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ABSTRACT

A compilation has been made of burnout (critical heat flux) data from the results of more than 12 000 tests on 321 electrically-heated, water-cooled experimental assemblies each simulating, to some extent, the operating or postulated accident conditions in the fuel elements of water-cooled nuclear power reactors. The main geometric characteristics of the assemblies are listed and references are given for the sources of information from which the data were gathered.

Three practical uses of the compilation are surveys of parametric effects on burnout, tests of burnout formulas, and optimisation of the empirical coefficients in burnout formulas.

The report presents details and discusses aspects of

(Continued)

(i) the composition of the compilation in terms of various distinctive features of the assemblies or tests;

(ii) the distributions of tests over the ranges of 20 important variables; and

(iii) the distributions of tests over various fields of conditions defined by variables considered simultaneously in pairs or sets of four.

Details of the composition of the compilation and of the distributions of tests are shown in tables and histograms. These provide information from which a user of the compilation may assess the relevance of the data to areas of particular interest.

The overall distribution of tests is discussed. It is concluded that although the adequacy of the compilation to furnish significant samples of data varies considerably with the location and delimitation of the area of interest, a reasonable latitude in defining this area enables the compilation to provide an effective data base.

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The following descriptors have been selected from the INIS Thesaurus to describe the subject content of this report for information retrieval purposes. For further details please refer to IAEA-INIS-12 (INIS: Manual for Indexing) and IAEA-INIS-13 (INIS: Thesaurus) published in Vienna by the International Atomic Energy Agency.

BURNOUT; FUEL ELEMENTS; REACTOR ACCIDENTS; SIMULATION; HEAT FLUX; WATER-COOLED REACTORS; EXPERIMENTAL DATA

PREFACE

A vital factor in the economy and safety of nuclear reactors is efficiency of heat transfer. When the reactor is cooled by a liquid, like most of those in use today, no aspect of heat transfer is more significant than burnout, a physical phenomenon which limits the rate of efficient heat removal from a surface by a boiling liquid. Burnout is the fundamental topic of this report; it is therefore appropriate to state briefly what it is, how the term is related to others in common use, and why it is necessary to study it.

'Burnout' is the popular term for an effect produced by a local transition in the mechanism of heat transfer which occurs at a surface cooled by a boiling liquid when the heat flux attains a certain critical level, dependent on the local conditions. At the transition, liquid ceases to wet the surface and there is an abrupt and often substantial reduction in the local heat transfer coefficient. In situations where the heat flux is independent of the heat transfer coefficient, this produces an abrupt rise in the temperature of the surface. The magnitude of the temperature rise depends on the conditions; it may be enough to destroy a metal surface and hence the effect is called 'burnout', whether or not the surface is damaged.

The term 'burnout' describes an effect which may be observed, but it does not signify the nature of the transition or crisis that causes it. There are different kinds of boiling crisis that result in burnout; generally the nature of the crisis cannot be observed, but it may be surmised. On this basis the term 'burnout' can be replaced by one of two more specific terms:

'Departure from nucleate boiling (DNB)' is a term denoting the crisis that locally terminates a nucleate boiling process; this crisis is a common cause of burnout when a coolant with low vapour content flows over a heated surface.

'Dryout' denotes a burnout that arises from the eventual disappearance of a liquid film that flows along the heated surface when the coolant has a high vapour content.

An older and more general term that is often preferred is:

'Critical heat flux (CHF)' which denotes the heat flux at a boiling crisis regardless of its effect. In a system in which the heat flux is controlled, the effect is burnout, whereas in a system with surface temperature control, the effect is the initiation of a limited phase of heat transfer in which there is a progressive reduction of heat flux with increasing surface temperature.

In water-cooled nuclear power reactors, the fuel is contained in long, parallel, cylindrical rods arranged in regular arrays called 'rod bundles'. The heat released in the fuel is transferred to water flowing axially through the rod bundles at or near boiling conditions and the ability to predict the burnout heat flux is essential, both for the avoidance of burnout under operating conditions and for an assessment of the safety of the reactor system under postulated accident conditions.

As a part of a varied program of research into safety assessment aspects of water-cooled nuclear reactors, the AAEC's Research Establishment at Lucas Heights has been investigating simple methods of predicting the burnout heat flux in water-cooled rod bundles. One of the first requirements of the investigation was the assembly of a bank of experimental data against which theoretical predictions could be tested. This report is concerned solely with a description of this data bank.

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1. INTRODUCTION

The fundamental importance of the burnout phenomenon in nuclear engineering has encouraged a search for theoretical explanations and there has been some success in the analytical treatment of dryout in tubes and rod bundles. However, extended study has so far failed to produce an adequate theory of burnout in flow boiling that would permit accurate prediction of the burnout heat flux in rod bundles. Investigators have therefore resorted to empirical methods. Since the 1950s, many tens of thousands of tests have been performed in laboratories around the world to measure burnout heat fluxes in electrically-heated, water-cooled test channels of many different forms, with many different conditions of the coolant.

At first, the aim was to derive a general empirical formula for the prediction of burnout heat flux and some measure of success was achieved in the cases of round tubes and annular ducts, the simplest forms of coolant channel. Burnout is essentially a local event, however, and in complex flow channels the internal variations of fluid condition determined by velocity, temperature, and voidage distributions can have a significant effect on the burnout heat flux. Since no terms have yet been found which express simply and adequately the influences of such variations, there has been only limited success in the derivation of a burnout formula for flow in rod bundles.

In more recent times, therefore, the aim of most burnout tests has been to determine the burnout characteristics of particular rod bundle arrangements directly, using full-scale models of either whole fuel element assemblies or portions of them. These tests have been performed on specially made and instrumented assemblies with electrically-heated rods simulating the fuel rods of a nuclear reactor. In some cases, the rods have been heated non-uniformly along their length, imitating to some degree the distribution of fission heat release in a reactor fuel element. Large test rig installations have been required to produce flow, pressure, and temperature conditions similar to those of an operating reactor, and to provide sufficient rates of heat release in the rods to cause burnout at these conditions which, of course, exceed the normal rates of heat release in the actual fuel rods.

In the absence of an adequate theory, the accumulated results of these tests are the only source of basic knowledge about burnout in rod bundles. Not all of the results are freely available; large-scale burnout experiments are very costly and many have been made during the development of commercial designs of fuel element; consequently there is an unknown, but probably very large, number of results which have not been published because they might disclose proprietary information. The results that have been reported in detail in the open literature, coming from a variety of sources and existing for a variety of reasons, form a medley of data in which systematic variation is confined to small ranges of a few variables. Nevertheless, they are sufficient in number and diversity to provide an effective general reference base of established burnout observations. This report describes, in detail, a systematic compilation of these published experimental burnout data, augmented by other data that have been made available to the authors. Only water test data are included and the compilation is expressly of rod bundle data; however, a limited amount of data for annular channels is admitted because these channels may be regarded as extreme cases of a rod bundle.

From time to time, additional data become available and, if considered admissible, these data are added to the data bank. The name BACE is used to refer to the compilation in general; various revisions are denoted by extensions to the name which indicate the date of revision. This is discussed in more detail in Section 4. The version described in this report is BACE279C.

Several previous compilations of rod bundle and annulus burnout data have been published. Table 1 gives brief particulars of these together with details of BACE279C. At about the time of the Barnett [1968] compilation, an unpublished computer file of burnout data was assembled at AEEW. A part of this file, consisting of the results of 367 tests on 24 rod bundles, was supplied to the authors and forms the nucleus of BACE.

In its current state, the compilation contains the results of 12 473 burnout tests. The data have been extracted from 91 reports of investigations carried out in 24 laboratories in nine countries. All admissible rod bundle data from sources named in the previous compilations (see Table 1) are included (no details of Mironov's sources appear to have been published). Location of the sources of early data was greatly assisted by published summaries, such as those of Tong [1969, 1972] which list particulars of more than 35 rod bundles and indicate the sources of data for 3148 tests, and Hughes [1970a] which lists particulars of 36 rod bundles and the sources of data for 1846 tests.

The system, structure, and format of the data records will be fully described in a users' manual. In the following sections, the rules adopted as the criteria for data admission are explained and the general features and scope of the compilation are described. Because this report is a general reference handbook for the BACE279C compilation, Sections 5 and 6 are quite detailed. They may be omitted by the casual reader, but should help the intending user who is interested in a particular aspect of the data.

Throughout this report, laboratories and reactor designs are referred to by acronym or abbreviated name; these are identified in Section 13. Notation and a glossary of terms are given in Sections 11 and 12 respectively. Referen`es by author(s) name and date are listed in Section 10.1 and references to tabulated sources of data are cited in numerical sequence in Section 10.2.

2. USES OF THE DATA COMPILATION

Three main uses for the data compilation are envisaged.

(a) Surveys of parametric effects

Nominally constant values may be chosen for all but one of the principal independent variables and data selected within limits set suitably close to the nominal values. The resulting data subset contains information revealing the isolated effect of the remaining independent variable upon the burnout heat flux. Variables may be simple or compound, a compound variable being a specific combination of simple variables.

(b) Tests of burnout formulas

Burnout test values of a variable may be compared with corresponding values calculated from a burnout formula. A statistically significant number of such comparisons indicates the accuracy of the formula within the range of the data selected. If small ranges are chosen and these are varied systematically, the influence of system conditions on the performance of the formula may be determined.

(c) Optimisation of burnout formulas

The empirical coefficients of a burnout formula may be optimised by methods of multiple regression using data sets generated from the compilation.

3. RULES FOR ADMISSION OF DATA

The following rules govern the admission of data to the BACE compilation:

(a) The data must have been obtained from detailed descriptions of water-cooled rod bundle or annulus assemblies, and from the tabulated results of actual tests on these assemblies in which burnout was detected. Data obtained by interpolation or scaled from graphical presentations of results are not admitted.

(b) There must not be any doubt about the validity of the data founded upon an objective assessment of the suitability of the test apparatus or the method of conducting the test.

(c) There must be no clear indication that burnout was induced by flow instability. A test result is not admitted if the measured burnout power is significantly and singularly lower than that measured in the same channel with substantially the same pressure and mass flux but higher enthalpy at the inlet to the channel.

(d) The data admitted from any one test series must be self-consistent. A test series is a number of tests performed on the same assembly with systematic variation of any of the independent variables governing the condition of the coolant. Graphical plots or statistical analysis of the data must clearly indicate, to the extent that is possible, a systematic relation between principal dependent and independent variables. Results which are plainly shown by the plots or analysis to be inconsistent with the main body of data are discarded.

(e) Data from tests on assemblies with unusual or abnormal features (such as an eccentric rod or rod bundle, a bowed rod, horizontal or downward flow, or misalignment of rods) are admitted. A system of labels is used to indicate the nature of the abnormality and permit preferential selection of data.

(f) All available data from tests on rod bundle assemblies satisfying the foregoing requirements are admitted without selection. A single rod enclosed in a non-circular duct is classed as a rod bundle. Data from tests on annular channels satisfying the foregoing requirements may be admitted, provided that annular channels are not disproportionately represented in the compilation. To ensure this, no more than about 10 per cent of the tests providing data in the compilation are to relate to annular channels. (This is about the greatest proportion of tests relating to any one number of rods in the BACE279C compilation and is roughly the same proportion as that relating to assemblies of seven, nine, nineteen or thirty-seven rods.)

4. NAMING OF REVISIONS OF THE COMPILATION

Revisions of the compilation are identified by adding to the generic name (BACE) three characters indicating the date of revision and one character indicating whether confidential data are included. The first of the three characters specifies the month, the other two the year. The first nine months of the year are indicated by the numerals 1 to 9, the last three by their initial letter. A final character C indicates that a compilation contains some confidential data, a final U denotes a version from which confidential data have been excluded. Thus, the name BACE279C identifies the state of the confidential version of the BACE compilation in February 1979.

5. DISTINCTIVE FEATURES OF THE TEST ASSEMBLIES AND TEST CONDITIONS

A list of the test assemblies included in the compilation is given in Table 2A. The entire data compilation which resides in a computer reference volume is, of course, too large to be listed here. The list indicates the sources of the data and summarises the main geometric characteristics of the assemblies. The distribution of heat flux over the heated surfaces, which is usually effected by varying the wall thickness, is regarded as a geometric characteristic. A complementary list (Table 2B) shows the number of burnout tests recorded for each assembly and the ranges of the principal test conditions. In this compilation, the identity of a test assembly is determined by the geometric characteristics; identical 'rebuilds' are not regarded as different assemblies, but an adjustment that effects a significant change in a characteristic is generally regarded as creating a different assembly. This explains the occurrence of numbers of very similar assemblies in the list. When adjustments are numerous, however, it is not practical to allocate separate identities to each modification and some assemblies have a variable geometric characteristic. In these cases, separate entries for the assembly are made in Tables 2A and 2B for groups of tests made with significantly different average values of the variable characteristic.

To simplify description of the composition of the data bank, burnout tests have been broadly classified according to various distinctive characteristics of the assembly or test condition, namely (i) the form of rod arrangement and duct shape, (ii) the distribution of heat flux, (iii) the phase condition of the coolant, and (iv) the presence of unusual or abnormal features. Each of these characteristics provides a different aspect from which the composition of the data bank can be viewed. In the remarks which follow, it is the composition of the data bank as a whole that is described. This does not mean that the compilation is an indivisible body of data; it may readily be subdivided, using computer sorting techniques, into subsets with particular characteristics. Qualitative as well as quantitative information is included in the data and many qualitative attributes such as rod pitch arrangement, form and skew of axial heat flux profile, and the nature of peculiarities may be identified for the purpose of sorting the data.

5.1 Rod Arrangement and Duct Shape

Table 3A shows the number of tests associated with various forms of rod arrangement or array. As might be expected, the two largest classes, accounting between them for 70 per cent of the tests, are the circular pitch and square pitch forms generally used in the fuel elements of water-cooled nuclear power reactors of the pressure tube and pressure vessel types respectively. Tests with circular pitch arrays outnumber those with square pitch arrays in the ratio 3:2. This bias is due largely to the substantial quantity of data for the former arrangement made available to the authors by AEEW.

The third largest class, accounting for 19 per cent of the total number of tests, contains tests performed on assemblies with rods arranged on an equilateral triangular pitch, as is specified in the design of fuel elements for the conceptual LWBR. One third of the tests included in this class were, in fact, made in support of the LWBR program. Half of the tests in the triangular pitch class were performed on bundles of three rods, an arrangement commonly used in the small-scale tests of early research programs. In this respect, the triangular pitch class contrasts strongly with the square pitch class, in which only 8 per cent of the tests were performed on elementary rod arrangements. The subject of rod number is treated more fully later in this report but, since size is an important characteristic of arrays, the three main classes of rod arrangement have been subdivided according to rod number. The details are given in Table 3B.

Six rods spaced evenly around a central rod may be regarded as either a circular pitch array or a triangular pitch array; such bundles are classed as the former if the enclosing duct is circular in section and as the latter if it is not circular. This classification, though logical, may not suit all purposes and, therefore, the number of tests on 7-rod bundles included in the circular pitch class is shown separately in Tables 3A and 3B.

The annular arrangement forms a small class because the number of annulus tests included in the compilation has been deliberately restricted to avoid an undue emphasis on single rod assemblies. However, in view of the relatively small quantity of data that is available from tests with axially non-uniform heat flux (in assemblies of any kind), a high proportion of the annulus data selected for inclusion is from tests of this type.

A classification of the tests according to the shape of the duct enclosing the rod bundle is given in Table 3C. All of the circular pitch arrays, most of the 3-rod triangular pitch arrays, and some of the 4-rod square pitch arrays are enclosed in ducts of circular cross-section. Annular arrangements, of course, also fall into this class. The result is that 60 per cent of the tests in the compilation are associated with circular ducts. The remainder of the square pitch arrays are enclosed in ducts of rectangular (mostly square) or cruciform cross-section. With the exception of the 3-rod arrays, which have either circular or triangular ducts, triangular pitch arrays are enclosed in ducts of hexagonal or parallelogrammatic cross-section. Those single rods not in annular or simulated circular pitch arrangements are enclosed in either square or hexagonal ducts.

5.2 Distribution of Heat Flux

A broad classification of the tests according to the distribution of heat flux over the heated surfaces is given in Table 4A. Although the data are fairly evenly divided between uniform and non-uniform distributions in the radial direction, 87 per cent of the tests were performed on test assemblies with rods heated uniformly along their length. The paucity of published burnout data for axially non-uniform heat flux can be attributed to the high cost of manufacturing and instrumenting the test assemblies, especially multi-rod bundles. Not only have fewer experiments been performed on assemblies with axially non-uniform heating, but a large proportion of the results that have been obtained is classed as proprietary information and is not freely available. It has already been mentioned, in connection with rod arrangement, that the axially non-uniform heat flux component of the data bank was reinforced by preferential selection of annulus tests. As a result, experiments with annular arrangements contribute almost a quarter of the total number of tests associated with axially non-uniform heat flux.

A large proportion of the axially non-uniform heat flux tests (95 per cent) provide information about the axial position of the burnout point. In about 2.5 per cent of the tests with axially uniform heat flux, burnout was first detected at a point upstream of the end of the heated length; its position is recorded in the data.

A further resolution of the axially non-uniform heat flux tests into classes according to the form and skew of the axial flux profile is given in Table 4B. Two-thirds of these tests are associated with profiles that are symmetrical about the mid-length of the channel; these profiles generally approximate a truncated cosine form. Among the remainder of the tests, those with profiles skewed towards the channel exit outnumber those with skew towards the inlet in the ratio of 5:2. Half of the latter were performed with step flux profiles but, in general, the number of tests associated with step or spike (i.e. 'hot patch') profiles is small.

In a small proportion of the tests (see Table 4C), the duct enclosing the rod or rod bundle was heated to simulate the effect of the surrounding rods in a larger array. All of the tests with axially non-uniform heating of the duct were performed on assemblies with single, uniformly-heated rods; about one third were performed on an annular assembly with a truncated cosine distribution of heat flux along the outer tube and the others were performed on a one-rod simulation of a circular pitch array with heating applied to only part of the length of the duct.

5.3 Phase Condition of the Coolant

In a large proportion (over 90 per cent) of the tests, the cooling water entered the test channel in a subcooled condition, i.e. at a temperature below saturation. In about one in seven cases, the average condition of the water at the cross-section containing the burnout point was also subcooled. The number of tests in each class is to be found in Table 5.

Burnout data from tests in which the coolant was admitted to the test channel with a small degree of subcooling or as a two-phase mixture must be used with discretion. It is well known that the presence of a compressible medium, both upstream and downstream of a test channel which has a sufficiently low pressure drop, enables flow oscillations to develop, inducing burnout at a lower heat flux. The results of burnout tests may thus be affected if there is surface or bulk boiling in the preheater, or if steam is mixed with the water admitted to the test channel. The flow oscillation is confined to the two-phase region and often escapes detection by the instruments normally used in burnout tests. A high pressure drop tends to inhibit flow oscillation and, in many of the reported tests with a steam-water mixture at the test channel inlet, stable flow conditions were achieved by placing a flow restriction just upstream of the test channel.

An endeavour has been made to exclude any data affected by flow oscillation by the application of rule (c) (Section 3), but this rule is by no means infallible. The stability of the flow cannot be inferred from the presence or absence of an upstream flow restriction because the insertion of a restriction is not always necessary, nor is it always sufficient, to produce flow stability. Judgement on whether a result is affected by flow oscillation rests entirely on a comparison of the result with others obtained in the same series of tests. In some series, the range of coolant inlet condition extended from a highly subcooled state, in which the results would not have been affected, into a two-phase state, in which they might have been. In these cases, affected results are easily recognised by a distinct lack of consistency with the trend of the unaffected results, which is a regular though not necessarily uniform decrease in burnout heat flux with increase in inlet enthalpy at constant pressure and mass flow rate. There are other series, however, in which all tests were performed with two-phase inlet conditions and any of the results might have been affected; about one third of the two-phase inlet tests included in the compilation are in this class.

In these cases, two methods have been used to single out affected data. Firstly, if repeated tests have produced significantly different results, the tests indicating the lower values of burnout heat flux have been excluded. Secondly, an unsystematic reversal of the normal trend of burnout results is considered to be a sign of premature burnout due to flow oscillation and a test has been excluded if it indicates a singularly lower burnout power than another test performed on the same assembly, at the same pressure and mass flow rate, but with a significantly higher inlet enthalpy.

The procedures described above do not ensure the exclusion of all data affected by flow oscillation. There are examples of data [ref. 42] which, in isolation, present a normal trend, but which are known to be affected because a repetition of the tests after the insertion of an upstream flow restriction produced different results. Such checks have not been the general rule in burnout experiments and, in some cases, affected data may not have been recognised and may be included in the compilation. Attention must be drawn to the fact that self-consistency of data is the only requirement that has been imposed; no test of compatibility between sets of data from different sources has been applied. Such a test might, of course, reveal an abnormality which could be attributed to the effect of flow oscillation. However, it is left to the user to make judgements of this kind. The authors have adhered to the principle that data should not be excluded solely on the grounds of nonconformity with the majority.

When the coolant is admitted as a two-phase mixture to a short test assembly, or to one in which there is little of the mixing action which may be provided by rod spacers, the burnout heat flux is affected by the distribution of the phases at inlet to the assembly. This distribution depends upon the methods of production and introduction of the mixture. The methods used in the tests were as follows:

(i) Combination of slightly subcooled water and saturated or slightly superheated steam in a mixing device designed to produce a uniform suspension of droplets, or 'fog'.

(ii) Throttling of high-pressure, subcooled water or steam-water mixture to produce a low quality steam-water mixture.

(iii) Partial evaporation of water in a once-through electric heater to produce a flowing steam-water mixture.

(iv) Use of a flow diverter in a flowing steam-water mixture to concentrate the flow (i.e. most of the water, since the liquid phase is more effectively diverted) into the core or rod-filled section of the test assembly.

(v) Injection of separate streams of subcooled water and superheated steam into an inlet chamber of the test assembly, the water being directed into the core of the assembly or sprayed onto unheated leading extensions of the rods.

In the compilation, phase distribution is broadly classed and indicated as uniform or non-uniform. Although only the first of the methods listed above is likely to have mixed the phases thoroughly, the first three are regarded as having produced uniform mixtures. The last two, by design, produced non-uniform mixing. In all cases of non-uniform mixing, the water was directed preferentially into the vicinity of the rods or onto their surfaces. The results of tests on annular assemblies with non-uniformly mixed two-phase inlet conditions [ref. 87] indicate an effect of the upstream unheated rod length on the burnout heat flux; consequently. this length is included in the data whenever the inlet phase distribution was non-uniform.

5.4 Unusual or Abnormal Features of Tests

More than 90 per cent of the tests were performed on assemblies of nominally clean, smooth, straight, parallel rods arranged centrally within vertical ducts and cooled by a forced upflow of water, or steam-water mixture. The remainder were performed on assemblies with unusual or abnormal features. Unusual features include downflow, natural circulation, heavy water coolant, converging rods, and horizontal arrangement of the assembly. Features which are designated abnormal are those simulating possible defects in normal assemblies and include a bowed rod, two rods touching, reduced clearance between a rod and the duct wall, eccentric arrangement of the rod bundle in the duct, misalignment of rods in a segmented bundle, partial blockage of a coolant flow channel, and a deposit of crud on the rods.

The total number of tests having unusual or abnormal features is shown in Table 6A and the numbers associated with each feature are given in Table 6B. Unusual and abnormal features are indicated in the compilation and the user may optionally include the associated data in a particular application.

6. DISTRIBUTIONS OF THE TESTS OVER THE RANGES OF PRINCIPAL VARIABLES

The manner in which the compiled data are distributed over the ranges of the principal variables, each considered in isolation from the others, is shown by a series of histograms in Figures 1 to 20. These figures show at a glance the range and disposition of the data with respect to single variables; however, the information they provide, although very useful, is of limited value because no single variable has a dominating influence on burnout and, to determine the relevance of the data to particular situations, it is necessary to consider the distributions of several variables simultaneously. This has been done for two and four variables; some multi-variable joint distributions of the data are shown in Tables 7 to 31. There is no difficulty in using these tables to determine the density of the data distribution in various regions of the multi-variable field but, as displays of the overall character of the distribution, they lack the simple clarity of histograms and require an effort of visualisation that increases with the number of variables. Some remarks about salient features of the data distribution are given in Section 6.1.

6.1 Distributions with Respect to Single Variables

Figures 1 to 5 are histograms showing the distribution of tests over the ranges of principal coolant conditions and Figures 16 to 20 show distributions over the ranges of variables that are dependent on coolant conditions. Because of the nature of the variables, these distributions tend to be continuous although, for reasons which will be explained, this is hardly so in the cases of pressure and mass flux. In contrast, the distributions of tests over the ranges of quantifiable characteristics of the test assembly (Figures 6 to 15) are highly discontinuous. This is due to the fixed nature of the variable within each assembly and the relatively small number of different assemblies (321). In all of the figures, whatever characteristic is shown, frequencies of occurrence are based on the number of tests (never the number of assemblies) associated with each interval of the variable.

6.1.1 Pressure

Figure 1 shows the distribution of tests over the range of system pressure. In some tests, the system pressure was measured at the test section inlet, in others at the outlet; reports often fail to indicate clearly where the measurement was made. In the absence of an indication, it has been assumed that the pressure was measured at the test section outlet, which is the normal position of burnout in an assembly with uniform axial distribution of heat flux. The stated or assumed location of the point at which the system pressure was measured is indicated in the data compilation but, because the pressure drop in the test assembly was recorded in only a small proportion of the tests (about 20 per cent), it is not possible to express the system pressure at a common location. Unavoidably, therefore, inlet and outlet pressures have been used without discrimination when determining the distribution of tests over the range of system pressure. Whenever it could be ascertained, the pressure at the test section outlet has been used, because this was where the measurement was made in most of the low pressure tests; it is in these tests that the difference between inlet and outlet pressure is most significant.

System absolute pressures range in the compilation from 0.04 MPa (sub-atmospheric) to 17.0 MPa. Tests at the lowest pressure were performed at ORNL on a 7-rod bundle, 0.295 m in length (denoted in Tables 2A and 2B as assembly number 181). Tests at the highest pressure were carried out at Columbia on assembly number 244, a 16-rod bundle, 2.44 m in length, with a non-uniform axial distribution of heat flux skewed towards the outlet. It has been the usual practice, in those burnout experiments in which pressure was varied systematically, to choose values which are multiples of either 100 psia or 1 MPa. Figure 1 distinctly shows the concentrations of tests at these standard pressures, which include the more common design pressures for water-cooled power reactors. The dominant peak between 6.8 and 7.0 MPa (nominally 1000 psia, a notional design pressure for boiling water reactors) represents 22 per cent of the tests included in the compilation and reflects a general tendency for a common pressure to be adopted in many early rod bundle experiments.

6.1.2 Mass flux

Coolant mass fluxes range in the compilation from 1.27 to 1557 g s^{-1} cm^{-2}; however, the mass flux exceeds 600 g s^{-1} cm^{-2} in only 2.4 per cent of the tests. Tests at the lowest mass flux were carried out on assembly number 181, as were those at the lowest pressure (see Section 6.1.1). The highest mass flux associated with a multi-rod bundle is 680.8 g s^{-1} cm^{-2}; it was attained in a test performed at Hanford on assembly number 134, a horizontal 19-rod wire-wrapped bundle 0.495 m in length. All higher values of mass flux occur in annular assemblies; the highest was attained in tests performed at SRL on assembly number A12 with heavy water flowing at a velocity of 14.5 m s^{-1}.

Systematic variation of mass flux has been common in burnout experiments but, as with pressure variation, the usual practice has been to adhere to standard intervals; Figure 2 shows distinct concentrations of tests at values of mass flux which are multiples of 0.5×10^6 lb h^{-1} ft^{-2}. Under normal operating conditions in water-cooled power reactors, the mass flux of the coolant in the fuel elements usually exceeds 300 g s^{-1} cm^{-2}, but it requires a large test facility to conduct burnout experiments on multi-rod bundles at such values of mass flux. The large test rigs which have come into use in more recent times are used mainly in the development of commercial designs of reactor fuel elements and the results have been disclosed less often than those of tests of a less specific nature performed with lower mass flux in smaller rigs. The effect of the greater availability of data in the lower ranges of mass flux is clearly seen in Figure 2; although there is a useful representation (10 per cent) of mass fluxes between 280 and 500 g s^{-1} cm^{-2}, a substantial proportion (88 per cent) of the tests were performed with mass fluxes less than 280 g s^{-1} cm^{-2}.

6.1.3 Inlet quality

Coolant qualities at channel inlet range from -1.08 to 0.895; Figure 3 shows the distribution of tests over this range. Negative quality is used to indicate subcooled conditions and also to express the degree of subcooling. Tests with the highest degree of inlet subcooling were performed at Bettis on bundles of 20 triangularly pitched rods (assemblies 160, 162, 164 and 166) in support of the LWBR program. The inlet pressure and temperature conditions were 13.8 MPa, 93°C (2000 psia, 200°F). Tests with the highest quality of mixture at inlet were performed at APED on a 2-rod assembly (assembly 145) in support of the United States Atomic Energy Commission's Superheat Development Program. Concentrations of tests are evident at frequently chosen inlet conditions, particularly at qualities -0.64 (2000 psia, 400°F), -0.40 (2000 psia, 500°F), and -0.14 (which includes the 1200 psia, 500°F condition). The -0.10 to -0.02 quality band which covers the design inlet conditions of most boiling water reactors, contains 28 per cent of the tests included in the compilation, and the -0.2 to -0.1 quality band contains 30 per cent. The -0.40 to -0.30 quality band, which covers the most common design inlet conditions of pressurised water reactors, contains 8 per cent of the tests. Only 9 per cent of the tests were performed with positive quality inlet conditions; Figure 3 shows very clearly the abrupt change in the distribution of tests near the saturated inlet condition.

6.1.4 Quality at burnout

Coolant bulk qualities at burnout range from -0.484 to 0.999; Figure 4 shows the distribution of tests over this range. The burnout quality is theoretical; it is the average quality of the coolant at the flow cross-section which contains the burnout point and it is calculated from the inlet condition of the coolant and the heat input up to the burnout section. When the heat flux distribution is non-uniform, burnout may be detected at a number of points simultaneously; in this case, the cross-section containing the burnout point with the lowest local heat flux is regarded as the burnout section. The quality depends, of course, upon the pressure at the relevant cross-section, but only when burnout occurs at the channel exit can the pressure at the burnout section be measured in a test. For this report, burnout quality has been calculated at the system pressure which, in most (but not all) cases, is the channel outlet pressure, regardless of the actual position in the channel of the burnout section.

The tests which yielded the lowest burnout quality (or highest burnout subcooling) were among those performed at Bettis on 20-rod bundles with the lowest inlet quality; this burnout quality was closely approached, however, in tests at SORIN on a 9-rod bundle (assembly 96) with higher inlet quality and lower mass flux, but considerably smaller ratio of length to heated equivalent diameter. The highest burnout qualities are not associated with positive quality inlet conditions. All of the burnout qualities higher than 0.910 in the compiled data occur with sub-cooled inlet conditions and low mass flux; the highest was reached in a CISE (Piacenza) program of tests on a very long (6 m) 19-rod bundle (assembly 194).

The most frequent burnout qualities lie in a band between 0.20 and 0.31. About 20 per cent of the tests are contained in this band, which is approximately that in which burnout would occur in a boiling water reactor core as a result of a rise in fission power or a reduction in coolant flow rate.

6.1.5 Burnout heat flux

Local burnout heat fluxes range from 2.4 to 2220 W cm^{-2}, but in only 0.5 per cent of the tests does the burnout heat flux exceed 1200 W cm^{-2}. Figure 5 shows the distribution of tests over the significant part of the range. Here, the term 'burnout heat flux' denotes the local value of the heat flux at the point at which burnout was first detected. If it is inferred from the test records that burnout occurred at a number of points simultaneously, the compiled data enable the local heat flux at any of the detected initial burnout points to be determined but, for the present purpose, the lowest value is regarded as the burnout heat flux.

Both extremes of burnout heat flux occur in annular assemblies. The lowest values come from tests at CRNL on short, internally heated annuli (assemblies A18, A19) with a half-cosine, inlet peaked axial distribution of heat flux and positive inlet quality. These very low burnout heat fluxes occurred at the downstream end of an extensive burnout region. The lowest heat flux at an isolated (or point) indication of burnout is 6.4 W cm^{-2}; it occurred at the outlet end of a long, uniformly-heated annulus (assembly A21) tested at CISE (Piacenza) with positive inlet quality. The highest burnout heat fluxes are associated with subcooled burnout at very high mass flux in annular assemblies (assemblies A8 to A17) which were tested at SRL and Columbia; all had downflow and some had heavy water coolant.

Burnout heat fluxes in non-annular assemblies are in the range 6.8 to 884 W cm^{-2}. The lowest occurred in tests at CISE (Piacenza) on a 19-rod bundle of length 6 m (assembly 194) with subcooled inlet conditions and low mass flux; these were also the tests that yielded the highest burnout quality. The highest burnout heat flux in a non-annular assembly occurred in tests at KEI on a single rod in a simulated concentric array (assembly 222). The highest burnout heat flux in any of the multi-rod assemblies is 698 W cm^{-2}, which was attained in further tests at KEI on a short 3-rod bundle (assembly 251).

Burnout heat flux was a dependent variable in the great majority of tests (94 per cent); the histogram shows an asymmetrical distribution typical of a random variable bounded at one extreme but not at the other. The effect of constant heat flux tests (notably those performed on 3-rod and 7-rod bundles at ABA) is, however, clearly discernible in concentrations of tests at 100 W cm^{-2} and, to a lesser degree, at other intervals of 25 W cm^{-2} between 75 and 200 W cm^{-2}. The most frequent burnout heat fluxes lie in the range 70 to 125 W cm^{-2}, a band lower than that in which burnout would be expected in water-cooled power reactor cores as a result of power increase or flow reduction. This characteristic of the compiled data is largely due to the abundance of tests with low mass flux which, with the same inlet condition, tends to produce burnout at higher quality and lower heat flux. The influence of the low mass flux data would have been more pronounced but for the opposing influence of another characteristic, namely the presence of a large number of tests performed on assemblies having a ratio of length to heated equivalent diameter less than that typical of power reactor fuel elements. This characteristic will be discussed in Section 6.1.10.

6.1.6 Number of rods

Figure 6 shows that the number of rods represented varies from one to thirty-seven, prominence being shared by the single rod of annular assemblies, the nine rods of the most common square array, and the seven, nineteen and thirty-seven rods of circular pitch arrays. It can be seen that single-rod assemblies are not disproportionately represented and, therefore, that the admission of tests performed on annular assemblies has been restricted to a suitable level. Forty-five per cent of the tests included in the compilation were performed on assemblies of 12 or more rods. The 37-rod assemblies and some of the 19-rod assemblies are the only ones simulating entire reactor fuel element assemblies. Many of the others represent regions of various extent in reactor fuel elements, whereas some are special experimental arrangements used in investigations of the effect of certain geometric characteristics on burnout.

6.1.7 Rod diameter

The rod diameter in multi-rod bundles varies from 5 mm, found in some 3-rod and 7-rod bundles, to 20 mm in the 19-rod bundles built to simulate the fuel elements of natural uranium-fuelled reactors. Figure 7 shows the distribution of tests over this range, but not the rod diameters of 25.4 and 54 mm found in a small number of tests on two annular assemblies. There has been little attempt in burnout experiments to vary rod diameter systematically and investigations have generally been confined to specific rod diameters used in particular reactor designs. There is, however, enough variety in these to provide a spread of diameters in the range 5 to 20 mm. The inclusion in the compilation of a substantial amount of data made available to the authors by the United Kingdom Atomic Energy Authority (UKAEA) is the cause of a prominent concentration of tests at 16 mm (0.625 inch), the fuel rod diameter used in the SGHWR. Other prominent concentrations occur at standard commercial tube sizes and at 10.7 mm (0.422 inch) and 14.3 mm (0.5625 inch), the rod diameters generally associated, respectively, with pressurised and boiling water reactors.

6.1.8 Rod spacing

Rod spacing (expressed here as a ratio of rod pitch to rod diameter) is a characteristic which, unlike rod diameter, has often been varied in experiments to determine its effect on burnout. One such experiment, conducted at KEI on a series of 3-rod bundles (assemblies 249 to 264), provided data for the closest rod spacing with an average rod pitch/diameter ratio of 1.01, the rods being nominally in contact along their entire length. Data for the widest rod spacings, with rod pitch/diameter ratios ranging from 1.83 to 2.22, were provided by experiments conducted at ABA and ASEA on 6-, 7-, 9- and 37-rod bundles as part of the Marviken BHWR research program. Figure 8 shows the distribution of tests over the range of rod spacing. A large proportion of the tests were performed on assemblies with the rod arrrangements of established reactor designs; the most frequent values of rod pitch/diameter ratio are those associated with light water-moderated, pressurised and boiling water reactors (1.31 to 1.33), the SGHWR (1.18 to 1.20), and the CIRENE heavy water-moderated, boiling water reactor (1.07 to 1.08).

6.1.9 Equivalent diameters and ratio of heated to wetted perimeter

Figure 9 shows the distribution of tests over the range of hydraulic equivalent diameter and Figure 10 the distribution over the range of heated equivalent diameter. Figure 11 shows the distribution over the range of the ratio of the equivalent diameters which, more simply, is the ratio of heated to wetted perimeters.

The range of hydraulic equivalent diameter extends from 2 mm occurring in tests carried out at Columbia on a bundle of 12 wire-wrapped rods arranged on a close triangular pitch in a close-fitting duct (assembly 7) to 39.5 mm in a 7-rod bundle (assembly 111) tested at ABA. Only 8 per cent of the tests were performed on assemblies having a hydraulic equivalent diameter greater than 13.8 mm and virtually all of these were in support of BHWR programs. In these experiments, a considerable variation of hydraulic equivalent diameter was achieved by changing the dimensions of the ducts surrounding the rod bundles. Prominent concentrations of tests at 7.6 and 10.8 mm indicate the constancy of hydraulic equivalent diameter maintained in tests supporting the CIRENE and SGHWR programs respectively.

In the coolant flow channels of reactor fuel elements, the ratio of heated to wetted perimeter is generally high, being about 0.8 in pressure tube reactors and even higher in pressure vessel reactors. Burnout test assemblies simulating entire fuel elements, such as the 37-rod and many of the 19-rod bundles, naturally reproduce this ratio exactly, but assemblies of fewer rods than the fuel element they represent cannot provide realistic ratios unless the enclosing duct is heated. In a few test assemblies, the rods were surrounded by heated rod segments which provided ratios of from 0.7 to 0.84, but such complex test apparatus has usually been avoided and most of the heated duct arrangements included in the compilation consist of three rods surrounded by a fully-heated circular duct. The majority of the test assemblies had unheated ducts and the range of heated to wetted perimeter ratios found in the compilation extends to quite low values that are not typical of reactor fuel elements. The lowest value (0.135) comes from tests performed at MAN on a 4-rod assembly with only one rod heated (assembly 149). The highest value in assemblies with some unheated surfaces is 0.834 and comes from tests performed at ORNL on 7-rod bundles with heated surrounding segments (assemblies 184, 188 to 193). Thirty-two per cent of the tests in the compilation are in the range 0.73 to 0.834, which might be considered typical of reactor fuel elements. This range also contains the most frequent values provided by tests on full simulations of the CIRENE and SGHWR pressure-tube reactor fuel elements.

Heated equivalent diameter can be obtained by dividing the hydraulic equivalent diameter by the ratio of heated to wetted perimeter. The distribution of tests over the range of heated equivalent diameter shown in Figure 10 is thus a modified form of the distribution shown in Figure 9. Fuel elements of the Marviken heavy water reactor have a heated equivalent diameter of 36.6 mm and values greater than this cannot be regarded as typical of reactor fuel elements. The lowest and highest values in the compiled data are 2.75 and 85.4 mm; these belong to the assemblies with the smallest and largest hydraulic equivalent diameters (assemblies 7 and 111). The CIRENE and SGHWR programs of tests on full simulations of reactor fuel elements, being highly consistent in both hydraulic equivalent diameter and heated to wetted perimeter ratio, provided the most frequent values of heated equivalent diameter at 9.7 and 13.5 mm.

6.1.10 Channel length, boiling length, and ratio of length to heated equivalent diameter

Figure 14 shows the distribution of tests over the range of heated length of rod, which extends from 100 mm for 1- and 3-rod assemblies tested at KEI (assemblies 224, 258) to 8230 mm for a single, uninterrupted heater rod used in a photographic study of transition boiling at APED (assembly 281). The longest multi-rod assembly included in the compilation is a 6 m, 19-rod bundle (assembly 194) tested at CISE (Piacenza) to provide information about the effect of boiling length on burnout in reactor power channels. Various channel lengths from 300 mm (11.5 inches) to 4600 mm (18 ft) are fairly evenly represented but by far the most frequent lengths are 3658 mm (12 ft) and 1829 mm (6 ft), the former because it is the most common length for the active region of power reactor fuel elements and the latter because many test rigs have had insufficient power to produce burnout at typical reactor flow conditions in multi-rod bundles of greater length.

More significant than channel length is the ratio of channel length to heated equivalent diameter, a measure of overall similarity in assemblies of different sizes. It is proportional to the ratio of heated surface area to coolant flow area and, therefore, determines the relation between average heat flux, coolant mass flux, and coolant enthalpy rise in channels of any size. The distribution of tests over the range of this variable is shown in Figure 15. The range extends from 2.3 to 766.5, the least value occurring in a short (100 mm) assembly with a single heated rod tested at KEI (assembly 224) and the greatest in a 3.29 m long annular channel (assembly A21) tested at CISE (Piacenza). The greatest ratio of length to heated equivalent diameter in a multi-rod bundle is 721.0 which occurs in two bundles of 20 closely-spaced rods, 2.39 m in length, used in tests at Bettis (assemblies 164, 166). In the fuel elements of nuclear power reactors, the ratio of active length to heated equivalent diameter usually exceeds 200, but two-thirds of the tests were performed on assemblies in which this ratio was less than 200.

It is more appropriate, however, to look at boiling length, rather than heated length, when considering the similarity of conditions at the burnout section in assemblies of different sizes, because the ratio of boiling length to heated equivalent diameter determines the relation between the average heat flux in the boiling region, the coolant mass flux, and the coolant bulk quality at the burnout section. Figure 16 shows the distribution of tests over the range of boiling length and Figure 17 the distribution over the range of the ratio of boiling length to heated equivalent diameter. Boiling length is dependent on coolant conditions; it is considered here to have a value only when the coolant is subcooled or saturated at the channel inlet and burnout occurs in bulk boiling conditions. Valid boiling lengths can be calculated for 78 per cent of the tests.

The range of boiling length extends from almost zero which occurs in many assemblies to 6830 mm in the assembly with the greatest heated length (assembly 281). The greatest boiling length in any of the multi-rod assemblies is 5817 mm and occurs in the longest rod bundle (assembly 194). The conspicuous concentration of tests in the narrow band of boiling length 250 to 300 mm is due to a large number of tests performed at ORNL on assemblies 181, 184 and 188 to 193, which had boiling conditions over almost their entire length of 295 mm. The ratio of boiling length to heated equivalent diameter extends to 756.7 in the annular channels and 624.4 in the multi-rod bundles. In this compilation the greatest ratios do not occur in the channels with longest boiling length, but in those having the greatest ratio of heated length to heated equivalent diameter (assemblies A21 and 166). In 56 per cent of the tests which have a valid boiling length, the ratio of boiling length to heated equivalent diameter is in the range 50 to 250; this is roughly the range of the ratio at the burnout power level for normal flow conditions in the fuel elements of water-cooled nuclear power reactors.

6.1.11 <u>Distribution of heat flux</u>

Only two characteristics of the heat flux distribution are considered here; these are the transverse and axial form factors. The form factors are defined as the ratio of the maximum to the mean heat flux, in the first case over the heated perimeter of the flow channel and in the second, over the heated length. Figures 12 and 13 show, respectively, the distributions of tests over the ranges of the transverse and axial form factors in assemblies with non-uniform distributions of heat flux.

