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**UNINSTRUMENTED ASSEMBLY AIRFLOW TESTING IN THE
ANNULAR FLOW DISTRIBUTION FACILITY (U)**

By

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Table of Contents

List of Figures	2
Summary	3
Introduction	4
Background	5
Test Section Configuration	7
Test Loops	8
Test Procedures	9
Quality Assurance Data Qualification	10
Discussion	11
Hypothesis of Geometric Effects	11
Inlet Pressure Control Hypothesis	12
Experimental Evidence of Bistability	13
Comparison to Other Experiments	14
Further Possible Mechanisms for Airflow Differences	15
Conclusions	16
Recommendations	17
References	17
Figures	19
Attachments	

List of Figures

1. Pressure Tap Arrangement in the Instrumented AFD (I-AFD) Assembly
2. Airflows in AFD (Instrumented and Uninstrumented) and A-Tank (Uninstrumented): $-1.5 < \Delta P < -1.1$ psid
3. Airflows in AFD (Instrumented and Uninstrumented) and A-Tank (Uninstrumented): $-2.32 < \Delta P < -1.77$ psid
4. Postulated Airflow-Pressure Drop Interaction
5. Comparison of Various Experimental Databases at 30 gpm Liquid Flow
6. Comparison of Various Experimental Databases at 25 gpm Liquid Flow
7. Effect of Liquid Flowrate on Airflow Behavior: **Positive and Negative Pressure Drops**
8. Comparison of Instrumented AFD and SPRITE 1 at 24-25 gpm: **Positive and Negative Pressure Drops**

Summary

Two-phase, air-water tests were performed in the Annular Flow Distribution (AFD) facility, located at Babcock and Wilcox, Alliance, Ohio. The tests formed a part of the experimental data used in analyzing the thermal-hydraulic consequences of the Emergency Cooling Phase of a large-break, Loss of Coolant Accident (ECS-LOCA). A set of assembly airflow tests was performed in the AFD facility, on a dummy Mark 22 assembly which had previously undergone similar testing in the A-Tank of SRL's Heat Transfer Laboratory. These tests were part of an investigation of apparent airflow differences between comparable testing at the AFD facility and the HTL. It had been hypothesized that the differences were due to the presence of instrumentation in the original AFD assembly. The new tests were performed although analysis showed the instrumentation effects to be negligible [1]. In this report, the new, uninstrumented assembly data are compared both to the data from the instrumented AFD assembly and to the A-Tank data. The new data agree with previous AFD data and disagree with the A-Tank data. This refutes the hypothesis that the presence of the instrumentation caused differences in airflow.

Another hypothesis advanced to explain the airflow differences concerned differences in test setup, viz., the use of a valve to control inlet pressure versus use of a pressure regulator. The present report shows that the airflow differences remain even when this difference in test setup was removed. This refutes the hypothesis that the inlet valving caused the observed differences in airflow.

This report also includes comparisons with two other HTL experiments, the Single Assembly Test Stand (SATS) testing and the SRS Prototypic Rig for Heat Transfer Experiments (SPRIHTE 1) assembly testing. There are differences in airflow among the various experiments. Under negative pressure drops, the AFD tests exhibit the lowest airflows, and the SPRIHTE airflows are the highest. There is indication that the AFD airflow data might be higher than the other experiments if positive pressure drops were tested. This implies that the AFD configuration has less phasic interaction between the air and water than the other experiments.

At liquid flowrates of about 60 gpm, the AFD testing revealed localized evidence of bistability, that is, two possible responses to the given set of hydraulic boundary conditions. The nominal assembly liquid flowrate predicted for the ECS-LOCA is near 60 gpm. It is assumed conservative to reduce this nominal flowrate by the uncertainties in the analysis; thus, the power limits are computed at a much lower flowrate (about 30 gpm). Since the observed bistability could lead to large uncertainty, consideration should be given to verifying that the power limit computed for the lower-bound flowrate of 30 gpm is indeed lower, hence more conservative, than for a flowrate of 60 gpm.

An assembly under ECS-LOCA conditions may be sensitive to unknown variables which may be difficult to predict under accident conditions. Differences in water chemistry remain a possible cause for airflow differences. The AFD and SPRIHTE loops used deionized, but not distilled, water. The hypothesis that water chemistry caused airflow differences should be checked. The working fluid during a LOCA is a mixture of D₂O and light, building water, while the working fluid for all of the ECS-LOCA experiments has been light water. If significant differences due to slight changes in water chemistry are shown to exist, the applicability of all ECS-LOCA experiments to reactor conditions must

be reexamined. Length of time at conditions, prior to taking data, is another difference between the different experiments which could be investigated.

Of the various databases compared in this report, only the AFD data are fully qualified. Further investigation into data differences should proceed only with fully qualified data. Until a hypothesis is confirmed which necessitates discarding some qualified data, all of the qualified data should be used in the LOCA analysis. Uncertainties appropriate to the combined database should be used. To date, the impact of the existing level of uncertainty on the reactor power limit has not been quantified. The magnitude of this effect should be a factor in decisions to pursue future experimental resolution of the assembly airflow issue.

Introduction

During the Emergency Cooling System phase of a postulated large-break loss of coolant accident (ECS-LOCA), air enters the primary loop and is pumped down the reactor assemblies. One of the experiments performed to support the analysis of this accident was the Annular Flow Distribution (AFD) experiment, conducted in a facility built for this purpose at Babcock and Wilcox Alliance Research Center in Alliance, Ohio. As part of this experiment, a large body of airflow data were acquired in a prototypical mockup of the Mark 22 reactor assembly. This assembly was known as the AFD reference assembly. For clarity in the present report, it will be referred to as the instrumented AFD (I-AFD) assembly. The I-AFD assembly was fully prototypical, having been manufactured in SRS's production fabrication facility (the 300 area). To avoid confusion for readers familiar with the AFD test program, it should be noted that the AFD loop under discussion was isolated from the parallel, test assembly AFD loop in which flow distribution measurements were made.

Similar Mark 22 mockup assemblies were tested in several test facilities in the SRS Heat Transfer Laboratory. Although comparisons between the facilities were confounded by several different piston ring configurations in the HTL tests (the presence of the ring could allow unmeasured airflow through the assembly), it became clear that the bulk of the HTL airflow data were higher than corresponding airflow data from the AFD facility, at least at negative pressure drops. In 1990, a set of tests was performed in A-Tank and replicated in the AFD facility to allow point-for-point comparison of results. These 1990 A-Tank assembly tests will be referred to as the uninstrumented A-Tank (U-AT) tests. The point-by-point comparison confirmed differences in airflow of up to 8 gpm at equivalent boundary conditions. Only tests at negative pressure drops were performed; such tests have sufficiently low airflows that these observed differences constitute a significant percentage of the airflows themselves. Since the U-AT data have never been fully qualified, the comparison should be regarded as a scoping test. In view of previous data, however, the qualitative observation was accepted that there were differences in airflow between experiments.

The present report documents further work done to address the discrepancy in airflow measurements between the AFD facility and HTL facilities. The same assembly which had been used in the U-AT tests was installed in the AFD reference assembly test loop. Testing in this configuration will be referred to in this report as the uninstrumented AFD (U-AFD) tests. The test conditions used for the previous point-by-point comparisons were repeated on the U-AFD configuration. This allowed simultaneous comparisons between U-AFD and I-AFD, and between U-AFD and U-AT.

The primary purpose of this report is to disseminate the data from the U-AFD tests, and to compare these test results to the I-AFD data and the U-AT data. A summary table of the test data and the B&W data transmittal letter are included as an attachment to this report. The full data transmittal volume from B&W (including time plots of the various instruments) is included as an appendix to this report.

These data are further analyzed by comparing them to two other HTL tests, namely, SPRITE 1 and the Single Assembly Test Stand (SATS). Note that at the time of this writing, only the I-AFD and U-AFD data have been fully qualified. The U-AT, SATS, and SPRITE data are all considered preliminary from the point of view of Quality Assurance. Finally, this report also includes recommendations for further work to resolve assembly airflow issues.

Background

The following section describes various experiments whose data are compared in this report. A summary of the comparative features of these experiments is contained in Table 1 on the following page.

Table 1
Comparison of Experimental Features for Data Considered in This Report

Feature	AFD	A-Tank	SPRIHTE	SATS
Piston Ring Leak Path	O-Ring	O-Ring	O-Ring	O-Ring
Transverse Tubing	I-AFD: Yes (2 channels, 6 levels); U-AFD: No	No	No	Yes (1 channel, 2 levels)
Outer Purge Channel	Yes	Yes	No	No
Test Section Mfg.	300-M	300-M	Off-site	300-M
Plenum positions	7 (assy in center)	19 (assy in center)	19 (assy at side)	1
Loop configuration	Closed	Closed	Closed	Open
Water Quality and Monitoring Tests	De-ionized; conductivity, pH, O ₂ , solids, carbon	Unknown	De-ionized; conductivity	Building; none
Backpressure regulation	Tank	Tank	Standpipes	Standpipes
Inlet Pressure Regulation	Air valve or open to atmosphere	Open to atmosphere	Air valve or open to atmosphere	Air valve or open to atmosphere
Time-dependence	steady-state	steady-state	steady-state	slow transient
Data qualification	Qualified	Unqualified	Unqualified	Unqualified
Air instrumentation	Inlet and outlet	Inlet only	Outlet only	Inlet only
Air inlet geometry	Above water inlet, 3 locations (most tests)	Top of plenum (1 location)	Top of plenum (1 location)	Top of plenum (1 location)

Test Section Configurations

To the best of this author's knowledge, the various assemblies used in the HTL tests were of prototypical geometry, except as noted below. Some early tests were done using a non-prototypical plenum sleeve, or with an unmeasured amount of air entering the assembly through the piston ring. Although these data were used initially to infer that the measured airflows were higher in the A-Tank facility than in the AFD facility, none of them will be discussed further because of their experimental deviations.

The U-AT tests were done with a dummy Mark 22 assembly manufactured according to the standard procedures of the SRS 300-M manufacturing facility. For the U-AT tests, test conditions were repeated using two different types of bottom fitting insert (BFI): P/L-80 holes and K/C-36 holes. No appreciable difference in airflow was observed. This confirmed the results obtained earlier in the AFD facility [1]. Therefore, results from either BFI will be used interchangeably in the following analysis. For the U-AT tests, an O-ring was installed at the location of the piston ring which is installed in the assembly housing at the base of the plenum, thereby sealing off this air path. Thus, the assembly airflow is given by the amount of air drawn into the assembly through the plenum.

The only known deviation from prototypicality in the I-AFD assembly was the inclusion of four pressure taps in each of the active flow channels, at six axial locations. The routing of these taps to the inner channels necessitated their passage through the surrounding channels. The arrangement is shown in Figure 1. The outer flow channel (denoted channel #2 in Figure 1) had pressure tubing routed to the inner and middle channels, while the middle channel (channel #3 in Figure 1) had tubing routed to the inner channel (channel #4). In the figure, the planes of the taps to all three channels are shown as one, although they were offset from one another slightly (about 0.4 inches). The maximum reduction in flow area, if all tubing at a given nominal axial location were in the same plane, was less than 8%.

An analysis of the frictional effect of these obstructions, Reference [2], indicated that the increase in drag was negligibly small. Analysis and scoping tests also indicated that the penetrations, made to accommodate the pressure tubing, allowed only negligible amounts of air and water to pass between annuli during the AFD testing [1, 3]. At the negative pressure drops for which data comparison was possible, the AFD airflows were lower than those of the HTL, however. A hypothesis was therefore advanced [4] that the routed pressure tubing in the I-AFD assembly caused an appreciable increase in flow resistance (in contradiction to the Reference [2] analysis), with a corresponding appreciable decrease in airflow. For this hypothesis to be confirmed, the U-AFD test results should agree with the U-AT results, since an uninstrumented assembly was used for these two sets of tests.

The U-AFD testing was done with the same dummy assembly as had been used in the U-AT tests. The P/L BFI was installed for the tests. As with the U-AT and I-AFD tests, an O-ring was installed in lieu of a piston ring.

Some testing was done in SATS in the HTL. These tests were done in an assembly in which the Universal Sleeve Housing (USH) had been removed. This would be significant if there is any effect on assembly airflow due to the presence of the outer purge channel. The SATS assembly also had several pressure taps with cross-channel routing.

At two locations, four pressure taps to the middle channel were routed through the outer channel, thereby obstructing the flow and reducing the flow area slightly at these locations. The arrangement is thus similar to that described for AFD testing, except that there were fewer axial locations, and taps were not routed to the innermost active flow channel (fewer tubes routed through the outer channels at a given axial location). There was no air path at the location of the piston ring; an O-ring was installed. The data from these tests will be discussed later in this report.

The SPRIHTE 1 test section is another full assembly mockup which was tested in the HTL. It differs from the other assemblies discussed in this report in that its primary purpose was to gain heated data (only unheated airflow results will be discussed here, however). Therefore, it uses heater tubes which are not manufactured by the SRS 300 area. It does not include an USH. It does not utilize pressure tubing routed through active flow channels. There are small deviations in upper geometry to accomodate the heater tubes and their bus bars. There is no air path at the piston ring location. The SPRIHTE 1 test results will be used for comparison later in this report.

Test Loops

The A-Tank loop has a mockup of a reactor tank with 19 positions (two rows of assembly positions around a center position). For the U-AT tests, the assembly was installed in the central position with the others plugged off. The tests were run in a closed loop. Since there is no reservoir in the loop, the tank level will drop when the assembly liquid flowrate is increased, unless testing is stopped and more water is added to the loop. Moreover, the piping is such that a higher liquid flowrate causes a higher vacuum in the plenum. Therefore, the pressure drop is not well controlled, although it can remain constant once set. For this reason, the U-AT tests were performed first, with the I-AFD and U-AFD tests following at matching boundary conditions.

For some of the U-AT tests, the heat exchanger was inadvertently valved off and the liquid temperature was not held constant during testing. The liquid temperature of each test point is not known. There was no apparent difference in airflow results due to the change in water temperature, however. This lack of an effect confirmed the results of a screening matrix performed previously in the AFD facility, wherein airflow was likewise shown to be unaffected by liquid temperature. This point is noteworthy since liquid temperature reportedly affected airflow in the SPRIHTE 1 tests.

The AFD loop used for the I-AFD and U-AFD tests has been extensively described in [1], where it is referred to as the "reference assembly" loop. The plenum has seven positions with the central one active. The tank is 3 feet in diameter and 8 feet tall, which is sufficient for the range of tank levels of interest. The tank includes a dummy monitor pin. The loop is closed and includes a reservoir and air blower. Therefore, both plenum pressure and tank level are well-controlled. Deionized water was used. Although the loop is closed, the specification was that the water should be saturated (i.e., in thermodynamic equilibrium) with air. Oxygen content of the water was monitored, as were particulate content, carbon content, pH, and conductivity.

The SATS loop at the time of data collection was open, and used building water. Building water is at least saturated and, based on visual observation, may have excess air. The "plenum" had a single position. Two standpipes, 21 feet tall, served to simulate the reactor tank.

The SPRIHTE loop has been extensively described in [5]. It includes a plenum with 19 positions, and standpipes in lieu of a tank. The loop is closed. Deionized water was used, and conductivity was monitored.

In the three HTL experiments, air was injected into the top of the plenum at one location. In contrast, in the AFD facility, air inlet lines were installed atop each of the three water inlet nozzles. Baffles were installed inside the water pipe to prevent direct impingement of the airflow on the water and to direct the air into the plenum. This arrangement was considered to be more prototypical of the ECS-LOCA scenario, where air and water would be pumped into the plenum inlet nozzles. To test the effect of air inlet configuration, one I-AFD test was repeated with the air piping rerouted to inject air through a vent pipe located in the plenum. No change in the assembly airflow was observed.

The assembly pressure drop boundary condition is defined as the pressure at the top of the plenum, minus the pressure at the bottom of the tank (i.e., outside the assembly). To the best of this author's knowledge, this definition was used consistently in all of the experiments discussed herein.

Test Procedures

The test procedure for the U-AT tests was as follows [6]: The tank level was set (to either 24 inches or 48 inches), then flow was set to 100 gpm (no time period specified), then reduced to the desired flowrate. The plenum air vent line was then opened, and the instrument readings recorded. At least some of the data were recorded by hand [7]. The air vent line was then closed, and the flowrate increased to 100 gpm before proceeding to the next flowrate.

Reference [8] was used as the test procedure in both the I-AFD and U-AFD tests. The first step of the AFD test procedure was to completely flush the air out of the assembly. This was achieved by running the system at 110-115 gpm for some 10 minutes, closing off all air paths, dropping the liquid flowrate to the desired value (thus inducing a strong plenum vacuum), then opening the air lines to achieve the desired plenum pressure. Under many test conditions, where a plenum pressure of zero psig was desired, this effectively meant that the inlet valve was full open. For some tests, where the system pulled a slight vacuum, the air compressor system was required to achieve the zero pressure condition, and a valve was adjusted on the compressor line. For other conditions, where a partial vacuum was desired in the plenum, the air line might be partially open.

During the AFD proof of principle test phase, a number of tests were performed to verify that specifying the pressure drop was a sufficient pressure boundary condition. For such tests, the pressure drop was achieved using two different plenum pressures. No differences were noted. These results are discussed more fully later in this report. During both U-AFD and I-AFD testing, hysteresis effects were checked by approaching a given test condition by alternate means from that described above--i.e., from a lower liquid flowrate or from a higher plenum pressure--in addition to the usual procedure. No hysteresis effects were observed.

The SATS tests were slow transient draindown tests in which the standpipe level was initially set to the highest level (about 21 feet) [9]. This also served to fill the assembly with water. The plenum was bled of air under a flowrate of 30 gpm if necessary to ensure air removal. The plenum air line was then opened and the standpipes drained at the rate of one foot per minute. After a hold of four minutes at the lowest tank level, the standpipes

were refilled at the same rate. Data were scanned at a sampling rate of 0.5 Hz during draindown and refill, using a data acquisition system.

The SPRIHTE 1 test procedure is described in [5]. The tests were run at steady state. The desired tank level was set first (due to the dependence of tank level on flow conditions, the level and thus the back pressure might vary by up to two inches). The desired flowrate was then set. As described in [5], the desired pressure drop was set by adjusting the air inlet flow, partially closing the air inlet valve for negative pressures, using the air blower for positive pressures, or leaving the valve full open for atmospheric inlet conditions. Most of the data of interest here were probably taken at atmospheric inlet conditions [10].

Quality Assurance Data Qualification

As noted above, none of the HTL databases are fully-qualified from a Quality Assurance standpoint as of this writing. The U-AT tests were to have been qualified, with B. R. Durig as Task Leader. These data were made available to this author in electronic form. Post-test calibrations on the air meters showed a significant shift in the calibration curves. The shift represents a difference in the measured airflow values of up to 3 gpm. Since there is no information available to this author which would discount one or the other calibration, the averaged value of these measurements, based on pre- and post-test calibrations, is used in this report. Airflow instrumentation was installed at the plenum only.

A correction was later made to the plenum pressure measurements to account for water head above the tap (the tap was installed mid-way up the plenum). As a result, the specified pressure drops, which were to have been identical for the U-AT, U-AFD, and I-AFD test series, are not necessarily identical. The correction is included in the data as used in this report. More recently, a non-conformance was identified in one of the pressure gauges used in determining the pressure drop, increasing its uncertainty to 0.1 psi. Assuming that the original uncertainty specification of 0.02 psi was maintained for the other measurement gives a pressure drop uncertainty of 0.102 psid.

The instrumented and uninstrumented AFD data were taken in accordance with the QA plan for the experiment [11]. The final data quality checks and post-test calibrations have been performed, so these data are fully qualified. The uncertainty of all instrumentation is listed in the B&W summary attached to this report. The experiment included airflow instrumentation in two different ranges (the range used for the reported reading is specified for each test point in the attachment). Instrumentation was installed at both the inlet and outlet to the test section. The redundant (i.e., inlet and outlet) airflow readings showed excellent agreement, well within the range of uncertainty. This indicates an absence of air leaks in the system.

The SATS data were released in preliminary form in Reference [12]. No other information on these data is available. Reference [12] states that pre- and post-test calibrations were performed satisfactorily, and that the data "could be qualified very easily if needed." Airflow instrumentation was installed at the plenum only.

The SPRIHTE 1 data are as described in [5]. Subsequent testing on another test section, SPRIHTE 2, confirms the SPRIHTE 1 airflow measurements, as discussed in [5]. These data are currently undergoing data qualification.

The pressure boundary conditions for the data discussed here are cast in terms of assembly pressure drop. It is generally accepted that this is the relevant boundary condition, rather than an individual specification of inlet and exit pressures. As noted above, this has been experimentally verified in the AFD loop, among others; it is also verified analytically. The pressure drops for the point-by-point comparison tests were, however, set up using the same inlet and outlet pressures (to within experimental limits) in each test configuration. Therefore, the comparisons are unaffected by any continuing controversy on this point.

Discussion

Hypothesis of Geometric Effects

Figures 2 and 3 present the U-AFD data in comparison to the I-AFD and U-AT results, at two different ranges of pressure drop. Because of the problems with the U-AT pressures, discussed above, the pressure drop was not the same from test to test, and the pressure drop for a given liquid flowrate may not be identical for the three different tests. For this reason, the data themselves are also tabulated in these figures. The tabulated data indicate that there are a number of tests at which at least a two-way, and sometimes three-way, comparison of boundary conditions is quite close. Particularly at the lower pressure drop (Figure 3), the differences in boundary conditions between compared points are probably not significant.

Figures 2 and 3 show that there is generally good agreement between the two assemblies tested in the AFD facility (U-AFD and I-AFD), and that there are much greater differences between the U-AFD and the U-AT results. Recall that the U-AFD and U-AT tests used the same Mark 22 dummy assembly. The largest differences between the AFD and A-Tank results (on a percent basis) generally occur between about 24-40 gpm.

At flows of 30 gpm and below, the U-AFD airflows are slightly higher than the I-AFD. Most of these differences are approximately within the uncertainty in the measurements themselves, however (< 1 gpm). The data repeatability within a single experiment is generally 3-5 gpm (see, e.g., the U-AT data of Figure 3). Therefore, the differences between I-AFD and U-AFD airflow data below 40 gpm are considered insignificant.

Of more interest are the data at 40 gpm and higher. For these higher liquid flowrates, Figure 2 shows that the U-AFD data fall below that of the I-AFD data. This is directly contrary to the hypothesis that the instrumented assembly's pressure tubing reduces the assembly airflow. These U-AFD and I-AFD data differences are still comparable to the 3-5 gpm spread within the U-AT data.

Based on Figures 2 and 3, the hypothesis that the pressure tubing in the I-AFD assembly caused a significant, non-prototypical reduction in airflow can be discounted. Use of the same assembly for the U-AFD and U-AT tests also discounts the possibility that an unidentified non-prototypicality in the uninstrumented assembly is responsible for the data differences. This indicates that the differences in airflow are due to either loop configuration, or to test procedure, or are indicative of a degree of "inherent" data scatter which is not well represented by these small data sets.

Inlet Pressure Control Hypothesis

In scoping tests, J. L. Steimke observed that, for the same test section pressure drop, a change in resistance, upstream of the test section, caused a difference in airflow [13]. A high inlet resistance gave a higher airflow for a given pressure drop, or the same airflow at a lower (more negative) pressure drop. Steimke hypothesized that the underlying issue was not resistance, per se, but the lack of control associated with attempting to set the inlet pressure by adjusting an air valve. The fluctuations in air intake are greater in this case than if a pressure regulator (e.g., a water column) is used to fix the inlet pressure. At pressure drops near zero psid, non-linear feedback effects were postulated to lead to differences in airflow for the same mean value of pressure drop. This is illustrated in Figure 4, using an idealized sample curve which represents the qualitative behavior of the airflow-pressure drop relationship (this is not meant to represent a particular test section). From this hypothetical curve, for a pressure drop of -0.3 psid, the true airflow is about 3.7 gpm. If there are uniform fluctuations of ± 0.1 psid around the average pressure drop, however, the measured airflow would be an average of the value at -0.4 psid (about 1.6 gpm) and that at -0.2 psid (about 8 gpm). This average is 4.8 gpm, which is about 30% higher than the "true" airflow of 3.7 gpm.

Unfortunately, most comparisons in the very limited database of Steimke's are confounded by the fact that two variables were changed at once, i.e., upstream resistance and pressure drop. Moreover, the data are all between about -1 and -0.4 psid, a region of extreme sensitivity of airflow to pressure drop. If the observations hold generally, however, then it suggests that controlling air flow, instead of pressure, is associated with higher airflow. According to this reasoning, however, higher airflow would be predicted for the AFD loop. The extension to the reactor system—that is, which type of inlet control is more appropriate—is unclear. If the plenum is in contact with atmosphere, pressure is "regulated," but if restrictions in the reactor loop piping are dominant, the configuration is more nearly analogous to the partially-closed air inlet.

For the U-AT tests considered here, the inlet was simply left open to atmosphere; this is in effect a pressure regulator. The system did pull a vacuum, however, which increased with increasing airflow, so pressure regulation was imperfect. The AFD loop generally did not pull as great a vacuum when the air inlet line was left full open; in order to match the U-AT plenum condition, the resistance was increased by partially closing the air inlet valve. The valve settings for each test were noted down in the log book [14]. For those tests where the resistance was increased in this way, the Steimke hypothesis suggests that a significant difference between the loops was introduced.

For the I-AFD tests at 24, 30, and 40 gpm with a pressure drop of -2.2 psid, the log book shows that the valves were fully opened [14]. These tests thus have the same loop configuration as for the A-Tank tests. These data have already been shown in Figure 3. The figure shows that the AFD airflow is lower than the comparable U-AT data between 24 and 40 gpm. This refutes the hypothesis that the difference in airflow is caused by a difference in inlet pressure control and fluctuation.

A further argument against the Steimke hypothesis is the experimental verification that pressure drop, not independent settings of inlet and outlet pressure, constitutes the pressure boundary condition. As noted earlier in this report, pairs of tests at 30, 40, and 60 gpm were performed in the AFD loop, in which two different inlet pressures were used in achieving the same pressure drop across the assembly (Table 2). One of these inlet pressures was that of atmospheric pressure; this would have been achieved by leaving the system lines fully open. The airflow results for each test of the pair were the same, to

within experimental error. Unfortunately, these tests were performed prior to installation of the low-flow meters, so the nominal experimental uncertainty is rather large.¹

Table 2
Effect of Inlet Pressure Setting on Assembly Airflow

Test ID	Flow [gpm]	Inlet P [psig]	Pressure Drop [psid]	Airflow [scfm]
897065	30.28	-0.042	-2.2	0.30
897067	30.29	-0.830	-2.1	0.19
897038	40.2	-0.045	-2.2	0.51
897053	39.88	-1.08	-2.2	0.48
897069	59.86	-0.096	-2.1	1.38
897071	60.43	-0.863	-2.0	1.37

In the SPRIHTE 1 tests, inlet pressure was to be controlled by setting the valve on the air inlet line [5]. The SPRIHTE 1 data are generally higher than the other data, which tends to support Steimke's hypothesis. Little, if any, restriction was actually imposed for the points which are shown in this report, however, since most of the tests for pressure drops of -1 psid or less were set up with an atmospheric inlet condition [16]. Any further investigation of Steimke's hypothesis should be done with the SPRIHTE data in mind, since some of these tests may have used the same method as the AFD test method.

Experimental Evidence of Bistability

Figure 3 shows a bistability at 60 gpm; two different airflows were measured. This test condition was repeated several times in the U-AFD tests to confirm the phenomenon; both airflow values were repeatable, though it was not possible to predict in advance which one would occur. During one test run, after holding at steady state for a period of time (on the order of 20-30 minutes), the test operators observed a sudden shift in plenum pressure,

¹ The manufacturer's uncertainty for the readings in Table 2 was reported as ± 0.75 scfm. In Reference [15], however, the performance of these meters was compared against that of more accurate Omega meters; the data agreed to within about 0.1 scfm. The uncertainty of the Omega meters is about 0.08 scfm. Therefore, the data of Table 1 is probably accurate to within about 0.1-0.2 scfm.

which required an adjustment to the "other" airflow value to correct. Thus, a dynamic transition from one state to another is possible.

The observed behavior may be related to a phenomenon observed previously during the AFD test program and discussed at length in [3]. For a narrow range of test conditions, the I-AFD assembly (which served to monitor hydraulic conditions in a second, geometrically-altered test assembly) showed a bistability in the pressure at the entrance to the flow channels. Like the phenomenon of Figure 3, this bistability also occurred at about 60 gpm, over a range of similar pressure drops (-4 to -2.6 psid). This bistability also was observed to transition between states after 30-45 minutes at a given state. This bistability was not observed at the next pressure drop tested, however (-1.8 psid), so its range of occurrence may or may not include the -2 psid pressure drop shown in Figure 3. The AFD test assembly, which was altered to allow the annular flow distribution to be measured, consistently adopted only one of the two alternate pressure configurations. The flow distribution which was measured was quite discontinuous with respect to the data for nearby conditions, however. This was in contrast to the rest of the test matrix, which showed smooth changes in the flow distribution. One can speculate that, had the test assembly adopted the alternate pressure configuration, the flow distribution might have changed to one more in keeping with the rest of the data.

Comparison to Other Experiments

The preceding results, wherein the airflow was shown to be unaffected by the presence of pressure tubing, show that the various test assemblies can be assumed physically interchangeable. It is of interest to compare these experimental results with other HTL experiments, to give some perspective on the data differences which can be expected between experiments of this type.

In Figures 5 and 6, airflow is plotted as a function of assembly pressure drop for two different liquid flowrates. The plots include data from five experiments: I-AFD, U-AFD, U-AT, SATS, and SPRIHTE 1. The liquid flowrates chosen are in the range where the differences between the AFD and A-Tank results are largest, so the plots represent the most extreme discrepancies which have been identified. At low pressure drops, the SATS data appear to either lie between the two AFD datasets and the U-AT (Figure 5) or to agree better with the U-AT (Figure 6). In Figure 5, while the AFD data appear low at about -1.5 psid, there is a U-AT data point at -2.25 psid which appears high. In Figure 6, one of the U-AT points is about 2 gpm lower than SATS, but the AFD points are 4-6 gpm below.

Above -1 psid, one can compare SATS with SPRIHTE 1 (Figure 5) or AFD with SPRIHTE (Figure 6). In both figures, there are clear data differences. Figure 5 shows differences between SATS and SPRIHTE 1, and within the SATS data themselves. The subset of the SATS data above -1 psid come from a single drain-down test. In such a test, the backpressure is lowered at intervals throughout the test, then raised during a refill phase. As can be seen from Figure 5, the pressure drop varied by about 0.5 psid during the course of the test. At the initial, high backpressures, the lower airflow was observed. The airflow then switched to the higher value, where it remained throughout the drain-down and refill phases of the test.²

² Somewhat similar behavior was observed during previous drain-down testing reported in [16]. These data were confounded by the unmeasured airflow past the installed piston ring, however, so it is difficult to draw conclusions from them.

One can compare these SATS points with the SPRIHTE 1 points either by observing the difference in airflow at a given pressure drop, or by observing what change in pressure drop is necessary to produce a given airflow in the two different rigs. From the latter viewpoint, the airflow seen in SPRIHTE 1 at -1 psid was produced in the SATS test over a range of pressure drops from about -0.85 to about -0.4 psid. Figure 6 shows a similar difference between the SPRIHTE 1 data and the U-AFD data, i.e., the SPRIHTE 1 airflow at -1 psid occurs at -0.4 psid in the U-AFD.

These comparisons consider only negative pressure drops. Assembly airflow shows a characteristic pattern: lower airflow at negative pressures is associated with a steeper gradient in the vicinity of 0 psid, and higher airflow at positive pressures. This is shown in Figure 7, in which airflow data (from I-AFD) for two different liquid flowrates are plotted. Intuitively, one expects that the lower liquid flowrate can neither pump as much air at negative pressure drops, nor resist as much the flow of air at positive pressure drops. That is, there is less coupling between phases at the lower flowrate, implying a lower interfacial drag. Figure 8 compares the I-AFD and SPRIHTE 1 data at 24-25 gpm over a wide range of pressure drops. Although the SPRIHTE 1 data extend only to zero psid, the lower slope of the SPRIHTE 1 data near zero psid suggests that the SPRIHTE 1 experiment would produce lower airflows at positive pressure drops than were seen in the I-AFD. If so, it suggests that the AFD loop (or test procedure) in some way enhances the decoupling of phases more than the HTL loops or test procedures do. At this point, it is not clear which result is more representative of the LOCA.

In summary, the data comparisons show that the U-AFD and I-AFD behave quite similarly. Data taken with the I-AFD assembly (i.e., including routed pressure tubing) are thus validated. The average difference in measured airflow between the AFD results and the HTL results is about the same as the magnitude of the data scatter (max-min) in the U-AFD and SATS data combined. Differences between AFD and SPRIHTE 1 are comparable to differences between SATS and SPRIHTE 1, if considered as a variation of pressure drop. The data suggest that the HTL tests represent a somewhat greater degree of phasic coupling than do the AFD tests. Multiple states were identified in both the AFD and SATS.

Further Possible Mechanisms for Airflow Differences

The experimental evidence of bistability and the investigations to date of airflow differences suggest that the assembly is sensitive to one or more as yet unidentified variables. These may or may not prove to be variables which could be predicted or controlled during a LOCA. For this reason, it might be prudent to consider all of the qualified data as valid, even if there is considerable data scatter between experiments, on the grounds that the results represent the range of possibilities during accident conditions. There are some differences between the AFD and HTL facilities which are rather subtle but which could be further explored, however.

One difference between the AFD tests and the HTL tests is the length of time allotted to reach steady state. The AFD tests typically took 40-50 minutes to set up; a 10 minute hold period was imposed after any loop adjustment. No such policy appears to have been followed in the A-Tank or SATS tests. If bistability is possible for the assembly, as has been shown in the AFD loop, the length of time at steady-state prior to data collection might be significant.

One other possible difference between the AFD loop and the various HTL loops is that of water quality. The quality of the A-Tank and SATS working fluids is not well-

characterized. Both the SPRITE and AFD loops used deionized water (monitored for conductivity), so it would appear that these two loops had equivalent working fluids. Deionization covers a broad range of techniques, however, not necessarily leaving chemically pure H_2O . Additional checks were imposed on the AFD working fluid (pH, solids content, oxygen content, and carbon content); no comparison is available for these parameters in the SPRITE loop. Wallis [17] shows that there can be differences in airflow when the water quality is varied, due to the latter's effect on the agglomeration of bubbles. There is thus a possibility that local water quality (Ohio vs. South Carolina) could have some effect on airflow.

If water chemistry affects airflow significantly, the mechanism is not clear. Visual observations in the HTL have shown that the presence of dye in the working fluid appeared to affect the flow regime [18], even though surface tension measurements of the dyed water showed it to be equivalent to undyed water [19]. The reactor working fluid is simulated in all the experiments with light water. During the hypothetical ECS-LOCA, this fluid is a mixture of D_2O and light water. The light water has not been deionized, and can derive either from the polybor header (i.e., with polyborate added) or directly from the Savannah River. The composition of the fluid is a function of time, and is not well-characterized. Therefore, if water chemistry affects airflow significantly, the water chemistry of all the experiments must be reviewed.

If an uncontrolled variable such as water chemistry is responsible for airflow differences, it should be recognized that the state of this variable is likewise not characterized for the LOCA condition itself. In this case, experimental data scatter must be considered representative of the range of responses possible during a LOCA.

Conclusions

1. The pressure instrumentation in the I-AFD assembly did not lower the assembly airflow, as shown by the good agreement between U-AFD and I-AFD data.
2. The same assembly was used both for the U-AFD tests and U-AT tests, yet the results differ by as much as 12 gpm. This points to a facility difference as the cause of the observed airflow differences.
3. The lower airflows in the AFD loop cannot be explained by the use of a valve, rather than a pressure regulator, to control the inlet pressure. Tests were identified in which the inlet control method was the same for both AFD and A-Tank, yet the airflows differed.
4. A bistability in airflow was observed at one set of test conditions in the U-AFD tests. These test conditions were similar to those which produced a bistability in channel inlet pressure and discontinuous changes in flow distribution during I-AFD testing.
5. The SPRITE 1 data are generally higher than the data from other experiments (at negative pressure drops). The airflows from the AFD facility are lower at negative pressure drops, but are probably higher at positive pressure drops, suggesting less coupling between the phases in the AFD setup.
6. Length of time to achieve steady state and water chemistry constitute remaining differences between the AFD and HTL facilities. Past visual observations in the HTL

suggested that water chemistry affects airflow, but the mechanism for the effect has not been uncovered. Neither facility has used a working fluid which is fully prototypical of LOCA conditions.

Recommendations

1. The data from A-Tank, SATS, and SPRIHTE 1, which have provided the comparison basis for the AFD data, are preliminary. Any further analysis of assembly airflow should be done using qualified databases.
2. Since the qualified AFD data have been shown to refute the extant hypotheses of experimental error, they should be used in the ECS-LOCA limits analysis. Airflow uncertainties in the ECS-LOCA analysis should be representative of the scatter in the set of all qualified data.
3. The nominal flows predicted by RELAP5 are of the order of 60 gpm. The observed bistability at 60 gpm highlights the fact that more liquid flow is not necessarily better (e.g., if an adverse flow distribution or high uncertainty is present). The limits calculations should be checked at flow conditions where discontinuous behavior has been observed.
4. If there is further investigation of the implications of controlling pressure by partially closing the air line, the SPRIHTE data should also be scrutinized, since this is also a method of control used in the SPRIHTE tests.
5. Length of time prior to data collection and water quality are areas that should be pursued in any future work on assembly airflow. The latter quantity would not be well-known or well-controlled during a LOCA, however. For this reason, it might be prudent to accept the existing variability in airflows as an inherent sensitivity in the airflow under ECS-LOCA conditions.

