8	841.7	632.2	568.4	612.1	763.2	813.4
337A	358.7	363.8	373.9	655.3	527.7	389.2	347.6	361.9	431.7	442.9
338B	592.4	601.8	632.4	903.1	981.5	652.7	608.6	709.3	840.6	894.7
341B	545.0	536.4	562.4	875.5	1022.1	628.5	575.3	652.7	771.7	795.6
342B	599.0	592.1	607.8	932.0	1011.0	733.8	667.9	746.2	951.5	1024.3
344B	301.1	301.1	328.5	428.1	435.6	323.7	323.7	369.2	402.2	423.5
345B	301.8	305.1	326.8	438.3	488.0	295.8	290.6	348.8	377.9	390.5
346B	324.5	353.7	457.1	550.6	573.9	397.0	416.8	458.6	454.3	455.7
347B	362.7	380.6	481.8	756.5	804.2	460.0	461.5	516.0	525.6	520.8
348B	316.1	320.8	336.2	483.5	459.5	363.1	344.1	380.4	424.9	470.3
348C	335.2	346.9	363.8	522.5	588.6	352.3	333.8	391.8	433.1	458.6
349B	456.1	483.5	567.6	985.9	1081.1	570.1	553.3	634.0	662.2	650.8
351B	407.7	414.5	434.9	650.0	692.4	514.4	482.2	519.2	635.9	660.3
351C	377.2	380.6	395.8	618.3	520.8	412.7	388.0	429.0	485.2	556.6
352B	519.0	522.5	552.3	727.2	831.3	583.9	548.3	635.9	719.4	771.7
353B	529.4	565.2	716.5	914.8	960.9	681.5	689.4	786.9	778.2	793.4
354B	417.2	423.0	433.2	720.1	727.2	470.3	470.3	519.2	637.7	660.3

Table A-4a. (cont'd)

RUN NO.	H 1 FT	H 2 FT	H 3 FT	H 4 FT	H 5 FT	H 1,T FT	H 2,T FT	H 3,T FT	H 4,T FT	H 5,T FT
355B	543.3	550.2	569.4	839.2	880.9	603.2	594.4	671.8	859.1	954.0
355C	664.4	684.6	736.9	1144.3	1325.2	709.3	737.9	902.0	987.4	1005.7
357B	459.9	478.7	527.0	975.3	1206.5	395.7	399.5	471.7	580.4	606.8
358B	601.1	611.7	643.3	880.9	973.4	658.4	664.1	769.6	926.5	964.2
359B	699.1	742.9	902.8	1227.7	1288.5	822.4	859.1	1019.0	1035.1	1035.1
363B	675.4	741.5	917.3	1124.4	1173.3	826.9	838.3	961.6	977.0	984.8
364B	505.2	517.3	538.1	810.3	897.3	582.1	533.6	624.8	771.7	875.6
365B	556.1	581.6	647.2	1115.8	1302.2	705.3	662.2	767.4	824.6	840.6
366B	543.3	564.1	635.9	950.3	1023.9	677.6	660.3	769.6	797.8	802.3
367B	508.7	519.0	539.8	770.8	862.8	637.7	597.9	637.7	817.9	840.6
367C	476.0	484.6	498.3	729.7	761.9	556.6	527.2	573.5	729.6	817.9
368B	558.9	587.2	671.2	1133.8	1235.6	650.8	624.8	735.8	780.3	776.0
369B	499.4	508.7	524.6	713.0	795.2	573.5	538.5	601.4	721.4	786.9
370B	470.8	477.7	496.6	763.7	792.4	546.7	514.4	555.0	691.3	763.2
371B	497.0	508.7	538.4	759.4	890.4	568.4	541.7	617.6	715.3	737.9
508B	357.4	379.9	447.9	548.8	636.2	434.5	429.0	530.4	550.0	540.1
508C	380.6	446.9	567.6	646.4	688.9	461.5	477.7	561.7	543.4	528.8
509B	359.7	377.2	407.7	495.9	592.4	435.9	419.4	519.2	553.3	553.3
509C	387.7	444.5	561.7	642.2	683.5	450.0	464.4	548.3	532.0	514.4
510B	393.1	411.1	434.9	519.0	708.4	444.3	431.7	551.6	603.2	580.4
510C	400.2	424.0	486.3	719.0	826.6	454.3	444.3	585.6	596.1	580.4
511B	379.9	392.5	418.2	497.0	682.1	410.1	400.9	492.8	525.6	503.5
511C	395.8	429.8	555.5	778.0	844.6	414.1	419.4	533.6	502.0	528.8

Table A-4a. (cont'd)

RUN NO.	H 1 FT	H 2 FT	H 3 FT	H 4 FT	H 5 FT	H 1,T FT	H 2,T FT	H 3,T FT	H 4,T FT	H 5,T FT
512B	415.2	427.8	451.7	570.1	865.3	471.7	474.7	505.1	566.7	558.3
513B	417.2	429.8	457.1	579.1	848.3	431.7	440.1	550.0	556.6	543.4
514B	499.7	512.1	537.7	635.5	783.4	533.6	540.1	641.4	717.4	705.3
514C	536.4	560.7	629.2	812.1	903.8	532.0	555.0	717.4	707.3	677.6
515B	616.6	627.1	667.6	812.1	1079.6	673.7	683.5	815.6	941.4	941.4
515C	701.3	828.4	1128.2	1334.8	1417.6	782.5	882.7	1013.7	982.2	936.4
517B	520.8	545.0	618.3	851.9	983.3	639.6	626.7	713.3	776.0	744.2
518B	641.2	674.7	749.4	955.8	1079.6	778.2	742.1	906.8	979.6	956.6
518C	687.1	775.1	969.7	1130.8	1189.5	822.4	826.9	979.6	954.0	936.4
520B	683.5	719.0	842.8	1053.6	1135.7	791.2	824.6	924.0	992.6	966.7
521A	424.0	429.8	450.3	568.7	966.1	480.7	458.6	500.4	566.7	565.0
522A	545.7	573.6	746.5	1240.2	1421.5	601.4	639.6	735.8	750.4	725.5
523B	668.3	690.6	746.5	955.4	1399.9	771.7	715.3	831.5	921.5	931.4
524B	676.5	702.3	824.0	1154.5	1308.7	754.7	829.2	880.3	959.1	946.4
526B	711.2	722.6	803.1	1118.8	1473.9	771.7	748.3	847.5	931.4	949.0
528B	392.1	397.9	426.1	518.7	610.3	468.8	450.0	538.5	556.6	533.6
528C	409.7	439.4	545.4	646.1	673.3	482.2	494.3	566.7	546.7	532.0
529B	483.2	487.7	518.7	607.1	756.9	603.2	566.7	679.6	735.8	733.8
529C	531.5	576.7	730.1	874.0	906.8	654.6	664.1	761.0	740.0	715.3
530B	653.9	664.4	701.6	861.3	1256.9	691.3	589.1	797.8	806.7	887.5
531B	363.1	361.7	375.2	419.3	489.0	454.3	431.7	506.6	558.3	563.4
532B	389.1	390.1	412.8	477.7	666.9	399.5	391.8	423.5	476.2	488.2

Table A-4a. (cont'd)

RUN NO.	H 1 FT	H 2 FT	H 3 FT	H 4 FT	H 5 FT	H 1,T FT	H 2,T FT	H 3,T FT	H 4,T FT	H 5,T FT
533B	399.6	411.4	437.0	521.1	830.5	420.8	474.7	468.8	520.8	524.0
536B	372.9	378.6	405.7	472.9	626.7	473.2	442.9	524.0	573.5	575.3
536C	412.5	420.3	469.5	670.1	793.8	482.2	445.7	550.0	551.6	536.8
537B	491.8	500.4	535.0	650.3	868.6	612.1	582.1	673.7	748.3	740.0
537C	524.6	555.8	691.7	960.9	1000.3	635.9	619.4	746.2	709.3	699.3
538B	576.7	599.4	655.6	808.9	983.7	719.4	713.3	806.7	971.9	911.7
538C	643.3	682.1	814.3	1054.3	1119.2	725.5	746.2	887.5	928.9	854.5
539B	491.5	507.7	538.8	653.1	940.8	632.2	613.9	671.8	778.2	756.8
540B	621.1	638.7	688.1	844.3	1140.6	778.2	731.7	831.5	977.0	946.4
541B	392.1	402.3	420.6	489.0	608.2	451.4	454.3	486.7	548.3	533.6
541C	398.9	416.9	468.1	646.4	678.6	438.7	447.1	509.7	520.8	494.3
542B	659.1	676.8	742.6	928.7	1350.5	733.8	695.3	813.4	902.0	899.5
543B	645.0	653.9	705.2	864.9	1275.9	786.9	811.2	914.2	1016.3	1040.5
544B	377.6	370.8	388.7	437.3	542.9	412.7	418.1	438.7	495.8	536.8
545B	485.6	493.5	511.8	591.7	856.6	422.2	394.4	464.4	528.8	514.4

Table A-4b. Experimental cavitation data for 0.357-inch ogive using liquid hydrogen (SI Units).

RUN NO.	CAVITY CM	TO DEG K	VO M/SEC	PO N/CM/CM	PV N/CM/CM	HO M	HV M	KV	T 1 DEG K	T 2 DEG K	T 3 DEG K	T 4 DEG K	T 5 DEG K
331A**		20.32	34.7	13.62	10.29	196.2	148.3	0.78					
331B	3.81	20.41	39.6	9.73	10.56	140.5	152.5	-0.15	19.20	19.14	19.55	19.77	19.88
331C	2.54	20.35	39.4	9.83	10.38	141.8	149.7	-0.10	18.94	18.95	19.53	19.70	19.81
331D**		20.52	34.5	14.31	10.91	206.9	157.8	0.81					
332A**		21.38	59.7	26.93	13.87	394.0	203.6	1.05					
332B	2.54	21.41	66.1	18.17	13.98	266.6	205.4	0.27	20.56	20.30	20.54	21.14	21.33
333A*		22.98	39.3	21.93	20.86	331.6	315.5	0.20					
334A**		20.95	52.8	21.86	12.32	317.8	179.6	0.97					
334B	3.30	20.99	58.3	15.01	12.46	218.7	181.7	0.21	19.34	19.19	19.46	19.86	20.20
334D**		21.16	51.6	23.52	13.06	343.0	191.0	1.12					
335B	3.05	22.23	65.2	19.79	17.33	294.8	258.3	0.17	21.19	20.83	21.08	21.85	22.08
336A*		22.96	39.9	21.52	20.76	325.2	313.9	0.14					
336B**		22.97	39.7	21.86	20.81	330.5	314.7	0.20					
337A	3.81	20.91	73.4	19.14	12.19	278.2	177.4	0.37	19.62	19.28	19.40	19.94	20.02
338A**		22.89	55.5	30.90	20.42	465.0	308.2	1.00					
338B	3.30	22.93	63.3	21.13	20.61	319.1	311.4	0.04	21.30	21.06	21.59	22.20	22.43
339A**		22.98	46.7	25.03	20.86	378.1	315.5	0.56					
340A**		22.02	54.8	25.93	16.43	384.0	243.9	0.92					
341B	2.29	22.17	74.6	22.76	17.07	338.3	254.1	0.30	21.17	20.87	21.30	21.89	22.00
342B	3.30	23.09	76.7	24.62	21.42	372.8	324.7	0.16	21.71	21.38	21.77	22.66	22.94
344B	3.30	20.27	38.4	9.56	10.14	137.7	146.1	-0.11	19.07	19.07	19.46	19.72	19.88

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-4b. (cont'd)

RUN NO.	CAVITY CM	TO DEG K	VO M/SEC	PO N/CM/CM	PV N/CM/CM	HO M	HV M	KV	T 1 DEG K	T 2 DEG K	T 3 DEG K	T 4 DEG K	T 5 DEG K
345A**		20.23	37.8	13.28	10.02	191.0	144.2	0.64					
345B	2.29	20.28	42.1	10.00	10.17	144.1	146.5	-0.03	18.81	18.76	19.29	19.53	19.63
345C**		20.35	38.0	14.11	10.38	203.3	149.7	0.73					
346A**		20.25	38.0	14.24	10.08	204.9	145.1	0.81					
346B	1.27	20.24	40.2	10.78	10.05	155.2	144.7	0.13	19.68	19.83	20.13	20.10	20.11
346C**		20.25	36.5	13.76	10.08	198.0	145.1	0.78					
347A**		20.46	48.6	20.02	10.72	288.7	154.9	1.11					
347B	1.27	20.51	53.1	14.42	10.87	208.3	157.3	0.36	20.14	20.15	20.51	20.57	20.54
347C**		20.53	48.2	19.62	10.94	283.3	158.2	1.06					
348B	3.30	20.55	54.6	13.00	11.00	188.1	159.2	0.19	19.41	19.25	19.55	19.89	20.21
348C	2.54	20.62	54.5	13.28	11.22	192.3	162.6	0.20	19.32	19.16	19.64	19.95	20.13
349A**		21.30	58.6	27.12	13.57	396.2	198.9	1.13					
349B	1.52	21.33	63.9	19.05	13.69	279.0	200.7	0.38	20.84	20.74	21.20	21.35	21.29
349C**		21.36	57.9	27.81	13.80	406.6	202.4	1.20					
350A**		22.02	42.6	20.02	16.43	296.9	243.9	0.57					
351A**		21.25	57.8	27.65	13.39	403.6	196.1	1.22					
351B	2.54	21.31	64.8	17.66	13.61	258.6	199.5	0.28	20.50	20.29	20.53	21.21	21.34
351C	3.30	21.31	64.8	17.24	13.61	252.5	199.5	0.25	19.80	19.61	19.92	20.31	20.76
351D**		21.34	57.8	25.59	13.72	374.2	201.3	1.01					
352A**		22.10	46.4	23.07	16.77	342.4	249.3	0.85					
352B	3.05	22.17	52.7	16.95	17.07	252.4	254.1	-0.01	20.92	20.71	21.21	21.64	21.89
352C**		22.25	47.4	23.72	17.42	353.1	259.7	0.82					
353A**		21.96	47.9	22.61	16.17	334.7	239.8	0.81					
353B	1.27	21.97	52.6	17.44	16.22	258.5	240.5	0.13	21.45	21.49	21.96	21.92	21.99
354B	3.05	21.35	73.5	20.06	13.76	293.8	201.8	0.33	20.21	20.21	20.53	21.22	21.34

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-4b. (cont'd)

RUN NO.	CAVITY CM	TO DEG K	VO M/SEC	PO N/CM/CM	PV N/CM/CM	HO M	HV M	KV	T 1 DEG K	T 2 DEG K	T 3 DEG K	T 4 DEG K	T 5 DEG K
355A**		22.93	64.3	35.25	20.61	530.4	311.4	1.04					
355B	3.81	22.99	72.5	23.00	20.91	347.7	316.3	0.12	21.03	20.98	21.40	22.28	22.67
355C	2.54	22.95	70.5	24.40	20.71	368.4	313.0	0.22	21.59	21.73	22.46	22.80	22.87
356A**		23.02	63.1	35.80	21.07	539.7	318.8	1.09					
357B	1.78	21.33	73.4	22.06	13.69	322.8	200.7	0.44	19.67	19.70	20.22	20.90	21.05
358B	3.30	22.99	61.2	21.57	20.91	326.2	316.3	0.05	21.33	21.36	21.88	22.56	22.71
359A**		22.97	54.7	30.15	20.81	454.7	314.7	0.92					
359B	1.52	22.99	60.9	23.46	20.91	354.6	316.3	0.20	22.12	22.28	22.92	22.98	22.98
360A**		22.98	43.8	24.24	20.86	366.2	315.5	0.52					
361A**		22.94	44.3	25.37	20.66	382.8	312.2	0.71					
362A**		23.05	47.5	26.63	21.22	402.7	321.3	0.71					
362C**		23.18	48.1	26.21	21.89	397.4	332.3	0.55					
363B	1.52	22.97	54.6	21.69	20.81	327.9	314.7	0.09	22.14	22.19	22.70	22.76	22.79
364A**		22.09	64.8	33.16	16.72	490.9	248.6	1.13					
364B	3.30	22.30	72.4	22.66	17.64	337.7	263.3	0.28	20.91	20.62	21.15	21.89	22.35
365B	1.78	22.07	72.0	23.46	16.64	348.0	247.2	0.38	21.57	21.35	21.87	22.13	22.20
366B	1.52	22.02	57.5	18.93	16.43	280.9	243.9	0.22	21.43	21.34	21.88	22.01	22.03
367B	2.54	22.19	66.2	20.69	17.16	307.9	255.5	0.23	21.22	21.00	21.22	22.10	22.20
367C	3.81	22.37	66.6	20.52	17.96	306.4	268.3	0.17	20.76	20.58	20.86	21.69	22.10
368A**		22.08	60.9	30.22	16.68	447.6	247.9	1.06					
368B	1.52	22.13	66.9	22.17	16.90	329.4	251.4	0.34	21.29	21.15	21.72	21.93	21.91

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-4b. (cont'd)

RUN NO.	CAVITY CM	TO DEG K	VO M/SEC	PO N/CM/CM	PV N/CM/CM	HO M	HV M	KV	T 1 DEG K	T 2 DEG K	T 3 DEG K	T 4 DEG K	T 5 DEG K
369A**		22.16	53.5	27.30	17.03	405.2	253.4	1.04					
369B	3.05	22.19	59.5	18.61	17.16	277.0	255.5	0.12	20.86	20.65	21.02	21.65	21.96
369C**		22.20	52.6	27.65	17.20	410.8	256.2	1.10					
370A**		22.02	64.9	33.58	16.43	496.5	243.9	1.18					
370B	3.30	22.03	72.8	21.86	16.47	324.2	244.5	0.29	20.70	20.50	20.75	21.50	21.85
370C**		22.14	63.3	34.41	16.94	509.8	252.0	1.26					
371A**		21.95	52.8	25.97	16.13	384.0	239.2	1.02					
371B	2.54	22.01	59.0	18.33	16.38	272.0	243.2	0.16	20.83	20.67	21.11	21.62	21.73
371C**		22.19	51.7	27.24	17.16	404.7	255.5	1.09					
507A**		20.79	35.5	13.56	11.78	196.9	171.2	0.40					
508A**		20.91	41.9	16.38	12.19	238.3	177.4	0.68					
508B	1.52	20.93	46.2	11.99	12.26	174.6	178.5	-0.04	19.96	19.92	20.60	20.72	20.66
508C	1.02	20.94	45.5	12.73	12.29	185.3	179.0	0.06	20.15	20.26	20.79	20.68	20.59
508D**		20.93	41.9	16.51	12.26	240.1	178.5	0.69					
509A**		20.95	41.1	15.68	12.32	228.2	179.6	0.56					
509B	2.29	20.96	45.2	11.68	12.36	170.2	180.1	-0.10	19.97	19.85	20.53	20.74	20.74
509C	1.02	20.93	44.2	12.68	12.26	184.6	178.5	0.06	20.07	20.17	20.71	20.61	20.50
509D**		20.99	41.1	15.76	12.46	229.6	181.7	0.56					
510A**		20.95	51.0	20.79	12.32	302.4	179.6	0.93					
510B	2.29	20.98	56.4	14.21	12.43	207.0	181.2	0.16	20.03	19.94	20.73	21.03	20.90
510C	1.52	20.99	55.8	14.52	12.46	211.6	181.7	0.19	20.10	20.03	20.93	20.99	20.90
511A**		20.91	50.7	20.36	12.19	295.9	177.4	0.90					
511B	2.54	20.92	55.8	13.92	12.22	202.6	178.0	0.15	19.78	19.71	20.36	20.57	20.43
511C	1.27	20.93	55.2	14.87	12.26	216.3	178.5	0.24	19.81	19.85	20.62	20.42	20.59
511D**		20.95	50.2	20.11	12.32	292.4	179.6	0.88					
512A**		20.92	58.0	25.62	12.22	372.0	178.0	1.13					
512B	1.90	20.96	64.6	16.50	12.36	240.2	180.1	0.28	20.22	20.24	20.44	20.82	20.77