In nearly all of the test assemblies providing data for this compilation, any axial variation of the heat flux applies in a strictly similar manner to all heated surfaces and therefore, in all tests on one assembly, both form factors are constant. In the few cases in which the form factors vary (the axial form factor from rod to rod and the transverse form factor from section to section), mean values have been inserted in Table 2A and used in Figures 12 and 13. The mean transverse form factor is defined as that which would exist if the duct and each rod were heated uniformly at their axially-averaged heat flux; it is the ratio of the highest average heat flux on any rod (or duct) to the average heat flux over the entire heated surface. The mean axial form factor is defined as that which would exist if the heated perimeter at each flow cross-section were heated uniformly at the transversely-averaged heat flux and the peak heat fluxes on all rods were in the same cross-section; thus, this factor is the ratio of the rod and duct peak heat fluxes averaged over the heated perimeter to the average heat flux over the entire heated surface. It should be noted that, whereas the product of constant transverse and axial form factors is the channel peaking factor, the product of mean form factors is meaningless.

The range of transverse form factor extends from values close to 1.0, which occur mainly in assemblies with marginally different heat fluxes on the rods and duct, to 3.36 in a test at KEI on a single-rod assembly (assembly 221), in which a part of the duct was heated at a low heat flux. Most of the other large values of transverse form factor occurred in tests in which one or more rods (or the duct) were heated at constant flux levels, while that on the remaining rods was raised until burnout was detected. In this type of experiment, the heat flux transverse form factor depends on the burnout heat flux and varies from test to test on the same assembly. In such cases, Table 2A gives the average value of transverse form factor for all tests performed on the assembly. The greatest systematic variation of heat flux across a rod bundle, from 0.5 to 1.5 times the mean value, occurs in triangular pitch arrays of 20 rods (assemblies 160, 162, 164, 265 to 268, 272, 273) which were tested at Bettis as part of the LWBR development program. Data from tests on full simulations of SGHWR fuel elements contribute to the high frequencies of occurrence of the values 1.02 and 1.22.

In the great majority (99.4 per cent) of the tests with axially non-uniform heating included in the compilation, the axial form factors range between 1.16 and 1.86. These extreme values occur in assemblies having asymmetric axial heat flux profiles with their peaks located in the downstream half of the channel, the lower in a 9-rod bundle, 1.83 m in length (assembly 113) tested at ARC, the higher in a series of 16-rod bundles, 2.44 m in length (assemblies 241 to 246), tested at Columbia. A small number of tests are included in which the heat flux axial form factor exceeds 1.86, the greatest value being 3.14. All of these large values occur in tests with heat flux distributions containing 'spikes' or 'hot patches'. The most frequent form factor in the non-uniform axial distributions of heat flux is 1.4; this is often considered to be typical of the axial heat flux distribution in water-cooled power reactors.

6.1.12 Boiling number, Weber number and Froude number

Non-dimensional compound variables can be useful indicators of similarity in particular aspects of test conditions. Figures 18 to 20 show the distributions of tests over the ranges of boiling number, Weber number and Froude number.

Boiling number, which expresses the ratio of mass flux of vapour away from the surface to the mass flux of fluid parallel to the surface, extends over the range 0.019×10^{-3} to 17.19×10^{-3}; the lowest value occurs in a 3.29 m long annular channel (assembly A21) tested at CISE (Piacenza) and the greatest in a 0.2 m long single-rod assembly simulating the central rod in a circular pitch array (assembly 222) tested at KEI.

Weber number expresses the ratio of fluid inertial force to surface tension force. When evaluated at the burnout cross-section, it extends over the range 16.4 to 178 300; the lowest value occurs in a 7-rod bundle (assembly 181) tested at low pressure and low mass flux at ORNL and the highest in a 9-rod bundle (assembly 247) tested at high pressure and high mass flux at Columbia.

Froude number expresses the ratio of fluid inertial force to gravitational force. A factor which has sometimes been found useful in correlating burnout data is the liquid Froude number which, in the compiled data, extends over the range 0.004 to 3036; the lowest value occurs in the 7-rod bundle (assembly 181) tested at low mass flux and the highest in a 12-rod bundle with a very small equivalent diameter (assembly 7) tested at fairly high mass flux at Columbia.

6.2 Distribution of Tests Over the Ranges of Two or More Variables Considered Simultaneously

The histograms that have been described in Section 6.1 have shown how the tests included in the compilation are distributed over the ranges of single variables; each variable was considered separately and without regard for the concurrent values of other variables. The term 'single variable' includes simple variables, like pressure and mass flux, and compound variables (which are fixed combinations of simple variables) like the non-dimensional groups.

However, to assess the relevance of the test data to any nominated set of conditions, it is essential to know how different variables are associated by value in the data; in this section, two or more variables, either simple or compound, are considered simultaneously and independently. The full range of each variable is divided into a number of intervals and the test condition field is thereby divided into regions, each region being defined by a different combination of intervals of the variables. In the case of two variables, the distribution of tests can be displayed as a simple table of the number of tests occurring in each region, the columns corresponding to intervals of one variable and the rows to intervals of the other. Tables 7 to 26 are displays of this kind. When four variables are considered, the display becomes a two-dimensional array, the elements of which are also two-dimensional arrays. The columns and rows of the main array correspond to intervals of two of the variables and the columns and rows of each inner array to intervals of the other two variables. Tables 27 to 31 are displays of this kind.

Tables 7 to 17 each show a distribution of tests among regions defined by a different pair of variables. The range of each variable has been divided into equal intervals. This method of dividing the ranges superimposes the separate distributions of the variables and, since these are very irregular in most cases, it produces many regions containing small numbers of tests (or none at all) and some containing large numbers of tests. When the purpose is to reveal the disposition of data in the compilation, regions containing no tests are as significant as those containing many and equal division of the variable ranges is preferable. Tables 7 to 17 show clearly the regions in which data are concentrated and those in which they are sparse. They also reveal many special characteristics of the data distribution: for example, the limited pressure range of tests with very high mass flux or very high local burnout heat flux (Tables 7,8) and the differing mass flux and burnout heat flux ranges associated with subcooled and quality burnout (Tables 10,17).

When, however, the purpose is to show how the distribution of tests over the range of one variable changes with the value of another, all intervals should have the same weight and therefore should contain the same number of tests. Tables 18 to 26 each show a distribution of tests among regions defined by a different pair of variables, the range of each variable being divided as nearly as possible into intervals containing equal numbers of tests. This method of dividing the ranges suppresses display of the separate distributions of each variable and allows the relative distribution to be seen. The same number of tests in every region would not necessarily indicate a uniform distribution of tests over the range of each variable, but rather a uniform association of the variables throughout the tests. Variations in the numbers of tests from region to region indicate a changing association of the variables; for instance, Table 18 indicates that although very low pressures are mainly associated with either very low or very high mass fluxes, medium pressures are mainly associated with medium mass fluxes and high pressures with high (but not low) mass fluxes.

When four variables are considered simultaneously, division of their ranges into many intervals produces a distribution table that is inconveniently large. From five to eight intervals, as used in Tables 27 to 31, is a practical choice. As the number of intervals is reduced, the empty columns or rows that are characteristic of equal range intervals become less tolerable; therefore, in all of the tables for four variables given here, intervals containing similar numbers of tests have been chosen. Tables 27 to 29 show distributions of tests among regions defined by intervals of heated equivalent diameter, pressure, mass flux, and one other variable, which may be inlet quality, bulk quality at burnout, or average surface heat flux at burnout. Table 30 shows the distribution in relation to four non-dimensional variables, namely the boiling, Weber and Froude numbers, and the bulk quality at burnout. A distribution of tests in relation to four geometric variables (number of rods, rod diameter, ratio of rod pitch to diameter, and ratio of length to heated equivalent diameter) is shown in Table 31.

7. GENERAL DISCUSSION

It has been pointed out (in Sections 1 and 6.1.6) that the results of burnout experiments on large rod bundle assemblies are seldom published, because they might reveal proprietary information about commercial design of fuel elements. On the other hand, the results of investigations carried out with smaller assemblies into more general aspects of burnout are very often published. It is therefore a feature of data compilations derived from published information that they contain a significant amount of data relating to small-scale experiments which do not reproduce simultaneously all of the characteristics and operating conditions of a reactor fuel element. In the compilation described here, this situation is partly relieved by the inclusion of confidential data made available to the authors by the UKAEA. Nevertheless, a large part of the data derives from small-scale experiments with bundles of nine rods or less. One effect of the small-scale test component is that although the ranges of important variables encompass typical reactor conditions, distributions of the tests over the ranges are often not centred upon these typical conditions. Particular examples of this are the distributions with respect to mass flux, burnout heat flux, and ratio of heated length to heated equivalent diameter, all of which have been discussed (see Sections 6.1.2, 6.1.5 and 6.1.10).

The inherent characteristics of the BACE compilation as a single body of data are not of great importance, however, because it should be regarded, not as an indivisible body, but as a pool from which suitable data may be selected for particular purposes. A substantial amount of data is included for larger scale tests on bundles of from 16 to 37 rods at conditions close to those of normal reactor operation. Small-scale tests, however, contribute most of the data for burnout at high mass flux, high heat flux, high inlet quality, and close rod spacing.

The ranges of the principal variables are extensive and, considered separately, embrace most of the conditions likely to occur in the normal operating and possible emergency states of water-cooled nuclear power reactors. Considered simultaneously, the ranges of the many variables define a vast field of conditions which is not fully represented in the compilation; areas in the vicinity of reactor operating conditions are well populated with tests, but fringe areas are thinly and irregularly populated. Generally, tests which extend the range of a variable beyond the limits of normal reactor operation do so within very narrow bands of other variables. This means that if burnout data for extreme values of a variable are sought from the compilation, there is little choice of the concurrent values of other variables.

8. CONCLUSIONS

(a) The distributions of burnout tests over the ranges of important variables considered singly, or simultaneously in pairs or sets of four, are presented in sufficient detail as histograms and tables to enable a prospective user to determine the relevance of the data to any conditions of particular interest.

(b) The distribution tables, especially those for four variables, indicate very clearly the dispersion of data due to the number of variables involved and the smallness of the sample that can result from the placing of close limits on more than one variable. The adequacy of the present compilation to provide significant samples of data varies considerably with the location and delimitation of the area of interest. If, however, the number and range of governing variables are chosen with discretion, the compilation provides an effective data base for operations such as:

(i) surveys of parametric effects on burnout conditions,

(ii) tests of the accuracy of burnout prediction formulas, and

(iii) optimisation of the empirical coefficients in burnout formulas.

(c) The possible ranges of the many important variables define a vast condition field; it is evident from the sparse and irregular distribution of burnout tests over the greater part of this field that the present compilation, despite the number of tests, is not completely adequate and that its usefulness can be increased by the addition of more data, especially in the fringe areas of the condition field.

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10. REFERENCES

10.1 General

Barnett, P.G. [1966] - A correlation of burnout data for uniformly heated annuli and its use for predicting burnout in uniformly heated rod bundles. AEEW-R463.

Barnett, P.G. [1968] - A comparison of the accuracy of some correlations for burnout in annuli and rod bundles. AEEW-R558.

Hughes, E.D. [1970a] - An examination of rod bundle critical heat flux data and correlations and their applicability to loss-of-coolant accident analyses. IN-1319.

Hughes, E.D. [1970b] - A correlation of rod bundle critical heat flux for water in the pressure range 150 to 725 psia. IN-1412.

Hughes, E.D., Ka-Lam Ip, Baker, A.N. and Carbon, M.W. [1974] - A compilation of rod array critical heat flux data sources and information. Nucl. Eng. Des., 30:20-35.

Lintner, M.A. [1970] - ERREST, a program to edit data, perform error calculations, and do nonlinear least square parameter estimations. Idaho Nuclear Corp. report, distributed by the Argonne Code Center.

Macbeth, R.V. [1964] - Burnout analysis Part 5: examination of published world data for rod bundles. AEEW-R358.

Mironov, Yu. V., Razina, N.S., Smolin, V.N. and Shpanskii, S.V. [1978] - Pool of experimental data on critical heat flux with water boiling in rod assemblies. Teploenergetika, 25(9)65-67.

Tong, L.S., Currin, H.B. and Engel, F.C. [1964] - DNB (burnout) studies in an open lattice core. Vol. II, WCAP-3736.

Tong, L.S. [1969] - Critical heat fluxes in rod bundles. Proc. ASME Symp. on Two-Phase Flow and Heat Transfer in Rod Bundles, Los Angeles, November, pp.31-46.

Tong, L.S. [1972] - Boiling crisis and critical heat flux. TID-25887.

10.2 Sources of Published Data

[1] Janssen, E. and Kervinen, J.A. [1963] - Burnout conditions for single rod in annular geometry, water at 600 to 1400 psia. GEAP-3899.

[2] Hench, J.E. [1963] - Multirod (four-rod) critical heat flux at 1000 psia. GEAP-4358.

[3] Matzner, B. [1961] - Basic experimental studies on boiling fluid flow and heat transfer at elevated pressures. Monthly Progress Report for November 1961. TID-14439.

[4] Matzner, B. [1963] - Basic experimental studies of boiling fluid flow and heat transfer at elevated pressures. Monthly Progress Report for February 1963. TID-18296.

[5] Matzner, B. [1961] - Basic experimental studies on boiling fluid flow and heat transfer at elevated pressures. Monthly Progress Report for May 1961. TID-12574.

[6] Matzner, B. [1961] - Basic experimental studies on boiling fluid flow and heat transfer at elevated pressures. Monthly Progress Report for July 1961. TID-13711.

[7] Matzner, B. [1963] - Heat transfer and hydraulic studies for SNAP-4 fuel element geometries. Topical Report No.2. TID-19563.

[8] Macbeth, R.V. [1964] - Burnout analysis Part 5: examination of published world data for rod bundles. AEEW-R358.

[9] Edwards, P.A. [1976] - An experimental study of burnout and pressure drop in 19-rod clusters. AEEW-R371. (Reprint).

[10] Excluded from this report.

[11] Janssen, E. [1968] - Nine-rod critical heat flux investigation, steam-water at 600 to 1400 psia. Final Summary Report. GEAP-5616.

[12] Becker, K.M., Hernborg, G., Bode, M. and Eriksson, O. [1965] - Burnout data for flow of boiling water in vertical round ducts, annuli and rod clusters. AE-177.

[13] Becker, K.M. [1967] - A burnout correlation for flow of boiling water in vertical rod bundles. AE-276.

[14] Nylund, O., Becker, K.M., Eklund, R., Gelius, O., Haga, I., Hansson, P.T., Hernborg, G. and Akerhielm, F. [1967] - Measurements of hydrodynamic characteristics, instability thresholds, and burnout limits for 6-rod clusters in natural and forced convection. ASEA and AB Atomenergi Report FRIGG-1.

[15] Nylund, O., Becker, K.M., Eklund, R., Gelius, O., Hernborg, G., Rouhani, Z. and Akerhielm, F. [1968] - Hydrodynamic and heat transfer measurements on a full-scale simulated 36-rod Marviken fuel element with uniform heat flux distribution. ASEA and AB Atomenergi Report FRIGG-2.

[16] Becker, K.M. [1967] - Measurements and predictions of burnout conditions in rod bundles. AES-366.

[17] Matzner, B. and Casterline, J.E. [1965] - The effect of length and pressure on the critical heat flux for a closely spaced 19-rod bundle in forced convection boiling. TID-22539.

[18] Hesson, G.M., Fitzsimmons, D.E. and Batch, J.M. [1965] - Experimental boiling burnout heat fluxes with an electrically heated 19-rod bundle test section. BNWL-206.

[19] Kunsemiller, D.F. [1966] - Multirod, forced flow, transition and film boiling measurements. GEAP-5073.

[20] Adorni, N., Gaspari, G.P., Germani, G., Peterlongo, G., Ravetta, R. and Zavattarelli, R. [1964] - Heat transfer crisis with steam-water mixtures in complex geometries. CISE R-123.

[21] Adorni, N., Gaspari, G.P., Germani, F., Hassid, A., Ravetta, R. and Rubiera, L. [1966] - Heat transfer crisis and pressure drop with steam-water mixtures: Experimental data with seven rod bundles at

50 and 70 kg/cm^2. CISE R-170.

[22] Excluded from this report.

[23] Excluded from this report.

[24] Excluded from this report.

[25] Campanile, A., Galimi, G. and Goffi, M. [1966] - Forced convection burnout and hydrodynamic instability experiments for water at high pressure. Part II. EUR-2963e.

[26] Excluded from this report.

[27] Polomik, E.E. and Quinn, E.P. [1962] - Multi-rod burnout at high pressure. GEAP-3940.

[28] Matzner, B. [1962] - Basic experimental studies on boiling fluid flow and heat transfer at elevated pressures. Monthly Progress Report for April 1962. TID-15637.

[29] Nylund, O., Becker, K.M., Eklund, R., Gelius, O., Haga, I., Jensen, A., Malnes, D., Olsen, A., Rouhani, Z., Skaug, J. and Akerhielm, F. [1969] - Hydrodynamic and heat transfer measurements on a full-scale simulated 36-rod Marviken fuel element with non-uniform radial heat flux distribution. ASEA-ATOM Report FRIGG-3.

[30] Nylund, O., Becker, K.M., Eklund, R., Gelius, O., Jensen, A., Malnes, D., Olsen, A., Rouhani, Z. and Akerhielm, F. [1970] - Hydrodynamic and heat transfer measurements on a full scale simulated 36-rod BHWR fuel element with non-uniform axial and radial heat flux distribution. ASEA-ATOM Report FRIGG-4.

[31] Campanile, A., Galimi, G., Goffi, M. and Passavanti, G. [1970] - Forced convection burnout and hydrodynamic instability experiments for water at high pressure. Part VI. EUR-4468e.

[32] Campanile, A., Galimi, G. and Goffi, M. [1968] - Forced convection burnout and hydrodynamic instability experiments for water at high pressure. Part IV. EUR-3881e.

[33] Campanile, A., Galimi, G., Goffi, M. and Passavanti, G. [1970] - Forced convection burnout and hydrodynamic instability experiments for water at high pressure. Part VII. EUR-4514e.

[34] Wilson, R.H., Stanek, L.J., Gellerstedt, J.S. and Lee, R.A. [1969] - Critical heat flux in a non-uniformly heated rod bundle. Proc. ASME Symp. on Two-Phase Flow and Heat Transfer in Rod Bundles, Los Angeles, November, pp.56-62.

[35] Gellerstedt, J.S., Lee, R.A., Oberjohn, W.J., Wilson, R.H., and Stanek, L.J. [1969] - Correlaticn of critical heat flux in a bundle cooled by pressurised water. Proc. ASME Symp. on Two-Phase Flow and Heat Transfer in Rod Bundles, Los Angeles, November, pp.63-71.

[36] Janssen, E., Schraub, F.A., Nixon, R.B., Matzner, B., and Casterline, J.E. [1969] - Sixteen-rod heat flux investigation, steam-water at 600 to 1250 psia. Proc. ASME Symp. on Two-Phase Flow and Heat Transfer in Rod Bundles, Los Angeles, November, pp.81-88.

[37] Cermak, J.O., Farman, R.F., Tong, L.S., Casterline, J.E., Kokolis, S. and Matzner, B. [1969] - The departure from nucleate boiling in rod bundles during pressure blowdown. J. Heat Transfer (Trans. ASME), 92C(4)621-627.

[38] Israel, S., Casterline, J.E. and Matzner, B. [1969] - Critical heat flux measurements in a 16-rod simulation of a BWR fuel assembly. J. Heat Transfer (Trans. ASME), 91C(3)355-363.

[39] Janssen, E. [1971] - Two-phase flow and heat transfer in multirod geometries. Final Report. GEAP-10347.

[40] Waters E.D., Hesson, G.M., Fitzsimmons, D.E. and Batch, J.M. [1963] - Boiling burnout experiments with 19-rod bundles in axial flow. HW-77303.

[41] LeTourneau, B.W. and Green, S.J. [1971] - Critical heat flux and pressure drop tests with parallel upflow of high pressure water in bundles of twenty 1/2-in. rods. Nucl. Sci. Eng. 43(1)90-104.

[42] Hesson, G.M., Fitzsimmons, D.E. and Batch, J.M. [1964] - Boiling burnout experiments with fog-cooled nineteen-rod bundle test sections. HW-80523-REV1

[43] Hesson, G.M., Fitzsimmons, D.E. and Batch, J.M. [1964] - Comparison of boiling burnout data for 19-rod bundles in horizontal and vertical positions. HW-83443-REV1.

[44] Batch, J.M. and Hesson, G.M. [1964] - Comparison of boiling burnout data for 19-rod bundle fuel elements spaced with 'wires' and 'warts'. HW-80391-REV1.

[45] Lahey, R.T., Kong, Y.H., Radcliffe, D.W. and Kiernan, S.A. [1972] - Deficient cooling. Tenth Quarterly Progress Report. GEAP-10221-10.

[46] Kervinen, J.A., Kong, Y.H., Radcliffe, D.W. and Clay, D.G. [1972] - Deficient cooling. 12th Quarterly Progress Report. GEAP-10221-12.

[47] Towell, R.H. [1965] - Effect of spacing on heat transfer burnout in rod bundles. DP-1013.

[48] Hench, J.E. [1964] - Transition and film boiling data at 600, 1000 and 1400 psia in forced convection heat transfer to water. GEAP-4492.

[49] Kastner, W. and Mayinger, F. [1970] - Burnout tests in connection with safety research. Final Report. Parts I and II. AEC-tr-7394.

[50] Bowring, R.W. and Spigt, C.L. [1965] - Seven-rod bundle, natural-circulation, stability and burnout tests with water at up to 28 atmospheres pressure. Nucl. Sci. Eng., 22(1)1-13.

[51] Becker, K.M., Flinta, J., Hernborg, G., Nylund, A., Nilsson, L. and Jensen, A. [1968] - Experimental studies of burnout conditions in vertical channels. AES-387.

[52] LeTourneau, B.W., Gavin, M.E. and Green, S.J. [1974] - Critical heat flux and pressure drop tests with parallel upflow of high pressure water in bundles of twenty 3/4-in. rods. Nucl. Sci. Eng., 54(2)214-242.

[53] Smolin, V.N. and Polyakov, V.K. [1967] - Critical heat flux with longitudinal flow round a rod bundle. Teploenergetika, 14(4)54-58.

[54] Gaspari, G.P., Hassid, A., Ravetta, R. and Rubiera, L. [1968] - Heat transfer crisis and pressure drop with steam-water mixtures in a nineteen uniformly heated rod bundle. CISE R-264.

[55] Gaspari, G.P., Ravetta, R., Rubiera, L. and Vanoli, G. [1970] - Heat transfer crisis and pressure drop measurements with steam-water mixtures in nineteen rod clusters. CISE R-294.

[56] Tong, L.S., Chelemer, H., Casterline, J.E. and Matzner, B. [1967] - Critical heat flux (DNB) in square and triangular array rod bundles. Proc. JSME 1967 Semi-International Symp., Tokyo, September, pp.25-34.

[57] Evangelisti, R., Gaspari, G.P., Rubiera, L. and Vanoli, G. [1972] - Heat transfer crisis data with steam-water mixture in a sixteen-rod bundle. Int. J. Heat Mass Transfer, 15:387-402.

[58] Nylund, O. [1969] - Full-scale loop studies of BHWR and BWR fuel assemblies. ASEA (Allm. Sven. Elektr. A.B.) Res., 10:63-125.

[59] Weisman, J., Wenzel, A.H., Tong, L.S., Fitzsimmons, D.E., Thorne, W. and Batch, J.M. [1968] - Experimental determination of the departure from nucleate boiling in large rod bundles at high pressures. Chem. Eng. Prog. Symp. Series, 64(82)114-125.

[60] Jones J.K. [1969] - An experimental study of the critical heat flux for low pressure boiling water in forced convection in a vertical seven heater rod bundle. ORNL-TM-2122.

[61] Gaspari, G.P., Hassid, A., Ravetta, R. and Rubiera, L. [1968] - Heat transfer crisis and pressure drop with steam-water mixtures: Further experimental data with seven-rod bundles. CISE R-208.

[62] Gaspari, G.P., Ravetta, R., Rubiera, L. and Vanoli, G. [1973] - Heat transfer crisis and pressure drop measurements with steam-water mixture in CIRENE 19-rod clusters (4 m long). CISE R-339.

[63] Ceresa, I., Gaspari, G.P., Lucchini, F. and Rubiera, L. [1973] - Heat transfer crisis and pressure drop measurements with steam-water mixtures in a 6-metre-long 19-rod cluster. CISE R-340.

[64] Excluded from this report.

[65] Marinelli, V., Gaspari, G.P., Greco, G. and Lucchini, F. [1975] - Dryout experiments in a 16-rod BWR geometry with six different radial heat flux distributions. ASME 75-HT-24.

[66] Moeck, E.O., Garg, S.C., Wikhammer, G.A., Stern, F. and Dempster, R.T. [1966] - 'SWIFT' dryout data for a 19-rod, 3.25 inch diameter bundle cooled by steam-water fog at 515 psia. AECL-2586.

[67] Marinkovitch, P.S. and Coeling, K.J. [1976] - Critical heat flux and pressure drop tests with high pressure water in a bundle of 0.571 and 0.526 in. dia. rods with a non-uniform radial and axial heat flux distribution. WAPD-TM-1162.

[68] Peterson, A.C. and Green, S.J. [1975] - Critical heat flux and pressure drop tests with parallel upflow of high pressure water in bundles of twenty-nine 0.301 in. dia. rods with a non-uniform radial and axial heat flux distribution. WAPD-TM-1170.

[69] Yates, J., Galbraith, K. and Collingham, R. [1975] - DNB and post DNB heat transfer data in 25-rod bundles. XN-75-54.

[70] Green, S.J., Maurer, G.W. and Weiss, A. [1962] - Burnout and pressure-drop studies for forced-convection flow of water parallel to rod bundles. ASME 62-HT-43.

[71] Bezrukov, Yu. A., Astakhov, V.I., Brantov, V.G., Abramov, V.I., Testov, I.I., Logvinov, S.A. and Rassokhin, N.G. [1976] - Experimental investigation and statistical analysis of data on burnout in rod bundles for water-moderated water-cooled reactors. Teploenergetika, 23(2)80-82.

[72] Yefimov, V.A., Marchenko, L.D. and Trutnev, D.P. [1969] - Study of the effect of rod bundles on boiling crisis. Heat Transfer-Sov. Res., 1(4)42-47.

[73] Yamazaki, Y., Iguchi, T., Niitsuma, Y. and Takano, K. [1975a] - Effect of the heated length on the burnout heat flux in the rod bundle test section. JAERI M-6030.

[74] Yamazaki, Y., Iguchi, T., Niitsuma, Y. [1975b] - Burnout heat flux of narrow spaced rod bundles. Effect of flow rate and steam quality. JAERI M-6031.

[75] Kunsemiller, D.F. [1965] - Transition boiling heat transfer program. Twelfth Quarterly Progress Report: (Task A-2 multirod tests). GEAP-5081.

[76] Rosal, E.R., Cermak, J.O., Tong, L.S., Casterline, J.E., Kokolis, S. and Matzner, B. [1974] - High pressure rod bundle DNB data with axially non-uniform heat flux. Nucl. Eng. Des., 31:1-20.

[77] Yefimov, V.A., Trutnev, D.P. and Marchenko, L.D. [1969] - A study of the boiling crisis with water in rod bundles. Heat Transfer-Sov. Res., 1(4)48-56.

[78] LeTourneau, B.W., Peterson, A.C., Coeling, K.J., Gavin, M.E. and Green, S.J. [1975] - Critical heat flux and pressure drop tests with parallel upflow of high pressure water in bundles of twenty 0.25 and 0.28 inch diameter rods. WAPD-TM-1013.

[79] Quinn, E.P. and Swan, C.L. [1964] - Visual observations of fluid behaviour in high-pressure transition boiling flows. GEAP-4636.

[80] Swan, C.L. [1966] - Photography of heated surface fluid behaviour for transition boiling at 1000 psia. GEAP-5094.

[81] Lund, K.O. [1975] - Critical heat flux in a subcooled, low-pressure rod-bundle with various rod spacings. ASME 75-HT-49.

[82] Green, S.J., LeTourneau, B.W. and Peterson, A.C. [1970] - Thermal and hydraulic effects of crud deposited on electrically heated rod bundles. WAPD-TM-918.

[83] Larsen, P.S., Kitzes, A.S., Stormer, T.D., Green, J. and Tong, L.S. [1966] - DNB measurements for upwards flow of water in an unheated

square channel with a single uniformly heated rod at 1600-2300 psia. Proc. ASME 3rd International Heat Transf. Conf., Chicago.

[84] Little, R.B. [1970] - Dryout tests on an internally heated annulus with variation of axial heat flux distribution. AEEW-R578.

[85] Janssen, E. and Kervinen,J.A. [1963] - Burnout conditions for non-uniformly heated rod in annular geometry, water at 1000 psia. GEAP-3755.

[86] Knoebel, D.H., Harris, S.D., Crain, B. Jr. and Biderman, R.M. [1973] - Forced-convection subcooled critical heat flux. DP-1306.

[87] Abraham, S.C., Macdonald, I.P.L., Moeck, E.O. and Wikhammer, G.A. [1966] - The effect of cosine and half-cosine heat fluxes on dryout for steam-water flow in an annulus at 1000 psia. AECL-2646.

[88] Quinn, E.P. [1965] - Single-rod, forced flow, transition boiling heat transfer from smooth and finned surfaces. GEAP-4786.

[89] Era, A., Gaspari, G.P., Hassid, A., Milani, A. and Zavattarelli, R. [1966] - Heat transfer data in the liquid deficient region for steam-water mixtures at 70 kg/cm^2 flowing in tubular and annular conduits. CISE R-184.

[90] Judd, D.F., Wilson, R.H., Welch, C.P. and Lee, R.A. [1967] - Non-uniform heat generation experimental program. Final Report. BAW-3238-13.

[91] Tong, L.S., Currin, H.B. and Engel, F.C. [1964] - DNB (burnout) studies in an open lattice core. Vol. 1. WCAP-3736.

11. NOTATION

Symbols

A	channel flow area
Bo	boiling number
D_e	hydraulic equivalent diameter
D_h	heated equivalent diameter
Fr	Froude number (liquid)
G	coolant mass flux
g	acceleration due to gravity
h	coolant enthalpy
L	heated length of channel
P_h	heated perimeter of flow channel
P_w	wetted perimeter of flow channel
q	heat flux
We	Weber number
X	coolant quality
ρ	coolant density
σ	surface tension

Subscripts

a	average
b	bulk
c	critical, i.e. at burnout
e	hydraulic equivalent
f	of the saturated liquid
fg	of vaporisation
g	of the dry, saturated vapour
h	heated
m	of the two-phase mixture
w	wetted

Symbolic Names of Variables Used in Tables

BO	boiling number
G	coolant mass flux
HEQD	heated equivalent diameter
L/D	ratio of heated length to heated equivalent diameter
LFR	liquid Froude number
P	system pressure
QBAV	average heat flux at the burnout section
QBO	local burnout heat flux
RDIA	rod diameter

RODS	number of rods
WE	Weber number
XBO	coolant bulk quality at the burnout section
XIN	coolant bulk quality at the channel inlet

12. GLOSSARY

Some of the terms used have well-established meanings, others have not. The definitions given here pertain strictly to the use of the terms in this report and are not necessarily applicable to the terms as they may be used generally in the literature.

Boiling length

The length of channel between the flow cross-section, at which the bulk enthalpy of the coolant is that of the saturated liquid, and the burnout cross-section.

Boiling number

A non-dimensional compound variable defined by the equation:

$$Bo = \frac{q_{ca}}{h_{fg}G}$$

Bulk

When applied to a condition of the coolant, this indicates the average condition over a flow cross-section calculated assuming thermal equilibrium (as in bulk enthalpy, bulk quality).

Bulk boiling

A condition of the coolant in which its bulk enthalpy lies between the enthalpies of the saturated liquid and the dry, saturated vapour at the prevailing pressure.

Burnout

One of the following:

(a) A sudden and disproportionate increase in the temperature of a heated surface, resulting from a very small increase in the surface heat flux or a very small change in the condition of the coolant.

(b) The onset of a marked increase in the rate at which the temperature of a heated surface rises with increase of surface heat flux or with change in a particular condition of the coolant.

Burnout condition

The critical combination of coolant bulk conditions and surface heat flux at which burnout occurs. A local burnout condition is defined by the local heat flux, and an average burnout condition by the average heat flux over the heated perimeter of the burnout section.

Burnout heat flux

The surface heat flux at which burnout occurs. A local burnout heat flux is the value of the heat flux at the burnout point. An average burnout heat flux is the average surface heat flux over the heated perimeter of the flow cross-section containing a burnout point.

Burnout point

A point on a heated surface where burnout first occurs.

Burnout power

The heating power input to a heated channel at the onset of burnout.

Burnout quality

The bulk quality of the coolant at a burnout section.

Burnout section

A flow cross-section containing a burnout point.

Burnout subcooling

The subcooling of the coolant at a burnout section.

Channel peaking factor

The ratio of the maximum local heat flux occurring in a channel to the average heat flux over the entire heated surface.

Circular pitch

Describes a rod array in which the rod centres are evenly spaced around the circumferences of concentric circles. One rod may be placed at the common centre.

Compound variable

An association of two or more independent variables in a fixed relation.

Critical heat flux

Synonymous with 'burnout heat flux'

Departure from nucleate boiling (DNB)

A sudden transition from heat transfer by bubble nucleation at a heated surface to heat transfer through a vapour film, causing burnout, usually of category (a).

Dryout

A transition from heat transfer through a thin liquid film to heat transfer through a vapour, causing burnout, often of category (b).

Flow cross-section

A cross-section of the flow passage normal to the principal direction of flow.

Form factor

The ratio of the maximum local value of a variable, which varies spatially over an axis or plane, to the average value over the axis or plane. Hence, an axial form factor is a form factor with reference to the longitudinal axis of a rod or channel, and a transverse form factor is one with reference to a cross-section of a channel.

Froude number

A non-dimensional compound variable defined by the equation:

$$Fr = \frac{G^2}{\rho_f^2 \, g \, D_e}$$

Heated equivalent diameter

A variable defined by the equation:

$$D_h = \frac{4A}{P_h}$$

Hydraulic equivalent diameter

A variable defined by the equation:

$$D_e = \frac{4A}{P_w}$$

Percentile division

Division of the range of a variable into intervals having approximately equal numbers of tests. Thus, in ten divisions, each interval contains ten per cent of the total number of tests and in five divisions each contains twenty per cent.

Quality

In two-phase flows, the ratio of the mass flow rate of vapour to the total mass flow rate at a flow cross-section. When the bulk enthalpy is below that of the saturated liquid, it is a notional quantity defined by the equation:

$$X = \frac{h-h_f}{h_{fg}}$$

Subcooled

Having a bulk enthalpy less than that of the saturated liquid at the prevailing pressure.

Subcooling

Generally, the difference between the enthalpy of the saturated liquid and the bulk enthalpy of the coolant. In this report, it is the ratio of this difference to the latent heat of vaporisation, numerically equal but opposite in sign to quality in a subcooled fluid.

Surface boiling

Local boiling at a heated surface when the coolant is sub-cooled.

System pressure

The pressure at the outlet of the heated channel, where it is included in or can be derived from the recorded data; otherwise, it is the pressure at the inlet of the heated channel.

Weber number

A non-dimensional compound variable defined by the equation:

$$We = \frac{D_e G^2}{\sigma_f \rho_m}$$

13. ABBREVIATIONS USED IN THE TEXT

13.1 Laboratory Names and Locations and Number of Tests

Abbreviation	Full Name and Location	Number of tests
ABA	Heat Engineering Laboratory, Aktiebolaget Atomenergi, Studsvik, Sweden.	792
AEEW	United Kingdom Atomic Energy Authority, Atomic Energy Establishment, Winfrith.	2260
ANL	Argonne National Laboratory, Argonne, Illinois.	60
APED	Heat Transfer Facility, Atomic Power Equipment Department, General Electric Co., San Jose, Calif.	1100
ARC	Alliance Research Centre, Babcock and Wilcox Co., Alliance, Ohio.	642
ASEA	ASEA-ATOM (Allmanna Svenska Elektriska Aktiebolaget), Vasteras, Sweden.	286
Bettis	Bettis Atomic Power Laboratory, Westinghouse Electric Corp., West Mifflin, Pennsylvania.	925

CISE (Genoa)	Centro Informazioni Studi Esperienze, Heat Transfer Facility, Stabilimento Meccanico Ansaldo, Genoa, Italy.	466
CISE (Piacenza)	Centro Informazioni Studi Esperienze, Heat Transfer Facility, Ente Nazionale per l'Energia Elettrica, Emilia Power Station, Piacenza, Italy.	1677
Columbia	Heat Transfer Research Facility, Department of Chemical Engineering, Columbia University, New York.	1323
CRNL	Chalk River Nuclear Laboratories, Atomic Energy of Canada Ltd, Ontario, Canada.	95
CWC	Atomic Energy Department, Canadian Westinghouse Co., Hamilton, Ontario, Canada.	75
ETU	Eindhoven Technological University, Eindhoven, The Netherlands.	7
Hanford	Hanford Laboratories, Hanford Atomic Products Operation, General Electric Co., Richland, Washington.	167
Ispra	Joint Research Centre, EURATOM (European Atomic Energy Community), Ispra, Italy.	*
KEI	Krzhizhanovskiy Energetics Institute, Moscow, USSR.	332
KIA	Kurchatov Institute of Atomic Energy, Moscow, USSR.	197
MAN	Maschinenfabrik Augsburg-Nurnberg, Nuremberg, Federal Republic of Germany	90
MEI	Moscow Power Institute, Moscow, USSR.	101
ORNL	Oak Ridge National Laboratory, Oak Ridge, Tennessee.	462
PNL	Pacific Northwest Laboratory, Battelle Memorial Institute, Richland, Washington.	162
SORIN	Societa Ricerche e Impianti Nucleari, Saluggia, Italy.	676
SRL	Savannah River Laboratory, E.I. Du Pont Nemours and Co., Aiken, South Carolina.	294
Tokai	Tokai Research Establishment, Japan Atomic Energy Research Institute, Japan.	284
Total		12473

*Some of the tests attributed to SORIN were performed at Ispra.

13.2 Names of Reactor Concepts and Designs

CIRENE CISE Reactore a Nebbia (CISE Fog-cooled Reactor) CISE, Milan, Italy.

BHWR Boiling Heavy Water Reactor.

LWBR Light Water Breeder Reactor, Westinghouse Electric Corp., Pittsburgh, Pennsylvania.

SGHWR Steam Generating Heavy Water Reactor, United Kingdom Atomic Energy Authority.

TABLES 1-31 : GENERAL COMMENT

Tables 2A and 2B each occupy four pages; they are arranged so that the first page of Table 2A can be read in conjunction with the first of Table 2B, and so on. Other tables are set out in the conventional manner.

TABLE 1

COMPILATIONS OF BURNOUT DATA FOR AXIAL FLOW OF WATER THROUGH ROD BUNDLES AND ANNULI

Reference	Rod Bundles		Annuli		Remarks
	No. of Assemblies	No. of Tests	No. of Assemblies	No. of Tests	
Macbeth [1964]	23	459	-	-	
Barnett [1966]	26	727	23	724	6.9 MPa (1000 psia) only.
Barnett [1968]	40	1007	29	830	Updating of Barnett (1966), numbers for which are included. 6.9 MPa (1000 psia) only.
Tong et al. [1964]	18	366	34	953	DNB Data Library; also included a large amount of data for round tubes.
Hughes [1970b]	20	735	-	-	Pressures between 1 and 5 MPa.
Hughes et al. [1974]	126	4277	-	-	Organised for computer use; available as part of ERREST program package [Lintner 1970].
Mironov et al. [1978]	76	~6000	-	-	Organised for computer use.
This work	297	11203	24	1270	Organised for computer use.

NOTES TO TABLE 2A

1. -0., -0.0, -0.00, and -0.000 indicate that the item is not applicable or the information is not given in the source of data.
2. Data source references (col.2) are listed in Section 10.2.
3. The meanings of symbols used to indicate special features (col.3) are given in Table 2C.
4. The number of grids (col.16) includes only those occurring in the heated length of the channel.
5. The meanings of grid type reference numbers (col.17) are given in Table 2D.
6. The symbol '&' following a grid type reference number (col.17) indicates that different grid types are used in the same assembly. The number of grids is the total number of all types, but only the principal type reference number is indicated.
7. Confidential information has been omitted from the table.