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Figure 1

Pressure Tap Arrangement in the Instrumented AFD (I-AFD) Assembly

Figure 2
Airflows in AFD (Instrumented and Uninstrumented) and A-Tank (Uninstrumented):
-1.5 < Delta P < -1.1 psid

instrumented, in AFD loop			uninstrumented, in AFD loop			uninstrumented, in A-Tank		
Flow, gpm	DP, psid	Airflow, gpm	Flow, gpm	DP, psid	Airflow, gpm	Flow, gpm	DP, psid	Airflow, gpm
15.00	-1.31	0.52	20.24	-1.13	1.35	20.18	-1.13	4.12
20.38	-1.13	0.71	20.27	-1.13	1.35	20.82	-1.18	3.71
23.90	-1.32	1.27	20.39	-1.12	1.42	25.75	-1.23	6.07
24.21	-1.45	1.25	23.75	-1.44	1.65	26.76	-1.27	6.13
30.24	-1.38	1.86	25.79	-1.22	2.39	30.45	-1.47	11.04
39.91	-1.38	7.70	30.74	-1.47	3.81	40.37	-1.39	14.14
40.48	-1.29	9.93	40.86	-1.43	6.28	40.71	-1.47	18.63
40.85	-1.28	9.90	52.70	-1.36	9.95	49.27	-1.43	18.84
40.92	-1.33	10.44	61.96	-1.24	13.69	52.71	-1.38	19.57
48.44	-1.11	17.14	70.12	-1.21	13.54	59.29	-1.31	18.90
52.45	-1.21	13.70				62.18	-1.27	19.22
58.43	-1.12	16.05				70.05	-1.22	18.27
62.39	-1.18	14.67				72.89	-1.20	16.63
70.19	-1.19	12.91						

Figure 3

Airflows in AFD (Instrumented and Uninstrumented) and A-Tank (Uninstrumented):
 $-2.32 < \Delta P < -1.77$ psid

AFD Data Are Critical Data
 Other Data Restricted Are Non-Critical Data
 Do Not Use For Critical Applications

Air
 Flow
 [gpm]

Instrumented, in AFD loop		
Flow, gpm	DP, psid	Airflow, gpm
2.90	-1.84	0.00
9.12	-1.80	0.00
10.00	-2.17	0.22
15.49	-1.85	0.12
20.52	-1.98	0.51
23.55	-2.17	1.05
23.77	-2.18	0.94
23.86	-2.19	0.97
23.87	-2.17	0.92
23.92	-2.18	0.84
23.92	-2.17	0.92
24.08	-2.17	0.97
24.10	-2.17	1.23
24.13	-2.18	0.90
24.20	-2.19	1.11
24.29	-2.17	0.98
24.50	-2.20	0.97
26.17	-1.81	1.21
26.71	-1.98	1.08
30.13	-2.18	1.31
30.40	-2.18	1.93
31.19	-2.00	1.41
37.03	-1.81	3.32
37.30	-1.83	3.13
39.77	-2.20	3.14
39.90	-2.13	2.39
40.40	-2.22	4.35
40.50	-2.22	2.84
41.02	-2.23	3.40
48.43	-1.79	7.91
58.95	-1.84	9.67
60.46	-1.89	10.13
69.60	-1.79	9.60
70.01	-1.81	8.15

uninstrumented, in AFD loop			uninstrumented, in A-Tank		
Flow, gpm	DP, psid	Airflow, gpm	Flow, gpm	DP, psid	Airflow, gpm
20.29	-1.97	0.90	19.91	-2.16	2.27
23.91	-2.17	1.42	20.43	-1.99	3.18
24.94	-2.17	1.50	24.76	-2.30	4.44
25.23	-2.32	1.50	26.46	-2.03	5.97
25.29	-2.32	1.50	29.61	-2.16	5.85
25.49	-2.17	1.57	30.72	-2.25	10.10
26.51	-2.00	1.65	31.07	-2.09	7.63
31.16	-2.10	2.47	40.69	-2.15	10.53
40.55	-2.11	4.26	40.71	-2.19	7.79
41.32	-2.29	4.34	41.31	-2.26	11.00
59.63	-1.98	10.25	49.39	-2.10	11.88
60.12	-1.98	10.10	60.28	-1.98	17.18
60.47	-1.97	9.80	61.41	-1.96	16.32
60.55	-1.97	4.04	61.66	-2.08	14.83
61.09	-1.97	4.11	69.63	-1.96	15.81
61.22	-2.00	10.40	70.79	-2.03	14.08
70.20	-1.98	10.40			

Figure 4
Postulated Airflow-Pressure Drop Interaction

Figure 5

Other Data Restricted Are Non-Critical Data Do Not Use For Critical Applications

Figure 6
Comparison of Various Experimental Databases at 25 gpm Liquid Flow

Figure 7
Effect of Liquid Flowrate on Airflow Behavior:
Positive and Negative Pressure Drops

■ Instrumented AFD, 24-25 gpm

□ Instrumented AFD, 37-40 gpm

**Critical Data
 May Be Used For Critical Applications**

Figure 8
Comparison of Instrumented AFD and SPRIHTE 1 at 24-25 gpm:
Positive and Negative Pressure Drops

AFD Data Are Critical Data

Other Data Restricted Are Non-Critical Data
Do Not Use For Critical Applications

■ Instrumented, AFD

□ SPRIHTE 1

Attachment 1: Uninstrumented Assembly Tests from the Annular Flow Distribution Facility

Test id	Flow (gpm)	DP (psid)	Plen Pres (psig)	Tank (ft)	air in (scfm)	air out (scfm)
965200	20.39	-1.116	-0.042	2.48	0.19	0.22
965201	25.79	-1.220	-0.12	2.54	0.32	0.34
965202	30.74	-1.468	-0.351	2.58	0.51	0.53
965203	40.86	-1.431	-0.275	2.67	0.84	0.86
965204	52.7	-1.361	-0.3	2.45	1.33	1.35
965205	61.96	-1.242	-0.298	2.18	1.83	2.31
965206	70.12	-1.213	-0.312	2.08	1.81	2.31
965207	20.24	-1.126	-0.043	2.5	0.18	0.2
965208	20.29	-1.970	-0.03	4.48	0.12	0.13
965209	26.51	-2.000	-0.086	4.42	0.22	0.24
965210	31.16	-2.098	-0.201	4.38	0.33	0.34
965211	41.32	-2.286	-0.42	4.31	0.58	0.59
965212	40.55	-2.106	-0.261	4.26	0.57	0.58
965213	60.55	-1.970	-0.229	4.02	0.54	0.55
965214	70.2	-1.980	-0.248	4	1.39	1.3
965215	20.27	-1.125	-0.047	2.49	0.18	0.19
965216	60.12	-1.980	-0.248	4	1.35	1.25
965217	61.09	-1.967	-0.213	4.05	0.55	0.51
965218	61.22	-2.001	-0.247	4.05	1.39	1.25
965219	23.75	-1.444	-0.019	3.29	0.22	0.23
965220	24.27	-0.476	0.953	3.3	1.76	2.19
965221	24.23	-0.467	0.962	3.3	1.79	2.22
965222	23.91	-2.172	-0.02	4.97	0.19	0.18
965223	23.9	-0.427	0.998	3.29	2.11	2.55
965224	23.94	1.153	2.006	1.97	50.78	52.34
965225	24.94	-2.170	-0.009	4.99	0.2	0.2
965226	25.49	-2.173	-0.012	4.99	0.21	0.2
965227	25.23	-2.321	-0.013	5.33	0.2	0.21
965228	25.29	-2.320	-0.012	5.33	0.2	0.2
965229	25.32	-2.455	-0.013	5.64	0.19	0.19
965230	25.14	-2.602	-0.013	5.98	0.18	0.18
965232	59.63	-1.979	-0.23	4.04	1.37	1.21
965233	30.23	-2.607	-0.026	5.96	0.29	0.27
965234	30.18	-2.752	-0.024	6.3	0.27	0.27
965240	60.47	-1.975	-0.234	4.02	1.31	1.34
965241	30.07	-2.887	-0.025	6.61	0.24	0.22
965242	29.99	-3.061	-0.025	7.01	0.25	0.24

Attachment 1: Uninstrumented Assembly Tests from the Annular Flow Distribution Facility

delta air	plen level (in)	bar pr in Hg	BFI	water T, °F	air T, °F	tank psig	note
-0.030	3.685	28.96	p/l	73.2	74.1	1.074	
-0.020	4.308	28.75	p/l	72.1	73.3	1.100	
-0.020	4.839	28.64	p/l	72.1	72.1	1.117	
-0.020	5.823	28.6	p/l	72.1	71.9	1.156	
-0.020	6.858	28.6	p/l	72.4	71.4	1.061	
-0.480	7.643	28.6	p/l	72.7	71.1	0.944	#(1)
-0.500	8.18	28.66	p/l	72.4	71.5	0.901	
-0.020	3.726	28.66	p/l	72.4	71.3	1.083	
-0.010	3.715	28.69	p/l	72.4	71.3	1.940	
-0.020	4.432	28.69	p/l	72.8	71.5	1.914	
-0.010	4.898	28.7	p/l	72.2	71.9	1.897	
-0.010	5.88	28.7	p/l	72.8	72.4	1.866	
-0.010	5.826	28.74	p/l	73.5	72.8	1.845	
-0.010	7.523	28.87	p/l	70.4	71.5	1.741	
0.090	8.232	29.13	p/l	70.7	72.2	1.732	
-0.010	3.728	29.13	p/l	71.1	73.3	1.078	
0.100	7.555	29.16	p/l	71.6	69.2	1.732	
0.040	7.603	29.34	p/l	69.9	71.6	1.754	
0.140	7.581	29.28	p/l	68.6	67.8	1.754	
-0.010	4.101	28.53	p/l	67.5	67.6	1.425	
-0.430	4.247	28.5	p/l	67.3	66.1	1.429	#(1)
-0.430	4.235	28.51	p/l	67.9	67.8	1.429	#(1)
0.010	4.144	28.54	p/l	68.5	68.4	2.152	
-0.440	4.135	28.58	p/l	69.3	73.1	1.425	#(1)
-1.560	3.762	28.65	p/l	70	70.7	0.853	
0.000	4.262	28.93	p/l	68.7	73.5	2.161	#(2)
0.010	4.344	28.91	p/l	68.9	72.2	2.161	
-0.010	4.343	28.91	p/l	68.7	71.3	2.308	#(2)
0.000	4.332	28.9	p/l	68.3	71	2.308	
0.000	4.348	28.9	p/l	68.1	71.2	2.442	
0.000	4.314	28.88	p/l	67.7	70.9	2.589	
0.160	7.437	28.88	p/l	67.7	68.9	1.749	#(2)
0.020	4.839	28.7	p/l	67.6	72	2.581	
0.000	4.834	28.7	p/l	68.7	73.3	2.728	
-0.030	7.508	29.97	p/l	68.4	67.1	1.741	#(3)
0.020	4.849	29.27	p/l	68.3	68.9	2.862	
0.010	4.853	29.28	p/l	69.1	71.8	3.036	

(1) Inlet air meter 0-25 scfm; outlet air meter 0-150 scfm

(2) Repeat test condition from a lower liquid flowrate

(3) Repeat test condition from a higher air flowrate

To A. L. KIELPINSKI - WESTINGHOUSE SAVANNAH RIVER COMPANY

From K. E. KNOLL - NUCLEAR STEAM SYSTEMS & COMPONENTS SECTION

Cust. WESTINGHOUSE SAVANNAH RIVER COMPANY

File No.
RDD:91:4558-01-01:02

Subj. UNINSTRUMENTED FUEL ASSEMBLY TEST FINAL REPORT

Date
SEPTEMBER 30, 1991

This letter to cover one customer and one subject only.

Attached are data summaries and time plots for tests conducted on the uninstrumented fuel assembly in the reference loop of the Annular Flow Distribution Test Facility between March 12 and April 2, 1991.

The objective of this test series was to obtain total assembly air flow for the Mark-22 fuel assembly over a range of assembly water flows and assembly pressure drops. Uninstrumented fuel assembly tests were intended to replicate test conditions from the instrumented fuel assembly test matrix to verify that instrumentation did not affect test results. The uninstrumented fuel assembly was therefore not instrumented for individual channel pressure drop information, but instead provided overall assembly pressure drop and air flow measurements that could be compared to previous test results. The enclosed technical discussion provides an overview of the uninstrumented fuel assembly tests performed, as well as an explanation of the technical direction as it evolved throughout the conduct of the test program.

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D. P. Birmingham
T. E. Moskal

WSRC

~~A. L. Kielpinski~~ (25 copies text, ~~5 copies with attachments~~)

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Page 2

September 30, 1991

RDD:91:4558-01-01:02

Five categories of tests were performed on the uninstrumented fuel assembly, as follows:

- baseline test data,
- water flow hysteresis test data,
- air flow hysteresis test data,
- time history test data,
- and BFI tank drain down test data.

Baseline test data were obtained to verify earlier results from an instrumented reference assembly with all boundary conditions being the same. Water and air flow hysteresis test data were obtained to determine if any hysteresis effects resulted by approaching the specified test conditions from either increasing water flow or decreasing air flow. Time history data were obtained to further explore hysteresis by determining test loop response to varying set up procedures for the same nominal test condition. BFI tank drain down test data were obtained to determine test loop response to varying BFI tank level. Data for the above tests are provided in the attachments.

Analysis of the test data showed no significant effect of assembly instrumentation on the air flow test results. Some test conditions were identified which showed a "bistable" operating condition where identical boundary conditions of inlet plenum pressure, BFI tank level, and water flow rate were achieved and found to provide one of two distinctly different values of assembly air flow. These observations are described more completely in the enclosed technical discussion.

Prepared by: K. E. Knoll
K. E. Knoll

Approved by: Thomas Moskal
T. E. Moskal

Approved by: D. P. Birmingham
D. P. Birmingham, Section Manager

Attachment

Keywords: annular flow distribution, Savannah River, production reactor, emergency cooling system

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Please help us do a better job for you.

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Report No.: RDD:91:4558-01-01:02

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**E. A. Womack, Jr., Vice President
The Babcock & Wilcox Company
Research and Development Division
Alliance Research Center
1562 Beeson Street
Alliance, Ohio 44601-2196**

Table of Contents

<u>Section</u>	<u>Page</u>
Technical Discussion	4
Attachment 1 Baseline Test data	A1-1 to A1-259
Water Flow Hysteresis Test Data	A1-260 to A1-266
Air Flow Hysteresis Test Data	A1-267 to A1-273
Attachment 2 Time History Test Data	A2-1 to A2-22
Attachment 3 BFI Tank Drain Down Test Data	A3-1 to A3-9
Attachment 4 Micromotion Mass Flowmeter Post-test Calibration Uncertainty	A4-1 to A4-3

List of Tables

Table 1.	Test List - Uninstrumented Fuel Assembly Tests	8
Table 2.	Comparison of Instrumented and Uninstrumented Assembly Results	10
Table 3.	Database Variable (VTAB) Measurement Definitions and Uncertainties	11

List of Figures

Figure 1.	Kurz Air Mass Flowmeter Uncertainty for Meter RPGM02 (0 - 25 scfm).	12
Figure 2.	Kurz Air Mass Flowmeter Uncertainty for Meter RPGM01 and RTGM01 (0 - 150 scfm).	13
Figure A.4.1	Micromotion Mass Flowmeter Uncertainty	A4-3

References

ARC-TP-965, Revision 2 - Technical Procedure, Annular Flow Distribution Test --
Air Flow Testing

Project Technical Plan, Revision 2

TECHNICAL DISCUSSION

This report documents the test results for the follow-on uninstrumented assembly testing performed on the Mark 22 fuel assembly in the Annular Flow Distribution (AFD) test facility. A summary of all conditions employed for the test matrix and the associated test identification numbers are provided in Table 1. All testing was conducted with the uninstrumented fuel assembly installed in the reference flow loop using the P/L-type bottom fitting insert (BFI). The procedure used for these tests is documented in test procedure ARC-TP-965, Revision 4, Annular Flow Distribution Test -- Air Flow Testing.

Test conditions employed were initially based on test specifications provided by WSRC on February 25, 1991 in letter NES-ETH-910128. Upon completion of the first half of the specified tests (all P/L-type BFI testing), an anomaly was noted for one of the test conditions. Specifically, a bistability was noticed at the test condition identified by test point 66; that is, identical boundary conditions of inlet plenum pressure, BFI tank level, and water flow rate were achieved and found to provide one of two significantly different values of assembly air flow rate. Furthermore, the two different values of air flow rate were repeatable and apparently steady once achieved. The observed bistability is apparent by comparing repeat runs of test point 66 where air flow rates of both 0.55 scfm (965213 and 965217) and 1.35 scfm (965216, 965218, 965232, and 965240) were recorded. The observed bistability is also apparent in the repeat run of test point 64 (965237) where inlet plenum pressure and assembly air flow rate both changed during the performance of the test.

At this point, effort was redirected by the WSRC technical manager to further examine the observed bistability and to explore other possible explanations for the differences noted between B&W and WSRC uninstrumented assembly test results. Testing proceeded by repeating tests performed previously in the Annular Flow Distribution facility on the instrumented Mark 22 fuel assembly with P/L-type BFI in an effort to confirm repeatability between instrumented and uninstrumented assembly results. A comparison of these results is presented in Table 2. Repeat tests were concentrated at 24 gpm because previous testing experience had shown this to be a flow rate which exhibited oscillatory behavior in the past. Testing therefore served as both a verification of previous test repeatability as well as a search for additional bistable conditions. Testing at these conditions was also intended to provide a three way comparison between AFD facility testing of the uninstrumented fuel assembly, AFD facility testing of the instrumented fuel assembly, and WSRC Heat Transfer Lab testing of the uninstrumented fuel assembly. With the exception of repeat tests for test point 2 (ARC-TP-965), all test results showed good agreement with previous instrumented assembly results. Air flow measurements for these tests were within or close to the measurement uncertainties of the air flowmeters used. The discrepancy noted for test point 2 repeats were subsequently identified as being a result of a condition known by WSRC to be extremely sensitive to small changes in total pressure drop. The observed scatter was therefore expected at this condition.

Subsequent direction from the WSRC technical manager resulted in the specification of test points 75 through 90. The emphasis of these additional tests was to investigate the observed bistability and examine possible causes for the differing results obtained between AFD and WSRC Heat Transfer Lab testing.

Test points 75 through 84 concentrated on exploring the bistability phenomenon by conducting tests which were previously performed at WSRC and shown to exhibit oscillatory behavior. Specifically, test points 75 through 80 were performed at 25 gpm water flow, 0.0 psig plenum pressure, and 5 to 6 ft BFI tank level, while test points 81 through 84 were performed at 30 gpm water flow, 0.0 psig plenum pressure, and 6 to 7 ft BFI tank level. These tests were initially performed by approaching test conditions from both increasing and decreasing water flow rate (test points 75 through 78) but, due to the limited time window for testing, were completed by approaching specified conditions only from standard (water solid) conditions.

Test points 85 and 89 were intended to further explore the observed bistability at the nominal conditions for test point 66. Test points 85 and 86 explored this phenomenon by setting up the nominal conditions for test point 66 either from increasing water flow or decreasing air flow, as a means of establishing any hysteresis effect. No such effect was observed. Test points 87 through 89 were performed to provide time history data of loop response to varying set up procedures for the same nominal conditions (test point 66). Data from the time history tests are included in Attachment 2.

Test point 90 was performed to observe test loop response to varying BFI tank level. As outlined in ARC-TP-965, BFI tank level was initially set at 20 ft, then reduced by the specified increments to a minimum value of 2 ft. The procedure continued by increasing the BFI tank level according to the reverse procedure back to the 20 ft tank level. Because the test loop was not designed to perform such a test, adherence to the test procedure was only approximate. Achievement of specified test conditions was limited by the test operator's ability to vary and hold the tank level using the restriction across a three inch ball valve. Data from the BFI tank drain down test are included in Attachment 3.

Data from each test has undergone a data qualification process as described in Section 3.0 of the Annular Flow Distribution Project Final Report (RDD:90:4558-05-01:02). Test data was examined to verify adherence to boundary condition requirements, instrument performance, and measurement consistency. Uncertainties for all measurement values are identical to those reported in the project Final Report and are also included here in Table 3. An exception is noted, however, for the reference assembly water flow measurement for which an instrument post-test calibration problem existed. This post-test calibration is discussed in Attachment 4 where the impact on the data was assessed to be minor. Data qualification check summaries identifying test condition or measurement deviations, along with an estimated impact on test data, is contained in the following. Each deviation is identified by the affected test number.

<u>TEST ID</u>	<u>DESCRIPTION OF BOUNDARY CONDITION DEVIATION</u>
965214	Boundary condition deviation - Water flow rate was 0.6 gpm above target value (0.1 gpm out of spec.), as noted on summary sheet. The water flow rate was steady throughout the test, and a 0.1 gpm deviation in boundary water flow is not expected to affect the usefulness of the data. Test is therefore accepted.
965217	Boundary condition deviation - Water flow rate was 0.79 gpm above target value (0.29 gpm out of spec.), as noted on summary sheet. The

water flow rate was steady throughout the test, and a 0.29 gpm deviation in boundary water flow is not expected to affect the usefulness of the data. Test is therefore accepted.

965218 Boundary-condition deviation - Water flow rate was 0.92 gpm above target value (0.42 gpm out of spec.), as noted on summary sheet. The water flow rate was steady throughout the test, and a 0.42 gpm deviation in boundary water flow is not expected to affect the usefulness of the data. Test is therefore accepted.

965232 Boundary condition deviation - Water flow rate was 0.67 gpm below target value (0.17 gpm out of spec.), as noted on summary sheet. The water flow rate was steady throughout the test, and a 0.17 gpm deviation in boundary water flow is not expected to affect the usefulness of the data. Test is therefore accepted.

965237 Boundary condition deviation - Water flow rate was 0.65 gpm above target value (0.15 gpm out of spec.), as noted on summary sheet. The water flow rate was steady throughout the test, and a 0.15 gpm deviation in boundary water flow is not expected to affect the usefulness of the data. Test is therefore accepted.

Boundary condition deviation - Inlet plenum pressure mean value changed by more than specified allowable. Specifically, the mean value changed from about -0.40 psig to about -0.28 psig. This change in inlet plenum pressure is believed to be an indication of a bistable operating condition for the fuel assembly. The air flow was also noticed to change at the same point in time.

Data contained in Attachment 1 are for the baseline tests and the water and air flow hysteresis tests. The term "baseline" data refers to tests performed by the standard procedure for obtaining steady-state data. Water and air flow hysteresis tests deviate from the standard procedure by exploring the effects of approaching the desired test conditions from either increasing water flow or decreasing air flow. For each test included in Attachment 1, the following data is provided:

- summary of uninstrumented assembly test conditions and results
- listing of time-averaged readings for all instruments and 2 σ (2 standard deviations) of each instrument reading over the test period
- time plots of the reference loop inlet plenum pressure and uninstrumented assembly inlet air flow rate (low and mid-range meters).

The data contained in Attachment 2 pertain specifically to the time history tests and as such a time trace for each instrument reading is provided. Test Procedure ARC-TP-965, Revision 4, outlines the test conduct for each of these tests.

The data contained in Attachment 3 describes the results of the BFI tank drain-down test. Similar to the time history tests, a time trace for each

instrument reading is provided. Technical Procedure ARC-TP-965, Revision 4, outlines the test conduct for this test.

Table 1
Test List - Uninstrumented Fuel Assembly Tests

<u>Test Point</u>	<u>Test ID</u>	<u>Water Flow (gpm)</u>	<u>Plenum Pressure (psig)</u>	<u>Tank Level (ft H₂O)</u>
[baseline test data, see Attachment 1]				
53	965200	20.2	-0.05	2.52
54	965201	25.7	-0.12	2.56
55	965202	30.4	-0.34	2.62
56	965203	40.7	-0.30	2.71
56	965238	40.7	-0.30	2.71
57	965204	52.7	-0.31	2.48
58	965205	62.2	-0.30	2.23
59	965206	70.2	-0.30	2.10
60	965207	20.2	-0.05	2.52
61	965208	20.4	-0.03	4.52
62	965209	26.5	-0.10	4.46
63	965210	31.1	-0.19	4.41
64	965211	41.3	-0.39	4.32
64	965237	41.3	-0.39	4.32
65	965212	40.7	-0.29	4.30
66	965213	60.3	-0.22	4.06
66	965216	60.3	-0.22	4.06
66	965217	60.3	-0.22	4.06
66	965218	60.3	-0.22	4.06
67	965214	69.6	-0.22	4.02
68	965215	20.2	-0.05	2.52
69	965219	24.0	0.0	3.30
70	965220	24.0	1.0	3.30
71	965221	24.0	1.0	3.30
72	965223	24.0	1.0	3.30
73	965222	24.0	0.0	5.00
74	965224	24.0	2.0	2.00
75	965226	25.0	0.0	5.00
76	965225	25.0	0.0	5.00
77	965228	25.0	0.0	5.33
78	965227	25.0	0.0	5.33
79	965229	25.0	0.0	5.67
80	965230	25.0	0.0	6.00
81	965233	30.0	0.0	6.00
82	965234	30.0	0.0	6.33
83	965241	30.0	0.0	6.67
84	965242	30.0	0.0	7.00

Table 1 (cont'd.)

<u>Test Point</u>	<u>Test ID</u>	<u>Water Flow (gpm)</u>	<u>Plenum Pressure (psig)</u>	<u>Tank Level (ft H₂O)</u>
[water flow hysteresis test data, see Attachment 1]				
85	965232	60.3	-0.22	4.06
[air flow hysteresis test data, see Attachment 1]				
86	965240	60.3	-0.22	4.06
[time history test data, see Attachment 2]				
87	965231	60.3	-0.22	4.06
88	965235	60.3	-0.22	4.06
89	965236	60.3	-0.22	4.06
[BFI tank drain down test data, see Attachment 3]				
90	965239	30.0	0.0	varied

Table 2
Comparison of Instrumented and Uninstrumented Assembly Results

TEST ID	TEST PT	BFI TYPE	WATER FLOW (GPM)	INLET		OUTLET		PLENUM PRESS (psig)	TANK LEVEL (ft)	ASSY DP (psid)		COMMENTS
				AIR FLOW (scfm)	AIR FLOW (scfm)	AIR FLOW (scfm)	AIR FLOW (scfm)					
965219	69	P/L	23.75	0.22	0.22	0.23	0.23	-0.02	3.29	-1.44	-1.44	Uninstrumented Assy.
965001	1	P/L	24.21	0.17	0.17	0.16	0.16	-0.01	3.33	-1.45	-1.45	Instrumented Assy. (Same conditions as TP 69)
965220	70	P/L	24.27	1.76	1.76	2.19	2.19	0.95	3.30	-0.48	-0.48	Uninstrumented Assy. (Approach from TP 69)
965221	71	P/L	24.23	1.79	1.79	2.22	2.22	0.96	3.30	-0.47	-0.47	Uninstrumented Assy. (Approach from Water Solid)
965223	73	P/L	23.90	2.11	2.11	2.55	2.55	1.00	3.29	-0.42	-0.42	Uninstrumented Assy. (Approach from Low Water Flow)
965002	2	P/L	24.10	0.38	0.38	0.39	0.39	1.00	3.32	-0.44	-0.44	Instrumented Assy. (Same conditions as TP 70,71,73)
965222	72	P/L	23.91	0.19	0.19	0.18	0.18	-0.02	4.97	-2.17	-2.17	Uninstrumented Assy.
965003	3	P/L	23.92	0.11	0.11	0.10	0.10	-0.01	5.01	-2.18	-2.18	Instrumented Assy. (Same conditions as TP 72)
965224	74	P/L	23.94	50.78	50.78	52.34	52.34	2.01	1.97	1.16	1.16	Uninstrumented Assy.
857039		K/C	24.00	50.91	50.91			2.01	1.99	1.15	1.15	Instrumented Assy. (Same conditions as TP 74)
965200	53	P/L	20.39	0.19	0.19	0.22	0.22	-0.04	2.48	-1.11	-1.11	Uninstrumented Assy.
965207	60	P/L	20.24	0.18	0.18	0.20	0.20	-0.04	2.50	-1.12	-1.12	Uninstrumented Assy. (Repeatability test of TP 53)
965215	68	P/L	20.27	0.18	0.18	0.19	0.19	-0.05	2.49	-1.13	-1.13	Uninstrumented Assy. (Repeatability test of TP 53)
965008	7	P/L	20.38	0.10	0.10	0.10	0.10	-0.04	2.52	-1.13	-1.13	Instrumented Assy. (Same conditions as TP 53)
965208	61	P/L	20.29	0.12	0.12	0.13	0.13	-0.03	4.48	-1.97	-1.97	Uninstrumented Assy.
965010	13	P/L	20.52	0.07	0.07	0.07	0.07	-0.03	4.51	-1.98	-1.98	Instrumented Assy. (Same conditions as TP 61)

Table 3
Database Variable (VTAB) Measurement Definitions and Uncertainties

<u>VTAB</u>	<u>B&W No.</u>	<u>Description</u>	<u>Uncertainty</u>
ASTC01	0890351	INLET PLENUM COMMON AIR TEMPERATURE	$\pm 1.9^{\circ}\text{F}$
RPTC01	0890353	REF INLET PLENUM LIQUID TEMPERATURE	$\pm 1.9^{\circ}\text{F}$
RPM01	0890414	LIQUID LOW FLOW RATE REF PLENUM	Attachment 4
RPM02	0850598	LIQUID HIGH FLOW RATE REF PLENUM	Attachment 4
RPGM01	0890388	AIR MASS FLOW RATE, REF INLET PLENUM	Figure 1
RPGM02	0890386	AIR MASS FLOW RATE, REF INLET PLENUM	Figure 2
RPGM03	0900244	AIR MASS FLOW RATE, REF INLET PLENUM	$\pm 0.07 \text{ scfm}$
RTGM01	0890387	AIR MASS FLOW RATE, REF ASSY OUTLET	Figure 2
RTGM02	0900331	AIR MASS FLOW RATE, REF ASSY OUTLET	$\pm 0.07 \text{ scfm}$
RPGP01	0890472	PRES., TOP OF REF INLET PLENUM, 230.4 in	$\pm 0.042 \text{ psig}$
RTGP01	0890444	PRES., REF ASSY TANK BOTTOM	$\pm 0.042 \text{ psig}$
RPLV01	0890636	LEVEL, REFERENCE INLET PLENUM	$\pm 0.14 \text{ inch}$

Figure 1. Kurz Air Mass Flowmeter Uncertainty for Meter RPGM02 (0 - 25 scfm).

Figure 2. Kurz Air Mass Flowmeter Uncertainty for Meters RPGM01 and RTGM01 (0 - 150 scfm).

QUALITY ASSURANCE PROGRAM

The B&W Research and Development Division quality policies are established by a Quality Assurance Manual and are further implemented by Administrative Procedures. For the Annular Flow Distribution Test, the project leader and quality administrator developed a quality assurance plan (QA Plan 88009) which identified the verification activities to be applied for the project based on the end use of the data and customer requirements. The Quality Assurance Plan was approved by the customer.

At the completion of the program, the final audit was performed by B&W Quality Assurance. All data collected for the project and included in the attachments are considered "Final". This status indicates successful completion of the quality assurance process, as identified by the statement of the Quality Assurance Manager, given below.

To the best of my knowledge and belief, this project was conducted in accordance with the requirements of Quality Assurance Plan 88009 Revision 0 dated December 30, 1988.

George W. Roberts
Manager of Quality Assurance

ATTACHMENT 1
Uninstrumented Fuel Assembly Test Data Summaries

Table of Contents

<u>Test Point</u>	<u>Test ID</u>	<u>Water Flow (gpm)</u>	<u>Plenum Pressure (psig)</u>	<u>Tank Level (ft H₂O)</u>	<u>Page</u>
[baseline test data]					
53	965200	20.2	-0.05	2.52	A1-1
54	965201	25.7	-0.12	2.56	A1-8
55	965202	30.4	-0.34	2.62	A1-15
56	965203	40.7	-0.30	2.71	A1-22
56	965238	40.7	-0.30	2.71	A1-29
57	965204	52.7	-0.31	2.48	A1-36
58	965205	62.2	-0.30	2.23	A1-43
59	965206	70.0	-0.30	2.10	A1-50
60	965207	20.2	-0.05	2.52	A1-57
61	965208	20.4	-0.03	4.52	A1-64
62	965209	26.5	-0.10	4.46	A1-71
63	965210	31.1	-0.19	4.41	A1-78
64	965211	41.3	-0.39	4.32	A1-85
64	965237	41.3	-0.39	4.32	A1-92
65	965212	40.7	-0.29	4.30	A1-99
66	965213	60.3	-0.22	4.06	A1-106
66	965216	60.3	-0.22	4.06	A1-113
66	965217	60.3	-0.22	4.06	A1-120
66	965218	60.3	-0.22	4.06	A1-127
67	965214	69.6	-0.22	4.02	A1-134
68	965215	20.2	-0.05	2.52	A1-141
69	965219	24.0	0.0	3.30	A1-148
70	965220	24.0	1.0	3.30	A1-155
71	965221	24.0	1.0	3.30	A1-162
72	965223	24.0	1.0	3.30	A1-169
73	965222	24.0	0.0	5.00	A1-176
74	965224	24.0	2.0	2.00	A1-183
75	965226	25.0	0.0	5.00	A1-190
76	965225	25.0	0.0	5.00	A1-197
77	965228	25.0	0.0	5.33	A1-204
78	965227	25.0	0.0	5.33	A1-211
79	965229	25.0	0.0	5.67	A1-218
80	965230	25.0	0.0	6.00	A1-225
81	965233	30.0	0.0	6.00	A1-232
82	965234	30.0	0.0	6.33	A1-239
83	965241	30.0	0.0	6.67	A1-246
84	965242	30.0	0.0	7.00	A1-253

ATTACHMENT 1

Table of Contents (cont'd.)

<u>Test Point</u>	<u>Test ID</u>	<u>Water Flow (gpm)</u>	<u>Plenum Pressure (psig)</u>	<u>Tank Level (ft H₂O)</u>	<u>Page</u>
		[water flow hysteresis test data]			
85	965232	60.3	-0.22	4.06	A1-260
		[air flow hysteresis test data]			
86	965240	60.3	-0.22	4.06	A1-267

Title: Uninstrumented Assembly Testing
Test date/time: 12-MAR-91, 13:26

Test: 965200
Test point: 53

SPECIFIED CONDITIONS:

Water Flow:	20.2 gpm	BFI Type:	P/L
Fluid Temp:	- 70 deg F	Piston Leakage:	0.00 scfm
Inlet Plenum Press.:	-0.05 psig		
Tank Water Level:	2.52 ft		

ACTUAL CONDITIONS (Uninstrumented Reference Assy.):

COMMENTS

Water Flow:	20.39 gpm	
Air Flow:	Inlet: 0.19 scfm	0-1.5 scfm Omega
	Outlet: 0.22 scfm	0-1.5 scfm Omega
Water Temperature:	73.2 deg F	
Air Temperature:	74.1 def F	
Inlet plenum pressure:	-0.04 psig	
Tank bottom pressure:	1.07 psig	
	(2.48 ft. H2O) (Tank Water Level)	
Inlet Plenum Level:	3.69 in. H2O	
Barometric pressure:	28.96 in. Hg at	74 deg F

Test Number 965200

VTAB AVERAGE UNITS 2*SIGMA

ASTC01	74.114	DEG F	0.201
TPTC01	0.000	DEG F	0.000
RPTC01	73.183	DEG F	0.470
TPMM02	0.000	GPM	0.000
RPMM02	20.387	GPM	0.155
TPMM01	0.000	GPM	0.000
RPMM01	0.008	GPM	0.098
TPGM01	0.000	SCFM	0.000
TPGM02	0.000	SCFM	0.000
RPGM01	-0.258	SCFM	0.076
RPGM02	0.175	SCFM	0.014
RTGM02	0.217	SCFM	0.047
RTGM01	-0.240	SCFM	0.063
T2GM01	0.000	SCFM	0.000
T3GM01	0.000	SCFM	0.000
T4GM01	0.000	SCFM	0.000
TPGM03	0.000	SCFM	0.000
RPGM03	0.192	SCFM	0.032
T2GM02	0.000	SCFM	0.000
T3GM02	0.000	SCFM	0.000
T4GM02	0.000	SCFM	0.000
RPGP01	-0.042	PSIG	0.008
RPGP02	0.000	PSIG	0.000
RPGP03	0.000	PSIG	0.000
TPGP01	0.000	PSIG	0.000
TPGP02	0.000	PSIG	0.000
TPGP03	0.000	PSIG	0.000
T2GP01	0.000	PSIG	0.000
T3GP01	0.000	PSIG	0.000
T4GP01	0.000	PSIG	0.000
T2GP02	0.000	PSIG	0.000
T3GP02	0.000	PSIG	0.000
T4GP02	0.000	PSIG	0.000
T2GP03	0.000	PSIG	0.000
T3GP03	0.000	PSIG	0.000
T4GP03	0.000	PSIG	0.000
T2GP04	0.000	PSIG	0.000
T3GP04	0.000	PSIG	0.000
T4GP04	0.000	PSIG	0.000
T2GP05	0.000	PSIG	0.000
T3GP05	0.000	PSIG	0.000
T4GP05	0.000	PSIG	0.000
T2GP06	0.000	PSIG	0.000
T3GP06	0.000	PSIG	0.000
T4GP06	0.000	PSIG	0.000
R2GP06	0.000	PSIG	0.000
R3GP06	0.000	PSIG	0.000
R4GP06	0.000	PSIG	0.000
R2GP02	0.000	PSIG	0.000
R3GP02	0.000	PSIG	0.000
R4GP02	0.000	PSIG	0.000
R2GP03	0.000	PSIG	0.000
R3GP03	0.000	PSIG	0.000
R4GP03	0.000	PSIG	0.000
R2GP04	0.000	PSIG	0.000
R3GP04	0.000	PSIG	0.000

Test Number 965200
 VTAB AVERAGE UNITS 2*SIGMA

R4GP04	0.000	PSIG	0.000
R2GP05	0.000	PSIG	0.000
R3GP05	0.000	PSIG	0.000
R4GP05	0.000	PSIG	0.000
RTGP01	1.073	PSIG	0.001
T2LC01	0.000	LBM	0.000
T2LC02	0.000	LBM	0.000
T3LC01	0.000	LBM	0.000
T3LC02	0.000	LBM	0.000
T4LC01	0.000	LBM	0.000
T4LC02	0.000	LBM	0.000
R2DP01	0.000	PSI	0.000
R3DP01	0.000	PSI	0.000
R4DP01	0.000	PSI	0.000
R2DP02	0.000	PSI	0.000
R3DP02	0.000	PSI	0.000
R4DP02	0.000	PSI	0.000
RPLV01	3.685	IN-H2O	0.021
TPLV01	0.000	IN-H2O	0.000
TPMM22	0.000	LBM/HR	0.000
RPMM22	10179.138	LBM/HR	77.619
TPMM21	0.000	LBM/HR	0.000
RPMM21	11.883	LBM/HR	35.918
T2LC30	0.000	LBM/HR	0.000
T3LC30	0.000	LBM/HR	0.000
T4LC30	0.000	LBM/HR	0.000

Test Name: 965200, 13:26
Test Date: 12-MAR-91

Today's Date: 05-Apr-91

Mark 22 Fuel Assembly
Annular Flow Distribution - Uninstrumented Assembly Testing
Test Notes ==> 20.2 GPM; 2.52 FT. BFI BACK PRESS.; Water Temp. 70F; P/L; TP 53

Reference Fuel Assembly

		Value	Two Std Deviation	UTAB
** Water **				
Temperature (F):	<	73.2	0.47	RPTC01
Flow Rate (gpm):	<	20.4	0.16	RPTM01+ RPTM02
** Air **				
Temperature (F):	<	74.11	0.20	ASTC01
Flow Rate (scfm):	<	0.19	0.03	RPGM03
** INLET PLENUM **				
Pressure (psig):	<	-0.042	0.008	RPGP01
Level (in):	<	3.685	0.022	RPLV01
** BOTTOM FITTING AND REACTOR TANK **				
Pressure (psig):	<	1.073	0.002	RTGP01

AFD - TEST 965200; VTABLE CREATED 21-DEC-90 19 55 48
12-MAR-91

PSIG
A1-5

TIME, HRS

AFD - TEST 965200; VTABLE CREATED 21-DEC-90 19 55 48
 12-MAR-91

SC
 12-01-M

AFD - TEST 965200; VTABLE CREATED: 21-DEC-90 19:55:48
12-MAR-91

SCFM
A1-7

Title: Uninstrumented Assembly Testing
Test date/time: 13-MAR-91, 10:45

Test: 965201
Test point: 54

SPECIFIED CONDITIONS:

Water Flow:	-	25.7 gpm	BFI Type:	P/L
Fluid Temp:		70 deg F	Piston Leakage:	0.00 scfm
Inlet Plenum Press.:		-0.12 psig		
Tank Water Level:		2.56 ft		

ACTUAL CONDITIONS (Uninstrumented Reference Assy.):

COMMENTS

Water Flow:	25.79 gpm	
Air Flow:	Inlet: 0.32 scfm	0-1.5 scfm Omega
	Outlet: 0.34 scfm	0-1.5 scfm Omega
Water Temperature:	72.1 deg F	
Air Temperature:	73.3 deg F	
Inlet plenum pressure:	-0.12 psig	
Tank bottom pressure:	1.10 psig	
	(2.54 ft. H2O) (Tank Water Level)	
Inlet Plenum Level:	4.31 in. H2O	
Barometric pressure:	28.75 in. Hg at	75 deg F

Test Number 965201

VTAB AVERAGE UNITS 2*SIGMA

ASTC01	73.347	DEG F	0.361
TPTC01	0.000	DEG F	0.000
RPTC01	72.089	DEG F	0.703
TPMM02	0.000	GPM	0.000
RPMM02	25.794	GPM	0.208
TPMM01	0.000	GPM	0.000
RPMM01	-0.062	GPM	0.036
TPGM01	0.000	SCFM	0.000
TPGM02	0.000	SCFM	0.000
RPGM01	-0.135	SCFM	0.074
RPGM02	0.309	SCFM	0.018
RTGM02	0.343	SCFM	0.043
RTGM01	-0.246	SCFM	0.062
T2GM01	0.000	SCFM	0.000
T3GM01	0.000	SCFM	0.000
T4GM01	0.000	SCFM	0.000
TPGM03	0.000	SCFM	0.000
RPGM03	0.317	SCFM	0.027
T2GM02	0.000	SCFM	0.000
T3GM02	0.000	SCFM	0.000
T4GM02	0.000	SCFM	0.000
RPGP01	-0.120	PSIG	0.014
RPGP02	0.000	PSIG	0.000
RPGP03	0.000	PSIG	0.000
TPGP01	0.000	PSIG	0.000
TPGP02	0.000	PSIG	0.000
TPGP03	0.000	PSIG	0.000
T2GP01	0.000	PSIG	0.000
T3GP01	0.000	PSIG	0.000
T4GP01	0.000	PSIG	0.000
T2GP02	0.000	PSIG	0.000
T3GP02	0.000	PSIG	0.000
T4GP02	0.000	PSIG	0.000
T2GP03	0.000	PSIG	0.000
T3GP03	0.000	PSIG	0.000
T4GP03	0.000	PSIG	0.000
T2GP04	0.000	PSIG	0.000
T3GP04	0.000	PSIG	0.000
T4GP04	0.000	PSIG	0.000
T2GP05	0.000	PSIG	0.000
T3GP05	0.000	PSIG	0.000
T4GP05	0.000	PSIG	0.000
T2GP06	0.000	PSIG	0.000
T3GP06	0.000	PSIG	0.000
T4GP06	0.000	PSIG	0.000
R2GP06	0.000	PSIG	0.000
R3GP06	0.000	PSIG	0.000
R4GP06	0.000	PSIG	0.000
R2GP02	0.000	PSIG	0.000
R3GP02	0.000	PSIG	0.000
R4GP02	0.000	PSIG	0.000
R2GP03	0.000	PSIG	0.000
R3GP03	0.000	PSIG	0.000
R4GP03	0.000	PSIG	0.000
R2GP04	0.000	PSIG	0.000
R3GP04	0.000	PSIG	0.000

