Enclosure 3

Westinghouse Electric Corporation

Water Reactor Divisions

Nuclear Technology Division

Box 355
Pittsburgh Pennsylvania 15230

February 9, 1984

CAW-84-8

Mr. Harold R. Denton
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

APPLICATION FOR WITHHOLDING PROPRIETARY

INFORMATION FROM PUBLIC DISCLOSURE

SUBJECT: 17X17 XL Hydraulic Flow Testing - NRC Question 231.8

REF: Houston Lighting and Power Letter, Goldberg to Denton

Dear Mr. Denton:

The proprietary material for which withholding is being requested is of the same technical type as that proprietary material previously submitted by Westinghouse concerning the Westinghouse optimized fuel assembly design. The previous application for withholding, AW-78-23, was accompanied by an affidavit signed by the owner of the proprietary information, Westinghouse Electric Corporation.

The undersigned has reviewed the information sought to be withheld and is authorized to apply for its withholding on behalf of Westinghouse, WRD, notification of which was sent to the Secretary of the Commission on April 19, 1976.

The affidavit accompanying this application sets forth the basis on which the information may be withheld from public disclosure by the Commission and addresses with specificity the considerations listed in paragraph (b)(4) of Section 2.790 of the Commission's regulations.

Accordingly, it is respectfully requested that the subject information which is proprietary to Westinghouse be withheld from public disclosure in accordance with 10 CFR Section 2.790 of the Commission's regulations.

Correspondence with respect to this application for withholding or the accompanying affidavit should reference CAW-84-8 and should be addressed to the undersigned.

Very truly yours,

Robert A. Wiesemann

Robert A. Wiesemann, Manager
Regulatory & Legislative Affairs

/bek

cc: E. C. Shomaker, Esq.
Office of the Executive Legal Director, NRC

AW-78-23

AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

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COUNTY OF ALLEGHENY:

Before me, the undersigned authority, personally appeared Robert A. Wiesemann, who, being by me duly sworn according to law, deposes and says that he is authorized to execute this Affidavit on behalf of Westinghouse Electric Corporation ("Westinghouse") and that the averments of fact set forth in this Affidavit are true and correct to the best of his knowledge, information, and belief:

Robert A. Wiesemann

Robert A. Wiesemann, Manager
Licensing Programs

Sworn to and subscribed before me this 20 day of March 1978.

Notary Public

AW-78-23

(1) I am Manager, Licensing Programs, in the Pressurized Water Reactor Systems Division, of Westinghouse Electric Corporation and as such, I have been specifically delegated the function of reviewing the proprietary information sought to be withheld from public disclosure in connection with nuclear power plant licensing or rulemaking proceedings, and am authorized to apply for its withholding on behalf of the Westinghouse Water Reactor Divisions.

(2) I am making this affidavit in conformance with the provisions of 10 CFR Section 2.790 of the Commission's regulations and in conjunction with the Westinghouse application for withholding accompanying this Affidavit.

(3) I have personal knowledge of the criteria and procedures utilized by Westinghouse Nuclear Energy Systems in designating information as a trade secret, privileged o.' as confidential commercial or financial information.

(4) Pursuant to the provisions of paragraph (b)(4) of Section 2.790 of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld.

(i) The information sought to be withheld from public disclosure is owned and has been held in confidence by Westinghouse.

(ii) The information is of a type customarily held in confidence by Westinghouse and not customarily disclosed to the public. Westinghouse has a rational basis for determining the types of information customarily held in confidence by it and, in that connection, utilizes a system to determine when and whether to hold certain types of information in confidence. The application of that system and the substance of that system constitutes Westinghouse policy and provides the rational basis required.

Criteria and Standards Utilized

In determining whether information in a document or report is proprietary, the following criteria and standards are utilized by Westinghouse. Information is proprietary if any one of the following are met:

(a) The information reveals the distinguishing aspects of a process (or component, structure, tool, method, etc.) where prevention of its use by any of Westinghouse's competitors without license from Westinghouse constitutes a competitive economic advantage over other companies.

(b) It consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), the application of which data secures a competitive economic advantage, e.g., by optimization or improved marketability.

(c) Its use by a competitor would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product.

(d) It reveals cost or price information, production capacities, budget levels, or commercial strategies of Westinghouse, its customers or suppliers.

(e) It reveals aspects of past, present, or future Westinghouse or customer funded development plans and programs of potential commercial value to Westinghouse.

