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**U.S./U.S.S.R. COOPERATIVE PROGRAM
IN OPEN-CYCLE MHD ELECTRICAL
POWER GENERATION**

MASTER**MASTER**

Joint Test Report No. 2

**Tests in the U-25B Facility:
MHD Generator Test No. 3**

U of C-AUA-USDOE

ARGONNE NATIONAL LABORATORY, ARGONNE, ILLINOIS

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MHD Generator Test No. 3

Editors

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April 1979

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P R E F A C E

This report is one in a series that describes the results of experiments on open-cycle magnetohydrodynamic power generation carried out jointly by specialists from the United States and the Soviet Union under the understanding on Open-Cycle MHD Cooperation, reached on October 6, 1972, by representatives of the U.S./U.S.S.R. Joint Working Group for Energy, meeting in Moscow, and endorsed as a cooperative program by the U.S./U.S.S.R. Joint Committee for Scientific and Technical Cooperation, in Washington, D.C., March 21, 1973.

These experiments are planned, conducted, and analyzed together by teams of specialists from both countries. Both countries also supply test components and equipment for the joint experiments. By combining resources in this cooperative program, the United States and the Soviet Union accelerate the development of open-cycle MHD systems in both countries. To provide rapid dissemination of information and data to other groups and countries interested in the development of MHD power systems, reports are issued a short time after completion of tests and experiments.

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FOREWORD

This report has been prepared in accordance with the U.S./U.S.S.R. Cooperative Program in the area of MHD energy conversion. The third test in the series scheduled for the U-25B facility was completed in June, 1978.

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SUMMARY

Several conclusions can be reached through review and analysis of the results of the third joint test in the U-25B facility.

1. In the third test, the combustor operated without difficulty for approximately 14 hours in a shortened configuration. The superconducting magnet system operated continuously for approximately 11 hours and at 5 T for more than 5 hours, with no problem. In total, the U-25B combustor has now operated for nearly 40 hours and the magnet has operated for more than 30 hours. Review of the data reveals no significant problems associated with vibration, stresses, or fluctuation of electrical and gasdynamic parameters of these components or others in the U-25B facility test leg.

2. A new oxygen addition system was placed into operation for this test, which has the capability of increasing, from 40% to 60%, the O_2 content of the oxidizer to the combustor. The use of this system to provide 50 vol % O_2 to the combustor for several points in this test run increased the plasma temperature from approximately 2700 K to between 2800 and 2850 K. Increasing the O_2 content from 40 vol % to 50 vol % also resulted in doubling the short-circuit current and, hence, electron number density, and increased the channel power output from approximately 115 kW to 360 kW.

3. Spectroscopic measurements were made of the temperature in the channel inlet and of the concentration of the alkaline seed atoms in the diffuser. Characteristic values of gas temperature during Test 3 were in the range of 2550 K to 2850 K, and the potassium atom concentration ranged from 3×10^{15} to $5 \times 10^{15}/\text{cm}^3$. The electrical conductivity of the working fluid in the nozzle portion of the flow train in the absence of the magnetic field was also measured. Characteristic values during the test were in the

range from 6 to 7 S/m. However, analysis has indicated that effective conductivities are lower in the MHD generator.

4. The MHD generator produced a maximum power of approximately 575 kW at a mass flow rate of 4 kg/s, a magnetic field of 5 T, and a potassium concentration of approximately 0.5% by weight. The maximum Hall voltage and Hall field achieved were 4.24 kV and approximately 2.1 kV/m respectively. The current distributions in the power takeoff sectors were more uniform than in the previous tests. At this test condition, a shock wave existed in the channel. The inverter load lines show that the first section of the generator operated at low conductivity compared to the last two sections. These results are similar to those obtained in the second test.

5. Analysis of the electrical performance of the channel on a local basis indicates that there are significant differences between the experimental data and theoretical predictions in the upstream portion of the channel. The exact reason for these differences is a subject for further investigation; some of the more probable causes may be boundary-layer separation, imperfect sidewall insulation, and nonuniformity of electrical conductivity. Additional channel diagnostic instrumentation would be useful in obtaining a fuller understanding of the channel flow and electrical performance.

6. Significant differences were found between experimental data and theoretical predictions of the axial field distribution along the channel, particularly for the upstream portion of the channel. For higher power levels, with a shock system in the channel, theoretical predictions were found to be less accurate, although perhaps capable of providing rough estimates of such major electrical parameters as total power and Hall potential. It is believed that the differences between the experimental and the calculated

results may be associated with lower-than-expected performance in the upstream portion of the channel.

7. The test was terminated by agreement of both groups when smoke was observed between the combustor and magnet. The shutdown was carried out in the normal manner, without incident. Post-test inspection revealed the problem was caused by failure of the rubber tubing connecting a channel static pressure orifice to the transducer. Careful inspection of the channel also showed that partial obstruction (by a fugitive metal scrap) of the water passage to frame No. 28 also caused some minor damage in the same region of the channel. The damage has since been repaired.

1.0 INTRODUCTION

The third joint test with a Soviet U-25B MHD generator and a U.S. superconducting magnet system (SCMS) was conducted in the Soviet U-25B Facility. As previously reported, the shakedown of the U-25B facility was conducted in December of 1977. During Test No. 2, which was conducted in March of 1978, the electrical power produced by the U-25B channel reached 242 kW. A detailed joint report was written (Ref 1.1), which includes short descriptions of the U25B facility, its basic elements and systems, and test results for the combustor, MHD channel, SCMS, seed injection system, and other components and systems of the flow train.

Goals and objectives of the third test in the U-25B Facility were agreed upon by both sides, and a joint test program was prepared and approved by both sides, which, based on analysis of the 1st and 2nd tests (Ref. 1.1), would satisfy the test objectives. The primary objectives of the 3rd test were: (1) to operate the facility and MHD channel over a wider range of test parameters, (2) to study the performance of all components and systems of the flow train at increased mass flow rates of combustion products (up to 4 kg/s), at high magnetic-field induction (up to 5 T), and high values of the electrical field in the MHD generator.

The third test has demonstrated that all components and systems of the U-25B facility performed reliably. The electric power generated by the MHD generator reached a maximum of 575 kW during this test. The MHD generator was operated under electrical loading conditions for 9 hours, and the combustor for a total of approximately 14 hours. Very high Hall fields (2.1 kV/m) were produced in the MHD channel, with a total Hall voltage of 4.24 kV.

This report describes in detail the (1) performance of all components and systems of the U-25B facility, (2) analysis of the thermal, gasdynamic, and electrical characteristics of the MHD generator, (3) results of plasma diagnostic studies, (4) studies of vibrational characteristics of the flow train, (5) fluctuation of electrodynamic and gasdynamic parameters, (6) interaction of the MHD generator with the superconducting magnet, and (7) an operational problem, which terminated the test.

2.0 COMPONENTS OF THE U-25B FACILITY

A schematic of the U-25B facility and a description of its basic elements and systems have been given in References 1.1 and 2.1-2.3. This section described improvements to a number of components of the facility, which were made in connection with Test No. 3.

2.1 Oxidizer Supply System

A system for additional supply of oxygen was installed and made operational by the beginning of the third test, in order to increase the plasma temperature at the MHD generator inlet by increasing the oxygen concentration in the oxidizer.

As was shown by the results of the first two U-25B tests, precise measurement of the flow rate of oxidizer entering the combustor is an important requirement.

2.1.1 Additional Oxygen Supply System

The additional oxygen supply system provides facilities for receiving and storing liquid oxygen, and for gasifying and supplying it to the U-25B and U-25 facilities. The system can deliver pure oxygen into the oxidizer supply line of the U-25B, or into the air or oxygen supply lines of the U-25.

The system components (Fig. 2.1) include:

- a. Vacuum insulated tank (I) for liquid oxygen: The tank volume is 66 m^3 , and it can store 68 metric tons of liquid oxygen. The losses from

evaporation at ambient conditions (20°C, 760 mm Hg) are less than 0.09% per day. Maximum working pressure is 8.5 kg/cm^2 (0.83 MPa).

b. Evaporator (II) for gasification of the liquid oxygen: The heating agent is steam at pressures of up to 0.7 kg/cm^2 (0.069 MPa). The working pressure in the evaporator is up to 6 kg/cm^2 (0.59 MPa), and it can handle up to 10 t/h of oxygen.

c. Evaporator (III) for raising the pressure in the tank (I). The heating agent for this evaporator is ambient air. The evaporator working pressure is up to 6 kg/cm^2 (0.59 MPa), with an oxygen flow rate up to $400 \text{ m}^3/\text{h}$.

d. Monitoring and measurement instruments. These provide the necessary information for control of the following parameters:

- oxygen pressure in the tank (I),
- oxygen pressure after evaporator (II),
- oxygen pressure after evaporator (III),
- vapor pressure in evaporator (II),
- liquid oxygen level in the tank (I),
- gaseous oxygen temperature after evaporator (II),
- oxygen concentration in the U-25 cold blow supply pipeline,
- oxygen concentration in the U-25B oxidizer supply pipeline.

e. Pipelines with shut-off, control, and safety fittings.

f. A system of communication with the main control panel.

System Operation

The oxygen tank (I) is filled with liquid oxygen through valves 1 and 2 prior to operation of the system. The oxygen is then piped through valve 3

to the evaporator (III), to raise the pressure in the tank. Ambient air is the heating agent in this evaporator.

Valve 3 maintains the oxygen tank pressure in the range of 5-6 atmospheres (0.5-0.6 MPa). Valve 5 controls steam to the evaporator (II) and valve 4 controls the delivery of oxygen into this evaporator. When valve 6 and the emergency shut-off valve, 7, are open, the gaseous oxygen can flow into the oxidizer pipeline through valve 8, into the air duct leading to the preheaters through valves 9 and 10, or into the U-25 oxygen pipeline through valves 9 and 11. The control for the shut-off valve, 7, is located at the main control panel of the facility.

2.1.2 Hot Oxidizer Mass Flow Rate

The mass flow rate of the hot oxidizer is determined by three methods:

a. Measuring orifice in oxidizer pipeline: In this instance, the oxidizer mass flow rate is determined from the pressure drop across an orifice, which is made from a special heat-resistant steel.

b. Mass flow calculations based on gas analysis data: This method requires the excess oxidizer coefficient as determined from gas analysis data:

$$(ALF) = \frac{2CO_2 + 1.5 CO - 0.5 H_2}{2(CO_2 + CO + CH_4)} \quad \text{when } \alpha < 1$$

$$(ALF) = \frac{2CO_2 + O_2}{2CO_2} \quad \text{when } \alpha > 1$$

where CO_2 , CO , O_2 , H_2 , CH_4 are the relative concentrations of these components in the combustion products.

The oxidizer mass flow rate is then determined from

$$G_{ox} = (ALF)\alpha G_{gas}$$

where α is the stoichiometric coefficient, which depends on the oxygen enrichment in the oxidizer, and G_{gas} is the CH_4 mass flow rate to the combustor.

c. An attempt was made during the test to determine the oxidizer mass flow rate, using a special cruciform probe installed in the oxidizer pipe line. This probe was made from a special heat-resistant steel and made it possible to determine dynamic and static pressure in two mutually perpendicular directions in the same plane. The value of the oxidizer mass flow rate was calculated by the formula

$$G_{ox} = 9.297 \sqrt{\frac{P \cdot \Delta P}{T}} \quad \text{kg/s}$$

where P and T are the static pressure and temperature, respectively, in the oxidizer supply line, and ΔP is a pressure difference recorded by the instrument, E-29. Values of oxidizer mass flow rates determined by these three methods are compared in Fig. 2.2, which shows that the values given by the measuring orifice and by the gas analysis data have satisfactory correlation.

The mass flow rate deduced from the cruciform probe is 10 to 15% higher.

2.2 Combustor

2.2.1 Interchange of Combustion Sections

During the third test, the cylindrical section of the combustion zone was shorter by 620 millimeters than was the case during the second test. This approach was taken in order to study the effect of combustor length on

its operational stability, in terms of axial and transverse pressure fluctuations, and also on the magnitude of the heat losses of the combustor. One section (the transition section) was moved from the combustion zone into the oxidizer pipe line system immediately preceding the burner (Fig. 2.3). (The combustor configuration for the second test is shown in Ref. 1.1, in Fig. 3.1a).

The shortening of the combustion zone length by 26% causes a corresponding decrease in the time that fuel and seed spend in the combustor. When the mass flow rate of the combustion products is 4 kg/s, the residence time, τ_t , of fuel in the combustor is given by

$$\tau_t = \frac{P_{kc} V_{kc}}{G R T_{kc}} = \frac{2.8 \times 10^4 \times 0.28}{4 \times 28 \times 2900} = 0.024 \text{ s},$$

where P_{kc} is the combustor pressure in kg/cm^2 , V_{kc} is the combustor volume in m^3 , G is the mass flow rate of the combustion products in kg/s , T_{kc} is the combustor temperature in K, and R is the gas constant for the combustion products in $\text{kgf}\cdot\text{m/kg}\cdot\text{K}$.

The comparison of the calculated value of τ_t with the data listed in the current literature on this topic indicates that the combustor configuration used in Test 3 should assure complete combustion of the fuel.

2.2.2 Improvement of the Seed Injection Nozzles

New seed injection nozzles with improved atomizers were installed into the nozzle section for Test 3. These atomizers have air jets angled at 30° to the seed jet; each atomizer has six peripheral air orifices and one central 3-mm diam orifice for injection of the seed. Compared with the

simple jet nozzles that were used during Test 2, these new units provide better atomizing of the seed and better dispersion of the smaller droplets. In test-stand operation of these nozzles prior to Test 3, visual observation showed that the atomization was satisfactory. On the test stand, the mass flow ratio of air and seed was changed from 0.3 to 1 at constant seed flow rate. Air flow changes within this range had negligible influence on atomization characteristics.

2.3 Superconducting Magnet System

The United States Superconducting Magnet System was incorporated into the bypass loop of the U-25 MHD facility of the Institute of High Temperatures in Moscow, U.S.S.R., in the summer of 1977. Details of the magnet have been previously described (Ref. 1.1).

Prior to run No. 3, a replacement set of three helium transfer lines to the magnet cryostat was installed. The new transfer lines were employed for the first time during this experiment, and their performance was found satisfactory in regard to heat losses. Detailed analysis of the test data indicated an overall transfer efficiency of 78% for the liquid transfer line from the helium supply dewar to the magnet cryostat. Additional tests will be conducted to determine the performance factors for the two helium gas refrigerator lines and to refine system operations further.

Modifications have been made to the SCMS control system, to extend the range of magnet operating parameters monitored and to increase the on-line computer monitoring and analysis capabilities. This work concerned the cryostat helium level, helium control valve operation, cold mass support load, and system pressure monitoring.

3.0 INSTRUMENTATION AND DATA ACQUISITION

As discussed in sections 4.0 and 6.7 of Joint Test Report No. 1 (Ref. 1.1), instrumentation, as well as two separate, minicomputer-based data acquisition systems, have been provided for measurement and recording of the many parameters associated with the U-25B facility. Facility parameters, such as flow rates, pressures, and temperatures for all major systems (i.e. oxidizer, fuel, seed, and cooling systems), are displayed on meters or recorders in the main control room. Inverter and magnet parameters are displayed in the electrical control room. During the third test, the Soviet data acquisition system was used for recording the steady-state values of all electrical and gas dynamic parameters, with the exception of the load cells, weak link sensors, and magnet operation sensors, which were recorded by the U.S. data acquisition system. The U.S. system was used for recording and displaying fluctuation and dynamic data. Real-time graphic displays of static pressure distributions, power take-off current distributions, interframe voltage distributions, and single-parameter fluctuations were available during the test.

A summary of the major gasdynamic, diagnostic, and electrical measurements associated with the MHD generator during the third test is given in Table 3.1. Essentially, the same gasdynamic and mechanical measurements were made in the third test as in the two previous tests (Ref 1.1). However, a larger number of electrical parameters was measured.

3.1 Electrical Instrumentation

The accompanying instrumentation diagram, Fig. 3.1, shows the electrical

Table 3.1

Instrumentation Summary

Measurement	Number of Measurements	Location	Method
Conductivity	1	nozzle	inductive probe
Plasma temperature	1	channel inlet	sodium line reversal
Seed atom concentration	1	diffuser	K doublet spectrum lines
Pressure fluctuations	12	combustion chamber	piezoelectric trans- ducer
Vibration	4	combustion chamber	piezoelectric ac- celerometer
Static pressure	23	channel, diffuser	force-balance trans- ducer
Load on bore tube	5 8	magnet magnet	strain-gauge load cells resistive links
Magnet unbalance voltages	2	magnet	difference amplifiers on potential taps
Take-off currents	26	channel	resistive shunts and optically coupled amplifiers
Inverter currents	3 3	inverter inverter	magnetic amplifier resistive shunts and optically-coupled amplifiers
Inverter voltages	3 4	inverter inverter	magnetic amplifier resistive dividers
Frame-to-ground voltages	175	channel	resistive dividers
Frame-to-frame voltages	51	channel	magnetically-coupled sensors

instrumentation provided for the channel and inverters during the third test. This figure indicates all of the voltages and currents measured as well as the location of each measurement.

The resistive voltage dividers attached to each frame, were calibrated for production of a 0-100 V output signal from a 0-10 000 V input signal. Absolute frame voltage measurements referenced to ground are obtained. The resistive dividers are indicated by the numbers K10 thru K165 on the instrumentation diagram.

To obtain a more accurate measurement of voltages between frames, dc current sensors were attached between approximately one-third of the channel frames. These instruments achieve the required voltage isolation rating of 10 000 V dc by utilizing magnetic coupling. A Hall-effect sensor is used to measure the magnetic field in a ferrite core. This field is produced by an input current signal. An output signal of 0-10 V results from an input current of 0-100 mA. The input circuitry was adjusted to provide 100 mA for 100 V between adjacent frames. These instruments are indicated by the numbers K171 thru K219 in Fig. 3.1.

The power takeoff currents, indicated by I8 thru I19 and I132 thru I143, were determined by measuring the millivolt signal produced across a resistive shunt inserted in series with each take-off frame. Optically-coupled transmitters were used to provide the required electrical isolation. The signals are amplified, converted to a frequency, transmitted through an optical coupler, then reconverted to a dc voltage. The units were calibrated for production of a 0-10 V output signal for a 0-75 mV input signal. The currents in the inverter balance taps (frames 57 and 93) were measured in similar fashion.

The inverter currents were measured by using magnetic amplifiers and

measuring the signal across a resistive shunt with the optically-coupled transmitter described above. These units are indicated by the IV and IV' numbers on the diagram.

As in the previous tests, the inverter voltages were measured by magnetic amplifiers, indicated as V17, V19, and V21 on the instrumentation diagram.

3.2 Gasdynamic Instrumentation

As in previous tests, the static pressure distribution along the generator was measured by force-balance transducers located approximately 10 m from the generator. The pressure taps in the channel are located in the vertical sections of the channel walls. The locations of these taps are listed in Table 3.2. In addition to the channel wall orifices, there is one orifice in the combustor, three orifices distributed along the diffuser, and two more located in the section downstream of the diffuser. The pressure signals are transmitted to the transducers through rubber hose and stainless steel tubing.

Three different techniques were used to determine the mass flow rate of the oxidizer: orifice, probe, and analysis of combustion products. These measurements are described in detail in Section 2.1. The flow rates of the fuel and seed are determined from pressure drops across orifices. In addition, the seed flow rate can be determined from the length of the piston stroke of the seed pump, which was calibrated before the test.

The stoichiometric ratio (oxidizer excess factor) is calculated by a program that requires as inputs the mass flow rates of the oxidizer and fuel, as well as the percentage of oxygen concentration (by volume). The

Table 3.2
Static Pressure Tap Locations

Location		
<u>Parameter</u>	<u>x(meters)</u>	<u>Channel frames</u>
C1, C11	0.150	Inlet section
C2, C12	0.700	15, 16
C3, C13	1.204	33, 34
C14	1.708	52
C15	2.212	70
C6, C16	2.716	87, 88
C17	3.220	106
C8, C18	3.724	123, 124
C9, C19	4.228	141, 142
C10, C20	4.808	Outlet Section

Note: C1-C10 are located on left side and C11-C20 on right side of the channel, looking downstream.

oxygen concentration is measured by oxygen analyzers. Two analyzers are provided, one before the preheaters and one in the first section of the combustor, before the burner.

3.3 Diagnostic Instrumentation

Special diagnostic instrumentation was provided to determine the 1) plasma temperature, 2) plasma conductivity, 3) seed atom concentration, and 4) radiative heat transfer in the combustor. These measurements are described in Section 5.2.

4.0 TEST OPERATIONS

4.1 Test Parameters

The basic purpose of the third test of the U-25B facility was to evaluate the operation of all systems and equipment of the loop at flow rates from 2 kg/s to 4 kg/s, at magnetic fields of up to 5 T, and at quite high values of electric fields (up to 2 kV/m) in the MHD generator.

The gasdynamic characteristics of the MHD generator under cold and warm blow conditions were determined. Studies of the performance of the seed injection and seed recovery systems, determination of the gasdynamic characteristics of the generator, diagnostic studies, and studies of vibration and fluctuation processes in the combustor, MHD channel, and other elements of the U-25B facility were conducted during the hot blow tests with the combustor turned on. The electrical characteristics of the MHD generator were studied using magnetic fields of from 2 to 5 T, oxygen enrichment of up to 50 vol %, and seed flow rates of 200 and 300 L/h.

4.2 Operation Schedule

A summary of the facility operation is given below.

June 12	11:00	Cooling of all loop components initiated.
	11:54	Air compressor turned on.
	12:31	Stack draft fan turned on.
	15:15	Start of cold blow, air flow = 1.5 kg/s.
	16:35	High voltage tests completed (V = 3.6 kV).

	16:50	Oxidizer flow established at 5 kg/s.
	17:20	Oxidizer flow established at 4.5 kg/s.
	17:35	Oxidizer flow established at 3.5 kg/s.
	18:40	Start of "warm blow." Temperature increased at the rate of 70-80°C/h (70-80 K/h).
June 13	12:17	Oxygen injection. Completion of loop high voltage tests ($V = 3.6$ kV).
June 14	10:17	Oxidizer flow established at 1.3 kg/s.
	10:23	Combustor ignited.
	11:15	$\alpha = 1.0$ mode of operation established.
	11:40	Oxygen injected in the cold blow air duct.
	12:52	Magnet energized.
	13:35	Magnetic field established at $B = 2$ T.
	13:40	Seeding introduced at 200 L/h.
	14:43	Plasma flow established at 2.5 kg/s.
	15:35	$B = 3$ T established.
	15:40	Seed flow of 300 L/h established.
	15:56	Oxygen discontinued.
	16:02	Seed flow discontinued.
	16:56	Seeding introduced at 200 L/h.
	17:02	Oxygen introduced at 40% concentration.
	17:30	$B = 4$ T established.
	19:15	$B = 5$ T established.

	19:38	Plasma flow of 2 kg/s established.
	20:35	Plasma flow of 2.7 kg/s established.
	20:50	Plasma flow of 3.1 kg/s established.
	21:07	Additional oxygen introduced. Enrichment to 50%.
	21:46	Second air exhaust blower started.
	21:50	Plasma flow of 3.5 kg/s established.
	22:10	Plasma flow of 3.7 kg/s established.
	22:40	Plasma flow of 3.9 kg/s established.
	23:10	Plasma flow of 4.0 kg/s established.
	23:50	Detection of smoke at the flanges of the channel.
	23:55	Plasma flow lowered to 2.5 kg/s.
	23:56	Oxygen supply to the hot air blow pipe line terminated.
	23:57	One air exhaust blower disconnected.
June 15	0:10	Seed injection terminated
	0:16	Combustor extinguished.
	0:20	Oxygen supply terminated.
	0:32	Lowering of the oxidizer temperature initiated at rate of 100°C/h (100 K/h).
	6:15	Oxidizer temperature 200°C (475 K).
	8:30	Flow through the loop terminated.
	16:45	Cooling systems off. All elements disconnected.

4.3 Oxidizer Supply

The preparation of the oxidizer for Run No. 3 was similar to the preparation of oxidizer during the two preceding runs. The required volume of oxidizer was supplied to two air ducts by one compressor. Because the minimum capacity of this compressor substantially exceeds the flow required for the test, the excess amount of oxidizer was released into the atmosphere through a relief valve. The 40% oxygen enrichment of air was done by piping oxygen from the oxygen plant. The oxidizer was heated in the preheaters of the U-25 facility. The loop was heated at a flow rate of 3.5 kg/s. The temperature of the oxidizer was increased to 800°C (1075 K) at a rate of 80°C/h (80 K/h). When the oxidizer flow was reduced to 1.5 kg/s, prior to ignition of the combustor, the temperature decreased to 780°C (1055 K).

An auxiliary oxygen supply system, described in Section 2.1, was used to increase the oxygen concentration to 50%.

The temperature of the additional oxygen before entering the preheated oxidizer was approximately 80°C (355 K). To determine the oxygen concentration in the oxidizer pipeline, sensors were installed in front of the ignitor. Tests conducted prior to the run indicated that the oxygen concentration was quite well distributed throughout the cross-sectional plane of the channel. It was determined during the run that the introduction of the cold oxygen (at 80°C) into the oxidizer pipe line (flow rate of 2.5 kg/s) led to a decrease in oxidizer temperature, which was reduced to 680°C (955 K) from 800°C (1075 K).

4.4 Combustion Chamber

4.4.1 Mode of Operation

During the third test, the initial combustor operation (with igniter on) was conducted at an oxidizer flow rate of 1.5 kg/s, a stoichiometric coefficient of 4.4, and a preheat temperature of approximately 780°C. The combustor operating mode required before energizing the magnet was accomplished in two stages, both under conditions of constant oxidizer flow. During the first stage, the combustor was adjusted to achieve a stoichiometric ratio of unity ($\alpha = 1$) using air as the oxidizer. In the second stage, oxygen was added to enrich the air up to 40 vol %, and combustor operation was readjusted gradually to $\alpha = 1$ by increasing the the fuel flow rate. The accumulated time to reach the final mode of $\alpha = 1$ with 40% enrichment was one hour and 40 minutes.

Subsequent changes of the combustion chamber operating mode were conducted in accordance with the test program. Mass flow rates up to 4.0 kg/s were achieved. Increases of total mass flow rates were accomplished by, first, increasing the oxidizer rate, then increasing the fuel rate until $\alpha = 1$ was obtained.

With a magnetic field of 5 T and a total mass flow rate of 3.0 kg/s, an additional supply of cold oxygen was added to the preheated oxidizer to achieve 50% enrichment. The addition of the cold oxygen lowered the temperature of the oxidizer entering the combustion chamber to a value of approximately 680°C.

Measurements of the oxygen distribution in the hot air supply duct before the burner indicated a uniform distribution. These measurements,

conducted prior to the test, were made by special probes installed in the transition block.

Maximum power was extracted from the generator under the following conditions: total mass flow rate of 4.02 kg/s at a pressure of 2.8 kg/cm^2 (0.27 MPa), 50 vol % oxygen enrichment, and preheat temperature of 680°C (955 K). With these conditions, the pressure of the natural gas supply header was 7 kg/cm^2 (0.69 MPa). The pressure drop from the supply header to the combustion chamber was approximately 4 kg/cm^2 (0.39 MPa). In the future, steps will be taken to reduce this drop, allowing a higher possible chamber pressure.

During the test, data was collected at nine different mass flow rates and two seed flow rates (200 and 300 L/h). The flow rate of atomizing air injected into the seeding nozzles was held constant at 0.056 kg/s during the test. Near the end of the test, this flow rate decreased to 0.048 kg/s because of the increased combustion chamber pressure. The ratio of air to seed varied from 0.58 to 1.00. The accumulated seeding time was nine hours and 36 minutes. Overall working time of the combustor was 13 hours and 52 minutes.

Post-test inspection of the combustion chamber revealed no burn marks or wall and liner damage.

4.4.2 Combustor Chamber Stability

The shortening of the combustion zone portion of the combustor resulted in a slight improvement in combustion stability, which was indicated by decrease in axial and radial oscillations as compared with test No. 2.

In this test, as in test No. 2, the combustion process was stable during all modes of operation. During start-up, a vibration amplitude of 2.7 g was experienced. The maximum vibration amplitude observed during the test was 3 g.

Typical vibration frequencies of approximately 5 kHz were observed. Injection of seed into the combustion chamber, at flow rates of 200 and 300 L/h, did not increase the vibration or introduce additional oscillations.

During the second test, major oscillations were recorded at low (300 to 500 Hz) as well as high (1000, 1250, and 2000 Hz) frequencies. The amplitude of those pressure oscillations reached 0.1 kg/cm^2 (9.8 kPa). The vibration increased when seed was injected at the higher rate of 300 L/h.

During the third test, pressure oscillations were observed during the transitional modes of operation (i.e., when the oxidizer mass flow rate was changed while fuel flow rate was held constant; $\alpha > 1$). The pressure oscillations were accompanied by some increase in vibration. During these changes, the stoichiometric coefficient (α) reached values of 1.4 to 1.7.

Pressure oscillations at a frequency of 360 to 780 Hz and amplitude up to 0.12 kg/cm^2 (11.8 kPa) were observed at a total mass flow rate of 2.2 kg/s, 1.17 kg/cm^2 (114 kPa) pressure, and 28% oxygen enrichment ($\alpha = 1.71$). As the percentage of oxygen enrichment was increased to 40%, the oscillation remained and the chamber vibrations increased slightly. As $\alpha = 1$ was approached, the oscillations and vibrations dropped sharply in all modes of operation.

Switching from one air preheater to another was accompanied by the appearance of major oscillations of 360 to 380 Hz with amplitudes of up to 0.2 kg/cm^2 (19.6 kPa), and chamber vibration also increased to the range of 5 to 8 g. This may be explained by an occurrence of combustion products in

the oxidizer immediately after changing preheaters, because of poor blowout of the loop. Consequently, the actual oxidizer content at the U-25B combustion chamber entrance may have been lowered considerably and the combustion performance substantially impaired. For future tests, it is necessary to analyze the α stability range in transitional modes of operation.

An overall improvement of the combustion chamber stability in the third run may be explained by the change of its acoustical characteristics. If,

f_2 = frequency of longitudinal pressure oscillations in the combustion chamber during the second test, and

f_3 = frequency of longitudinal pressure oscillations in the combustion chamber during the third test,

then, the longitudinal frequency for the third test would be,

$$f_3 = f_2 \frac{L_2}{L_3} = 280 \times \frac{2220}{1600} = 390 \text{ Hz},$$

where L_2 and L_3 represent the combustion zone lengths in the chamber during the second and third runs, respectively. The measured frequency was 360-380 Hz. As can be seen, the calculated and actual values of the longitudinal frequencies compare very well.

No major oscillations (such as occurred in the combustion chamber during the second run) were observed in the third run.

4.4.3 Heat Losses in the Combustion Chamber

The water cooling system of the combustion chamber performed as expected. The temperature rise of the water did not exceed calculated values. A maximum rise of 15°C (15 K) was recorded during the maximum MHD channel power loading. The total heat transfer from the combustion chamber during

this mode of operation was 342 kcal/s (1.43 MW). The distribution of heat losses in the combustion chamber components is shown in Table 4.1.

The construction details of the supporting section and the transition section are identical. The reduction in heat losses in test No. 3 (as compared with test No. 2) as a result of moving the transition section from the combustion zone to the inlet zone is:

$$\Delta Q = 31.5 + \frac{21.4}{2} = 42.2 \text{ kcal/s (0.177 MW)}$$

or, in %,

$$\Delta Q = \frac{42.2 \times 100}{342.4 + 42.2} = 11\%.$$

In the above calculation, it is assumed that the heat losses to the transition section (installed in the oxidizer line for the third run) were zero. Heat losses in the combustor for the second and third tests are shown in Fig. 4.1.

4.4.4 Conclusions

During the third test, the combustion chamber performed reliably, without oscillations, at the optimum value of the stoichiometric coefficient ($\alpha = 1.0$). Data analysis indicated that the reduction in length of the cylindrical portion of the chamber increased the stability of the combustion process. The longitudinal and lateral pressure oscillations recorded were smaller than in test No. 2. During transitional modes of operation, with substantial deviations from the optimum value of α , increases in chamber vibrations and in pressure oscillations were recorded. The limits of stable

Table 4.1

Heat Loss in Combustion Chamber

<u>Component</u>	<u>Heat Loss</u>		<u>% of Total</u>
	<u>kcal/s</u>	<u>MW</u>	
Burner	93.5	0.391	27.3
Chamber body	21.4	0.090	6.2
Nozzle shield	50.8	0.213	14.8
Support section shield	31.5	0.132	9.2
Nozzle	<u>145.2</u>	<u>0.608</u>	<u>42.4</u>
TOTAL	342.4	1.434	100.0

combustion chamber operation must be investigated further during future tests.

During the third test, the seed injection nozzles provided better atomizing of the seed and dispersion of smaller droplets.

Post-test inspection of the combustion chamber revealed no burns or other wall damage. The combustion chamber may be used for future tests without reconditioning.

4.5 Magnet

Possible interactions between the magnet system and the MHD flow train were monitored during the course of Test 3, as during the previous tests (see Ref. 1.1). A summary of the cryogenic and/or related mechanical observations follows:

1. Cryogenics: During all runs, the operating conditions of the magnet were monitored and studied. As of this date, no interactions between the MHD generator and the magnet have been observed that significantly affect the cryogenic operation of the system. Liquid levels have been steady and readily maintained, and no increased boiloff has been seen to result from operation with the channel. Operating data will continue to be gathered and analyzed on the cryogenic aspects of the magnet system performance. These data will be used to establish and further refine the operating parameters for the system and to determine areas of possible improvements to the system.

2. Vibration and Noise: During operation of the MHD flow train, the magnet platform is subject to considerable vibration and a high level of acoustical noise. The primary frequency of the vibration is approximately

360 Hz, which corresponds to that observed in the pressure fluctuations in the MHD combustor. No detrimental coupling to the magnet cryostat was observed; however, potentially damaging coupling to some of the ancillary equipment on the magnet platform, particularly a power supply, was noted, and corrective measures involving mechanical isolation are under study.

3. Fringe Field: The fringe field of the magnet at 5 T has not resulted in any problems with nearby magnet-related equipment. Measurements of the fringe fields existing on the magnet platform are given in Fig. 4.2; those for the second, fourth, fifth, and sixth floors of the U-25 facility in Figs. 4.3a to 4.3d. At the end of the third test, products from the MHD channel were released into the warm bore of the magnet. By agreement of both sides, the combustor was then manually shut down (see Section 8.0 for details). Post-test inspection revealed that the loss of a channel pressure tap instrumentation tube, which melted, was responsible for the release. The shutdown, together with the fact that the pressure tap (1) was in a subatmospheric pressure region of the channel and (2) passed through the frame cooling water passage, where the combustion products were cooled, prevented damage to the warm bore of the magnet. The epoxy-fiberglass insulating liner of the warm bore was discolored in the area of the gas release. Steps being taken to minimize possible effects of future plasma or gas release include improved pressure tap piping, early detection of gas escape and shutdown, and use of ablative liners and shields.

4.5.2 Non-Test Operation

In periods between MHD tests, the superconducting magnet system is maintained in a standby mode. From a cryogenic viewpoint, the standby mode

implies that either the magnet cryostat be maintained with a liquid level between half-full and full, or the magnet cold-mass temperature be maintained at or below 20 K. The standby mode has been instituted since commissioning of the magnet at the U-25B facility, and no significant problems have been encountered in maintaining the conditions. The refrigeration equipment has operated reliably and the prescribed maintenance procedures have been followed. To date, the equipment has been operated approximately 10 000 hours.

4.5.3 Operational Parameters

During the periods of the MHD tests and during the standby mode, data have been taken on the cryogenic performance of the magnet system. The values for system operation parameters determined to date are as given in Table 4.2.

1. Liquid Helium Use: A comparison of the liquid helium use rates for the standby and MHD test modes indicates a substantial increase in the use rate when the magnet liquid level is maintained as required for magnet operation. This increase is related not to MHD channel operation but, rather, to the design constraints imposed on the magnet cryostat by the requirement of an air-transportable geometry. Those constraints severely limited the overall vertical height of the magnet, thus necessitating compromises in the length and nature of the 300 K to 4.2 K penetration and in the resulting quantity of liquid that could be stored above the coil assembly. The resulting configuration is one having a higher conduction heat flux and a small liquid ullage (i.e., 8.1 L between fills). The configuration

Table 4.2 U.S. SCMS Cryogenic Operating Parameters

I. Helium Inventory

- A. Cryostat, 1600 L
- B. System total, L (liquid equivalent)

II. Standby Mode

- A. Cryostat pressure, 1.07 atm (1.0 psig, 108 kPa)
- B. Liquid helium use rate
 - 1. Cryostat total (1/2 full with current leads closed), 14.4 L/h (10.29 W)
 - 2. Cryostat total (1/2 full with current leads open), 9.4 L/h (6.71 W)
 - 3. Current lead contribution (1/2 full), 5.0 L/h (3.58 W)

III. MHD Run Mode

- A. Cryostat pressure
 - 1. Start fill, 1.18 atm (2.6 psig, 119.6 kPa)
 - 2. Filling, 1.14 atm (2.0 psig, 115.5 kPa)
 - 3. Evaporation, 1.10 atm (1.5 psig, 111.5 kPa)
- B. Fill cycle period, 22 min
- C. Fill levels
 - 1. Low, 15% of 10-cm probe
 - 2. Low control set point, 25% of 10-cm probe
 - 3. High control set point, 45% of 10-cm probe
 - 4. High, 65% of 10-cm probe
 - 5. Equivalent liquid (low to high), 8.1 L
- D. Liquid helium use rate
 - 1. Liquid delivered to cryostat, 22.1 L/h
 - 2. Liquid transferred from storage dewar No. 1, 28.3 L/h
- E. Transfer efficiency, 78%

IV. Helium Loss

- A. Initial
 - 1. Liquid equivalent, 20 L/day
 - 2. % based on total inventory, 1%/day
- B. Present
 - 1. Liquid equivalent, 5 L/day
 - 2. % based on total inventory, 0.25%/day

requires 22.1 L/h to maintain the magnet in its operating condition, as compared to 9.4 L/h for the standby mode.

In order to reduce the frequency of liquid transfer, an operating mode in which the refrigerator/liqefier makes liquid helium directly in the magnet cryostat will be attempted. The optimum parameters for such an operating mode are being established. At present, the cryostat helium vessel is being filled by transferring liquid from the cold boxes to the storage dewars to the magnet cryostat. The new operating mode will provide a more direct supply of liquid helium to the magnet cryostat and will result in an essentially closed-loop system that will increase the overall system performance, reduce helium losses (a goal of three liters per day, approximately 0.15% of total inventory, has been established), and reduce the possibility of impurities being drawn into the gas stream.

2. Helium Loss: The initial helium loss from the system was high--20 equivalent liquid liters per day. This loss rate was a result of the extensive nature of the system piping, coupled with the unavailability of sensitive portable leak detection equipment at the facility. A program for regular leak detection, employing a suitable instrument, has been instituted and has reduced the loss to 5 equivalent liquid liters per day.

4.6 Seed Injection and Recovery System

After the second run, the seed injection system of the U-25B facility was rebuilt in order to increase the reliability of its performance. New atomizers with a 3-mm central hole for seed injection and six side holes of 2.5 mm for injection of atomizing air were made. A 7-mm orifice was installed for measurement of the seed flow and, in addition, two screen filters

with 1-mm mesh openings were installed in the seed supply pipeline. The discharge tube of the storage tank was raised 1/2 m, in order to prevent pollutants from entering the seed injection system from the storage tank.

The flow of the atomizing air remained constant during the run at 56 g/s. At the end of the run, during the maximum power mode, the air flow decreased to 48 g/s because of the increase of pressure in the combustor. The ratio of air to seed varied from 0.58 to 1.00. Seed injection regimes are indicated in Table 4.3.

Table 4.3

June 14, 1978 Time	Seed Flow		Seed Pressure	Combustion Product Flow	Potassium Concentration in Combustion Products
	L/h	kg/s	kg/cm ²	kg/s	Mass %
13:40--15:40	200	0.082	1.4 (137 kPa)	1.9-2.4	1.02-0.81
15:40--16:02	300	0.12	1.4 (137 kPa)	2.4	1.22
16:48--24:10	185	0.075	1.4-2.5 (137--245 kPa)	2.3-4.0	0.75-0.45

The seed recovery system worked in a variety of regimes. The flow of the seed solution through the nozzles of the recovery system was constant at 100 t/h. With one exhaust fan was in operation, the system capacity was 28 kg/s. The experiment had shown that, at this rate, the efficiency of seed recovery was 96%. After the second exhaust fan was activated, the flow of combustion products and air through the seed recovery system increased to 35 kg/s, and the efficiency of seed recovery reached 99.5%.

4.7 Electrical Loading

The MHD Channel loading schematic for the third run of the U-25B facility is shown in Fig. 4.4. To minimize losses from electrical resistivity, the power takeoff sections of the channel were expanded to 12 frames each, compared to 7 frames each during the second test. The additional frames were located closer to the active part of the channel. The first upstream inverter, No. 17, was connected to frames 8 through 19, and the last inverter, No. 21, to frames 132 through 143. As in the previous test, diodes were installed in the power takeoff leads to prevent circulation of current between electrodes that may short-circuit. In addition, 0.5-ohm balancing resistors were added to each branch of the current takeoff electrodes. These resistors aid in preventing the flow of high currents from individual electrodes.

Because a higher Hall voltage (4 kV) was expected during the third test than during the second test (3 kV), the generator was loaded with three inverters connected in series (No. 17, 19, and 21), rather than two inverters, as during the second test. Two inverter balancing connections were required; the junction between inverters No. 17 and 19 was connected to frame No. 57 and the junction between inverters 19 and 21 to frame 93.

In preparation for the third MHD test, a special test was conducted to study the performance of inverters connected in series. The objectives were to minimize the current loads in the balancing connections and to improve the inverter control system so as to obtain steeper load characteristics (higher ratio of voltage to current). Such a system should prevent the appearance of large differences in inverter currents in cases of large

voltage deviations in adjacent inverters and, thus, minimize the currents in the balancing connections (frames 57 and 93).

5.0 TEST RESULTS

5.1 Test Program

As in the two previous tests of the U-25B facility, the test program included periods of "cold blow" and "warm blow" before ignition of the combustor. Static pressure measurements in the combustor, channel, and diffuser were monitored for "cold blow" air flow rates of 3.5 to 5.0 kg/s. Warm preheated air was then blown through the flow train, its temperature being raised at the rate of 50°C/h (50 K/h). Similar static pressure measurements were obtained with an air flow rate of 3.62 kg/s at 694°C (965 K). Tests of the new system for increasing the oxygen enrichment were carried out, and a 3.6 kV/ac high voltage isolation test was performed.

The test program for the magnet and channel performance was conducted with two principal combustor operating conditions. Natural gas was burned with air having either 40 or 50 vol % oxygen enrichment. The oxidizer was preheated to near 850°C (1125 K) for 40% O₂ enrichment and approximately 680°C (950 K) at 50% O₂ enrichment. The fuel-oxidizer ratio was maintained close to a stoichiometric value equal to unity. Except for one short period, the seed flow rate was maintained in the range 180-230 L/h throughout the test. The seed mixture was maintained at 50/50 mass % potassium carbonate and water. Diagnostic tests of the plasma were carried out before the magnetic field was energized.

During the channel and magnet evaluation tests, the magnetic field was increased from 2 to 4 T in steps of 1.0 T, and to 5 T in steps of 0.5 T. The mass flow rate was maintained near constant at 2.5 kg/s (with oxidizer oxygen enrichment at 40%) as the magnetic field increased. The program for

subsequent variation of mass flow rate and oxygen enrichment during the operation at 5 T is most easily described with reference to Fig. 5.1. From the experience gained in Test 2, it was known that the flow conditions at point II.1. would be supersonic. After obtaining data at II.1, the flow rate was decreased to establish, at point II.2, a test condition with the channel operating entirely subsonically. A limited amount of fluid dynamics and electrical data was obtained at conditions intermediate between points II.1 and II.2. The mass flow rate was then increased to approximately 3.0 kg/s (point II.3), with O₂ enrichment maintained at 40%. Next, the oxygen content of the oxidizer was increased to 50% (point III.1). Three additional mass flow rates (points III.2 through III.4) were achieved before the appearance of smoke near the entrance to the warm bore tube led to the joint decision to terminate the experiment.

Using the instrumentation and data acquisition equipment described in Section 3.0, data on the behavior of the magnet, channel, and other elements of the flow train were recorded throughout the test. In addition, the current-voltage characteristics of the MHD channel were obtained at most of the points indicated by the symbols in Fig 5.1. Diagnostic measurements of the plasma properties were obtained at many of the operational points of Fig. 5.1; new instrumentation used for this purpose included an improved conductivity probe and a submillimeter laser system. In addition, the flow of radiant energy to the combustor walls was measured. Section 5.2 contains the details of these measurements.

5.2 Diagnostic Studies

Diagnostic studies made during Test 3 included spectroscopic measurements to determine the gas temperature at the inlet of the channel and the concentration of potassium seed atoms at the channel exit; electrical conductivity probe measurements to determine the plasma conductivity in the nozzle region in the absence of a magnetic field; tests of a new electrical conductivity measuring system in the magnetic fringe field of an operating MHD generator; measurements of radiant energy flux from the working fluid over a wide spectral range, and feasibility tests of a submillimeter laser system within the fringe fields of the superconducting magnet system.

5.2.1 Gas Temperature Measurements

Gas temperature was measured at the inlet of the generator channel with the spectroscopic equipment employed in previous tests in the U-25 and U-25B facilities. These measurements were made through coaxial optical windows 18 mm in diameter; the detector was located 18 m from the SCMS, and the light beam from the channel was transmitted to the detector by means of pivoted mirrors. Characteristic values of gas temperature obtained during Test 3 were in the range 2550-2850 K. These measurements appear in the printout from the data processing system.

It should be noted that, during certain periods of Test 3, the plasma temperature measurements were not reliable. This could be attributed to imperfect seed injection, which was observed at times and would affect the sodium concentrations, because the sodium content in the seed is the basis of the plasma temperature measurements. In order to avoid such seed

supply instability impact on temperature measurements, a specialized sodium injection system will be used in future experiments.

5.2.2 Measurements of Potassium Atom Concentration

In order to monitor the performance of the seed injection system and to determine the completeness of evaporation of the seed, the potassium atom concentration (N_k) was recorded by the line reversal method. An ISP-51 spectrograph was used, together with a long-focal length UF-58 camera with special photoelectric attachment, to record the line shape. The spectrograph is mounted outside the magnet fringe field. Fiber optics were used to transmit the signal from the plasma (at the diffuser inlet) to the ISP-51 slit. Because no temperature measurement was available at the diffuser window, the interpretation of the spectral-line contour required the use of a calculated temperature based on channel heat losses and power takeoff. In the interpretation procedure, the effect of the walls is included by assuming $T_w = 1000$ K, but preliminary analyses have shown that the results are relatively insensitive to this assumption. The results obtained during Test 3 are given in Table 5.1, with experimental values falling far below the theoretical concentration expected. However, the theoretical predictions themselves are extremely sensitive to the value of temperature used in the equilibrium calculation. A 60 K change at a temperature level of 2300 K will change the calculated KOH concentration by 30%, and this reflects in a 50% change in N_k . In order to achieve a valid comparison between theory and experiment, it is necessary to measure N_k and plasma temperature simultaneously.

Table 5.1
Potassium Atom Concentration Measurements

No.	Time	Meas. No.	No. of Measurements	Atomic Concentration of K		Ratio Exp./Calc.
				Exp. $10^{-15}/\text{cm}^3$	Calc. $10^{-15}/\text{cm}^3$	
1	14:09	189	40	5 ± 1	11	0.45
2	15:08	236	20	4.8 ± 1.4	8.6	0.54
3	17:13	337	23	3.5 ± 0.9	6	0.58
4	18:50	433	13	3.4 ± 0.8	6	0.56
5	19:30	450	21	3.2 ± 0.6	6	0.53
6	20:40	556	23	3 ± 0.7	6.6	0.45

5.2.3 Measurement of Electrical Conductivity of Plasma

In Test 3, data on the electrical conductivity of the plasma in the U-25B facility were obtained with a new, modified measurement system (SILEP-1), which differs from the one that was used in the second test. The conductivity sensor, coated with Teflon and made up of a transmitter and high-frequency generator, was installed in a streamlined probe that was traversed into the plasma. The teflon coating of the sensor prevented arcing during measurement of electrical conductivity in a magnetic field.

The new measurement system had a special calibration device that made it possible to calibrate immediately before and after the measurement and, thus, decreased measurement errors. An optical isolation system was used to transmit the signal from regions of high voltage to instrumentation located at ground potential.

This was the first time that this electrical conductivity measurement system had been tested in a magnetic field under MHD generator operation conditions, and these preliminary tests indicated that the system can perform under such test conditions. Electrical conductivity values obtained with this system in a magnetic field should be regarded only as a first approximation of the actual value. Electrical conductivity measurements were made without a magnetic field on June 14, 1978 at 12:25 and 12:28 hours, and indicated typical values of 6.0 to 6.1 S/m. Electrical conductivity measurements in the presence of a magnetic field were made at approximately $B = 2$ and 3 T in the channel between 15:06 and 17:06 hours. Values of those measured electrical conductivities were approximately 6.0 to 6.3 S/m. The calculated values of electrical conductivity were in the range of 7.6 to 8.6 S/m.

5.2.4 Submillimeter Laser System Tests

A submillimeter laser system has been set up for measurement of the concentration and mobility of electrons in a plasma. The main component of the system is a CW gas discharge HCN laser, the performance of which could be significantly affected by the external magnetic field. The laser cavity length was approximately 2.3 m, the length of the discharge was 2.0 m, and the inner diameter of the discharge tube was 55 mm. A mixture of CH_4 and N_2 gases, fed from supply tanks through flow valves, was continuously pumped through the discharge tube. The experimentally determined optimal conditions for laser operation are: $\text{CH}_4 + \text{N}_2$ mixture pressure, approximately 1.2 torr (160 Pa); pressure ratio of $\text{CH}_4 : \text{N}_2 = 1:1$, and discharge current, 0.4-0.5 A.

The output mirror is a two-dimensional nickel mesh with a 3% coefficient of transmission. The laser beam dispersion angle at a wavelength of 0.337 mm is 0.012 rad. Polarization of the fundamental mode is linear, with approximately 98% polarization. The power of the single mode beam in the optimum mode of operation is approximately 15 mW, with fluctuations on the order of $\pm 2\%$.

A slow detuning of the laser cavity caused by various thermal and mechanical processes resulted in a decrease of the power output during operation. Semiautomatic remote adjustment of the cavity is achieved by means of reversible microsensors, which control the fine-tuning screws of the resonator. The laser beam passes through an amplitude modulator, and a small part of its power is reflected from a beam-splitter into a pyro-electrical detector. The output signal of this instrument, which is proportional to the power of the laser beam, is preamplified and transmitted to a tuned amplifier, located at the main control panel of the equipment. The

monitoring of the signal level is performed by an ac voltmeter and strip chart recorder. During operation, the laser is remotely adjusted by the operator, using a special system to control the microserves. When remote adjustment of the cavity is used, the power decreases gradually, at the rate of 1.5% per hour, because of change in pressure of the working gases in the supply tank and the instability of the flow vents.

This submillimeter laser system was stationed approximately seven meters from the axis of the MHD generator, two meters above the floor and facing the windows in the nozzle of the generator. No shielding was provided for the laser receiver or electronic equipment. The experiment showed that the system performed normally at all values of the magnetic field and can be used for measurement of the concentration and mobility of electrons in the working fluid of an MHD generator. Only the operation of the system was checked during the test; no electron number density data were obtained.

5.2.5 Measurement of Radiant Energy Flow from Generator Working Fluid

Energy radiated from the combustor of the U-25B facility was measured in Test 3. The optical system is shown in Fig. 5.2.

Light was transmitted from the combustor (1), through quartz windows of 38-mm diam (2), mounted in optical tubes, which have an inside diameter of 36 mm (3).

A pyrometer (6) was used as the sensor for the radiant energy. The optical system contains two choppers (4) and (5), the first (4) of which chops the emitted radiation at the rate of 32 Hz. The signal from the pyrometer is amplified in a narrow band amplifier tuned to this frequency; it records

the magnitude of the energy radiated from the combustor. The second modulator (5) rotates very slowly (0.2 rpm); its purpose is to isolate parasitic signals, background light, and noise appearing when the light flow from the combustor is interrupted.

The voltage-power sensitivity of the pyrometer was determined experimentally by calibration against an absolute standard in a laboratory mock-up, prior to the U-25B run. A constant reference tungsten lamp was used as a light source for this calibration. This lamp was set at the focal point of the lens. The volt-power sensitivity is given by an S value of 0.133 V/W.

Measurements of radiated energy, W , as detected by the pyrometer are plotted versus time in Fig. 5.3. This plot correctly reflects the qualitative loss of radiative energy that accompanied changes in the operating mode of the combustor up to 15:30 hours. Thus, the increase of recorded energy from 11:22 to 11:50 reflects the increase of temperature, water vapor content, and CO_2 content corresponding to the increased flow of the gas and oxidizer while the oxygen enrichment increased to about 40%. Some decrease in emitted energy at 12:00, compared to 11:30, is caused by a 20% decrease of mass flow. Maximum emission is measured at 12:28, when seed was introduced. When the seed was shut off at 12:30, the instrument reading decreased sharply. The further decrease of emitted energy is explained by some decrease in oxygen enrichment and flow of combustion products. Further increase of seed content in the channel increased the plasma energy emission (12:40 through 14:30); finally, when the seed was shut off at 14:52, the emitted energy again decreased.

The power (in W/cm^2), W , of the emission measured by the pyrometer is related to the power, W_1 , emitted per unit surface area of the combustor through the solid angle, yielding

$$W_1 = W \frac{L^2 \pi}{S_w S_D} = 2 \times 10^4 W,$$

where $L = 675$ cm is the distance from the combustor to the pyrometer and S_w and S_D are the areas of the window and the detector, in that order. It is assumed that the plasma emission is subject to Lambert's law.

Estimated values of the calibration error and of error resulting from fluctuations of the signal and noise are 10% for the former, 15% for the latter. The spectral range of the measured emission is limited by the light transmittance of the quartz window. The fused quartz transparency transmittance is 94% in the wave range of 0.2-3.0 μm and it is 10% for $\lambda = 4$ μm , so that there is no sharp cutoff. This is confirmed by the fact that the wavelength range 0.0-3.0 micrometers contains approximately 87% of the integral radiation from a black body in the temperature range of interest. However, calculations of radiant energy emitted from the working fluid should include losses attributable to the quartz window.

Emission from the opposite wall of the combustion chamber may contribute to the measured emission. From the positions and dimensions of the optical system elements (Fig. 5.2), it can be seen that emission from the refractory material surface immediately adjoining the 40 mm-diam aperture for the optical tube opposite the pyrometer could reach the pyrometer. The energy radiated by an annular area, 0.4 mm in width, encircling the 40.0 mm-diam hole in the refractory surface was calculated by the Stefan-Boltzmann formula, taking the wall temperature as 2100 K and the emissivity as 0.5. It was found that the calculated contribution of the opposite wall to the measured signal does not exceed 20%.

Absorption of the radiation by the water vapor and CO_2 in the air between the window and the sensor should also be considered. Absorption by CO_2 in the air is minor, less than 1.0%. According to published data (Ref. 5.1 and 5.2), the water vapor fraction of the emission measured in this spectral interval is attenuated by only 10% over the 7-m pathway in air at room temperature. In the integral emission under study, the water vapor contribution does not exceed 50%. Thus, the attenuation of the integral emission that results from absorption in air does not exceed 4.0%.

5.3 Gasdynamic Characteristics

5.3.1 Cold and Warm Blow

As in the previous tests of the facility, the static pressure measurements obtained during the "cold blow" and "warm blow" provided a means for evaluating the flow characteristics of the channel. Seventeen channel pressure orifices were used, including seven pairs of taps on opposite vertical walls of the channel, with three additional single taps on one vertical wall. As in the previous tests, there were also three taps in the diffuser and two in the downstream cooling section.

The cold blow tests were conducted by supplying compressed air to the combustor at a temperature of approximately 100°C (375 K) and mass flow rates in the range 3.5-5.0 kg/s. The warm blow tests used air flowing from the preheaters; gasdynamic measurements were obtained when the air temperature was approximately 700-750°C (975-1025 K). For these tests, the agreement between pressures measured on opposite sides of the channel was good within the accuracy of the transducers (i.e., $\pm 5\%$).

From the continuity equations and the equation of state, together with an assumption of isentropic conditions, values of the velocities and stagnation pressures at each axial location can be determined from the known values of static pressure, mass flow, and stagnation temperature, T_0 (T_0 was assumed to be constant along the channel and equal to the combustor stagnation temperature).

5.3.2 Hot Blow

The program for Test 3 included performance testing with combustion product mass flows of up to $G = 4$ kg/s. The experiments were conducted with oxidizer oxygen enrichment of 50% or 40%, and with magnetic field strengths in the range of $B = 2$ T to $B = 5$ T. During most of the test the channel flow was partly supersonic, with the supersonic region originating at or near the end of the constant area section. Because of high stagnation pressure in the diffuser, such supersonic flows became subsonic within the MHD channel through a shock or system of shock waves.

Experimental data were used to determine values of the gasdynamic parameters for a number of typical modes of operation. The primary data processed included: the fuel flow, combustion product mass flow rate (determined as the sum of the mass flows of fuel components and seed), static temperature in channel inlet, measured distribution of the static pressure along the channel, heat losses to the channel walls, and electrical power generated. These data provided sufficient information for evaluation of the average values of the basic gasdynamic parameters at each location for which static pressure data were available. The variation of stagnation enthalpy along the channel was determined by a computer program that included the effects of heat loss from the combustion products to the walls and losses resulting from takeoff of electrical power.

As in the cold and warm blow cases, mean pressures were used at the stations with pressure taps on opposite walls. From the discussion of static pressure data given in 5.3.3, it may be seen that this procedure is adequate for most axial stations, because the opposing pairs of values agree in general within ± 5 -10%. The exception is the 0.15 m station, where the

static pressure measurements on opposite walls differed by up to approximately 0.6 kg/cm^2 (59 kPa) during the later stages of Test 3. This is probably attributable to seed deposit blockage of one of the taps; consequently, the mean pressure values for the 0.15 m station may be in error by up to 25% for the later runs shown in Table 5.2.

Table 5.2 shows the distribution of gasdynamic parameters along the channel for a number of typical modes of operation.

All calculated and measured channel properties varied smoothly as the mass flow rate was increased, including the stagnation pressure loss between inlet and outlet. The combustor static pressure variation with mass flow rate was not fully consistent with the calculated channel inlet stagnation pressure, but the discrepancy was within the accuracy of the pressure transducer used ($\pm 6\%$). For all mass flow rates investigated, the channel operated in a subsonic mode, which is consistent with the fact that the corresponding theoretical critical mass flow rate exceeds 5 kg/s.

For the warm blow case, also shown in Table 5.2, the variations of measured and calculated properties again are smooth, except that the calculations show supersonic flow in the vicinity of the 0.7 m station, indicating that the mass flow had reached the critical value.

Table 5.2 also shows friction coefficient values deduced from the cold and warm blow data. The method of analysis used will be discussed in Section 5.3.4.

In general, for the hot blow tests, the tabulated pressure distributions exhibit smooth variation on either side of any discontinuity resulting from the presence of a shock wave in the channel. Variations in the resulting computed values, which are listed in Table 5.3, are also reasonably smooth and provide an adequate description of the channel flow properties during Test 3.