Test Number 965201

VTAB AVERAGE UNITS 2*SIGMA

R4GP04	0.000	PSIG	0.000
R2GP05	0.000	PSIG	0.000
R3GP05	0.000	PSIG	0.000
R4GP05	0.000	PSIG	0.000
RTGP01	1.097	PSIG	0.002
T2LC01	0.000	LBM	0.000
T2LC02	0.000	LBM	0.000
T3LC01	0.000	LBM	0.000
T3LC02	0.000	LBM	0.000
T4LC01	0.000	LBM	0.000
T4LC02	0.000	LBM	0.000
R2DP01	0.000	PSI	0.000
R3DP01	0.000	PSI	0.000
R4DP01	0.000	PSI	0.000
R2DP02	0.000	PSI	0.000
R3DP02	0.000	PSI	0.000
R4DP02	0.000	PSI	0.000
RPLV01	4.308	IN-H2O	0.027
TPLV01	0.000	IN-H2O	0.000
TPMM22	0.000	LBM/HR	0.000
RPMM22	12879.052	LBM/HR	103.804
TPMM21	0.000	LBM/HR	0.000
RPMM21	0.000	LBM/HR	0.000
T2LC30	0.000	LBM/HR	0.000
T3LC30	0.000	LBM/HR	0.000
T4LC30	0.000	LBM/HR	0.000

Test Name: 965201, 10:45
Test Date: 13-MAR-91

Today's Date: 05-Apr-91

Mark 22 Fuel Assembly
Annular Flow Distribution - Uninstrumented Assembly Testing
Test Notes ==> 25.7 GPM; 2.56 FT. BFI BACK PRESS.; Water Temp. 70F; P/L; TP 54

Reference Fuel Assembly

		Value	Two Std Deviation	VTAB
** Water **				
Temperature (F):	<	72.1	0.70	RPTC01
Flow Rate (gpm):	<	25.8	0.21	RPM01+ RPM02
** Air **				
Temperature (F):	<	73.35	0.36	ASTC01
Flow Rate (scfm):	<	0.32	0.03	RPGM03
** INLET PLENUM **				
Pressure (psig):	<	-0.120	0.014	RPGP01
Level (in):	<	4.308	0.026	RPLV01
** BOTTOM FITTING AND REACTOR TANK **				
Pressure (psig):	<	1.097	0.002	RTGP01

AFD - TEST 965201; VTABLE CREATED: 21-DEC-90 19 55 48
13-MAR-91

AFD - TEST 965201; VTABLE CREATED 21-DEC-90 19 55 48
13-MAR-91

AFD - TEST 965201; VTABLE CREATED 21-DEC-90 19 55 48
13-MAR-91

Title: Uninstrumented Assembly Testing
Test date/time: 13-MAR-91, 12:56

Test: 965202
Test point: 55

SPECIFIED CONDITIONS:

Water Flow:	30.4 gpm	BFI Type:	P/L
Fluid Temp:	70 deg F	Piston Leakage:	0.00 scfm
Inlet Plenum Press.:	-0.34 psig		
Tank Water Level:	2.62 ft		

ACTUAL CONDITIONS (Uninstrumented Reference Assy.):

COMMENTS

Water Flow:	30.74 gpm	
Air Flow:	Inlet: 0.51 scfm	0-1.5 scfm Omega
	Outlet: 0.53 scfm	0-1.5 scfm Omega
Water Temperature:	72.1 deg F	
Air Temperature:	72.1 def F	
Inlet plenum pressure:	-0.35 psig	
Tank bottom pressure:	1.11 psig	
	(2.58 ft. H2O) (Tank Water Level)	
Inlet Plenum Level:	4.84 in. H2O	
Barometric pressure:	28.64 in. Hg at	76 deg F

Test Number 965202

VTAB AVERAGE UNITS 2*SIGMA

ASTC01	72.139	DEG F	0.360
TPTC01	0.000 -	DEG F	0.000
RPTC01	72.114	DEG F	0.618
TPMM02	0.000	GPM	0.000
RPMM02	30.741	GPM	0.197
TPMM01	0.000	GPM	0.000
RPMM01	-0.056	GPM	0.027
TPGM01	0.000	SCFM	0.000
TPGM02	0.000	SCFM	0.000
RPGM01	0.061	SCFM	0.073
RPGM02	0.555	SCFM	0.024
RTGM02	0.527	SCFM	0.052
RTGM01	-0.259	SCFM	0.064
T2GM01	0.000	SCFM	0.000
T3GM01	0.000	SCFM	0.000
T4GM01	0.000	SCFM	0.000
TPGM03	0.000	SCFM	0.000
RPGM03	0.508	SCFM	0.028
T2GM02	0.000	SCFM	0.000
T3GM02	0.000	SCFM	0.000
T4GM02	0.000	SCFM	0.000
RPGP01	-0.351	PSIG	0.030
RPGP02	0.000	PSIG	0.000
RPGP03	0.000	PSIG	0.000
TPGP01	0.000	PSIG	0.000
TPGP02	0.000	PSIG	0.000
TPGP03	0.000	PSIG	0.000
T2GP01	0.000	PSIG	0.000
T3GP01	0.000	PSIG	0.000
T4GP01	0.000	PSIG	0.000
T2GP02	0.000	PSIG	0.000
T3GP02	0.000	PSIG	0.000
T4GP02	0.000	PSIG	0.000
T2GP03	0.000	PSIG	0.000
T3GP03	0.000	PSIG	0.000
T4GP03	0.000	PSIG	0.000
T2GP04	0.000	PSIG	0.000
T3GP04	0.000	PSIG	0.000
T4GP04	0.000	PSIG	0.000
T2GP05	0.000	PSIG	0.000
T3GP05	0.000	PSIG	0.000
T4GP05	0.000	PSIG	0.000
T2GP06	0.000	PSIG	0.000
T3GP06	0.000	PSIG	0.000
T4GP06	0.000	PSIG	0.000
R2GP06	0.000	PSIG	0.000
R3GP06	0.000	PSIG	0.000
R4GP06	0.000	PSIG	0.000
R2GP02	0.000	PSIG	0.000
R3GP02	0.000	PSIG	0.000
R4GP02	0.000	PSIG	0.000
R2GP03	0.000	PSIG	0.000
R3GP03	0.000	PSIG	0.000
R4GP03	0.000	PSIG	0.000
R2GP04	0.000	PSIG	0.000
R3GP04	0.000	PSIG	0.000

Test Number 965202

VTAB AVERAGE UNITS 2*SIGMA

R4GP04	0.000	PSIG	0.000
R2GP05	0.000	PSIG	0.000
R3GP05	0.000	PSIG	0.000
R4GP05	0.000	PSIG	0.000
RTGP01	1.114	PSIG	0.003
T2LC01	0.000	LBM	0.000
T2LC02	0.000	LBM	0.000
T3LC01	0.000	LBM	0.000
T3LC02	0.000	LBM	0.000
T4LC01	0.000	LBM	0.000
T4LC02	0.000	LBM	0.000
R2DP01	0.000	PSI	0.000
R3DP01	0.000	PSI	0.000
R4DP01	0.000	PSI	0.000
R2DP02	0.000	PSI	0.000
R3DP02	0.000	PSI	0.000
R4DP02	0.000	PSI	0.000
RPLV01	4.839	IN-H2O	0.020
TPLV01	0.000	IN-H2O	0.000
TPMM22	0.000	LBM/HR	0.000
RPMM22	15349.108	LBM/HR	98.597
TPMM21	0.000	LBM/HR	0.000
RPMM21	0.000	LBM/HR	0.000
T2LC30	0.000	LBM/HR	0.000
T3LC30	0.000	LBM/HR	0.000
T4LC30	0.000	LBM/HR	0.000

Test Name: 965202, 12:56
Test Date: 13-MAR-91

Today's Date: 05-Apr-91

Mark 22 Fuel Assembly
Annular Flow Distribution - Uninstrumented Assembly Testing
Test Notes ==> 30.4 GPM; 2.62 FT. BFI BACK PRESS.; Water Temp. 70F; P/L; TP 55

Reference Fuel Assembly

		Value	Two Std Deviation	VTAB
** Water **				
Temperature (F):	<	72.1	0.62	RPTC01
Flow Rate (gpm):	<	30.7	0.20	RPM01+ RPM02
** Air **				
Temperature (F):	<	72.14	0.36	ASTC01
Flow Rate (scfm):	<	0.51	0.03	RPGM03
** INLET PLENUM **				
Pressure (psig):	<	-0.351	0.030	RPGP01
Level (in):	<	4.839	0.020	RPLV01
** BOTTOM FITTING AND REACTOR TANK **				
Pressure (psig):	<	1.111	0.002	RTGP01

AFD - TEST 965202; VTABLE CREATED: 21-DEC-90 19 55 48
13-MAR-91

AFD - TEST 965202, VTABLE CREATED 21-DEC-90 19 55 48
13-MAR-91

AFD - TEST 965202, VTABLE CREATED 21-DEC-90 19 55 48
13-MAR-91

Title: Uninstrumented Assembly Testing
Test date/time: 13-MAR-91, 14:35

Test: 965203
Test point: 56

SPECIFIED CONDITIONS:

Water Flow:	40.7 gpm	BFI Type:	P/L
Fluid Temp:	70 deg F	Piston Leakage:	0.00 scfm
Inlet Plenum Press.:	-0.3 psig		
Tank Water Level:	2.71 ft		

ACTUAL CONDITIONS (Uninstrumented Reference Assy.):

COMMENTS

Water Flow:	40.86 gpm	
Air Flow:	Inlet: 0.84 scfm	0-1.5 scfm Omega
	Outlet: 0.86 scfm	0-1.5 scfm Omega
Water Temperature:	72.1 deg F	
Air Temperature:	71.9 deg F	
Inlet plenum pressure:	-0.28 psig	
Tank bottom pressure:	1.15 psig	
	(2.67 ft. H2O) (Tank Water Level)	
Inlet Plenum Level:	5.82 in. H2O	
Barometric pressure:	28.6 in. Hg at	77 deg F

Test Number 965203

VTAB AVERAGE UNITS

2*SIGMA

ASTC01	71.861	DEG F	0.247
TPTC01	0.000	DEG F	0.000
RPTC01	72.108	DEG F	0.453
TPMM02	0.000	GPM	0.000
RPMM02	40.861	GPM	0.174
TPMM01	0.000	GPM	0.000
RPMM01	-0.061	GPM	0.039
TPGM01	0.000	SCFM	0.000
TPGM02	0.000	SCFM	0.000
RPGM01	0.582	SCFM	0.079
RPGM02	0.918	SCFM	0.036
RTGM02	0.858	SCFM	0.041
RTGM01	-0.256	SCFM	0.064
T2GM01	0.000	SCFM	0.000
T3GM01	0.000	SCFM	0.000
T4GM01	0.000	SCFM	0.000
TPGM03	0.000	SCFM	0.000
RPGM03	0.841	SCFM	0.056
T2GM02	0.000	SCFM	0.000
T3GM02	0.000	SCFM	0.000
T4GM02	0.000	SCFM	0.000
RPGP01	-0.275	PSIG	0.031
RPGP02	0.000	PSIG	0.000
RPGP03	0.000	PSIG	0.000
TPGP01	0.000	PSIG	0.000
TPGP02	0.000	PSIG	0.000
TPGP03	0.000	PSIG	0.000
T2GP01	0.000	PSIG	0.000
T3GP01	0.000	PSIG	0.000
T4GP01	0.000	PSIG	0.000
T2GP02	0.000	PSIG	0.000
T3GP02	0.000	PSIG	0.000
T4GP02	0.000	PSIG	0.000
T2GP03	0.000	PSIG	0.000
T3GP03	0.000	PSIG	0.000
T4GP03	0.000	PSIG	0.000
T2GP04	0.000	PSIG	0.000
T3GP04	0.000	PSIG	0.000
T4GP04	0.000	PSIG	0.000
T2GP05	0.000	PSIG	0.000
T3GP05	0.000	PSIG	0.000
T4GP05	0.000	PSIG	0.000
T2GP06	0.000	PSIG	0.000
T3GP06	0.000	PSIG	0.000
T4GP06	0.000	PSIG	0.000
R2GP06	0.000	PSIG	0.000
R3GP06	0.000	PSIG	0.000
R4GP06	0.000	PSIG	0.000
R2GP02	0.000	PSIG	0.000
R3GP02	0.000	PSIG	0.000
R4GP02	0.000	PSIG	0.000
R2GP03	0.000	PSIG	0.000
R3GP03	0.000	PSIG	0.000
R4GP03	0.000	PSIG	0.000
R2GP04	0.000	PSIG	0.000
R3GP04	0.000	PSIG	0.000

Test Number 965203

VTAB AVERAGE UNITS 2*SIGMA

R4GP04	0.000	PSIG	0.000
R2GP05	0.000	PSIG	0.000
R3GP05	0.000	PSIG	0.000
R4GP05	0.000	PSIG	0.000
RTGP01	1.153	PSIG	0.004
T2LC01	0.000	LBM	0.000
T2LC02	0.000	LBM	0.000
T3LC01	0.000	LBM	0.000
T3LC02	0.000	LBM	0.000
T4LC01	0.000	LBM	0.000
T4LC02	0.000	LBM	0.000
R2DP01	0.000	PSI	0.000
R3DP01	0.000	PSI	0.000
R4DP01	0.000	PSI	0.000
R2DP02	0.000	PSI	0.000
R3DP02	0.000	PSI	0.000
R4DP02	0.000	PSI	0.000
RPLV01	5.823	IN-H2O	0.018
TPLV01	0.000	IN-H2O	0.000
TPMM22	0.000	LBM/HR	0.000
RPMM22	20401.836	LBM/HR	86.715
TPMM21	0.000	LBM/HR	0.000
RPMM21	0.000	LBM/HR	0.000
T2LC30	0.000	LBM/HR	0.000
T3LC30	0.000	LBM/HR	0.000
T4LC30	0.000	LBM/HR	0.000

Test Name: 965203, 14:35
Test Date: 13-MAR-91

Today's Date: 05-Apr-91

Mark 22 Fuel Assembly
Annular Flow Distribution - Uninstrumented Assembly Testing
Test Notes ==> 40.7 GPM; 2.71 FT. BFI BACK PRESS.; Water Temp. 70F; P/L; TP 56

Reference Fuel Assembly

		Value	Two Std Deviation	VTAB
** Water **				
Temperature (F):	<	72.1	0.45	RPTC01
Flow Rate (gpm):	<	40.9	0.17	RPM01+ RPM02
** Air **				
Temperature (F):	<	71.86	0.25	ASTC01
Flow Rate (scfm):	<	0.84	0.06	RPGM03

**** INLET PLENUM ****

Pressure (psig):	<	-0.275	0.030	RPGP01
Level (in):	<	5.823	0.018	RPLV01

**** BOTTOM FITTING AND REACTOR TANK ****

Pressure (psig):	<	1.153	0.004	RTGP01
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AFD - TEST 965203; VTABLE CREATED 21-DEC-90 19:55 48
13-MAR-91

AFD - TEST 965203; VTABLE CREATED: 21-DEC-90 19:55:48
13-MAR-91

AFD - TEST 965203; VTABLE CREATED: 21-DEC-90 19:55:48
13-MAR-91

Title: Uninstrumented Assembly Testing
Test date/time: 22-MAR-91, 13:55

Test: 965238
Test point: 56

SPECIFIED CONDITIONS:

Water Flow: 40.7 gpm
Fluid Temp: 70 deg F
Inlet Plenum Press.: -0.3 psig
Tank Water Level: 2.71 ft

BFI Type: P/L
Piston Leakage: 0.00 scfm

ACTUAL CONDITIONS (Uninstrumented Reference Assy.):

COMMENTS

Water Flow: 40.91 gpm
Air Flow: Inlet: 0.75 scfm
 Outlet: 0.68 scfm
Water Temperature: 68.7 deg F
Air Temperature: 65.6 deg F
Inlet plenum pressure: -0.29 psig
Tank bottom pressure: 1.16 psig
 (2.68 ft. H2O) (Tank Water Level)
Inlet Plenum Level: 5.88 in. H2O
Barometric pressure: 28.8 in. Hg at 68 deg F

0-1.5 scfm Omega
0-1.5 scfm Omega

Comments:

Repeat of test point 56 - performed to explore observed bistability phenomenon.

Test Number 965238

VTAB	AVERAGE	UNITS	2*SIGMA
ASTC01	65.597	DEG F	0.195
TPTC01	0.000	DEG F	0.000
RPTC01	68.718	DEG F	0.389
TPMM02	0.000	GPM	0.000
RPMM02	40.905	GPM	0.156
TPMM01	0.000	GPM	0.000
RPMM01	-0.014	GPM	0.052
TPGM01	0.000	SCFM	0.000
TPGM02	0.000	SCFM	0.000
RPGM01	0.474	SCFM	0.095
RPGM02	0.824	SCFM	0.046
RTGM02	0.682	SCFM	0.050
RTGM01	-0.241	SCFM	0.063
T2GM01	0.000	SCFM	0.000
T3GM01	0.000	SCFM	0.000
T4GM01	0.000	SCFM	0.000
TPGM03	0.000	SCFM	0.000
RPGM03	0.751	SCFM	0.058
T2GM02	0.000	SCFM	0.000
T3GM02	0.000	SCFM	0.000
T4GM02	0.000	SCFM	0.000
RPGP01	-0.293	PSIG	0.039
RPGP02	0.000	PSIG	0.000
RPGP03	0.000	PSIG	0.000
TPGP01	0.000	PSIG	0.000
TPGP02	0.000	PSIG	0.000
TPGP03	0.000	PSIG	0.000
T2GP01	0.000	PSIG	0.000
T3GP01	0.000	PSIG	0.000
T4GP01	0.000	PSIG	0.000
T2GP02	0.000	PSIG	0.000
T3GP02	0.000	PSIG	0.000
T4GP02	0.000	PSIG	0.000
T2GP03	0.000	PSIG	0.000
T3GP03	0.000	PSIG	0.000
T4GP03	0.000	PSIG	0.000
T2GP04	0.000	PSIG	0.000
T3GP04	0.000	PSIG	0.000
T4GP04	0.000	PSIG	0.000
T2GP05	0.000	PSIG	0.000
T3GP05	0.000	PSIG	0.000
T4GP05	0.000	PSIG	0.000
T2GP06	0.000	PSIG	0.000
T3GP06	0.000	PSIG	0.000
T4GP06	0.000	PSIG	0.000
R2GP06	0.000	PSIG	0.000
R3GP06	0.000	PSIG	0.000
R4GP06	0.000	PSIG	0.000
R2GP02	0.000	PSIG	0.000
R3GP02	0.000	PSIG	0.000
R4GP02	0.000	PSIG	0.000
R2GP03	0.000	PSIG	0.000
R3GP03	0.000	PSIG	0.000
R4GP03	0.000	PSIG	0.000
R2GP04	0.000	PSIG	0.000
R3GP04	0.000	PSIG	0.000

Test Number 965238
VTAB AVERAGE UNITS 2*SIGMA

R4GP04	0.000	PSIG	0.000
R2GP05	0.000	PSIG	0.000
R3GP05	0.000	PSIG	0.000
R4GP05	0.000	PSIG	0.000
RTGP01	1.160	PSIG	0.005
T2LC01	0.000	LBM	0.000
T2LC02	0.000	LBM	0.000
T3LC01	0.000	LBM	0.000
T3LC02	0.000	LBM	0.000
T4LC01	0.000	LBM	0.000
T4LC02	0.000	LBM	0.000
R2DP01	0.000	PSI	0.000
R3DP01	0.000	PSI	0.000
R4DP01	0.000	PSI	0.000
R2DP02	0.000	PSI	0.000
R3DP02	0.000	PSI	0.000
R4DP02	0.000	PSI	0.000
RPLV01	5.883	IN-H2O	0.014
TPLV01	0.000	IN-H2O	0.000
TPMM22	0.000	LBM/HR	0.000
RPMM22	20423.920	LBM/HR	77.727
TPMM21	0.000	LBM/HR	0.000
RPMM21	1.135	LBM/HR	5.047
T2LC30	0.000	LBM/HR	0.000
T3LC30	0.000	LBM/HR	0.000
T4LC30	0.000	LBM/HR	0.000

Test Name: 965238, 13:55
Test Date: 22-MAR-91

Today's Date: 05-Apr-91

Mark 22 Fuel Assembly
Annular Flow Distribution - Uninstrumented Assembly Testing
Test Notes ==> 40.7 GPM; 2.71 FT. BFI BACK PRESS.; Water Temp. 70F; P/L; TP 56

Reference Fuel Assembly

		Value	Two Std Deviation	VTAB
** Water **				
Temperature (F):	<	68.7	0.39	RPTC01
Flow Rate (gpm):	<	40.9	0.16	RPM01+ RPM02
** Air **				
Temperature (F):	<	65.60	0.20	ASTC01
Flow Rate (scfm):	<	0.75	0.06	RPGM03
** INLET PLENUM **				
Pressure (psig):	<	-0.293	0.038	RPGP01
Level (in):	<	5.883	0.014	RPLV01
** BOTTOM FITTING AND REACTOR TANK **				
Pressure (psig):	<	1.160	0.004	RTGP01

AFD - TEST 965238, VTABLE CREATED 13-MAR-91 18 20 23
22-MAR-91

AFD - TEST 965238; VTABLE CREATED 13-MAR-91 18 20 23
 22-MAR-91

AFD - TEST 965238; VTABLE CREATED: 13-MAR-91 18 20 23
22-MAR-91

Title: Uninstrumented Assembly Testing
Test date/time: 13-MAR-91, 16:20

Test: 965204
Test point: 57

SPECIFIED CONDITIONS:

Water Flow:	52.7 gpm	BFI Type:	P/L
Fluid Temp:	70 deg F	Piston Leakage:	0.00 scfm
Inlet Plenum Press.:	-0.31 psig		
Tank Water Level:	2.48 ft		

ACTUAL CONDITIONS (Uninstrumented Reference Assy.):

COMMENTS

Water Flow:	52.50 gpm	
Air Flow:	Inlet: 1.33 scfm	0-1.5 scfm Omega
	Outlet: 1.35 scfm	0-1.5 scfm Omega
Water Temperature:	72.4 deg F	
Air Temperature:	71.4 deg F	
Inlet plenum pressure:	-0.30 psig	
Tank bottom pressure:	1.06 psig	
	(2.45 ft. H2O) (Tank Water Level)	
Inlet Plenum Level:	6.86 in. H2O	
Barometric pressure:	28.6 in. Hg at	77 deg F

Test Number 965204

VTAB	AVERAGE	UNITS	2*SIGMA
ASTC01	71.402	DEG F	0.201
TPTC01	0.000	DEG F	0.000
RPTC01	72.419	DEG F	0.350
TPMM02	0.000	GPM	0.000
RPMM02	52.497	GPM	0.535
TPMM01	0.000	GPM	0.000
RPMM01	-0.046	GPM	0.054
TPGM01	0.000	SCFM	0.000
TPGM02	0.000	SCFM	0.000
RPGM01	1.269	SCFM	0.090
RPGM02	1.302	SCFM	0.040
RTGM02	1.346	SCFM	0.031
RTGM01	-0.251	SCFM	0.059
T2GM01	0.000	SCFM	0.000
T3GM01	0.000	SCFM	0.000
T4GM01	0.000	SCFM	0.000
TPGM03	0.000	SCFM	0.000
RPGM03	1.325	SCFM	0.069
T2GM02	0.000	SCFM	0.000
T3GM02	0.000	SCFM	0.000
T4GM02	0.000	SCFM	0.000
RPGP01	-0.300	PSIG	0.022
RPGP02	0.000	PSIG	0.000
RPGP03	0.000	PSIG	0.000
TPGP01	0.000	PSIG	0.000
TPGP02	0.000	PSIG	0.000
TPGP03	0.000	PSIG	0.000
T2GP01	0.000	PSIG	0.000
T3GP01	0.000	PSIG	0.000
T4GP01	0.000	PSIG	0.000
T2GP02	0.000	PSIG	0.000
T3GP02	0.000	PSIG	0.000
T4GP02	0.000	PSIG	0.000
T2GP03	0.000	PSIG	0.000
T3GP03	0.000	PSIG	0.000
T4GP03	0.000	PSIG	0.000
T2GP04	0.000	PSIG	0.000
T3GP04	0.000	PSIG	0.000
T4GP04	0.000	PSIG	0.000
T2GP05	0.000	PSIG	0.000
T3GP05	0.000	PSIG	0.000
T4GP05	0.000	PSIG	0.000
T2GP06	0.000	PSIG	0.000
T3GP06	0.000	PSIG	0.000
T4GP06	0.000	PSIG	0.000
R2GP06	0.000	PSIG	0.000
R3GP06	0.000	PSIG	0.000
R4GP06	0.000	PSIG	0.000
R2GP02	0.000	PSIG	0.000
R3GP02	0.000	PSIG	0.000
R4GP02	0.000	PSIG	0.000
R2GP03	0.000	PSIG	0.000
R3GP03	0.000	PSIG	0.000
R4GP03	0.000	PSIG	0.000
R2GP04	0.000	PSIG	0.000
R3GP04	0.000	PSIG	0.000

Test Number 965204

VTAB AVERAGE UNITS 2*SIGMA

R4GP04	0.000	PSIG	0.000
R2GP05	0.000	PSIG	0.000
R3GP05	0.000	PSIG	0.000
R4GP05	0.000	PSIG	0.000
RTGP01	1.058	PSIG	0.005
T2LC01	0.000	LBM	0.000
T2LC02	0.000	LBM	0.000
T3LC01	0.000	LBM	0.000
T3LC02	0.000	LBM	0.000
T4LC01	0.000	LBM	0.000
T4LC02	0.000	LBM	0.000
R2DP01	0.000	PSI	0.000
R3DP01	0.000	PSI	0.000
R4DP01	0.000	PSI	0.000
R2DP02	0.000	PSI	0.000
R3DP02	0.000	PSI	0.000
R4DP02	0.000	PSI	0.000
RPLV01	6.858	IN-H2O	0.016
TPLV01	0.000	IN-H2O	0.000
TPMM22	0.000	LBM/HR	0.000
RPMM22	26211.727	LBM/HR	267.274
TPMM21	0.000	LBM/HR	0.000
RPMM21	0.592	LBM/HR	5.571
T2LC30	0.000	LBM/HR	0.000
T3LC30	0.000	LBM/HR	0.000
T4LC30	0.000	LBM/HR	0.000

Test Name: 965204, 16:20
Test Date: 13-MAR-91

Today's Date: 05-Apr-91

Mark 22 Fuel Assembly
Annular Flow Distribution - Uninstrumented Assembly Testing
Test Notes --> 52.7 GPM; 2.48 FT. BFI BACK PRESS.; Water Temp. 70F; P/L; TP 57

Reference Fuel Assembly

		Value	Two Std Deviation	VTAB
** Water **				
Temperature (F):	<	72.4	0.35	RPTC01
Flow Rate (gpm):	<	52.5	0.54	RPM01+ RPM02
** Air **				
Temperature (F):	<	71.40	0.20	ASTC01
Flow Rate (scfm):	<	1.33	0.07	RPGM03

**** INLET PLENUM ****

Pressure (psig):	<	-0.300	0.022	RPGP01
Level (in):	<	6.858	0.016	RPLV01

**** BOTTOM FITTING AND REACTOR TANK ****

Pressure (psig):	<	1.058	0.004	RTGP01
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AFD - TEST 965204, VTABLE CREATED 21-DEC-90 19 55 48
13-MAR-91

AFD - TEST 965204, VTABLE CREATED: 21-DEC-90 19:55:48
13-MAR-91

AFD - TEST 965204; VTABLE CREATED: 21-DEC-90 19 55 48
13-MAR-91

Title: Uninstrumented Assembly Testing
Test date/time: 13-MAR-91, 17:51

Test: 965205
Test point: 58

SPECIFIED CONDITIONS:

Water Flow:	62.2 gpm	BFI Type:	P/L
Fluid Temp:	70 deg F	Piston Leakage:	0.00 scfm
Inlet Plenum Press.:	-0.3 psig		
Tank Water Level:	2.23 ft		

ACTUAL CONDITIONS (Uninstrumented Reference Assy.):

COMMENTS

Water Flow:	61.96 gpm	
Air Flow:	Inlet: 1.83 scfm	0-25 scfm Kurz
	Outlet: 2.31 scfm	0-150 scfm Kurz
Water Temperature:	72.7 deg F	
Air Temperature:	71.1 deg F	
Inlet plenum pressure:	-0.30 psig	
Tank bottom pressure:	0.94 psig	
	(2.18 ft. H2O) (Tank Water Level)	
Inlet Plenum Level:	7.64 in. H2O	
Barometric pressure:	28.6 in. Hg at	76 deg F

Test Number 965205

VTAB AVERAGE UNITS 2*SIGMA

ASTC01	71.092	DEG F	0.171
TPTC01	0.000	DEG F	0.000
RPTC01	72.723	DEG F	0.258
TPMM02	0.000	GPM	0.000
RPMM02	61.960	GPM	0.309
TPMM01	0.000	GPM	0.000
RPMM01	-0.052	GPM	0.082
TPGM01	0.000	SCFM	0.000
TPGM02	0.000	SCFM	0.000
RPGM01	1.766	SCFM	0.108
RPGM02	1.834	SCFM	0.104
RTGM02	0.015	SCFM	0.007
RTGM01	2.311	SCFM	0.146
T2GM01	0.000	SCFM	0.000
T3GM01	0.000	SCFM	0.000
T4GM01	0.000	SCFM	0.000
TPGM03	0.000	SCFM	0.000
RPGM03	-0.001	SCFM	0.001
T2GM02	0.000	SCFM	0.000
T3GM02	0.000	SCFM	0.000
T4GM02	0.000	SCFM	0.000
RPGP01	-0.298	PSIG	0.025
RPGP02	0.000	PSIG	0.000
RPGP03	0.000	PSIG	0.000
TPGP01	0.000	PSIG	0.000
TPGP02	0.000	PSIG	0.000
TPGP03	0.000	PSIG	0.000
T2GP01	0.000	PSIG	0.000
T3GP01	0.000	PSIG	0.000
T4GP01	0.000	PSIG	0.000
T2GP02	0.000	PSIG	0.000
T3GP02	0.000	PSIG	0.000
T4GP02	0.000	PSIG	0.000
T2GP03	0.000	PSIG	0.000
T3GP03	0.000	PSIG	0.000
T4GP03	0.000	PSIG	0.000
T2GP04	0.000	PSIG	0.000
T3GP04	0.000	PSIG	0.000
T4GP04	0.000	PSIG	0.000
T2GP05	0.000	PSIG	0.000
T3GP05	0.000	PSIG	0.000
T4GP05	0.000	PSIG	0.000
T2GP06	0.000	PSIG	0.000
T3GP06	0.000	PSIG	0.000
T4GP06	0.000	PSIG	0.000
R2GP06	0.000	PSIG	0.000
R3GP06	0.000	PSIG	0.000
R4GP06	0.000	PSIG	0.000
R2GP02	0.000	PSIG	0.000
R3GP02	0.000	PSIG	0.000
R4GP02	0.000	PSIG	0.000
R2GP03	0.000	PSIG	0.000
R3GP03	0.000	PSIG	0.000
R4GP03	0.000	PSIG	0.000
R2GP04	0.000	PSIG	0.000
R3GP04	0.000	PSIG	0.000

Test Number 965205

VTAB AVERAGE UNITS 2*SIGMA

R4GP04	0.000	PSIG	0.000
R2GP05	0.000	PSIG	0.000
R3GP05	0.000	PSIG	0.000
R4GP05	0.000	PSIG	0.000
RTGP01	0.944	PSIG	0.003
T2LC01	0.000	LBM	0.000
T2LC02	0.000	LBM	0.000
T3LC01	0.000	LBM	0.000
T3LC02	0.000	LBM	0.000
T4LC01	0.000	LBM	0.000
T4LC02	0.000	LBM	0.000
R2DP01	0.000	PSI	0.000
R3DP01	0.000	PSI	0.000
R4DP01	0.000	PSI	0.000
R2DP02	0.000	PSI	0.000
R3DP02	0.000	PSI	0.000
R4DP02	0.000	PSI	0.000
RPLV01	7.643	IN-H2O	0.031
TPLV01	0.000	IN-H2O	0.000
TPMM22	0.000	LBM/HR	0.000
RPMM22	30936.531	LBM/HR	154.211
TPMM21	0.000	LBM/HR	0.000
RPMM21	1.313	LBM/HR	9.146
T2LC30	0.000	LBM/HR	0.000
T3LC30	0.000	LBM/HR	0.000
T4LC30	0.000	LBM/HR	0.000

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2 of 4

Test Name: 965205, 17:51
Test Date: 13-MAR-91

Today's Date: 05-Apr-91

Mark 22 Fuel Assembly
Annular Flow Distribution - Uninstrumented Assembly Testing
Test Notes ==> 62.2 GPM; 2.23 FT. BFI BACK PRESS.; Water Temp. 70F; P/L; TP 58

Reference Fuel Assembly

		Value	Two Std Deviation	VTAB
** Water **				
Temperature (F):	<	72.7	0.26	RPTC01
Flow Rate (gpm):	<	62.0	0.31	RPM01+ RPM02
** Air **				
Temperature (F):	<	71.09	0.17	ASTC01
Flow Rate (scfm):	<	1.83	0.10	RPGM02
** INLET PLENUM **				
Pressure (psig):	<	-0.298	0.024	RPGP01
Level (in):	<	7.643	0.030	RPLV01
** BOTTOM FITTING AND REACTOR TANK **				
Pressure (psig):	<	0.944	0.004	RTGP01

AFD - TEST 965205, VTABLE CREATED 21-DEC-90 19 55 48
13-MAR-91

PSIC

A1-47

AFD - TEST 965205, VTABLE CREATED: 21-DEC-90 19 55 48
13-MAR-91

Title: Uninstrumented Assembly Testing
Test date/time: 14-MAR-91, 09:12

Test: 965206
Test point: 59

SPECIFIED CONDITIONS:

Water Flow:	70.0 gpm	BFI Type:	P/L
Fluid Temp: -	70 deg F	Piston Leakage:	0.00 scfm
Inlet Plenum Press.:	-0.3 psig		
Tank Water Level:	2.10 ft		

ACTUAL CONDITIONS (Uninstrumented Reference Assy.):

COMMENTS

Water Flow:	70.12 gpm	
Air Flow:	Inlet: 1.81 scfm	0-25 scfm Kurz
	Outlet: 2.31 scfm	0-150 scfm Kurz
Water Temperature:	72.4 deg F	
Air Temperature:	71.5 def F	
Inlet plenum pressure:	-0.31 psig	
Tank bottom pressure:	0.90 psig	
	(2.08 ft. H2O) (Tank Water Level)	
Inlet Plenum Level:	8.18 in. H2O	
Barometric pressure:	28.66 in. Hg at	72 deg F

Test Number 965206

VTAB AVERAGE UNITS 2*SIGMA

ASTC01	71.459	DEG F	0.279
TPTC01	0.000	DEG F	0.000
RPTC01	72.426	DEG F	0.455
TPMM02	0.000	GPM	0.000
RPMM02	70.117	GPM	0.425
TPMM01	0.000	GPM	0.000
RPMM01	-0.032	GPM	0.088
TPGM01	0.000	SCFM	0.000
TPGM02	0.000	SCFM	0.000
RPGM01	1.822	SCFM	0.094
RPGM02	1.805	SCFM	0.092
RTGM02	0.015	SCFM	0.013
RTGM01	2.313	SCFM	0.118
T2GM01	0.000	SCFM	0.000
T3GM01	0.000	SCFM	0.000
T4GM01	0.000	SCFM	0.000
TPGM03	0.000	SCFM	0.000
RPGM03	0.000	SCFM	0.001
T2GM02	0.000	SCFM	0.000
T3GM02	0.000	SCFM	0.000
T4GM02	0.000	SCFM	0.000
RPGP01	-0.312	PSIG	0.019
RPGP02	0.000	PSIG	0.000
RPGP03	0.000	PSIG	0.000
TPGP01	0.000	PSIG	0.000
TPGP02	0.000	PSIG	0.000
TPGP03	0.000	PSIG	0.000
T2GP01	0.000	PSIG	0.000
T3GP01	0.000	PSIG	0.000
T4GP01	0.000	PSIG	0.000
T2GP02	0.000	PSIG	0.000
T3GP02	0.000	PSIG	0.000
T4GP02	0.000	PSIG	0.000
T2GP03	0.000	PSIG	0.000
T3GP03	0.000	PSIG	0.000
T4GP03	0.000	PSIG	0.000
T2GP04	0.000	PSIG	0.000
T3GP04	0.000	PSIG	0.000
T4GP04	0.000	PSIG	0.000
T2GP05	0.000	PSIG	0.000
T3GP05	0.000	PSIG	0.000
T4GP05	0.000	PSIG	0.000
T2GP06	0.000	PSIG	0.000
T3GP06	0.000	PSIG	0.000
T4GP06	0.000	PSIG	0.000
R2GP06	0.000	PSIG	0.000
R3GP06	0.000	PSIG	0.000
R4GP06	0.000	PSIG	0.000
R2GP02	0.000	PSIG	0.000
R3GP02	0.000	PSIG	0.000
R4GP02	0.000	PSIG	0.000
R2GP03	0.000	PSIG	0.000
R3GP03	0.000	PSIG	0.000
R4GP03	0.000	PSIG	0.000
R2GP04	0.000	PSIG	0.000
R3GP04	0.000	PSIG	0.000

Test Number 965206

VTAB AVERAGE UNITS 2*SIGMA

R4GP04	0.000	PSIG	0.000
R2GP05	0.000	PSIG	0.000
R3GP05	0.000	PSIG	0.000
R4GP05	0.000 -	PSIG	0.000
RTGP01	0.898	PSIG	0.004
T2LC01	0.000	LBM	0.000
T2LC02	0.000	LBM	0.000
T3LC01	0.000	LBM	0.000
T3LC02	0.000	LBM	0.000
T4LC01	0.000	LBM	0.000
T4LC02	0.000	LBM	0.000
R2DP01	0.000	PSI	0.000
R3DP01	0.000	PSI	0.000
R4DP01	0.000	PSI	0.000
R2DP02	0.000	PSI	0.000
R3DP02	0.000	PSI	0.000
R4DP02	0.000	PSI	0.000
RPLV01	8.180	IN-H2O	0.045
TPLV01	0.000	IN-H2O	0.000
TPMM22	0.000	LBM/HR	0.000
RPMM22	35008.980	LBM/HR	212.041
TPMM21	0.000	LBM/HR	0.000
RPMM21	1.896	LBM/HR	11.489
T2LC30	0.000	LBM/HR	0.000
T3LC30	0.000	LBM/HR	0.000
T4LC30	0.000	LBM/HR	0.000

Test Name: 965206, 09:12
Test Date: 14-MAR-91

Today's Date: 05-Apr-91

Mark 22 Fuel Assembly
Annular Flow Distribution - Uninstrumented Assembly Testing
Test Notes ==> 70.0 GPM; 2.10 FT. BFI BACK PRESS.; Water Temp. 70F; P/L; TP 59

Reference Fuel Assembly

		Value	Two Std Deviation	VTAB
** Water **				
Temperature (F):	<	72.4	0.45	RPTC01
Flow Rate (gpm):	<	70.1	0.42	RPMM01+ RPMM02
** Air **				
Temperature (F):	<	71.46	0.28	ASTC01
Flow Rate (scfm):	<	1.81	0.09	RPGM02
** INLET PLENUM **				
Pressure (psig):	<	-0.312	0.018	RPGP01
Level (in):	<	8.180	0.046	RPLV01
** BOTTOM FITTING AND REACTOR TANK **				
Pressure (psig):	<	0.898	0.004	RTGP01

AFD - TEST 965206; VTABLE CREATED: 13-MAR-91 18 20 23
 14-MAR-91

AFD - TEST 965206; VTABLE CREATED: 13-MAR-91 18:20 23
 14-MAR-91

AFD - TEST 965206, VTABLE CREATED: 13-MAR-91 18 20 23
 14-MAR-91

Title: Uninstrumented Assembly Testing
Test date/time: 14-MAR-91, 10:22

Test: 965207
Test point: 60
(Repeat of T.P. 53)

SPECIFIED CONDITIONS:

Water Flow:	20.2 gpm	BFI Type:	P/L
Fluid Temp:	70 deg F	Piston Leakage:	0.00 scfm
Inlet Plenum Press.:	-0.05 psig		
Tank Water Level:	2.52 ft		

ACTUAL CONDITIONS (Uninstrumented Reference Assy.):

COMMENTS

Water Flow:	20.24 gpm	
Air Flow:	Inlet: 0.18 scfm	0-1.5 scfm Omega
	Outlet: 0.20 scfm	0-1.5 scfm Omega
Water Temperature:	72.4 deg F	
Air Temperature:	71.3 def F	
Inlet plenum pressure:	-0.04 psig	
Tank bottom pressure:	1.08 psig	
	(2.50 ft. H2O) (Tank Water Level)	
Inlet Plenum Level:	3.73 in. H2O	
Barometric pressure:	28.66 in. Hg at	72 deg F

Comments:

Repeat of test point 53 - performed to confirm test repeatability.