TABLE 2A

MAIN CHARACTERISTICS OF TEST ASSEMBLIES

ASS.	DATA SRCE REF.	SPECIAL FEATRS	NO. OF RODS	ROD DIAM. MM	ROD GAP MM	ROD PITCH /DIAM.	HEATED LENGTH MM	LENGTH /HEATD EQ.DIA	HEATD/ WETTED PERIM.	FLOW AREA SQ.MM	HYD'C EQUIV. DIAM. MM	HEATED EQUIV. DIAM. MM	RADIAL FORM FACTOR	AXIAL FORM FACTOR	NO. OF GRIDS	GRID TYPE
1	1	X	3.	6.35	1.57	1.248	1372.	70.1	0.461	293.	[illegible]	19.58	1.000	1.000	18.	4.3 &
2	2	+#	4.	11.11	4.75	1.427	914.	46.5	0.538	687.	10.55	19.66	1.073	1.000	3.	3.2
3	2	+#	4.	11.11	4.75	1.427	1219.	61.9	0.538	687.	10.59	19.68	1.070	1.000	4.	3.2
4	3		19.	13.97	2.11	1.151	914.	95.0	0.783	2215.	7.54	9.63	1.131	1.000	4.	2.0
5	4		19.	13.97	2.11	1.151	1829.	189.9	0.783	2215.	7.54	9.63	1.163	1.000	8.	2.0
6	5,6	*7	7.	13.97	2.11	1.151	940.	118.7	0.665	687.	5.27	7.92	1.107	1.000	4.	2.0
7	7	X#	12.	11.18	0.56	1.050	432.	157.2	0.730	304.	2.01	2.75	1.030	1.000	3.	2.0
8	8	7	7.	12.70	2.54	1.200	1829.	116.1	0.556	943.	8.75	15.75	1.000	1.000	4.	4.2
9	9		19.	15.87	2.20	1.138	1219.	112.8	0.781	2778.	8.45	10.81	1.227	1.000	6.	1.0
10	9		19.	15.87	2.84	1.179	1219.	97.0	0.727	2821.	9.13	12.57	1.140	1.000	10.	5.0 &
11	9		19.	15.87	2.20	1.138	1219.	112.8	0.781	2778.	8.45	10.81	1.347	1.000	6.	1.0
13	9		19.	15.87	2.84	1.179	1219.	97.0	0.727	2821.	9.13	12.57	1.105	1.000	5.	5.0
14	9		19.	15.87	2.20	1.138	1219.	112.8	0.781	2778.	8.45	10.81	1.213	1.000	6.	2.0
15	9		19.	15.87	2.84	1.179	1219.	97.0	0.727	2821.	9.13	12.57	1.112	1.000	10.	10.0 $
16	9		19.	15.87	2.20	1.138	1219.	112.8	0.781	2778.	8.45	10.81	1.220	1.000	3.	2.0
17	9		19.	15.87	2.20	1.138	1219.	98.5	0.724	2779.	8.96	12.38	1.105	1.000	10.	8.0 &
18	9		19.	15.87	2.84	1.179	1219.	98.5	0.724	2779.	8.96	12.38	1.174	1.000	10.	7.0 &
19	11	+#	9.	11.11	4.75	1.427	762.	39.1	0.631	1531.	12.31	19.49	1.000	1.000	2.	3.2 &
20	11	+#	9.	11.11	4.75	1.427	762.	39.1	0.631	1531.	12.31	19.49	1.112	1.000	2.	3.2 &
21	12	X$	3.	10.01	6.40	1.639	835.	44.1	1.000	1047.	18.92	18.92	1.028	1.000	-0.	-0.0
22	12	X	3.	10.01	6.40	1.639	835.	18.8	0.426	1047.	18.92	44.40	1.000	1.000	-0.	-0.0
23	12	X$	3.	10.01	6.40	1.639	835.	44.1	1.000	1047.	18.92	18.92	1.879	1.000	-0.	-0.0
24	12	X$	3.	10.01	6.40	1.639	835.	44.1	1.000	1047.	18.92	18.92	1.514	1.000	-0.	-0.0
24	12	X$	3.	10.01	6.40	1.639	835.	44.1	1.000	1047.	18.92	18.92	1.291	1.000	-0.	-0.0
25	12	X$	3.	10.01	6.40	1.639	835.	44.1	1.000	1047.	18.92	18.92	1.191	1.000	-0.	-0.0
25	12	X$	3.	10.01	6.40	1.639	835.	44.1	1.000	1047.	18.92	18.92	1.169	1.000	-0.	-0.0
25	12	X$	3.	10.01	6.40	1.639	835.	44.1	1.000	1047.	18.92	18.92	1.142	1.000	-0.	-0.0
25	12	X$	3.	10.01	6.40	1.639	835.	44.1	1.000	1047.	18.92	18.92	1.109	1.000	-0.	-0.0
26	13	X	3.	13.80	8.80	1.638	4000.	76.5	0.442	1700.	23.09	52.27	1.000	1.000	-0.	-0.0
27	14		6.	13.80	11.60	1.841	4420.	93.9	0.538	3062.	25.35	47.08	1.000	1.000	4.	7.0
28	14	7	7.	13.80	7.80	1.565	4380.	103.7	0.476	2748.	20.13	42.25	1.000	1.000	4.	7.0
29	15		37.	13.80	7.80	1.565	4375.	119.5	0.735	14282.	26.89	36.60	1.000	1.000	7.	7.0
30	16	7	7.	10.00	4.00	1.400	3000.	148.3	0.603	1112.	12.21	20.23	1.000	1.000	-0.	-0.0
31	16		6.	10.00	4.00	1.400	3000.	118.7	0.566	1191.	14.30	25.27	1.000	1.000	-0.	-0.0
32	16	7	7.	10.00	4.00	1.400	3000.	127.1	0.517	1112.	12.21	23.60	1.000	1.000	-0.	-0.0
33	17		19.	19.81	1.02	1.051	457.	53.5	0.785	2528.	6.71	8.55	1.117	1.000	2.	3.2
34	17		19.	19.81	1.02	1.051	889.	104.0	0.785	2528.	6.71	8.55	1.125	1.000	4.	3.2
35	17		19.	19.81	1.02	1.051	1829.	213.9	0.785	2528.	6.71	8.55	1.117	1.000	8.	3.2
36	17		19.	19.81	1.02	1.051	2743.	320.8	0.785	2528.	6.71	8.55	1.141	1.000	12.	3.2
37	18		19.	15.54	1.02	1.065	1930.	256.4	0.782	1746.	5.88	7.53	1.077	1.000	7.	3.2
38	11	+#	9.	11.11	4.75	1.427	1524.	78.2	0.631	1531.	12.31	19.49	1.070	1.000	2.	3.2 &
39	19	X#	3.	12.70	3.94	1.310	4521.	200.3	0.498	675.	11.24	22.57	1.000	1.000	19.	3.4
40	19	X#	3.	12.70	5.51	1.434	4521.	200.3	0.498	675.	11.24	22.57	1.000	1.000	19.	3.4
41	20	7	7.	10.20	3.80	1.373	407.	21.4	0.610	1068.	11.62	19.05	1.000	1.000	0.	0.0
42	20	7	7.	10.20	3.80	1.373	407.	21.4	0.610	1068.	11.62	19.05	1.085	1.000	0.	0.0
43	20	7	7.	10.20	3.80	1.373	1634.	85.8	0.610	1068.	11.62	19.05	1.000	1.000	3.	3.4
44	20	7	7.	10.20	3.80	1.373	1634.	85.8	0.610	1068.	11.62	19.05	1.000	1.000	4.	4.3 &
45	20	7	7.	10.20	3.80	1.373	1634.	85.8	0.610	1068.	11.62	19.05	1.000	1.000	3.	4.3
46	21	7	7.	10.20	3.80	1.373	1634.	85.8	0.610	1068.	11.62	19.05	1.000	1.000	3.	3.4
47	21	7	7.	10.20	2.20	1.216	1630.	140.3	0.644	652.	7.48	11.62	1.000	1.000	3.	3.4
48	21	7	7.	10.20	1.25	1.123	1600.	210.5	0.667	426.	5.07	7.60	1.000	1.000	3.	3.4
49	21	7	7.	10.20	1.25	1.123	1634.	241.8	0.689	419.	4.66	6.76	1.072	1.000	7.	3.1 &
50	21	7	7.	10.20	1.25	1.123	1634.	175.3	0.673	578.	6.27	9.32	1.072	1.000	7.	3.1 &
51	21	7	7.	17.95	1.38	1.077	1645.	163.0	0.679	996.	6.85	10.09	1.000	1.000	3.	3.4
52	20	X	3.	5.01	2.00	1.399	711.	64.7	0.492	130.	5.41	11.00	1.000	1.000	6.	4.2
53	20	X	3.	5.01	2.00	1.399	686.	62.4	0.492	130.	5.41	11.00	1.000	1.000	6.	4.2
55	20	X	3.	5.01	2.00	1.399	730.	64.0	0.489	135.	5.58	11.41	1.000	1.000	7.	3.4
64	12	X$	3.	10.06	6.40	1.636	835.	59.0	1.000	725.	14.16	14.16	1.016	1.000	-0.	-0.0
65	12	X	3.	10.06	6.40	1.636	835.	27.3	0.463	725.	14.16	30.60	1.000	1.000	-0.	-0.0
66	12	X$	3.	10.06	6.40	1.636	835.	59.0	1.000	725.	14.16	14.16	1.089	1.000	-0.	-0.0
67	12	X$	3.	10.06	6.40	1.636	835.	59.0	1.000	725.	14.16	14.16	1.560	1.000	-0.	-0.0
68	12	X$	3.	10.06	6.40	1.636	835.	59.0	1.000	725.	14.16	14.16	1.201	1.000	-0.	-0.0
69	12	X$	3.	10.06	6.40	1.636	835.	59.0	1.000	725.	14.16	14.16	1.395	1.000	-0.	-0.0
70	25	#	1.	10.20	-0.00	-0.000	1183.	66.1	0.348	143.	6.23	17.89	1.000	1.000	3.	3.1
71	25	#	1.	10.20	-0.00	-0.000	560.	31.3	0.348	143.	6.23	17.89	1.000	1.000	1.	3.1
72	18		19.	15.54	1.02	1.065	1930.	256.4	0.782	1746.	5.88	7.53	1.077	1.000	31.	3.2 &
73	17		19.	19.81	1.02	1.051	1829.	213.9	0.785	2528.	6.71	8.55	1.119	1.000	24.	3.2 &
74	14		6.	13.90	11.50	1.827	4420.	95.0	0.540	3049.	25.14	46.54	1.000	1.000	4.	7.0
75	26		19.	19.81	1.02	1.051	2743.	303.9	0.743	2528.	6.71	9.03	1.107	1.000	12.	3.2
76	26		19.	19.74	0.97	1.049	2499.	267.2	0.742	2610.	6.94	9.35	1.111	1.223	-0.	-0.0
77	27	+#	9.	9.52	4.78	1.501	457.	20.0	0.602	1540.	13.76	22.87	1.154	1.000	2.	6.2
78	27	+#	9.	9.52	4.78	1.501	457.	20.0	0.602	1540.	13.76	22.87	1.369	1.000	2.	6.2
79	5	*7	7.	13.97	2.11	1.151	940.	102.0	0.638	708.	5.88	9.22	1.005	1.000	1.	4.1
80	28		19.	13.97	2.11	1.151	914.	95.0	0.783	2215.	7.54	9.63	1.124	1.000	4.	2.0
81	29		37.	13.80	7.80	1.565	4365.	119.3	0.735	14282.	26.89	36.60	1.180	1.000	7.	7.0
82	30		37.	13.80	7.80	1.565	4365.	119.3	0.735	14282.	26.89	36.60	1.098	1.185	7.	7.0
83	31	+#	9.	10.20	3.20	1.314	1183.	96.9	0.642	881.	7.84	12.21	1.000	1.000	5.	5.0
84	31	+#	9.	10.20	3.20	1.314	1183.	80.8	0.630	1056.	9.22	14.64	1.000	1.000	5.	5.0
85	32	+#*	2.	10.20	3.20	1.314	590.	12.0	0.177	395.	8.73	49.33	1.000	1.000	2.	3.1
86	32	+#*	2.	10.20	3.20	1.314	590.	23.9	0.354	395.	8.73	24.66	1.246	1.000	2.	3.1
87	32	+#*	2.	10.20	3.20	1.314	590.	23.9	0.354	395.	8.73	24.66	1.093	1.000	2.	3.1
88	32	+#*	2.	10.20	3.20	1.314	590.	23.9	0.354	395.	8.73	24.66	1.017	1.000	2.	3.1
89	32	+#*$	2.	10.20	3.20	1.314	590.	35.9	0.531	395.	8.73	16.44	1.567	1.000	2.	3.1
90	32	+#*$	2.	10.20	3.20	1.314	590.	35.9	0.531	395.	8.73	16.44	1.122	1.000	2.	3.1

TABLE 2B

NUMBER AND RANGE OF BURNOUT TESTS WITH EACH ASSEMBLY

ASS.	NO. OF TESTS	PRESSURE RANGE MPA	MASS FLUX RANGE G/S.SQCM	INLET QUALITY RANGE	BURNOUT QUALITY RANGE	BURNOUT HEAT FLUX RANGE W/SQCM
1	15.	6.895: 6.895	44.62: 100.50	-0.220:-0.054	0.204: 0.389	113.2: 187.4
2	18.	6.895: 6.895	23.87: 129.11	-0.468:-0.047	0.090: 0.461	124.6: 345.1
3	27.	6.895: 6.895	27.60: 207.37	-0.429:-0.022	0.099: 0.539	117.0: 324.0
4	4.	6.895: 6.895	66.59: 68.76	-0.102:-0.040	0.380: 0.417	120.1: 130.1
5	44.	6.998: 6.998	66.46: 272.60	-0.499:-0.040	0.178: 0.496	79.8: 231.6
6	5.	6.846: 6.895	72.56: 215.64	-0.238:-0.061	0.179: 0.439	122.0: 195.5
7	51.	8.274: 8.274	65.10: 554.70	-0.626:-0.000	-0.020: 0.524	84.7: 404.0
8	18.	6.895: 6.895	78.66: 204.79	-0.089:-0.003	0.225: 0.427	123.6: 191.8
9	40.	6.653: 6.895	35.26: 345.84	-0.324:-0.028	0.017: 0.647	97.9: 259.6
10	9.	6.729: 6.895	68.08: 203.43	-0.179:-0.019	0.124: 0.461	150.4: 266.4
11	19.	6.895: 6.895	68.35: 347.19	-0.329:-0.038	0.013: 0.347	98.0: 235.6
13	15.	6.805: 6.895	32.55: 200.72	-0.259:-0.040	0.158: 0.661	102.9: 294.6
14	15.	6.819: 6.895	65.10: 268.53	-0.255:-0.041	0.050: 0.374	116.0: 244.1
15	12.	6.791: 6.867	56.46: 264.46	-0.255:-0.036	0.200: 0.479	157.1: 275.3
16	16.	6.826: 6.895	63.74: 337.70	-0.260:-0.045	0.064: 0.383	118.8: 265.9
17	6.	6.833: 6.895	65.10: 265.82	-0.196:-0.046	0.022: 0.408	125.5: 246.1
18	12.	6.784: 6.874	65.10: 269.89	-0.255:-0.031	0.155: 0.521	163.9: 265.1
19	13.	6.895: 6.895	66.86: 138.88	-0.285:-0.025	0.101: 0.290	216.7: 301.9
20	30.	6.895: 6.895	40.69: 173.46	-0.420:-0.020	0.036: 0.393	191.2: 362.1
21	36.	1.520: 4.020	9.55: 14.02	-0.391:-0.171	0.589: 0.727	94.9: 125.5
22	89.	1.010: 4.560	3.41: 54.41	-0.407:-0.126	0.080: 0.849	88.2: 306.3
23	13.	1.570: 4.020	15.66: 24.54	-0.388:-0.171	0.227: 0.328	192.6: 201.2
24	11.	2.060: 4.020	17.57: 22.63	-0.359:-0.214	0.322: 0.405	193.1: 199.7
24	1.	2.540: 2.540	21.87: 21.87	-0.269:-0.269	0.418: 0.418	197.6: 197.6
25	2.	3.040: 3.040	10.03: 10.22	-0.306:-0.301	0.719: 0.731	125.9: 125.9
25	2.	3.040: 3.040	10.12: 10.12	-0.308:-0.306	0.740: 0.743	83.1: 83.1
25	2.	3.040: 3.040	10.12: 10.50	-0.306:-0.294	0.735: 0.762	88.7: 88.7
25	2.	2.840: 3.430	11.17: 11.54	-0.337:-0.286	0.670: 0.678	96.3: 96.6
26	39.	3.040: 4.510	19.63: 93.40	-0.230:-0.046	0.214: 0.486	72.7: 150.4
27	6.	5.000: 5.010	54.20: 148.50	-0.028:-0.008	0.220: 0.404	102.5: 150.3
28	31.	1.270: 5.020	35.60: 228.70	-0.087:-0.008	0.116: 0.448	61.4: 151.4
29	16.	4.950: 5.010	36.60: 107.20	-0.072:-0.010	0.226: 0.515	65.0: 103.2
30	30.	3.040: 6.960	21.00: 117.70	-0.575:-0.212	0.222: 0.595	60.0: 166.4
31	21.	3.040: 5.000	22.80: 94.10	-0.435:-0.187	0.242: 0.641	84.7: 181.2
32	26.	3.040: 6.960	28.30: 104.80	-0.563:-0.262	0.219: 0.569	86.8: 180.5
33	12.	6.860: 8.267	67.81: 268.53	-0.327:-0.028	-0.127: 0.224	125.8: 244.2
34	54.	3.337: 8.274	13.56: 410.94	-0.327:-0.022	-0.077: 0.777	30.8: 277.7
35	41.	3.316: 8.274	13.56: 406.87	-0.315:-0.020	0.049: 0.914	17.4: 161.2
36	32.	3.261: 8.239	13.56: 271.25	-0.326:-0.021	0.254: 0.983	19.2: 113.2
37	38.	6.895: 8.274	136.98: 410.94	-0.579: 0.391	-0.143: 0.618	39.7: 174.8
38	59.	4.137: 9.653	65.91: 172.92	-0.342:-0.011	0.137: 0.415	130.9: 331.5
39	44.	4.137: 9.653	33.23: 136.17	-0.283: 0.019	0.204: 0.785	45.1: 108.8
40	15.	6.895: 6.895	66.59: 135.76	-0.257:-0.033	0.191: 0.478	67.2: 114.5
41	27.	4.950: 5.000	107.00: 222.00	0.036: 0.608	0.119: 0.638	61.8: 318.8
42	22.	4.990: 6.480	109.00: 222.00	-0.254:-0.015	-0.131: 0.150	326.9: 525.1
43	70.	4.980: 6.520	74.00: 222.00	-0.347: 0.613	0.123: 0.688	25.0: 237.5
44	14.	5.020: 5.030	108.00: 112.00	-0.143: 0.598	0.250: 0.652	27.7: 204.3
45	21.	5.000: 5.090	108.00: 221.00	-0.190: 0.609	0.192: 0.652	22.5: 218.8
46	14.	6.476: 6.997	78.61: 151.50	-0.251:-0.081	0.160: 0.322	143.9: 231.9
47	83.	5.006: 7.066	76.75: 383.90	-0.276: 0.497	0.114: 0.620	28.4: 256.1
48	68.	5.036: 7.232	79.05: 387.20	-0.224: 0.412	0.095: 0.622	32.7: 227.3
49	51.	5.084: 7.297	79.08: 384.60	-0.217: 0.508	0.116: 0.646	46.8: 217.7
50	42.	5.054: 7.117	79.72: 387.40	-0.207: 0.057	-0.033: 0.378	59.1: 207.4
51	54.	5.032: 7.110	79.15: 369.00	-0.199: 0.420	0.168: 0.606	51.1: 151.9
52	94.	5.090: 8.940	109.00: 251.00	-0.154: 0.698	0.192: 0.733	22.2: 324.4
53	9.	4.970: 8.890	109.00: 110.00	0.021: 0.321	0.262: 0.454	91.8: 161.4
55	20.	7.000: 7.130	110.00: 151.00	0.135: 0.857	0.395: 0.877	15.5: 201.6
64	34.	1.570: 3.680	14.43: 43.08	-0.276:-0.113	0.398: 0.717	102.7: 190.9
65	56.	1.570: 3.730	8.64: 49.70	-0.447:-0.089	0.137: 0.469	100.0: 304.0
66	17.	1.570: 3.580	15.00: 25.46	-0.284:-0.134	0.608: 0.780	99.6: 145.6
67	20.	1.520: 3.530	18.17: 34.41	-0.288:-0.079	0.291: 0.446	144.5: 194.0
68	15.	1.570: 3.480	20.10: 39.50	-0.275:-0.131	0.343: 0.535	141.3: 191.3
69	5.	2.550: 3.530	32.76: 34.96	-0.215:-0.162	0.336: 0.373	189.8: 191.3
70	45.	3.187:13.072	91.80: 403.00	-0.696:-0.040	-0.405: 0.211	103.9: 492.8
71	62.	3.256:13.190	68.50: 418.50	-0.699:-0.006	-0.445: 0.156	146.0: 710.5
72	25.	6.895: 6.895	141.05: 410.94	-0.504: 0.190	0.105: 0.560	66.8: 172.4
73	20.	3.303: 8.246	13.56: 404.16	-0.323:-0.023	0.138: 0.835	18.8: 164.5
74	3.	5.030: 5.130	51.20: 102.20	-0.038:-0.031	0.259: 0.403	97.1: 127.8
75	24.	3.447: 8.274	27.12: 271.25	-0.324:-0.023	0.263: 0.855	32.8: 122.9
76	45.	5.171: 8.274	135.62: 271.25	-0.197: 0.189	0.307: 0.483	73.1: 147.1
77	22.	6.895: 9.756	75.27: 154.61	-0.072: 0.233	0.011: 0.330	145.1: 271.3
78	5.	6.874: 6.929	75.27: 76.76	0.008: 0.173	0.140: 0.260	173.5: 258.7
79	3.	6.860: 6.895	69.17: 191.23	-0.054:-0.046	0.210: 0.375	107.0: 177.3
80	13.	6.881: 6.895	67.81: 271.25	-0.321:-0.049	0.090: 0.344	137.0: 314.1
81	38.	3.000: 8.730	42.01: 178.90	-0.086:-0.007	0.181: 0.489	85.7: 127.0
82	82.	2.960: 6.970	19.70: 136.60	-0.189:-0.008	0.246: 0.735	35.8: 98.2
83	57.	8.430:14.460	46.40: 226.50	-0.448:-0.029	-0.006: 0.499	86.9: 183.3
84	178.	7.890:15.610	41.40: 309.00	-0.604:-0.018	-0.113: 0.533	99.9: 278.5
85	20.	12.750:13.140	50.10: 230.00	-0.446:-0.103	-0.364:-0.005	178.8: 444.8
86	5.	13.140:13.340	50.30: 221.40	-0.429:-0.273	-0.246:-0.045	221.6: 395.7
87	4.	12.850:13.140	50.00: 227.70	-0.452:-0.290	-0.282:-0.077	245.0: 437.9
88	14.	5.150:13.340	49.40: 224.60	-0.448:-0.030	-0.263: 0.104	179.3: 450.2
89	5.	12.750:13.290	135.50: 151.00	-0.374:-0.098	-0.186: 0.024	203.2: 335.5
90	5.	12.940:13.140	135.00: 141.00	-0.415:-0.015	-0.148: 0.130	172.6: 320.1

TABLE 2A (CONTINUED)

MAIN CHARACTERISTICS OF TEST ASSEMBLIES

ASS.	DATA SRCE REF.	SPECIAL FEATRS	NO. OF RODS	ROD DIAM. MM	ROD GAP MM	ROD PITCH /DIAM.	HEATED LENGTH MM	LENGTH /HEATD EQ.DIA	HEATD/ WETTED PERIM.	FLOW AREA SQ.MM	HYD'C EQUIV. DIAM. MM	HEATED EQUIV. DIAM. MM	RADIAL FORM FACTOR	AXIAL FORM FACTOR	NO. OF GRIDS	GRID TYPE
91	32	+#*$	2.	10.20	3.20	1.314	590.	47.8	0.708	395.	8.73	12.33	1.763	1.000	2.	3.1
92	32	+#*$	2.	10.20	3.20	1.314	590.	47.8	0.708	395.	8.73	12.33	1.501	1.000	2.	3.1
93	32	+#*$	2.	10.20	3.20	1.314	590.	47.8	0.708	395.	8.73	12.33	1.133	1.000	2.	3.1
94	33	+#	9.	10.20	3.20	1.314	1183.	74.0	0.553	1024.	8.64	15.98	1.000	1.000	5.	5.0
95	33	+#	9.	10.20	3.20	1.314	1183.	53.9	0.420	1056.	9.22	21.96	1.000	1.000	5.	5.0
96	33	+#	9.	10.20	3.20	1.314	1183.	44.9	0.350	1056.	9.22	26.35	1.081	1.000	5.	5.0
97	33	+#	9.	10.20	3.20	1.314	1183.	46.3	0.346	1024.	8.84	25.57	1.081	1.000	5.	5.0
98	33	+#	9.	10.20	3.20	1.314	1183.	80.8	0.630	1056.	9.22	14.64	1.298	1.000	5.	5.0
99	33	+#	9.	10.20	3.20	1.314	1183.	46.3	0.346	1024.	8.84	25.57	1.000	1.728	5.	5.0
100	12	X	3.	10.06	6.40	1.636	1670.	54.6	0.463	725.	14.16	30.60	1.000	1.000	-0.	-0.0
101	12	X$	3.	10.06	6.40	1.636	1670.	117.9	1.000	725.	14.16	14.16	1.701	1.000	-0.	-0.0
101	12	X$	3.	10.06	6.40	1.636	1670.	117.9	1.000	725.	14.16	14.16	1.623	1.000	-0.	-0.0
101	12	X$	3.	10.06	6.40	1.636	1670.	117.9	1.000	725.	14.16	14.16	1.551	1.000	-0.	-0.0
102	12	X$	3.	10.06	6.40	1.636	1670.	117.9	1.000	725.	14.16	14.16	1.452	1.000	-0.	-0.0
102	12	X$	3.	10.06	6.40	1.636	1670.	117.9	1.000	725.	14.16	14.16	1.380	1.000	-0.	-0.0
102	12	X$	3.	10.06	6.40	1.636	1670.	117.9	1.000	725.	14.16	14.16	1.315	1.000	-0.	-0.0
103	12	X$	3.	10.06	6.40	1.636	1670.	117.9	1.000	725.	14.16	14.16	1.236	1.000	-0.	-0.0
103	12	X$	3.	10.06	6.40	1.636	1670.	117.9	1.000	725.	14.16	14.16	1.191	1.000	-0.	-0.0
103	12	X$	3.	10.06	6.40	1.636	1670.	117.9	1.000	725.	14.16	14.16	1.126	1.000	-0.	-0.0
104	12	X$	3.	10.06	6.40	1.636	1670.	117.9	1.000	725.	14.16	14.16	1.093	1.000	-0.	-0.0
104	12	X$	3.	10.06	6.40	1.636	1670.	117.9	1.000	725.	14.16	14.16	1.034	1.000	-0.	-0.0
104	12	X$	3.	10.06	6.40	1.636	1670.	117.9	1.000	725.	14.16	14.16	1.003	1.000	-0.	-0.0
105	12	X$	3.	10.06	6.40	1.636	1670.	117.9	1.000	725.	14.16	14.16	1.042	1.000	-0.	-0.0
105	12	X$	3.	10.06	6.40	1.636	1670.	117.9	1.000	725.	14.16	14.16	1.096	1.000	-0.	-0.0
106	12	X	3.	13.00	2.00	1.154	830.	27.0	0.486	941.	14.93	30.74	1.000	1.000	1.	4.2
107	12	X	3.	13.00	6.00	1.462	830.	27.0	0.486	941.	14.93	30.74	1.000	1.000	1.	4.2
108	12	X*	3.	13.00	6.00	1.462	830.	34.5	0.369	736.	8.88	24.04	1.000	1.000	1.	4.2
109	12	7	7.	10.06	6.00	1.596	1670.	65.8	0.585	1403.	14.84	25.37	1.000	1.000	4.	12.0 &
110	12	7	7.	10.06	6.00	1.596	1670.	34.7	0.524	2661.	25.20	48.11	1.000	1.000	4.	12.0 &
111	12	7	7.	10.06	6.00	1.596	1670.	19.5	0.462	4725.	39.47	85.42	1.000	1.000	4.	12.0 &
112	13	X	3.	13.80	7.80	1.565	4440.	90.6	0.448	1594.	21.97	49.03	1.000	1.000	-0.	-0.0
113	34	+#>	9.	10.67	3.51	1.329	1829.	136.0	0.639	1014.	8.59	13.45	1.000	1.160	5.	5.0
114	35	+#	9.	10.67	3.51	1.329	1829.	136.0	0.639	1014.	8.59	13.45	1.000	1.000	5.	5.0
115	36	+#	16.	14.29	4.46	1.312	1829.	99.1	0.711	3314.	13.13	18.46	1.000	1.000	7.	3.2
116	36	+#	16.	14.29	4.46	1.312	1829.	99.1	0.711	3314.	13.13	18.46	1.000	1.000	4.	10.0
117	36	+#	16.	14.29	4.46	1.312	1829.	99.1	0.711	3314.	13.13	18.46	1.000	1.000	3.	10.0
118	36	+#	16.	14.29	4.46	1.312	1829.	99.1	0.711	3314.	13.13	18.46	1.250	1.000	7.	3.2
119	37	+#	21.	10.72	3.40	1.318	1524.	93.4	0.717	2885.	11.70	16.32	1.066	1.000	5.	7.0
120	37	+#	21.	10.72	3.40	1.318	1524.	93.4	0.717	2885.	11.70	16.32	1.086	1.000	5.	11.0
121	38	+#	16.	14.29	3.33	1.233	1829.	115.1	0.713	2851.	11.32	15.88	1.320	1.000	7.	3.2
121	38	+#	16.	14.29	3.33	1.233	1829.	115.1	0.713	2851.	11.32	15.88	1.320	1.000	7.	3.2
122	38	+#	16.	14.29	3.33	1.233	1829.	115.1	0.713	2851.	11.32	15.88	1.320	1.000	8.	3.2 &
123	38	EL+#	16.	14.29	3.33	1.233	1829.	115.1	0.713	2851.	11.32	15.88	1.320	1.000	7.	3.2
124	39	+#@	9.	14.48	4.27	1.295	1829.	94.5	0.653	1980.	12.63	19.35	1.000	1.000	4.	10.0
125	39	+#	9.	14.48	4.27	1.295	1829.	94.5	0.653	1980.	12.63	19.35	1.000	1.000	3.	10.0
126	36	+#	16.	14.29	4.46	1.312	1829.	99.1	0.711	3314.	13.13	18.46	1.250	1.000	3.	10.0
127	40		19.	14.33	1.88	1.131	470.	44.5	0.767	2257.	8.10	10.56	1.067	1.000	2.	1.0
128	41	+#	20.	12.70	4.19	1.330	2438.	134.6	0.716	3614.	12.96	18.12	1.500	1.000	4.	7.0
129	41	+#	20.	12.70	4.19	1.330	2438.	134.6	0.716	3614.	12.96	18.12	1.000	1.000	4.	7.0
130	39	+#	9.	14.48	4.27	1.295	1829.	94.5	0.653	1980.	12.63	19.35	1.000	1.000	3.	10.0
131	39	+#	9.	14.48	4.27	1.295	1829.	94.5	0.653	1980.	12.63	19.35	1.000	1.000	4.	10.0
132	40	=	19.	15.98	0.38	1.024	495.	79.4	0.798	1510.	4.98	6.24	1.010	1.000	4.	1.0 &
133	40	=	19.	14.91	1.27	1.085	495.	55.0	0.774	2004.	6.97	9.01	1.000	1.000	4.	1.0 &
134	40	=	19.	14.91	1.27	1.085	495.	58.0	0.816	2004.	6.97	8.55	1.035	1.000	4.	1.0 &
135	40	=	19.	14.91	1.27	1.085	1943.	227.4	0.816	2004.	6.97	8.55	1.048	1.000	8.	1.0
136	42		19.	14.33	1.88	1.131	495.	46.9	0.767	2258.	8.10	10.56	1.069	1.000	2.	3.2
137	43		19.	14.91	1.27	1.085	1930.	225.9	0.834	2004.	7.13	8.55	1.048	1.000	8.	1.0
138	11	+#	9.	14.48	4.65	1.321	1829.	94.0	0.648	1991.	12.61	19.45	1.000	1.000	4.	3.2
139	11	+#	9.	14.48	4.65	1.321	1829.	120.3	0.664	1556.	10.09	15.21	1.000	1.000	4.	3.2
140	44		19.	14.91	1.27	1.085	495.	48.8	0.774	2258.	7.86	10.15	1.000	1.000	2.	3.2
141	45	+#	9.	14.33	4.42	1.309	1829.	96.4	0.650	1921.	12.34	18.97	1.000	1.000	3.	10.0
142	46	+#	16.	14.27	4.44	1.311	3658.	195.9	0.711	3348.	13.27	18.67	1.000	1.387	8.	10.0
143	47	*	1.	12.70	-0.00	-0.000	1219.	95.7	0.313	127.	3.99	12.74	1.000	1.000	12.	4.1
144	47	*	1.	14.33	-0.00	-0.000	1219.	148.3	0.340	93.	2.79	8.22	1.000	1.000	12.	4.1
145	48	#	2.	11.11	4.75	1.427	762.	31.5	0.423	422.	10.22	24.16	1.000	1.000	-0.	-0.0
146	47	*$C	1.	12.70	-0.00	-0.000	1219.	159.6	0.522	127.	3.99	7.64	1.414	1.000	14.	4.1
147	49	+#	4.	10.00	3.50	1.350	1900.	107.7	0.539	554.	9.51	17.64	1.000	1.000	5.	10.0
148	49	+#C	4.	10.00	3.50	1.350	1900.	107.7	0.539	554.	9.51	17.64	2.294	1.000	5.	10.0
149	49	+#	4.	10.00	3.50	1.350	1900.	26.9	0.135	554.	9.51	70.55	1.000	1.000	5.	10.0
150	45	+#C	4.	10.00	3.50	1.350	1900.	107.7	0.539	554.	9.51	17.64	1.283	1.000	5.	10.0
151	50	N7>I	7.	12.70	10.30	1.811	1600.	37.7	0.559	2962.	23.73	42.42	1.004	1.245	1.	13.1
152	50	N7<I	7.	13.25	9.75	1.736	1600.	40.4	0.570	2883.	22.56	39.58	1.029	1.368	1.	13.1
153	50	N7<I	7.	13.25	9.75	1.736	1600.	40.4	0.570	2883.	22.56	39.58	1.029	1.368	1.	13.1
154	49	+#C	4.	10.00	3.50	1.350	1900.	107.7	0.539	554.	9.51	17.64	1.403	1.000	5.	10.0
155	49	+#C	4.	10.00	3.50	1.350	1900.	107.7	0.539	554.	9.51	17.64	1.187	1.000	5.	10.0
156	49	+#C	4.	10.00	3.50	1.350	1900.	107.7	0.539	554.	9.51	17.64	2.180	1.000	5.	10.0
157	51	+#	9.	11.70	14.30	2.222	1700.	23.4	0.501	6014.	36.44	72.71	1.000	1.000	-0.	-0.0
158	51	+#	9.	11.70	14.30	2.222	1700.	25.4	0.498	5538.	33.31	66.96	1.000	1.000	-0.	-0.0
159	51	X	3.	13.80	6.80	1.493	4000.	81.6	0.448	1594.	21.96	49.02	1.000	1.473	-0.	-0.0
160	52	X#	20.	19.05	0.38	1.020	2388.	539.1	0.773	1325.	3.42	4.43	1.500	1.000	23.	3.5 &
161	53	X#	7.	5.00	1.70	1.340	500.	70.3	0.618	195.	4.39	7.11	1.000	1.000	2.	3.3
162	52	X#(	20.	19.05	0.38	1.020	2388.	539.1	0.773	1325.	3.42	4.43	1.500	1.000	23.	3.5 &
163	53	X#	7.	5.00	2.75	1.550	500.	70.3	0.618	195.	4.39	7.11	1.000	1.000	2.	3.3
164	52	X#*	20.	19.05	0.38	1.020	2388.	721.0	0.737	991.	2.44	3.31	1.500	1.000	23.	3.5 &

TABLE 2B (CONTINUED)

NUMBER AND RANGE OF BURNOUT TESTS WITH EACH ASSEMBLY

ASS.	NO. OF TESTS	PRESSURE RANGE	MASS FLUX RANGE	INLET QUALITY RANGE	BURNOUT QUALITY RANGE	BURNOUT HEAT FLUX RANGE
		MPA	G/S.SQCM			W/SQCM
91	4.	13.090:13.340	149.60: 156.60	-0.368:-0.076	-0.186: 0.049	205.3: 310.3
92	3.	12.700:13.190	153.60: 156.00	-0.319:-0.085	-0.106: 0.055	193.4: 293.5
93	8.	12.750:13.630	132.70: 160.90	-0.387:-0.109	-0.077: 0.087	198.2: 314.2
94	41.	7.650:13.630	50.00: 240.20	-0.658:-0.043	-0.071: 0.427	96.3: 213.3
95	22.	12.550:14.220	44.30: 238.10	-0.402:-0.117	-0.174: 0.255	102.7: 267.0
96	64.	12.870:15.490	92.30: 300.90	-0.776:-0.116	-0.479: 0.082	127.4: 305.4
97	34.	4.220:13.580	50.80: 234.90	-0.518:-0.036	-0.218: 0.280	106.7: 237.8
98	24.	8.340:13.730	51.10: 235.00	-0.540:-0.039	-0.005: 0.405	108.7: 178.0
99	61.	2.340:15.470	46.20: 302.80	-0.600:-0.038	-0.361: 0.281	28.0: 294.5
100	44.	2.060: 4.020	16.40: 133.00	-0.289:-0.138	0.111: 0.428	94.3: 299.3
101	24.	2.060: 4.220	19.68: 52.03	-0.307:-0.159	0.286: 0.521	98.5: 162.1
101	6.	2.060: 4.270	21.34: 53.41	-0.306:-0.170	0.337: 0.533	104.4: 159.8
101	4.	2.060: 4.130	22.65: 49.28	-0.271:-0.204	0.335: 0.548	104.4: 158.5
102	15.	2.060: 4.130	23.95: 56.57	-0.307:-0.178	0.313: 0.542	103.1: 160.9
102	14.	2.060: 4.120	21.89: 59.05	-0.324:-0.184	0.345: 0.581	96.4: 159.2
102	6.	2.060: 4.270	26.15: 59.74	-0.273:-0.191	0.358: 0.576	104.1: 158.9
103	7.	2.060: 4.170	27.53: 62.49	-0.264:-0.180	0.395: 0.579	102.8: 159.2
103	13.	2.060: 4.270	25.74: 59.60	-0.312:-0.171	0.383: 0.592	99.6: 158.5
103	7.	2.060: 4.220	30.70: 67.45	-0.242:-0.182	0.383: 0.599	102.8: 160.3
104	3.	3.040: 3.040	30.45: 66.62	-0.280:-0.179	0.400: 0.580	105.3: 158.5
104	13.	2.060: 4.270	27.53: 69.92	-0.370:-0.133	0.401: 0.602	102.6: 160.5
104	2.	3.040: 4.020	34.14: 35.10	-0.249:-0.239	0.559: 0.576	103.2: 104.9
105	4.	2.060: 4.120	36.20: 38.27	-0.253:-0.204	0.496: 0.578	104.2: 105.9
105	4.	2.060: 4.220	37.44: 39.92	-0.249:-0.232	0.503: 0.633	102.8: 104.9
106	11.	0.360: 0.950	7.68: 20.39	-0.213:-0.130	0.030: 0.232	62.7: 65.5
107	38.	0.320: 0.970	3.67: 35.17	-0.238:-0.124	-0.003: 0.517	47.1: 115.5
108	39.	0.270: 1.060	7.60: 36.51	-0.238:-0.118	0.026: 0.377	66.0: 114.2
109	40.	1.080: 4.020	17.96: 68.15	-0.311:-0.066	0.203: 0.567	86.1: 226.5
110	29.	3.040: 4.020	7.84: 43.81	-0.360:-0.082	0.169: 0.611	90.9: 204.2
111	25.	3.040: 4.020	6.68: 29.09	-0.277:-0.120	0.126: 0.565	117.4: 215.7
112	5.	3.040: 3.040	52.80: 117.60	-0.044:-0.028	0.224: 0.350	101.8: 146.5
113	81.	13.599:16.656	135.76: 483.17	-0.760:-0.073	-0.031: 0.254	61.6: 277.7
114	513.	6.657:16.956	26.62: 492.98	-0.812:-0.017	-0.056: 0.743	33.8: 246.5
115	54.	4.137: 8.618	34.45: 174.55	-0.422:-0.031	0.182: 0.619	86.4: 245.7
116	48.	4.137: 8.618	34.45: 173.05	-0.404:-0.027	0.196: 0.628	90.2: 253.6
117	26.	6.895: 6.895	68.63: 179.84	-0.404:-0.029	0.170: 0.469	133.8: 254.3
118	26.	6.895: 6.895	68.76: 174.55	-0.384:-0.033	0.125: 0.441	155.5: 316.4
119	17.	4.585:10.342	201.40: 410.80	-0.265:-0.010	-0.028: 0.229	184.9: 312.3
120	32.	5.171:10.342	135.62: 409.58	-0.263:-0.042	0.016: 0.257	159.3: 340.1
121	14.	6.895: 6.895	67.68: 243.71	-0.250:-0.040	0.119: 0.413	133.8: 218.3
121	26.	5.171: 6.895	67.54: 244.26	-0.404:-0.032	0.066: 0.389	128.4: 259.3
122	39.	6.895: 6.895	66.32: 245.07	-0.410:-0.030	0.033: 0.408	106.0: 259.6
123	15.	6.895: 6.895	67.54: 246.16	-0.236:-0.036	-0.008: 0.325	106.3: 198.7
124	142.	4.089: 9.784	33.36: 205.88	-0.671:-0.012	0.081: 0.614	92.7: 277.9
125	121.	4.123: 9.673	33.50: 169.53	-0.658:-0.011	0.016: 0.591	89.0: 259.3
126	4.	6.895: 6.895	103.21: 106.19	-0.252:-0.041	0.200: 0.298	171.9: 222.4
127	14.	8.375: 8.375	65.10: 397.38	-0.460:-0.017	-0.011: 0.310	184.9: 310.4
128	43.	8.274:13.790	16.95: 275.31	-0.967:-0.078	-0.169: 0.698	52.1: 214.5
129	60.	8.274:13.790	16.95: 269.89	-1.070:-0.066	0.062: 0.844	33.1: 163.1
130	35.	6.800: 6.998	33.36: 169.26	-0.645:-0.011	0.111: 0.610	91.2: 268.1
131	34.	5.206: 7.205	33.09: 153.80	-0.365:-0.018	0.159: 0.609	85.5: 258.7
132	19.	8.375: 8.375	67.81: 546.56	-0.448:-0.045	-0.279: 0.112	44.8: 300.6
133	17.	8.375: 8.375	67.61: 545.20	-0.469:-0.028	-0.218: 0.168	78.5: 364.0
134	18.	8.375: 8.375	67.81: 680.83	-0.611:-0.045	-0.268: 0.170	93.4: 495.3
135	21.	8.375: 8.375	67.81: 410.94	-0.604:-0.112	0.069: 0.359	54.9: 155.5
136	7.	8.274: 8.274	67.81: 203.43	-0.070: 0.341	0.099: 0.498	86.4: 256.5
137	15.	8.377: 8.377	67.81: 412.29	-0.609:-0.037	0.107: 0.508	59.9: 161.5
138	35.	6.895: 6.895	65.64: 164.65	-0.420:-0.018	0.248: 0.494	114.5: 203.8
139	14.	6.895: 6.895	61.30: 103.48	-0.391:-0.034	0.269: 0.511	118.6: 171.9
140	19.	8.377: 8.377	67.81: 679.47	-0.611:-0.079	-0.337: 0.098	92.1: 506.3
141	63.	5.440: 6.943	32.83: 137.11	-0.531:-0.010	0.194: 0.662	93.3: 258.3
142	50.	5.495: 6.957	33.65: 136.84	-0.254:-0.032	0.276: 0.731	22.6: 113.5
143	4.	6.895: 6.895	135.62: 257.68	-0.408:-0.177	0.132: 0.224	221.5: 357.7
144	2.	6.895: 6.695	162.75: 189.87	-0.397:-0.351	0.177: 0.209	232.8: 278.2
145	65.	4.137: 9.653	64.56: 263.92	0.002: 0.895	0.187: 0.910	7.6: 184.9
146	5.	6.895: 6.895	135.62: 311.93	-0.348:-0.243	0.028: 0.181	181.7: 352.1
147	23.	13.750:13.750	48.90: 295.50	-0.336:-0.094	-0.118: 0.631	78.3: 159.7
148	11.	13.730:13.730	88.90: 174.60	-0.390:-0.374	-0.177:-0.029	164.5: 223.9
149	33.	6.860:13.730	127.10: 294.40	-0.385:-0.027	-0.287: 0.059	190.4: 284.5
150	2.	13.730:13.730	168.60: 221.00	-0.377:-0.373	-0.147:-0.071	164.5: 165.4
151	1.	2.837: 2.837	55.80: 55.80	-0.013:-0.013	0.188: 0.188	133.7: 133.7
152	5.	0.365: 1.520	14.10: 54.80	-0.033:-0.005	0.148: 0.403	80.5: 273.9
153	1.	2.837: 2.837	29.90: 29.90	-0.009:-0.009	0.329: 0.329	111.7: 111.7
154	2.	6.850: 6.850	202.50: 202.60	-0.071:-0.070	0.090: 0.091	161.0: 161.7
155	3.	6.850: 6.850	16[illegible].10: 238.70	-0.074:-0.071	0.092: 0.156	143.7: 173.7
156	16.	6.860: 6.860	113.00: 225.10	-0.097:-0.069	0.035: 0.124	155.8: 193.8
157	62.	4.000: 9.800	106.40: 199.30	-0.209:-0.014	-0.046: 0.107	201.3: 401.3
158	38.	6.000: 9.800	69.10: 198.00	-0.221:-0.026	-0.047: 0.159	194.0: 343.0
159	18.	3.040: 8.924	21.10: 98.80	-0.586:-0.079	-0.058: 0.188	57.0: 133.8
160	60.	8.274:13.790	20.21: 406.87	-1.077:-0.112	-0.484: 0.658	9.8: 101.7
161	160.	2.940:13.700	31.50: 493.50	-0.720: 0.230	-0.186: 0.530	87.0: 398.0
162	21.	8.274:13.790	69.03: 210.08	-1.070:-0.112	-0.476: 0.290	15.9: 78.1
163	37.	6.860: 6.860	77.40: 167.00	-0.440: 0.440	0.026: 0.640	85.0: 228.0
164	48.	8.274:13.790	34.58: 413.65	-1.075:-0.114	-0.121: 0.634	14.7: 114.5

TABLE 2A (CONTINUED)