Table 5.2
Distribution of the Basic Gasdynamic Parameters
along the MHD Channel during Cold and Warm Blows

Test Parameters	x, M	P, kg/cm ²	P ₀ , kg/cm ²	u, m/s	M	Re _d x10 ⁻⁶	Re _x x10 ⁻⁷	C _f x10 ³
G=3.56 kg/s	0.15	0.936	1.068	166	0.439	1.087	.316	90.7
P _{kc} = 1.084	0.70	0.894	1.028	171	0.452	1.080	.693	22.2
kg/cm ²	1.20	0.918	1.016	146	0.384	.998	.896	8.86
T ₀ =371 K	1.71	0.942	1.013	124	0.324	.922	1.028	2.96
	2.21	0.967	1.013	99	0.259	.829	1.046	-
	2.72	0.978	1.010	83	0.217	.759	1.055	7.36
	3.22	0.986	1.009	71	0.184	.700	1.050	3.91
	3.72	0.986	1.006	62	0.162	.657	1.057	19.0
	4.23	0.985	1.001	58	0.150	.631	1.100	42.1
	4.81	0.987	1.000	53	0.138	.605	1.142	3.20
G=4.48 kg/s	0.15	0.887	1.108	213	0.573	1.399	.406	-
P _{kc} = 1.08	0.70	0.812	1.047	228	0.614	1.398	.896	20.6
kg/cm ²	1.20	0.859	1.025	191	0.509	1.281	1.150	9.63
T ₀ = 365 K	1.71	0.901	1.018	160	0.423	1.177	1.312	4.05
	2.21	0.938	1.013	127	0.334	1.054	1.330	5.35
	2.72	0.960	1.012	105	0.276	.963	1.339	1.77
	3.22	0.972	1.009	89	0.234	.887	1.331	6.58
	3.72	0.978	1.007	78	0.205	.832	1.339	9.34
	4.23	0.975	1.000	73	0.190	.799	1.392	33.8
	4.81	0.979	1.000	67	0.174	.766	1.445	-
G=5.0 kg/s	0.15	0.859	1.147	243	0.657	1.574	.457	19.9
P _{kc} = 1.084	0.70	0.747	1.071	270	0.787	1.585	1.016	11.7
kg/cm ²	1.20	0.815	1.036	222	0.596	1.440	1.293	5.34
T ₀ = 372 K	1.71	0.872	1.025	183	0.487	1.317	1.468	4.60
	2.21	0.923	1.019	144	0.379	1.175	1.482	1.37
	2.72	0.952	1.018	119	0.311	1.072	1.490	7.39
	3.22	0.967	1.014	101	0.263	.987	1.480	8.40
	3.72	0.975	1.011	88	0.230	.924	1.488	27.3
	4.23	0.973	1.004	82	0.213	.888	1.547	3.49
	4.81	0.977	1.003	75	0.196	.851	1.605	-

Table 5.2 (cont)

Test Parameters	x, M	P, kg/cm ²	P _o , kg/cm ²	u, m/s	M	Re _d x10 ⁻⁶	Re _x x10 ⁻⁷	C _f x10 ³
G=3.62 kg/s	0.15	0.875	1.261	435	0.754	.603	.175	-
P _{kc} = 1.332	0.70	0.560	1.169	598	1.094	.644	.413	16.5
kg/cm ²	1.20	0.658	1.029	474	0.838	.572	.513	29.3
T _o = 967 K	1.71	0.796	1.029	371	0.628	.502	.560	-
	2.21	0.896	1.032	278	0.463	.446	.446	-
	2.72	0.929	1.022	228	0.379	.407	.566	9.82
	3.22	0.947	1.013	193	0.319	.374	.562	12.5
	3.72	0.955	1.006	169	0.279	.351	.565	15.3
	4.23	0.959	1.002	156	0.258	.337	.587	9.82
	4.81	0.959	0.996	144	0.237	.323	.609	17.8

Table 5.3
Distribution of Gasdynamic Parameters for Hot Blow

No.	Parameters	x, m	P, kg/cm ²	P ₀ , kg/cm ²	T, K	T ₀ , K	u, m/s	M
244	G _{cp} =2.43 kg/s G _{seed} =308 L/h $\psi=0.38$ B= 3 T N=34 kW	.15	1.063	1.547	2551	2644	784	.830
		.7	.769	1.466	2443	2608	1008	1.092
		1.2	.691	1.251	2415	2567	959	1.045
		1.71	.691	1.080	2411	2528	828	.903
		2.21	.882	1.066	2443	2495	539	.584
		2.72	.904	1.027	2422	2457	439	.478
		3.22	.916	1.002	2395	2420	365	.400
		3.72	.930	.994	2361	2380	312	.343
		4.23	.912	.966	2320	2337	288	.320
		4.81	.934	.978	2274	2288	253	.284
362	G _{cp} =2.34 kg/s G _{seed} =182 L/h $\psi=0.4$ B=4 T N=66 kW	.15	1.093	1.529	2588	2670	747	.786
		.7	.725	1.426	2459	2631	1037	1.12
		1.2	.708	1.209	2451	2588	917	.992
		1.71	.808	1.105	2467	2549	701	.755
		2.21	.938	1.098	2472	2513	495	.533
		2.72	.937	1.047	2443	2473	412	.446
		3.22	.940	1.018	2411	2432	345	.337
		3.72	.949	1.007	2373	2391	296	.325
		4.23	.935	.984	2329	2344	272	.301
		4.81	.943	.983	2277	2289	242	.271
412	G _{cp} =2.31 kg/s G _{seed} =181 L/h $\psi=0.4$ B=4.5 T N=73 kW	.15	1.09	1.505	2549	2630	725	.769
		.7	.723	1.386	2422	2588	1001	1.096
		1.2	.705	1.131	2412	2545	892	.973
		1.71	.798	1.084	2425	2507	685	.746
		2.21	.940	1.092	2429	2469	478	.519
		2.72	.942	1.046	2400	2428	396	.433
		3.22	.938	1.012	2363	2385	333	.367
		3.72	.946	1.001	2324	2340	286	.317
		4.23	.944	.990	2279	2293	259	.290
		4.81	.142	.980	2222	2234	232	.243

Table 5.3 (cont)

Distribution of Gasdynamic Parameters for Hot Blow

No.	Parameters	x, m	P, kg/cm ²	P ₀ , kg/cm ²	T, K	T ₀ , K	u, m/s	M
406	G _{cp} =2.35 kg/s G _{seed} =181 L/h ψ =.397 B=4.5 T N=61 kW	.15	1.087	1.578	2750	2841	823	.831
		.7	.723	1.524	2627	2810	1136	1.183
		1.2	.639	1.257	2625	2769	1004	1.046
		1.71	.798	1.138	2648	2736	780	.809
		2.21	.940	1.120	2666	2710	548	.566
		2.72	.943	1.066	2647	2678	456	.473
		3.22	.940	1.028	2624	2647	386	.405
		3.72	.944	1.01	2600	2618	335	.351
		4.23	.944	.999	2570	2586	305	.322
		4.81	.942	.988	2533	2547	276	.284
553	G _{cp} =2.84 kg/s G _{seed} =181 L/h ψ =0.397 B=5 T N=117 kW	.15	1.075	1.720	2856	2990	1066	-
		.7	.775	2.105	2740	2992	1362	1.38
		1.2	.770	1.668	2754	2944	1196	1.208
		1.71	.847	1.386	2786	2905	957	.959
		2.21	.935	1.198	2809	2872	719	-
		2.72	.964	1.145	2806	2848	587	-
		3.22	.959	1.099	2792	2824	500	.5
		3.72	.949	1.056	2773	2800	441	.443
		4.23	.942	1.033	2752	2776	406	.41
		4.81	.942	1.018	2728	2748	369	.375
552*	G _{cp} =2.85 kg/s G _{seed} =181 L/h ψ =0.39 B=5 T N=116 kW	.15	1.07	1.796	2600	2729	935	.98
		.7	.774	1.863	2478	2703	1193	1.284
		1.2	.768	1.519	2486	2657	1048	1.125
		1.71	.847	1.303	2511	2619	832	.889
		2.21	.935	1.189	2525	2585	621	.662
		2.72	.963	1.131	2512	2551	505	.540
		3.22	.962	1.081	2489	2518	427	.458
		3.72	.949	1.040	2459	2484	376	.406
		4.23	.942	1.019	2426	2448	345	.375
		4.81	.942	1.005	2388	2407	311	.341
613*	G _{cp} =2.91 kg/s G _{seed} =182 L/h ψ =0.508 B=5 T N=116 kW	.15	1.226	1.894	2697	2809	877	.899
		.7	.964	1.838	2610	2771	1050	1.098
		1.2	.940	1.566	2599	2724	928	.773
		1.71	.847	1.342	2564	2678	872	.921
		2.21	.954	1.222	2578	2638	639	.673
		2.72	.955	1.137	2555	2598	532	.563
		3.22	.923	1.055	2521	2556	462	.492
		3.72	.922	1.022	2488	2515	401	.430
		4.23	.927	1.009	2448	2472	361	.391
		4.81	.935	1.002	2401	2420	322	.352

Table 5.3 (cont)

Distribution of Gasdynamic Parameters for Hot Blow

No.	Parameters	x, m	P, kg/cm ²	P ₀ , kg/cm ²	T, K	T ₀ , K	u, m/s	M
655	G _{cp} =3.44 kg/s G _{seed} =183 L/h $\psi=0.477$ B=5 T N=485 kW	.15	1.284	2.246	2723	2869	1004	1.022
		.7	.963	2.358	2617	2842	1246	1.301
		1.2	.960	1.906	2625	2798	1087	1.133
		1.71	.844	1.619	2591	2753	1050	1.103
		2.21	.847	1.314	2599	2708	860	.901
		2.72	.906	1.194	2604	2671	679	.711
		3.22	.896	1.099	2585	2636	580	.610
		3.72	.876	1.032	2557	2602	516	.546
		4.23	.893	1.02	2531	2567	462	.492
		4.81	.911	1.014	2498	2526	410	.440
699	G _{cp} =3.95 kg/s G _{seed} =183 L/h $\psi=0.5$ B=5 T N=477 kW	.15	1.551	2.543	2676	2810	932	.953
		.7	1.168	2.569	2576	2780	1154	1.216
		1.2	.986	2.22	2533	2740	1160	1.234
		1.71	.844	1.892	2493	2700	1146	1.229
		2.21	.740	1.487	2474	2650	1058	1.139
		2.72	.55	1.297	2396	2611	1156	1.265
		3.22	.745	1.072	2475	2569	757	.815
		3.72	.815	1.034	2472	2535	610	.657
		4.23	.808	.991	2443	2500	561	.608
		4.81	.885	1.022	2420	2459	466	.508
704	G _{cp} =3.96 kg/s G _{seed} =183 L/h $\psi=0.5$ B=5 T N=345 kW	.15	1.551	2.541	2666	2798	928	.958
		.7	1.167	2.567	2564	2769	1151	1.216
		1.2	.987	2.21	2523	2730	1156	1.232
		1.71	.844	1.89	2483	2690	1142	1.228
		2.21	.740	1.48	2465	2641	1056	1.139
		2.72	.542	1.307	2383	2604	1168	1.282
		3.22	.740	1.070	2467	2563	761	.821
		3.72	.810	1.031	2465	2529	613	.661
		4.23	.802	.987	2437	2495	585	.613
		4.81	.882	1.02	2416	2455	468	.510
709	G _{cp} =3.98 kg/s G _{seed} =183 L/h $\psi=0.5$ B=5 T N=137 kW	.15	1.553	2.557	2672	2806	935	.963
		.7	1.171	2.59	2572	2778	1158	1.221
		1.2	.987	2.242	2531	2740	1166	1.241
		1.71	.847	1.911	2493	2702	1150	1.234
		2.21	.740	1.503	2475	2654	1066	1.148
		2.72	.538	1.331	2391	2618	1188	1.301
		3.22	.750	1.082	2483	2578	761	.818
		3.72	.812	1.037	2481	2545	619	.666
		4.23	.802	.991	2455	2513	572	.619
		4.81	.884	1.024	2436	2476	474	.514

For the first cases analyzed, the combustor mass flow rate remained roughly constant at 2.5 kg/s, while the magnetic field strength was increased from 2 T to 5 T. The values shown in Table 5.3 indicate that the variation of gasdynamic parameters with magnetic field was minimal, because the electromagnetic interaction was limited and changes did not lead to any restructuring of the flow in the channel. For this mode of operation, the shock was located in the region $0.7 \text{ m} < x < 1.2 \text{ m}$, and its location did not appear to change with increase of magnetic field. The maximum Mach number was approximately 1.1. With the subsequent increase in mass flow, the shock started moving downstream (i.e., the zone of supersonic flow lengthened) and its intensity kept increasing. Thus, for the case of $G = 4 \text{ kg/s}$, the maximum Mach number was approximately 1.35 and the shock was located between $x = 2.72 \text{ m}$ and $x = 3.22 \text{ m}$.

This estimate of shock position is consistent with the results in Fig. 5.10, which shows the shock location as a function of combustion products mass flow rate with 40% and 50% oxygen enrichment. Although the static pressure data from a given MEAS number can only bracket the shock position to within a range of 0.5 m, Fig. 5.10 provides somewhat more precise shock location information (the generation of the data for this figure is discussed in Section 5.3.3).

The flow restructuring observed when the MHD interaction changed in Test 3 is of interest; compare point #552 and #613. The mass flow rate of the combustion products was maintained reasonably constant ($G \approx 3 \text{ kg/s}$), and the increase of MHD interaction was achieved by increasing the oxygen content of the oxidizer from 40% to 50%, thus producing a substantial increase in the plasma conductivity. The electromagnetic interaction was sufficient to cause appreciable changes in the distribution of gasdynamic

parameters along the channel. An increase of approximately 12% in combustor pressure was required to maintain the constant value of G , thus forcing the flow into a subsonic operating mode. The calculated flow properties for this case show a Mach number slightly greater than unity near the $x = 0.7$ m station, but this computed Mach number is sensitive to any error in static pressure measurement. Thus, the tabulated flow properties for No. 613 are consistent with subcritical mass flow rate in the channel. However, a comparison of measurements 610 and 617, for which Hall voltage was 3.5 kV and 1.25 kV, respectively, shows that this fairly substantial change of interaction made no observable difference in the channel flow properties.

It should be noted that Table 5.3 shows data for two similar measurement points (552 and 553) for $G = 2.85$ kg/s and 40% oxygen enrichment. For No. 553 the tabulated values are based on the measured inlet static temperature, 2856 K (which seems unreasonably high), whereas calculations for No. 552 use a theoretical temperature of 2600 K. This variation changes some of the gasdynamics parameters by up to 30%, but the major impact would be on the electrical properties, because of the sensitivity of conductivity to temperature. The occasional disagreement between measured and calculated temperatures may be attributable to seed maldistribution, as mentioned in Section 5.4.

Calorimetric measurements of the heat flux to the MHD channel cooling water were made, as in previous tests. The amount of heat removed by the channel cooling system is a function of combustion products flow. When the combustor had reached its optimal mode of operation, heat losses to the channel walls increased with G and with oxygen enrichment, from 2.6 MW to 4.9 MW.

5.3.3 Measurements of Channel Static Pressure

As discussed in the previous section, sidewall static pressure taps are located at 10 axial locations in the channel. The notation and locations are listed below:

Distance from Channel Inlet, m	0.15	0.70	1.20	1.71	2.21	2.72	3.22	3.72	4.23	4.81
Static Pressure Tap Number	C1 C11	C2 C12	C3 C13	C4 C14	C5 C15	C6 C16	C7 C17	C8 C18	C9 C19	C10 C20

Figures 5.4, 5.5, and 5.6 show the static pressures recorded at the first three axial locations; the abscissa in each plot is time, covering the entire period of the "hot" tests with magnet energized. Each figure also shows the combustor pressure, P_{kc} , and the combustion products mass flow rate, G . Three aspects of the static pressure behavior are discussed in this section: (1) the reliability and consistency of the measurements; (2) the channel phenomenology that can be deduced from these measurements, and (3) the reproducibility of the channel behavior as determined by comparison with similar measurements taken in Test 2. This comparison can be made with the aid of Figures 5.7, 5.8 and 5.9, which show the corresponding data for the relevant periods of Test 2.

0.15 m Station: In general, the readings at C1 follow the behavior of P_{kc} in a manner that indicates rather high subsonic Mach number, as expected near the inlet of the constant area section of a channel operating with critical or choking mass flow over most of the time interval of Fig. 5.4. Prior to the addition of seed, C11 had also been responding to variations in P_{kc} , but C11 consistently read slightly higher than C1, the difference being

a monotonic function of G . Figure 5.7 shows that the same behavior was present in Test 2. Thus, C11 indicates fairly consistently a lower subsonic Mach number than C1, possibly because of a local separation near the transition from the nozzle to the constant area section of the channel. In both tests, however, C11 ceases to give reliable pressure measurements shortly after the introduction of seed. In Fig. 5.4, it is indicated that seeding commenced at 13:40; however, there had been a period of seed injection at approximately 12:30, and C11 had responded sluggishly from 12:50 onward. The pressure tap was not completely blocked, as shown by the slow rise in signal after 21:00, but there was no response to the reduction in G that began at 23:50. The fact that Fig. 5.7 also shows early blockage of C11 tends to confirm the likelihood that C11 is located in a region of separated flow.

0.7 m Station: Figures 5.5 and 5.8 show the behavior of the readings at C2 and C12 in Test 3 and Test 2, in that order. Again there is a remarkable consistency, with C12 in general indicating slightly lower Mach number than C2 during subsonic flow prior to injection of seed. When the flow is supersonic at this station, C2 and C12 are generally in fairly close agreement, although Fig. 5.8 shows that the pressure at C12 is frequently slightly higher than that at C2. Partial seed blockage eventually occurred in C12, at approximately 16:30 on Fig. 5.5. The reason for the abrupt drop in pressure for C12 in Test 2 immediately before its blockage is not obvious, but this pressure tap remained blocked during "cold" blow tests on the following day (March 17, 1978, see Ref. 1.1). One further comment may be made from comparison of Test 2 and Test 3 data for this location. The differences in static pressure could be spurious, caused by slow response of the C12 sensor due to seed plugging, or they could be a real effect attributable to increased roughness of the channel in Test 3 as compared

with Test 2 and/or flow separation. Because of the uncertainty, these data are not used in later analysis.

1.2 m Station: The most interesting phenomena are exhibited in Figs. 5.6 and 5.9, which show both similarities and differences in behavior. In Fig. 5.6, the values at C3 and C13 are similar until 13:50, the time at which seed flow rate reached 200 L/h with $B = 2$ T and $G = 1.9$ kg/s. At this time, a difference between the C3 and C13 readings is noted, with C13 giving higher values. The effect continued throughout the ensuing seven hours, the pressure difference being somewhat dependent on mass flow rate, but remaining remarkably reproducible as G was varied over the range 1.7-2.4 kg/s. The only period in which C3 and C13 did not show a pressure difference was between 16:00 and 17:00, when the seed flow rate was reduced to zero without appreciable change in G . This suggests that the effect may be induced by MHD interaction. Unfortunately, any pressure differences between C3 and C13 that occurred during the high-power period of Test 3 could not be observed, because pressure tap C3 became open to the atmosphere at approximately 21:20; tap C13, apparently clogged and lost all responsiveness at approximately the same time. From the C3 values during the period of 20:20 to 21:00, it can be deduced that the flow at 1.2 m is fully supersonic for $G \geq 2.4$ kg/s.

Very similar disagreement between C3 and C13 readings is seen in Fig. 5.9 and the effect may be triggered by the onset of MHD interaction. At approximately 14:30, the mass flow rate reached 2.4 kg/s and the flow became fully supersonic at the 1.20 m location; thereafter, the pressure difference remained fairly small throughout the remainder of Test 2. However, for $G < 2.4$ kg/s, the pressure difference at a given value of G was much larger in Test 2 than in Test 3. For the former, the maximum

pressure difference was 0.32 kg/cm^2 (31.4 kPa), whereas, it was 0.16 kg/cm^2 (15.7 kPa) for Test 3. In both tests, therefore, there is an indication of a complex flow pattern in the vicinity of $x = 1.2 \text{ m}$; unfortunately, there are no data available to define the axial extent of the nonuniformity. (As will be discussed, there is evidence that it does not persist as far as $x = 2.7 \text{ m}$.)

In regard to the relative magnitudes of the pressure differences in the two tests, it may be stated that the only significant difference in configuration that might have affected this behavior was the distribution of upstream current-takeoff electrodes. In both cases, load current fluxes existed immediately downstream of the end of the constant area section of the channel ($x = 0.63 \text{ m}$), but four additional frames (16 through 19) were in use in Test 3. These probably moved the major interaction region slightly downstream from the end of the constant area section.

For the remaining axial stations, Test 3 plots similar to Fig. 5.4 have been made and are presented in Appendix C. Their information content may be summarized as follows:

1.7 m Station: Pressure readings from C14 appeared to be unreliable throughout Test 3, as was the case in Test 2, after seed injection was begun.

2.2 m Station: Data from C15 in Test 2 were good, giving a clear indication of shock location downstream of this station for $G > 3.0 \text{ kg/s}$, $O_2 = 40\%$, and $B = 5 \text{ T}$. In Test 3, the C15 pressure tap appeared to be blocked until the oxygen content of the oxidizer was increased to 50%. From the subsequent data, it seems likely that the shock was upstream of $x = 2.2 \text{ m}$ until $G > 3.4 \text{ kg/s}$. That is, the increased interaction (higher O_2 content, higher plasma temperature) moved the shock upstream, and an increase in

mass flow rate, from 3.0 to 3.4 kg/s, was necessary to restore supersonic flow at $x = 2.2$ m.

2.7 m Station: Data from C6 and C16 were in excellent agreement throughout both tests. Data from Test 3 indicate that the flow at $x = 2.7$ m becomes supersonic for $G > 3.8$ kg/s with $B = 5$ T and $O_2 = 50\%$. At $x = 2.7$ m, there was no evidence of persistence of the asymmetrical flow observed at $x = 1.2$ m.

3.2 m Station: For both tests, data from C17 appeared to respond to variations in combustor pressure as well as would be expected in a pressure tap so close to the channel exit. Flow remained subsonic at this station for all mass flow rates of Test 3, i.e., $G \leq 4.0$ kg/s.

3.7 m Station: Data from C8 and C18 appeared to be reliable and in agreement throughout both tests.

4.2 m Station: C19 consistently showed pressure readings slightly higher than C9 (indicative of lower subsonic Mach number) in both Test 3 and Test 2, but the maximum deviation is approximately 0.05 kg/cm^2 (4.9 kPa), which may not be significant.

4.8 m Station: Data from C10 and C20 were in good agreement in Test 2, with maximum deviation of 0.04 kg/cm^2 (3.9 kPa). In Test 3, the C20 tap was either inoperative or became plugged, so that no comparison with C10 was possible.

Summary: Figure 5.10 provides a summary of the information on shock location in the channel. The plots of static pressure versus time have been used to determine the mass flow rate required to drive the shock wave downstream of any given axial station. Uncertainties arise from possible slow response of the static pressure measuring devices, because of the length of tubing between the pressure tap and the transducer.

It is also of interest to note the effect of increased MHD interaction by comparing conditions in Fig. 5.4 for times 20:48 and 21:24, i.e., MEAS numbers 566 and 613, both of which have $G \approx 2.92$ kg/s. The combustor pressures and oxygen enrichment ratios for No. 566 and 613 are, respectively, 1.905 and 2.194 kg/cm² (187 kPa and 215 kPa), 40 and 50%. If both cases were operating at the critical mass flow rate, their respective combustor pressures should also be unchanged, except for the effect attributable to increased combustor temperature. However, the increase in P_{kc} required to maintain the same mass flow is approximately 15%, and the corresponding increase in combustor temperature (because of increased O_2) is probably less than 4%. Thus, increased MHD interaction forces the channel to operate in the subsonic mode for No. 613, and an appreciable increase in mass flow rate would be required to restore supersonic flow conditions. This conclusion is in accordance with the discussion of flow properties for No. 613 presented in Section 5.3.2 and with the shock location data of Fig. 5.10.

Figure 5.11 provides a comparative summary of the static pressures measured in Tests 2 and 3. Four pairs of conditions are compared, each pair having matching values of G and P_{kc} , and the diagrams permit rapid evaluation of the similarities and differences in Tests 2 and 3. For example, case A shows the differences between C3 and C13, but good agreement at most other stations. The comparisons established that no significant increase in combustor pressure was required to maintain a given mass flow rate as long as the channel continued to operate in choked mode. Case D, however, shows a pronounced shift in shock location, caused by the increased MHD interaction, as would be expected from the curves of Fig. 5.10.

5.3.4 Analysis of MHD Channel Skin Friction

No special test points for determining skin friction in the MHD channel were included in Test 3. The measured static pressure distribution in the channel was used as a basis for estimating the coefficient of skin friction. The methods used for determining the values of the basic gasdynamic parameters have been described in foregoing discussions.

With weak MHD interaction and no shock wave present, the stagnation pressure loss between any two axial stations is attributable to friction at the channel walls. The dimensionless friction coefficient can be expressed in terms of the pressure loss as follows:

$$C_f = \frac{\tau_w}{1/2 \rho V^2} = \frac{\Delta P_o}{1/2 \rho V^2} \cdot \frac{F}{S},$$

where,

C_f = friction coefficient,

ΔP_o = loss of stagnation pressure,

V = flow velocity,

ρ = density,

S = surface area, and

F = area of the channel cross section.

Table 5.2 shows C_f values calculated from the data obtained during the cold and warm blows. Figure 5.12 shows C_f values in the constant area channel section (from $x = 0.15$ m to $x = 0.7$ m) as a function of Reynolds number, Re_d , based on the equivalent diameter. The C_f values shown in Fig. 5.12 are derived for the cold and warm blow modes and for a number of cases

with the combustor operating, for $2.32 \leq G \leq 3$ kg/s. The figure also shows C_f values for rough pipes in the infinite Reynolds number limit, with relative roughness between $0.005 \leq K_s/d \leq 0.1$.

As can be seen from the figure, the scatter of the experimental data is quite large. The mean value of the friction coefficient is $C_f \approx 0.018$, which corresponds to the effective value of friction for an equivalent pipe with roughness of K_s 6 to 8 mm. No systematic variation of friction coefficient in the inlet section of the channel was observed during Test 3.

Figure 5.13 shows values of C_f derived for various locations in the channel as a function of the Reynolds number ($Re_x = \rho v(x + x_0)/\mu$, when $x_0 = 0.3$ m). The same figure shows C_f for flat plates with different roughness heights, with Re_x values based on fluid properties for the cold blow data at $G = 4.48$ kg/s.

Although the experimental data bracket the C_f values from the rough flat plate correlations, the scatter is very large. This is mainly because of the poor accuracy of pressure difference measurements. Improved values of channel skin friction coefficient could be obtained by measuring selected pressure differences directly, rather than differencing the absolute values of static pressures.

5.4 Channel Electrical Performance

5.4.1 Current Measurements

During Test 2 (Ref. 1.1), it was found that the summation of the electrode currents was less than the inverter currents. Prior to Test 3, all current sensors were carefully calibrated, and additional current sensors were installed to measure the inverter currents. Current measurements for Test 3 were more consistent than those made during the second test; however, the magnetic-type sensors used still indicated slightly higher currents. The magnetic-sensor measurements have been used herein in the presentation of load lines and other overall channel current data.

Typical current distributions over the current-collecting electrodes are shown in Fig. 5.14. Extension of the current collection region into the electrically active region of the channel for this test resulted in somewhat smoother current distribution than that of the second test (Ref. 1.1, Fig. 7.5). Figures 5.14 (a) and (b) indicate that the axial current gradient became steeper over the upstream current-collection electrodes when the O_2 enrichment was increased from 40 vol % to 50 vol %. In the downstream section, currents were uniformly distributed at this mass flow, and increasing the O_2 enrichment merely raised the level. As the mass flow was increased to 4 kg/s, the axial current distributions over the downstream current collectors became steeper and appeared similar to the distribution upstream, which probably reflects changing voltage and current distribution throughout the channel with changing mass flow. In (c) and (d) of Fig. 5.14, the current

distributions are compared at near the maximum power point and at near short circuit for $G = 4.0 \text{ kg/s}$ and $B = 5 \text{ T}$. These current distributions are similar in shape, and the current level shifted upward as short circuit conditions were approached.

The currents in frames 57 and 93 during the entire test, as shown in Fig. 5.15, illustrate that, at most test conditions, the currents flowing in the balancing connections to these electrodes were low. Almost all of the high current "spikes" appear to be associated with short circuit operation. The highest current measured was for frame 93, which at one point near short circuit carried more than 100 amperes. In most cases, however, currents in the voltage balancing lines and frames 57 and 93 were less than 5 amps.

Typical current fluctuations are shown in Fig. 5.16 for frame 19 and for inverter 17. The observed fluctuations at 300, 600, and 900 hertz are associated with the inverter operation. The predominant fluctuations in current flow in current-collection electrodes were at frequencies below 200 hertz. Most of the electrode current fluctuation frequencies also appear in the inverter, but at different amplitudes. It is also of interest to note that there were no significant electrode current fluctuations at frequencies above 400 hertz.

5.4.2 Generator Characteristics

Table 5.4 summarizes the overall electrical characteristics of the generator at each of the test points shown in Fig. 5.1. Typical load lines for each of the inverters, as well as a composite load line for the entire channel are given in Fig. 5.17 for a range of electromagnetic interactions and flow conditions. It should be noted that linear extrapolations have been employed

Table 5.4
Summary of Test Results

Mass Flow Rate (ks/s)	B (tesla)	O ₂ (% by vol)	Seed (K ₂ CO ₃ : H ₂ O=1:1) L/h	Preheat Temp. (°C)	Maximum Power			Voc (kV)	I _{sc} (A)	E _{max} (kV/m)	ΔV _{max} (V/frame)
					V (kV)	I (A)	Power (kW)				
2.0	2.0	40	200	800	Data are not reliable due to low current					0.2	7
2.5	3.0	40	300	815	1.44	46	38	2.2	68	1.0	30
2.5	4.0	40	182	820	1.80	100	69	2.8	100	1.0	31
2.5	4.5	40	182	805	2.27	90	13	2.8	110	1.2	35
2.5	5.0	40	182	805	2.00	85	102	3.0	140	1.0	30
1.9	5.0	40	182	790	0.51	100	55	4.0	110	0.7	20
3.0	5.0	40	182	800	2.50	91	150	4.0	135	1.5	43
3.0	5.0	50	182	680	3.50	190	360	5.5	260	1.5	45
3.5	5.0	50	182	680	3.75	200	460	7.5	250	1.7	50
3.9	5.0	50	182	670	4.20	220	505	8.8	235	2.0	55
4.0	5.0	50	182	680	4.24	200	575	8.7	245	2.1	60

to estimate open circuit voltages and short circuit currents. In practice, however, these load lines may be nonlinear, especially at open circuit, where MHD interaction is highest. In this instance, the real value of open circuit voltage may be lower than is shown in Fig. 5.17 (see Section 6.1). Load line changes caused by change of MHD interaction, which resulted from increasing the O_2 enrichment from 40% and 50% at $G = 3$ kg/s and $B = 5$ T, are observed by comparing Figs. 5.17 (a) and 5.17 (b). Load data varying from the lowest ($G \approx 2$ kg/s, $B = 5$ T, and $\psi = 0.5$) to the highest interactions ($G = 4.0$ kg/s, $B = 5$ T, and $\psi = 0.5$) for these tests are summarized in Fig. 5.18.

The inverter load lines show that, when the shock wave was located in the upstream portion of the channel, the first section of the channel operated at low conductivity as compared to the last two sections. These results are similar to those obtained in the second test. Figure 5.17 (a) shows that with, 40% O_2 enrichment, the first section (i.e., one-third of channel) has a steeper V-I characteristic and higher impedance than the last two sections. When the O_2 enrichment was increased to 50% (Fig. 5.17 (b)), the slope of load lines for each inverter became similar, suggesting that the shock system moved well upstream, and the flow could have become subsonic over most of the channel. The increase in excess O_2 resulted in a doubling of the short circuit current (see Table 5.4). This indicates a doubling of the electron density. From heat balance calculations, the additional oxygen would be expected to yield only a 50% increase in electrical conductivity. The higher electrical conductivity observed may be caused by enhanced seed vaporization at higher combustion temperature. The maximum power increased to 360 kW, and the maximum measured Hall voltage to 3.5 kV when the O_2 enrichment increased.

The mass flow rate was subsequently increased in steps to approximately 4.0 kg/s at a constant magnetic field of 5 T and seed flow rate of 182 L/h,

resulting finally in the load line given in Fig. 5.18 (c). At $G = 4.0$ kg/s, a maximum power of 575 kW was obtained. In this case, the slopes of the load line in the first two sections (where the flow was supersonic) were similar to, but steeper than, that of the last section (where the flow was subsonic), indicating downstream movement of the shock system with increasing mass flow. At $G = 4.0$ kg/s, the shock had moved to a location of 2.7 to 3.5 m in the channel.

5.4.3 Potential Distribution

Figures 5.19 to 5.22 compare the voltage distribution along the generator with the corresponding pressure distribution. A low mass flow rate is shown in Fig. 5.19, whereas Figures 5.20 to 5.22 show higher mass flow conditions at three different loads. Near short-circuit condition, the first two channel sections, connected across inverters 17 and 19, operated in the energy sink mode, where power is absorbed in portions of the channel. The upstream part of the channel was supersonic; consequently, much lower transverse electrical conductivity existed, resulting from lower electrical conductivity and higher Hall parameter. Therefore, much higher impedance existed in the upstream portion of the generator. When the load current is near, or exceeds, the short circuit current for any portion of the generator, that portion will absorb energy from elsewhere in the channel, in order to support such a load current. At moderate voltage levels, the Hall voltage distribution is reasonably uniform; however, at high Hall voltage (>4000 V), large interframe voltage fluctuations occurred, as shown in Fig. 5.22. The maximum Hall field produced during these tests was approximately 2100 V/m.

In addition to the Hall voltage, differential voltages also were measured at selected locations between frames. An example of these results is given

in Fig. 5.23, which summarizes interframe voltages at the maximum mass flow and magnetic field values for the test ($G = 4.0$ kg/s and $B = 5$ T) for two points on the load line. The large interframe voltage variation for the powered point further confirms the irregular nature of the V_x distribution at high voltages, which has been noted in the foregoing discussion. Interframe voltages occasionally reached values above 70 volts. The frequency spectra of the interframe voltage at three locations in the channel [between (1) frames 19 and 20, (2) frames 61 and 62, and (3) frames 86 and 87] are shown in Fig. 5.24 for same test conditions as those for Fig. 5.23. Again the 300, 600 and 900 hertz frequencies imposed by the inverter are observed. It may also be noted that the voltage frequency spectrum of frame 19 is similar to the current spectrum at that frame, but with different amplitudes. Moreover, most of these voltage fluctuations persist through the channel.

5.4.4 Local Electric Field Behavior

Analysis of the detailed generator performance, as carried out in Section 6.1, requires estimates of the local short-circuit current and open-circuit electric field at arbitrary stations within the channel. For any given channel operating conditions, the local value of E_x can be obtained from the frame potential measurements or from interframe voltage instrumentation if available. As part of the data analysis capability, a semiautomatic procedure has been set up for determination of local E_x values at given stations in the channel and for assembling groups of (J_{load}, E_x) pairs, so that local electric field-load current characteristics can be generated for channel operating points with given B , G , and ψ values.

Examples of the output from this processing procedure are given in Appendix A. The ordinates of the plots are electric fields (in V/m) at frame numbers 38, 74, or 110, and the abscissae are the corresponding inverter currents (I17, I19, or I21), in each case normalized by the cross-sectional area of the channel at the appropriate station. In the case of frame 74, there are three distinct sets of data, one derived from the frame potentials, and the other two from the values of interframe voltage recorded by the U.S. and Soviet data acquisition systems. (The two systems did not record simultaneously, so there are two independent sets of data from the same instrumentation).

Load-lines of this type for several frame locations have been generated for all usable data from Test 3 and Test 2. Wherever there are sufficient data points (with adequate spread) to define a line, its intercepts with the axes are taken as the values of $E_{x_{oc}}$ and J_{sc}/A required in Section 6.1. The assembled values appear in Tables 6.1 through 6.5.

6.0 MHD Generator Test Analysis

This section discusses the comparisons of measured and predicted fluid, mechanical, and electrical characteristics for the U-25B channel. Both the local electrical performance at several axial locations in the generator and the overall performance of the generator are considered. The local analysis highlights the comparison of the electrical behavior and identifies areas where further investigation is likely to be most fruitful.

6.1 Local Electrical Analysis

This section discusses the comparison of predicted and measured load-line characteristics (i.e., V/x versus I/A characteristics) at several locations in the channel. To focus on the local electrical behavior in the channel, the local fluid properties are determined, using the experimentally measured static pressures and in some cases the measured heat loss to the channel walls. The actual load-line characteristics, represented by the open-circuit voltage and short-circuit current, are expressed as

$$E_{x_{oc}} = - \left[\frac{\cot \gamma + \beta}{1 + \cot^2 \gamma} \right] U_c B r_{oc} = E_{x_{oc,ideal}} r_{oc} \quad 6.1a$$

$$\langle J \rangle_{sc} = \frac{I_{sc}}{A_{cross}} = \left[\frac{\cot \gamma + \beta}{1 + \beta^2} \right] U_c B \sigma_c r_{sc} = \frac{I_{sc,ideal}}{A_{cross}} \cdot r_{sc} \quad 6.1b$$

where γ is the angle of the frames with respect to the flow direction, A_{cross} is the local channel cross-sectional area, the subscript c denotes

core value and r_{OC} and r_{SC} are the experimentally determined or analytically predicted loss factors in open-circuit voltage and short-circuit current, respectively. It has been suggested that the observed degradation in performance could be ascribed to nonuniformities of the "layer" type, i.e., to effects of the boundary layer on the electrode wall. Neglecting variation of Hall parameter and assuming infinite segmentation, the predicted values of r_{OC} and r_{SC} due to boundary layers can be presented as

$$r_{OC} = \frac{\langle u \rangle}{U_c} \frac{(1 + \cot^2 \gamma)}{1 + \cot^2 \gamma + \alpha(1 + \beta^2)}, \quad 6.2a$$

and

$$r_{SC} = \frac{\langle u \rangle}{U_c} \frac{\langle \sigma \rangle}{\sigma_c} \frac{1}{1 + \alpha}, \quad 6.2b$$

where $\alpha \equiv \langle \sigma \rangle \langle 1/\sigma \rangle - 1$ and $\langle \rangle$ denotes spatial average, with averages taken over the entire cross section of the channel. The layer model is strictly applicable only to a channel with insulating sidewalls. Moreover, in the infinite segmentation limit, it will overpredict the degradation of performance for a frame-type channel, as discussed by Medin, Ref. 1.1.

6.1.1 Calculation of Nonuniformity Factor

The electrode voltage drop is directly proportional to $\langle 1/\sigma \rangle$, which is the most important and most difficult of the parameters to evaluate. Part of the difficulty lies in the techniques for integration of $1/\sigma$ in the region close to the wall. An adequate technique is the method used by

Kessler, Ref.6.2. Use of more sophisticated calculation procedures (now available at MIT, IVTAN, ANL, and elsewhere) would not alter the conclusions reached here. Kessler's method assumes that a power-law variation can be used for velocity and nondimensional stagnation enthalpy and that the conductivity can be evaluated as the equilibrium conductivity. Regardless of what profiles are used, special attention to the near-wall region is necessary, because equilibrium conductivity becomes very low near the wall. A variety of effects, including finite electron-ion recombination, electron temperature nonequilibrium and space-charge effects, combine to control the current conduction in this region (see Ref. 6.3). In the method of Kessler, the resistance ($\langle 1/\sigma \rangle$) calculation is terminated at a distance from the wall equal to the Debye length. The calculated variation of α with wall temperature is displayed in Fig. 6.1 for conditions typical of the U-25B channel. A wall temperature in the range of 1400 to 1600 K is characteristic of these experiments, indicating that α is in the range of 0.12 to 0.19 in the upstream section of the channel. Thicker boundary layers in the downstream section of the channel result in α values in the range of 0.2 to 0.32.

In application of the above equations for comparison with the experimental data, it is particularly important to know how the nonuniformity factor, α , varies with mass flow rate. Increases in mass flow rate result in a thinning of the boundary layer, which reduces α . The influence of mass flow rate on the average wall temperature can be estimated by characterizing the average thermal conductance per unit area from the electrode surface to the cooling water supply by h_e and the thermal conductance on the plasma side by h_p . The average surface temperature can then be expressed as

$$\frac{T_{\text{surf}} - T_{\text{water}}}{T_{\text{plasma}} - T_{\text{water}}} = \frac{h_p}{h_e + h_p} \quad , \quad 6.3$$

where T_{plasma} , T_{water} , and T_{surf} are the plasma core temperature, cooling water temperature, and electrode surface temperature in that order. The heat transfer coefficient can be approximated by the simple flat plate correlation (Ref. 6.4),

$$h_p = \rho c_p U_\infty St_x = .0295 \frac{Re_x^{-0.2}}{Pr^{0.4}} \rho c_p U_\infty \quad , \quad 6.4$$

where St_x is the local Stanton number, Re_x is the local Reynolds number, Pr is the Prandtl number, and c_p is the specific heat at constant pressure. In terms of the channel mass flow rate, this expression can be written as

$$h_p = .0295 \frac{1}{Pr^{0.4}} \left(\frac{\mu}{x} \right)^{0.2} c_p \left(\frac{G}{A_{\text{cross}}} \right)^{0.8} \quad , \quad 6.5a$$

or

$$h_p = h_{p_o} (G/G_o)^{0.8} \quad , \quad 6.5b$$

where the subscript, o, denotes a reference condition. At $G = 2.5 \text{ kg/s}$, the calculated values are $h_p = 516 \text{ W/(m}^2\cdot\text{K)}$ at $x = 1.5 \text{ m}$ and $h_p = 256 \text{ W/(m}^2\cdot\text{K)}$ at $x = 3.5 \text{ m}$. Assuming a water temperature of 400 K, a plasma

temperature of 2700 K and that the surface temperature* was 1500 K at $x = 1.5$ m and 1400 K at $x = 3.5$ m, values of $h_e = 516$ W/(m²·K) at $x = 1.5$ m and $h_e = 300$ W/(m²·K) at $x = 3.5$ m are obtained. The resulting variations of surface temperature and nonuniformity factor with mass flow rate are significant, and are shown in Figure 6.2a for the upstream section and Figure 6.2b for the downstream section. More detailed calculations of the electrode wall temperature, carried out at IVTAN, suggest the wall temperature variation with mass flow rate is less severe; the corresponding variations of the nonuniformity factor and IVTAN calculated T_w are also displayed in Figure 6.2.

Although neither the assumed values of wall temperature (at different axial locations) nor the calculation of their variations with mass flow rate can be compared directly with experimental conditions, the variations shown in Fig. 6.2 provide a basis for evaluation of theoretical channel electrical performance that can be compared with experimental data. Calculations of local electrical performance have been carried out for both variations shown in Fig. 6.2, and these are presented later and shown to be insensitive to the choice of α .

6.1.2 Determination of Local Fluid Properties

Whenever possible, it would be preferable to use fluid properties determined by the method discussed in Section 5.3. However, other techniques must be used for analysis of Test 2 data and for the upstream section at some of the test conditions of Test 3, which depends upon channel flow conditions.

*based on IVTAN calculations

(a) Upstream Section Operating Supersonically

If the flow is supersonic, the velocity does not change significantly with increases in mass flow rate, and static pressure at a given location can be scaled with mass flow rate if the pressure is known at any particular value of G . This scaling is shown below for two axial locations in the upstream section, based on Test 2 pressure data for $G = 3.22$ kg/s. Also shown are average flow velocities computed from the pressure measurements with an assumed plasma temperature of 2500 K.

Determination Of Local Properties in Upstream Section of the Supersonically Operating Channel

$$X = 1.49 \text{ m}$$

$$p \text{ (atm)} = 0.21 G$$

$$\langle u \rangle = 1300 \text{ m/s}$$

$$X = 1.38 \text{ m}$$

$$p \text{ (atm)} = 0.25 G, \text{ where } G \text{ is given in kg/s}$$

$$\langle u \rangle = 1160 \text{ m/s}$$

If it is assumed that variations in temperature are negligible (except as they affect the electrical conductivity), the variation of mobility can be determined from the pressure, as in Ref. 1.11:

$$\mu = 0.45/P \text{ (atm)} \text{ in units } \text{m}^2/\text{V/s},$$

where a temperature of 2500 K has been assumed. With the above assumptions and with the values of the nonuniformity factor determined in the previous section, all terms in Equations 6.1a and 6.2a can be determined and the open-circuit field can be computed for the upstream section of the channel for Test 2 and for some of the conditions of Test 3.

Determination of the short-circuit current requires an evaluation of the electrical conductivity. The approach taken is to account for variations of conductivity with mass flow rate and oxygen enrichment and use the comparison of experimental and theoretical results to infer a value for the electrical conductivity. This value can then be compared with the value expected on the basis of a heat balance calculation for the combustion gases. Increases in mass flow rate tend to increase the conductivity, because heat loss decreases as a percentage of the thermal input with increased mass flow rate, as shown in Figure 4.1. The seed fraction, however, decreases with increased mass flow rate, because the seed flow rate is fixed. Changes in oxygen enrichment also change the conductivity considerably.

The average conductivity at a particular axial location is then expressed in terms of the parameter, ξ , as

$$\sigma(G, \Psi) = \xi \sigma (2.5 \text{ kg/s, } 40\% \text{ O}_2) = \xi \sigma_0 \quad (6.6)$$

where σ_0 is the conductivity at the nominal (or reference) condition of 2.5 kg/s, 40% O₂ enrichment.

(b) Subsonic Operation

An integral method for determining the average velocity and plasma temperature during the third test has been discussed in Section 5.3.2, and the results have been used in the local electrical calculations performed for the two downstream sections of the generator. Unfortunately, such calculations were not available for the second experiment (Ref 1.1), and a simpler method had to be used. As in the case of supersonic operation, it is assumed that variations in plasma temperature with mass flow rate or

generator loading are negligible except as they affect the electrical conductivity. The density and Hall parameter are functions of the pressure, only, and are given as

$$\rho = 0.11 P (\text{kg/m}^3), \quad 6.7$$

and

$$\beta = \mu B = 0.45 B/P, \quad 6.8$$

where the pressure is expressed in atmospheres and is determined from experimental data. The average velocity can be determined from the equation for conservation of mass as

$$\langle u \rangle = \frac{G}{\rho A}.$$

With the above assumptions, the open-circuit axial electric field can be determined from Equation 6.1a and 6.2a. The measured and predicted short-circuit current levels can be utilized to infer a value of conductivity as discussed above in reference to supersonic operation.

6.1.3 Comparisons For Test 3

In Test 3, the local generator characteristics were analyzed at three locations, corresponding to the midpoints between the inverter taps, as shown schematically in Fig. 4.4. A summary of the results for locations $x = 1.37$, $x = 2.4$, and $x = 3.4$ m are displayed in Tables 6.1, 6.2, and 6.3, respectively. The techniques used to determine the local fluid properties are noted in the table. The method for determining the open-circuit

TABLE 6.1 SUMMARY OF EXPERIMENTAL AND THEORETICAL VALUES OF LOCAL OPEN CIRCUIT
AXIAL FIELD AND SHORT CIRCUIT CURRENT DENSITY AT $x = 1.37$ m FOR TEST 3
For this location $A = 0.0292$ m², $B = 0.8 B_{max}$, $\langle \sigma / \sigma_c \rangle = 0.80$.

Mass Flow Rate, G	Maximum Magnetic Field B _{max}	Oxygen Enrichment ϕ	Average ¹ Velocity ⟨u⟩	Hall Parameter B	Experimental		IVTAN T _w Values				"Steep" Values of T _w			
					Open Circuit Field E _{x oc}	Short Circuit Current Density I/A _{sc}	Open Circuit Field E _{x oc}	Short Circuit Current Density		Non-uniformity Factor α	Open Circuit Field E _{x oc}	Short Circuit Current Density I/A I/a _{ref}	Non-uniformity Factor α	Inferred Conductivity σ _{ref}
								I/a _{sc}	I/a _{ref}					
2.39	2.0	38	1160	1.23	*	*	1750	1148	.147	1734	1141	.153	-	
2.43	3.0	38	1160	1.81	1711	1577	2984	1281	.145	2959	1276	.151	1.24	
2.35	4.0	40	1160	2.50	1895	2219	4232	1240	.148	4150	1231	.156	1.80	
2.34	4.5	40	1160	2.82	1969	2279	4800	1229	.148	4609	1219	.157	1.87	
2.33	5.0	40	1160	3.15	*	2380	5320	1215	.148	5179	1205	.157	1.98	
2.26	5.0	40	1160	3.25	*	2262	5283	1161	.150	5090	1149	.162	1.97	
2.06	5.0	40	1160	3.56	*	2163	5132	1008	.155	4784	989	.177	2.19	
1.83	5.0	40	1160	4.01	*	1900	4084	838	.162	4340	813	.197	2.34	
1.60	5.0	40	600	2.25	*	1500-1700	2584	739	.168	2346	709	.219	2.26	
2.90	5.0	40	1160	2.53	2554	2179	5480	1649	.134	5608	1663	.124	1.31	
2.94	5.0	40	1160	2.50	3382	2070	5480	1680	.133	5622	1694	.122	1.22	
2.91	5.0	50	900	2.12	3403	7959	4108	2544	.133	4189	2566	.124	3.1	
3.46	5.0	50	1160	2.12	3968	7715	5440	3440	.121	5660	3500	.102	2.21	
3.96	5.0	50	1160	1.85	3832	8030	5323	4073	.11	5543	4157	.088	1.93	

* Data not adequate to determine load line characteristics.

¹ Local properties calculation: Supersonic analysis for $\langle u \rangle = 1160$,
Subsonic analysis for $\langle u \rangle < 1160$.

TABLE 6.2 SUMMARY OF EXPERIMENTAL AND THEORETICAL VALUES OF LOCAL OPEN CIRCUIT
AXIAL FIELD AND SHORT CIRCUIT CURRENT DENSITY AT $X = 2.3$ m FOR TEST 3
For this axial location $A = 0.042$ m², $B = 0.85$ B_{max}, $\langle \sigma / \sigma_c \rangle = 0.73$.

Mass Flow Rate, G	Maximum Magnetic Field B _{max}	Oxygen Enrichment %	Average ¹ Velocity <u>	Hall Parameter β	Experimental		IVTAN T _w Values			"Steep" Values of T _w			
					Open Circuit Field Ex _{oc}	Short Circuit Current Density I/A _{sc}	Open Circuit Field Ex _{oc}	Short Circuit Current Density I/A _{sc}	Non-uniformity Factor α	Open Circuit Field Ex _{oc}	Short Circuit Current Density I/A _{sc}	Non-uniformity Factor α	Inferred Conductivity σ_{ref}
2.39	2.0	38	450	0.86	560 ⁺	1030 ⁺	606	495	.22	602	491	.23	2.1
2.43	3.0	38	450	1.29	797 ^Δ	2360 ⁺	1033	601	.22	1025	597	.226	4.0
2.35	4.0	40	450	1.72	*	*	1468	631	.221	1443	624	.234	-
2.34	4.5	40	450	1.84	1090 ^Δ	4590 ⁺	1667	670	.222	1635	662	.235	6.9
2.33	5.0	30	450	2.04	*	*	1874	674	.222	1832	666	.236	-
2.26	5.0	30	436	2.04	*	*	1807	644	.225	1754	634	.244	-
2.06	5.0	40	400	2.04	*	*	1636	565	.233	1552	550	.267	-
1.83	5.0	40	350	2.04	*	*	1410	466	.243	1299	447	.297	-
1.60	5.0	40	310	2.04	*	*	1226	385	.253	1096	362	.331	-
2.90	5.0	40	580	2.04	*	*	2505	945	.200	2566	956	.186	-
2.94	5.0	40	580	2.04	*	*	2511	949	.199	2579	961	.183	-
2.91	5.0	40	600	2.04	1987 ^Δ	8071 ^Δ	2593	1631	.20	2658	1651	.186	4.9
3.46	5.0	50	750	2.16	2820 ⁺	7330 ^Δ	3377	2045	.181	3564	2095	.153	3.5
3.96	5.0	50	1150	3.34	3120 ^Δ	5620 ^Δ	5376	2097	.165	5963	2157	.132	2.61
4.06	5.0	50	1150	3.34	3500	5420	5426	2116	.162	6028	2177	.129	2.49

¹ Local properties by 5.3.2 method.

* Data not adequate to determine load line characteristics.

Δ $\approx$ 10% spread } Average of values determined from frame
+ $\approx$ 30% spread } potentials and from interframe voltages.

TABLE 6.3 SUMMARY OF EXPERIMENTAL AND THEORETICAL VALUES OF LOCAL OPEN CIRCUIT
AXIAL FIELD AND SHORT CIRCUIT CURRENT DENSITY AT X = 3.4 m FOR TEST 3
For this axial location A = 0.058, B = 0.64 B_{max}, $\alpha/\alpha_c> = 0.66$.

Mass Flow Rate, G	Maximum Magnetic Field B _{max}	Oxygen Enrichment ψ	Average ¹ Velocity <u>	Hall Parameter B	Experimental		IVTAN T _w Values			"Steep" Values of T _w			
					Open Circuit Field Ex _{oc}	Short Circuit Current Density I/A _{sc}	Open Circuit Field Ex _{oc}	Short Circuit Current Density I/A _{sc}	Non-uniformity Factor α	Open Circuit Field Ex _{oc}	Short Circuit Current Density I/A _{sc}	Non-uniformity Factor α	Inferred Conductivity σ_{ref}
2.39	2.0	38	320	0.64	*	*	276	240	.309	274	238	.323	-
2.43	3.0	38	320	0.96	770	890	465	318	.307	461	315	.318	2.80
2.35	4.0	40	320	1.21	*	*	655	367	.311	644	362	.329	-
2.34	4.5	40	316	1.36	*	*	744	375	.312	730	370	.331	-
2.33	5.0	40	316	1.52	*	*	840	384	.312	822	378	.332	-
2.26	5.0	40	305	1.52	*	*	807	365	.316	785	358	.343	-
2.06	5.0	40	280	1.52	*	*	732	320	.328	697	309	.375	-
1.83	5.0	40	245	1.52	*	1100	631	263	.341	584	249	.417	-
1.60	5.0	40	220	1.52	*	1100	559	220	.355	501	203	.465	-
2.90	5.0	40	410	1.52	*	*	1127	545	.281	1153	554	.262	-
2.94	5.0	40	410	1.52	*	*	1130	548	.279	1158	557	.258	-
2.91	5.0	50	440	1.52	1030	4205	1210	976	.281	1239	992	.261	4.31
3.46	5.0	50	560	1.64	2550	4003	1611	1239	.254	1695	1280	.214	3.23
3.96	5.0	50	780	1.92	2660	5390	2365	1580	.231	2541	1641	.185	3.28

*Indicates data not adequate to determine load line characteristics.

¹Local properties by 5.3.2 method.

TABLE 6.4 SUMMARY OF EXPERIMENTAL AND THEORETICAL VALUES OF LOCAL OPEN CIRCUIT
AXIAL FIELD AND SHORT CIRCUIT CURRENT DENSITY AT X = 1.5 m FOR TEST 2
For this axial location A = 0.0292 m², B = 0.94 B_{max} and $\langle \sigma/\sigma_c \rangle = 0.79$.

Mass Flow Rate, G	Maximum Magnetic Field B_{max}	Oxygen Enrichment y	Average ¹ Velocity $\langle u \rangle$	Hall Parameter B	Experimental		IVTAN T _w Values			"Steep" Values of T _w			
					Open Circuit Field Ex _{oc}	Short Circuit Current Density I/A _{sc}	Open Circuit Field Ex _{oc}	Short Circuit Current Density I/A _{sc}	Non-uniformity Factor α	Open Circuit Field Ex _{oc}	Short Circuit Current Density I/A _{sc}	Non-uniformity Factor α	Inferred Conductivity σ_{ref}
1.98	3	40	748	1.59	723	1900	2122	975	.166	2045	953	.194	1.99
2.15	3	40	812	1.59	890	1950	2320	1101	.161	2260	1084	.179	1.80
2.21	3	40	834	1.59	1115	2140	2390	1146	.159	2340	1131	.175	1.90
2.09	3.5	40	789	1.86	1110	2203	2735	1079	.163	2642	1059	.184	2.10
2.5	3.5	40	1300	2.74	2094	2580	4886	1318	.151	4851	1315	.154	1.96
2.16	4.0	40	815	2.12	3798	2164	3333	1143	.161	3223	1125	.179	1.92
2.42	4.0	40	1044	2.43	1705	2699	4419	1349	.154	4361	1342	.159	2.01
2.53	4.0	40	1300	3.09	1934	2560	5596	1333	.151	5569	1331	.152	1.92
2.17	4.5	40	819	2.39	1838	3160	3834	1153	.160	3694	1137	.178	2.78
2.49	4.5	40	1300	3.53	2472	3134	6190	1293	.152	6126	1289	.155	2.43
2.87	4.5	40	1300	3.06	2516	3281	6466	1579	.142	6646	1592	.133	2.10
2.83	5.0	40	1300	3.45	3237	3476	7170	1540	.143	7305	1551	.135	2.24
2.99	5.0	40	1300	3.27	5764	3797	7238	1657	.139	7529	1674	.127	2.27
3.25	5.0	40	1300	3.01	-	3582	7392	1854	.132	7791	1882	.115	1.90

¹ Local properties calculation: Supersonic analysis for $\langle u \rangle = 1300$,
Subsonic analysis for $\langle u \rangle < 1300$.

*Indicates data not adequate to determine the load line characteristics.

TABLE 6.5 SUMMARY OF EXPERIMENTAL AND THEORETICAL VALUES OF LOCAL OPEN CIRCUIT
AXIAL FIELD AND SHORT CIRCUIT CURRENT DENSITY AT $X = 3.4$ m FOR TEST 2
For this axial location $A = 0.058$ m², $B = 0.64 B_{max}$, $\langle \alpha/\alpha_c \rangle = 0.66$.

Mass Flow Rate, G	Maximum Magnetic Field B_{max}	Oxygen Enrichment ψ	Average ¹ Velocity $\langle u \rangle$	Hall Parameter B	Experimental		IVTAN T_w Values			"Steep" Values of T_w			
					Open Circuit Field $E_{x_{oc}}$	Short Circuit Current Density I/A_{sc}	Open Circuit Field $E_{x_{oc}}$	Short Circuit Current Density I/A_{sc}	Non-uniformity Factor α	Open Circuit Field $E_{x_{oc}}$	Short Circuit Current Density I/A_{sc}	Non-uniformity Factor α	Inferred Conductivity σ_{ref}
1.98	3	40	346	0.96	541	1077	494	311	.332	474	298	.339	3.61
2.15	3	40	376	0.96	584	1220	540	352	.322	525	343	.350	3.56
2.21	3	40	386	0.96	469	1120	556	337	.319	544	359	.350	3.12
2.09	3.5	40	365	1.12	609	1381	634	363	.326	612	352	.370	3.92
2.50	3.5	40	437	1.12	700	2684	773	473	.303	770	471	.30E	5.7
2.16	4.0	40	377	1.28	620	1423	773	401	.322	748	390	.35E	3.65
2.42	4.0	40	423	1.28	757	2400	878	474	.307	869	470	.315	5.1
2.53	4.0	40	442	1.28	942	2312	924	506	.301	921	504	.304	4.6
2.17	4.5	40	379	1.44	573	2000	892	417	.321	861	406	.357	4.9
2.49	4.5	40	435	1.44	1080	2685	1043	511	.303	1036	508	.310	5.3
2.87	4.5	40	502	1.44	1167	3234	1228	623	.283	1253	631	.265	5.13
2.83	5.0	40	495	1.60	1093	3006	1365	621	.285	1392	633	.269	4.8
2.99	5.0	40	523	1.60	1216	3651	1456	672	.277	1499	685	.2E3	5.33
3.25	5.0	40	568	1.60	1784	3471	1608	751	.264	1677	772	.2E0	4.5

¹ Local properties by subsonic analysis method.

electric field and short-circuit current has been discussed in Section 5.4.4. As can be observed in Table 6.3, rough agreement of predicted and measured open-circuit electric field is obtained in the downstream section, at least for the relatively few cases where load lines could be determined from the available data. In the upstream section, agreement is generally poor, especially for test points where enrichment is 40%. Agreement with predicted values is not particularly good in the central section either, predictions there being typically 40% higher than the measured values. The data for short-circuit current indicate a core conductivity in the general range of 2 to 4 S/m at 40% enrichment and roughly 3.3 to 7 S/m at 50% enrichment. Because of the discrepancy between experimental and calculated values of open-circuit voltage for the upstream part of the channel, it is also of interest to examine some additional analyses of experimental data obtained during Test 2. Taken together, the two tests provide a very wide range of operating conditons for comparisons of theory and experiment.

6.1.4 Comparisons for Test 2

Local generator characteristics for Test 2 were analyzed for two axial locations, one in the upstream section of the channel, where the flow was sometimes subsonic and sometimes supersonic, and the other in the downstream section, where the flow was always subsonic. Summaries of the results for locations $x = 1.5$ m and $x = 3.4$ m are displayed in Tables 6.4 and 6.5, in that order. Table 6.5 shows good agreement of predicted and measured open-circuit electric field for the downstream section of the channel. In the upstream section, however, the agreement is poor; predicted values of open-circuit electric field are as much as a factor of three higher

than those measured in the experiments. Explanation of the discrepancies in the upstream section on the basis of the nonuniformity factors alone would require very high values of α , approximately four times larger than those calculated from the gasdynamics considerations discussed above. The results obtained for the two different wall temperature variations with mass flow rate are somewhat different, but both yield the same conclusion, that is, the performance in the upstream section is poorly predicted.

Note that the Hall parameters achieved in the upstream section were significantly higher in the second experiment than in the third.

Values of conductivity inferred from the comparisons of predictions and experiments are also shown in the Tables. For the upstream section, the inferred nominal conductivity is roughly the same for all combinations of mass flow rate and magnetic field strength tested, indicating a core conductivity of approximately 2 S/m in the upstream section of the channel. This indicates that, at least in the upstream section, the variation of conductivity with mass flow rate is well modeled by Eq. 6.6. Values of nominal conductivity inferred for the downstream section show slightly more variation with mass flow rate and magnetic field, but the modeling appears to be adequate. The general level of core conductivity indicated is from 3.0 to 5.4 S/m for the nominal conditions ($\dot{m} = 2.5$ kg/s, $O_2 = 40\%$).

6.1.5 Discussion of Results of Test 3 and Test 2

The generally good agreement obtained in the downstream section of the channel, especially for Test 2, suggests that the local average velocity and Hall parameter are properly taken into account and, more importantly, that the calculation procedure for the nonuniformity factor from gasdynamic

effects is adequate. In contrast to the good agreement observed for the downstream section, the predicted values of open-circuit electric field in the upstream section are as much as 3 times higher than the measured values. Substantial increases in the nonuniformity factor would be required to bring the predicted and measured values into agreement. However, there is little justification for increasing the nonuniformity factor resulting from gasdynamic effects in the upstream section without a corresponding increase in the downstream values. An increase in the downstream values would destroy the good agreement observed for the downstream section. Several phenomena that are not included in the analysis presented above, could contribute to the discrepancy observed for the upstream section of the channel. Although it is not the purpose of this section to discuss these effects in detail, or to determine precisely the importance of each one, it is useful to identify the phenomena, so that future work can proceed toward the better understanding of the generator performance.

(a) Effects of Imperfect Insulation

Imperfect electrical insulation between the electrode frames, which increases the effective nonuniformity factor, is not included in the analysis

$$\alpha_{\text{eff}} = \alpha_{\text{gasdynamic}} + (1 + \alpha_{\text{gasdynamic}}) \cdot \tilde{R} ,$$

where $\tilde{R}$ represents the ratio of plasma resistance to wall resistance. For operation in the mixed subsonic/supersonic regime, plasma conductivity and temperature differences between the upstream and downstream sections of the channel may result in a more pronounced effect of wall leakage in the upstream section.

(b) Inhomogeneities in Electrical Conductivity

Inhomogeneous distribution of electrical conductivity has been shown to degrade significantly the generator performance for high values of the Hall parameter. Inhomogeneous distribution of electrical conductivity can be caused by seed maldistribution and by spatial or temporal variations in combustor operation. These effects would tend to be reduced toward the end of the channel, and could be part of the explanation for the reduced performance in the upstream section of the channel.

(c) Effects of Finite Segmentation and Diagonal Conducting Walls

The model utilized above is valid only for an infinitely segmented generator with insulating sidewalls. The diagonal-conducting-wall (D.C.W.) U-25B channel has an electrode pitch-to-channel height ratio ranging from 0.17 to 0.10. For the infinite segmentation limit, Medin (Ref 6.1) has shown that the effective nonuniformity factor for a D.C.W. channel is lower than for an insulating wall channel, because of the ability of current to bypass the large electrode wall voltage drop and enter the conducting side bars. For a finitely segmented channel, local shorting of the axial field in both the electrode wall and the conducting sidewall results in a degradation in the generator performance from that of an infinitely segmented generator, with the effects being more pronounced for high Hall parameters and pitch-to-height ratios characteristic of the upstream section of the channel.

(d) Axial Variations In Electrode Surface Temperature

The model utilized above characterizes the electrode wall at a given axial location by a single surface temperature, whereas it is clear that significant axial gradients in wall temperature will exist, as shown schematically in Figure 6.3. These axial wall temperature gradients could result in conductivity profiles significantly different from those determined by a power-law profile, especially in the region closest to the wall. Further, the details of the temperature distribution could influence the effective area available for current to enter the electrode, which also could influence the performance characteristics.

(e) Periodic Roughness

Periodic roughness introduced by erosion of the ceramic material in the copper cups also could lead to profiles significantly different from those used to calculate the nonuniformity factor resulting from gasdynamic effects. This is especially true for operation at supersonic velocities and might also contribute to the difficulties in modeling the upstream section of the channel.

(f) Boundary Layer Separation

If boundary layer separation occurs in the upstream portion of the channel as discussed in Section 5.3.3, it would contribute significantly to the differences between predictions and experiments noted here.

(g) Effects of Nonlinearity of V-I Characteristics

Estimates of open-circuit voltage were made by means of linear extrapolation of the experimental data of the V-I characteristics, most of which were based on data spanning only the central region of each load line. This approach is valid only if all electrical and gasdynamic parameters remain constant along the load line. As shown in Section 6.2, the overall V-I characteristics of an MHD generator are nonlinear in nature, apparently because of the variation in electrical and gasdynamic parameters along the load line.

Therefore, in the general case, the V-I characteristic will be nonlinear and open-circuit voltage values determined by means of linear extrapolation may be substantially higher than the actual values. Taking this fact into account may decrease the discrepancy between calculated and experimental data for open-circuit voltage.

6.1.6 Summary

In general, the agreement of the local analysis and experimental data in the downstream section of the channel is good, suggesting that the local properties are correctly taken into account and, more importantly, that the calculation procedure for the nonuniformity factor is adequate. In contrast, the measured and predicted values of open-circuit axial field in the upstream section differ by as much as a factor of 3, the predicted values being higher than those measured. Agreement is improved as the generator approaches subsonic operation and when the oxygen enrichment is increased to 50%. Several phenomena that could contribute to this discrepancy have

been identified. In particular the effects of

- a) imperfect insulation,
- b) inhomogeneous distribution of conductivity,
- c) finite segmentation and the conducting side bars,
- d) axial variation in electrode surface temperature,
- e) periodic wall roughness,
- f) flow separation, and
- g) nonlinearity of load lines

may be potentially important phenomena for conditions for the U-25B experiments. Optical diagnostics at the channel inlet could provide a determination of the level of inhomogeneity in plasma conductivity and, consequently, might contribute to the understanding of the observed discrepancy.

6.2 Comparison of Calculated and Experimental Data

This section deals with preliminary calculations of the MHD channel performance made at ANL and IVTAN to provide (1) prediction of operational test parameters and (2) comparison of calculations with experimental data. At this stage in the joint test program, a detailed comparison between experimental results and analytical predictions is not completely meaningful because the exact degree of seed ionization is not yet known and the fluid flow and wall electrical-isolation characteristics of the channel are not completely defined. Nevertheless, preliminary comparisons are informative and useful, because they aid in defining diagnostic measurements that are needed to guide future tests and better understand the channel operation.

The main initial information for gasdynamic calculations of the MHD generator is the plasma temperature at the channel inlet. Calculation of plasma temperature was carried out for cases of 40 to 50 vol % oxygen enrichment with combustor heat losses considered to correspond to the actual test conditions. The same calculational methods for the mechanical and electrical characteristics of the channel fluid that are outlined in Ref. 1.1 for the second test were used for the third test.

Calculations have been compared in a preliminary way with test results for the third test, for the channel operating with subsonic flow (measurement points 471, 476, and 486) and for a higher-power operational mode (measuring point No. 720) that corresponds to a mixed-flow mode with shock-waves in the channel.

6.2.1 Combustion Temperature

The flame temperatures, needed for prediction of the U-25B channel performance, were calculated for different combustor pressures at both IVTAN and ANL.

The ANL calculations were made for various heat losses (defined as the ratio, expressed in per cent, of the total enthalpy of the combustion products to the total enthalpy of combustion products with zero heat loss). These calculations were carried out for 1) $O_2/(O_2 + N_2) = 40\%$ and 50% (by volume), 2) a stoichiometric ratio of 1.0, 3) a seed addition of 1.0% K by weight ($K_2CO_3/H_2O = 1/1$ by weight), 4) 800°C oxidizer preheat temperature for 40% O_2 , and 5) when $\psi = 50\%$, the additional 10% O_2 was assumed to have a temperature of 300 K . The results of ANL and IVTAN computations are shown in Figs. 6.4 and 6.5 for 40% and 50% oxygen enrichment, respectively. When the flame temperature predictions made by both laboratories are compared for the case of no heat loss, they show agreement to within 10 K .

On the basis of combustor thermal loss data obtained during the second test (see Fig. 6.1, Ref. 1.1), the expected flame temperature is approximately $2700\text{--}2750\text{ K}$ for a mass flow rate of 2 kg/s with 10% heat loss and 40% oxygen enrichment, and approximately $2800\text{--}2850\text{ K}$ for a mass flow rate of 4 kg/s with approximately 8% heat loss and 50% oxygen enrichment. The computational combustor models for predicting combustor temperatures appear to be adequate.