Test Number 965207

VTAB AVERAGE UNITS 2*SIGMA

ASTC01	71.314	DEG F	0.323
TPTC01	0.000	DEG F	0.000
RPTC01	72.422	DEG F	0.557
TPMM02	0.000	GPM	0.000
RPMM02	20.236	GPM	0.222
TPMM01	0.000	GPM	0.000
RPMM01	-0.061	GPM	0.031
TPGM01	0.000	SCFM	0.000
TPGM02	0.000	SCFM	0.000
RPGM01	-0.223	SCFM	0.073
RPGM02	0.153	SCFM	0.016
RTGM02	0.198	SCFM	0.045
RTGM01	-0.247	SCFM	0.067
T2GM01	0.000	SCFM	0.000
T3GM01	0.000	SCFM	0.000
T4GM01	0.000	SCFM	0.000
TPGM03	0.000	SCFM	0.000
RPGM03	0.178	SCFM	0.036
T2GM02	0.000	SCFM	0.000
T3GM02	0.000	SCFM	0.000
T4GM02	0.000	SCFM	0.000
RPGP01	-0.043	PSIG	0.007
RPGP02	0.000	PSIG	0.000
RPGP03	0.000	PSIG	0.000
TPGP01	0.000	PSIG	0.000
TPGP02	0.000	PSIG	0.000
TPGP03	0.000	PSIG	0.000
T2GP01	0.000	PSIG	0.000
T3GP01	0.000	PSIG	0.000
T4GP01	0.000	PSIG	0.000
T2GP02	0.000	PSIG	0.000
T3GP02	0.000	PSIG	0.000
T4GP02	0.000	PSIG	0.000
T2GP03	0.000	PSIG	0.000
T3GP03	0.000	PSIG	0.000
T4GP03	0.000	PSIG	0.000
T2GP04	0.000	PSIG	0.000
T3GP04	0.000	PSIG	0.000
T4GP04	0.000	PSIG	0.000
T2GP05	0.000	PSIG	0.000
T3GP05	0.000	PSIG	0.000
T4GP05	0.000	PSIG	0.000
T2GP06	0.000	PSIG	0.000
T3GP06	0.000	PSIG	0.000
T4GP06	0.000	PSIG	0.000
R2GP06	0.000	PSIG	0.000
R3GP06	0.000	PSIG	0.000
R4GP06	0.000	PSIG	0.000
R2GP02	0.000	PSIG	0.000
R3GP02	0.000	PSIG	0.000
R4GP02	0.000	PSIG	0.000
R2GP03	0.000	PSIG	0.000
R3GP03	0.000	PSIG	0.000
R4GP03	0.000	PSIG	0.000
R2GP04	0.000	PSIG	0.000
R3GP04	0.000	PSIG	0.000

Test Number 965207

VTAB AVERAGE UNITS 2*SIGMA

R4GP04	0.000	PSIG	0.000
R2GP05	0.000	PSIG	0.000
R3GP05	0.000	PSIG	0.000
R4GP05	0.000	PSIG	0.000
RTGP01	1.079	PSIG	0.001
T2LC01	0.000	LBM	0.000
T2LC02	0.000	LBM	0.000
T3LC01	0.000	LBM	0.000
T3LC02	0.000	LBM	0.000
T4LC01	0.000	LBM	0.000
T4LC02	0.000	LBM	0.000
R2DP01	0.000	PSI	0.000
R3DP01	0.000	PSI	0.000
R4DP01	0.000	PSI	0.000
R2DP02	0.000	PSI	0.000
R3DP02	0.000	PSI	0.000
R4DP02	0.000	PSI	0.000
RPLV01	3.726	IN-H2O	0.014
TPLV01	0.000	IN-H2O	0.000
TPMM22	0.000	LBM/HR	0.000
RPMM22	10103.818	LBM/HR	111.016
TPMM21	0.000	LBM/HR	0.000
RPMM21	0.000	LBM/HR	0.000
T2LC30	0.000	LBM/HR	0.000
T3LC30	0.000	LBM/HR	0.000
T4LC30	0.000	LBM/HR	0.000

Test Name: 965207, 10:22
Test Date: 14-MAR-91

Today's Date: 05-Apr-91

Mark 22 Fuel Assembly
Annular Flow Distribution - Uninstrumented Assembly Testing
Test Notes —> 20.2 GPM; 2.52 FT. BFI BACK PRESS.; Water Temp. 70F; P/L; TP 60

Reference Fuel Assembly

		Value	Two Std Deviation	VTAB
** Water **				
Temperature (F):	<	72.4	0.56	RPTC01
Flow Rate (gpm):	<	20.2	0.22	RPM01+ RPM02
** Air **				
Temperature (F):	<	71.31	0.32	ASTC01
Flow Rate (scfm):	<	0.18	0.04	RPGM03
** INLET PLENUM **				
Pressure (psig):	<	-0.043	0.008	RPGP01
Level (in):	<	3.726	0.014	RPLV01
** BOTTOM FITTING AND REACTOR TANK **				
Pressure (psig):	<	1.079	0.002	RTGP01

AFD - TEST 965207, VTABLE CREATED 13-MAR-91 18 20 23
14-MAR-91

P S I C
Al-61

AFD - TEST 965207; VTABLE CREATED: 13-MAR-91 18 20 23
14-MAR-91

AFD - TEST 965207, VTABLE CREATED 13-MAR-91 18 20 23
14-MAR-91

Title: Uninstrumented Assembly Testing
Test date/time: 14-MAR-91, 11:53

Test: 965208
Test point: 61

SPECIFIED CONDITIONS:

Water Flow:	-	20.4 gpm	BFI Type:	P/L
Fluid Temp:		70 deg F	Piston Leakage:	0.00 scfm
Inlet Plenum Press.:		-0.03 psig		
Tank Water Level:		4.52 ft		

ACTUAL CONDITIONS (Uninstrumented Reference Assy.):

COMMENTS

Water Flow:	20.29 gpm	
Air Flow:	Inlet: 0.12 scfm	0-1.5 scfm Omega
	Outlet: 0.13 scfm	0-1.5 scfm Omega
Water Temperature:	72.1 deg F	
Air Temperature:	70.9 deg F	
Inlet plenum pressure:	-0.03 psig	
Tank bottom pressure:	1.94 psig	
	(4.48 ft. H2O) (Tank Water Level)	
Inlet Plenum Level:	3.72 in. H2O	
Barometric pressure:	28.69 in. Hg at	73 deg F

Test Number 965208

VTAB AVERAGE UNITS 2*SIGMA

ASTC01	70.933	DEG F	0.275
TPTC01	0.000	DEG F	0.000
RPTC01	72.120	DEG F	0.451
TPMM02	0.000	GPM	0.000
RPMM02	20.289	GPM	0.178
TPMM01	0.000	GPM	0.000
RPMM01	-0.062	GPM	0.026
TPGM01	0.000	SCFM	0.000
TPGM02	0.000	SCFM	0.000
RPGM01	-0.304	SCFM	0.075
RPGM02	0.085	SCFM	0.020
RTGM02	0.130	SCFM	0.090
RTGM01	-0.254	SCFM	0.061
T2GM01	0.000	SCFM	0.000
T3GM01	0.000	SCFM	0.000
T4GM01	0.000	SCFM	0.000
TPGM03	0.000	SCFM	0.000
RPGM03	0.116	SCFM	0.060
T2GM02	0.000	SCFM	0.000
T3GM02	0.000	SCFM	0.000
T4GM02	0.000	SCFM	0.000
RPGP01	-0.030	PSIG	0.009
RPGP02	0.000	PSIG	0.000
RPGP03	0.000	PSIG	0.000
TPGP01	0.000	PSIG	0.000
TPGP02	0.000	PSIG	0.000
TPGP03	0.000	PSIG	0.000
T2GP01	0.000	PSIG	0.000
T3GP01	0.000	PSIG	0.000
T4GP01	0.000	PSIG	0.000
T2GP02	0.000	PSIG	0.000
T3GP02	0.000	PSIG	0.000
T4GP02	0.000	PSIG	0.000
T2GP03	0.000	PSIG	0.000
T3GP03	0.000	PSIG	0.000
T4GP03	0.000	PSIG	0.000
T2GP04	0.000	PSIG	0.000
T3GP04	0.000	PSIG	0.000
T4GP04	0.000	PSIG	0.000
T2GP05	0.000	PSIG	0.000
T3GP05	0.000	PSIG	0.000
T4GP05	0.000	PSIG	0.000
T2GP06	0.000	PSIG	0.000
T3GP06	0.000	PSIG	0.000
T4GP06	0.000	PSIG	0.000
R2GP06	0.000	PSIG	0.000
R3GP06	0.000	PSIG	0.000
R4GP06	0.000	PSIG	0.000
R2GP02	0.000	PSIG	0.000
R3GP02	0.000	PSIG	0.000
R4GP02	0.000	PSIG	0.000
R2GP03	0.000	PSIG	0.000
R3GP03	0.000	PSIG	0.000
R4GP03	0.000	PSIG	0.000
R2GP04	0.000	PSIG	0.000
R3GP04	0.000	PSIG	0.000

Test Number 965208

VTAB AVERAGE UNITS 2*SIGMA

R4GP04	0.000	PSIG	0.000
R2GP05	0.000	PSIG	0.000
R3GP05	0.000	PSIG	0.000
R4GP05	0.000	PSIG	0.000
RTGP01	1.938	PSIG	0.001
T2LC01	0.000	LBM	0.000
T2LC02	0.000	LBM	0.000
T3LC01	0.000	LBM	0.000
T3LC02	0.000	LBM	0.000
T4LC01	0.000	LBM	0.000
T4LC02	0.000	LBM	0.000
R2DP01	0.000	PSI	0.000
R3DP01	0.000	PSI	0.000
R4DP01	0.000	PSI	0.000
R2DP02	0.000	PSI	0.000
R3DP02	0.000	PSI	0.000
R4DP02	0.000	PSI	0.000
RPLV01	3.715	IN-H2O	0.015
TPLV01	0.000	IN-H2O	0.000
TPMM22	0.000	LBM/HR	0.000
RPMM22	10130.130	LBM/HR	88.903
TPMM21	0.000	LBM/HR	0.000
RPMM21	0.000	LBM/HR	0.000
T2LC30	0.000	LBM/HR	0.000
T3LC30	0.000	LBM/HR	0.000
T4LC30	0.000	LBM/HR	0.000

Test Name: 965208, 11:53
Test Date: 14-MAR-91

Today's Date: 05-Apr-91

Mark 22 Fuel Assembly
Annular Flow Distribution - Uninstrumented Assembly Testing
Test Notes —> 20.4 GPM; 4.52 FT. BFI BACK PRESS.; Water Temp. 70F; P/L; TP 61

Reference Fuel Assembly

		Value	Two Std Deviation	VTAB
** Water **				
Temperature (F):	<	72.1	0.45	RPTC01
Flow Rate (gpm):	<	20.3	0.18	RPM01+ RPM02
** Air **				
Temperature (F):	<	70.93	0.27	ASTC01
Flow Rate (scfm):	<	0.12	0.06	RPGM03
** INLET PLENUM **				
Pressure (psig):	<	-0.030	0.008	RPGP01
Level (in):	<	3.715	0.016	RPLV01
** BOTTOM FITTING AND REACTOR TANK **				
Pressure (psig):	<	1.938	0.002	RTGP01

AFD - TEST 965208; VTABLE CREATED 13-MAR-91 18 20 23
14-MAR-91

P S I C
A1-68

AFD - TEST 965208; VTABLE CREATED: 13-MAR-91 18:20 23
14-MAR-91

AFD - TEST 965208; VTABLE CREATED 13-MAR-91 18:20 23
14-MAR-91

SCFM
A1-70

Title: Uninstrumented Assembly Testing
Test date/time: 14-MAR-91, 13:12

Test: 965209
Test point: 62

SPECIFIED CONDITIONS:

Water Flow:	26.5 gpm	BFI Type:	P/L
Fluid Temp:	70 deg F	Piston Leakage:	0.00 scfm
Inlet Plenum Press.:	-0.1 psig		
Tank Water Level:	4.46 ft		

ACTUAL CONDITIONS (Uninstrumented Reference Assy.):

COMMENTS

Water Flow:	26.51 gpm	
Air Flow:	Inlet: 0.22 scfm	0-1.5 scfm Omega
	Outlet: 0.24 scfm	0-1.5 scfm Omega
Water Temperature:	72.8 deg F	
Air Temperature:	71.5 deg F	
Inlet plenum pressure:	-0.09 psig	
Tank bottom pressure:	1.91 psig	
	(4.42 ft. H2O) (Tank Water Level)	
Inlet Plenum Level:	4.43 in. H2O	
Barometric pressure:	28.69 in. Hg at	72 deg F

Test Number 965209

VTAB	AVERAGE	UNITS	2*SIGMA
ASTC01	71.491	DEG F	0.496
TPTC01	0.000	DEG F	0.000
RPTC01	72.788	DEG F	0.793
TPMM02	0.000	GPM	0.000
RPMM02	26.512	GPM	0.144
TPMM01	0.000	GPM	0.000
RPMM01	-0.023	GPM	0.046
TPGM01	0.000	SCFM	0.000
TPGM02	0.000	SCFM	0.000
RPGM01	-0.167	SCFM	0.077
RPGM02	0.199	SCFM	0.021
RTGM02	0.241	SCFM	0.059
RTGM01	-0.257	SCFM	0.065
T2GM01	0.000	SCFM	0.000
T3GM01	0.000	SCFM	0.000
T4GM01	0.000	SCFM	0.000
TPGM03	0.000	SCFM	0.000
RPGM03	0.223	SCFM	0.030
T2GM02	0.000	SCFM	0.000
T3GM02	0.000	SCFM	0.000
T4GM02	0.000	SCFM	0.000
RPGP01	-0.086	PSIG	0.015
RPGP02	0.000	PSIG	0.000
RPGP03	0.000	PSIG	0.000
TPGP01	0.000	PSIG	0.000
TPGP02	0.000	PSIG	0.000
TPGP03	0.000	PSIG	0.000
T2GP01	0.000	PSIG	0.000
T3GP01	0.000	PSIG	0.000
T4GP01	0.000	PSIG	0.000
T2GP02	0.000	PSIG	0.000
T3GP02	0.000	PSIG	0.000
T4GP02	0.000	PSIG	0.000
T2GP03	0.000	PSIG	0.000
T3GP03	0.000	PSIG	0.000
T4GP03	0.000	PSIG	0.000
T2GP04	0.000	PSIG	0.000
T3GP04	0.000	PSIG	0.000
T4GP04	0.000	PSIG	0.000
T2GP05	0.000	PSIG	0.000
T3GP05	0.000	PSIG	0.000
T4GP05	0.000	PSIG	0.000
T2GP06	0.000	PSIG	0.000
T3GP06	0.000	PSIG	0.000
T4GP06	0.000	PSIG	0.000
R2GP06	0.000	PSIG	0.000
R3GP06	0.000	PSIG	0.000
R4GP06	0.000	PSIG	0.000
R2GP02	0.000	PSIG	0.000
R3GP02	0.000	PSIG	0.000
R4GP02	0.000	PSIG	0.000
R2GP03	0.000	PSIG	0.000
R3GP03	0.000	PSIG	0.000
R4GP03	0.000	PSIG	0.000
R2GP04	0.000	PSIG	0.000
R3GP04	0.000	PSIG	0.000

Test Number 965209

VTAB AVERAGE UNITS 2*SIGMA

R4GP04	0.000	PSIG	0.000
R2GP05	0.000	PSIG	0.000
R3GP05	0.000	PSIG	0.000
R4GP05	0.000	PSIG	0.000
RTGP01	1.912	PSIG	0.002
T2LC01	0.000	LBM	0.000
T2LC02	0.000	LBM	0.000
T3LC01	0.000	LBM	0.000
T3LC02	0.000	LBM	0.000
T4LC01	0.000	LBM	0.000
T4LC02	0.000	LBM	0.000
R2DP01	0.000	PSI	0.000
R3DP01	0.000	PSI	0.000
R4DP01	0.000	PSI	0.000
R2DP02	0.000	PSI	0.000
R3DP02	0.000	PSI	0.000
R4DP02	0.000	PSI	0.000
RPLV01	4.432	IN-H2O	0.017
TPLV01	0.000	IN-H2O	0.000
TPMM22	0.000	LBM/HR	0.000
RPMM22	13237.198	LBM/HR	71.882
TPMM21	0.000	LBM/HR	0.000
RPMM21	0.027	LBM/HR	0.399
T2LC30	0.000	LBM/HR	0.000
T3LC30	0.000	LBM/HR	0.000
T4LC30	0.000	LBM/HR	0.000

Test Name: 965209, 13:12
Test Date: 14-MAR-91

Today's Date: 05-Apr-91

Mark 22 Fuel Assembly
Annular Flow Distribution - Uninstrumented Assembly Testing
Test Notes —> 26.5 GPM; 4.46 FT. BFI BACK PRESS.; Water Temp. 70F; P/L; TP 62

Reference Fuel Assembly

		Value	Two Std Deviation VTAB	
** Water **				
Temperature (F):	<	72.8	0.79	RPTC01
Flow Rate (gpm):	<	26.5	0.14	RPM01+ RPM02
** Air **				
Temperature (F):	<	71.49	0.50	ASTC01
Flow Rate (scfm):	<	0.22	0.03	RPGM03
** INLET PLENUM **				
Pressure (psig):	<	-0.086	0.016	RPGP01
Level (in):	<	4.432	0.018	RPLV01
** BOTTOM FITTING AND REACTOR TANK **				
Pressure (psig):	<	1.912	0.002	RTGP01

AFD - TEST 965209; VTABLE CREATED: 13-MAR-91 18:20 23
14-MAR-91

AFD - TEST 965209; VTABLE CREATED: 13-MAR-91 18 20 23
14-MAR-91

SCFM
A1-76

AFD - TEST 965209; VTABLE CREATED: 13-MAR-91 18:20:23
14-MAR-91

Title: Uninstrumented Assembly Testing
Test date/time: 14-MAR-91, 14:24

Test: 965210
Test point: 63

SPECIFIED CONDITIONS:

Water Flow:	31.1 gpm	BFI Type:	P/L
Fluid Temp:	70 deg F	Piston Leakage:	0.00 scfm
Inlet Plenum Press.:	-0.19 psig		
Tank Water Level:	4.41 ft		

ACTUAL CONDITIONS (Uninstrumented Reference Assy.):

COMMENTS

Water Flow:	31.16 gpm	
Air Flow:	Inlet: 0.33 scfm	0-1.5 scfm Omega
	Outlet: 0.34 scfm	0-1.5 scfm Omega
Water Temperature:	72.2 deg F	
Air Temperature:	71.9 deg F	
Inlet plenum pressure:	-0.20 psig	
Tank bottom pressure:	1.89 psig	
	(4.38 ft. H2O) (Tank Water Level)	
Inlet Plenum Level:	4.90 in. H2O	
Barometric pressure:	28.7 in. Hg at	74 deg F

Test Number 965210

VTAB AVERAGE UNITS 2*SIGMA

ASTC01	71.891	DEG F	0.243
TPTC01	0.000	DEG F	0.000
RPTC01	72.220	DEG F	0.476
TPMM02	0.000	GPM	0.000
RPMM02	31.164	GPM	0.123
TPMM01	0.000	GPM	0.000
RPMM01	-0.033	GPM	0.050
TPGM01	0.000	SCFM	0.000
TPGM02	0.000	SCFM	0.000
RPGM01	-0.034	SCFM	0.077
RPGM02	0.317	SCFM	0.024
RTGM02	0.340	SCFM	0.093
RTGM01	-0.258	SCFM	0.060
T2GM01	0.000	SCFM	0.000
T3GM01	0.000	SCFM	0.000
T4GM01	0.000	SCFM	0.000
TPGM03	0.000	SCFM	0.000
RPGM03	0.334	SCFM	0.031
T2GM02	0.000	SCFM	0.000
T3GM02	0.000	SCFM	0.000
T4GM02	0.000	SCFM	0.000
RPGP01	-0.201	PSIG	0.029
RPGP02	0.000	PSIG	0.000
RPGP03	0.000	PSIG	0.000
TPGP01	0.000	PSIG	0.000
TPGP02	0.000	PSIG	0.000
TPGP03	0.000	PSIG	0.000
T2GP01	0.000	PSIG	0.000
T3GP01	0.000	PSIG	0.000
T4GP01	0.000	PSIG	0.000
T2GP02	0.000	PSIG	0.000
T3GP02	0.000	PSIG	0.000
T4GP02	0.000	PSIG	0.000
T2GP03	0.000	PSIG	0.000
T3GP03	0.000	PSIG	0.000
T4GP03	0.000	PSIG	0.000
T2GP04	0.000	PSIG	0.000
T3GP04	0.000	PSIG	0.000
T4GP04	0.000	PSIG	0.000
T2GP05	0.000	PSIG	0.000
T3GP05	0.000	PSIG	0.000
T4GP05	0.000	PSIG	0.000
T2GP06	0.000	PSIG	0.000
T3GP06	0.000	PSIG	0.000
T4GP06	0.000	PSIG	0.000
R2GP06	0.000	PSIG	0.000
R3GP06	0.000	PSIG	0.000
R4GP06	0.000	PSIG	0.000
R2GP02	0.000	PSIG	0.000
R3GP02	0.000	PSIG	0.000
R4GP02	0.000	PSIG	0.000
R2GP03	0.000	PSIG	0.000
R3GP03	0.000	PSIG	0.000
R4GP03	0.000	PSIG	0.000
R2GP04	0.000	PSIG	0.000
R3GP04	0.000	PSIG	0.000

Test Number 965210

VTAB AVERAGE UNITS 2*SIGMA

R4GP04	0.000	PSIG	0.000
R2GP05	0.000	PSIG	0.000
R3GP05	0.000	PSIG	0.000
R4GP05	0.000	PSIG	0.000
RTGP01	1.892	PSIG	0.003
T2LC01	0.000	LBM	0.000
T2LC02	0.000	LBM	0.000
T3LC01	0.000	LBM	0.000
T3LC02	0.000	LBM	0.000
T4LC01	0.000	LBM	0.000
T4LC02	0.000	LBM	0.000
R2DP01	0.000	PSI	0.000
R3DP01	0.000	PSI	0.000
R4DP01	0.000	PSI	0.000
R2DP02	0.000	PSI	0.000
R3DP02	0.000	PSI	0.000
R4DP02	0.000	PSI	0.000
RPLV01	4.898	IN-H2O	0.013
TPLV01	0.000	IN-H2O	0.000
TPMM22	0.000	LBM/HR	0.000
RPMM22	15560.029	LBM/HR	61.498
TPMM21	0.000	LBM/HR	0.000
RPMM21	0.000	LBM/HR	0.000
T2LC30	0.000	LBM/HR	0.000
T3LC30	0.000	LBM/HR	0.000
T4LC30	0.000	LBM/HR	0.000

Test Name: 965210, 14:24
Test Date: 14-MAR-91

Today's Date: 05-Apr-91

Mark 22 Fuel Assembly
Annular Flow Distribution - Uninstrumented Assembly Testing
Test Notes ==> 31.1 GPM; 4.41 FT. BFI BACK PRESS.; Water Temp. 70F; P/L; TP 63

Reference Fuel Assembly

		Value	Two Std Deviation	VTAB
** Water **				
Temperature (F):	<	72.2	0.48	RPTC01
Flow Rate (gpm):	<	31.2	0.12	RPMM01+ RPMM02
** Air **				
Temperature (F):	<	71.89	0.24	ASTC01
Flow Rate (scfm):	<	0.33	0.03	RPGM03
 ** INLET PLENUM **				
Pressure (psig):	<	-0.201	0.028	RPGP01
Level (in):	<	4.898	0.014	RPLV01
 ** BOTTOM FITTING AND REACTOR TANK **				
Pressure (psig):	<	1.892	0.004	RTGP01

AFD - TEST 965210, VTABLE CREATED: 13-MAR-91 18 20 23
14-MAR-91

AFD - TEST 965210; VTABLE CREATED 13-MAR-91 18:20:23
14-MAR-91

SCFM

A1-83

AFD - TEST 965210; VTABLE CREATED: 13-MAR-91 18 20:23
 14-MAR-91

Title: Uninstrumented Assembly Testing
Test date/time: 14-MAR-91, 15:27

Test: 965211
Test point: 64

SPECIFIED CONDITIONS:

Water Flow:	41.3 gpm	BFI Type:	P/L
Fluid Temp:	70 deg F	Piston Leakage:	0.00 scfm
Inlet Plenum Press.:	-0.39 psig		
Tank Water Level:	4.32 ft		

ACTUAL CONDITIONS (Uninstrumented Reference Assy.):

COMMENTS

Water Flow:	41.32 gpm	
Air Flow:	Inlet: 0.58 scfm	0-1.5 scfm Omega
	Outlet: 0.59 scfm	0-1.5 scfm Omega
Water Temperature:	72.8 deg F	
Air Temperature:	72.4 def F	
Inlet plenum pressure:	-0.42 psig	
Tank bottom pressure:	1.86 psig	
	(4.31 ft. H2O) (Tank Water Level)	
Inlet Plenum Level:	5.88 in. H2O	
Barometric pressure:	28.7 in. Hg at	75 deg F

Test Number 965211

VTAB AVERAGE UNITS 2*SIGMA

ASTC01	72.407	DEG F	0.262
TPTC01	0.000	DEG F	0.000
RPTC01	72.774	DEG F	0.510
TPMM02	0.000	GPM	0.000
RPMM02	41.322	GPM	0.157
TPMM01	0.000	GPM	0.000
RPMM01	-0.063	GPM	0.065
TPGM01	0.000	SCFM	0.000
TPGM02	0.000	SCFM	0.000
RPGM01	0.205	SCFM	0.073
RPGM02	0.641	SCFM	0.030
RTGM02	0.586	SCFM	0.080
RTGM01	-0.263	SCFM	0.062
T2GM01	0.000	SCFM	0.000
T3GM01	0.000	SCFM	0.000
T4GM01	0.000	SCFM	0.000
TPGM03	0.000	SCFM	0.000
RPGM03	0.583	SCFM	0.036
T2GM02	0.000	SCFM	0.000
T3GM02	0.000	SCFM	0.000
T4GM02	0.000	SCFM	0.000
RPGP01	-0.420	PSIG	0.043
RPGP02	0.000	PSIG	0.000
RPGP03	0.000	PSIG	0.000
TPGP01	0.000	PSIG	0.000
TPGP02	0.000	PSIG	0.000
TPGP03	0.000	PSIG	0.000
T2GP01	0.000	PSIG	0.000
T3GP01	0.000	PSIG	0.000
T4GP01	0.000	PSIG	0.000
T2GP02	0.000	PSIG	0.000
T3GP02	0.000	PSIG	0.000
T4GP02	0.000	PSIG	0.000
T2GP03	0.000	PSIG	0.000
T3GP03	0.000	PSIG	0.000
T4GP03	0.000	PSIG	0.000
T2GP04	0.000	PSIG	0.000
T3GP04	0.000	PSIG	0.000
T4GP04	0.000	PSIG	0.000
T2GP05	0.000	PSIG	0.000
T3GP05	0.000	PSIG	0.000
T4GP05	0.000	PSIG	0.000
T2GP06	0.000	PSIG	0.000
T3GP06	0.000	PSIG	0.000
T4GP06	0.000	PSIG	0.000
R2GP06	0.000	PSIG	0.000
R3GP06	0.000	PSIG	0.000
R4GP06	0.000	PSIG	0.000
R2GP02	0.000	PSIG	0.000
R3GP02	0.000	PSIG	0.000
R4GP02	0.000	PSIG	0.000
R2GP03	0.000	PSIG	0.000
R3GP03	0.000	PSIG	0.000
R4GP03	0.000	PSIG	0.000
R2GP04	0.000	PSIG	0.000
R3GP04	0.000	PSIG	0.000

Test Number 965211

VTAB AVERAGE UNITS 2*SIGMA

R4GP04	0.000	PSIG	0.000
R2GP05	0.000	PSIG	0.000
R3GP05	0.000	PSIG	0.000
R4GP05	0.000	PSIG	0.000
RTGP01	1.863	PSIG	0.004
T2LC01	0.000	LBM	0.000
T2LC02	0.000	LBM	0.000
T3LC01	0.000	LBM	0.000
T3LC02	0.000	LBM	0.000
T4LC01	0.000	LBM	0.000
T4LC02	0.000	LBM	0.000
R2DP01	0.000	PSI	0.000
R3DP01	0.000	PSI	0.000
R4DP01	0.000	PSI	0.000
R2DP02	0.000	PSI	0.000
R3DP02	0.000	PSI	0.000
R4DP02	0.000	PSI	0.000
RPLV01	5.880	IN-H2O	0.017
TPLV01	0.000	IN-H2O	0.000
TPMM22	0.000	LBM/HR	0.000
RPMM22	20632.143	LBM/HR	78.399
TPMM21	0.000	LBM/HR	0.000
RPMM21	0.064	LBM/HR	0.942
T2LC30	0.000	LBM/HR	0.000
T3LC30	0.000	LBM/HR	0.000
T4LC30	0.000	LBM/HR	0.000

Test Name: 965211, 15:27
Test Date: 14-MAR-91

Today's Date: 05-Apr-91

Mark 22 Fuel Assembly
Annular Flow Distribution - Uninstrumented Assembly Testing
Test Notes ==> 41.3 GPM; 4.32 FT. BFI BACK PRESS.; Water Temp. 70F; P/L; TP 64

Reference Fuel Assembly

		Value	Two Std Deviation	VTAB
** Water **				
Temperature (F):	<	72.8	0.51	RPTC01
Flow Rate (gpm):	<	41.3	0.16	RPTM01+ RPTM02
** Air **				
Temperature (F):	<	72.41	0.26	ASTC01
Flow Rate (scfm):	<	0.58	0.04	RPGM03
** INLET PLENUM **				
Pressure (psig):	<	-0.420	0.044	RPGP01
Level (in):	<	5.880	0.018	RPLV01
** BOTTOM FITTING AND REACTOR TANK **				
Pressure (psig):	<	1.863	0.004	RTGP01

AFD - TEST 965211; VTABLE CREATED: 13-MAR-91 18 20 23
14-MAR-91

AFD - TEST 965211, VTABLE CREATED 13-MAR-91 18 20 23
14-MAR-91

SCFM
A1-90

AFD - TEST 965211; VTABLE CREATED 13-MAR-91 18 20 23
14-MAR-91

Title: Uninstrumented Assembly Testing
Test date/time: 21-MAR-91, 19:07

Test: 965237
Test point: 64

SPECIFIED CONDITIONS:

Water Flow:	41.3 gpm	BFI Type:	P/L
Fluid Temp:	70 deg F	Piston Leakage:	0.00 scfm
Inlet Plenum Press.:	-0.39 psig		
Tank Water Level:	4.32 ft		

ACTUAL CONDITIONS (Uninstrumented Reference Assy.):

COMMENTS

Water Flow:	41.95 gpm *	
Air Flow:	Inlet: 0.53 scfm	0-1.5 scfm Omega
	Outlet: 0.49 scfm	0-1.5 scfm Omega
Water Temperature:	69.5 deg F	
Air Temperature:	71.5 deg F	
Inlet plenum pressure:	-0.31 psig +	
Tank bottom pressure:	1.86 psig	
	(4.31 ft. H2O) (Tank Water Level)	
Inlet Plenum Level:	5.93 in. H2O	
Barometric pressure:	28.75 in. Hg at	72 deg F

- * Actual water flow rate was 0.65 gpm above target value (0.15 gpm out of spec.).
- + Inlet plenum pressure changed during test conduct by amount greater than specified allowable.

Comments:

Repeat of test point 64 - performed to explore observed bistability phenomenon.

Test Number 965237

VTAB	AVERAGE	UNITS	2*SIGMA
ASTC01	71.481	DEG F	0.502
TPTC01	0.000	DEG F	0.000
RPTC01	69.476	DEG F	0.323
TPMM02	0.000	GPM	0.000
RPMM02	41.949	GPM	0.174
TPMM01	0.000	GPM	0.000
RPMM01	-0.049	GPM	0.057
TPGM01	0.000	SCFM	0.000
TPGM02	0.000	SCFM	0.000
RPGM01	0.149	SCFM	0.092
RPGM02	0.570	SCFM	0.076
RTGM02	0.487	SCFM	0.089
RTGM01	-0.204	SCFM	0.062
T2GM01	0.000	SCFM	0.000
T3GM01	0.000	SCFM	0.000
T4GM01	0.000	SCFM	0.000
TPGM03	0.000	SCFM	0.000
RPGM03	0.532	SCFM	0.070
T2GM02	0.000	SCFM	0.000
T3GM02	0.000	SCFM	0.000
T4GM02	0.000	SCFM	0.000
RPGP01	-0.313	PSIG	0.070
RPGP02	0.000	PSIG	0.000
RPGP03	0.000	PSIG	0.000
TPGP01	0.000	PSIG	0.000
TPGP02	0.000	PSIG	0.000
TPGP03	0.000	PSIG	0.000
T2GP01	0.000	PSIG	0.000
T3GP01	0.000	PSIG	0.000
T4GP01	0.000	PSIG	0.000
T2GP02	0.000	PSIG	0.000
T3GP02	0.000	PSIG	0.000
T4GP02	0.000	PSIG	0.000
T2GP03	0.000	PSIG	0.000
T3GP03	0.000	PSIG	0.000
T4GP03	0.000	PSIG	0.000
T2GP04	0.000	PSIG	0.000
T3GP04	0.000	PSIG	0.000
T4GP04	0.000	PSIG	0.000
T2GP05	0.000	PSIG	0.000
T3GP05	0.000	PSIG	0.000
T4GP05	0.000	PSIG	0.000
T2GP06	0.000	PSIG	0.000
T3GP06	0.000	PSIG	0.000
T4GP06	0.000	PSIG	0.000
R2GP06	0.000	PSIG	0.000
R3GP06	0.000	PSIG	0.000
R4GP06	0.000	PSIG	0.000
R2GP02	0.000	PSIG	0.000
R3GP02	0.000	PSIG	0.000
R4GP02	0.000	PSIG	0.000
R2GP03	0.000	PSIG	0.000
R3GP03	0.000	PSIG	0.000
R4GP03	0.000	PSIG	0.000
R2GP04	0.000	PSIG	0.000
R3GP04	0.000	PSIG	0.000

Test Number 965237

VTAB AVERAGE UNITS 2*SIGMA

R4GP04	0.000	PSIG	0.000
R2GP05	0.000	PSIG	0.000
R3GP05	0.000	PSIG	0.000
R4GP05	0.000	PSIG	0.000
RTGP01	1.864	PSIG	0.004
T2LC01	0.000	LBM	0.000
T2LC02	0.000	LBM	0.000
T3LC01	0.000	LBM	0.000
T3LC02	0.000	LBM	0.000
T4LC01	0.000	LBM	0.000
T4LC02	0.000	LBM	0.000
R2DP01	0.000	PSI	0.000
R3DP01	0.000	PSI	0.000
R4DP01	0.000	PSI	0.000
R2DP02	0.000	PSI	0.000
R3DP02	0.000	PSI	0.000
R4DP02	0.000	PSI	0.000
RPLV01	5.928	IN-H2O	0.017
TPLV01	0.000	IN-H2O	0.000
TPMM22	0.000	LBM/HR	0.000
RPMM22	20945.029	LBM/HR	86.769
TPMM21	0.000	LBM/HR	0.000
RPMM21	0.000	LBM/HR	0.000
T2LC30	0.000	LBM/HR	0.000
T3LC30	0.000	LBM/HR	0.000
T4LC30	0.000	LBM/HR	0.000

Test Name: 965237, 19:07
Test Date: 21-MAR-91

Today's Date: 05-Apr-91

Mark 22 Fuel Assembly
Annular Flow Distribution - Uninstrumented Assembly Testing
Test Notes ==> 41.3 GPM; 4.32 FT. BFI BACK PRESS.; Water Temp. 70F; P/L; TP 64

Reference Fuel Assembly

		Value	Two Std Deviation	VTAB
** Water **				
Temperature (F):	<	69.5	0.32	RPTC01
Flow Rate (gpm):	<	41.9	0.17	RPMM01+ RPMM02
** Air **				
Temperature (F):	<	71.48	0.50	ASTC01
Flow Rate (scfm):	<	0.53	0.07	RPGM03
** INLET PLENUM **				
Pressure (psig):	<	-0.313	0.070	RPGP01
Level (in):	<	5.928	0.016	RPLV01
** BOTTOM FITTING AND REACTOR TANK **				
Pressure (psig):	<	1.864	0.004	RTGP01

AFD - TEST 965237, VTABLE CREATED 13-MAR-91 18 20 23
21-MAR-91

P S I C
A1-96

AFD - TEST 965237; VTABLE CREATED 13-MAR-91 18 20 23
21-MAR-91

AFD - TEST 965237, VTABLE CREATED: 13-MAR-91 18:20:23
21-MAR-91

Title: Uninstrumented Assembly Testing
Test date/time: 14-MAR-91, 16:55

Test: 965212
Test point: 65

SPECIFIED CONDITIONS:

Water Flow:	40.7 gpm	BFI Type:	P/L
Fluid Temp:	70 deg F	Piston Leakage:	0.00 scfm
Inlet Plenum Press.:	-0.29 psig		
Tank Water Level:	4.30 ft		

ACTUAL CONDITIONS (Uninstrumented Reference Assy.):

COMMENTS

Water Flow:	40.55 gpm	
Air Flow:	Inlet: 0.57 scfm	0-1.5 scfm Omega
	Outlet: 0.58 scfm	0-1.5 scfm Omega
Water Temperature:	73.5 deg F	
Air Temperature:	72.8 deg F	
Inlet plenum pressure:	-0.26 psig	
Tank bottom pressure:	1.84 psig	
	(4.26 ft. H2O) (Tank Water Level)	
Inlet Plenum Level:	5.83 in. H2O	
Barometric pressure:	28.74 in. Hg at	74 deg F

Test Number 965212

VTAB	AVERAGE	UNITS	2*SIGMA
ASTC01	72.758	DEG F	0.232
TPTC01	0.000	DEG F	0.000
RPTC01	73.510	DEG F	0.513
TPMM02	0.000	GPM	0.000
RPMM02	40.545	GPM	0.190
TPMM01	0.000	GPM	0.000
RPMM01	-0.023	GPM	0.059
TPGM01	0.000	SCFM	0.000
TPGM02	0.000	SCFM	0.000
RPGM01	0.198	SCFM	0.079
RPGM02	0.623	SCFM	0.057
RTGM02	0.580	SCFM	0.071
RTGM01	-0.256	SCFM	0.061
T2GM01	0.000	SCFM	0.000
T3GM01	0.000	SCFM	0.000
T4GM01	0.000	SCFM	0.000
TPGM03	0.000	SCFM	0.000
RPGM03	0.571	SCFM	0.066
T2GM02	0.000	SCFM	0.000
T3GM02	0.000	SCFM	0.000
T4GM02	0.000	SCFM	0.000
RPGP01	-0.261	PSIG	0.050
RPGP02	0.000	PSIG	0.000
RPGP03	0.000	PSIG	0.000
TPGP01	0.000	PSIG	0.000
TPGP02	0.000	PSIG	0.000
TPGP03	0.000	PSIG	0.000
T2GP01	0.000	PSIG	0.000
T3GP01	0.000	PSIG	0.000
T4GP01	0.000	PSIG	0.000
T2GP02	0.000	PSIG	0.000
T3GP02	0.000	PSIG	0.000
T4GP02	0.000	PSIG	0.000
T2GP03	0.000	PSIG	0.000
T3GP03	0.000	PSIG	0.000
T4GP03	0.000	PSIG	0.000
T2GP04	0.000	PSIG	0.000
T3GP04	0.000	PSIG	0.000
T4GP04	0.000	PSIG	0.000
T2GP05	0.000	PSIG	0.000
T3GP05	0.000	PSIG	0.000
T4GP05	0.000	PSIG	0.000
T2GP06	0.000	PSIG	0.000
T3GP06	0.000	PSIG	0.000
T4GP06	0.000	PSIG	0.000
R2GP06	0.000	PSIG	0.000
R3GP06	0.000	PSIG	0.000
R4GP06	0.000	PSIG	0.000
R2GP02	0.000	PSIG	0.000
R3GP02	0.000	PSIG	0.000
R4GP02	0.000	PSIG	0.000
R2GP03	0.000	PSIG	0.000
R3GP03	0.000	PSIG	0.000
R4GP03	0.000	PSIG	0.000
R2GP04	0.000	PSIG	0.000
R3GP04	0.000	PSIG	0.000