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-4b. (cont'd)

RUN NO.	CAVITY CM	TO DEG K	VO M/SEC	PO N/CM/CM	PV N/CM/CM	HO M	HV M	KV	T 1 DEG K	T 2 DEG K	T 3 DEG K	T 4 DEG K	T 5 DEG K
513A**		20.90	55.6	25.69	12.15	372.8	176.9	1.24					
513B	1.90	20.94	62.6	16.20	12.29	235.7	179.0	0.28	19.94	20.00	20.72	20.76	20.68
514A**		21.82	45.1	22.30	15.59	329.3	230.7	0.95					
514B	2.54	21.89	51.7	15.74	15.88	233.1	235.2	-0.02	20.62	20.66	21.24	21.63	21.57
514C	1.52	21.91	50.9	16.54	15.96	245.0	236.5	0.06	20.61	20.75	21.63	21.58	21.43
514D**		21.96	45.2	22.59	16.17	334.4	239.8	0.91					
515A**		22.83	58.5	33.27	20.12	499.9	303.3	1.13					
515B	2.54	22.88	66.7	21.55	20.37	325.2	307.4	0.08	21.41	21.46	22.09	22.62	22.62
515C	1.02	22.90	64.9	24.10	20.47	363.6	309.0	0.25	21.94	22.38	22.90	22.78	22.60
516A**		22.90	42.9	24.90	20.47	375.4	309.0	0.71					
517A**		21.90	52.0	24.61	15.92	363.7	235.9	0.93					
517B	1.52	21.92	58.1	17.55	16.01	260.0	237.2	0.13	21.23	21.16	21.61	21.91	21.76
517C**		21.90	52.6	24.01	15.92	355.0	235.9	0.84					
518A**		22.83	50.4	26.78	20.12	403.0	303.3	0.77					
518B	1.90	22.86	56.3	19.97	20.27	301.2	305.7	-0.03	21.92	21.75	22.48	22.77	22.68
518C	1.27	22.87	55.7	21.14	20.32	318.9	306.5	0.08	22.12	22.14	22.77	22.67	22.60
518D**		22.86	50.1	27.07	20.27	407.6	305.7	0.80					
519A**		22.88	43.7	24.86	20.37	374.8	307.4	0.69					
520A**		22.88	49.9	27.64	20.37	416.3	307.4	0.86					
520B	1.52	22.90	56.5	20.52	20.47	309.8	309.0	0.01	21.98	22.13	22.55	22.82	22.72
521A	2.29	21.00	76.9	19.44	12.50	282.9	182.2	0.33	20.28	20.13	20.41	20.82	20.81
522A	1.27	21.90	76.0	22.84	15.92	337.8	235.9	0.35	21.02	21.23	21.72	21.79	21.67
522B**		22.00	68.0	34.69	16.34	512.5	242.5	1.14					
523A**		22.84	69.5	38.98	20.17	584.8	304.1	1.14					
523B	1.90	22.91	79.0	24.98	20.51	376.8	309.8	0.21	21.89	21.62	22.16	22.54	22.58

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-4b. (cont'd)

RUN NO.	CAVITY CM	TO DEG K	VO M/SEC	PO N/CM/CM	PV N/CM/CM	HO M	HV M	KV	T 1 DEG K	T 2 DEG K	T 3 DEG K	T 4 DEG K	T 5 DEG K
524A**		22.80	59.4	33.09	19.97	496.8	301.0	1.09					
524B	1.52	22.84	67.0	22.86	20.17	344.5	304.1	0.18	21.81	22.15	22.37	22.69	22.64
526A**		22.89	68.1	39.27	20.42	589.8	308.2	1.19					
526B	1.52	23.13	76.9	26.07	21.63	394.9	328.0	0.22	21.89	21.78	22.23	22.58	22.65
528A**		20.89	38.9	16.00	12.12	232.6	176.4	0.73					
528B	2.03	20.90	42.8	12.10	12.15	176.1	176.9	-0.01	20.20	20.07	20.65	20.76	20.62
528C	1.02	20.88	42.4	12.94	12.09	188.3	175.9	0.14	20.29	20.37	20.82	20.70	20.61
528D**		20.90	39.2	16.03	12.15	233.1	176.9	0.72					
529A**		21.80	45.4	21.53	15.51	317.8	229.4	0.84					
529B	2.54	21.81	51.1	15.60	15.55	230.6	230.0	0.00	21.03	20.82	21.44	21.72	21.71
529C	1.02	21.84	50.3	17.15	15.68	253.6	232.0	0.17	21.31	21.36	21.84	21.74	21.62
529D**		21.88	46.6	21.55	15.84	318.6	234.6	0.76					
530A**		22.98	68.7	40.49	20.86	609.0	315.5	1.22					
530B	2.29	23.10	77.8	25.52	21.47	386.5	325.5	0.20	21.50	20.95	22.01	22.05	22.40
531A**		20.87	58.5	26.86	12.05	389.4	175.3	1.23					
531B	3.30	20.87	65.9	16.29	12.05	236.7	175.3	0.28	20.10	19.94	20.45	20.77	20.80
531C**		20.91	58.5	27.16	12.19	394.1	177.4	1.24					
532A**		20.86	67.0	31.36	12.02	454.3	174.8	1.22					
532B	2.54	20.91	74.6	19.23	12.19	279.5	177.4	0.36	19.70	19.64	19.88	20.25	20.33
532C**		20.94	67.2	31.85	12.29	461.9	179.0	1.23					
533A**		20.80	66.5	30.88	11.82	446.9	171.7	1.22					
533B	2.29	20.88	74.8	19.35	12.09	281.1	175.9	0.37	19.86	20.24	20.20	20.54	20.56
533C**		20.91	67.1	31.35	12.19	454.5	177.4	1.21					
534A**		22.66	44.7	23.86	19.30	358.0	290.0	0.67					
534C**		22.79	44.2	24.90	19.93	374.7	300.2	0.75					

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-4b. (cont'd)

RUN NO.	CAVITY CM	TO DEG K	VO M/SEC	PO N/CM/CM	PV N/CM/CM	HO M	HV M	KV	T 1 DEG K	T 2 DEG K	T 3 DEG K	T 4 DEG K	T 5 DEG K
535A**		22.74	44.0	24.39	19.68	366.6	296.2	0.71					
535C**		22.88	43.8	25.59	20.37	385.7	307.4	0.80					
536A**		20.83	50.3	21.32	11.92	309.3	173.3	1.05					
536B	2.54	20.85	56.2	14.31	11.98	207.9	174.3	0.21	20.23	20.02	20.56	20.86	20.87
536C	1.52	20.88	55.6	15.07	12.09	219.0	175.9	0.27	20.29	20.04	20.72	20.73	20.64
537A**		21.67	52.6	24.99	14.99	367.8	221.1	1.04					
537B	2.29	21.74	59.7	17.32	15.27	255.7	225.5	0.17	21.08	20.91	21.41	21.78	21.74
537C	1.27	21.76	59.2	18.77	15.35	277.0	226.8	0.28	21.21	21.12	21.77	21.59	21.54
538A**		22.71	51.3	27.92	19.54	419.0	293.9	0.93					
538B	2.54	22.74	59.3	19.66	19.68	295.9	296.2	-0.00	21.64	21.61	22.05	22.74	22.50
538C	1.52	22.76	58.8	20.99	19.78	316.0	297.8	0.10	21.67	21.77	22.40	22.57	22.26
539A**		21.69	60.0	28.26	15.07	415.7	222.4	1.05					
539B	2.29	21.74	66.4	19.19	15.27	283.1	225.5	0.26	21.19	21.09	21.40	21.92	21.82
540A**		22.85	59.6	33.61	20.22	505.1	304.9	1.11					
540B	2.29	22.93	68.4	22.49	20.61	339.6	311.4	0.12	21.92	21.70	22.16	22.76	22.64
541A**		20.86	41.5	16.91	12.02	245.6	174.8	0.81					
541B	2.29	20.89	46.9	12.56	12.12	182.8	176.4	0.06	20.08	20.10	20.32	20.71	20.62
541C	1.52	20.85	46.6	13.00	11.98	189.0	174.3	0.13	19.99	20.05	20.47	20.54	20.37
541D**		20.84	42.0	17.66	11.95	256.5	173.8	0.92					
542A**		22.95	71.1	40.07	20.71	602.4	313.0	1.12					
542B	2.29	22.99	80.2	26.42	20.91	399.0	316.3	0.25	21.71	21.52	22.08	22.46	22.45
543A**		22.85	69.5	39.90	20.22	598.6	304.9	1.19					
543B	2.54	22.92	79.0	25.63	20.56	386.5	310.6	0.24	21.96	22.07	22.51	22.91	23.00
543C**		22.93	69.5	39.80	20.61	598.1	311.4	1.17					
544A**		20.73	66.5	29.59	11.58	427.9	168.1	1.15					
544B	3.30	20.82	73.6	18.58	11.88	269.7	172.7	0.35	19.80	19.84	19.99	20.38	20.64

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-4b. (cont'd)

RUN NO.	CAVITY CM	TO DEG K	VO M/SEC	PO N/CM/CM	PV N/CM/CM	HO M	HV M	KV	T 1 DEG K	T 2 DEG K	T 3 DEG K	T 4 DEG K	T 5 DEG K
545A**		21.62	67.1	33.16	14.79	486.6	218.0	1.17					
545B	2.54	21.74	75.3	21.18	15.27	312.4	225.5	0.30	19.87	19.66	20.17	20.59	20.50
546A**		21.73	69.2	35.35	15.23	519.5	224.9	1.21					

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-4b. (cont'd)

RUN NO.	P 1 N/CM/CM	P 2 N/CM/CM	P 3 N/CM/CM	P 4 N/CM/CM	P 5 N/CM/CM	P 1,T N/CM/CM	P 2,T N/CM/CM	P 3,T N/CM/CM	P 4,T N/CM/CM	P 5,T N/CM/CM
331B	6.76	7.32	6.83	8.92	8.85	7.28	7.14	8.14	8.72	9.01
331C	6.78	7.40	7.21	9.43	9.90	6.68	6.70	8.09	8.53	8.82
332B	8.97	9.07	9.38	14.21	15.18	11.03	10.23	10.97	12.99	13.69
334B	7.79	7.79	8.09	11.45	10.90	7.61	7.25	7.91	8.96	9.93
335B	10.60	10.65	10.95	15.96	17.22	13.17	11.92	12.78	15.72	16.68
337A	7.69	7.80	8.00	13.62	11.11	8.32	7.47	7.76	9.18	9.41
338B	12.39	12.58	13.18	18.39	19.86	13.57	12.71	14.68	17.20	18.23
341B	11.45	11.28	11.80	17.86	20.62	13.10	12.05	13.57	15.88	16.34
342B	12.52	12.38	12.69	18.93	20.42	15.15	13.87	15.39	19.30	20.66
344B	6.51	6.51	7.07	9.11	9.26	6.97	6.97	7.91	8.58	9.01
345B	6.52	6.59	7.04	9.31	10.31	6.40	6.29	7.49	8.09	8.34
346B	6.99	7.59	9.69	11.56	12.02	8.48	8.88	9.72	9.64	9.67
347B	7.78	8.14	10.19	15.59	16.51	9.75	9.78	10.87	11.06	10.97
348B	6.82	6.92	7.23	10.22	9.74	7.79	7.40	8.14	9.04	9.96
348C	7.21	7.45	7.80	11.00	12.31	7.56	7.18	8.37	9.21	9.72
349B	9.67	10.22	11.90	19.95	21.72	11.95	11.62	13.21	13.76	13.54
351B	8.69	8.83	9.25	13.52	14.35	10.84	10.20	10.94	13.24	13.72
351C	8.07	8.14	8.45	12.90	10.97	8.80	8.29	9.13	10.26	11.68
352B	10.94	11.00	11.60	15.02	17.02	12.22	11.52	13.24	14.87	15.88
353B	11.14	11.85	14.82	18.61	19.48	14.14	14.29	16.17	16.01	16.30
354B	8.89	9.00	9.21	14.89	15.02	9.96	9.96	10.94	13.28	13.72

Table A-4b. (cont'd)

RUN NO.	P 1 N/CM/CM	P 2 N/CM/CM	P 3 N/CM/CM	P 4 N/CM/CM	P 5 N/CM/CM	P 1,T N/CM/CM	P 2,T N/CM/CM	P 3,T N/CM/CM	P 4,T N/CM/CM	P 5,T N/CM/CM
355B	11.42	11.56	11.93	17.[illegible]7	17.97	12.60	12.43	13.95	17.55	19.35
355C	13.80	14.20	15.21	22.[illegible]8	26.17	14.68	15.23	18.37	19.97	20.32
357B	9.75	10.13	11.09	19.[illegible]5	24.02	8.45	8.53	9.99	12.15	12.67
358B	12.56	12.77	13.39	17.97	19.71	13.69	13.80	15.84	18.83	19.54
359B	14.48	15.33	18.38	24.41	25.51	16.85	17.55	20.56	20.86	20.86
363B	14.02	15.30	18.66	22.52	23.41	16.94	17.16	19.49	19.78	19.93
364B	10.66	10.90	11.31	16.62	18.28	12.19	11.22	13.03	15.88	17.87
365B	11.67	12.18	13.47	22.35	25.76	14.60	13.76	15.80	16.90	17.20
366B	11.42	11.83	13.24	19.23	20.66	14.06	13.72	15.84	16.38	16.47
367B	10.73	10.94	11.35	15.8[illegible]	17.62	13.28	12.50	13.28	16.77	17.20
367C	10.07	10.25	10.52	15.07	15.69	11.68	11.10	12.02	15.07	16.77
368B	11.73	12.29	13.93	22.6[illegible]	24.55	13.54	13.03	15.19	16.05	15.96
369B	10.54	10.73	11.05	14.7[illegible]	16.33	12.02	11.32	12.57	14.91	16.17
370B	9.97	10.11	10.49	15.7[illegible]	16.28	11.48	10.84	11.65	14.33	15.72
371B	10.49	10.73	11.32	15.64	18.15	11.92	11.39	12.89	14.79	15.23
508B	7.67	8.13	9.51	11.5[illegible]	13.25	9.24	9.13	11.16	11.55	11.35
508C	8.14	9.49	11.90	13.4[illegible]	14.28	9.78	10.11	11.78	11.42	11.13
509B	7.72	8.07	8.69	10.47	12.39	9.27	8.93	10.94	11.62	11.62
509C	8.29	9.44	11.78	13.37	14.18	9.55	9.84	11.52	11.19	10.84
510B	8.40	8.76	9.25	10.94	14.66	9.44	9.18	11.58	12.60	12.15
510C	8.54	9.03	10.28	14.87	16.93	9.64	9.44	12.26	12.46	12.15
511B	8.13	8.38	8.91	10.49	14.15	8.74	8.56	10.41	11.06	10.62
511C	8.45	9.14	11.66	16.00	17.28	8.82	8.93	11.22	10.59	11.13

Table A-4b. (cont'd)

RUN NO.	P 1 N/CM/CM	P 2 N/CM/CM	P 3 N/CM/CM	P 4 N/CM/CM	P 5 N/CM/CM	P 1,T N/CM/CM	P 2,T N/CM/CM	P 3,T N/CM/CM	P 4,T N/CM/CM	P 5,T N/CM/CM
512B	8.85	9.10	9.58	11.95	17.67	9.99	10.05	10.66	11.88	11.72
513B	8.89	9.14	9.69	12.13	17.35	9.18	9.35	11.55	11.68	11.42
514B	10.55	10.80	11.31	13.24	16.11	11.22	11.35	13.35	14.83	14.60
514C	11.28	11.76	13.11	16.66	18.40	11.19	11.65	14.83	14.64	14.06
515B	12.87	13.07	13.87	16.66	21.69	13.98	14.17	16.72	19.11	19.11
515C	14.52	16.97	22.59	26.34	27.83	16.09	18.00	20.47	19.88	19.02
517B	10.97	11.45	12.90	17.42	19.90	13.32	13.06	14.75	15.96	15.35
518B	13.35	14.00	15.45	19.38	21.69	16.01	15.31	18.46	19.83	19.40
518C	14.24	15.95	19.64	22.64	23.71	16.85	16.94	19.83	19.35	19.02
520B	14.18	14.87	17.24	21.21	22.73	16.26	16.90	18.78	20.07	19.59
521A	9.03	9.14	9.56	11.92	19.57	10.17	9.72	10.56	11.88	11.85
522A	11.47	12.02	15.40	24.63	27.90	12.57	13.32	15.19	15.47	14.99
523B	13.88	14.31	15.40	19.37	27.51	15.88	14.79	17.03	18.74	18.92
524B	14.04	14.54	16.89	23.07	25.88	15.55	16.98	17.96	19.44	19.21
526B	14.71	14.93	16.49	22.41	28.83	15.88	15.43	17.33	18.92	19.25
528B	8.38	8.49	9.07	10.93	12.74	9.93	9.55	11.32	11.68	11.22
528C	8.74	9.34	11.46	13.44	13.98	10.20	10.44	11.88	11.48	11.19
529B	10.22	10.31	10.93	12.68	15.60	12.60	11.88	14.10	15.19	15.15
529C	11.18	12.08	15.08	17.84	18.46	13.61	13.80	15.68	15.27	14.79
530B	13.60	13.80	14.53	17.60	24.94	14.33	12.32	16.38	16.55	18.09
531B	7.78	7.76	8.03	8.93	10.34	9.64	9.18	10.69	11.72	11.82
532B	8.32	8.34	8.80	10.11	13.85	8.53	8.37	9.01	10.08	10.32

Table A-4b. (cont'd)

RUN NO.	P 1 N/CM/CM	P 2 N/CM/CM	P 3 N/CM/CM	P 4 N/CM/CM	P 5 N/CM/CM	P 1,T N/CM/CM	P 2,T N/CM/CM	P 3,T N/CM/CM	P 4,T N/CM/CM	P 5,T N/CM/CM
533B	8.53	8.77	9.29	10.98	17.01	8.96	10.05	9.93	10.97	11.03
536B	7.98	8.10	8.65	10.01	13.07	10.02	9.41	11.03	12.02	12.05
536C	8.79	8.95	9.94	13.91	16.31	10.20	9.46	11.55	11.58	11.29
537B	10.39	10.56	11.25	13.53	17.73	12.78	12.19	13.98	15.43	15.27
537C	11.05	11.67	14.33	19.48	20.22	13.24	12.92	15.39	14.68	14.48
538B	12.08	12.53	13.63	16.60	19.91	14.87	14.75	16.55	19.68	18.55
538C	13.39	14.15	16.70	21.22	22.42	14.99	15.39	18.09	18.88	17.47
539B	10.38	10.71	11.33	13.58	19.10	13.17	12.81	13.95	16.01	15.59
540B	12.96	13.30	14.27	17.27	22.81	16.01	15.11	17.03	19.78	19.21
541B	8.38	8.58	8.96	10.34	12.70	9.58	9.64	10.29	11.52	11.22
541C	8.52	8.88	9.91	13.45	14.08	9.32	9.49	10.75	10.97	10.44
542B	13.70	14.04	15.32	18.87	26.63	15.15	14.40	16.68	18.37	18.32
543B	13.42	13.60	14.60	17.66	25.28	16.17	16.64	18.60	20.51	20.97
544B	8.08	7.94	8.31	9.29	11.41	8.80	8.91	9.32	10.47	11.29
545B	10.27	10.42	10.79	12.38	17.51	8.99	8.42	9.84	11.13	10.84

Table A-4b. (cont'd)