6.2.2 Channel Performance for Subsonic Flow^{*}

Because the flow field is simpler, it is of interest to compare the performance of MHD channels in the subsonic mode of operation with analytical calculations. During the course of the third test, only a few measurement points were taken at or near subsonic flow, and complete load-line data were not obtained at constant mass flow. Moreover, there is a difficulty

^{*}Subsequent to the preparation of this joint report, the section has been revised, based on further analysis, and may differ slightly from the Russian language version.

in the interpretation of the flow condition from the axial wall-pressure distribution as discussed in Section 5.3.3 and shown in Fig. 6.6. All of these factors complicate comparison between experiment and analytical calculations.

During this test, a few static pressure taps appeared to be plugged, and they are not represented in Fig. 6.6. However, orifices C3 and C13, both located about 1.2 m into the channel on opposing sidewalls, are believed to have been functioning properly. The pressure at orifice C13 would indicate that the flow for $G = 2.2$ kg/s is subsonic throughout the channel, whereas C3 indicates a local region of supersonic flow. This apparent transverse pressure gradient at this axial location may indicate 1) the existence of flow separation on one wall, or 2) that one of the pressure orifices is being affected by local disturbances or roughness of the wall and its reading is anomalous. The Hall voltage distribution in the channel at this measurement point (#471) is given in Figure 6.7. The Hall voltage also demonstrates an unusual characteristic in the first quarter of the channel (up to $X = 1.2$ m), suggesting that the generator may be absorbing power. Such a characteristic may result from flow separation, imperfect wall electrical resistance, or other factors. In any event, the existing analytical models do not account for these complications, which may be a source of differences between analytical predictions and experimental results discussed in the previous section.

Gasdynamic calculations have been carried out for subsonic flow, using a two-dimensional ANL computer model to provide a reference subsonic performance point for comparison with experiment. The computations were made for the following conditions:

mass flow = 2.1 kg/s

channel inlet stagnation temperature = 2720 K

length of channel = 5.06 m

oxygen enrichment = 40 % (by volume)

wall roughness = 5 mm

stagnation pressure at the channel exit = 1.06 atm (106 kPa)

static pressure at the channel exit = 0.94 atm (94 kPa)

The channel geometry and magnetic field distribution along the channel are shown in Table 6.6.

At mass flow that resulted in subsonic flow, the seed addition rate corresponded to roughly 1.0 % potassium by weight. Measured electrical conductivities suggest that the effective seed concentration was 0.5 % K, i.e., only approximately half of the potassium was ionized. Consequently, subsonic flow calculations were made at ANL for 1.0 % and 0.5 % potassium addition.* The calculational results for 0.5 % potassium seed, using the flow conditions listed above, are summarized in Table 6.7.

Calculated reference values of the generator power output and the voltage-current characteristics are given in Figure 6.8, in which the solid and dashed lines indicate potassium concentrations of 1.0 % and 0.5 %, respectively. Experimental test results for Point 471 are also shown in this figure. A small zone of supersonic flow may have existed at this point. It is observed that the experimental data lie closer to the calculated curves for 0.5 % potassium concentration (the solid line). These analytical curves were also extrapolated to lower mass flow (on the basis of experimental data). These extrapolations compare reasonably well with experimental results at mass flows of 2.06 and 1.9 kg/s (Points 476 and

*A 0.5% seed addition rate is equivalent to 1% seed addition and, assuming a conductivity correction factor (K_g) of 0.7, as is employed in the next section.

Table 6.6

U-25B Channel Geometry and Magnetic Field Distribution

X,m	0.000	0.500	0.630	0.750	1.000	1.250	1.500	1.650	2.000	2.500	3.000	3.500	4.000	4.500	5.060
y,m	0.154	0.154	0.154	0.157	0.162	0.168	0.174	0.179	0.191	0.209	0.227	0.243	0.255	0.265	0.275
B,T	0.000	0.180	0.470	0.840	1.970	3.370	4.720	5.000	4.730	4.210	3.680	3.150	2.190	0.540	0.000

Table 6.7

Results of the MHD Channel Calculations for Comparison
with the Experiment (Test No. 471)

$G = 2.1 \text{ kg/s}; \quad P_{O_2} = 1.06 \text{ atm}; \quad O_2 = 40\% \quad B_{\max} = 5.0 \text{ T}; \quad I = 60 \text{ A}$ Seed concentration = 0.5% K (by weight)											
X	y	A	B	T0	T	P ₀	P	U	M	σ	β
m	m	m ²	T	K	K	atm	atm	m/s	-	S/m	-
0.63	0.154	0.024	0.47	2720	2574	1.333	0.720	1039	1.072	6.25	0.33
0.88	0.160	0.025	1.38	-	2597	1.303	0.737	950	0.990	6.64	1.13
1.13	0.165	0.027	2.68	-	2610	1.259	0.819	890	0.916	7.07	1.65
1.88	0.187	0.035	4.85	-	2621	1.202	0.830	783	0.809	6.96	2.91
2.13	0.196	0.038	4.59	-	2624	1.189	0.848	751	0.776	7.04	2.63
2.88	0.223	0.050	3.81	-	2636	1.140	0.881	678	0.698	7.13	2.15
4.13	0.258	0.066	1.77	-	2601	1.095	0.932	538	0.559	5.84	0.94
5.06	0.275	0.076	0.00	-	2563	1.062	0.939	446	0.466	4.75	0.00
$J_{y\max} = 0.28 \text{ A/cm}^2 \quad (E_x)_{\max} = 9 \text{ V/m}$ $V_L = 1.1 \text{ kV}$ Power Output = 65 kW											

486, respectively). Considering the uncertainty of the experimental conditions, the comparison with analytical models is surprisingly good. However, the Hall potential distribution does not compare well with the experimental measurements, particularly in the upstream portion of the channel. This is probably because of the reasons discussed previously.

6.2.3 Channel Performance with Supersonic-Subsonic Flow

During the preparation for the third test at the U-25 B facility, calculations predicting channel gasdynamic characteristics of the MHD generator were also carried out, utilizing the IVTAN computer model. The most important of these predictive calculations are those pertaining to operation at the maximum power levels expected for the test.

In accordance with the overall program plan to extend the operational range of the U-25B facility for the third test, and taking the results of the second test into consideration, the following parameters were chosen to predict the power level for this test:

- (a) oxygen enrichment, $\psi = 50 \%$ (by volume)
- (b) mass flow rate, $G = 4 \text{ kg/s}$
- (c) seed content in combustion products, $K = 1 \%$ (by weight)
- (d) degree of potassium atom ionization, $K_a = 1$
- (e) channel outlet pressure, $P_{02} = 1.0 \text{ atm}$

The gas side channel dimensions and the magnetic field profile used in the calculations are given in Table 6.6.

Results of the calculations indicated that, with these expected test conditions, the channel would produce a Hall potential of 3.8 kV and

electrical current of approximately 0.2 kA. At these conditions, the power output should have been 0.8 MW. In addition, a shockwave would be expected to exist in the channel.

Operating parameters achieved during the third test, however, significantly differed from the anticipated conditions used in the predictive calculations. A comparison of the expected and the actual experimental values of major test parameters can be seen in Table 6.8. Despite these differences in test conditions, the values of the major channel performance parameters achieved during the experiment are in reasonable agreement with theoretical calculations, as also shown in Table 6.8. In particular, the pretest predicted output power of 0.8 MW was approximately achieved during the experiment, when a maximum output power of nearly 0.6 MW was measured (actually 575 kW was produced at Test Point 719, time--23:29:27, see summary printout in Appendix A). The predicted value of the Hall potential (3.8 kV) was close to the experimental value of 4.0 to 4.3 kV. There is greater discrepancy in the case of the electrical current; the measured current was 0.12 kA as compared with the calculated value of 0.2 kA.

The main reason for the differences between experimental results and theoretical predictions are (a) the lower seed flow rate than that assumed in calculations and (b) the incomplete ionization of potassium atoms. Both of these factors resulted in a substantial reduction in the plasma conductivity in the MHD channel (approximately half of that which was theoretically estimated), as shown in Table 6.8. The existence of a lower conductivity in the experiment was also apparent in the analysis given in Section 6.2.2.

To compare theoretical calculations and experimental data properly, it was necessary to repeat the performance calculations, using the actual test conditions. As pointed out above, the maximum electrical output power

Table 6.8

Analytical Operating Conditions and Results and their Comparison
with the Experimental Data

No.	Operating Parameter	Analysis	Experiment
1	Mass flow rate (kg/s)	4.0	4.04
2	Oxygen enrichment (% , by volume)	50	49-50
3	Potassium concentration (% , by weight)	1.0	0.5-0.6
4	Degree of seed ionization compared to equilibrium	1.0	0.5
5	Hall potential (kV)	3.8	4.4
6	Load current (A)	220	120
7	Electrical power output (MW)	0.8	0.5-0.6

achieved during the third test was 575 kW. Unfortunately, detailed data printouts are not available for this test point; consequently, further comparison between theory and experiment was made for a test point approaching maximum power regime (measured power output 516 kW, test #721, time 23:33:03, see Appendix A) This test point corresponds to the maximum magnetic field of 5 T, oxygen enrichment of 53 mass %, and mass flow rate of 4 kg/s.

As pointed out in the comparison between experiment and ANL code calculation for subsonic flow, the plasma conductivity in the MHD generator appears lower than expected. At the maximum plasma flow rate of 4.04 kg/s, the potassium seed addition rate corresponded to 0.56 mass % potassium. Consequently, the IVTAN channel code had to be corrected for two factors: 1) percent potassium content in combustion products and 2) the degree of ionization of the potassium atoms.

As was pointed out in Section 5.2, plasma diagnostic measurements performed during the experiment showed that seed-atom concentration and electrical conductivity values were lower (by approximately 50 %) than the theoretical values based on the assumption of equilibrium ionization of the injected seed. Because of this, a coefficient was introduced into the calculational model to correct the conductivity to values appropriate to the K_o of the experiment. Analytical calculations were performed for $K_o = 1.0, 0.7$, and 0.5 for a channel 5.06 m long, and with the channel geometry and the magnetic field distribution given in Table 6.6. The channel exit pressure was assumed to be 1.07 atm (107 kPa), and the mass flow rate 4.04 kg/s.

The results of these analytical calculations for MHD channel performance are given in Table 6.9, with an adjustment made for K_o . Figure 6.9

Table 6.9

Results of the Gasdynamic Calculations for the MHD
Channel for Comparison with the Experiment
(Run #720, Third Test, at 23.33.03, 6/16/78)

G=4.04 kg/s; P02=1.07 atm; O ₂ =50%; B _{max} = 5T I-120 A Seed concentration=0.56%												
X	y	A	B	T ₀	T	P ₀	p	U	M	σ	β	Frame No.
m	m	m ²	T	K	K	atm	atm	m/s	-	S/m	-	
0.00	0.154	0.024	0.00	2825	2749	2.762	2.037	739	0.721	5.26	0.000	-
0.64	0.154	0.024	0.51	2791	2647	2.524	1.410	1005	1.000	4.23	0.186	12
1.00	0.163	0.027	1.99	2772	2594	2.327	1.119	1117	1.123	3.81	0.895	25
1.65	0.178	0.032	5.00	2732	2570	1.914	0.976	1064	1.074	3.72	2.541	48
1.90	0.187	0.035	4.38	2716	2537	1.756	0.832	1114	1.132	3.49	2.823	57
2.96	0.210	0.051	3.72	2654	2447	1.248	0.515	1191	1.232	2.93	3.290	95
4.08	0.257	0.066	1.92	2617	2574	1.097	0.915	546	0.551	4.00	1.043	135
5.06	0.275	0.076	0.00	2596	2564	1.070	0.937	463	0.468	3.75	0.000	-
Jy _{max} =0.36 A/cm ² ; (Ex) _{max} =23 V/m V _L =4.4 kV Power Output=530 kW												

compares theoretical V-I characteristics for the three assumed values of K_o , together with the ranges of the experimental data shown by the cross-hatched region. Comparison of the theoretical curves and experimental data illustrate that the best agreement is achieved for values of $K_o = 0.6$ to 0.8. Calculated output power for the same ranges of K_o also correspond roughly to the experimental values. For test point No. 720 with $K_o = 0.7$, the calculated power is 530 kW; the experimental value was 516 kW.

Comparison of the static pressure distribution between experiment and theory is shown in Fig. 6.10. Calculation of the static pressure distribution is given for two values of K_o , 1.0 and 0.7. In the upstream section of the channel, the calculated pressure distributions for the two values of K_o coincide. At an axial distance of 1.5 m, the calculated pressures start to diverge, indicating substantial differences in the location and magnitude of the shock waves. A value of $K_o = 0.7$ corresponds to a more pronounced shock wave (Mach number before the shock wave is 1.2). After the shock, pressure values for the two cases under consideration begin to converge and the calculations are practically coincident after $x = 3$ m.

Figure 6.10 also presents some of the measured static pressure distribution data (measurement No. 764). In the upstream section of the channel, wall pressure data from opposing sidewall orifices C11 and C1 and from orifices C2 and C12 differ (see Section 5.3.3). These differences might result from either 1) flow separation in the upstream section of the channel or 2) plugging of pressure taps by seed. From the entire pressure distribution, the pressure profile corresponding to mixed flow in the channel with the shock wave occurring at $x = 3.0 \pm 0.2$ m is clearly evident. A comparison of experimental and calculated pressure distributions indicates good agreement for the value, $K_o = 0.7$, from the viewpoint of the location and intensity of the shock system.

According to the calculations, the shock occurs between 3 and 3.5 m, with the most probable location being 3.1 m. For $K_G = 1.0$ (equilibrium ionization), the calculations of shock intensity and location do not agree with the experimental results.

Table 6.9 presents some theoretical calculations of gasdynamic parameters along the channel. The calculated static temperature may be compared with the experimental value obtained in the cross-section located at the combustor nozzle outlet. At test point 720, the measured temperature is 2693 K, whereas the calculated temperature (see Table 6.9) is 2749 K. From this comparison, it may be seen that the measured temperatures are lower than the calculated values. This discrepancy may be the result of inaccuracies in the plasma temperature measurements. It should be pointed out that the detailed data summary printout for the entire test (Appendix A) shows higher measured plasma temperatures. In particular, during the time period, 23:32:41, with power output of 499 kW, plasma temperature was 2743 K. This value is in a much better agreement with the calculated value of 2749 K.

6.2.4 Effect of Wall Roughness on the MHD Channel Performance

Effective roughness of the walls is among the important factors determining surface friction in the channels and MHD generator performance. The operating conditions of the MHD generator at high plasma temperatures and large electrical potentials do not allow reliable measurements of the roughness of the channel walls and changes of the surface during the operation.

Thus, it is important to determine analytically the influence of the surface roughness on channel performance. These computations may be compared with experimental measurements, leading to an estimate of the effective level of surface roughness and to corresponding recommendations for the design and operation of the MHD generator.

Calculations for the critical mass flow rates for the U-25B channel were carried out for different conditions, 1) $O_2/(O_2+N_2) = 40\%$, 50% (by volume), 2) seed concentration, $K = 1\%$, 0.5% (by weight), and 3) for surface roughness = 0.0 , 1.0 , 3.0 mm. The combustion temperatures were assumed to be 2700 K and 2800 K for 40% and 50% oxygen enrichment, respectively. Furthermore, for this preliminary analysis the Hall field was taken as $E_x \leq 0$, regardless of the location of the power take-off region. The results of these computations, as obtained from the ANL two-dimensional code, are presented in Table 6.10, and indicate that surface roughness has a strong effect on the critical mass flow rate.

Figure 6.11 shows the variation of critical mass flow rate for surface roughness up to 5 mm. In these calculations, the stagnation temperature at the channel inlet was taken to be 2720 K and the power take-off regions were taken from the experiment to be between frames 8 to 19 , near the channel inlet, and frames 132 to 143 , near the channel exit. The experimental results indicate that, with 40% O_2 enrichment, the critical mass flow was approximately 20 kg/s (see Section 5.3.3 and Fig. 5.4). Comparison of these values with the calculations suggests that the effective channel surface roughness is close to 5 mm, which is close to the value suggested by skin friction analysis in Section 5.3.4.

The effect of wall roughness on the channel performance is shown in Fig. 6.12, where the calculated short-circuit currents and maximum power outputs are plotted for different wall roughnesses and at their corresponding critical mass flow rates (see Fig. 6.11). The calculations show that, as wall roughness increases, the short-circuit current and the power output decrease.

The measured power for subsonic flow ($G = 2.06$ kg/s) as shown in

Figure 6.6 is plotted, also, in Figure 6.12. It is observed to agree with the calculated value for a wall roughness of 5 mm. The few available experimental test results for subsonic flow and the visual observation of the wall following the tests suggest that the effective channel wall roughness is 5 mm to 8 mm.

Table 6.10

Results of the Critical Mass Flow Rate Calculations

$B = 5 \text{ T}$, $T_0 = 2700 \text{ K (40\% O}_2\text{)}, = 2800 \text{ K (50\% O}_2\text{)}$

Wall Roughness	$G_{\text{critical}} \text{ (40\% O}_2\text{)}$		$G_{\text{critical}} \text{ (50\% O}_2\text{)}$	
	0.5% K	1% K	0.5% K	1% K
smooth	2.2	2.42	2.45	2.85
1 mm	2.1	2.3	2.33	2.5
3 mm	2.05	2.15	2.18	2.35

7.0 VIBRATION AND FLUCTUATION ANALYSIS

7.1 Channel Vibration and Loads

The MHD channel is supported by the SCM warm bore tube at eight pairs of discrete points. The support system consists of 3 pairs of supports on the top and 5 pairs on the bottom of the channel. Each pair of bottom supports is provided with a load cell in one support and a weak link in the other. The top supports are provided only with weak links, one in each pair of supports. The weak link is located within the piston of the pneumatic cylinder (for further details and exact locations see Ref. 1.1, Fig. 5.2.).

The loads transmitted from the channel to the SCM warm-bore tube are measured by means of titanium load cells designed and manufactured by IVTAN. Despite the absence of dynamic calibration data, the measured forces are probably reliable in the low frequency range. Unfortunately, one of the load cells (LC8) developed problems during the test, because of lack of grounding. The weak links were the same as those used in the second test. Software to monitor and interpret the load data was prepared by the US side. In addition to recording raw data for historical files, during Test 3 it was possible for the first time to generate frequency spectra and perform correlation and cross-correlation analyses of various loads and potential forcing functions.

Analysis of the recorded raw data indicates that the maximum force measured was in the neighborhood of 800 kg (7.84 kN) (LC7), with maximum fluctuations on the order of 40 kg (392 N) (prior to the exclusion of instrument-generated noise). There was some correlation between the forces

and the intensity of the magnetic field. For example, at $B = 0$, the maximum force in support 7 was 610 kg (5.98 kN); at $B = 3$ T, it increased to 685 kg (6.72 kN), and, at $B = 5$ T, increased further, to 800 kg. At the same time, the force in support 6 (i.e., LC6) was decreasing, but more dramatically, with increase in B .

A more sophisticated analysis of the loads was performed at two different time periods. The first period was from 15:52:27 to 16:09:32 on the test date. During this period the preheaters were switched on, the magnetic field was $B = 3$ T, and, in the absence of seed, there was no interaction between the electromagnetic and mechanical fields.

The measured combustor pressure (P_2) and diffuser pressure (P_4) show an almost perfect sinusoidal time variation (see Fig. 7.1). While the period in both cases was 0.0028 sec (i.e., ≈ 360 Hz) the magnitudes of the average pressures and amplitudes were $\langle P_2 \rangle = 0.77$ atm (78 kPa), $\Delta P_2 = 0.11$ atm (11.15 kPa), and $\langle P_4 \rangle = -1320$ mm H₂O, (-12.9 kPa), $\Delta P_4 = 950$ mm H₂O (9.3 kPa).

The spectral density plots of the data (Figs. 7.2 and 7.3) show peaks in the low-frequency domain, i.e., frequencies less than 40 Hz, especially in the case of load cell LC10, located in the downstream end of the channel. The high-frequency domain (with typical peaks at 1100 and 1700 Hz) may not be reliable in absence of more careful calibration. In all cases, the spectral density had a narrow-band characteristic. The gas pressure in the combustor (Fig 7.3) was characterized by well-developed peaks at 100 Hz and, especially, at 350 Hz to 360 Hz, which might be associated with the combustor vibrations described in the next section.

A very strong correlation between the gas pressures P_2 and P_4 was detected during this period (Fig. 7.4). The delay time was approximately

0.0003 s, with an amplitude correlation of 0.85. In other words, the system behaved at that time as a longitudinal oscillator. The correlation (Fig. 7.5) between the data of load cells LC6 and LC10 was not quite as strong. Again, the delay time was approximately 0.0003 s, but the amplitude correlation decreased to 0.5. The cross-correlation between the radiation intensity R_{I1} , and the combustor gas pressure P_2 (Fig. 7.6) was not significant.

The integrated square spectral density shows rather small dynamic (fluctuating) loads, on the order of 12 kg (118 N) over the frequency range of 0.0 to 2000 Hz, 8.5 kg (83 N) over the range of 0.0 to 50 Hz, in case of load cell LC10.

The second period of interest was at 23:08:06, when the facility was operating at $B = 5$ T, and $G = 4$ kg/s. The loads in LC6 were drastically reduced, to an average of approximately 60 kg (588 N), compared with approximately 320 kg (3.14 kN) at the previous time interval. The raw data from this period showed almost totally random frequency characteristics, especially in the case of load cells.

The spectral density plots (Fig. 7.7) show (1) an absence of significant low frequency peaks for LC6, (2) some peaks at approximately 40 Hz for LC7, and (3) significant peaks in the entire 0.0 to 40 Hz domain for LC10. The high-frequency readings were again considered less reliable in the absence of calibration data.

The integrated square spectral density shows dynamic loads of 24.5 kg (239 N) over the broad range up to 2000 Hz and 12.5 kg (122 N) over the range up to 50 Hz. The correlation between forces at various supports was not apparent.

On the basis of the measured static and dynamic load levels, it can be

stated that the third run of the U-25B system inflicted no fatigue damage on the SCM warm bore tube. No additional weak-link grounds were broken, which indicates that there was no further crack propagation in the precracked portion of the weak link. The measured and recorded fluctuation data proved significant in understanding the mechanical behavior of the system.

7.2 Fluctuations of Gasdynamic and Electric Parameters

During different operating of modes of the U-25B Facility, fluctuations of gasdynamic parameters were observed. The primary cause of these fluctuations is associated with unstable vibration-type combustion. Combustion-induced vibrations are caused by the interaction between the combustion process and the fuel system, leading to low-frequency instability, and by the acoustic resonance of the combustor, resulting in high-frequency instability (see Refs. 7.1 and 7.2). In addition, some fluctuation of the gasdynamic parameters could be caused by the fluctuation of the electrical parameters.

Usually, the combustion processes are assumed to be unstable if the amplitude of the pressure fluctuations in the combustor exceeds by 5% the mean value of the pressure. Combustion fluctuations lead to an increase in the thermal and mechanical stress of the structural elements, possibly leading to burnout or destruction of structures (Ref. 7.2). Pulsating combustion also causes strong fluctuations of the electrical parameters of the MHD generator, which decreases the effective conductivity of the plasma, decreases the electric field (Ref 7.3, 7.4), and contributes to arcing between electrodes (Ref. 7.5). In addition to these negative effects, combustion pulsations may also have a positive effect: improvement in

fuel combustion, which increases the mean plasma temperature and, thus, the mean power of the MHD generator.

During the first two runs in the U-25B facility, vibrations generated by combustion fluctuations were investigated. The vibrations and forces in the MHD channel supports were measured. In addition, vibrations in the basic elements of the flow train were measured. During the third run, reported here, fluctuations of the electric and gasdynamic parameters were also investigated.

During the experiment, the U.S. HP2112 computer recorded the fluctuations of the following parameters: 1) pressure of the combustion products in the combustor, 2) pressure of the seed in the seed injection pipeline, 3) pressure of the natural gas, 4) pressure of the combustion products in the diffuser, 5) radiation intensity of the flame, 6) loads in the channel supports, 7) electrode currents, 8) interelectrodes voltages, and 9) inverter currents. These parameters were sampled in groups of eight at a sampling rate of 32 kilohertz and 8192 points per sample. This gave 1024 points at an effective sample rate of 4 kilohertz for each parameter. The parameters were sampled in groups, so that cross-correlations could be done on parameters in the same group. Some of these results are reported and described in other sections of this report.

In addition to the data recorded by the HP2112 computer, some parameters were recorded on an oscillograph strip chart (Type 9-SO-1), namely 1) oxidizer pressure in front of the combustor, 2) natural gas pressure, 3) combustion pressure in the injection system, 4) combustion product pressure in the nozzle, 5) diffuser pressure, 6) vibration of the transition section along the Z axis, 7) vibration of the nozzle section of the combustor along the X and Z axis, and 8) vibration of the shell of the channel.

The combustor pressure fluctuation was measured by electrical water-cooled Type LX-613 transducers, which were installed in the combustor walls. The range of the measured pressure pulsations was 0.05 to 1.0 atmospheres (5-100 kPa) with a static pressure range of 1.1 to 6.0 atmospheres (110-600 kPa). The capacitance of the sensor is 1200 ± 300 picofarads, and the maximum frequency was not lower than 30 kilohertz.

The vibration of the structure was measured along planes X and Z by a Type IS-318 piezoelectric accelerometer. The sensitivity of the TYPE IS-318 accelerometer when loaded with 2500 picofarad capacitance is 5 ± 2 mV/g.

High-voltage type LX-613 isolation sensors were used to measure the pressure fluctuations of the combustion products. These sensors were connected to a type LX-7005 amplifier, which has a frequency span of 10 to 1000 Hz, output current of 0.0-125 mA, input resistance of $1.5 \text{ m}\Omega$, and input capacitance of $0.033 \text{ }\mu\text{F}$.

Low frequency sensors (1 to 10 kilohertz) were used to measure electrical parameter fluctuations. Circuits incorporating capacitor separators singled out the alternating components of the signal in frequencies of from 50 to a few hundred hertz. Dual beam oscilloscopes with differential input were used for recording.

Acoustic fluctuations generated in the power train of the U-25B facility during this run were spectrally analyzed in real time by a Type 8054A analyzer, which has a frequency range of 50-10000 Hz and amplitude range of 1.0 mV-10V. The electrical signals from the sensors, which recorded pressure fluctuations of the oxidizer and the combustion products (in the injection system and in the nozzle of the combustor), as well as vibration of the combustor nozzle and channel shell, were fed into the analyzer by a scanner, after amplification in the LX-7005. The spectrums

of these signals were displayed on the screen of the analyzer, and also recorded on a strip chart.

Examination indicated that, at a flow rate of 1.6 kg/s and 21% oxygen content, the performance of the combustor was stable over the full range of the test changes in the stoichiometric coefficient (from $\alpha = 10$ to $\alpha = 1$). The amplitude of combustion product pressure fluctuations did not exceed 0.05 atm (5 kPa), and the vibratory acceleration of the nozzle shell was 2.7 g. Oxidizer pressure fluctuation at the inlet of the combustor was 0.03 atmospheres (3 kPa), and diffuser pressure fluctuation was 0.008 atm (0.8 kPa).

The maximum vibratory acceleration of the channel shell was 1.7 g. Maximum intensities in the pressure fluctuation spectrums of the oxidizer and the combustion products were observed at frequencies of 100 to 160 Hz, and structural vibrations of the nozzle and of the channel shell, at 4000 and 5000 hertz (Figs. 7.8 and 7.9).

Increasing the oxygen content to 28% and the oxidizer flow rate to 2.1 kg/s led to the generation of fluctuations in the U-25B flow train. These fluctuations were harmonic and had a frequency of 360 hertz. The amplitude of the oxidizer pressure fluctuations was approximately 0.1 atmosphere (10 kPa), and that of the combustion product pressure fluctuations in the combustor was approximately 0.12 atm (12 kPa); in the nozzle, pressure fluctuation was 0.08 atm. (8 kPa), and in the diffuser 0.03 atm (3 kPa). These fluctuations were accompanied by loud noises. Combustion product pressure fluctuation in the nozzle and the nozzle vibrations during this mode of operation are shown in Fig. 7.10. The maximum spectral intensity (Figs. 7.8 and 7.9) was at 400 hertz. The fluctuation intensity at this frequency exceeds by 20 to 25 decibels the average value, of 70 to

75 decibels, which occurs at frequencies of 50 and 800 hertz. Two basic frequencies, 400 and 5000 hertz, should be particularly noted in regard to nozzle vibration (Figure 7.9). These are practically equal in intensity and exceed the average level by 5 to 10 decibels. An increase in oxygen content of the oxidizer (up to 40%) and some decrease in oxidizer flow rate (to 1.85 kg/s) produced little change in the nature of the fluctuations in the flow train.

It should be noted that, during switching of air preheaters, additional fluctuations occurred in the flow train, at a frequency of 360 hertz; the nature of the combustor and diffuser pressure fluctuations that accompanied this switching of air heaters is indicated in Figs. 7.11 and 7.12. Increasing the flow of oxidizer with oxygen content and natural gas flow rate held constant, led to stable operation. The observable fluctuation frequency disappeared. The maximum intensity in the pressure fluctuation spectrum was observed at and 8000 Hz, and exceeded the pulsation level of the basic spectrum by approximately 10 dB. The amplitudes of the combustor nozzle and the channel body shell vibrations remained practically at the previous level during this mode of operation. In the vibration spectrums, the predominant high frequency components were 5000 and 8000 Hz. In this mode of operation, the combustion chamber pressure was approximately 1.3 atm (0.13 MPa). Injecting seed into the combustion chamber at rates of 200 and 300 liters per hour did not change the amplitude of pressure fluctuation or the vibration of the structure. The oscillograph recording of the seed pressure pulsations is shown in Fig. 7.13. The basic frequency of the seed injection, approximately 1.5 Hz, is modulated by 40 Hz. Injection of seed increased somewhat the ratio of low-frequency components in the fluctuation spectrum.

Gasdynamic fluctuations in the flow train were not influenced by magnet start-up, increase of the magnetic field, or increase in the flow of combustion products, (comparison of combustor operation during the second and third tests indicates that the combustor performed more stably during the third test); combustion pulsation stopped when oxidizer flow reached 1.8 kg/s; the oxygen content, 40%, and combustor pressure, 1.3 atm (0.13 MPa). During the second run (Ref 1.1), pulsations existed at the same flow rates and oxidizer oxygen contents, but with combustor pressure of 1.45 atm (0.145 MPa). The fact that the harmonic fluctuations start at lower pressures indicates that there is a great reserve of stability in operation of combustor. It should be noted, also, that the 300 Hz component was missing from the spectrum of pressure pulsation and combustor nozzle vibration, during this test whereas it was the frequency of maximum fluctuation intensity during the second test. This variance may be associated with different flow and boundary conditions, altering the upstream propagation of fluctuations in the channel, a phenomenon on that may be studied in future tests. However, there is a mechanical link between the combustor and the channel, and it is possible that fluctuations from the channel could be propagated into combustor. It is known (Ref 7.2) that the acoustic conduction of the nozzle increases with frequency. Other tests have shown that the critical frequency for this nozzle design is 160-200 Hz. Thus, fluctuation frequencies higher than 200 Hz are strongly attenuated in the nozzle, and practically do not enter the channel.

During the present run, combustor stability during changes of seed injection rates was substantially improved: during Test 2 injection of seed at the rate of 300 L/h led to a substantial increase in the amplitude of combustor pressure fluctuations; however, during the third run, there

was, for all practical purposes, no change in combustor performance with changes in seed injection rate. The improvement in combustor performance is associated with the fact that the rearrangement of the combustion zone shortened it 620 mm by the removal of one section of the combustor. This modification of the combustor increased its resonant frequency, which is inversely proportional to the length of the duct. During Test 2 (Ref 1.1), this resonant frequency was 250 Hz; in the third run, it increased to 380 Hz, which led to improvement in the phase ratio of thermal and pressure fluctuations.

During MHD channel operation, electrical parameter fluctuations were observed. Those at a frequency of approximately 400 Hz were caused by changes in gasdynamic parameters, which, in turn, resulted from fluctuations in combustor performance. The fluctuations observed at 300 Hz were caused by the inverters. There were also indications of fluctuations at approximately 1.0 kHz.

Among electrical parameter fluctuations, those of interframe voltage were of greatest interest, because they permit the monitoring of arcing between adjacent electrodes (see Ref. 7.6). This is particularly interesting because conditions in the U-25B facility differ greatly from those of the U-25 installation. The former has much higher magnetic field and Hall field values.

The fluctuations of between-frames voltage at different modes of generator operation were generally approximately 10% of the average value. In the open-circuit mode, with resulting increase in voltage between the frames, the level of fluctuations decreased somewhat; in the short-circuit mode, the level of fluctuations increased.

In channel operation at close to maximum power, a high frequency noise

sometimes appeared in the interelectrode voltage spectrum. This noise, which is characteristic of an unstable, low-intensity Hall field arc, had a frequency of more than 100 kHz and an effective amplitude of 2.0-3.0 V. The induced magnetic field, B , was 5 T when the noise was observed. When the magnetic field was reduced in the open-circuit mode, the high frequency noise in the interelectrode voltage spectrum disappeared.

Figures 7.14(a) thru 7.14(h) show the spectral densities of fluctuations in the fuel, combustor, diffuser, and seed pressures, the radiation intensity of the plasma, current in frame 18, current in inverter 21, and interelectrode voltage between frames 19 and 20. These figures were generated from data sampled during a test point at maximum power.

It can be seen that all electrical signals have peaks at quite low frequencies and at 300 Hz. The diffuser pressure spectrum has a peak at approximately 470 Hz, and the flame radiation spectrum has a peak at 400 Hz (the peaks at 100 Hz are related to an instrument function inherent in this method of measurement). The combustor pressure spectrum has peaks at 100 and 200 Hz.

Appearance of low-frequency components in the electric signals seems to be connected with the fluctuations of electrical conductivity that are caused by the seed injection fluctuations. A possible explanation for the occurrence of the maximum spectral density of the radiation intensity at the frequency of 400 hertz, is that the fluctuation of hot air injection is in phase with fluctuations of combustion product pressure in the combustor. In the future, it will be necessary to find the relationship between fluctuations of radiation intensity and pressure fluctuations in the combustor.

Various cross-correlations of the fluctuations have been examined.

Some are discussed in other sections. For example, an attempt was made to determine whether a high degree of cross correlation existed in the electrode voltage at different points in the generator but shifted in time. The existence of such a correlation would allow measurement of the flow velocity between various points in the channel. This analysis is not definitive, because the sampling time (0.24 s) was too short for good statistical sampling. Nevertheless, these preliminary results are encouraging and suggest that the average velocity in the channel is in the range of 1000 to 1300 m/s. This technique may be used in future tests.

7.3 Electromagnetic Interactions Between the Magnet and Channel

The Magnet Unbalance Voltage (MUB1) and the Conductor Unbalance Voltage (MUB2) were among the computer-logged parameters of the third experiment. MUB2 is shown in Fig. 7.15 during a 12-hour period spanning the magnet energization and MHD experiment. The offsets during the first half of the period, and the large peak at the end of the period, are the result of instrument malfunctions; the magnet charge (or discharge) voltage had become coupled to the MUB potential taps because of the formation of water ice in the magnet cryostat instrumentation enclosure. These offsets are of no concern here.

Data logged by the computer at 21:33 hours is chosen for the following analysis. At that time, the combustion gas mass flow was 3.0 kg/s, the oxygen enrichment 50%, and the generated power approximately 325 kW. The MUB1 and MUB2 data, digitized at 4 kHz, is frequency analyzed in Fig. 7.16. Note the complete absence of components above 300 Hz. The calculated cross-spectrum of MUB1 and MUB2 is shown in Fig. 7.17. This spectrum

clearly identifies the frequencies of 10, 18, 45, 50, 125, and 298 Hz as strongly present in both signals. Smaller components are present at 24, 35, and 120 Hz.

The same cross-spectrum, from data taken at 13:33 hours (during a period when the inverter system was not loading the channel), shows essentially no 300 Hz component (Fig. 7.18). Most probably, therefore, the 300 Hz component present in the magnet unbalance voltage signals during MHD power generation comes from plasma oscillations induced by the inverter system. Such a component is very strong, for example, in the cross-spectrum of a Channel Frame Voltage (ED 19) and MUB1 (Fig. 7.19).

The high frequency components in the load cell data (e.g., LC6) shown in Fig. 7.20 were not seen in the MUB data, but the cross-spectrum of LC6 and MUB1 (Fig. 7.21) shows the strong overlap at 125 Hz, as well as at lower frequencies. If the frequencies observed in LC6 are electromagnetic (as well as, perhaps, acoustic, etc.), then the shielding properties of the magnet cryostat and bore tube very effectively attenuate the high-frequency components. The lower frequency oscillations, however, do appear coupled to the magnet windings, as is seen in Fig. 7.21. The physical origins of the 125 Hz component in MUB, as well as the frequencies below that, remain to be identified.

The unbalance voltage never exceeds 750 mV during MHD power generation. No cryogenic losses attributed to these phenomena are observable, and the stability of the magnet was not impaired in any way.

8.0 POST-TEST CHANNEL INSPECTION

8.1 Channel Conditions After Test

8.1.1 Post-Test Inspection

There was noticeable discoloration of the lower outside of the fiberglass body of the channel in the vicinity of frame No. 28, also a black spot, approximately 5 mm in diameter, at the longitudinal joint made by the two halves of the body. (Sealing between the two halves is by means of circular section gasket cord.) A small puddle of dark colored resin was discovered on the surface of the magnet warm bore under this spot.

Overheating of Frame No. 28 caused these faults. The frame overheated because the cooling water tubing from the header to the frame became partially plugged by a bead of oval-shaped stainless steel, which had major and minor axes of 7 and 4 mm, respectively. The bead was inadvertently introduced into the cooling water system during welding operations on the piping. The heat from the frame was transferred through the fiberglass channel body and the gasket, causing the fiberglass epoxy binder to melt and form the resin puddle. Some information about the temperature in this area was provided by three heat-sensitive paints, which change color at 65, 90, and 120°C, respectively, on the channel cooling system discharge tubes. All three were discolored for frames No. 22, 26, and 30, signifying that the temperature in those areas reached or exceeded 120°C. All other locations were below 90°C, as indicated by lack of paint discoloration.

8.1.2 Electrode Water Leak

A small leak was detected in the upper part of frame No. 28 at the brazed joint of the frame halves.

8.1.3 Static Pressure Tube Failure

A static-pressure rubber tube (sensor C₃) on frame No. 33 had a charred spot in the large radius face of the bend. There was a dark-colored deposit on the face of the warm bore tube opposite the charred spot.

8.1.4 Channel Gas-side Wall Condition

The channel surface was in satisfactory condition, with no traces of arcing damage. However, the surface was rougher than at the start of the tests, because of erosion of the electrode material and interframe electrical insulation. Electrode erosion was up to 2.5 mm at the upstream end of the channel and up to 1.0 mm at the downstream end. Because of interframe insulation erosion, there was undercutting in the channel surface between frames, up to 5 mm at the upstream end and up to 10 mm at the downstream end.

8.1.5 Interframe Insulation

Interframe insulation resistance of between 17 and 400 ohms was measured June 23, 1978, very shortly after the test and before drying operations started on the channel. Six distinct zones of insulation level (resistance) were evident, as shown in Table 8.1.

Table 8.1
Channel Insulation Levels

<u>Frame Nos.</u>	<u>Resistance (ohms)</u>
1-6	20-50
7-53	100-400
54-75	40-80
75-132	17-25
133-145	35-50
146-156	17-20

An exception was the insulation resistance between the downstream end section and frame, which was 5 ohms.

8.2 Channel Repairs

8.2.1 Electrode Water Leak

The leak in frame No. 28 was the most troublesome area to repair. Normal brazing procedures would have necessitated channel disassembly, a lengthy and cumbersome operation. Because of the insignificance of the leak (judged by the rate of pressure drop) a fault of capillary nature was assumed. Such defects can be repaired by using anaerobic sealants. Accordingly, frame No. 28 was filled with such a sealant and pressurized for 10 hours, using nitrogen at 70 atm (7 MPa), the hydrostatic test pressure of the frame. The frame was leaktight after draining, as shown by hydrostatic testing. To prevent future blocking of water cooling passages, 2.5 x 2.5 mm mesh screens were installed in the delivery headers.

8.2.2 Fiberglass Pressure Vessel

Channel body repairs in the area of frame No. 28 were made as follows:

- a) A 100 x 100 mm opening was cut in the body.
- b) The thermocement was removed and the frames inspected.
- c) New thermocement was added.
- d) A fiberglass patch, of the same composition as the body, was fitted and sealed in place, using an epoxy cement.
- e) A pneumatic test showed the patch to be completely tight.

8.2.3 Static Pressure Tubing

The rubber tubing static-pressure sensor was replaced. Connections were reworked, as shown in Fig. 8.1, to prevent hot plasma leakage with possible resultant damage to the magnet. During the repair process, air was blown through the static-pressure sensor and the passage was checked with a 1-mm diameter probe to ensure unobstructed flow. Such a check was not made immediately after the channel test run; thus, it is not known if these passages were blocked during operation by seed that later dissolved in the presence of ambient moisture.

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- I LIQUID OXYGEN TANK
 II LIQUID OXYGEN EVAPORATOR
 III EVAPORATOR
 1-11 SEE DISCUSSION IN SECTION 2.1.1

FIGURE 2.1 ADDITIONAL OXYGEN INJECTION SYSTEM

FIGURE 2.2 OXIDIZER FLOW RATE VS TIME

FIGURE 2.3 OVERALL VIEW OF THE U-25B FACILITY COMBUSTOR IN TEST NO. 3

1 - Burner; 2 - Seed Injection Section; 3 - Transition Section; 4 - Support Section;
5 - Nozzle; 6 - Igniter; 7 - Seed Injection Nozzle; 8 - Refractory Coating

FIG. 3.1 - ELECTRICAL INSTRUMENTATION DIAGRAM

FIGURE 4.1 COMBUSTOR HEAT LOSSES FOR 2nd AND 3rd TESTS

FIGURE 4.2 MAGNET PLATFORM - FRINGE FIELD MEASUREMENTS

GAUSSMETER READINGS	
Measurement Location	Magnetic Field, Gauss ($1 \times 10^{-4} \text{T}$)
Inverter #1	1.1
2	1.3
3	1.8
4	2.2
5	2.9
6	3.3
7	3.7
8	2.8
9	2.8
10	2.2
11	1.5
12	1.2
A	16
B	16
C	16
D	17

a) Second floor

NOTE: All readings were taken at peak magnet field of 5 teslas.

Inverter floor 9.6 m below magnet platform.

(Drawing not to scale)

GAUSSMETER READINGS (At Peak Magnet Fields of 2 T, 3 T, 4 T, & 5 T)				
Measurement Location	MAGNETIC FIELD, Gauss ($1 \times 10^{-4} \text{T}$)			
	2 T	3 T	4 T	5 T
1	10	15	20	33
2	30	45	52	70
3	-	-	-	450
4	-	-	36	65
5	2.4	4.0	5.5	9.5
6	9.5	30	60	85
7	4.0	10	12	15
8	-	-	-	200
9	-	-	-	10
10	-	-	-	20
11	-	-	-	40
12	-	-	-	20
13	-	-	-	10
14	-	-	-	120
15	-	-	-	140
16	-	-	-	50
17	-	-	-	40

b) Third floor

FIGURE 4.3 MAGNETIC FRINGE FIELD MEASUREMENTS

(Drawing not to scale)

NOTE: Large amount of sheet metal in this area.

Inverter Control Room 10 m above platform.

GAUSSMETER READINGS (at Peak Magnet Fields of 2 T, 3 T, 4 T, & 5 T)				
Measurement Location	MAGNETIC FIELD, Gauss ($1 \times 10^{-4} \text{T}$)			
	@ 2 T	@ 3 T	@ 4 T	@ 5 T
1	1.5	3.0	4.5	6.1
2	1.0	2.0	2.5	6.0
3	.5	1.4	1.4	3.5
4	3.5	6.0	9.0	13.5

c) Fifth floor

(Drawing not to scale)

Main control room is 15 m above magnet platform.

GAUSSMETER READINGS (At Peak Magnet Fields of 2 T, 3 T, 4 T, & 5 T)				
Measurement Location	MAGNETIC FIELD, Gauss ($1 \times 10^{-4} \text{T}$)			
	@ 2 T	@ 3 T	@ 4 T	@ 5 T
1	1.2	1.9	2.7	4.8
2	1.2	2.2	2.8	5.2
3	1.0	1.7	2.5	4.5
4	2.0	3.0	4.5	7.1
5	1.0	1.7	4.2	4.1
6	1.0	1.8	4.5	4.2
7	1.0	2.0	4.7	4.3
8	-	3.4	6.2	6.7
9	-	1.5	4.2	4.1
10	-	3.0	6.0	6.2

d) Sixth floor

FIGURE 4.3 (CONTINUED)

FIGURE 4.4 ELECTRICAL LOADING SCHEMATIC

FIGURE 5.1 SUMMARY OF TEST POINTS

FIGURE 5.2 OPTICAL MEASUREMENT SYSTEM

- 1 - Combustor, diam= 500 mm; 2 - Quartz Window, diam= 38 mm;
 3 - Optical Tube, Ins. diam= 36 mm; 4 - Modulator, $F = 32$ Hz;
 5 - Modulator, $F = .2$ rpm; 6 - Pyrometer

FIGURE 5.3 RADIATED ENERGY VS TIME

FIGURE 5.4 MASS FLOW RATE AND PRESSURE RECORDS, TEST 3; $X = 0.15 \text{ m}$

FIGURE 5.5 MASS FLOW RATE AND PRESSURE RECORDS, TEST 3; $X = 0.70$ m

FIGURE 5.6 MASS FLOW RATE AND PRESSURE RECORDS, TEST 3; $x = 1.20$ m

FIGURE 5.7 MASS FLOW RATE AND PRESSURE RECORDS, TEST 2. $X = 0.15$ m

FIGURE 5.8 MASS FLOW RATE AND PRESSURE RECORDS, TEST 2. $X = 0.70$ m

FIGURE 5.9 MASS FLOW RATE AND PRESSURE RECORDS, TEST 2. $X = 1.20$ m

FIGURE 5.10 APPROXIMATE LOCATION OF SUPERSONIC FLOW REGIONS

(At each axial station the dashed curves indicate the minimum mass flow required to ensure fully supersonic flow at that station. Curve A is derived from test 2 data and curves B and C from test 3. Static pressure data at the 0.7 m and 1.2 m stations indicate regions of mixed subsonic-supersonic flow in certain mass flow regimes.)

FIGURE 5.11 COMPARISON OF CHANNEL STATIC PRESSURE VALUES FOR TEST 2 AND TEST 3

(Each of the 4 pairs shows static pressures for the first 2.7 m of the channel.
 The left side of each pair is for test 2; the right side for test 3.)

FIGURE 5.12 FRICTION COEFFICIENTS FOR CONSTANT AREA CHANNEL SECTION

- 1 - Cold blow flow rates from 3.5 kg/s to 5.0 kg/s.
- 2 - Warm blow flow rate of 3.62 kg/s.
- 3 - Combustion products flow rates from 2.32 kg/s to 2.43 kg/s.
- 4 - Combustion products flow rate of approximately 3 kg/s.

FIGURE 5.13 FRICTION COEFFICIENT DISTRIBUTION ALONG CHANNEL AXIS

1, 2, 3 - Cold blow flow rates of 3.56 kg/s,
4.48 kg/s, and 5.0 kg/s.

4 - Warm blow flow rate of 3.62 kg/s.

FIGURE 5.14 - TYPICAL CURRENT DISTRIBUTIONS OVER THE CURRENT COLLECTING ELECTRODES

FIGURE 5.15 - TIME HISTORY OF CURRENTS IN FRAMES 57 and 93

06/14/78 23:08:09

06/14/78 23:08:06

FIGURE 5.16 - TYPICAL SPECTRAL DENSITY PLOTS FOR CURRENTS
IN FRAME 19 AND INVERTER 17

FIGURE 5.17 - TYPICAL GENERATOR LOAD LINES

FIGURE 5.18 LOAD DATA AT DIFFERENT MHD INTERACTIONS FOR $B = 5 \text{ T}$

FIGURE 5.19 VOLTAGE DISTRIBUTION ALONG THE GENERATOR: MEAS. 476

FIGURE 5.20 VOLTAGE DISTRIBUTION ALONG THE GENERATOR: MEAS. 710

FIGURE 5.21 VOLTAGE DISTRIBUTION ALONG THE GENERATOR: MEAS. 699

FIGURE 5.22 VOLTAGE DISTRIBUTION ALONG THE GENERATOR: MEAS. 720

FIGURE 5.23 - TYPICAL INTERFRAME VOLTAGE DISTRIBUTIONS

FIGURE 5.24 - TYPICAL INTERFRAME VOLTAGE SPECTRAL DENSITY PLOTS

FIGURE 6.1 VARIATION OF NON-UNIFORMITY FACTOR, α , WITH ELECTRODE WALL TEMPERATURE

FIGURE 6.2 VARIATION OF ELECTRODE WALL TEMPERATURE AND NONUNIFORMITY FACTOR WITH MASS FLOW RATE

- a. Upstream section ($X = 1.5$ m)
- b. Downstream section ($X = 3.5$ m)

(a) SCHEMATIC OF ELECTRODE DESIGN

(b) SCHEMATIC OF EXPECTED SURFACE TEMP. DISTRIBUTION.

FIGURE 6.3 ELECTRODE DESIGN AND EXPECTED SURFACE TEMPERATURE DISTRIBUTION

FIGURE 6.4 EFFECT OF HEAT LOSS ON COMBUSTOR TEMPERATURE
FOR DIFFERENT COMBUSTOR PRESSURES

FIGURE 6.5 - EFFECT OF HEAT LOSS ON COMBUSTOR TEMPERATURE FOR DIFFERENT COMBUSTOR PRESSURES

FIGURE 6.6
 STATIC PRESSURE DISTRIBUTION ALONG THE
 U-25B CHANNEL

FIGURE 6.7 AXIAL DISTRIBUTION OF HALL POTENTIAL
ALONG THE U-25B CHANNEL

(Analysis for $G = 2.1$ kg/s, $B = 5$ T, $T_0 = 2720$ K,
 $O_2 = 40\%$, seed = 0.5%, wall roughness = 5 mm)

FIGURE 6.8 LOAD CURRENT-VOLTAGE CHARACTERISTICS FOR THE U-25B CHANNEL $B=5$ T, $T_0 = 2720$ K, $O_2 = 40\%$

FIGURE 6.9 VOLTAGE CURRENT CHARACTERISTICS AND CHANNEL POWER OUTPUT

FIGURE 6.10
STATIC PRESSURE DISTRIBUTION ALONG
AXIS OF MHD CHANNEL

FIGURE 6.11 EFFECT OF SURFACE ROUGHNESS ON THE CRITICAL MASS FLOW RATE

FIGURE 6.12 EFFECT OF WALL ROUGHNESS ON SHORT CIRCUIT CURRENT AND MAXIMUM POWER OUTPUT (FOR MASS FLOW RATES, SEE FIGURE 6.11)

FIGURE 7.1 COMBUSTOR AND DIFFUSER PRESSURE FLUCTUATIONS

06/14/78 15:53:36

06/14/78 15:53:36

06/14/78 15:53:36

FIGURE 7.2 - SPECTRAL DENSITY OF LOAD CELLS AT 15:53:36

FIGURE 7.3 SPECTRAL DENSITY OF COMBUSTOR AT 16:07:58

FIGURE 7.4 P2 vs P4 CROSS CORRELATION AT 16:09:35

FIGURE 7.5 LC6 VS LC10 CROSS CORRELATION AT 16:09:32

FIGURE 7.6 P2 vs R11 CROSS CORRELATION AT 16:52:59

FIGURE 7.7 - SPECTRAL DENSITY OF LOAD CELLS AT 23:08:06

FIGURE 7.3 - SPECTRAL DENSITY OF COMBUSTOR PRESSURE FLUCTUATIONS IN THE COMBUSTOR NOZZLE

FIGURE 7.9 - SPECTRAL DENSITY OF COMBUSTOR NOZZLE VIBRATION

FIGURE 7.10 - PULSATIONS OF OXIDIZER PRESSURE AND COMBUSTION PRODUCTS PRESSURE IN NOZZLE, AND VIBRATION OF COMBUSTOR NOZZLE CAUSED BY PULSATIONS IN LOOP

FIGURE 7.11 COMBUSTOR PRESSURE PULSATIONS DURING SWITCHING OF AIR PREHEATERS

FIGURE 7.12 DIFFUSER PRESSURE PULSATIONS DURING SWITCHING OF AIR PREHEATERS

FIGURE 7.13 SEED PRESSURE PULSATIONS

06/14/78 23:33:51

06/14/78 23:33:56

FIGURE 7.14 - SPECTRAL DENSITIES
 (a) fuel pressure, P1, (b) combustor pressure, P2

06/14/78 23:33:51

06/14/78 23:33:51

FIGURE 7.14 - SPECTRAL DENSITIES
(c) diffuser pressure, P4,
(d) seed pressure, P3

06/14/78 23:33:51

06/14/78 23:33:51

FIGURE 7.14 - SPECTRAL DENSITIES
(e) Radiation intensity, R11,
(f) Current in frame 18, I18

FIGURE 7.14 SPECTRAL DENSITIES
 (g) Current in inverter 21, IV21
 (h) Voltage between frames 19 and 20, ED19

FIGURE 7.15 MAGNET UNBALANCE VOLTAGE

FIGURE 7.16 FREQUENCY SPECTRUM OF UNBALANCE VOLTAGES
DURING MHD POWER GENERATION

FIGURE 7.17 AMPLITUDE OF CROSS-SPECTRUM OF MUB1 AND MUB2
DURING MHD POWER GENERATION

FIGURE 7.18 AMPLITUDE OF CROSS-SPECTRUM OF MUB1 AND MUB2 DURING
PERIOD WHEN INVERTER SYSTEM IS NOT LOADING CHANNEL

FIGURE 7.19 AMPLITUDE OF CROSS SPECTRUM OF MUB1
AND ED19 DURING MHD POWER GENERATION

FIGURE 7.20 FREQUENCY COMPONENTS IN LC6 DURING MHD POWER GENERATION

FIGURE 7.21 AMPLITUDE OF CROSS-SPECTRUM BETWEEN MUB1
AND LC6 DURING MHD POWER GENERATION

FIGURE 8.1 STATIC PRESSURE CONNECTION ASSEMBLY

APPENDIX A
REPRESENTATIVE TEST DATA--GASDYNAMIC AND ELECTRICAL MEASUREMENTS

APPENDIX A--Representative Test Data--Gasdynamic and Electrical Measurements

LEGEND FOR PARAMETER IDENTIFICATION

A. Express Data

DATA - Date (day, month, year)

MEAS - Number of measurement

TIME - Time (h, min, s)

POWER - Total power produced by MHD generator (kilowatts)

HOLL - Hall voltage (V)

B - Magnetic field intensity (T)

ALC - Oxidizer excess factor (U25 only)

O2 - Percentage of oxygen in oxidizer before preheaters

ALF - Oxidizer excess factor

O% - Percentage of oxygen in oxidizer (after injection of additional oxygen)

VG - Oxidizer flow rate (kg/s)

TGD - Air preheat temperature (°C)

VGD - Natural gas flow rate (kg/s)

TPL - Plasma temperature at channel entrance (K)

PR41 - Seed flow rate (L/h)

B. Gasdynamic Data

DATA - Date (day, month, year)

MEAS - Number of measurement

TIME - Time (h, min, s)

TIME (KC) - Combustion chamber time (h, min, s)

POWER - Total power produced by MHD generator (kW)

ALF - Oxidizer excess factor
 ALC - Oxidizer excess factor (U25 only)
 KCK87 - Total gas volumetric flow rate to combustor (m^3/h)
 B38 - Hot blow temperature ($^{\circ}\text{C}$)
 BV7 - percentage of oxygen in oxidizer (after injection of additional oxygen)
 B7 - percentage of oxygen in oxidizer before preheaters
 B34 - Hot blow pressure (kg/cm^2)
 BKC141 - Oxidizer pressure before combustion chamber
 B6 - cold blow pressure (kg/cm^2)
 KC24 - Gas pressure in pipeline upstream of damper (kg/cm^2)
 KC64 - Oxidizer - combustion products pressure drop (kg/cm^2)
 BV1 - Oxidizer flow rate (orifice method, kg/s)
 E29 - Oxidizer flow rate (probe method, kg/s)
 PR41 - Seed flow rate (L/h)
 PR40 - Seed pressure (10^5 Pa)
 TPL1 - Plasma temperature at channel entrance (K)
 TPL2 - Plasma temperature at diffuser entrance (K)
 KC23 - Static pressure in combustion chamber (10^5 Pa)
 C1-C20 - Static pressure in channel (10^5 Pa)
 D1-D3 - Static pressure in diffuser (10^5 Pa)
 T1-T2 - Static pressure beyond diffuser (10^5 Pa)
 BKC2 - Cooling water flow rate at combustion chamber outlet (Mg/h)
 BG25 - Cooling water flow rate at MHD channel drain (Mg/h)
 BG47 - Cooling water flow rate at diffuser drain (Mg/h)
 BKC24 - Cooling water temperature rise in combustion chamber ($^{\circ}\text{C}$)
 BG43 - Cooling water temperature rise in channel ($^{\circ}\text{C}$)

BG44 - Cooling water temperature rise in diffuser (°C)
DQ1 - Combustion chamber heat loss to cooling system (MW)
DQ2 - Channel heat loss to cooling system (MW)
DQ3 - Diffuser heat loss to cooling system (MW)
QKC - Enthalpy flow rate after combustion (MW)
OTP - Combustor heat loss in per cent ($DQ1/QKC \times 100$)

C. Electrical Data

DATA - Date (day, month, year)
MEAS - Number of measurement
TIME - Time (h, min, s)
TIME (KC) - Combustion chamber time (h, min, s)
K0-K6- Voltage on insulator section in front of combustor (V)
K7 - Combustion chamber voltage (V)
K8-K9 - Inlet flange voltages (V)
K10-K165 - Channel frame voltages (V)
K166-K168 - Outlet flange voltages (V)
K169-K170 - Diffuser voltages (V)
K171-K172 - Voltages between frames 6-8 (V)
K173-K174 - Voltages between frames 19-21 (V)
K175-K180 - Voltages between frames 54-60 (V)
K181-K204 - Voltages between frames 61-85 (V)
K206-K215 - Voltages between frames 87-97 (V)
K216-K217 - Voltages between frames 131-133 (V)
K218-K219 - Voltages between frames 143-145 (V)
GR - Inverter number
I - Inverter current (A)
U - Inverter voltage (V)

POWER - Inverter power (kW)
B - Magnetic field intensity (T)
HOLL - Hall voltage (V)
SUM. POWER - Total power (kW)
I'17 - Inverter 17 current (A)
I'19 - Inverter 19 current (A)
I'21 - Inverter 21 current (A)
I8-I9 - Takeoff currents; frames 8-14 (A)
+I57 - Takeoff current; frame 57 postive direction (A)
-I57 - Takeoff current; frame 57 negative direction (A)
+I93 - Takeoff current; frame 93 postive direction (A)
-I93 - Takeoff current; frame 93 negative direction (A)
+I132-I143 - Takeoff current; frames 137-143 (A)

PUSK 3 DATE 14/ 8/78

MEAS 242 TIME 15.48.5 TIME (KC) = 0. 5.22.52

GR 1 U POWER OR 1 U POWER GR 1 U POWER

17 32.7 339.9 11.1 19 35.2 492.2 16.3 21 30.8 249.0 7.7

B1= 3.00 HALL= 1025. SUM POWER = 35.1

I 17= 29.5 I 19= 24.4 I 21= 28.1

+157 0.7 -157 1.7 +193 2.3 -193 0.4

18 1.1 1132 0.0 19 0.7 1133 2.6

110 1.2 1134 2.7 111 1.6 1135 2.3

112 1.0 1136 2.9 113 0.5 1137 2.7

114 3.2 1138 2.1 115 2.3 1139 1.9

116 2.7 1140 2.1 117 3.0 1141 1.9

118 4.2 1142 1.6 119 5.3 1143 1.6

SUM 18-119 = 27.7 SUM 1132-1143 = 24.6

MEAS 242 TIME 15.48.5 TIME (KC) = 0. 5.22.52

POWER= 35.1 B-38= 815. BKC-141=1.74 BV-1= 2.09

ALF= 0.97 BV-7= 38.31 B-6= 1.83 E-29= 2.374

ALC= 0.99 B-7= 39.12 KC-24= 7.011 PR-41= 305.

KCK-87= 0.24 B-34= 1.740 KC-84= 0.035 PR-40= 3.921

TPL1= 2613. TPL2= 0.

KC-23= 1.669 C10 0.935 C16 0.989 D2 1.003

C1 1.101 C11 1.028 C17 0.913 D3 0.981

C2 0.779 C12 0.759 C18 0.930 T1 0.984

C3 0.649 C13 0.737 C19 0.925 T2 0.977

C6 0.920 C14 0.681 C20 0.938

C8 0.950 C15 0.681 D1 0.664

C9 0.898 BKC-24= 6.0 D01= 1.125 OKC= 13.211

BAC-2= 161. BQ-43= 10.4 D02= 3.210 OTP= 8.513

BQ-25= 255. BQ-44= 14.0 D03= 3.724

PUSK 3 DATE 14/ 8/78

MEAS 242 TIME 15.48.5 TIME (KC) = 0. 5.22.52

K F1 K F1 K F1 K F1 K F1 K F1 K F1 K F1

0 -88.0 37 -805.0 74 -233.4 111 179.4 143 336.3 185 18.0

1 -178.8 38 -691.8 75 -270.3 112 202.5 149 322.0 186 0.4

2 -251.0 39 -555.1 76 -281.6 113 176.1 150 349.9 187 19.5

3 -314.8 40 -699.2 77 -284.5 114 272.9 151 373.2 188 3.7

4 -353.4 41 -699.8 78 -204.5 115 270.6 152 357.7 189 20.6

5 -515.4 42 -759.1 79 -223.1 116 270.0 153 345.5 190 13.8

6 -617.0 43 -604.3 80 -203.9 117 335.9 154 365.2 191 7.3

7 -746.8 44 -676.3 81 -151.1 118 294.4 155 413.6 192 20.7

8 -708.4 45 -669.1 82 -174.2 119 310.2 156 425.0 193 19.0

9 -693.6 46 -650.3 83 -209.4 120 283.5 157 391.1 194 23.1

10 -767.2 47 -614.1 84 -162.4 121 290.1 158 425.7 195 19.0

11 -719.7 48 -594.2 85 -157.0 122 314.1 159 416.0 196 17.1

12 -737.9 49 -583.4 86 -81.8 123 360.0 160 338.9 197 18.1

13 -687.8 50 -554.9 87 -50.1 124 323.0 161 317.5 198 14.1

14 -777.4 51 -568.4 88 -77.2 125 289.4 162 379.5 199 13.0

15 -685.8 52 -578.1 89 -89.8 126 367.8 163 367.1 200 7.1

16 -713.6 53 -575.9 90 -45.1 127 302.6 164 415.9 201 20.8

17 -713.0 54 -560.7 91 21.8 128 371.9 165 337.7 202 14.0

18 -724.2 55 -499.1 92 39.8 129 397.7 166 304.9 203 17.6

19 -682.7 56 -375.0 93 -24.4 130 442.8 167 358.4 204 0.4

20 -702.8 57 -375.2 94 7.5 131 389.5 169 326.2 205 14.1

21 -729.0 58 -463.8 95 25.5 132 399.7 169 329.6 206 13.1

22 -680.8 59 -491.2 96 106.3 133 436.9 170 225.3 207 8.0

23 -691.6 60 -506.8 97 56.2 134 403.6 171 -1.2 208 15.0

24 -761.1 61 -420.4 98 115.2 135 346.6 172 3.5 209 7.8

25 -682.4 62 -338.1 99 114.5 136 366.3 173 -26.2 210 9.5

26 -735.6 63 -434.2 100 88.3 137 321.6 174 -21.9 211 12.6

27 -633.3 64 -454.4 101 148.1 138 391.1 175 18.1 212 17.0

28 -657.8 65 -373.8 102 202.2 139 431.6 176 18.4 213 10.4

29 -718.5 66 -423.8 103 222.2 140 493.5 177 1.2 214 -0.2

30 -751.2 67 -375.2 104 218.9 141 415.3 178 44.8 215 -0.1

31 -730.6 68 -397.1 105 213.1 142 370.1 179 0.7 216 -1.6

32 -746.3 69 -368.7 106 145.0 143 327.0 180 24.2 217 -0.1

33 -778.4 70 -369.6 107 159.3 144 365.4 181 32.2 218 5.6

34 -746.3 71 -343.7 108 212.8 145 390.3 182 11.1 219 -0.4

35 -721.3 72 -282.5 109 180.7 146 340.8 183 10.9

36 -711.9 73 -241.6 110 257.7 147 352.2 184 0.4

PUSK 3 DATE 14/ 8/78

MEAS 383 TIME 17.48.13 TIME (KC) = 0. 7.21. 0

GR 1 U POWER OR 1 U POWER GR 1 U POWER

17 60.5 102.5 6.2 19 60.5 618.2 37.4 21 60.5 360.4 21.8

B1= 4.00 HALL= 980. SUM POWER = 65.5

I 17= 57.9 I 19= 51.8 I 21= 57.9

+157 3.0 -157 2.8 +193 1.2 -193 1.9

18 2.7 1132 0.0 19 2.5 1133 4.5

110 2.6 1134 5.5 111 3.3 1135 4.5

112 3.4 1136 5.3 113 1.5 1137 4.7

114 5.3 1138 4.8 115 4.2 1139 4.0

116 3.2 1140 4.7 117 6.2 1141 4.5

118 7.1 1142 4.3 119 10.2 1143 4.4

SUM 18-119 = 54.4 SUM 1132-1143 = 51.6

MEAS 383 TIME 17.48.13 TIME (KC) = 0. 7.21. 0

POWER= 65.5 B-38= 821. BKC-141=1.73 BV-1= 2.04

ALF= 1.04 BV-7= 39.99 B-6= 1.81 E-29= 2.335

ALC= 1.05 B-7= 40.20 KC-24= 7.023 PR-41= 182.