Test Number 965212

VTAB AVERAGE UNITS 2*SIGMA

R4GP04	0.000	PSIG	0.000
R2GP05	0.000	PSIG	0.000
R3GP05	0.000	- PSIG	0.000
R4GP05	0.000	PSIG	0.000
RTGP01	1.843	PSIG	0.004
T2LC01	0.000	LBM	0.000
T2LC02	0.000	LBM	0.000
T3LC01	0.000	LBM	0.000
T3LC02	0.000	LBM	0.000
T4LC01	0.000	LBM	0.000
T4LC02	0.000	LBM	0.000
R2DP01	0.000	PSI	0.000
R3DP01	0.000	PSI	0.000
R4DP01	0.000	PSI	0.000
R2DP02	0.000	PSI	0.000
R3DP02	0.000	PSI	0.000
R4DP02	0.000	PSI	0.000
RPLV01	5.826	IN-H2O	0.014
TPLV01	0.000	IN-H2O	0.000
TPMM22	0.000	LBM/HR	0.000
RPMM22	20243.816	LBM/HR	94.879
TPMM21	0.000	LBM/HR	0.000
RPMM21	0.529	LBM/HR	3.181
T2LC30	0.000	LBM/HR	0.000
T3LC30	0.000	LBM/HR	0.000
T4LC30	0.000	LBM/HR	0.000

Test Name: 965212, 16:55
Test Date: 14-MAR-91

Today's Date: 05-Apr-91

Mark 22 Fuel Assembly
Annular Flow Distribution - Uninstrumented Assembly Testing
Test Notes ==> 40.7 GPM; 4.30 FT. BFI BACK PRESS.; Water Temp. 70F; P/L; TP 65

Reference Fuel Assembly

		Value	Two Std Deviation	VTAB
** Water **				
Temperature (F):	<	73.5	0.51	RPTC01
Flow Rate (gpm):	<	40.5	0.19	RPMM01+ RPMM02
** Air **				
Temperature (F):	<	72.76	0.23	ASTC01
Flow Rate (scfm):	<	0.57	0.07	RPGM03
** INLET PLENUM **				
Pressure (psig):	<	-0.261	0.050	RPGP01
Level (in):	<	5.826	0.014	RPLV01
** BOTTOM FITTING AND REACTOR TANK **				
Pressure (psig):	<	1.843	0.004	RTGP01

AFD - TEST 965212, VTABLE CREATED: 13-MAR-91 18 20 23
14-MAR-91

AFD - TEST 965212; VTABLE CREATED: 13-MAR-91 18:20:23
14-MAR-91

AFD - TEST 965212; VTABLE CREATED: 13-MAR-91 18:20:23
14-MAR-91

Title: Uninstrumented Assembly Testing
Test date/time: 14-MAR-91, 21:31

Test: 965213
Test point: 66

SPECIFIED CONDITIONS:

Water Flow:	60.3 gpm	BFI Type:	P/L
Fluid Temp:	70 deg F	Piston Leakage:	0.00 scfm
Inlet Plenum Press.:	-0.22 psig		
Tank Water Level:	4.06 ft		

ACTUAL CONDITIONS (Uninstrumented Reference Assy.):

COMMENTS

Water Flow:	60.55 gpm	
Air Flow:	Inlet: 0.54 scfm	0-1.5 scfm Omega
	Outlet: 0.55 scfm	0-1.5 scfm Omega
Water Temperature:	70.4 deg F	
Air Temperature:	71.5 def F	
Inlet plenum pressure:	-0.23 psig	
Tank bottom pressure:	1.74 psig	
	(4.02 ft. H2O) (Tank Water Level)	
Inlet Plenum Level:	7.52 in. H2O	
Barometric pressure:	28.87 in. Hg at	72 deg F

Test Number 965213

VTAB AVERAGE UNITS 2*SIGMA

ASTC01	71.470	DEG F	0.257
TPTC01	0.000	DEC	0.000
RPTC01	70.412	DEG F	0.607
TPMM02	0.000	GPM	0.000
RPMM02	60.545	GPM	0.253
TPMM01	0.000	GPM	0.000
RPMM01	-0.037	GPM	0.091
TPGM01	0.000	SCFM	0.000
TPGM02	0.000	SCFM	0.000
RPGM01	0.158	SCFM	0.076
RPGM02	0.599	SCFM	0.020
RTGM02	0.549	SCFM	0.090
RTGM01	-0.259	SCFM	0.061
T2GM01	0.000	SCFM	0.000
T3GM01	0.000	SCFM	0.000
T4GM01	0.000	SCFM	0.000
TPGM03	0.000	SCFM	0.000
RPGM03	0.543	SCFM	0.026
T2GM02	0.000	SCFM	0.000
T3GM02	0.000	SCFM	0.000
T4GM02	0.000	SCFM	0.000
RPGP01	-0.229	PSIG	0.012
RPGP02	0.000	PSIG	0.000
RPGP03	0.000	PSIG	0.000
TPGP01	0.000	PSIG	0.000
TPGP02	0.000	PSIG	0.000
TPGP03	0.000	PSIG	0.000
T2GP01	0.000	PSIG	0.000
T3GP01	0.000	PSIG	0.000
T4GP01	0.000	PSIG	0.000
T2GP02	0.000	PSIG	0.000
T3GP02	0.000	PSIG	0.000
T4GP02	0.000	PSIG	0.000
T2GP03	0.000	PSIG	0.000
T3GP03	0.000	PSIG	0.000
T4GP03	0.000	PSIG	0.000
T2GP04	0.000	PSIG	0.000
T3GP04	0.000	PSIG	0.000
T4GP04	0.000	PSIG	0.000
T2GP05	0.000	PSIG	0.000
T3GP05	0.000	PSIG	0.000
T4GP05	0.000	PSIG	0.000
T2GP06	0.000	PSIG	0.000
T3GP06	0.000	PSIG	0.000
T4GP06	0.000	PSIG	0.000
R2GP06	0.000	PSIG	0.000
R3GP06	0.000	PSIG	0.000
R4GP06	0.000	PSIG	0.000
R2GP02	0.000	PSIG	0.000
R3GP02	0.000	PSIG	0.000
R4GP02	0.000	PSIG	0.000
R2GP03	0.000	PSIG	0.000
R3GP03	0.000	PSIG	0.000
R4GP03	0.000	PSIG	0.000
R2GP04	0.000	PSIG	0.000
R3GP04	0.000	PSIG	0.000

Test Number 965213
 VTAB AVERAGE UNITS 2*SIGMA

R4GP04	0.000	PSIG	0.000
R2GP05	0.000	PSIG	0.000
R3GP05	0.000	PSIG	0.000
R4GP05	0.000	PSIG	0.000
RTGP01	1.736	PSIG	0.005
T2LC01	0.000	LBM	0.000
T2LC02	0.000	LBM	0.000
T3LC01	0.000	LBM	0.000
T3LC02	0.000	LBM	0.000
T4LC01	0.000	LBM	0.000
T4LC02	0.000	LBM	0.000
R2DP01	0.000	PSI	0.000
R3DP01	0.000	PSI	0.000
R4DP01	0.000	PSI	0.000
R2DP02	0.000	PSI	0.000
R3DP02	0.000	PSI	0.000
R4DP02	0.000	PSI	0.000
RPLV01	7.523	IN-H2O	0.019
TPLV01	0.000	IN-H2O	0.000
TPMM22	0.000	LBM/HR	0.000
RPMM22	30229.805	LBM/HR	126.255
TPMM21	0.000	LBM/HR	0.000
RPMM21	2.253	LBM/HR	14.256
T2LC30	0.000	LBM/HR	0.000
T3LC30	0.000	LBM/HR	0.000
T4LC30	0.000	LBM/HR	0.000

Test Name: 965213, 21:31
Test Date: 14-MAR-91

Today's Date: 05-Apr-91

Mark 22 Fuel Assembly
Annular Flow Distribution - Uninstrumented Assembly Testing
Test Notes → 60.3 GPM; 4.06 FT. BFI BACK PRESS.; Water Temp. 70F; P/L; TP 66

Reference Fuel Assembly

		Value	Two Std Deviation VTAB	
** Water **				
Temperature (F):	<	70.4	0.61	RPTC01
Flow Rate (gpm):	<	60.5	0.25	RPMM01+ RPMM02
** Air **				
Temperature (F):	<	71.47	0.26	ASTC01
Flow Rate (scfm):	<	0.54	0.03	RPGM03

**** INLET PLENUM ****

Pressure (psig):	<	-0.229	0.012	RPGP01
Level (in):	<	7.523	0.018	RPLV01

**** BOTTOM FITTING AND REACTOR TANK ****

Pressure (psig):	<	1.736	0.006	RTGP01
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AFD - TEST 965213; VTABLE CREATED: 13-MAR-91 18 20:23
14-MAR-91

AFD - TEST 965213; VTABLE CREATED 13-MAR-91 18 20 23
 14-MAR-91

AFD - TEST 965213; VTABLE CREATED: 13-MAR-91 18:20:23
14-MAR-91

Title: Uninstrumented Assembly Testing
Test date/time: 15-1AR-91, 17:37

Test: 965216
Test point: 66

SPECIFIED CONDITIONS:

Water Flow:	60.3 gpm	BFI Type:	P/L
Fluid Temp:	70 deg F	Piston Leakage:	0.00 scfm
Inlet Plenum Press.:	-0.22 psig		
Tank Water Level:	4.06 ft		

ACTUAL CONDITIONS (Uninstrumented Reference Assy.):

COMMENTS

Water Flow:	60.12 gpm	
Air Flow:	Inlet: 1.35 scfm	0-1.5 scfm Omega
	Outlet: 1.25 scfm	0-1.5 scfm Omega
Water Temperature:	71.6 deg F	
Air Temperature:	69.2 deg F	
Inlet plenum pressure:	-0.25 psig	
Tank bottom pressure:	1.73 psig	
	(4.00 ft. H ₂ O) (Tank Water Level)	
Inlet Plenum Level:	7.56 in. H ₂ O	
Barometric pressure:	29.16 in. Hg at	76 deg F

Comments:

Repeat of test point 66 - performed to explore observed bistability phenomenon.

Test Number 965216

VTAB AVERAGE UNITS 2*SIGMA

ASTC01	69.241	DEG F	0.078
TPTC01	0.000	DEG F	0.000
RPTC01	71.592	DEG F	0.271
TPMM02	0.000	GPM	0.000
RPMM02	60.118	GPM	0.286
TPMM01	0.000	GPM	0.000
RPMM01	-0.047	GPM	0.086
TPGM01	0.000	SCFM	0.000
TPGM02	0.000	SCFM	0.000
RPGM01	1.315	SCFM	0.087
RPGM02	1.312	SCFM	0.044
RTGM02	1.245	SCFM	0.043
RTGM01	-0.226	SCFM	0.063
T2GM01	0.000	SCFM	0.000
T3GM01	0.000	SCFM	0.000
T4GM01	0.000	SCFM	0.000
TPGM03	0.000	SCFM	0.000
RPGM03	1.350	SCFM	0.080
T2GM02	0.000	SCFM	0.000
T3GM02	0.000	SCFM	0.000
T4GM02	0.000	SCFM	0.000
RPGP01	-0.248	PSIG	0.017
RPGP02	0.000	PSIG	0.000
RPGP03	0.000	PSIG	0.000
TPGP01	0.000	PSIG	0.000
TPGP02	0.000	PSIG	0.000
TPGP03	0.000	PSIG	0.000
T2GP01	0.000	PSIG	0.000
T3GP01	0.000	PSIG	0.000
T4GP01	0.000	PSIG	0.000
T2GP02	0.000	PSIG	0.000
T3GP02	0.000	PSIG	0.000
T4GP02	0.000	PSIG	0.000
T2GP03	0.000	PSIG	0.000
T3GP03	0.000	PSIG	0.000
T4GP03	0.000	PSIG	0.000
T2GP04	0.000	PSIG	0.000
T3GP04	0.000	PSIG	0.000
T4GP04	0.000	PSIG	0.000
T2GP05	0.000	PSIG	0.000
T3GP05	0.000	PSIG	0.000
T4GP05	0.000	PSIG	0.000
T2GP06	0.000	PSIG	0.000
T3GP06	0.000	PSIG	0.000
T4GP06	0.000	PSIG	0.000
R2GP06	0.000	PSIG	0.000
R3GP06	0.000	PSIG	0.000
R4GP06	0.000	PSIG	0.000
R2GP02	0.000	PSIG	0.000
R3GP02	0.000	PSIG	0.000
R4GP02	0.000	PSIG	0.000
R2GP03	0.000	PSIG	0.000
R3GP03	0.000	PSIG	0.000
R4GP03	0.000	PSIG	0.000
R2GP04	0.000	PSIG	0.000
R3GP04	0.000	PSIG	0.000

Test Number 965216

VTAB AVERAGE UNITS 2*SIGMA

R4GP04	0.000	PSIG	0.000
R2GP05	0.000	PSIG	0.000
R3GP05	0.000	-PSIG	0.000
R4GP05	0.000	PSIG	0.000
RTGP01	1.730	PSIG	0.007
T2LC01	0.000	LBM	0.000
T2LC02	0.000	LBM	0.000
T3LC01	0.000	LBM	0.000
T3LC02	0.000	LBM	0.000
T4LC01	0.000	LBM	0.000
T4LC02	0.000	LBM	0.000
R2DP01	0.000	PSI	0.000
R3DP01	0.000	PSI	0.000
R4DP01	0.000	PSI	0.000
R2DP02	0.000	PSI	0.000
R3DP02	0.000	PSI	0.000
R4DP02	0.000	PSI	0.000
RPLV01	7.555	IN-H2O	0.023
TPLV01	0.000	IN-H2O	0.000
TPMM22	0.000	LBM/HR	0.000
RPMM22	30016.957	LBM/HR	142.821
TPMM21	0.000	LBM/HR	0.000
RPMM21	0.053	LBM/HR	0.753
T2LC30	0.000	LBM/HR	0.000
T3LC30	0.000	LBM/HR	0.000
T4LC30	0.000	LBM/HR	0.000

Test Name: 965216, 17:37
Test Date: 15-MAR-91

Today's Date: 05-Apr-91

Mark 22 Fuel Assembly
Annular Flow Distribution - Uninstrumented Assembly Testing
Test Notes → 60.3 GPM; 4.06 FT. BFI BACK PRESS.; Water Temp. 70F; P/L; TP 66

Reference Fuel Assembly

		Value	Two Std Deviation	VTAB
** Water **				
Temperature (F):	<	71.6	0.27	RPTC01
Flow Rate (gpm):	<	60.1	0.29	RPM01+ RPM02
** Air **				
Temperature (F):	<	69.24	0.08	ASTC01
Flow Rate (scfm):	<	1.35	0.08	RPGM03
** INLET PLENUM **				
Pressure (psig):	<	-0.248	0.016	RPGP01
Level (in):	<	7.555	0.024	RPLV01
** BOTTOM FITTING AND REACTOR TANK **				
Pressure (psig):	<	1.730	0.006	RTGP01

AFD - TEST 965216, VTABLE CREATED 13-MAR-91 18 20 23
15-MAR-91

AFD - TEST 965216; VTABLE CREATED: 13-MAR-91 18 20 23
15-MAR-91

SCFM
A1-118

AFD - TEST 965216; VTABLE CREATED: 13-MAR-91 18 20 23
15-MAR-91

Title: Uninstrumented Assembly Testing
Test date/time: 16-MAR-91, 10:11

Test: 965217
Test point: 66

SPECIFIED CONDITIONS:

Water Flow:	60.3 gpm	BFI Type:	P/L
Fluid Temp: -	70 deg F	Piston Leakage:	0.00 scfm
Inlet Plenum Press.:	-0.22 psig		
Tank Water Level:	4.06 ft		

ACTUAL CONDITIONS (Uninstrumented Reference Assy.):

COMMENTS

Water Flow:	61.09 gpm *	
Air Flow:	Inlet: 0.55 scfm	0-1.5 scfm Omega
	Outlet: 0.51 scfm	0-1.5 scfm Omega
Water Temperature:	69.9 deg F	
Air Temperature:	71.6 deg F	
Inlet plenum pressure:	-0.21 psig	
Tank bottom pressure:	1.75 psig	
	(4.05 ft. H2O) (Tank Water Level)	
Inlet Plenum Level:	7.60 in. H2O	
Barometric pressure:	29.34 in. Hg at	76 deg F

* Actual water flow rate was 0.79 gpm above target value (0.29 gpm out of spec.).

Comments:

Repeat of test point 66 - performed to explore observed bistability phenomenon.

Test Number 965217

VTAB AVERAGE UNITS 2*SIGMA

ASTC01	71.586	DEG F	0.270
TPTC01	0.000	-DEG F	0.000
RPTC01	69.870	DEG F	0.584
TPMM02	0.000	GPM	0.000
RPMM02	61.092	GPM	0.383
TPMM01	0.000	GPM	0.000
RPMM01	0.036	GPM	0.088
TPGM01	0.000	SCFM	0.000
TPGM02	0.000	SCFM	0.000
RPGM01	0.175	SCFM	0.078
RPGM02	0.587	SCFM	0.021
RTGM02	0.513	SCFM	0.081
RTGM01	-0.161	SCFM	0.061
T2GM01	0.000	SCFM	0.000
T3GM01	0.000	SCFM	0.000
T4GM01	0.000	SCFM	0.000
TPGM03	0.000	SCFM	0.000
RPGM03	0.546	SCFM	0.028
T2GM02	0.000	SCFM	0.000
T3GM02	0.000	SCFM	0.000
T4GM02	0.000	SCFM	0.000
RPGP01	-0.213	PSIG	0.011
RPGP02	0.000	PSIG	0.000
RPGP03	0.000	PSIG	0.000
TPGP01	0.000	PSIG	0.000
TPGP02	0.000	PSIG	0.000
TPGP03	0.000	PSIG	0.000
T2GP01	0.000	PSIG	0.000
T3GP01	0.000	PSIG	0.000
T4GP01	0.000	PSIG	0.000
T2GP02	0.000	PSIG	0.000
T3GP02	0.000	PSIG	0.000
T4GP02	0.000	PSIG	0.000
T2GP03	0.000	PSIG	0.000
T3GP03	0.000	PSIG	0.000
T4GP03	0.000	PSIG	0.000
T2GP04	0.000	PSIG	0.000
T3GP04	0.000	PSIG	0.000
T4GP04	0.000	PSIG	0.000
T2GP05	0.000	PSIG	0.000
T3GP05	0.000	PSIG	0.000
T4GP05	0.000	PSIG	0.000
T2GP06	0.000	PSIG	0.000
T3GP06	0.000	PSIG	0.000
T4GP06	0.000	PSIG	0.000
R2GP06	0.000	PSIG	0.000
R3GP06	0.000	PSIG	0.000
R4GP06	0.000	PSIG	0.000
R2GP02	0.000	PSIG	0.000
R3GP02	0.000	PSIG	0.000
R4GP02	0.000	PSIG	0.000
R2GP03	0.000	PSIG	0.000
R3GP03	0.000	PSIG	0.000
R4GP03	0.000	PSIG	0.000
R2GP04	0.000	PSIG	0.000
R3GP04	0.000	PSIG	0.000

Test Number 965217

VTAB AVERAGE UNITS 2*SIGMA

R4GP04	0.000	PSIG	0.000
R2GP05	0.000	PSIG	0.000
R3GP05	0.000	PSIG	0.000
R4GP05	0.000	PSIG	0.000
RTGP01	1.752	PSIG	0.005
T2LC01	0.000	LBM	0.000
T2LC02	0.000	LBM	0.000
T3LC01	0.000	LBM	0.000
T3LC02	0.000	LBM	0.000
T4LC01	0.000	LBM	0.000
T4LC02	0.000	LBM	0.000
R2DP01	0.000	PSI	0.000
R3DP01	0.000	PSI	0.000
R4DP01	0.000	PSI	0.000
R2DP02	0.000	PSI	0.000
R3DP02	0.000	PSI	0.000
R4DP02	0.000	PSI	0.000
RPLV01	7.603	IN-H2O	0.035
TPLV01	0.000	IN-H2O	0.000
TPMM22	0.000	LBM/HR	0.000
RPMM22	30502.984	LBM/HR	191.398
TPMM21	0.000	LBM/HR	0.000
RPMM21	20.265	LBM/HR	31.459
T2LC30	0.000	LBM/HR	0.000
T3LC30	0.000	LBM/HR	0.000
T4LC30	0.000	LBM/HR	0.000

Test Name: 965217, 10:11
Test Date: 16-MAR-91

Today's Date: 05-Apr-91

Mark 22 Fuel Assembly
Annular Flow Distribution - Uninstrumented Assembly Testing
Test Notes ==> 60.3 GPM; 4.06 FT. BFI BACK PRESS.; Water Temp. 70F; P/L; TP 66

Reference Fuel Assembly

		Value	Two Std Deviation	VTAB
** Water **				
Temperature (F):	<	69.9	0.58	RPTC01
Flow Rate (gpm):	<	61.1	0.38	RPM01+ RPM02
** Air **				
Temperature (F):	<	71.59	0.27	ASTC01
Flow Rate (scfm):	<	0.55	0.03	RPGM03
** INLET PLENUM **				
Pressure (psig):	<	-0.213	0.010	RPGP01
Level (in):	<	7.603	0.036	RPLV01
** BOTTOM FITTING AND REACTOR TANK **				
Pressure (psig):	<	1.752	0.004	RTGP01

AFD - TEST 965217; VTABLE CREATED 13-MAR-91 18 20 23
16-MAR-91

AFD - TEST 965217; VTABLE CREATED: 13-MAR-91 18 20 23
16-MAR-91

AFD - TEST 965217; VTABLE CREATED 13-MAR-91 18:20 23
 16-MAR-91

SCFM

A1-126

Title: Uninstrumented Assembly Testing
Test date/time: 16-MAR-91, 13:17

Test: 965218
Test point: 66

SPECIFIED CONDITIONS:

Water Flow:	-	60.3 gpm	BFI Type:	P/L
Fluid Temp:		70 deg F	Piston Leakage:	0.00 scfm
Inlet Plenum Press.:		-0.22 psig		
Tank Water Level:		4.06 ft		

ACTUAL CONDITIONS (Uninstrumented Reference Assy.):

COMMENTS

Water Flow:	51.22 gpm *	
Air Flow:	Inlet: 1.39 scfm	0-1.5 scfm Omega
	Outlet: 1.25 scfm	0-1.5 scfm Omega
Water Temperature:	68.6 deg F	
Air Temperature:	67.8 deg F	
Inlet plenum pressure:	-0.25 psig	
Tank bottom pressure:	1.75 psig	
	(4.05 ft. H2O) (Tank Water Level)	
Inlet Plenum Level:	7.58 in. H2O	
Barometric pressure:	29.28 in. Hg at	74 deg F

* Actual water flow rate was 0.92 gpm above target value (0.42 gpm out of spec.).

Comments:

Repeat of test point 66 - performed to explore observed bistability phenomenon.

Test Number 965218

VTAB AVERAGE UNITS 2*SIGMA

ASTC01	67.778	DEG F	0.228
TPTC01	0.000	DEG F	0.000
RPTC01	68.572	DEG F	0.417
TPMM02	0.000	GPM	0.000
RPMM02	61.222	GPM	0.311
TPMM01	0.000	GPM	0.000
RPMM01	0.024	GPM	0.092
TPGM01	0.000	SCFM	0.000
TPGM02	0.000	SCFM	0.000
RPGM01	1.414	SCFM	0.095
RPGM02	1.324	SCFM	0.046
RTGM02	1.253	SCFM	0.053
RTGM01	-0.123	SCFM	0.061
T2GM01	0.000	SCFM	0.000
T3GM01	0.000	SCFM	0.000
T4GM01	0.000	SCFM	0.000
TPGM03	0.000	SCFM	0.000
RPGM03	1.394	SCFM	0.084
T2GM02	0.000	SCFM	0.000
T3GM02	0.000	SCFM	0.000
T4GM02	0.000	SCFM	0.000
RPGP01	-0.247	PSIG	0.016
RPGP02	0.000	PSIG	0.000
RPGP03	0.000	PSIG	0.000
TPGP01	0.000	PSIG	0.000
TPGP02	0.000	PSIG	0.000
TPGP03	0.000	PSIG	0.000
T2GP01	0.000	PSIG	0.000
T3GP01	0.000	PSIG	0.000
T4GP01	0.000	PSIG	0.000
T2GP02	0.000	PSIG	0.000
T3GP02	0.000	PSIG	0.000
T4GP02	0.000	PSIG	0.000
T2GP03	0.000	PSIG	0.000
T3GP03	0.000	PSIG	0.000
T4GP03	0.000	PSIG	0.000
T2GP04	0.000	PSIG	0.000
T3GP04	0.000	PSIG	0.000
T4GP04	0.000	PSIG	0.000
T2GP05	0.000	PSIG	0.000
T3GP05	0.000	PSIG	0.000
T4GP05	0.000	PSIG	0.000
T2GP06	0.000	PSIG	0.000
T3GP06	0.000	PSIG	0.000
T4GP06	0.000	PSIG	0.000
R2GP06	0.000	PSIG	0.000
R3GP06	0.000	PSIG	0.000
R4GP06	0.000	PSIG	0.000
R2GP02	0.000	PSIG	0.000
R3GP02	0.000	PSIG	0.000
R4GP02	0.000	PSIG	0.000
R2GP03	0.000	PSIG	0.000
R3GP03	0.000	PSIG	0.000
R4GP03	0.000	PSIG	0.000
R2GP04	0.000	PSIG	0.000
R3GP04	0.000	PSIG	0.000

Test Number 965218

VTAB AVERAGE UNITS 2*SIGMA

R4GP04	0.000	PSIG	0.000
R2GP05	0.000	PSIG	0.000
R3GP05	0.000	PSIG	0.000
R4GP05	0.000	PSIG	0.000
RTGP01	1.752	PSIG	0.008
T2LC01	0.000	LBM	0.000
T2LC02	0.000	LBM	0.000
T3LC01	0.000	LBM	0.000
T3LC02	0.000	LBM	0.000
T4LC01	0.000	LBM	0.000
T4LC02	0.000	LBM	0.000
R2DP01	0.000	PSI	0.000
R3DP01	0.000	PSI	0.000
R4DP01	0.000	PSI	0.000
R2DP02	0.000	PSI	0.000
R3DP02	0.000	PSI	0.000
R4DP02	0.000	PSI	0.000
RPLV01	7.581	IN-H2O	0.023
TPLV01	0.000	IN-H2O	0.000
TPMM22	0.000	LBM/HR	0.000
RPMM22	30568.055	LBM/HR	155.375
TPMM21	0.000	LBM/HR	0.000
RPMM21	14.536	LBM/HR	29.780
T2LC30	0.000	LBM/HR	0.000
T3LC30	0.000	LBM/HR	0.000
T4LC30	0.000	LBM/HR	0.000

Test Name: 965218, 13:17
Test Date: 16-MAR-91

Today's Date: 05-Apr-91

Mark 22 Fuel Assembly
Annular Flow Distribution - Uninstrumented Assembly Testing
Test Notes ==> 60.3 GPM; 4.06 FT. BFI BACK PRESS.; Water Temp. 70F; P/L; TP 66

Reference Fuel Assembly

		Value	Two Std Deviation	VTAB
** Water **				
Temperature (F):	<	68.6	0.42	RPTC01
Flow Rate (gpm):	<	61.2	0.31	RPM01+ RPM02
** Air **				
Temperature (F):	<	67.78	0.23	ASTC01
Flow Rate (scfm):	<	1.39	0.08	RPGM03
** INLET PLENUM **				
Pressure (psig):	<	-0.247	0.016	RPGP01
Level (in):	<	7.581	0.024	RPLV01
** BOTTOM FITTING AND REACTOR TANK **				
Pressure (psig):	<	1.752	0.008	RTGP01

AFD - TEST 965218; VTABLE CREATED: 13-MAR-91 18 20 23
16-MAR-91

P S I C

A1-131

AFD - TEST 965218; VTABLE CREATED: 13-MAR-91 18:20:23
16-MAR-91

AFD - TEST 965218; VTABLE CREATED: 13-MAR-91 18:20:23
16-MAR-91

Title: Uninstrumented Assembly Testing
Test date/time: 15-MAR-91, 12:56

Test: 965214
Test point: 67

SPECIFIED CONDITIONS:

Water Flow: 69.6 gpm
Fluid Temp: 70 deg F
Inlet Plenum Press.: -0.22 psig
Tank Water Level: 4.02 ft

BFI Type: P/L
Piston Leakage: 0.00 scfm

ACTUAL CONDITIONS (Uninstrumented Reference Assy.):

COMMENTS

Water Flow: 70.20 gpm *

Air Flow: Inlet: 1.39 scfm
Outlet: 1.30 scfm

0-1.5 scfm Omega
0-1.5 scfm Omega

Water Temperature: 70.7 deg F

Air Temperature: 72.2 deg F

Inlet plenum pressure: -0.25 psig

Tank bottom pressure: 1.73 psig
(4.00 ft. H2O) (Tank Water Level)

Inlet Plenum Level: 8.23 in. H2O

Barometric pressure: 29.13 in. Hg at 74 deg F

* Actual water flow rate was 0.6 gpm above target value (0.1 gpm out of spec.).

Test Number 965214

VTAB AVERAGE UNITS 2*SIGMA

ASTC01	72.222	DEG F	0.237
TPTC01	0.000	DEG F	0.000
RPTC01	70.673	DEG F	0.464
TPMM02	0.000	GPM	0.000
RPMM02	70.202	GPM	0.456
TPMM01	0.000	GPM	0.000
RPMM01	-0.056	GPM	0.122
TPGM01	0.000	SCFM	0.000
TPGM02	0.000	SCFM	0.000
RPGM01	1.358	SCFM	0.124
RPGM02	1.336	SCFM	0.082
RTGM02	1.297	SCFM	0.052
RTGM01	-0.239	SCFM	0.063
T2GM01	0.000	SCFM	0.000
T3GM01	0.000	SCFM	0.000
T4GM01	0.000	SCFM	0.000
TPGM03	0.000	SCFM	0.000
RPGM03	1.394	SCFM	0.125
T2GM02	0.000	SCFM	0.000
T3GM02	0.000	SCFM	0.000
T4GM02	0.000	SCFM	0.000
RPGP01	-0.248	PSIG	0.022
RPGP02	0.000	PSIG	0.000
RPGP03	0.000	PSIG	0.000
TPGP01	0.000	PSIG	0.000
TPGP02	0.000	PSIG	0.000
TPGP03	0.000	PSIG	0.000
T2GP01	0.000	PSIG	0.000
T3GP01	0.000	PSIG	0.000
T4GP01	0.000	PSIG	0.000
T2GP02	0.000	PSIG	0.000
T3GP02	0.000	PSIG	0.000
T4GP02	0.000	PSIG	0.000
T2GP03	0.000	PSIG	0.000
T3GP03	0.000	PSIG	0.000
T4GP03	0.000	PSIG	0.000
T2GP04	0.000	PSIG	0.000
T3GP04	0.000	PSIG	0.000
T4GP04	0.000	PSIG	0.000
T2GP05	0.000	PSIG	0.000
T3GP05	0.000	PSIG	0.000
T4GP05	0.000	PSIG	0.000
T2GP06	0.000	PSIG	0.000
T3GP06	0.000	PSIG	0.000
T4GP06	0.000	PSIG	0.000
R2GP06	0.000	PSIG	0.000
R3GP06	0.000	PSIG	0.000
R4GP06	0.000	PSIG	0.000
R2GP02	0.000	PSIG	0.000
R3GP02	0.000	PSIG	0.000
R4GP02	0.000	PSIG	0.000
R2GP03	0.000	PSIG	0.000
R3GP03	0.000	PSIG	0.000
R4GP03	0.000	PSIG	0.000
R2GP04	0.000	PSIG	0.000
R3GP04	0.000	PSIG	0.000

Test Number 965214

VTAB AVERAGE UNITS 2*SIGMA

R4GP04	0.000	PSIG	0.000
R2GP05	0.000	PSIG	0.000
R3GP05	0.000	PSIG	0.000
R4GP05	0.000	PSIG	0.000
RTGP01	1.728	PSIG	0.008
T2LC01	0.000	LBM	0.000
T2LC02	0.000	LBM	0.000
T3LC01	0.000	LBM	0.000
T3LC02	0.000	LBM	0.000
T4LC01	0.000	LBM	0.000
T4LC02	0.000	LBM	0.000
R2DP01	0.000	PSI	0.000
R3DP01	0.000	PSI	0.000
R4DP01	0.000	PSI	0.000
R2DP02	0.000	PSI	0.000
R3DP02	0.000	PSI	0.000
R4DP02	0.000	PSI	0.000
RPLV01	8.232	IN-H2O	0.041
TPLV01	0.000	IN-H2O	0.000
TPMM22	0.000	LBM/HR	0.000
RPMM22	35051.703	LBM/HR	227.722
TPMM21	0.000	LBM/HR	0.000
RPMM21	1.444	LBM/HR	11.620
T2LC30	0.000	LBM/HR	0.000
T3LC30	0.000	LBM/HR	0.000
T4LC30	0.000	LBM/HR	0.000

Test Name: 965214, 12:56
Test Date: 15-MAR-91

Today's Date: 05-Apr-91

Mark 22 Fuel Assembly
Annular Flow Distribution - Uninstrumented Assembly Testing
Test Notes ==> 69.6 GPM; 4.02 FT. BFI BACK PRESS.; Water Temp. 70F; P/L; TP 67

Reference Fuel Assembly

		Value	Two Std Deviation	VTAB
** Water **				
Temperature (F):	<	70.7	0.46	RPTC01
Flow Rate (gpm):	<	70.2	0.46	RPTM01+ RPTM02
** Air **				
Temperature (F):	<	72.22	0.24	ASTC01
Flow Rate (scfm):	<	1.39	0.12	RPGM03

**** INLET PLENUM ****

Pressure (psig):	<	-0.248	0.022	RPGP01
Level (in):	<	8.232	0.040	RPLV01

**** BOTTOM FITTING AND REACTOR TANK ****

Pressure (psig):	<	1.728	0.008	RTGP01
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AFD - TEST 965214; VTABLE CREATED 13-MAR-91 18:20 23
15-MAR-91

AFD - TEST 965214; VTABLE CREATED: 13-MAR-91 18:20:23
15-MAR-91

SCFM
AI-139

AFD - TEST 965214; VTABLE CREATED 13-MAR-91 18 20 23
15-MAR-91

SCFM
A1-140

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3 of 4

Title: Uninstrumented Assembly Testing
Test date/time: 15-MAR-91, 14:32

Test: 96:215
Test point: 68

SPECIFIED CONDITIONS:

Water Flow:	20.2 gpm	BFI Type:	P/L
Fluid Temp: -	70 deg F	Piston Leakage:	0.00 scfm
Inlet Plenum Press.:	-0.05 psig		
Tank Water Level:	2.52 ft		

ACTUAL CONDITIONS (Uninstrumented Reference Assy.):

COMMENTS

Water Flow:	20.27 gpm	
Air Flow: Inlet:	0.18 scfm	0-1.5 scfm Omega
Outlet:	0.19 scfm	0-1.5 scfm Omega
Water Temperature:	71.1 deg F	
Air Temperature:	73.3 deg F	
Inlet plenum pressure:	-0.05 psig	
Tank bottom pressure:	1.08 psig (2.49 ft. H2O) (Tank Water Level)	
Inlet Plenum Level:	3.73 in. H2O	
Barometric pressure:	29.13 in. Hg at 75 deg F	

Comments:

Repeat of test point 53 - performed to confirm test repeatability.

Test Number 965215

VTAB	AVERAGE	UNITS	2*SIGMA
ASTC01	73.338	DEG F	0.335
TPTC01	0.000	DEG F	0.000
RPTC01	71.146	DEG F	0.510
TPMM02	0.000	GPM	0.000
RPMM02	20.266	GPM	0.124
TPMM01	0.000	GPM	0.000
RPMM01	-0.046	GPM	0.052
TPGM01	0.000	SCFM	0.000
TPGM02	0.000	SCFM	0.000
RPGM01	-0.307	SCFM	0.077
RPGM02	0.158	SCFM	0.015
RTGM02	0.193	SCFM	0.043
RTGM01	-0.218	SCFM	0.062
T2GM01	0.000	SCFM	0.000
T3GM01	0.000	SCFM	0.000
T4GM01	0.000	SCFM	0.000
TPGM03	0.000	SCFM	0.000
RPGM03	0.182	SCFM	0.034
T2GM02	0.000	SCFM	0.000
T3GM02	0.000	SCFM	0.000
T4GM02	0.000	SCFM	0.000
RPGP01	-0.047	PSIG	0.008
RPGP02	0.000	PSIG	0.000
RPGP03	0.000	PSIG	0.000
TPGP01	0.000	PSIG	0.000
TPGP02	0.000	PSIG	0.000
TPGP03	0.000	PSIG	0.000
T2GP01	0.000	PSIG	0.000
T3GP01	0.000	PSIG	0.000
T4GP01	0.000	PSIG	0.000
T2GP02	0.000	PSIG	0.000
T3GP02	0.000	PSIG	0.000
T4GP02	0.000	PSIG	0.000
T2GP03	0.000	PSIG	0.000
T3GP03	0.000	PSIG	0.000
T4GP03	0.000	PSIG	0.000
T2GP04	0.000	PSIG	0.000
T3GP04	0.000	PSIG	0.000
T4GP04	0.000	PSIG	0.000
T2GP05	0.000	PSIG	0.000
T3GP05	0.000	PSIG	0.000
T4GP05	0.000	PSIG	0.000
T2GP06	0.000	PSIG	0.000
T3GP06	0.000	PSIG	0.000
T4GP06	0.000	PSIG	0.000
R2GP06	0.000	PSIG	0.000
R3GP06	0.000	PSIG	0.000
R4GP06	0.000	PSIG	0.000
R2GP02	0.000	PSIG	0.000
R3GP02	0.000	PSIG	0.000
R4GP02	0.000	PSIG	0.000
R2GP03	0.000	PSIG	0.000
R3GP03	0.000	PSIG	0.000
R4GP03	0.000	PSIG	0.000
R2GP04	0.000	PSIG	0.000
R3GP04	0.000	PSIG	0.000

Test Number 965215

VTAB AVERAGE UNITS 2*SIGMA

R4GP04	0.000	PSIG	0.000
R2GP05	0.000	PSIG	0.000
R3GP05	0.000	PSIG	0.000
R4GP05	0.000 -	PSIG	0.000
RTGP01	1.078	PSIG	0.002
T2LC01	0.000	LBM	0.000
T2LC02	0.000	LBM	0.000
T3LC01	0.000	LBM	0.000
T3LC02	0.000	LBM	0.000
T4LC01	0.000	LBM	0.000
T4LC02	0.000	LBM	0.000
R2DP01	0.000	PSI	0.000
R3DP01	0.000	PSI	0.000
R4DP01	0.000	PSI	0.000
R2DP02	0.000	PSI	0.000
R3DP02	0.000	PSI	0.000
R4DP02	0.000	PSI	0.000
RPLV01	3.728	IN-H2O	0.020
TPLV01	0.000	IN-H2O	0.000
TPMM22	0.000	LBM/HR	0.000
RPMM22	10118.656	LBM/HR	61.866
TPMM21	0.000	LBM/HR	0.000
RPMM21	0.000	LBM/HR	0.000
T2LC30	0.000	LBM/HR	0.000
T3LC30	0.000	LBM/HR	0.000
T4LC30	0.000	LBM/HR	0.000

Test Name: 965215, 14:32
Test Date: 15-MAR-91

Today's Date: 05-Apr-91

Mark 22 Fuel Assembly
Annular Flow Distribution - Uninstrumented Assembly Testing
Test Notes ==> 20.2 GPM; 2.52 FT. BFI BACK PRESS.; Water Temp. 70F; P/L; TP 68

Reference Fuel Assembly

		Value	Two Std Deviation	VTAB
** Water **				
Temperature (F):	<	71.1	0.51	RPTC01
Flow Rate (gpm):	<	20.3	0.12	RPMM01+ RPMM02
** Air **				
Temperature (F):	<	73.34	0.33	ASTC01
Flow Rate (scfm):	<	0.18	0.03	RPGM03
** INLET PLENUM **				
Pressure (psig):	<	-0.047	0.008	RPGP01
Level (in):	<	3.728	0.020	RPLV01
** BOTTOM FITTING AND REACTOR TANK **				
Pressure (psig):	<	1.078	0.002	RTGP01

AFD - TEST 965215, VTABLE CREATED 13-MAR-91 18 20 23
15-MAR-91

AFD - TEST 965215, VTABLE CREATED 13-MAR-91 18 20 23
15-MAR-91

SCFM

A1-146

AFD - TEST 965215, VTABLE CREATED 13-MAR-91 18 20 23
15-MAR-91

Title: Uninstrumented Assembly Testing
Test date/time: 18-MAR-91, 09:59

Test: 965219
Test point: 69

SPECIFIED CONDITIONS:

Water Flow:	24.0 gpm	BFI Type:	P/L
Fluid Temp:	70 deg F	Piston Leakage:	0.00 scfm
Inlet Plenum Press.:	0 psig		
Tank Water Level:	3.30 ft		

ACTUAL CONDITIONS (Uninstrumented Reference Assy.):

COMMENTS

Water Flow:	23.75 gpm	
Air Flow:	Inlet: 0.22 scfm	0-1.5 scfm Omega
	Outlet: 0.23 scfm	0-1.5 scfm Omega
Water Temperature:	67.5 deg F	
Air Temperature:	67.6 def F	
Inlet plenum pressure:	-0.02 psig	
Tank bottom pressure:	1.42 psig	
	(3.29 ft. H2O) (Tank Water Level)	
Inlet Plenum Level:	4.10 in. H2O	
Barometric pressure:	28.53 in. Hg at	72 deg F

Comments:

Repeat of test point 1 (ARC-TP-965) - performed to confirm repeatability of previous (instrumented fuel assembly) ARC tests.