RUN NO.	H 1 M	H 2 M	H 3 M	H 4 M	H 5 M	H 1,T M	H 2,T M	H 3,T M	H 4,T M	H 5,T M
331B	95.5	103.7	96.6	127.7	126.6	103.1	101.0	115.9	124.6	129.1
331C	95.7	105.0	102.2	135.4	142.5	94.3	94.7	115.2	121.8	126.2
332B	128.4	130.0	134.6	208.9	224.0	159.7	147.4	158.7	189.9	200.7
334B	110.8	110.8	115.3	166.1	157.7	108.1	102.8	112.5	128.3	142.9
335B	153.2	153.9	158.4	236.5	256.6	192.7	173.3	186.6	232.6	247.9
337A	109.3	110.9	114.0	199.7	160.8	118.6	106.0	110.3	131.6	135.0
338B	180.6	183.4	192.7	275.3	299.2	198.9	185.5	216.2	256.2	272.7
341B	166.1	163.5	171.4	266.8	311.5	191.6	175.3	198.9	235.2	242.5
342B	182.6	180.5	185.3	284.1	308.2	223.7	203.6	227.5	290.0	312.2
344B	91.8	91.8	100.1	130.5	132.8	98.7	98.7	112.5	122.6	129.1
345B	92.0	93.0	99.6	133.6	148.7	90.2	88.6	106.3	115.2	119.0
346B	98.9	107.8	139.3	167.8	174.9	121.0	127.0	139.8	138.5	138.9
347B	110.6	116.0	146.9	230.6	245.1	140.2	140.7	157.3	160.2	158.7
348B	96.4	97.8	102.5	147.4	140.1	110.7	104.9	115.9	129.5	143.3
348C	102.2	105.7	110.9	159.3	179.4	107.4	101.7	119.4	132.0	139.8
349B	139.0	147.4	173.0	300.5	329.5	173.8	168.6	193.2	201.8	198.4
351B	124.3	126.3	132.6	198.1	211.0	156.8	147.0	158.2	193.8	201.3
351C	115.0	116.0	120.7	188.5	158.7	125.8	118.2	130.8	147.9	169.7
352B	158.2	159.3	168.3	221.7	253.4	178.0	167.1	193.8	219.3	235.2
353B	161.4	172.3	218.4	278.8	292.9	207.7	210.1	239.8	237.2	241.8
354B	127.2	128.9	132.0	219.5	221.7	143.3	143.3	158.2	194.4	201.3

Table A-4b. (cont'd)

RUN NO.	H 1 M	H 2 M	H 3 M	H 4 M	H 5 M	H 1,T M	H 2,T M	H 3,T M	H 4,T M	H 5,T M
355B	165.6	167.7	173.5	255.8	268.5	183.9	181.2	204.8	261.9	290.8
355C	202.5	208.7	224.6	348.8	403.9	216.2	224.9	274.9	301.0	306.5
357B	140.2	145.9	160.6	297.3	367.7	120.6	121.8	143.8	176.9	184.9
358B	183.2	186.4	196.1	268.5	296.7	200.7	202.4	234.6	282.4	293.9
359B	213.1	226.4	275.2	374.2	392.7	250.7	261.9	310.6	315.5	315.5
363B	205.9	226.0	279.6	342.7	357.6	252.0	255.5	293.1	297.8	300.2
364B	154.0	157.7	164.0	247.0	273.5	177.4	162.6	190.4	235.2	266.9
365B	169.5	177.3	197.3	340.1	396.9	215.0	201.8	233.9	251.4	256.2
366B	165.6	172.0	193.8	289.6	312.1	206.5	201.3	234.6	243.2	244.5
367B	155.0	158.2	164.5	234.9	263.0	194.4	182.2	194.4	249.3	256.2
367C	145.1	147.7	151.9	222.4	232.2	169.7	160.7	174.8	222.4	249.3
368B	170.4	179.0	204.6	345.6	376.6	198.4	190.4	224.3	237.8	236.5
369B	152.2	155.0	159.9	217.3	242.4	174.8	164.1	183.3	219.9	239.8
370B	143.5	145.6	151.4	232.8	241.5	166.6	156.8	169.2	210.7	232.6
371B	151.5	155.0	164.1	231.5	271.4	173.3	165.1	188.2	218.0	224.9
508B	108.9	115.8	136.5	167.3	193.9	132.4	130.8	161.7	167.6	164.6
508C	116.0	136.2	173.0	197.0	210.0	140.7	145.6	171.2	165.6	161.2
509B	109.6	115.0	124.3	151.2	180.6	132.9	127.8	158.2	168.6	168.6
509C	118.2	135.5	171.2	195.7	208.3	137.2	141.5	167.1	162.1	156.8
510B	119.8	125.3	132.6	158.2	215.9	135.4	131.6	168.1	183.9	176.9
510C	122.0	129.2	148.2	219.2	251.9	138.5	135.4	178.5	181.7	176.9
511B	115.8	119.6	127.5	151.5	207.9	125.0	122.2	150.2	160.2	153.5
511C	120.7	131.0	169.3	237.1	257.4	126.2	127.8	162.6	153.0	161.2

Table A-4b. (cont'd)

RUN NO.	H 1 M	H 2 M	H 3 M	H 4 M	H 5 M	H 1,T M	H 2,T M	H 3,T M	H 4,T M	H 5,T M
512B	126.5	130.4	137.7	173.8	263.7	143.8	144.7	153.9	172.7	170.2
513B	127.2	131.0	139.3	176.5	258.6	131.6	134.1	167.6	169.7	165.6
514B	152.3	156.1	163.9	193.7	238.8	162.6	164.6	195.5	218.7	215.0
514C	163.5	170.9	191.8	247.5	275.5	162.1	169.2	218.7	215.6	206.5
515B	187.9	191.1	203.5	247.5	329.1	205.4	208.3	248.6	286.9	286.9
515C	213.7	252.5	343.9	406.8	432.1	238.5	269.1	309.0	299.4	285.4
517B	158.7	166.1	188.5	259.7	299.7	194.9	191.0	217.4	236.5	226.8
518B	195.4	205.6	228.4	291.3	329.1	237.2	226.2	276.4	298.6	291.6
518C	209.4	236.3	295.6	344.7	362.6	250.7	252.0	298.6	290.8	285.4
520B	208.3	219.2	256.9	321.1	346.2	241.2	251.4	281.6	302.5	294.7
521A	129.2	131.0	137.2	173.3	294.5	146.5	139.8	152.5	172.7	172.2
522A	166.3	174.8	227.5	378.0	433.3	183.3	194.9	224.3	228.7	221.1
523B	203.7	210.5	227.5	291.2	426.7	235.2	218.0	253.4	280.9	283.9
524B	206.2	214.1	251.2	351.9	398.9	230.0	252.7	268.3	292.3	288.5
526B	216.8	220.2	244.8	341.0	449.3	235.2	228.1	258.3	283.9	289.2
528B	119.5	121.3	129.9	158.1	186.0	142.9	137.2	164.1	169.7	162.6
528C	124.9	133.9	166.2	196.9	205.2	147.0	150.7	172.7	166.6	162.1
529B	147.3	148.6	158.1	185.0	230.7	183.9	172.7	207.1	224.3	223.7
529C	162.0	175.8	222.5	266.4	276.4	199.5	202.4	232.0	225.5	218.0
530B	199.3	202.5	213.9	262.5	383.1	210.7	179.6	243.2	245.9	270.5
531B	110.7	110.3	114.4	127.8	149.1	138.5	131.6	154.4	170.2	171.7
532B	118.6	118.9	125.8	145.6	203.3	121.8	119.4	129.1	145.1	148.8

Table A-4b. (cont'd)

RUN NO.	H 1 M	H 2 M	H 3 M	H 4 M	H 5 M	H 1,T M	H 2,T M	H 3,T M	H 4,T M	H 5,T M
533B	121.8	125.4	133.2	158.8	253.2	128.3	144.7	142.9	158.7	159.7
536B	113.6	115.4	123.6	144.1	191.0	144.2	135.0	159.7	174.8	175.3
536C	125.7	128.1	143.1	204.2	241.9	147.0	135.9	167.6	168.1	163.6
537B	149.9	152.5	163.1	198.2	264.7	186.6	177.4	205.4	228.1	225.5
537C	159.9	169.4	210.8	292.9	304.9	193.8	188.8	227.5	216.2	213.1
538B	175.8	182.7	199.8	246.6	299.8	219.3	217.4	245.9	296.2	277.9
538C	196.1	207.9	248.2	321.4	341.1	221.1	227.5	270.5	283.1	260.4
539B	149.8	154.7	164.2	199.1	286.7	192.7	187.1	204.8	237.2	230.7
540B	189.3	194.7	209.7	257.3	347.6	237.2	223.0	253.4	297.8	288.5
541B	119.5	122.6	128.2	149.1	185.4	137.6	138.5	148.3	167.1	162.6
541C	121.6	127.1	142.7	197.0	206.8	133.7	136.3	155.4	158.7	150.7
542B	200.9	206.3	226.3	283.1	411.6	223.7	211.9	247.9	274.9	274.2
543B	196.6	199.3	214.9	263.6	388.9	239.8	247.2	278.6	309.8	317.1
544B	115.1	113.0	118.5	133.3	165.5	125.8	127.4	133.7	151.1	163.6
545B	148.0	150.4	156.0	180.4	261.1	128.7	120.2	141.5	161.2	156.8

Table A-5a. Experimental cavitation data for 0.420-inch ogive using liquid nitrogen (English Units).

RUN NO.	CAVITY INCHES	TO DEG R	VO FT/SEC	PO PSIA	PV PSIA	HO FT	HV FT	KV	T 1 DEG R	T 2 DEG R	T 3 DEG R	T 4 DEG R	T 5 DEG R
431A**		140.45	28.6	20.15	15.88	57.8	45.5	0.96					
431B	1.80	140.56	30.2	16.52	15.99	47.4	45.9	0.11	138.82	138.76	138.85	139.10	139.37
431C	1.05	140.62	29.8	16.96	16.05	48.7	46.0	0.19	139.21	139.39	139.75	140.18	140.47
432A	0.92	140.83	29.6	17.12	16.27	49.2	46.7	0.18	139.52	139.72	140.06	140.53	140.80
432B	1.18	140.76	29.5	16.95	16.20	48.7	46.5	0.16	139.25	139.43	139.72	140.22	140.54
432C	0.72	140.90	29.3	17.37	16.35	49.9	46.9	0.22	139.77	140.00	140.44	140.85	140.81
432D	0.32	140.89	28.8	18.07	16.33	51.9	46.9	0.39	140.17	140.63	140.90	140.99	141.07
432F**		140.87	28.0	20.05	16.31	57.6	46.8	0.88					
433A**		140.17	38.8	24.45	15.59	70.0	44.7	1.08					
433C	0.63	140.13	41.1	18.77	15.56	53.8	44.6	0.35	139.01	139.28	139.86	140.35	140.36
433D	1.18	140.18	41.3	18.16	15.61	52.0	44.7	0.28	138.56	138.62	139.07	139.61	140.02
433E	0.52	140.18	41.1	19.07	15.61	54.6	44.7	0.38	139.05	139.39	139.93	140.29	140.31
434C	0.72	139.99	56.3	21.98	15.41	62.9	44.1	0.38	137.59	137.99	138.67	139.25	139.28
434D	1.06	140.13	55.9	21.58	15.56	61.8	44.6	0.36	137.50	137.81	138.37	138.94	139.37
434F**		140.17	53.1	31.55	15.59	90.4	44.7	1.04					
435A**		150.41	40.3	35.96	28.77	106.6	85.3	0.84					
435B	0.78	150.55	42.4	29.78	29.00	88.3	86.0	0.08	148.07	148.63	149.53	150.23	150.39
435C	0.64	150.55	42.1	30.37	29.00	90.1	86.0	0.15	148.41	149.17	150.05	150.50	150.55
435D	0.40	150.59	41.5	31.40	29.05	93.1	86.2	0.26	148.90	149.89	150.44	150.68	150.64
435E**		150.55	39.8	36.13	29.00	107.1	86.0	0.86					
435F	0.64	150.64	41.8	30.30	29.14	89.9	86.5	0.13	148.36	149.02	149.94	150.41	150.50
435G	0.80	150.66	41.9	29.83	29.17	88.5	86.5	0.07	147.94	148.48	149.36	150.12	150.34
436A	0.52	150.01	56.9	33.37	28.14	98.8	83.3	0.31	147.53	148.36	149.45	149.98	149.96
436B	0.70	150.01	57.2	32.58	28.14	96.4	83.3	0.26	147.13	147.80	148.91	149.76	149.83
436C**		149.98	54.7	42.25	28.08	125.0	83.1	0.90					
436D	1.16	150.12	57.8	31.72	28.31	93.9	83.8	0.19	146.72	146.88	147.78	148.70	149.42
436F**		150.26	54.0	44.53	28.54	131.9	84.6	1.05					
437A**		149.69	63.5	47.30	27.63	139.8	81.7	0.93					
437C	0.94	149.71	66.4	33.79	27.66	99.9	81.8	0.26	146.66	147.08	148.16	149.26	149.51
437D	1.56	149.74	66.5	32.83	27.72	97.1	82.0	0.22	145.84	145.96	146.75	147.55	148.45

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-5a. (cont'd)

RUN NO.	CAVITY INCHES	TO DEG R	VO FT/SEC	PO PSIA	PV PSIA	HO FT	HV FT	KV	T 1 DEG R	T 2 DEG R	T 3 DEG R	T 4 DEG R	T 5 DEG R
439A**		160.87	56.5	60.66	49.42	186.8	152.2	0.70					
439B	0.34	160.92	58.6	52.84	49.55	162.8	152.6	0.19	158.94	160.38	160.88	161.08	161.06
439C	0.90	160.94	59.3	49.72	49.59	153.2	152.8	0.01	157.09	158.63	160.00	160.61	160.83
439D	0.48	160.96	59.0	51.21	49.63	157.8	152.9	0.09	157.93	159.64	160.54	160.85	160.90
439E**		160.97	56.5	61.71	49.68	190.1	153.1	0.74					
439F	0.40	161.24	59.0	52.68	50.33	162.5	155.2	0.13	158.80	160.42	160.99	161.17	161.23
439G**		161.39	55.6	62.59	50.68	193.1	156.4	0.76					
440A**		165.58	49.4	68.30	61.65	214.3	193.4	0.55					
440D**		165.58	48.7	68.18	61.65	213.9	193.4	0.55					
440F**		165.67	48.8	69.63	61.90	218.5	194.3	0.65					
441A	0.48	165.53	66.7	64.13	61.50	201.2	192.9	0.12	161.86	164.00	164.84	165.24	165.28
442A**		160.58	66.3	68.64	48.73	211.0	149.9	0.89					
442B	0.81	160.58	70.5	50.73	48.73	156.1	149.9	0.08	155.18	156.40	158.45	159.73	160.13
442C	0.60	160.74	69.8	52.31	49.12	161.0	151.2	0.13	156.20	158.13	159.77	160.34	160.40
442D**		161.06	65.4	68.43	49.89	210.8	153.8	0.86					
443A**		149.65	69.0	53.35	27.58	157.6	81.5	1.03					
443B	1.16	149.81	72.0	35.66	27.83	105.5	82.3	0.29	146.36	146.59	147.58	148.55	149.29
443C	0.39	149.78	70.1	38.55	27.77	114.0	82.2	0.42	146.92	148.09	149.20	149.54	149.44
444A**		139.25	66.7	39.70	14.69	113.4	42.0	1.03					
444B	0.75	139.27	69.4	25.53	14.71	72.9	42.0	0.41	137.12	137.39	138.04	138.67	138.98
444C	0.35	139.27	68.8	26.97	14.71	77.0	42.0	0.48	137.45	138.02	138.69	139.07	139.03
445A	1.26	139.54	63.1	23.17	14.97	66.2	42.8	0.38	137.52	137.52	138.06	138.67	139.09
445B	0.40	139.57	62.2	24.68	15.00	70.6	42.9	0.46	138.24	138.60	139.27	139.63	139.59
445C**		139.55	57.9	34.84	14.99	99.6	42.9	1.09					
445D	0.65	139.57	60.2	23.08	15.00	66.0	42.9	0.41	137.56	137.97	138.56	139.05	139.23
446A**		140.31	28.1	19.44	15.74	55.7	45.1	0.87					
446B	1.40	140.31	30.0	16.34	15.74	46.8	45.1	0.12	138.06	138.85	139.14	139.50	139.88
446C	0.40	140.31	28.9	17.37	15.74	49.8	45.1	0.36	139.32	139.97	140.11	140.24	140.27

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-5a. (cont'd)

RUN NO.	CAVITY INCHES	TO DEG R	VO FT/SEC	PO PSIA	PV PSIA	HO FT	HV FT	KV	T 1 DEG R	T 2 DEG R	T 3 DEG R	T 4 DEG R	T 5 DEG R
446D	0.65	140.33	29.0	17.04	15.75	48.8	45.2	0.28	139.12	139.50	139.95	140.24	140.27
446E**		140.27	27.5	19.74	15.70	56.6	45.0	0.98					
447A**		140.22	38.7	24.38	15.65	69.9	44.8	1.07					
447B	1.42	140.26	41.5	18.10	15.68	51.9	44.9	0.26	138.06	138.22	138.73	139.18	139.50
447C	0.62	140.22	41.4	18.84	15.65	54.0	44.8	0.34	138.33	138.76	139.45	139.88	139.79
447D**		140.22	38.6	24.04	15.65	68.9	44.8	1.04					
448A**		139.97	53.2	33.77	15.39	96.7	44.1	1.19					
448B	1.30	140.09	56.6	21.64	15.52	62.0	44.5	0.35	138.26	138.44	139.00	139.66	140.04
448C	0.45	140.24	56.0	23.07	15.66	66.1	44.9	0.44	138.80	139.36	140.04	140.54	140.47
448D**		140.47	52.9	33.64	15.90	96.4	45.6	1.17					
449A**		150.19	40.0	36.24	28.42	107.3	84.2	0.93					
449B	0.95	150.28	43.0	29.16	28.56	86.4	84.6	0.06	147.24	147.65	148.59	149.29	149.72
449C	0.75	150.25	42.9	29.65	28.51	87.8	84.5	0.12	147.29	147.91	148.95	149.51	149.71
449D**		150.35	39.8	36.37	28.68	107.8	85.0	0.93					
449E**		150.39	39.4	37.32	28.74	110.6	85.2	1.05					
450A**		150.37	54.3	44.62	28.71	132.2	85.1	1.03					
450B	1.66	150.41	57.7	31.92	28.77	94.6	85.3	0.18	146.99	147.28	147.94	148.66	149.47
450C	1.16	150.44	58.2	32.32	28.82	95.8	85.5	0.20	147.22	147.65	148.63	149.63	150.25
450D	0.76	150.44	57.9	33.12	28.82	98.2	85.5	0.24	147.55	148.25	149.40	150.30	150.46
450E	0.44	150.46	57.5	34.68	28.85	102.8	85.5	0.34	147.74	148.95	150.03	150.34	150.32
450F**		150.53	54.4	45.28	28.97	134.2	85.9	1.05					
451A**		160.60	43.5	54.68	48.78	168.2	150.1	0.62					
451B	0.75	160.60	45.7	48.49	48.78	149.2	150.1	-0.03	158.26	159.44	159.95	160.20	160.43
451C	0.55	160.58	45.4	49.08	48.73	151.0	149.9	0.03	158.36	159.52	159.95	160.16	160.29
451D	0.35	160.56	45.1	49.94	48.69	153.6	149.8	0.12	158.74	159.59	159.95	160.06	160.18
451E**		160.65	42.6	55.74	48.90	171.5	150.5	0.75					
452A**		165.55	49.1	70.06	61.55	219.7	193.1	0.71					

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-5a. (cont'd)

