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TEGENA: Detaillierte experimentelle Untersuchungen der Temperatur- und Geschwindigkeitsverteilungen in Stabbündel-Geometrien mit turbulenter Natriumströmung

KURZFASSUNG

Für die Auslegung von Brennelementen (längsdurchströmte Stabbündel) ist die genaue Kenntnis der Geschwindigkeits- und Temperaturverteilungen notwendig. Die zur Feinanalyse von ungleichmäßig gekühlten Bündelzonen erforderlichen Detail-Codes befinden sich in der Entwicklung. Zur Verifikation solcher Rechenprogramme wurden in einem beheizten, reihenförmigen 4-Stabbündel TEGENA (P/D = W/D = 1.147) mit Natriumkühlung (Pr ≈ 0.005) mittlere Fluidtemperaturen und die zugehörigen RMS-Werte der Temperaturfluktuationen gemessen. Die Temperaturverteilung in den Strukturen wurde als notwendige Randbedingung für die Temperaturprofile im Fluid ermittelt. Die Experimente wurden mit unterschiedlicher Beheizung (Gleichlast und Schieflast) durchgeführt, die Strömungszustände wurden in den Bereichen 4000 ≦ Re ≦ 76000, 20 ≦ Pe ≦ 400 variiert.

Die wesentlichen thermischen Einlaufvorgänge erfolgen bei Gleichlast innerhalb einer beheizten Bündellänge von rund 100 hydraulischen Durchmessern. In der Hauptmeßebene am Ende der beheizten Zone nach 200 hydraulischen Durchmessern kann die Strömung als weitgehend thermisch eingelaufen bezeichnet werden. Die gemessenen Temperaturprofile im Fluid zeigen hier ausgeprägte Maxima in den engsten Spalten der Unterkanäle und ausgeprägte Minima in den Unterkanalmitten an der unbeheizten Wand. In Bereichen mit den größten Temperaturgradienten erreichen die Temperaturfluktuationen jeweils Maximalwerte und Minimalwerte dort, wo die Temperaturgradienten verschwinden. Bei allen untersuchten Schieflastfällen ist die Strömung am Ende der beheizten Zone thermisch nicht eingelaufen.

Durch Kontrolle sämtlicher Thermoelemente in regelmäßigen isothermen Versuchen, durch redundante Anordnung der beweglichen Meßsonden-Thermoelemente und durch den Nachweis reproduzierbarer Meßergebnisse konnten die Experimente gut abgesichert werden. Parallel zu den Temperaturmessungen wurden Laufzeitmessungen zur Ermittlung der Geschwindigkeitsverteilungen durchgeführt; hierzu ist die Auswertung noch nicht abgeschlossen.

ABSTRACT

Precise knowledge of the velocity and temperature distributions is necessary in fuel element design (rod bundles with longitudinal flow). The detail codes required in the fine analysis of non-uniformly cooled bundle zones are presently at the stage of development. In order to verify these computer codes, the mean fluid temperatures and the related RMS values of the temperature fluctuations were measured in a heated bundle, TEGENA, containing four rods arranged in one row ($P/D = W/D = 1.147$) with sodium cooling ($Pr \approx 0.005$). The temperature distribution in the structures was determined as the necessary boundary condition for the temperature profiles in the fluid. The experiments were carried out with different types of heating (uniform load and flux tilting) and the flow conditions were varied in the ranges $4000 \lesssim Re \lesssim 76{,}000; 20 \leqq Pe \leqq 400$.

The essential processes of thermal development took place under uniform load within a heated bundle length of about 100 hydraulic diameters. In the main measuring plane at the end of the heated zone, after 200 hydraulic diameters, the flow can be termed largeley developed thermally. There, the temperature profiles measured in the fluid exhibit pronounced maxima in the narrowest gaps of the subchannels as well as pronounced minima in the centers of the subchannels at the unheated wall. In the zones of maximum temperature gradients the temperature fluctuations attain maximum and minimum values, respectively, at the points of disappearance of the temperature gradients. In all cases of flux tilting investigated the flow at the end of the heated zone had not yet developed thermally.

By inspection of all thermocouples in isothermal experiments performed at regular intervals, by redundant arrangement of the mobile probe thermocouples, and by demonstration of the reproducibility of results of measurement the experiments have been validated satisfactorily. Parallel to the temperature measurements the transit times were measured in order to determine the velocity distributions; the evaluation has not yet been terminated.