KCK-87= 0.23 B-34= 1.718 KC-84= 0.036 PR-40= 3.444

TPL1= 2511. TPL2= 0.

KC-23= 1.670 C10 0.950 C16 0.925 D2 1.005

C1 1.111 C11 1.077 C17 0.940 D3 0.981

C2 0.759 C12 0.693 C18 0.957 T1 0.984

C3 0.332 C13 0.764 C19 0.950 T2 0.979

C6 0.952 C14 0.806 C20 0.938

C8 0.945 C15 0.940 D1 0.967

C9 0.920 BKC-24= 6.0 D01= 1.126 OKC= 12.651

BAC-2= 161. BQ-43= 10.9 D02= 3.281 OTP= 8.992

BQ-25= 259. BQ-44= 14.4 D03= 3.820

PUSK 3 DATE 14/ 8/78

MEAS 363 TIME 17.46.13 TIME (KC) = 0. 7.21. 0

K F1 K F1 K F1 K F1 K F1 K F1 K F1 K F1

0 -45.8 37 -589.7 74 -260.5 111 375.0 148 609.0 185 13.5

1 -112.3 38 -588.3 75 -244.1 112 415.0 149 629.5 186 0.2

2 -144.6 39 -589.7 76 -209.0 113 394.9 150 651.3 187 20.1

3 -190.9 40 -606.8 77 -228.7 114 426.3 151 806.1 188 12.2

4 -242.3 41 -602.4 78 -141.3 115 448.9 152 613.6 189 22.7

5 -311.6 42 -592.8 79 -189.6 116 406.8 153 679.0 190 8.5

6 -359.5 43 -579.2 80 -170.7 117 443.9 154 614.5 191 17.1

7 -452.5 44 -578.7 81 -154.7 118 444.8 155 652.4 192 33.1

8 -401.5 45 -538.0 82 -86.9 119 485.7 156 618.7 193 3.4

9 -394.6 46 -585.5 83 -102.4 120 504.7 157 658.8 194 31.0

10 -379.1 47 -595.0 84 -79.7 121 505.5 158 630.7 195 21.0

11 -418.4 48 -557.8 85 -43.8 122 484.6 159 628.5 196 23.0

12 -424.1 49 -550.8 86 -60.7 123 542.2 160 587.2 197 19.1

13 -442.8 50 -569.7 87 12.3 124 513.7 161 652.3 198 16.8

14 -462.7 51 -550.7 88 49.4 125 515.1 162 617.3 199 24.7

15 -449.3 52 -568.4 89 14.5 126 530.1 163 627.8 200 15.4

16 -403.9 53 -506.5 90 39.7 127 509.4 164 583.2 201 20.3

17 -430.4 54 -533.1 91 54.3 128 512.2 165 550.5 202 19.7

18 -414.1 55 -512.1 92 117.7 129 541.0 166 555.5 203 18.3

19 -419.0 56 -538.8 93 132.5 130 533.5 167 520.3 204 14.9

20 -412.9 57 -524.1 94 110.1 131 561.4 168 566.4 205 2.3

21 -427.4 58 -479.1 95 98.7 132 551.4 169 637.8 206 24.0

22 -453.9 59 -439.8 96 103.7 133 615.0 170 100.3 207 15.3

23 -422.9 60 -458.8 97 117.3 134 526.2 171 -0.3 208 19.6

24 -445.5 61 -462.3 98 226.8 135 552.6 172 10.6 209 10.8

25 -420.6 62 -444.2 99 212.8 136 578.5 173 -6.4 210 13.0

26 -444.4 63 -395.5 100 235.6 137 565.2 174 -38.4 211 16.2

27 -502.9 64 -393.4 101 196.1 138 535.0 175 16.2 212 15.1

28 -440.3 65 -395.7 102 225.2 139 576.5 176 19.1 213 15.6

29 -412.9 66 -353.5 103 213.5 140 605.3 177 18.5 214 -0.2

30 -424.6 67 -542.8 104 271.5 141 568.4 178 33.2 215 -0.1

31 -562.3 68 -349.9 105 268.5 142 615.7 179 2.2 216 0.9

32 -610.7 69 -309.7 106 291.6 143 608.7 180 23.5 217 0.5

33 -613.7 70 -322.5 107 364.9 144 567.4 181 31.9 218 12.3

34 -587.5 71 -389.8 108 365.1 145 613.5 182 14.2 219 -0.4

35 -549.1 72 -321.9 109 347.2 146 589.8 183 13.9

36 -520.9 73 -321.9 110 379.3 147 634.7 184 10.2

PUSK 3 -27- DATE 14/ 6/78

MEAS 414 TIME 18.25.29 TIME (KC) = 0. 8. 0.16
GR I U POWER GR I U POWER GR I U POWER
17 46.4 451.2 20.9 19 43.0 817.4 35.1 21 44.4 413.1 18.4
B1= 4.50 HALL= 1582. SUM POWER = 74.4
I 17= 43.0 I 19= 34.4 I 21= 41.7
+157 3.5 -157 0.7 +193 1.2 -193 3.0
18 1.5 1132 0.0 19 1.4 1133 3.1
110 1.9 1134 4.7 111 2.5 1135 3.4
112 2.9 1136 4.5 113 1.1 1137 3.3
114 4.4 1138 3.5 115 3.3 1139 2.7
116 4.1 1140 3.5 117 4.7 1141 3.3
118 5.9 1142 3.0 119 7.2 1143 3.3
SUM 15-119 = 41.0 SUM 1132-1143 = 38.2

MEAS 414 TIME 18.25.29 TIME (KC) = 0. 8. 0.16
POWER= 74.4 B-38= 805. BKC-141=1.71 BV-1= 2.01
ALF= 1.05 BV-7= 39.78 B-6= 1.80 E-29= 2.313
ALC= 1.05 B-7= 39.84 KC-24= 7.017 PR-41= 181.
KCK-87= 0.22 B-34= 1.720 KC-64= 0.035 PR-40= 3.444
TPL1= 2801. TPL2= 0.
KC-23= 1.665 C10 0.850 C16 0.935 D2 1.003
C1 1.108 C11 1.072 C17 0.938 D3 0.681
C2 0.754 C12 0.691 C18 0.842 T1 0.984
C3 0.642 C13 0.772 C19 0.962 T2 0.977
C6 0.952 C14 0.708 C20 0.938
C8 0.950 C15 0.940 D1 0.967
C9 0.925 BKC-24= 5.5 DO1= 1.105 QKC= 12.306
BG-25= 257. BG-43= 10.8 DO2= 3.222 OTP= 8.976
BG-47= 229. BG-44= 14.8 DO3= 3.927

MEAS 442 TIME 19.25.42 TIME (KC) = 0. 9. 0.29
GR I U POWER GR I U POWER GR I U POWER
17 56.4 149.4 9.9 19 64.0 540.8 33.8 21 83.0 442.4 27.9
B1= 5.01 HALL= 1330. SUM POWER = 91.6
I 17= 63.7 I 19= 55.7 I 21= 60.8
+157 4.7 -157 2.4 +193 2.0 -193 1.6
18 2.5 1132 0.0 19 2.6 1133 4.1
110 3.0 1134 5.7 111 3.9 1135 4.9
112 4.5 1136 5.7 113 2.2 1137 4.7
114 6.2 1138 5.0 115 4.8 1139 4.1
116 5.3 1140 5.4 117 6.9 1141 5.1
118 8.2 1142 5.1 119 10.4 1143 5.3
SUM 18-119 = 60.5 SUM 1132-1143 = 53.4

MEAS 442 TIME 19.25.42 TIME (KC) = 0. 9. 0.29
POWER= 91.6 B-38= 804. BKC-141=1.77 BV-1= 2.07
ALF= 1.07 BV-7= 39.84 B-6= 1.78 E-29= 2.385
ALC= 1.04 B-7= 38.62 KC-24= 7.011 PR-41= 181.
KCK-87= 0.22 B-34= 1.770 KC-64= 0.036 PR-40= 3.493
TPL1= 2596. TPL2= 0.
KC-23= 1.711 C10 0.950 C16 0.947 D2 0.999
C1 1.145 C11 1.062 C17 0.952 D3 0.979
C2 0.808 C12 0.691 C18 0.952 T1 0.981
C3 0.679 C13 0.828 C19 0.960 T2 0.974
C6 0.974 C14 0.847 C20 0.935
C8 0.950 C15 0.935 D1 0.967
C9 0.923 BKC-24= 6.0 DO1= 1.127 QKC= 12.478
BG-25= 257. BG-43= 11.2 DO2= 3.359 OTP= 9.029
BG-47= 228. BG-44= 14.5 DO3= 3.845

PUSK 3 -28- DATE 14/ 6/78

MEAS 414 TIME 18.25.29 TIME (KC) = 0. 8. 0.16
K FI K FI K FI K FI K FI K FI
0 -156.2 57 -1247.0 74 -522.9 111 191.4 148 542.9 185 17.7
1 -314.1 38 -1301.8 75 -572.9 112 310.8 149 830.7 185 10.5
2 -453.5 39 -1306.1 76 -527.8 113 352.9 150 547.9 127 29.1
3 -591.9 40 -1222.8 77 -477.0 114 307.9 151 510.6 188 13.1
4 -722.9 41 -1169.5 78 -465.3 115 326.2 152 467.9 189 38.5
5 -870.8 42 -1115.1 79 -450.9 116 418.8 153 454.7 120 13.8
6 -1084.4 43 -1102.3 80 -465.2 117 341.9 154 477.7 191 17.1
7 -1254.8 44 -1159.0 81 -412.2 118 349.2 155 474.9 192 33.6
8 -1114.9 45 -1237.6 82 -405.9 119 401.7 156 505.5 193 31.4
9 -1192.6 46 -1187.8 83 -325.3 120 348.0 157 555.6 194 20.4
10 -1174.2 47 -1223.0 84 -374.3 121 358.8 158 519.9 195 27.2
11 -1164.3 48 -1122.8 85 -334.8 122 348.6 159 571.9 196 24.2
12 -1266.9 49 -1110.8 86 -238.7 123 330.3 160 601.7 197 33.6
13 -1235.8 50 -1094.2 87 -153.0 124 396.6 161 670.9 198 20.0
14 -1373.9 51 -1085.6 88 -259.7 125 440.0 162 575.3 199 25.5
15 -1331.9 52 -1054.2 89 -220.9 126 445.2 163 439.2 200 17.3
16 -1297.0 53 -1039.1 90 -203.1 127 399.4 164 482.0 201 25.4
17 -1225.2 54 -939.1 91 -165.4 128 448.0 165 497.4 202 22.6
18 -1134.2 55 -876.6 92 -81.7 129 459.8 166 459.6 203 25.2
19 -1156.5 56 -881.4 93 37.4 130 524.4 167 380.5 204 21.3
20 -1174.7 57 -869.6 94 -90.0 131 447.3 168 369.0 205 18.2
21 -1305.9 58 -823.7 95 -82.8 132 497.9 169 449.6 206 24.2
22 -1254.9 59 -894.7 96 -48.7 133 501.1 170 153.7 207 15.9
23 -1106.7 60 -878.4 97 -34.6 134 437.9 171 -2.9 208 23.5
24 -1215.4 61 -875.6 98 41.3 135 478.3 172 1.9 209 14.0
25 -1197.0 62 -771.8 99 -22.4 136 506.1 173 -40.2 210 20.0
26 -1341.7 63 -855.5 100 135.8 137 474.1 174 -36.0 211 22.5
27 -49.9 64 -822.5 101 98.9 138 472.0 175 20.7 212 13.4
28 -1065.8 65 -674.4 102 128.2 139 461.9 176 25.0 213 17.9
29 -38.4 66 -670.0 103 133.4 140 475.2 177 17.0 214 -0.2
30 -1155.5 67 -720.7 104 129.9 141 560.0 178 24.6 215 -0.1
31 -1231.9 68 -726.4 105 205.1 142 492.5 179 28.1 216 -1.5
32 -1223.5 69 -531.5 106 189.3 143 530.8 180 38.2 217 1.3
33 -1202.2 70 -577.7 107 184.0 144 480.0 181 22.6 218 11.7
34 -1260.3 71 -600.6 108 276.4 145 555.7 182 20.0 219 -0.3
35 -1227.3 72 -545.2 109 257.8 146 577.2 183 19.3
36 -1195.2 73 -566.4 110 245.0 147 530.4 184 24.9

MEAS 442 TIME 19.25.42 TIME (KC) = 0. 9. 0.29
K FI K FI K FI K FI K FI K FI
0 -106.9 37 -1118.1 74 -662.4 111 190.3 148 451.5 185 21.8
1 -218.3 38 -1212.2 75 -628.8 112 247.6 149 470.6 186 16.2
2 -285.5 39 -1073.8 76 -647.4 113 240.0 150 462.9 187 22.1
3 -382.1 40 -1209.5 77 -586.0 114 256.8 151 469.9 188 11.9
4 -469.4 41 -1150.6 78 -583.7 115 255.9 152 444.6 189 41.7
5 -568.9 42 -1112.3 79 -535.8 116 274.8 153 463.4 190 0.7
6 -758.9 43 -1174.5 80 -509.5 117 262.7 154 457.5 191 33.5
7 -871.4 44 -1164.4 81 -483.0 118 290.1 155 457.5 192 35.5
8 -842.3 45 -1134.8 82 -472.1 119 312.8 156 478.4 193 21.3
9 -39.1 46 -1179.1 83 -443.9 120 346.2 157 453.4 194 26.9
10 -775.1 47 -1174.0 84 -426.5 121 348.9 158 438.3 195 31.8
11 -852.1 48 -1130.8 85 -379.3 122 371.0 159 449.4 196 26.4
12 -845.6 49 -1169.6 86 -335.8 123 395.0 160 453.7 197 30.4
13 -824.8 50 -1148.8 87 -321.1 124 403.4 161 465.0 198 20.7
14 -863.9 51 -1103.3 88 -295.7 125 382.0 162 418.0 199 30.5
15 -899.4 52 -1091.9 89 -282.4 126 377.7 163 433.2 200 20.3
16 -833.8 53 -1109.0 90 -246.7 127 359.3 164 451.6 201 27.7
17 -910.7 54 -1068.2 91 -212.5 128 408.5 165 468.3 202 22.9
18 -817.8 55 -1047.5 92 -208.9 129 399.2 166 438.5 203 24.5
19 -886.7 56 -1002.1 93 -178.1 130 442.0 167 470.8 204 26.2
20 -846.9 57 -995.1 94 -143.8 131 440.5 168 421.6 205 14.9
21 -905.4 58 -861.6 95 -133.0 132 444.3 169 398.0 206 22.7
22 -880.3 59 -989.6 96 -86.3 133 428.9 170 339.3 207 20.3
23 -955.1 60 -966.2 97 -92.9 134 440.2 171 -1.7 208 23.8
24 -890.8 61 -909.0 98 -101.3 135 481.0 172 9.1 209 14.8
25 -28.7 62 -906.6 99 -44.9 136 432.4 173 -79.5 210 20.6
26 -887.2 63 -924.1 100 -21.4 137 474.7 174 -35.7 211 24.4
27 -23.1 64 -909.4 101 -8.0 138 478.8 175 17.9 212 20.8
28 -892.3 65 -894.5 102 31.8 139 481.7 176 20.5 213 13.7
29 -38.1 66 -841.8 103 98.4 140 498.2 177 24.0 214 -0.2
30 -999.1 57 -845.9 104 88.7 141 464.2 178 -16.4 215 0.0
31 -1029.5 68 -762.0 105 59.8 142 433.5 179 32.3 216 -0.2
32 -1092.1 69 -747.9 106 86.4 143 430.9 180 33.1 217 1.4
33 -1084.5 70 -719.5 107 121.1 144 443.5 181 19.6 218 14.7
34 -1132.6 71 -673.8 108 132.8 145 490.7 182 22.3 219 0.0
35 -1045.1 72 -699.8 109 181.0 146 475.7 183 24.3
36 -1038.2 73 -889.9 110 189.0 147 463.8 184 14.1

PUSK 3 -33- DATE 14/ 6/78

MEAS 489 TIME 19.40.55 TIME (KC) = 0. 9.15.42
GR 1 U POWER GR 1 U POWER GR 1 U POWER
17 64.0 99.6 0.4 19 82.5 706.1 44.1 21 62.0 357.4 22.2
B1= 5.01 HALL= 1049. SUM POWER = 72.7
I 17= 51.0 I 19= 54.4 I 21= 60.1
+157 4.0 -157 3.3 +193 1.6 -193 1.7
18 3.1 1132 0.4 19 3.0 1133 4.6
110 3.3 1134 5.6 111 4.0 1135 5.0
112 4.5 1136 5.4 113 2.0 1137 4.6
114 5.5 1138 4.5 115 4.2 1139 3.9
116 4.5 1140 5.1 117 6.2 1141 4.7
118 7.1 1142 4.6 119 10.3 1143 5.2
SUM 18-119 = 67.2 SUM 1132-1143 = 53.2

MEAS 469 TIME 19.40.55 TIME (KC) = 0. 9.15.42
POWER= 72.7 B-38= 799. BKC-141=1.68 BV-1= 1.95
ALF= 0.93 BV-7= 39.99 B-6= 1.76 E-29= 2.248
ALC= 0.91 B-7= 38.91 KC-24= 7.017 PR-41= 133.
KCK-37= 0.24 B-34= 1.663 KC-64= 0.035 PR-40= 3.493
TPL1= 0. TPL2= 0.
KC-23= 1.635 C10 0.952 C16 0.950 D2 1.001
C1 1.143 C11 1.062 C17 0.955 D3 0.979
C2 0.803 C12 0.693 C18 0.947 T1 0.984
C3 0.691 C13 0.823 C19 0.960 T2 0.977
C6 0.977 C14 0.847 C20 0.935
C8 0.952 C15 0.935 D1 0.972
C9 0.925 BKC-24= 5.9 DQ1= 1.099 OKC= 13.243
BKC-2= 161. BQ-43= 11.0 DQ2= 3.308 OTP= 8.300
BQ-25= 259. BQ-44= 14.2 DQ3= 3.615
BQ-47= 231.

MEAS 470 TIME 19.41.29 TIME (KC) = 0. 9.16.16
GR 1 U POWER GR 1 U POWER GR 1 U POWER
17 66.4 149.4 9.9 19 82.0 833.3 40.5 21 62.0 304.7 18.9
B1= 5.01 HALL= 850. SUM POWER = 69.3
I 17= 64.0 I 19= 54.0 I 21= 59.6
+157 6.1 -157 2.0 +193 1.5 -193 1.8
18 3.3 1132 1.4 19 3.2 1133 4.4
110 3.7 1134 5.6 111 4.2 1135 4.6
112 4.8 1136 5.3 113 2.4 1137 4.4
114 6.1 1138 4.5 115 4.3 1139 3.7
116 4.8 1140 4.9 117 6.2 1141 4.6
118 7.3 1142 4.5 119 10.5 1143 5.3
SUM 18-119 = 60.6 SUM 1132-1143 = 53.5

MEAS 470 TIME 19.41.29 TIME (KC) = 0. 9.16.16
POWER= 69.3 B-38= 797. BKC-141=1.68 BV-1= 1.95
ALF= 0.95 BV-7= 39.99 B-6= 1.76 E-29= 2.212
ALC= 0.93 B-7= 39.05 KC-24= 7.017 PR-41= 133.
KCK-37= 0.24 B-34= 1.660 KC-64= 0.035 PR-40= 3.444
TPL1= 0. TPL2= 0.
KC-23= 1.616 C10 0.952 C16 0.950 D2 1.001
C1 1.140 C11 1.062 C17 0.955 D3 0.979
C2 0.803 C12 0.691 C18 0.947 T1 0.984
C3 0.691 C13 0.823 C19 0.960 T2 0.974
C6 0.977 C14 0.847 C20 0.935
C8 0.950 C15 0.935 D1 0.972
C9 0.925 BKC-24= 5.8 DQ1= 1.087 OKC= 12.949
BKC-2= 161. BQ-43= 10.8 DQ2= 3.264 OTP= 8.398
BQ-25= 260. BQ-44= 14.0 DQ3= 3.656
BQ-47= 225.

PUSK 3 -34- DATE 14/ 6/78

MEAS 459 TIME 19.40.55 TIME (KC) = 0. 9.15.42
K FI K FI K FI K FI K FI K FI
0 -90.7 37 -824.0 74 -504.3 111 213.8 148 378.1 185 13.5
1 -190.6 38 -969.9 75 -464.1 112 243.2 149 373.7 186 15.2
2 -225.6 39 -995.1 76 -426.1 113 286.5 150 404.1 187 18.2
3 -308.7 40 -975.5 77 -406.9 114 274.3 151 401.0 188 6.2
4 -425.1 41 -967.3 78 -373.9 115 273.4 152 375.2 189 39.3
5 -523.8 42 -963.0 79 -326.0 116 305.9 153 391.1 190 0.4
6 -611.0 43 -1022.4 80 -300.5 117 302.8 154 399.5 191 25.2
7 -730.0 44 -1003.2 81 -305.0 118 298.5 155 428.1 192 29.3
8 -743.8 45 -974.7 82 -299.6 119 314.1 156 412.5 193 22.6
9 -43.4 46 -936.9 83 -283.9 120 335.8 157 354.9 194 17.3
10 -749.8 47 -937.9 84 -268.5 121 349.3 158 385.8 195 27.3
11 -757.5 48 -881.7 85 -250.0 122 339.6 159 402.5 196 20.8
12 -637.2 49 -940.2 86 -221.4 123 353.0 160 398.4 197 26.2
13 -650.0 50 -854.9 87 -177.8 124 350.4 161 400.8 198 15.0
14 -723.2 51 -859.7 88 -148.6 125 358.6 162 368.9 199 26.7
15 -681.8 52 -663.1 89 -118.7 126 334.6 163 360.4 200 8.8
16 -626.0 53 -863.3 90 -109.3 127 339.7 164 382.9 201 24.8
17 -627.4 54 -356.6 91 -117.7 128 352.5 165 368.0 202 18.7
18 -619.8 55 -866.4 92 -156.7 129 348.2 166 373.2 203 20.7
19 -656.0 56 -846.0 93 -122.7 130 372.4 167 336.5 204 21.8
20 -574.6 57 -908.0 94 -84.2 131 359.9 168 349.4 205 14.6
21 -702.2 58 -819.2 95 -44.2 132 379.4 169 338.4 206 18.6
22 -727.5 59 -717.5 96 -11.6 133 396.9 170 262.8 207 13.9
23 -724.4 60 -723.0 97 -28.7 134 399.9 171 -0.7 208 15.5
24 -684.0 61 -736.1 98 11.3 135 383.1 172 14.7 209 14.4
25 -640.8 62 -753.2 99 23.5 136 380.4 173 -20.8 210 18.1
26 -709.2 63 -717.4 100 99.0 137 385.9 174 -37.8 211 14.6
27 -672.3 64 -692.5 101 102.5 138 407.1 175 17.4 212 14.0
28 -694.2 65 -647.0 102 126.5 139 444.7 176 14.5 213 14.3
29 -3.5 66 -633.8 103 134.7 140 425.1 177 27.4 214 -0.2
30 -844.4 67 -664.7 104 138.3 141 416.9 178 -0.2 215 0.0
31 -816.4 68 -654.8 105 138.8 142 393.8 179 37.5 216 0.2
32 -838.9 69 -651.0 106 111.3 143 379.8 180 27.4 217 -1.2
33 -849.5 70 -618.6 107 151.5 144 406.2 181 6.3 218 13.9
34 -902.7 71 -597.6 108 173.3 145 429.9 182 21.5 219 0.5
35 -945.5 72 -546.3 109 203.3 146 419.5 183 20.7
36 -886.6 73 -497.2 110 219.1 147 418.3 184 10.6

MEAS 470 TIME 19.41.29 TIME (KC) = 0. 9.16.16
K FI K FI K FI K FI K FI K FI
0 -73.4 37 -776.2 74 -504.5 111 141.3 148 341.1 185 15.3
1 -167.8 38 -765.2 75 -484.7 112 160.1 149 339.8 186 14.0
2 -212.0 39 -786.6 76 -500.1 113 160.2 150 329.3 187 17.3
3 -264.1 40 -778.7 77 -511.7 114 169.3 151 341.2 188 5.7
4 -353.2 41 -840.2 78 -511.8 115 178.7 152 351.1 189 38.3
5 -479.4 42 -767.0 79 -474.9 116 194.2 153 353.8 190 0.4
6 -537.6 43 -798.4 80 -487.4 117 232.2 154 359.9 191 25.3
7 -552.5 44 -764.8 81 -427.9 118 256.8 155 356.0 192 29.9
8 -592.2 45 -794.8 82 -423.2 119 248.2 156 351.4 193 22.0
9 -867.5 46 -789.0 83 -375.3 120 260.3 157 345.7 194 20.8
10 -576.8 47 -789.8 84 -348.3 121 249.1 158 341.1 195 26.1
11 -553.2 48 -791.7 85 -371.6 122 274.1 159 333.3 196 19.4
12 -586.8 49 -801.3 86 -323.4 123 275.6 160 340.2 197 28.2
13 -578.5 50 -742.9 87 -270.0 124 275.5 161 344.3 198 14.5
14 -560.6 51 -785.6 88 -252.0 125 275.6 162 338.5 199 28.5
15 -570.6 52 -800.7 89 -223.8 126 283.4 163 335.6 200 12.3
16 -563.0 53 -768.6 90 -224.8 127 291.4 164 335.5 201 21.6
17 -557.5 54 -749.2 91 -167.3 128 303.3 165 328.8 202 19.4
18 -522.9 55 -723.4 92 -166.8 129 315.8 166 316.4 203 21.2
19 -602.5 56 -764.7 93 -160.2 130 313.1 167 311.2 204 22.3
20 -589.8 57 -728.4 94 -139.6 131 321.7 168 507.3 205 12.9
21 -580.1 58 -695.3 95 -116.5 132 331.8 169 290.9 206 18.1
22 -596.3 59 -718.1 96 -111.2 133 326.1 170 241.3 207 14.6
23 -634.6 60 -683.5 97 -74.9 134 341.0 171 -0.9 208 16.8
24 -636.9 61 -654.7 98 -61.5 135 344.4 172 17.5 209 10.8
25 -495.6 62 -628.6 99 -73.1 136 354.1 173 -80.0 210 16.0
26 -511.8 63 -672.6 100 -53.9 137 329.3 174 -42.4 211 20.4
27 -723.4 64 -643.5 101 -34.3 138 342.4 175 20.5 212 14.8
28 -548.7 65 -631.4 102 -36.1 139 344.8 176 13.8 213 11.4
29 -260.3 66 -595.5 103 -15.6 140 334.4 177 27.1 214 -0.2
30 -652.2 67 -659.5 104 7.4 141 354.8 178 -0.1 215 0.0
31 -693.3 68 -592.7 105 15.5 142 343.5 179 26.6 216 -2.8
32 -676.2 69 -567.1 106 34.8 143 343.3 180 22.4 217 -2.6
33 -772.1 70 -585.0 107 31.0 144 341.5 181 8.2 218 13.5
34 -741.7 71 -544.6 108 83.0 145 339.2 182 20.5 219 1.0
35 -726.4 72 -526.7 109 111.9 146 335.6 183 21.4
36 -710.7 73 -512.7 110 129.6 147 336.7 184 10.9

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MEAS 471 TIME 19.42.12 TIME (KC) = 0. 9.18.59
 GR I U POWER GR I U POWER GR I U POWER
 17 63.3 125.6 14.3 19 62.0 593.0 36.2 21 63.0 199.2 12.5
 B1= 5.00 HALL= 951. SUM POWER = 63.0
 I 17= 61.3 I 19= 53.5 I 21= 60.5
 +157 3.1 -157 1.2 +193 1.1 -193 2.8
 18 3.1 1132 0.0 19 3.1 1133 4.9
 110 3.5 1134 5.8 111 4.1 1135 4.8
 112 4.7 1136 5.2 113 2.4 1137 4.3
 114 5.9 1138 4.3 115 4.2 1139 3.5
 116 4.6 1140 4.8 117 6.1 1141 4.2
 118 7.3 1142 4.3 119 8.9 1143 5.2
 SUM 18-119 = 58.1 SUM 1132-1143 = 57.4

MEAS 471 TIME 19.42.12 TIME (KC) = 0. 9.18.59
 POWER= 63.0 B-38= 793. BKC-141=1.63 BV-1= 1.88
 ALF= 0.92 BV-7= 39.94 B-6= 1.71 E-29= 2.167
 ALC= 0.90 B-7= 39.05 KC-24= 7.011 PR-41= 183.
 KCK-87= 0.24 B-34= 1.633 KC-64= 0.033 PR-40= 3.419
 TPL1= 0. TPL2= 0.
 KC-23= 1.589
 C1 1.135 C10 0.952 C16 0.950 D2 1.001
 C2 0.803 C11 1.060 C17 0.955 D3 0.981
 C3 0.693 C12 0.688 C18 0.945 T1 0.984
 C6 0.977 C13 0.825 C19 0.960 T2 0.974
 C8 0.950 C14 0.847 C20 0.935
 C9 0.625 C15 0.935 D1 0.969
 BKC-2= 161. BKC-24= 5.8 DQ1= 1.082 QKC= 12.871
 BQ-25= 257. BQ-43= 10.7 DQ2= 3.197 OTP= 8.409
 BQ-47= 228. BQ-44= 14.0 DQ3= 3.707

PUSK 3 DATE 14/ 8/78

MEAS 471 TIME 19.42.12 TIME (KC) = 0. 9.18.59
 K FI K FI K FI K FI K FI K FI
 0 -71.1 37 -868.0 74 -467.5 111 213.2 146 321.1 185 13.0
 1 -141.7 38 -869.3 75 -474.8 112 225.5 149 334.7 186 12.6
 2 -183.7 39 -889.6 76 -438.8 113 224.1 150 311.3 187 14.7
 3 -235.5 40 -857.3 77 -428.6 114 235.5 151 315.6 188 3.5
 4 -317.4 41 -856.2 78 -414.9 115 267.0 152 357.3 189 38.0
 5 -389.9 42 -805.7 79 -378.7 116 246.3 153 354.6 190 0.3
 6 -482.2 43 -879.3 80 -383.3 117 215.7 154 342.1 191 21.3
 7 -534.7 44 -862.9 81 -353.2 118 241.9 155 325.9 192 28.6
 8 -563.1 45 -868.2 82 -316.8 119 272.7 156 329.4 193 19.2
 9 -606.9 46 -850.7 83 -289.5 120 274.6 157 340.8 194 14.5
 10 -583.6 47 -829.0 84 -276.7 121 308.1 158 358.7 195 26.0
 11 -590.8 48 -789.0 85 -253.5 122 316.1 159 317.8 196 17.3
 12 -581.3 49 -772.1 86 -243.1 123 272.6 160 311.8 197 23.2
 13 -573.2 50 -749.3 87 -216.3 124 288.2 161 321.3 198 13.4
 14 -605.3 51 -779.1 88 -222.8 125 292.6 162 334.4 199 27.0
 15 -589.5 52 -772.4 89 -178.6 126 277.1 163 334.9 200 7.3
 16 -590.8 53 -776.7 90 -143.2 127 317.2 164 325.1 201 21.7
 17 -587.8 54 -754.2 91 -102.3 128 340.5 165 326.1 202 17.3
 18 -582.7 55 -764.6 92 -107.3 129 339.4 166 309.6 203 18.4
 19 -598.8 56 -711.3 93 -85.5 130 340.9 167 313.8 204 17.5
 20 -593.0 57 -717.4 94 -81.9 131 366.1 168 310.3 205 11.7
 21 -610.9 58 -734.5 95 -70.6 132 341.8 169 311.6 206 15.3
 22 -631.3 59 -712.6 96 -38.1 133 349.6 170 230.1 207 11.4
 23 -603.4 60 -675.2 97 4.2 134 345.2 171 -0.3 208 12.8
 24 -592.1 61 -710.6 98 27.2 135 335.3 172 18.0 209 12.3
 25 -606.6 62 -695.0 99 49.3 136 370.8 173 -75.5 210 15.7
 26 -573.5 63 -650.2 100 33.0 137 379.2 174 -33.2 211 11.4
 27 -552.6 64 -636.8 101 93.6 138 353.5 175 13.9 212 13.5
 28 -600.1 65 -641.5 102 83.8 139 363.0 176 17.6 213 9.0
 29 -458.1 66 -616.7 103 106.4 140 358.0 177 18.0 214 -0.2
 30 -703.2 67 -629.6 104 125.6 141 380.7 178 1.9 215 0.0
 31 -707.8 68 -565.6 105 122.1 142 354.5 179 37.1 216 -7.6
 32 -742.7 69 -551.6 106 141.3 143 327.0 180 31.3 217 -9.6
 33 -685.1 70 -524.0 107 126.0 144 333.1 181 6.7 218 15.9
 34 -780.5 71 -534.0 108 102.6 145 360.7 182 18.2 219 1.0
 35 -772.2 72 -483.8 109 123.1 146 345.0 183 17.3
 36 -802.6 73 -490.7 110 218.2 147 358.7 184 8.8

MEAS 472 TIME 19.42.46 TIME (KC) = 0. 9.17.33
 K FI K FI K FI K FI K FI K FI
 0 -69.0 37 -769.7 74 -426.7 111 136.0 148 328.5 185 12.5
 1 -143.8 38 -791.8 75 -409.9 112 146.1 149 306.0 186 14.4
 2 -185.3 39 -887.1 76 -391.4 113 160.1 150 314.0 187 15.0
 3 -237.2 40 -826.5 77 -402.7 114 158.4 151 333.4 188 2.1
 4 -331.9 41 -864.8 78 -329.6 115 177.2 152 358.8 189 32.7
 5 -422.9 42 -890.5 79 -380.6 116 188.9 153 362.5 190 0.3
 6 -493.4 43 -892.0 80 -348.4 117 207.4 154 358.0 191 20.8
 7 -606.9 44 -891.3 81 -360.7 118 220.1 155 351.2 192 25.4
 8 -626.3 45 -896.4 82 -294.3 119 210.9 156 331.3 193 20.8
 9 -72.3 46 -858.9 83 -272.9 120 243.5 157 342.4 194 14.8
 10 -586.2 47 -822.4 84 -299.9 121 244.7 158 338.6 195 28.4
 11 -605.3 48 -806.2 85 -274.4 122 242.2 159 312.1 196 18.0
 12 -628.8 49 -862.8 86 -227.8 123 252.5 160 308.6 197 25.4
 13 -605.9 50 -767.5 87 -199.4 124 272.3 161 328.3 198 13.0
 14 -565.0 51 -787.4 88 -190.3 125 263.6 162 323.9 199 26.8
 15 -542.4 52 -757.9 89 -170.8 126 294.7 163 309.4 200 9.8
 16 -652.5 53 -772.5 90 -161.1 127 275.0 164 308.2 201 19.7
 17 -649.5 54 -693.1 91 -154.4 128 307.5 165 318.9 202 19.2
 18 -595.3 55 -727.5 92 -103.3 129 298.7 166 319.2 203 17.2
 19 -619.8 56 -690.5 93 -105.6 130 315.0 167 291.2 204 20.6
 20 -546.4 57 -683.2 94 -69.0 131 294.9 168 300.5 205 12.5
 21 -680.1 58 -871.8 95 -71.8 132 312.7 169 315.0 206 16.1
 22 -626.6 59 -698.8 96 -18.2 133 338.1 170 231.3 207 12.3
 23 -678.4 60 -981.7 97 -34.0 134 310.6 171 0.2 208 14.0
 24 -691.8 61 -687.6 98 -5.2 135 299.0 172 19.8 209 15.9
 25 -773.5 62 -663.0 99 -3.9 136 306.6 173 -100.6 210 15.9
 26 -604.2 63 -639.9 100 20.1 137 317.3 174 -13.2 211 18.4
 27 -645.1 64 -630.1 101 6.5 138 363.7 175 41.4 212 10.3
 28 -626.7 65 -629.4 102 37.4 139 350.1 176 11.4 213 8.5
 29 -923.7 66 -585.1 103 77.4 140 348.2 177 18.2 214 -0.2
 30 -736.5 67 -605.2 104 105.0 141 342.3 178 4.8 215 0.0
 31 -820.5 68 -517.5 105 60.8 142 337.8 179 42.3 216 -5.7
 32 -897.6 69 -475.0 106 84.7 143 316.6 180 24.4 217 -8.5
 33 -794.5 70 -505.4 107 94.0 144 321.0 181 27.6 218 14.6
 34 -763.7 71 -472.6 108 131.8 145 333.4 182 14.2 219 1.3
 35 -792.8 72 -495.4 109 134.4 146 313.6 183 13.2
 36 -795.2 73 -451.9 110 138.0 147 315.9 184 3.4

MEAS 472 TIME 19.42.46 TIME (KC) = 0. 9.17.33
 GR I U POWER GR I U POWER GR I U POWER
 17 64.9 70.3 4.6 19 62.0 644.6 40.0 21 63.0 276.3 17.5
 B1= 5.01 HALL= 867. SUM POWER = 62.1
 I 17= 62.3 I 19= 54.0 I 21= 61.0
 +157 4.7 -157 2.1 +193 0.7 -193 2.8
 18 3.4 1132 1.1 19 3.4 1133 4.7
 110 3.6 1134 5.7 111 4.2 1135 5.1
 112 4.4 1136 5.4 113 2.1 1137 4.7
 114 5.4 1138 4.7 115 4.1 1139 3.9
 116 4.5 1140 4.9 117 5.9 1141 4.5
 118 7.0 1142 4.5 119 11.2 1143 5.1
 SUM 18-119 = 59.1 SUM 1132-1143 = 64.5
 MEAS 472 TIME 19.42.46 TIME (KC) = 0. 9.17.33
 POWER= 62.1 B-38= 791. BKC-141=1.81 BV-1= 1.89
 ALF= 0.93 BV-7= 39.99 B-6= 1.69 E-29= 2.148
 ALC= 0.91 B-7= 39.05 KC-24= 7.017 PR-41= 183.
 KCK-87= 0.24 B-34= 1.618 KC-64= 0.033 PR-40= 3.419
 TPL1= 0. TPL2= 0.
 KC-23= 1.572
 C1 1.133 C10 0.952 C16 0.950 D2 1.001
 C2 0.803 C11 1.062 C17 0.955 D3 0.979
 C3 0.693 C12 0.693 C18 0.947 T1 0.984
 C6 0.977 C13 0.825 C19 0.960 T2 0.974
 C8 0.950 C14 0.847 C20 0.938
 C9 0.928 C15 0.935 D1 0.972
 BKC-2= 160. BKC-24= 5.8 DQ1= 1.073 QKC= 12.889
 BQ-25= 258. BQ-43= 10.8 DQ2= 3.185 OTP= 8.323
 BQ-47= 227. BQ-44= 13.8 DQ3= 3.645

PUSK 3 -43- DATE 14/ 8/78

MEAS 473 TIME 19.43.20 TIME (KC) = 0. 9.18. 7
GR I U POWER GR I U POWER GR I U POWER
17 57.1 132.3 8.7 19 82.0 439.5 27.3 21 83.0 228.5 14.4
B1= 5.01 HALL= 580. SUM POWER = 50.4
I 17= 54.4 I 19= 53.7 I 21= 60.5
+157 0.8 -157 8.0 +193 0.3 -193 1.8
18 2.9 1132 0.0 19 2.9 1133 4.9
110 3.2 1134 5.8 111 3.6 1135 4.9
112 3.8 1136 5.3 113 1.8 1137 4.4
114 4.5 1139 4.4 115 3.3 1139 3.5
116 4.4 1140 4.9 117 5.0 1141 4.2
118 7.0 1142 4.4 119 8.8 1143 5.3
SUM 18-119 = 51.0 SUM 1132-1143 = 62.2

MEAS 473 TIME 19.43.20 TIME (KC) = 0. 9.18. 7
POWER= 50.4 B-38= 788. BKC-141=1.59 BV-1= 1.87
ALF= 0.92 BV-7= 39.99 B-6= 1.68 E-20= 2.109
ALC= 0.90 B-7= 39.05 KC-24= 7.017 PR-41= 183.
KCK-87= 0.24 B-34= 1.591 KC-64= 0.032 PR-40= 3.394
TPL1= 0. TPL2= 0.
KC-23= 1.555
C1 1.128 C10 0.952 C16 0.950 D2 1.001
C2 0.798 C11 1.062 C17 0.955 D3 0.981
C3 0.693 C12 0.691 C18 0.847 T1 0.984
C8 0.977 C13 0.828 C19 0.960 T2 0.974
C8 0.952 C14 0.847 C20 0.935
C9 0.928 C15 0.935 D1 0.972
BKC-2= 161. BKC-24= 5.7 DQ1= 1.069 QKC= 12.869
BG-25= 257. BG-43= 10.5 DQ2= 3.131 OTP= 8.304
BG-47= 225. BG-44= 13.6 DQ3= 3.570

PUSK 3 -42- DATE 14/ 8/78

MEAS 473 TIME 19.43.20 TIME (KC) = 0. 9.18. 7
K FI K FI K FI K FI K FI K FI K FI
0 -63.1 37 -714.8 74 -355.5 111 214.2 148 332.2 182 9.8
1 -133.7 38 -770.8 75 -323.9 112 214.2 149 371.1 185 7.8
2 -170.4 39 -743.1 76 -317.7 113 212.0 150 384.0 187 11.7
3 -223.6 40 -765.9 77 -313.5 114 225.6 151 357.2 188 2.6
4 -313.9 41 -735.2 78 -307.9 115 228.4 152 355.2 189 33.4
5 -359.9 42 -736.9 79 -302.7 116 234.9 153 383.0 190 0.3
6 -465.9 43 -721.6 80 -297.8 117 263.4 154 356.1 191 17.5
7 -542.3 44 -726.9 81 -271.2 118 306.3 155 356.1 192 26.1
8 -524.3 45 -695.6 82 -291.5 119 314.7 156 351.9 193 16.8
9 -30.5 46 -717.8 83 -251.9 120 325.8 157 331.9 194 12.9
10 -528.5 47 -621.6 84 -223.5 121 327.1 158 342.4 195 24.2
11 -546.0 48 -683.0 85 -199.3 122 346.5 159 337.5 196 14.4
12 -547.2 49 -682.5 86 -190.4 123 330.1 160 341.0 197 24.7
13 -552.5 50 -663.1 87 -147.5 124 302.0 161 326.3 198 11.2
14 -560.9 51 -643.5 88 -141.1 125 317.9 162 351.5 199 26.1
15 -570.4 52 -628.1 89 -102.7 126 341.3 163 302.0 200 7.1
16 -531.0 53 -601.0 90 -74.4 127 332.0 164 310.6 201 16.9
17 -427.6 54 -623.2 91 -79.0 128 339.5 165 299.7 202 18.7
18 -467.2 55 -590.3 92 -68.0 129 361.7 166 312.9 203 14.2
19 -534.3 56 -613.9 93 -33.5 130 363.1 167 291.2 204 18.7
20 -530.9 57 -584.7 94 -25.7 131 370.3 168 301.4 205 11.1
21 -570.9 58 -595.5 95 -8.4 132 369.0 169 318.1 206 17.4
22 -542.9 59 -549.4 96 0.6 133 366.4 170 198.7 207 9.7
23 -484.8 60 -545.7 97 5.0 134 353.4 171 0.0 208 10.9
24 -521.7 61 -543.4 98 39.8 135 364.8 172 18.6 209 11.1
25 -607.3 62 -533.2 99 101.3 136 356.4 173 -79.5 210 13.0
26 -510.2 63 -521.2 100 76.4 137 352.3 174 -37.8 211 14.5
27 -301.7 64 -522.9 101 98.6 138 358.2 175 11.0 212 8.9
28 -532.5 65 -508.9 102 122.7 139 324.6 176 9.4 213 7.5
29 -912.4 66 -495.0 103 169.4 140 349.1 177 15.3 214 -0.2
30 -644.0 67 -474.2 104 101.8 141 315.0 178 -0.3 215 0.0
31 -663.6 68 -433.5 105 114.1 142 335.7 179 35.1 216 -5.4
32 -659.1 69 -404.0 106 170.9 143 337.4 180 22.4 217 -5.3
33 -685.5 70 -399.8 107 173.1 144 334.7 181 25.4 218 13.5
34 -696.5 71 -382.1 108 191.4 145 337.0 182 9.0 219 1.4
35 -701.8 72 -375.2 109 184.2 146 337.3 183 10.7
36 -699.6 73 -362.8 110 217.9 147 344.5 184 5.0

MEAS 474 TIME 19.43.54 TIME (KC) = 0. 9.18.41
GR I U POWER GR I U POWER GR I U POWER
17 59.1 149.4 8.8 19 82.0 445.3 27.6 21 83.0 190.4 12.0
B1= 8.01 HALL= 531. SUM POWER = 48.4
I 17= 55.7 I 19= 54.0 I 21= 60.5
+157 1.5 -157 5.1 +193 0.7 -193 1.8
18 2.9 1132 0.0 19 3.1 1133 4.8
110 3.4 1134 5.8 111 3.7 1135 4.7
112 3.8 1136 5.4 113 1.8 1137 4.2
114 4.7 1138 4.3 115 3.6 1139 3.3
116 4.2 1140 4.9 117 5.3 1141 4.2
118 7.1 1142 4.4 119 9.2 1143 5.5
SUM 18-119 = 52.7 SUM 1132-1143 = 51.4

MEAS 474 TIME 19.43.54 TIME (KC) = 0. 9.18.41
POWER= 48.4 B-38= 788. BKC-141=1.66 BV-1= 1.81
ALF= 0.92 BV-7= 39.99 B-6= 1.64 E-20= 2.107
ALC= 0.90 B-7= 39.05 KC-24= 7.017 PR-41= 184.
KCK-87= 0.23 B-34= 1.574 KC-64= 0.031 PR-40= 3.394
TPL1= 0. TPL2= 0.
KC-23= 1.533
C1 1.126 C10 0.955 C18 0.950 D2 0.999
C2 0.793 C11 1.062 C17 0.955 D3 0.979
C3 0.866 C12 0.891 C18 0.947 T1 0.981
C8 0.977 C13 0.830 C19 0.960 T2 0.974
C8 0.950 C14 0.847 C20 0.938
C9 0.930 C15 0.935 D1 0.972
BKC-2= 161. BKC-24= 5.7 DQ1= 1.074 QKC= 12.451
BG-25= 257. BG-43= 10.3 DQ2= 3.088 OTP= 8.624
BG-47= 226. BG-44= 13.4 DQ3= 3.524

MEAS 474 TIME 19.43.54 TIME (KC) = 0. 9.18.41
K FI K FI K FI K FI K FI K FI K FI
0 -43.7 37 -601.2 74 -349.3 111 72.4 148 260.2 185 5.2
1 -98.5 38 -572.3 75 -351.0 112 102.8 149 249.0 186 1.8
2 -127.3 39 -594.4 76 -348.9 113 117.7 150 252.5 187 10.6
3 -159.4 40 -591.9 77 -327.8 114 107.9 151 250.2 188 0.4
4 -198.5 41 -609.7 78 -338.3 115 131.0 152 252.5 189 30.5
5 -269.0 42 -626.3 79 -314.2 116 118.6 153 266.6 190 0.2
6 -316.9 43 -580.4 80 -285.2 117 127.9 154 258.1 191 12.8
7 -351.2 44 -609.3 81 -280.5 118 137.6 155 271.6 192 21.3
8 -355.6 45 -609.8 82 -250.1 119 147.5 156 267.7 193 18.1
9 -192.0 46 -622.0 83 -235.5 120 160.7 157 254.1 194 11.5
10 -332.5 47 -575.0 84 -248.0 121 163.5 158 254.8 195 23.3
11 -369.6 48 -585.1 85 -217.5 122 166.6 159 251.2 196 14.3
12 -367.0 49 -590.3 86 -208.8 123 182.0 160 248.1 197 22.3
13 -376.4 50 -597.9 87 -196.1 124 197.2 161 255.9 198 9.1
14 -366.2 51 -583.5 88 -185.4 125 215.3 162 216.9 189 23.5
15 -407.9 52 -581.3 89 -165.4 126 226.4 163 236.4 200 7.3
16 -379.1 53 -565.4 90 -157.3 127 221.9 164 230.0 201 16.3
17 -347.9 54 -566.0 91 -136.2 128 232.0 165 217.8 202 16.2
18 -314.4 55 -526.2 92 -122.0 129 223.5 166 223.1 203 13.0
19 -330.5 56 -542.9 93 -104.0 130 232.1 167 229.3 204 18.7
20 -331.0 57 -523.8 94 -81.0 131 244.0 168 214.3 205 10.5
21 -333.0 58 -530.4 95 -82.8 132 -216.5 169 206.3 206 14.4
22 -363.5 59 -533.2 96 -64.7 133 256.1 170 143.0 207 9.7
23 -370.9 60 -493.2 97 -48.8 134 270.2 171 -0.1 208 12.0
24 -374.2 61 -487.4 98 -38.3 135 243.3 172 17.8 209 8.0
25 -706.7 62 -474.5 99 -26.8 136 236.0 173 -89.5 210 15.5
26 -395.8 63 -456.5 100 -1.8 137 262.9 174 -34.9 211 18.0
27 -197.2 64 -449.9 101 5.7 138 248.5 175 15.9 212 8.4
28 -376.5 65 -449.5 102 5.7 139 245.7 176 15.3 213 5.4
29 -669.1 66 -443.3 103 6.9 140 285.1 177 23.9 214 -0.2
30 -512.3 67 -409.9 104 9.8 141 253.9 178 5.0 215 0.0
31 -498.0 68 -415.6 105 3.4 142 249.1 179 17.1 216 -8.9
32 -503.2 69 -395.0 106 32.7 143 263.0 180 12.2 217 -7.4
33 -504.6 70 -366.8 107 50.0 144 258.8 181 23.9 218 15.0
34 -546.9 71 -395.4 108 57.9 145 243.9 182 6.4 219 2.0
35 -613.8 72 -373.9 109 68.2 146 249.3 183 6.7
36 -502.5 73 -357.8 110 86.2 147 259.4 184 2.7

PUSK 3 DATE 14/ 8/78

MEAS 475 TIME 19.44.26 TIME (KC) = 0. 9.19.13
 GR 1 U POWER GR 1 U POWER GR 1 U POWER
 17 58.6 149.4 5.8 19 62.0 430.7 26.7 21 82.5 184.0 11.5
 B1= 5.00 HALL= 527. SUM POWER = 47.0
 I 17= 55.4 I 19= 54.0 I 21= 80.3
 +157 1.2 -157 5.3 +193 0.7 -193 1.8
 18 3.1 1132 0.0 19 3.1 1133 4.9
 110 3.3 1134 5.7 111 3.8 1135 4.9
 112 4.0 1136 5.3 113 1.8 1137 4.2
 114 4.7 1138 4.3 115 3.4 1139 3.4
 116 4.2 1140 4.8 117 5.2 1141 4.2
 118 6.6 1142 4.3 119 9.2 1143 5.3
 SUM 18-119 = 52.1 SUM 1132-1143 = 51.4

MEAS 475 TIME 19.44.26 TIME (KC) = 0. 9.19.13
 POWER= 47.0 B-38= 787. BKC-141=1.58 BV-1= 1.78
 ALF= 0.90 BV-7= 39.99 E-6= 1.63 E-29= 2.070
 ALC= 0.88 B-7= 39.05 KC-24= 7.011 PR-41= 185.
 KCK-87= 0.23 B-34= 1.559 KC-64= 0.030 PR-40= 3.344
 TPL1= 0. TPL2= 0.
 KC-23= 1.520 C10 0.955 C16 0.947 D2 0.999
 C1 1.123 C11 1.062 C17 0.955 D3 0.979
 C2 0.789 C12 0.691 C18 0.947 T1 0.984
 C3 0.698 C13 0.830 C19 0.960 T2 0.974
 C6 0.977 C14 0.847 C20 0.935
 C8 0.952 C15 0.935 D1 0.974
 C9 0.930 BKC-24= 5.6 DQ1= 1.053 QKC= 12.408
 BKC-2= 161. BG-43= 10.3 DQ2= 3.094 OTP= 8.489
 BG-25= 259. BG-44= 13.6 DQ3= 3.580
 BG-47= 226.

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MEAS 475 TIME 10.44.26 TIME (KC) = 0. 6.19.15
 K FI K FI K FI K FI K FI K FI
 0 -40.2 37 -373.0 74 -341.0 111 110.8 148 213.7 185 7.3
 1 -56.9 38 -385.2 75 -326.5 112 128.8 149 210.0 196 1.1
 2 -116.8 39 -378.8 76 -354.2 113 137.4 150 214.5 187 7.5
 3 -153.9 40 -603.4 77 -322.2 114 133.4 151 217.4 188 0.8
 4 -193.7 41 -364.5 78 -327.7 115 150.4 152 201.2 189 26.5
 5 -235.4 42 -383.8 79 -270.2 116 151.3 153 227.8 190 0.1
 6 -305.1 43 -607.7 80 -296.4 117 153.2 154 223.7 191 12.2
 7 -348.6 44 -536.2 81 -258.6 118 169.0 155 220.5 192 19.2
 8 -344.0 45 -591.0 82 -273.0 119 173.6 156 224.9 193 15.4
 9 -201.4 46 -537.9 83 -248.6 120 170.8 157 211.7 194 10.9
 10 -342.6 47 -533.4 84 -243.5 121 178.6 158 205.5 195 21.5
 11 -352.1 48 -526.3 85 -218.4 122 192.1 159 202.4 196 11.8
 12 -365.9 49 -551.3 86 -205.2 123 185.9 160 216.6 197 21.8
 13 -338.8 50 -526.5 87 -171.7 124 194.3 161 202.0 198 10.3
 14 -363.6 51 -528.7 88 -156.8 125 196.2 162 215.3 199 24.1
 15 -342.4 52 -536.5 89 -163.3 126 214.0 163 205.4 200 4.9
 16 -335.8 53 -554.7 90 -161.1 127 202.5 164 201.9 201 16.7
 17 -341.5 54 -508.9 91 -123.4 128 200.7 165 206.5 202 18.9
 18 -335.6 55 -495.8 92 -121.4 129 204.9 166 189.7 203 11.6
 19 -353.8 56 -480.8 93 -93.2 130 220.1 167 189.1 204 18.4
 20 -353.0 57 -462.6 94 -93.8 131 215.1 168 181.3 205 10.9
 21 -322.5 58 -503.7 95 -65.0 132 225.2 169 183.2 206 14.9
 22 -333.4 59 -483.8 96 -62.1 133 227.2 170 133.5 207 9.2
 23 -319.0 60 -467.5 97 -41.5 134 226.0 171 0.4 208 11.3
 24 -340.6 61 -451.4 98 -30.5 135 225.7 172 21.1 209 9.1
 25 -167.1 62 -444.1 99 10.9 136 222.8 173 -93.2 210 14.0
 26 -341.7 63 -428.9 100 -10.5 137 226.9 174 -30.2 211 16.0
 27 -430.0 64 -420.1 101 9.3 138 231.9 175 7.0 212 5.6
 28 -334.0 65 -422.5 102 23.8 139 220.6 176 10.9 213 6.7
 29 -106.7 66 -419.7 103 32.2 140 234.8 177 20.3 214 -0.2
 30 -447.2 67 -394.8 104 32.4 141 209.8 178 -5.5 215 0.0
 31 -497.0 68 -367.1 105 54.5 142 209.3 179 10.1 216 -7.3
 32 -491.3 69 -342.4 106 60.0 143 209.9 180 16.1 217 -8.2
 33 -500.8 70 -359.0 107 76.0 144 201.6 181 15.4 218 15.0
 34 -494.6 71 -345.9 108 69.0 145 218.5 182 4.3 219 1.8
 35 -541.1 72 -377.1 109 91.4 146 223.1 183 3.4
 36 -528.3 73 -337.0 110 100.0 147 209.4 184 2.3

MEAS 476 TIME 19.45. 1 TIME (KC) = 0. 9.19.48
 GR 1 U POWER GR 1 U POWER GR 1 U POWER
 17 88.4 143.8 9.5 19 62.0 483.4 30.0 21 82.5 184.1 10.3
 B1= 5.01 HALL= 588. SUM POWER = 49.8
 I 17= 64.0 I 19= 54.4 I 21= 80.3
 +157 5.2 -157 1.4 +193 1.2 -193 1.6
 18 3.6 1132 0.4 19 3.7 1133 5.1
 110 3.8 1134 5.7 111 4.3 1135 4.9
 112 4.4 1136 5.3 113 1.9 1137 4.2
 114 5.1 1138 4.3 115 4.0 1139 3.4
 116 4.6 1140 4.6 117 6.0 1141 4.1
 118 7.3 1142 4.1 119 11.8 1143 5.1
 SUM 18-119 = 60.5 SUM 1132-1143 = 61.3

MEAS 476 TIME 19.45. 1 TIME (KC) = 0. 9.19.48
 POWER= 49.8 B-38= 787. BKC-141=1.53 BV-1= 1.75
 ALF= 0.89 BV-7= 39.99 E-6= 1.61 E-29= 2.040
 ALC= 0.87 B-7= 39.05 KC-24= 7.011 PR-41= 183.
 KCK-87= 0.23 B-34= 1.542 KC-64= 0.031 PR-40= 3.344
 TPL1= 0. TPL2= 0.
 KC-23= 1.501 C10 0.955 C16 0.950 D2 1.001
 C1 1.118 C11 1.062 C17 0.955 D3 0.981
 C2 0.781 C12 0.691 C18 0.947 T1 0.984
 C3 0.701 C13 0.833 C19 0.982 T2 0.977
 C6 0.977 C14 0.847 C20 0.935
 C8 0.952 C15 0.935 D1 0.972
 C9 0.930 BKC-24= 5.6 DQ1= 1.057 QKC= 12.384
 BKC-2= 161. BG-43= 10.2 DQ2= 3.047 OTP= 8.534
 BG-25= 258. BG-44= 13.4 DQ3= 3.563
 BG-47= 226.