Test Number 965219

VTAB	AVERAGE	UNITS	2*SIGMA
ASTC01	67.613	DEG F	0.241
TPTC01	0.000	DEG F	0.000
RPTC01	67.536 -	DEG F	0.504
TPMM02	0.000	GPM	0.000
RPMM02	23.750	GPM	0.203
TPMM01	0.000	GPM	0.000
RPMM01	0.002	GPM	0.052
TPGM01	0.000	SCFM	0.000
TPGM02	0.000	SCFM	0.000
RPGM01	-0.139	SCFM	0.079
RPGM02	0.214	SCFM	0.033
RTGM02	0.230	SCFM	0.053
RTGM01	-0.231	SCFM	0.063
T2GM01	0.000	SCFM	0.000
T3GM01	0.000	SCFM	0.000
T4GM01	0.000	SCFM	0.000
TPGM03	0.000	SCFM	0.000
RPGM03	0.219	SCFM	0.142
T2GM02	0.000	SCFM	0.000
T3GM02	0.000	SCFM	0.000
T4GM02	0.000	SCFM	0.000
RPGP01	-0.019	PSIG	0.005
RPGP02	0.000	PSIG	0.000
RPGP03	0.000	PSIG	0.000
TPGP01	0.000	PSIG	0.000
TPGP02	0.000	PSIG	0.000
TPGP03	0.000	PSIG	0.000
T2GP01	0.000	PSIG	0.000
T3GP01	0.000	PSIG	0.000
T4GP01	0.000	PSIG	0.000
T2GP02	0.000	PSIG	0.000
T3GP02	0.000	PSIG	0.000
T4GP02	0.000	PSIG	0.000
T2GP03	0.000	PSIG	0.000
T3GP03	0.000	PSIG	0.000
T4GP03	0.000	PSIG	0.000
T2GP04	0.000	PSIG	0.000
T3GP04	0.000	PSIG	0.000
T4GP04	0.000	PSIG	0.000
T2GP05	0.000	PSIG	0.000
T3GP05	0.000	PSIG	0.000
T4GP05	0.000	PSIG	0.000
T2GP06	0.000	PSIG	0.000
T3GP06	0.000	PSIG	0.000
T4GP06	0.000	PSIG	0.000
R2GP06	0.000	PSIG	0.000
R3GP06	0.000	PSIG	0.000
R4GP06	0.000	PSIG	0.000
R2GP02	0.000	PSIG	0.000
R3GP02	0.000	PSIG	0.000
R4GP02	0.000	PSIG	0.000
R2GP03	0.000	PSIG	0.000
R3GP03	0.000	PSIG	0.000
R4GP03	0.000	PSIG	0.000
R2GP04	0.000	PSIG	0.000
R3GP04	0.000	PSIG	0.000

Test Number 965219

VTAB AVERAGE UNITS 2*SIGMA

R4GP04	0.000	PSIG	0.000
R2GP05	0.000	PSIG	0.000
R3GP05	0.000	PSIG	0.000
R4GP05	0.000	PSIG	0.000
RTGP01	1.423	PSIG	0.002
T2LC01	0.000	LBM	0.000
T2LC02	0.000	LBM	0.000
T3LC01	0.000	LBM	0.000
T3LC02	0.000	LBM	0.000
T4LC01	0.000	LBM	0.000
T4LC02	0.000	LBM	0.000
R2DP01	0.000	PSI	0.000
R3DP01	0.000	PSI	0.000
R4DP01	0.000	PSI	0.000
R2DP02	0.000	PSI	0.000
R3DP02	0.000	PSI	0.000
R4DP02	0.000	PSI	0.000
RPLV01	4.101	IN-H2O	0.016
TPLV01	0.000	IN-H2O	0.000
TPMM22	0.000	LBM/HR	0.000
RPMM22	11858.441	LBM/HR	101.390
TPMM21	0.000	LBM/HR	0.000
RPMM21	3.232	LBM/HR	10.776
T2LC30	0.000	LBM/HR	0.000
T3LC30	0.000	LBM/HR	0.000
T4LC30	0.000	LBM/HR	0.000

Test Name: 965219, 09:59
Test Date: 18-MAR-91

Today's Date: 05-Apr-91

Mark 22 Fuel Assembly
Annular Flow Distribution - Uninstrumented Assembly Testing
Test Notes ==> 24.0 GPM; 3.3 FT. BFI BACK PRESS.; Water Temp. 70F; P/L; TP 69

Reference Fuel Assembly

		Value	Two Std Deviation	VTAB
** Water **				
Temperature (F):	<	67.5	0.50	RPTC01
Flow Rate (gpm):	<	23.8	0.20	RPMM01+ RPMM02
** Air **				
Temperature (F):	<	67.61	0.24	ASTC01
Flow Rate (scfm):	<	0.22	0.14	RPGM03
** INLET PLENUM **				
Pressure (psig):	<	-0.019	0.006	RPGP01
Level (in):	<	4.101	0.016	RPLV01
** BOTTOM FITTING AND REACTOR TANK **				
Pressure (psig):	<	1.423	0.002	RTGP01

AFD - TEST 965219; VTABLE CREATED: 13-MAR-91 18 20 23
18-MAR-91

P S I G
AI-152

AFD - TEST 965219, VTABLE CREATED 13-MAR-91 18 20:23
18-MAR-91

S C F M

A1-153

AFD - TEST 965219; VTABLE CREATED: 13-MAR-91 18:20:23
18-MAR-91

SCFM

A1-154

Title: Uninstrumented Assembly Testing
Test date/time: 18-MAR-91, 11:28

Test: 965220
Test point: 70

SPECIFIED CONDITIONS:

Water Flow:	24.0 gpm	BFI Type:	P/L
Fluid Temp:	70 deg F	Piston Leakage:	0.00 scfm
Inlet Plenum Press.:	1 psig		
Tank Water Level:	3.30 ft		

ACTUAL CONDITIONS (Uninstrumented Reference Assy.):

COMMENTS

Water Flow:	24.27 gpm	
Air Flow:	Inlet: 1.76 scfm	0-25 scfm Kurz
	Outlet: 2.19 scfm	0-150 scfm Kurz
Water Temperature:	67.3 deg F	
Air Temperature:	66.1 deg F	
Inlet plenum pressure:	0.95 psig	
Tank bottom pressure:	1.43 psig	
	(3.30 ft. H2O) (Tank Water Level)	
Inlet Plenum Level:	4.25 in. H2O	
Barometric pressure:	28.5 in. Hg at	68 deg F

Comments:

Repeat of test point 2 (ARC-TP-965) - performed to confirm repeatability of previous (instrumented fuel assembly) ARC tests.

Test point approached directly from conditions of test point 69.

Test Number 965220

VTAB	AVERAGE	UNITS	2*SIGMA
ASTC01	66.133	DEG F	0.183
TPTC01	0.000	DEG F	0.000
RPTC01	67.265	DEG F	0.437
TPMM02	0.000	GPM	0.000
RPMM02	24.266	GPM	0.153
TPMM01	0.000	GPM	0.000
RPMM01	0.019	GPM	0.062
TPGM01	0.000	SCFM	0.000
TPGM02	0.000	SCFM	0.000
RPGM01	1.733	SCFM	0.075
RPGM02	1.761	SCFM	0.046
RTGM02	0.022	SCFM	0.010
RTGM01	2.193	SCFM	0.093
T2GM01	0.000	SCFM	0.000
T3GM01	0.000	SCFM	0.000
T4GM01	0.000	SCFM	0.000
T2GM03	0.000	SCFM	0.000
RPGM03	1.563	SCFM	0.006
T2GM02	0.000	SCFM	0.000
T3GM02	0.000	SCFM	0.000
T4GM02	0.000	SCFM	0.000
RPGP01	0.953	PSIG	0.022
RPGP02	0.000	PSIG	0.000
RPGP03	0.000	PSIG	0.000
TPGP01	0.000	PSIG	0.000
TPGP02	0.000	PSIG	0.000
TPGP03	0.000	PSIG	0.000
T2GP01	0.000	PSIG	0.000
T3GP01	0.000	PSIG	0.000
T4GP01	0.000	PSIG	0.000
T2GP02	0.000	PSIG	0.000
T3GP02	0.000	PSIG	0.000
T4GP02	0.000	PSIG	0.000
T2GP03	0.000	PSIG	0.000
T3GP03	0.000	PSIG	0.000
T4GP03	0.000	PSIG	0.000
T2GP04	0.000	PSIG	0.000
T3GP04	0.000	PSIG	0.000
T4GP04	0.000	PSIG	0.000
T2GP05	0.000	PSIG	0.000
T3GP05	0.000	PSIG	0.000
T4GP05	0.000	PSIG	0.000
T2GP06	0.000	PSIG	0.000
T3GP06	0.000	PSIG	0.000
T4GP06	0.000	PSIG	0.000
R2GP06	0.000	PSIG	0.000
R3GP06	0.000	PSIG	0.000
R4GP06	0.000	PSIG	0.000
R2GP02	0.000	PSIG	0.000
R3GP02	0.000	PSIG	0.000
R4GP02	0.000	PSIG	0.000
R2GP03	0.000	PSIG	0.000
R3GP03	0.000	PSIG	0.000
R4GP03	0.000	PSIG	0.000
R2GP04	0.000	PSIG	0.000
R3GP04	0.000	PSIG	0.000

Test Number 965220
 VTAB AVERAGE UNITS 2*SIGMA

R4GP04	0.000	PSIG	0.000
R2GP05	0.000	PSIG	0.000
R3GP05	0.000	PSIG	0.000
R4GP05	0.000	PSIG	0.000
RTGP01	1.428	PSIG	0.001
T2LC01	0.000	LBM	0.000
T2LC02	0.000	LBM	0.000
T3LC01	0.000	LBM	0.000
T3LC02	0.000	LBM	0.000
T4LC01	0.000	LBM	0.000
T4LC02	0.000	LBM	0.000
R2DP01	0.000	PSI	0.000
R3DP01	0.000	PSI	0.000
R4DP01	0.000	PSI	0.000
R2DP02	0.000	PSI	0.000
R3DP02	0.000	PSI	0.000
R4DP02	0.000	PSI	0.000
RPLV01	4.247	IN-H2O	0.010
TPLV01	0.000	IN-H2O	0.000
TPMM22	0.000	LBM/HR	0.000
RPMM22	12115.909	LBM/HR	76.476
TPMM21	0.000	LBM/HR	0.000
RPMM21	8.676	LBM/HR	23.718
T2LC30	0.000	LBM/HR	0.000
T3LC30	0.000	LBM/HR	0.000
T4LC30	0.000	LBM/HR	0.000

Test Name: 965220, 11:28
Test Date: 18-MAR-91

Today's Date: 05-Apr-91

Mark 22 Fuel Assembly
Annular Flow Distribution - Uninstrumented Assembly Testing
Test Notes ==> 24.0 GPM; 3.3 FT. BFI BACK PRESS.; Water Temp. 70F; P/L; TP 70

Reference Fuel Assembly

		Value	Two Std Deviation	VTAB
** Water **				
Temperature (F):	<	67.3	0.44	RPTC01
Flow Rate (gpm):	<	24.3	0.15	RPMM01+ RPMM02
** Air **				
Temperature (F):	<	66.13	0.18	ASTC01
Flow Rate (scfm):	<	1.76	0.05	RPGM02
** INLET PLENUM **				
Pressure (psig):	<	0.953	0.022	RPGP01
Level (in):	<	4.247	0.010	RPLV01
** BOTTOM FITTING AND REACTOR TANK **				
Pressure (psig):	<	1.428	0.002	RTGP01

AFD - TEST 965220; VTABLE CREATED: 13-MAR-91 18:20 23
 18-MAR-91

AFD - TEST 965220, VTABLE CREATED: 13-MAR-91 18 20 23
18-MAR-91

SCFM
Al-160

AFD - TEST 965220; VTABLE CREATED 13-MAR-91 18 20 23
 18-MAR-91

SCFM

A1-161

Title: Uninstrumented Assembly Testing
Test date/time: 18-MAR-91, 13:10

Test: 965221
Test point: 71

SPECIFIED CONDITIONS:

Water Flow:	24.0 gpm	BFI Type:	P/L
Fluid Temp:	70 deg F	Piston Leakage:	0.00 scfm
Inlet Plenum Press.:	1 psig		
Tank Water Level:	3.30 ft		

ACTUAL CONDITIONS (Uninstrumented Reference Assy.):

COMMENTS

Water Flow:	24.23 gpm	
Air Flow:	Inlet: 1.79 scfm	0-25 scfm Kurz
	Outlet: 2.22 scfm	0-150 scfm Kurz
Water Temperature:	67.9 deg F	
Air Temperature:	67.8 deg F	
Inlet plenum pressure:	0.96 psig	
Tank bottom pressure:	1.43 psig	
	(3.30 ft. H2O) (Tank Water Level)	
Inlet Plenum Level:	4.24 in. H2O	
Barometric pressure:	28.51 in. Hg at	66 deg F

Comments:

Repeat of test point 2 (ARC-TP-965) - performed to confirm repeatability of previous (instrumented fuel assembly) ARC tests.

Test point approached from standard water solid conditions.

Test Number 965221

VTAB	AVERAGE	UNITS	2*SIGMA
ASTC01	67.807	DEG F	0.774
TPTC01	0.000	DEG F	0.000
RPTC01	67.911	DEG F	0.871
TPMM02	0.000	GPM	0.000
RPMM02	24.227	GPM	0.108
TPMM01	0.000	GPM	0.000
RPMM01	0.033	GPM	0.058
TPGM01	0.000	SCFM	0.000
TPGM02	0.000	SCFM	0.000
RPGM01	1.732	SCFM	0.072
RPGM02	1.789	SCFM	0.048
RTGM02	0.015	SCFM	0.015
RTGM01	2.220	SCFM	0.079
T2GM01	0.000	SCFM	0.000
T3GM01	0.000	SCFM	0.000
T4GM01	0.000	SCFM	0.000
TPGM03	0.000	SCFM	0.000
RPGM03	1.561	SCFM	0.005
T2GM02	0.000	SCFM	0.000
T3GM02	0.000	SCFM	0.000
T4GM02	0.000	SCFM	0.000
RPGP01	0.962	PSIG	0.017
RPGP02	0.000	PSIG	0.000
RPGP03	0.000	PSIG	0.000
TPGP01	0.000	PSIG	0.000
TPGP02	0.000	PSIG	0.000
TPGP03	0.000	PSIG	0.000
T2GP01	0.000	PSIG	0.000
T3GP01	0.000	PSIG	0.000
T4GP01	0.000	PSIG	0.000
T2GP02	0.000	PSIG	0.000
T3GP02	0.000	PSIG	0.000
T4GP02	0.000	PSIG	0.000
T2GP03	0.000	PSIG	0.000
T3GP03	0.000	PSIG	0.000
T4GP03	0.000	PSIG	0.000
T2GP04	0.000	PSIG	0.000
T3GP04	0.000	PSIG	0.000
T4GP04	0.000	PSIG	0.000
T2GP05	0.000	PSIG	0.000
T3GP05	0.000	PSIG	0.000
T4GP05	0.000	PSIG	0.000
T2GP06	0.000	PSIG	0.000
T3GP06	0.000	PSIG	0.000
T4GP06	0.000	PSIG	0.000
R2GP06	0.000	PSIG	0.000
R3GP06	0.000	PSIG	0.000
R4GP06	0.000	PSIG	0.000
R2GP02	0.000	PSIG	0.000
R3GP02	0.000	PSIG	0.000
R4GP02	0.000	PSIG	0.000
R2GP03	0.000	PSIG	0.000
R3GP03	0.000	PSIG	0.000
R4GP03	0.000	PSIG	0.000
R2GP04	0.000	PSIG	0.000
R3GP04	0.000	PSIG	0.000

Test Number 965221

VTAB AVERAGE UNITS 2*SIGMA

R4GP04	0.000	PSIG	0.000
R2GP05	0.000	PSIG	0.000
R3GP05	0.000	PSIG	0.000
R4GP05	0.000	PSIG	0.000
RTGP01	1.426	PSIG	0.002
T2LC01	0.000	LBM	0.000
T2LC02	0.000	LBM	0.000
T3LC01	0.000	LBM	0.000
T3LC02	0.000	LBM	0.000
T4LC01	0.000	LBM	0.000
T4LC02	0.000	LBM	0.000
R2DP01	0.000	PSI	0.000
R3DP01	0.000	PSI	0.000
R4DP01	0.000	PSI	0.000
R2DP02	0.000	PSI	0.000
R3DP02	0.000	PSI	0.000
R4DP02	0.000	PSI	0.000
RPLV01	4.235	IN-H2O	0.023
TPLV01	0.000	IN-H2O	0.000
TPMM22	0.000	LBM/HR	0.000
RPMM22	12096.544	LBM/HR	53.831
TPMM21	0.000	LBM/HR	0.000
RPMM21	16.585	LBM/HR	24.145
T2LC30	0.000	LBM/HR	0.000
T3LC30	0.000	LBM/HR	0.000
T4LC30	0.000	LBM/HR	0.000

Test Name: 965221, 13:10
Test Date: 18-MAR-91

Today's Date: 05-Apr-91

Mark 22 Fuel Assembly
Annular Flow Distribution - Uninstrumented Assembly Testing
Test Notes ==> 24.0 GPM; 3.3 FT. BFI BACK PRESS.; Water Temp. 70F; P/L; TP 71

Reference Fuel Assembly

		Value	Two Std Deviation	VTAB
** Water **				
Temperature (F):	<	67.9	0.87	RPTC01
Flow Rate (gpm):	<	24.2	0.11	RPM01+ RPM02
** Air **				
Temperature (F):	<	67.81	0.77	ASTC01
Flow Rate (scfm):	<	1.79	0.05	RPGM02

**** INLET PLENUM ****

Pressure (psig):	<	0.962	0.016	RPGP01
Level (in):	<	4.235	0.024	RPLV01

**** BOTTOM FITTING AND REACTOR TANK ****

Pressure (psig):	<	1.426	0.002	RTGP01
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AFD - TEST 965221, VTABLE CREATED 13-MAR-91 18:20:23
18-MAR-91

TIME, HRS

AFD - TEST 965221; VTABLE CREATED: 13-MAR-91 18:20:23
18-MAR-91

SCFM
A1-167

AFD - TEST 965221, VTABLE CREATED: 13-MAR-91 18 20 23
18-MAR-91

TIME, HRS

Title: Uninstrumented Assembly Testing
Test date/time: 18-MAR-91, 18:26

Test: 965223
Test point: 72

SPECIFIED CONDITIONS:

Water Flow:	24.0 gpm	BFI Type:	P/L
Fluid Temp:	70 deg F	Piston Leakage:	0.00 scfm
Inlet Plenum Press.:	1 psig		
Tank Water Level:	3.30 ft		

ACTUAL CONDITIONS (Uninstrumented Reference Assy.):

COMMENTS

Water Flow:	23.90 gpm	
Air Flow:	Inlet: 2.11 scfm	0-25 scfm Kurz
	Outlet: 2.55 scfm	0-150 scfm Kurz
Water Temperature:	69.3 deg F	
Air Temperature:	73.1 deg F	
Inlet plenum pressure:	1.00 psig	
Tank bottom pressure:	1.42 psig	
	(3.29 ft. H2O) (Tank Water Level)	
Inlet Plenum Level:	4.14 in. H2O	
Barometric pressure:	28.58 in. Hg at	74 deg F

Comments:

Repeat of test point 2 (ARC-TP-965) - performed to confirm repeatability of previous (instrumented fuel assembly) ARC tests.

Test point approached from low water flow (15 gpm).

Test Number 965223

VTAB AVERAGE UNITS 2*SIGMA

ASTC01	73.079	DEG F	0.308
TPTC01	0.000	DEG F	0.000
RPTC01	69.337	DEG F	0.464
TPMM02	0.000	GPM	0.000
RPMM02	23.899	GPM	0.101
TPMM01	0.000	GPM	0.000
RPMM01	0.014	GPM	0.046
TPGM01	0.000	SCFM	0.000
TPGM02	0.000	SCFM	0.000
RPGM01	2.070	SCFM	0.086
RPGM02	2.113	SCFM	0.062
RTGM02	0.020	SCFM	0.006
RTGM01	2.554	SCFM	0.082
T2GM01	0.000	SCFM	0.000
T3GM01	0.000	SCFM	0.000
T4GM01	0.000	SCFM	0.000
TPGM03	0.000	SCFM	0.000
RPGM03	-0.002	SCFM	0.002
T2GM02	0.000	SCFM	0.000
T3GM02	0.000	SCFM	0.000
T4GM02	0.000	SCFM	0.000
RPGP01	0.998	PSIG	0.014
RPGP02	0.000	PSIG	0.000
RPGP03	0.000	PSIG	0.000
TPGP01	0.000	PSIG	0.000
TPGP02	0.000	PSIG	0.000
TPGP03	0.000	PSIG	0.000
T2GP01	0.000	PSIG	0.000
T3GP01	0.000	PSIG	0.000
T4GP01	0.000	PSIG	0.000
T2GP02	0.000	PSIG	0.000
T3GP02	0.000	PSIG	0.000
T4GP02	0.000	PSIG	0.000
T2GP03	0.000	PSIG	0.000
T3GP03	0.000	PSIG	0.000
T4GP03	0.000	PSIG	0.000
T2GP04	0.000	PSIG	0.000
T3GP04	0.000	PSIG	0.000
T4GP04	0.000	PSIG	0.000
T2GP05	0.000	PSIG	0.000
T3GP05	0.000	PSIG	0.000
T4GP05	0.000	PSIG	0.000
T2GP06	0.000	PSIG	0.000
T3GP06	0.000	PSIG	0.000
T4GP06	0.000	PSIG	0.000
R2GP06	0.000	PSIG	0.000
R3GP06	0.000	PSIG	0.000
R4GP06	0.000	PSIG	0.000
R2GP02	0.000	PSIG	0.000
R3GP02	0.000	PSIG	0.000
R4GP02	0.000	PSIG	0.000
R2GP03	0.000	PSIG	0.000
R3GP03	0.000	PSIG	0.000
R4GP03	0.000	PSIG	0.000
R2GP04	0.000	PSIG	0.000
R3GP04	0.000	PSIG	0.000

Test Number 965223

VTAB AVERAGE UNITS 2*SIGMA

R4GP04	0.000	PSIG	0.000
R2GP05	0.000	PSIG	0.000
R3GP05	0.000	PSIG	0.000
R4GP05	0.000	PSIG	0.000
RTGP01	1.421	PSIG	0.001
T2LC01	0.000	LBM	0.000
T2LC02	0.000	LBM	0.000
T3LC01	0.000	LBM	0.000
T3LC02	0.000	LBM	0.000
T4LC01	0.000	LBM	0.000
T4LC02	0.000	LBM	0.000
R2DP01	0.000	PSI	0.000
R3DP01	0.000	PSI	0.000
R4DP01	0.000	PSI	0.000
R2DP02	0.000	PSI	0.000
R3DP02	0.000	PSI	0.000
R4DP02	0.000	PSI	0.000
RPLV01	4.135	IN-H2O	0.016
TPLV01	0.000	IN-H2O	0.000
TPMM22	0.000	LBM/HR	0.000
RPMM22	11932.767	LBM/HR	50.370
TPMM21	0.000	LBM/HR	0.000
RPMM21	7.802	LBM/HR	12.865
T2LC30	0.000	LBM/HR	0.000
T3LC30	0.000	LBM/HR	0.000
T4LC30	0.000	LBM/HR	0.000

Test Name: 965223, 18:26
Test Date: 18-MAR-91

Today's Date: 05-Apr-91

Mark 22 Fuel Assembly
Annular Flow Distribution - Uninstrumented Assembly Testing
Test Notes ==> 24.0 GPM; 3.3 FT. BFI BACK PRESS.; Water Temp. 70F; P/L; TP 72

Reference Fuel Assembly

		Value	Two Std Deviation	VTAB
** Water **				
Temperature (F):	<	69.3	0.46	RPTC01
Flow Rate (gpm):	<	23.9	0.10	RPMM01+ RPMM02
** Air **				
Temperature (F):	<	73.08	0.31	ASTC01
Flow Rate (scfm):	<	2.11	0.06	RPGM02
** INLET PLENUM **				
Pressure (psig):	<	0.998	0.014	RPGP01
Level (in):	<	4.135	0.016	RPLV01
** BOTTOM FITTING AND REACTOR TANK **				
Pressure (psig):	<	1.421	0.002	RTGP01

AFD - TEST 965223; VTABLE CREATED: 13-MAR-91 18:20 23
 18-MAR-91

AFD - TEST 965223; VTABLE CREATED 13-MAR-91 18 20 23
18-MAR-91

SCFM

AI-174

AFD - TEST 965223, VTABLE CREATED: 13-MAR-91 18 20 23
18-MAR-91

Title: Uninstrumented Assembly Testing
Test date/time: 18-MAR-91, 15:26

Test: 965222
Test point: 73

SPECIFIED CONDITIONS:

Water Flow:	24.0 gpm	BFI Type:	P/L
Fluid Temp: -	70 deg F	Piston Leakage:	0.00 scfm
Inlet Plenum Press.:	0 psig		
Tank Water Level:	5.00 ft		

ACTUAL CONDITIONS (Uninstrumented Reference Assy.):

COMMENTS

Water Flow:	23.91 gpm	
Air Flow:	Inlet: 0.19 scfm	0-1.5 scfm Omega
	Outlet: 0.18 scfm	0-1.5 scfm Omega
Water Temperature:	68.5 deg F	
Air Temperature:	68.4 def F	
Inlet plenum pressure:	-0.02 psig	
Tank bottom pressure:	2.15 psig	
	(4.97 ft. H2O) (Tank Water Level)	
Inlet Plenum Level:	4.14 in. H2O	
Barometric pressure:	28.54 in. Hg at	72 deg F

Comments:

Repeat of test point 3 (ARC-TP-965) - performed to confirm repeatability of previous (instrumented fuel assembly) ARC tests.

Test Number 965222

VTAB	AVERAGE	UNITS	2*SIGMA
ASTC01	68.443	DEG F	0.289
TPTC01	0.000	DEG F	0.000
RPTC01	68.522	DEG F	0.366
TPMM02	0.000	GPM	0.000
RPMM02	23.905	GPM	0.150
TPMM01	0.000	GPM	0.000
RPMM01	0.021	GPM	0.060
TPGM01	0.000	SCFM	0.000
TPGM02	0.000	SCFM	0.000
RPGM01	-0.198	SCFM	0.083
RPGM02	0.177	SCFM	0.033
RTGM02	0.183	SCFM	0.056
RTGM01	-0.227	SCFM	0.062
T2GM01	0.000	SCFM	0.000
T3GM01	0.000	SCFM	0.000
T4GM01	0.000	SCFM	0.000
TPGM03	0.000	SCFM	0.000
RPGM03	0.189	SCFM	0.131
T2GM02	0.000	SCFM	0.000
T3GM02	0.000	SCFM	0.000
T4GM02	0.000	SCFM	0.000
RPGP01	-0.020	PSIG	0.005
RPGP02	0.000	PSIG	0.000
RPGP03	0.000	PSIG	0.000
TPGP01	0.000	PSIG	0.000
TPGP02	0.000	PSIG	0.000
TPGP03	0.000	PSIG	0.000
T2GP01	0.000	PSIG	0.000
T3GP01	0.000	PSIG	0.000
T4GP01	0.000	PSIG	0.000
T2GP02	0.000	PSIG	0.000
T3GP02	0.000	PSIG	0.000
T4GP02	0.000	PSIG	0.000
T2GP03	0.000	PSIG	0.000
T3GP03	0.000	PSIG	0.000
T4GP03	0.000	PSIG	0.000
T2GP04	0.000	PSIG	0.000
T3GP04	0.000	PSIG	0.000
T4GP04	0.000	PSIG	0.000
T2GP05	0.000	PSIG	0.000
T3GP05	0.000	PSIG	0.000
T4GP05	0.000	PSIG	0.000
T2GP06	0.000	PSIG	0.000
T3GP06	0.000	PSIG	0.000
T4GP06	0.000	PSIG	0.000
R2GP06	0.000	PSIG	0.000
R3GP06	0.000	PSIG	0.000
R4GP06	0.000	PSIG	0.000
R2GP02	0.000	PSIG	0.000
R3GP02	0.000	PSIG	0.000
R4GP02	0.000	PSIG	0.000
R2GP03	0.000	PSIG	0.000
R3GP03	0.000	PSIG	0.000
R4GP03	0.000	PSIG	0.000
R2GP04	0.000	PSIG	0.000
R3GP04	0.000	PSIG	0.000

Test Number 965222
 VTAB AVERAGE UNITS 2*SIGMA

R4GP04	0.000	PSIG	0.000
R2GP05	0.000	PSIG	0.000
R3GP05	0.000	PSIG	0.000
R4GP05	0.000-	PSIG	0.000
RTGP01	2.150	PSIG	0.002
T2LC01	0.000	LBM	0.000
T2LC02	0.000	LBM	0.000
T3LC01	0.000	LBM	0.000
T3LC02	0.000	LBM	0.000
T4LC01	0.000	LBM	0.000
T4LC02	0.000	LBM	0.000
R2DP01	0.000	PSI	0.000
R3DP01	0.000	PSI	0.000
R4DP01	0.000	PSI	0.000
R2DP02	0.000	PSI	0.000
R3DP02	0.000	PSI	0.000
R4DP02	0.000	PSI	0.000
RPLV01	4.144	IN-H2O	0.016
TPLV01	0.000	IN-H2O	0.000
TPMM22	0.000	LBM/HR	0.000
RPMM22	11935.640	LBM/HR	75.078
TPMM21	0.000	LBM/HR	0.000
RPMM21	11.746	LBM/HR	22.971
T2LC30	0.000	LBM/HR	0.000
T3LC30	0.000	LBM/HR	0.000
T4LC30	0.000	LBM/HR	0.000

Test Name: 965222, 15:26
Test Date: 18-MAR-91

Today's Date: 05-Apr-91

Mark 22 Fuel Assembly
Annular Flow Distribution - Uninstrumented Assembly Testing
Test Notes ==> 24.0 GPM; 5.0 FT. BFI BACK PRESS.; Water Temp. 70F; P/L; TP 73

Reference Fuel Assembly

		Value	Two Std Deviation	VTAB
** Water **				
Temperature (F):	<	68.5	0.57	RPTC01
Flow Rate (gpm):	<	23.9	0.15	RPMM01+ RPMM02
** Air **				
Temperature (F):	<	68.44	0.29	ASTC01
Flow Rate (scfm):	<	0.19	0.13	RPGM03
** INLET PLENUM **				
Pressure (psig):	<	-0.020	0.006	RPGP01
Level (in):	<	4.144	0.016	RPLV01
** BOTTOM FITTING AND REACTOR TANK **				
Pressure (psig):	<	2.150	0.002	RTGP01

AFD - TEST 965222, VTABLE CREATED: 13-MAR-91 18 20 23
18-MAR-91

AF0 - TEST 965222; VTABLE CREATED: 13-MAR-91 18 20:23
18-MAR-91

Al-181

AFD - TEST 965222, VTABLE CREATED 13-MAR-91 18 20 23
18-MAR-91

Title: Uninstrumented Assembly Testing
Test date/time: 18-MAR-91, 20:10

Test: 965224
Test point: 74

SPECIFIED CONDITIONS:

Water Flow:	24.0 gpm	BFI Type:	P/L
Fluid Temp:	70 deg F	Piston Leakage:	0.00 scfm
Inlet Plenum Press.:	2 psig		
Tank Water Level:	2.00 ft		

ACTUAL CONDITIONS (Uninstrumented Reference Assy.):

COMMENTS

Water Flow:	23.94 gpm	
Air Flow:	Inlet: 50.78 scfm	0-150 scfm Kurz
	Outlet: 52.34 scfm	0-150 scfm Kurz
Water Temperature:	70.0 deg F	
Air Temperature:	70.7 deg F	
Inlet plenum pressure:	2.01 psig	
Tank bottom pressure:	0.85 psig	
	(1.97 ft. H2O) (Tank Water Level)	
Inlet Plenum Level:	3.76 in. H2O	
Barometric pressure:	28.65 in. Hg at	74 deg F

Comments:

Repeat of test 897039 (ARC-TP-897) - performed to confirm repeatability of previous (instrumented fuel assembly) ARC tests.

Test Number 965224

VTAB AVERAGE UNITS 2*SIGMA

ASTC01	70.651	DEG F	0.213
TPTC01	0.000	DEG F	0.000
RPTC01	70.040	DEG F	0.291
TPMM02	0.000	GPM	0.000
RPMM02	23.939	GPM	0.152
TPMM01	0.000	GPM	0.000
RPMM01	0.005	GPM	0.057
TPGM01	0.000	SCFM	0.000
TPGM02	0.000	SCFM	0.000
RPGM01	50.784	SCFM	0.179
RPGM02	0.181	SCFM	0.012
RTGM02	0.024	SCFM	0.004
RTGM01	52.341	SCFM	0.251
T2GM01	0.000	SCFM	0.000
T3GM01	0.000	SCFM	0.000
T4GM01	0.000	SCFM	0.000
TPGM03	0.000	SCFM	0.000
RPGM03	-0.002	SCFM	0.001
T2GM02	0.000	SCFM	0.000
T3GM02	0.000	SCFM	0.000
T4GM02	0.000	SCFM	0.000
RPGP01	2.006	PSIG	0.036
RPGP02	0.000	PSIG	0.000
RPGP03	0.000	PSIG	0.000
TPGP01	0.000	PSIG	0.000
TPGP02	0.000	PSIG	0.000
TPGP03	0.000	PSIG	0.000
T2GP01	0.000	PSIG	0.000
T3GP01	0.000	PSIG	0.000
T4GP01	0.000	PSIG	0.000
T2GP02	0.000	PSIG	0.000
T3GP02	0.000	PSIG	0.000
T4GP02	0.000	PSIG	0.000
T2GP03	0.000	PSIG	0.000
T3GP03	0.000	PSIG	0.000
T4GP03	0.000	PSIG	0.000
T2GP04	0.000	PSIG	0.000
T3GP04	0.000	PSIG	0.000
T4GP04	0.000	PSIG	0.000
T2GP05	0.000	PSIG	0.000
T3GP05	0.000	PSIG	0.000
T4GP05	0.000	PSIG	0.000
T2GP06	0.000	PSIG	0.000
T3GP06	0.000	PSIG	0.000
T4GP06	0.000	PSIG	0.000
R2GP06	0.000	PSIG	0.000
R3GP06	0.000	PSIG	0.000
R4GP06	0.000	PSIG	0.000
R2GP02	0.000	PSIG	0.000
R3GP02	0.000	PSIG	0.000
R4GP02	0.000	PSIG	0.000
R2GP03	0.000	PSIG	0.000
R3GP03	0.000	PSIG	0.000
R4GP03	0.000	PSIG	0.000
R2GP04	0.000	PSIG	0.000
R3GP04	0.000	PSIG	0.000

Test Number 965224

VTAB AVERAGE UNITS 2*SIGMA

R4GP04	0.000	PSIG	0.000
R2GP05	0.000	PSIG	0.000
R3GP05	0.000	PSIG	0.000
R4GP05	0.000	PSIG	0.000
RTGP01	0.853	PSIG	0.008
T2LC01	0.000	LBM	0.000
T2LC02	0.000	LBM	0.000
T3LC01	0.000	LBM	0.000
T3LC02	0.000	LBM	0.000
T4LC01	0.000	LBM	0.000
T4LC02	0.000	LBM	0.000
R2DP01	0.000	PSI	0.000
R3DP01	0.000	PSI	0.000
R4DP01	0.000	PSI	0.000
R2DP02	0.000	PSI	0.000
R3DP02	0.000	PSI	0.000
R4DP02	0.000	PSI	0.000
RPLV01	3.762	IN-H2O	0.016
TPLV01	0.000	IN-H2O	0.000
TPMM22	0.000	LBM/HR	0.000
RPMM22	11952.605	LBM/HR	75.963
TPMM21	0.000	LBM/HR	0.000
RPMM21	4.269	LBM/HR	13.368
T2LC30	0.000	LBM/HR	0.000
T3LC30	0.000	LBM/HR	0.000
T4LC30	0.000	LBM/HR	0.000

Test Name: 965224, 20:10
Test Date: 18-MAR-91

Today's Date: 05-Apr-91

Mark 22 Fuel Assembly
Annular Flow Distribution - Uninstrumented Assembly Testing
Test Notes ==> 24.0 GPM; 2.0 FT. BFI BACK PRESS.; Water Temp. 70F; P/L; TP 74

Reference Fuel Assembly

		<u>Value</u>	<u>Two Std Deviation</u>	<u>VTAB</u>
** Water **				
Temperature (F):	<	70.0	0.29	RPTC01
Flow Rate (gpm):	<	23.9	0.15	RPMM01+ RPMM02
** Air **				
Temperature (F):	<	70.65	0.21	ASTC01
Flow Rate (scfm):	<	0.18	0.01	RPGM02
** INLET PLENUM **				
Pressure (psig):	<	2.006	0.036	RPGP01
Level (in):	<	3.762	0.016	RPLV01
** BOTTOM FITTING AND REACTOR TANK **				
Pressure (psig):	<	0.853	0.008	RTGP01

AFD - TEST 965224; VTABLE CREATED 13-MAR-91 18:20:23
18-MAR-91

AFD - TEST 965224, VTABLE CREATED: 13-MAR-91 18 20 23
 18-MAR-91

SCFM

A1-188

AFD - TEST 965224; VTABLE CREATED: 13-MAR-91 18:20:23
 18-MAR-91

Title: Uninstrumented Assembly Testing
Test date/time: 20-MAR-91, 13:51

Test: 965226
Test point: 75

SPECIFIED CONDITIONS:

Water Flow:	25.0 gpm	BFI Type:	P/L
Fluid Temp: -	70 deg F	Piston Leakage:	0.00 scfm
Inlet Plenum Press.:	0 psig		
Tank Water Level:	5.00 ft		

ACTUAL CONDITIONS (Uninstrumented Reference Assy.):

COMMENTS

Water Flow:	25.49 gpm	
Air Flow:	Inlet: 0.21 scfm	0-1.5 scfm Omega
	Outlet: 0.20 scfm	0-1.5 scfm Omega
Water Temperature:	68.9 deg F	
Air Temperature:	72.2 def F	
Inlet plenum pressure:	-0.01 psig	
Tank bottom pressure:	2.16 psig	
	(4.99 ft. H2O) (Tank Water Level)	
Inlet Plenum Level:	4.34 in. H2O	
Barometric pressure:	28.91 in. Hg at	74 deg F

Test Number 965226

VTAB AVERAGE UNITS

2*SIGMA

ASTC01	72.176	DEG F	0.179
TPTC01	0.000	DEG F	0.000
RPTC01	68.873	DEG F	0.470
TPMM02	0.000	GPM	0.000
RPMM02	25.489	GPM	0.145
TPMM01	0.000	GPM	0.000
RPMM01	-0.016	GPM	0.052
TPGM01	0.000	SCFM	0.000
TPGM02	0.000	SCFM	0.000
RPGM01	-0.206	SCFM	0.081
RPGM02	0.188	SCFM	0.035
RTGM02	0.204	SCFM	0.074
RTGM01	-0.152	SCFM	0.063
T2GM01	0.000	SCFM	0.000
T3GM01	0.000	SCFM	0.000
T4GM01	0.000	SCFM	0.000
TPGM03	0.000	SCFM	0.000
RPGM03	0.213	SCFM	0.141
T2GM02	0.000	SCFM	0.000
T3GM02	0.000	SCFM	0.000
T4GM02	0.000	SCFM	0.000
RPGP01	-0.012	PSIG	0.005
RPGP02	0.000	PSIG	0.000
RPGP03	0.000	PSIG	0.000
TPGP01	0.000	PSIG	0.000
TPGP02	0.000	PSIG	0.000
TPGP03	0.000	PSIG	0.000
T2GP01	0.000	PSIG	0.000
T3GP01	0.000	PSIG	0.000
T4GP01	0.000	PSIG	0.000
T2GP02	0.000	PSIG	0.000
T3GP02	0.000	PSIG	0.000
T4GP02	0.000	PSIG	0.000
T2GP03	0.000	PSIG	0.000
T3GP03	0.000	PSIG	0.000
T4GP03	0.000	PSIG	0.000
T2GP04	0.000	PSIG	0.000
T3GP04	0.000	PSIG	0.000
T4GP04	0.000	PSIG	0.000
T2GP05	0.000	PSIG	0.000
T3GP05	0.000	PSIG	0.000
T4GP05	0.000	PSIG	0.000
T2GP06	0.000	PSIG	0.000
T3GP06	0.000	PSIG	0.000
T4GP06	0.000	PSIG	0.000
R2GP06	0.000	PSIG	0.000
R3GP06	0.000	PSIG	0.000
R4GP06	0.000	PSIG	0.000
R2GP02	0.000	PSIG	0.000
R3GP02	0.000	PSIG	0.000
R4GP02	0.000	PSIG	0.000
R2GP03	0.000	PSIG	0.000
R3GP03	0.000	PSIG	0.000
R4GP03	0.000	PSIG	0.000
R2GP04	0.000	PSIG	0.000
R3GP04	0.000	PSIG	0.000

Test Number 965226

VTAB AVERAGE UNITS 2*SIGMA

R4GP04	0.000	PSIG	0.000
R2GP05	0.000	PSIG	0.000
R3GP05	0.000	PSIG	0.000
R4GP05	0.000	PSIG	0.000
RTGP01	2.157	PSIG	0.002
T2LC01	0.000	LBM	0.000
T2LC02	0.000	LBM	0.000
T3LC01	0.000	LBM	0.000
T3LC02	0.000	LBM	0.000
T4LC01	0.000	LBM	0.000
T4LC02	0.000	LBM	0.000
R2DP01	0.000	PSI	0.000
R3DP01	0.000	PSI	0.000
R4DP01	0.000	PSI	0.000
R2DP02	0.000	PSI	0.000
R3DP02	0.000	PSI	0.000
R4DP02	0.000	PSI	0.000
RPLV01	4.344	IN-H2O	0.018
TPLV01	0.000	IN-H2O	0.000
TPMM22	0.000	LBM/HR	0.000
RPMM22	12726.540	LBM/HR	72.489
TPMM21	0.000	LBM/HR	0.000
RPMM21	1.269	LBM/HR	4.513
T2LC30	0.000	LBM/HR	0.000
T3LC30	0.000	LBM/HR	0.000
T4LC30	0.000	LBM/HR	0.000

Test Name: 965226, 13:51
Test Date: 20-MAR-91

Today's Date: 05-Apr-91

Mark 22 Fuel Assembly
Annular Flow Distribution - Uninstrumented Assembly Testing
Test Notes ==> 25.0 GPM; 5.0 FT. BFI BACK PRESS.; Water Temp. 70F; P/L; TP 75

Reference Fuel Assembly

		Value	Two Std Deviation	VTAB
** Water **				
Temperature (F):	<	68.9	0.47	RPTC01
Flow Rate (gpm):	<	25.5	0.15	RPTM01+ RPTM02
** Air **				
Temperature (F):	<	72.18	0.18	ASTC01
Flow Rate (scfm):	<	0.21	0.14	RPGM03
** INLET PLENUM **				
Pressure (psig):	<	-0.012	0.004	RPGP01
Level (in):	<	4.344	0.018	RPLV01
** BOTTOM FITTING AND REACTOR TANK **				
Pressure (psig):	<	2.157	0.002	RTGP01

AFD - TEST 965226, VTABLE CREATED 13-MAR-91 18 20 23
20-MAR-91

AFD - TEST 965226, VTBL8LE CREATED 13-MAR-91 18:20 23
20-MAR-91

AFD - TEST 965226, VTABLE CREATED 13-MAR-91 18:20 23
20-MAR-91

Title: Uninstrumented Assembly Testing
Test date/time: 20-MAR-91, 12:44

Test: 965225
Test point: 76

SPECIFIED CONDITIONS:

Water Flow:	25.0 gpm	BFI Type:	P/L
Fluid Temp:	70 deg F	Piston Leakage:	0.00 scfm
Inlet Plenum Press.:	0 psig		
Tank Water Level:	5.00 ft		

ACTUAL CONDITIONS (Uninstrumented Reference Assy.):

COMMENTS

Water Flow:	24.94 gpm	
Air Flow:	Inlet: 0.20 scfm	0-1.5 scfm Omega
	Outlet: 0.20 scfm	0-1.5 scfm Omega
Water Temperature:	68.7 deg F	
Air Temperature:	73.5 deg F	
Inlet plenum pressure:	-0.01 psig	
Tank bottom pressure:	2.16 psig	
	(4.99 ft. H2O) (Tank Water Level)	
Inlet Plenum Level:	4.26 in. H2O	
Barometric pressure:	28.93 in. Hg at	74 deg F

Comments:

Repeat of test point 75, but approached from low water flow (15 gpm).