(f) It contains patentable ideas, for which patent protection may be desirable.

(g) It is not the property of Westinghouse, but must be treated as proprietary by Westinghouse according to agreements with the owner.

(iii) The information is being transmitted to the Commission in confidence and, under the provisions of 10 CFR Section 2.790, it is to be received in confidence by the Commission.

(iv) The information is not available in public sources to the best of our knowledge and belief.

(v) The proprietary information sought to be withheld in this submittal are the copies of slides utilized by Westinghouse in its presentation to the NRC at the March 21, 1978 meeting concerning the Westinghouse optimized fuel assembly. The letter and the copies of slides are being submitted in preliminary form to the Commission for review and comment on the Westinghouse optimized fuel assembly in advance of a formal submittal for NRC approval.

Public disclosure of this information is likely to cause substantial harm to the competitive position of Westinghouse as it would reveal the description of the approved design, the comparison of the improved design with the standard design, the nature of the tests conducted, the test conditions, the test results and the conclusions of the testing program, all of which is recognized by the Staff to be of competitive value and because of the large amount of effort and money expended by Westinghouse over a period of several years in carrying out this particular development program. Further, it would enable competitors to use the information for commercial purposes and also to meet NRC requirements for licensing documentation, each without purchasing the right from Westinghouse to use the information.

Information regarding its development programs is valuable to Westinghouse because:

(a) Information resulting from its development programs gives Westinghouse a competitive advantage over its competitors. It is, therefore, withheld from disclosure to protect the Westinghouse competitive position.

(b) It is information which is marketable in many ways. The extent to which such information is available to competitors diminishes the Westinghouse ability to sell products and services involving the use of the information.

(c) Use by our competitor would put Westinghouse at a competitive disadvantage by reducing his expenditure of resources at our expense.

(d) Each component of proprietary information pertinent to a particular competitive advantage is potentially as valuable as the total competitive advantage. If competitors acquire components of proprietary information, any one component may be the key to the entire puzzle, thereby depriving Westinghouse of a competitive advantage.

(e) The Westinghouse capacity to invest corporate assets in research and development depends upon the success in obtaining and maintaining a competitive advantage.

Being an innovative concept, this information might not be discovered by the competitors of Westinghouse independently. To duplicate this information, competitors would first have to be similarly inspired and would then have to expend an effort similar to that of Westinghouse to develop the design.

Further the deponent sayeth not.

Attachment

17x17 XL
HYDRAULIC FLOW TESTING

1.0 INTRODUCTION

As a part of confirmatory tests of the Westinghouse 17x17 XL Fuel Assembly design, full-scale hydraulic flow tests using a prototype test assembly were performed in the Westinghouse D-loop facility. Test conditions simulated reactor flow and temperature conditions. Hydraulic tests on a 10 grid, 17x17 XL assembly provided data to determine assembly pressure drops, lift forces and fuel rod wear.

Section 2 describes the test assembly and D-loop test facility, Section 3 describe the instrumentation and test conditions, and Section 4 presents the test results and conclusions.

2.0 DESCRIPTION OF TEST ASSEMBLY AND D-LOOP FACILITY

2.1 17x17 XL TEST ASSEMBLY

The prototype 17 x 17 XL 10-grid test assembly tested in the D-Loop facility is shown in Figure 1. The assembly consisted of 10 Inconel grids, 264 dummy fuel rods, 24 thimble tubes and 1 instrumentation tube, and a top and bottom nozzle. The fuel rod cladding, thimble tubes, and instrumentation tube were made of Zircaloy-4, the same material to be used in the reactor. The dummy fuel rods contained 167.5 inches of 0.308 inch O.D. lead bars to simulate UO_2 weight in fuel rods. The density of the lead was approximately the same as the density of 95 percent dense UO_2. The lead-filled fuel rods contained a fuel rod spring and were prepressurized with He. The test assembly Inconel grids have the same design, spring forces and contact points on the dummy fuel rods as the Inconel grids to be used in the South Texas fuel assemblies.

The test assembly was dimensionally, structurally and hydraulically representative of assemblies to be used in the South Texas nuclear plant. A rod cluster control assembly inserted into the XL test assembly restricted the bypass flow to values encountered in reactor operation.