RUN NO.	CAVITY INCHES	TO DEG R	VO FT/SEC	PO PSIA	PV PSIA	HO FT	HV FT	KV	T 1 DEG R	T 2 DEG R	T 3 DEG R	T 4 DEG R	T 5 DEG R
453A**		165.56	63.2	75.95	61.60	238.2	193.3	0.72					
453B	0.64	165.64	66.0	63.44	61.80	199.1	194.0	0.08	161.80	163.76	164.88	165.60	165.67
453C	0.42	165.60	64.9	64.52	61.70	202.4	193.6	0.13	162.25	164.30	165.11	165.74	165.60
453D	0.32	165.53	64.4	66.24	61.50	207.8	192.9	0.23	162.97	164.79	165.26	165.69	165.40
453E**		165.64	62.2	75.93	61.80	238.2	194.0	0.74					
454A**		165.69	63.5	75.15	61.95	235.8	194.5	0.66					
454B	0.75	165.65	67.2	62.88	61.85	197.4	194.1	0.05	161.42	163.19	164.48	165.46	165.49
454C	0.40	165.73	66.1	65.44	62.05	205.4	194.8	0.16	162.95	164.88	165.49	166.14	165.89
454D**		165.60	62.3	75.90	61.70	238.0	193.6	0.74					
455A**		160.67	55.5	59.69	48.95	183.6	150.6	0.69					
455B	0.70	160.63	58.1	49.22	48.86	151.5	150.4	0.02	156.56	158.24	159.57	160.09	160.27
455C**		160.74	54.4	59.42	49.12	182.9	151.2	0.69					
456A**		160.45	64.7	64.80	48.44	199.2	148.9	0.77					
456B	0.88	160.51	68.4	50.24	48.56	154.5	149.4	0.07	156.26	156.91	158.62	160.07	160.45
456C	1.08	160.52	67.8	49.80	48.61	153.2	149.5	0.05	155.86	156.44	158.13	159.68	160.25
456D	1.34	160.56	67.8	49.40	48.69	152.0	149.8	0.03	155.34	155.72	157.32	158.90	159.80
456E**		160.69	64.2	62.75	48.99	193.0	150.8	0.66					
457A**		149.80	62.6	48.82	27.80	144.3	82.2	1.02					
457B	1.56	149.92	66.2	33.42	28.00	98.9	82.9	0.24	146.57	146.74	147.47	148.25	149.06
457C	0.72	150.07	66.2	34.75	28.22	102.9	83.6	0.28	147.38	148.09	149.26	150.12	150.12
457D	0.35	150.10	65.2	37.43	28.28	110.8	83.7	0.41	147.82	149.13	149.92	150.16	150.10
457E**		150.23	62.4	47.55	28.48	140.8	84.4	0.93					
458A**		149.72	68.2	52.29	27.69	154.5	81.9	1.00					
458B	0.84	149.99	71.5	36.39	28.11	107.7	83.2	0.31	147.22	147.80	148.82	149.71	149.98
458C**		150.32	67.3	52.76	28.62	156.3	84.8	1.01					
459A**		139.90	61.9	37.78	15.32	108.1	43.9	1.08					
459B	1.65	139.97	64.9	23.91	15.39	68.5	44.1	0.37	137.83	137.99	138.44	139.09	139.43

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-5a. (cont'd)

RUN NO.	CAVITY INCHES	TO DEG R	VO FT/SEC	PO PSIA	PV PSIA	HO FT	HV FT	KV	T 1 DEG R	T 2 DEG R	T 3 DEG R	T 4 DEG R	T 5 DEG R
459C	0.52	140.06	64.0	25.26	15.48	72.3	44.3	0.44	138.42	138.92	139.61	140.24	140.17
459D	0.64	140.15	64.0	24.68	15.57	70.7	44.6	0.41	138.22	138.65	139.30	139.95	140.13
459E**		140.60	60.8	37.93	16.03	108.8	46.0	1.09					
460A**		139.93	65.7	41.01	15.36	117.4	44.0	1.09					
460B	0.55	139.97	67.4	25.92	15.39	74.2	44.1	0.43	138.24	138.62	139.32	139.99	139.97
460C	1.05	140.15	66.2	24.68	15.57	70.7	44.6	0.38	138.28	138.49	139.16	139.81	140.11
460D	0.36	140.08	64.5	26.47	15.50	75.8	44.4	0.49	138.82	139.27	139.97	140.29	140.18
460E**		140.11	60.8	36.81	15.54	105.4	44.5	1.06					
461A**		139.81	66.0	43.39	15.23	124.1	43.6	1.19					
461B	0.90	139.86	68.0	25.41	15.29	72.7	43.8	0.40	138.04	138.28	138.85	139.66	139.82
461C**		140.08	61.6	38.17	15.50	109.3	44.4	1.10					
462A**		140.29	28.6	19.80	15.72	56.7	45.1	0.92					
462B	0.82	140.44	30.0	17.16	15.86	49.2	45.5	0.27	139.25	139.46	139.84	140.24	140.47
462C**		140.47	28.1	19.65	15.90	56.4	45.6	0.87					
462D	0.75	140.67	28.9	16.92	16.10	48.6	46.2	0.18	139.48	139.75	140.15	140.49	140.67
462E**		140.81	27.3	19.77	16.25	56.8	46.7	0.87					

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-5a. (cont'd)

RUN NO.	P 1 PSIA	P 2 PSIA	P 3 PSIA	P 4 PSIA	P 5 PSIA	P 1,T PSIA	P 2,T PSIA	P 3,T PSIA	P 4,T PSIA	P 5,T PSIA
431B	14.29	14.35	14.50	14.55	14.84	14.28	14.23	14.31	14.55	14.81
431C	14.68	14.64	14.94	15.64	17.00	14.65	14.83	15.18	15.61	15.90
432A	14.80	14.87	15.20	16.00	17.52	14.95	15.14	15.48	15.96	16.23
432B	14.73	14.73	14.98	15.40	16.50	14.69	14.86	15.14	15.65	15.97
432C	14.92	15.12	15.50	16.65	18.19	15.20	15.43	15.86	16.29	16.25
432D	15.27	15.65	17.22	18.49	19.07	15.59	16.07	16.35	16.44	16.52
433C	14.27	14.37	14.80	16.50	20.12	14.47	14.72	15.29	15.77	15.79
433D	13.81	13.85	14.09	14.68	15.75	14.04	14.09	14.52	15.04	15.45
433E	14.35	14.60	15.15	18.40	20.79	14.50	14.83	15.36	15.72	15.74
434C	13.95	14.11	14.51	15.68	20.21	13.16	13.52	14.14	14.69	14.72
434D	13.78	13.83	14.15	14.98	16.28	13.08	13.35	13.86	14.40	14.81
435B	24.90	25.24	26.12	29.08	31.14	25.21	26.02	27.38	28.48	28.74
435C	25.27	25.70	27.27	30.80	32.24	25.71	26.83	28.19	28.91	29.00
435D	26.00	26.77	29.87	32.50	33.50	26.43	27.94	28.82	29.20	29.14
435F	25.40	25.82	27.30	30.70	32.10	25.63	26.62	28.03	28.77	28.91
435G	24.98	25.28	26.08	28.90	30.81	25.03	25.81	27.13	28.31	28.65
436A	24.20	24.87	26.84	32.94	36.80	24.44	25.63	27.27	28.08	28.05
436B	23.95	24.28	25.45	29.48	34.88	23.88	24.82	26.45	27.74	27.86
436D	23.28	23.50	24.08	25.88	29.12	23.31	23.53	24.79	26.13	27.22
437C	22.29	22.79	23.79	26.09	32.36	23.24	23.81	25.34	26.97	27.36
437D	21.50	21.78	22.30	23.55	25.65	22.13	22.30	23.36	24.46	25.76
439B	41.31	46.09	51.17	54.97	57.17	44.98	48.27	49.46	49.94	49.89
439C	38.62	40.26	45.18	48.74	51.42	40.99	44.30	47.39	48.82	49.33
439D	40.06	43.58	48.76	53.04	55.39	42.78	46.56	48.65	49.38	49.50
439F	41.20	46.70	50.70	54.64	56.96	44.66	48.35	49.72	50.15	50.28
441A	49.67	55.23	61.10	65.79	68.93	51.82	57.32	59.60	60.69	60.79
442B	36.60	37.57	40.30	47.93	53.39	37.16	39.59	43.91	46.77	47.68
442C	37.91	39.91	45.81	53.61	57.57	39.19	43.20	46.85	48.18	48.31
443B	22.10	22.60	23.46	25.16	28.81	22.83	23.14	24.51	25.92	27.02
443C	23.59	24.65	28.92	40.81	44.31	23.58	25.23	26.89	27.41	27.24

Table A-5a. (cont'd)

RUN NO.	P 1 PSIA	P 2 PSIA	P 3 PSIA	P 4 PSIA	P 5 PSIA	P 1,T PSIA	P 2,T PSIA	P 3,T PSIA	P 4,T PSIA	P 5,T PSIA
444B	12.77	13.43	13.87	14.77	18.67	12.75	12.99	13.56	14.14	14.43
444C	13.40	14.12	15.20	23.95	31.84	13.04	13.55	14.16	14.52	14.48
445A	12.90	13.15	13.35	13.97	14.92	13.10	13.10	13.58	14.14	14.53
445B	13.51	14.16	15.03	22.21	28.80	13.74	14.08	14.71	15.06	15.02
445D	13.35	13.82	14.35	15.58	22.42	13.13	13.50	14.04	14.50	14.67
446B	13.94	14.02	14.26	14.58	15.40	13.58	14.31	14.59	14.93	15.30
446C	14.60	14.77	16.00	17.82	18.49	14.76	15.39	15.54	15.66	15.70
446D	14.41	14.68	15.08	16.38	18.04	14.57	14.93	15.38	15.66	15.70
447B	13.58	13.66	13.94	14.40	15.18	13.58	13.73	14.19	14.62	14.93
447C	14.02	14.22	14.74	16.74	20.69	13.83	14.23	14.88	15.30	15.21
448B	13.46	13.62	14.00	14.42	15.32	13.76	13.93	14.45	15.09	15.46
448C	14.22	14.57	15.32	19.85	26.67	14.26	14.79	15.46	15.97	15.90
449B	24.06	24.36	25.02	27.16	29.64	24.03	24.61	25.97	27.02	27.69
449C	24.52	24.80	25.82	28.84	31.45	24.11	24.97	26.51	27.36	27.66
450B	23.07	23.32	23.97	24.92	26.67	23.68	24.08	25.03	26.08	27.30
450C	23.47	23.82	24.57	26.30	29.47	24.01	24.61	26.02	27.55	28.51
450D	24.09	24.69	25.76	29.09	35.48	24.46	25.47	27.19	28.59	28.85
450E	24.68	25.48	28.68	35.78	39.94	24.74	26.51	28.17	28.65	28.62
451B	41.62	44.82	46.99	48.99	50.94	43.47	46.11	47.26	47.85	48.40
451C	42.70	46.28	47.92	50.28	52.22	43.71	46.27	47.26	47.76	48.06
451D	43.42	47.52	49.04	51.29	53.16	44.54	46.44	47.26	47.51	47.81
453B	49.26	53.56	58.96	63.47	68.44	51.69	56.70	59.70	61.70	61.90
453C	50.65	56.82	61.37	66.54	71.52	52.81	58.14	60.34	62.10	61.70
453D	52.14	59.47	63.67	68.81	73.94	54.63	59.45	60.74	61.95	61.14
454B	48.62	51.62	57.75	62.28	66.84	50.76	55.19	58.62	61.29	61.40
454C	51.14	57.91	62.71	68.04	73.37	54.59	59.70	61.40	63.23	62.51
455B	38.65	40.54	45.37	49.72	53.59	39.92	43.44	46.40	47.60	48.02

Table A-5a. (cont'd)

RUN NO.	P 1 PSIA	P 2 PSIA	P 3 PSIA	P 4 PSIA	P 5 PSIA	P 1,T PSIA	P 2,T PSIA	P 3,T PSIA	P 4,T PSIA	P 5,T PSIA
456B	36.61	37.71	40.57	46.61	53.17	39.30	40.62	44.26	47.55	48.44
456C	36.30	37.36	39.46	44.68	51.06	38.50	39.66	43.20	46.64	47.97
456D	35.80	36.45	38.25	42.30	47.40	37.48	38.22	41.48	44.90	46.93
457B	21.82	22.22	22.85	23.99	25.99	23.12	23.34	24.36	25.47	26.67
457C	22.78	23.55	25.02	29.42	38.62	24.23	25.23	26.97	28.31	28.31
457D	23.35	25.00	31.13	40.23	45.50	24.85	26.78	28.00	28.37	28.28
458B	22.76	23.69	24.89	27.59	37.99	24.01	24.82	26.32	27.66	28.08
459B	12.88	13.21	13.51	13.94	14.38	13.37	13.52	13.93	14.53	14.86
459C	13.58	14.41	15.08	18.03	29.49	13.91	14.38	15.04	15.66	15.59
459D	13.45	14.15	14.63	16.58	24.15	13.73	14.13	14.74	15.38	15.56
460B	13.19	14.29	14.85	17.25	29.25	13.74	14.09	14.76	15.41	15.39
460C	13.03	13.63	13.93	14.53	16.63	13.78	13.98	14.60	15.23	15.54
460D	13.54	14.27	16.37	28.67	34.17	14.28	14.71	15.39	15.72	15.61
461B	12.98	13.51	14.13	14.81	17.76	13.56	13.78	14.31	15.09	15.25
462B	14.63	14.86	14.93	15.86	17.56	14.69	14.90	15.27	15.66	15.90
462D	14.48	14.64	14.82	16.24	17.80	14.92	15.18	15.57	15.92	16.10

Table A-5a. (cont'd)

RUN NO.	H 1 FT	H 2 FT	H 3 FT	H 4 FT	H 5 FT	H 1,T FT	H 2,T FT	H 3,T FT	H 4,T FT	H 5,T FT
431B	40.8	41.0	41.4	41.5	42.4	40.7	40.6	40.8	41.6	42.3
431C	41.9	41.8	42.7	44.8	48.9	41.9	42.4	43.4	44.7	45.6
432A	42.3	42.5	43.5	45.9	50.5	42.7	43.3	44.3	45.8	46.6
432B	42.1	42.1	42.8	44.1	47.4	42.0	42.5	43.3	44.8	45.8
432C	42.7	43.3	44.4	47.9	52.5	43.5	44.2	45.5	46.8	46.7
432D	43.7	44.8	49.6	53.4	55.2	44.7	46.1	46.9	47.2	47.5
433C	40.7	41.0	42.3	47.4	58.4	41.3	42.1	43.8	45.2	45.3
433D	39.3	39.5	40.2	41.9	45.1	40.0	40.2	41.4	43.0	44.2
433E	41.0	41.7	43.3	53.2	60.5	41.4	42.4	44.0	45.1	45.1
434C	39.8	40.2	41.4	44.9	58.7	37.4	38.5	40.3	42.0	42.1
434D	39.2	39.4	40.4	42.8	46.7	37.2	38.0	39.5	41.1	42.3
435B	73.2	74.2	77.0	86.3	92.8	74.1	76.7	80.9	84.4	85.2
435C	74.3	75.7	80.6	91.7	96.3	75.7	79.2	83.5	85.7	86.0
435D	76.6	79.0	88.8	97.1	100.3	77.9	82.7	85.5	86.6	86.5
435F	74.7	76.0	80.7	91.4	95.8	75.4	78.5	82.9	85.3	85.7
435G	73.4	74.4	76.8	85.7	91.7	73.6	76.0	80.2	83.8	84.9
436A	71.0	73.1	79.2	98.5	110.9	71.7	75.4	80.6	83.1	83.0
436B	70.2	71.2	74.9	87.5	104.7	70.0	72.9	78.0	82.1	82.4
436D	68.1	68.8	70.6	76.2	86.4	68.2	68.9	72.8	77.0	80.4
437C	65.1	66.6	69.7	76.9	96.7	68.0	69.8	74.5	79.6	80.8
437D	62.6	63.5	65.1	69.0	75.5	64.6	65.1	68.4	71.8	75.8
439B	125.5	141.2	158.0	170.8	178.2	137.5	148.4	152.3	153.9	153.8
439C	116.8	122.1	138.2	150.0	158.9	124.5	135.3	145.5	150.2	151.9
439D	121.4	132.9	150.0	164.3	172.2	130.3	142.7	149.6	152.1	152.5
439F	125.1	143.2	156.5	169.7	177.5	136.5	148.7	153.2	154.6	155.1
441A	153.0	171.7	191.6	207.6	218.5	160.2	178.7	186.5	190.2	190.5
442B	110.2	113.4	122.2	147.3	165.5	112.1	119.9	134.0	143.4	146.4
442C	114.5	120.9	140.3	166.2	179.6	118.6	131.7	143.7	148.1	148.5
443B	64.5	66.0	68.7	74.0	85.4	66.7	67.7	72.0	76.3	79.8
443C	69.1	72.4	85.8	123.9	135.3	69.1	74.2	79.4	81.0	80.5

Table A-5a. (cont'd)

RUN NO.	H 1 FT	H 2 FT	H 3 FT	H 4 FT	H 5 FT	H 1,T FT	H 2,T FT	H 3,T FT	H 4,T FT	H 5,T FT
444B	36.2	38.2	39.5	42.2	54.0	36.2	36.9	38.6	40.3	41.2
444C	38.1	40.3	43.5	70.2	95.0	37.0	38.6	40.4	41.4	41.3
445A	36.6	37.4	38.0	39.8	42.7	37.2	37.2	38.7	40.3	41.5
445B	38.4	40.4	43.0	64.8	85.4	39.1	40.1	42.0	43.1	43.0
445D	38.0	39.4	41.0	44.6	65.5	37.3	38.4	40.0	41.4	41.9
446B	39.7	40.0	40.7	41.6	44.1	38.7	40.8	41.7	42.7	43.8
446C	41.7	42.2	45.9	51.4	53.4	42.2	44.1	44.5	44.9	45.0
446D	41.1	41.9	43.1	47.0	52.1	41.6	42.7	44.0	44.9	45.0
447B	38.7	38.9	39.7	41.1	43.4	38.7	39.1	40.5	41.8	42.7
447C	40.0	40.6	42.1	48.1	60.2	39.4	40.6	42.5	43.8	43.5
448B	38.3	38.8	39.9	41.2	43.9	39.2	39.7	41.2	43.2	44.3
448C	40.6	41.6	43.9	57.6	78.7	40.7	42.3	44.3	45.8	45.6
449B	70.6	71.5	73.5	80.2	88.0	70.5	72.3	76.5	79.8	81.9
449C	72.0	72.9	76.0	85.5	93.8	70.7	73.4	78.2	80.8	81.8
450B	67.5	68.3	70.3	73.2	78.7	69.4	70.6	73.6	76.8	80.7
450C	68.7	69.8	72.1	77.5	87.5	70.4	72.3	76.7	81.5	84.5
450D	70.7	72.5	75.9	86.3	106.6	71.8	74.9	80.3	84.7	85.5
450E	72.5	75.0	85.0	107.6	121.0	72.7	78.2	83.4	84.9	84.8
451B	126.5	137.0	144.2	150.8	157.3	132.6	141.2	145.1	147.0	148.8
451C	130.0	141.8	147.2	155.1	161.6	133.3	141.8	145.1	146.7	147.7
451D	132.4	145.9	150.9	158.4	164.7	136.1	142.3	145.1	145.9	146.9
453B	151.7	166.0	184.3	199.7	216.8	159.8	176.6	186.8	193.6	194.3
453C	156.3	177.0	192.5	210.2	227.5	163.5	181.5	189.0	195.0	193.6
453D	161.3	186.0	200.4	218.1	236.0	169.7	186.0	190.3	194.5	191.7
454B	149.6	159.5	180.2	195.6	211.3	156.7	171.5	183.1	192.2	192.6
454C	157.9	180.7	197.1	215.4	234.0	169.5	186.8	192.6	198.8	196.4
455B	116.9	123.0	138.8	153.2	166.1	121.0	132.4	142.2	146.2	147.5

Table A-5a. (cont'd)

RUN NO.	H 1 FT	H 2 FT	H 3 FT	H 4 FT	H 5 FT	H 1,T FT	H 2,T FT	H 3,T FT	H 4,T FT	H 5,T FT
456B	110.3	113.8	123.1	142.9	164.7	118.9	123.2	135.2	146.0	148.9
456C	109.3	112.7	119.5	136.5	157.7	116.4	120.1	131.7	143.0	147.4
456D	107.7	109.8	115.6	128.7	145.5	113.1	115.5	126.0	137.3	144.0
457B	63.6	64.9	66.8	70.3	76.6	67.6	68.3	71.5	74.9	78.7
457C	66.6	69.0	73.5	87.3	116.8	71.1	74.2	79.6	83.8	83.8
457D	68.4	73.5	92.7	122.0	139.2	73.0	79.0	82.9	84.0	83.7
458B	66.5	69.4	73.1	81.6	114.7	70.4	72.9	77.6	81.8	83.1
459B	36.6	37.6	38.4	39.7	41.0	38.0	38.5	39.7	41.5	42.5
459C	38.7	41.1	43.1	52.0	87.6	39.6	41.0	43.0	44.9	44.7
459D	38.3	40.4	41.8	47.7	70.8	39.1	40.3	42.1	44.0	44.6
460B	37.5	40.8	42.4	49.7	86.8	39.1	40.2	42.2	44.1	44.1
460C	37.0	38.8	39.7	41.5	47.8	39.2	39.8	41.7	43.6	44.5
460D	38.5	40.7	47.0	85.0	102.4	40.7	42.0	44.1	45.1	44.7
461B	36.9	38.4	40.3	42.3	51.2	38.6	39.2	40.8	43.2	43.6
462B	41.8	42.5	42.7	45.5	50.6	42.0	42.6	43.7	44.9	45.6
462D	41.3	41.8	42.4	46.6	51.3	42.6	43.4	44.6	45.7	46.2

Table A-5b. Experimental data for 0.420-inch ogive using liquid nitrogen (SI Units).