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1. INTRODUCTION

1.1 The Problem

Knowledge of the precise temperature distribution in the various components (cladding tubes, wrapper tubes, spacers) is necessary in performance of the strength analyses of fuel elements (rod bundles with longitudinal flow). The thermal-hydraulics calculation of these rod bundles is normally carried out by the use of subchannel analysis. Each subchannel of the bundle is assigned mean values of velocity and temperature, and the mass and energy exchange between the subchannels is described by global exchange coefficients. The limits of this global method of calculation become quickly evident if there are major differences in geometry between the bundle subchannels. Such differences in geometry occur on the perimeter of the rod bundle and they result from operation induced deformations of the structural components; last but not least, spacers give rise to local redistributions of flow which bear consequences on the temperature distributions. These problems as well as the special conditions of liquid metal cooling were subjects treated in the experimental investigations of a heated 19-rod bundle with sodium cooling. Essential results have been represented in /1, 2, 3, 4/. Also here it has appeared that the complicated thermal-hydraulic conditions prevailing in a rod bundle geometry cannot be described with sufficient accuracy by the subchannel analysis.

Therefore, computer codes have been developed by several institutions which allow a more detailed calculation to be made of the velocity and temperature distributions of turbulent flow through rod bundles (fine analysis). Verifications with these detail codes of the 19-rod bundle experiments mentioned before have been described in /5/ and /6/. The first attempts made to describe the precise temperature distributions in rod bundles partly reveal clear deviations from the experimental results. There are different explanations for this:

a) The models describe but inadequately the physics of turbulent flow in rod bundles.

b) The coefficients used in the models to describe turbulent rod bundle flow are not known.

c) Only some of the uncertainties prevailing in the experiment can be quantified satisfactorily. For instance, the deviations from ideal state of the bundle geometry under operating conditions can be estimated only.

More sophisticated experiments were performed at KfK-INR in order to further develop and verify the detail codes. Hydraulic experiments performed on a 4-rod bundle test bed with air flow yielded the distribution of the flow velocities averaged over time, the wall shear stresses, the turbulant shear stresses normal and parallel to the walls, and the turbulence intensities for different bundle cross-section geometries. The most recent status of these comprehensive investigations has been represented in /7/.

Supplementing these activities, thermal-hydraulic experiments were carried out in a similar 4-rod bundle geometry in order to study the chracteristic conditions of liquid-metal cooling. Two test series (TEGENA 1 and TEGENA 2)* were conducted. Important partial results have already been given /8, 9, 10, 11/. The test setup, the measuring equipment, preliminary tests and Part One of the results measured in the TEGENA 1 test series have been described in detail in /12/. The TEGENA experiments were terminated in 1987. A summarizing description of the whole project will be given in this report.

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*TEGENA = Temperaturen und Geschwindigkeiten in Natriumströmung (German acronym for temperatures and velocities in sodium flow).

1.2 Objective of this Work

The objective pursued under the project was described in a feasibility study in 1979 /13/. To support, further develop and calibrate thermal-hydraulic detail codes it was proposed to measure local temperature distributions in characteristic subchannels of heated rod bundle configurations with liquid metal cooling. At the same time, wall temperatures in the structures as well as the azimuthal distribution of heat flow in the claddings of the heater rods were to be measured. In order to separate from each other the variables influencing the temperature distribution and to create clearly defined experimental boundary conditions the project was to be divided into several stages:

I. Symmetric rod configuration without spacers, hydraulically and thermally developed flow.

II. Asymmetric heating with a view to generating strong temperature gradients between the subchannels.

III. Asymmetric rod configuration.

IV. Experiments involving spacers and blockages.

Work on items I and II has been completed; they are the topics treated here. Items III and IV were postponed for lack of time.

1.3 Possible Solutions

Unlike in the central bundle zone, considerable variations in temperature occur in the bundle boundary zone on the perimeter of the fuel rod cladding tubes which diminish the time to failure and hence the lifetime of these important components. Therefore, the experimental investigations were made in typical subchannels of the bundle boundary zone (wall channels, corner channels).

Wall and corner channels with four rods arranged in one row were simulated in preparation of extensive isothermal, fluid dynamics experiements /14, 15/. By analogy with these hydraulic experiments and supplementing them, also a 4-rod configuration in one row was selected for the thermal experiments to be described here. A pitch to diameter ratio of the rod, $P/D \approx 1.15$, was fixed as the cross-sectional geometry for an advanced reactor concept.

Sodium was chosen as the liquid-metal coolant because a suitable test bench and practical experience had been available.

The absolute dimensions of the bundle cross-section were determined by the capability of fabricating with sufficient measurement acuracy the largest possible heater rods and the smallest possible measuring probes. At the time, a heater rod diameter of 25 mm and a minimum possible probe size of 2 mm seemed to be feasible. Both the excessively large heater rods and miniature measuring probes with related adjusting devices for operation in hot sodium had to be developed, built and tested.

2. TEST PROGRAM

The test programm consisted of three parts.

In a number of preliminary tests the following items were worked out

- Measurement of the flow distribution in the inlet section preceding the bundle.
- Heater rod testing in stagnant air and in flowing sodium.
- Testing the probe adjusting devices in the measuring chamber with sodium flow.
- Measurement of sodium velocities in the rectangular channel without heater rods.