2.2 D-Loop Test Facility

Figure 2 is a schematic representation of the D-Loop Test Facility located at Forest Hills, Pa. The D-loop services a 24-inch ID x 40 foot long test vessel which contains the Reactor Evaluation Channel (Figure 3). This vessel can accommodate full scale models of large pressurized water reactor core components for operational studies. As shown in Figure 3, the D-loop flow moves up the Reactor Evaluation Channel which contains the instrumented prototype 17x17 XL 10-grid test assembly.

The D-loop piping is designed for flow rates up to 4,500 gpm, a maximum operation pressure of 2,400 psig, and temperatures to 650°F. At 3,000 gpm, the canned motor pump is capable of developing a head of 270 feet of water. All piping in the primary is stainless steel. Loop pressure is automatically controlled by a constantly operating makeup and letdown system. Loop temperature during steady-state operation is maintained by controlling a bypass steam through the loop coolers.

3.0 INSTRUMENTATION AND TEST CONDITIONS

3.1 PRESSURE DROP MEASUREMENTS

Static pressure taps were used to measure the test assembly pressure drops. These were located on the baffle enclosure, which forms the boundaries of the test vessel reactor evaluation channel. The upper pressure tap was one inch below the upper core plate, and the lower pressure tap was one inch ~~below~~ above the ~~upper~~ lower core plate. Each pressure measurement tap had a redundant tap located at the same elevation on a perpendicular baffle wall (90° apart). A data acquisition system was used to collect and condition the data, which consisted of 12 to 36 ΔP readings for each set of flow and temperature condition.

Test assembly pressure drop measurements were obtained at the following nominal test conditions:

Temperature(°F)	Pressure (psia)	Flow (gpm)
96	1600	1285
103	1615	965
103	1630	1305
253	1615	970
253	1615	1310
590	2050	965
590	2020	1310
590	2050	2400

3.2 TEST ASSEMBLY LIFT FORCE

Lift measurements were obtained by use of eight strain gages mounted on the bottom nozzle. The strain gages were weldable types with a built-in temperature correction. The gages on the bottom nozzle were temperature cycled from room temperature to 600°F until their readings stabilized, and the nozzle was then load and temperature cycled to obtain a calibration of load versus strain as a function of temperature. The nozzle was then attached to the test assembly which was installed in the Reactor Evaluation Channel of the D-Loop Test Vessel. The test assembly was loaded and unloaded axially until the bottom nozzle strain gages gave consistent readings. Two LVDTs were installed into the lower core plate to monitor when fuel assembly lift-off occurs.

For measuring lift forces, the bottom nozzle strain gages were connected to a digital voltmeter/printer. The system scanned all eight strain gages in two seconds. Calibration of the instrumentation was made by using a known micro-strain input to each channel. The strain measured is the sum of all eight gages and is linear and repeatable to ± one percent.

Strain data were taken at test assembly nominal conditions of 1000, 1300 and 2700 gpm flow occurring at 585°F and 2000 psi. The flow was increased until the LVDTs indicated test assembly lift-off.

3.3 Vibrational Amplitudes of Test Rods

To determine rod vibration amplitudes during D-loop hydraulic testing of a 9 grid XL test assembly, 16 strain gages were attached to four dummy fuel rods at span locations 4 and 5 from the assembly bottom grid. No strain gages were used on the 10 grid test assembly since their span lengths are shorter and vibration amplitudes would be less than a 9 grid assembly.

The dynamic signals from these gages were fed into a two channel fast fourier transformer analyzer, and rms strain values were determined. The signals also were fed to an oscillograph and analyzed for maximum strains at the rod natural frequencies. The strain was transformed to an amplitude using calibration curves previously determined from single rod tests.

The data from these tests were conservatively used to predict fuel rod wear in a 10 grid XL fuel assembly, as described in Section 4.3 of this report.

4.0 TEST RESULTS AND CONCLUSIONS

4.1 ASSEMBLY PRESSURE DROP

Figure 4 presents the D-loop flow test results for the test assembly pressure drop versus assembly flow. The results were consistent with those expected based on the 17x17 standard 12 foot D-loop tests.