MAIN CHARACTERISTICS OF TEST ASSEMBLIES

ASS.	DATA SRCE REF.	SPECIAL FEATRS	NO. OF RODS	ROD DIAM. MM	ROD GAP MM	ROD PITCH /DIAM.	HEATED LENGTH MM	LENGTH /HEATD EQ.DIA	HEATD/ WETTED PERIM.	FLOW AREA SQ.MM	HYD'C EQUIV. DIAM. MM	HEATED EQUIV. DIAM. MM	RADIAL FORM FACTOR	AXIAL FORM FACTOR	NO. OF GRIDS	GRID TYPE
165	54		19.	19.97	1.53	1.077	3000.	309.3	0.781	2890.	7.58	9.70	1.000	1.000	5.	6.1
166	52	X#*	20.	19.05	0.38	1.020	2388.	721.0	0.737	991.	2.44	3.31	1.000	1.000	23.	3.5 &
167	54		19.	19.97	1.50	1.075	3000.	309.3	0.781	2890.	7.58	9.70	1.512	1.000	5.	6.1
168	56	+#	21.	10.72	3.40	1.318	1524.	94.8	0.714	2843.	11.43	16.08	1.087	1.000	4.	7.0
169	55		19.	19.97	1.50	1.075	3000.	309.3	0.781	2890.	7.58	9.70	1.105	1.000	5.	6.1
170	56	+#	21.	10.72	3.40	1.318	1524.	116.4	0.747	2734.	9.77	13.09	1.246	1.000	4.	2.0
171	55		19.	19.97	1.50	1.075	3000.	309.3	0.781	2890.	7.58	9.70	1.105	1.000	5.	13.0
172	56	X#	19.	10.72	4.42	1.412	1524.	87.9	0.720	2772.	12.47	17.33	1.097	1.000	4.	7.0
173	55		19.	19.97	1.50	1.075	3000.	309.3	0.781	2890.	7.58	9.70	1.000	1.000	5.	13.0
174	56	X#	19.	10.72	4.42	1.412	1524.	118.7	0.764	2588.	9.81	12.84	1.341	1.000	4.	2.0
175	57	+#<¬	16.	15.06	4.24	1.282	2700.	145.9	0.712	3502.	13.18	18.50	1.000	1.444	6.	5.1
176	58	N	37.	13.80	7.80	1.565	4365.	119.3	0.735	14282.	26.89	36.60	1.180	1.000	7.	7.0
177	59	+#	25.	10.72	3.38	1.315	2134.	140.6	0.740	3194.	11.24	15.18	1.000	1.000	10.	10.0 &
178	59	+#	25.	10.72	3.38	1.315	2134.	128.7	0.708	3350.	11.74	16.58	1.118	1.000	10.	10.0 &
179	59	+#	25.	10.72	3.38	1.315	2134.	129.1	0.702	3339.	11.60	16.53	1.098	1.000	10.	10.0 &
180	59	+#	25.	10.72	3.38	1.315	2134.	134.0	0.738	3350.	11.74	15.92	1.122	1.000	10.	10.0 &
181	60	*7	7.	12.70	1.59	1.125	295.	39.2	0.645	526.	4.86	7.54	1.000	1.000	1.	3.2
182	61	7	7.	17.96	1.38	1.077	1635.	161.7	0.679	999.	6.87	10.11	1.000	1.000	3.	7.0
183	61	7	7.	17.96	1.38	1.077	1615.	159.7	0.679	999.	6.87	10.11	1.000	1.000	3.	6.2
184	60	*7$C	7.	12.70	1.59	1.125	295.	50.6	0.834	526.	4.86	5.83	1.222	1.000	1.	3.2
185	62		19.	20.00	1.50	1.075	3816.	396.5	0.782	2872.	7.52	9.62	1.141	1.000	9.	7.0
186	62		19.	20.00	1.40	1.070	3816.	396.5	0.782	2872.	7.52	9.62	1.141	1.000	42.	6.2 &
187	62		19.	20.00	1.50	1.075	3816.	408.6	0.754	2788.	7.04	9.34	1.141	1.000	9.	7.0
188	60	*7$C	7.	12.70	1.59	1.125	295.	50.6	0.834	526.	4.86	5.83	1.181	1.000	1.	3.2
189	60	*7$C	7.	12.70	1.59	1.125	295.	50.6	0.834	526.	4.86	5.83	1.157	1.000	1.	3.2
190	60	*7$C	7.	12.70	1.59	1.125	295.	50.6	0.834	526.	4.86	5.83	1.122	1.000	1.	3.2
191	60	*7$C	7.	12.70	1.59	1.125	295.	50.6	0.834	526.	4.86	5.83	1.096	1.000	1.	3.2
192	60	*7$C	7.	12.70	1.59	1.125	295.	50.6	0.834	526.	4.86	5.83	1.081	1.000	1.	3.2
193	60	*7$C	7.	12.70	1.59	1.125	295.	50.6	0.834	526.	4.86	5.83	1.086	1.000	1.	3.2
194	63		19.	20.00	15.30	1.765	6000.	621.6	0.782	2881.	7.54	9.65	1.128	1.000	12.	7.0
200	65	+#	16.	15.00	4.50	1.300	3660.	195.7	0.712	3525.	13.31	18.70	1.007	1.000	7.	10.0
201	65	+#	16.	15.00	4.50	1.300	3660.	195.7	0.712	3525.	13.31	18.70	1.203	1.000	7.	10.0
202	65	+#	16.	15.00	4.50	1.300	3660.	195.7	0.712	3525.	13.31	18.70	1.203	1.000	7.	10.0
203	65	+#	16.	15.00	4.50	1.300	3660.	195.7	0.712	3525.	13.31	18.70	1.196	1.000	7.	10.0
204	65	+#	16.	15.00	4.50	1.300	3660.	195.7	0.712	3525.	13.31	18.70	1.197	1.000	7.	10.0
205	65	+#	16.	15.00	4.50	1.300	3660.	195.7	0.712	3525.	13.31	18.70	1.263	1.000	7.	10.0
206	66	"	19.	15.24	1.27	1.083	489.	58.9	0.778	1886.	6.45	8.29	1.086	1.000	7.	3.3 &
207	66	"	19.	15.24	1.27	1.083	489.	58.9	0.778	1886.	6.45	8.29	1.086	1.000	8.	3.3 &
208	66	"	19.	15.24	1.27	1.083	489.	58.9	0.778	1886.	6.45	8.29	1.086	1.000	10.	3.3 &
209	66	"	19.	15.24	1.27	1.083	489.	58.9	0.778	1886.	6.45	8.29	1.086	1.000	12.	3.3 &
210	66	"M	19.	15.24	1.27	1.083	489.	58.9	0.778	1886.	6.45	8.29	1.086	1.000	7.	3.3 &
211	66	"M	19.	15.24	1.27	1.083	489.	58.9	0.778	1886.	6.45	8.29	1.086	1.000	12.	3.3 &
212	67	X#*¬<:	24.	14.50	1.52	1.105	2134.	245.4	0.760	2283.	6.61	8.69	1.286	1.452	4.	8.3 &
213	68	X#>¬	29.	7.65	1.70	1.223	2419.	413.3	0.793	1019.	4.64	5.85	1.568	2.258	7.	8.3
214	68	X#>¬	29.	7.65	1.70	1.223	2419.	413.3	0.793	1019.	4.64	5.85	1.638	2.315	7.	8.3
215	68	X#>¬	29.	7.65	1.70	1.223	2419.	413.3	0.793	1019.	4.64	5.85	1.736	2.257	7.	8.3
216	69	+#	25.	10.77	3.53	1.328	1676.	104.4	0.636	2987.	10.21	16.05	1.085	1.000	2.	11.0
217	69	+#@	25.	10.69	3.43	1.321	1829.	114.3	0.603	2821.	9.64	15.99	1.093	1.000	4.	11.0
218	70	+#	9.	10.49	1.40	1.133	235.	31.1	0.677	561.	5.12	7.56	1.000	1.000	0.	0.0
219	71	X#	7.	9.10	3.50	1.385	2500.	196.6	0.619	636.	7.88	12.72	1.000	1.000	10.	12.0
220	71	X#	7.	9.10	3.50	1.385	1750.	137.6	0.619	636.	7.88	12.72	1.000	1.000	7.	12.0
221	72	*$¬>	1.	10.00	-0.00	-0.000	200.	20.9	1.000	346.	9.56	9.56	2.638	1.419	0.	0.0
222	72	*	1.	10.00	-0.00	-0.000	200.	4.5	0.217	346.	9.56	44.03	1.000	1.000	1.	15.1
223	72	*$¬>	1.	10.00	-0.00	-0.000	200.	20.9	1.000	346.	9.56	9.56	2.599	1.379	1.	15.1
224	72	*@	1.	10.00	-0.00	-0.000	100.	2.3	0.217	346.	9.56	44.03	1.000	1.000	4.	15.2 &
225	72	*	1.	10.00	-0.00	-0.000	290.	6.6	0.217	346.	9.56	44.03	1.000	1.000	4.	15.1 &
226	73	X	3.	10.00	1.75	1.175	300.	20.7	0.525	341.	7.61	14.48	1.000	1.000	1.	4.3
227	73	X	3.	10.00	1.75	1.175	600.	41.4	0.525	341.	7.61	14.48	1.000	1.000	3.	4.3
228	73	X	3.	10.00	1.75	1.175	900.	62.2	0.525	341.	7.61	14.48	1.000	1.000	5.	4.3
229	74	+	4.	10.00	1.75	1.175	300.	23.7	0.570	397.	7.22	12.65	1.000	1.000	0.	0.0
230	74	+	4.	10.00	1.75	1.175	300.	23.7	0.570	397.	7.22	12.65	1.000	1.000	1.	4.3
231	74	+	4.	10.00	2.50	1.250	300.	17.9	0.550	526.	9.21	16.73	1.000	1.000	0.	0.0
232	74	+	4.	10.00	4.00	1.400	300.	11.7	0.514	608.	13.22	25.72	1.000	1.000	0.	0.0
233	74	X	3.	10.00	1.75	1.175	300.	20.7	0.525	341.	7.61	14.48	1.000	1.000	0.	0.0
234	74	X	3.	10.00	2.50	1.250	300.	15.9	0.505	443.	9.50	18.81	1.000	1.000	0.	0.0
235	74	X	3.	10.00	4.00	1.400	300.	10.4	0.468	678.	13.46	28.76	1.000	1.000	0.	0.0
236	72	*	1.	10.00	-0.00	-0.000	200.	4.5	0.217	346.	9.56	44.03	1.000	1.000	0.	0.0
237	75	X#	3.	7.94	4.76	1.600	1270.	66.0	0.473	360.	9.10	19.25	1.000	1.000	4.	3.4
238	76	+#	16.	10.72	3.38	1.315	2438.	145.9	0.689	2251.	11.51	16.71	1.047	1.563	9.	11.0 &
239	76	+#	16.	10.72	3.38	1.315	2438.	145.9	0.689	2251.	11.51	16.71	1.047	1.563	8.	11.3 &
240	76	+#	16.	10.72	3.38	1.315	2438.	145.9	0.689	2251.	11.51	16.71	1.047	1.563	9.	11.6 &
241	76	+#>	16.	10.72	3.38	1.315	2438.	145.9	0.689	2251.	11.51	16.71	1.145	1.856	9.	11.0 &
242	76	+#>	16.	10.72	3.38	1.315	2438.	145.9	0.689	2251.	11.51	16.71	1.146	1.856	9.	10.2 &
243	76	+#>	16.	10.72	3.38	1.315	2438.	145.9	0.689	2251.	11.51	16.71	1.146	1.856	9.	10.2
244	76	+#>	16.	10.72	3.38	1.315	2438.	145.9	0.689	2251.	11.51	16.71	1.146	1.856	9.	10.1
245	76	+#>	16.	10.72	3.38	1.315	2438.	145.9	0.689	2251.	11.51	16.71	1.159	1.856	9.	11.4 &
246	76	+#>	16.	10.72	3.38	1.315	2438.	145.9	0.689	2251.	11.51	16.71	1.157	1.856	9.	11.4
247	76	+#>	9.	12.70	4.01	1.316	4267.	197.7	0.618	1937.	13.34	21.58	1.000	1.691	17.	11.0 &
248	76	+#	9.	12.70	4.01	1.316	4267.	197.7	0.618	1937.	13.34	21.58	1.000	1.672	16.	11.3 &
249	77	X*	3.	9.00	3.20	1.356	400.	24.7	0.460	344.	7.46	16.21	1.000	1.000	2.	16.0
250	77	X*	3.	10.00	4.30	1.430	200.	9.2	0.448	511.	9.71	21.68	1.000	1.000	2.	16.0
251	77	X*	3.	10.00	4.30	1.430	420.	19.4	0.448	511.	9.71	21.68	1.000	1.000	3.	16.0
252	77	X#*	3.	10.00	4.30	1.430	200.	15.9	0.488	296.	6.12	12.55	1.000	1.000	2.	4.3
253	77	X#*	3.	10.00	4.30	1.430	400.	31.9	0.488	296.	6.12	12.55	1.000	1.000	2.	4.3

TABLE 2B (CONTINUED)

NUMBER AND RANGE OF BURNOUT TESTS WITH EACH ASSEMBLY

ASS.	NO. OF TESTS	PRESSURE RANGE	MASS FLUX RANGE	INLET QUALITY RANGE	BURNOUT QUALITY RANGE	BURNOUT HEAT FLUX RANGE
		MPA	G/S.SQCM			W/SQCM
165	98.	3.059: 6.149	18.90: 148.02	-0.228:-0.013	0.264: 0.802	20.9: 89.2
166	51.	8.274:13.790	34.45: 409.53	-1.072:-0.125	0.129: 0.844	12.5: 94.0
167	63.	5.031: 6.100	38.05: 377.34	-0.225:-0.026	0.100: 0.649	52.2: 209.9
168	11.	10.342:10.342	128.84: 273.96	-0.261:-0.130	-0.006: 0.191	152.1: 256.2
169	116.	3.069: 5.688	15.58: 218.32	-0.212:-0.009	0.257: 0.840	23.8: 138.2
170	11.	10.342:10.342	134.27: 410.94	-0.265:-0.127	-0.044: 0.132	117.7: 219.6
171	185.	3.050: 6.149	14.70: 262.72	-0.203:-0.014	0.279: 0.880	19.2: 121.9
172	11.	10.342:10.342	134.27: 408.23	-0.273:-0.132	-0.053: 0.159	161.5: 280.4
173	106.	4.923: 5.247	18.71: 295.12	-0.206: 0.249	0.196: 0.797	20.1: 124.2
174	9.	10.342:10.342	135.62: 272.60	-0.263:-0.134	-0.024: 0.196	153.9: 236.3
175	43.	6.727: 6.982	69.46: 162.60	-0.220:-0.009	0.272: 0.609	83.1: 143.2
176	10.	4.970: 6.990	38.10: 82.20	-0.052:-0.039	0.311: 0.514	80.8: 111.1
177	11.	12.507:13.886	70.04: 400.09	-0.448:-0.180	0.075: 0.360	75.7: 201.9
178	32.	11.128:15.954	72.60: 295.22	-0.518:-0.089	0.033: 0.366	76.0: 224.8
179	42.	11.128:15.954	76.64: 372.69	-0.749:-0.131	-0.023: 0.145	117.6: 231.3
180	4.	12.507:13.886	74.89: 297.00	-0.275:-0.197	0.064: 0.285	94.6: 175.2
181	380.	0.041: 0.157	1.27: 8.50	-0.070: 0.006	0.364: 0.916	16.9: 52.6
182	70.	3.052: 5.237	37.72: 234.74	-0.240: 0.414	0.290: 0.632	40.9: 153.2
183	147.	2.961: 6.109	36.05: 298.56	-0.257: 0.421	0.177: 0.645	50.6: 252.6
184	7.	0.099: 0.099	3.37: 5.21	-0.018:-0.016	0.480: 0.600	25.5: 35.7
185	262.	2.591: 7.109	18.54: 391.29	-0.198: 0.277	0.255: 0.960	14.8: 120.7
186	102.	4.597: 5.678	19.87: 302.74	-0.202: 0.469	0.292: 0.864	13.9: 115.5
187	22.	4.874: 5.354	39.31: 299.42	-0.201:-0.026	0.245: 0.801	36.6: 116.3
188	9.	0.100: 0.100	2.43: 5.30	-0.019:-0.014	0.482: 0.663	21.2: 35.7
189	29.	0.098: 0.100	1.71: 6.11	-0.057:-0.014	0.420: 0.804	17.4: 51.5
190	8.	0.099: 0.099	2.56: 5.29	-0.018:-0.016	0.501: 0.676	21.2: 35.2
191	12.	0.099: 0.099	1.82: 7.68	-0.060:-0.052	0.461: 0.801	16.6: 51.8
192	7.	0.099: 0.099	2.97: 7.27	-0.059:-0.057	0.496: 0.706	25.5: 50.9
193	10.	0.099: 0.099	2.26: 7.26	-0.060:-0.058	0.525: 0.885	[illegible]: 52.4
194	29.	5.001: 6.355	8.64: 363.72	-0.190:-0.078	0.342: 0.999	6.8: 115.0
200	40.	6.860: 7.200	11.22: 200.25	-0.539:-0.055	0.150: 0.955	21.5: 242.7
201	33.	6.650: 7.020	10.75: 204.56	-0.528:-0.040	0.050: 0.916	23.2: 262.2
202	26.	6.860: 7.030	12.05: 205.60	-0.428:-0.049	0.102: 0.841	26.4: 228.6
203	20.	6.930: 7.050	11.82: 200.52	-0.395:-0.052	0.112: 0.984	26.9: 222.5
204	27.	6.890: 7.000	11.17: 203.25	-0.508:-0.043	0.110: 0.822	24.6: 212.5
205	22.	6.920: 7.000	11.83: 200.87	-0.402:-0.057	0.129: 0.807	27.0: 196.4
206	23.	3.551: 3.551	70.25: 196.65	0.325: 0.683	0.373: 0.724	16.4: 76.1
207	11.	3.551: 3.551	69.57: 196.11	0.351: 0.681	0.431: 0.743	31.9: 92.8
208	10.	3.551: 3.551	69.85: 195.43	0.439: 0.673	0.508: 0.747	33.9: 81.9
209	7.	3.551: 4.137	66.18: 201.40	0.351: 0.682	0.446: 0.775	50.8: 102.1
210	15.	3.551: 3.551	69.57: 194.62	0.486: 0.607	0.507: 0.669	22.9: 49.4
211	9.	3.551: 3.551	69.98: 196.11	0.482: 0.610	0.509: 0.691	23.8: 57.9
212	5.	13.790:13.790	67.00: 136.03	-0.343:-0.179	0.012: 0.283	15.1: 22.8
213	1.	13.790:13.790	135.49: 135.49	-0.353:-0.353	-0.078:-0.078	97.3: 97.3
214	4.	13.790:13.790	204.25: 406.19	-0.349:-0.339	-0.130:-0.108	121.4: 209.3
215	1.	13.790:13.790	399.82: 399.82	-0.138:-0.138	-0.000:-0.000	138.4: 138.4
216	59.	11.962:16.203	131.55: 372.96	-0.766:-0.094	-0.140: 0.102	128.9: 299.1
217	54.	10.170:15.686	138.34: 371.61	-0.683:-0.092	-0.173: 0.102	170.4: 340.4
218	2.	13.790:13.790	54.66: 134.81	-0.257:-0.039	0.177: 0.266	249.8: 253.3
219	9.	12.300:12.400	203.80: 253.70	-0.512:-0.324	0.110: 0.150	165.0: 191.0
220	92.	12.200:13.900	150.00: 305.00	-0.754:-0.145	-0.003: 0.147	144.0: 263.0
221	60.	9.800:13.700	29.00: 223.00	-0.816: 0.011	-0.418: 0.282	214.0: 710.0
222	59.	9.800:13.700	28.00: 331.00	-0.727: 0.015	-0.414: 0.132	248.0: 884.0
223	27.	9.800:13.700	29.30: 231.70	-0.821: 0.006	-0.398: 0.286	238.0: 664.0
224	10.	9.800: 9.800	69.30: 87.30	-0.432:-0.016	-0.402: 0.011	466.0: 790.0
225	1.	9.800: 9.800	234.00: 234.00	-0.178:-0.178	-0.136:-0.136	490.0: 490.0
226	53.	0.740: 1.670	67.20: 277.80	-0.105: 0.237	-0.023: 0.310	157.2: 485.0
227	29.	1.030: 4.220	101.90: 273.10	-0.158:-0.064	0.019: 0.129	260.5: 428.0
228	41.	0.590: 4.170	65.80: 271.90	-0.162:-0.081	0.035: 0.276	172.1: 346.6
229	26.	0.880: 1.960	49.10: 266.60	-0.100: 0.212	-0.008: 0.374	170.1: 506.7
230	21.	0.980: 1.620	96.00: 267.80	-0.074: 0.217	0.083: 0.314	197.9: 456.9
231	36.	0.690: 1.370	44.80: 252.40	-0.059: 0.224	0.073: 0.336	141.1: 487.1
232	4.	0.980: 1.570	90.90: 92.00	-0.015: 0.079	0.091: 0.165	324.7: 412.6
233	28.	0.880: 1.230	90.40: 271.80	-0.044: 0.290	0.063: 0.340	95.8: 505.6
234	33.	0.780: 1.620	90.90: 270.10	-0.006: 0.279	0.061: 0.326	136.1: 485.1
235	13.	0.910: 1.570	105.90: 177.50	-0.015: 0.111	0.055: 0.168	281.0: 506.7
236	43.	9.800:13.700	29.40: 334.00	-0.692:-0.002	-0.462: 0.125	233.0: 780.0
237	4.	6.895: 6.895	33.91: 135.62	0.256: 0.517	0.345: 0.710	37.5: 69.1
238	11.	10.280:14.513	280.74: 492.31	-0.314:-0.073	-0.063: 0.059	230.7: 356.1
239	32.	10.273:16.768	273.96: 499.09	-0.565:-0.094	-0.159: 0.038	155.4: 327.7
240	36.	10.225:16.644	203.43: 486.89	-0.526:-0.089	-0.200: 0.050	240.1: 396.7
241	29.	10.363:16.616	259.04: 490.96	-0.433:-0.092	-0.146: 0.024	113.4: 421.4
242	23.	10.287:14.810	203.43: 490.96	-0.457:-0.079	-0.146: 0.050	187.2: 309.7
243	17.	10.328:14.541	212.93: 495.02	-0.449:-0.107	-0.149: 0.026	187.9: 355.4
244	35.	10.321:17.030	279.38: 535.71	-0.610:-0.116	-0.266: 0.045	82.8: 279.3
245	18.	10.280:16.547	345.84: 501.80	-0.334:-0.081	-0.114: 0.028	264.1: 428.7
246	30.	10.321:16.747	272.60: 490.96	-0.533:-0.087	-0.211: 0.039	196.6: 452.8
247	33.	10.342:16.527	271.25: 465.53	-0.537:-0.121	-0.043: 0.095	170.5: 318.0
248	14.	12.355:16.720	340.41: 503.16	-0.401:-0.104	-0.088: 0.090	219.0: 318.8
249	10.	10.300:10.300	76.80: 434.40	-0.609:-0.051	-0.209: 0.126	263.0: 475.0
250	13.	9.800: 9.800	29.60: 432.50	-0.835: 0.180	-0.352: 0.273	210.0: 640.0
251	19.	4.900: 9.800	30.00: 443.00	-0.876: 0.300	-0.323: 0.480	93.0: 698.0
252	6.	9.800: 9.800	31.10: 222.40	-0.436:-0.020	-0.174: 0.307	221.0: 668.0
253	10.	9.800: 9.800	30.30: 235.80	-0.902:-0.011	-0.232: 0.243	198.0: 430.0

TABLE 2A (CONTINUED)
MAIN CHARACTERISTICS OF TEST ASSEMBLIES

ASS.	DATA SRCE REF.	SPECIAL FEATRS	NO. OF RODS	ROD DIAM. MM	ROD GAP MM	ROD PITCH /DIAM.	HEATED LENGTH MM	LENGTH /HEATD EQ.DIA	HEATD/ WETTED PERIM.	FLOW AREA SQ.MM	HYD'C EQUIV. DIAM. MM	HEATED EQUIV. DIAM. MM	RADIAL FORM FACTOR	AXIAL FORM FACTOR	NO. OF GRIDS	GRID TYPE
254	77	X*	3.	10.00	4.30	1.430	420.	23.9	0.464	414.	8.14	17.57	1.000	1.000	3.	4.3
255	77	X*	3.	10.00	4.30	1.430	420.	23.9	0.464	414.	8.14	17.57	1.000	1.000	3.	4.3 &
256	77	X#*	3.	10.00	2.30	1.230	200.	15.9	0.488	296.	6.12	12.55	1.000	1.000	2.	16.0
257	77	X#*	3.	10.00	2.30	1.230	420.	33.5	0.488	296.	6.12	12.55	1.000	1.000	3.	16.0
258	77	X#*	3.	10.00	0.10	1.010	100.	8.0	0.488	296.	6.12	12.55	1.000	1.000	2.	16.0
259	77	X#*	3.	10.00	0.10	1.010	200.	15.9	0.488	296.	6.12	12.55	1.000	1.000	3.	16.0
260	77	X#*	3.	10.00	0.40	1.040	200.	15.9	0.488	296.	6.12	12.55	1.000	1.000	3.	16.0
261	77	X#*Y	3.	10.00	4.30	1.430	200.	15.9	0.488	296.	6.12	12.55	1.000	1.000	3.	16.0
262	77	X#*Y	3.	10.00	4.30	1.430	200.	15.9	0.488	296.	6.12	12.55	1.000	1.000	3.	16.0
263	77	X#*Y	3.	10.00	4.30	1.430	420.	33.5	0.488	296.	6.12	12.55	1.000	1.000	3.	16.0
264	77	X#*Y	3.	10.00	4.30	1.430	420.	33.5	0.488	296.	6.12	12.55	1.000	1.000	3.	16.0
265	78	X#	20.	6.35	2.29	1.360	1372.	152.8	0.720	896.	6.46	8.98	1.500	1.000	5.	17.1
266	78	X#@	20.	6.35	2.29	1.360	1372.	152.8	0.720	896.	6.46	8.98	1.500	1.000	6.	17.1 &
267	78	X#@	20.	6.35	2.29	1.360	1372.	152.8	0.720	896.	6.46	8.98	1.500	1.000	5.	17.2
268	78	X#	20.	6.35	2.29	1.360	1372.	152.8	0.720	896.	6.46	8.98	1.500	1.000	4.	17.2
269	78	X#	20.	6.35	2.29	1.360	1372.	152.8	0.720	896.	6.46	8.98	1.000	1.000	6.	17.2 &
270	78	X#@	20.	6.35	2.29	1.360	1372.	152.8	0.720	896.	6.46	8.98	1.000	1.000	5.	17.2
271	78	X#	20.	6.35	2.29	1.360	1372.	152.8	0.720	896.	6.46	8.98	1.000	1.000	4.	17.2
272	78	X#	20.	6.35	2.29	1.360	1372.	152.8	0.720	896.	6.46	8.98	1.500	1.000	4.	8.2
273	78	X#	20.	6.35	2.29	1.360	1372.	175.6	0.726	779.	5.67	7.81	1.500	1.000	4.	8.2
274	78	X#	20.	6.35	2.29	1.360	1372.	152.8	0.720	896.	6.46	8.98	1.000	1.000	4.	8.2
275	78	X#	20.	6.35	2.29	1.360	1372.	152.8	0.720	896.	6.46	8.98	1.000	1.000	4.	8.1
276	78	X#<¬	20.	6.35	2.29	1.360	1372.	152.8	0.720	896.	6.46	8.98	1.029	1.387	4.	17.2
277	78	X#	20.	7.11	1.52	1.214	1372.	247.9	0.748	618.	4.14	5.53	1.000	1.000	4.	8.3
278	78	X#@	20.	7.11	1.52	1.214	1372.	247.9	0.748	618.	4.14	5.53	1.000	1.000	5.	8.3
279	78	X#$-	20.	7.11	1.52	1.214	1372.	247.9	0.748	618.	4.14	5.53	1.107	1.000	5.	8.3
280	79	#	1.	9.52	-0.00	-0.000	914.	17.1	0.270	400.	14.44	53.42	1.000	1.000	3.	3.1
281	80	#	1.	9.52	-0.00	-0.000	8230.	154.1	0.270	400.	14.44	53.42	1.000	1.000	-0.	-0.0
282	81	+#)	25.	13.75	2.51	1.183	559.	45.5	0.763	3314.	9.37	12.27	1.680	1.000	2.	10.0
283	82	X#@	20.	6.35	2.29	1.360	1372.	152.8	0.720	896.	6.46	8.98	1.000	1.000	4.	8.2
284	82	X#;	20.	6.35	2.29	1.360	1372.	152.8	0.720	896.	6.46	8.98	1.000	1.000	4.	8.2
285	82	X#	20.	6.35	2.29	1.360	1372.	152.8	0.720	896.	6.46	8.98	1.000	1.000	4.	10.1
286	82	X#:	20.	6.35	2.29	1.360	1372.	152.8	0.720	896.	6.46	8.98	1.000	1.000	4.	10.1
287	82	X#	20.	6.35	2.29	1.360	1372.	152.8	0.720	896.	6.46	8.98	1.000	1.000	4.	17.2 &
288	82	X#;	20.	6.35	2.29	1.360	1372.	152.8	0.720	896.	6.46	8.98	1.000	1.000	4.	17.2 &
289	45	+#L	9.	14.33	4.42	1.309	1829.	96.4	0.650	1921.	12.34	18.97	1.000	1.000	3.	10.0
289	45	+#L	9.	14.33	4.42	1.309	1829.	96.4	0.650	1921.	12.34	18.97	1.000	1.000	3.	10.0
290	45	+#L	9.	14.33	4.42	1.309	1829.	96.4	0.650	1921.	12.34	18.97	1.000	1.000	3.	10.0
290	45	+#L	9.	14.33	4.42	1.309	1829.	96.4	0.650	1921.	12.34	18.97	1.000	1.000	3.	10.0
291	46	+#L	16.	14.27	4.44	1.311	3658.	195.9	0.711	3348.	13.27	18.67	1.000	1.387	8.	10.0
291	46	+#L	16.	14.27	4.44	1.311	3658.	195.9	0.711	3348.	13.27	18.67	1.000	1.387	8.	10.0
292	83	#	1.	8.12	-0.00	-0.000	711.	39.2	0.334	116.	6.05	18.14	1.000	1.000	0.	0.0
293	33	+#O	9.	10.20	3.20	1.314	1183.	80.8	0.630	1056.	9.23	14.64	1.000	1.000	5.	5.0
294	25	#E	1.	10.20	-0.00	-0.000	1183.	66.1	0.348	143.	6.23	17.89	1.000	1.000	7.	3.1
295	91	+#|<	5.	10.95	3.12	1.265	2774.	162.9	0.507	732.	8.63	17.03	1.000	3.139	22.	3.4
296	18	"	19.	15.54	1.02	1.065	1930.	256.4	0.782	1746.	5.88	7.53	1.077	1.000	7.	3.2
297	18	"	19.	15.54	1.02	1.065	1930.	256.4	0.782	1746.	5.88	7.53	1.077	1.000	31.	3.2 &
298	42	"	19.	14.33	1.88	1.131	495.	46.9	0.767	2258.	8.10	10.56	1.069	1.000	2.	3.2
A1	84		1.	15.87	-0.00	-0.000	4572.	387.9	0.431	147.	5.08	11.79	1.000	1.000	13.	4.1
A2	84		1.	15.87	-0.00	-0.000	3658.	310.3	0.431	147.	5.08	11.79	1.000	1.000	10.	4.1
A3	84		1.	15.87	-0.00	-0.000	3658.	310.3	0.431	147.	5.08	11.79	1.000	1.446	10.	4.1
A4	84	<	1.	15.87	-0.00	-0.000	3658.	310.3	0.431	147.	5.08	11.79	1.000	1.160	10.	4.1
A5	84	>	1.	15.87	-0.00	-0.000	3658.	310.3	0.431	147.	5.08	11.79	1.000	1.744	10.	4.1
A6	85	>	1.	13.72	-0.00	-0.000	2743.	123.0	0.382	240.	8.51	22.30	1.000	1.395	9.	3.1 &
A6	85	>	1.	13.72	-0.00	-0.000	2743.	123.0	0.382	240.	8.51	22.30	1.000	1.432	9.	3.1 &
A6	85	>	1.	13.72	-0.00	-0.000	2743.	123.0	0.382	240.	8.51	22.30	1.000	1.446	9.	3.1 &
A7	85		1.	13.72	-0.00	-0.000	2311.	103.7	0.382	240.	8.51	22.30	1.000	1.320	5.	3.1
A7	85		1.	13.72	-0.00	-0.000	2311.	103.7	0.382	240.	8.51	22.30	1.000	1.347	5.	3.1
A7	85		1.	13.72	-0.00	-0.000	2311.	103.7	0.382	240.	8.51	22.30	1.000	1.356	5.	3.1
A8	86	V	1.	12.70	-0.00	-0.000	610.	23.3	0.364	261.	9.53	26.20	1.000	1.000	2.	3.1
A9	86	V	1.	19.05	-0.00	-0.000	610.	32.3	0.415	282.	7.82	18.85	1.000	1.000	6.	3.1
A10	86	V	1.	53.97	-0.00	-0.000	610.	33.5	0.464	771.	8.43	18.18	1.000	1.000	6.	3.1
A11	86	V	1.	25.40	-0.00	-0.000	610.	32.0	0.430	380.	8.20	19.06	1.000	1.000	6.	3.1
A12	86	DV	1.	12.70	-0.00	-0.000	610.	23.3	0.364	261.	9.53	26.20	1.000	1.000	2.	3.1
A13	86	DV	1.	19.05	-0.00	-0.000	610.	32.3	0.415	282.	7.82	18.85	1.000	1.000	6.	3.1
A14	86	V	1.	19.05	-0.00	-0.000	610.	32.3	0.415	282.	7.82	18.85	1.000	1.000	6.	3.1
A15	86	DV	1.	19.05	-0.00	-0.000	610.	32.3	0.415	282.	7.82	18.85	1.000	1.000	6.	3.1
A16	86	V	1.	19.05	-0.00	-0.000	610.	32.3	0.415	282.	7.82	18.85	1.000	1.000	6.	3.1
A17	86	DV	1.	19.05	-0.00	-0.000	610.	32.3	0.415	282.	7.82	18.85	1.000	1.000	6.	3.1
A18	87	"<	1.	15.19	-0.00	-0.000	488.	35.5	0.420	164.	5.77	13.72	1.000	1.460	2.	3.1
A18	87	"<	1.	15.19	-0.00	-0.000	488.	35.5	0.420	164.	5.77	13.72	1.000	1.460	2.	3.1
A18	87	"<	1.	15.19	-0.00	-0.000	488.	35.5	0.420	164.	5.77	13.72	1.000	1.460	2.	3.1
A19	87	"	1.	15.19	-0.00	-0.000	980.	71.4	0.420	164.	5.77	13.72	1.000	1.344	4.	3.1
A19	87	"	1.	15.19	-0.00	-0.000	980.	71.4	0.420	164.	5.77	13.72	1.000	1.344	4.	3.1
A20	88		1.	12.70	-0.00	-0.000	6502.	248.2	0.364	261.	9.53	26.20	1.000	1.000	28.	3.1
A21	89		1.	14.98	-0.00	-0.000	3288.	766.5	0.469	50.	2.01	4.29	1.000	1.000	8.	3.1
A22	89		1.	10.21	-0.00	-0.000	1191.	97.1	0.403	98.	4.94	12.27	1.000	1.000	2.	3.1
A23	89		1.	10.21	-0.00	-0.000	795.	64.8	0.403	98.	4.94	12.27	1.000	1.000	2.	3.1
A24	90	$	1.	15.42	-0.00	-0.000	1829.	161.4	1.000	375.	11.33	11.33	1.001	1.260	4.	3.1

TABLE 2B (CONTINUED)

NUMBER AND RANGE OF BURNOUT TESTS WITH EACH ASSEMBLY

ASS.	NO. OF TESTS	PRESSURE RANGE	MASS FLUX RANGE	INLET QUALITY RANGE	BURNOUT QUALITY RANGE	BURNOUT HEAT FLUX RANGE
		MPA	G/S.SQCM			W/SQCM
254	6.	9.800: 9.800	37.40: 230.00	-0.640:-0.024	-0.174: 0.209	268.0: 580.0
255	8.	4.900: 9.800	82.80: 233.00	-0.599:-0.002	-0.161: 0.233	256.0: 510.0
256	2.	9.800: 9.800	96.80: 234.00	-0.396:-0.258	-0.177:-0.151	442.0: 525.0
257	9.	9.600: 9.800	74.00: 470.00	-0.462:-0.020	-0.179: 0.209	175.0: 407.0
258	5.	9.800: 9.800	99.00: 440.00	-0.362:-0.016	-0.328: 0.008	93.0: 326.0
259	2.	9.800: 9.800	219.00: 220.40	-0.233:-0.059	-0.203:-0.031	128.0: 140.0
260	5.	9.600: 9.600	74.00: 446.00	-0.419:-0.020	-0.300: 0.071	140.0: 280.0
261	9.	4.900: 9.600	100.00: 235.00	-0.553:-0.093	-0.395: 0.005	221.0: 500.0
262	4.	4.900: 9.300	72.00: 209.00	-0.269:-0.002	-0.090: 0.132	186.0: 396.0
263	16.	9.800: 9.800	75.00: 447.00	-0.402: 0.600	-0.168: 0.709	81.0: 314.0
264	8.	9.800: 9.600	76.00: 442.50	-0.624: 0.250	-0.289: 0.311	128.0: 430.0
265	39.	8.274:13.790	33.63: 546.56	-0.856:-0.118	-0.144: 0.512	57.6: 374.8
266	32.	8.274:13.790	33.50: 542.49	-1.077:-0.127	-0.421: 0.515	47.5: 358.2
267	42.	8.274:13.790	33.77: 545.20	-1.068:-0.125	-0.451: 0.500	56.8: 493.5
268	36.	8.274:13.790	31.06: 543.85	-1.075:-0.118	-0.409: 0.488	51.0: 401.7
269	5.	13.790:13.790	33.77: 135.69	-0.637:-0.347	0.048: 0.636	63.1: 165.3
270	30.	8.274:13.790	33.63: 490.96	-1.077:-0.118	-0.031: 0.687	48.2: 269.7
271	40.	8.274:13.790	33.77: 409.58	-1.081:-0.114	-0.440: 0.635	45.0: 327.4
272	50.	8.274:13.790	33.50: 526.22	-1.075:-0.103	-0.304: 0.468	51.1: 368.1
273	54.	8.239:13.858	35.52: 469.12	-1.079:-0.125	-0.347: 0.424	47.3: 487.4
274	25.	8.239:13.845	31.46: 271.65	-1.072:-0.122	-0.017: 0.689	46.4: 199.7
275	33.	8.274:13.790	33.50: 272.35	-1.075:-0.122	-0.339: 0.639	45.1: 212.0
276	32.	8.274:13.790	33.63: 406.73	-1.064:-0.118	-0.168: 0.631	20.7: 314.8
277	45.	8.274:13.790	33.63: 543.17	-1.075:-0.116	-0.173: 0.741	31.5: 292.1
278	54.	2.758:13.790	33.91: 406.23	-1.077:-0.063	-0.024: 0.774	36.6: 255.2
279	15.	8.274:13.790	6.75: 24.09	-0.642:-0.138	0.672: 0.958	11.8: 36.3
280	19.	6.895: 6.895	66.46: 135.62	0.300: 0.710	0.333: 0.729	25.2: 97.8
281	4.	6.895: 6.895	36.62: 135.62	-0.130:-0.053	0.208: 0.502	55.5: 86.8
282	21.	0.094: 0.137	241.70: 629.70	-0.160:-0.090	-0.121:-0.068	135.5: 335.1
283	6.	8.274: 8.274	67.40: 272.47	-0.325:-0.134	0.159: 0.515	95.3: 191.2
284	5.	8.274: 8.274	67.81: 209.94	-0.318:-0.136	0.193: 0.449	93.7: 163.7
285	40.	8.274:13.790	33.50: 274.09	-1.083:-0.118	-0.348: 0.640	45.1: 212.0
286	15.	8.274:13.790	67.81: 272.20	-0.402:-0.138	-0.042: 0.441	72.6: 202.2
287	16.	8.274:13.790	67.40: 271.92	-0.640:-0.128	-0.137: 0.432	53.6: 242.9
288	15.	8.274:13.790	67.95: 271.79	-0.636:-0.131	-0.138: 0.418	51.4: 236.3
289	35.	5.516: 6.895	34.03: 136.75	-0.511:-0.012	0.107: 0.636	91.6: 213.0
289	35.	5.516: 6.895	32.90: 138.93	-0.540:-0.012	0.134: 0.630	90.5: 239.7
290	23.	5.516: 6.895	33.11: 136.92	-0.535:-0.012	0.118: 0.655	90.4: 209.1
290	24.	5.516: 6.895	33.38: 138.20	-0.510:-0.013	0.136: 0.641	88.2: 229.7
291	40.	5.481: 6.964	33.92: 137.82	-0.378:-0.032	0.228: 0.756	24.0: 150.9
291	40.	5.392: 6.998	33.30: 138.82	-0.400:-0.039	0.252: 0.769	22.8: 123.9
292	57.	10.411:15.996	66.32: 410.67	-0.497:-0.059	-0.174: 0.278	143.2: 493.1
293	18.	12.940:13.780	47.90: 224.10	-0.704:-0.105	0.045: 0.415	89.1: 184.8
294	2.	12.974:13.004	93.30: 94.00	-0.212:-0.198	0.072: 0.082	108.7: 117.7
295	3.	13.900:13.907	190.55: 260.40	-0.348:-0.286	-0.227:-0.163	87.3: 118.7
296	5.	6.895: 6.895	136.98: 409.58	0.024: 0.177	0.233: 0.498	56.2: 109.4
297	5.	6.895: 6.895	139.69: 410.94	0.025: 0.171	0.311: 0.570	71.2: 150.1
298	37.	6.895: 8.274	67.81: 271.25	-0.355: 0.323	0.096: 0.493	87.1: 289.6
A1	19.	6.722: 6.998	131.42: 403.34	-0.242:-0.008	0.138: 0.353	49.4: 143.5
A2	308.	5.068: 7.102	134.27: 339.46	-0.404:-0.034	0.160: 0.389	64.5: 175.8
A3	156.	5.102: 7.067	134.54: 345.02	-0.271:-0.034	0.100: 0.360	35.4: 123.8
A4	50.	6.516: 6.998	134.00: 339.60	-0.236:-0.028	0.185: 0.355	25.1: 72.4
A5	23.	6.688: 6.998	134.54: 339.33	-0.245:-0.035	0.177: 0.328	76.6: 138.4
A6	1.	6.895: 6.895	150.54: 150.54	-0.056:-0.056	0.265: 0.265	111.3: 111.3
A6	19.	6.895: 6.929	112.57: 189.87	-0.462:-0.026	0.010: 0.309	89.2: 415.9
A6	5.	6.895: 6.895	150.54: 189.87	-0.471:-0.018	0.193: 0.245	109.5: 215.8
A7	5.	6.833: 6.998	188.52: 189.87	-0.335:-0.043	0.080: 0.204	183.8: 332.7
A7	6.	6.895: 6.929	153.25: 154.61	-0.372:-0.058	0.141: 0.249	178.2: 285.7
A7	12.	6.860: 6.964	112.57: 153.25	-0.413:-0.060	0.117: 0.267	151.0: 292.8
A8	246.	0.222: 0.732	401.04:1365.72	-0.244:-0.081	-0.148:-0.023	379.8:1144.2
A9	16.	0.446: 0.712	437.79:1342.13	-0.230:-0.119	-0.124:-0.053	470.0:1156.2
A10	22.	0.474: 0.625	420.84:1328.16	-0.294:-0.122	-0.154:-0.054	421.5:1240.1
A11	4.	0.474: 0.563	439.28: 882.09	-0.247:-0.133	-0.118:-0.058	709.8:1053.9
A12	37.	0.397: 0.531	500.45:1556.95	-0.374:-0.210	-0.231:-0.126	1277.6:2220.2
A13	7.	0.563: 0.722	960.89:1463.91	-0.317:-0.150	-0.167:-0.065	878.6:2036.9
A14	57.	0.477: 0.791	430.33:1335.89	-0.280:-0.128	-0.132:-0.051	471.9:1611.0
A15	5.	0.461: 0.590	161.26: 969.70	-0.321:-0.193	-0.123:-0.081	577.9:1389.0
A16	4.	0.446: 0.446	890.77: 914.32	-0.333:-0.159	-0.274:-0.142	255.5: 880.1
A17	6.	0.450: 0.598	492.72: 999.81	-0.433:-0.236	-0.291:-0.107	1101.6:1858.1
A18	18.	6.915: 7.060	39.97: 97.30	0.309: 0.755	0.346: 0.768	2.4: 59.7
A18	6.	6.991: 7.074	52.72: 88.94	0.445: 0.756	0.479: 0.764	10.9: 65.4
A18	5.	6.915: 7.033	48.89: 97.23	0.433: 0.754	0.486: 0.777	4.2: 16.4
A19	10.	6.957: 7.171	31.19: 104.24	0.247: 0.745	0.402: 0.782	4.4: 21.8
A19	11.	6.950: 7.115	39.14: 93.67	0.360: 0.759	0.486: 0.821	7.1: 21.8
A20	21.	6.895: 6.895	66.73: 201.54	-0.563:-0.049	0.226: 0.514	64.7: 150.8
A21	71.	5.263: 8.280	78.27: 385.28	-0.300: 0.488	0.203: 0.864	6.4: 69.4
A22	23.	6.983: 7.156	110.36: 381.99	-0.227: 0.515	0.121: 0.598	27.0: 241.6
A23	39.	7.001: 7.123	110.10: 383.94	-0.190: 0.522	0.094: 0.584	31.7: 388.0
A24	48.	6.750:13.921	67.68: 342.31	-0.417:-0.026	-0.020: 0.696	18.8: 201.7

TABLE 2C

MEANINGS OF SYMBOLS USED TO INDICATE SPECIAL FEATURES OF ASSEMBLIES

SYM.	NO. OF ASSYS	NO. OF TESTS	MEANING
#	145	4941	NON-CIRCULAR DUCT.
+	92	3446	SQUARE PITCH ARRAY.
X	88	2340	TRIANGULAR PITCH ARRAY.
*	48	1024	DUCT PROTUBERANCES SIMULATING EITHER A PART OF THE SURFACE OF SURROUNDING RODS OR THE BOUNDARY OF ADJACENT ROD CELLS.
7	33	1359	SEVEN-ROD BUNDLE ENCLOSED IN CIRCULAR DUCT.
$	31	544	HEATED DUCT.
>	16	408	ASYMMETRIC AXIAL DISTRIBUTION OF HEAT FLUX WITH PEAK IN DOWNSTREAM HALF OF CHANNEL.
C	13	121	CONSTANT HEAT FLUX MAINTAINED ON PART OF HEATED SURFACE.
"	11	172	SEPARATED STEAM AND WATER PHASES AT INLET TO CHANNEL.
V	10	404	DOWNFLOW OF COOLANT.
@	8	370	BURNOUT NOT AT OUTLET OF CHANNEL WITH AXIALLY UNIFORM HEAT FLUX.
¬	8	173	STEPPED PROFILE OF AXIAL DISTRIBUTION OF HEAT FLUX.
<	8	168	ASYMMETRIC AXIAL DISTRIBUTION OF HEAT FLUX WITH PEAK IN UPSTREAM HALF OF CHANNEL.
E	4	226	BUNDLE MOUNTED ECCENTRICALLY IN DUCT.
L	4	212	ROD TO DUCT GAP REDUCED BY ROD BOWING OR ATTACHMENT OF PADS TO DUCT WALL.
=	4	75	HORIZONTAL CHANNEL.
D	4	55	HEAVY WATER COOLANT.
Y	4	37	RODS CONVERGE TOWARDS DOWNSTREAM END OF BUNDLE.
N	4	17	NATURAL CIRCULATION OF COOLANT.
|	4	10	SPIKE OR HOT PATCH IN AXIAL DISTRIBUTION OF HEAT FLUX.
/	3	234	HEAT FLUX TILT ACROSS SOME RODS IN BUNDLE.
;	3	35	CRUD DEPOSIT DELIBERATELY FORMED ON RODS BEFORE TEST.
M	2	24	MISALIGNMENT OF RODS IN ADJACENT AXIAL SEGMENTS OF BUNDLE.
(	1	21	TWO RODS IN CONTACT.
)	1	21	ROD GAP REDUCED BY BOWING OF ROD.
O	1	18	PARTIAL BLOCKAGE OF COOLANT FLOW PASSAGE.
-	1	15	SIGNIFICANT HEAT LOSS FROM DUCT.
:	1	5	BUNDLE CONTAINS HEATED RODS OF DIFFERENT DIAMETERS.