RUN NO.	CAVITY CM	TO DEG K	VO M/SEC	PO N/CM/CM	PV N/CM/CM	HO M	HV M	KV	T 1 DEG K	T 2 DEG K	T 3 DEG K	T 4 DEG K	T 5 DEG K
431A**		78.03	8.7	13.89	10.95	17.6	13.9	0.96					
431B	4.57	78.09	9.2	11.39	11.03	14.4	14.0	0.11	77.12	77.09	77.14	77.28	77.43
431C	2.66	78.12	9.1	11.69	11.07	14.8	14.0	0.19	77.34	77.44	77.64	77.88	78.04
432A	2.33	78.24	9.0	11.80	11.22	15.0	14.2	0.18	77.51	77.62	77.81	78.07	78.22
432B	2.99	78.20	9.0	11.69	11.17	14.8	14.2	0.16	77.36	77.46	77.62	77.90	78.08
432C	1.82	78.28	8.9	11.98	11.27	15.2	14.3	0.22	77.65	77.78	78.02	78.25	78.23
432D	0.81	78.27	8.8	12.46	11.26	15.8	14.3	0.39	77.87	78.13	78.28	78.33	78.37
432F**		78.26	8.5	13.82	11.24	17.5	14.3	0.88					
433A**		77.87	11.8	16.86	10.75	21.3	13.6	1.08					
433C	1.60	77.85	12.5	12.94	10.72	16.4	13.6	0.35	77.23	77.38	77.70	77.97	77.98
433D	2.99	77.88	12.6	12.52	10.76	15.9	13.6	0.28	76.98	77.01	77.26	77.56	77.79
433E	1.32	77.88	12.5	13.15	10.76	16.7	13.6	0.38	77.25	77.44	77.74	77.94	77.95
434C	1.82	77.77	17.2	15.15	10.63	19.2	13.5	0.38	76.44	76.66	77.04	77.36	77.38
434D	2.69	77.85	17.0	14.88	10.72	18.8	13.6	0.36	76.39	76.56	76.87	77.19	77.43
434F**		77.87	16.2	21.75	10.75	27.5	13.6	1.04					
435A**		83.56	12.3	24.79	19.83	32.5	26.0	0.84					
435B	1.98	83.64	12.9	20.53	19.99	26.9	26.2	0.08	82.26	82.57	83.07	83.46	83.55
435C	1.62	83.64	12.8	20.94	19.99	27.5	26.2	0.15	82.45	82.87	83.36	83.61	83.64
435D	1.01	83.66	12.6	21.65	20.03	28.4	26.3	0.26	82.72	83.27	83.58	83.71	83.69
435E**		83.64	12.1	24.91	19.99	32.7	26.2	0.86					
435F	1.62	83.69	12.7	20.89	20.09	27.4	26.4	0.13	82.42	82.79	83.30	83.56	83.61
435G	2.03	83.70	12.8	20.57	20.11	27.0	26.4	0.07	82.19	82.49	82.98	83.40	83.52
436A	1.32	83.34	17.3	23.01	19.40	30.1	25.4	0.31	81.96	82.42	83.03	83.32	83.31
436B	1.77	83.34	17.4	22.46	19.40	29.4	25.4	0.26	81.74	82.11	82.73	83.20	83.24
436C**		83.32	16.7	29.13	19.36	38.1	25.3	0.90					
436D	2.94	83.40	17.6	21.87	19.52	28.6	25.6	0.19	81.51	81.60	82.10	82.61	83.01
436F**		83.48	16.5	30.70	19.67	40.2	25.8	1.05					
437A**		83.16	19.4	32.61	19.05	42.6	24.9	0.93					
437C	2.38	83.17	20.2	23.30	19.07	30.5	24.9	0.26	81.48	81.71	82.31	82.92	83.06
437D	3.96	83.19	20.3	22.64	19.11	29.6	25.0	0.22	81.02	81.09	81.53	81.97	82.47

* DENOTES AN INCIPIENT RUN

** DENOTES A DESINENT RUN

Table A-5b. (cont'd)

RUN NO.	CAVITY CM	TO DEG K	VO M/SEC	PO N/CM/CM	PV N/CM/CM	HO M	HV M	KV	T 1 DEG K	T 2 DEG K	T 3 DEG K	T 4 DEG K	T 5 DEG K
439A**		89.37	17.2	41.82	34.07	56.9	46.4	0.70					
439B	0.86	89.40	17.9	36.43	34.16	49.6	46.5	0.19	88.30	89.10	89.38	89.49	89.48
439C	2.28	89.41	18.1	34.28	34.19	46.7	46.6	0.01	87.27	88.13	88.89	89.23	89.35
439D	1.21	89.42	18.0	35.31	34.22	48.1	46.6	0.09	87.74	88.69	89.19	89.36	89.39
439E**		89.43	17.2	42.55	34.25	57.9	46.7	0.74					
439F	1.01	89.58	18.0	36.32	34.70	49.5	47.3	0.13	88.22	89.12	89.44	89.54	89.57
439G**		89.66	17.0	43.15	34.94	58.9	47.7	0.76					
440A**		91.99	15.0	47.09	42.50	65.3	59.0	0.55					
440D**		91.99	14.8	47.01	42.50	65.2	59.0	0.55					
440F**		92.04	14.9	48.01	42.68	66.6	59.2	0.65					
441A	1.21	91.96	20.3	44.22	42.40	61.3	58.8	0.12	89.92	91.11	91.58	91.80	91.82
442A**		89.21	20.2	47.33	33.60	64.3	45.7	0.89					
442B	2.05	89.21	21.5	34.98	33.60	47.6	45.7	0.08	86.21	86.89	88.03	88.74	88.96
442C	1.52	89.30	21.3	36.07	33.87	49.1	46.1	0.13	86.78	87.85	88.76	89.08	89.11
442D**		89.48	19.9	47.18	34.40	64.2	46.9	0.86					
443A**		83.14	21.0	36.78	19.01	48.0	24.9	1.03					
443B	2.94	83.23	22.0	24.59	19.19	32.1	25.1	0.29	81.31	81.44	81.99	82.53	82.94
443C	0.99	83.21	21.4	26.58	19.15	34.7	25.0	0.42	81.62	82.27	82.89	83.08	83.02
444A**		77.36	20.3	27.37	10.13	34.6	12.8	1.03					
444B	1.90	77.37	21.2	17.60	10.14	22.2	12.8	0.41	76.18	76.33	76.69	77.04	77.21
444C	0.88	77.37	21.0	18.60	10.14	23.5	12.8	0.48	76.36	76.68	77.05	77.26	77.24
445A	3.20	77.52	19.2	15.98	10.32	20.2	13.0	0.38	76.40	76.40	76.70	77.04	77.27
445B	1.01	77.54	19.0	17.02	10.34	21.5	13.1	0.46	76.80	77.00	77.37	77.57	77.55
445C**		77.53	17.7	24.02	10.33	30.4	13.1	1.09					
445D	1.65	77.54	18.4	15.91	10.34	20.1	13.1	0.41	76.42	76.65	76.98	77.25	77.35
446A**		77.95	8.5	13.40	10.85	17.0	13.7	0.87					
446B	3.55	77.95	9.1	11.27	10.85	14.3	13.7	0.12	76.70	77.14	77.30	77.50	77.71
446C	1.01	77.95	8.8	11.98	10.85	15.2	13.7	0.36	77.40	77.76	77.84	77.91	77.93

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-5b. (cont'd)

RUN NO.	CAVITY CM	TO DEG K	VO M/SEC	PO N/CM/CM	PV N/CM/CM	HO M	HV M	KV	T 1 DEG K	T 2 DEG K	T 3 DEG K	T 4 DEG K	T 5 DEG K
446D	1.65	77.96	8.8	11.75	10.86	14.9	13.8	0.28	77.29	77.50	77.75	77.91	77.93
446E**		77.93	8.4	13.61	10.82	17.2	13.7	0.98					
447A**		77.90	11.8	16.81	10.79	21.3	13.7	1.07					
447B	3.60	77.92	12.6	12.48	10.81	15.8	13.7	0.26	76.70	76.79	77.07	77.32	77.50
447C	1.57	77.90	12.6	12.99	10.79	16.5	13.7	0.34	76.85	77.09	77.47	77.71	77.66
447D**		77.90	11.8	16.57	10.79	21.0	13.7	1.04					
448A**		77.76	16.2	23.28	10.61	29.5	13.4	1.19					
448B	3.30	77.83	17.3	14.92	10.70	18.9	13.5	0.35	76.81	76.91	77.22	77.59	77.80
448C	1.14	77.91	17.1	15.91	10.80	20.1	13.7	0.44	77.11	77.42	77.80	78.08	78.04
448D**		78.04	16.1	23.19	10.96	29.4	13.9	1.17					
449A**		83.44	12.2	24.99	19.60	32.7	25.7	0.93					
449B	2.41	83.49	13.1	20.11	19.69	26.3	25.8	0.06	81.80	82.03	82.55	82.94	83.18
449C	1.90	83.47	13.1	20.44	19.66	26.8	25.7	0.12	81.83	82.17	82.75	83.06	83.17
449D**		83.53	12.1	25.08	19.77	32.9	25.9	0.93					
449E**		83.55	12.0	25.73	19.81	33.7	26.0	1.05					
450A**		83.54	16.6	30.76	19.79	40.3	25.9	1.03					
450B	4.21	83.56	17.6	22.01	19.83	28.8	26.0	0.18	81.66	81.82	82.19	82.59	83.04
450C	2.94	83.58	17.7	22.28	19.87	29.2	26.0	0.20	81.79	82.03	82.57	83.13	83.47
450D	1.93	83.58	17.7	22.84	19.87	29.9	26.0	0.24	81.97	82.36	83.00	83.50	83.59
450E	1.11	83.59	17.5	23.91	19.89	31.3	26.1	0.34	82.08	82.75	83.35	83.52	83.51
450F**		83.63	16.6	31.22	19.97	40.9	26.2	1.05					
451A**		89.22	13.3	37.70	33.63	51.3	45.7	0.62					
451B	1.90	89.22	13.9	33.43	33.63	45.5	45.7	-0.03	87.92	88.58	88.86	89.00	89.13
451C	1.39	89.21	13.8	33.84	33.60	46.0	45.7	0.03	87.98	88.62	88.86	88.98	89.05
451D	0.88	89.20	13.7	34.43	33.57	46.8	45.7	0.12	88.19	88.66	88.86	88.92	88.99
451E**		89.25	13.0	38.43	33.72	52.3	45.9	0.75					
452A**		91.97	15.0	48.30	42.43	67.0	58.9	0.71					

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-5b. (cont'd)

RUN NO.	CAVITY CM	TO DEG K	VO M/SEC	PO N/CM/CM	PV N/CM/CM	HO M	HV M	KV	T 1 DEG K	T 2 DEG K	T 3 DEG K	T 4 DEG K	T 5 DEG K
453A**		91.98	19.3	52.37	42.47	72.6	58.9	0.72					
453B	1.62	92.02	20.1	43.74	42.61	60.7	59.1	0.08	89.89	90.98	91.60	92.00	92.04
453C	1.06	92.00	19.8	44.48	42.54	61.7	59.0	0.13	90.14	91.28	91.73	92.08	92.00
453D	0.81	91.96	19.6	45.67	42.40	63.3	58.8	0.23	90.54	91.55	91.81	92.05	91.89
453E**		92.02	18.9	52.35	42.61	72.6	59.1	0.74					
454A**		92.05	19.4	51.81	42.71	71.9	59.3	0.66					
454B	1.90	92.03	20.5	43.35	42.64	60.2	59.2	0.05	89.68	90.66	91.38	91.92	91.94
454C	1.01	92.07	20.1	45.12	42.78	62.6	59.4	0.16	90.53	91.60	91.94	92.30	92.16
454D**		92.00	19.0	52.33	42.54	72.6	59.0	0.74					
455A**		89.26	16.9	41.15	33.75	56.0	45.9	0.69					
455B	1.77	89.24	17.7	33.94	33.69	46.2	45.8	0.02	86.98	87.91	88.65	88.94	89.04
455C**		89.30	16.6	40.97	33.87	55.7	46.1	0.69					
456A**		89.14	19.7	44.68	33.40	60.7	45.4	0.77					
456B	2.23	89.17	20.8	34.64	33.48	47.1	45.5	0.07	86.81	87.17	88.12	88.93	89.14
456C	2.74	89.18	20.7	34.34	33.51	46.7	45.6	0.05	86.59	86.91	87.85	88.71	89.03
456D	3.40	89.20	20.7	34.06	33.57	46.3	45.7	0.03	86.30	86.51	87.40	88.28	88.78
456E**		89.27	19.6	43.26	33.78	58.8	46.0	0.66					
457A**		83.22	19.1	33.66	19.17	44.0	25.1	1.02					
457B	3.96	83.29	20.2	23.04	19.30	30.1	25.3	0.24	81.43	81.52	81.93	82.36	82.81
457C	1.82	83.37	20.2	23.96	19.46	31.4	25.5	0.28	81.88	82.27	82.92	83.40	83.40
457D	0.88	83.39	19.9	25.81	19.50	33.8	25.5	0.41	82.12	82.85	83.29	83.42	83.39
457E**		83.46	19.0	32.78	19.64	42.9	25.7	0.93					
458A**		83.18	20.8	36.05	19.09	47.1	25.0	1.00					
458B	2.13	83.33	21.8	25.09	19.38	32.8	25.4	0.31	81.79	82.11	82.68	83.17	83.32
458C**		83.51	20.5	36.38	19.73	47.6	25.9	1.01					
459A**		77.72	18.9	26.05	10.56	33.0	13.4	1.08					
459B	4.19	77.76	19.8	16.49	10.61	20.9	13.4	0.37	76.57	76.66	76.91	77.27	77.46

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-5b. (cont'd)

RUN NO.	CAVITY CM	TO DEG K	VO M/SEC	PO N/CM/CM	PV N/CM/CM	HO M	HV M	KV	T 1 DEG K	T 2 DEG K	T 3 DEG K	T 4 DEG K	T 5 DEG K
459C	1.32	77.81	19.5	17.42	10.68	22.0	13.5	0.44	76.90	77.18	77.56	77.91	77.87
459D	1.62	77.86	19.5	17.02	10.74	21.5	13.6	0.41	76.79	77.03	77.39	77.75	77.85
459E**		78.11	18.5	26.15	11.05	33.2	14.0	1.09					
460A**		77.74	20.0	28.28	10.59	35.8	13.4	1.09					
460B	1.39	77.76	20.5	17.87	10.61	22.6	13.4	0.43	76.80	77.01	77.40	77.77	77.76
460C	2.66	77.86	20.2	17.02	10.74	21.5	13.6	0.38	76.82	76.94	77.31	77.67	77.84
460D	0.91	77.82	19.7	18.25	10.69	23.1	13.5	0.49	77.12	77.37	77.76	77.94	77.88
460E**		77.84	18.5	25.38	10.71	32.1	13.6	1.06					
461A**		77.67	20.1	29.92	10.50	37.8	13.3	1.19					
461B	2.28	77.70	20.7	17.52	10.54	22.2	13.3	0.40	76.69	76.82	77.14	77.59	77.68
461C**		77.82	18.8	26.32	10.69	33.3	13.5	1.10					
462A**		77.94	8.7	13.65	10.84	17.3	13.7	0.92					
462B	2.08	78.02	9.2	11.83	10.94	15.0	13.9	0.27	77.36	77.48	77.69	77.91	78.04
462C**		78.04	8.6	13.55	10.96	17.2	13.9	0.87					
462D	1.90	78.15	8.8	11.67	11.10	14.8	14.1	0.18	77.49	77.64	77.86	78.05	78.15
462E**		78.23	8.3	13.63	11.21	17.3	14.2	0.87					

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-5b. (cont'd)

RUN NO.	P 1 N/CM/CM	P 2 N/CM/CM	P 3 N/CM/CM	P 4 N/CM/CM	P 5 N/CM/CM	P 1•T N/CM/CM	P 2•T N/CM/CM	P 3•T N/CM/CM	P 4•T N/CM/CM	P 5•T N/CM/CM
431B	9.85	9.89	10.00	10.03	10.23	9.84	9.81	9.87	10.03	10.21
431C	10.12	10.09	10.30	10.78	11.72	10.10	10.22	10.47	10.76	10.96
432A	10.20	10.25	10.48	11.03	12.08	10.31	10.44	10.68	11.00	11.19
432B	10.16	10.16	10.33	10.62	11.38	10.13	10.25	10.44	10.79	11.01
432C	10.29	10.42	10.69	11.48	12.54	10.48	10.64	10.94	11.23	11.21
432D	10.53	10.79	11.87	12.75	13.15	10.75	11.08	11.27	11.34	11.39
433C	9.84	9.91	10.20	11.38	13.87	9.97	10.15	10.54	10.88	10.89
433D	9.52	9.55	9.71	10.12	10.86	9.68	9.72	10.01	10.37	10.65
433E	9.89	10.07	10.45	12.69	14.33	10.00	10.22	10.59	10.84	10.85
434C	9.62	9.73	10.00	10.81	13.93	9.08	9.32	9.75	10.13	10.15
434D	9.50	9.54	9.76	10.33	11.22	9.02	9.21	9.56	9.93	10.21
435B	17.17	17.40	18.01	20.05	21.47	17.38	17.94	18.88	19.64	19.81
435C	17.42	17.72	18.80	21.24	22.23	17.72	18.50	19.44	19.93	19.99
435D	17.93	18.46	20.59	22.41	23.10	18.22	19.26	19.87	20.13	20.09
435F	17.51	17.80	18.82	21.17	22.13	17.67	18.35	19.32	19.83	19.93
435G	17.22	17.43	17.98	19.93	21.24	17.26	17.80	18.71	19.52	19.75
436A	16.69	17.15	18.51	22.71	25.37	16.85	17.67	18.80	19.36	19.34
436B	16.51	16.74	17.55	20.33	24.05	16.47	17.11	18.24	19.13	19.21
436D	16.05	16.20	16.60	17.84	20.08	16.07	16.23	17.10	18.02	18.77
437C	15.37	15.71	16.40	17.99	22.31	16.02	16.41	17.47	18.60	18.86
437D	14.82	15.02	15.38	16.24	17.69	15.26	15.37	16.11	16.87	17.76
439B	28.48	31.78	35.28	37.90	39.42	31.01	33.28	34.10	34.43	34.40
439C	26.63	27.76	31.15	33.61	35.45	28.26	30.54	32.67	33.66	34.01
439D	27.62	30.05	33.62	36.57	38.19	29.49	32.10	33.54	34.04	34.13
439F	28.41	32.20	34.96	37.67	39.27	30.79	33.34	34.28	34.58	34.67
441A	34.25	38.08	42.13	45.36	47.53	35.73	39.52	41.09	41.85	41.92
442B	25.23	25.90	27.79	33.05	36.81	25.62	27.29	30.27	32.24	32.87
442C	26.14	27.52	31.58	36.96	39.69	27.02	29.79	32.30	33.22	33.31
443B	15.24	15.58	16.18	17.35	19.86	15.74	15.96	16.90	17.87	18.63
443C	16.26	17.00	19.94	28.14	30.55	16.26	17.40	18.54	18.90	18.78