MEAS 476 TIME 19.45. 1 TIME (KC) = 0. 9.19.48
 K FI K FI K FI K FI K FI K FI
 0 -39.3 37 -548.2 74 -335.4 111 97.9 148 189.6 185 4.1
 1 -83.1 38 -573.5 75 -337.6 112 113.0 149 197.9 186 0.8
 2 -104.8 39 -527.8 76 -332.8 113 123.4 150 191.1 187 7.7
 3 -150.7 40 -520.0 77 -327.8 114 123.1 151 188.4 188 0.7
 4 -186.5 41 -539.0 78 -340.4 115 128.6 152 189.1 189 24.2
 5 -223.8 42 -541.4 79 -294.4 116 144.5 153 217.2 190 0.2
 6 -294.6 43 -544.1 80 -277.3 117 148.6 154 221.5 191 11.2
 7 -353.1 44 -543.3 81 -265.5 118 148.6 155 216.0 192 18.2
 8 -307.4 45 -534.3 82 -262.6 119 157.0 156 206.8 193 14.4
 9 -448.6 46 -529.0 83 -234.8 120 168.5 157 205.0 194 10.9
 10 -309.3 47 -528.4 84 -244.2 121 165.5 158 200.9 195 20.7
 11 -302.5 48 -505.9 85 -210.2 122 177.3 159 198.1 196 10.4
 12 -328.1 49 -549.9 86 -181.4 123 185.2 160 180.0 197 21.9
 13 -314.1 50 -555.7 87 -176.7 124 190.5 161 191.8 198 9.4
 14 -350.1 51 -503.4 88 -165.5 125 177.6 162 190.0 199 22.1
 15 -341.0 52 -574.0 89 -142.2 126 192.7 163 191.7 200 5.2
 16 -305.8 53 -499.3 90 -141.3 127 207.0 164 192.6 201 14.5
 17 -318.9 54 -519.7 91 -126.0 128 211.6 165 202.9 202 15.7
 18 -321.9 55 -525.1 92 -122.7 129 218.6 166 193.0 203 10.9
 19 -323.2 56 -563.5 93 -95.6 130 221.5 167 152.2 204 17.5
 20 -339.2 57 -545.8 94 -86.1 131 223.3 168 188.4 205 10.0
 21 -300.9 58 -537.4 95 -76.8 132 212.4 169 186.2 206 15.5
 22 -339.8 59 -476.3 96 -59.6 133 196.3 170 116.9 207 8.0
 23 -342.2 60 -475.3 97 -50.7 134 204.1 171 0.4 208 10.6
 24 -320.3 61 -489.5 98 -36.9 135 218.9 172 23.6 209 7.3
 25 -155.6 62 -467.1 99 -9.3 136 226.8 173 -76.4 210 14.1
 26 -315.6 63 -450.7 100 -33.7 137 213.6 174 -38.8 211 18.2
 27 -554.3 64 -428.0 101 0.9 138 207.7 175 10.3 212 5.3
 28 -346.8 65 -433.0 102 4.3 139 211.7 176 6.8 213 4.5
 29 -25.5 66 -406.4 103 24.2 140 206.1 177 20.2 214 -0.2
 30 -468.3 67 -398.2 104 13.8 141 202.0 178 -4.5 215 0.0
 31 -489.2 68 -368.8 105 32.2 142 195.3 179 8.7 216 -7.7
 32 -489.1 69 -361.2 106 48.1 143 203.6 180 11.6 217 -7.5
 33 -511.5 70 -364.7 107 45.2 144 208.4 181 18.5 218 13.7
 34 -486.5 71 -341.1 108 56.2 145 188.4 182 3.3 219 1.8
 35 -508.7 72 -342.7 109 70.2 146 186.3 183 2.6
 36 -499.5 73 -324.3 110 64.1 147 191.5 184 1.4

PUSK 3 -70- DATE 14/ 6/78

MEAS 488 TIME 19.51. 0 TIME (KC) = 0. 9.25.47

POWER= 18.9	B-38= 781.	BKC-141=1.38	DV-1= 1.59
ALF= 1.13	BV-7= 39.99	B-6= 1.47	E-29= 1.824
ALC= 1.11	B-7= 39.05	KC-24= 7.011	PR-41= 183.
KCK-87= 0.16	B-34= 1.379	KC-64= 0.027	PR-40= 3.145
TPL1= 0.	TPL2= 0.		
KC-23= 1.544			
C1 1.062	C10 0.960	C16 0.950	D2 1.001
C2 0.754	C11 1.057	C17 0.955	D3 0.981
C3 0.746	C12 0.691	C18 0.947	T1 0.984
C6 0.674	C13 0.847	C19 0.967	T2 0.974
C8 0.952	C14 0.847	C20 0.935	
C9 0.638	C15 0.935	D1 0.977	

MEAS 489 TIME 19.51. 3 TIME (KC) = 0. 9.25.50

DR 1 U POWER GR I U POWER GR I U POWER								
17 50.3 143.6	7.2 19 63.0	120.1 7.6 21 62.5	23.4 1.5					
B1= 5.00	HALL= 140.	SUM POWER =	16.3					
I 17= 47.1	I 19= 54.0	I 21= 60.3						
+157 0.0	-157 13.3	+193 0.9	-193 1.0					
18 2.4	1132 0.0	19 2.2	1133 5.3					
110 2.4	1134 6.0	111 2.9	1135 4.6					
112 2.9	1136 5.1	113 1.2	1137 4.1					
114 4.4	1138 3.8	115 3.4	1139 2.8					
116 3.9	1140 4.3	117 4.2	1141 3.5					
118 5.9	1142 3.7	119 8.5	1143 5.2					
SUM 18-119 =	44.4	SUM 1132-1143 =	48.6					

MEAS 489 TIME 19.51. 3 TIME (KC) = 0. 9.25.50

POWER= 16.3	B-38= 780.	BKC-141=1.38	BV-1= 1.54
ALF= 1.10	BV-7= 39.99	B-6= 1.47	E-29= 1.845
ALC= 1.07	B-7= 39.05	KC-24= 7.017	PR-41= 183.
KCK-87= 0.16	B-34= 1.382	KC-64= 0.027	PR-40= 3.170
TPL1= 0.	TPL2= 0.		
KC-23= 1.344			
C1 1.062	C10 0.960	C16 0.950	D2 1.001
C2 0.752	C11 1.055	C17 0.955	D3 0.979
C3 0.745	C12 0.693	C18 0.947	T1 0.984
C6 0.917	C13 0.847	C19 0.967	T2 0.974
C8 0.955	C14 0.847	C20 0.938	
C9 0.958	C15 0.935	D1 0.977	
BKC-2= 161.	BKC-24= 5.3	DO1= 0.983	QKC= 9.049
BG-25= 258.	BG-43= 9.4	DO2= 2.818	OTP= 10.962
BG-47= 223.	BG-44= 12.4	DO3= 3.246	

MEAS 489 TIME 19.51. 3 TIME (KC) = 0. 9.25.50

K FI	K FI	K FI	K FI	K FI	K FI	K FI	K FI
0 -8.0 37 -230.6 74 -142.8 111 64.2 148 28.8 183 -3.2							
1 -13.1 38 -199.4 75 -139.4 112 59.8 149 29.2 186 -3.8							
2 -19.5 39 -194.3 76 -138.2 113 63.9 150 15.1 187 -2.7							
3 -26.4 40 -225.8 77 -149.2 114 73.3 151 14.5 188 -0.3							
4 -33.9 41 -234.5 78 -145.4 115 63.9 152 16.2 189 9.2							
5 -25.0 42 -226.8 79 -111.2 116 65.4 153 42.4 190 0.0							
6 -37.9 43 -211.4 80 -121.6 117 69.1 154 40.0 191 2.9							
7 -69.6 44 -210.7 81 -117.9 118 58.7 155 34.9 192 6.4							
8 -74.2 45 -228.1 82 -104.7 119 78.8 158 33.6 193 5.7							
9 -140.2 46 -214.9 83 -113.3 120 97.9 157 31.3 194 2.8							
10 -60.6 47 -235.0 84 -107.3 121 85.7 158 35.5 195 12.4							
11 -88.3 48 -226.3 85 -91.6 122 91.2 159 34.7 196 4.8							
12 -79.3 49 -216.4 86 -94.2 123 96.7 160 36.1 197 12.4							
13 -68.5 50 -203.2 87 -85.6 124 95.3 161 38.0 198 5.0							
14 -84.6 51 -221.0 88 -86.5 125 81.9 162 34.1 199 10.1							
15 -72.6 52 -217.7 89 -86.4 126 84.3 163 21.1 200 1.7							
16 -53.7 53 -232.0 90 -88.6 127 92.4 164 31.2 201 16.4							
17 -46.9 54 -248.7 91 -54.9 128 86.4 165 25.5 202 5.5							
18 -48.4 55 -226.6 92 -64.7 129 67.1 160 17.6 203 6.2							
19 -42.6 56 -237.7 93 -53.8 130 74.7 167 16.3 204 11.5							
20 -40.3 57 -229.7 94 -43.9 131 83.0 168 17.6 205 5.0							
21 -54.4 58 -228.7 95 -54.2 132 65.5 169 18.8 206 6.5							
22 -58.2 59 -241.1 96 -43.5 133 89.5 170 4.2 207 4.1							
23 -16.9 60 -234.0 97 -46.9 134 84.1 171 0.4 208 2.7							
24 -50.0 61 -247.3 98 -46.6 135 76.6 172 26.2 209 4.1							
25 35.8 62 -200.7 99 -25.7 136 65.3 173 -55.7 210 0.1							
26 -57.0 63 -187.7 100 8.2 137 73.9 174 -34.1 211 12.5							
27 -150.1 64 -198.5 101 9.2 138 56.4 175 9.0 212 3.5							
28 -39.8 65 -192.1 102 15.6 139 56.2 176 3.3 213 1.6							
29 -451.5 66 -174.2 103 22.8 140 39.0 177 43.9 214 -0.2							
30 -117.7 67 -178.8 104 30.4 141 31.9 178 -37.8 215 0.0							
31 -138.3 68 -172.1 105 36.6 142 26.4 179 0.6 216 -12.9							
32 -161.4 69 -161.3 106 47.1 143 27.3 180 0.2 217 -10.0							
33 -164.3 70 -187.9 107 37.1 144 28.3 181 3.3 218 14.4							
34 -192.7 71 -162.1 108 55.4 145 18.9 182 -3.1 219 3.1							
35 -183.5 72 -160.3 109 68.2 146 25.1 183 -2.2							
36 -178.4 73 -158.0 110 63.1 147 38.1 184 -1.1							

PUSK 3 -73- DATE 14/ 6/78

MEAS	490	TIME 19.51.23	TIME (KC) =	0. 9.26.10			
POWER=	17.3	B-38=	780.	BKC-141=1.37	BV-1=	1.54	
ALF=	0.90	BV-7=	39.94	B-6=	1.46	E-29=	1.829
ALC=	0.88	B-7=	39.05	KC-24=	7.011	PR-41=	183.
KCK-87=	0.20	B-34=	1.372	KC-64=	0.026	PR-40=	3.143
TPL1=	2092.	TPL2=	0.				
KC-23=	1.337						
C1	1.057	C10	0.960	C16	0.950	D2	1.001
C2	0.752	C11	1.055	C17	0.955	D3	0.979
C3	0.747	C12	0.691	C18	0.947	T1	0.984
C6	0.974	C13	0.847	C19	0.967	T2	0.974
C8	0.952	C14	0.847	C20	0.935		
C9	0.938	C15	0.935	D1	0.977		

MEAS	491	TIME 19.51.47	TIME (KC) =	0. 9.26.34							
GR 1	U	POWER GR 1	U	POWER GR 1	U	POWER					
17	49.3	140.8	0.9	19	63.0	102.5	6.5	21	63.0	53.7	3.5
B1=	5.01	HALL=	141.	SUM POWER =	18.9						
I 17=	48.6	I 19=	34.7	I 21=	60.3						
+157	0.0	-157	13.4	+193	0.7	-193	1.0				
18	2.4	1132	0.0	19	2.3	1133	5.8				
110	2.4	1134	6.0	111	2.8	1135	4.6				
112	2.9	1136	5.0	113	0.9	1137	4.0				
114	4.2	1138	3.8	115	3.5	1139	2.9				
116	3.6	1140	4.3	117	4.2	1141	3.5				
118	5.8	1142	3.7	119	8.6	1143	5.0				
SUM 18-119 =	43.8	SUM 1132-1143 =	48.4								

MEAS	491	TIME 19.51.47	TIME (KC) =	0. 9.26.34			
POWER=	16.9	B-38=	780.	BKC-141=1.36	BV-1=	1.50	
ALF=	0.88	BV-7=	39.94	B-6=	1.46	E-29=	1.798
ALC=	0.86	B-7=	39.05	KC-24=	7.011	PR-41=	183.
KCK-87=	0.20	B-34=	1.365	KC-64=	0.027	PR-40=	3.143
TPL1=	2594.	TPL2=	0.				
KC-23=	1.329						
C1	1.055	C10	0.962	C16	0.950	D2	0.999
C2	0.752	C11	1.055	C17	0.955	D3	0.981
C3	0.747	C12	0.691	C18	0.947	T1	0.984
C6	0.977	C13	0.850	C19	0.967	T2	0.974
C8	0.953	C14	0.847	C20	0.935		
C9	0.938	C15	0.935	D1	0.977		
BKC-2=	160.	BKC-24=	5.2	DQ1=	0.971	QKC=	10.709
BQ-25=	238.	BQ-43=	9.3	DQ2=	2.775	QTP=	9.070
BQ-47=	230.	BQ-44=	12.4	DQ3=	3.320		

MEAS	491	TIME 19.51.47	TIME (KC) =	0. 9.26.34							
K	F1	K	F1	K	F1	K	F1	K	F1	K	F1
0	-1.0	37	-162.7	74	-118.8	111	83.4	148	22.5	185	-5.4
1	-4.9	38	-172.6	75	-117.1	112	77.4	149	19.7	186	-3.3
2	-9.2	39	-170.3	76	-129.5	113	76.8	150	23.7	187	-1.9
3	-3.5	40	-161.2	77	-141.8	114	77.8	151	13.1	188	-0.2
4	-5.0	41	-174.8	78	-137.2	115	69.8	152	10.5	189	9.4
5	-5.4	42	-166.4	79	-131.9	116	69.0	153	24.0	190	0.0
6	-1.6	43	-173.4	80	-122.3	117	74.6	154	38.2	191	2.5
7	-17.6	44	-177.0	81	-118.7	118	76.9	155	42.2	192	5.9
8	-6.1	45	-187.6	82	-105.2	119	76.6	156	31.4	193	6.2
9	-57.7	46	-174.6	83	-92.5	120	87.6	157	21.5	194	1.8
10	-0.9	47	-141.7	84	-87.1	121	78.3	158	23.6	195	12.3
11	-6.3	48	-159.0	85	-95.3	122	78.7	159	22.3	196	5.9
12	-28.8	49	-160.5	86	-89.1	123	73.9	160	34.1	197	13.9
13	-7.5	50	-177.8	87	-71.1	124	65.2	161	32.7	198	5.0
14	-33.3	51	-174.8	88	-62.1	125	88.3	162	25.8	199	7.8
15	-21.8	52	-195.0	89	-59.2	126	69.3	163	38.5	200	1.9
16	-25.4	53	-154.9	90	-44.3	127	73.8	164	24.2	201	11.1
17	-3.7	54	-157.3	91	-43.9	128	74.9	165	19.9	202	5.8
18	-14.3	55	-141.3	92	-38.2	129	85.1	166	13.4	203	7.2
19	0.0	56	-159.4	93	-44.6	130	80.4	167	15.1	204	10.4
20	17.7	57	-145.0	94	-36.7	131	65.8	168	9.3	205	5.5
21	0.0	58	-154.3	95	-34.7	132	77.5	169	13.9	206	6.6
22	13.1	59	-153.3	96	-36.7	133	72.8	170	5.2	207	3.5
23	12.5	60	-137.3	97	-18.7	134	59.6	171	0.3	208	2.7
24	10.2	61	-147.0	98	-15.1	135	58.7	172	22.3	209	4.0
25	-192.3	62	-133.9	99	-5.6	136	60.8	173	-52.5	210	3.7
26	12.3	63	-131.4	100	-8.8	137	62.8	174	-35.5	211	12.2
27	145.4	64	-111.8	101	2.5	138	62.9	175	6.5	212	2.2
28	11.4	65	-119.2	102	21.5	139	46.1	176	4.0	213	1.6
29	258.8	66	-89.2	103	17.6	140	23.1	177	39.2	214	-0.2
30	-90.3	67	-133.5	104	30.1	141	12.0	178	-65.9	215	0.0
31	-89.6	68	-126.3	105	34.1	142	15.2	179	2.8	216	-11.0
32	-104.4	69	-112.5	106	40.1	143	22.3	180	0.0	217	-16.6
33	-134.3	70	-115.5	107	55.1	144	23.3	181	1.2	218	15.2
34	-117.4	71	-100.3	108	41.0	145	20.7	182	-2.9	219	3.1
35	-117.0	72	-110.2	109	66.7	146	24.5	183	-2.8		
36	-110.6	73	-109.8	110	62.0	147	30.0	184	-1.1		

PUSK 3 -79- DATE 14/ 6/78

MEAS 493 TIME 19.53.13 TIME (KC) = 0. 9.28. 0
GR I U POWER GR I U POWER GR I U POWER
17 50.3 145.5 7.4 19 82.0 79.1 4.9 21 82.0 114.3 7.1
B1= 5.00 HALL= 211. SUM POWER = 19.4
I 17= 47.1 I 19= 54.0 I 21= 59.8
+157 0.0 -157 12.5 +193 0.6 -193 0.8
18 2.4 1132 0.0 19 2.3 1133 5.0
110 2.5 1134 5.9 111 3.1 1135 4.3
112 2.7 1136 4.8 113 0.7 1137 3.9
114 4.1 1138 3.7 115 3.7 1139 2.8
116 3.7 1140 4.2 117 4.2 1141 3.3
118 6.1 1142 3.5 119 8.2 1143 5.1
SUM 18-119 = 43.7 SUM 1132-1143 = 47.7

MEAS 493 TIME 19.53.13 TIME (KC) = 0. 9.28. 0
POWER= 19.4 B-38= 779. BKC-141= 1.33 BV-1= 1.48
ALF= 0.86 BV-7= 39.94 B-6= 1.43 E-29= 1.745
ALC= 0.85 B-7= 39.05 KC-24= 7.017 PR-41= 183.
KCK-87= 0.19 B-34= 1.337 KC-64= 0.025 PR-40= 3.145
TPL1= 2608. TPL2= 0.
KC-23= 1.305
C1 1.043 C10 0.062 C16 0.947 D2 0.699
C2 0.754 C11 1.052 C17 0.955 D3 0.979
C3 0.754 C12 0.691 C18 0.950 T1 0.994
C6 0.574 C13 0.852 C19 0.967 T2 0.977
C8 0.955 C14 0.850 C20 0.935
C9 0.838 C15 0.935 D1 0.977
BKC-2= 160. BKC-24= 5.2 OKC= 10.542
BQ-25= 258. BG-43= 9.1 DO2= 2.725 OTP= 9.131
BQ-47= 228. BQ-44= 11.8 DO3= 3.122

PUSK 3 -78- DATE 14/ 6/78

MEAS 493 TIME 19.53.13 TIME (KC) = 0. 9.28. 0
K FI K FI K FI K FI K FI K FI K FI K FI
0 3.2 37 -85.5 74 -92.8 111 51.4 148 -33.8 185 -5.0
1 5.0 38 -113.4 75 -85.9 112 52.9 149 -29.4 196 -2.0
2 10.2 39 -108.8 76 -93.2 113 55.1 150 -26.2 187 -1.0
3 8.8 40 -117.0 77 -88.0 114 60.5 151 3.2 188 -0.1
4 16.9 41 -137.0 78 -100.8 115 79.8 152 -4.8 189 7.6
5 18.7 42 -102.1 79 -80.0 116 57.1 153 8.4 190 0.0
6 19.5 43 -109.0 80 -88.1 117 73.2 154 16.1 191 3.3
7 20.3 44 -111.0 81 -84.4 118 56.0 155 17.2 192 8.7
8 13.2 45 -138.0 82 -86.3 119 50.1 156 19.9 193 1.4
9 94.1 46 -111.4 83 -87.7 120 54.9 157 9.5 194 2.3
10 38.9 47 -101.4 84 -85.3 121 51.2 158 13.4 195 8.7
11 37.7 48 -129.6 85 -72.6 122 50.8 159 18.5 196 2.1
12 37.0 49 -109.6 86 -72.0 123 59.3 160 9.8 197 11.7
13 11.5 50 -130.8 87 -53.5 124 62.8 161 -0.6 198 3.9
14 18.0 51 -135.6 88 -44.7 125 51.1 162 5.2 199 8.4
15 15.5 52 -100.8 89 -40.6 126 52.9 163 7.6 200 1.2
16 35.5 53 -103.8 90 -32.1 127 50.0 164 -6.6 201 6.7
17 50.7 54 -109.6 91 -18.8 128 59.3 165 0.6 202 1.9
18 36.9 55 -133.6 92 -17.8 129 60.3 166 0.8 203 7.6
19 54.9 56 -134.2 93 -13.8 130 57.5 167 4.7 204 8.2
20 45.0 57 -102.0 94 -12.9 131 60.0 168 -7.2 205 4.1
21 48.0 58 -115.7 95 -6.1 132 54.6 169 -1.4 206 6.8
22 47.3 59 -87.1 96 -0.3 133 48.9 170 -1.8 207 2.2
23 39.5 60 -99.5 97 -8.7 134 34.9 171 1.0 208 1.7
24 41.0 61 -94.7 98 7.5 135 40.8 172 27.9 209 4.1
25 43.1 62 -101.4 99 10.3 136 31.0 173 -53.5 210 5.9
26 32.1 63 -100.6 100 11.2 137 32.5 174 -36.7 211 3.9
27 193.2 64 -78.0 101 12.8 138 22.2 175 5.1 212 3.4
28 58.6 65 -85.3 102 14.0 139 19.2 176 0.8 213 1.6
29 -302.5 66 -29.1 103 24.3 140 3.0 177 36.0 214 -0.2
30 -70.1 57 -78.5 104 28.2 141 -13.7 178 -47.8 215 0.0
31 -76.0 68 -74.9 105 16.8 142 -17.9 179 3.3 216 -11.7
32 -60.1 89 -80.3 106 31.5 143 -7.4 180 -0.2 217 -18.6
33 -87.1 70 -74.2 107 42.7 144 -4.9 181 2.5 218 15.9
34 -82.7 71 -77.9 108 41.3 145 -8.8 182 2.8 219 3.5
35 -101.9 72 -71.3 109 44.2 146 -20.2 183 -2.7
36 -77.3 73 -71.3 110 50.0 147 -14.1 184 -2.0

MEAS 498 TIME 19.57.17 TIME (KC) = 0. 9.32. 4
GR I U POWER GR I U POWER GR I U POWER
17 41.5 143.0 6.0 19 80.1 85.0 5.1 21 54.2 117.2 6.4
B1= 5.01 HALL= 346. SUM POWER = 17.4
I 17= 38.8 I 19= 51.8 I 21= 51.5
+157 0.0 -157 18.7 +193 5.5 -193 0.0
18 1.9 1132 0.0 19 2.1 1133 6.0
110 1.8 1134 5.3 111 2.3 1135 3.8
112 2.6 1136 3.9 113 0.0 1137 3.2
114 3.5 1138 3.0 115 2.8 1139 2.2
116 3.2 1140 3.4 117 3.2 1141 2.8
118 4.9 1142 2.9 119 7.0 1143 4.7
SUM 18-119 = 35.3 SUM 1132-1143 = 41.2
MEAS 498 TIME 19.57.17 TIME (KC) = 0. 9.32. 4
POWER= 17.4 B-38= 778. BKC-141= 1.28 BV-1= 1.40
ALF= 0.91 BV-7= 40.04 B-6= 1.40 E-29= 1.627
ALC= 0.89 B-7= 39.12 KC-24= 7.017 PR-41= 182.
KCK-87= 0.18 B-34= 1.273 KC-64= 0.024 PR-40= 3.145
TPL1= 2692. TPL2= 0.
KC-23= 1.246
C1 1.011 C10 0.967 C15 0.950 D2 0.959
C2 0.762 C11 1.047 C17 0.955 D3 0.979
C3 0.772 C12 0.693 C18 0.950 T1 0.984
C6 0.974 C13 0.862 C19 0.969 T2 0.974
C8 0.957 C14 0.850 C20 0.938
C9 0.945 C15 0.935 D1 0.979
BKC-2= 160. BKC-24= 4.9 OKC= 9.677
BQ-25= 259. BG-43= 8.6 DO2= 2.599 OTP= 9.505
BQ-47= 227. BQ-44= 11.5 DO3= 3.047

MEAS 498 TIME 19.57.17 TIME (KC) = 0. 9.32. 4
K FI K FI K FI K FI K FI K FI K FI K FI K FI K FI
0 8.7 37 -51.0 74 -55.1 111 -8.1 148 -95.7 185 -12.2
1 19.9 38 -34.6 75 -70.8 112 -2.3 149 -90.0 186 -8.4
2 26.0 39 -40.7 76 -69.4 113 4.5 150 -87.7 187 -6.0
3 38.0 40 -51.1 77 -85.1 114 0.1 151 -82.8 188 -0.4
4 45.9 41 -43.6 78 -85.3 115 0.4 152 -86.9 189 0.4
5 56.3 42 -52.6 79 -84.2 116 10.4 153 -83.8 190 -0.1
6 69.9 43 -53.2 80 -97.6 117 4.3 154 -76.0 191 0.4
7 84.3 44 -54.3 81 -73.8 118 6.0 155 -74.5 192 5.0
8 89.3 45 -57.6 82 -67.9 119 6.8 156 -77.6 193 1.2
9 235.2 46 -58.9 83 -73.1 120 4.3 157 -84.0 194 2.2
10 84.0 47 -56.2 84 -80.3 121 -3.2 158 -77.9 195 4.3
11 83.5 48 -49.4 85 -82.0 122 2.3 159 -74.8 196 1.6
12 82.1 49 -70.8 86 -74.4 123 -1.3 160 -72.8 197 8.1
13 81.9 50 -50.2 87 -57.9 124 2.4 161 -77.0 198 2.4
14 78.1 51 -56.0 88 -48.8 125 0.9 162 -75.7 199 5.6
15 79.4 52 -57.2 89 -38.0 126 -4.8 163 -79.7 200 0.6
16 74.5 53 -66.1 90 -45.0 127 6.1 164 -92.9 201 1.1
17 98.9 54 -69.8 91 -38.8 128 5.8 165 -82.6 202 0.8
18 103.6 55 -68.7 92 -49.2 129 -6.4 166 -83.8 203 5.0
19 101.7 56 -62.0 93 -40.9 130 -12.7 167 -92.8 204 2.9
20 96.5 57 -69.5 94 -29.1 131 -17.8 168 -86.0 205 1.7
21 92.6 58 -56.4 95 -31.4 132 -20.9 169 -86.8 206 2.8
22 96.7 59 -60.5 96 -33.4 133 -13.9 170 -26.6 207 1.0
23 99.2 60 -53.9 97 -20.1 134 -20.0 171 0.0 208 1.1
24 98.3 61 -44.8 98 -32.3 135 -29.4 172 23.4 209 1.2
25 143.2 62 -49.9 99 -22.9 136 -28.3 173 -49.1 210 0.6
26 104.0 63 -45.9 100 -29.5 137 -37.2 174 -35.2 211 2.4
27 -101.0 64 -41.5 101 -25.7 138 -37.5 175 7.7 212 2.7
28 93.1 65 -40.1 102 -22.3 139 -44.2 176 1.8 213 1.5
29 290.9 66 19.8 103 -10.4 140 -52.8 177 59.6 214 -0.2
30 14.4 67 1.7 104 -26.9 141 -84.6 178 -18.7 215 0.0
31 11.2 68 -24.6 105 -19.8 142 -82.5 179 -26.2 216 -13.9
32 -2.5 69 -28.4 106 -6.2 143 -86.1 180 -5.2 217 -21.2
33 -20.3 70 -33.0 107 -10.1 144 -92.5 181 -0.3 218 3.9
34 -29.2 71 -38.0 108 -6.7 145 -88.5 182 -6.7 219 8.6
35 -27.0 72 -39.7 109 -4.5 146 -83.7 183 -6.6
36 -19.2 73 -48.7 110 -4.6 147 -80.9 184 -5.5

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MEAS 503 TIME 20.18.55 TIME (KC) = 0.9.51.43

POWER= 17.4	B-38= 775.	BKC-141=1.31	BV-1= 1.53
ALF= 1.00	BV-7= 40.15	B-6= 1.41	E-29= 1.739
ALC= 0.97	B-7= 38.76	KC-24= 7.017	PR-41= 181.
KCK-37= 0.18	B-34= 1.315	KC-64= 0.024	PR-40= 3.095
TPL1= 2696.	TPL2= 0.		
KC-23= 1.276			
C1 0.945	C10 0.959	C16 0.950	D2 0.999
C2 0.793	C11 1.023	C17 0.980	D3 0.981
C3 0.806	C12 0.691	C18 0.955	T1 0.984
C6 0.969	C13 0.898	C19 0.959	T2 0.974
C8 0.964	C14 0.847	C20 0.935	
C9 0.945	C15 0.940	D1 0.977	

MEAS 507 TIME 20.31. 8 TIME (KC) = 0.10. 5.53

GR 1 U	POWER GR 1 U	POWER GR 1 U	POWER GR 1 U
17 62.0 114.3	7.1 19 62.5 735.4 46.0 21	62.0 372.1 23.1	
B1= 5.00	HALL= 1107.	SUM POWER = 76.1	
I 17= 59.3	I 19= 54.4	I 21= 60.1	

*157 3.0	-157 4.0	*183 1.5	-183 1.7
18 2.7	1132 0.2	19 2.8	1133 4.5
110 3.1	1134 5.0	111 3.8	1135 4.8
112 4.4	1136 5.8	113 2.0	1137 4.3
114 5.8	1138 4.6	115 4.2	1139 3.7
116 4.9	1140 5.2	117 6.0	1141 4.8
118 6.8	1142 4.8	119 9.3	1143 4.9
SUM 18-119 = 55.8		SUM 1132-1143 = 53.5	

MEAS 507 TIME 20.31. 8 TIME (KC) = 0.10. 5.53

POWER= 76.1	B-38= 788.	BKC-141=1.70	BV-1= 2.05
ALF= 1.00	BV-7= 39.89	B-6= 1.78	E-29= 2.324
ALC= 0.98	E-7= 38.27	KC-24= 7.017	PR-41= 179.
KCK-37= 0.24	E-34= 1.703	KC-64= 0.033	PR-40= 3.444
TPL1= 2767.	TPL2= 0.		
KC-23= 1.650			
C1 0.991	C10 0.957	C16 0.950	D2 0.999
C2 0.740	C11 1.018	C17 0.957	D3 0.984
C3 0.796	C12 0.691	C18 0.955	T1 0.986
C6 0.974	C13 0.876	C19 0.959	T2 0.974
C8 0.962	C14 0.847	C20 0.938	
C9 0.935	C15 0.938	D1 0.969	
BKC-2= 160.	BKC-24= 5.7	DO1= 1.058	QKC= 13.076
BG-25= 259.	BG-43= 10.8	DO2= 3.268	OTP= 8.004
BG-47= 228.	BG-44= 14.0	DO3= 3.962	

K	FI	K	FI	K	FI	K	FI	K	FI	K	FI	K	FI
0	-117.4	37	-1200.4	74	-351.1	111	180.1	148	435.9	185	21.9		
1	-232.3	38	-1139.2	75	-312.3	112	201.1	149	429.0	186	4.7		
2	-325.3	39	-1129.3	76	-314.3	113	233.5	150	423.1	187	20.3		
3	-446.0	40	-1118.7	77	-312.2	114	237.0	151	418.4	188	11.1		
4	-513.2	41	-1149.1	78	-278.3	115	255.4	152	437.0	189	33.0		
5	-682.9	42	-1116.1	79	-265.4	116	262.7	153	448.2	190	0.6		
6	-837.5	43	-1104.4	80	-273.9	117	288.7	154	459.0	191	24.5		
7	-901.3	44	-1090.5	81	-261.1	118	270.2	155	458.3	192	29.3		
8	-997.4	45	-1080.6	82	-234.8	119	253.4	156	387.5	193	33.5		
9	-36.3	46	-1043.4	83	-180.5	120	295.7	157	429.0	194	13.4		
10	-973.3	47	-1041.2	84	-282.0	121	349.4	158	397.2	195	36.1		
11	-969.0	48	-960.4	85	-265.2	122	299.6	159	398.2	196	21.9		
12	-1028.2	49	-1004.9	86	-260.4	123	311.8	160	414.2	197	28.9		
13	-1000.9	50	-1017.3	87	-188.2	124	336.9	161	437.5	198	23.4		
14	-948.5	51	-969.0	88	-195.3	125	403.2	162	404.9	199	29.7		
15	-579.9	52	-1015.9	89	-177.7	126	392.1	163	412.9	200	11.5		
16	-690.3	53	-932.3	90	-166.1	127	365.9	164	397.4	201	22.4		
17	-974.4	54	-1016.7	91	-191.1	128	358.9	165	425.6	202	22.7		
18	-685.7	55	-937.5	92	-120.9	129	363.5	166	372.4	203	25.9		
19	-965.2	56	-898.2	93	-102.5	130	402.4	167	361.6	204	20.7		
20	-538.0	57	-372.3	94	-100.1	131	352.1	168	368.3	205	20.2		
21	-907.0	58	-839.6	95	-102.3	132	412.4	169	354.5	206	21.4		
22	-684.0	59	-853.9	96	-89.9	133	409.4	170	218.0	207	16.5		
23	-943.1	60	-841.4	97	12.5	134	395.0	171	-1.4	208	20.1		
24	-560.1	61	-754.5	98	23.4	135	425.2	172	9.9	209	12.3		
25	-44.3	62	-811.9	99	10.4	136	421.3	173	-81.1	210	11.0		
26	-48.8	63	-709.9	100	15.0	137	435.4	174	-40.6	211	25.5		
27	-142.4	64	-779.1	101	44.7	138	407.4	175	20.2	212	16.1		
28	-671.5	65	-562.3	102	72.2	139	449.5	176	14.9	213	16.7		
29	-37.8	66	-551.3	103	9.6	140	410.4	177	29.0	214	-0.2		
30	-1100.1	67	-487.6	104	71.1	141	455.6	178	-48.9	215	0.0		
31	-1047.7	68	-455.8	105	113.7	142	412.6	179	28.0	216	-1.3		
32	-1093.4	69	-431.1	106	140.0	143	372.8	180	25.0	217	1.2		
33	-1125.4	70	-454.6	107	138.2	144	437.8	181	33.1	218	18.2		
34	-1131.0	71	-429.2	108	135.5	145	430.3	182	17.9	219	0.2		
35	-1152.3	72	-400.2	109	163.2	146	398.6	183	18.6				
36	-1042.0	73	-383.0	110	158.7	147	425.5	184	5.4				

MEAS 537 TIME 20.40.18 TIME (KC) = 0.10.15.3
 GR 1 U POWER GR 1 U POWER GR 1 U POWER
 17 88.4 161.1 10.7 19 102.1 480.3 49.0 21 102.5 357.4 36.7
 B1= 5.00 HALL= 744. SUM POWER = 96.4
 I 17= 84.0 I 19= 94.0 I 21= 99.9
 +157 0.0 -157 35.2 +193 1.1 -193 1.8
 18 3.0 1132 0.1 19 3.0 1133 7.7
 110 3.5 1134 8.3 111 4.0 1135 7.6
 112 4.8 1136 8.1 113 2.3 1137 7.4
 114 5.9 1138 7.4 115 4.7 1139 8.3
 116 5.1 1140 8.4 117 6.7 1141 7.8
 118 7.4 1142 8.6 119 10.1 1143 9.0
 SUM 18-119 = 60.5 SUM 1132-1143 = 86.7

MEAS 537 TIME 20.40.18 TIME (KC) = 0.10.15.3
 POWER= 96.4 B-38= 794. BKC-141=1.88 BV-1= 2.23
 ALF= 1.02 BV-7= 39.73 B-6= 1.87 E-29= 2.550
 ALC= 0.88 B-7= 38.34 KC-24= 7.017 PR-41= 180.
 KCK-87= 0.25 B-34= 1.876 KC-64= 0.039 PR-40= 3.593
 TPL1= 2868. TPL2= 0.
 KC-23= 1.824
 C1 1.091 C10 0.950 C16 0.955 D2 0.999
 C2 0.837 C11 1.016 C17 0.960 D3 0.981
 C3 0.732 C12 0.691 C18 0.942 T1 0.984
 C6 0.977 C13 0.798 C19 0.967 T2 0.974
 C8 0.960 C14 0.847 C20 0.938
 C9 0.925 C15 0.935 D1 0.967

MEAS 538 TIME 20.40.18 TIME (KC) = 0.10.15.3
 GR 1 U POWER GR 1 U POWER GR 1 U POWER
 17 87.4 161.1 10.9 19 102.1 480.3 49.0 21 102.5 360.4 37.0
 B1= 6.00 HALL= 744. SUM POWER = 97.4
 I 17= 84.7 I 19= 94.2 I 21= 99.9
 +157 0.0 -157 34.5 +193 1.1 -193 1.8
 18 3.0 1132 0.0 19 3.1 1133 7.7
 110 3.5 1134 8.3 111 4.1 1135 7.6
 112 4.8 1136 8.1 113 2.4 1137 7.4
 114 6.1 1138 7.4 115 4.9 1139 8.3
 116 5.1 1140 8.3 117 6.7 1141 7.8
 118 7.6 1142 8.0 119 10.1 1143 9.0
 SUM 18-119 = 61.3 SUM 1132-1143 = 90.5

MEAS 538 TIME 20.40.18 TIME (KC) = 0.10.15.6
 POWER= 97.4 B-38= 755. BKC-141=1.88 BV-1= 2.47
 ALF= 1.13 BV-7= 39.73 B-6= 1.87 E-29= 2.544
 ALC= 1.09 B-7= 38.34 KC-24= 7.017 PR-41= 180.
 KCK-87= 0.25 B-34= 1.876 KC-64= 0.039 PR-40= 3.593
 TPL1= 2871. TPL2= 0.
 KC-23= 1.826
 C1 1.094 C10 0.950 C16 0.955 D2 0.999
 C2 0.837 C11 1.013 C17 0.960 D3 0.981
 C3 0.732 C12 0.691 C18 0.942 T1 0.984
 C6 0.977 C13 0.798 C19 0.967 T2 0.977
 C8 0.960 C14 0.847 C20 0.938
 C9 0.925 C15 0.936 D1 0.967

MEAS 551 TIME 20.42.34 TIME (KC) = 0.10.17.21
 GR 1 U POWER GR 1 U POWER GR 1 U POWER
 17 48.8 539.1 26.3 19 50.3 1130.9 56.9 21 48.8 700.2 34.2
 B1= 5.00 HALL= 2250. SUM POWER = 117.4
 I 17= 45.9 I 19= 41.3 I 21= 46.1
 +157 1.9 -157 3.2 +193 2.5 -193 1.7
 18 0.9 1132 0.0 19 1.1 1133 2.3
 110 1.9 1134 3.9 111 2.6 1135 3.9
 112 3.2 1136 4.6 113 1.1 1137 3.4
 114 4.9 1138 4.1 115 3.7 1139 3.7
 116 3.9 1140 5.0 117 5.8 1141 4.6
 118 6.7 1142 4.7 119 7.6 1143 4.5
 SUM 18-119 = 43.2 SUM 1132-1143 = 44.6
 MEAS 551 TIME 20.42.34 TIME (KC) = 0.10.17.21
 POWER= 117.4 B-38= 794. BKC-141=1.91 DV-1= 2.23
 ALF= 0.96 BV-7= 39.73 B-6= 1.90 E-29= 2.586
 ALC= 0.93 B-7= 38.34 KC-24= 7.017 PR-41= 181.
 KCK-87= 0.27 B-34= 1.901 KC-64= 0.041 PR-40= 3.643
 TPL1= 2874. TPL2= 0.
 KC-23= 1.853
 C1 1.121 C10 0.947 C16 0.955 D2 0.999
 C2 0.855 C11 1.016 C17 0.960 D3 0.984
 C3 0.735 C12 0.691 C18 0.940 T1 0.984
 C6 0.974 C13 0.801 C19 0.964 T2 0.974
 C8 0.960 C14 0.847 C20 0.938
 C9 0.920 C15 0.935 D1 0.964
 BYC-2= 166. EKC-24= 6.2 DO1= 1.164 OKC= 14.635
 BG-25= 259. BG-43= 11.8 DO2= 3.537 OTP= 7.953
 EG-47= 229. BG-44= 15.7 DO3= 4.178

MEAS 551 TIME 20.42.34 TIME (KC) = 0.10.17.21
 K FI K FI K FI K FI K FI K FI
 1 -157.4 37 -1360.6 74 -807.0 111 368.3 148 789.5 185 27.8
 2 -341.3 38 -1355.3 75 -793.9 112 415.8 149 806.4 186 21.7
 3 -433.3 39 -1405.5 76 -765.1 113 441.2 150 786.1 187 31.3
 4 -536.2 40 -1431.8 77 -748.3 114 407.3 151 780.9 188 24.4
 5 -720.2 41 -1468.4 78 -676.5 115 420.3 152 768.0 189 49.1
 6 -918.5 42 -1405.5 79 -630.8 116 434.7 153 821.2 190 1.2
 7 -1093.7 43 -1373.7 80 -665.3 117 521.0 154 808.7 191 41.0
 8 -1276.8 44 -1347.2 81 -576.9 118 505.2 155 802.6 192 35.0
 9 -1288.8 45 -1529.0 82 -556.8 119 512.2 156 801.7 193 36.3
 10 -67.1 46 -1495.4 83 -534.8 120 515.3 157 790.6 194 30.2
 11 -1249.2 47 -1362.5 84 -473.7 121 523.8 158 809.3 195 39.5
 12 -1321.8 48 -1333.6 85 -451.5 122 570.8 159 785.3 196 32.5
 13 -1252.2 49 -1354.1 86 -403.2 123 568.7 160 781.0 197 33.8
 14 -1337.8 50 -1293.4 87 -385.7 124 578.4 161 775.7 198 31.8
 15 -1308.4 51 -1376.6 88 -321.0 125 591.2 162 785.5 199 36.7
 16 -1249.5 52 -1384.8 89 -271.7 126 614.8 163 819.4 200 31.4
 17 -1300.4 53 -1365.7 90 -270.3 127 595.3 164 789.2 201 26.6
 18 -1317.7 54 -1314.8 91 -254.7 128 661.0 165 805.3 202 54.2
 19 -1336.3 55 -1318.9 92 -215.3 129 661.0 166 810.2 203 37.5
 20 -1238.0 56 -1247.6 93 -188.8 130 720.9 167 796.4 204 28.9
 21 -310.6 57 -1292.3 94 -182.4 131 715.5 168 761.4 205 23.7
 22 -1361.2 58 -1297.9 95 -96.6 132 722.6 169 732.9 206 34.8
 23 -1367.3 59 -1225.2 96 -121.1 133 721.2 170 455.5 207 23.8
 24 -1322.4 60 -1192.8 97 -31.2 134 718.3 171 -2.9 208 31.6
 25 -1289.4 61 -1158.3 98 -4.1 135 712.6 172 -0.9 209 19.4
 26 -50.2 62 -1144.9 99 30.9 136 756.8 173 -62.7 210 24.5
 27 -1263.2 63 -1101.5 100 54.2 137 821.3 174 -34.2 211 27.0
 28 -50.0 64 -1061.8 101 54.7 138 853.2 175 24.8 212 25.1
 29 -1274.7 65 -1022.0 102 52.9 139 846.9 176 25.9 213 34.4
 30 -47.8 66 -1008.3 103 119.6 140 790.6 177 39.7 214 -0.2
 31 -1404.7 67 -1010.1 104 190.0 141 816.3 178 22.2 215 0.0
 32 -1395.0 69 -941.3 105 222.4 142 799.7 179 33.9 216 5.7
 33 -1487.7 69 -928.5 106 248.9 143 775.0 180 35.2 217 6.9
 34 -1405.6 70 -857.2 107 236.0 144 813.7 181 37.0 218 14.3
 35 -1440.5 71 -865.5 108 235.2 145 793.6 182 27.4 219 -1.1
 36 -1401.4 72 -847.9 109 299.8 146 775.5 183 29.0
 37 -1411.8 73 -820.2 110 363.8 147 810.3 184 22.6

PUSK 3 -11- DATE 14/ 8/78

MEAS 554 TIME 20.43.31 TIME (KC) = 0.10.18.13
GR I U POWER GR I U POWER GR I U POWER
17 38.8 532.6 31.2 19 39.1 1262.7 49.3 31 38.1 770.5 29.3
B1= 5.01 HALL= 2707. SUM POWER = 109.9
I 17= 33.4 I 19= 30.5 I 21= 35.4
+157 0.7 -157 3.8 +193 2.7 -193 1.9
18 0.2 1132 0.0 19 0.2 1133 0.9
110 1.0 1134 3.0 111 1.6 1135 3.2
112 2.1 1136 3.4 113 0.8 1137 3.0
114 4.0 1138 3.3 115 2.7 1139 3.0
116 3.0 1140 3.6 117 4.3 1141 3.8
118 5.3 1142 3.9 119 6.0 1143 3.3
SUM 18-119 = 31.4 SUM 1132-1143 = 34.6

MEAS 554 TIME 20.43.31 TIME (KC) = 0.10.18.18
POWER= 109.9 B-38= 795. BKC-141=1.92 BV-1= 2.49
ALF= 1.07 BV-7= 39.73 B-6= 1.90 E-29= 2.601
ALC= 1.04 B-7= 38.34 KC-24= 7.017 PR-41= 181.
KCK-87= 0.27 B-34= 1.911 KC-64= 0.040 PR-40= 3.667
TPL1= 2876. TPL2= 0.
KC-23= 1.883 C10 0.947 C16 0.952 D2 0.999
C1 1.130 C11 1.016 C17 0.960 D3 0.981
C2 0.852 C12 0.688 C18 0.940 T1 0.984
C3 0.740 C13 0.801 C19 0.964 T2 0.974
C6 0.974 C14 0.847 C20 0.938
C8 0.960 C15 0.935 D1 0.984
C9 0.920 BKC-24= 6.3 D01= 1.170 QKC= 14.953
BKC-2= 160. BG-43= 11.7 D02= 3.533 OTP= 7.822
BG-25= 250. BG-44= 15.8 D03= 4.194

PUSK 3 -10- DATE 14/ 8/78

MEAS 554 TIME 20.43.31 TIME (KC) = 0.10.18.18
K FI K FI K FI K FI K FI K FI
0 -208.8 37 -1836.2 74 -593.2 111 541.1 148 -1017.2 125 36.8
1 -443.0 38 -1866.3 75 -582.6 112 533.1 149 -1017.1 188 31.8
2 -501.1 39 -1789.5 76 -553.4 113 554.3 150 -1033.4 187 38.2
3 -785.7 40 -1864.2 77 -546.1 114 557.9 151 -1002.8 188 33.8
4 -945.4 41 -1850.6 78 -507.8 115 583.3 152 -1017.8 189 49.4
5 -1204.0 42 -1841.2 79 -469.5 116 630.0 153 -1059.5 190 17.4
6 -1507.1 43 -1838.3 80 -479.4 117 610.6 154 -1077.9 191 40.2
7 -1672.5 44 -1734.3 81 -428.6 118 621.5 155 -1097.4 192 37.9
8 -1690.9 45 -1693.9 82 -413.9 119 657.9 156 -1029.8 193 39.1
9 -102.4 46 -1713.5 83 -354.5 120 695.7 157 -1042.5 194 39.3
10 -1761.1 47 -1651.3 84 -331.5 121 716.3 158 -1029.9 195 42.4
11 -1714.9 48 -1630.2 85 -267.9 122 712.8 159 -1071.1 196 37.3
12 -1746.2 49 -1581.9 86 -216.8 123 779.5 160 -1016.1 197 40.8
13 -1774.0 50 -1556.5 87 -177.7 124 782.3 161 989.0 198 34.9
14 -1790.3 51 -1511.6 88 -132.8 125 789.3 162 989.3 199 39.5
15 -1739.3 52 -1489.7 89 -127.8 126 798.4 163 1018.5 200 29.6
16 -1746.2 53 -1415.7 90 -100.2 127 859.6 164 993.2 201 35.3
17 -1766.4 54 -1358.3 91 -81.2 128 855.2 165 1005.7 202 31.0
18 -1749.3 55 -1338.1 92 -28.1 129 876.4 166 1020.1 203 39.3
19 -1785.5 56 -1329.4 93 -14.8 130 919.3 167 1036.1 204 30.8
20 -1815.8 57 -1255.8 94 71.7 131 876.6 168 1000.7 205 23.7
21 -1817.9 58 -1215.4 95 92.4 132 902.5 169 1009.8 206 32.5
22 -1837.3 59 -1202.0 96 80.5 133 859.8 170 659.1 207 22.8
23 -1798.3 60 -1187.4 97 131.7 134 948.2 171 -5.4 208 33.0
24 -1766.7 61 -1125.7 98 176.2 135 922.1 172 -4.1 209 20.2
25 -82.0 62 -1076.9 99 169.9 136 985.2 173 -46.1 210 27.3
26 -1799.6 63 -1057.8 100 207.2 137 988.7 174 -30.7 211 26.7
27 -86.4 64 -1012.2 101 228.5 138 1005.0 175 38.9 212 27.3
28 -1842.5 65 -992.5 102 228.5 139 914.3 176 36.7 213 34.9
29 -85.9 66 -934.6 103 267.8 140 824.2 177 48.3 214 -0.2
30 -2010.0 67 -840.6 104 318.2 141 949.9 178 22.8 215 0.0
31 -1928.2 68 -866.0 105 377.6 142 1014.6 179 47.4 216 7.8
32 -1931.9 69 -812.4 106 371.3 143 1000.6 180 49.6 217 12.9
33 -1802.7 70 -822.0 107 406.0 144 1018.4 181 46.1 218 10.1
34 -1839.0 71 -738.2 108 416.3 145 1020.1 182 39.3 219 -1.7
35 -1863.5 72 -675.5 109 491.1 146 1007.9 183 37.8
36 -1819.7 73 -655.1 110 481.6 147 1027.2 184 29.1

MEAS 555 TIME 20.43.52 TIME (KC) = 0.10.18.39
GR I U POWER GR I U POWER GR I U POWER
17 26.4 1157.3 30.5 19 29.8 1309.6 39.0 21 27.8 802.8 22.3
B1= 5.00 HALL= 3065. SUM POWER = 91.9
I 17= 23.4 I 19= 20.8 I 21= 25.4
+157 0.0 -157 3.4 +193 3.1 -193 1.9
18 0.0 1132 0.0 19 0.0 1133 0.5
110 0.3 1134 2.6 111 0.8 1135 2.4
112 1.0 1136 2.0 113 0.4 1137 2.1
114 3.1 1138 2.6 115 1.6 1139 2.3
116 2.1 1140 2.4 117 3.8 1141 2.9
118 4.3 1142 2.8 119 4.6 1143 2.3
SUM 18-119 = 22.4 SUM 1132-1143 = 25.0

MEAS 555 TIME 20.43.52 TIME (KC) = 0.10.18.39
POWER= 91.9 B-38= 795. BKC-141=1.92 BV-1= 2.26
ALF= 0.97 BV-7= 39.73 B-6= 1.92 E-29= 2.614
ALC= 0.94 B-7= 38.27 KC-24= 7.017 PR-41= 181.
KCK-87= 0.27 B-34= 1.911 KC-64= 0.040 PR-40= 3.667
TPL1= 2876. TPL2= 0.
KC-23= 1.866 C10 0.945 C16 0.952 D2 0.999
C1 1.138 C11 1.016 C17 0.960 D3 0.981
C2 0.862 C12 0.621 C18 0.940 T1 0.984
C3 0.740 C13 0.798 C19 0.960 T2 0.974
C6 0.974 C14 0.847 C20 0.938
C8 0.960 C15 0.935 D1 0.984
C9 0.920 BKC-24= 6.3 D01= 1.173 QKC= 14.738
BKC-2= 160. BG-43= 11.7 D02= 3.507 OTP= 7.963
BG-25= 259. BG-44= 16.0 D03= 4.212

MEAS 555 TIME 20.43.52 TIME (KC) = 0.10.18.39
K FI K FI K FI K FI K FI K FI
0 -234.9 37 -2045.6 74 -671.8 111 542.7 148 1123.4 185 38.9
1 -492.5 38 -2008.9 75 -631.3 112 604.1 149 1111.8 186 30.9
2 -537.5 39 -1939.0 76 -781.0 113 651.2 150 1119.8 187 39.0
3 -835.5 40 -1916.1 77 -583.8 114 676.0 151 1123.3 188 34.1
4 -1102.3 41 -1913.5 78 -574.3 115 686.1 152 1105.4 189 47.5
5 -1390.6 42 -1855.7 79 -512.1 116 719.5 153 1105.9 190 23.9
6 -1636.2 43 -1858.6 80 -453.2 117 787.8 154 1111.8 191 42.9
7 -1894.9 44 -1835.2 81 -409.2 118 770.8 155 1120.5 192 37.4
8 -1897.4 45 -1713.4 82 -394.8 119 753.9 156 1107.2 193 43.1
9 -89.8 46 -1772.2 83 -369.0 120 794.8 157 1058.4 194 40.5
10 -1883.0 47 -1635.3 84 -335.4 121 794.4 158 1095.4 195 42.6
11 -1888.8 48 -1658.4 85 -220.9 122 819.1 159 1077.0 196 37.0
12 -1937.9 49 -1610.3 86 -194.1 123 854.3 160 1066.3 197 42.3
13 -1954.6 50 -1622.0 87 -138.5 124 894.5 161 1063.4 198 32.4
14 -1929.4 51 -1572.2 88 -132.1 125 897.2 162 1087.3 199 37.9
15 -1924.6 52 -1583.7 89 -139.7 126 957.5 163 1127.2 200 29.2
16 -1894.5 53 -1434.5 90 -63.1 127 942.5 164 1125.1 201 35.4
17 -1931.4 54 -1462.9 91 -27.5 128 957.4 165 1076.3 202 32.5
18 -1870.7 55 -1409.8 92 19.6 129 935.4 166 1025.1 203 38.6
19 -1977.5 56 -1433.4 93 32.7 130 996.6 167 1050.3 204 33.5
20 -1948.5 57 -1332.0 94 73.2 131 1066.4 168 1018.0 205 18.1
21 -1925.9 58 -1296.8 95 137.8 132 1031.3 169 1024.7 206 35.3
22 -2000.4 59 -1290.3 96 149.1 133 983.7 170 746.6 207 29.9
23 -1990.3 60 -1238.8 97 157.4 134 1014.2 171 -5.7 208 31.2
24 -1950.2 61 -1201.1 98 202.4 135 1060.6 172 -4.7 209 23.1
25 -95.4 62 -1160.9 99 268.0 136 1019.4 173 -25.6 210 24.4
26 -1979.7 63 -1127.0 100 316.6 137 1055.7 174 -28.5 211 30.2
27 -92.8 64 -1079.5 101 275.8 138 1113.5 175 45.6 212 30.1
28 -1944.1 65 -1022.0 102 346.4 139 1123.5 176 41.6 213 35.3
29 -62.1 66 -982.5 103 331.2 140 1117.4 177 45.8 214 -0.2
30 -1955.3 67 -920.9 104 378.9 141 1117.7 178 5.0 215 0.0
31 -1991.6 68 -863.6 105 412.5 142 1136.4 179 42.3 216 7.7
32 -2045.9 69 -843.3 106 432.2 143 1126.1 180 52.4 217 12.9
33 -2042.9 70 -828.4 107 472.6 144 1128.1 181 50.1 218 9.0
34 -1989.8 71 -774.3 108 481.6 145 1103.0 182 42.0 219 -1.9
35 -2026.6 72 -657.9 109 521.9 146 1059.4 183 42.6
36 -2087.7 73 -629.2 110 514.0 147 1101.4 184 34.0

PUSK 3 -15- DATE 14/ 6/78

MEAS 558 TIME 20.44.11 TIME (KC) = 0.10.18.58
 GR 1 U POWER GR 1 U POWER GR 1 U POWER
 17 27.8 1441.5 40.1 19 29.8 1423.9 42.4 21 26.9 770.5 20.7
 B1= 5.00 HALL= 3422. SUM POWER = 103.2
 I 17= 24.9 I 19= 21.0 I 21= 24.2
 +157 0.2 -157 2.2 +193 4.5 -193 2.0
 18 0.0 1132 0.0 19 0.0 1133 0.7
 110 0.3 1134 2.3 111 0.9 1135 2.3
 112 1.3 1136 2.3 113 0.1 1137 2.0
 114 3.6 1138 2.2 115 1.9 1139 2.1
 116 2.3 1140 2.4 117 3.9 1141 2.7
 118 4.5 1142 2.6 119 4.2 1143 1.9
 SUM 18-119 = 23.2 SUM 1132-1143 = 23.6

MEAS 556 TIME 20.44.11 TIME (KC) = 0.10.18.58
 POWER= 103.2 B-38= 795. BKC-141=1.92 BV-1= 2.52
 ALF= 1.09 BV-7= 39.73 B-6= 1.92 E-29= 2.613
 ALC= 1.05 B-7= 38.34 KC-24= 7.017 PR-41= 182.
 KCK-87= 0.27 B-34= 1.917 KC-64= 0.040 PR-40= 3.643
 TPL1= 2880. TPL2= 0.
 KC-23= 1.868 C10 0.945 C16 0.932 D2 0.999
 C1 1.135 C11 1.016 C17 0.960 D3 0.981
 C2 0.862 C12 0.691 C18 0.940 T1 0.984
 C3 0.740 C13 0.803 C19 0.960 T2 0.974
 C6 0.974 C14 0.847 C20 0.938
 C8 0.960 C15 0.935 D1 0.964
 CS 0.920 BKC-2= 161. BKC-24= 6.3 OKC= 14.957
 BG-25= 256. BG-43= 11.6 DO1= 1.177
 BG-47= 227. BG-44= 16.1 DO2= 3.459 OTP= 7.870
 DO3= 4.238

PUSK 3 -14- DATE 14/ 6/78

MEAS 558 TIME 20.44.11 TIME (KC) = 0.10.18.58
 K FI K FI K FI K FI K FI K FI
 0 -248.1 37 -2159.1 74 -663.2 111 639.4 148 1143.2 155 35.2
 1 -530.0 38 -2131.7 75 -645.1 112 671.7 149 1148.8 166 39.4
 2 -698.2 39 -2190.8 76 -592.9 113 719.4 150 1169.2 187 46.5
 3 -942.7 40 -2161.6 77 -566.1 114 739.8 151 1200.6 188 37.6
 4 -1219.1 41 -2080.9 78 -523.8 115 719.7 152 1133.7 189 56.5
 5 -1451.7 42 -1986.3 79 -455.8 116 727.9 153 1169.9 190 35.7
 6 -1745.4 43 -1981.6 80 -438.1 117 742.5 154 1143.0 191 39.8
 7 -2012.1 44 -1974.6 81 -408.0 118 796.0 155 1141.4 192 45.8
 8 -2142.9 45 -1930.6 82 -328.2 119 822.7 156 1139.2 193 45.3
 9 -120.0 46 -1933.3 83 -303.2 120 860.7 157 1165.4 194 44.3
 10 -2120.4 47 -1856.0 84 -290.0 121 885.5 158 1129.0 195 42.7
 11 -2162.9 48 -1817.0 85 -240.1 122 776.8 159 1157.6 196 41.4
 12 -2161.0 49 -1791.0 86 -209.7 123 661.2 160 1187.4 197 42.7
 13 -2130.3 50 -1725.4 87 -151.6 124 904.7 161 1227.0 198 35.7
 14 -2133.2 51 -1723.9 88 -157.3 125 771.2 162 1239.7 199 44.5
 15 -2229.5 52 -1728.9 89 -74.7 126 1004.7 163 1190.1 200 31.2
 16 -2195.4 53 -1558.1 90 -23.7 127 971.0 164 1191.0 201 38.8
 17 -2117.2 54 -1570.2 91 15.4 128 873.0 165 1194.7 202 37.1
 18 -2088.5 55 -1535.6 92 69.6 129 908.2 166 1136.1 203 38.5
 19 -2154.5 56 -1451.4 93 107.8 130 946.2 167 1167.1 204 36.2
 20 -2158.7 57 -1393.6 94 169.0 131 989.2 168 1148.2 205 21.1
 21 -2165.6 58 -1366.5 95 192.5 132 1022.9 169 1134.9 206 35.7
 22 -2151.9 59 -1310.1 96 187.6 133 1047.1 170 840.5 207 33.0
 23 -2151.9 60 -1216.4 97 203.9 134 1073.0 171 -6.2 208 33.5
 24 -2202.7 61 -1155.2 98 251.4 135 1048.4 172 -5.3 209 24.3
 25 -100.7 62 -1191.4 99 301.8 136 1100.3 173 -10.4 210 28.9
 26 -2103.5 63 -1120.0 100 306.8 137 1051.6 174 -13.3 211 31.2
 27 -104.5 64 -1061.5 101 343.7 138 1119.8 175 47.5 212 29.6
 28 -2187.1 65 -1026.0 102 391.1 139 1106.1 176 44.0 213 35.6
 29 -92.1 66 -1011.7 103 424.6 140 1120.3 177 58.3 214 -0.2
 30 -2260.1 67 -929.7 104 419.9 141 1131.0 178 55.6 215 0.0
 31 -2243.7 68 -912.2 105 442.7 142 1136.5 179 58.3 216 8.2
 32 -2304.0 69 -833.5 106 486.1 143 1036.2 180 52.5 217 10.0
 33 -2218.0 70 -829.6 107 530.4 144 1147.9 181 58.9 218 7.5
 34 -2167.7 71 -800.7 108 530.6 145 1166.5 182 44.8 219 -2.3
 35 -2185.3 72 -738.4 109 655.2 146 1161.6 183 42.4
 36 -2169.1 73 -706.9 110 599.8 147 1142.8 184 37.7

MEAS 571 TIME 20.53.39 TIME (KC) = 0.10.28.28
 GR 1 U POWER GR 1 U POWER GR 1 U POWER
 17 39.6 753.0 29.8 19 64.2 1072.3 58.1 21 55.2 758.8 41.9
 B1= 5.01 HALL= 2438. SUM POWER = 129.8
 I 17= 36.9 I 19= 46.1 I 21= 52.0
 +157 0.0 -157 15.0 +193 1.5 -193 2.1
 18 0.2 1132 0.0 19 0.2 1133 1.7
 110 1.1 1134 3.9 111 1.7 1135 4.5
 112 2.3 1136 4.8 113 2.1 1137 4.6
 114 4.3 1138 4.5 115 3.0 1139 4.2
 116 3.5 1140 5.9 117 4.9 1141 5.4
 118 5.9 1142 5.6 119 6.5 1143 5.4
 SUM 18-119 = 35.7 SUM 1132-1143 = 50.5

MEAS 571 TIME 20.53.39 TIME (KC) = 0.10.28.28
 POWER= 129.8 B-38= 799. BKC-141=2.00 BV-1= 2.63
 ALF= 1.09 BV-7= 39.57 B-6= 1.99 E-29= 2.705
 ALC= 1.06 B-7= 38.27 KC-24= 7.017 PR-41= 181.
 KCK-87= 0.28 B-34= 1.990 KC-64= 0.042 PR-40= 3.717
 TPL1= 2860. TPL2= 0.
 KC-23= 1.944 C10 0.940 C16 0.942 D2 0.999
 C1 1.213 C11 1.018 C17 0.950 D3 0.981
 C2 0.837 C12 0.691 C18 0.923 T1 0.984
 C3 0.767 C13 0.813 C19 0.962 T2 0.974
 C6 0.969 C14 0.847 C20 0.938
 C8 0.935 C15 0.935 D1 0.960
 C2 0.913 BKC-2= 161. BKC-24= 6.4 OKC= 15.478
 BG-25= 258. BG-43= 12.0 DO1= 1.163
 BG-47= 229. BG-44= 16.1 DO2= 3.603
 DO3= 4.291

MEAS 571 TIME 20.53.39 TIME (KC) = 0.10.28.28
 K FI K FI K FI K FI K FI K FI
 0 -222.3 37 -1932.9 74 -819.5 111 296.7 148 736.9 185 28.0
 1 -462.8 38 -1916.0 75 -811.4 112 364.4 149 757.1 186 26.2
 2 -528.5 39 -1967.7 76 -821.5 113 311.1 150 777.2 187 21.3
 3 -783.5 40 -1945.6 77 -734.8 114 317.3 151 774.4 188 25.9
 4 -1006.7 41 -1850.2 78 -760.1 115 327.7 152 701.5 189 42.2
 5 -1286.3 42 -1802.4 79 -720.1 116 362.0 153 792.7 190 16.4
 6 -1552.3 43 -1762.6 80 -652.3 117 391.6 154 766.8 191 37.2
 7 -1772.7 44 -1792.5 81 -603.2 118 423.7 155 781.7 192 39.1
 8 -1794.0 45 -1757.1 82 -509.8 119 460.8 156 747.7 193 27.4
 9 -117.9 46 -1734.9 83 -617.8 120 475.3 157 721.9 194 34.3
 10 -1790.9 47 -1653.4 84 -594.9 121 542.9 158 756.1 195 43.2
 11 -1817.0 48 -1653.6 85 -515.2 122 543.4 159 764.1 196 42.2
 12 -1773.5 49 -1647.7 86 -468.9 123 529.4 160 741.1 197 15.5
 13 -1776.0 50 -1626.9 87 -446.5 124 519.6 161 761.4 198 40.2
 14 -1784.6 51 -1602.0 88 -412.9 125 583.6 162 716.4 199 36.3
 15 -1626.8 52 -1549.6 89 -377.9 126 528.1 163 710.3 200 32.7
 16 -1737.9 53 -1505.1 90 -300.6 127 579.0 164 742.3 201 36.5
 17 -1838.4 54 -1503.9 91 -229.3 128 583.5 165 722.1 202 31.1
 18 -1878.0 55 -1486.4 92 -190.7 129 570.2 166 711.9 203 34.3
 19 -1846.5 56 -1418.1 93 -188.1 130 646.9 167 675.8 204 32.5
 20 -1855.6 57 -1419.0 94 -180.8 131 636.3 168 704.7 205 22.3
 21 -1784.4 58 -1338.7 95 -180.7 132 704.8 169 625.3 206 36.7
 22 -1951.2 59 -1327.3 96 -134.3 133 879.8 170 594.8 207 27.0
 23 -1969.4 60 -1279.8 97 -89.5 134 663.7 171 -5.2 208 33.7
 24 -1788.9 61 -1259.4 98 -34.6 135 692.3 172 -3.2 209 18.7
 25 -90.4 62 -1187.6 99 -90.5 136 722.3 173 -54.1 210 28.5
 26 -1696.4 83 -1142.1 100 -69.2 137 722.2 174 -27.1 211 25.9
 27 -82.9 64 -1169.8 101 -46.5 138 759.5 175 45.5 212 25.7
 28 -1807.4 65 -1101.4 102 -28.5 139 754.6 176 30.9 213 30.8
 29 -55.4 66 -1004.3 103 22.3 140 740.5 177 74.5 214 -0.2
 30 -1908.3 67 -995.4 104 95.1 141 760.7 178 -5.6 215 0.0
 31 -1962.1 68 -966.9 105 141.6 142 777.3 179 25.2 216 8.2
 32 -1952.3 69 -941.6 106 154.9 143 778.4 180 36.5 217 13.0
 33 -1957.3 70 -954.6 107 187.5 144 750.0 181 36.5 218 10.8
 34 -2035.4 71 -932.3 108 189.7 145 750.2 182 29.8 219 -0.9
 35 -2028.3 72 -915.9 109 230.1 146 760.7 183 29.4
 36 -1985.3 73 -855.1 110 205.7 147 750.3 184 21.7

PUSK 3 -19- DATE 14/ 6/78

MEAS 558 TIME 20.44.51 TIME (KC) = 0.10.19.38
GR 1 U POWER GR 1 U POWER GR 1 U POWER
17 26.9 1324.3 35.8 19 29.3 1377.0 40.3 21 26.9 796.2 21.4
B1= 5.00 HALL= 3299. SUM POWER = 97.3
I 17= 24.2 I 19= 20.5 I 21= 24.2
+157 0.2 -157 2.7 +193 4.2 -193 2.0
18 0.0 1132 0.0 19 0.0 1133 0.8
110 0.2 1134 2.0 111 0.7 1135 2.3
112 1.0 1136 2.4 113 0.3 1137 2.0
114 3.4 1138 2.0 115 1.9 1139 2.2
116 2.3 1140 2.6 117 3.9 1141 2.8
118 4.5 1142 2.8 119 4.8 1143 1.9
SUM 18-119 = 23.0 SUM 1132-1143 = 23.7

MEAS 558 TIME 20.44.51 TIME (KC) = 0.10.19.38
POWER= 97.3 B-38= 797. BKC-141=1.93 BV-1= 2.49
ALF= 1.07 BV-7= 39.73 B-6= 1.92 E-29= 2.623
ALC= 1.04 B-7= 38.34 KC-24= 7.017 PR-41= 181.
KCK-87= 0.27 B-34= 1.927 KC-64= 0.041 PR-40= 3.643
TPL1= 2864. TPL2= 0.
KC-23= 1.890
C1 1.143 C10 0.945 C16 0.952 D2 0.999
C2 0.867 C11 1.018 C17 0.960 D3 0.981
C3 0.745 C12 0.691 C18 0.940 T1 0.984
C6 0.972 C13 0.803 C19 0.962 T2 0.974
C8 0.960 C14 0.847 C20 0.938
C9 0.920 C15 0.935 C1 0.964
KCK-2= 160. BKC-24= 6.3 D01= 1.178 OKC= 14.056
BG-25= 260. BG-43= 11.6 D02= 3.499 OTP= 7.875
BG-47= 225. BG-44= 16.2 D03= 4.227

MEAS 559 TIME 20.45.35 TIME (KC) = 0.10.20.22
GR 1 U POWER GR 1 U POWER GR 1 U POWER
17 42.0 824.0 26.2 19 46.4 1242.2 58.4 21 44.4 785.2 34.9
B1= 5.01 HALL= 2496. SUM POWER = 117.5
I 17= 39.3 I 19= 36.4 I 21= 41.7
+157 1.4 -157 4.8 +193 2.7 -193 2.2
18 0.3 1132 0.0 19 0.4 1133 1.6
110 1.4 1134 2.7 111 1.9 1135 3.8
112 2.5 1136 3.6 113 0.7 1137 3.5
114 4.4 1138 3.9 115 3.2 1139 3.5
116 3.5 1140 4.7 117 5.1 1141 4.7
118 6.1 1142 4.7 119 7.2 1143 4.1
SUM 18-119 = 36.8 SUM 1132-1143 = 40.6