TABLE 2D

GRID OR ROD SPACER TYPES AND REFERENCE NUMBERS

REF. NO.	NO. OF ASSYS	NO. OF TESTS	GRID TYPE
-0.0	29	837	INSUFFICIENT INFORMATION GIVEN IN SOURCE OF DATA.
0.0	12	351	NO SPACERS IN HEATED LENGTH OF CHANNEL.
			WRAPPED WIRE (NUMBER OF GRIDS = NUMBER OF COMPLETE TURNS):
1.0	8	163	WOUND OPPOSITE HAND ON ADJACENT RODS.
1.1			WOUND ON BUNDLE ONLY.
2.0	9	168	WOUND SAME HAND ON ALL WRAPPED RODS.
3.0			RADIAL PINS, WARTS, OR STUDS ATTACHED TO RODS OR DUCT:
3.1	34	1003	DUCT-TO-ROD ONLY.
3.2	33	1151	ROD-TO-ROD AND DUCT-TO-ROD.
3.3	8	272	ROD-TO-ROD ONLY.
3.4	10	375	DUCT-TO-ROD, PLUS AXIAL TUBES ROD-TO-ROD.
3.5	4	182	ROD-TO-ROD AND DUCT-TO-ROD, STAGGERED AXIALLY.
4.0			AXIAL PINS OR TUBES ATTACHED TO RODS OR DUCT:
4.1	9	570	DUCT-TO-ROD ONLY.
4.2	6	209	ROD-TO-ROD AND DUCT-TO-ROD.
4.3	11	224	ROD-TO-ROD ONLY.
5.0	13	1117	AXIAL TUBES INTERCONNECTED TO FORM GRID.
5.1	1	43	ROD-SPACING RINGS INTERCONNECTED TO FORM GRID.
6.0			BAFFLE PLATES:
6.1	3	277	FULL PLATE WITH CUT-OUT FLOW ORIFICES.
6.2	4	276	PLATE SECTIONS BAFFLING SPACES BETWEEN RODS.
7.0	24	1408	INTERCONNECTED ROD-SURROUNDING RINGS WITH PADS, WARTS, OR TONGUES.
7.1	5	723	CLOSELY-CONNECTED ROD-SURROUNDING RINGS AND RADIAL RIBS WITH PADS, WARTS, OR TONGUES.
8.0	1	6	ROD-INTERWEAVING BANDS WITH PADS.
8.1	1	33	CORRUGATED STRIPS (PARALLEL TO A ROD PITCH LINE) WITH TONGUES.
8.2	5	140	CORRUGATED STRIPS (PERPENDICULAR TO A ROD PITCH LINE) WITH TONGUES.
8.3	7	125	HALF-HEXAGON STRIPS WITH TONGUES.
9.0			FILM-STRIPPING RING ATTACHED TO DUCT WALL.
9.1			FILM-STRIPPING RINGS ATTACHED TO RODS.
10.0	32	1365	EGG-CRATE OR HONEYCOMB GRIDS WITH PADS OR TONGUES, WITHOUT MIXING VANES:
10.1	3	90	SIMPLE SUPPORT.
10.2	2	40	WESTINGHOUSE T-H.
11.0	6	218	EGG-CRATE OR HONEYCOMB GRIDS WITH PADS OR TONGUES AND MIXING VANES:
11.1			SIMPLE SUPPORT.
11.2			WESTINGHOUSE T-H.
11.3	2	46	NO PERIPHERAL VANES.
11.4	2	48	T-H, NO PERIPHERAL VANES.
11.5			EGG-CRATE OR HONEYCOMB GRIDS WITH PADS OR TONGUES AND MIXING SCOOPS:
11.6	1	36	NO PERIPHERAL SCOOPS.
12.0	5	195	RING GRIDS WITH RADIAL STRIPS (SPIDER'S WEB), WITH PADS OR TONGUES.
13.0	2	291	ROD-GRIPPING SLEEVES WITH INTERCONNECTING PADS.
13.1	3	7	ROD-GRIPPING SLEEVES WITH INTERCONNECTING STRIPS.
14.0			CANDU END-PLATE.
15.0			CHORDAL STRIPS:
15.1	3	87	ROD CONTACTED ON ONE SIDE ONLY.
15.2	1	10	ROD CONTACTED ON TWO SIDES.
16.0	12	102	BAND OR SLEEVE WRAPPING BUNDLE CIRCUMFERENCE.
17.0			SEPARATE SPRING SLEEVES ATTACHED TO RODS:
17.1	2	71	SINGLE FLOW WINDOW.
17.2	8	216	DOUBLE FLOW WINDOW.

TABLE 3A

COMPOSITION OF THE DATA BANK IN RESPECT OF ROD ARRANGEMENT

Form of Rod Arrangement	Numbers of Tests included for Assemblies with: Axially Uniform Heat Flux	Axially Non-uniform Heat Flux	All Distributions of Heat Flux
Circular pitch *	4604	559	5163
Square pitch	2850	596	3446
Triangular pitch	2279	61	2340
(7-rod within circular duct) #	(1352) #	(7)#	(1359)#
2-rod, not simulating square pitch	65	0	65
Single rod with non-circular duct	189	0	189
Annulus	895	375	1270
All forms	10 882	1591	12 473

Item and numbers enclosed in brackets are included in the circular pitch class.

* See Glossary for definitions of terms.

TABLE 3B

SUBDIVISION OF ROD ARRANGEMENT CLASSES ACCORDING TO NUMBER OF RODS

Circular Pitch Arrays: Number of Rods	Number of Tests$	Square Pitch Arrays: Number of Rods	Number of Tests$	Triangular Pitch Arrays: Number of Rods	Number of Tests$
1§	211 [87]	2+	68 [0]	3	1151 [18]
6	30 [0]	4	222 [0]	7	298 [0]
		5	3 [3]		
7	1359 [7]	9	1932 [189]	(7)#	(1359 [7])#
19	1731 [45]	16	824 [404]	12	51 [0]
37	1832 [420]	20	103 [0]	19	20 [0]
		21	71 [0]	20	809 [32]
		25	223 [0]	24	5 [5]
				29	6 [6]
ALL	5163 [559]	ALL	3446 [596]	ALL	2340 [61]

Notes to Table 3B

§ simulating central rod in a circular pitch array.
+ simulating square pitch.
# enclosed in circular duct; numbers included in total for circular pitch array.
$ numbers of tests with axially non-uniform heating are enclosed in square brackets.

TABLE 3C

COMPOSITION OF THE DATA BANK IN RESPECT OF THE SHAPE OF THE ASSEMBLY DUCT

Shape of Duct Cross-Section	Number of Tests included for Assemblies with: Axially Uniform Heat Flux	Axially Non-uniform Heat Flux	All Distributions of Heat Flux
Circular, no P*	5891	865	6756
Circular, with P	689	87	776
All circular shapes:	6580	952	7532
Rectangular, no P	2855	593	3448
Rectangular, with P	68	0	68
All rectangular shapes:	2923	593	3516
Cruciform	71	3	74
Parallelogrammatic, no P	729	32	761
Parallelogrammatic, with P	99	5	104
All parallelogrammatic shapes:	828	37	865
Hexagonal, no P	341	6	347
Hexagonal, with P	76	0	76
All hexagonal shapes:	417	6	423
Triangular	63	0	63
All shapes	10 882	1591	12 473

* P = protuberances, simulating either part of the surface of surrounding rods or the boundary of adjacent rod cells.

TABLE 4A

COMPOSITION OF THE DATA BANK IN RESPECT OF HEAT FLUX DISTRIBUTION

Radial Distribution	Number of Tests included for Assemblies with:				
	Axially Uniform Distribution		Axially Non-uniform Distribution		All Axial Distributions
	Burnout at Exit	Upstream Burnout	Position of Burnout Detected	Position of Burnout Not Detected	
Uniform	5909	188	712	30	6839
Non-uniform	4709	76	795	54	5634
All radial distributions	10 618	264	1507	84	12 473

TABLE 4B

SUBDIVISION OF TESTS WITH AXIALLY NON-UNIFORM HEATING ACCORDING TO FLUX PROFILE

Position of Peak	Number of Tests included for Assemblies with Axial Heating Profiles of the Form:			
	Smooth	Step	Spike	All Types
Towards inlet	79	80	9	168
Symmetrical	1015	0	0	1015
Towards outlet	314	93	1	408
All positions of peak	1408	173	10	1591

TABLE 4C

DISTRIBUTION OF TESTS BETWEEN ASSEMBLIES WITH UNHEATED AND HEATED DUCTS

State of Duct Heating	Number of Tests included for Assemblies with:		
	Axially Uniform Heat Flux	Axially Non-uniform Heat Flux	All Distributions of Heat Flux
Unheated duct	10 473	1456	11 929
Heated duct	409	135	544
All states	10 882	1591	12 473

TABLE 5

DISTRIBUTION OF BURNOUT TESTS ACCORDING TO PHASE CONDITION OF THE COOLANT

Condition of Coolant	Number of Tests included for Assemblies with: Axially Uniform Heat Flux	Axially Non-uniform Heat Flux	All Distributions of Heat Flux
Subcooled or saturated water at burnout section	1255	305	1560
Subcooled or saturated water at inlet, steam-water mixture at burnout	8584	1206	9790
Subcooled or saturated water at inlet	9839	1511	11 350
Steam-water mixture at inlet, uniformly mixed	933	30	963
Steam-water mixture at inlet, non-uniformly mixed	110	50	160
Steam-water mixture at inlet	1043	80	1123
All conditions	10 882	1591	12 473

TABLE 6A

COMPOSITION OF THE DATA BANK IN RESPECT OF UNUSUAL OR ABNORMAL FEATURES OF THE TEST ASSEMBLY

Assembly	Number of Tests included for Assemblies with:		
	Axially Uniform Heat Flux	Axially Non-uniform Heat Flux	All Distributions of Heat Flux
With unusual or abnormal features	988	87	1075
Without unusual or abnormal features	9894	1504	11398
All assemblies	10 882	1591	12 473

TABLE 6B

NUMBERS OF TESTS ASSOCIATED WITH INDIVIDUAL FEATURES

Feature	Number of Tests included for Assemblies with:		
	Axially Uniform Heat Flux	Axially Non-uniform Heat Flux	All Distributions of Heat Flux
Unusual features:			
Horizontal arrangement	75		75
Downflow	404		404
Natural circulation	10	7	17
Heavy water coolant	55		55
Converging rods	37		37
Abnormal features:			
Eccentric bundle	226		226
Bowed rod	21		21
Rods touching	21		21
Reduced rod-shroud clearance	132	80	212
Misalignment in segmented bundle	24		24
Flow obstruction	18		18
Crud deposit	35		35

TABLE 7

DISTRIBUTION OF TESTS AMONG REGIONS DEFINED BY EQUAL
DIVISIONS OF THE RANGES OF 2 VARIABLES CONSIDERED SIMULTANEOUSLY

THE TOTAL NUMBER OF TESTS IS 12473
THE SYMBOLIC NAMES OF THE VARIABLES AND THEIR RANGE DIVISIONS ARE:

DIV.	RANGE OF G	RANGE OF P
	G/S.SQCM	MPA
1	0.0 : 50.0000	0.0 : 1.00000
2	50.0001: 100.000	1.00001: 2.00000
3	100.001: 150.000	2.00001: 3.00000
4	150.001: 200.000	3.00001: 4.00000
5	200.001: 250.000	4.00001: 5.00000
6	250.001: 300.000	5.00001: 6.00000
7	300.001: 350.000	6.00001: 7.00000
8	350.001: 400.000	7.00001: 8.00000
9	400.001: 450.000	8.00001: 9.00000
10	450.001: 500.000	9.00001: 10.0000
11	500.001: 550.000	10.0001: 11.0000
12	550.001: 600.000	11.0001: 12.0000
13	600.001: 650.000	12.0001: 13.0000
14	650.001: 700.000	13.0001: 14.0000
15	700.001: 750.000	14.0001: 15.0000
16	750.001: 800.000	15.0001: 16.0000
17	800.001: 850.000	16.0001: 17.0000
18	850.001: 900.000	17.0001: 18.0000
19	900.001: 950.000	
20	950.001: 1000.00	
21	1000.01: 1050.00	
22	1050.01: 1100.00	
23	1100.01: 1150.00	
24	1150.01: 1200.00	
25	1200.01: 1250.00	
26	1250.01: 1300.00	
27	1300.01: 1350.00	
28	1350.01: 1400.00	
29	1400.01: 1450.00	
30	1450.01: 1500.00	
31	1500.01: 1550.00	
32	1550.01: 1600.00	

TABLE 7 (CONTINUED)

P / G	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	555	58	174	367	175	211	299	14	87	98	17	15	10	153	2	14	14	.
2	29	59	31	162	225	427	726	62	223	143	27	38	43	264	19	41	23	.
3	6	22	25	176	238	741	935	152	187	53	43	26	28	227	2	61	24	.
4	17	50	11	42	40	96	308	43	24	24	2	6	74	129	8	30	4	.
5	5	.	.	25	131	367	304	77	36	68	33	10	68	181	5	46	14	.
6	14	39	9	3	43	196	263	13	88	.	41	18	47	126	25	54	27	.
7	.	.	.	.	7	56	164	31	11	18	43	1	10	27	25	33	33	.
8	.	.	.	3	.	39	24	23	15	.	12	2	17	18	5	15	3	.
9	80	.	.	.	.	4	28	.	47	12	16	9	11	40	32	10	24	.
10	26	.	.	.	.	.	1	.	10	1	26	2	22	11	23	7	16	1
11	8	.	.	.	.	.	.	.	19	.	.	.	.	8	.	.	3	.
12	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.
13	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
14	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.
15	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
16	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
17	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
18	100	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
19	15	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
20	11	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
21	20	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
22	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
23	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
24	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
25	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
26	13	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
27	58	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
28	9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
29	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
30	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
31	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
32	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

TABLE 8

DISTRIBUTION OF TESTS AMONG REGIONS DEFINED BY EQUAL
DIVISIONS OF THE RANGES OF 2 VARIABLES CONSIDERED SIMULTANEOUSLY

THE TOTAL NUMBER OF TESTS IS 12473
THE SYMBOLIC NAMES OF THE VARIABLES AND THEIR RANGE DIVISIONS ARE:

DIV.	RANGE OF QBO W/SQ.CM	RANGE OF P MPA
1	0.0 : 50.0000	0.0 : 1.00000
2	50.0001: 100.000	1.00001: 2.00000
3	100.001: 150.000	2.00001: 3.00000
4	150.001: 200.000	3.00001: 4.00000
5	200.001: 250.000	4.00001: 5.00000
6	250.001: 300.000	5.00001: 6.00000
7	300.001: 350.000	6.00001: 7.00000
8	350.001: 400.000	7.00001: 8.00000
9	400.001: 450.000	8.00001: 9.00000
10	450.001: 500.000	9.00001: 10.0000
11	500.001: 550.000	10.0001: 11.0000
12	550.001: 600.000	11.0001: 12.0000
13	600.001: 650.000	12.0001: 13.0000
14	650.001: 700.000	13.0001: 14.0000
15	700.001: 750.000	14.0001: 15.0000
16	750.001: 800.000	15.0001: 16.0000
17	800.001: 850.000	16.0001: 17.0000
18	850.001: 900.000	17.0001: 18.0000
19	900.001: 950.000	
20	950.001: 1000.00	
21	1000.01: 1050.00	
22	1050.01: 1100.00	
23	1100.01: 1150.00	
24	1150.01: 1200.00	
25	1200.01: 1250.00	
26	1250.01: 1300.00	
27	1300.01: 1350.00	
28	1350.01: 1400.00	
29	1400.01: 1450.00	
30	1450.01: 1500.00	
31	1500.01: 1550.00	
32	1550.01: 1600.00	
33	1600.01: 1650.00	
34	1650.01: 1700.00	
35	1700.01: 1750.00	
36	1750.01: 1800.00	
37	1800.01: 1850.00	
38	1850.01: 1900.00	
39	1900.01: 1950.00	
40	1950.01: 2000.00	
41	2000.01: 2050.00	
42	2050.01: 2100.00	
43	2100.01: 2150.00	
44	2150.01: 2200.00	
45	2200.01: 2250.00	

TABLE 8 (CONTINUED)

P / CBD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	432	.	2	131	69	291	243	69	64	6	1	24	.	123	.	4	10	.
2	104	13	40	275	341	839	766	76	142	21	30	26	3	243	8	57	35	1
3	18	32	85	196	247	681	903	113	180	48	39	33	32	277	19	65	35	.
4	8	32	60	109	115	207	674	73	174	47	67	24	94	261	24	77	25	.
5	13	21	28	31	37	68	315	45	95	47	48	9	87	142	26	78	35	.
6	19	26	9	17	27	21	101	25	53	44	33	7	48	67	29	22	14	.
7	13	29	19	13	10	17	34	13	17	40	25	1	30	33	28	7	16	.
8	15	24	4	4	3	7	12	1	13	22	9	2	16	17	9	1	3	.
9	13	33	3	.	5	3	2	.	7	44	5	1	7	5	2	.	2	.
10	24	15	.	1	1	3	2	.	5	29	3	.	7	8	1	.	.	.
11	17	3	.	.	3	.	.	.	1	20	.	.	2	5	.	.	.	.
12	26	.	.	.	.	.	.	.	1	22	.	.	1	3	.	.	.	.
13	16	.	.	1	.	.	.	.	.	11	.	.	2	.	.	.	.	.
14	15	.	.	.	1	.	.	.	.	9	.	.	.	.	.	.	.	.
15	15	.	.	.	.	.	.	.	.	2	.	.	1	.	.	.	.	.
16	29	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.
17	34	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.
18	15	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.
19	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
20	71	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
21	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
22	21	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
23	12	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
24	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
25	8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
26	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
27	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
28	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
29	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
30	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
31	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
32	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
33	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
34	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
35	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
36	11	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
37	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
38	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
39	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
40	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
41	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
42	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
43	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
44	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
45	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

TABLE 9

DISTRIBTUION OF TESTS AMONG REGIONS DEFINED BY EQUAL DIVISIONS OF THE RANGES OF 2 VARIABLES CONSIDERED SIMULTANEOUSLY

THE TOTAL NUMBER OF TESTS IS 12473
THE SYMBOLIC NAMES OF THE VARIABLES AND THEIR RANGE DIVISIONS ARE:

DIV.	RANGE OF G G/S.SQCM	RANGE OF QBO W/SQ.CM
1	0.0 : 50.0000	0.0 : 100.000
2	50.0001: 100.000	100.001: 200.000
3	100.001: 150.000	200.001: 300.000
4	150.001: 200.000	300.001: 400.000
5	200.001: 250.000	400.001: 500.000
6	250.001: 300.000	500.001: 600.000
7	300.001: 350.000	600.001: 700.000
8	350.001: 400.000	700.001: 800.000
9	400.001: 450.000	800.001: 900.000
10	450.001: 500.000	900.001: 1000.00
11	500.001: 550.000	1000.01: 1100.00
12	550.001: 600.000	1100.01: 1200.00
13	600.001: 650.000	1200.01: 1300.00
14	650.001: 700.000	1300.01: 1400.00
15	700.001: 750.000	1400.01: 1500.00
16	750.001: 800.000	1500.01: 1600.00
17	800.001: 850.000	1600.01: 1700.00
18	850.001: 900.000	1700.01: 1800.00
19	900.001: 950.000	1800.01: 1900.00
20	950.001: 1000.00	1900.01: 2000.00
21	1000.01: 1050.00	2000.01: 2100.00
22	1050.01: 1100.00	2100.01: 2200.00
23	1100.01: 1150.00	2200.01: 2300.00
24	1150.01: 1200.00	
25	1200.01: 1250.00	
26	1250.01: 1300.00	
27	1300.01: 1350.00	
28	1350.01: 1400.00	
29	1400.01: 1450.00	
30	1450.01: 1500.00	
31	1500.01: 1550.00	
32	1550.01: 1600.00	

TABLE 9 (CONTINUED)

OBRG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	1460	625	89	50	20	14	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2	1178	1085	180	37	39	15	5	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
3	1135	1313	404	70	21	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
4	187	352	262	87	18	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
5	312	751	214	37	31	13	8	1	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.
6	137	552	209	67	36	4	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	47	251	101	38	13	8	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
8	19	70	59	17	8	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
9	12	69	93	46	35	21	20	8	6	2	1	.	.	.	.	.	.	.	.	.	.	.	.
10	2	15	63	44	7	5	4	1	1	2	1	1	.	.	.	.	.	.	.	.	.	.	.
11	.	1	12	13	3	1	.	.	.	.	.	.	2	2	1	3	.	.	.	.	.	.	.
12	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
13	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
14	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
15	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
16	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
17	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
18	.	.	1	.	.	16	10	24	25	67	7	6	4	.	.	.	.	.	.	.	.	.	.
19	.	.	.	.	.	.	1	1	1	8	4	.	.	.	.	.	.	.	.	.	.	.	.
20	.	.	.	.	.	.	.	.	.	1	3	.	1	1	1	.	2	1	1	.	.	.	.
21	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	2	4	8	.	4	1	.	.
22	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
23	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
24	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
25	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
26	.	.	.	.	.	.	.	2	2	3	4	1	1	.	.	.	.	.	.	.	.	.	.
27	.	.	.	.	.	.	.	7	13	17	8	4	4	2	1	1	1	.	.	.	.	.	.
28	.	.	.	.	.	.	.	.	.	1	2	6	.	.	.	.	.	.	.	.	.	.	.
29	.	.	.	.	.	.	.	.	1	.	1	.	1	.	.	.	.	.	.	.	.	.	.
30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	1	.	2	.	.
31	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	1
32	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.

TABLE 10

DISTRIBUTION OF TESTS AMONG REGIONS DEFINED BY EQUAL DIVISIONS OF THE RANGES OF 2 VARIABLES CONSIDERED SIMULTANEOUSLY

THE TOTAL NUMBER OF TESTS IS 12473
THE SYMBOLIC NAMES OF THE VARIABLES AND THEIR RANGE DIVISIONS ARE:

DIV.	RANGE OF G G/S.SQCM	RANGE OF XBO
1	0.0 : 50.0000	-0.50000:-0.40000
2	50.0001: 100.000	-0.39999:-0.30000
3	100.001: 150.000	-0.29999:-0.20000
4	150.001: 200.000	-0.19999:-0.10000
5	200.001: 250.000	-0.09999:-0.00000
6	250.001: 300.000	0.00001: 0.10000
7	300.001: 350.000	0.10001: 0.20000
8	350.001: 400.000	0.20001: 0.30000
9	400.001: 450.000	0.30001: 0.40000
10	450.001: 500.000	0.40001: 0.50000
11	500.001: 550.000	0.50001: 0.60000
12	550.001: 600.000	0.60001: 0.70000
13	600.001: 650.000	0.70001: 0.80000
14	650.001: 700.000	0.80001: 0.90000
15	700.001: 750.000	0.90001: 1.00000
16	750.001: 800.000	
17	800.001: 850.000	
18	850.001: 900.000	
19	900.001: 950.000	
20	950.001: 1000.00	
21	1000.01: 1050.00	
22	1050.01: 1100.00	
23	1100.01: 1150.00	
24	1150.01: 1200.00	
25	1200.01: 1250.00	
26	1250.01: 1300.00	
27	1300.01: 1350.00	
28	1350.01: 1400.00	
29	1400.01: 1450.00	
30	1450.01: 1500.00	
31	1500.01: 1550.00	
32	1550.01: 1600.00	

TABLE 10 (CONTINUED)

XSO G	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	3	7	11	15	23	43	120	172	211	441	453	315	251	149	49
2	4	13	28	30	58	115	188	388	531	466	316	330	58	16	1
3	5	10	12	35	80	204	367	577	805	586	187	62	11	5	.
4	4	9	28	39	64	189	197	161	126	61	16	11	2	1	.
5	2	13	30	54	89	177	200	474	298	27	5	1	.	.	.
6	5	3	11	56	110	200	195	401	20	3	2	.	.	.	.
7	.	1	1	18	62	94	175	99	8	1	.	.	.	.	.
8	1	2	2	10	26	45	55	31	4	.	.	.	.	.	.
9	2	.	4	47	130	76	46	7	1	.	.	.	.	.	.
10	.	.	1	15	57	56	17	.	.	.	.	.	.	.	.
11	.	1	5	13	7	7	5	.	.	.	.	.	.	.	.
12	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.
13	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
14	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.
15	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
16	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
17	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
18	.	.	.	72	88	.	.	.	.	.	.	.	.	.	.
19	.	.	3	12	.	.	.	.	.	.	.	.	.	.	.
20	.	.	3	6	2	.	.	.	.	.	.	.	.	.	.
21	.	.	2	18	.	.	.	.	.	.	.	.	.	.	.
22	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
23	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
24	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
25	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
26	.	.	.	.	13	.	.	.	.	.	.	.	.	.	.
27	.	.	.	6	52	.	.	.	.	.	.	.	.	.	.
28	.	.	.	3	6	.	.	.	.	.	.	.	.	.	.
29	.	.	.	1	2	.	.	.	.	.	.	.	.	.	.
30	.	.	.	6	.	.	.	.	.	.	.	.	.	.	.
31	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.
32	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.

TABLE 11

DISTRIBUTION OF TESTS AMONG REGIONS DEFINED BY EQUAL DIVISIONS OF THE RANGES OF 2 VARIABLES CONSIDERED SIMULTANEOUSLY

THE TOTAL NUMBER OF TESTS IS 12473
THE SYMBOLIC NAMES OF THE VARIABLES AND THEIR RANGE DIVISIONS ARE:

DIV.	RANGE OF G G/S.SQCM	RANGE OF XIN
1	0.0 : 50.0000	-1.10000:-1.00000
2	50.0001: 100.000	-0.99999:-0.90000
3	100.001: 150.000	-0.89999:-0.80000
4	150.001: 200.000	-0.79999:-0.70000
5	200.001: 250.000	-0.69999:-0.60000
6	250.001: 300.000	-0.59999:-0.50000
7	300.001: 350.000	-0.49999:-0.40000
8	350.001: 400.000	-0.39999:-0.30000
9	400.001: 450.000	-0.29999:-0.20000
10	450.001: 500.000	-0.19999:-0.10000
11	500.001: 550.000	-0.09999:-0.00000
12	550.001: 600.000	0.00001: 0.10000
13	600.001: 650.000	0.10001: 0.20000
14	650.001: 700.000	0.20001: 0.30000
15	700.001: 750.000	0.30001: 0.40000
16	750.001: 800.000	0.40001: 0.50000
17	800.001: 850.000	0.50001: 0.60000
18	850.001: 900.000	0.60001: 0.70000
19	900.001: 950.000	0.70001: 0.80000
20	950.001: 1000.00	0.80001: 0.90000
21	1000.01: 1050.00	
22	1050.01: 1100.00	
23	1100.01: 1150.00	
24	1150.01: 1200.00	
25	1200.01: 1250.00	
26	1250.01: 1300.00	
27	1300.01: 1350.00	
28	1350.01: 1400.00	
29	1400.01: 1450.00	
30	1450.01: 1500.00	
31	1500.01: 1550.00	
32	1550.01: 1600.00	

TABLE 11 (CONTINUED)

XIN G	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	17	1	8	10	59	36	88	207	432	543	796	33	8	7	4	6	3	4	1	.
2	14	1	4	12	61	45	116	226	334	692	731	70	77	50	18	31	27	19	12	2
3	13	.	3	6	67	32	67	187	301	974	907	107	88	54	39	41	30	19	6	5
4	2	.	.	6	17	15	40	81	105	214	307	52	26	6	7	12	12	3	2	1
5	4	.	1	2	16	25	51	104	134	429	455	73	40	20	7	8	1	.	.	.
6	4	.	2	.	21	11	48	101	124	281	360	40	5	3	3	2	1	.	.	.
7	1	.	.	.	2	1	10	38	75	103	201	13	8	4	3	.	.	.	.	.
8	.	.	.	.	1	1	6	12	33	52	48	14	8	1	.	.	.	.	.	.
9	.	.	.	.	6	1	6	29	83	141	42	5	.	.	.	.	.	.	.	.
10	.	.	.	.	1	.	.	9	27	63	26	.	.	.	.	.	.	.	.	.
11	.	.	.	.	2	.	1	15	6	10	4	.	.	.	.	.	.	.	.	.
12	.	.	.	.	.	.	.	1	.	1	.	.	.	.	.	.	.	.	.	.
13	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
14	.	.	.	.	.	.	.	.	1	2	.	.	.	.	.	.	.	.	.	.
15	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
16	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
17	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
18	.	.	.	.	.	.	.	.	14	136	10	.	.	.	.	.	.	.	.	.
19	.	.	.	.	.	.	.	1	2	12	.	.	.	.	.	.	.	.	.	.
20	.	.	.	.	.	.	1	3	5	2	.	.	.	.	.	.	.	.	.	.
21	.	.	.	.	.	.	.	2	18	.	.	.	.	.	.	.	.	.	.	.
22	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
23	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
24	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
25	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
26	.	.	.	.	.	.	.	.	.	13	.	.	.	.	.	.	.	.	.	.
27	.	.	.	.	.	.	.	.	8	49	1	.	.	.	.	.	.	.	.	.
28	.	.	.	.	.	.	.	.	.	9	.	.	.	.	.	.	.	.	.	.
29	.	.	.	.	.	.	.	.	1	2	.	.	.	.	.	.	.	.	.	.
30	.	.	.	.	.	.	.	1	5	.	.	.	.	.	.	.	.	.	.	.
31	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.
32	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.

TABLE 12

DISTRIBUTION OF TESTS AMONG REGIONS DEFINED BY EQUAL DIVISIONS OF THE RANGES OF 2 VARIABLES CONSIDERED SIMULTANEOUSLY

THE TOTAL NUMBER OF TESTS IS 12473
THE SYMBOLIC NAMES OF THE VARIABLES AND THEIR RANGE DIVISIONS ARE:

DIV.	RANGE OF G G/S.SQCM	RANGE OF HEQD MM
1	0.0 : 50.0000	2.00000: 5.00000
2	50.0001: 100.000	5.00001: 8.00000
3	100.001: 150.000	8.00001: 11.0000
4	150.001: 200.000	11.0001: 14.0000
5	200.001: 250.000	14.0001: 17.0000
6	250.001: 300.000	17.0001: 20.0000
7	300.001: 350.000	20.0001: 23.0000
8	350.001: 400.000	23.0001: 26.0000
9	400.001: 450.000	26.0001: 29.0000
10	450.001: 500.000	29.0001: 32.0000
11	500.001: 550.000	32.0001: 35.0000
12	550.001: 600.000	35.0001: 38.0000
13	600.001: 650.000	38.0001: 41.0000
14	650.001: 700.000	41.0001: 44.0000
15	700.001: 750.000	44.0001: 47.0000
16	750.001: 800.000	47.0001: 50.0000
17	800.001: 850.000	50.0001: 53.0000
18	850.001: 900.000	53.0001: 56.0000
19	900.001: 950.000	56.0001: 59.0000
20	950.001: 1000.00	59.0001: 62.0000
21	1000.01: 1050.00	62.0001: 65.0000
22	1050.01: 1100.00	65.0001: 68.0000
23	1100.01: 1150.00	68.0001: 71.0000
24	1150.01: 1200.00	71.0001: 74.0000
25	1200.01: 1250.00	74.0001: 77.0000
26	1250.01: 1300.00	77.0001: 80.0000
27	1300.01: 1350.00	80.0001: 83.0000
28	1350.01: 1400.00	83.0001: 86.0000
29	1400.01: 1450.00	
30	1450.01: 1500.00	
31	1500.01: 1550.00	
32	1550.01: 1600.00	

TABLE 12 (CONTINUED)

LEGD G	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
1	31	553	482	91	247	328	30	111	.	126	.	46	5	5	118	41	22	2	.	.	.	.	.	.	.	.	.	25
2	54	160	560	608	251	518	74	95	17	18	.	86	1	10	38	17	17	10	.	.	.	8	.	.	.	.	.	.
3	67	227	839	828	166	608	49	36	18	5	.	11	.	11	9	6	.	11	.	.	.	17	3	35	.	.	.	.
4	1	118	95	182	127	192	39	42	37	.	.	3	.	4	.	8	.	.	.	.	.	13	20	27	.	.	.	.
5	49	121	259	646	97	104	21	17	19	.	.	.	.	2	20	6	.	.	.	.	.	.	9	.	.	.	.	.
6	34	46	208	484	161	48	8	11	5	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.
7	15	20	19	290	80	.	12	1	2	.	.	.	.	.	20	.	.	.	.	.	.	.	.	.	.	.	.	.
8	18	35	23	31	49	20	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
9	17	30	52	49	49	51	19	.	46	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
10	7	7	3	29	71	8	12	.	9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
11	8	4	15	.	2	.	1	.	8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
12	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
13	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
14	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
15	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
16	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
17	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
18	.	.	.	.	.	35	.	.	125	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
19	.	.	.	.	.	3	.	.	12	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
20	.	.	.	.	.	11	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
21	.	.	.	.	.	.	.	.	20	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
22	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
23	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
24	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
25	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
26	.	.	.	.	.	13	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
27	.	.	.	.	.	14	.	.	44	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
28	.	.	.	.	.	.	.	.	9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
29	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
30	.	.	.	.	.	1	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
31	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
32	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

TABLE 13

DISTRIBUTION OF TESTS AMONG REGIONS DEFINED BY EQUAL DIVISIONS OF THE RANGES OF 2 VARIABLES CONSIDERED SIMULTANEOUSLY

THE TOTAL NUMBER OF TESTS IS 12469
THE SYMBOLIC NAMES OF THE VARIABLES AND THEIR RANGE DIVISIONS ARE:

DIV.	RANGE OF RODS	RANGE OF G G/S.SQCM
1	0.50000: 1.50000	0.0 : 50.0000
2	1.50001: 2.50000	50.0001: 100.000
3	2.50001: 3.50000	100.001: 150.000
4	3.50001: 4.50000	150.001: 200.000
5	4.50001: 5.50000	200.001: 250.000
6	5.50001: 6.50000	250.001: 300.000
7	6.50001: 7.50000	300.001: 350.000
8	7.50001: 8.50000	350.001: 400.000
9	8.50001: 9.50000	400.001: 450.000
10	9.50001: 10.5000	450.001: 500.000
11	10.5001: 11.5000	500.001: 550.000
12	11.5001: 12.5000	550.001: 600.000
13	12.5001: 13.5000	600.001: 650.000
14	13.5001: 14.5000	650.001: 700.000
15	14.5001: 15.5000	700.001: 750.000
16	15.5001: 16.5000	750.001: 800.000
17	16.5001: 17.5000	800.001: 850.000
18	17.5001: 18.5000	850.001: 900.000
19	18.5001: 19.5000	900.001: 950.000
20	19.5001: 20.5000	950.001: 1000.00
21	20.5001: 21.5000	1000.01: 1050.00
22	21.5001: 22.5000	1050.01: 1100.00
23	22.5001: 23.5000	1100.01: 1150.00
24	23.5001: 24.5000	1150.01: 1200.00
25	24.5001: 25.5000	1200.01: 1250.00
26	25.5001: 26.5000	1250.01: 1300.00
27	26.5001: 27.5000	1300.01: 1350.00
28	27.5001: 28.5000	1350.01: 1400.00
29	28.5001: 29.5000	1400.01: 1450.00
30	29.5001: 30.5000	1450.01: 1500.00
31	30.5001: 31.5000	
32	31.5001: 32.5000	
33	32.5001: 33.5000	
34	33.5001: 34.5000	
35	34.5001: 35.5000	
36	35.5001: 36.5000	
37	36.5001: 37.5000	

TABLE 13 (CONTINUED)

G / RODS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	93	176	268	99	258	169	145	37	100	17	8	.	.	.	.	.	1	160	15	11	20	.	.	.	.	13	59	9	3	6
2	2	24	49	38	12	8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
3	575	199	171	76	57	57	.	.	15	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
4	34	64	25	61	26	12	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
5	.	.	.	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
6	10	16	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	656	260	314	102	210	47	22	45	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
9	232	538	483	226	148	65	87	9	40	31	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
11	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
12	.	6	6	.	.	11	.	5	7	7	8	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
13	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
14	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
15	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
16	108	162	214	86	29	46	54	12	40	71	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
17	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
18	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
19	318	400	573	75	142	159	15	16	41	.	8	1	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
20	177	201	231	16	82	121	8	3	53	9	11	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
21	.	.	19	.	13	15	17	1	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
22	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
23	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
24	.	3	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
25	.	16	37	12	44	59	6	36	3	9	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
26	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
27	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
28	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
29	.	.	1	.	1	1	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
31	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
32	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
33	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
34	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
35	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
36	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
37	58	427	549	114	347	215	104	11	7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

TABLE 14

DISTRIBUTION OF TESTS AMONG REGIONS DEFINED BY EQUAL
DIVISIONS OF THE RANGES OF 2 VARIABLES CONSIDERED SIMULTANEOUSLY

THE TOTAL NUMBER OF TESTS IS 12473
THE SYMBOLIC NAMES OF THE VARIABLES AND THEIR RANGE DIVISIONS ARE:

DIV.	RANGE OF RODS	RANGE OF P MPA
1	0.50000: 1.50000	0.0 : 1.00000
2	1.50001: 2.50000	1.00001: 2.00000
3	2.50001: 3.50000	2.00001: 3.00000
4	3.50001: 4.50000	3.00001: 4.00000
5	4.50001: 5.50000	4.00001: 5.00000
6	5.50001: 6.50000	5.00001: 6.00000
7	6.50001: 7.50000	6.00001: 7.00000
8	7.50001: 8.50000	7.00001: 8.00000
9	8.50001: 9.50000	8.00001: 9.00000
10	9.50001: 10.5000	9.00001: 10.0000
11	10.5001: 11.5000	10.0001: 11.0000
12	11.5001: 12.5000	11.0001: 12.0000
13	12.5001: 13.5000	12.0001: 13.0000
14	13.5001: 14.5000	13.0001: 14.0000
15	14.5001: 15.5000	14.0001: 15.0000
16	15.5001: 16.5000	15.0001: 16.0000
17	16.5001: 17.5000	16.0001: 17.0000
18	17.5001: 18.5000	17.0001: 18.0000
19	18.5001: 19.5000	
20	19.5001: 20.5000	
21	20.5001: 21.5000	
22	21.5001: 22.5000	
23	22.5001: 23.5000	
24	23.5001: 24.5000	
25	24.5001: 25.5000	
26	25.5001: 26.5000	
27	26.5001: 27.5000	
28	27.5001: 28.5000	
29	28.5001: 29.5000	
30	29.5001: 30.5000	
31	30.5001: 31.5000	
32	31.5001: 32.5000	
33	32.5001: 33.5000	
34	33.5001: 34.5000	
35	34.5001: 35.5000	
36	35.5001: 36.5000	
37	36.5001: 37.5000	

TABLE 14 (CONTINUED)

P / ECDS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	404	.	.	7	.	153	575	133	26	156	17	9	76	96	1	17	.	.
2	.	.	.	.	8	4	49	.	.	8	.	.	30	34	.	.	.	.
3	125	157	181	259	114	38	65	59	16	127	10	.	.	.	.	.	.	.
4	28	59	.	.	.	.	74	10	.	.	.	.	.	51	.	.	.	.
5	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.
6	.	.	.	11	14	5	.	.	.	.	.	.	.	.	.	.	.	.
7	463	12	44	159	128	377	238	97	.	33	.	.	59	57	.	.	.	.
8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
9	.	.	.	5	39	141	485	79	128	93	98	18	94	335	56	232	129	.
10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
11	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
12	.	.	.	.	.	.	.	.	51	.	.	.	.	.	.	.	.	.
13	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
14	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
15	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
16	.	.	.	.	19	42	499	21	13	.	54	1	30	1	89	.	55	1
17	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
18	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
19	.	.	1	245	65	716	475	15	214	.	20	.	.	.	.	.	.	.
20	.	.	7	.	.	4	.	.	288	.	3	90	.	520	.	.	.	.
21	.	.	.	.	2	4	11	.	9	.	45	.	.	.	.	.	.	.
22	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
23	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
24	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.	.	.	.
25	21	.	.	.	.	.	.	.	.	.	13	9	41	76	.	62	1	.
26	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
27	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
28	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
29	.	.	.	.	.	.	.	.	.	.	.	.	.	6	.	.	.	.
30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
31	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
32	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
33	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
34	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
35	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
36	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
37	.	.	17	52	480	653	582	1	7	.	.	.	.	.	.	.	.	.