4.2 ASSEMBLY LIFT

Figure 5 presents the D-loop flow test results for the test assembly lift forces versus assembly flow. Actual assembly lift-off occurred at approximately [ ]$^{+}$ gpm compared to expected lift-off of [ ]$^{+}$ gpm. (a,b,c

4.3 FUEL ROD WEAR

Fuel rod wear during reactor operation can be caused by flow induced vibrat and a [ ]+ during the fuel rod reactor (a,c) life (approximately 27,000 effective full power hours). Using a conservativ fuel rod vibration amplitude obtained from hydraulic tests, fuel rod wear during reactor life is determined as per the Figure 6 flow chart. Calculational inputs for wear used a [ ]+ (a,b,c) maximum test rod amplitude obtained from strain gage measurements during the grid hydraulic flow tests (See Section 3.3). The maximum amplitude was obtained at span 4 of the assembly during the 3000 gpm flow and 585°F maximum test conditions. Vibrational amplitudes from a 9 grid assembly test result i larger amplitudes and a larger calculated wear than would occur from 10 grid assembly test results. Using the [ ]+ fuel rod (a,b,c) amplitude, the Westinghouse model (Figure 6) predicts fuel rod wear depth of [ ]+ mils at the end of the planned reactor life for the South Texas (a,c) 10-grid 17x17XL fuel assembly. This wear is considered [ ]+ Westinghouse uses (a,c) [ ]+ wall thickness as a general guide for acceptable maximum fuel rod (a,c) clad wear.

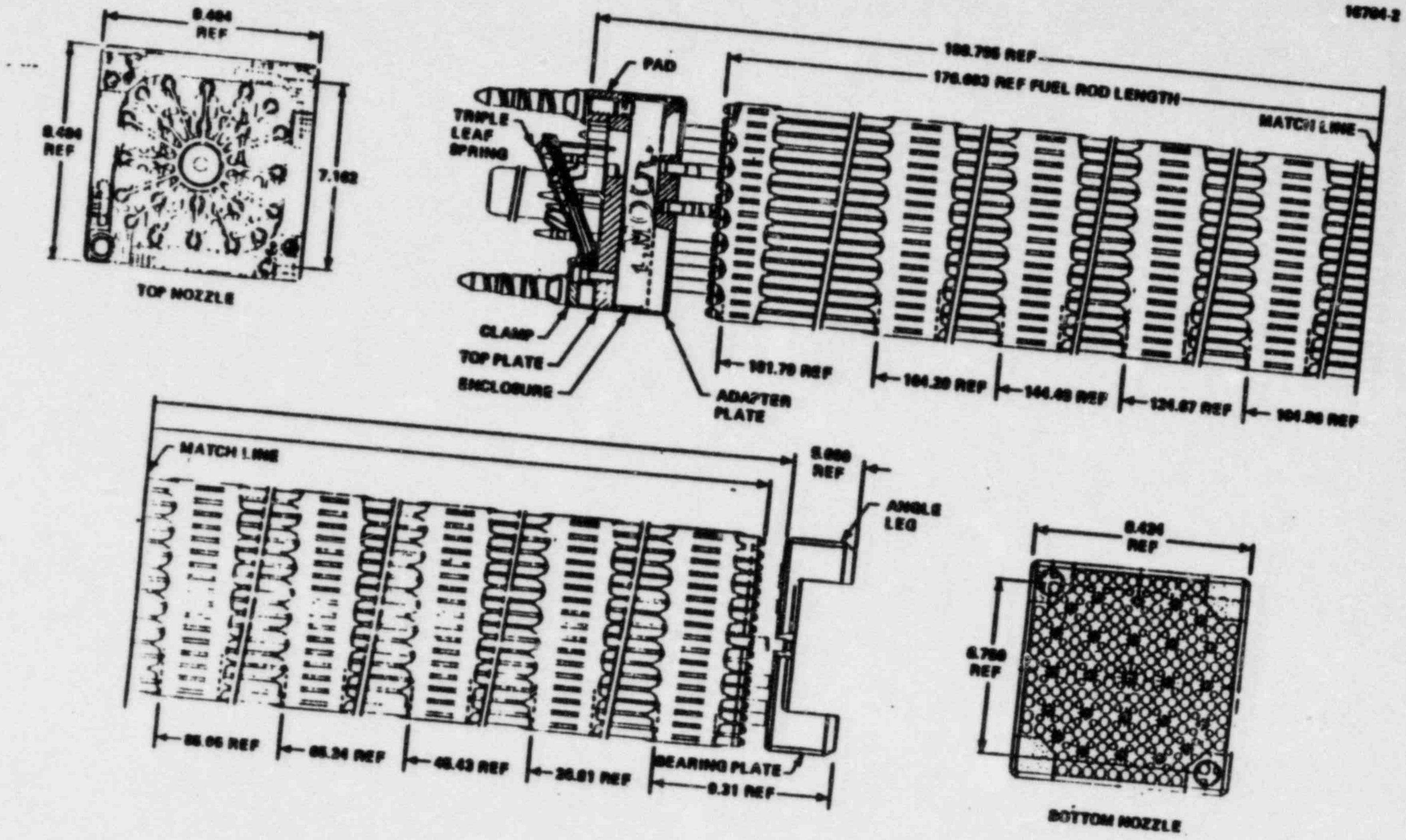

Figure 1 Prototype 17 x 17 XL 10-Grid Fuel Assembly

Figure 3 D-Loop Test Vessel Flow Diagram

+(b,c)