MEAS 559 TIME 20.45.35 TIME (KC) = 0.10.20.22
POWER= 117.5 B-38= 797. BKC-141=1.94 BV-1= 2.51
ALF= 1.07 BV-7= 39.63 B-6= 1.93 E-29= 2.631
ALC= 1.04 B-7= 38.41 KC-24= 7.017 PR-41= 181.
KCK-87= 0.27 B-34= 1.932 KC-64= 0.040 PR-40= 3.667
TPL1= 2846. TPL2= 0.
KC-23= 1.838
C1 1.150 C10 0.945 C16 0.952 D2 0.999
C2 0.867 C11 1.018 C17 0.957 D3 0.981
C3 0.750 C12 0.691 C18 0.940 T1 0.986
C6 0.972 C13 0.806 C19 0.960 T2 0.974
C8 0.960 C14 0.847 C20 0.938
C9 0.918 C15 0.935 C1 0.964
KCK-2= 161. BKC-24= 6.3 D01= 1.183 OKC= 14.967
BG-25= 258. BG-43= 11.8 D02= 3.480 OTP= 7.901
BG-47= 227. BG-44= 16.2 D03= 4.271

PUSK 3 -19- DATE 14/ 6/78

MEAS 559 TIME 20.44.51 TIME (KC) = 0.10.19.38
K FI K FI K FI K FI K FI K FI
0 -263.8 37 -2354.3 74 -728.1 111 525.0 148 1119.3 185 34.3
1 -557.7 38 -2330.2 75 -708.5 112 591.5 149 1098.7 186 37.8
2 -765.3 39 -2263.9 76 -650.9 113 611.5 150 1082.4 187 40.5
3 -1032.9 40 -2195.1 77 -635.7 114 554.3 151 1065.0 188 35.8
4 -1312.8 41 -2144.2 78 -563.1 115 631.5 152 1101.1 189 45.4
5 -1676.9 42 -2155.5 79 -466.5 116 650.0 153 1109.6 190 36.1
6 -2017.9 43 -2134.8 80 -635.5 117 641.3 154 1104.4 191 42.9
7 -2273.1 44 -2110.6 81 -460.1 118 713.2 155 1109.7 192 39.5
8 -2313.2 45 -2042.6 82 -410.6 119 751.4 156 1134.2 193 40.0
9 -107.9 46 -2014.8 83 -373.7 120 767.8 157 1095.4 194 42.8
10 -2307.9 47 -1929.4 84 -326.8 121 750.1 158 1090.9 195 41.3
11 -2317.0 48 -1897.7 85 -281.0 122 763.0 159 1070.0 196 38.1
12 -2343.9 49 -1851.7 86 -246.5 123 836.1 160 1030.3 197 36.6
13 -2381.9 50 -1785.2 87 -232.6 124 810.3 161 1049.4 198 32.5
14 -2426.7 51 -1756.7 88 -220.9 125 825.0 162 1044.0 199 45.3
15 -2408.4 52 -1785.9 89 -159.6 126 859.8 163 986.1 200 30.1
16 -2403.8 53 -1646.0 90 -104.8 127 920.6 164 1011.0 201 37.8
17 -2402.6 54 -1650.7 91 -79.1 128 887.1 165 1013.2 202 33.8
18 -2423.1 55 -1606.9 92 -21.4 129 914.3 166 1017.9 203 38.3
19 -2399.6 56 -1567.3 93 -2.4 130 974.7 167 1031.1 204 30.9
20 -2442.5 57 -1503.5 94 56.4 131 864.9 168 987.4 205 22.1
21 -2436.7 58 -1451.8 95 119.2 132 1001.8 169 990.9 206 33.2
22 -2410.0 59 -1424.8 96 157.3 133 976.2 170 817.7 207 32.6
23 -2456.4 60 -1339.3 97 186.0 134 1000.3 171 -5.4 208 32.5
24 -2427.6 61 -1366.5 98 189.9 135 1016.6 172 -5.1 209 22.4
25 -120.1 62 -1288.0 99 132.1 136 1005.7 173 -12.8 210 28.5
26 -2374.2 63 -1205.5 100 200.1 137 1029.2 174 -16.3 211 27.1
27 -116.5 64 -1132.0 101 245.7 138 1047.9 175 49.8 212 50.2
28 -2357.9 65 -1108.7 102 222.7 139 1040.1 176 47.0 213 33.4
29 -57.7 66 -1056.9 103 279.7 140 1044.6 177 52.1 214 -3.2
30 -2422.1 67 -1016.4 104 331.5 141 1054.1 178 15.0 215 0.0
31 -2378.5 68 -1016.0 105 343.3 142 1066.2 179 48.0 216 9.5
32 -2369.5 69 -976.7 106 401.4 143 1086.9 180 57.5 217 10.2
33 -2379.3 70 -923.6 107 365.9 144 1074.5 181 40.2 218 8.6
34 -2386.0 71 -846.1 108 393.8 145 1065.9 182 45.1 219 -2.7
35 -2387.6 72 -824.4 109 495.6 146 1101.9 183 47.1
36 -2412.8 73 -789.8 110 420.3 147 1112.3 184 38.6

MEAS 559 TIME 20.45.35 TIME (KC) = 0.10.20.22
K FI K FI K FI K FI K FI K FI
0 -249.8 37 -2069.7 74 -930.5 111 340.6 148 827.6 185 31.9
1 -536.4 38 -2054.4 75 -895.5 112 404.3 149 852.3 186 33.2
2 -685.9 39 -2019.7 76 -889.5 113 427.1 150 895.8 187 42.5
3 -940.6 40 -1981.5 77 -832.4 114 427.0 151 858.7 188 28.9
4 -1206.4 41 -2024.4 78 -730.3 115 449.0 152 898.4 189 41.0
5 -1472.8 42 -1985.8 79 -725.0 116 473.0 153 888.9 190 28.7
6 -1774.5 43 -1933.8 80 -722.1 117 525.0 154 935.0 191 39.1
7 -1990.3 44 -1914.2 81 -692.5 118 535.6 155 925.1 192 37.5
8 -2015.9 45 -1866.4 82 -642.0 119 545.8 156 909.2 193 39.1
9 -119.1 46 -1903.4 83 -576.0 120 552.5 157 861.2 194 39.7
10 -2078.9 47 -1773.9 84 -535.1 121 562.2 158 898.8 195 41.8
11 -2111.0 48 -1788.3 85 -479.1 122 570.5 159 910.4 196 38.0
12 -2059.7 49 -1734.8 86 -444.9 123 608.6 160 917.6 197 41.4
13 -2050.4 50 -1758.2 87 -432.8 124 626.6 161 877.6 198 31.2
14 -2119.6 51 -1746.7 88 -381.0 125 645.0 162 900.9 199 44.1
15 -2121.9 52 -1595.9 89 -360.3 126 709.3 163 852.7 200 30.7
16 -2691.8 53 -1663.3 90 -296.9 127 704.5 164 850.1 201 33.9
17 -2028.7 54 -1637.5 91 -212.3 128 723.2 165 891.2 202 34.4
18 -2049.0 55 -1541.8 92 -232.2 129 747.9 166 893.7 203 39.5
19 -2079.4 56 -1552.3 93 -170.2 130 788.5 167 849.8 204 32.8
20 -2114.4 57 -1505.5 94 -153.4 131 804.0 168 840.0 205 20.4
21 -2100.8 58 -1471.4 95 -91.0 132 804.0 169 860.5 206 27.0
22 -2121.8 59 -1425.2 96 -85.0 133 818.6 170 710.7 207 35.6
23 -2073.9 60 -1380.5 97 -83.6 134 817.6 171 -4.9 208 34.8
24 -2094.0 61 -1361.5 98 -26.1 135 880.0 172 -5.1 209 20.3
25 -104.9 62 -1327.6 99 13.1 136 851.7 173 -36.3 210 27.6
26 -2038.8 63 -1277.1 100 42.2 137 841.8 174 -31.2 211 28.2
27 -93.5 64 -1222.2 101 68.2 138 878.6 175 38.1 212 28.0
28 -1959.0 65 -1184.9 102 103.0 139 830.3 176 39.9 213 35.0
29 -92.4 66 -1163.7 103 113.7 140 887.9 177 46.8 214 -0.2
30 -2024.4 67 -1154.5 104 124.0 141 886.3 178 71.9 215 0.0
31 -2064.1 68 -1136.7 105 149.6 142 898.9 179 45.5 216 9.8
32 -2179.3 69 -1062.6 106 234.7 143 855.0 180 60.3 217 12.5
33 -2349.5 70 -1053.5 107 278.6 144 868.3 181 11.1 218 11.6
34 -2018.9 71 -1015.2 108 299.9 145 821.8 182 45.4 219 -1.8
35 -2034.3 72 -990.0 109 257.7 146 897.3 183 44.7
36 -2060.8 73 -951.2 110 333.5 147 918.7 184 32.0

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MEAS 561 TIME 20.46.18 TIME (KC) = 0.10.21.5
GR 1 U POWER GR 1 U POWER GR 1 U POWER
17 52.2 268.8 13.0 19 55.7 1174.8 65.4 21 55.2 755.9 41.7
B1= 5.00 HALL= 2088. SUM POWER = 121.0
I 17= 49.6 I 19= 47.1 I 21= 52.5
+157 1.6 -157 5.1 +193 2.3 -193 1.9
18 1.0 1132 0.0 19 1.3 1133 2.1
110 2.0 1134 4.0 111 2.8 1135 4.3
112 3.0 1136 4.3 113 1.2 1137 4.4
114 5.3 1138 4.9 115 4.0 1139 4.2
116 4.2 1140 5.2 117 6.0 1141 5.5
118 6.8 1142 5.8 119 8.3 1143 5.7
SUM 18-119 = 46.6 SUM 1132-1143 = 50.5

MEAS 561 TIME 20.46.18 TIME (KC) = 0.10.21.5
POWER= 121.0 B-38= 798. BKC-141=1.94 BV-1= 2.56
ALF= 1.10 BV-7= 39.63 B-6= 1.94 E-29= 2.643
ALC= 1.06 B-7= 38.34 KC-24= 7.017 PR-41= 181.
KCK-87= 0.27 E-34= 1.937 KC-64= 0.041 PR-40= 3.667
TPL1= 2885. TPL2= 0.
KC-23= 1.893
C1 1.157 C10 0.845 C18 0.952 D2 0.999
C2 0.669 C11 1.018 C17 0.957 D3 0.981
C3 0.750 C12 0.691 C18 0.938 T1 0.984
C8 0.972 C13 0.808 C19 0.952 T2 0.974
C8 0.957 C14 0.847 C20 0.938
C9 0.918 C15 0.935 D1 0.964
BKC-2= 161. BKC-24= 6.3 DQ1= 1.188
BG-23= 259. BG-43= 11.7 DQ2= 3.531
BG-47= 229. BG-44= 16.2 DQ3= 4.306

MEAS 563 TIME 20.46.58 TIME (KC) = 0.10.21.45
GR 1 U POWER GR 1 U POWER GR 1 U POWER
17 59.1 169.9 10.0 19 61.0 1130.9 69.0 21 60.1 726.6 43.4
B1= 5.00 HALL= 1869. SUM POWER = 122.7
I 17= 56.4 I 19= 52.7 I 21= 57.9
+157 2.4 -157 4.3 +193 2.1 -193 1.9
18 1.6 1132 0.0 19 1.8 1133 2.9
110 2.5 1134 3.7 111 3.3 1135 4.8
112 4.1 1136 4.7 113 1.6 1137 4.8
114 5.7 1138 5.2 115 4.5 1139 4.6
116 4.7 1140 6.3 117 8.5 1141 5.9
118 7.5 1142 6.1 119 9.4 1143 6.0
SUM 18-119 = 53.2 SUM 1132-1143 = 55.1

MEAS 563 TIME 20.46.58 TIME (KC) = 0.10.21.45
POWER= 122.7 B-38= 798. BKC-141=1.95 BV-1= 2.54
ALF= 1.09 BV-7= 39.57 B-6= 1.95 E-29= 2.641
ALC= 1.06 B-7= 38.34 KC-24= 7.017 PR-41= 181.
KCK-87= 0.27 B-34= 1.942 KC-64= 0.041 PR-40= 3.667
TPL1= 2898. TPL2= 0.
KC-23= 1.895
C1 1.162 C10 0.845 C18 0.952 D2 0.999
C2 0.667 C11 1.018 C17 0.957 D3 0.981
C3 0.750 C12 0.691 C18 0.938 T1 0.984
C8 0.969 C13 0.808 C19 0.962 T2 0.974
C8 0.957 C14 0.847 C20 0.938
C9 0.918 C15 0.935 D1 0.964
BKC-2= 161. BKC-24= 6.3 DQ1= 1.183
BG-23= 258. BG-43= 11.8 DQ2= 3.546
BG-47= 227. BG-44= 16.1 DQ3= 4.253

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MEAS 561 TIME 20.46.18 TIME (KC) = 0.10.21.5
K F1 K F1 K F1 K F1 K F1 K F1
0 -194.6 37 -1779.4 74 -924.5 111 315.3 148 858.3 185 30.3
1 -417.7 38 -1757.8 75 -909.3 112 353.0 149 859.0 186 28.4
2 -513.8 39 -1756.6 76 -867.5 113 396.7 150 855.1 187 32.5
3 -756.2 40 -1834.2 77 -831.9 114 444.7 151 805.8 188 27.0
4 -923.4 41 -1821.1 78 -792.3 115 430.9 152 842.6 189 46.8
5 -1144.8 42 -1698.7 79 -697.6 116 473.7 153 862.2 190 25.1
6 -1375.7 43 -1728.5 80 -675.5 117 481.0 154 829.3 191 37.9
7 -1558.1 44 -1721.7 81 -669.2 118 516.7 155 944.7 192 40.0
8 -1516.2 45 -1670.0 82 -621.9 119 497.2 156 852.4 193 40.1
9 -55.0 46 -1668.5 83 -592.1 120 527.4 157 824.9 194 40.3
10 -1664.8 47 -1700.0 84 -531.8 121 570.6 158 822.3 195 41.4
11 -1647.9 48 -1627.8 85 -480.6 122 556.3 159 854.0 196 37.4
12 -1724.0 49 -1535.7 86 -491.9 123 593.7 160 818.8 197 40.6
13 -1591.5 50 -1594.6 87 -423.7 124 623.1 161 807.2 198 34.5
14 -1603.1 51 -1587.4 88 -350.3 125 636.3 162 788.2 199 36.6
15 -1655.8 52 -1606.3 89 -391.3 126 647.6 163 801.9 200 32.9
16 -1663.3 53 -1551.3 90 -317.0 127 678.4 164 799.3 201 35.2
17 -1730.0 54 -1510.1 91 -313.3 128 692.2 165 810.0 202 35.3
18 -1716.6 55 -1465.3 92 -235.5 129 695.9 166 813.1 203 35.2
19 -1708.1 56 -1437.7 93 -207.8 130 722.6 167 797.1 204 32.2
20 -1677.3 57 -1440.3 94 -164.3 131 739.4 168 750.5 205 27.2
21 -1645.6 58 -1446.2 95 -145.0 132 752.9 169 790.3 206 23.9
22 -1742.0 59 -1407.1 96 -125.1 133 770.7 170 629.4 207 32.5
23 -1681.7 60 -1358.2 97 -28.6 134 767.3 171 -3.4 208 33.2
24 -1619.5 61 -1399.5 98 -93.3 135 807.2 172 -2.5 209 19.4
25 -62.8 62 -1309.4 99 10.4 136 833.5 173 -56.6 210 27.5
26 -1626.6 63 -1295.6 100 96.9 137 826.2 174 -27.4 211 29.4
27 -59.9 64 -1272.9 101 109.0 138 829.1 175 16.8 212 30.9
28 -1578.5 65 -1240.2 102 139.9 139 844.1 176 37.6 213 34.0
29 -89.6 66 -1147.5 103 167.1 140 813.7 177 40.6 214 -0.2
30 -1767.6 67 -1132.2 104 184.2 141 851.1 178 24.1 215 0.0
31 -1736.3 68 -1118.1 105 238.2 142 846.7 179 50.0 216 7.8
32 -1760.0 69 -1046.3 106 250.5 143 865.0 180 49.5 217 11.7
33 -1771.8 70 -1109.2 107 242.1 144 876.4 181 7.7 218 11.0
34 -1740.0 71 -1021.8 108 269.5 145 864.3 182 39.9 219 1.2
35 -1837.2 72 -967.5 109 287.5 146 849.9 183 40.9
36 -1892.8 73 -943.2 110 290.6 147 836.8 184 27.5

MEAS 563 TIME 20.46.58 TIME (KC) = 0.10.21.45
K F1 K F1 K F1 K F1 K F1 K F1
0 -154.8 37 -1557.5 74 -931.8 111 195.4 148 690.6 185 27.4
1 -341.3 38 -1493.3 75 -878.9 112 239.2 149 672.9 186 23.6
2 -438.6 39 -1532.1 76 -870.4 113 242.6 150 674.8 187 29.5
3 -602.0 40 -1576.6 77 -943.6 114 316.5 151 669.0 188 22.1
4 -731.8 41 -1518.7 78 -935.0 115 337.1 152 678.9 189 44.3
5 -896.8 42 -1540.1 79 -868.7 116 406.8 153 681.7 190 29.5
6 -1067.1 43 -1461.5 80 -850.6 117 382.8 154 888.3 191 30.7
7 -1269.7 44 -1518.4 81 -846.6 118 431.8 155 650.2 192 42.8
8 -1238.4 45 -1492.2 82 -772.2 119 426.1 156 683.3 193 34.2
9 -49.4 46 -1449.1 83 -749.1 120 454.0 157 682.0 194 38.0
10 -1279.2 47 -1514.4 84 -701.2 121 457.5 158 682.9 195 40.1
11 -1313.7 48 -1535.4 85 -642.6 122 461.8 159 701.8 196 33.4
12 -1222.3 49 -1553.3 86 -601.8 123 450.5 160 650.0 197 36.7
13 -1180.9 50 -1531.9 87 -627.8 124 456.0 161 721.4 198 37.1
14 -1226.2 51 -1570.7 88 -569.2 125 491.8 162 718.2 199 29.0
15 -1252.7 52 -1533.9 89 -527.9 126 498.7 163 673.2 200 35.5
16 -1271.7 53 -1576.9 90 -428.4 127 544.7 164 668.2 201 31.1
17 -1264.0 54 -1481.6 91 -419.4 128 591.4 165 676.5 202 35.3
18 -1314.2 55 -1513.0 92 -396.0 129 578.4 166 653.0 203 37.3
19 -1219.2 56 -1488.2 93 -372.1 130 594.5 167 622.5 204 32.0
20 -1248.2 57 -1499.7 94 -334.0 131 577.2 168 624.3 205 25.5
21 -1391.8 58 -1480.6 95 -261.7 132 601.1 169 652.4 206 28.3
22 -1316.1 59 -1441.1 96 -279.6 133 611.9 170 500.9 207 30.8
23 -1295.4 60 -1394.5 97 -235.3 134 636.8 171 -2.8 208 28.7
24 -1291.6 61 -1406.5 98 -204.0 135 641.1 172 1.9 209 19.5
25 -38.8 62 -1326.7 99 -154.3 136 651.4 173 -65.1 210 27.3
26 -1330.6 63 -1319.1 100 -151.1 137 642.1 174 -33.2 211 30.5
27 -42.2 64 -1326.0 101 -136.0 138 676.6 175 12.6 212 27.3
28 -1314.0 65 -1315.5 102 -118.4 139 663.2 176 34.4 213 32.7
29 -45.2 66 -1257.3 103 -99.0 140 661.5 177 37.4 214 -0.2
30 -1346.3 67 -1246.8 104 0.4 141 645.4 178 15.4 215 0.0
31 -1391.7 68 -1226.7 105 35.7 142 656.2 179 53.7 216 6.8
32 -1410.8 69 -1166.8 106 69.2 143 653.9 180 46.5 217 9.3
33 -1517.2 70 -1133.8 107 69.2 144 662.0 181 8.3 218 13.7
34 -1494.0 71 -1115.2 108 151.9 145 668.5 182 37.3 219 1.0
35 -1454.9 72 -1122.5 109 215.6 146 667.1 183 37.1
36 -1449.5 73 -1058.3 110 219.3 147 703.2 184 23.9

PUSK 3 -33- DATE 14/ 6/78

MEAS 505 TIME 20.47.44 TIME (KC) = 0.10.22.31
GR 1 U POWER GR 1 U POWER GR 1 U POWER
17 84.9 149.4 9.7 19 66.4 1119.2 74.3 21 85.9 697.3 46.0
B1= 5.01 HALL= 1693. SUM POWER = 130.0
I 17= 82.3 I 19= 58.4 I 21= 63.2
+157 2.5 -157 4.2 +193 2.8 -193 2.1
18 2.2 1132 0.0 19 2.4 1133 3.4
110 3.0 1134 5.1 111 3.7 1135 5.1
112 4.5 1136 5.1 113 2.1 1137 5.1
114 8.2 1138 5.8 115 4.9 1139 4.9
116 5.2 1140 6.6 117 6.8 1141 8.1
118 7.9 1142 6.4 119 10.3 1143 6.4
SUM 18-119 = 59.3 SUM 1132-1143 = 59.8

MEAS 565 TIME 20.47.44 TIME (KC) = 0.10.22.31
POWER= 130.0 B-38= 798. BKC-141=1.95 BV-1= 2.52
ALF= 1.09 BV-7= 39.63 B-6= 1.96 E-29= 2.635
ALC= 1.05 B-7= 38.34 KC-24= 7.017 PR-41= 181.
KCK-87= 0.27 B-34= 1.942 KC-64= 0.041 PR-40= 3.667
TPL1= 2863. TPL2= 0.
KC-23= 1.902
C1 1.169 C10 0.945 C16 0.952 D2 0.999
C2 0.869 C11 1.018 C17 0.955 D3 0.981
C3 0.752 C12 0.691 C18 0.938 T1 0.984
C6 0.969 C13 0.808 C19 0.960 T2 0.974
C8 0.957 C14 0.847 C20 0.938
C9 0.916 C15 0.935 D1 0.964
BKC-2= 160. BKC-24= 6.3 DQ1= 1.181 QKC= 14.984
BG-25= 259. BG-43= 11.9 DQ2= 3.588 OTP= 7.879
BG-47= 229. BG-44= 16.1 DQ3= 4.289

MEAS 567 TIME 20.48.24 TIME (KC) = 0.10.23.11
GR 1 U POWER GR 1 U POWER GR 1 U POWER
17 59.1 199.2 11.8 19 61.0 1136.8 69.4 21 60.1 711.9 42.8
B1= 5.00 HALL= 1904. SUM POWER = 123.9
I 17= 56.6 I 19= 52.7 I 21= 57.6
+157 2.8 -157 4.3 +193 2.2 -193 1.8
18 1.4 1132 0.0 19 1.7 1133 2.9
110 2.5 1134 3.8 111 3.3 1135 4.7
112 4.0 1136 4.7 113 1.8 1137 4.7
114 5.9 1138 5.3 115 4.5 1139 4.6
116 4.8 1140 6.2 117 8.7 1141 5.8
118 7.8 1142 6.0 119 9.2 1143 6.0
SUM 18-119 = 53.6 SUM 1132-1143 = 54.7

MEAS 567 TIME 20.48.24 TIME (KC) = 0.10.23.11
POWER= 123.9 B-38= 798. BKC-141=1.96 BV-1= 2.55
ALF= 1.09 BV-7= 39.63 B-6= 1.96 E-29= 2.635
ALC= 1.06 B-7= 38.34 KC-24= 7.017 PR-41= 181.
KCK-87= 0.27 B-34= 1.952 KC-64= 0.041 PR-40= 3.567
TPL1= 2882. TPL2= 0.
KC-23= 1.905
C1 1.174 C10 0.945 C18 0.952 D2 0.999
C2 0.867 C11 1.018 C17 0.955 D3 0.981
C3 0.754 C12 0.691 C18 0.938 T1 0.984
C6 0.969 C13 0.808 C19 0.962 T2 0.974
C8 0.957 C14 0.847 C20 0.938
C9 0.916 C15 0.935 D1 0.964
BKC-2= 161. BKC-24= 6.4 DQ1= 1.191 QKC= 15.012
BG-25= 258. BG-43= 11.9 DQ2= 3.582 OTP= 7.938
BG-47= 229. BG-44= 16.2 DQ3= 4.297

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MEAS 555 TIME 20.47.44 TIME (KC) = 0.10.22.31
K FI K FI K FI K FI K FI K FI
0 -130.9 37 -1308.7 74 -1027.5 111 82.2 148 500.9 185 21.0
1 -279.7 38 -1439.0 75 -1011.6 112 108.2 149 514.6 185 23.5
2 -364.7 39 -1456.8 76 -985.4 113 121.4 150 506.1 187 27.2
3 -499.4 40 -1424.4 77 -968.9 114 133.1 151 480.7 188 21.6
4 -610.8 41 -1417.5 78 -946.2 115 133.8 152 514.9 189 36.8
5 -761.1 42 -1427.3 79 -876.9 116 178.3 153 531.2 190 22.6
6 -949.5 43 -1461.7 80 -856.9 117 216.0 154 549.6 191 30.3
7 -1136.4 44 -1407.8 81 -850.3 118 233.3 155 528.1 192 40.8
8 -1127.0 45 -1382.7 82 -790.8 119 244.2 156 519.4 193 37.9
9 -47.9 46 -1414.5 83 -752.6 120 253.0 157 502.8 194 37.0
10 -1115.3 47 -1392.8 84 -719.4 121 272.1 158 534.4 195 41.1
11 -1112.6 48 -1451.2 85 -695.3 122 281.3 159 507.4 196 35.1
12 -1081.2 49 -1406.6 86 -644.3 123 321.7 160 519.7 197 34.8
13 -1119.1 50 -1413.0 87 -592.8 124 312.9 161 505.9 198 37.1
14 -1093.6 51 -1451.9 88 -566.0 125 339.0 162 489.2 199 26.0
15 -1079.9 52 -1430.8 89 -515.8 126 354.9 163 509.3 200 34.0
16 -1140.9 53 -1394.8 90 -490.2 127 384.0 164 520.4 201 30.4
17 -1147.5 54 -1456.4 91 -471.0 128 392.2 165 488.3 202 33.9
18 -1093.6 55 -1441.8 92 -455.7 129 388.4 166 491.5 203 35.2
19 -1141.0 56 -1398.3 93 -403.3 130 407.9 167 485.5 204 31.4
20 -1143.1 57 -1390.8 94 -355.0 131 429.0 168 480.0 205 25.6
21 -1105.0 58 -1452.4 95 -338.5 132 438.2 169 471.4 206 26.8
22 -1150.1 59 -1363.5 96 -319.3 133 452.0 170 406.6 207 33.3
23 -1108.3 60 -1309.3 97 -279.6 134 465.1 171 -2.2 208 32.7
24 -1111.7 61 -1347.6 98 -245.4 135 455.5 172 5.4 209 18.6
25 -41.1 62 -1337.6 99 -222.6 136 389.7 173 -84.9 210 26.4
26 -1095.4 63 -1294.2 100 -204.3 137 507.5 174 -36.7 211 28.3
27 -36.9 64 -1254.1 101 -198.1 138 485.6 175 11.8 212 21.3
28 -1104.3 65 -1232.7 102 -162.9 139 486.7 176 26.0 213 34.2
29 -45.8 66 -1242.6 103 -130.2 140 503.8 177 40.4 214 -0.2
30 -1204.2 67 -1230.7 104 -94.7 141 505.7 178 -14.2 215 0.0
31 -1241.0 68 -1202.7 105 -55.2 142 509.8 179 21.7 216 5.0
32 -1289.3 69 -1121.5 106 -50.9 143 502.3 180 36.2 217 6.8
33 -1322.9 70 -1135.9 107 -18.3 144 536.9 181 8.2 218 18.5
34 -1333.1 71 -1125.8 108 12.0 145 519.0 182 29.7 219 0.1
35 -1356.3 72 -1076.1 109 28.2 146 514.8 183 35.2
36 -1352.6 73 -1048.7 110 47.9 147 518.0 184 19.4

MEAS 567 TIME 20.48.24 TIME (KC) = 0.10.23.11
K FI K FI K FI K FI K FI K FI
0 -168.9 37 -1624.2 74 -1031.2 111 92.2 148 624.2 185 23.4
1 -353.0 38 -1625.9 75 -1036.1 112 159.3 149 608.2 186 21.3
2 -429.1 39 -1520.8 76 -1038.8 113 182.6 150 595.8 187 28.7
3 -603.7 40 -1584.7 77 -985.4 114 203.3 151 599.7 188 22.6
4 -775.8 41 -1546.0 78 -985.4 115 258.6 152 640.9 189 42.8
5 -1010.8 42 -1485.9 79 -917.0 116 306.9 153 880.1 190 24.4
6 -1212.8 43 -1558.6 80 -874.6 117 307.0 154 654.0 191 31.5
7 -1326.4 44 -1597.5 81 -861.6 118 283.1 155 611.4 192 42.5
8 -1366.3 45 -1584.4 82 -974.6 119 256.5 156 639.6 193 34.2
9 -52.5 46 -1550.2 83 -806.0 120 315.5 157 621.8 194 40.6
10 -1385.6 47 -1596.3 84 -766.1 121 320.0 158 601.6 195 40.4
11 -1404.0 48 -1562.8 85 -688.4 122 335.4 159 618.7 196 37.8
12 -1368.9 49 -1553.4 86 -640.8 123 367.7 160 594.4 197 36.0
13 -1351.4 50 -1562.5 87 -826.9 124 384.7 161 581.8 198 35.5
14 -1385.1 51 -1594.7 88 -578.2 125 406.1 162 618.3 199 36.6
15 -1350.8 52 -1545.1 89 -492.9 126 405.2 163 606.5 200 30.9
16 -1437.8 53 -1541.8 90 -446.6 127 461.8 164 603.8 201 33.7
17 -1395.3 54 -1522.3 91 -483.1 128 486.2 165 619.3 202 33.3
18 -1440.6 55 -1518.1 92 -446.2 129 479.8 166 568.5 203 36.0
19 -1419.2 56 -1461.6 93 -415.8 130 467.1 167 585.3 204 35.4
20 -1408.9 57 -1476.9 94 -359.7 131 511.9 168 585.8 205 23.4
21 -1410.4 58 -1420.2 95 -348.9 132 527.0 169 590.8 206 38.1
22 -1397.8 59 -1460.2 96 -290.0 133 514.3 170 514.0 207 30.1
23 -1400.8 60 -1415.0 97 -283.5 134 554.9 171 -3.1 208 35.0
24 -1293.4 61 -1390.5 98 -236.9 135 533.8 172 0.3 209 18.6
25 -59.3 62 -1333.2 99 -201.3 136 523.6 173 -66.5 210 28.9
26 -1373.2 63 -1332.3 100 -170.5 137 552.0 174 -32.6 211 30.2
27 -44.0 64 -1309.2 101 -132.5 138 566.8 175 27.3 212 20.0
28 -1358.4 65 -1327.2 102 -96.9 139 565.3 176 16.0 213 35.0
29 -46.8 66 -1294.6 103 -108.4 140 620.9 177 39.8 214 -0.2
30 -1569.8 67 -1222.0 104 -83.3 141 618.1 178 9.9 215 0.0
31 -1472.3 68 -1168.8 105 -22.9 142 621.9 179 40.0 216 6.5
32 -1525.6 69 -1156.4 106 -12.2 143 618.8 180 43.6 217 11.7
33 -1521.1 70 -1129.3 107 3.7 144 650.9 181 8.4 218 15.3
34 -1595.1 71 -1116.8 108 70.4 145 655.6 182 35.1 219 -0.1
35 -1601.0 72 -1093.2 109 40.8 146 627.2 183 39.8
36 -1649.2 73 -1056.1 110 88.8 147 615.7 184 22.3

PUSK 3 -80- DATE 14/ 8/78

MEAS 805 TIME 21.21.19 TIME (KC) = 0.10.58.8
 GR I U POWER GR I U POWER GR I U POWER
 17 142.6 938.0 136.8 19 143.6 1054.7 151.4 21 146.5 372.1 34.5
 B1= 4.09 HALL= 2297. SUM POWER = 342.5
 I 17=139.9 I 19=136.0 I 21=144.0
 +157 1.0 -157 1.0 +193 2.7 -193 5.9
 18 3.8 1132 5.1 19 4.6 1133 10.2
 110 6.3 1134 11.7 111 8.2 1135 11.4
 112 10.2 1136 10.6 113 7.8 1137 11.5
 114 14.1 1138 10.5 115 12.8 1139 9.7
 116 12.5 1140 12.2 117 17.1 1141 11.1
 118 18.0 1142 11.7 119 21.5 1143 12.8
 SUM 18-119 = 136.9 SUM 1132-1143 = 129.2

MEAS 805 TIME 21.21.19 TIME (KC) = 0.10.58.6
 POWER= 342.5 B-38= 678. BKC-141=2.27 BV-1= 2.47
 ALF= 1.01 BV-7= 50.85 B-6= 2.23 E-29= 2.808
 ALC= 0.78 B-7= 38.34 KC-24= 7.017 PR-41= 182.
 KCK-87= 0.35 B-34= 2.245 KC-64= 0.070 PR-40= 3.941
 TPL1= 2859. TPL2= 0.
 KC-23= 2.189
 C1 1.384 C10 0.930 C16 0.952 D2 0.999
 C2 0.962 C11 1.055 C17 0.920 D3 0.981
 C3 0.923 C12 0.967 C18 0.916 T1 0.984
 C5 0.940 C13 0.874 C19 0.955 T2 0.974
 C8 0.925 C14 0.845 C20 0.938
 C9 0.901 C15 0.952 D1 0.955
 BKC-2= 161. BKC-24= 8.3 DQ1= 1.546 OKC= 18.687
 BG-25= 258. BG-43= 14.8 DQ2= 4.427 OTP= 8.273
 BG-47= 228. BG-44= 19.0 DQ3= 5.051

PUSK 3 -79- DATE 14/ 8/78

MEAS 805 TIME 21.21.19 TIME (KC) = 0.10.58.8
 K FI K FI K FI K FI K FI K FI
 0 -179.1 37 -1539.8 74 -415.7 111 382.2 146 521.5 195 20.9
 1 -396.0 38 -1525.7 75 -413.7 112 408.2 149 550.0 186 29.5
 2 -478.4 39 -1551.2 76 -352.0 113 419.9 150 526.0 187 19.2
 3 -670.0 40 -1514.4 77 -341.1 114 418.1 151 575.0 188 27.8
 4 -814.9 41 -1530.8 78 -343.4 115 440.8 152 554.7 189 35.8
 5 -1042.4 42 -1511.2 79 -265.2 116 432.8 153 588.2 190 30.7
 6 -1299.7 43 -1418.7 80 -286.6 117 455.1 154 599.5 191 22.4
 7 -1473.5 44 -1425.7 81 -271.1 118 466.7 155 580.4 192 17.2
 8 -1510.8 45 -1405.3 82 -229.9 119 441.8 156 600.7 193 53.4
 9 -60.1 46 -1372.9 83 -205.6 120 501.4 157 549.8 194 35.9
 10 -1435.6 47 -1328.1 84 -188.2 121 488.1 158 587.3 195 28.1
 11 -1406.8 48 -1270.5 85 -106.6 122 483.9 159 587.6 196 29.7
 12 -1442.8 49 -1255.0 86 -94.1 123 516.1 160 591.0 197 32.3
 13 -1446.8 50 -1233.0 87 -69.5 124 483.2 161 592.2 198 23.6
 14 -1459.2 51 -1210.6 88 -31.6 125 511.6 162 569.1 199 28.8
 15 -1439.5 52 -1162.5 89 -2.0 126 523.1 163 574.5 200 21.4
 16 -1500.2 53 -1123.1 90 -6.1 127 516.6 164 568.8 201 27.4
 17 -1455.8 54 -1109.7 91 62.8 128 544.9 165 561.0 202 23.7
 18 -1476.1 55 -1056.0 92 81.0 129 548.3 166 570.8 203 27.1
 19 -1485.2 56 -1009.4 93 93.4 130 572.1 167 548.4 204 22.9
 20 -1459.3 57 -974.0 94 105.8 131 561.0 168 523.8 205 18.7
 21 -1452.4 58 -954.0 95 120.9 132 556.1 169 541.0 206 26.9
 22 -1497.7 59 -916.2 96 170.1 133 543.4 170 465.8 207 18.5
 23 -1537.7 60 -887.0 97 161.1 134 551.7 171 -1.1 208 19.2
 24 -1489.4 61 -857.4 98 160.5 135 545.0 172 3.7 209 12.9
 25 -82.3 62 -783.4 99 193.0 136 542.5 173 -42.9 210 18.6
 26 -1495.1 63 -777.2 100 210.0 137 577.8 174 -27.8 211 19.1
 27 -52.7 64 -726.0 101 249.4 138 566.5 175 36.1 212 12.5
 28 -1509.3 65 -698.5 102 272.9 139 580.4 176 26.4 213 18.8
 29 -58.2 66 -668.8 103 281.6 140 541.4 177 35.1 214 -0.2
 30 -1559.1 67 -641.6 104 298.7 141 547.8 178 34.2 215 0.0
 31 -1587.4 68 -623.8 105 311.6 142 537.9 179 40.7 216 -4.8
 32 -1490.0 69 -586.0 106 318.1 143 541.3 180 42.2 217 -10.9
 33 -1614.1 70 -556.8 107 324.6 144 524.8 181 36.9 218 33.3
 34 -1571.4 71 -516.7 108 363.2 145 548.5 182 29.8 219 -0.3
 35 -1537.9 72 -510.8 109 363.3 146 527.2 183 28.5
 36 -1596.9 73 -469.7 110 351.8 147 518.0 184 24.8

MEAS 806 TIME 21.21.44 TIME (KC) = 0.10.56.31
 GR I U POWER GR I U POWER GR I U POWER
 17 124.6 1145.5 142.0 19 124.5 1177.8 140.7 21 129.4 421.9 54.6
 B1= 5.00 HALL= 2666. SUM POWER = 343.9
 I 17=122.8 I 19=117.7 I 21=127.0
 +157 1.6 -157 1.7 +193 2.5 -193 6.7
 18 2.5 1132 3.9 19 3.4 1133 9.5
 110 5.1 1134 10.5 111 7.0 1135 10.3
 112 9.0 1136 9.8 113 6.7 1137 10.4
 114 12.8 1138 9.5 115 11.5 1139 8.7
 116 11.0 1140 10.9 117 15.2 1141 10.0
 118 16.3 1142 10.3 119 19.1 1143 11.3
 SUM 18-119 = 119.7 SUM 1132-1143 = 114.8

MEAS 806 TIME 21.21.44 TIME (KC) = 0.10.56.31
 POWER= 343.9 B-38= 678. BKC-141=2.27 BV-1= 2.48
 ALF= 1.01 BV-7= 50.80 B-6= 2.23 E-29= 2.815
 ALC= 0.78 B-7= 38.34 KC-24= 7.017 PR-41= 182.
 KCK-87= 0.35 B-34= 2.248 KC-64= 0.071 PR-40= 3.941
 TPL1= 2884. TPL2= 0.
 KC-23= 2.189
 C1 1.384 C10 0.930 C16 0.952 D2 0.999
 C2 0.962 C11 1.055 C17 0.920 D3 0.979
 C3 0.920 C12 0.967 C18 0.916 T1 0.984
 C6 0.940 C13 0.874 C19 0.957 T2 0.974
 C9 0.925 C14 0.845 C20 0.938
 C9 0.903 C15 0.947 D1 0.955
 BKC-2= 160. BKC-24= 8.3 DQ1= 1.547 OKC= 18.714
 BG-25= 261. BG-43= 14.7 DQ2= 4.457 OTP= 8.267
 BG-47= 223. BG-44= 19.0 DQ3= 5.059

MEAS 806 TIME 21.21.44 TIME (KC) = 0.10.56.31
 K FI K FI K FI K FI K FI K FI
 0 -215.7 37 -1777.0 74 -459.5 111 472.1 148 680.7 195 26.2
 1 -471.6 38 -1789.5 75 -408.4 112 510.0 149 685.6 196 36.9
 2 -578.2 39 -1762.5 76 -386.0 113 486.8 150 685.9 197 19.8
 3 -811.2 40 -1734.8 77 -365.3 114 500.6 151 656.9 198 35.0
 4 -1005.0 41 -1737.5 78 -335.6 115 525.9 152 669.4 199 42.2
 5 -1286.5 42 -1709.6 79 -330.2 116 536.2 153 694.3 200 35.5
 6 -1535.7 43 -1684.3 80 -298.1 117 546.8 154 702.8 201 18.4
 7 -1815.0 44 -1665.8 81 -245.7 118 557.5 155 700.5 202 15.7
 8 -1730.5 45 -1629.7 82 -228.1 119 552.5 156 689.0 203 37.5
 9 -60.2 46 -1589.2 83 -169.3 120 552.3 157 686.9 204 41.0
 10 -1776.8 47 -1536.0 84 -153.0 121 574.3 158 674.8 205 30.4
 11 -1730.5 48 -1461.9 85 -135.8 122 584.3 159 680.2 206 32.8
 12 -1799.3 49 -1448.1 86 -91.2 123 604.5 160 676.7 207 32.3
 13 -1715.1 50 -1403.2 87 -46.4 124 575.3 161 668.6 208 29.3
 14 -1718.4 51 -1374.1 88 -82.5 125 611.3 162 668.3 209 31.3
 15 -1732.5 52 -1319.7 89 -60.1 126 652.6 163 646.2 200 22.4
 16 -1786.8 53 -1256.7 90 25.8 127 634.4 164 657.7 201 26.8
 17 -1782.4 54 -1265.8 91 47.0 128 623.6 165 646.3 202 26.9
 18 -1753.7 55 -1155.3 92 67.7 129 664.2 166 662.5 203 29.3
 19 -1814.3 56 -1135.8 93 101.0 130 670.2 167 656.6 204 24.2
 20 -1744.6 57 -1115.2 94 149.2 131 669.0 168 628.1 205 18.5
 21 -1789.6 58 -1078.0 95 180.6 132 652.9 169 619.0 206 28.5
 22 -1827.0 59 -1022.7 96 166.7 133 669.3 170 589.0 207 19.9
 23 -1819.9 60 -999.7 97 189.7 134 678.6 171 -1.8 208 20.3
 24 -1842.3 61 -940.3 98 230.7 135 665.9 172 3.0 209 14.2
 25 -90.5 62 -905.9 99 227.9 136 662.1 173 -34.8 210 19.5
 26 -1815.4 63 -868.6 100 250.4 137 682.5 174 -24.8 211 19.2
 27 -87.6 64 -832.1 101 287.1 138 696.1 175 43.1 212 20.8
 28 -1777.9 65 -770.7 102 305.8 139 714.7 176 34.5 213 18.1
 29 -84.5 66 -706.8 103 336.7 140 691.5 177 44.0 214 -0.2
 30 -1820.0 67 -692.9 104 347.0 141 680.1 178 36.3 215 0.0
 31 -1922.0 68 -703.8 105 353.5 142 676.8 179 40.2 216 -3.2
 32 -1909.2 69 -625.8 106 386.0 143 893.6 180 54.3 217 -2.6
 33 -1848.7 70 -588.8 107 395.5 144 671.7 181 41.8 218 27.8
 34 -1875.7 71 -528.5 108 418.6 145 681.6 182 33.4 219 -0.3
 35 -1838.3 72 -534.9 109 429.2 146 669.3 183 32.8
 36 -1805.2 73 -421.2 110 439.2 147 683.3 184 31.8

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MEAS	608	TIME 21.22.45	TIME (KC) =	0.10.57.32
GR 1	U	POWER	GR 1	U POWER
17 109.9	1450.2	152.3	19 107.9	1330.1 143.5
21 112.8	486.3	54.9		
B1= 5.00	HALL= 3147.	SUM POWER =	357.7	
I 17=107.4	I 19=100.1	I 21=110.4		
+157 2.5	-157 0.4	+193 2.1	-193 7.4	
19 1.8	1132 3.7	19 2.7	1133 8.1	
110 4.5	1134 9.4	111 6.4	1135 9.2	
112 8.3	1136 8.2	113 6.0	1137 8.9	
114 11.9	1138 8.5	115 10.1	1139 7.7	
116 9.9	1140 9.6	117 13.1	1141 8.8	
118 14.4	1142 8.8	119 15.8	1143 4.6	
SUM 18-119 =	104.7	SUM 1132-1143 =	100.5	
MEAS 608	TIME 21.22.45	TIME (KC) =	0.10.57.32	
POWER= 357.7	B-38= 679.	BKC-141=2.27	BV-1= 2.46	
ALF= 0.99	BV-7= 50.80	E-29= 2.23	E-29= 2.810	
ALC= 0.76	B-7= 38.34	KC-24= 7.011	PR-41= 182.	
KCK-87= 0.36	B-34= 2.253	KC-64= 0.071	PR-40= 3.941	
TPL1= 2872.	TPL2= 0.			
KC-23= 2.189				
C1 1.387	C10 0.930	C16 0.950	D2 0.999	
C2 0.962	C11 1.057	C17 0.920	D3 0.979	
C3 0.928	C12 0.967	C18 0.919	T1 0.981	
C6 0.955	C13 0.876	C19 0.957	T2 0.974	
C8 0.928	C14 0.845	C20 0.938		
C9 0.896	C15 0.947	D1 0.955		
BKC-2= 161.	BKC-24= 8.3	DO1= 1.548	OKC= 18.914	
BQ-25= 258.	BQ-43= 14.6	DO2= 4.376	OTP= 8.186	
BQ-47= 230.	BQ-44= 19.0	DO3= 5.085		

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PUSK 3 DATE 14/ 6/78

MEAS	608	TIME 21.22.45	TIME (KC) =	0.10.57.32
K FI	K FI	K FI	K FI	K FI
0 -205.2	37 -2340.3	74 -574.7	111 571.8	148 888.8
1 -807.7	38 -2329.7	75 -509.7	112 609.7	149 869.5
2 -804.0	39 -2280.3	76 -470.0	113 627.1	150 867.3
3 -1051.7	40 -2241.3	77 -465.0	114 633.2	151 875.0
4 -1331.4	41 -2241.4	78 -391.2	115 678.3	152 883.4
5 -1657.6	42 -2183.0	79 -346.2	116 635.8	153 907.3
6 -2010.2	43 -2113.1	80 -302.4	117 682.8	154 920.6
7 -2310.4	44 -2082.6	81 -318.0	118 638.8	155 899.2
8 -2313.2	45 -2037.4	82 -256.7	119 716.8	156 909.4
9 -115.0	46 -1930.5	83 -250.6	120 745.9	157 880.9
10 -2318.9	47 -1865.6	84 -222.3	121 738.9	158 899.2
11 -2352.6	48 -1833.9	85 -176.1	122 739.0	159 905.4
12 -2356.7	49 -1821.8	86 -116.9	123 744.2	160 901.9
13 -2319.8	50 -1746.9	87 -65.4	124 785.9	161 883.4
14 -2370.6	51 -1728.3	88 -27.4	125 798.9	162 830.2
15 -2377.9	52 -1659.5	89 14.3	126 800.0	163 860.4
16 -2391.1	53 -1572.0	90 42.9	127 794.2	164 854.1
17 -2312.6	54 -1534.2	91 88.8	128 815.7	165 864.9
18 -2356.4	55 -1499.3	92 110.5	129 811.5	166 873.7
19 -2348.2	56 -1433.9	93 143.8	130 836.4	167 847.8
20 -2397.5	57 -1347.7	94 156.3	131 840.2	168 829.5
21 -2356.9	58 -1309.4	95 218.7	132 850.5	169 819.5
22 -2387.9	59 -1262.9	96 241.1	133 856.0	170 756.1
23 -2383.4	60 -1254.7	97 301.1	134 855.7	171 -2.7
24 -2341.4	61 -1199.7	98 294.6	135 847.6	172 -1.7
25 -126.8	62 -1149.8	99 316.5	136 876.9	173 -12.0
26 -2402.6	63 -1103.0	100 327.2	137 881.0	174 -18.5
27 -112.9	64 -1039.6	101 368.9	138 877.5	175 57.6
28 -2388.9	65 -978.0	102 394.6	139 879.9	176 47.2
29 -105.4	66 -921.0	103 412.0	140 875.7	177 51.6
30 -2404.2	67 -876.8	104 439.6	141 889.3	178 50.6
31 -2421.6	68 -826.7	105 454.7	142 880.6	179 49.6
32 -2439.7	69 -776.3	106 490.4	143 874.2	180 63.2
33 -2399.4	70 -725.5	107 510.2	144 881.9	181 50.5
34 -2385.8	71 -692.7	108 544.4	145 873.1	182 43.6
35 -2388.6	72 -657.9	109 585.0	146 888.4	183 43.6
36 -2404.5	73 -591.6	110 588.1	147 896.2	184 39.6

MEAS	610	TIME 21.23.26	TIME (KC) =	0.10.58.13
GR 1	U	POWER	GR 1	U POWER
17 93.3	1620.2	151.1	19 89.8	1473.7 132.4
21 96.2	636.1	61.6		
B1= 4.99	HALL= 3498.	SUM POWER =	335.1	
I 17= 90.8	I 19= 82.3	I 21= 93.5		
+157 3.4	-157 0.3	+193 1.7	-193 8.1	
18 1.0	1132 3.5	19 1.8	1133 7.2	
110 3.7	1134 8.6	111 5.6	1135 8.0	
112 7.1	1136 7.3	113 4.8	1137 7.6	
114 10.7	1138 7.4	115 8.2	1139 6.5	
116 8.4	1140 8.0	117 11.4	1141 7.4	
118 12.1	1142 7.2	119 12.7	1143 7.6	
SUM 18-119 =	88.2	SUM 1132-1143 =	86.2	
MEAS 610	TIME 21.23.26	TIME (KC) =	0.10.58.13	
POWER= 335.1	B-38= 678.	BKC-141=2.27	BV-1= 2.48	
ALF= 0.99	BV-7= 50.75	E-29= 2.23	E-29= 2.809	
ALC= 0.76	B-7= 38.27	KC-24= 7.017	PR-41= 182.	
KCK-87= 0.36	B-34= 2.248	KC-64= 0.071	PR-40= 3.941	
TPL1= 0.	TPL2= 0.			
KC-23= 2.189				
C1 1.389	C10 0.930	C16 0.950	D2 0.999	
C2 0.962	C11 1.057	C17 0.920	D3 0.979	
C3 0.989	C12 0.964	C18 0.916	T1 0.984	
C6 0.955	C13 0.876	C19 0.955	T2 0.974	
C8 0.925	C14 0.845	C20 0.940		
C9 0.901	C15 0.955	D1 0.955		
BKC-2= 161.	BKC-24= 8.3	DO1= 1.560	OKC= 18.987	
BQ-25= 259.	BQ-43= 14.5	DO2= 4.370	OTP= 8.214	
BQ-47= 226.	BQ-44= 19.0	DO3= 4.981		

MEAS	610	TIME 21.23.26	TIME (KC) =	0.10.58.13
K FI	K FI	K FI	K FI	K FI
0 -348.9	37 -2786.2	74 -738.2	111 657.2	148 1051.9
1 -734.0	38 -2801.8	75 -676.5	112 485.8	149 1065.8
2 -659.1	39 -2709.4	76 -619.8	113 711.7	150 1048.4
3 -1277.9	40 -2649.5	77 -577.8	114 740.9	151 1053.1
4 -1629.1	41 -2615.2	78 -521.9	115 770.8	152 1055.5
5 -2027.9	42 -2575.4	79 -445.8	116 791.4	153 1063.2
6 -2435.6	43 -2491.8	80 -402.5	117 798.5	154 1079.4
7 -2853.1	44 -2423.2	81 -375.5	118 821.8	155 1083.8
8 -2858.5	45 -2401.0	82 -372.8	119 838.9	156 1074.5
9 -1481.5	46 -2373.9	83 -301.8	120 848.6	157 1051.0
10 -2837.5	47 -2289.4	84 -207.9	121 882.5	158 1061.3
11 -2856.9	48 -2237.5	85 -165.7	122 874.1	159 1062.6
12 -2887.3	49 -2184.8	86 -150.4	123 886.9	160 1066.7
13 -2892.6	50 -2097.7	87 -135.5	124 905.3	161 1055.9
14 -2862.6	51 -2020.0	88 -48.7	125 919.7	162 1059.4
15 -2889.4	52 -1957.5	89 2.8	126 938.8	163 1050.0
16 -2885.5	53 -1912.7	90 41.2	127 947.5	164 1047.2
17 -2851.1	54 -1855.2	91 81.0	128 957.7	165 1049.7
18 -2849.8	55 -1791.4	92 94.7	129 969.4	166 1033.6
19 -2865.8	56 -1742.8	93 148.2	130 993.5	167 1009.8
20 -2868.6	57 -1645.4	94 191.1	131 889.5	168 885.8
21 -2859.7	58 -1610.8	95 208.1	132 1007.0	169 991.2
22 -2870.0	59 -1566.2	96 253.0	133 1005.7	170 908.5
23 -2859.2	60 -1520.4	97 283.1	134 1024.0	171 -3.1
24 -2871.2	61 -1470.9	98 328.6	135 1039.1	172 -2.9
25 -854.1	62 -1393.3	99 357.3	136 1034.5	173 1.7
26 -2878.8	63 -1336.9	100 364.7	137 1040.8	174 -11.4
27 -131.2	64 -1283.3	101 423.3	138 1034.1	175 44.3
28 -2885.4	65 -1235.7	102 436.2	139 1052.3	176 55.8
29 -137.6	66 -1170.2	103 461.8	140 1053.3	177 52.3
30 -2905.8	67 -1109.8	104 481.4	141 1053.6	178 66.0
31 -2903.5	68 -1038.2	105 508.3	142 1063.4	179 58.8
32 -2933.8	69 -957.2	106 530.5	143 1064.2	180 72.1
33 -2952.2	70 -932.5	107 541.4	144 1078.3	181 52.4
34 -2814.8	71 -872.2	108 612.7	145 1066.0	182 53.6
35 -2802.1	72 -857.0	109 611.1	146 1083.8	183 53.4
36 -2842.2	73 -775.3	110 651.4	147 1051.6	184 45.6

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MEAS 812 TIME 21.24.3 TIME (KC) = 0.10.58.50
 GR 1 U POWER GR 1 U POWER GR 1 U POWER
 17 109.9 1453.2 159.7 19 107.9 1327.2 143.2 21 112.8 501.0 56.5
 B1= 4.99 HALL= 3182. SUM POWER = 359.4
 I 17=107.4 I 19=100.1 I 21=110.4
 +157 2.6 -157 0.5 +193 2.0 -193 7.8
 18 1.7 1132 2.8 19 2.6 1133 8.3
 110 4.4 1134 9.6 111 6.4 1135 9.0
 112 8.3 1136 8.0 113 5.9 1137 9.0
 114 12.0 1138 8.6 115 10.2 1139 7.9
 116 9.8 1140 9.7 117 13.2 1141 8.7
 118 14.5 1142 9.0 119 15.9 1143 9.3
 SUM 18-119 = 104.8 SUM 1132-1143 = 100.4

MEAS 812 TIME 21.24.3 TIME (KC) = 0.10.58.50
 POWER= 359.4 B-38= 678. BKC-141=2.27 BV-1= 2.46
 ALF= 0.99 BV-7= 50.80 B-6= 2.23 E-29= 2.813
 ALC= 0.76 B-7= 38.34 KC-24= 7.017 PR-41= 182.
 KCK-87= 0.38 B-34= 2.253 KC-64= 0.072 PR-40= 3.941
 TPL1= 0. TPL2= 0.
 KC-23= 2.191
 C1 1.389 C10 0.930 C16 0.950 D2 0.999
 C2 0.964 C11 1.060 C17 0.923 D3 0.981
 C3 1.001 C12 0.964 C18 0.918 T1 0.984
 C5 0.960 C13 0.879 C19 0.957 T2 0.974
 C8 0.925 C14 0.847 C20 0.940
 C9 0.896 C15 0.955 D1 0.955
 BKC-2= 161. BKC-24= 8.3 DO1= 1.556 OKC= 18.990
 BG-25= 259. BG-43= 14.5 DO2= 4.377 OTP= 8.194
 BG-47= 232. BG-44= 19.1 DO3= 5.169

MEAS 613 TIME 21.24.23 TIME (KC) = 0.10.59.10
 GR 1 U POWER GR 1 U POWER GR 1 U POWER
 17 127.0 1280.3 162.6 19 125.6 1201.2 150.7 21 120.4 445.3 67.6
 B1= 5.00 HALL= 2842. SUM POWER = 370.9
 I 17=124.5 I 19=118.2 I 21=127.0
 +157 1.9 -157 0.6 +193 2.3 -193 6.4
 18 2.7 1132 4.5 19 3.5 1133 9.4
 110 5.5 1134 10.1 111 7.4 1135 10.0
 112 9.4 1136 9.0 113 7.0 1137 10.2
 114 13.0 1138 9.8 115 11.6 1139 8.9
 116 11.2 1140 11.2 117 15.1 1141 10.0
 118 16.4 1142 10.4 119 18.9 1143 11.6
 SUM 18-119 = 121.7 SUM 1132-1143 = 115.2
 MEAS 613 TIME 21.24.23 TIME (KC) = 0.10.59.10
 POWER= 370.9 B-38= 678. BKC-141=2.27 BV-1= 2.48
 ALF= 0.99 BV-7= 50.80 B-6= 2.23 E-29= 2.818
 ALC= 0.76 B-7= 38.41 KC-24= 7.017 PR-41= 182.
 KCK-87= 0.36 B-34= 2.253 KC-64= 0.072 PR-40= 3.941
 TPL1= 0. TPL2= 0.
 KC-23= 2.194
 C1 1.392 C10 0.930 C16 0.950 D2 0.999
 C2 0.964 C11 1.062 C17 0.923 D3 0.981
 C3 1.001 C12 0.964 C18 0.916 T1 0.984
 C6 0.962 C13 0.879 C19 0.957 T2 0.974
 C8 0.928 C14 0.847 C20 0.940
 C9 0.898 C15 0.955 D1 0.955
 BKC-2= 161. BKC-24= 8.3 DO1= 1.558 OKC= 19.001
 BG-25= 254. BG-43= 14.5 DO2= 4.366 OTP= 8.198
 BG-47= 230. BG-44= 19.0 DO3= 5.082

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MEAS 812 TIME 21.24.3 TIME (KC) = 0.10.58.50
 K FI K FI K FI K FI K FI K FI
 0 -237.3 37 -2391.0 74 -632.0 111 549.0 148 884.6 185 35.4
 1 -612.7 38 -2342.6 75 -562.2 112 580.5 149 893.7 186 44.4
 2 -804.0 39 -2358.2 76 -535.8 113 590.8 150 893.5 187 43.6
 3 -1073.6 40 -2238.0 77 -495.4 114 612.6 151 887.0 188 39.1
 4 -1373.6 41 -2259.2 78 -447.5 115 619.1 152 893.8 189 50.6
 5 -1699.1 42 -2207.1 79 -423.0 116 645.6 153 930.1 190 43.8
 6 -2077.7 43 -2174.5 80 -370.8 117 657.9 154 922.5 191 18.2
 7 -2366.7 44 -2103.6 81 -365.8 118 629.0 155 917.5 192 40.9
 8 -2393.7 45 -2091.5 82 -325.4 119 593.4 156 905.0 193 42.3
 9 -116.0 46 -2021.7 83 -247.8 120 707.8 157 883.1 194 45.3
 10 -2396.7 47 -1574.9 84 -199.6 121 733.7 158 907.7 195 38.8
 11 -2394.5 48 -1927.7 85 -193.2 122 749.3 159 922.3 196 39.3
 12 -2435.1 49 -1887.3 86 -115.4 123 749.7 160 901.5 197 42.2
 13 -2439.7 50 -1830.2 87 -84.7 124 758.9 161 904.4 198 34.7
 14 -2456.1 51 -1764.1 88 -18.0 125 777.9 162 828.1 199 36.3
 15 -2399.4 52 -1725.0 89 5.4 126 791.0 163 893.4 200 28.0
 16 -2391.1 53 -1665.8 90 26.0 127 799.9 164 859.9 201 31.4
 17 -2401.0 54 -1606.2 91 76.5 128 805.7 165 838.2 202 32.5
 18 -2409.8 55 -1562.4 92 60.6 129 818.2 166 874.5 203 30.4
 19 -2422.8 56 -1518.9 93 134.8 130 855.7 167 862.5 204 30.4
 20 -2408.1 57 -1441.5 94 185.8 131 829.5 168 843.0 205 14.8
 21 -2419.3 58 -1408.0 95 210.1 132 859.3 169 843.1 206 41.8
 22 -2446.1 59 -1342.2 96 211.7 133 871.2 170 766.0 207 27.9
 23 -2442.6 60 -1329.6 97 226.8 134 878.5 171 -2.3 208 24.4
 24 -2446.4 61 -1263.5 98 287.8 135 882.6 172 -2.2 209 17.9
 25 -125.3 62 -1212.9 99 299.6 136 888.7 173 -11.2 210 27.2
 26 -2430.2 63 -1135.4 100 282.1 137 884.8 174 -14.8 211 27.3
 27 -119.6 64 -1102.0 101 318.3 138 882.9 175 47.0 212 20.9
 28 -2432.4 65 -1012.6 102 368.7 139 862.9 176 47.0 213 21.3
 29 -169.2 66 -968.4 103 388.2 140 876.0 177 48.2 214 -0.2
 30 -2468.6 67 -923.0 104 391.1 141 899.2 178 56.6 215 0.0
 31 -2465.6 68 -891.6 105 433.4 142 899.5 179 51.7 216 0.0
 32 -2469.0 69 -827.1 106 445.6 143 899.8 180 61.9 217 0.8
 33 -2460.6 70 -833.5 107 458.8 144 892.1 181 40.3 218 23.5
 34 -2467.3 71 -754.6 108 452.4 145 894.9 182 46.0 219 -0.3
 35 -2425.1 72 -710.0 109 513.7 146 877.6 183 45.4
 36 -2463.8 73 -680.8 110 518.5 147 907.7 184 36.2

MEAS 613 TIME 21.24.23 TIME (KC) = 0.10.59.10
 K FI K FI K FI K FI K FI K FI
 0 -261.0 37 -2137.5 74 -535.8 111 495.9 148 787.7 185 31.0
 1 -543.0 38 -2082.7 75 -526.8 112 535.4 149 806.2 186 38.5
 2 -717.5 39 -2111.5 76 -467.0 113 534.8 150 810.0 187 30.6
 3 -943.2 40 -2035.1 77 -452.4 114 543.6 151 797.4 188 36.1
 4 -1219.8 41 -2046.8 78 -391.5 115 563.8 152 786.3 189 38.8
 5 -1494.9 42 -1983.1 79 -377.6 116 589.5 153 819.6 190 39.4
 6 -1780.6 43 -1946.2 80 -351.7 117 586.3 154 832.0 191 26.7
 7 -2073.1 44 -1903.8 81 -325.3 118 623.5 155 813.2 192 18.6
 8 -2102.6 45 -1889.2 82 -291.4 119 617.5 156 807.7 193 40.9
 9 -123.8 46 -1788.7 83 -232.2 120 618.9 157 817.7 194 46.1
 10 -2103.7 47 -1792.5 84 -147.1 121 643.6 158 838.3 195 34.5
 11 -2111.8 48 -1718.4 85 -154.5 122 676.3 159 806.7 196 35.3
 12 -2191.0 49 -1671.8 86 -133.6 123 689.4 160 793.5 197 39.3
 13 -2141.2 50 -1664.3 87 -88.7 124 697.7 161 806.8 198 32.0
 14 -2163.8 51 -1566.7 88 -93.4 125 684.6 162 800.8 199 34.3
 15 -2075.8 52 -1574.2 89 -15.2 126 690.7 163 799.0 200 26.5
 16 -2194.9 53 -1479.5 90 20.1 127 699.5 164 769.1 201 34.4
 17 -2138.7 54 -1462.5 91 31.4 128 714.2 165 778.6 202 22.2
 18 -2135.1 55 -1369.9 92 43.1 129 730.2 166 781.9 203 31.1
 19 -2148.5 56 -1369.0 93 103.3 130 744.3 167 775.2 204 25.4
 20 -2171.9 57 -1293.1 94 94.8 131 728.5 168 745.1 205 10.8
 21 -2198.0 58 -1229.3 95 151.7 132 745.7 169 753.0 206 39.3
 22 -2207.2 59 -1227.7 96 163.3 133 755.3 170 690.7 207 24.5
 23 -2232.7 60 -1199.5 97 211.6 134 777.8 171 -2.1 208 23.8
 24 -2172.3 61 -1134.6 98 214.7 135 771.4 172 0.8 209 16.5
 25 -119.0 62 -1070.8 99 234.9 136 761.1 173 -19.8 210 24.7
 26 -2154.4 63 -1040.7 100 241.8 137 780.4 174 -19.1 211 23.2
 27 -98.6 64 -970.9 101 288.8 138 764.0 175 50.8 212 21.7
 28 -2143.8 65 -935.5 102 316.1 139 801.5 176 41.9 213 21.4
 29 -105.2 66 -862.7 103 326.7 140 802.7 177 45.3 214 -0.2
 30 -2212.1 67 -818.1 104 342.5 141 794.9 178 47.8 215 0.0
 31 -2229.4 68 -773.5 105 368.9 142 780.3 179 47.6 216 0.4
 32 -2183.3 69 -708.3 106 398.0 143 804.8 180 58.0 217 0.4
 33 -2199.3 70 -686.7 107 402.5 144 802.8 181 28.3 218 24.1
 34 -2195.1 71 -861.0 108 432.9 145 750.6 182 44.1 219 -0.1
 35 -2202.1 72 -535.9 109 451.9 146 781.2 183 45.1
 36 -2145.7 73 -383.6 110 463.0 147 781.5 184 34.5