The TEGENA 1 test series (1985) included:

- Isothermal tests (measuring sensor check and calibration).
- Measurement of the wall temperatures (3D).
- Measurement of the fluid temperatures (2D) for mean and large Re-numbers.
- Tests under uniform load and in two cases of flux tilting.
- Measurement of the temperature fluctuations (in some tests).

The TEGENA 2 test series (1987) included:

- Isothermal tests (measuring sensor check and calibration).
- Measurement of the wall temperatures (3D)
- Measurement of the fluid temperatures (2D) from small up to great Re-numbers.
- Tests under uniform load and in four cases of flux tilting.
- Measurement of the temperature fluctuations.
- Measurement of transit times to determine the flow velocities.*

* These measurements will be reported elsewhere /16/.

3. TEST SECTION

Only the principle of the test section will be described here, to the extent which is necessary to understand the results of measurement. A more detailed description of the test equipment with the various components as well as notes on the major preliminary tests will be given in the Annex.

3.1 Geometry

The test section has been represented schematically in Fig. 1. It consists of four heater rods suspended vertically in a rectangular channel with a cylindric measuring chamber at the top end.

The heater rods are 25 mm in diameter and about 4 m in length, 2.5 m of them heated. In the rectangular channel of about 6 m length and 118.5 x 32.4 mm inner width the heater rods are fixed on the perimeter at axial spacings of 550 mm with four small pins each in such a manner that their spacings with respect to the channel wall and with respect to each other are 3.7 mm. The geometry parameters of the 4-rod bundle consequently are P/D = W/D = 1.147. This geometry corresponds to the mean of three different bundle geometries on which Rehme /7/ had made hydraulic measurements. The sodium flows from an inlet section (see Annex A1.2) in the open rectangular channel into the 4-rod bundle. It first passes an unheated bundle zone of 1288 mm length, is then heated by 100 K at the maximum in the heated zone and leaves the cylindrical mesuring chamber through a nozzle provided on its side. The unheated bundle length of 1288 mm corresponds to 105 hydraulic diameters DH, i.e. the mean hydraulic diameter DH = 4·F/U, with F being the free flow crosssection in the bundle and U the entire fluid wetted perimeter in the flow cross-section. The maximum heat flux densities generated on the rod surfaces were 60 W/cm^2. The selected heated length of 2456 mm (201 hydraulic diameters DH) up to the main plane of measurement ME6 was considered sufficient to obtain a thermally developed flow provided that the rod bundle was uniformly heated /13/. In order to be able to examine this requirement, the rectangular channel was equipped on its perimeter with 24 thermocouples each at five axially displaced measuring planes (ME1 through ME5). In the measuring plane ME0 the uniformity of the temperature of sodium supply into the unheated bundle zone was checked with six thermocouples distributed along the perimeter. In the TEGENA 1-experiments the measuring planes were termed ME, in the TEGENA 2-experiments they were termed MP. The axial positions of the measuring planes were the same in both test series, while on account of different heater rods used, slight differences can been detected between the two test series as regards the cross-sectional geometries.

The temperature in the sodium flowing through the bundle subchannels is measured more carefully in the horizontal main plane of measurement ME6 (TEGENA 1), 29 mm ahead of the end of the rectangular channel, still in the heated bundle zone. In the TEGENA 2 experiments the corresponding value in the main plane of measurement (MP6) is 31.5 mm. Two cross slides have been installed in the cylindric measuring chamber in parallel with the long sides of the rectangular channel. A 70 mm long measuring probe has been fixed to the externally adjustable measuring slides in such a manner that it can be moved in X and Y direction within the bundle subchannels. The maximum path lengths of the probe tips are 75 mm in X direction and 25 mmm in Y direction. The thermocouple TEN measures the sodium inlet temperature in the rectangular channel ahead of the unheated bundle zone. The thermocouple TAS measures the sodium outlet temperature in the nozzle provided on the side of the measuring chamber.

The major technical data of the test section have been summarized in Table 1. Detail views of the test bed are shown in Fig 2.

3.2 Instrumentation

3.2.1 Temperature Measuring Probes

The temperature measuring probes (Figs. 3 and 4) are capillary tubes bent to form rectangles, 2 mm diameter at the maximum, whose horizontal part is clamped into the measurement slides by a reinforcing sleeve. The vertical part of the probes is 70 mm in length and protrudes about 30 mm into the subchannels of the rectangular channels opposed to the direction of flow. From the free ends of the vertical probe shafts four or five miniature thermocouples protrude. In the main measurement cross sections (ME6 and MP6, repsectively) four thermocouples are arranged quadratically in X/Y-direction in all cases with a centerline distance of about 2 mm. The axes of this coordinate system used to represent the results are formed by the inner contours of the long wall (X-axis) and the short wall (Y-axis) of the rectangular channel (Figs. 3b and 4b). Four thermocouples were used because

- the measurements were to be made as closely as possible to the heated walls;
- local temperature gradients between two thermocouples each were to be recorded with high accuracy;
- the measurements were to be redundant.