Test Number 965225

VTAB AVERAGE UNITS 2*SIGMA

ASTC01	73.535	DEG F	0.118
TPTC01	0.000	DEG F	0.000
RPTC01	68.685-	DEG F	0.181
TPMM02	0.000	GPM	0.000
RPMM02	24.943	GPM	0.104
TPMM01	0.000	GPM	0.000
RPMM01	-0.013	GPM	0.042
TPGM01	0.000	SCFM	0.000
TPGM02	0.000	SCFM	0.000
RPGM01	-0.189	SCFM	0.074
RPGM02	0.184	SCFM	0.031
RTGM02	0.204	SCFM	0.065
RTGM01	-0.151	SCFM	0.060
T2GM01	0.000	SCFM	0.000
T3GM01	0.000	SCFM	0.000
T4GM01	0.000	SCFM	0.000
TPGM03	0.000	SCFM	0.000
RPGM03	0.203	SCFM	0.132
T2GM02	0.000	SCFM	0.000
T3GM02	0.000	SCFM	0.000
T4GM02	0.000	SCFM	0.000
RPGP01	-0.009	PSIG	0.005
RPGP02	0.000	PSIG	0.000
RPGP03	0.000	PSIG	0.000
TPGP01	0.000	PSIG	0.000
TPGP02	0.000	PSIG	0.000
TPGP03	0.000	PSIG	0.000
T2GP01	0.000	PSIG	0.000
T3GP01	0.000	PSIG	0.000
T4GP01	0.000	PSIG	0.000
T2GP02	0.000	PSIG	0.000
T3GP02	0.000	PSIG	0.000
T4GP02	0.000	PSIG	0.000
T2GP03	0.000	PSIG	0.000
T3GP03	0.000	PSIG	0.000
T4GP03	0.000	PSIG	0.000
T2GP04	0.000	PSIG	0.000
T3GP04	0.000	PSIG	0.000
T4GP04	0.000	PSIG	0.000
T2GP05	0.000	PSIG	0.000
T3GP05	0.000	PSIG	0.000
T4GP05	0.000	PSIG	0.000
T2GP06	0.000	PSIG	0.000
T3GP06	0.000	PSIG	0.000
T4GP06	0.000	PSIG	0.000
R2GP06	0.000	PSIG	0.000
R3GP06	0.000	PSIG	0.000
R4GP06	0.000	PSIG	0.000
R2GP02	0.000	PSIG	0.000
R3GP02	0.000	PSIG	0.000
R4GP02	0.000	PSIG	0.000
R2GP03	0.000	PSIG	0.000
R3GP03	0.000	PSIG	0.000
R4GP03	0.000	PSIG	0.000
R2GP04	0.000	PSIG	0.000
R3GP04	0.000	PSIG	0.000

Test Number 965225
 VTAB AVERAGE UNITS 2*SIGMA

R4GP04	0.000	PSIG	0.000
R2GP05	0.000	PSIG	0.000
R3GP05	0.000	PSIG	0.000
R4GP05	0.000	PSIG	0.000
RTGP01	2.156	-PSIG	0.002
T2LC01	0.000	LBM	0.000
T2LC02	0.000	LBM	0.000
T3LC01	0.000	LBM	0.000
T3LC02	0.000	LBM	0.000
T4LC01	0.000	LBM	0.000
T4LC02	0.000	LBM	0.000
R2DP01	0.000	PSI	0.000
R3DP01	0.000	PSI	0.000
R4DP01	0.000	PSI	0.000
R2DP02	0.000	PSI	0.000
R3DP02	0.000	PSI	0.000
R4DP02	0.000	PSI	0.000
RPLV01	4.262	IN-H2O	0.011
TPLV01	0.000	IN-H2O	0.000
TPMM22	0.000	LBM/HR	0.000
RPMM22	12454.154	LBM/HR	51.943
TPMM21	0.000	LBM/HR	0.000
RPMM21	0.405	LBM/HR	1.811
T2LC30	0.000	LBM/HR	0.000
T3LC30	0.000	LBM/HR	0.000
T4LC30	0.000	LBM/HR	0.000

Test Name: 965225, 12:44
Test Date: 20-MAR-91

Today's Date: 05-Apr-91

Mark 22 Fuel Assembly
Annular Flow Distribution - Uninstrumented Assembly Testing
Test Notes ==> 25.0 GPM; 5.0 FT. BFI BACK PRESS.; Water Temp. 70F; P/L; TP 76

Reference Fuel Assembly

		Value	Two Std Deviation	VTAB
** Water **				
Temperature (F):	<	68.7	0.18	RPTC01
Flow Rate (gpm):	<	24.9	0.10	RPMM01+ RPMM02
** Air **				
Temperature (F):	<	73.54	0.12	ASTC01
Flow Rate (scfm):	<	0.20	0.13	RPGM03
 ** INLET PLENUM **				
Pressure (psig):	<	-0.009	0.004	RPGP01
Level (in):	<	4.262	0.012	RPLV01
 ** BOTTOM FITTING AND REACTOR TANK **				
Pressure (psig):	<	2.156	0.002	RTGP01

AFD - TEST 965225; VTABLE CREATED 13-MAR-91 18:20.23
20-MAR-91

AFD - TEST 965225, VTABLE CREATED: 13-MAR-91 18 20 23
20-MAR-91

AFD - TEST 965225, VTABLE CREATED 13-MAR-91 18 20 23
20-MAR-91

Title: Uninstrumented Assembly Testing
Test date/time: 20-MAR-91, 16:01

Test: 965228
Test point: 77

SPECIFIED CONDITIONS:

Water Flow:	25.0 gpm	BFI Type:	P/L
Fluid Temp:	70 deg F	Piston Leakage:	0.00 scfm
Inlet Plenum Press.:	0 psig		
Tank Water Level:	5.33 ft		

ACTUAL CONDITIONS (Uninstrumented Reference Assy.):

COMMENTS

Water Flow:	25.29 gpm	
Air Flow:	Inlet: 0.20 scfm	0-1.5 scfm Omega
	Outlet: 0.20 scfm	0-1.5 scfm Omega
Water Temperature:	68.3 deg F	
Air Temperature:	71.0 deg F	
Inlet plenum pressure:	-0.01 psig	
Tank bottom pressure:	2.30 psig	
	(5.33 ft. H2O) (Tank Water Level)	
Inlet Plenum Level:	4.33 in. H2O	
Barometric pressure:	28.9 in. Hg at	75 deg F

Test Number 965228

VTAB AVERAGE UNITS 2*SIGMA

ASTC01	70.964	DEG F	0.352
TPTC01	0.000	DEG F	0.000
RPTC01	68.308	DEG F	0.617
TPMM02	0.000	GPM	0.000
RPMM02	25.287	GPM	0.137
TPMM01	0.000	GPM	0.000
RPMM01	-0.009	GPM	0.057
TPGM01	0.000	SCFM	0.000
TPGM02	0.000	SCFM	0.000
RPGM01	-0.210	SCFM	0.073
RPGM02	0.176	SCFM	0.034
RTGM02	0.196	SCFM	0.079
RTGM01	-0.179	SCFM	0.063
T2GM01	0.000	SCFM	0.000
T3GM01	0.000	SCFM	0.000
T4GM01	0.000	SCFM	0.000
TPGM03	0.000	SCFM	0.000
RPGM03	0.198	SCFM	0.148
T2GM02	0.000	SCFM	0.000
T3GM02	0.000	SCFM	0.000
T4GM02	0.000	SCFM	0.000
RPGP01	-0.012	PSIG	0.005
RPGP02	0.000	PSIG	0.000
RPGP03	0.000	PSIG	0.000
TPGP01	0.000	PSIG	0.000
TPGP02	0.000	PSIG	0.000
TPGP03	0.000	PSIG	0.000
T2GP01	0.000	PSIG	0.000
T3GP01	0.000	PSIG	0.000
T4GP01	0.000	PSIG	0.000
T2GP02	0.000	PSIG	0.000
T3GP02	0.000	PSIG	0.000
T4GP02	0.000	PSIG	0.000
T2GP03	0.000	PSIG	0.000
T3GP03	0.000	PSIG	0.000
T4GP03	0.000	PSIG	0.000
T2GP04	0.000	PSIG	0.000
T3GP04	0.000	PSIG	0.000
T4GP04	0.000	PSIG	0.000
T2GP05	0.000	PSIG	0.000
T3GP05	0.000	PSIG	0.000
T4GP05	0.000	PSIG	0.000
T2GP06	0.000	PSIG	0.000
T3GP06	0.000	PSIG	0.000
T4GP06	0.000	PSIG	0.000
R2GP06	0.000	PSIG	0.000
R3GP06	0.000	PSIG	0.000
R4GP06	0.000	PSIG	0.000
R2GP02	0.000	PSIG	0.000
R3GP02	0.000	PSIG	0.000
R4GP02	0.000	PSIG	0.000
R2GP03	0.000	PSIG	0.000
R3GP03	0.000	PSIG	0.000
R4GP03	0.000	PSIG	0.000
R2GP04	0.000	PSIG	0.000
R3GP04	0.000	PSIG	0.000

Test Number 965228

VTAB AVERAGE UNITS 2*SIGMA

R4GP04	0.000	PSIG	0.000
R2GP05	0.000	PSIG	0.000
R3GP05	0.000	PSIG	0.000
R4GP05	0.000	PSIG	0.000
RTGP01	2.303	PSIG	0.002
T2LC01	0.000	LBM	0.000
T2LC02	0.000	LBM	0.000
T3LC01	0.000	LBM	0.000
T3LC02	0.000	LBM	0.000
T4LC01	0.000	LBM	0.000
T4LC02	0.000	LBM	0.000
R2DP01	0.000	PSI	0.000
R3DP01	0.000	PSI	0.000
R4DP01	0.000	PSI	0.000
R2DP02	0.000	PSI	0.000
R3DP02	0.000	PSI	0.000
R4DP02	0.000	PSI	0.000
RPLV01	4.332	IN-H2O	0.025
TPLV01	0.000	IN-H2O	0.000
TPMM22	0.000	LBM/HR	0.000
RPMM22	12625.700	LBM/HR	68.357
TPMM21	0.000	LBM/HR	0.000
RPMM21	3.206	LBM/HR	7.700
T2LC30	0.000	LBM/HR	0.000
T3LC30	0.000	LBM/HR	0.000
T4LC30	0.000	LBM/HR	0.000

Test Name: 965228, 16:01
Test Date: 20-MAR-91

Today's Date: 05-Apr-91

Mark 22 Fuel Assembly
Annular Flow Distribution - Uninstrumented Assembly Testing
Test Notes ==> 25.0 GPM; 5.33 FT. BFI BACK PRESS.; Water Temp. 70F; P/L; TP 77

Reference Fuel Assembly

		Value	Two Std Deviation	VTAB
** Water **				
Temperature (F):	<	68.3	0.62	RPTC01
Flow Rate (gpm):	<	25.3	0.14	RPM01+ RPM02
** Air **				
Temperature (F):	<	70.96	0.35	ASTC01
Flow Rate (scfm):	<	0.20	0.15	RPGM03
** INLET PLENUM **				
Pressure (psig):	<	-0.012	0.006	RPGP01
Level (in):	<	4.332	0.024	RPLV01
** BOTTOM FITTING AND REACTOR TANK **				
Pressure (psig):	<	2.303	0.002	RTGP01

AFD - TEST 965228; VTABLE CREATED: 13-MAR-91 18:20 23
20-MAR-91

AFD - TEST 965228; VTABLE CREATED: 13-MAR-91 18 20 23
20-MAR-91

AFD - TEST 965228; VTABLE CREATED: 13-MAR-91 18:20 23
20-MAR-91

Title: Uninstrumented Assembly Testing
Test date/time: 20-MAR-91, 15:00

Test: 965227
Test point: 78

SPECIFIED CONDITIONS:

Water Flow:	25.0 gpm	BFI Type:	P/L
Fluid Temp:	70 deg F	Piston Leakage:	0.00 scfm
Inlet Plenum Press.:	0 psig		
Tank Water Level:	5.33 ft		

ACTUAL CONDITIONS (Uninstrumented Reference Assy.):

COMMENTS

Water Flow:	25.23 gpm	
Air Flow:	Inlet: 0.20 scfm	0-1.5 scfm Omega
	Outlet: 0.21 scfm	0-1.5 scfm Omega
Water Temperature:	68.7 deg F	
Air Temperature:	71.3 deg F	
Inlet plenum pressure:	-0.01 psig	
Tank bottom pressure:	2.31 psig	
	(5.33 ft. H2O) (Tank Water Level)	
Inlet Plenum Level:	4.34 in. H2O	
Barometric pressure:	28.91 in. Hg at	73 deg F

Comments:

Repeat of test point 77, but approached from low water flow (15 gpm).

Test Number 965227

VTAB AVERAGE UNITS 2*SIGMA

ASTC01	71.332	DEG F	0.336
TPTC01	0.000	DEG F	0.000
RPTC01	68.724	DEG F	0.556
TPMM02	0.000	GPM	0.000
RPMM02	25.228	GPM	0.166
TPMM01	0.000	GPM	0.000
RPMM01	-0.048	GPM	0.042
TPGM01	0.000	SCFM	0.000
TPGM02	0.000	SCFM	0.000
RPGM01	-0.199	SCFM	0.090
RPGM02	0.184	SCFM	0.036
RTGM02	0.210	SCFM	0.085
RTGM01	-0.175	SCFM	0.062
T2GM01	0.000	SCFM	0.000
T3GM01	0.000	SCFM	0.000
T4GM01	0.000	SCFM	0.000
TPGM03	0.000	SCFM	0.000
RPGM03	0.202	SCFM	0.138
T2GM02	0.000	SCFM	0.000
T3GM02	0.000	SCFM	0.000
T4GM02	0.000	SCFM	0.000
RPGP01	-0.013	PSIG	0.005
RPGP02	0.000	PSIG	0.000
RPGP03	0.000	PSIG	0.000
TPGP01	0.000	PSIG	0.000
TPGP02	0.000	PSIG	0.000
TPGP03	0.000	PSIG	0.000
T2GP01	0.000	PSIG	0.000
T3GP01	0.000	PSIG	0.000
T4GP01	0.000	PSIG	0.000
T2GP02	0.000	PSIG	0.000
T3GP02	0.000	PSIG	0.000
T4GP02	0.000	PSIG	0.000
T2GP03	0.000	PSIG	0.000
T3GP03	0.000	PSIG	0.000
T4GP03	0.000	PSIG	0.000
T2GP04	0.000	PSIG	0.000
T3GP04	0.000	PSIG	0.000
T4GP04	0.000	PSIG	0.000
T2GP05	0.000	PSIG	0.000
T3GP05	0.000	PSIG	0.000
T4GP05	0.000	PSIG	0.000
T2GP06	0.000	PSIG	0.000
T3GP06	0.000	PSIG	0.000
T4GP06	0.000	PSIG	0.000
R2GP06	0.000	PSIG	0.000
R3GP06	0.000	PSIG	0.000
R4GP06	0.000	PSIG	0.000
R2GP02	0.000	PSIG	0.000
R3GP02	0.000	PSIG	0.000
R4GP02	0.000	PSIG	0.000
R2GP03	0.000	PSIG	0.000
R3GP03	0.000	PSIG	0.000
R4GP03	0.000	PSIG	0.000
R2GP04	0.000	PSIG	0.000
R3GP04	0.000	PSIG	0.000

Test Number 965227

VTAB AVERAGE UNITS 2*SIGMA

R4GP04	0.000	PSIG	0.000
R2GP05	0.000	PSIG	0.000
R3GP05	0.000	PSIG	0.000
R4GP05	0.000	PSIG	0.000
RTGP01	2.305	PSIG	0.002
T2LC01	0.000	LBM	0.000
T2LC02	0.000	LBM	0.000
T3LC01	0.000	LBM	0.000
T3LC02	0.000	LBM	0.000
T4LC01	0.000	LBM	0.000
T4LC02	0.000	LBM	0.000
R2DP01	0.000	PSI	0.000
R3DP01	0.000	PSI	0.000
R4DP01	0.000	PSI	0.000
R2DP02	0.000	PSI	0.000
R3DP02	0.000	PSI	0.000
R4DP02	0.000	PSI	0.000
RPLV01	4.343	IN-H2O	0.032
TPLV01	0.000	IN-H2O	0.000
TPMM22	0.000	LBM/HR	0.000
RPMM22	12596.304	LBM/HR	83.081
TPMM21	0.000	LBM/HR	0.000
RPMM21	0.000	LBM/HR	0.000
T2LC30	0.000	LBM/HR	0.000
T3LC30	0.000	LBM/HR	0.000
T4LC30	0.000	LBM/HR	0.000

Test Name: 965227, 15:00
Test Date: 20-MAR-91

Today's Date: 05-Apr-91

Mark 22 Fuel Assembly
Annular Flow Distribution - Uninstrumented Assembly Testing
Test Notes ==> 25.0 GPM; 5.33 FT. BFI BACK PRESS.; Water Temp. 70F; P/L; TP 78

Reference Fuel Assembly

		Value	Two Std Deviation	VTAB
** Water **				
Temperature (F):	<	68.7	0.56	RPTC01
Flow Rate (gpm):	<	25.2	0.17	RPMM01+ RPMM02
** Air **				
Temperature (F):	<	71.33	0.34	ASTC01
Flow Rate (scfm):	<	0.20	0.14	RPGM03
** INLET PLENUM **				
Pressure (psig):	<	-0.013	0.004	RPGP01
Level (in):	<	4.343	0.032	RPLV01
** BOTTOM FITTING AND REACTOR TANK **				
Pressure (psig):	<	2.305	0.002	RTGP01

AFD - TEST 965227, VTABLE CREATED 13-MAR-91 18 20 23
20-MAR-91

AFD - TEST 965227; VTABLE CREATED: 13-MAR-91 18:20 23
20-MAR-91

AFD - TEST 965227, VTABLE CREATED 13-MAR-91 18 20 23
20-MAR-91

SCFM
A1-217

Title: Uninstrumented Assembly Testing
Test date/time: 20-MAR-91, 17:06

Test: 965229
Test point: 79

SPECIFIED CONDITIONS:

Water Flow:	25.0 gpm	BFI Type:	P/L
Fluid Temp:	70 deg F	Piston Leakage:	0.00 scfm
Inlet Plenum Press.:	0 psig		
Tank Water Level:	5.67 ft		

ACTUAL CONDITIONS (Uninstrumented Reference Assy.):

COMMENTS

Water Flow:	25.32 gpm	
Air Flow:	Inlet: 0.19 scfm	0-1.5 scfm Omega
	Outlet: 0.19 scfm	0-1.5 scfm Omega
Water Temperature:	68.1 deg F	
Air Temperature:	71.2 deg F	
Inlet plenum pressure:	-0.01 psig	
Tank bottom pressure:	2.44 psig	
	(5.64 ft. H2O) (Tank Water Level)	
Inlet Plenum Level:	4.35 in. H2O	
Barometric pressure:	28.9 in. Hg at	75 deg F

Test Number 965229

VTAB	AVERAGE	UNITS	2*SIGMA
ASTC01	71.236	DEG F	0.171
TPTC01	0.000	DEG F	0.000
RPTC01	68.055	DEG F	0.308
TPMM02	0.000	GPM	0.000
RPMM02	25.318	GPM	0.165
TPMM01	0.000	GPM	0.000
RPMM01	-0.005	GPM	0.056
TPGM01	0.000	SCFM	0.000
TPGM02	0.000	SCFM	0.000
RPGM01	-0.232	SCFM	0.081
RPGM02	0.166	SCFM	0.031
RTGM02	0.188	SCFM	0.074
RTGM01	-0.174	SCFM	0.061
T2GM01	0.000	SCFM	0.000
T3GM01	0.000	SCFM	0.000
T4GM01	0.000	SCFM	0.000
TPGM03	0.000	SCFM	0.000
RPGM03	0.192	SCFM	0.138
T2GM02	0.000	SCFM	0.000
T3GM02	0.000	SCFM	0.000
T4GM02	0.000	SCFM	0.000
RPGP01	-0.013	PSIG	0.005
RPGP02	0.000	PSIG	0.000
RPGP03	0.000	PSIG	0.000
TPGP01	0.000	PSIG	0.000
TPGP02	0.000	PSIG	0.000
TPGP03	0.000	PSIG	0.000
T2GP01	0.000	PSIG	0.000
T3GP01	0.000	PSIG	0.000
T4GP01	0.000	PSIG	0.000
T2GP02	0.000	PSIG	0.000
T3GP02	0.000	PSIG	0.000
T4GP02	0.000	PSIG	0.000
T2GP03	0.000	PSIG	0.000
T3GP03	0.000	PSIG	0.000
T4GP03	0.000	PSIG	0.000
T2GP04	0.000	PSIG	0.000
T3GP04	0.000	PSIG	0.000
T4GP04	0.000	PSIG	0.000
T2GP05	0.000	PSIG	0.000
T3GP05	0.000	PSIG	0.000
T4GP05	0.000	PSIG	0.000
T2GP06	0.000	PSIG	0.000
T3GP06	0.000	PSIG	0.000
T4GP06	0.000	PSIG	0.000
R2GP06	0.000	PSIG	0.000
R3GP06	0.000	PSIG	0.000
R4GP06	0.000	PSIG	0.000
R2GP02	0.000	PSIG	0.000
R3GP02	0.000	PSIG	0.000
R4GP02	0.000	PSIG	0.000
R2GP03	0.000	PSIG	0.000
R3GP03	0.000	PSIG	0.000
R4GP03	0.000	PSIG	0.000
R2GP04	0.000	PSIG	0.000
R3GP04	0.000	PSIG	0.000

Test Number 965229

VTAB AVERAGE UNITS 2*SIGMA

R4GP04	0.000	PSIG	0.000
R2GP05	0.000	PSIG	0.000
R3GP05	0.000	PSIG	0.000
R4GP05	0.000	PSIG	0.000
RTGP01	2.439	PSIG	0.002
T2LC01	0.000	LBM	0.000
T2LC02	0.000	LBM	0.000
T3LC01	0.000	LBM	0.000
T3LC02	0.000	LBM	0.000
T4LC01	0.000	LBM	0.000
T4LC02	0.000	LBM	0.000
R2DP01	0.000	PSI	0.000
R3DP01	0.000	PSI	0.000
R4DP01	0.000	PSI	0.000
R2DP02	0.000	PSI	0.000
R3DP02	0.000	PSI	0.000
R4DP02	0.000	PSI	0.000
RPLV01	4.348	IN-H2O	0.030
TPLV01	0.000	IN-H2O	0.000
TPMM22	0.000	LBM/HR	0.000
RPMM22	12641.406	LBM/HR	82.372
TPMM21	0.000	LBM/HR	0.000
RPMM21	4.135	LBM/HR	8.591
T2LC30	0.000	LBM/HR	0.000
T3LC30	0.000	LBM/HR	0.000
T4LC30	0.000	LBM/HR	0.000

Test Name: 965229, 17:06
Test Date: 20-MAR-91

Today's Date: 05-Apr-91

Mark 22 Fuel Assembly
Annular Flow Distribution - Uninstrumented Assembly Testing
Test Notes ==> 25.0 GPM; 5.67 FT. BFI BACK PRESS.; Water Temp. 70F; P/L; TP 79

Reference Fuel Assembly

		Value	Two Std Deviation	VTAB
** Water **				
Temperature (F):	<	68.1	0.31	RPTC01
Flow Rate (gpm):	<	25.3	0.16	RPMM01+ RPMM02
** Air **				
Temperature (F):	<	71.24	0.17	ASTC01
Flow Rate (scfm):	<	0.19	0.14	RPGM03
** INLET PLENUM **				
Pressure (psig):	<	-0.013	0.004	RPGP01
Level (in):	<	4.348	0.030	RPLV01
** BOTTOM FITTING AND REACTOR TANK **				
Pressure (psig):	<	2.439	0.002	RTGP01

AFD - TEST 965229; VTABLE CREATED: 13-MAR-91 18:20:23
20-MAR-91

P S I C
A1-222

AFD - TEST 965229, VTABLE CREATED: 13-MAR-91 18:20:23
20-MAR-91

AFD - TEST 965229, VTABLE CREATED: 13-MAR-91 18:20:23
20-MAR-91

Title: Uninstrumented Assembly Testing
Test date/time: 20-MAR-91, 18:16

Test: 965230
Test point: 80

SPECIFIED CONDITIONS:

Water Flow:	25.0 gpm	BFI Type:	P/L
Fluid Temp:	70 deg F	Piston Leakage:	0.00 scfm
Inlet Plenum Press.:	0 psig		
Tank Water Level:	6.00 ft		

ACTUAL CONDITIONS (Uninstrumented Reference Assy.):

COMMENTS

Water Flow:	25.14 gpm	
Air Flow:	Inlet: 0.18 scfm	0-1.5 scfm Omega
	Outlet: 0.18 scfm	0-1.5 scfm Omega
Water Temperature:	67.7 deg F	
Air Temperature:	70.9 deg F	
Inlet plenum pressure:	-0.01 psig	
Tank bottom pressure:	2.59 psig	
	(5.98 ft. H2O) (Tank Water Level)	
Inlet Plenum Level:	4.31 in. H2O	
Barometric pressure:	28.88 in. Hg at	76 deg F

Test Number 965230

VTAB AVERAGE UNITS 2*SIGMA

ASTC01	70.893	DEG F	0.214
TPTC01	0.000	DEG F	0.000
RPTC01	67.680	DEG F	0.401
TPMM02	0.000	GPM	0.000
RPMM02	25.138	GPM	0.141
TPMM01	0.000	GPM	0.000
RPMM01	-0.022	GPM	0.058
TPGM01	0.000	SCFM	0.000
TPGM02	0.000	SCFM	0.000
RPGM01	-0.253	SCFM	0.086
RPGM02	0.158	SCFM	0.036
RTGM02	0.183	SCFM	0.089
RTGM01	-0.177	SCFM	0.063
T2GM01	0.000	SCFM	0.000
T3GM01	0.000	SCFM	0.000
T4GM01	0.000	SCFM	0.000
TPGM03	0.000	SCFM	0.000
RPGM03	0.180	SCFM	0.129
T2GM02	0.000	SCFM	0.000
T3GM02	0.000	SCFM	0.000
T4GM02	0.000	SCFM	0.000
RPGP01	-0.013	PSIG	0.005
RPGP02	0.000	PSIG	0.000
RPGP03	0.000	PSIG	0.000
TPGP01	0.000	PSIG	0.000
TPGP02	0.000	PSIG	0.000
TPGP03	0.000	PSIG	0.000
T2GP01	0.000	PSIG	0.000
T3GP01	0.000	PSIG	0.000
T4GP01	0.000	PSIG	0.000
T2GP02	0.000	PSIG	0.000
T3GP02	0.000	PSIG	0.000
T4GP02	0.000	PSIG	0.000
T2GP03	0.000	PSIG	0.000
T3GP03	0.000	PSIG	0.000
T4GP03	0.000	PSIG	0.000
T2GP04	0.000	PSIG	0.000
T3GP	0.000	PSIG	0.000
T4GP04	0.000	PSIG	0.000
T2GP05	0.000	PSIG	0.000
T3GP05	0.000	PSIG	0.000
T4GP05	0.000	PSIG	0.000
T2GP06	0.000	PSIG	0.000
T3GP06	0.000	PSIG	0.000
T4GP06	0.000	PSIG	0.000
R2GP06	0.000	PSIG	0.000
R3GP06	0.000	PSIG	0.000
R4GP06	0.000	PSIG	0.000
R2GP02	0.000	PSIG	0.000
R3GP02	0.000	PSIG	0.000
R4GP02	0.000	PSIG	0.000
R2GP03	0.000	PSIG	0.000
R3GP03	0.000	PSIG	0.000
R4GP03	0.000	PSIG	0.000
R2GP04	0.000	PSIG	0.000
R3GP04	0.000	PSIG	0.000

Test Number 965230

VTAB AVERAGE UNITS 2*SIGMA

R4GP04	0.000	PSIG	0.000
R2GP05	0.000	PSIG	0.000
R3GP05	0.000	PSIG	0.000
R4GP05	0.000	PSIG	0.000
RTGP01	2.586	PSIG	0.002
T2LC01	0.000	LBM	0.000
T2LC02	0.000	LBM	0.000
T3LC01	0.000	LBM	0.000
T3LC02	0.000	LBM	0.000
T4LC01	0.000	LBM	0.000
T4LC02	0.000	LBM	0.000
R2DP01	0.000	PSI	0.000
R3DP01	0.000	PSI	0.000
R4DP01	0.000	PSI	0.000
R2DP02	0.000	PSI	0.000
R3DP02	0.000	PSI	0.000
R4DP02	0.000	PSI	0.000
RPLV01	4.314	IN-H2O	0.044
TPLV01	0.000	IN-H2O	0.000
TPMM22	0.000	LBM/HR	0.000
RPMM22	12551.527	LBM/HR	70.545
TPMM21	0.000	LBM/HR	0.000
RPMM21	1.051	LBM/HR	4.722
T2LC30	0.000	LBM/HR	0.000
T3LC30	0.000	LBM/HR	0.000
T4LC30	0.000	LBM/HR	0.000

Test Name: 965230, 18:16
Test Date: 20-MAR-91

Today's Date: 05-Apr-91

Mark 22 Fuel Assembly
Annular Flow Distribution - Uninstrumented Assembly Testing
Test Notes ==> 25.0 GPM; 6.0 FT. BFI BACK PRESS.; Water Temp. 70F; P/L; TP 80

Reference Fuel Assembly

		Value	Two Std Deviation	VTAB
** Water **				
Temperature (F):	<	67.7	0.40	RPTC01
Flow Rate (gpm):	<	25.1	0.14	RPMM01+ RPMM02
** Air **				
Temperature (F):	<	70.89	0.21	ASTC01
Flow Rate (scfm):	<	0.18	0.13	RPGM03
** INLET PLENUM **				
Pressure (psig):	<	-0.013	0.004	RPGP01
Level (in):	<	4.314	0.044	RPLV01
** BOTTOM FITTING AND REACTOR TANK **				
Pressure (psig):	<	2.586	0.002	RTGP01

AFD - TEST 965230; VTABLE CREATED: 13-MAR-91 18:20:23
20-MAR-91

AFD - TEST 965230; VTABLE CREATED: 13-MAR-91 18:20:23
20-MAR-91

AFD - TEST 965230; VTABLE CREATED: 13-MAR-91 18:20:23
20-MAR-91

Title: Uninstrumented Assembly Testing
Test date/time: 21-MAR-91, 12:24

Test: 965233
Test point: 81

SPECIFIED CONDITIONS:

Water Flow:	30.0 gpm	BFI Type:	P/L
Fluid Temp:	70 deg F	Piston Leakage:	0.00 scfm
Inlet Plenum Press.:	0 psig		
Tank Water Level:	6.00 ft		

ACTUAL CONDITIONS (Uninstrumented Reference Assy.):

COMMENTS

Water Flow:	30.23 gpm	
Air Flow:	Inlet: 0.29 scfm	0-1.5 scfm Omega
	Outlet: 0.27 scfm	0-1.5 scfm Omega
Water Temperature:	67.6 deg F	
Air Temperature:	72.0 def F	
Inlet plenum pressure:	-0.03 psig	
Tank bottom pressure:	2.58 psig	
	(5.96 ft. H2O) (Tank Water Level)	
Inlet Plenum Level:	4.84 in. H2O	
Barometric pressure:	28.7 in. Hg at	70 deg F

Test Number 965233

VTAB	AVERAGE	UNITS	2*SIGMA
ASTC01	71.954	DEG F	0.194
TPTC01	0.000	DEG F	0.000
RPTC01	67.599	DEG F	0.293
TPMM02	0.000	GPM	0.000
RPMM02	30.232	GPM	0.123
TPMM01	0.000	GPM	0.000
RPMM01	-0.044	GPM	0.058
TPGM01	0.000	SCFM	0.000
TPGM02	0.000	SCFM	0.000
RPGM01	-0.117	SCFM	0.094
RPGM02	0.261	SCFM	0.052
RTGM02	0.265	SCFM	0.123
RTGM01	-0.242	SCFM	0.062
T2GM01	0.000	SCFM	0.000
T3GM01	0.000	SCFM	0.000
T4GM01	0.000	SCFM	0.000
TPGM03	0.000	SCFM	0.000
RPGM03	0.286	SCFM	0.205
T2GM02	0.000	SCFM	0.000
T3GM02	0.000	SCFM	0.000
T4GM02	0.000	SCFM	0.000
RPGP01	-0.026	PSIG	0.009
RPGP02	0.000	PSIG	0.000
RPGP03	0.000	PSIG	0.000
TPGP01	0.000	PSIG	0.000
TPGP02	0.000	PSIG	0.000
TPGP03	0.000	PSIG	0.000
T2GP01	0.000	PSIG	0.000
T3GP01	0.000	PSIG	0.000
T4GP01	0.000	PSIG	0.000
T2GP02	0.000	PSIG	0.000
T3GP02	0.000	PSIG	0.000
T4GP02	0.000	PSIG	0.000
T2GP03	0.000	PSIG	0.000
T3GP03	0.000	PSIG	0.000
T4GP03	0.000	PSIG	0.000
T2GP04	0.000	PSIG	0.000
T3GP04	0.000	PSIG	0.000
T4GP04	0.000	PSIG	0.000
T2GP05	0.000	PSIG	0.000
T3GP05	0.000	PSIG	0.000
T4GP05	0.000	PSIG	0.000
T2GP06	0.000	PSIG	0.000
T3GP06	0.000	PSIG	0.000
T4GP06	0.000	PSIG	0.000
R2GP06	0.000	PSIG	0.000
R3GP06	0.000	PSIG	0.000
R4GP06	0.000	PSIG	0.000
R2GP02	0.000	PSIG	0.000
R3GP02	0.000	PSIG	0.000
R4GP02	0.000	PSIG	0.000
R2GP03	0.000	PSIG	0.000
R3GP03	0.000	PSIG	0.000
R4GP03	0.000	PSIG	0.000
R2GP04	0.000	PSIG	0.000
R3GP04	0.000	PSIG	0.000

Test Number 965233

VTAB AVERAGE UNITS 2*SIGMA

R4GP04	0.000	PSIG	0.000
R2GP05	0.000	PSIG	0.000
R3GP05	0.000	PSIG	0.000
R4GP05	0.000	PSIG	0.000
RTGP01	2.576	PSIG	0.004
T2LC01	0.000	LBM	0.000
T2LC02	0.000	LBM	0.000
T3LC01	0.000	LBM	0.000
T3LC02	0.000	LBM	0.000
T4LC01	0.000	LBM	0.000
T4LC02	0.000	LBM	0.000
R2DP01	0.000	PSI	0.000
R3DP01	0.000	PSI	0.000
R4DP01	0.000	PSI	0.000
R2DP02	0.000	PSI	0.000
R3DP02	0.000	PSI	0.000
R4DP02	0.000	PSI	0.000
RPLV01	4.839	IN-H2O	0.011
TPLV01	0.000	IN-H2O	0.000
TPMM22	0.000	LBM/HR	0.000
RPMM22	15094.673	LBM/HR	61.560
TPMM21	0.000	LBM/HR	0.000
RPMM21	0.000	LBM/HR	0.000
T2LC30	0.000	LBM/HR	0.000
T3LC30	0.000	LBM/HR	0.000
T4LC30	0.000	LBM/HR	0.000

Test Name: 965233, 12:24
Test Date: 21-MAR-91

Today's Date: 05-Apr-91

Mark 22 Fuel Assembly
Annular Flow Distribution - Uninstrumented Assembly Testing
Test Notes ==> 30 GPM; 6.0 FT. BFI BACK PRESS.; Water Temp. 70F; P/L; TP 81

Reference Fuel Assembly

		Value	Two Std Deviation	VTAB
** Water **				
Temperature (F):	<	67.6	0.29	RPTC01
Flow Rate (gpm):	<	30.2	0.12	RPMM01+ RPMM02
** Air **				
Temperature (F):	<	71.95	0.19	ASTC01
Flow Rate (scfm):	<	0.29	0.21	RPGM03
** INLET PLENUM **				
Pressure (psig):	<	-0.026	0.010	RPGP01
Level (in):	<	4.839	0.010	RPLV01
** BOTTOM FITTING AND REACTOR TANK **				
Pressure (psig):	<	2.576	0.004	RTGP01