Table A-5b. (cont'd)

RUN NO.	P 1 N/CM/CM	P 2 N/CM/CM	P 3 N/CM/CM	P 4 N/CM/CM	P 5 N/CM/CM	P 1,T N/CM/CM	P 2,T N/CM/CM	P 3,T N/CM/CM	P 4,T N/CM/CM	P 5,T N/CM/CM
444B	8.80	9.26	9.56	10.18	12.87	8.79	8.96	9.35	9.75	9.95
444C	9.24	9.74	10.48	16.51	21.95	8.99	9.34	9.76	10.01	9.99
445A	8.89	9.07	9.20	9.63	10.29	9.03	9.03	9.36	9.75	10.02
445B	9.31	9.76	10.36	15.31	19.86	9.48	9.71	10.14	10.38	10.36
445D	9.20	9.53	9.89	10.74	15.46	9.05	9.31	9.68	10.00	10.12
446B	9.61	9.67	9.83	10.05	10.62	9.36	9.87	10.06	10.30	10.55
446C	10.07	10.18	11.03	12.29	12.75	10.18	10.61	10.71	10.80	10.82
446D	9.94	10.12	10.40	11.29	12.44	10.04	10.30	10.60	10.80	10.82
447B	9.36	9.42	9.61	9.93	10.47	9.36	9.47	9.79	10.08	10.30
447C	9.67	9.80	10.16	11.54	14.27	9.53	9.81	10.26	10.55	10.49
448B	9.28	9.39	9.65	9.94	10.56	9.49	9.60	9.96	10.40	10.66
448C	9.80	10.05	10.56	13.69	18.39	9.83	10.20	10.66	11.01	10.96
449B	16.59	16.80	17.25	18.73	20.44	16.57	16.97	17.91	18.63	19.09
449C	16.91	17.10	17.80	19.88	21.68	16.62	17.22	18.28	18.86	19.07
450B	15.91	16.08	16.53	17.18	18.39	16.33	16.60	17.26	17.98	18.82
450C	16.18	16.42	16.94	18.13	20.32	16.55	16.97	17.94	18.99	19.66
450D	16.61	17.02	17.76	20.06	24.46	16.87	17.56	18.75	19.71	19.89
450E	17.02	17.57	19.77	24.67	27.54	17.06	18.28	19.42	19.75	19.73
451B	28.70	30.90	32.40	33.78	35.12	29.97	31.79	32.59	32.99	33.37
451C	29.44	31.91	33.04	34.67	36.00	30.14	31.90	32.59	32.93	33.13
451D	29.94	32.76	33.81	35.36	36.65	30.71	32.02	32.59	32.76	32.96
453B	33.96	36.93	40.65	43.76	47.19	35.64	39.09	41.16	42.54	42.68
453C	34.92	39.18	42.31	45.88	49.31	36.41	40.08	41.61	42.82	42.54
453D	35.95	41.00	43.90	47.44	50.98	37.67	40.99	41.88	42.71	42.16
454B	33.52	35.59	39.82	42.94	46.08	35.00	38.05	40.42	42.26	42.33
454C	35.26	39.93	43.24	46.91	50.59	37.64	41.16	42.33	43.59	43.10
455B	26.65	27.95	31.28	34.28	36.95	27.52	29.95	31.99	32.82	33.11

Table A-5b. (cont'd)

RUN NO.	P 1 N/CM/CM	P 2 N/CM/CM	P 3 N/CM/CM	P 4 N/CM/CM	P 5 N/CM/CM	P 1,T N/CM/CM	P 2,T N/CM/CM	P 3,T N/CM/CM	P 4,T N/CM/CM	P 5,T N/CM/CM
456B	25.24	26.00	27.97	32.14	36.66	27.09	28.00	30.52	32.79	33.40
456C	25.03	25.76	27.21	30.81	35.20	26.55	27.34	29.79	32.16	33.08
456D	24.68	25.13	26.37	29.16	32.68	25.84	26.35	28.60	30.96	32.36
457B	15.04	15.32	15.75	16.54	17.92	15.94	16.09	16.80	17.56	18.39
457C	15.71	16.24	17.25	20.28	26.63	16.71	17.40	18.60	19.52	19.52
457D	16.10	17.24	21.46	27.74	31.37	17.13	18.46	19.30	19.56	19.50
458B	15.69	16.33	17.16	19.02	26.19	16.55	17.11	18.15	19.07	19.36
459B	8.88	9.11	9.31	9.61	9.91	9.22	9.32	9.60	10.02	10.25
459C	9.36	9.94	10.40	12.43	20.33	9.59	9.91	10.37	10.80	10.75
459D	9.27	9.76	10.09	11.43	16.65	9.47	9.74	10.16	10.60	10.72
460B	9.09	9.85	10.24	11.89	20.17	9.48	9.72	10.18	10.63	10.61
460C	8.98	9.40	9.60	10.02	11.47	9.50	9.64	10.07	10.50	10.71
460D	9.34	9.84	11.29	19.77	23.56	9.84	10.14	10.61	10.84	10.76
461B	8.95	9.31	9.74	10.21	12.25	9.35	9.50	9.87	10.40	10.51
462B	10.09	10.25	10.29	10.94	12.11	10.13	10.27	10.53	10.80	10.96
462D	9.98	10.09	10.22	11.20	12.27	10.28	10.47	10.74	10.98	11.10

Table A-5b. (cont'd)

RUN NO.	H 1 M	H 2 M	H 3 M	H 4 M	H 5 M	H 1,T M	H 2,T M	H 3,T M	H 4,T M	H 5,T M
431B	12.4	12.5	12.6	12.7	12.9	12.4	12.4	12.4	12.7	12.9
431C	12.8	12.7	13.0	13.7	14.9	12.8	12.9	13.2	13.6	13.9
432A	12.9	13.0	13.3	14.0	15.4	13.0	13.2	13.5	14.0	14.2
432B	12.8	12.8	13.1	13.4	14.5	12.8	12.9	13.2	13.7	14.0
432C	13.0	13.2	13.5	14.6	16.0	13.3	13.5	13.9	14.3	14.2
432D	13.3	13.7	15.1	16.3	16.8	13.6	14.1	14.3	14.4	14.5
433C	12.4	12.5	12.9	14.5	17.8	12.6	12.8	13.3	13.8	13.8
433D	12.0	12.0	12.2	12.8	13.8	12.2	12.2	12.6	13.1	13.5
433E	12.5	12.7	13.2	16.2	18.4	12.6	12.9	13.4	13.7	13.7
434C	12.1	12.3	12.6	13.7	17.9	11.4	11.7	12.3	12.8	12.8
434D	12.0	12.0	12.3	13.1	14.2	11.3	11.6	12.0	12.5	12.9
435B	22.3	22.6	23.5	26.3	28.3	22.6	23.4	24.7	25.7	26.0
435C	22.7	23.1	24.6	28.0	29.3	23.1	24.1	25.4	26.1	26.2
435D	23.3	24.1	27.1	29.6	30.6	23.8	25.2	26.0	26.4	26.4
435F	22.8	23.2	24.6	27.9	29.2	23.0	23.9	25.3	26.0	26.1
435G	22.4	22.7	23.4	26.1	28.0	22.4	23.2	24.4	25.6	25.9
436A	21.6	22.3	24.1	30.0	33.8	21.9	23.0	24.6	25.3	25.3
436B	21.4	21.7	22.8	26.7	31.9	21.3	22.2	23.8	25.0	25.1
436D	20.8	21.0	21.5	23.2	26.3	20.8	21.0	22.2	23.5	24.5
437C	19.8	20.3	21.3	23.4	29.5	20.7	21.3	22.7	24.3	24.6
437D	19.1	19.4	19.8	21.0	23.0	19.7	19.8	20.8	21.9	23.1
439B	38.3	43.0	48.2	52.1	54.3	41.9	45.2	46.4	46.9	46.9
439C	35.6	37.2	42.1	45.7	48.4	37.9	41.2	44.3	45.8	46.3
439D	37.0	40.5	45.7	50.1	52.5	39.7	43.5	45.6	46.3	46.5
439F	38.1	43.6	47.7	51.7	54.1	41.6	45.3	46.7	47.1	47.3
441A	46.6	52.3	58.4	63.3	66.6	48.8	54.5	56.8	58.0	58.1
442B	33.6	34.6	37.3	44.9	50.4	34.2	36.5	40.8	43.7	44.6
442C	34.9	36.9	42.8	50.7	54.7	36.1	40.1	43.8	45.1	45.3
443B	19.7	20.1	20.9	22.5	26.0	20.3	20.6	21.9	23.3	24.3
443C	21.1	22.1	26.1	37.8	41.2	21.1	22.6	24.2	24.7	24.5

Table A-5b. (cont'd)

RUN NO.	H 1 M	H 2 M	H 3 M	H 4 M	H 5 M	H 1,T M	H 2,T M	H 3,T M	H 4,T M	H 5,T M
444B	11.0	11.6	12.0	12.9	16.5	11.0	11.2	11.8	12.3	12.6
444C	11.6	12.3	13.3	21.4	29.0	11.3	11.8	12.3	12.6	12.6
445A	11.2	11.4	11.6	12.1	13.0	11.3	11.3	11.8	12.3	12.6
445B	11.7	12.3	13.1	19.8	26.0	11.9	12.2	12.8	13.1	13.1
445D	11.6	12.0	12.5	13.6	20.0	11.4	11.7	12.2	12.6	12.8
446B	12.1	12.2	12.4	12.7	13.4	11.8	12.4	12.7	13.0	13.4
446C	12.7	12.9	14.0	15.7	16.3	12.9	13.4	13.6	13.7	13.7
446D	12.5	12.8	13.1	14.3	15.9	12.7	13.0	13.4	13.7	13.7
447B	11.8	11.9	12.1	12.5	13.2	11.8	11.9	12.3	12.7	13.0
447C	12.2	12.4	12.8	14.7	18.3	12.0	12.4	13.0	13.4	13.3
448B	11.7	11.8	12.2	12.5	13.4	11.9	12.1	12.6	13.2	13.5
448C	12.4	12.7	13.4	17.6	24.0	12.4	12.9	13.5	14.0	13.9
449B	21.5	21.8	22.4	24.5	26.8	21.5	22.0	23.3	24.3	25.0
449C	21.9	22.2	23.2	26.1	28.6	21.6	22.4	23.8	24.6	24.9
450B	20.6	20.8	21.4	22.3	24.0	21.1	21.5	22.4	23.4	24.6
450C	20.9	21.3	22.0	23.6	26.7	21.5	22.0	23.4	24.8	25.7
450D	21.5	22.1	23.1	26.3	32.5	21.9	22.8	24.5	25.8	26.1
450E	22.1	22.9	25.9	32.8	36.9	22.2	23.8	25.4	25.9	25.9
451B	38.6	41.8	43.9	46.0	47.9	40.4	43.1	44.2	44.8	45.4
451C	39.6	43.2	44.9	47.3	49.2	40.6	43.2	44.2	44.7	45.0
451D	40.4	44.5	46.0	48.3	50.2	41.5	43.4	44.2	44.5	44.8
453B	46.2	50.6	56.2	60.9	66.1	48.7	53.8	56.9	59.0	59.2
453C	47.6	54.0	58.7	64.1	69.3	49.8	55.3	57.6	59.4	59.0
453D	49.2	56.7	61.1	66.5	71.9	51.7	56.7	58.0	59.3	58.4
454B	45.6	48.6	54.9	59.6	64.4	47.8	52.3	55.8	58.6	58.7
454C	48.1	55.1	60.1	65.7	71.3	51.7	56.9	58.7	60.6	59.9
455B	35.6	37.5	42.3	46.7	50.6	36.9	40.4	43.3	44.5	45.0

Table A-5b. (cont'd)

RUN NO.	H 1 M	H 2 M	H 3 M	H 4 M	H 5 M	H 1,T M	H 2,T M	H 3,T M	H 4,T M	H 5,T M
456B	33.6	34.7	37.5	43.6	50.2	36.3	37.6	41.2	44.5	45.4
456C	33.3	34.3	36.4	41.6	48.1	35.5	36.6	40.1	43.6	44.9
456D	32.8	33.5	35.2	39.2	44.4	34.5	35.2	38.4	41.8	43.9
457B	19.4	19.8	20.4	21.4	23.3	20.6	20.8	21.8	22.8	24.0
457C	20.3	21.0	22.4	26.6	35.6	21.7	22.6	24.3	25.6	25.6
457D	20.8	22.4	28.3	37.2	42.4	22.3	24.1	25.3	25.6	25.5
458B	20.3	21.2	22.3	24.9	35.0	21.5	22.2	23.7	24.9	25.3
459B	11.1	11.4	11.7	12.1	12.5	11.6	11.7	12.1	12.6	12.9
459C	11.8	12.5	13.1	15.9	26.7	12.1	12.5	13.1	13.7	13.6
459D	11.7	12.3	12.7	14.5	21.6	11.9	12.3	12.8	13.4	13.6
460B	11.4	12.4	12.9	15.1	26.5	11.9	12.2	12.9	13.5	13.4
460C	11.3	11.8	12.1	12.6	14.6	12.0	12.1	12.7	13.3	13.6
460D	11.7	12.4	14.3	25.9	31.2	12.4	12.8	13.4	13.7	13.6
461B	11.2	11.7	12.3	12.9	15.6	11.8	12.0	12.4	13.2	13.3
462B	12.7	12.9	13.0	13.9	15.4	12.8	13.0	13.3	13.7	13.9
462D	12.6	12.7	12.9	14.2	15.6	13.0	13.2	13.6	13.9	14.1

Table A-6a. Experimental cavitation data for 0.420-inch ogive using liquid hydrogen (English Units).

RUN NO.	CAVITY INCHES	TO DEG R	VO FT/SEC	PO PSIA	PV PSIA	HO FT	HV FT	KV	T 1 DEG R	T 2 DEG R	T 3 DEG R	T 4 DEG R	T 5 DEG R
463A**		37.44	111.3	19.72	17.14	647.9	563.4	0.44					
463B	0.90	37.60	116.2	16.42	17.58	540.6	578.7	-0.18	36.27	36.92	37.58	37.28	37.44
464A**		37.44	113.6	19.61	17.14	644.3	563.4	0.40					
464B	0.90	37.58	121.1	15.92	17.53	524.1	577.0	-0.23	36.09	36.56	37.48	37.28	37.44
465A**		37.66	130.5	22.08	17.73	726.7	583.9	0.54					
465B	0.62	37.71	136.2	17.45	17.88	575.0	589.1	-0.05	36.13	36.63	37.15	37.21	37.49
466A**		39.20	121.2	25.42	22.38	849.4	748.3	0.44					
467A**		38.99	123.8	25.68	21.68	856.1	723.5	0.56					
467B**		39.22	126.4	24.90	22.44	832.3	750.4	0.33					
468A**		37.53	131.3	23.22	17.38	763.2	571.8	0.71					
468B	0.55	37.67	140.0	17.88	17.78	588.9	585.6	0.01	35.93	36.65	37.39	37.40	37.35
469A**		39.31	138.1	26.90	22.74	899.7	761.0	0.47					
469B	0.86	39.40	146.7	21.52	23.03	721.1	771.7	-0.15	37.03	37.75	39.02	39.24	39.28
470A**		39.13	135.1	28.04	22.15	935.9	740.0	0.69					
470B**		39.31	136.7	27.68	22.74	925.7	761.0	0.57					
471A**		41.04	128.0	30.91	28.97	1053.2	987.4	0.26					
472B**		41.15	126.2	30.48	29.40	1039.9	1003.1	0.15					
473A**		41.09	137.2	33.72	29.18	1149.0	995.2	0.53					
475A**		40.88	153.5	35.62	28.34	1210.3	964.2	0.67					
476A**		41.00	153.1	35.74	28.83	1216.1	982.2	0.64					
476B**		41.15	153.9	36.29	29.40	1236.8	1003.1	0.63					

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-6a. (cont'd)

RUN NO.	CAVITY INCHES	TO DEG R	VO FT/SEC	PO PSIA	PV PSIA	HO FT	HV FT	KV	T 1 DEG R	T 2 DEG R	T 3 DEG R	T 4 DEG R	T 5 DEG R
477A**		37.42	152.0	26.39	17.09	866.1	561.7	0.85					
477B	0.62	37.51	162.6	18.79	17.33	617.9	570.1	0.12	35.98	36.25	37.17	37.26	37.33
478A	1.36	37.84	163.6	17.62	18.23	581.3	601.4	-0.05	37.84	37.84	37.84	37.84	37.84
478B	1.45	37.55	164.5	17.19	17.43	565.6	573.5	-0.02	37.55	37.55	37.55	37.55	37.55
478C	0.60	37.44	162.4	18.65	17.14	612.8	563.4	0.12	35.39	36.45	36.99	37.24	37.19
479A**		39.29	154.2	31.05	22.68	1037.6	758.9	0.75					
479B**		39.53	153.0	31.22	23.46	1045.8	786.9	0.71					
480B	0.74	39.17	166.2	21.82	22.26	729.3	744.2	-0.03	36.61	37.12	38.50	38.88	38.90
481A	0.90	39.33	136.2	20.62	22.80	690.5	763.2	-0.25	39.33	39.33	39.33	39.33	39.33
481B	0.76	39.29	135.9	21.02	22.68	703.6	758.9	-0.19	39.29	39.29	39.29	39.29	39.29
481C**		39.26	128.6	25.74	22.56	860.6	754.7	0.41					
482A	0.60	41.18	169.1	29.39	29.54	1003.4	1008.4	-0.01	41.18	41.18	41.18	41.18	41.18
483A	0.64	41.13	152.9	28.49	29.32	972.2	1000.5	-0.08	39.74	40.81	40.59	40.81	40.72
483B**		41.22	146.3	33.67	29.68	1149.0	1013.7	0.41					
484A	0.80	37.84	144.3	17.12	18.23	564.9	601.4	-0.11	37.84	37.84	37.84	37.84	37.84
484B	0.93	37.66	145.5	16.45	17.73	541.9	583.9	-0.13	37.66	37.66	37.66	37.66	37.66
484C	0.54	37.60	143.6	17.39	17.58	572.4	578.7	-0.02	37.60	37.60	37.60	37.60	37.60
485A	0.72	39.37	150.1	22.12	22.92	740.8	767.4	-0.08	39.37	39.37	39.37	39.37	39.37
485B	1.09	39.33	151.0	21.16	22.80	708.5	763.2	-0.15	39.33	39.33	39.33	39.33	39.33
485C	0.46	39.28	149.1	22.92	22.62	766.8	756.8	0.03	37.78	38.86	38.79	38.93	38.92
485D**		39.38	142.5	27.90	22.97	933.7	769.6	0.52					
486A	0.82	39.29	168.5	21.79	22.68	729.3	758.9	-0.07	39.29	39.29	39.29	39.29	39.29
486B	1.06	39.26	169.1	21.42	22.56	716.6	754.7	-0.09	39.26	39.26	39.26	39.26	39.26
486C	0.50	39.11	166.6	22.89	22.09	764.5	737.9	0.06	36.95	38.03	38.57	38.77	38.77
486D**		39.44	157.4	29.92	23.15	1001.5	776.0	0.59					