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Figure 2 D-Loop Flow Sche...

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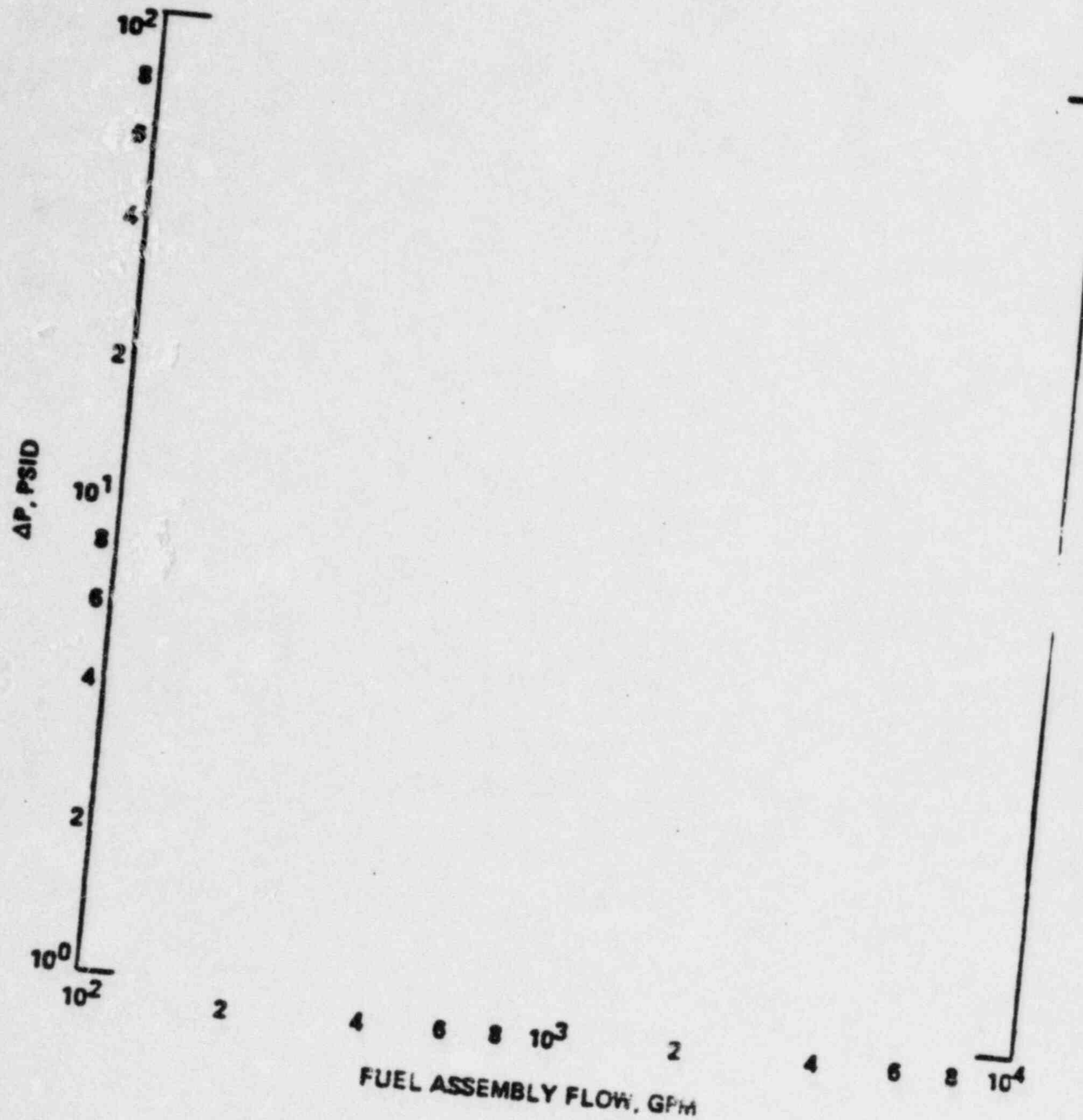