TABLE 15

DISTRIBUTION OF TESTS AMONG REGIONS DEFINED BY EQUAL DIVISIONS OF THE RANGES OF 2 VARIABLES CONSIDERED SIMULTANEOUSLY

THE TOTAL NUMBER OF TESTS IS 12473
THE SYMBOLIC NAMES OF THE VARIABLES AND THEIR RANGE DIVISIONS ARE:

DIV.	RANGE OF RODS	RANGE OF HEQD MM
1	0.50000: 1.50000	2.00000: 6.00000
2	1.50001: 2.50000	6.00001: 10.0000
3	2.50001: 3.50000	10.0001: 14.0000
4	3.50001: 4.50000	14.0001: 18.0000
5	4.50001: 5.50000	18.0001: 22.0000
6	5.50001: 6.50000	22.0001: 26.0000
7	6.50001: 7.50000	26.0001: 30.0000
8	7.50001: 8.50000	30.0001: 34.0000
9	8.50001: 9.50000	34.0001: 38.0000
10	9.50001: 10.5000	38.0001: 42.0000
11	10.5001: 11.5000	42.0001: 46.0000
12	11.5001: 12.5000	46.0001: 50.0000
13	12.5001: 13.5000	50.0001: 54.0000
14	13.5001: 14.5000	54.0001: 58.0000
15	14.5001: 15.5000	58.0001: 62.0000
16	15.5001: 16.5000	62.0001: 66.0000
17	16.5001: 17.5000	66.0001: 70.0000
18	17.5001: 18.5000	70.0001: 74.0000
19	18.5001: 19.5000	74.0001: 78.0000
20	19.5001: 20.5000	78.0001: 82.0000
21	20.5001: 21.5000	82.0001: 86.0000
22	21.5001: 22.5000	
23	22.5001: 23.5000	
24	23.5001: 24.5000	
25	24.5001: 25.5000	
26	25.5001: 26.5000	
27	26.5001: 27.5000	
28	27.5001: 28.5000	
29	28.5001: 29.5000	
30	29.5001: 30.5000	
31	30.5001: 31.5000	
32	31.5001: 32.5000	
33	32.5001: 33.5000	
34	33.5001: 34.5000	
35	34.5001: 35.5000	
36	35.5001: 36.5000	
37	36.5001: 37.5000	

TABLE 15 (CONTINUED)

HEAD / LEADS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	71	94	730	109	178	48	304	.	.	.	113	.	23	.	.	.	.	.	.	.	.
2	.	.	15	10	.	88	.	.	.	.	.	20	.	.	.	.	.	.	.	.	.
3	.	.	199	388	153	98	13	149	.	.	89	23	39	.	.	.	.	.	.	.	.
4	.	.	47	53	45	4	.	.	.	.	.	.	.	.	.	.	.	33	.	.	.
5	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
6	.	.	.	.	.	21	.	.	.	.	.	9	.	.	.	.	.	.	.	.	.
7	82	746	455	18	198	66	.	.	.	6	32	29	.	.	.	.	.	.	.	.	25
8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
9	.	2	651	275	718	122	64	.	.	.	.	.	.	.	.	.	38	62	.	.	.
10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
11	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
12	51	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
13	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
14	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
15	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
16	.	.	.	325	499	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
17	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
18	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
19	.	1510	230	11	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
20	294	515	.	.	103	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
21	.	.	11	60	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
22	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
23	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
24	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
25	.	.	21	202	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
26	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
27	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
28	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
29	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
31	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
32	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
33	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
34	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
35	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
36	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
37	.	265	1421	.	.	.	.	.	146	.	.	.	.	.	.	.	.	.	.	.	.

TABLE 16

DISTRIBUTION OF TESTS AMONG REGIONS DEFINED BY EQUAL DIVISIONS OF THE RANGES OF 2 VARIABLES CONSIDERED SIMULTANEOUSLY

THE TOTAL NUMBER OF TESTS IS 12473
THE SYMBOLIC NAMES OF THE VARIABLES AND THEIR RANGE DIVISIONS ARE:

DIV.	RANGE OF RDIA MM	RANGE OF HEQD MM
1	0.0 : 2.00000	2.00000: 6.00000
2	2.00001: 4.00000	6.00001: 10.0000
3	4.00001: 6.00000	10.0001: 14.0000
4	6.00001: 8.00000	14.0001: 18.0000
5	8.00001: 10.0000	18.0001: 22.0000
6	10.0001: 12.0000	22.0001: 26.0000
7	12.0001: 14.0000	26.0001: 30.0000
8	14.0001: 16.0000	30.0001: 34.0000
9	16.0001: 18.0000	34.0001: 38.0000
10	18.0001: 20.0000	38.0001: 42.0000
11	20.0001: 22.0000	42.0001: 46.0000
12	22.0001: 24.0000	46.0001: 50.0000
13	24.0001: 26.0000	50.0001: 54.0000
14	26.0001: 28.0000	54.0001: 58.0000
15	28.0001: 30.0000	58.0001: 62.0000
16	30.0001: 32.0000	62.0001: 66.0000
17	32.0001: 34.0000	66.0001: 70.0000
18	34.0001: 36.0000	70.0001: 74.0000
19	36.0001: 38.0000	74.0001: 78.0000
20	38.0001: 40.0000	78.0001: 82.0000
21	40.0001: 42.0000	82.0001: 86.0000
22	42.0001: 44.0000	
23	44.0001: 46.0000	
24	46.0001: 48.0000	
25	48.0001: 50.0000	
26	50.0001: 52.0000	
27	52.0001: 54.0000	

TABLE 16 (CONTINUED)

HEDD / BDIA	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
3	.	197	123	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
4	120	515	.	.	19	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
5	.	87	224	268	152	78	13	.	.	.	113	.	23	.	.	.	.	33	.	.	.
6	51	163	841	1100	406	223	64	100	.	.	89	49	.	.	.	.	38	62	.	.	25
7	62	454	25	18	150	146	304	49	146	6	32	32	39	.	.	.	.	.	.	.	.
8	71	245	2296	108	1046	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
9	.	.	271	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
10	180	1476	.	.	95	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
11	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
12	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
13	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
14	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
15	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
16	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
17	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
18	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
19	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
20	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
21	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
22	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
23	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
24	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
25	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
26	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
27	.	.	.	.	22	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

TABLE 17

DISTRIBUTION OF TESTS AMONG REGIONS DEFINED BY EQUAL
DIVISIONS OF THE RANGES OF 2 VARIABLES CONSIDERED SIMULTANEOUSLY

THE TOTAL NUMBER OF TESTS IS 12473
THE SYMBOLIC NAMES OF THE VARIABLES AND THEIR RANGE DIVISIONS ARE:

DIV.	RANGE OF QBAV W/SQ.CM	RANGE OF XBO
1	0.0 : 50.0000	-0.50000:-0.40000
2	50.0001: 100.000	-0.39999:-0.30000
3	100.001: 150.000	-0.29999:-0.20000
4	150.001: 200.000	-0.19999:-0.10000
5	200.001: 250.000	-0.09999:-0.00000
6	250.001: 300.000	0.00001: 0.10000
7	300.001: 350.000	0.10001: 0.20000
8	350.001: 400.000	0.20001: 0.30000
9	400.001: 450.000	0.30001: 0.40000
10	450.001: 500.000	0.40001: 0.50000
11	500.001: 550.000	0.50001: 0.60000
12	550.001: 600.000	0.60001: 0.70000
13	600.001: 650.000	0.70001: 0.80000
14	650.001: 700.000	0.80001: 0.90000
15	700.001: 750.000	0.90001: 1.00000
16	750.001: 800.000	
17	800.001: 850.000	
18	850.001: 900.000	
19	900.001: 950.000	
20	950.001: 1000.00	
21	1000.01: 1050.00	
22	1050.01: 1100.00	
23	1100.01: 1150.00	
24	1150.01: 1200.00	
25	1200.01: 1250.00	
26	1250.01: 1300.00	
27	1300.01: 1350.00	
28	1350.01: 1400.00	
29	1400.01: 1450.00	
30	1450.01: 1500.00	
31	1500.01: 1550.00	
32	1550.01: 1600.00	
33	1600.01: 1650.00	
34	1650.01: 1700.00	
35	1700.01: 1750.00	
36	1750.01: 1800.00	
37	1800.01: 1850.00	

DIV.	RANGE OF QBAV W/SQ.CM
38	1850.01: 1900.00
39	1900.01: 1950.00
40	1950.01: 2000.00
41	2000.01: 2050.00
42	2050.01: 2100.00
43	2100.01: 2150.00
44	2150.01: 2200.00
45	2200.01: 2250.00

TABLE 17 (CONTINUED)

XBO / OBAV	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	2	2	5	11	25	30	34	72	118	271	310	283	263	168	50
2	3	1	6	18	37	89	137	511	776	790	521	369	37	1	.
3	.	7	11	41	71	158	455	951	799	437	144	60	22	2	.
4	2	7	13	52	127	325	412	497	266	86	4	7	.	.	.
5	2	5	25	53	124	317	275	222	38	1	.	.	.	.	.
6	2	6	25	35	114	106	134	50	7	.	.	.	.	.	.
7	3	7	16	30	66	83	66	7	.	.	.	.	.	.	.
8	1	5	9	13	25	45	27	.	.	.	.	.	.	.	.
9	1	4	6	10	37	36	17	.	.	.	.	.	.	.	.
10	2	2	.	17	33	16	8	.	.	.	.	.	.	.	.
11	2	5	6	5	23	2	.	.	.	.	.	.	.	.	.
12	.	3	2	5	32	.	.	.	.	.	.	.	.	.	.
13	2	.	3	11	10	.	.	.	.	.	.	.	.	.	.
14	3	1	.	9	10	.	.	.	.	.	.	.	.	.	.
15	1	.	1	4	11	.	.	.	.	.	.	.	.	.	.
16	.	1	2	2	26	.	.	.	.	.	.	.	.	.	.
17	.	1	.	4	30	.	.	.	.	.	.	.	.	.	.
18	.	2	1	4	10	.	.	.	.	.	.	.	.	.	.
19	.	.	.	13	17	.	.	.	.	.	.	.	.	.	.
20	.	.	.	54	17	.	.	.	.	.	.	.	.	.	.
21	.	.	.	7	3	.	.	.	.	.	.	.	.	.	.
22	.	.	.	6	15	.	.	.	.	.	.	.	.	.	.
23	.	.	.	7	5	.	.	.	.	.	.	.	.	.	.
24	.	.	.	5	1	.	.	.	.	.	.	.	.	.	.
25	.	.	.	6	2	.	.	.	.	.	.	.	.	.	.
26	.	.	.	4	1	.	.	.	.	.	.	.	.	.	.
27	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
28	.	.	1	3	1	.	.	.	.	.	.	.	.	.	.
29	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.
30	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.
31	.	.	3	2	.	.	.	.	.	.	.	.	.	.	.
32	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.
33	.	.	.	6	.	.	.	.	.	.	.	.	.	.	.
34	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.
35	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.
36	.	.	.	11	.	.	.	.	.	.	.	.	.	.	.
37	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.
38	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.
39	.	.	1	3	.	.	.	.	.	.	.	.	.	.	.
40	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.
41	.	.	1	2	.	.	.	.	.	.	.	.	.	.	.
42	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
43	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
44	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
45	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.

TABLE 18

DISTRIBUTION OF TESTS AMONG REGIONS DEFINED BY PERCENTILE DIVISIONS OF THE RANGES OF 2 VARIABLES CONSIDERED SIMULTANEOUSLY

THE TOTAL NUMBER OF TESTS IS 12473
THE SYMBOLIC NAMES OF THE VARIABLES AND THEIR RANGE DIVISIONS ARE:

DIV.	RANGE OF P (MPA)	RANGE OF G (G/S.SQCM)
1	0.0 : 3.03500	0.0 : 30.3500
2	3.03501: 4.99500	30.3501: 58.5000
3	4.99501: 5.85800	58.5001: 70.3100
4	5.85801: 6.80620	70.3101: 101.970
5	6.80621: 6.92600	101.971: 135.210
6	6.92601: 8.37600	135.211: 140.700
7	8.37601: 13.6999	140.701: 202.300
8	13.7000: 17.0400	202.301: 237.320
9		237.321: 337.600
10		337.601: 1557.00

G / P	1	2	3	4	5	6	7	8	9	10
1	695	116	12	101	42	11	83	1	67	415
2	275	278	188	138	175	192	99	134	65	3
3	60	186	89	242	324	92	167	244	116	36
4	4	20	130	42	85	171	76	147	155	59
5	40	151	437	219	243	364	286	189	223	99
6	70	162	174	162	190	179	172	149	196	152
7	54	190	76	258	70	91	216	212	159	185
8	53	141	141	83	98	170	145	174	267	298

TABLE 19

DISTRIBUTION OF TESTS AMONG REGIONS DEFINED BY PERCENTILE DIVISIONS OF THE RANGES OF 2 VARIABLES CONSIDERED SIMULTANEOUSLY

THE TOTAL NUMBER OF TESTS IS 12473
THE SYMBOLIC NAMES OF THE VARIABLES AND THEIR RANGE DIVISIONS ARE:

DIV.	RANGE OF QBC W/SQ.CM	RANGE OF G G/S.SQCM
1	C.0 : 44.7500	0.0 : 3C.3500
2	44.7501: 71.1560	30.3501: 58.5000
3	71.1561: 88.9600	58.5001: 70.3100
4	88.9601: 106.320	70.3101: 101.970
5	1C6.321: 125.372	101.971: 135.210
6	125.373: 149.840	135.211: 140.700
7	149.841: 177.631	140.701: 202.300
8	177.632: 215.80C	202.301: 237.320
9	215.801: 297.200	237.321: 337.600
10	297.201: 2221.00	337.601: 1557.00

G / CBC	1	2	3	4	5	6	7	8	9	10
1	574	260	82	73	83	73	37	30	26	9
2	180	2C8	188	166	175	97	70	81	62	21
3	28	127	354	119	161	160	149	97	40	12
4	161	171	112	113	145	217	107	130	72	19
5	41	141	89	123	109	253	102	229	123	38
6	75	112	144	143	97	116	87	207	218	48
7	30	86	147	153	123	94	137	141	212	124
8	74	49	103	156	135	132	191	111	171	128
9	41	32	24	104	123	110	249	132	184	246
10	47	58	4	95	76	18	115	92	140	602

TABLE 20

DISTRIBUTION OF TESTS AMONG REGIONS DEFINED BY PERCENTILE DIVISIONS OF THE RANGES OF 2 VARIABLES CONSIDERED SIMULTANEOUSLY

THE TOTAL NUMBER OF TESTS IS 12473
THE SYMBOLIC NAMES OF THE VARIABLES AND THEIR RANGE DIVISIONS ARE:

DIV.	RANGE OF XBC	RANGE OF G (G/S.SQCM)
1	-0.50000:-0.03820	0.0 : 30.3500
2	-0.03819: 0.08035	30.3501: 58.5000
3	0.08036: 0.16897	58.5001: 70.3100
4	0.16898: 0.22790	70.3101: 101.970
5	0.22791: 0.28198	101.971: 135.210
6	0.28199: 0.34090	135.211: 140.700
7	0.34091: 0.40477	140.701: 202.300
8	0.40478: 0.48075	202.301: 237.320
9	0.48076: 0.60150	237.321: 337.600
10	0.60151: 1.00000	337.601: 1557.00

XBC \ G	1	2	3	4	5	6	7	8	9	10
1	21	34	20	80	30	53	129	140	157	583
2	19	37	32	75	75	89	217	145	254	305
3	38	51	39	129	118	150	201	140	210	171
4	73	32	62	89	109	114	158	132	319	159
5	62	40	86	159	149	114	134	254	231	19
6	50	84	122	138	201	168	94	322	60	8
7	82	118	193	164	174	243	173	87	11	2
8	198	168	224	110	166	269	87	21	4	.
9	301	255	186	217	155	50	34	8	2	.
10	407	385	283	84	50	20	17	1	.	.

TABLE 21

DISTRIBUTION OF TESTS AMONG REGIONS DEFINED BY PERCENTILE DIVISIONS OF THE RANGES OF 2 VARIABLES CONSIDERED SIMULTANEOUSLY

THE TOTAL NUMBER OF TESTS IS 12473
THE SYMBOLIC NAMES OF THE VARIABLES AND THEIR RANGE DIVISIONS ARE:

DIV.	RANGE OF XIN	RANGE OF G G/S.SQCM
1	-1.10000:-0.37750	0.0 : 30.3500
2	-0.37749:-0.25930	30.3501: 58.5000
3	-0.25929:-0.19883	58.5001: 70.3100
4	-0.19882:-0.16215	70.3101: 101.970
5	-0.16214:-0.13153	101.971: 135.210
6	-0.13152:-0.09910	135.211: 140.700
7	-0.09909:-0.06829	140.701: 202.300
8	-0.06828:-0.04037	202.301: 237.320
9	-0.04036:-0.01000	237.321: 337.600
10	-0.00999: 0.90000	337.601: 1557.00

G / XIN	1	2	3	4	5	6	7	8	9	10
1	80	231	159	127	76	138	141	119	120	56
2	177	137	133	137	56	102	113	94	125	174
3	177	172	123	100	106	94	101	87	107	180
4	111	146	156	115	109	132	83	105	88	202
5	86	135	129	87	120	153	100	105	118	215
6	39	75	135	75	130	187	124	190	133	159
7	45	55	127	114	146	148	137	167	174	90
8	221	67	97	95	94	123	123	145	191	91
9	276	110	118	147	142	99	125	84	104	45
10	39	72	70	248	248	94	197	154	88	35

TABLE 22

DISTRIBUTION OF TESTS AMONG REGIONS DEFINED BY PERCENTILE DIVISIONS OF THE RANGES OF 2 VARIABLES CONSIDERED SIMULTANEOUSLY

THE TOTAL NUMBER OF TESTS IS 12473
THE SYMBOLIC NAMES OF THE VARIABLES AND THEIR RANGE DIVISIONS ARE:

DIV.	RANGE OF HEQD MM	RANGE OF G G/S.SQCM
1	2.70000: 7.60000	0.0 : 30.3500
2	7.60001: 9.35000	30.3501: 58.5000
3	9.35001: 10.1000	58.5001: 70.3100
4	10.1001: 12.2500	70.3101: 101.970
5	12.2501: 13.4200	101.971: 135.210
6	13.4201: 13.8000	135.211: 140.700
7	13.8001: 17.2000	140.701: 202.300
8	17.2001: 19.0000	202.301: 237.320
9	19.0001: 25.6000	237.321: 337.600
10	25.6001: 86.0000	337.601: 1557.00

G / HEQD	1	2	3	4	5	6	7	8	9	10
1	480	83	66	90	49	82	90	81	93	112
2	25	122	211	62	132	235	121	122	134	97
3	124	210	22	207	233	50	160	132	56	14
4	.	63	62	111	222	118	113	236	235	91
5	1	14	199	106	57	215	123	213	177	28
6	36	79	163	78	70	222	44	205	269	176
7	118	189	45	149	89	47	160	80	183	243
8	129	139	197	144	115	113	158	50	49	155
9	78	174	204	188	168	173	146	79	21	48
10	260	171	78	110	92	15	129	52	31	283

TABLE 23

DISTRIBUTION OF TESTS AMONG REGIONS DEFINED BY PERCENTILE DIVISIONS OF THE RANGES OF 2 VARIABLES CONSIDERED SIMULTANEOUSLY

THE TOTAL NUMBER OF TESTS IS 12473
THE SYMBOLIC NAMES OF THE VARIABLES AND THEIR RANGE DIVISIONS ARE:

DIV.	RANGE OF XBO	RANGE OF QBAV W/SQ.CM
1	-0.50000:-0.03820	0.0 : 41.7500
2	-0.03819: 0.08035	41.7501: 65.4750
3	0.08036: 0.16897	65.4751: 81.8300
4	0.16898: 0.22790	81.8301: 100.520
5	0.22791: 0.28198	100.521: 117.950
6	0.28199: 0.34090	117.951: 136.840
7	0.34091: 0.40477	136.841: 166.247
8	0.40478: 0.48075	166.248: 203.090
9	0.48076: 0.60150	203.091: 277.200
10	0.60151: 1.00000	277.201: 2221.00

QBAV / XBO	1	2	3	4	5	6	7	8	9	10
1	22	21	12	20	28	43	52	118	206	725
2	32	18	22	59	42	58	119	248	375	275
3	25	25	31	39	75	100	251	238	267	196
4	19	49	55	93	118	239	232	177	230	35
5	25	74	83	129	170	255	166	216	117	13
6	32	85	129	209	200	254	151	138	46	4
7	54	128	225	227	271	132	121	82	7	.
8	125	239	207	257	191	95	107	26	.	.
9	291	366	252	147	97	51	38	6	.	.
10	621	244	231	68	55	20	8	.	.	.

TABLE 24

DISTRIBUTION OF TESTS AMONG REGIONS DEFINED BY PERCENTILE
DIVISIONS OF THE RANGES OF 2 VARIABLES CONSIDERED SIMULTANEOUSLY

THE TOTAL NUMBER OF TESTS IS 12473
THE SYMBOLIC NAMES OF THE VARIABLES AND THEIR RANGE DIVISIONS ARE:

DIV.	RANGE OF BC X1000	RANGE OF XBO
1	0.0 : 0.26000	-0.50000:-0.03820
2	0.26001: 0.35400	-0.03819: 0.08035
3	0.35401: 0.44525	0.08036: 0.16897
4	0.44526: 0.54640	0.16898: 0.22790
5	0.54641: 0.68060	0.22791: 0.28198
6	0.68061: 0.84060	0.28199: 0.34090
7	0.84061: 1.06750	0.34091: 0.40477
8	1.06751: 1.41600	0.40478: 0.48075
9	1.41601: 2.29600	0.48076: 0.60150
10	2.29601: 17.2000	0.60151: 1.00000

XBO / BC	1	2	3	4	5	6	7	8	9	10
1	53	41	69	230	172	177	141	138	113	113
2	80	72	72	207	260	169	121	67	123	77
3	110	94	120	89	95	226	185	124	110	94
4	184	148	141	100	55	76	148	217	99	79
5	138	157	129	102	86	64	87	61	129	255
6	140	195	155	91	116	97	91	92	62	208
7	167	181	191	129	145	115	101	90	74	54
8	151	141	136	119	137	129	150	135	64	85
9	109	124	153	85	109	123	136	119	194	96
10	115	55	81	95	73	71	87	204	280	186

TABLE 25

DISTRIBUTION OF TESTS AMONG REGIONS DEFINED BY PERCENTILE DIVISIONS OF THE RANGES OF 2 VARIABLES CONSIDERED SIMULTANEOUSLY

THE TOTAL NUMBER OF TESTS IS 12473
THE SYMBOLIC NAMES OF THE VARIABLES AND THEIR RANGE DIVISIONS ARE:

DIV.	RANGE OF BO X1000	RANGE OF L/D
1	C.0 : 0.26000	2.00000: 31.6000
2	0.26001: 0.35400	31.6001: 58.0000
3	0.35401: 0.44525	58.0001: 94.50C0
4	C.44526: 0.5464C	94.5001: 118.000
5	0.54641: 0.6806C	118.001: 146.000
6	C.68061: 0.8406C	146.001: 196.000
7	C.84061: 1.06750	196.001: 271.000
8	1.06751: 1.4160C	271.001: 310.000
9	1.41601: 2.2960C	310.001: 767.000
10	2.29601: 17.20CC	

L/D / BO	1	2	3	4	5	6	7	8	9
1	41	35	115	13	27	19	215	68	714
2	66	20	42	38	19	92	353	209	409
3	69	42	49	55	94	148	222	348	220
4	120	53	60	70	202	192	164	305	81
5	65	56	90	108	245	237	161	200	86
6	83	91	137	173	258	217	93	182	13
7	139	96	207	277	285	193	45	3	2
8	153	138	223	361	200	141	31	.	.
9	265	145	288	336	141	70	3	.	.
10	404	665	130	34	10	4	.	.	.

TABLE 26

DISTRIBUTION OF TESTS AMONG REGIONS DEFINED BY PERCENTILE DIVISIONS OF THE RANGES OF 2 VARIABLES CONSIDERED SIMULTANEOUSLY

THE TOTAL NUMBER OF TESTS IS 12473
THE SYMBOLIC NAMES OF THE VARIABLES AND THEIR RANGE DIVISIONS ARE:

DIV.	RANGE OF BC X1000	RANGE OF WE
1	0.0 : 0.26000	0.0 : 628.300
2	0.26001: 0.35400	628.301: 1721.00
3	0.35401: 0.44525	1721.01: 3373.00
4	0.44526: 0.54640	3373.01: 4764.20
5	0.54641: 0.68060	4764.21: 6296.50
6	0.68061: 0.84060	6296.51: 8990.00
7	0.84061: 1.06750	8990.01: 12360.0
8	1.06751: 1.41600	12360.1: 16099.0
9	1.41601: 2.29600	16099.1: 25660.0
10	2.29601: 17.2000	25660.1: 179000.

BC \ WE	1	2	3	4	5	6	7	8	9	10
1	10	56	59	48	92	93	154	220	263	252
2	20	24	17	24	82	137	178	195	223	348
3	19	21	40	71	127	146	189	180	267	187
4	15	33	50	120	106	109	123	345	181	165
5	51	98	119	131	206	110	149	110	124	150
6	44	69	123	147	258	156	167	96	90	97
7	31	106	164	182	130	257	188	74	76	39
8	58	140	243	332	175	177	65	26	22	9
9	108	357	392	187	69	59	33	1	2	.
10	891	304	40	5	3	3	1	.	.	.

NOTE

As Tables 27 to 29 each occupy two pages and are to be read in conjunction, the first of these commences on page 98.

TABLE 27

DISTRIBUTION OF TESTS AMONG REGIONS DEFINED BY PERCENTILE
DIVISIONS OF THE RANGES OF 4 VARIABLES CONSIDERED SIMULTANEOUSLY

THE TOTAL NUMBER OF TESTS IS 12473
THE SYMBOLIC NAMES OF THE VARIABLES AND THEIR RANGE DIVISIONS ARE:

DIV.	RANGE OF XIN	RANGE OF G G/S.SQCM	RANGE OF P MPA	RANGE OF HEQD MM
1	-1.10000:-0.25930	0.0 : 58.5000	0.0 : 3.03500	2.70000: 9.35000
2	-0.25929:-0.16215	58.5001: 101.970	3.03501: 4.99500	9.35001: 12.2500
3	-0.16214:-0.09910	101.971: 140.700	4.99501: 5.85800	12.2501: 13.8000
4	-0.09909:-0.04037	140.701: 237.320	5.85801: 6.80620	13.8001: 19.0000
5	-0.04036: 0.90000	237.321: 1557.00	6.80621: 6.92600	19.0001: 86.0000
6			6.92601: 8.37600	
7			8.37601: 13.6999	
8			13.7000: 17.0400	

TABLE 27 (CONTINUED)

HEQD		1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5
	G	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
P	XIN																									
1	1	3	6	1	.	.	.	.	.	.	.	.	.	.	.	.	12	.	.	1	16	15	.	.	.	22
1	2	2	3	.	.	.	2	.	.	.	.	.	.	.	.	.	73	.	.	.	71	94	4	.	.	94
1	3	.	4	.	.	.	3	.	.	.	.	.	.	4	.	21	30	3	12	12	38	58	.	.	.	160
1	4	202	2	1	.	1	1	.	.	.	.	1	8	4	.	1	2	5	16	11	18	9	3	2	1	11
1	5	272	1	1	2	.	2	.	.	.	.	5	15	.	12	5	12	47	.	34	24	13	12	12	11	.
2	1	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	76	.	.	.	.	82	15	3	1	.
2	2	14	8	14	8	.	27	12	16	2	.	.	14	4	.	.	78	16	1	.	1	103	21	13	1	.
2	3	12	17	43	26	1	29	10	23	8	.	.	24	41	23	.	1	8	5	5	4	28	11	10	.	.
2	4	4	7	20	49	1	33	12	29	12	.	.	28	38	43	49	.	2	4	.	.	19	22	10	.	.
2	5	3	34	23	29	3	27	23	22	8	.	.	9	10	4	7	.	4	2	4	2	17	29	33	10	.
3	1	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	13	14	4	.	.	28	18	2	.	.
3	2	5	8	8	4	1	35	30	40	53	13	.	1	.	.	.	6	12	7	.	.	.	6	9	2	.
3	3	.	8	7	5	8	31	35	43	74	26	.	.	7	3	.	4	8	14	.	.	1	5	7	2	.
3	4	4	4	10	8	6	39	33	48	66	33	.	4	3	1	4	4	8	12	1	1	5	10	9	4	.
3	5	3	11	22	22	13	46	8C	112	137	44	.	.	1	.	3	2	8	9	.	.	18	28	41	25	.
4	1	.	.	1	.	.	.	1	1	1	.	3	5	.	.	.	.	.	.	.	.	.	.	1	.	.
4	2	.	.	4	.	.	4	7	12	5	4	1	35	31	8	.	.	2	1	.	.	.	2	3	3	.
4	3	.	.	6	4	4	4	4	14	6	10	.	44	63	57	20	.	.	.	.	.	2	2	9	8	.
4	4	.	.	5	10	3	3	6	9	4	11	.	43	57	75	122	.	1	1	.	.	.	3	8	5	.
4	5	.	.	1	9	10	5	3	8	4	3	1	11	17	19	25	.	1	1	1	2	1	2	3	4	.
5	1	8	14	7	12	13	.	6	9	2	2	1	2	3	1	.	21	44	18	3	.	26	36	16	10	.
5	2	3	11	15	9	10	5	19	33	41	37	4	56	26	10	2	15	44	50	13	1	21	38	30	14	.
5	3	2	8	7	11	8	2	9	21	27	27	1	48	45	43	30	12	18	29	16	4	12	22	27	11	.
5	4	5	13	8	20	7	.	8	21	17	28	2	46	42	54	86	17	37	39	36	7	13	39	28	22	.
5	5	3	28	19	38	18	1	5	16	5	11	7	17	18	17	19	4	27	30	13	4	6	57	50	30	8
6	1	32	52	50	17	40	.	12	4	3	1	.	.	1	.	.	38	20	2	20	2	18	25	15	3	.
6	2	1	6	11	9	28	5	10	23	32	41	.	.	2	.	.	24	15	5	20	2	3	15	14	3	.
6	3	18	35	42	16	69	7	4	15	22	37	.	.	2	2	1	20	18	6	17	2	2	10	16	12	.
6	4	3	10	14	6	35	6	9	28	30	29	1	.	2	3	4	27	11	2	18	2	4	9	14	20	1
6	5	.	12	12	12	17	6	13	56	34	16	16	31	22	15	21	1	2	.	.	.	.	17	11	7	.
7	1	11	13	7	4	5	31	13	2	5	7	11	23	11	48	13	32	46	17	66	47	39	45	7	64	7
7	2	11	13	14	7	20	10	8	.	9	6	2	2	8	18	23	22	27	17	37	63	12	23	10	28	10
7	3	3	1	1	3	2	4	4	1	8	3	3	3	6	4	18	6	11	12	17	46	10	15	7	31	7
7	4	.	3	.	1	.	3	6	2	3	3	4	4	4	9	20	4	14	3	11	19	7	12	6	11	8
7	5	2	2	1	4	2	7	3	8	8	.	2	14	2	9	5	1	5	1	4	1	7	24	14	19	9
8	1	63	70	94	45	80	7	6	2	5	2	36	30	54	62	51	14	40	33	63	144	5	.	3	31	23
8	2	3	2	1	2	7	6	5	!	3	1	12	9	15	18	45	1	10	3	11	79	2	.	.	6	18
8	3	18	19	27	17	24	2	1	.	3	.	7	10	8	12	22	3	7	8	13	28	.	.	2	1	5
8	4	.	.	.	2	.	.	1	1	2	1	10	10	10	15	33	.	.	.	1	2	.	.	1	1	.
8	5	.	4	1	3	.	2	.	2	2	.	.	.	.	.	.	.	.	.	.	.	3	.	2	1	.

TABLE 28

DISTRIBUTION OF TESTS AMONG REGIONS DEFINED BY PERCENTILE DIVISIONS OF THE RANGES OF 4 VARIABLES CONSIDERED SIMULTANEOUSLY

THE TOTAL NUMBER OF TESTS IS 12473
THE SYMBOLIC NAMES OF THE VARIABLES AND THEIR RANGE DIVISIONS ARE:

DIV.	RANGE OF XBO	RANGE OF G G/S.SQCM	RANGE OF P MPA	RANGE OF HEQD MM
1	-0.50000: 0.08035	0.0 : 58.5000	0.0 : 3.03500	2.70000: 9.35000
2	0.08036: 0.22790	58.5001: 101.970	3.03501: 4.99500	9.35001: 12.2500
3	0.22791: 0.34090	101.971: 140.700	4.99501: 5.85800	12.2501: 13.8000
4	0.34091: 0.48075	140.701: 237.320	5.85801: 6.80620	13.8001: 19.0000
5	0.48076: 1.00000	237.321: 1557.00	6.80621: 6.92600	19.0001: 86.0000
6			6.92601: 8.37600	
7			8.37601: 13.6999	
8			13.7000: 17.0400	

TABLE 28 (CONTINUED)

P	XPC	HEQD 1, G 1	HEQD 1, G 2	HEQD 1, G 3	HEQD 1, G 4	HEQD 1, G 5
1	1	.	.	.	.	.
1	2	1	7	.	.	.
1	3	.	6	1	2	1
1	4	168	1	2	.	.
1	5	310	2	.	.	.
2	1	.	.	.	.	.
2	2	.	.	1	.	2
2	3	.	1	1	8	3
2	4	.	2	38	80	.
2	5	33	63	60	24	.
3	1	.	.	.	.	1
3	2	.	.	2	3	16
3	3	.	2	6	14	11
3	4	.	6	17	18	.
3	5	12	23	22	4	.
4	1	.	.	.	.	.
4	2	.	.	.	.	2
4	3	.	.	2	.	13
4	4	.	.	5	20	2
4	5	.	.	10	3	.
5	1	.	6	5	6	24
5	2	2	9	13	32	20
5	3	.	24	12	25	11
5	4	4	24	13	24	1
5	5	15	11	13	3	.
6	1	.	14	27	13	81
6	2	.	16	33	20	89
6	3	4	22	36	15	17
6	4	11	31	21	11	2
6	5	39	32	12	1	.
7	1	.	5	6	8	15
7	2	2	7	10	9	11
7	3	6	8	5	2	3
7	4	9	4	2	.	.
7	5	10	8	.	.	.
8	1	1	29	75	45	95
8	2	7	27	36	19	13
8	3	12	21	11	4	3
8	4	18	12	1	1	.
8	5	46	6	.	.	.

P	XPC	HEQD 2, G 1	HEQD 2, G 2	HEQD 2, G 3	HEQD 2, G 4	HEQD 2, G 5
1	1	.	.	.	.	.
1	2	.	.	.	.	.
1	3	.	.	.	.	.
1	4	.	.	.	.	.
1	5	8	.	.	.	.
2	1	.	.	.	.	.
2	2	.	.	.	9	.
2	3	.	.	22	8	.
2	4	3	25	62	13	.
2	5	113	32	6	.	.
3	1	.	.	.	.	.
3	2	.	.	.	34	66
3	3	.	.	42	187	46
3	4	.	47	132	99	4
3	5	153	131	70	10	.
4	1	.	.	.	.	.
4	2	.	.	.	2	21
4	3	.	.	15	5	5
4	4	.	5	26	13	2
4	5	16	16	3	.	.
5	1	.	.	.	3	19
5	2	.	8	7	21	78
5	3	.	19	48	68	8
5	4	.	24	42	.	.
5	5	8	.	3	.	.
6	1	.	1	1	.	3
6	2	.	3	7	24	105
6	3	.	9	46	87	15
6	4	.	32	47	4	1
6	5	24	3	25	6	.
7	1	29	11	3	14	16
7	2	9	8	1	16	3
7	3	6	8	4	3	.
7	4	8	3	5	.	.
7	5	3	4	.	.	.
8	1	4	.	6	6	2
8	2	5	4	.	7	2
8	3	.	4	.	2	.
8	4	8	5	.	.	.
8	5	.	.	.	.	.

P	XPC	HEQD 3, G 1	HEQD 3, G 2	HEQD 3, G 3	HEQD 3, G 4	HEQD 3, G 5
1	1	.	.	.	.	22
1	2	1	13	.	12	5
1	3	3	10	1	.	.
1	4	2	.	7	.	.
1	5	.	.	.	.	.
2	1	.	.	4	.	.
2	2	.	1	1	1	16
2	3	.	.	7	61	40
2	4	.	.	78	8	.
2	5	.	74	6	.	.
3	1	.	.	.	.	.
3	2	.	.	.	.	6
3	3	.	.	1	4	1
3	4	.	.	10	.	.
3	5	.	5	.	.	.
4	1	.	.	.	.	.
4	2	.	.	.	5	82
4	3	.	.	14	118	85
4	4	.	3	150	36	.
4	5	5	135	4	.	.
5	1	.	.	.	.	1
5	2	.	.	2	13	86
5	3	.	8	13	86	50
5	4	.	27	119	26	.
5	5	15	134	.	.	.
6	1	.	.	.	.	.
6	2	.	.	3	10	20
6	3	.	.	14	7	4
6	4	2	9	7	3	2
6	5	15	22	5	.	.
7	1	.	22	5	49	27
7	2	4	10	12	33	52
7	3	1	4	13	6	.
7	4	1	9	1	.	.
7	5	16	1	.	.	.
8	1	.	1	5	39	59
8	2	.	11	59	64	92
8	3	4	28	23	4	.
8	4	29	19	.	.	.
8	5	32	.	.	.	.

P	XPC	HEQD 4, G 1	HEQD 4, G 2	HEQD 4, G 3	HEQD 4, G 4	HEQD 4, G 5
1	1	1	.	4	23	148
1	2	8	24	24	35	19
1	3	21	31	.	.	.
1	4	41	.	.	.	.
1	5	58	.	.	.	.
2	1	.	1	.	2	6
2	2	.	3	5	6	1
2	3	12	4	5	1	.
2	4	41	20	2	.	.
2	5	102	2	.	.	.
3	1	.	.	.	.	.
3	2	.	1	12	1	1
3	3	.	12	29	.	.
3	4	2	28	5	.	.
3	5	27	9	.	.	.
4	1	.	.	.	.	.
4	2	.	.	.	1	2
4	3	.	.	1	.	.
4	4	.	.	2	.	.
4	5	.	4	.	.	.
5	1	.	.	2	16	3
5	2	.	8	51	36	13
5	3	.	38	91	27	.
5	4	2	104	22	2	.
5	5	67	20	.	.	.
6	1	.	3	.	10	6
6	2	.	5	2	37	2
6	3	1	23	9	25	.
6	4	17	33	4	3	.
6	5	92	2	.	.	.
7	1	1	27	15	93	162
7	2	4	40	32	40	14
7	3	23	24	3	2	.
7	4	25	12	.	.	.
7	5	12	.	.	.	.
8	1	.	12	26	64	237
8	2	.	22	16	24	16
8	3	1	16	2	.	.
8	4	5	6	.	.	.
8	5	12	1	.	.	.

P	XPC	HEQD 5, G 1	HEQD 5, G 2	HEQD 5, G 3	HEQD 5, G 4	HEQD 5, G 5
1	1	14	.	2	3	287
1	2	68	9	10	9	.
1	3	60	5	2	.	.
1	4	35	5	.	.	.
1	5	12	.	.	.	.
2	1	2	2	7	2	.
2	2	62	18	21	6	.
2	3	68	38	27	4	.
2	4	72	40	5	.	.
2	5	45	.	9	.	.
3	1	2	1	5	5	.
3	2	1	2	14	12	.
3	3	1	30	24	14	.
3	4	21	26	12	5	.
3	5	27	8	13	1	.
4	1	.	.	8	14	.
4	2	.	.	10	6	.
4	3	.	7	6	.	.
4	4	.	2	.	.	.
4	5	3	.	.	.	.
5	1	.	.	6	9	.
5	2	.	29	56	56	1
5	3	5	56	67	12	2
5	4	32	86	12	2	3
5	5	41	22	10	8	2
6	1	3	1	13	25	1
6	2	3	14	35	17	.
6	3	.	36	21	3	.
6	4	8	25	1	.	.
6	5	13	.	.	.	.
7	1	47	71	14	142	40
7	2	14	21	16	11	1
7	3	8	11	8	.	.
7	4	2	16	2	.	.
7	5	4	.	4	.	.
8	1	7	.	8	40	44
8	2	3	.	.	.	2
8	3	.	.	.	.	.
8	4	.	.	.	.	.
8	5	.	.	.	.	.