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-6a. (cont'd)

RUN NO.	CAVITY INCHES	TO DEG R	VO FT/SEC	PO PSIA	PV PSIA	HO FT	HV FT	KV	T 1 DEG R	T 2 DEG R	T 3 DEG R	T 4 DEG R	T 5 DEG R
487A	0.66	37.49	128.9	16.62	17.28	546.6	568.4	-0.08	36.27	36.99	37.40	37.13	37.08
487B**		37.69	121.5	20.72	17.83	682.3	587.4	0.41					
488A	0.60	37.44	121.2	16.90	17.14	555.5	563.4	-0.03	37.01	37.01	37.01	37.01	37.01
488B	1.00	37.28	124.2	15.37	16.70	504.5	548.3	-0.18	37.28	37.28	37.28	37.28	37.28
488C	1.00	37.31	124.1	15.27	16.80	501.4	551.6	-0.21	37.31	37.31	37.31	37.31	37.31
488D	0.57	37.28	122.8	16.17	16.70	530.7	548.3	-0.08	37.28	37.28	37.28	37.28	37.28
489B**		39.35	117.5	26.85	22.86	898.4	765.3	0.62					
490A**		37.19	115.2	20.57	16.47	674.1	540.1	0.65					
491A	0.92	37.42	137.8	15.87	17.09	521.6	561.7	-0.14	37.42	37.42	37.42	37.42	37.42
491B	0.95	37.19	138.2	16.37	16.47	536.8	540.1	-0.01	37.19	37.19	37.19	37.19	37.19
491C**		37.13	128.8	21.72	16.33	711.3	535.2	0.68					
492A	1.00	37.60	139.7	16.37	17.58	538.9	578.7	-0.13	37.60	37.60	37.60	37.60	37.60
492B	0.55	37.15	138.3	16.80	16.37	550.7	536.8	0.05	35.42	36.47	36.76	36.99	36.97
492C**		37.10	129.2	23.03	16.23	753.8	532.0	0.85					
493B	0.76	39.22	129.9	21.30	22.44	712.4	750.4	-0.15	37.37	38.56	38.83	38.83	38.83
493C**		39.26	121.6	26.32	22.56	879.9	754.7	0.54					
494A	0.98	39.44	144.3	21.80	23.15	730.7	776.0	-0.14	39.44	39.44	39.44	39.44	39.44
494B	0.44	39.33	141.5	23.27	22.80	778.9	763.2	0.05	38.29	39.04	38.92	38.95	38.88
494C**		39.29	134.8	27.50	22.68	919.5	758.9	0.57					
495A	1.02	39.42	146.0	21.50	23.09	720.6	773.9	-0.16	39.42	39.42	39.42	39.42	39.42
495B	0.60	39.29	143.7	22.67	22.68	758.6	758.9	-0.00	37.69	38.81	39.01	38.97	38.99
495C**		39.20	135.0	28.17	22.38	940.9	748.3	0.68					
496B**		40.90	112.2	30.87	28.41	1050.0	966.7	0.43					
497A**		40.88	114.7	30.77	28.34	1046.4	964.2	0.40					

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-6a. (cont'd)

RUN NO.	CAVITY INCHES	TO DEG R	VO FT/SEC	PO PSIA	PV PSIA	HO FT	HV FT	KV	T 1 DEG R	T 2 DEG R	T 3 DEG R	T 4 DEG R	T 5 DEG R
498A	1.25	39.37	162.5	21.50	22.92	720.1	767.4	-0.12	39.37	39.37	39.37	39.37	39.37
498B	0.61	39.22	160.9	22.56	22.44	754.3	750.4	0.01	39.22	39.22	39.22	39.22	39.22
498C**		39.08	148.9	30.20	21.97	1007.0	733.8	0.79					
499B**		41.15	132.7	31.80	29.40	1084.7	1003.1	0.30					
500B**		40.84	130.1	32.45	28.20	1102.8	959.1	0.55					
501A	1.21	39.22	161.8	21.23	22.44	710.0	750.4	-0.10	39.22	39.22	39.22	39.22	39.22
501B	0.62	39.11	160.2	22.35	22.09	746.5	737.9	0.02	37.12	38.30	38.61	38.77	38.66
501C**		39.01	149.6	29.87	21.74	995.3	725.5	0.78					
502A	0.82	40.91	162.9	27.56	28.48	938.2	969.3	-0.08	40.91	40.91	40.91	40.91	40.91
502B**		40.86	148.8	36.53	28.27	1240.8	961.6	0.81					
503A	0.66	40.84	161.0	28.00	28.20	952.3	959.1	-0.02	40.84	40.84	40.84	40.84	40.84
503B**		40.73	143.4	35.77	27.79	1213.4	943.9	0.79					
504B**		40.81	121.3	31.22	28.06	1060.8	954.0	0.47					
505A	1.40	37.46	163.4	17.40	17.19	572.0	565.0	0.02	37.46	37.46	37.46	37.46	37.46
505B	1.16	37.24	162.4	17.70	16.61	580.6	545.0	0.09	37.24	37.24	37.24	37.24	37.24
505C	0.65	37.24	159.1	18.46	16.61	605.5	545.0	0.15	35.71	36.22	36.65	36.90	36.68
505D**		37.37	146.3	25.76	16.94	845.0	556.6	0.87					
506A	1.48	37.37	167.0	17.55	16.94	576.4	556.6	0.05	37.37	37.37	37.37	37.37	37.37
506B	0.70	37.26	163.9	18.63	16.66	611.1	546.7	0.15	35.59	36.07	36.58	37.01	36.94
506C**		37.31	150.9	28.00	16.80	917.7	551.6	1.03					

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-6a. (cont'd)

RUN NO.	P 1 PSIA	P 2 PSIA	P 3 PSIA	P 4 PSIA	P 5 PSIA	P 1,T PSIA	P 2,T PSIA	P 3,T PSIA	P 4,T PSIA	P 5,T PSIA
463B	11.97	14.52	15.77	17.02	17.77	14.19	15.77	17.53	16.70	17.14
464B	11.19	13.19	14.99	16.42	17.32	13.77	14.88	17.23	16.70	17.14
465B	11.58	13.70	16.28	18.65	19.15	13.85	15.05	16.37	16.52	17.28
468B	11.91	14.08	16.78	18.95	19.71	13.40	15.10	16.99	17.04	16.90
469B	15.05	17.02	19.89	22.22	23.29	16.05	17.98	21.80	22.50	22.62
477B	11.44	12.29	15.54	19.99	20.91	13.52	14.14	16.42	16.66	16.85
478A	10.45	10.85	11.85	13.67	17.02	18.23	18.23	18.23	18.23	18.23
478B	10.12	10.42	10.99	12.19	15.32	17.43	17.43	17.43	17.43	17.43
478C	11.15	12.03	15.05	19.62	20.75	12.22	14.62	15.96	16.61	16.47
480B	14.19	14.99	17.59	22.49	23.92	15.01	16.28	20.17	21.34	21.40
481A	14.79	16.79	19.29	21.09	22.05	22.80	22.80	22.80	22.80	22.80
481B	15.32	17.85	20.05	22.05	22.79	22.68	22.68	22.68	22.68	22.68
482A	20.12	24.02	28.12	30.96	31.69	29.54	29.54	29.54	29.54	29.54
483A	21.29	25.76	27.59	29.86	30.59	24.19	28.06	27.24	28.06	27.72
484A	11.32	12.02	14.32	17.69	18.79	18.23	18.23	18.23	18.23	18.23
484B	10.95	11.33	12.63	15.73	17.65	17.73	17.73	17.73	17.73	17.73
484C	11.52	12.56	15.49	18.46	19.29	17.58	17.58	17.58	17.58	17.58
485A	15.02	17.49	20.69	23.22	24.05	22.92	22.92	22.92	22.92	22.92
485B	14.29	15.66	18.43	21.59	22.83	22.80	22.80	22.80	22.80	22.80
485C	15.62	19.55	21.99	24.25	24.92	18.08	21.29	21.06	21.51	21.46
486A	14.12	14.89	16.96	21.82	23.76	22.68	22.68	22.68	22.68	22.68
486B	13.89	14.35	15.52	19.22	22.42	22.56	22.56	22.56	22.56	22.56
486C	14.79	16.16	20.29	24.32	25.09	15.86	18.79	20.39	21.00	21.00
487A	11.42	13.97	15.77	17.62	18.22	14.19	15.96	17.04	16.33	16.19

Table A-6a. (cont'd)

RUN NO.	P 1 PSIA	P 2 PSIA	P 3 PSIA	P 4 PSIA	P 5 PSIA	P 1,T PSIA	P 2,T PSIA	P 3,T PSIA	P 4,T PSIA	P 5,T PSIA
488A	12.05	13.95	16.05	17.45	18.25	16.00	16.00	16.00	16.00	16.00
488B	11.00	11.47	12.70	14.97	16.60	16.70	16.70	16.70	16.70	16.70
488C	10.82	11.35	12.55	15.00	16.42	16.80	16.80	16.80	16.80	16.80
488D	11.47	12.54	14.74	16.67	17.64	16.70	16.70	16.70	16.70	16.70
491A	10.67	11.07	12.57	15.42	17.27	17.09	17.09	17.09	17.09	17.09
491B	10.80	12.04	13.77	15.74	17.17	16.47	16.47	16.47	16.47	16.47
492A	10.84	11.30	12.64	14.97	16.74	17.58	17.58	17.58	17.58	17.58
492B	10.93	12.00	14.63	17.47	18.62	12.29	14.66	15.37	15.96	15.91
493B	16.03	18.63	20.33	21.97	23.00	16.94	20.34	21.17	21.17	21.17
494A	15.47	16.60	19.77	22.30	23.60	23.15	23.15	23.15	23.15	23.15
494B	16.87	20.74	22.40	24.24	25.37	19.53	21.86	21.46	21.57	21.34
495A	14.93	15.85	18.78	21.25	22.92	23.09	23.09	23.09	23.09	23.09
495B	15.87	18.57	21.50	23.59	24.82	17.83	21.12	21.74	21.63	21.68
498A	13.80	14.27	15.10	17.57	20.70	22.92	22.92	22.92	22.92	22.92
498B	14.76	15.96	19.33	23.32	24.96	22.44	22.44	22.44	22.44	22.44
501A	14.17	14.47	15.63	18.83	22.13	22.44	22.44	22.44	22.44	22.44
501B	14.60	15.80	18.90	23.05	24.70	16.28	19.58	20.50	21.00	20.67
502A	19.20	21.66	25.36	28.29	29.89	28.48	28.48	28.48	28.48	28.48
503A	19.75	22.80	26.30	28.95	30.40	28.20	28.20	28.20	28.20	28.20
505A	10.44	10.67	11.04	12.30	15.30	17.19	17.19	17.19	17.19	17.19
505B	10.55	10.65	11.90	13.95	16.80	16.61	16.61	16.61	16.61	16.61
505C	11.23	11.83	14.00	18.86	20.72	12.92	14.06	15.10	15.73	15.19
506A	10.55	10.45	10.65	11.40	14.10	16.94	16.94	16.94	16.94	16.94
506B	11.30	11.77	13.23	18.30	20.89	12.64	13.73	14.92	16.00	15.82

Table A-6a. (cont'd)

RUN NO.	H 1 FT	H 2 FT	H 3 FT	H 4 FT	H 5 FT	H 1,T FT	H 2,T FT	H 3,T FT	H 4,T FT	H 5,T FT
463B	386.0	472.9	515.9	559.3	585.4	461.5	516.0	577.0	548.3	563.4
464B	359.7	427.4	489.0	538.4	569.7	447.1	485.2	566.7	548.3	563.4
465B	372.9	444.8	533.6	616.2	633.8	450.0	491.2	536.8	541.7	568.4
468B	384.0	457.8	550.9	626.7	653.5	434.5	492.8	558.3	560.0	555.0
469B	491.1	559.3	659.8	742.6	780.9	525.6	592.6	727.6	752.6	756.8
477B	368.1	396.9	508.0	663.4	695.9	438.7	460.0	538.5	546.7	553.3
478A	334.9	348.3	382.0	443.8	559.3	601.4	601.4	601.4	601.4	601.4
478B	323.8	333.9	353.0	393.5	500.4	573.5	573.5	573.5	573.5	573.5
478C	358.4	388.1	491.1	650.3	690.3	394.4	476.2	522.4	545.0	540.1
480B	461.6	489.0	579.1	752.2	803.5	489.7	533.6	669.9	711.3	713.3
481A	482.2	551.3	638.7	702.3	736.5	763.2	763.2	763.2	763.2	763.2
481B	500.4	588.2	665.5	736.5	762.9	758.9	758.9	758.9	758.9	758.9
482A	668.0	807.1	956.1	1061.0	1088.2	1008.4	1008.4	1008.4	1008.4	1008.4
483A	709.4	870.0	936.7	1020.2	1047.3	813.4	954.0	924.0	954.0	941.4
484A	364.1	387.7	466.0	582.6	621.1	601.4	601.4	601.4	601.4	601.4
484B	351.6	364.4	408.4	514.6	581.2	583.9	583.9	583.9	583.9	583.9
484C	370.8	406.0	506.3	609.6	638.7	578.7	578.7	578.7	578.7	578.7
485A	490.1	575.6	688.1	778.4	808.2	767.4	767.4	767.4	767.4	767.4
485B	465.0	512.1	608.5	720.1	764.4	763.2	763.2	763.2	763.2	763.2
485C	510.8	647.9	734.4	815.4	839.6	596.1	709.3	701.3	717.4	715.3
486A	459.2	485.6	557.2	728.3	797.7	758.9	758.9	758.9	758.9	758.9
486B	451.3	467.1	507.3	636.2	749.7	754.7	754.7	754.7	754.7	754.7
486C	482.2	529.4	674.0	817.9	845.7	519.2	621.2	677.6	699.3	699.3
487A	367.5	454.0	515.9	580.2	601.1	461.5	522.4	560.0	535.2	530.4

Table A-6a. (cont'd)

RUN NO.	H 1 FT	H 2 FT	H 3 FT	H 4 FT	H 5 FT	H 1,T FT	H 2,T FT	H 3,T FT	H 4,T FT	H 5,T FT
488A	388.7	453.4	525.6	574.3	602.2	524.0	524.0	524.0	524.0	524.0
488B	353.3	369.1	410.8	488.4	544.7	548.3	548.3	548.3	548.3	548.3
488C	347.3	365.1	405.7	489.4	538.4	551.6	551.6	551.6	551.6	551.6
488D	369.1	405.3	480.4	547.1	580.9	548.3	548.3	548.3	548.3	548.3
491A	342.2	355.7	406.3	503.9	568.0	561.7	561.7	561.7	561.7	561.7
491B	346.6	388.4	447.2	514.9	564.5	540.1	540.1	540.1	540.1	540.1
492A	347.9	363.4	408.7	488.4	549.5	578.7	578.7	578.7	578.7	578.7
492B	351.0	387.0	476.7	574.9	615.2	397.0	477.7	502.0	522.4	520.8
493B	524.9	615.5	675.4	733.6	770.5	556.6	675.7	705.3	705.3	705.3
494A	505.6	544.7	655.6	745.4	792.0	776.0	776.0	776.0	776.0	776.0
494B	554.1	689.9	749.0	815.0	855.9	647.0	729.6	715.3	719.4	711.3
495A	487.0	518.7	620.8	708.0	767.6	773.9	773.9	773.9	773.9	773.9
495B	519.4	613.4	716.9	791.6	836.0	587.4	703.3	725.5	721.4	723.5
498A	448.2	464.3	492.8	578.4	688.5	767.4	767.4	767.4	767.4	767.4
498B	481.1	522.5	640.1	781.9	841.0	750.4	750.4	750.4	750.4	750.4
501A	460.9	471.2	511.1	622.5	739.4	750.4	750.4	750.4	750.4	750.4
501B	475.6	517.0	625.0	772.3	831.6	533.6	648.9	681.5	699.3	687.4
502A	635.5	722.6	855.5	962.4	1021.4	969.3	969.3	969.3	969.3	969.3
503A	654.9	763.3	889.6	986.7	1040.2	959.1	959.1	959.1	959.1	959.1
505A	334.5	342.2	354.7	397.2	499.7	565.0	565.0	565.0	565.0	565.0
505B	338.2	341.6	383.7	453.4	551.6	545.0	545.0	545.0	545.0	545.0
505C	361.1	381.3	455.1	623.6	689.2	418.1	457.1	492.8	514.4	495.8
506A	338.2	334.9	341.6	366.8	458.5	556.6	556.6	556.6	556.6	556.6
506B	363.4	379.3	428.8	603.9	695.2	408.7	445.7	486.7	524.0	517.6

Table A-6b. Experimental cavitation data for 0.420-inch ogive using liquid hydrogen (SI Units).