Figure 4 17 x 17 XL D-Loop Flow Test, Fuel Assembly ΔP vs. Assembly Flow

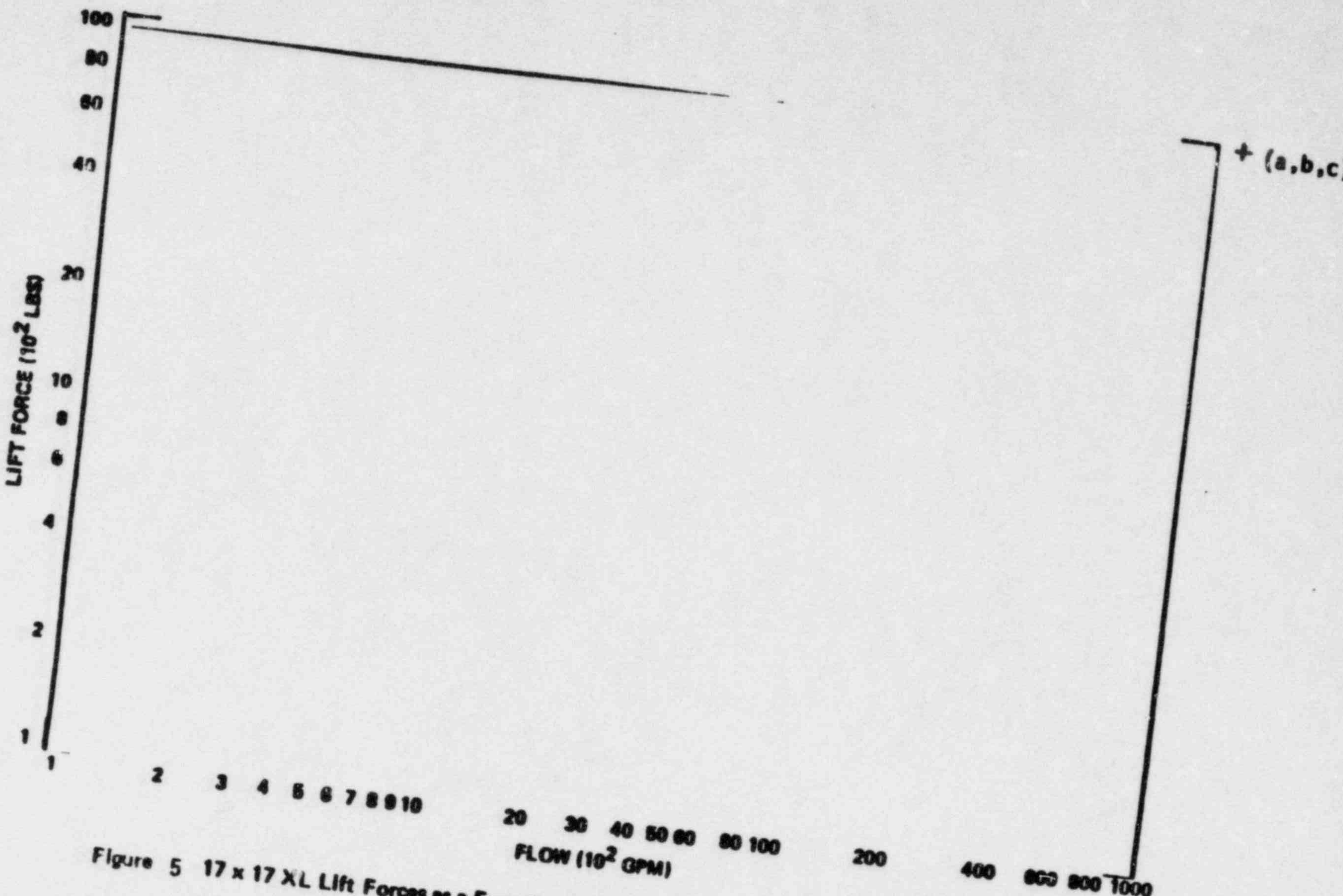

Figure 5 17 x 17 XL Lift Forces as a Function of Flow at 585°F, 2000 PSI

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Figure 6 Flow Chart of Vibratory Wear Calculation