TABLE 29

DISTRIBUTION OF TESTS AMONG REGIONS DEFINED BY PERCENTILE DIVISIONS OF THE RANGES OF 4 VARIABLES CONSIDERED SIMULTANEOUSLY

THE TOTAL NUMBER OF TESTS IS 12473
THE SYMBOLIC NAMES OF THE VARIABLES AND THEIR RANGE DIVISIONS ARE:

DIV.	RANGE OF GBAV W/SQ.CM	RANGE OF G G/S.SQCM	RANGE OF P MPA	RANGE OF HEQD MM
1	0.0 : 65.4750	0.0 : 58.5000	0.0 : 3.03500	2.70000: 9.35000
2	65.4751: 100.520	58.5001: 101.970	3.03501: 4.99500	9.35001: 12.2500
3	100.521: 136.840	101.971: 140.700	4.99501: 5.85800	12.2501: 13.8000
4	136.841: 203.090	140.701: 237.320	5.85801: 6.80620	13.8001: 19.0000
5	203.091: 2221.00	237.321: 1557.00	6.80621: 6.92600	19.0001: 86.0000
6			6.92601: 8.37600	
7			8.37601: 13.6999	
8			13.7000: 17.0400	

TABLE 29 (CONTINUED)

HECD		1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5
	G	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
P	OBAV																									
1	1	464	.	.	.	.	7	.	.	.	.	.	.	.	.	.	5	.	.	.	.	33	.	.	.	.
1	2	1	1	.	.	.	1	.	.	.	.	.	.	1	.	3	29	1	.	.	.	67	10	2	.	.
1	3	10	1	.	.	.	.	.	.	.	.	.	.	7	.	5	59	3	.	.	.	41	1	5	4	.
1	4	4	5	3	.	1	.	.	.	.	.	3	2	.	.	13	36	10	2	4	.	27	.	.	2	.
1	5	.	9	.	2	.	.	.	.	.	.	3	21	.	12	6	.	41	26	54	167	21	8	7	6	287
2	1	33	53	86	48	.	101	15	13	1	.	.	4	7	.	.	11	.	.	.	.	16	4	7	.	.
2	2	.	11	9	64	1	15	23	52	10	.	.	70	33	18	6	55	.	.	.	.	62	26	9	.	.
2	3	.	2	3	.	.	.	17	20	10	.	.	.	52	51	41	75	4	.	.	.	50	15	5	2	.
2	4	.	.	2	.	3	.	2	5	9	.	.	.	.	1	9	14	21	.	.	.	75	42	12	3	.
2	5	.	.	.	.	1	.	.	.	.	.	.	1	4	.	.	.	5	12	9	7	46	11	36	7	.
3	1	12	15	13	11	1	142	112	95	75	6	.	2	1	.	.	5	4	.	.	.	11	7	12	3	.
3	2	.	11	16	11	3	11	46	107	136	43	.	3	8	2	1	4	14	4	.	.	25	14	6	5	.
3	3	.	5	14	7	6	.	19	24	74	43	.	.	2	2	5	12	7	11	.	.	15	10	13	7	.
3	4	.	.	4	10	11	.	1	13	31	15	.	.	.	.	1	8	23	18	.	.	1	33	16	11	.
3	5	.	.	.	.	7	.	.	5	14	9	.	.	.	.	.	.	2	13	1	1	.	3	21	11	.
4	1	.	.	13	17	11	16	5	9	1	11	1	28	7	.	.	.	.	.	.	.	1	.	.	.	.
4	2	.	.	4	6	1	.	11	19	10	4	3	100	71	20	15	.	3	.	.	.	.	2	.	.	.
4	3	.	.	.	.	4	.	4	13	5	11	1	4	89	134	107	.	1	3	.	.	2	2	.	.	.
4	4	.	.	.	.	1	.	1	3	4	2	.	6	1	3	42	.	.	.	1	.	.	5	7	.	.
4	5	.	.	.	.	.	.	.	.	.	.	.	.	.	2	3	.	.	.	.	2	.	.	17	20	.
5	1	13	8	12	7	.	5	.	46	16	11	3	21	8	.	.	26	.	.	.	.	15	17	16	9	3
5	2	2	14	13	14	2	2	5	33	33	12	9	106	78	13	5	19	53	15	15	.	13	42	17	2	3
5	3	4	16	10	15	9	1	30	10	26	33	3	10	39	92	99	20	49	30	20	1	30	9	18	7	1
5	4	2	30	17	22	26	.	14	6	14	40	.	27	6	9	22	4	67	89	30	11	16	102	46	19	1
5	5	.	6	4	32	19	.	2	5	3	9	.	5	3	11	11	.	1	32	16	4	4	22	54	50	.
6	1	37	36	20	17	19	24	.	46	15	27	17	31	5	5	5	56	.	.	.	.	3	.	.	.	.
6	2	17	49	31	9	8	.	15	27	39	23	.	.	5	2	2	21	7	2	.	.	6	7	2	.	.
6	3	.	24	38	20	28	.	19	23	33	38	.	.	7	2	5	16	28	7	23	1	15	8	.	2	.
6	4	.	6	37	14	64	.	11	19	21	26	.	.	9	4	6	17	24	5	28	.	3	51	30	10	.
6	5	.	.	3	.	70	.	3	11	13	10	.	.	3	7	8	.	7	1	24	7	.	10	38	33	1
7	1	15	11	6	4	4	1	1	.	.	.	5	.	.	.	.	.	.	.	.	1	15	10	5	.	.
7	2	2	10	7	2	4	3	5	3	3	1	10	7	5	.	.	8	6	1	2	4	5	7	8	3	.
7	3	8	2	9	2	3	17	8	2	3	1	2	7	14	12	4	33	24	6	10	2	7	20	3	5	.
7	4	2	9	1	4	16	22	11	5	17	3	.	16	8	37	50	22	48	33	62	27	12	35	7	45	6
7	5	.	.	.	7	2	12	9	3	10	14	5	16	4	39	25	2	25	10	61	142	36	47	21	100	35
8	1	68	43	36	15	17	4	5	1	3	.	41	11	2	1	.	11	4	.	.	1	.	.	.	.	.
8	2	15	40	37	15	11	6	.	1	.	2	22	27	29	19	.	3	26	10	12	3	.	.	.	.	.
8	3	.	10	33	15	13	4	5	1	5	.	2	17	23	25	15	4	12	10	24	12	.	.	.	2	.
8	4	.	2	16	22	35	2	3	2	5	2	.	4	31	41	76	.	12	17	43	71	.	.	.	11	14
8	5	1	.	1	2	35	1	.	1	2	.	.	.	2	21	60	.	3	7	9	166	10	.	8	27	32

TABLE 30

DISTRIBUTION OF TESTS AMONG REGIONS DEFINED BY PERCENTILE
DIVISIONS OF THE RANGES OF 4 VARIABLES CONSIDERED SIMULTANEOUSLY

THE TOTAL NUMBER OF TESTS IS 12473
THF SYMBOLIC NAMES CF THE VARIABLES AND THEIR RANGE DIVISIONS ARE:

DIV.	RANGE CF BO X10CC	RANGE OF WE	RANGE OF LFR	RANGE OF XBO
1	3.0 : 0.35400	C.0 : 1721.00	0.0 : 6.35000	-0.50000: 0.08035
2	0.35401: 0.54640	1721.01: 4764.20	6.35001: 21.7500	0.08036: 0.22790
3	C.54641: C.84060	4764.21: 8990.00	21.7501: 55.2700	0.22791: 0.34090
4	C.84061: 1.41600	8990.01: 16099.C	55.2701: 150.100	0.34091: 0.48075
5	1.416C1: 17.2C00	16099.1: 17900C.	150.101: 3036.00	0.43076: 1.00000

LER	XBC / WE / BO	1 / 1	1 / 2	1 / 3	1 / 4	1 / 5	2 / 1	2 / 2	2 / 3	2 / 4	2 / 5	3 / 1	3 / 2	3 / 3	3 / 4	3 / 5	4 / 1	4 / 2	4 / 3	4 / 4	4 / 5	5 / .	5 / 2	5 / 3	5 / 4	5 / 5
1	1	5	.	.	.	.	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	14	1	2	.	.
1	2	5	.	.	.	.	2	.	1	.	.	1	.	.	2	.	.	.	.	.	.	47	35	6	.	.
1	3	3	.	.	.	.	.	.	.	.	.	3	.	2	11	1	2	5	34	17	.	193	56	14	.	.
1	4	2	.	.	.	.	1	2	4	1	.	2	32	11	1	.	34	54	40	1	.	155	68	10	.	.
1	5	79	1	1	.	.	16C	20	5	.	.	146	40	.	.	.	353	61	4	.	.	687	54	1	.	.
2	1	.	1	.	.	.	2	.	.	.	1	.	1	.	.	.	6	.	.	.	.	14	49	45	14	.
2	2	3	.	.	.	.	2	.	.	3	7	1	.	.	2	3	6	27	8	10	.	8	121	94	15	.
2	3	4	1	.	.	.	8	6	3	7	1	9	18	25	11	2	2	96	35	31	.	1	73	271	27	.
2	4	24	2	1	26	14	34	45	33	2	1	11	99	133	8	.	4	234	64	6	.	7	23	8	.	.
2	5	96	13	25	7	.	45	88	25	17	.	44	119	18	2	.	19	107	2	.	.	7	7	.	.	.
3	1	11	2	.	.	.	6	.	4	.	.	7	.	13	7	2	3	3	44	178	8	5	12	101	72	19
3	2	3	2	.	.	.	.	4	6	3	13	.	9	27	92	13	1	10	125	357	70	6	2	40	.	1
3	3	12	10	2	.	.	4	19	39	44	6	.	26	78	76	10	1	29	49	14	1	2	12	4	.	.
3	4	18	39	24	8	.	6	63	158	72	12	13	62	41	80	3	5	20	8	.	2	2	4	.	.	.
3	5	51	26	2	1	.	1C	32	7	.	.	2	4	1	.	.	.	.	.	.	.	.	.	.	.	.
4	1	22	3	15	2	1	2	5	4	8	72	.	2	68	72	399	.	.	46	61	71	4	16	3	16	29
4	2	3	9	15	9	7	.	10	29	69	56	.	5	61	26	173	.	.	36	4	18	.	.	2	5	.
4	3	14	60	40	44	19	.	23	24	110	78	.	6	35	27	5	.	2	12	.	.	.	.	1	.	.
4	4	14	103	97	68	3	.	22	56	36	13	.	14	15	.	.	.	.	4	.	.	.	.	.	.	.
4	5	1	43	32	7	.	.	4	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
5	1	6	30	16	45	87	1	9	8	160	293	.	8	13	100	86	.	3	19	11	14	.	2	3	1	4
5	2	.	44	29	133	274	.	2	8	72	163	.	.	1	34	2	.	1	.	1	.	.	.	.	.	.
5	3	2	69	36	74	280	1	6	20	20	58	1	2	6	9	.	.	1	.	.	.	.	.	.	.	.
5	4	2	31	26	41	97	1	4	6	2	1	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.
5	5	.	5	10	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

TABLE 31

DISTRIBUTION OF TESTS AMONG REGIONS DEFINED BY PERCENTILE DIVISIONS OF THE RANGES OF 4 VARIABLES CONSIDERED SIMULTANEOUSLY

THE TOTAL NUMBER OF TESTS IS 10803
THE SYMBOLIC NAMES OF THE VARIABLES AND THEIR RANGE DIVISIONS ARE:

DIV.	RANGE OF FP/D	RANGE OF L/D	RANGE OF RDIA MM	RANGE OF RODS
1	1.00000: 1.08500	0.0 : 62.0000	0.0 : 10.1000	2.00000: 7.00000
2	1.08501: 1.19000	62.0001: 114.000	10.1001: 10.8000	7.00001: 16.0000
3	1.19001: 1.31200	114.001: 155.000	10.8001: 14.4000	16.0001: 20.0000
4	1.31201: 1.35600	155.001: 272.000	14.4001: 15.9500	20.0001: 37.0000
5	1.35601: 2.23000	272.001: 730.000	15.9501: 21.0000	

	RODS	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4
	L/D	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
RDIA	FF/C																				
1	1	12	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1	2	157	41	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1	3	80	15	.	.	.	.	.	.	.	.	.	.	.	114	.	.	.	.	.	6
1	4	43	217	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1	5	519	234	291	9	.	27	.	.	.	.	.	.	461	54	.	.	.	.	.	.
2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2	2	.	.	.	161	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2	3	.	.	83	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2	4	68	.	.	.	.	181	318	825	.	.	.	.	.	.	.	.	119	154	.	.
2	5	49	119	.	.	.	.	.	.	.	.	.	11	9	.	.	.	.	.	.	.
3	1	.	.	.	.	.	.	.	.	51	.	.	.	.	.	.	.	.	.	.	.
3	2	473	3	5	.	.	.	.	.	.	.	58	17	.	44	.	21	.	.	.	.
3	3	.	.	18	47	.	.	338	94	130	.	.	.	.	.	.	.	.	.	.	.
3	4	.	.	.	.	.	.	.	.	47	.	.	.	103	.	.	.	.	.	.	.
3	5	194	102	.	15	.	143	59	.	.	.	.	.	.	.	.	.	.	146	.	.
4	1	.	.	.	.	.	.	.	.	.	.	75	.	.	73	.	.	.	.	.	.
4	2	.	.	.	.	.	.	.	.	.	.	54	144	.	36	.	.	.	.	5	723
4	3	.	.	.	.	.	.	332	43	168	.	.	.	.	.	.	.	.	.	698	.
4	4	.	.	.	.	.	.	35	14	.	.	.	.	.	.	.	.	.	.	.	.
4	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
5	1	.	.	.	271	.	.	.	.	.	.	12	73	.	106	1190	.	.	.	.	265
5	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
5	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
5	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
5	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	29	.	.	.	.	.