RUN NO.	CAVITY CM	TO DEG K	VO M/SEC	PO N/CM/CM	PV N/CM/CM	HO M	HV M	KV	T 1 DEG K	T 2 DEG K	T 3 DEG K	T 4 DEG K	T 5 DEG K
463A**		20.80	33.9	13.60	11.82	197.5	171.7	0.44					
463B	2.28	20.89	35.4	11.32	12.12	164.8	176.4	-0.18	20.15	20.51	20.88	20.71	20.80
464A**		20.80	34.6	13.52	11.82	196.4	171.7	0.40					
464B	2.28	20.88	36.9	10.98	12.09	159.7	175.9	-0.23	20.05	20.31	20.82	20.71	20.80
465A**		20.92	39.8	15.22	12.22	221.5	178.0	0.54					
465B	1.57	20.95	41.5	12.03	12.32	175.3	179.6	-0.05	20.07	20.35	20.64	20.67	20.83
466A**		21.78	36.9	17.53	15.43	258.9	228.1	0.44					
467A**		21.66	37.7	17.71	14.95	260.9	220.5	0.56					
467B**		21.79	38.5	17.17	15.47	253.7	228.7	0.33					
468A**		20.85	40.0	16.01	11.98	232.6	174.3	0.71					
468B	1.39	20.93	42.7	12.33	12.26	179.5	178.5	0.01	19.96	20.36	20.77	20.78	20.75
469A**		21.84	42.1	18.55	15.68	274.2	232.0	0.47					
469B	2.18	21.89	44.7	14.84	15.88	219.8	235.2	-0.15	20.57	20.97	21.68	21.80	21.82
470A**		21.74	41.2	19.33	15.27	285.2	225.5	0.69					
470B**		21.84	41.7	19.08	15.68	282.1	232.0	0.57					
471A**		22.80	39.0	21.31	19.97	321.0	301.0	0.26					
472B**		22.86	38.5	21.02	20.27	317.0	305.7	0.15					
473A**		22.83	41.8	23.25	20.12	350.2	303.3	0.53					
475A**		22.71	46.8	24.56	19.54	368.9	293.9	0.67					
476A**		22.78	46.7	24.64	19.88	370.7	299.4	0.64					
476B**		22.86	46.9	25.02	20.27	377.0	305.7	0.63					

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-6b. (cont'd)

RUN NO.	CAVITY CM	TO DEG K	VO M/SEC	PO N/CM/CM	PV N/CM/CM	HO M	HV M	KV	T 1 DEG K	T 2 DEG K	T 3 DEG K	T 4 DEG K	T 5 DEG K
477A**		20.79	46.3	18.20	11.78	264.0	171.2	0.85					
477B	1.57	20.84	49.6	12.96	11.95	188.3	173.8	0.12	19.99	20.14	20.65	20.70	20.74
478A	3.45	21.02	49.9	12.15	12.57	177.2	183.3	-0.05	21.02	21.02	21.02	21.02	21.02
478B	3.68	20.86	50.2	11.85	12.02	172.4	174.8	-0.02	20.86	20.86	20.86	20.86	20.86
478C	1.52	20.80	49.5	12.86	11.82	186.8	171.7	0.12	19.66	20.25	20.55	20.69	20.66
479A**		21.83	47.0	21.41	15.64	316.3	231.3	0.75					
479B**		21.96	46.6	21.53	16.17	318.8	239.8	0.71					
480B	1.88	21.76	50.7	15.04	15.35	222.3	226.8	-0.03	20.34	20.62	21.39	21.60	21.61
481A	2.28	21.85	41.5	14.22	15.72	210.5	232.6	-0.25	21.85	21.85	21.85	21.85	21.85
481B	1.93	21.83	41.4	14.49	15.64	214.4	231.3	-0.19	21.83	21.83	21.83	21.83	21.83
481C**		21.81	39.2	17.75	15.55	262.3	230.0	0.41					
482A	1.52	22.88	51.5	20.26	20.37	305.8	307.4	-0.01	22.88	22.88	22.88	22.88	22.88
483A	1.62	22.85	46.6	19.64	20.22	296.3	304.9	-0.08	22.08	22.67	22.55	22.67	22.62
483B**		22.90	44.6	23.21	20.47	350.2	309.0	0.41					
484A	2.03	21.02	44.0	11.80	12.57	172.2	183.3	-0.11	21.02	21.02	21.02	21.02	21.02
484B	2.36	20.92	44.3	11.34	12.22	165.2	178.0	-0.13	20.92	20.92	20.92	20.92	20.92
484C	1.37	20.89	43.8	11.99	12.12	174.5	176.4	-0.02	20.89	20.89	20.89	20.89	20.89
485A	1.82	21.87	45.8	15.25	15.80	225.8	233.9	-0.08	21.87	21.87	21.87	21.87	21.87
485B	2.76	21.85	46.0	14.59	15.72	216.0	232.6	-0.15	21.85	21.85	21.85	21.85	21.85
485C	1.16	21.82	45.4	15.80	15.59	233.7	230.7	0.03	20.99	21.59	21.55	21.63	21.62
485D**		21.88	43.4	19.24	15.84	284.6	234.6	0.52					
486A	2.08	21.83	51.3	15.02	15.64	222.3	231.3	-0.07	21.83	21.83	21.83	21.83	21.83
486B	2.69	21.81	51.5	14.77	15.55	218.4	230.0	-0.09	21.81	21.81	21.81	21.81	21.81
486C	1.27	21.73	50.8	15.78	15.23	233.0	224.9	0.06	20.53	21.13	21.43	21.54	21.54
486D**		21.91	48.0	20.63	15.96	305.3	236.5	0.59					

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-6b. (cont'd)

RUN NO.	CAVITY CM	TO DEG K	VO M/SEC	PO N/CM/CM	PV N/CM/CM	HO M	HV M	KV	T 1 DEG K	T 2 DEG K	T 3 DEG K	T 4 DEG K	T 5 DEG K
487A	1.67	20.83	39.3	11.46	11.92	166.6	173.3	-0.08	20.15	20.55	20.78	20.63	20.60
487B**		20.94	37.0	14.29	12.29	208.0	179.0	0.41					
488A	1.52	20.80	36.9	11.65	11.82	169.3	171.7	-0.03	20.56	20.56	20.56	20.56	20.56
488B	2.54	20.71	37.9	10.60	11.52	153.8	167.1	-0.18	20.71	20.71	20.71	20.71	20.71
488C	2.54	20.73	37.8	10.53	11.58	152.8	168.1	-0.21	20.73	20.73	20.73	20.73	20.73
488D	1.44	20.71	37.4	11.15	11.52	161.8	167.1	-0.08	20.71	20.71	20.71	20.71	20.71
489B**		21.06	35.8	18.51	15.76	273.8	233.3	0.62					
490A**		20.66	35.1	14.18	11.35	205.5	164.6	0.65					
491A	2.33	20.79	42.0	10.94	11.78	159.0	171.2	-0.14	20.79	20.79	20.79	20.79	20.79
491B	2.41	20.66	42.1	11.29	11.35	163.6	164.6	-0.01	20.66	20.66	20.66	20.66	20.66
491C**		20.63	39.3	14.98	11.26	216.8	163.1	0.68					
492A	2.54	20.89	42.6	11.29	12.12	164.3	176.4	-0.13	20.89	20.89	20.89	20.89	20.89
492B	1.39	20.64	42.2	11.58	11.29	167.8	163.6	0.05	19.68	20.26	20.42	20.55	20.54
492C**		20.61	39.4	15.88	11.19	229.8	162.1	0.85					
493B	1.93	21.79	39.6	14.69	15.47	217.1	228.7	-0.15	20.76	21.42	21.57	21.57	21.57
493C**		21.81	37.1	18.15	15.55	268.2	230.0	0.54					
494A	2.48	21.91	44.0	15.03	15.96	222.7	236.5	-0.14	21.91	21.91	21.91	21.91	21.91
494B	1.11	21.85	43.1	16.04	15.72	237.4	232.6	0.05	21.27	21.69	21.62	21.64	21.60
494C**		21.83	41.1	18.96	15.64	280.3	231.3	0.57					
495A	2.59	21.90	44.5	14.82	15.92	219.6	235.9	-0.16	21.90	21.90	21.90	21.90	21.90
495B	1.52	21.83	43.8	15.63	15.64	231.2	231.3	-0.00	20.94	21.56	21.67	21.65	21.66
495C**		21.78	41.1	19.42	15.43	286.8	228.1	0.68					
496B**		22.72	34.2	21.28	19.59	320.1	294.7	0.43					
497A**		22.71	35.0	21.22	19.54	319.0	293.9	0.40					

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-6b. (cont'd)

RUN NO.	CAVITY CM	TO DEG K	VO M/SEC	PO N/CM/CM	PV N/CM/CM	HO M	HV M	KV	T 1 DEG K	T 2 DEG K	T 3 DEG K	T 4 DEG K	T 5 DEG K
498A	3.17	21.87	49.5	14.82	15.80	219.5	233.9	-0.12	21.87	21.87	21.87	21.87	21.87
498B	1.54	21.79	49.0	15.55	15.47	229.9	228.7	0.01	21.79	21.79	21.79	21.79	21.79
498C**		21.71	45.4	20.82	15.15	306.9	223.7	0.79					
499B**		22.86	40.5	21.93	20.27	330.6	305.7	0.30					
500B**		22.69	39.6	22.37	19.44	336.1	292.3	0.55					
501A	3.07	21.79	49.3	14.64	15.47	216.4	228.7	-0.10	21.79	21.79	21.79	21.79	21.79
501B	1.57	21.73	48.8	15.41	15.23	227.5	224.9	0.02	20.62	21.28	21.45	21.54	21.48
501C**		21.67	45.6	20.59	14.99	303.4	221.1	0.78					
502A	2.08	22.73	49.6	19.00	19.64	286.0	295.4	-0.08	22.73	22.73	22.73	22.73	22.73
502B**		22.70	45.4	25.19	19.49	378.2	293.1	0.81					
503A	1.67	22.69	49.1	19.31	19.44	290.3	292.3	-0.02	22.69	22.69	22.69	22.69	22.69
503B**		22.63	45.2	24.66	19.16	369.8	287.7	0.79					
504B**		22.67	37.0	21.53	19.35	323.3	290.8	0.47					
505A	3.55	20.81	49.8	12.00	11.85	174.3	172.2	0.02	20.81	20.81	20.81	20.81	20.81
505B	2.94	20.69	49.5	12.20	11.45	177.0	166.1	0.09	20.69	20.69	20.69	20.69	20.69
505C	1.65	20.69	48.5	12.73	11.45	184.5	166.1	0.15	19.84	20.12	20.36	20.50	20.38
505D**		20.76	44.6	17.76	11.68	257.6	169.7	0.87					
506A	3.75	20.76	50.9	12.10	11.68	175.7	169.7	0.05	20.76	20.76	20.76	20.76	20.76
506B	1.77	20.70	50.0	12.84	11.48	186.3	166.6	0.15	19.77	20.04	20.32	20.56	20.52
506C**		20.73	46.0	19.31	11.58	279.7	168.1	1.03					

* DENOTES AN INCIPIENT RUN
** DENOTES A DESINENT RUN

Table A-6b. (cont'd)

RUN NO.	P 1 N/CM/CM	P 2 N/CM/CM	P 3 N/CM/CM	P 4 N/CM/CM	P 5 N/CM/CM	P 1,T N/CM/CM	P 2,T N/CM/CM	P 3,T N/CM/CM	P 4,T N/CM/CM	P 5,T N/CM/CM
463B	8.25	10.01	10.87	11.73	12.25	9.78	10.87	12.09	11.52	11.82
464B	7.72	9.09	10.34	11.32	11.94	9.49	10.26	11.88	11.52	11.82
465B	7.98	9.45	11.22	12.86	13.20	9.55	10.38	11.29	11.39	11.92
468B	8.21	9.71	11.57	13.07	13.59	9.24	10.41	11.72	11.75	11.65
469B	10.38	11.73	13.71	15.32	16.06	11.06	12.39	15.03	15.51	15.59
477B	7.89	8.47	10.71	13.78	14.42	9.32	9.75	11.32	11.48	11.62
478A	7.21	7.48	8.17	9.43	11.73	12.57	12.57	12.57	12.57	12.57
478B	6.98	7.18	7.58	8.40	10.56	12.02	12.02	12.02	12.02	12.02
478C	7.69	8.29	10.38	13.53	14.31	8.42	10.08	11.00	11.45	11.35
480B	9.78	10.34	12.13	15.51	16.49	10.35	11.22	13.91	14.71	14.75
481A	10.20	11.58	13.30	14.54	15.20	15.72	15.72	15.72	15.72	15.72
481B	10.56	12.31	13.82	15.20	15.71	15.64	15.64	15.64	15.64	15.64
482A	13.87	16.56	19.39	21.35	21.85	20.37	20.37	20.37	20.37	20.37
483A	14.68	17.76	19.02	20.59	21.09	16.68	19.35	18.78	19.35	19.11
484A	7.80	8.29	9.87	12.20	12.96	12.57	12.57	12.57	12.57	12.57
484B	7.55	7.81	8.71	10.85	12.17	12.22	12.22	12.22	12.22	12.22
484C	7.94	8.66	10.68	12.73	13.30	12.12	12.12	12.12	12.12	12.12
485A	10.36	12.06	14.27	16.01	16.58	15.80	15.80	15.80	15.80	15.80
485B	9.85	10.80	12.71	14.89	15.74	15.72	15.72	15.72	15.72	15.72
485C	10.77	13.48	15.16	16.72	17.18	12.46	14.68	14.52	14.83	14.79
486A	9.74	10.27	11.69	15.04	16.38	15.64	15.64	15.64	15.64	15.64
486B	9.58	9.89	10.70	13.25	15.46	15.55	15.55	15.55	15.55	15.55
486C	10.20	11.14	13.99	16.77	17.30	10.94	12.96	14.06	14.48	14.48
487A	7.87	9.63	10.87	12.15	12.56	9.78	11.00	11.75	11.26	11.16

Table A-6b. (cont'd)

RUN NO.	P 1 N/CM/CM	P 2 N/CM/CM	P 3 N/CM/CM	P 4 N/CM/CM	P 5 N/CM/CM	P 1,T N/CM/CM	P 2,T N/CM/CM	P 3,T N/CM/CM	P 4,T N/CM/CM	P 5,T N/CM/CM
488A	8.31	9.62	11.07	12.03	12.58	11.03	11.03	11.03	11.03	11.03
488B	7.58	7.91	8.76	10.32	11.45	11.52	11.52	11.52	11.52	11.52
488C	7.46	7.83	8.65	10.34	11.32	11.58	11.58	11.58	11.58	11.58
488D	7.91	8.65	10.16	11.49	12.16	11.52	11.52	11.52	11.52	11.52
491A	7.36	7.63	8.67	10.63	11.91	11.78	11.78	11.78	11.78	11.78
491B	7.45	8.30	9.49	10.85	11.84	11.35	11.35	11.35	11.35	11.35
492A	7.47	7.79	8.71	10.32	11.54	12.12	12.12	12.12	12.12	12.12
492B	7.54	8.27	10.09	12.05	12.84	8.48	10.11	10.59	11.00	10.97
493B	11.05	12.84	14.02	15.15	15.86	11.68	14.02	14.60	14.60	14.60
494A	10.67	11.45	13.63	15.38	16.27	15.96	15.96	15.96	15.96	15.96
494B	11.63	14.30	15.44	16.71	17.49	13.46	15.07	14.79	14.87	14.71
495A	10.29	10.93	12.95	14.65	15.80	15.92	15.92	15.92	15.92	15.92
495B	10.94	12.80	14.82	16.26	17.11	12.29	14.56	14.99	14.91	14.95
498A	9.51	9.84	10.41	12.11	14.27	15.80	15.80	15.80	15.80	15.80
498B	10.18	11.00	13.33	16.08	17.21	15.47	15.47	15.47	15.47	15.47
501A	9.77	9.98	10.78	12.98	15.26	15.47	15.47	15.47	15.47	15.47
501B	10.07	10.89	13.03	15.89	17.03	11.22	13.50	14.14	14.48	14.25
502A	13.24	14.93	17.49	19.51	20.61	19.64	19.64	19.64	19.64	19.64
503A	13.62	15.72	18.13	19.96	20.96	19.44	19.44	19.44	19.44	19.44
505A	7.20	7.36	7.61	8.48	10.55	11.85	11.85	11.85	11.85	11.85
505B	7.27	7.34	8.20	9.62	11.58	11.45	11.45	11.45	11.45	11.45
505C	7.74	8.16	9.65	13.00	14.29	8.91	9.69	10.41	10.84	10.47
506A	7.27	7.21	7.34	7.86	9.72	11.68	11.68	11.68	11.68	11.68
506B	7.79	8.12	9.12	12.62	14.40	8.72	9.46	10.29	11.03	10.91

Table A-6b. (cont'd)

RUN NO.	H 1 M	H 2 M	H 3 M	H 4 M	H 5 M	H 1,T M	H 2,T M	H 3,T M	H 4,T M	H 5,T M
463B	117.7	144.1	157.3	170.5	178.4	140.7	157.3	175.9	167.1	171.7
464B	109.6	130.3	149.1	164.1	173.7	136.3	147.9	172.7	167.1	171.7
465B	113.6	135.6	162.6	187.8	193.2	137.2	149.7	163.6	165.1	173.3
468B	117.0	139.5	167.9	191.0	199.2	132.4	150.2	170.2	170.7	169.2
469B	149.7	170.5	201.1	226.3	238.0	160.2	180.6	221.8	229.4	230.7
477B	112.2	121.0	154.8	202.2	212.1	133.7	140.2	164.1	166.6	168.6
478A	102.1	106.2	116.4	135.3	170.5	183.3	183.3	183.3	183.3	183.3
478B	98.7	101.8	107.6	119.9	152.5	174.8	174.8	174.8	174.8	174.8
478C	109.2	118.3	149.7	198.2	210.4	120.2	145.1	159.2	166.1	164.6
480B	140.7	149.1	176.5	229.3	244.9	149.3	162.6	204.2	216.8	217.4
481A	147.0	168.0	194.7	214.1	224.5	232.6	232.6	232.6	232.6	232.6
481B	152.5	179.3	202.8	224.5	232.5	231.3	231.3	231.3	231.3	231.3
482A	203.6	246.0	291.4	323.4	331.7	307.4	307.4	307.4	307.4	307.4
483A	216.2	265.2	285.5	311.0	319.2	247.9	290.8	281.6	290.8	286.9
484A	111.0	118.2	142.0	177.6	189.3	183.3	183.3	183.3	183.3	183.3
484B	107.2	111.1	124.5	156.8	177.2	178.0	178.0	178.0	178.0	178.0
484C	113.0	123.8	154.3	185.8	194.7	176.4	176.4	176.4	176.4	176.4
485A	149.4	175.5	209.7	237.2	246.3	233.9	233.9	233.9	233.9	233.9
485B	141.7	156.1	185.5	219.5	233.0	232.6	232.6	232.6	232.6	232.6
485C	155.7	197.5	223.8	248.5	255.9	181.7	216.2	213.7	218.7	218.0
486A	140.0	148.0	169.8	222.0	243.2	231.3	231.3	231.3	231.3	231.3
486B	137.6	142.4	154.6	193.9	228.5	230.0	230.0	230.0	230.0	230.0
486C	147.0	161.4	205.4	249.3	257.8	158.2	189.3	206.5	213.1	213.1
487A	112.0	138.4	157.3	176.8	183.2	140.7	159.2	170.7	163.1	161.7

Table A-6b. (cont'd)

RUN NO.	H 1 M	H 2 M	H 3 M	H 4 M	H 5 M	H 1,T M	H 2,T M	H 3,T M	H 4,T M	H 5,T M
488A	118.5	138.2	160.2	175.0	183.6	159.7	159.7	159.7	159.7	159.7
488B	107.7	112.5	125.2	148.9	166.0	167.1	167.1	167.1	167.1	167.1
488C	105.8	111.3	123.6	149.2	164.1	168.1	168.1	168.1	168.1	168.1
488D	112.5	123.5	146.4	166.8	177.1	167.1	167.1	167.1	167.1	167.1
491A	104.3	108.4	123.9	153.6	173.1	171.2	171.2	171.2	171.2	171.2
491B	105.6	118.4	136.3	156.9	172.1	164.6	164.6	164.6	164.6	164.6
492A	106.1	110.8	124.6	148.9	167.5	176.4	176.4	176.4	176.4	176.4
492B	107.0	118.0	145.3	175.2	187.5	121.0	145.6	153.0	159.2	158.7
493B	160.0	187.6	205.9	223.6	234.8	169.7	205.9	215.0	215.0	215.0
494A	154.1	166.0	199.8	227.2	241.4	236.5	236.5	236.5	236.5	236.5
494B	168.9	210.3	228.3	248.4	260.9	197.2	222.4	218.0	219.3	216.8
495A	148.4	158.1	189.2	215.8	234.0	235.9	235.9	235.9	235.9	235.9
495B	158.3	187.0	218.5	241.3	254.8	179.0	214.4	221.1	219.9	220.5
498A	136.6	141.5	150.2	176.3	209.9	233.9	233.9	233.9	233.9	233.9
498B	146.6	159.3	195.1	238.3	256.3	228.7	228.7	228.7	228.7	228.7
501A	140.5	143.6	155.8	189.7	225.4	228.7	228.7	228.7	228.7	228.7
501B	145.0	157.6	190.5	235.4	253.5	162.6	197.8	207.7	213.1	209.5
502A	193.7	220.2	260.8	293.3	311.3	295.4	295.4	295.4	295.4	295.4
503A	199.6	232.7	271.2	300.7	317.1	292.3	292.3	292.3	292.3	292.3
505A	102.0	104.3	108.1	121.1	152.3	172.2	172.2	172.2	172.2	172.2
505B	103.1	104.1	116.9	138.2	168.1	166.1	166.1	166.1	166.1	166.1
505C	110.1	116.2	138.7	190.1	210.1	127.4	139.3	150.2	156.8	151.1
506A	103.1	102.1	104.1	111.8	139.8	169.7	169.7	169.7	169.7	169.7
506B	110.8	115.6	130.7	184.1	211.9	124.6	135.9	148.3	159.7	157.8