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4 of 4

AFD - TEST 965233; VTABLE CREATED 13-MAR-91 18 20:23
21-MAR-91

AFD - TEST 965233; VTABLE CREATED: 13-MAR-91 18:20 23
21-MAR-91

SCFM
A1-237

AFD - TEST 965233; VTABLE CREATED: 13-MAR-91 18:20:23
21-MAR-91

Title: Uninstrumented Assembly Testing
Test date/time: 21-MAR-91, 14:28

Test: 965234
Test point: 82

SPECIFIED CONDITIONS:

Water Flow:	30.0 gpm	BFI Type:	P/L
Fluid Temp:	70 deg F	Piston Leakage:	0.00 scfm
Inlet Plenum Press.:	0 psig		
Tank Water Level:	6.33 ft		

ACTUAL CONDITIONS (Uninstrumented Reference Assy.):

COMMENTS

Water Flow:	30.18 gpm	
Air Flow:	Inlet: 0.27 scfm	0-1.5 scfm Omega
	Outlet: 0.27 scfm	0-1.5 scfm Omega
Water Temperature:	68.7 deg F	
Air Temperature:	73.3 def F	
Inlet plenum pressure:	-0.02 psig	
Tank bottom pressure:	2.72 psig	
	(6.30 ft. H2O) (Tank Water Level)	
Inlet Plenum Level:	4.83 in. H2O	
Barometric pressure:	28.7 in. Hg at	72 deg F

Test Number 965234

VTAB	AVERAGE	UNITS	2*SIGMA
ASTC01	73.292	DEG F	0.162
TPTC01	0.000	DEG F	0.000
RPTC01	68.708	DEG F	0.270
TPMM02	0.000	GPM	0.000
RPMM02	30.184	GPM	0.166
TPMM01	0.000	GPM	0.000
RPMM01	-0.078	GPM	0.048
TPGM01	0.000	SCFM	0.000
TPGM02	0.000	SCFM	0.000
RPGM01	-0.122	SCFM	0.110
RPGM02	0.255	SCFM	0.061
RTGM02	0.270	SCFM	0.143
RTGM01	-0.251	SCFM	0.062
T2GM01	0.000	SCFM	0.000
T3GM01	0.000	SCFM	0.000
T4GM01	0.000	SCFM	0.000
TPGM03	0.000	SCFM	0.000
RPGM03	0.272	SCFM	0.198
T2GM02	0.000	SCFM	0.000
T3GM02	0.000	SCFM	0.000
T4GM02	0.000	SCFM	0.000
RPGP01	-0.024	PSIG	0.010
RPGP02	0.000	PSIG	0.000
RPGP03	0.000	PSIG	0.000
TPGP01	0.000	PSIG	0.000
TPGP02	0.000	PSIG	0.000
TPGP03	0.000	PSIG	0.000
T2GP01	0.000	PSIG	0.000
T3GP01	0.000	PSIG	0.000
T4GP01	0.000	PSIG	0.000
T2GP02	0.000	PSIG	0.000
T3GP02	0.000	PSIG	0.000
T4GP02	0.000	PSIG	0.000
T2GP03	0.000	PSIG	0.000
T3GP03	0.000	PSIG	0.000
T4GP03	0.000	PSIG	0.000
T2GP04	0.000	PSIG	0.000
T3GP04	0.000	PSIG	0.000
T4GP04	0.000	PSIG	0.000
T2GP05	0.000	PSIG	0.000
T3GP05	0.000	PSIG	0.000
T4GP05	0.000	PSIG	0.000
T2GP06	0.000	PSIG	0.000
T3GP06	0.000	PSIG	0.000
T4GP06	0.000	PSIG	0.000
R2GP06	0.000	PSIG	0.000
R3GP06	0.000	PSIG	0.000
R4GP06	0.000	PSIG	0.000
R2GP02	0.000	PSIG	0.000
R3GP02	0.000	PSIG	0.000
R4GP02	0.000	PSIG	0.000
R2GP03	0.000	PSIG	0.000
R3GP03	0.000	PSIG	0.000
R4GP03	0.000	PSIG	0.000
R2GP04	0.000	PSIG	0.000
R3GP04	0.000	PSIG	0.000

Test Number 965234

VTAB AVERAGE UNITS 2*SIGMA

R4GP04	0.000	PSIG	0.000
R2GP05	0.000	PSIG	0.000
R3GP05	0.000	PSIG	0.000
R4GP05	0.000	PSIG	0.000
RTGP01	2.723	PSIG	0.004
T2LC01	0.000	LBM	0.000
T2LC02	0.000	LBM	0.000
T3LC01	0.000	LBM	0.000
T3LC02	0.000	LBM	0.000
T4LC01	0.000	LBM	0.000
T4LC02	0.000	LBM	0.000
R2DP01	0.000	PSI	0.000
R3DP01	0.000	PSI	0.000
R4DP01	0.000	PSI	0.000
R2DP02	0.000	PSI	0.000
R3DP02	0.000	PSI	0.000
R4DP02	0.000	PSI	0.000
RPLV01	4.834	IN-H2O	0.025
TPLV01	0.000	IN-H2O	0.000
TPMM22	0.000	LBM/HR	0.000
RPMM22	15070.653	LBM/HR	82.976
TPMM21	0.000	LBM/HR	0.000
RPMM21	0.000	LBM/HR	0.000
T2LC30	0.000	LBM/HR	0.000
T3LC30	0.000	LBM/HR	0.000
T4LC30	0.000	LBM/HR	0.000

Test Name: 965234, 14:28
Test Date: 21-MAR-91

Today's Date: 05-Apr-91

Mark 22 Fuel Assembly
Annular Flow Distribution - Uninstrumented Assembly Testing
Test Notes ==> 30 GPM; 6.33 FT. BFI BACK PRESS.; Water Temp. 70F; P/L; TP 82

Reference Fuel Assembly

		Value	Two Std Deviation	VTAB
** Water **				
Temperature (F):	<	68.7	0.27	RPTC01
Flow Rate (gpm):	<	30.2	0.17	RPMM01+ RPMM02
** Air **				
Temperature (F):	<	73.29	0.16	ASTC01
Flow Rate (scfm):	<	0.27	0.20	RPGM03
** INLET PLENUM **				
Pressure (psig):	<	-0.024	0.010	RPGP01
Level (in):	<	4.834	0.024	RPLV01
** BOTTOM FITTING AND REACTOR TANK **				
Pressure (psig):	<	2.723	0.004	RTGP01

AFD - TEST 965234; VTABLE CREATED: 13-MAR-91 18 20 23
21-MAR-91

P S I C
A1-243

TIME, HRS

AFD - TEST 965234; VTABLE CREATED: 13-MAR-91 18:20:23
21-MAR-91

SCFM

A1-244

AFD - TEST 965234; VTABLE CREATED: 13-MAR-91 18:20:23
21-MAR-91

Title: Uninstrumented Assembly Testing
Test date/time: 2-APR-91, 14:51

Test: 965241
Test point: 83

SPECIFIED CONDITIONS:

Water Flow:	30.0 gpm	BFI Type:	P/L
Fluid Temp:	70 deg F	Piston Leakage:	0.00 scfm
Inlet Plenum Press.:	0 psig		
Tank Water Level:	6.67 ft		

ACTUAL CONDITIONS (Uninstrumented Reference Assy.):

COMMENTS

Water Flow:	30.07 gpm	
Air Flow:	Inlet: 0.24 scfm	0-1.5 scfm Omega
	Outlet: 0.22 scfm	0-1.5 scfm Omega
Water Temperature:	68.3 deg F	
Air Temperature:	68.9 deg F	
Inlet plenum pressure:	-0.03 psig	
Tank bottom pressure:	2.86 psig	
	(6.61 ft. H2O) (Tank Water Level)	
Inlet Plenum Level:	4.85 in. H2O	
Barometric pressure:	29.27 in. Hg at	74 deg F

Test Number 965241

VTAB AVERAGE UNITS 2*SIGMA

ASTC01	68.917	DEG F	0.186
TPTC01	0.000	DEG F	0.000
RPTC01	68.321	DEG F	0.279
TPMM02	0.000	GPM	0.000
RPMM02	30.072	GPM	0.107
TPMM01	0.000	GPM	0.000
RPMM01	0.040	GPM	0.058
TPGM01	0.000	SCFM	0.000
TPGM02	0.000	SCFM	0.000
RPGM01	-0.180	SCFM	0.089
RPGM02	0.210	SCFM	0.049
RTGM02	0.217	SCFM	0.143
RTGM01	-0.258	SCFM	0.065
T2GM01	0.000	SCFM	0.000
T3GM01	0.000	SCFM	0.000
T4GM01	0.000	SCFM	0.000
TPGM03	0.000	SCFM	0.000
RPGM03	0.241	SCFM	0.167
T2GM02	0.000	SCFM	0.000
T3GM02	0.000	SCFM	0.000
T4GM02	0.000	SCFM	0.000
RPGP01	-0.025	PSIG	0.007
RPGP02	0.000	PSIG	0.000
RPGP03	0.000	PSIG	0.000
TPGP01	0.000	PSIG	0.000
TPGP02	0.000	PSIG	0.000
TPGP03	0.000	PSIG	0.000
T2GP01	0.000	PSIG	0.000
T3GP01	0.000	PSIG	0.000
T4GP01	0.000	PSIG	0.000
T2GP02	0.000	PSIG	0.000
T3GP02	0.000	PSIG	0.000
T4GP02	0.000	PSIG	0.000
T2GP03	0.000	PSIG	0.000
T3GP03	0.000	PSIG	0.000
T4GP03	0.000	PSIG	0.000
T2GP04	0.000	PSIG	0.000
T3GP04	0.000	PSIG	0.000
T4GP04	0.000	PSIG	0.000
T2GP05	0.000	PSIG	0.000
T3GP05	0.000	PSIG	0.000
T4GP05	0.000	PSIG	0.000
T2GP06	0.000	PSIG	0.000
T3GP06	0.000	PSIG	0.000
T4GP06	0.000	PSIG	0.000
R2GP06	0.000	PSIG	0.000
R3GP06	0.000	PSIG	0.000
R4GP06	0.000	PSIG	0.000
R2GP02	0.000	PSIG	0.000
R3GP02	0.000	PSIG	0.000
R4GP02	0.000	PSIG	0.000
R2GP03	0.000	PSIG	0.000
R3GP03	0.000	PSIG	0.000
R4GP03	0.000	PSIG	0.000
R2GP04	0.000	PSIG	0.000
R3GP04	0.000	PSIG	0.000

Test Number 965241

VTAB AVERAGE UNITS 2*SIGMA

R4GP04	0.000	PSIG	0.000
R2GP05	0.000	PSIG	0.000
R3GP05	0.000	PSIG	0.000
R4GP05	0.000	PSIG	0.000
RTGP01	2.856	PSIG	0.003
T2LC01	0.000	LBM	0.000
T2LC02	0.000	LBM	0.000
T3LC01	0.000	LBM	0.000
T3LC02	0.000	LBM	0.000
T4LC01	0.000	LBM	0.000
T4LC02	0.000	LBM	0.000
R2DP01	0.000	PSI	0.000
R3DP01	0.000	PSI	0.000
R4DP01	0.000	PSI	0.000
R2DP02	0.000	PSI	0.000
R3DP02	0.000	PSI	0.000
R4DP02	0.000	PSI	0.000
RPLV01	4.849	IN-H2O	0.025
TPLV01	0.000	IN-H2O	0.000
TPMM22	0.000	LBM/HR	0.000
RPMM22	15014.748	LBM/HR	53.264
TPMM21	0.000	LBM/HR	0.000
RPMM21	19.143	LBM/HR	28.239
T2LC30	0.000	LBM/HR	0.000
T3LC30	0.000	LBM/HR	0.000
T4LC30	0.000	LBM/HR	0.000

Test Name: 965241, 14:51
Test Date: 2-APR-91

Today's Date: 05-Apr-91

Mark 22 Fuel Assembly
Annular Flow Distribution - Uninstrumented Assembly Testing
Test Notes ==> 30.0 GPM; 6.67 FT. BFI BACK PRESS.; Water Temp. 70F; P/L; TP 83

Reference Fuel Assembly

		Value	Two Std Deviation	VTAB
** Water **				
Temperature (F):	<	68.3	0.28	RPTC01
Flow Rate (gpm):	<	30.1	0.11	RPMM01.+ RPMM02
** Air **				
Temperature (F):	<	68.92	0.19	ASTC01
Flow Rate (scfm):	<	0.24	0.17	RPGM03
** INLET PLENUM **				
Pressure (psig):	<	-0.025	0.008	RPGP01
Level (in):	<	4.849	0.024	RPLV01
** BOTTOM FITTING AND REACTOR TANK **				
Pressure (psig):	<	2.856	0.004	RTGP01

AFD - TEST 965241; VTABLE CREATED 13-MAR-91 18 20 23
02-APR-91

AFD - TEST 965241; VTABLE CREATED 13-MAR-91 18 20 23
02-APR-91

AFD - TEST 965241, VTABLE CREATED: 13-MAR-91 18 20 23
02-APR-91

Title: Uninstrumented Assembly Testing
Test date/time: 2-APR-91, 17:08

Test: 965242
Test point: 84

SPECIFIED CONDITIONS:

Water Flow:	30.0 gpm	BFI Type:	P/L
Fluid Temp:	70 deg F	Piston Leakage:	0.00 scfm
Inlet Plenum Press.:	0 psig		
Tank Water Level:	7.00 ft		

ACTUAL CONDITIONS (Uninstrumented Reference Assy.):

COMMENTS

Water Flow:	29.99 gpm	
Air Flow:	Inlet: 0.25 scfm	0-1.5 scfm Omega
	Outlet: 0.24 scfm	0-1.5 scfm Omega
Water Temperature:	69.1 deg F	
Air Temperature:	71.8 deg F	
Inlet plenum pressure:	-0.03 psig	
Tank bottom pressure	3.03 psig	
	7.01 ft. H2O) (Tank Water Level)	
Inlet Plenum Level:	4.85 in. H2O	
Barometric pressure:	29.28 in. Hg at	74 deg F

Test Number 965242

VTAB	AVERAGE	UNITS	2*SIGMA
ASTC01	71.820	DEG F	0.222
TPTC01	0.000	DEG F	0.000
RPTC01	69.130	DEG F	0.346
TPMM02	0.000	GPM	0.000
RPMM02	29.992	GPM	0.217
TPMM01	0.000	GPM	0.000
RPMM01	0.053	GPM	0.053
TPGM01	0.000	SCFM	0.000
TPGM02	0.000	SCFM	0.000
RPGM01	-0.183	SCFM	0.098
RPGM02	0.215	SCFM	0.056
RTGM02	0.235	SCFM	0.163
RTGM01	-0.252	SCFM	0.064
T2GM01	0.000	SCFM	0.000
T3GM01	0.000	SCFM	0.000
T4GM01	0.000	SCFM	0.000
TPGM03	0.000	SCFM	0.000
RPGM03	0.253	SCFM	0.195
T2GM02	0.000	SCFM	0.000
T3GM02	0.000	SCFM	0.000
T4GM02	0.000	SCFM	0.000
RPGP01	-0.025	PSIG	0.008
RPGP02	0.000	PSIG	0.000
RPGP03	0.000	PSIG	0.000
TPGP01	0.000	PSIG	0.000
TPGP02	0.000	PSIG	0.000
TPGP03	0.000	PSIG	0.000
T2GP01	0.000	PSIG	0.000
T3GP01	0.000	PSIG	0.000
T4GP01	0.000	PSIG	0.000
T2GP02	0.000	PSIG	0.000
T3GP02	0.000	PSIG	0.000
T4GP02	0.000	PSIG	0.000
T2GP03	0.000	PSIG	0.000
T3GP03	0.000	PSIG	0.000
T4GP03	0.000	PSIG	0.000
T2GP04	0.000	PSIG	0.000
T3GP04	0.000	PSIG	0.000
T4GP04	0.000	PSIG	0.000
T2GP05	0.000	PSIG	0.000
T3GP05	0.000	PSIG	0.000
T4GP05	0.000	PSIG	0.000
T2GP06	0.000	PSIG	0.000
T3GP06	0.000	PSIG	0.000
T4GP06	0.000	PSIG	0.000
R2GP06	0.000	PSIG	0.000
R3GP06	0.000	PSIG	0.000
R4GP06	0.000	PSIG	0.000
R2GP02	0.000	PSIG	0.000
R3GP02	0.000	PSIG	0.000
R4GP02	0.000	PSIG	0.000
R2GP03	0.000	PSIG	0.000
R3GP03	0.000	PSIG	0.000
R4GP03	0.000	PSIG	0.000
R2GP04	0.000	PSIG	0.000
R3GP04	0.000	PSIG	0.000

Test Number 965242
 VTAB AVERAGE UNITS 2*SIGMA

R4GP04	0.000	PSIG	0.000
R2GP05	0.000	PSIG	0.000
R3GP05	0.000	PSIG	0.000
R4GP05	0.000	PSIG	0.000
RTGP01	3.030	PSIG	0.004
T2LC01	0.000	LBM	0.000
T2LC02	0.000	LBM	0.000
T3LC01	0.000	LBM	0.000
T3LC02	0.000	LBM	0.000
T4LC01	0.000	LBM	0.000
T4LC02	0.000	LBM	0.000
R2DP01	0.000	PSI	0.000
R3DP01	0.000	PSI	0.000
R4DP01	0.000	PSI	0.000
R2DP02	0.000	PSI	0.000
R3DP02	0.000	PSI	0.000
R4DP02	0.000	PSI	0.000
RPLV01	4.853	IN-H2O	0.027
TPLV01	0.000	IN-H2O	0.000
TPMM22	0.000	LBM/HR	0.000
RPMM22	14975.132	LBM/HR	108.356
TPMM21	0.000	LBM/HR	0.000
RPMM21	25.579	LBM/HR	27.236
T2LC30	0.000	LBM/HR	0.000
T3LC30	0.000	LBM/HR	0.000
T4LC30	0.000	LBM/HR	0.000

Test Name: 965242, 17:08
Test Date: 2-APR-91

Today's Date: 05-Apr-91

Mark 22 Fuel Assembly
Annular Flow Distribution - Uninstrumented Assembly Testing
Test Notes ==> 30.0 GPM; 7.00 FT. BFI BACK PRESS.; Water Temp. 70F; P/L; TP 84

Reference Fuel Assembly

		Value	Two Std Deviation	VTAB
** Water **				
Temperature (F):	<	69.1	0.35	RPTC01
Flow Rate (gpm):	<	30.0	0.22	RPMM01+ RPMM02
** Air **				
Temperature (F):	<	71.82	0.22	ASTC01
Flow Rate (scfm):	<	0.25	0.20	RPGM03
** INLET PLENUM **				
Pressure (psig):	<	-0.025	0.008	RPGP01
Level (in):	<	4.853	0.028	RPLV01
** BOTTOM FITTING AND REACTOR TANK **				
Pressure (psig):	<	3.030	0.004	RTGP01

AFD - TEST 965242; VTABLE CREATED 13-MAR-91 18 20 23
02-APR-91

AFD - TEST 965242; VTABLE CREATED: 13-MAR-91 18:20:23
02-APR-91

Title: Uninstrumented Assembly Testing
Test date/time: 20-MAR-91, 21:13

Test: 965232
Test point: 85

SPECIFIED CONDITIONS:

Water Flow:	60.3 gpm	BFI Type:	P/L
Fluid Temp:	70 deg F	Piston Leakage:	0.00 scfm
Inlet Plenum Press.:	-0.22 psig		
Tank Water Level:	4.06 ft		

ACTUAL CONDITIONS (Uninstrumented Reference Assy.):

COMMENTS

Water Flow:	59.63 gpm *	
Air Flow:	Inlet: 1.37 scfm	0-1.5 scfm Omega
	Outlet: 1.21 scfm	0-1.5 scfm Omega
Water Temperature:	67.7 deg F	
Air Temperature:	68.9 deg F	
Inlet plenum pressure:	-0.23 psig	
Tank bottom pressure:	1.75 psig	
	(4.04 ft. H2O) (Tank Water Level)	
Inlet Plenum Level:	7.44 in. H2O	
Barometric pressure:	28.88 in. Hg at	75 deg F

* Actual water flow rate was 0.67 gpm below target value (0.17 gpm out of spec.).

Comments:

Same nominal as test point 66, approached from increasing water flow.

Test Number 965232
 VTAB AVERAGE UNITS 2*SIGMA

ASTC01	68.926	DEG F	0.135
TPTC01	0.000	DEG F	0.000
RPTC01	67.722	DEG F	0.219
TPMM02	0.000	GPM	0.000
RPMM02	59.629	GPM	0.288
TPMM01	0.000	GPM	0.000
RPMM01	-0.062	GPM	0.082
TPGM01	0.000	SCFM	0.000
TPGM02	0.000	SCFM	0.000
RPGM01	1.369	SCFM	0.082
RPGM02	1.315	SCFM	0.033
RTGM02	1.206	SCFM	0.039
RTGM01	-0.179	SCFM	0.065
T2GM01	0.000	SCFM	0.000
T3GM01	0.000	SCFM	0.000
T4GM01	0.000	SCFM	0.000
TPGM03	0.000	SCFM	0.000
RPGM03	1.366	SCFM	0.075
T2GM02	0.000	SCFM	0.000
T3GM02	0.000	SCFM	0.000
T4GM02	0.000	SCFM	0.000
RPGP01	-0.230	PSIG	0.016
RPGP02	0.000	PSIG	0.000
RPGP03	0.000	PSIG	0.000
TPGP01	0.000	PSIG	0.000
TPGP02	0.000	PSIG	0.000
TPGP03	0.000	PSIG	0.000
T2GP01	0.000	PSIG	0.000
T3GP01	0.000	PSIG	0.000
T4GP01	0.000	PSIG	0.000
T2GP02	0.000	PSIG	0.000
T3GP02	0.000	PSIG	0.000
T4GP02	0.000	PSIG	0.000
T2GP03	0.000	PSIG	0.000
T3GP03	0.000	PSIG	0.000
T4GP03	0.000	PSIG	0.000
T2GP04	0.000	PSIG	0.000
T3GP04	0.000	PSIG	0.000
T4GP04	0.000	PSIG	0.000
T2GP05	0.000	PSIG	0.000
T3GP05	0.000	PSIG	0.000
T4GP05	0.000	PSIG	0.000
T2GP06	0.000	PSIG	0.000
T3GP06	0.000	PSIG	0.000
T4GP06	0.000	PSIG	0.000
R2GP06	0.000	PSIG	0.000
R3GP06	0.000	PSIG	0.000
R4GP06	0.000	PSIG	0.000
R2GP02	0.000	PSIG	0.000
R3GP02	0.000	PSIG	0.000
R4GP02	0.000	PSIG	0.000
R2GP03	0.000	PSIG	0.000
R3GP03	0.000	PSIG	0.000
R4GP03	0.000	PSIG	0.000
R2GP04	0.000	PSIG	0.000
R3GP04	0.000	PSIG	0.000

Test Number 965232

VTAB AVERAGE UNITS 2*SIGMA

R4GP04	0.000	PSIG	0.000
R2GP05	0.000	PSIG	0.000
R3GP05	0.000	PSIG	0.000
R4GP05	0.000	PSIG	0.000
RTGP01	1.745	PSIG	0.007
T2LC01	0.000	LBM	0.000
T2LC02	0.000	LBM	0.000
T3LC01	0.000	LBM	0.000
T3LC02	0.000	LBM	0.000
T4LC01	0.000	LBM	0.000
T4LC02	0.000	LBM	0.000
R2DP01	0.000	PSI	0.000
R3DP01	0.000	PSI	0.000
R4DP01	0.000	PSI	0.000
R2DP02	0.000	PSI	0.000
R3DP02	0.000	PSI	0.000
R4DP02	0.000	PSI	0.000
RPLV01	7.437	IN-H2O	0.026
TPLV01	0.000	IN-H2O	0.000
TPMM22	0.000	LBM/HR	0.000
RPMM22	29772.523	LBM/HR	144.001
TPMM21	0.000	LBM/HR	0.000
RPMM21	0.065	LBM/HR	0.919
T2LC30	0.000	LBM/HR	0.000
T3LC30	0.000	LBM/HR	0.000
T4LC30	0.000	LBM/HR	0.000

Test Name: 965232, 20:13
Test Date: 20-MAR-91

Today's Date: 05-Apr-91

Mark 22 Fuel Assembly
Annular Flow Distribution - Uninstrumented Assembly Testing
Test Notes ==> 60.3 GPM; 4.06 FT. BFI BACK PRESS.; Water Temp. 70F; P/L; TP 85

Reference Fuel Assembly

		Value	Two Std Deviation	VTAB
** Water **				
Temperature (F):	<	67.7	0.22	RPTC01
Flow Rate (gpm):	<	59.6	0.29	RPTM01+ RPTM02
** Air **				
Temperature (F):	<	68.93	0.13	ASTC01
Flow Rate (scfm):	<	1.37	0.07	RFGM03
** INLET PLENUM **				
Pressure (psig):	<	-0.230	0.016	RPGP01
Level (in):	<	7.437	0.026	RPLV01
** BOTTOM FITTING AND REACTOR TANK **				
Pressure (psig):	<	1.745	0.006	RTGP01

AFD - TEST 965232; VTABLE CREATED: 13-MAR-91 18:20:23
20-MAR-91

TIME, HRS

AFD - TEST 965232; VTABLE CREATED: 13-MAR-91 18:20 23
20-MAR-91

SCFM
A1-265

AFD - TEST 965232; VTABLE CREATED: 13-MAR-91 18 20 23
20-MAR-91

Title: Uninstrumented Assembly Testing
Test date/time: 2-APR-91, 13:38

Test: 965240
Test point: 86

SPECIFIED CONDITIONS:

Water Flow: 60.3 gpm
Fluid Temp: 70 deg F
Inlet Plenum Press.: -0.22 psig
Tank Water Level: 4.06 ft

BFI Type: P/L
Piston Leakage: 0.00 scfm

ACTUAL CONDITIONS (Uninstrumented Reference Assy.):

COMMENTS

Water Flow: 60.47 gpm

Air Flow: Inlet: 1.31 scfm
Outlet: 1.34 scfm

0-1.5 scfm Omega
0-1.5 scfm Omega

Water Temperature: 68.4 deg F

Air Temperature: 67.1 def F

Inlet plenum pressure: -0.23 psig

Tank bottom pressure: 1.74 psig
(4.02 ft. H2O) (Tank Water Level)

Inlet Plenum Level: 7.51 in. H2O

Barometric pressure: 29.97 in. Hg at 73 deg F

Comments:

Same nominal as test point 66, approached from decreasing air flow.

Test Number 965240

VTAB AVERAGE UNITS 2*SIGMA

ASTC01	67.136	DEG F	0.150
TPTC01	0.000	DEG F	0.000
RPTC01	68.380	DEG F	0.266
TPMM02	0.000	GPM	0.000
RPM02	60.473	GPM	0.379
TPMM01	0.000	GPM	0.000
RPM01	0.001	GPM	0.080
TPGM01	0.000	SCFM	0.000
TPGM02	0.000	SCFM	0.000
RPGM01	1.287	SCFM	0.096
RPGM02	1.246	SCFM	0.045
RTGM02	1.343	SCFM	0.027
RTGM01	-0.256	SCFM	0.062
T2GM01	0.000	SCFM	0.000
T3GM01	0.000	SCFM	0.000
T4GM01	0.000	SCFM	0.000
TPGM03	0.000	SCFM	0.000
RPGM03	1.308	SCFM	0.079
T2GM02	0.000	SCFM	0.000
T3GM02	0.000	SCFM	0.000
T4GM02	0.000	SCFM	0.000
RPGP01	-0.234	PSIG	0.016
RPGP02	0.000	PSIG	0.000
RPGP03	0.000	PSIG	0.000
TPGP01	0.000	PSIG	0.000
TPGP02	0.000	PSIG	0.000
TPGP03	0.000	PSIG	0.000
T2GP01	0.000	PSIG	0.000
T3GP01	0.000	PSIG	0.000
T4GP01	0.000	PSIG	0.000
T2GP02	0.000	PSIG	0.000
T3GP02	0.000	PSIG	0.000
T4GP02	0.000	PSIG	0.000
T2GP03	0.000	PSIG	0.000
T3GP03	0.000	PSIG	0.000
T4GP03	0.000	PSIG	0.000
T2GP04	0.000	PSIG	0.000
T3GP04	0.000	PSIG	0.000
T4GP04	0.000	PSIG	0.000
T2GP05	0.000	PSIG	0.000
T3GP05	0.000	PSIG	0.000
T4GP05	0.000	PSIG	0.000
T2GP06	0.000	PSIG	0.000
T3GP06	0.000	PSIG	0.000
T4GP06	0.000	PSIG	0.000
R2GP06	0.000	PSIG	0.000
R3GP06	0.000	PSIG	0.000
R4GP06	0.000	PSIG	0.000
R2GP02	0.000	PSIG	0.000
R3GP02	0.000	PSIG	0.000
R4GP02	0.000	PSIG	0.000
R2GP03	0.000	PSIG	0.000
R3GP03	0.000	PSIG	0.000
R4GP03	0.000	PSIG	0.000
R2GP04	0.000	PSIG	0.000
R3GP04	0.000	PSIG	0.000

Test Number 965240

VTAB AVERAGE UNITS 2*SIGMA

R4GP04	0.000	PSIG	0.000
R2GP05	0.000	PSIG	0.000
R3GP05	0.000	PSIG	0.000
R4GP05	0.000-	PSIG	0.000
RTGP01	1.737	PSIG	0.006
T2LC01	0.000	LBM	0.000
T2LC02	0.000	LBM	0.000
T3LC01	0.000	LBM	0.000
T3LC02	0.000	LBM	0.000
T4LC01	0.000	LBM	0.000
T4LC02	0.000	LBM	0.000
R2DP01	0.000	PSI	0.000
R3DP01	0.000	PSI	0.000
R4DP01	0.000	PSI	0.000
R2DP02	0.000	PSI	0.000
R3DP02	0.000	PSI	0.000
R4DP02	0.000	PSI	0.000
RPLV01	7.508	IN-H2O	0.036
TPLV01	0.000	IN-H2O	0.000
TPMM22	0.000	LBM/HR	0.000
RPMM22	30193.816	LBM/HR	188.993
TPMM21	0.000	LBM/HR	0.000
RPMM21	6.025	LBM/HR	16.043
T2LC30	0.000	LBM/HR	0.000
T3LC30	0.000	LBM/HR	0.000
T4LC30	0.000	LBM/HR	0.000

Test Name: 965240, 13:38
Test Date: 2-APR-91

Today's Date: 05-Apr-91

Mark 22 Fuel Assembly
Annular Flow Distribution - Uninstrumented Assembly Testing
Test Notes ==> 60.3 GPM; 4.06 FT. BFI BACK PRESS.; Water Temp. 70F; P/L; TP 86

Reference Fuel Assembly

		Value	Two Std Deviation	VTAB
** Water **				
Temperature (F):	<	68.4	0.27	RPTC01
Flow Rate (gpm):	<	60.5	0.38	RPMM01+ RPMM02
** Air **				
Temperature (F):	<	67.14	0.15	ASTC01
Flow Rate (scfm):	<	1.31	0.08	RPGM03
** INLET PLENUM **				
Pressure (psig):	<	-0.234	0.016	RPGP01
Level (in):	<	7.508	0.036	RPLV01
** BOTTOM FITTING AND REACTOR TANK **				
Pressure (psig):	<	1.737	0.006	RTGP01

AFD - TEST 965240, VTABLE CREATED 13-MAR-91 18 20 23
02-APR-91

AFD - TEST 965240; VTABLE CREATED 13-MAR-91 18 20 23
02-APR-91

AFD - TEST 965240; VTABLE CREATED 13-MAR-91 18 20 23
02-APR-91

SCFM
A1-273

ATTACHMENT 2
Uninstrumented Fuel Assembly Test Data Summaries

Table of Contents

<u>Test Point</u>	<u>Test ID</u>	<u>Water Flow (gpm)</u>	<u>Plenum Pressure (psig)</u>	<u>Tank Level (ft H₂O)</u>	<u>Page</u>
		[time history test data]			
87	965231	60.3	-0.22	4.06	A2-1
88	965235	60.3	-0.22	4.06	A2-7
89	965236	60.3	-0.22	4.06	A2-15

AFD - TEST 965231; VTABLE CREATED 13-MAR-91 18:20 23
20-MAR-91

Test Point: 87

CPM

A2-1

AFD - TEST 965231; VTABLE CREATED: 13-MAR-91 18:20:23
20-MAR-91

Test Point: 87

AFD - TEST 965231; VTABLE CREATED: 13-MAR-91 18:20:23
20-MAR-91

Test Point: 87

AFD - TEST 965231; VTABLE CREATED: 13-MAR-91 18:20:23
20-MAR-91 Test Point: 87

AFD - TEST 965231; VTABLE CREATED: 13-MAR-91 18:20:23
20-MAR-91

Test Point: 87

AFD - TEST 965231; VTABLE CREATED: 13-MAR-91 18:20:23
 20-MAR-91 Test Point: 87

AFD - TEST 965235; VTABLE CREATED: 13-MAR-91 18:20 23
21-MAR-91

Test Point: 88

AFD - TEST 965235; VTABLE CREATED: 13-MAR-91 18:20:23
21-MAR-91 Test Point: 88

AFD - TEST 965235; VTABLE CREATED: 13-MAR-91 18:20:23
21-MAR-91 Test Point: 88

AFD - TEST 965235; VTABLE CREATED: 13-MAR-91 18:20:23
21-MAR-91
Test Point: 88

AFD - TEST 965235, VTABLE CREATED: 13-MAR-91 18:20 23
21-MAR-91

Test Point: 88

9.000001

INCHES OF WATER

AFD - TEST 965235; VTABLE CREATED: 13-MAR-91 18:20:23
21-MAR-91

Test Point: 88

AFD - TEST 965235, VTABLE CREATED: 13-MAR-91 18:20:23
21-MAR-91

Test Point: 88

AFD - TEST 965235, VTABLE CREATED: 13-MAR-91 18:20:23
 21-MAR-91
 Test Point: 88

SCFM

A2-14

AFD - TEST 965236; VTABLE CREATED: 13-MAR-91 18:20:23
21-MAR-91

Test Point: 89

AFD - TEST 965236; VTABLE CREATED: 13-MAR-91 18:20:23
 21-MAR-91

Test Point: 89

TIME URS

P S I C

A2-16

AFD - TEST 965236; VTABLE CREATED: 13-MAR-91 18:20:23
21-MAR-91

Test Point: 89

AFD - TEST 965236; VTABLE CREATED: 13-MAR-91 18:20:23
21-MAR-91
Test Point: 89

AFD - TEST 965236; VTABLE CREATED: 13-MAR-91 18 20 23
21-MAR-91 Test Point: 89

AFD - TEST 965236; VTABLE CREATED: 13-MAR-91 18:20:23
21-MAR-91

Test Point: 89

SCFM

A2-20

AFD - TEST 965236; VTABLE CREATED: 13-MAR-91 18:20:23
21-MAR-91

Test Point: 89

SCFM
A2-21

AFD - TEST 965236; VTABLE CREATED: 13-MAR-91 18:20:23
 21-MAR-91 Test Point: 89

ATTACHMENT 3
Uninstrumented Fuel Assembly Test Data Summaries

Table of Contents

<u>Test</u> <u>Point</u>	<u>Test</u> <u>ID</u>	<u>Water</u> <u>Flow</u> <u>(gpm)</u>	<u>Plenum</u> <u>Pressure</u> <u>(psig)</u>	<u>Tank</u> <u>Level</u> <u>(ft H₂O)</u>	<u>Page</u>
[BFI tank drain down test data]					
90	965239	30.0	0.0	varied	A3-1

AFD - TEST 965239; VTABLE CREATED: 13-MAR-91 18:20:23
02-APR-91 Test Point: 90

cont

AFD - TEST 965239; VTABLE CREATED: 13-MAR-91 18:20:23
02-APR-91 Test Point: 90

AFD - TEST 965239; VTABLE CREATED: 13-MAR-91 18:20:23
02-APR-91 Test Point: 90

TIME, HRS

hco

P
33-31
G

hco

AFD - TEST 965239; VTABLE CREATED: 13-MAR-91 18:20:23
02-APR-91 Test Point: 90

AFD - TEST 965239; VTABLE CREATED: 13-MAR-91 18:20:23
02-APR-91 Test Point: 90

hco

PSSIC
A3-5

hco AFD - TEST 965239; VTABLE CREATED: 13-MAR-91 18:20:23
9.000001 02-APR-91 Test Point: 90

INCHES OF WATER

TIME, HRS

AFD - TEST 965239; VTABLE CREATED: 13-MAR-91 18:20:23
02-APR-91

Test Point: 90

hco
cont

INCHES OF WATER
A3-107

TIME, HRS

AFD - TEST 965239; VTABLE CREATED: 13-MAR-91 18:20:23
02-APR-91 Test Point: 90

AFD - TEST 965239; VTABLE CREATED: 13-MAR-91 18:20:23
 02-APR-91 Test Point: 90

ATTACHMENT 4
Micromotion Post-test Calibration Uncertainty

List of Figures

<u>Figure Description</u>	<u>Page</u>
Figure A.4.1 Micromotion Mass Flowmeter Uncertainty	A4-3

Micromotion Post-test Calibration Uncertainty

The post-test calibration performed on Micromotion mass flowmeter RPMM01 (BWSN 0890414) following the single phase pressure drop and uninstrumented fuel assembly testing reported that the flowmeter was exhibiting an error outside of its specified range of uncertainty. For this reason, the reported uncertainty for water flow measurements acquired with this meter was widened to encompass the new error values. The validity of the post-test calibration performed, however, is felt to be questionable due to circumstances surrounding its performance. Although the results of this calibration were incorporated in the final report, their effect on the reported data is not felt to be as severe as the uncertainties would indicate. The following justifies this claim and describes the reason for the post-test calibration to be considered questionable.

The Quality Assurance Plan for this project required that both pre-test and post-test calibrations be performed on all instrument from which "certified" data is to be acquired. Certified data refers to any data which is considered critical to the project results and is to be incorporated in the project final report. Because the measurement of water flow entering the reference fuel assembly was considered certified, appropriate calibrations were performed. Calibrations of the Micromotion mass flowmeters used to obtain this water flow data were performed by Micromotion Inc. of Boulder, Colorado. Calibrations from this vendor have not typically been a problem, however, on the most recent calibration of flowmeter RPMM01, the "as-received" calibration data was lost prior to the meter's return to ARC. Since this "as-received" data is relied on to provide the post-test calibration and since the flowmeter electronics was adjusted to provide a new calibration as requested, no history of the post-test calibration status was available for this meter. Conversations with Micromotion Inc. provided verbal indication that the flowmeter did, in fact, perform within the manufacturer's stated accuracy for the unit. Micromotion further suggested that they felt confident they could redo the "as-received" calibration on the flowmeter in question by resetting the internal calibration switches to their pre-calibration positions. While the redone calibration procedure would not account for any electronic shift which may have occurred within the meter as a consequence of the new calibration, no suitable alternative appeared to exist. B&W therefore accepted the re-calibration to count as the "as-received" post-test calibration of the flowmeter with a knowledge that the data may be questionable.

The redone calibration performed by Micromotion showed the flowmeter to be exhibiting an error of -1.84% to -1.89%, with the error being nearly constant throughout the flowmeter range. This error is outside of the $\pm 0.22\%$ to $\pm 0.28\%$ which is specified for this meter by Micromotion. It is assumed that a shift occurred within the electronics of the flowmeter as a consequence of the calibration procedure or as a consequence of the shipping required to perform the re-calibration. Assuming that the initial verbal information, which suggested that the meter showed an as-received calibration within specification, was correct, then this re-calibration is not an accurate representation of the flowmeter's actual post-test calibration status. Because there is no written verification of this fact, however, the errors shown by the re-calibration must be accepted as the flowmeter's post-test calibration.

Uncertainties for the water flow measurements acquired with this meter were adjusted by incorporating the new calibration results in the uncertainty

analysis. The results of this analysis are shown in Figure A.3.1, with both the original (using manufacturer's stated accuracy) and the revised uncertainty being shown. The figure shows that at the flowmeter full scale of 500 lbm/hr, the measurement uncertainty increased from about 0.22% to about 1.9%. The higher values of measurement uncertainty are taken to apply to all single phase pressure drop and uninstrumented fuel assembly testing for which flowmeter RPMM01 was used. All water flow data taken with flowmeter RPMM02 is assigned an uncertainty described by the "original" uncertainty plot. It is noted, however, that both flowmeters are probably operating within the original uncertainty limits for the reasons described above.

Figure A.4.1. Micromotion Mass Flowmeter Uncertainty.

**DATE
FILMED**

8/12/93

END