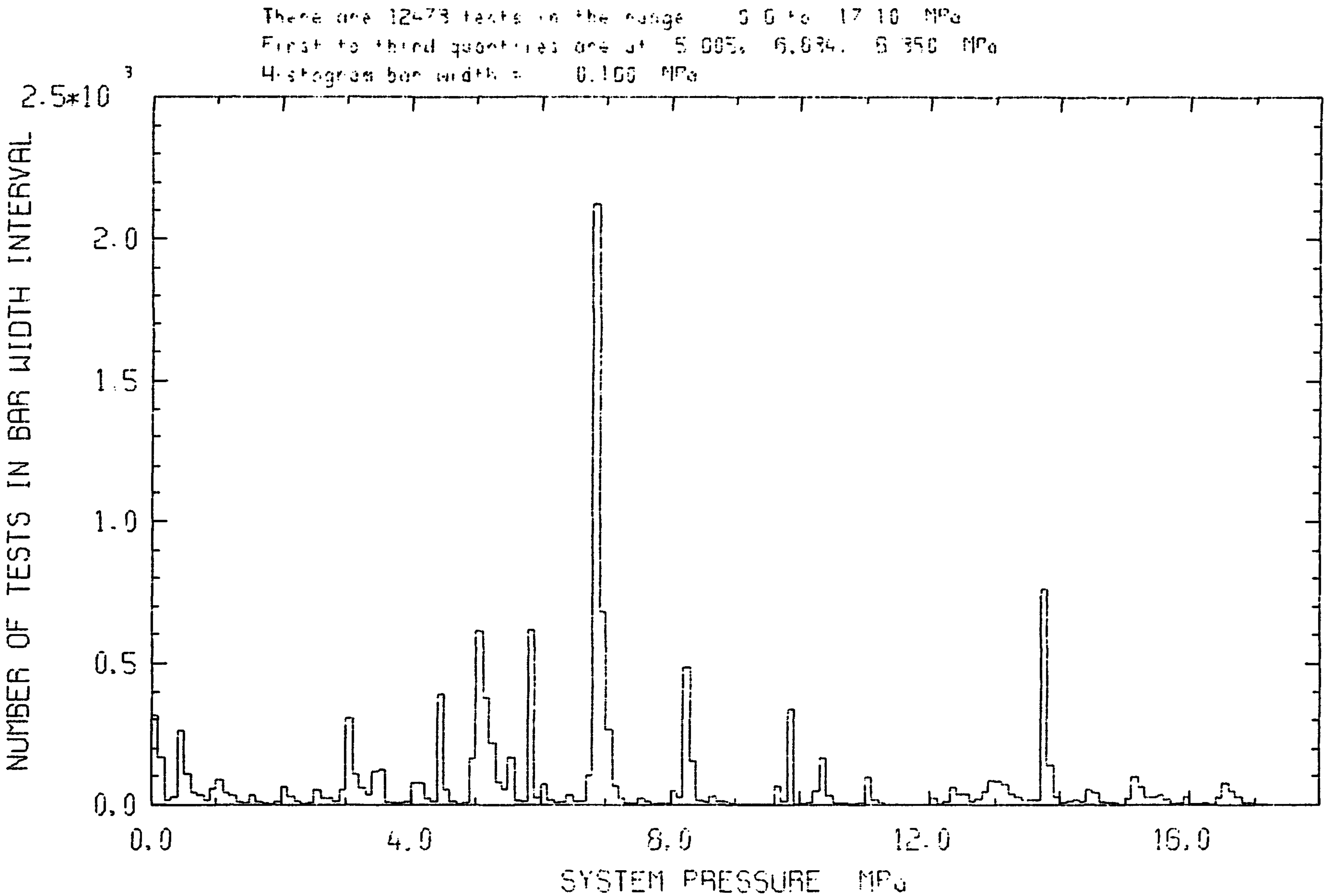

FIGURE 1. DISTRIBUTION OF TESTS OVER THE RANGE OF SYSTEM PRESSURE

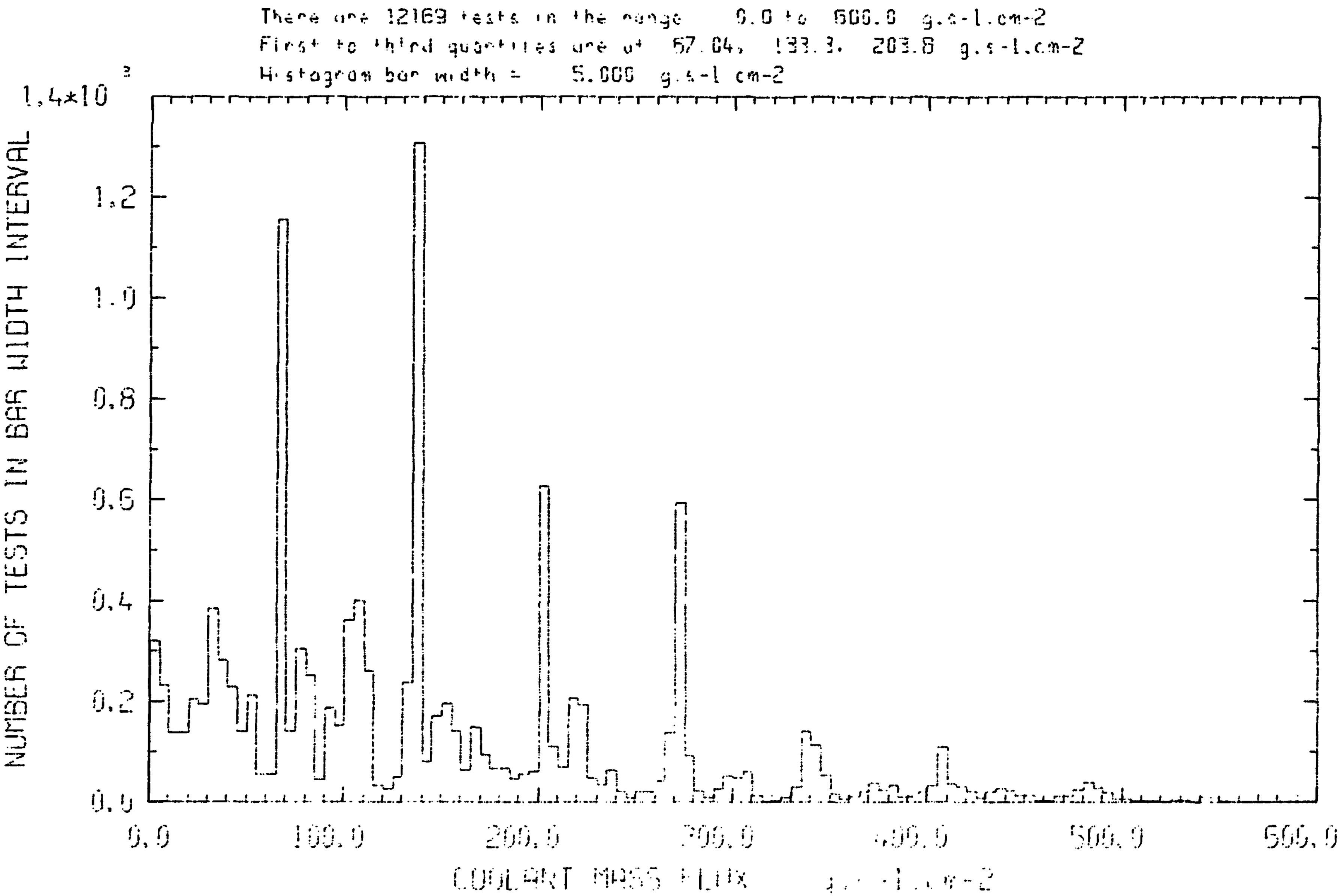

FIGURE 2. DISTRIBUTION OF TESTS OVER THE RANGE OF COOLANT MASS FLUX

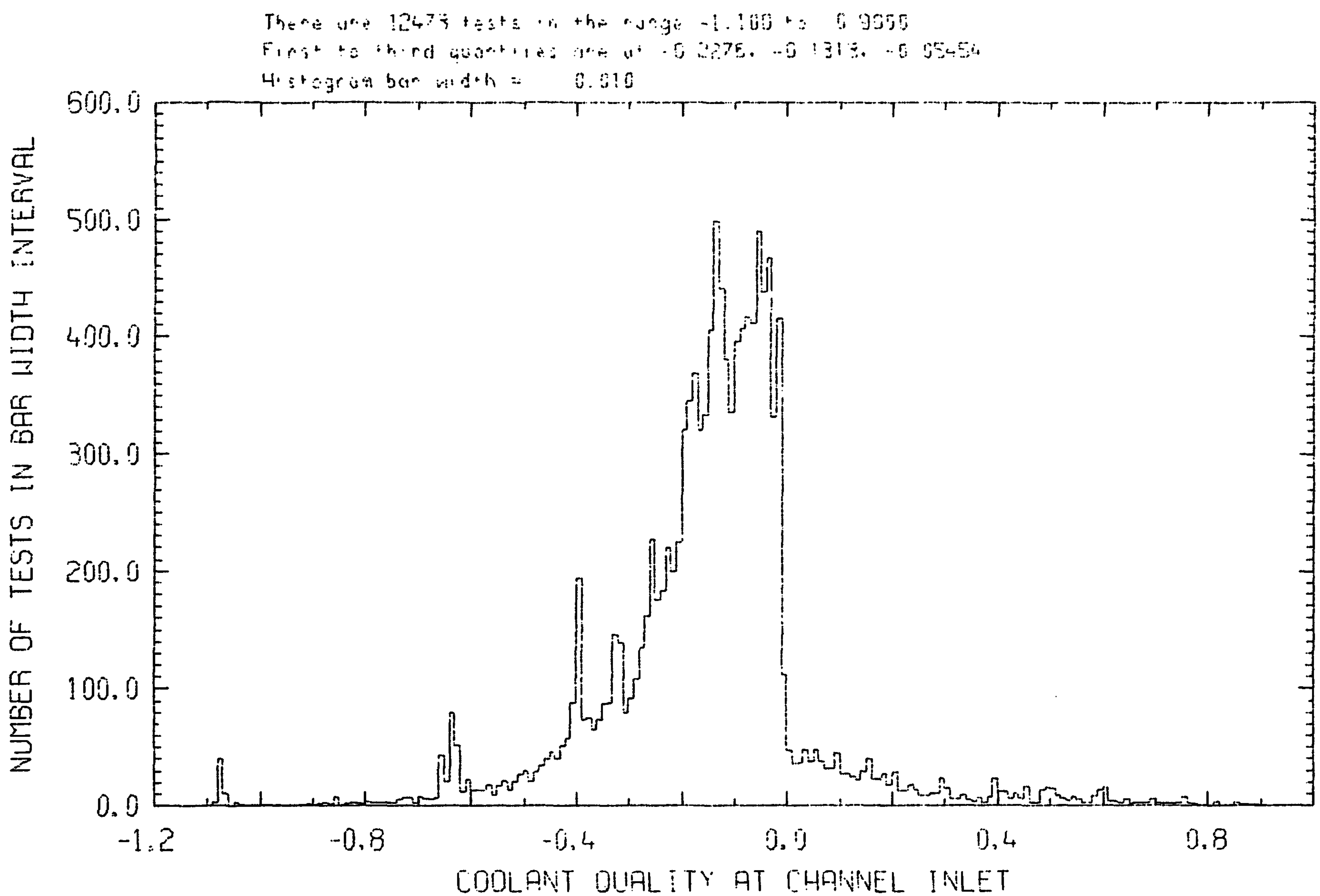

FIGURE 3. DISTRIBUTION OF TESTS OVER THE RANGE OF COOLANT QUALITY AT CHANNEL INLET

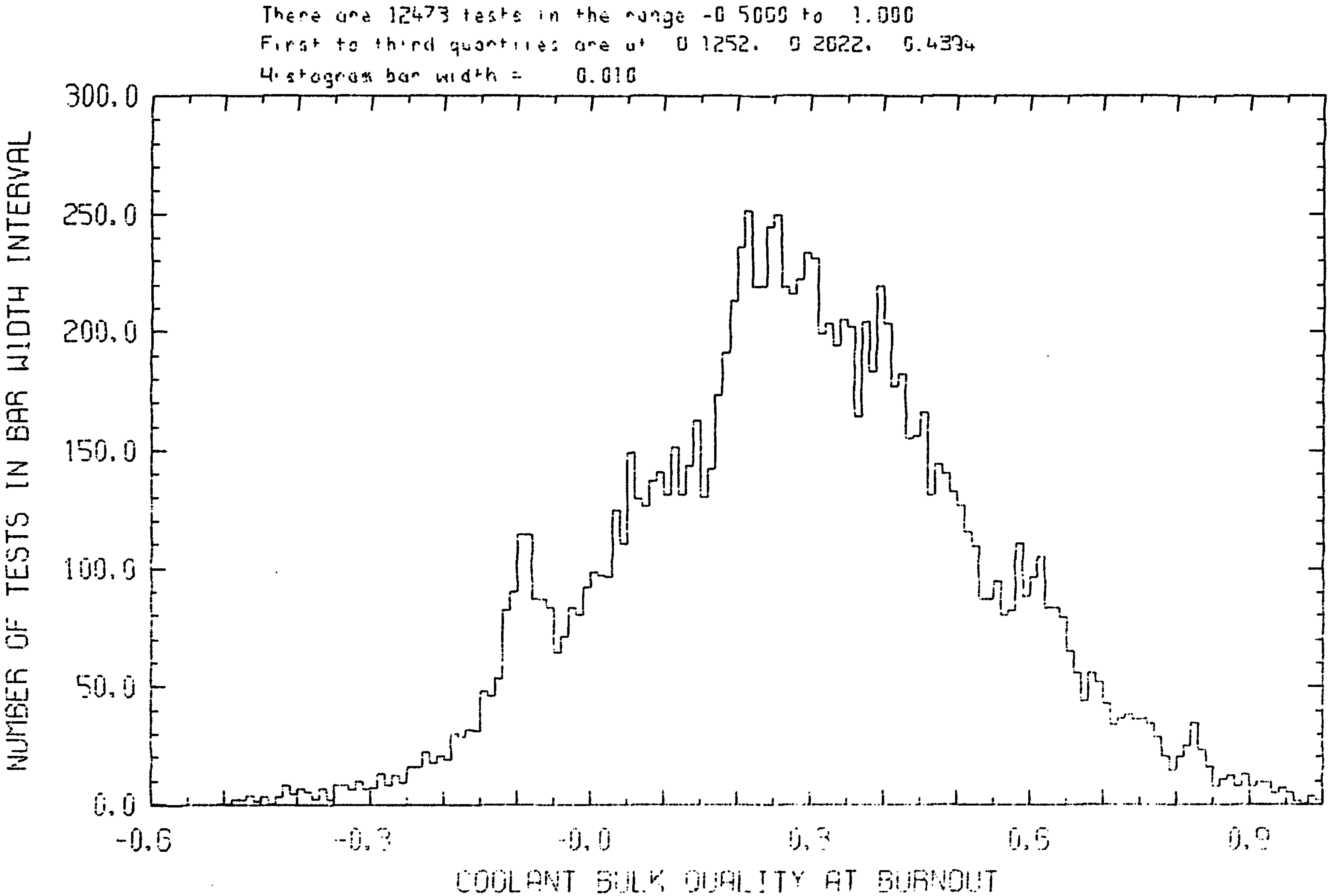

FIGURE 4. DISTRIBUTION OF TESTS OVER THE RANGE OF COOLANT BULK QUALITY AT BURNOUT

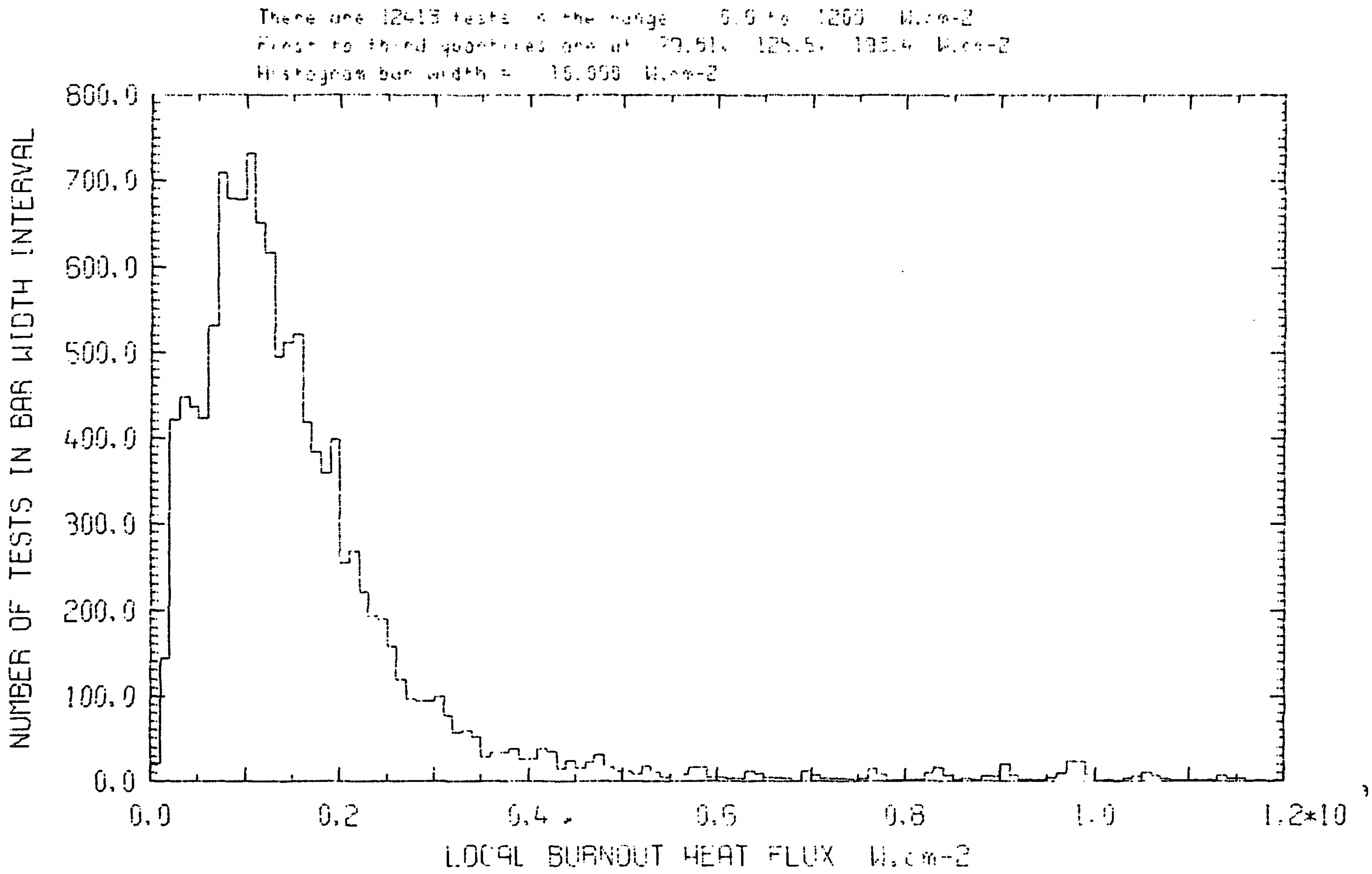

FIGURE 5. DISTRIBUTION OF TESTS OVER THE RANGE OF LOCAL BURNOUT HEAT FLUX

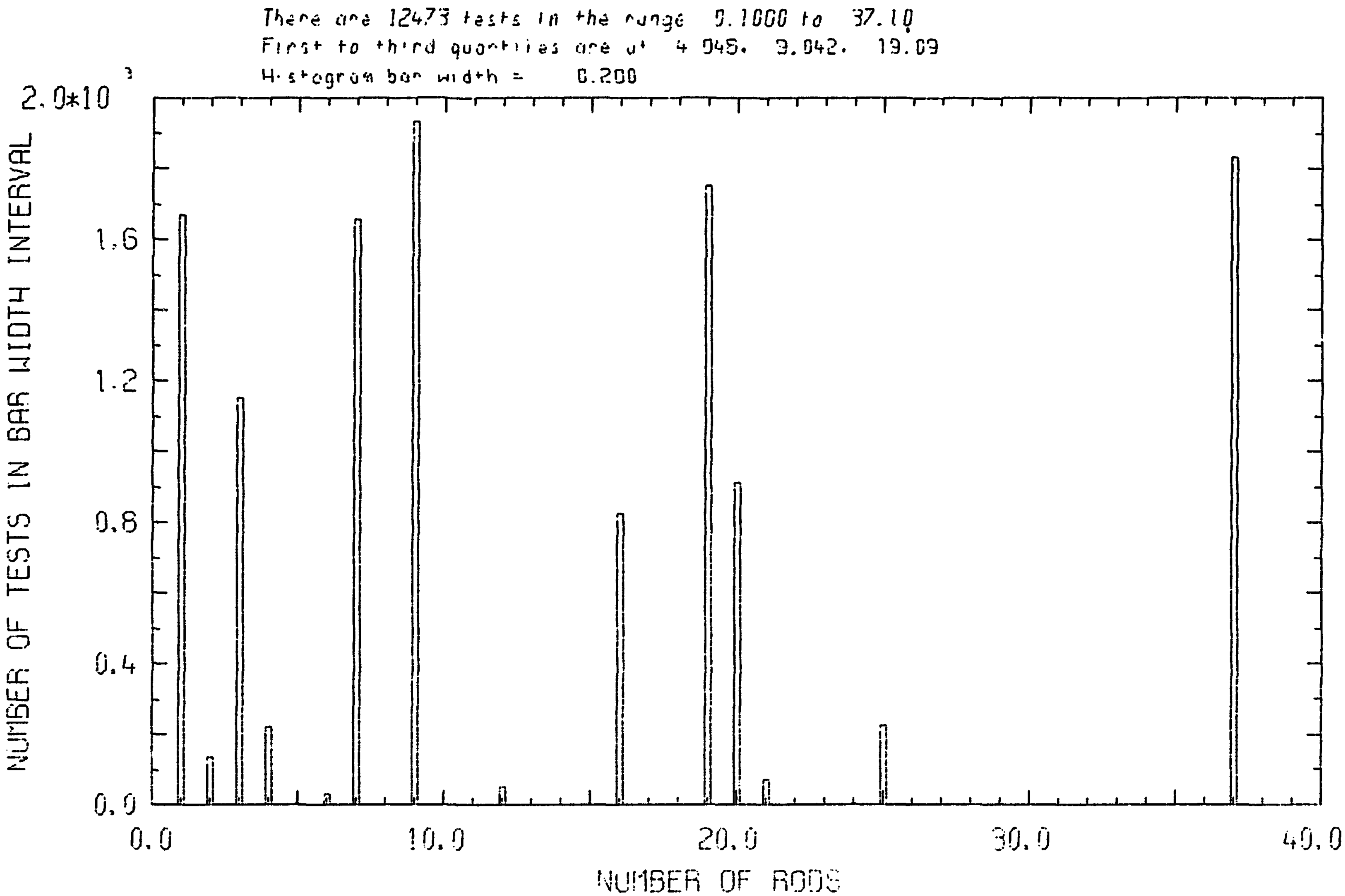

FIGURE 6. DISTRIBUTION OF TESTS OVER THE RANGE OF NUMBER OF RODS

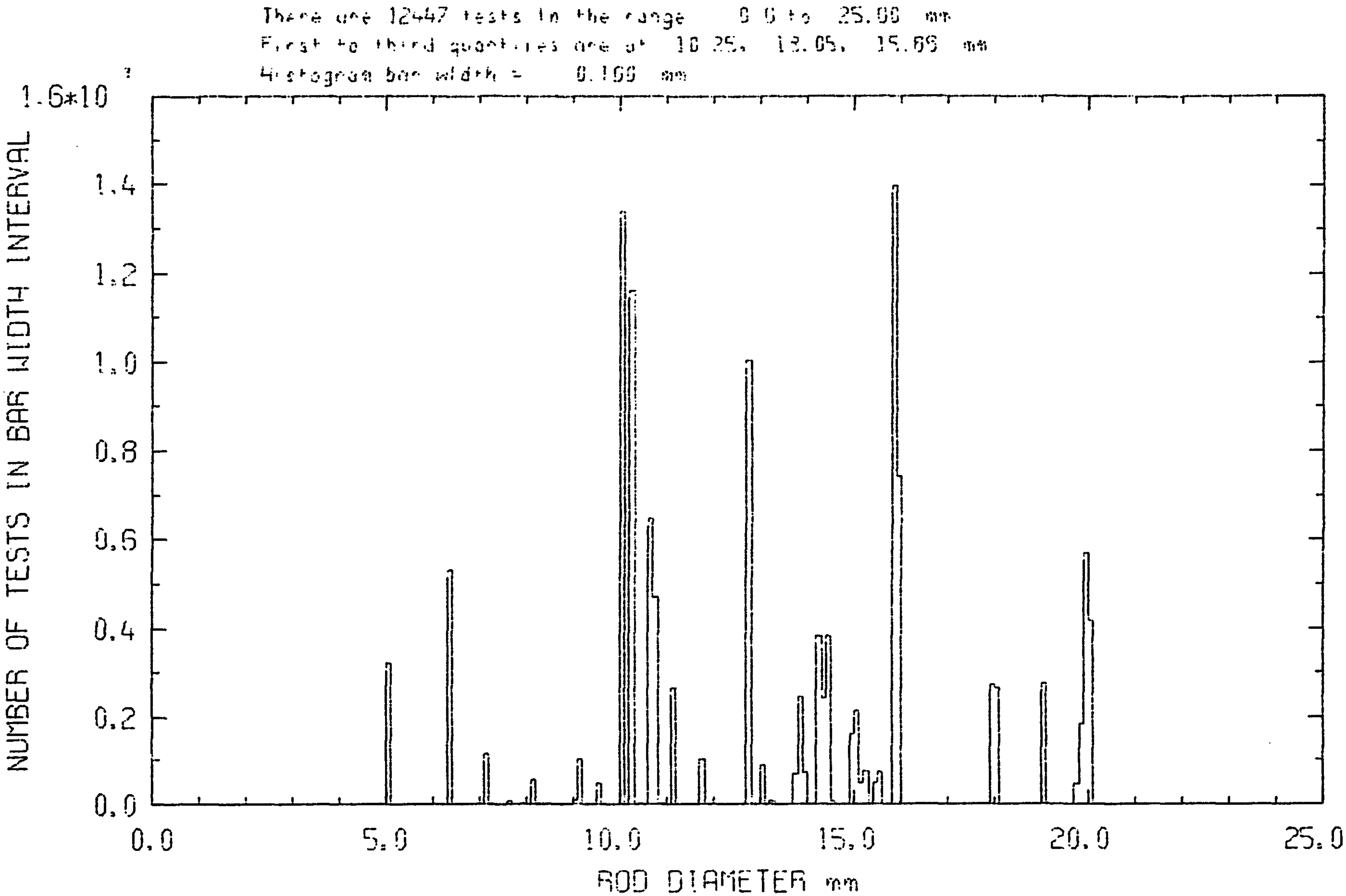

FIGURE 7. DISTRIBUTION OF TESTS OVER THE RANGE OF ROD DIAMETER

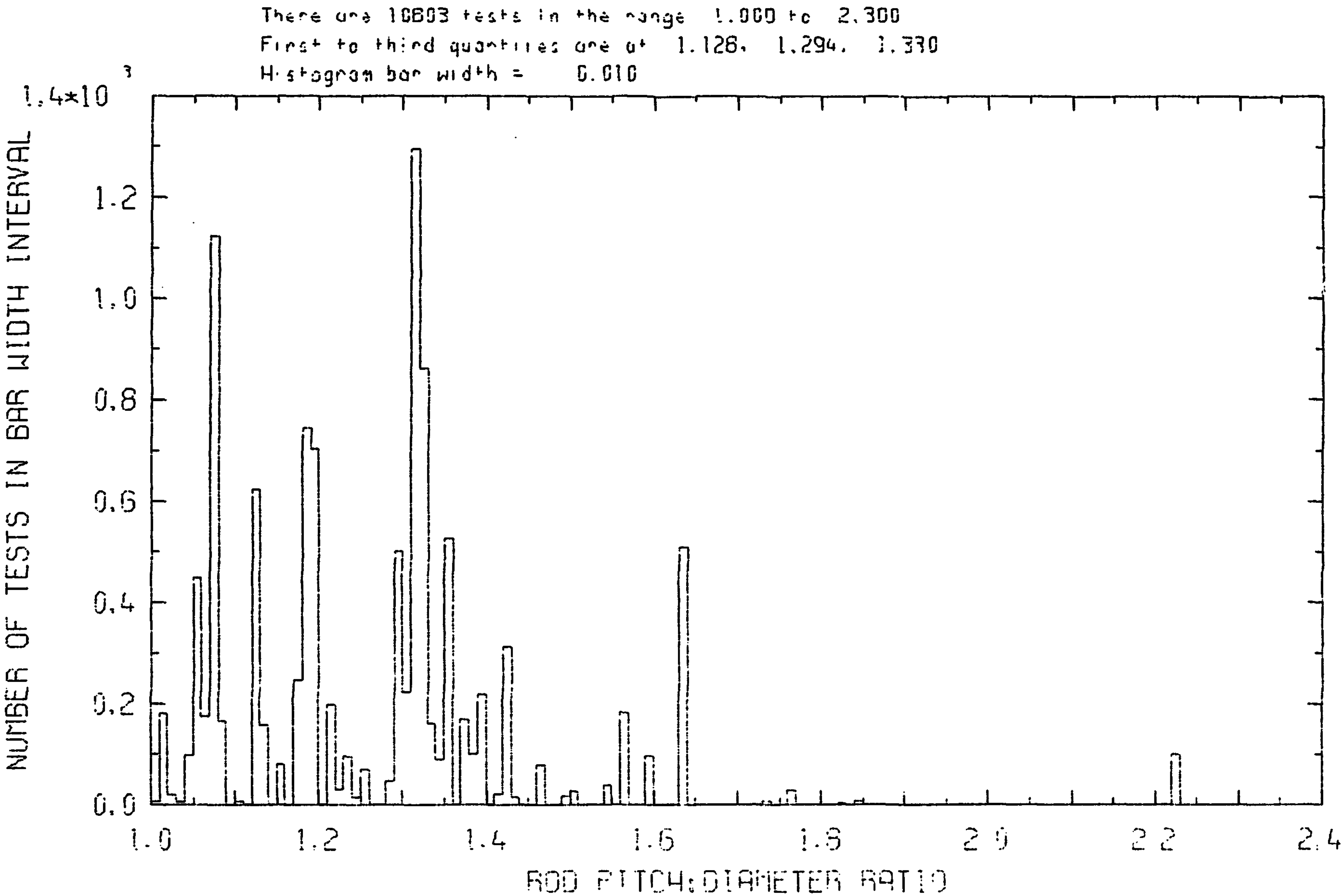

FIGURE 8. DISTRIBUTION OF TESTS OVER THE RANGE OF ROD PITCH:DIAMETER RATIO

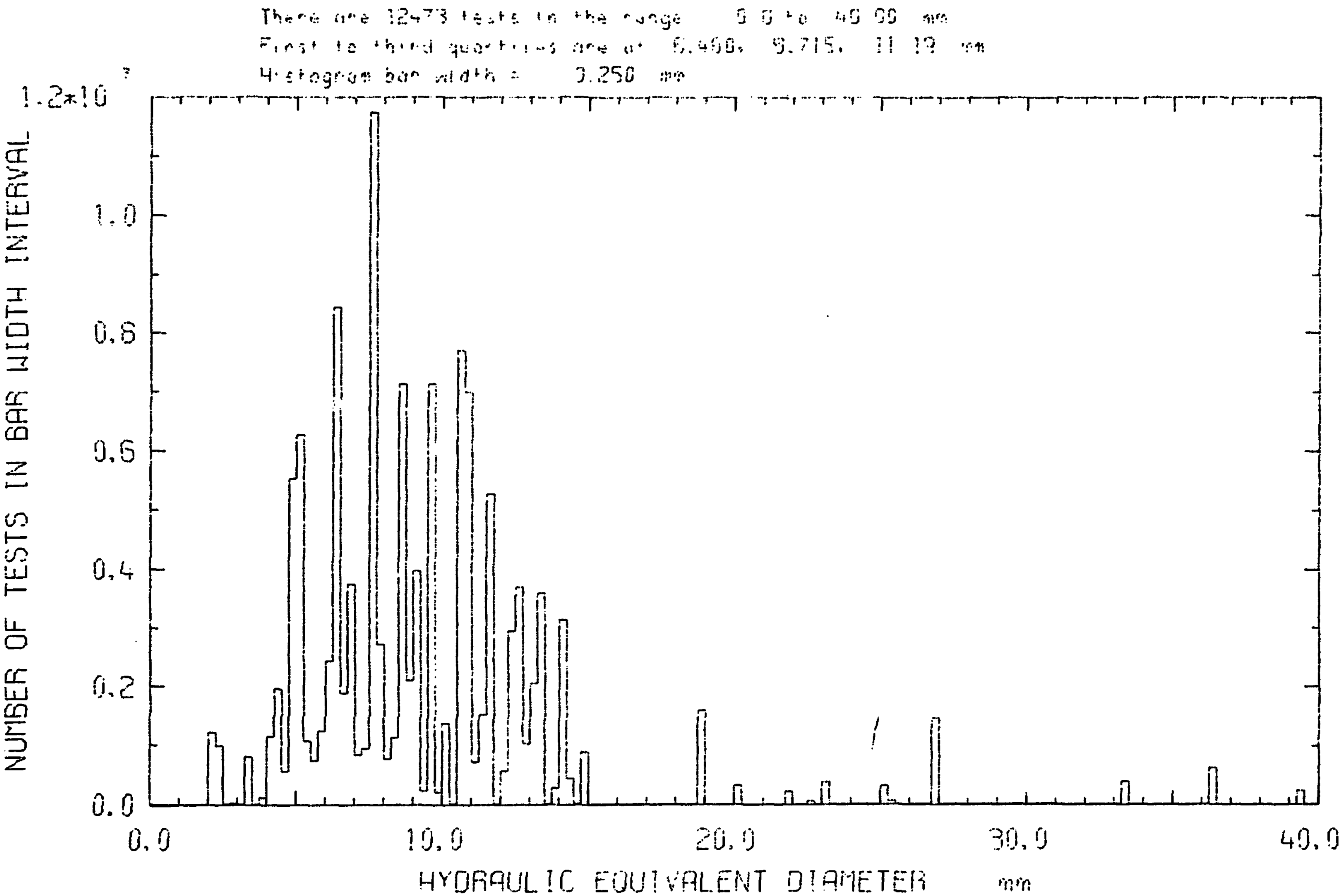

FIGURE 9. DISTRIBUTION OF TESTS OVER THE RANGE OF HYDRAULIC EQUIVALENT DIAMETER

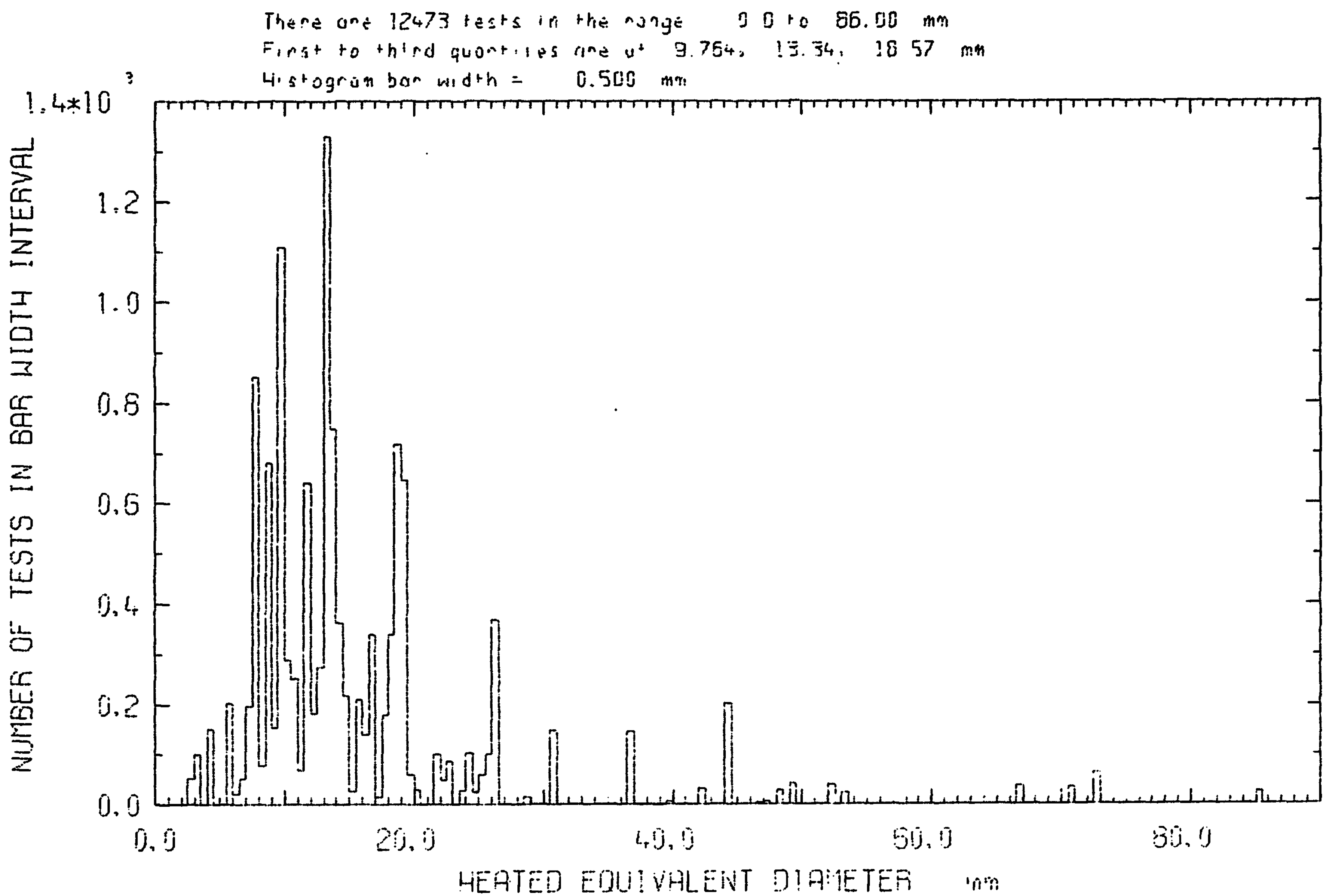

FIGURE 10. DISTRIBUTION OF TESTS OVER THE RANGE OF HEATED EQUIVALENT DIAMETER

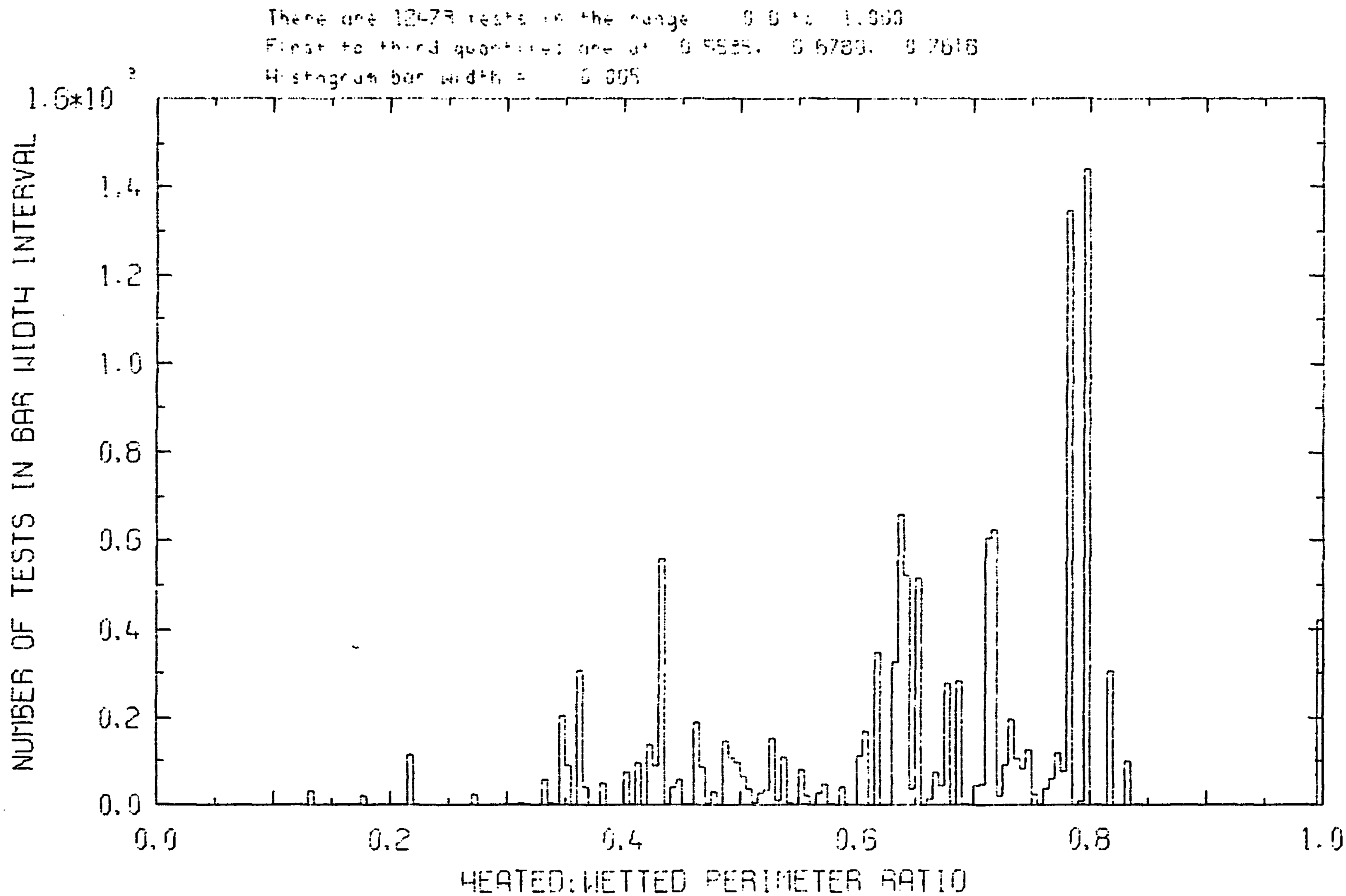

FIGURE 11. DISTRIBUTION OF TESTS OVER THE RANGE OF HEATED:WETTED PERIMETER RATIO

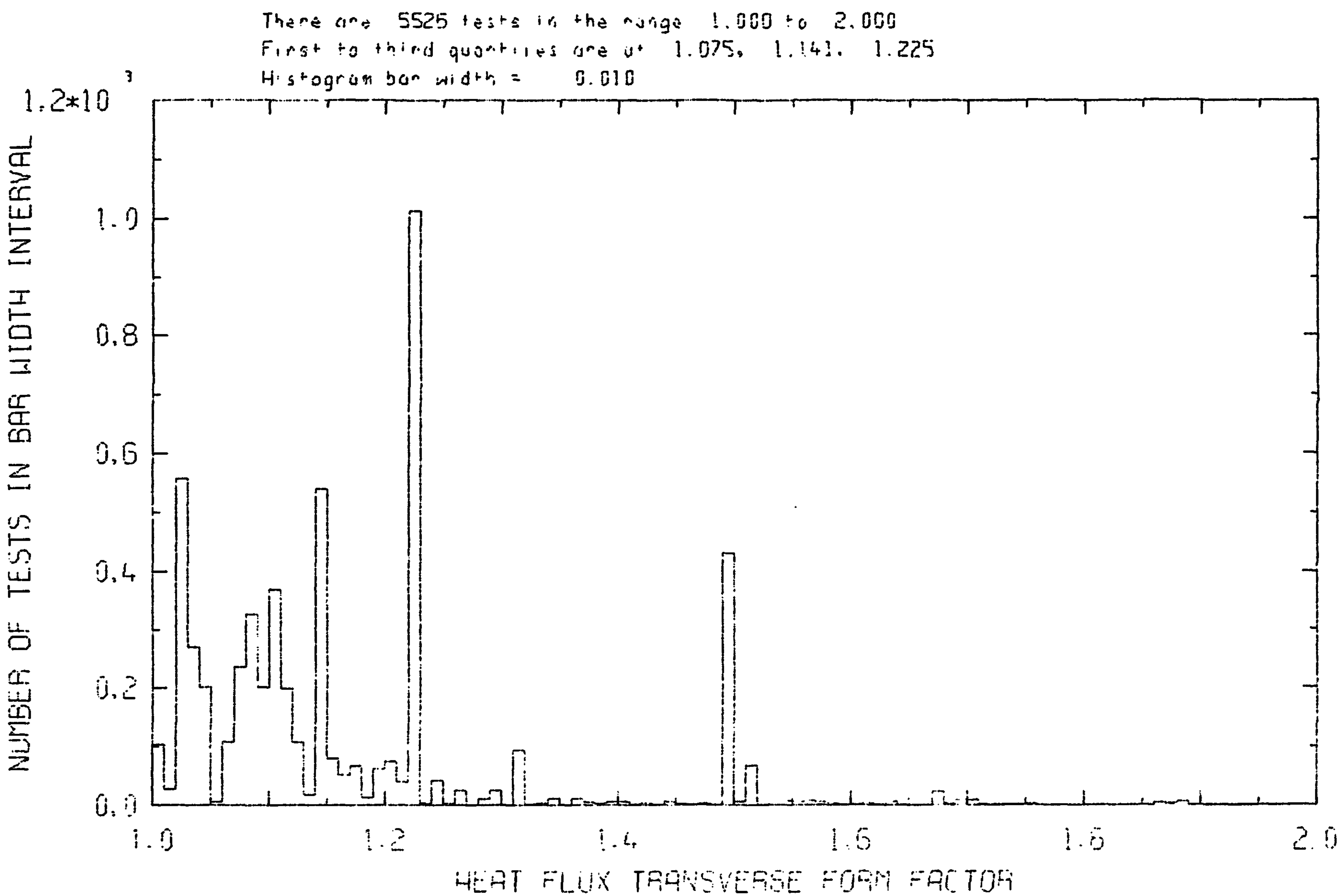

FIGURE 12. DISTRIBUTION OF TESTS OVER THE RANGE OF HEAT FLUX TRANSVERSE FORM FACTOR

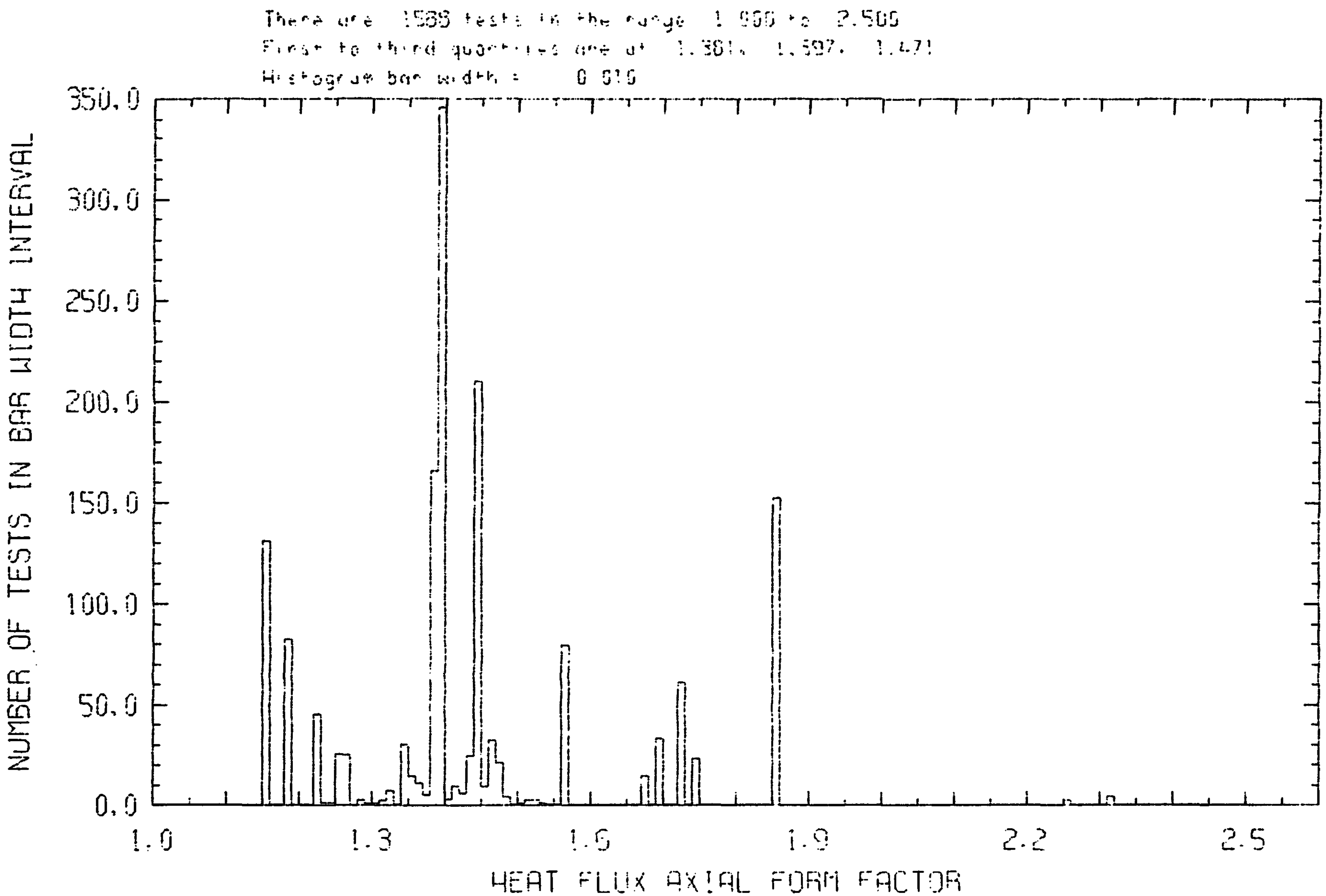

FIGURE 13. DISTRIBUTION OF TESTS OVER THE RANGE OF HEAT FLUX AXIAL FORM FACTOR

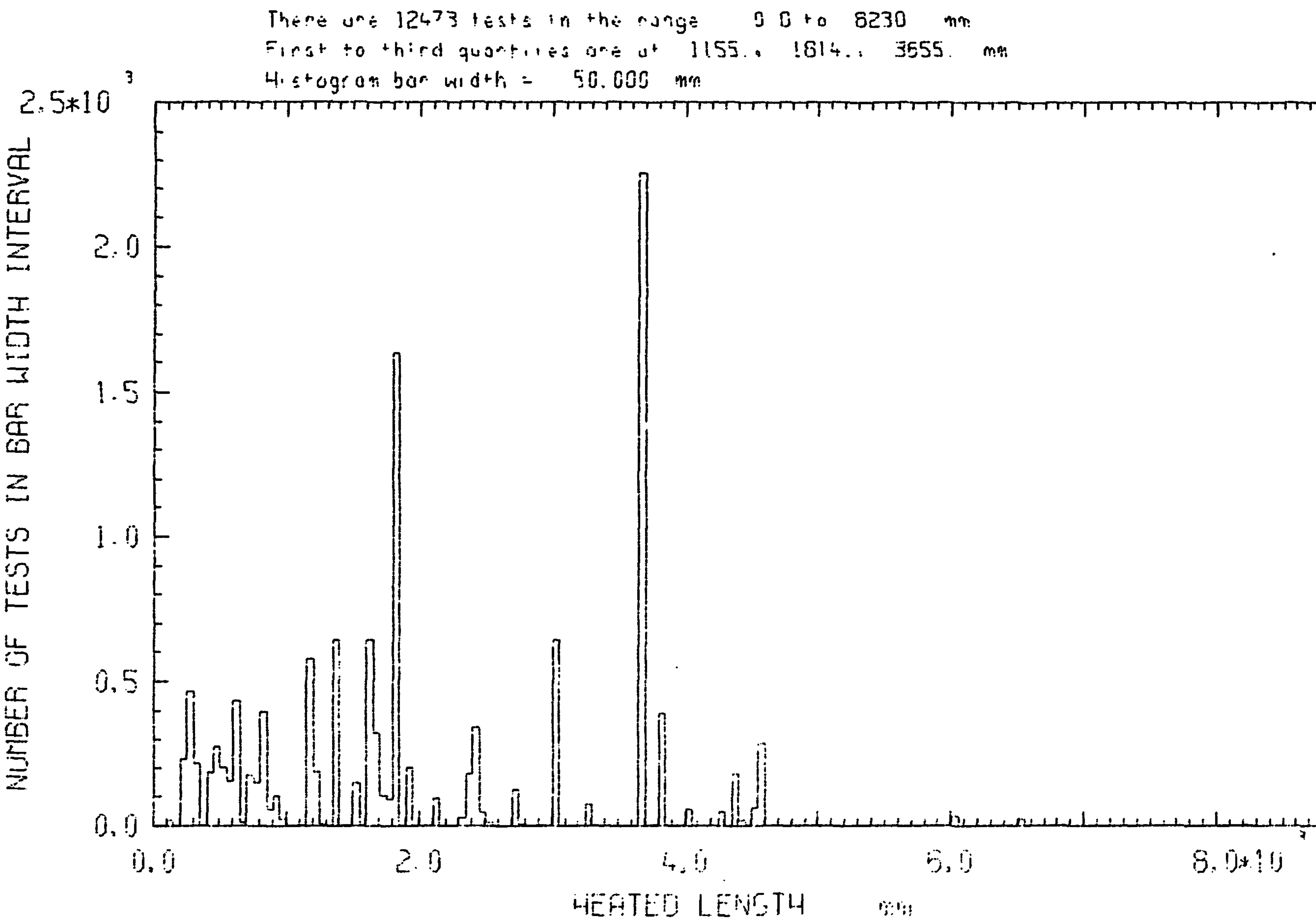

FIGURE 14. DISTRIBUTION OF TESTS OVER THE RANGE OF HEATED LENGTH

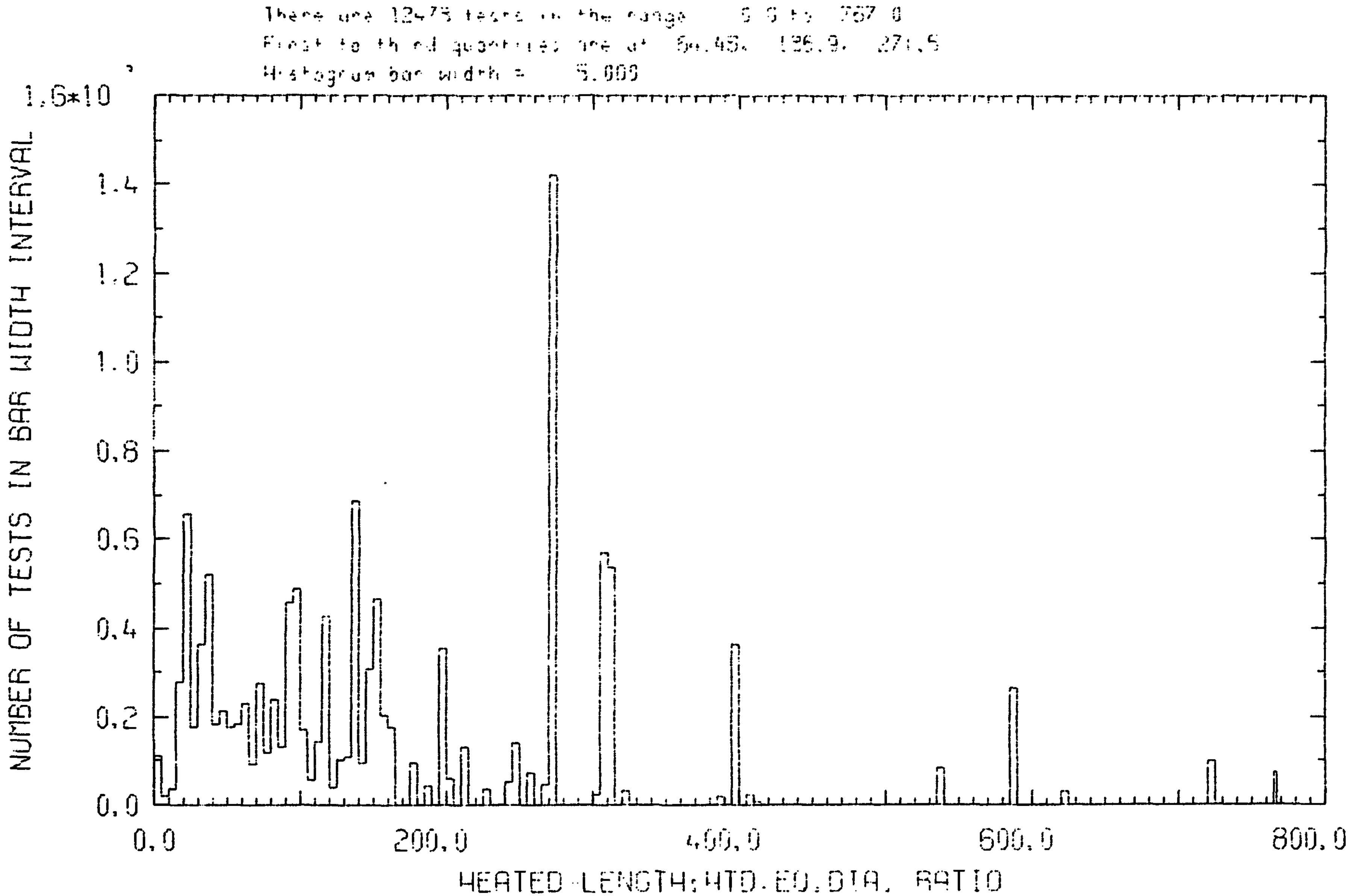

FIGURE 15. DISTRIBUTION OF TESTS OVER THE RATIO OF HEATED LENGTH TO HEATED EQUIVALENT DIAMETER

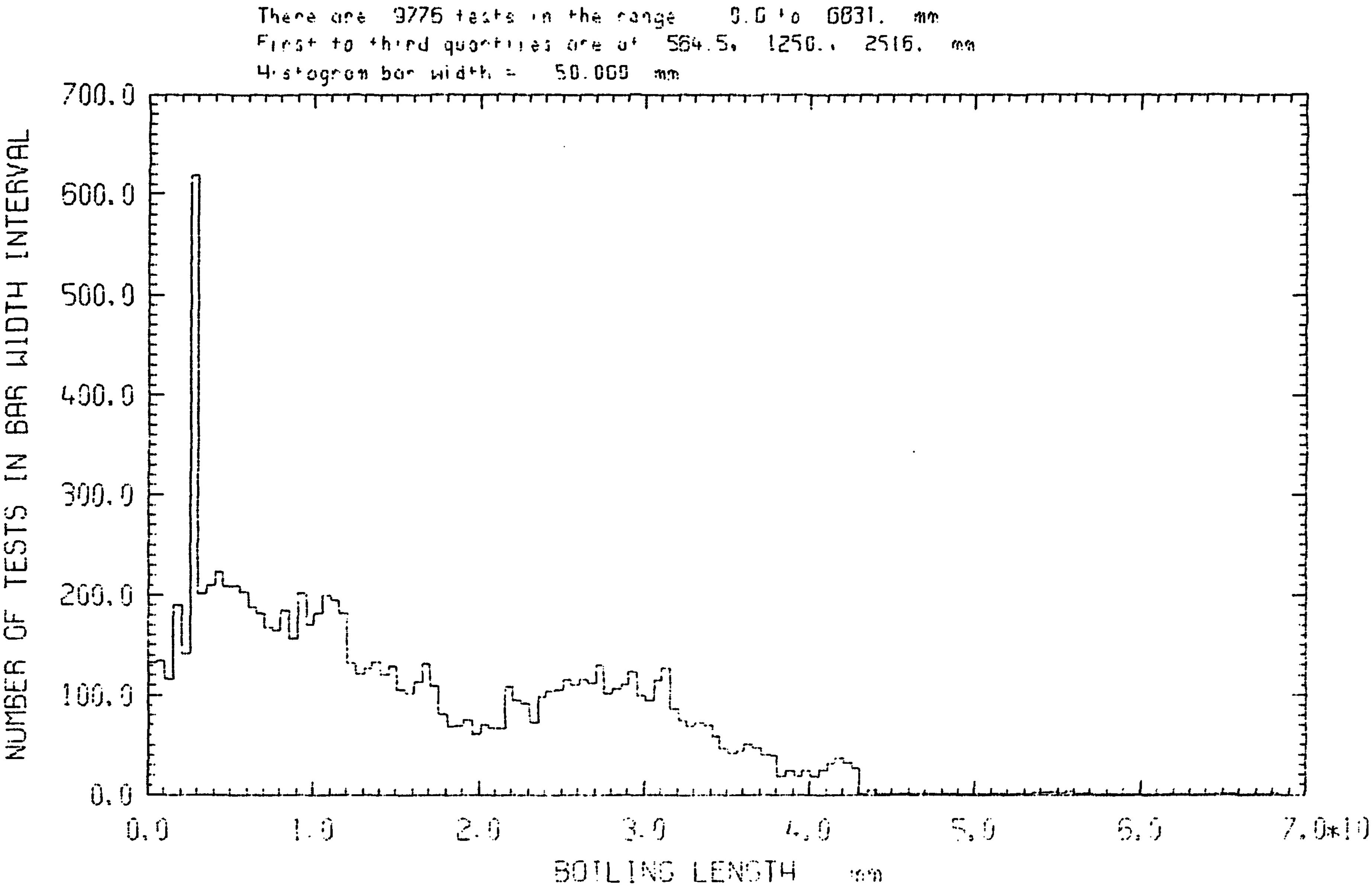

FIGURE 16. DISTRIBUTION OF TESTS OVER THE RANGE OF BOILING LENGTH

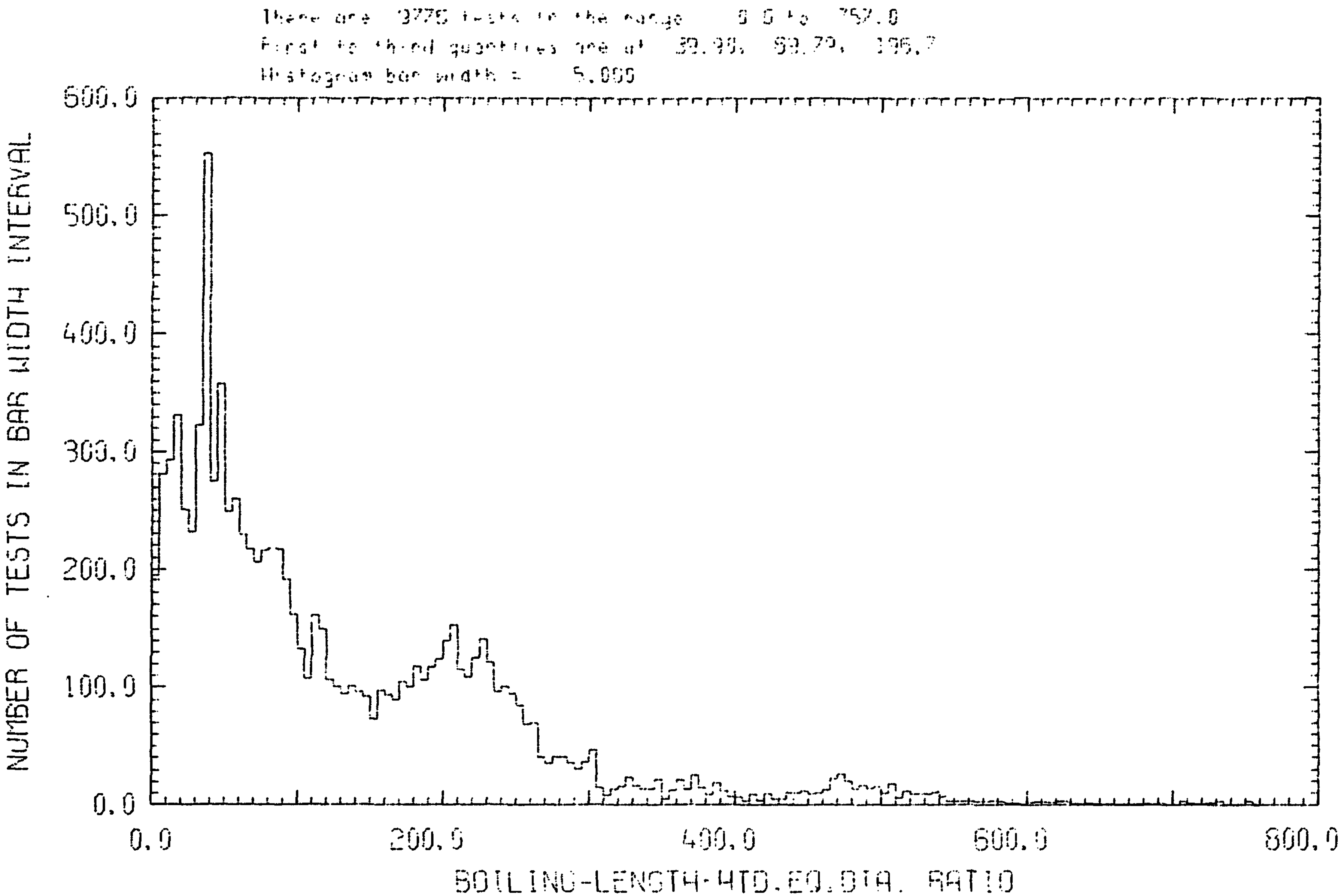

FIGURE 17. DISTRIBUTION OF TESTS OVER THE RATIO OF BOILING LENGTH TO HEATED EQUIVALENT DIAMETER

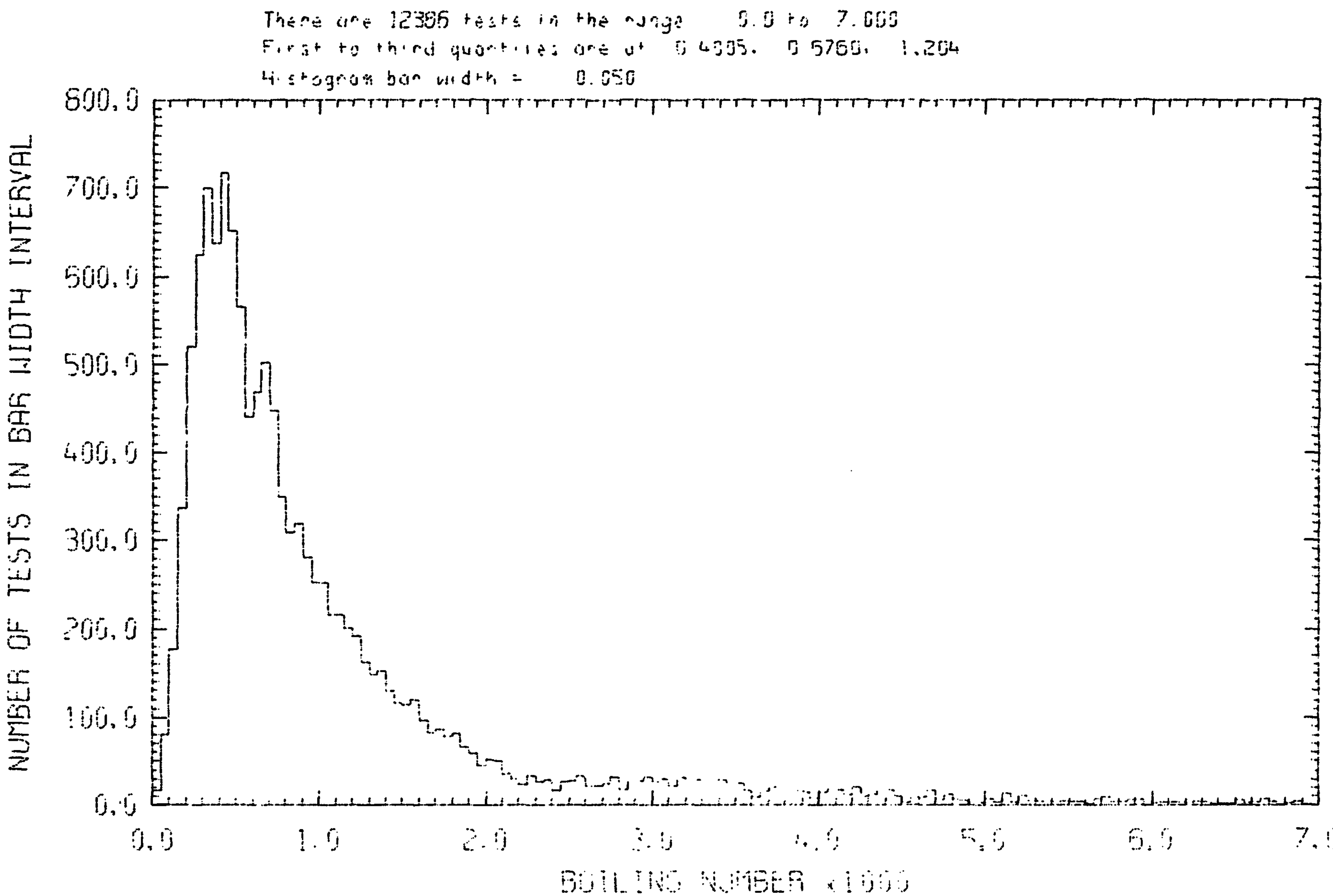

FIGURE 18. DISTRIBUTION OF TESTS OVER THE RANGE OF BOILING NUMBER × 1000

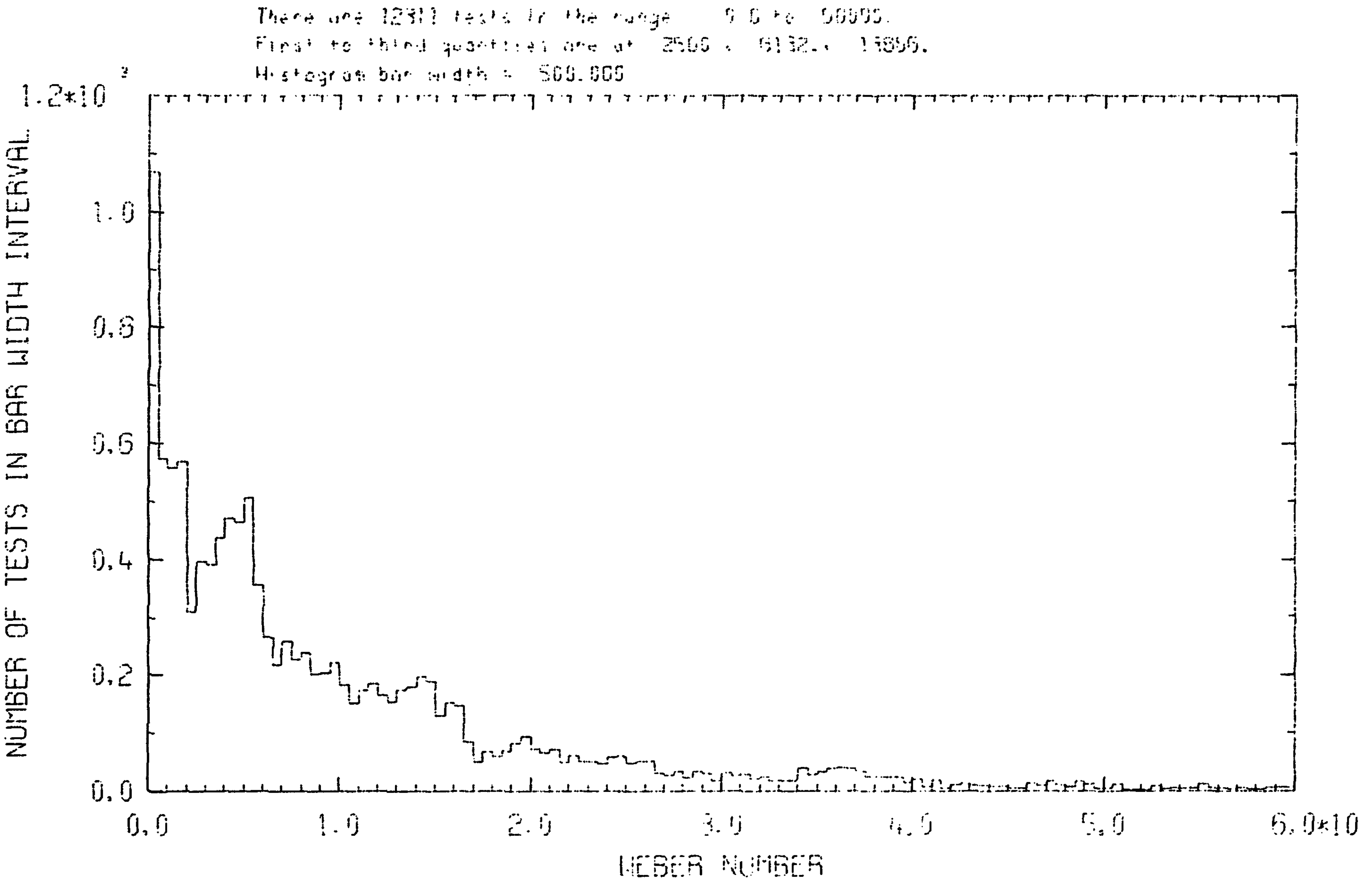

FIGURE 19. DISTRIBUTION OF TESTS OVER THE RANGE OF WEBER NUMBER

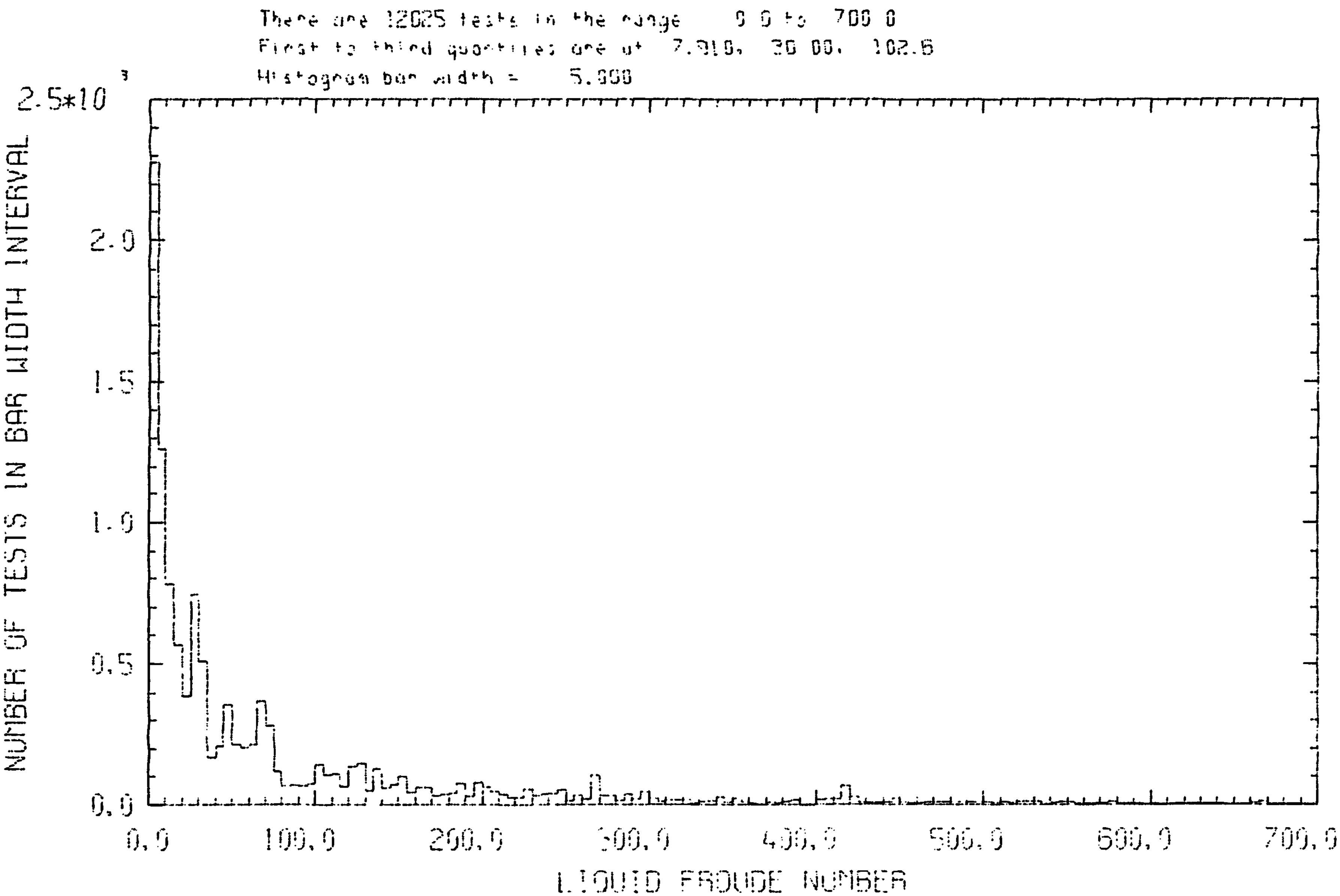

FIGURE 20. DISTRIBUTION OF TESTS OVER THE RANGE OF LIQUID FROUDE NUMBER

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