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MEAS 614 TIME 21.24.42 TIME (KC) = 0.10.59.29
 GR 1 U POWER GR 1 U POWER GR 1 U POWER
 17 143.1 1054.7 150.9 19 143.1 1084.0 155.1 21 146.0 339.4 55.2
 B1= 5.00 HALL= 2467. SUM POWER = 384.2
 I 17=140.4 I 19=135.5 I 21=143.8
 +157 1.1 -157 1.2 +193 2.7 -193 5.9
 I8 3.7 I132 5.0 I19 4.5 I133 10.7
 I10 6.1 I134 11.1 I11 8.1 I135 11.1
 I12 10.3 I136 10.2 I13 9.0 I137 11.4
 I14 14.0 I138 10.8 I15 12.8 I139 10.0
 I16 12.5 I140 12.5 I17 16.8 I141 11.1
 I18 12.8 I142 12.0 I19 21.9 I143 13.2
 SUM 18-119 = 137.4 SUM 1132-1143 = 129.2
 MEAS 614 TIME 21.24.42 TIME (KC) = 0.10.59.29
 POWER= 354.2 B-38= 678. BKC-141=2.27 BV-1= 2.46
 ALF= 0.99 BV-7= 50.80 B-6= 2.23 E-29= 2.814
 ALC= 0.76 B-7= 38.34 KC-24= 7.017 PR-41= 182.
 KCK-87= 0.36 B-34= 2.255 KC-64= 0.072 PR-40= 3.941
 TPL1= 0. TPL2= 0.
 KC-23= 2.191
 C1 1.392 C10 0.930 C16 0.950 D2 0.999
 C2 0.964 C11 1.062 C17 0.923 D3 0.981
 C3 1.001 C12 0.964 C18 0.916 T1 0.984
 C6 0.962 C13 0.879 C19 0.955 T2 0.977
 C8 0.928 C14 0.847 C20 0.938
 C9 0.898 C15 0.957 D1 0.955
 BKC-2= 160. BKC-24= 8.3 DQ1= 1.554 OKC= 18.986
 BG-25= 258. BG-43= 14.6 DQ2= 4.395 OTP= 8.185
 BG-47= 230. BG-44= 18.6 DQ3= 5.052

MEAS 615 TIME 21.25. 2 TIME (KC) = 0.10.59.49
 GR 1 U POWER GR 1 U POWER GR 1 U POWER
 17 168.2 770.5 121.9 19 161.1 975.6 157.2 21 162.6 380.4 58.6
 B1= 5.00 HALL= 2057. SUM POWER = 337.7
 I 17=156.0 I 19=153.8 I 21=159.9
 +157 0.9 -157 3.2 +193 3.0 -193 4.7
 I8 5.0 I132 4.9 I19 5.7 I133 12.1
 I10 7.0 I134 12.5 I11 9.1 I135 12.3
 I12 11.3 I136 11.1 I13 8.9 I137 12.5
 I14 14.9 I138 11.9 I15 13.7 I139 11.1
 I16 13.7 I140 13.7 I17 18.3 I141 12.4
 I18 20.5 I142 13.5 I19 24.8 I143 14.8
 SUM 18-119 = 152.7 SUM 1132-1143 = 142.9
 MEAS 615 TIME 21.25. 2 TIME (KC) = 0.10.59.49
 POWER= 337.7 B-39= 578. BKC-141=2.27 BV-1= 2.48
 ALF= 0.99 BV-7= 50.75 B-6= 2.23 E-29= 2.818
 ALC= 0.76 B-7= 38.27 KC-24= 7.017 PR-41= 182.
 KCK-87= 0.36 B-34= 2.255 KC-64= 0.071. PR-40= 3.941
 TPL1= 0. TPL2= 0.
 KC-23= 2.191
 C1 1.392 C10 0.930 C16 0.950 D2 0.999
 C2 0.964 C11 1.062 C17 0.920 D3 0.979
 C3 1.001 C12 0.964 C18 0.916 T1 0.984
 C6 0.962 C13 0.881 C19 0.955 T2 0.974
 C8 0.925 C14 0.845 C20 0.940
 C9 0.898 C15 0.960 D1 0.955
 BKC-2= 181. BKC-24= 8.3 DQ1= 1.555 OKC= 19.003
 BG-25= 260. BG-43= 14.7 DQ2= 4.427 OTP= 8.184
 BG-47= 226. BG-44= 18.9 DQ3= 4.964

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MEAS 614 TIME 21.24.42 TIME (KC) = 0.10.59.29
 K FI K FI K FI K FI K FI K FI
 0 -222.5 37 -1944.1 74 -554.3 111 456.8 148 685.8 125 27.0
 1 -477.6 38 -1900.4 75 -494.0 112 476.1 149 692.2 125 37.2
 2 -821.6 39 -1867.3 76 -474.7 113 491.0 150 824.2 187 27.2
 3 -820.7 40 -1859.3 77 -478.1 114 519.5 151 703.3 188 37.5
 4 -1053.4 41 -1835.2 78 -411.1 115 520.2 152 685.8 169 14.4
 5 -1337.3 42 -1759.3 79 -392.8 116 512.7 153 713.1 190 42.9
 6 -1605.5 43 -1759.0 80 -340.2 117 517.6 154 723.6 191 32.5
 7 -1837.9 44 -1708.0 81 -324.7 118 555.9 155 655.2 182 20.6
 8 -1881.2 45 -1675.2 82 -297.7 119 567.1 156 887.5 193 36.5
 9 -96.4 46 -1642.2 83 -267.0 120 581.5 157 682.9 194 42.7
 10 -1870.5 47 -1625.8 84 -205.5 121 572.1 158 706.7 195 29.8
 11 -1864.9 48 -1559.3 85 -146.5 122 584.7 159 627.3 196 32.0
 12 -1865.3 49 -1525.9 86 -141.3 123 607.5 160 693.4 197 33.6
 13 -1891.3 50 -1470.3 87 -114.1 124 604.3 161 651.4 198 32.8
 14 -1855.8 51 -1437.4 88 -71.1 125 513.3 162 692.6 199 51.0
 15 -1833.6 52 -1405.0 89 -57.1 126 634.1 163 662.9 200 24.7
 16 -1874.5 53 -1372.5 90 -11.0 127 642.4 164 672.7 201 31.5
 17 -1381.2 54 -1304.7 91 20.2 128 654.5 165 678.2 202 22.3
 18 -1825.3 55 -1284.9 92 62.6 129 669.7 166 658.4 203 27.1
 19 -1830.9 56 -1260.9 93 81.8 130 667.5 167 652.3 204 28.1
 20 -1891.4 57 -1188.9 94 98.4 131 673.7 168 652.9 205 8.7
 21 -1916.1 58 -1182.8 95 122.5 132 675.3 169 645.4 206 36.6
 22 -1914.5 59 -1108.3 96 132.7 133 683.3 170 602.0 207 22.2
 23 -1892.6 60 -1110.5 97 165.3 134 682.9 171 -1.4 208 23.3
 24 -1864.5 61 -1069.4 98 190.1 135 694.0 172 2.5 209 14.5
 25 -99.0 62 -1022.3 99 210.7 136 690.8 173 -32.0 210 22.7
 26 -1866.8 63 -998.8 100 222.9 137 702.4 174 -25.4 211 21.5
 27 -83.0 64 -537.3 101 242.7 138 707.0 175 48.7 212 19.2
 28 -1933.6 65 -891.0 102 291.1 139 742.2 176 33.9 213 19.3
 29 -60.8 66 -860.2 103 315.3 140 715.2 177 40.3 214 -0.2
 30 -1963.5 67 -834.0 104 334.7 141 718.0 178 37.8 215 0.0
 31 -1973.8 68 -756.4 105 341.0 142 699.1 179 45.6 216 -1.5
 32 -1933.8 69 -723.5 106 346.5 143 694.7 180 53.0 217 -4.1
 33 -1962.2 70 -705.8 107 383.8 144 688.7 181 20.6 218 26.0
 34 -1885.2 71 -682.0 108 386.3 145 703.6 182 39.8 219 0.4
 35 -1919.4 72 -609.8 109 426.6 146 677.6 183 40.0
 36 -1967.6 73 -558.0 110 437.1 147 702.1 184 29.9

MEAS 615 TIME 21.25. 2 TIME (KC) = 0.10.59.49
 K FI K FI K FI K FI K FI K FI
 0 -186.4 37 -1850.8 74 -503.1 111 347.5 148 573.0 185 24.3
 1 -400.2 38 -1565.4 75 -466.1 112 416.4 149 580.1 186 33.7
 2 -523.8 39 -1577.4 76 -395.4 113 421.9 150 594.0 187 23.3
 3 -694.2 40 -1541.2 77 -401.9 114 413.7 151 599.9 188 33.7
 4 -891.4 41 -1577.9 78 -361.0 115 423.1 152 548.3 189 11.2
 5 -1109.3 42 -1565.6 79 -320.1 116 430.8 153 617.0 190 40.3
 6 -1327.4 43 -1530.0 80 -312.5 117 454.5 154 630.0 191 33.8
 7 -1491.9 44 -1448.8 81 -268.9 118 467.3 155 620.5 192 17.9
 8 -1523.5 45 -1421.4 82 -266.4 119 489.0 156 596.7 193 33.0
 9 -92.1 46 -1408.0 83 -232.8 120 492.5 157 574.5 194 38.8
 10 -1506.6 47 -1406.7 84 -204.8 121 511.7 158 593.8 195 29.1
 11 -1553.1 48 -1355.7 85 -147.5 122 526.7 159 613.6 196 50.7
 12 -1531.0 49 -1319.7 86 -109.2 123 538.1 160 599.9 197 30.5
 13 -1528.7 50 -1313.0 87 -74.4 124 545.9 161 584.6 198 29.0
 14 -1544.2 51 -1263.5 88 -59.8 125 555.8 162 609.3 199 27.6
 15 -1589.3 52 -1247.0 89 -55.5 126 559.4 163 563.5 200 23.4
 16 -1593.1 53 -1181.8 90 -13.6 127 545.5 164 566.6 201 28.9
 17 -1524.1 54 -1181.9 91 -7.4 128 544.9 165 573.8 202 21.8
 18 -1540.9 55 -1134.2 92 -8.8 129 539.3 166 577.0 203 24.1
 19 -1529.8 56 -1099.3 93 20.6 130 565.7 167 552.2 204 26.3
 20 -1554.0 57 -1058.7 94 35.1 131 558.4 168 533.3 205 2.6
 21 -1601.8 58 -1011.0 95 80.0 132 574.8 169 529.2 206 36.7
 22 -1572.2 59 -980.3 96 92.3 133 580.8 170 508.8 207 20.7
 23 -1560.8 60 -973.7 97 141.6 134 566.6 171 -1.6 208 17.1
 24 -1590.8 61 -933.8 98 163.7 135 551.4 172 3.7 209 14.2
 25 -62.5 62 -905.8 99 142.2 136 588.9 173 -36.4 210 21.8
 26 -1557.6 63 -850.0 100 144.9 137 593.3 174 -28.8 211 17.1
 27 -52.5 64 -756.1 101 170.0 138 577.9 175 41.7 212 18.2
 28 -1515.6 65 -781.2 102 199.5 139 586.2 176 29.5 213 17.5
 29 -50.7 66 -758.2 103 198.3 140 568.8 177 35.9 214 -0.2
 30 -1615.2 67 -700.3 104 228.1 141 566.7 178 33.6 215 0.0
 31 -1663.3 68 -685.3 105 244.9 142 568.4 179 41.2 216 -3.2
 32 -1612.6 69 -636.4 106 250.9 143 554.2 180 45.9 217 -6.6
 33 -1016.6 70 -589.4 107 294.6 144 578.5 181 17.0 218 25.7
 34 -1657.4 71 -611.8 108 314.2 145 554.3 182 35.0 219 0.7
 35 -1632.8 72 -565.4 109 374.8 146 547.9 183 35.9
 36 -1629.5 73 -527.3 110 367.7 147 572.2 184 27.3

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MEAS 818 TIME 21.25.23 TIME (KC) = 0.11. 0.10
 OR 1 U POWER OR 1 U POWER OR 1 U POWER
 17 127.6 445.3 33.5 19 192.4 788.1 151.6 21 100.0 225.6 43.1
 B1= 5.00 HALL= 1441. SUM POWER = 278.2
 I 17=185.3 I 19=185.6 I 21=188.3
 +157 0.6 -157 5.0 +193 4.1 -193 2.8
 18 6.8 1132 8.5 19 7.6 1133 14.9
 110 8.5 1134 14.4 111 10.8 1135 14.5
 112 13.5 1136 12.8 113 10.8 1137 14.6
 114 17.2 1138 13.5 115 16.1 1139 12.7
 116 16.1 1140 15.6 117 21.3 1141 14.1
 118 23.6 1142 15.8 119 29.4 1143 17.2
 SUM 18-119 = 181.6 SUM 1132-1143 = 168.6

MEAS 618 TIME 21.25.23 TIME (KC) = 0.11. 0.10
 POWER= 278.2 B-39= 678. BKC-141= 2.27 BV-1= 2.48
 ALF= 0.99 BV-7= 30.80 B-6= 2.23 E-29= 2.833
 ALC= 0.75 B-7= 38.34 KC-24= 7.017 PR-41= 182.
 KCK-87= 0.38 B-34= 2.250 KC-64= 0.071 PR-40= 3.941
 TPL1= 0. TPL2= 0.
 KC-23= 2.194 C10 0.930 C16 0.950 D2 0.999
 C1 1.394 C11 1.064 C17 0.923 D3 0.981
 C2 0.964 C12 0.964 C18 0.918 T1 0.984
 C3 1.001 C13 0.881 C19 0.957 T2 0.977
 C6 0.967 C14 0.845 C20 0.940
 C8 0.923 C15 0.960 D1 0.955
 C9 0.901 BKC-24= 8.3 DO1= 1.549 OKC= 19.001
 BKC-2= 161. BG-43= 14.7 DO2= 4.413 OTP= 8.154
 BG-25= 253. BG-44= 18.9 DO3= 5.002
 BG-47= 223.

MEAS 817 TIME 21.25.44 TIME (KC) = 0.11. 0.31
 OR 1 U POWER OR 1 U POWER OR 1 U POWER
 17 189.9 272.5 51.8 19 196.3 753.0 147.8 21 194.8 234.4 43.7
 B1= 5.00 HALL= 1248. SUM POWER = 245.2
 I 17=187.5 I 19=189.2 I 21=192.6
 +157 1.0 -157 6.0 +193 3.9 -193 2.8
 18 7.1 1132 7.4 19 7.9 1133 15.2
 110 8.8 1134 14.7 111 10.9 1135 14.8
 112 13.4 1136 13.2 113 10.7 1137 14.9
 114 17.2 1138 13.8 115 16.2 1139 13.0
 116 16.4 1140 15.8 117 21.3 1141 14.4
 118 23.9 1142 16.2 119 30.3 1143 17.6
 SUM 18-119 = 184.1 SUM 1132-1143 = 171.0

MEAS 617 TIME 21.25.44 TIME (KC) = 0.11. 0.31
 POWER= 245.2 B-39= 678. BKC-141= 2.27 BV-1= 2.47
 ALF= 0.99 BV-7= 30.80 B-6= 2.23 E-29= 2.807
 ALC= 0.75 B-7= 38.34 KC-24= 7.017 PR-41= 182.
 KCK-87= 0.36 B-34= 2.253 KC-64= 0.071 PR-40= 3.941
 TPL1= 2697. TPL2= 0.
 KC-23= 2.196 C10 0.930 C16 0.950 D2 0.999
 C1 1.394 C11 1.064 C17 0.923 D3 0.979
 C2 0.964 C12 0.964 C18 0.918 T1 0.981
 C3 1.001 C13 0.884 C19 0.957 T2 0.977
 C6 0.967 C14 0.845 C20 0.938
 C8 0.928 C15 0.960 D1 0.957
 C9 0.901 BKC-24= 8.3 DO1= 1.547 OKC= 18.993
 BKC-2= 161. BG-43= 14.8 DO2= 4.431 OTP= 8.143
 BG-25= 229. BG-44= 19.0 DO3= 5.039
 BG-47= 223.

PUSK 3 -101- DATE 14/ 8/78

MEAS 616 TIME 21.25.23 TIME (KC) = 0.11. 0.10
 K FI K FI K FI K FI K FI K FI
 0 -147.8 37 -1401.7 74 -304.0 111 305.3 148 474.0 183 19.6
 1 -308.4 38 -1488.3 75 -484.3 112 350.6 149 495.9 186 28.2
 2 -387.3 39 -1450.2 76 -469.0 113 349.2 150 464.6 187 19.2
 3 -586.6 40 -1382.2 77 -413.5 114 346.9 151 486.0 188 31.8
 4 -705.3 41 -1350.0 78 -373.0 115 351.3 152 476.0 159 9.8
 5 -920.6 42 -1348.1 79 -431.1 116 379.7 153 508.8 190 39.0
 6 -1043.9 43 -1373.9 80 -351.0 117 399.3 154 467.0 191 21.9
 7 -1274.6 44 -1299.0 81 -347.3 118 371.8 155 511.2 192 17.3
 8 -1290.8 45 -1270.4 82 -313.8 119 372.2 156 494.3 193 30.3
 9 -91.6 46 -1272.8 83 -266.6 120 371.4 157 471.1 194 34.5
 10 -1277.9 47 -1224.2 84 -242.7 121 397.8 158 484.6 195 28.8
 11 -1290.3 48 -1227.0 85 -217.1 122 427.5 159 468.0 196 27.6
 12 -1261.4 49 -1179.4 86 -178.7 123 420.0 160 429.7 197 20.0
 13 -1284.2 50 -1148.5 87 -180.0 124 413.4 161 433.1 198 25.8
 14 -1288.7 51 -1135.3 88 -159.7 125 432.6 162 477.2 199 24.4
 15 -1236.8 52 -1093.3 89 -134.9 126 447.8 163 480.9 200 20.3
 16 -1303.7 53 -1062.4 90 -111.4 127 439.2 164 477.3 201 26.8
 17 -1288.7 54 -1057.8 91 -61.8 128 474.0 165 465.8 202 24.2
 18 -1256.7 55 -867.4 92 -32.0 129 481.8 166 489.8 203 21.1
 19 -1356.0 56 -967.4 93 -28.0 130 482.6 167 454.9 204 23.1
 20 -1334.2 57 -933.0 94 -2.7 131 460.5 168 455.6 205 2.5
 21 -1352.9 58 -920.0 95 2.9 132 474.0 169 465.3 206 34.5
 22 -1264.8 59 -898.7 96 42.2 133 489.7 170 396.1 207 19.3
 23 -1259.5 60 -878.0 97 85.7 134 495.5 171 -1.1 208 15.3
 24 -1274.6 61 -861.9 98 102.0 135 465.9 172 6.3 209 12.6
 25 -45.4 62 -847.4 99 137.1 136 494.8 173 -53.5 210 12.2
 26 -1224.2 63 -783.9 100 144.1 137 501.6 174 -29.7 211 14.6
 27 -42.4 64 -809.8 101 133.3 138 487.0 175 34.6 212 17.8
 28 -1504.0 65 -820.5 102 174.0 139 476.2 176 24.2 213 16.0
 29 -45.0 66 -714.9 103 204.9 140 489.2 177 34.2 214 -0.2
 30 -1385.6 67 -672.8 104 225.0 141 465.5 178 25.8 215 0.0
 31 -1371.6 68 -657.3 105 213.4 142 459.8 179 36.9 216 -5.9
 32 -1380.1 69 -624.5 106 239.3 143 444.4 180 41.7 217 -10.7
 33 -1421.8 70 -592.4 107 265.6 144 472.9 181 15.5 218 27.9
 34 -1433.4 71 -566.6 108 291.6 145 473.3 182 20.3 219 1.0
 35 -1411.0 72 -546.7 109 288.2 146 453.1 183 20.2
 36 -1359.7 73 -511.2 110 303.7 147 467.5 184 23.3

MEAS 617 TIME 21.25.44 TIME (KC) = 0.11. 0.31
 K FI K FI K FI K FI K FI K FI
 0 -125.0 37 -1162.0 74 -492.6 111 294.2 149 396.5 185 15.9
 1 -259.1 38 -1190.7 75 -450.9 112 324.3 149 354.6 186 24.6
 2 -355.4 39 -1089.0 76 -430.6 113 335.9 150 386.4 187 17.5
 3 -456.9 40 -1145.4 77 -442.1 114 357.2 151 381.5 188 25.3
 4 -542.8 41 -1075.7 78 -420.7 115 368.8 152 378.7 189 14.9
 5 -675.9 42 -1025.0 79 -373.2 116 330.8 153 410.6 190 31.2
 6 -847.0 43 -1057.3 80 -342.1 117 348.9 154 404.7 191 14.8
 7 -969.5 44 -1070.3 81 -325.5 118 352.7 155 377.4 192 17.9
 8 -977.5 45 -1052.7 82 -324.5 119 365.5 156 415.7 193 29.7
 9 -37.2 46 -1021.2 83 -257.2 120 384.5 157 395.7 194 31.0
 10 -957.0 47 -1048.1 84 -221.8 121 403.4 158 394.9 195 26.2
 11 -972.7 48 -1001.7 85 -184.0 122 395.6 159 378.0 196 26.2
 12 -941.4 49 -1021.7 86 -116.9 123 418.8 160 396.7 197 24.2
 13 -925.3 50 -1007.2 87 -104.3 124 402.5 161 371.6 198 23.9
 14 -995.8 51 -925.7 88 -99.1 125 416.7 162 362.8 199 22.0
 15 -1038.4 52 -898.7 89 -105.4 126 418.0 163 366.4 200 20.3
 16 -973.8 53 -910.0 90 -122.8 127 433.4 164 366.0 201 22.6
 17 -993.4 54 -931.4 91 -30.8 128 418.8 165 376.9 202 21.9
 18 -1043.0 55 -894.7 92 34.5 129 432.5 166 360.0 203 18.8
 19 -1022.8 56 -912.7 93 2.4 130 428.6 167 360.2 204 22.4
 20 -999.0 57 -850.2 94 01.3 131 419.2 168 358.4 205 2.4
 21 -998.8 58 -842.4 95 77.7 132 430.5 169 352.5 206 31.5
 22 -938.0 59 -831.3 96 59.3 133 419.8 170 321.0 207 17.0
 23 -980.4 60 -770.3 97 104.2 134 409.1 171 -0.7 208 12.7
 24 -903.0 61 -746.8 98 113.8 135 434.0 172 8.0 209 12.3
 25 -42.5 62 -715.2 99 109.1 136 428.9 173 -54.4 210 18.3
 26 -067.8 63 -693.3 100 125.8 137 422.4 174 -34.5 211 13.5
 27 -27.9 64 -696.5 101 151.4 138 411.5 175 31.2 212 18.9
 28 -904.0 65 -661.6 102 178.2 139 423.8 176 22.6 213 16.7
 29 -34.2 66 -615.1 103 187.8 140 404.2 177 23.0 214 -0.2
 30 -1120.8 67 -636.7 104 197.8 141 389.7 178 22.2 215 0.0
 31 -1144.8 68 -593.6 105 243.0 142 399.8 179 27.7 216 -5.1
 32 -1096.5 69 -542.4 106 225.8 143 419.0 180 35.1 217 -13.5
 33 -1053.8 70 -577.5 107 274.3 144 397.8 181 16.8 218 28.2
 34 -1146.8 71 -535.4 108 267.8 145 583.3 182 25.1 219 0.9
 35 -1173.9 72 -525.1 109 267.6 146 376.5 183 23.8
 36 -1097.8 73 -489.5 110 306.4 147 385.6 184 20.7

PUSK 3 -142- DATE 14/ 6/78

MEAS 653 TIME 21.51.28 TIME (KC) = 0.11.26.15
 GR 1 U POWER GR 1 U POWER GR 1 U POWER
 17 139.2 1210.0 168.4 19 140.1 1353.6 189.7 21 139.2 706.1 92.3
 B1= 5.00 HALL= 3182. SUM POWER = 456.3
 I 17=136.7 I 19=132.8 I 21=136.7
 +157 0.8 -157 1.4 +193 3.9 -193 3.2
 18 4.7 1132. 0.0 19 5.4 1133 8.4
 110 6.3 1134 9.9 111 8.3 1135 10.4
 112 10.5 1136 9.3 113 7.3 1137 11.2
 114 12.8 1138 10.9 115 12.4 1139 10.4
 116 12.2 1140 12.8 117 15.2 1141 11.9
 118 17.4 1142 12.8 119 20.4 1143 14.3
 SUM 18-119 = 133.5 SUM 1132-1143 = 122.2

MEAS 653 TIME 21.51.28 TIME (KC) = 0.11.26.15
 POWER= 456.3 E-38= 679. BKC-141=2.47 DV-1= 2.98
 ALF= 1.07 EV-7= 49.77 B-6= 2.40 E-29= 3.092
 ALC= 0.84 B-7= 38.48 KC-24= 7.023 PR-41= 182.
 KCK-87= 0.39 B-34= 2.451 KC-64= 0.078 PR-40= 4.140
 TPL1= 2721. TPL2= 0.
 KC-23= 2.375
 C1 1.450 C10 0.884 C16 0.881 D2 0.974
 C2 0.972 C11 1.116 C17 0.901 D3 0.945
 C3 1.001 C12 0.955 C18 0.857 T1 0.947
 C6 0.930 C13 0.923 C19 0.923 T2 0.945
 C8 0.698 C14 0.847 C20 0.940
 C9 0.867 C15 0.793 D1 0.911
 BKC-2= 161. BKC-24= 8.6 OKC= 20.985
 BG-25= 259. BG-43= 15.2 DO2= 4.575
 BG-47= 229. BG-44= 19.5 DO3= 5.176

PUSK 3 -141- DATE 14/ 6/78

MEAS 653 TIME 21.51.28 TIME (KC) = 0.11.26.15
 K FI K FI K FI K FI K FI K FI
 0 -142.3 37 -1226.9 74 -110.3 111 1110.7 148 1394.2 185 33.8
 1 -320.5 38 -1230.5 75 -78.2 112 1149.5 149 1362.8 186 31.9
 2 -400.1 39 -1225.7 76 -12.3 113 1205.8 150 1371.2 187 32.4
 3 -532.2 40 -1211.9 77 21.5 114 1268.6 151 1395.3 188 30.9
 4 -696.1 41 -1197.2 78 72.1 115 1305.2 152 1639.3 189 45.5
 5 -813.7 42 -1172.4 79 125.9 116 1268.8 153 1635.3 190 35.6
 6 -1064.1 43 -1067.0 80 200.0 117 1275.4 154 1589.1 191 33.3
 7 -1193.4 44 -1077.8 81 220.0 118 1305.5 155 1505.5 192 47.2
 8 -1179.2 45 -1084.6 82 280.9 119 1314.8 156 1580.1 193 18.9
 9 -41.7 46 -1051.6 83 281.5 120 1331.5 157 1539.6 194 49.3
 10 -1220.5 47 -1012.5 84 232.3 121 1219.2 158 1563.6 195 34.0
 11 -1202.1 48 -1007.0 85 299.5 122 1267.5 159 1550.2 196 36.5
 12 -1206.3 49 -860.5 86 412.9 123 1382.7 160 1566.5 197 36.7
 13 -1191.0 50 -858.3 87 454.9 124 1362.7 161 1663.6 198 36.5
 14 -1153.3 51 -831.7 88 541.0 125 1470.6 162 1533.5 199 32.0
 15 -1186.3 52 -836.3 89 593.3 126 1324.1 163 1437.8 200 31.3
 16 -1197.1 53 -800.2 90 570.5 127 1345.5 164 1464.7 201 25.8
 17 -1213.5 54 -729.2 91 620.4 128 1418.0 165 1464.8 202 36.2
 18 -1210.2 55 -699.2 92 836.5 129 1380.8 166 1503.6 203 30.2
 19 -1210.9 56 -688.4 93 686.9 130 1436.4 167 1466.6 204 33.0
 20 -1225.2 57 -632.1 94 818.0 131 1419.5 168 1453.5 205 22.9
 21 -1201.0 58 -605.5 95 901.0 132 1461.0 169 1457.8 206 37.4
 22 -1179.8 59 -566.4 96 932.4 133 1453.4 170 94.7 207 29.5
 23 -1178.0 60 -546.4 97 923.2 134 1558.2 171 -0.9 208 23.6
 24 -1186.7 61 -466.0 98 885.0 135 1527.8 172 5.2 209 16.1
 25 -48.9 62 -445.5 99 863.2 136 1520.5 173 -48.2 210 30.9
 26 -1175.0 63 -432.6 100 899.6 137 1501.5 174 -31.7 211 24.3
 27 -48.8 64 -388.9 101 910.4 138 1490.5 175 37.0 212 22.5
 28 -1182.4 65 -365.1 102 900.8 139 1632.8 176 27.3 213 31.9
 29 -43.5 66 -330.9 103 1092.5 140 1548.8 177 -41.9 214 -0.2
 30 -1212.2 67 -272.1 104 1077.8 141 1553.5 178 41.6 215 0.0
 31 -1221.2 68 -142.3 105 1055.4 142 1599.5 179 14.2 216 5.2
 32 -1246.0 69 -125.8 106 1091.4 143 1614.1 180 58.0 217 1.9
 33 -1198.7 70 -150.1 107 1060.8 144 1601.5 181 20.1 218 27.5
 34 -1230.9 71 -109.1 108 1051.5 145 1550.4 182 37.6 219 -0.6
 35 -1268.4 72 -146.0 109 1131.8 146 1657.3 183 38.8
 36 -1185.1 73 -113.1 110 1206.5 147 1658.2 184 34.4

MEAS 656 TIME 21.52.26 TIME (KC) = 0.11.27.13
 GR 1 U POWER GR 1 U POWER GR 1 U POWER
 17 138.7 1163.1 161.3 19 140.1 1371.1 192.2 21 139.2 747.1 104.0
 B1= 5.00 HALL= 3223. SUM POWER = 457.4
 I 17=136.2 I 19=132.8 I 21=137.0
 +157 0.9 -157 2.3 +193 3.8 -193 3.2
 18 4.5 1132 0.0 19 5.2 1133 8.2
 110 6.4 1134 9.7 111 8.3 1135 10.0
 112 10.2 1136 9.0 113 7.1 1137 11.0
 114 12.8 1138 10.9 115 12.2 1139 10.6
 116 12.1 1140 13.3 117 15.8 1141 12.2
 118 17.3 1142 13.2 119 21.0 1143 14.7
 SUM 18-119 = 132.9 SUM 1132-1143 = 122.9

MEAS 656 TIME 21.52.26 TIME (KC) = 0.11.27.13
 POWER= 457.4 B-38= 678. BKC-141=2.47 BV-1= 2.70
 ALF= 0.88 BV-7= 49.77 B-6= 2.41 E-29= 3.100
 ALC= 0.77 B-7= 38.55 KC-24= 7.023 PR-41= 183.
 KCK-87= 0.39 B-34= 2.444 KC-64= 0.078 PR-40= 4.140
 TPL1= 2721. TPL2= 0.
 KC-23= 2.380
 C1 1.453 C10 0.876 C16 0.881 D2 0.974
 C2 0.972 C11 1.118 C17 0.856 D3 0.945
 C3 0.999 C12 0.955 C18 0.857 T1 0.947
 C6 0.930 C13 0.923 C19 0.920 T2 0.947
 C8 0.891 C14 0.847 C20 0.940
 C9 0.864 C15 0.798 D1 0.913
 BKC-2= 161. BKC-24= 8.7 OKC= 20.755
 BG-25= 259. BG-43= 15.1 DO2= 4.509
 BG-47= 229. BG-44= 19.5 DO3= 5.147

MEAS 656 TIME 21.52.26 TIME (KC) = 0.11.27.13
 K FI K FI K FI K FI K FI K FI
 0 -175.0 37 -1453.5 74 173.2 111 1365.4 148 2008.9 185 39.1
 1 -368.1 38 -1412.7 75 229.5 112 1305.5 149 1952.1 186 35.7
 2 -495.2 39 -1463.3 76 209.8 113 1458.9 150 1926.9 187 44.1
 3 -645.6 40 -1436.9 77 314.1 114 1442.4 151 1912.9 188 32.4
 4 -871.9 41 -1407.7 78 308.6 115 1437.8 152 2006.8 189 43.7
 5 -1046.8 42 -1376.7 79 420.3 116 1540.8 153 1997.8 190 42.6
 6 -1257.7 43 -1319.4 80 467.1 117 1521.6 154 2023.6 191 37.3
 7 -1496.8 44 -1261.8 81 420.7 118 1534.4 155 1970.8 192 31.3
 8 -1421.8 45 -1251.8 82 542.1 119 1539.4 156 1932.4 193 42.1
 9 -89.6 46 -1188.6 83 541.1 120 1555.1 157 1624.2 194 50.9
 10 -1392.3 47 -1126.7 84 603.0 121 1582.7 158 2005.5 195 40.3
 11 -1348.3 48 -1119.4 85 668.2 122 1521.9 159 1984.3 196 40.0
 12 -1463.7 49 -1079.8 86 645.1 123 1558.1 160 2005.3 197 38.8
 13 -1495.9 50 -967.3 87 668.4 124 1626.2 161 1892.0 198 37.9
 14 -1444.0 51 -906.2 88 772.7 125 1647.9 162 1855.9 199 36.3
 15 -1447.0 52 -946.6 89 732.4 126 1641.4 163 1847.1 200 38.3
 16 -1441.6 53 -825.9 90 813.5 127 1688.7 164 1827.4 201 27.2
 17 -1473.4 54 -809.7 91 853.1 128 1745.2 165 1857.6 202 42.8
 18 -1495.7 55 -774.5 92 909.2 129 1803.9 166 1936.5 203 33.7
 19 -1448.3 56 -713.1 93 842.2 130 1798.1 167 1943.7 204 37.2
 20 -1449.1 57 -719.1 94 823.8 131 1774.3 168 1825.5 205 34.1
 21 -1451.1 58 -673.2 95 919.4 132 1802.9 169 1808.3 206 40.3
 22 -1472.1 59 -555.7 96 1031.5 133 1842.7 170 165.6 207 31.4
 23 -1508.0 60 -548.1 97 985.5 134 1863.0 171 -1.2 208 28.8
 24 -1476.2 61 -495.9 98 953.3 135 1840.5 172 3.4 209 15.8
 25 -58.2 62 -433.9 99 1112.0 136 1732.3 173 -27.2 210 29.3
 26 -1484.9 63 -436.9 100 1074.0 137 1811.5 174 -24.9 211 32.7
 27 -46.2 64 -372.1 101 1097.4 138 1841.0 175 58.8 212 27.9
 28 -1417.6 65 -258.9 102 1050.4 139 1866.0 176 43.5 213 35.3
 29 -47.8 66 -233.0 103 1200.0 140 1831.9 177 57.4 214 -0.2
 30 -1472.6 67 -157.8 104 1211.7 141 1870.2 178 50.1 215 0.0
 31 -1515.4 68 -160.5 105 1213.9 142 1822.0 179 43.2 216 7.1
 32 -1501.8 69 -55.5 106 1303.0 143 1852.8 180 66.8 217 8.1
 33 -1443.8 70 6.6 107 1211.4 144 2094.3 181 10.8 218 25.6
 34 -1515.7 71 -56.8 108 1291.8 145 1960.9 182 48.4 219 -1.0
 35 -1512.2 72 88.1 109 1326.5 146 1868.6 183 49.7
 36 -1562.7 73 94.3 110 1292.4 147 1980.3 184 33.6

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MEAS	886	TIME 21.58.50	TIME (KC) =	0.11.31.37
GR 1	U	POWER	GR 1	U
17 198.8	348.8	68.6	19 197.3	855.5 168.6
21 198.7	480.0	91.4		
B1= 5.00	HALL= 1647.	SUM POWER =	328.8	
I 17=194.3	I 19=190.2	I 21=196.5		
+157 2.7	-157 3.0	+193 1.7	-193 3.8	
18 7.7	1132 0.1	19 8.2	1133 13.7	
110 9.3	1134 14.1	111 11.4	1135 14.3	
112 13.7	1130 13.2	113 10.8	1137 15.3	
114 16.9	1138 14.5	115 17.0	1139 14.0	
116 17.2	1140 17.5	117 22.1	1141 15.6	
118 24.9	1142 17.7	119 31.2	1143 19.2	
SUM 18-119 =	190.5	SUM 1132-1143 =	169.3	
MEAS 666	TIME 21.56.50	TIME (KC) =	0.11.31.37	
POWER= 328.8	B-38= 678.	BKC-141=2.48	BV-1= 3.00	
ALF= 1.08	BV-7= 49.37	B-6= 2.41	E-29= 3.094	
ALC= 0.85	B-7= 38.62	KC-24= 7.023	PR-41= 183.	
KCK-87= 0.39	B-34= 2.452	KC-64= 0.078	PR-40= 4.140	
TPL1= 2734.	TPL2= 0.			
KC-23= 2.385				
C1 1.460	C10 0.876	C16 0.886	D2 0.974	
C2 0.974	C11 1.126	C17 0.876	D3 0.945	
C3 0.999	C12 0.935	C18 0.857	T1 0.947	
C6 0.928	C13 0.930	C19 0.918	T2 0.947	
C8 0.886	C14 0.845	C20 0.938		
C9 0.855	C15 0.798	D1 0.911		
BKC-2= 161.	BKC-24= 8.6	DO1= 1.617	OKC= 20.965	
BG-25= 260.	BQ-43= 14.7	DO2= 4.438	OTP= 7.714	
BG-47= 227.	BQ-44= 18.5	DO3= 4.983		

PUSK 3 -167- DATE 14/ 6/78

MEAS	886	TIME 21.56.50	TIME (KC) =	0.11.31.37
K FI	K FI	K FI	K FI	K FI
0 -91.4 37	-886.3 74	-271.6 111	564.0 148	1008.3 185
1 -101.3 38	-831.0 75	-238.5 112	655.9 149	854.1 166
2 -236.8 39	-806.8 76	-265.7 113	678.8 150	906.6 187
3 -333.7 40	-777.8 77	-333.1 114	691.3 151	920.2 188
4 -404.7 41	-767.8 78	-343.1 115	698.7 152	917.3 189
5 -515.7 42	-783.7 79	-223.0 116	686.5 153	915.6 190
6 -598.5 43	-770.2 80	-239.2 117	663.1 154	852.8 191
7 -696.7 44	-759.2 81	-214.6 118	674.1 155	837.0 192
8 -728.4 45	-768.0 82	-212.5 119	707.0 156	801.2 193
9 -25.5 46	-761.2 83	-200.2 120	813.6 157	824.4 194
10 -711.4 47	-722.0 84	-125.1 121	819.5 158	842.9 195
11 -675.7 48	-863.0 85	-70.5 122	862.0 159	909.8 196
12 -683.5 49	-543.3 86	-82.9 123	884.8 160	928.9 197
13 -674.7 50	-835.5 87	31.4 124	889.2 161	891.2 198
14 -631.1 51	-653.5 88	105.5 125	849.1 162	878.1 199
15 -603.3 52	-652.8 89	131.8 126	865.2 163	907.4 200
16 -639.9 53	-584.5 90	156.6 127	835.5 164	865.2 201
17 -610.5 54	-625.4 91	153.1 128	857.8 165	891.0 202
18 -598.4 55	-618.7 92	97.4 129	883.8 166	911.4 203
19 -637.7 56	-622.5 93	128.9 130	882.3 167	867.6 204
20 -630.5 57	-543.8 94	142.5 131	892.1 168	875.9 205
21 -651.5 58	-555.1 95	185.8 132	936.5 169	896.6 206
22 -611.6 59	-555.5 96	256.2 133	826.5 170	143.3 207
23 -681.0 60	-535.4 97	259.2 134	831.6 171	-0.2 208
24 -683.5 61	-483.4 98	268.6 135	860.3 172	9.0 209
25 -754.3 62	-480.9 99	277.8 136	879.0 173	-50.6 210
26 -712.0 63	-456.9 100	339.9 137	906.2 174	-37.3 211
27 -928.2 64	-498.3 101	334.4 138	863.4 175	16.9 212
28 -562.6 65	-454.3 102	323.8 139	841.9 176	12.1 213
29 -708.6 66	-437.7 103	472.1 140	850.6 177	28.1 214
30 -865.8 67	-455.1 104	638.8 141	862.4 178	22.5 215
31 -779.0 68	-441.4 105	605.2 142	1008.7 179	16.8 216
32 -762.1 69	-368.9 106	661.4 143	822.3 180	36.3 217
33 -840.6 70	-344.0 107	638.2 144	862.8 181	12.3 218
34 -856.9 71	-357.8 108	755.0 145	982.0 182	13.6 219
35 -824.1 72	-380.8 109	668.1 146	980.2 183	14.8
36 -829.2 73	-352.9 110	760.6 147	936.2 184	18.9

MEAS	702	TIME 23. 3.13	TIME (KC) =	0.12.38. 0
GR 1	U	POWER	GR 1	U
17 150.9	963.9	145.4	19 150.4	1054.7 158.8
21 148.4	1110.4	164.8		
B1= 5.00	HALL= 3076.	SUM POWER =	468.9	
I 17=148.4	I 19=142.8	I 21=146.2		
+157 1.5	-157 0.7	+193 2.5	-193 0.8	
18 5.6	1132 0.0	19 5.8	1133 3.9	
110 7.2	1134 8.2	111 8.5	1135 8.4	
112 10.4	1136 8.7	113 7.8	1137 11.4	
114 13.0	1138 13.1	115 12.7	1139 13.0	
116 13.5	1140 16.0	117 16.9	1141 14.7	
118 20.3	1142 18.4	119 23.5	1143 19.7	
SUM 18-119 =	145.2	SUM 1132-1143 =	135.5	
MEAS 702	TIME 23. 3.13	TIME (KC) =	0.12.38. 0	
POWER= 468.9	B-38= 673.	BKC-141=2.92	BV-1= 3.41	
ALF= 1.00	BV-7= 50.59	B-6= 2.81	E-29= 3.587	
ALC= 0.80	B-7= 39.62	KC-24= 7.023	PR-41= 183.	
KCK-87= 0.49	B-34= 2.875	KC-64= 0.097	PR-40= 4.512	
TPL1= 2662.	TPL2= 0.			
KC-23= 2.791				
C1 1.853	C10 0.828	C16 0.544	D2 0.974	
C2 1.091	C11 1.248	C17 0.742	D3 0.947	
C3 0.999	C12 1.243	C18 0.608	T1 0.947	
C5 0.544	C13 0.974	C19 0.828	T2 0.947	
C8 0.811	C14 0.845	C20 0.938		
C9 0.784	C15 0.740	D1 0.930		
BKC-2= 161.	BKC-24= 9.7	DO1= 1.823	OKC= 25.849	
BG-25= 259.	BQ-43= 16.1	DO2= 4.852	OTP= 7.054	
BG-47= 227.	BQ-44= 20.4	DO3= 5.385		

MEAS	702	TIME 23. 3.13	TIME (KC) =	0.12.38. 0
K FI	K FI	K FI	K FI	K FI
0 -203.2 37	-1644.7 74	-352.0 111	912.1 148	1504.1 185
1 -442.1 38	-1625.1 75	-264.6 112	857.5 149	1501.5 186
2 -566.6 39	-1593.0 76	-245.7 113	922.0 150	1635.0 187
3 -794.7 40	-1618.4 77	-105.1 114	888.3 151	1717.3 188
4 -1071.7 41	-1468.0 78	-213.9 115	848.6 152	1563.5 189
5 -1381.2 42	-1563.2 79	66.2 116	1098.8 153	1818.3 190
6 -1702.2 43	-1488.3 80	40.3 117	1055.9 154	1698.5 191
7 -1761.5 44	-1401.7 81	1.8 118	1032.1 155	1608.0 192
8 -1775.3 45	-1332.3 82	83.1 119	1137.9 156	1698.6 193
9 -1711.4 46	-1342.5 83	129.7 120	1181.9 157	1764.1 194
10 -1817.2 47	-1237.2 84	217.6 121	1263.5 158	1801.9 195
11 -1815.8 48	-1209.8 85	247.3 122	1201.1 159	1770.2 196
12 -1891.3 49	-1232.7 86	145.9 123	1230.3 160	1786.5 197
13 -1874.8 50	-1157.3 87	191.7 124	1182.2 161	1784.3 198
14 -1797.5 51	-1229.0 88	237.9 125	1247.1 162	1837.5 199
15 -1908.7 52	-1674.0 89	344.7 126	1251.7 163	1778.3 200
16 -1952.1 53	-1069.2 90	270.8 127	1257.0 164	1716.9 201
17 -1877.3 54	-1093.1 91	385.5 128	1174.0 165	1777.0 202
18 -1953.7 55	-1058.0 92	275.4 129	1318.0 166	1668.0 203
19 -2083.9 56	-884.6 93	368.8 130	1438.7 167	1647.5 204
20 -1945.5 57	-876.4 94	424.9 131	1377.5 168	1731.4 205
21 -1873.7 58	-858.4 95	401.0 132	1315.4 169	1545.8 206
22 -1829.7 59	-870.8 96	372.6 133	1471.2 170	154.1 207
23 -1792.0 60	-1012.7 97	482.7 134	1496.0 171	-1.1 208
24 -1845.2 61	-866.2 98	557.3 135	1419.5 172	5.4 209
25 -89.4 62	-879.4 99	483.9 136	1440.9 173	-33.8 210
26 -1812.8 63	-656.4 100	337.8 137	1473.0 174	-30.3 211
27 -54.8 64	-665.4 101	413.0 138	1615.9 175	47.6 212
28 -1831.1 65	-725.7 102	451.1 139	1492.0 176	30.7 213
29 -52.7 66	-613.4 103	414.8 140	1591.0 177	45.7 214
30 -1852.3 67	-526.3 104	499.6 141	1728.3 178	38.7 215
31 -1621.8 68	-460.9 105	437.5 142	1659.0 179	49.1 216
32 -1658.8 69	-486.0 106	579.1 143	1642.3 180	56.7 217
33 -1555.6 70	-457.6 107	587.1 144	1665.6 181	44.7 218
34 -1609.0 71	-471.6 108	660.2 145	1583.7 182	36.0 219
35 -1568.6 72	-371.3 109	716.6 146	1679.8 183	35.3
36 -1520.6 73	-289.9 110	614.3 147	1534.6 184	24.7

PUSK 3 -226- DATE 14/ 6/78

MEAS 703 TIME 23. 3.41 TIME (KC) = 0.12.38.28
 GR 1 U POWER GR 1 U POWER GR 1 U POWER
 17 176.3 553.7 97.6 19 176.3 621.1 109.5 21 173.8 990.3 172.1
 B1= 5.00 HALL= 2127. SUM POWER = 379.2
 I 17=174.1 I 19=169.0 I 21=171.6
 +157 1.7 -157 1.0 +193 3.9 -193 1.7
 18 7.1 1132 0.0 19 7.1 1133 6.5
 110 8.3 1134 10.0 111 9.8 1135 10.3
 112 11.8 1136 10.1 113 9.0 1137 13.0
 114 14.6 1138 14.4 115 14.6 1139 14.4
 116 15.8 1140 16.0 117 19.5 1141 16.7
 118 23.9 1142 20.6 119 28.9 1143 21.9
 SUM 18-119 = 170.4 SUM 1132-1143 = 155.7

MEAS 703 TIME 23. 3.41 TIME (KC) = 0.12.38.29
 POWER= 379.2 B-38= 874. BKC-141=2.92 BV-1= 3.40
 ALF= 1.00 BV-7= 50.59 B-6= 2.81 E-29= 3.802
 ALC= 0.79 B-7= 39.62 KC-24= 7.023 PR-41= 183.
 KCK-87= 0.49 B-34= 2.875 KC-64= 0.099 PR-40= 4.537
 TPL1= 2679. TPL2= 0.
 KC-23= 2.791
 C1 1.853 C10 0.828 C16 0.544 D2 0.974
 C2 1.094 C11 1.248 C17 0.742 D3 0.947
 C3 1.001 C12 1.245 C18 0.808 T1 0.947
 C6 0.544 C13 0.974 C19 0.826 T2 0.947
 C8 0.813 C14 0.847 C20 0.938
 C9 0.784 C15 0.740 D1 0.930
 BKC-2= 161. BKC-24= 9.7 DO1= 1.825 QKC= 25.367
 BG-25= 260. BG-43= 16.1 DO2= 4.862 OTP= 7.057
 BG-47= 231. BG-44= 20.4 DO3= 5.497

PUSK 3 -225- DATE 14/ 6/78

MEAS 703 TIME 23. 3.41 TIME (KC) = 0.12.38.28
 K FI K FI K FI K FI K FI K FI
 0 -147.8 37 -1396.1 74 -148.7 111 588.1 148 1493.3 155 29.3
 1 -307.6 38 -1314.2 75 -214.1 112 600.3 149 1389.3 186 23.7
 2 -423.2 39 -1496.2 76 -174.8 113 558.1 150 1423.0 187 21.0
 3 -548.5 40 -1267.9 77 -212.9 114 707.8 151 1400.7 188 34.7
 4 -661.2 41 -1177.5 78 -130.8 115 799.6 152 1453.4 189 37.7
 5 -852.6 42 -1128.2 79 -91.7 116 918.3 153 1452.9 190 20.3
 6 -1035.5 43 -1165.2 80 -63.4 117 854.5 154 1481.2 191 28.9
 7 -1195.3 44 -1181.9 81 -124.8 118 915.4 155 1376.6 192 31.2
 8 -1227.4 45 -1136.0 82 7.3 119 925.8 156 1583.4 193 23.8
 9 -1193.6 46 -1090.6 83 -51.5 120 1019.9 157 1402.2 194 40.1
 10 -1123.5 47 -1062.6 84 116.5 121 1091.5 158 1453.0 195 31.4
 11 -1275.1 48 -1021.2 85 137.4 122 941.8 159 1375.8 196 20.9
 12 -1086.2 49 -902.1 86 155.5 123 1075.4 160 1445.2 197 21.2
 13 -1135.5 50 -964.2 87 206.5 124 1019.7 161 1564.3 198 22.6
 14 -1060.2 51 -1036.0 88 179.6 125 1019.4 162 1432.1 199 18.3
 15 -1141.0 52 -921.3 89 225.4 126 1173.8 163 1501.2 200 23.3
 16 -973.4 53 -855.3 90 330.6 127 1085.8 164 1294.8 201 8.4
 17 -1046.4 54 -829.0 91 223.5 128 1141.6 165 1347.3 202 32.5
 18 -1048.2 55 -888.8 92 284.9 129 1186.1 166 1493.1 203 13.3
 19 -982.5 56 -862.5 93 241.8 130 1203.1 167 1383.0 204 15.0
 20 -1047.7 57 -826.5 94 289.1 131 1178.8 168 1494.2 205 18.6
 21 -1169.2 58 -749.9 95 267.0 132 1129.0 169 1471.4 206 23.1
 22 -1202.8 59 -666.1 96 284.3 133 1241.3 170 122.1 207 1.4
 23 -1165.1 60 -708.8 97 321.6 134 1228.5 171 -0.7 208 22.2
 24 -1262.6 61 -645.7 98 308.0 135 1176.5 172 6.4 209 0.4
 25 -38.6 62 -593.4 99 325.6 136 1189.6 173 -40.4 210 22.0
 26 -1259.3 63 -508.6 100 268.4 137 1206.8 174 -34.2 211 18.6
 27 -44.0 64 -534.9 101 267.3 138 1327.2 175 -41.3 212 29.1
 28 -1230.9 65 -515.3 102 320.8 139 1257.7 176 21.9 213 34.0
 29 -28.8 66 -486.9 103 427.2 140 1307.4 177 43.4 214 -0.2
 30 -1333.5 67 -426.7 104 256.3 141 1353.4 178 44.1 215 0.0
 31 -1334.5 68 -475.2 105 482.6 142 1257.4 179 36.1 216 16.4
 32 -1300.8 69 -454.8 106 335.0 143 1314.0 180 47.4 217 31.5
 33 -1314.1 70 -383.1 107 377.1 144 1344.4 181 28.2 218 22.5
 34 -1281.3 71 -369.7 108 426.4 145 1271.8 182 27.7 219 1.8
 35 -1372.4 72 -296.2 109 466.3 146 1376.9 183 26.5
 36 -1331.4 73 -286.0 110 544.5 147 1399.6 184 20.3

MEAS 704 TIME 23. 4. 8 TIME (KC) = 0.12.38.53
 GR 1 U POWER GR 1 U POWER GR 1 U POWER
 17 188.6 401.4 75.7 19 189.0 492.2 93.0 21 185.8 952.2 176.7
 B1= 5.00 HALL= 1828. SUM POWER = 345.3
 I 17=186.5 I 19=182.4 I 21=183.4
 +157 1.4 -157 1.4 +193 5.1 -193 1.5
 18 7.6 1132 0.0 19 7.5 1133 7.5
 110 8.9 1134 10.0 111 10.4 1135 10.4
 112 12.5 1136 10.9 113 9.7 1137 14.0
 114 15.5 1138 15.4 115 15.5 1139 15.3
 116 16.7 1140 19.2 117 20.9 1141 17.8
 118 25.9 1142 22.0 119 31.4 1143 22.7
 SUM 18-119 = 182.6 SUM 1132-1143 = 165.0

MEAS 704 TIME 23. 4. 8 TIME (KC) = 0.12.38.53
 POWER= 345.3 B-38= 673. BKC-141=2.92 BV-1= 3.40
 ALF= 1.00 BV-7= 50.54 B-6= 2.81 E-29= 3.611
 ALC= 0.79 B-7= 39.55 KC-24= 7.023 PR-41= 183.
 KCK-87= 0.49 B-34= 2.877 KC-64= 0.097 PR-40= 4.512
 TPL1= 2665. TPL2= 0.
 KC-23= 2.791
 C1 1.853 C10 0.826 C16 0.542 D2 0.974
 C2 1.091 C11 1.250 C17 0.740 D3 0.947
 C3 1.001 C12 1.243 C18 0.808 T1 0.950
 C6 0.542 C13 0.974 C19 0.825 T2 0.945
 C8 0.813 C14 0.845 C20 0.938
 C9 0.779 C15 0.740 D1 0.930
 BKC-2= 161. BKC-24= 9.7 DO1= 1.814 QKC= 25.889
 BG-25= 259. BG-43= 16.0 DO2= 4.835 OTP= 7.008
 BG-47= 231. BG-44= 20.5 DO3= 5.511

MEAS 704 TIME 23. 4. 8 TIME (KC) = 0.12.38.53
 K FI K FI K FI K FI K FI K FI
 0 -124.7 37 -1265.4 74 -205.4 111 442.3 148 1181.2 185 24.1
 1 -265.4 38 -1234.4 75 -143.0 112 501.6 149 1175.5 186 16.3
 2 -356.1 39 -1192.4 76 -224.5 113 610.8 150 1030.4 187 12.8
 3 -474.0 40 -1223.0 77 -177.4 114 623.8 151 988.1 188 25.5
 4 -593.3 41 -1121.8 78 -208.3 115 580.9 152 1077.4 189 34.5
 5 -906.4 42 -1132.9 79 -209.2 116 631.4 153 1126.8 190 16.5
 6 -1029.9 43 -1106.3 80 -209.7 117 641.0 154 1036.8 191 24.9
 7 -1116.5 44 -1055.3 81 -145.9 118 590.1 155 1122.9 192 33.4
 8 -973.5 45 -970.3 82 -96.5 119 617.8 156 1096.0 193 18.5
 9 -949.8 46 -1025.6 83 -54.7 120 523.1 157 1100.6 194 28.8
 10 -924.6 47 -938.4 84 -44.4 121 636.2 158 1137.5 195 20.8
 11 -958.0 48 -860.3 85 -155.4 122 626.7 159 1044.5 196 13.9
 12 -979.1 49 -886.4 86 -98.9 123 712.5 160 1054.4 197 18.5
 13 -891.7 50 -875.0 87 26.2 124 728.3 161 1132.6 198 18.5
 14 -1016.0 51 -930.3 88 -1.8 125 742.4 162 1149.4 199 5.7
 15 -982.8 52 -863.6 89 93.8 126 905.1 163 1130.2 200 21.0
 16 -972.2 53 -813.3 90 139.9 127 870.1 164 1056.6 201 4.2
 17 -1002.5 54 -767.7 91 136.4 128 829.9 165 1124.1 202 21.7
 18 -961.5 55 -752.9 92 45.8 129 805.1 166 1083.9 203 9.9
 19 -915.1 56 -710.9 93 97.5 130 938.0 167 1088.3 204 13.5
 20 -875.7 57 -652.8 94 97.3 131 1004.6 168 1098.5 205 10.4
 21 -681.6 58 -674.5 95 106.1 132 976.7 169 1127.2 206 15.2
 22 -971.1 59 -637.1 96 127.4 133 1084.5 170 90.4 207 0.4
 23 -945.4 60 -687.6 97 105.6 134 991.4 171 -0.3 208 13.7
 24 -892.3 61 -568.8 98 111.3 135 1063.6 172 7.2 209 0.1
 25 -32.7 62 -512.6 99 172.5 136 1047.6 173 -48.0 210 22.4
 26 -927.7 63 -534.0 100 111.3 137 1247.1 174 -37.6 211 17.7
 27 -36.4 64 -515.0 101 132.7 138 1033.5 175 31.2 212 27.6
 28 -1035.1 65 -468.6 102 190.5 139 1132.6 176 14.7 213 26.8
 29 -38.9 66 -463.2 103 186.5 140 1168.0 177 32.5 214 -0.2
 30 -1304.3 67 -394.3 104 245.0 141 1117.6 178 27.5 215 0.0
 31 -1249.0 68 -444.5 105 238.2 142 1071.7 179 32.2 216 18.2
 32 -1207.4 69 -341.7 106 312.0 143 1121.0 180 37.7 217 29.6
 33 -1059.9 70 -403.4 107 256.1 144 1094.0 181 24.6 218 23.7
 34 -1136.4 71 -343.6 108 259.1 145 1140.4 182 22.0 219 2.2
 35 -1156.1 72 -287.0 109 366.2 146 1088.2 183 21.4
 36 -1244.1 73 -233.0 110 423.8 147 1172.4 184 11.8

PUSK 3 -230- DATE 14/ 8/78

MEAS 705 TIME 23. 4.35 TIME (KC) = 0.12.39.22
GR I U POWER GR I U POWER GR I U POWER
17 196.8 275.4 54.2 19 196.8 331.1 65.1 21 193.4 887.7 171.7
B1= 5.00 HALL= 1488. SUM POWER = 291.0
I 17=194.3 I 19=190.4 I 21=191.2
+157 -1.7 -157 1.6 +193 5.9 -193 2.1
18 8.3 1132 0.0 19 8.1 1133 8.1
110 9.4 1134 10.8 111 10.7 1135 11.3
112 12.9 1136 11.4 113 10.2 1137 14.3
114 16.0 1138 15.8 115 16.1 1139 15.7
116 17.2 1140 19.7 117 21.6 1141 18.3
118 26.9 1142 22.3 119 33.1 1143 23.5
SUM 18-119 = 190.4 SUM 1132-1143 = 171.3

MEAS 705 TIME 23. 4.35 TIME (KC) = 0.12.39.22
POWER= 291.0 B-38= 673. BKC-141=2.92 BV-1= 3.38
ALF= 0.99 BV-7= 50.59 B-6= 2.81 E-29= 3.606
ALC= 0.79 B-7= 39.62 KC-24= 7.023 PR-41= 183.
KCK-87= 0.49 B-34= 2.877 KC-64= 0.098 PR-40= 4.537
TPL1= 2686. TPL2= 0.
KC-23= 2.791
C1 1.853 C10 0.828 C16 0.540 D2 0.974
C2 1.094 C11 1.250 C17 0.740 D3 0.947
C3 0.999 C12 1.243 C18 0.808 T1 0.947
C6 0.544 C13 0.974 C19 0.825 T2 0.947
C8 0.813 C14 0.845 C20 0.938
C9 0.779 C15 0.740 D1 0.930
SKC-2= 161. SKC-24= 9.7 DQ1= 1.825 QKC= 25.851
BG-25= 261. BG-43= 16.2 DQ2= 4.910 OTP= 7.059
BG-47= 228. BG-44= 20.6 DQ3= 5.472

PUSK 3 -229- DATE 14/ 8/78

MEAS 705 TIME 23. 4.35 TIME (KC) = 0.12.39.22
K FI K FI K FI K FI K FI K FI
0 -87.6 37 -1019.5 74 -253.0 111 221.4 143 944.4 163 19.5
1 -189.9 38 -940.9 75 -211.5 112 99.6 142 1032.1 126 10.9
2 -294.2 39 -916.2 76 -172.9 113 222.2 150 1028.3 127 13.0
3 -358.6 40 -1012.9 77 -95.0 114 176.1 151 911.7 128 20.6
4 -471.4 41 -857.8 78 -248.7 115 113.3 152 922.0 129 28.5
5 -590.8 42 -962.5 79 -226.2 116 297.4 153 1032.8 130 7.8
6 -690.3 43 -964.2 80 -238.0 117 220.4 154 1003.8 131 13.5
7 -641.0 44 -956.2 81 -216.2 118 350.1 155 964.6 132 19.9
8 -643.1 45 -933.4 82 -181.5 119 369.1 156 948.7 133 13.8
9 -679.2 46 -878.1 83 -139.9 120 338.6 157 259.2 134 23.3
10 -695.1 47 -858.1 84 -137.2 121 569.1 158 959.6 135 17.1
11 -750.8 48 -856.7 85 -100.3 122 532.7 159 1015.1 136 16.5
12 -730.3 49 -752.2 86 -126.3 123 477.0 160 917.9 137 12.9
13 -835.0 50 -759.8 87 -88.2 124 631.1 161 1066.7 138 13.8
14 -742.7 51 -760.1 88 -93.5 125 611.5 162 941.5 139 0.9
15 -796.2 52 -771.0 89 -95.5 126 632.3 163 1014.5 140 13.0
16 -775.9 53 -710.5 90 -87.8 127 675.7 164 1000.8 141 -0.2
17 -820.8 54 -695.7 91 -51.3 128 712.4 165 982.3 142 12.0
18 -703.9 55 -624.9 92 -128.1 129 746.6 166 925.8 143 6.3
19 -832.4 56 -585.1 93 -78.2 130 752.8 167 978.5 144 2.5
20 -779.0 57 -596.6 94 -29.1 131 816.4 168 1036.8 145 0.7
21 -777.1 58 -541.9 95 -92.7 132 911.9 169 955.0 146 8.0
22 -741.3 59 -518.7 96 -127.2 133 901.1 170 84.7 147 0.2
23 -814.4 60 -552.7 97 39.1 134 921.9 171 -0.3 148 11.1
24 -847.7 61 -527.8 98 -31.0 135 916.8 172 3.9 149 0.1
25 -28.8 62 -523.1 99 -115.4 136 874.7 173 -51.7 150 24.6
26 -807.6 53 -533.4 100 -89.2 137 909.5 174 -35.1 151 13.9
27 -23.5 64 -458.5 101 -104.2 138 1035.3 175 36.3 152 27.7
28 -872.3 65 -430.1 102 25.9 139 971.6 176 12.9 153 27.4
29 -38.1 66 -356.3 103 -24.0 140 936.7 177 42.0 154 -0.2
30 -1015.8 67 -355.8 104 16.1 141 1022.7 178 24.6 155 0.0
31 -268.5 68 -335.9 105 75.0 142 976.5 179 30.7 156 14.7
32 -1100.5 69 -283.0 106 126.3 143 1014.2 180 34.4 157 25.6
33 -1019.1 70 -304.4 107 85.8 144 1008.7 181 16.2 158 24.1
34 -1015.7 71 -329.9 108 161.7 145 865.6 182 17.5 159 2.2
35 -1696.3 72 -349.4 109 221.7 146 1034.5 183 15.7
36 -980.4 73 -339.9 110 154.1 147 1025.0 184 6.0

MEAS 706 TIME 23. 5. 5 TIME (KC) = 0.12.39.52
GR I U POWER GR I U POWER GR I U POWER
17 214.4 64.5 13.8 19 216.8 128.0 27.3 21 211.4 799.8 169.1
B1= 5.00 HALL= 920. SUM POWER = 210.2
I 17=212.4 I 19=210.2 I 21=209.2
+157 1.1 -157 2.9 +193 7.4 -193 2.1
18 9.3 1132 0.0 19 8.9 1133 10.2
110 10.2 1134 12.5 111 11.7 1135 12.9
112 13.9 1136 12.6 113 11.1 1137 15.6
114 17.2 1138 16.7 115 17.2 1139 16.7
116 18.8 1140 20.9 117 23.5 1141 19.4
118 29.7 1142 23.8 119 36.7 1143 24.9
SUM 18-119 = 203.2 SUM 1132-1143 = 180.2

MEAS 706 TIME 23. 5. 5 TIME (KC) = 0.12.39.52
POWER= 210.2 B-38= 673. BKC-141=2.92 BV-1= 3.41
ALF= 1.00 BV-7= 30.59 B-6= 2.81 E-29= 3.594
ALC= 0.80 B-7= 39.69 KC-24= 7.023 PR-41= 183.
KCK-87= 0.49 B-34= 2.877 KC-64= 0.098 PR-40= 4.537
TPL1= 2656. TPL2= 0.
KC-23= 2.794
C1 1.853 C10 0.828 C16 0.540 D2 0.974
C2 1.094 C11 1.250 C17 0.740 D3 0.947
C3 0.999 C12 1.243 C18 0.808 T1 0.950
C6 0.542 C13 0.974 C19 0.825 T2 0.947
C8 0.813 C14 0.847 C20 0.938
C9 0.779 C15 0.740 D1 0.930
SKC-2= 161. SKC-24= 9.7 DQ1= 1.822 QKC= 25.899
BG-25= 261. BG-43= 16.1 DQ2= 4.906 OTP= 7.035
BG-47= 227. BG-44= 20.7 DQ3= 5.459

MEAS 706 TIME 23. 5. 5 TIME (KC) = 0.12.39.52
K FI K FI K FI K FI K FI K FI
0 -79.3 37 -781.6 74 -328.9 111 88.8 148 744.8 125 19.8
1 -140.0 38 -818.4 75 -359.6 112 78.3 149 771.2 126 2.9
2 -197.8 39 -923.2 76 -349.5 113 88.2 150 780.5 127 8.2
3 -261.6 40 -636.7 77 -345.6 114 166.9 151 842.8 128 15.7
4 -290.0 41 -670.6 78 -380.4 115 216.2 152 680.8 129 16.7
5 -409.4 42 -697.5 79 -324.5 116 141.8 153 840.4 130 1.2
6 -502.0 43 -640.7 80 -240.0 117 305.5 154 721.6 131 13.7
7 -562.0 44 -621.9 81 -174.3 118 252.5 155 712.6 132 13.6
8 -603.9 45 -622.8 82 -223.2 119 359.2 156 674.0 133 6.0
9 -20.5 46 -651.5 83 -261.4 120 227.9 157 647.0 134 13.0
10 -608.8 47 -585.7 84 -241.3 121 474.1 158 798.8 135 10.3
11 -580.0 48 -563.4 85 -200.7 122 313.2 159 873.0 136 9.6
12 -622.6 49 -660.6 86 -206.1 123 322.8 160 698.3 137 5.0
13 -641.8 50 -600.3 87 -174.2 124 468.0 161 790.9 138 8.3
14 -613.1 51 -601.3 88 -220.1 125 443.4 162 718.7 139 -2.0
15 -647.6 52 -592.0 89 -134.0 126 517.2 163 771.3 140 5.1
16 -674.9 53 -576.6 90 -142.5 127 536.8 164 783.9 141 -0.8
17 -561.4 54 -511.2 91 -238.0 128 522.3 165 825.9 142 1.8
18 -593.6 55 -521.2 92 -219.5 129 454.1 166 810.1 143 -0.3
19 -675.9 56 -548.3 93 -167.7 130 344.8 167 789.2 144 -0.2
20 -596.7 57 -535.8 94 -176.3 131 547.7 168 846.8 145 0.2
21 -602.0 58 -504.4 95 -166.5 132 493.5 169 783.3 146 0.1
22 -591.4 59 -472.1 96 -162.1 133 571.3 170 82.2 147 -0.1
23 -589.8 60 -527.8 97 -204.2 134 551.4 171 0.2 148 -1.1
24 -561.9 61 -450.7 98 -192.3 135 654.0 172 9.5 149 -0.1
25 -849.7 62 -438.0 99 -175.6 136 655.6 173 -65.4 150 10.1
26 -650.2 63 -448.1 100 -112.5 137 620.6 174 -43.9 151 9.5
27 -577.3 64 -425.8 101 -130.9 138 680.4 175 19.2 152 28.9
28 -650.0 65 -456.6 102 -124.3 139 701.7 176 2.0 153 23.5
29 -520.1 66 -371.8 103 -82.8 140 781.1 177 12.6 154 -0.2
30 -861.2 67 -369.1 104 -125.6 141 784.4 178 11.4 155 0.0
31 -832.4 68 -344.8 105 -84.7 142 774.4 179 21.1 156 11.8
32 -881.8 69 -325.6 106 -138.6 143 841.9 180 22.6 157 23.3
33 -755.8 70 -354.3 107 49.2 144 764.3 181 3.2 158 25.4
34 -856.0 71 -289.7 108 106.1 145 721.8 182 10.3 159 2.1
35 -823.0 72 -347.0 109 117.7 146 714.4 183 10.0
36 -814.7 73 -352.3 110 64.3 147 747.7 184 1.1

PUSK 2

DATE 14/ 8/78

MEAS 707 TIME 23. 5.42 TIME (KC) = 0.12.40.29

GR	1	U	POWER	GR	1	U	POWER	GR	1	U	POWER
17	217.3	82.0	17.8	19	226.1	38.1	8.6	21	223.2	876.3	151.0

B1= 5.00 HALL= 633. SUM POWER = 177.6

I 17=215.1 I 19=219.7 I 21=221.4

+157	0.4	-157	8.8	+193	6.9	-193	3.3
18	9.6	1132	0.0	19	9.2	1133	11.4
110	10.4	1134	13.5	111	11.8	1135	14.0
112	14.2	1136	13.4	113	11.3	1137	18.2
114	17.3	1138	17.3	115	17.5	1139	17.2
116	18.9	1140	21.7	117	23.9	1141	20.0
118	29.8	1142	25.0	119	37.1	1143	25.0
SUM 18-119	=	210.9		SUM 1132-1143	=	195.8	

MEAS 707 TIME 23. 5.42 TIME (KC) = 0.12.40.29

POWER= 177.5 B-38= 673. BXC-141=2.92 BV-1= 3.41

ALF= 1.00 BV-7= 50.54 B-6= 2.81 E-29= 3.623

ALC= 0.79 B-7= 39.41 KC-24= 7.023 PR-41= 183.

KCK-87= 0.49 B-34= 2.877 KC-64= 0.097 PR-40= 4.487

TPL1= 2685. TPL2= 0.

KC-23= 2.791		C10	0.828	C16	0.537	D2	0.974
C1	1.851	C11	1.250	C17	0.742	D3	0.945
C2	1.054	C12	1.243	C18	0.806	T1	0.947
C3	1.001	C13	0.674	C19	0.825	T2	0.945
C6	0.542	C14	0.845	C20	0.935		
C8	0.813	C15	0.740	D1	0.930		
C9	0.779	BKC-2= 161.		DQ1= 1.825		OKC= 25.874	
BG-25= 258.		BG-43= 16.3		DQ2= 4.883		OTP= 7.056	
BG-47= 227.		BG-44= 20.8		DQ3= 5.487			

PUSK 3

DATE 14/ 8/78

MEAS 707 TIME 23. 5.42 TIME (KC) = 0.12.40.29

K	FI	K	FI	K	FI	K	FI	K	FI	K	FI
0	-47.5	37	-435.8	74	-393.3	111	-90.1	143	595.9	185	7.3
1	-35.7	38	-538.8	75	-355.5	112	-125.8	140	459.5	186	0.3
2	-120.9	39	-589.6	76	-342.0	113	-123.9	150	531.1	187	3.5
3	-165.1	40	-581.3	77	-358.5	114	-130.2	151	504.6	188	0.2
4	-194.3	41	-574.8	78	-363.5	115	-32.7	152	589.2	189	10.9
5	-227.8	42	-490.8	79	-377.8	116	-86.1	153	582.7	190	-0.1
6	-313.4	43	-481.0	80	-359.0	117	-45.2	154	590.8	191	8.7
7	-353.5	44	-530.8	81	-387.9	118	24.6	155	577.8	192	14.6
8	-373.7	45	-503.2	82	-357.2	119	69.9	156	604.9	193	4.0
9	-368.8	46	-524.8	83	-340.3	120	100.2	157	601.2	194	10.8
10	-355.6	47	-478.9	84	-326.7	121	88.9	158	548.2	195	10.8
11	-378.5	48	-534.7	85	-280.2	122	155.0	159	616.0	196	3.2
12	-446.8	49	-514.4	86	-242.2	123	194.1	160	565.5	197	3.8
13	-414.8	50	-510.2	87	-314.5	124	241.1	161	557.9	198	2.2
14	-438.8	51	-422.2	88	-301.8	125	256.3	162	609.3	199	-2.5
15	-425.1	52	-458.4	89	-305.9	126	301.5	163	580.1	200	0.5
16	-411.2	53	-497.4	90	-362.1	127	312.6	164	552.2	201	-0.8
17	-453.0	54	-513.2	91	-309.5	128	396.1	165	518.4	202	0.3
18	-491.9	55	-446.0	92	-317.7	129	360.0	166	520.1	203	-0.6
19	-446.0	56	-501.1	93	-346.3	130	428.0	167	576.0	204	-0.5
20	-420.3	57	-467.8	94	-343.8	131	407.7	168	515.0	205	0.4
21	-450.9	58	-472.6	95	-524.6	132	348.9	169	408.5	206	1.1
22	-425.2	59	-449.2	96	-321.4	133	468.7	170	27.9	207	-0.2
23	-457.0	60	-405.5	97	-301.0	134	467.8	171	0.1	208	0.4
24	-432.8	61	-456.5	98	-259.3	135	369.8	172	10.7	209	0.0
25	-469.9	62	-415.8	99	-311.4	136	493.8	173	-70.0	210	11.4
26	-388.0	63	-421.9	100	-308.6	137	422.0	174	-44.9	211	5.1
27	-513.2	64	-365.9	101	-312.9	138	466.6	175	11.7	212	23.0
28	-580.8	65	-437.8	102	-278.9	139	510.9	176	2.2	213	20.4
29	-721.3	66	-427.9	103	-238.5	140	567.3	177	20.4	214	-0.2
30	-541.7	67	-419.8	104	-267.1	141	477.3	178	12.1	215	0.0
31	-586.2	68	-368.4	105	-257.8	142	465.7	179	15.1	216	10.7
32	-554.1	69	-380.0	106	-211.6	143	532.2	180	17.1	217	21.2
33	-560.2	70	-394.1	107	-214.1	144	512.5	181	-0.5	218	26.2
34	-568.1	71	-380.1	108	-225.8	145	477.9	182	2.9	219	3.3
35	-622.8	72	-366.6	109	-184.3	146	506.8	183	3.0		
36	-621.1	73	-411.0	110	-120.7	147	450.7	184	0.1		

MEAS 708 TIME 23. 6.11 TIME (KC) = 0.12.40.58

GR	1	U	POWER	GR	1	U	POWER	GR	1	U	POWER
17	215.9	114.3	24.4	19	222.7	52.7	11.7	21	234.4	833.2	125.0

B1= 5.00 HALL= 510. SUM POWER = 161.2

I 17=211.7 I 19=216.1 I 21=232.7

+157	0.0	-157	8.4	+193	0.7	-193	12.9
18	9.3	1132	0.0	19	9.0	1133	12.7
110	10.0	1134	14.3	111	11.6	1135	14.8
112	13.8	1136	14.1	113	11.1	1137	16.8
114	17.0	1138	17.9	115	17.1	1139	17.8
116	18.8	1140	22.3	117	23.6	1141	20.7
118	29.6	1142	25.7	119	36.5	1143	26.8
SUM 18-119	=	207.5		SUM 1132-1143	=	203.9	

MEAS 708 TIME 23. 6.11 TIME (KC) = 0.12.40.58

POWER= 161.2 B-38= 673. BXC-141=2.82 BV-1= 3.39

ALF= 1.00 BV-7= 50.59 B-6= 2.81 E-29= 3.613

ALC= 0.79 B-7= 39.48 KC-24= 7.029 PR-41= 183.

KCK-87= 0.49 B-34= 2.880 KC-64= 0.099 PR-40= 4.537

TPL1= 2677. TPL2= 0.

KC-23= 2.794		C10	0.828	C16	0.537	D2	0.974
C1	1.853	C11	1.250	C17	0.745	D3	0.947
C2	1.099	C12	1.243	C18	0.808	T1	0.947
C3	1.001	C13	0.974	C19	0.828	T2	0.947
C6	0.544	C14	0.847	C20	0.938		
C8	0.813	C15	0.740	D1	0.930		
C9	0.779	BKC-2= 161.		DQ1= 1.818		OKC= 25.891	
BG-25= 251.		BG-43= 16.3		DQ2= 4.950		OTP= 7.023	
BG-47= 229.		BG-44= 20.6		DQ3= 5.672			

MEAS 708 TIME 23. 6.11 TIME (KC) = 0.12.40.58

K	FI	K	FI	K	FI	K	FI	K	FI	K	FI
0	-41.9	37	-617.1	74	-330.0	111	-136.3	148	365.8	185	-0.3
1	-78.1	38	-591.9	75	-355.7	112	-134.5	149	395.6	186	-0.5
2	-103.7	39	-584.8	76	-351.3	113	-126.9	150	560.5	187	0.3
3	-139.4	40	-553.4	77	-381.2	114	-88.2	151	380.6	188	-0.4
4	-164.2	41	-579.8	78	-367.3	115	-67.3	152	315.3	189	2.0
5	-235.0	42	-566.6	79	-380.6	116	-12.5	153	394.4	190	-0.5
6	-266.4	43	-633.4	80	-339.8	117	17.0	154	406.5	191	0.8
7	-258.7	44	-563.8	81	-338.4	118	58.4	155	341.2	192	3.7
8	-309.2	45	-530.1	82	-312.4	119	83.1	156	403.3	193	0.9
9	-290.7	46	-482.3	83	-340.4	120	55.3	157	341.1	194	0.5
10	-342.4	47	-560.7	84	-319.2	121	83.0	158	387.4	195	1.7
11	-367.7	48	-550.1	85	-340.7	122	112.9	159	422.1	196	2.2
12	-313.4	49	-492.4	86	-351.4	123	97.8	160	407.3	197	0.6
13	-321.4	50	-512.8	87	-305.8	124	188.4	161	371.1	198	-0.7
14	-305.5	51	-468.9	88	-347.8	125	156.5	162	342.6	199	-2.7
15	-303.4	52	-481.3	89	-334.3	126	159.4	163	334.2	200	-0.2
16	-286.4	53	-462.4	90	-321.8	127	217.0	164	333.5	201	-1.3
17	-294.0	54	-493.4	91	-332.9	128	217.7	165	343.0	202	-0.7
18	-293.3	55	-457.3	92	-359.4	129	249.4	166	375.9	203	-1.4
19	-305.1	56	-432.6	93	-309.7	130	228.3	167	569.0	204	-2.5
20	-260.4	57	-400.4	94	-357.5	131	222.4	168	358.4	205	0.0
21	-272.0	58	-410.9	95	-358.1	132	284.4	169	387.4	206	-7.6
22	-278.1	59	-367.0	96	-309.4	133	264.6	170	16.7	207	-0.8
23	-305.8	60	-348.8	97	-292.3	134	281.0	171	0.4	208	-1.6
24	-279.8	61	-330.4	98	-334.1	135	369.5	172	10.7	209	0.1
25	-293.6	62	-364								

PUSK \$ DATE 14/ 6/78

MEAS 700				TIME 23. 0.40				TIME [KC] = 0.12.41.27			
GR	I	U	POWER	GR	I	U	POWER	GR	I	U	POWER
17	216.3	114.3	24.7	19	223.6	55.7	12.4	21	247.6	401.4	99.4
B1= 5.00			HALL= 393.			SUM POWER =			136.5		
I 17=213.6			I 19=216.8			I 21=245.1					
+157	0.2		-157	7.4		+193	0.0		-193	24.7	
18	9.6		1132	0.0		10	9.2		1133	14.0	
110	10.2		1134	15.2		111	11.7		1135	15.8	
112	14.0		1136	14.9		113	11.3		1137	17.8	
114	17.2		1138	18.6		115	17.3		1139	18.4	
116	18.9		1140	23.0		117	23.7		1141	21.4	
118	29.6		1142	27.0		119	36.5		1143	27.5	
SUM 18-119 =			209.2			SUM 1132-1143 =			213.2		

MEAS	709	TIME 23. 6.40	TIME (KC) =	0.12.41.27			
POWER=	-136.5	B-33=	873.	BK-141=	2.92	BV-1=	3.42
ALF=	1.00	BV-7=	50.34	B-6=	2.81	E-29=	3.613
ALC=	0.79	B-7=	39.48	KC-24=	7.023	PR-41=	183.
XKC-87=	0.49	B-34=	2.880	KC-84=	0.099	PR-40=	4.537
TPL1=	2671.	TP12=	0.				
KC-23=	2.794						
C1	1.833	C10	0.828	C16	0.533	D2	0.974
C2	1.099	C11	1.252	C17	0.747	D3	0.967
C3	0.999	C12	1.243	C18	0.808	T1	0.945
C6	0.344	C13	0.974	C19	0.325	T2	0.945
C8	0.315	C14	0.845	C20	0.938		
C9	0.779	C15	0.740	D1	0.933		
BK-2=	161.	BK-24=	9.7	D01=	1.818	QK=	25.900
BG-25=	258.	BQ-43=	16.3	D02=	4.886	QTP=	7.017
BQ-47=	232.	BQ-44=	21.0	D03=	5.563		

MEAS 710				TIME 23.7.8				TIME (KC) = 0.12.41.55			
GR	I	U	POWER	GR	I	U	POWER	GR	I	U	POWER
17	218.3	102.4	23.7	19	226.1	81.5	13.9	21	259.3	313.5	21.3
E1= 5.01			HALL= 322.			SUM POWER = 118.0					
I 17=218.3.			I 19=219.5			I 21=257.1					
+157	0.0		-157	7.4		+193	0.0		-193	34.2	
18	9.6		1132	0.0		19	8.1		1133	15.3	
110	10.2		1134	16.2		111	11.7		1135	16.8	
112	14.1		1136	15.8		113	11.4		1137	18.6	
114	17.4		1138	19.3		115	17.5		1139	19.1	
116	19.0		1140	24.0		117	24.3		1141	22.1	
118	30.3		1142	27.9		119	37.2		1143	28.3	
SUM 18-119 = 211.8						SUM 1132-1143 = 223.1					

MEAS	710	TIME 23. 7. 8	TIME (KC) =	0.12.41.55
POWER=	118.9	B-38= 674.	BKC-141=2.92	BV-1= 3.41
ALF=	1.00	BV-7= 50.54	B-6= 2.81	E-29= 3.535
ALC=	0.79	B-7= 39.41	KC-24= 7.073	PR-41= 183.
KC-87=	0.49	B-34= 2.882	KC-64= 0.099	PR-40= 4.537
TPL1=	2681.	TPL2= 0.		
KC-23=	2.794			
C1	1.853	C10= 0.830	C16 0.535	D2 0.974
C2	1.099	C11 1.252	C17 0.750	D3 0.947
C3	1.001	C12 1.243	C18 0.808	T1 0.947
C5	0.542	C13 0.974	C19 0.825	T2 0.947
C8	0.815	C14 0.847	C20 0.938	
C9	0.779.	C15 0.740	D1 0.933.	
BKC-2=	161.	BKC-24= 9.7	D01= 1.821	QKC= 25.904
SG-25=	257.	BQ-43= 10.3	D02= 4.880	OTP= 7.029
BQ-47=	229.	BQ-44= 21.0	D03= 5.595	

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PUSK \$ DATE 14/ 8/78

K	MEAS	769	TIME 23. 8.40	TIME (KCI) =	0.12.41.27						
K	F1	K	F1	K	F1	K	F1				
0	-26.7	37	-413.4	74	-301.6	111	-181.2	148	273.6	185	-0.2
1	-61.5	38	-398.6	75	-320.7	112	-160.5	149	269.5	186	-0.3
2	-82.6	39	-408.2	76	-344.3	113	-155.8	150	281.1	187	0.0
3	-109.8	40	-380.4	77	-303.3	114	-105.7	151	272.0	188	0.0
4	-164.8	41	-407.6	78	-308.4	115	-121.6	152	262.1	189	4.4
5	-174.2	42	-427.6	79	-300.6	116	-81.0	153	310.9	190	-0.6
6	-220.6	43	-403.6	80	-285.3	117	-93.2	154	355.3	191	1.6
7	-248.5	44	-371.9	81	-288.7	118	-90.3	155	355.1	192	3.4
8	-230.0	45	-367.1	82	-256.6	119	-8.0	156	347.9	193	1.8
9	-228.6	46	-373.2	83	-225.2	120	-6.7	157	310.9	194	-0.1
10	-229.1	47	-384.8	84	-213.7	121	41.0	158	344.1	195	1.3
11	-221.2	48	-364.4	85	-248.0	122	15.6	159	346.2	196	0.5
12	-260.7	49	-403.4	86	-223.3	123	25.0	160	303.9	197	-0.2
13	-267.9	50	-376.8	87	-265.7	124	45.3	161	331.2	198	-0.3
14	-249.7	51	-354.9	88	-266.6	125	73.5	162	311.2	199	-2.7
15	-235.3	52	-390.9	89	-214.5	126	115.3	163	252.2	200	-0.4
16	-252.4	53	-380.8	90	-265.1	127	99.8	164	328.9	201	-1.2
17	-252.9	54	-375.4	91	-226.0	128	114.1	165	320.5	202	-1.2
18	-252.4	55	-325.5	92	-235.0	129	114.9	166	313.6	203	-1.5
19	-208.5	56	-374.8	93	-201.6	130	169.2	167	286.4	204	-5.5
20	-239.7	57	-258.9	94	-251.0	131	162.1	168	296.5	205	-0.1
21	-233.1	58	-312.9	95	-275.4	132	188.1	169	312.4	206	-11.2
22	-249.5	59	-328.7	96	-309.9	133	209.2	170	14.7	207	-0.8
23	-257.3	60	-289.7	97	-306.7	134	198.3	171	0.4	208	-2.1
24	-248.9	61	-279.9	98	-287.6	135	202.8	172	10.6	209	-0.3
25	-219.0	62	-291.2	99	-246.5	136	259.0	173	-76.8	210	-0.1
26	-209.6	63	-271.3	100	-303.1	137	269.6	174	-49.9	211	3.3
27	-217.6	64	-266.0	101	-244.0	138	301.7	175	8.4	212	-0.5
28	-203.9	65	-269.6	102	-318.0	139	269.2	176	0.5	213	2.9
29	-428.0	66	-213.4	103	-259.5	140	256.9	177	13.4	214	-0.2
30	-342.8	67	-257.5	104	-281.9	141	318.7	178	-3.2	215	0.0
31	-363.1	68	-282.4	105	-276.2	142	272.4	179	7.9	216	6.7
32	-385.0	69	-269.0	106	-221.2	143	293.1	180	9.7	217	14.9
33	-422.4	70	-282.3	107	-220.4	144	273.3	181	-11.2	218	27.7
34	-427.0	71	-333.1	108	-204.9	145	348.4	182	-0.5	219	2.9
35	-425.9	72	-324.3	109	-194.7	146	314.8	183	-0.3		
36	-372.0	73	-340.9	110	-228.8	147	320.5	184	-0.5		

MEAS	710	TIME 23. 7. 8	TIME (XC) *	0.12.41.55							
K	F1	K	F1	K	F1	K	F1	K	F1		
0	-24.8	37	-399.6	74	-242.7	111	-145.6	148	233.4	185	0.0
1	-46.9	39	-355.9	75	-175.3	112	-161.2	149	265.8	196	-0.4
2	-71.5	39	-386.6	76	-200.4	113	-103.5	150	222.2	187	0.5
3	-89.7	40	-351.0	77	-245.9	114	-106.5	151	229.8	188	0.7
4	-120.9	41	-411.2	78	-243.4	115	-114.3	152	253.3	189	5.8
5	-132.2	42	-375.0	79	-230.7	116	-85.5	153	222.3	190	-0.5
6	-115.9	43	-343.9	80	-211.8	117	-83.9	154	301.1	191	2.6
7	-190.5	44	-339.0	81	-225.5	118	-51.4	155	299.2	192	4.0
8	-179.4	45	-373.0	82	-259.7	119	-60.5	156	267.1	193	1.7
9	-154.1	46	-365.4	83	-247.8	120	-45.5	157	238.5	194	0.4
10	-161.0	47	-355.4	84	-215.9	121	13.9	158	230.4	195	1.3
11	-175.4	48	-491.2	85	-261.0	122	1.9	159	184.5	196	3.1
12	-177.2	49	-351.0	86	-243.4	123	32.4	160	285.9	197	0.4
13	-193.2	50	-307.4	87	-207.1	124	48.4	161	237.9	198	-0.1
14	-169.5	51	-279.9	88	-234.3	125	39.2	152	258.4	199	-0.2
15	-175.5	52	-343.8	89	-257.1	126	68.6	163	230.5	200	-0.2
16	-189.6	53	-344.8	90	-240.8	127	73.6	164	205.3	201	-1.3
17	-166.8	54	-291.2	91	-235.3	128	145.4	165	223.9	202	-1.3
18	-129.8	55	-313.1	92	-224.5	129	115.8	166	228.9	203	-1.0
19	-150.3	56	-287.8	93	-162.7	130	60.9	167	207.3	204	-7.5
20	-161.4	57	-309.2	94	-223.7	131	103.9	168	200.8	205	0.0
21	-194.8	58	-255.8	95	-253.9	132	161.1	169	210.6	206	-15.1
22	-201.8	59	-241.7	96	-220.1	133	146.3	170	20.5	207	-0.8
23	-183.7	60	-260.2	97	-209.4	134	145.0	171	0.4	208	-3.7
24	-200.3	61	-256.0	98	-243.7	135	162.0	172	11.1	209	-0.3
25	-105.5	62	-287.1	99	-230.2	136	165.0	173	-71.6	210	-0.1
26	-204.6	63	-278.0	100	-276.1	137	171.0	174	-50.4	211	1.5
27	-91.6	64	-219.7	101	-261.1	138	250.7	175	7.8	212	-2.4
28	-208.0	65	-203.0	102	-246.7	139	214.9	176	1.8	213	-3.0
29	-235.8	66	-180.8	103	-303.8	140	192.1	177	14.9	214	-0.2
30	-113.9	67	-197.6	104	-263.7	141	238.4	178	-216	215	0.0
31	-326.4	68	-159.8	105	-243.4	142	194.8	179	10.3	216	4.2
32	-340.1	69	-207.4	106	-203.0	143	235.9	180	12.0	217	12.1
33	-376.9	70	-196.9	107	-231.9	144	235.9	181	-11.8	218	29.6
34	-365.5	71	-232.3	108	-214.6	145	212.4	182	-0.4	219	2.7
35	-395.9	72	-180.3	109	-111.8	146	189.1	183	-0.3		
36	-382.5	73	-202.1	110	-153.1	147	209.4	184	-0.3		

PUSK 3 -242- DATE 14/ 6/78

MEAS 711 TIME 23. 7.38 TIME (KC) = 0.12.42.25
 GR 1 U POWER GR 1 U POWER GR 1 U POWER
 17 227.1 108.4 24.6 19 232.4 61.5 14.3 21 271.0 219.7 59.5
 B1= 5.00 HALL= 240. SUM POWER = 98.5
 I 17=225.1 I 19=226.1 I 21=269.5
 +157 1.0 -157 6.0 +193 0.0 -193 40.0
 18 10.3 1132 0.0 19 9.9 1133 16.7
 110 10.8 1134 17.1 111 12.4 1135 17.8
 112 14.8 1136 16.6 113 12.0 1137 19.2
 114 18.2 1138 19.9 115 18.3 1139 19.8
 116 19.7 1140 24.8 117 25.0 1141 22.7
 118 31.0 1142 28.8 119 38.5 1143 29.2
 SUM 18-119 = 220.9 SUM 1132-1143 = 232.0

MEAS 711 TIME 23. 7.38 TIME (KC) = 0.12.42.25
 POWER= 98.5 E-38= 674. BXC-141=2.92 BV-1= 3.40
 ALF= 1.00 EV-7= 50.49 B-6= 2.81 E-29= 3.599
 ALC= 0.79 E-7= 39.48 KC-24= 7.023 PR-41= 183.
 KCK-87= 0.49 E-34= 2.880 KC-64= 0.099 FR-40= 4.537
 TPL1= 2685. TPL2= 0.
 KC-23= 2.794
 C1 1.853 C10 0.830 C16 0.535 D2 0.974
 C2 1.101 C11 1.252 C17 0.745 D3 0.947
 C3 1.001 C12 1.243 C18 0.808 T1 0.947
 C6 0.542 C13 0.974 C19 0.825 T2 0.945
 C8 0.815 C14 0.847 C20 0.938
 C9 0.776 C15 0.740 D1 0.933
 BXC-2= 161. BXC-24= 9.7 OKC= 25.894
 BG-25= 260. BG-43= 16.3 DO2= 4.932 OTP= 6.995
 BG-47= 229. BG-44= 21.2 DO3= 5.614

MEAS 712 TIME 23. 8.18 TIME (KC) = 0.12.43. 5
 GR 1 U POWER GR 1 U POWER GR 1 U POWER
 17 141.1 1069.4 150.9 19 146.0 981.6 143.3 21 138.7 1092.8 151.5
 B1= 5.01 HALL= 3100. SUM POWER = 445.7
 I 17=138.7 I 19=138.4 I 21=138.7
 +157 0.0 -157 4.7 +193 6.7 -193 0.0
 18 4.9 1132 0.0 19 5.2 1133 3.7
 110 0.6 1134 7.4 111 8.0 1135 8.6
 112 9.8 1136 8.3 113 7.0 1137 10.8
 114 12.3 1138 12.3 115 12.0 1139 12.4
 116 12.6 1140 15.0 117 16.1 1141 14.5
 118 19.2 1142 17.4 119 21.6 1143 17.8
 SUM 18-119 = 135.4 SUM 1132-1143 = 128.1

MEAS 712 TIME 23. 8.18 TIME (KC) = 0.12.43. 5
 POWER= 445.7 B-38= 673. BXC-141=2.92 BV-1= 3.42
 ALF= 1.00 EV-7= 50.49 B-8= 2.81 E-29= 3.618
 ALC= 0.79 E-7= 39.41 KC-24= 7.023 PR-41= 183.
 KCK-87= 0.49 E-34= 2.880 KC-64= 0.099 PR-40= 4.537
 TPL1= 2671. TPL2= 0.
 KC-23= 2.794
 C1 1.851 C10 0.828 C16 0.532 D2 0.974
 C2 1.101 C11 1.252 C17 0.742 D3 0.945
 C3 1.001 C12 1.243 C18 0.808 T1 0.947
 C6 0.542 C13 0.974 C19 0.825 T2 0.945
 C8 0.811 C14 0.847 C20 0.938
 C9 0.776 C15 0.740 D1 0.930
 BXC-2= 162. BXC-24= 9.7 DO1= 1.815 OKC= 25.900
 BG-25= 259. BG-43= 16.3 DO2= 4.900 OTP= 7.007
 BG-47= 226. BG-44= 21.2 DO3= 5.577

PUSK 3 -241- DATE 14/ 6/78

MEAS 711 TIME 23. 7.38 TIME (KC) = 0.12.42.25
 K FI K FI K FI K FI K FI K FI
 0 -11.9 37 -381.2 74 -223.7 111 -182.3 148 105.7 185 0.0
 1 -58.8 38 -343.9 75 -262.3 112 -209.7 149 78.3 185 -0.4
 2 -32.3 39 -377.2 76 -241.9 113 -184.8 150 79.4 187 1.3
 3 -60.0 40 -342.1 77 -241.3 114 -189.8 151 100.5 188 2.2
 4 -37.0 41 -424.4 78 -210.1 115 -177.5 152 97.7 189 4.4
 5 -56.5 42 -448.8 79 -185.4 116 -126.8 153 97.6 190 -0.3
 6 -78.4 43 -421.9 80 -189.6 117 -126.6 154 123.9 191 1.6
 7 -111.5 44 -423.3 81 -202.8 118 -119.2 155 123.2 192 5.1
 8 -152.4 45 -338.2 82 -190.9 119 -113.1 156 133.9 193 2.9
 9 -195.7 46 -416.9 83 -177.6 120 -111.5 157 110.1 194 3.4
 10 -216.8 47 -371.3 84 -207.4 121 -117.7 158 125.5 195 1.2
 11 -197.4 48 -349.6 85 -172.7 122 -106.4 159 133.7 196 2.7
 12 -110.7 49 -354.8 86 -187.6 123 -97.5 160 153.6 197 0.2
 13 -103.7 50 -432.0 87 -197.0 124 -29.5 161 105.7 198 -0.2
 14 -118.2 51 -353.9 88 -173.5 125 -46.8 162 94.5 199 -2.7
 15 -157.8 52 -372.9 89 -185.4 126 -59.6 163 109.6 200 -0.1
 16 -139.4 53 -401.1 90 -133.6 127 -23.0 164 98.9 201 -1.2
 17 -184.1 54 -327.2 91 -163.2 128 -32.8 165 98.7 202 -1.1
 18 -141.4 55 -317.0 92 -139.0 129 12.9 166 102.6 203 -1.1
 19 -136.8 56 -296.8 93 -195.3 130 23.6 167 62.8 204 -8.8
 20 -104.5 57 -243.5 94 -201.5 131 20.7 168 82.6 205 -0.1
 21 -149.9 58 -240.2 95 -249.8 132 59.2 169 79.0 206 -14.9
 22 -155.4 59 -321.6 96 -219.6 133 72.2 170 11.0 207 -1.0
 23 -155.1 60 -301.8 97 -237.5 134 20.5 171 0.5 208 -4.8
 24 -154.9 61 -284.6 98 -266.3 135 2.7 172 11.3 209 -0.4
 25 24.5 62 -248.3 99 -240.0 136 62.7 173 -70.7 210 0.1
 26 -176.0 63 -229.7 100 -293.0 137 65.5 174 -47.7 211 2.4
 27 45.5 64 -208.9 101 -245.2 138 87.6 175 11.4 212 -2.8
 28 -170.6 65 -232.8 102 -250.8 139 83.3 176 1.5 213 -10.4
 29 -87.0 66 -209.0 103 -228.1 140 95.0 177 11.1 214 -0.2
 30 -328.0 67 -244.3 104 -242.0 141 97.7 178 -1.5 215 0.0
 31 -332.2 68 -212.5 105 -243.5 142 93.2 179 10.4 216 3.3
 32 -273.2 69 -189.1 106 -244.5 143 108.1 180 10.5 217 11.6
 33 -319.3 70 -188.6 107 -255.2 144 103.8 181 -9.9 218 29.7
 34 -342.4 71 -249.2 108 -242.7 145 98.5 182 -0.3 219 2.9
 35 -335.8 72 -226.7 109 -240.8 146 120.7 183 -0.3
 36 -356.6 73 -258.1 110 -240.8 147 102.4 184 -0.5

MEAS 712 TIME 23. 8.18 TIME (KC) = 0.12.43. 5
 K FI K FI K FI K FI K FI K FI
 0 -11.3 37 -266.7 74 -117.8 111 -172.8 148 88.9 185 0.2
 1 -19.4 38 -258.3 75 -137.3 112 -168.1 149 78.0 186 -0.3
 2 5.5 39 -254.5 76 -105.8 113 -147.7 150 96.6 187 0.4
 3 7.3 40 -285.5 77 -126.2 114 -153.6 151 105.0 188 0.0
 4 -12.4 41 -238.4 78 -142.6 115 -165.6 152 97.6 189 5.6
 5 -34.9 42 -318.3 79 -106.4 116 -150.4 153 114.5 190 -0.2
 6 -23.5 43 -284.1 80 -114.6 117 -132.4 154 110.2 191 0.9
 7 -28.4 44 -265.1 81 -109.6 118 -133.1 155 110.7 192 4.4
 8 -31.5 45 -204.7 82 -82.3 119 -138.4 156 128.2 193 2.2
 9 -51.0 46 -181.6 83 -117.5 120 -137.1 157 92.9 194 1.5
 10 -48.5 47 -217.6 84 -89.9 121 -85.0 158 110.9 195 1.0
 11 -40.2 48 -173.5 85 -43.5 122 -84.9 159 86.7 196 2.0
 12 -68.9 49 -226.5 86 -90.8 123 -84.9 160 89.0 197 0.1
 13 -108.7 50 -234.7 87 -17.0 124 -84.6 161 101.4 198 -0.4
 14 -77.4 51 -165.4 88 -47.3 125 -68.2 162 103.8 199 -2.6
 15 -83.1 52 -180.1 89 12.3 126 -51.7 163 84.8 200 -0.2
 16 -86.0 53 -158.1 90 -56.4 127 -51.1 164 91.2 201 -1.1
 17 2.3 54 -176.2 91 -70.3 128 -67.4 165 102.1 202 -1.3
 18 -61.4 55 -134.3 92 -104.0 129 -5.4 166 105.5 203 -0.8
 19 -23.9 56 -124.7 93 -124.1 130 -11.6 167 70.8 204 -9.4
 20 -90.5 57 -101.2 94 -91.5 131 -3.1 168 89.9 205 0.0
 21 -115.1 58 -123.8 95 -124.5 132 9.2 159 97.5 206 -17.0
 22 -78.9 59 -110.4 96 -119.7 133 -14.0 170 16.5 207 -1.1
 23 -96.4 60 -106.8 97 -108.8 134 -10.5 171 0.3 208 -8.5
 24 -98.3 61 -132.0 98 -145.7 135 2.2 172 11.4 209 -0.3
 25 -1.0 62 -143.3 99 -162.2 136 11.4 173 -78.1 210 0.1
 26 -66.4 63 -86.8 100 -108.1 137 7.7 174 -54.6 211 15.9
 27 269.1 64 -92.9 101 -137.4 138 27.3 175 11.7 212 -29.1
 28 -66.1 65 -83.8 102 -167.8 139 11.1 176 3.0 213 -12.4
 29 -623.5 66 -108.0 103 -125.3 140 56.5 177 13.4 214 -0.2
 30 -173.9 67 -109.6 104 -202.8 141 86.7 178 -6.6 215 0.0
 31 -188.7 68 -89.8 105 -152.6 142 62.3 179 6.6 216 1.5
 32 -222.9 69 -97.0 106 -153.5 143 55.6 180 9.8 217 9.0
 33 -268.0 70 -105.8 107 -179.4 144 77.3 181 -10.9 218 30.3
 34 -271.4 71 -111.9 108 -154.3 145 89.1 182 -0.4 219 2.9
 35 -285.5 72 -137.9 109 -167.1 146 97.1 183 -0.4
 36 -294.1 73 -127.1 110 -160.5 147 83.0 184 -0.4

PUSK 3 -258- DATE 14/ 8/78

MEAS 719 TIME 23.32.29 TIME (KC) = 0.13. 7.19
GR 1 U POWER CR 1 U POWER GR 1 U POWER
17 141.1 905.5 127.8 19 142.1 1318.4 187.3 21 141.6 1160.2 164.3
B1= 5.00 HALL= 3311. SUM POWER = 479.4
I 17=137.9 I 19=134.0 I 21=138.9
+157 2.1 -157 2.8 +193 1.8 -193 2.0
18 3.1 1132 0.0 19 3.7 1133 4.1
110 5.7 1134 8.0 111 7.2 1135 8.3
112 9.1 1136 8.2 113 7.4 1137 10.7
114 12.6 1138 12.5 115 12.3 1139 12.5
116 13.1 1140 16.5 117 17.7 1141 14.5
118 20.1 1142 17.5 119 24.6 1143 18.1
SUM 18-119 = 138.0 SUM 1132-1143 = 130.9

MEAS 719 TIME 23.32.29 TIME (KC) = 0.13. 7.18
POWER= 479.4 B-38= 682. BKC-141=2.94 BV-1= 3.51
ALF= 1.09 BV-7= 49.67 B-6= 2.83 E-29= 3.778
ALC= 0.87 B-7= 39.05 KC-24= 7.035 PR-41= 184.
KCK-87= 0.46 B-34= 2.904 KC-64= 0.097 PR-40= 4.537
TPL1= 2716. TPL2= 0.
KC-23= 2.818 C10 0.820 C16 0.518 D2 0.969
C1 1.838 C11 1.270 C17 0.752 D3 0.940
C2 1.113 C12 1.235 C18 0.789 T1 0.942
C3 1.003 C13 0.981 C19 0.818 T2 0.940
C6 0.557 C14 0.847 C20 0.938
C8 0.303 C15 0.740 D1 0.891
C9 0.759 BKC-2= 161. DQ1= 1.839 OKC= 24.442
BQ-23= 259. BG-43= 16.0 DQ2= 4.839 OTP= 7.440
BG-47= 230. BG-44= 21.8 DQ3= 5.833

PUSK 3 -257- DATE 14/ 8/78

MEAS 719 TIME 23.32.29 TIME (KC) = 0.13. 7.18
K FI K FI K FI K FI K FI K FI
0 -215.7 37 -1892.0 74 -426.0 111 1180.4 148 1826.2 185 56.9
1 -450.2 38 -2797.9 75 -680.1 112 1242.8 149 1656.6 186 31.9
2 -524.9 39 -2205.8 76 -379.0 113 1368.8 150 1312.7 187 29.2
3 -767.6 40 -1709.2 77 -190.4 114 1235.7 151 1830.0 188 40.1
4 -922.8 41 -2097.8 78 -229.8 115 1372.1 152 1659.0 189 58.0
5 -1171.2 42 -1759.6 79 -139.2 116 1325.5 153 1951.9 190 31.9
6 -1489.5 43 -1542.3 80 -193.7 117 1160.2 154 1628.2 191 51.5
7 -1552.2 44 -1565.6 81 -85.6 118 1639.6 155 1920.8 192 39.6
8 -1559.8 45 -1969.3 82 107.4 119 1291.7 156 1910.3 193 33.8
9 -114.2 46 -1422.3 83 382.9 120 1430.7 157 1925.4 194 54.8
10 -1932.3 47 -1460.2 84 261.7 121 1588.5 158 1575.0 195 40.2
11 -1903.8 48 -1530.2 85 -294.6 122 1458.6 159 1447.1 196 39.2
12 -1761.0 49 -1339.3 86 306.1 123 1661.1 160 2009.6 197 30.4
13 -1807.4 50 -1275.3 87 129.3 124 1826.6 161 1878.3 198 25.0
14 -1936.1 51 -1722.0 88 297.2 125 1780.3 162 1899.6 199 41.2
15 -1857.0 52 -1200.9 89 260.2 126 1803.4 163 1664.7 200 35.3
16 -1866.9 53 -1143.9 90 426.5 127 1821.8 164 1367.6 201 40.6
17 -1558.3 54 -1602.3 91 546.8 128 1346.0 165 1460.0 202 33.0
18 -1808.8 55 -1019.8 92 129.2 129 1430.6 166 2035.8 203 32.9
19 -2197.0 56 -1060.5 93 418.9 130 1732.8 167 1924.2 204 40.3
20 -1831.3 57 -933.2 94 414.6 131 1792.4 168 1579.4 205 27.1
21 -2254.2 58 -1616.6 95 531.5 132 1714.9 169 1890.1 206 29.4
22 -2434.9 59 -857.7 96 338.3 133 1607.2 170 144.1 207 34.1
23 -1797.3 60 -827.0 97 702.1 134 1797.6 171 -1.8 208 35.2
24 -2111.5 61 -638.5 98 784.5 135 1642.9 172 1.7 209 4.9
25 -59.0 62 -1247.3 99 439.8 136 1685.5 173 -51.0 210 41.3
26 -2390.9 63 -950.9 100 121.2 137 1592.0 174 -35.5 211 32.7
27 -61.5 64 -1133.7 101 497.3 138 1880.7 175 60.9 212 43.8
28 -1595.1 65 -1187.2 102 762.6 139 1836.9 176 42.6 213 36.5
29 -54.5 66 -1065.6 103 320.7 140 2007.5 177 22.3 214 -0.2
30 -1809.2 67 -1370.4 104 1054.2 141 1871.9 178 66.5 215 0.0
31 -1587.7 68 -924.8 105 947.2 142 1498.7 179 42.6 216 17.5
32 -1877.3 69 -764.2 106 1032.5 143 1708.6 180 72.7 217 31.3
33 -2683.5 70 -1347.0 107 1044.3 144 1742.8 181 42.1 218 27.3
34 -1792.1 71 -328.4 108 1044.1 145 1641.9 182 38.3 219 0.6
35 -2401.6 72 -945.6 109 1131.6 146 1411.1 183 44.2
36 -1677.9 73 -254.8 110 1197.8 147 1851.9 184 40.2

MEAS 720 TIME 23.33. 3 TIME (KC) = 0.13. 7.50
GR 1 U POWER GR 1 U POWER GR 1 U POWER
17 119.6 1274.5 152.5 19 121.6 1725.6 209.8 21 121.6 1262.7 153.6
B1= 5.01 HALL= 4137. SUM POWER = 515.9
I 17=115.7 I 19=113.0 I 21=118.4
+157 1.5 -157 3.0 +193 2.2 -193 2.9
18 1.4 1132 0.0 19 2.3 1133 0.0
110 4.4 1134 6.3 111 6.1 1135 6.4
112 8.0 1136 7.1 113 6.2 1137 9.9
114 15.3 1138 11.3 115 10.8 1139 11.2
116 15.5 1140 14.5 117 15.5 1141 12.8
118 17.2 1142 15.3 119 20.1 1143 15.7
SUM 18-119 = 115.1 SUM 1132-1143 = 110.6

MEAS 720 TIME 23.33. 3 TIME (KC) = 0.13. 7.50
POWER= 515.8 B-38= 683. BKC-141=2.94 BV-1= 3.52
ALF= 1.09 BV-7= 49.72 B-6= 2.83 E-29= 3.759
ALC= 0.87 B-7= 39.05 KC-24= 7.035 PR-41= 184.
KCK-87= 0.46 B-34= 2.904 KC-64= 0.097 PR-40= 4.561
TPL1= 2693. TPL2= 0.
KC-23= 2.818 C10 0.820 C16 0.518 D2 0.969
C1 1.838 C11 1.270 C17 0.752 D3 0.940
C2 1.116 C12 1.235 C18 0.789 T1 0.942
C3 1.003 C13 0.981 C19 0.818 T2 0.940
C6 0.559 C14 0.847 C20 0.938
C8 0.803 C15 0.740 D1 0.894
C9 0.772 BKC-2= 161. DQ1= 1.839 OKC= 24.402
BQ-23= 259. BG-43= 16.0 DQ2= 4.840 OTP= 7.535
BG-47= 233. BG-44= 21.7 DQ3= 5.882

MEAS 720 TIME 23.33. 3 TIME (KC) = 0.13. 7.50
K FI K FI K FI K FI K FI K FI
0 -400.9 37 -3319.4 74 -1008.9 111 1214.4 148 2171.9 185 62.7
1 -674.7 38 -3055.4 75 -1504.1 112 885.4 149 2292.5 186 40.9
2 -981.6 39 -3426.1 76 -1464.7 113 1210.7 150 2232.6 187 45.9
3 -1583.9 40 -2842.0 77 -1444.8 114 1204.6 151 1608.2 188 43.1
4 -1829.3 41 -3480.4 78 -891.9 115 1317.9 152 2276.2 189 65.4
5 -1671.3 42 -2641.9 79 -1181.4 116 1547.7 153 2434.6 190 39.7
6 -2452.1 43 -2400.2 80 -1427.9 117 1100.4 154 1573.4 191 63.7
7 -3025.0 44 -3108.8 81 -850.0 118 1467.2 155 1951.0 192 49.8
8 -3054.3 45 -3129.3 82 -816.4 119 1012.7 156 2361.2 193 43.3
9 -1179.3 46 -2829.5 83 -840.6 120 -851.8 157 2196.9 194 56.3
10 -2816.2 47 -2168.4 84 -1266.0 121 -913.7 158 2109.6 195 48.8
11 -2862.2 48 -2928.8 85 -339.8 122 1333.6 159 2365.0 196 44.0
12 -3166.1 49 -2406.2 86 -1170.4 123 1839.8 160 2070.2 197 35.0
13 -2499.3 50 -2764.6 87 -667.0 124 1254.0 161 1723.3 198 50.2
14 -2837.0 51 -2784.6 88 -932.9 125 1703.6 162 1444.0 199 49.2
15 -2795.0 52 -1846.0 89 130.8 126 1555.3 163 1744.2 200 45.1
16 -3536.5 53 -1758.7 90 151.8 127 1405.4 164 2403.4 201 46.2
17 -2772.4 54 -2549.2 91 682.0 128 1515.5 165 1904.8 202 49.7
18 -2858.9 55 -1731.0 92 249.2 129 1264.1 166 1982.0 203 41.1
19 -3001.0 56 -1811.6 93 408.1 130 2091.1 167 1857.9 204 48.4
20 -3157.3 57 -1569.7 94 -164.4 131 1564.9 168 1513.8 205 40.3
21 -2573.9 58 -2530.8 95 85.8 132 1812.3 169 1535.9 206 48.6
22 -3103.5 59 -1368.6 96 81.2 133 1728.8 170 104.7 207 41.3
23 -3204.7 60 -1823.4 97 -59.5 134 1075.4 171 -3.1 208 36.3
24 -2535.7 61 -1657.0 98 -83.0 135 1199.7 172 -2.7 209 10.2
25 -960.3 62 -1673.9 99 126.2 136 1482.8 173 -39.1 210 46.1
26 -2559.7 63 -1578.8 100 569.4 137 1743.9 174 -34.6 211 39.7
27 -887.5 64 -2923.4 101 322.1 138 852.5 175 77.1 212 51.5
28 -3095.6 65 -1183.3 102 957.1 139 1250.0 176 55.0 213 36.4
29 -831.9 66 -1890.3 103 -182.1 140 1293.8 177 31.6 214 -0.2
30 -3477.3 67 -1666.7 104 866.7 141 2695.0 178 74.2 215 0.0
31 -3326.5 68 -1914.0 105 826.5 142 1871.7 179 43.9 216 16.0
32 -3265.4 69 -870.6 106 1107.6 143 2444.0 180 82.4 217 35.2
33 -3184.7 70 -870.3 107 1258.9 144 2235.3 181 55.3 218 24.8
34 -3123.1 71 -1595.2 108 870.3 145 1867.4 182 47.4 219 0.3
35 -2367.8 72 -1551.7 109 87.2 146 2364.7 183 49.2
36 -3159.1 73 -1590.3 110 622.3 147 2410.1 184 43.6

APPENDIX B
LOCAL ELECTRIC FIELD-LOAD CURRENT CHARACTERISTICS

16-MAR-79
15:29:15

O XAXIS YAXIS
 MEAS I 17 /A E 38 (15)
 602 4397.166 1670.053
 603 4764.989 1693.749
 604 6018.934 1024.545
 605 4882.024 1121.238
 606 4263.412 1325.724
 607 3761.833 1525.437
 608 3761.833 1858.552
 609 3193.379 2008.239
 610 3193.379 2066.337
 611 3193.379 1956.105
 612 3761.833 1730.691
 613 4347.008 1546.378
 614 4898.744 1370.625
 615 5417.041 1041.297
 616 6420.196 875.320
 617 6503.792 497.015
 618 5985.496 785.407
 619 6002.215 795.266
 620 6018.934 790.325
 621 5968.776 815.454
 622 5968.776 756.397
 623 5968.776 978.009
 624 6035.653 847.932
 625 6002.215 820.672

LEAST SQUARES LINES:
 Y-INT= 3402.5 X-INT= 7958.5
 SLOPE= -0.43 CORR.= -0.96 RM=0.0407

Δ XAXIS YAXIS
 MEAS I 17 /A E 38 (15)
 652 5433.760 909.153
 653 4764.989 1201.243
 654 4798.428 1539.766
 655 4146.376 1759.830
 656 4748.270 1652.712
 657 5868.461 1044.886
 658 6069.092 870.775
 659 7406.633 704.531
 660 7272.878 85.594
 661 7707.579 -113.311
 662 7339.755 339.503
 663 6654.266 535.079
 664 6654.266 489.901
 665 6687.705 494.479
 666 6737.862 480.872
 667 6670.985 419.740

LEAST SQUARES LINES:
 Y-INT= 3957.9 X-INT= 7715.2
 SLOPE= -0.51 CORR.= -0.94 RM=0.0478

+ XAXIS YAXIS
 MEAS I 17 /A E 38 (15)
 683 8292.753 164.056
 684 8292.753 189.107
 685 7657.421 195.533
 686 7757.737 40.530
 687 7540.387 128.901
 688 7540.387 3.393
 689 7657.421 223.256
 690 7506.948 289.218
 691 7741.018 182.115
 692 7557.106 143.107
 693 7807.895 390.595
 694 7674.141 154.801
 695 7858.053 358.214
 696 7222.721 369.151
 697 6269.723 756.499
 698 6286.442 754.711
 699 5300.005 1169.063

(CONTINUED)

(CONTINUED)
 700 4581.078 1692.224
 701 4698.112 1814.394
 702 5166.252 1315.803
 703 6035.653 987.306
 704 6453.635 1013.406
 705 6737.862 692.382
 706 7339.755 280.787
 707 7440.071 150.696
 708 7323.037 300.286
 709 7406.633 62.899
 710 7473.509 153.541
 711 7774.457 114.625
 713 4815.147 1225.411
 714 5283.287 809.742
 715 5300.005 1344.134
 716 5316.725 1280.489
 717 5283.287 1323.919
 LEAST SQUARES LINES:
 Y-INT= 3831.8 X-INT= 8030.0
 SLOPE= -0.48 CORR.= -0.95 RM=0.0453

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SYMBOL	MEASURE #S	X	Y	G	%O ₂	B	V _{HALL}
○	602.603.604.605.606. 607.608.609.610.611. 612.613.614.615.616. 617.618.619.620.621. 622.623.624.625.	I 21 /A	E 110 (15)	2.91	50.6	5.0	1693.4
Δ	652.653.654.655. 656.657.658.659.660.661. 662.663.664.665.666.667.	I 21 /A	E 110 (15)	3.46	49.6	5.0	1423.9
+	683.684.685.686.687. 688.689.690.691.692.693. 694.695.696.697.698.699. 700.701.702.703.704.705. 706.707.708.709.710.711. 713.714.715.716.717.	I 21 /A	E 110 (15)	3.96	50.3	5.0	2543.0

O XAXIS YAXIS
 MEAS 1 21 /A E 110 (15)
 602 2206.078 424.061
 603 2408.936 488.131
 604 3076.676 270.811
 605 2535.722 289.789
 606 2239.888 333.102
 607 1944.053 470.480
 608 1952.506 470.826
 609 1665.124 574.704
 610 1665.124 784.283
 611 1665.124 506.218
 612 1952.506 555.481
 613 2239.888 460.287
 614 2527.270 375.843
 615 2814.651 425.119
 616 3304.891 244.076
 617 3372.510 241.288
 618 3085.128 303.873
 619 3085.128 369.464
 620 3085.128 308.278
 621 3085.128 350.474
 622 3085.128 254.961
 623 3093.581 280.290
 624 3085.128 389.737
 625 3085.128 178.056
 LEAST SQUARES LINES:
 Y-INT= 1032.6 X-INT= 4205.4
 SLOPE= -0.25 CORR.= -0.83 RM=0.0765

A XAXIS YAXIS
 MEAS 1 21 /A E 110 (15)
 652 2772.389 634.145
 653 2408.936 443.902
 654 2400.483 608.994
 655 2070.839 758.022
 656 2408.936 565.492
 657 3017.509 561.752
 658 3102.033 689.454
 659 3778.225 72.410
 660 3786.678 267.648
 661 4116.322 218.483
 662 3778.225 485.414
 663 3448.582 105.198
 664 3440.129 308.415
 665 3440.129 206.103
 666 3440.129 655.543
 667 3448.582 1085.077
 LEAST SQUARES LINES:
 Y-INT= 2553.6 X-INT= 4002.6
 SLOPE= -0.64 CORR.= -0.47 RM=0.1350

+ XAXIS YAXIS
 MEAS 1 21 /A E 110 (15)
 683 4462.871 640.722
 684 4183.941 700.580
 685 3330.248 1072.284
 686 2510.365 1183.456
 687 2510.365 1410.418
 688 2130.006 1525.252
 689 2096.197 1723.617
 690 2104.649 1661.971
 691 3997.988 1662.629
 692 3989.536 625.759
 693 3989.536 717.068
 694 3997.988 541.081
 695 3997.988 610.057
 696 3651.439 889.130
 697 3152.747 854.217
 698 3152.747 807.552
 699 2628.698 1042.519

(CONTINUED)

(CONTINUED)
 700 2349.769 1126.704
 701 2341.316 1540.565
 702 2569.531 1097.631
 703 3009.057 1279.630
 704 3211.914 584.971
 705 3347.153 1419.762
 706 3659.892 1036.093
 707 3862.750 1155.344
 708 4057.155 799.728
 709 4285.370 670.796
 710 4488.228 554.401
 711 4691.085 392.447
 713 2417.388 1310.268
 714 2696.318 1137.363
 715 2713.222 883.810
 716 2696.318 1099.550
 717 2696.318 842.118
 LEAST SQUARES LINES:
 Y-INT= 2659.1 X-INT= 5389.1
 SLOPE= -0.49 CORR.= -0.71 RM=0.1078

16-MAR-79
15:30:23

SYMBOL	MEASURE #S	X	Y	G	%O ₂	B	V _{HALL}
O	602.603.604.605.606. 607.608.609.610.611. 612.613.614.615.616. 617.618.619.620.621. 622.623.624.625.	I 19 /A	E 74 (15)	2.91	50.6	5.0	1693.4
Δ	652.653.654.655. 656.657.658.659.660.661. 662.663.664.665.666.667.	I 19 /A	E 74 (15)	3.46	49.6	5.0	1423.9
+	683.684.685.686.687. 688.689.690.691.692.693. 694.695.696.697.698.699. 700.701.702.703.704.705. 706.707.708.709.710.711. 713.714.715.716.717.	I 19 /A	E 74 (15)	3.96	50.3	5.0	2543.0

O R XAXIS YAXIS
 MEAS I 19 /A E 74 (15)
 602 2965.960 1298.595
 603 3303.265 1038.297
 604 4233.762 927.942
 605 3419.577 984.422
 606 2965.960 1017.966
 607 2558.867 1194.066
 608 2570.498 1304.496
 609 2151.775 1571.709
 610 2140.143 1650.600
 611 2151.775 1537.367
 612 2570.498 1480.242
 613 2989.222 1244.917
 614 3407.946 1221.198
 615 3838.301 1035.329
 616 4582.698 899.392
 617 4675.748 1004.042
 618 4257.024 939.388
 619 4245.393 1093.447
 620 4257.024 845.453
 621 4245.393 821.581
 622 4245.393 914.853
 623 4257.024 804.743
 624 4257.024 977.337
 625 4257.024 920.422
 LEAST SQUARES LINES:
 Y-INT= 2144.5 X-INT= 7373.1
 SLOPE= -0.29 CORR.= -0.89 RM=0.0538

Δ XAXIS YAXIS
 MEAS I 19 /A E 74 (15)
 652 3803.407 1009.018
 653 3338.158 1511.271
 654 3338.158 1536.446
 655 2896.172 1779.802
 656 3338.158 1412.229
 657 4117.450 1222.864
 658 4233.762 1374.330
 659 5164.259 1214.198
 660 5152.628 576.461
 661 5594.614 589.211
 662 5140.997 752.227
 663 4664.117 1578.381
 664 4664.117 1152.059
 665 4675.748 504.643
 666 4699.011 1250.404
 667 4675.748 1162.846
 LEAST SQUARES LINES:
 Y-INT= 3487.2 X-INT= 6589.7
 SLOPE= -0.53 CORR.= -0.73 RM=0.0838

+ XAXIS YAXIS
 MEAS I 19 /A E 74 (15)
 683 6245.962 -21.704
 684 5769.082 -28.164
 685 5629.508 99.523
 686 6001.707 148.608
 687 5710.926 -35.395
 688 5769.082 -20.724
 689 5897.025 -32.486
 690 5687.664 -9.607
 691 5652.770 -17.542
 692 5501.565 90.309
 693 5664.401 83.521
 694 5664.401 -69.500
 695 5710.926 -6.831
 696 5100.152 351.023
 697 4361.705 536.271
 698 4350.074 751.320
 699 3710.357 961.458

(CONTINUED)

(CONTINUED)
 700 3268.371 1489.270
 701 3245.109 1775.459
 702 3582.414 1270.116
 703 4198.868 1293.395
 704 4501.280 826.409
 705 4687.379 320.990
 706 5164.259 529.484
 707 5385.252 221.482
 708 5303.833 106.294
 709 5327.096 221.372
 710 5385.252 -39.159
 711 5536.458 164.218
 713 3489.364 1102.872
 714 3663.833 1442.098
 715 3675.464 874.331
 716 3663.833 829.248
 717 3663.833 1148.256
 LEAST SQUARES LINES:
 Y-INT= 3469.2 X-INT= 5697.3
 SLOPE= -0.61 CORR.= -0.94 RM=0.0547

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15:31:44

SYMBOL	MEASURE #S	X	Y	G	%O ₂	B	V _{HALL}
○	602.603.604.605.606. 607.608.609.610.611. 612.613.614.615.616. 617.618.619.620.621. 622.623.624.625	I 19 /A	E 74 (21)	2.91	50.6	5.0	1693.4
Δ	652.653.654.655. 656.657.658.659.660.661. 662.663.664.665.666.667	I 19 /A	E 74 (21)	3.46	49.6	5.0	1423.9
+	683.684.685.686.687. 688.689.690.691.692.693. 694.695.696.697.698.699. 700.701.702.703.704.705. 706.707.708.709.710.711. 713.714.715.716.717	I 19 /A	E 74 (21)	3.96	50.3	5.0	2543.0

①
 MEAS XAXIS YAXIS
 I 19 /A E 74 (21)
 602 2965.960 1179.046
 603 3303.265 1147.610
 604 4233.762 937.441
 605 3419.577 1003.826
 606 2965.960 1077.105
 607 2558.867 1197.048
 608 2570.498 1331.037
 609 2151.775 1443.722
 610 2140.143 1596.865
 611 2151.775 1484.918
 612 2570.498 1359.141
 613 2989.222 1229.752
 614 3407.746 1197.021
 615 3838.301 1116.585
 616 4582.698 1008.997
 617 4675.748 883.485
 618 4257.024 957.743
 619 4245.393 966.701
 620 4257.024 986.509
 621 4245.393 985.587
 622 4245.393 1008.243
 623 4257.024 1010.480
 624 4257.024 959.983
 625 4257.024 986.730

LEAST SQUARES LINES:
 Y-INT= 1920.4 X-INT= 8561.9
 SLOPE= -0.22 CORR.= -0.92 RM=0.0391

Δ
 MEAS XAXIS YAXIS
 I 19 /A E 74 (21)
 652 3803.407 1131.034
 653 3338.158 1293.746
 654 3338.158 1424.264
 655 2896.172 1601.953
 656 3338.158 1426.733
 657 4117.450 1325.345
 658 4233.762 1185.309
 659 5164.259 1108.634
 660 5152.628 984.636
 661 5594.614 470.037
 662 5140.997 881.354
 663 4664.117 959.612
 664 4664.117 976.711
 665 4675.748 999.944
 666 4699.011 998.670
 667 4675.748 1031.811

LEAST SQUARES LINES:
 Y-INT= 2596.0 X-INT= 7628.7
 SLOPE= -0.34 CORR.= -0.90 RM=0.0457

+
 MEAS XAXIS YAXIS
 I 19 /A E 74 (21)
 683 6245.962 9.766
 684 5769.082 -16.138
 685 5629.508 2.827
 686 6001.707 -10.971
 687 5710.926 -34.514
 688 5769.082 -48.540
 689 5897.025 -32.300
 690 5687.664 -53.011
 691 5652.770 -34.579
 692 5501.565 24.803
 693 5664.401 19.895
 694 5664.401 27.271
 695 5710.926 31.447
 696 5199.152 128.016
 697 4361.705 562.994
 698 4350.074 709.271
 699 3710.357 1086.919

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(CONTINUED)
 700 3268.371 1675.154
 701 3245.109 1402.802
 702 3582.414 1115.745
 703 4198.868 948.308
 704 4501.280 763.814
 705 4687.379 524.130
 706 5164.259 320.220
 707 5385.252 231.310
 708 5303.833 35.900
 709 5327.096 29.401
 710 5385.252 50.581
 711 5536.458 65.012
 713 3489.364 1138.363
 714 3663.833 985.985
 715 3675.464 938.423
 716 3663.833 937.086
 717 3663.833 972.688
 LEAST SQUARES LINES:
 Y-INT= 3159.6 X-INT= 5664.1
 SLOPE= -0.56 CORR.= -0.97 RM=0.0398

APPENDIX C
STATIC PRESSURE DISTRIBUTIONS

MASS FLOW RATE AND PRESSURE RECORDS, TEST 3

X = 1.71 m

MASS FLOW RATE AND PRESSURE RECORDS, TEST 3; X = 2.21 m

MASS FLOW AND PRESSURE RECORDS, TEST 3. $X = 2.72$ m

MASS FLOW RATE AND PRESSURE RECORDS, TEST 3. $X = 3.22$ m

MASS FLOW RATE AND PRESSURE RECORDS, TEST 3. $X = 3.72 \text{ m}$

MASS FLOW RATE AND PRESSURE RECORDS, TEST 3.

 $x = 4.23 \text{ m}$

MASS FLOW RATE AND PRESSURE RECORDS, TEST 3; $X = 4.81$ m

Distribution for ANL-IVTAN-JT2

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