The maximum displacement paths of the probes are 75 mm in X-direction and 25 mm in Y-direction.

In the probe S1 (TEGENA 1) the four thermocouples are routed in the probe shaft (1.6 x 0.1 mm) and soldered to the probe shaft in a bored plug; Fig. 3. The diameter of the thermocouples is 0.24 mm and the centerline distance 1.96 mm. The measurement tips are insulated electrically with compacted boron nitride powder. The thermocouples are designated TE11, TE12, TE13 and TE14.

The probe S2 (TEGENA 1) is similar to probe S1 in design. However, the diameter of the thermocouple in this case is 0.38 mm and the centerline distance is 1.83 mm. The measurement tips are likewise insulated electrically with respect to the sheath through compacted boron nitride powder. The thermocouples are designated TE21, TE22, TE23 and TE24.

In the probe P1 (TEGENA 2) all five thermocouples are routed in the probe shaft (1.8 x 0.12mm) and solderedd to the probe shaft in a bored plug. All diameters are 0.36 mm and the measurement tips are insulated electrically with compacted boron nitride powder. The centerline distance of the four quadratically arranged thermocouples (TC11, TC12, TC13, TC14) is 2.05 mm. The central thermocouple TC15 displaced axially by 8.1 mm in the direction of flow, combined with one of the four quadratically arranged thermocouples, serves for transit time measurements. The transit times are determined using the cross-correlation analysis. The ratio of the axial distance of the thermocouples to the transit time determined at each location gives then the velocity at this location; see /16/.

In the probe P2 (TEGENA 2) an additional miniature permanent magnet (1.65 mm diameter, 1.5 mm length) is installed at the end of the probe shaft (2.0 x 0.2 mm); Fig. 4. The central thermocouple TC25 extending into the sodium flow is insulated electrically with boron nitride powder; its diameter is only 0.24 mm; it is routed centrically through the magnet and welded at the end of the shaft in a plug. The sodium flow induces a voltage in the magnet which is a direct measure of the flow velocity. However, if the magnet is placed in a field with temperature gradients, the additional superimposed voltage must be compensated. This is achieved in metrology by means of two additional thermocouples installed near the magnet poles. The principle of this newly developed temperature compensated magnet probe as well as results of measurement obtained with it have been described in /17/. The two magnet thermocouples and the central thermocouple TC25 of probe P2 are routed within the probe shaft. For design reasons the four quadratically arranged thermocouples (TC21, TC22, TC23, TC24) had thus to be fixed to the external side of the probe shaft using bandages. These thermocouples are 0.37 mm in diameter with 2.65 mm centerline spacing. Their measurement tips are welded with the thermocouple sheath. The axial distance of these thermocouples from the central thermocouple TC25 is 8.0 mm. The velocities determined by transit time measurements between the axially displaced thermocouples (similar to probe P1) were to be supplemented by the velocities determined with the permanent magnet and compared with them. However, the magnet did not work in the experiment so that it was not possible to make this comparison.

Views of the temperature measuring probes installed are presented in Fig. 5

3.2.2 Velocity Measuring Probes

The measuring chamber with the two measuring probe adjusting devices was tested in the WÜP II sodium test bench without heater rods under real operating conditions at sodium temperatures up to 500°C /18/. Instead of the temperature measuring probes used in the subsequent main test two velocity measuring probes were used in this preliminary test. The principle according to which similar probes work has been described in /19/ and corresponds to the velocity measurement with probe P2 (Fig. 4).

Two probes, GS1 and GS2, 71 mm in axial length and 2.0 mm outer diameter, were fabricated (Fig. 6). The permanent magnets, 1.5 mm diameter and 1 mm length, installed in the probe tip give rise to minimum induction voltages proportional to the flow velocity in liquid metal flow. The sensitivity of the probe signal was about 12 $\mu V m^{-1} s$ in these miniature magnets.

3.2.3 Wall Thermocouples

The rectangular flow channel was equipped with 126 thermocouples in total in order to be able to evaluate the conditions of thermal flow development in the heated bundle zone. In five axially displaced measuring planes (ME1 through ME5 for TEGENA 1, MP1 through MP5 for TEGENA 2) 24 wall thermocouples each have been installed on the perimeter of the rectangular channel: The measuring planes ME0 and MP0, respectively, in the unheated bundle zone are provided with six wall thermocouples (Fig. 7; Fig. 1). The 1 mm thick thermocouples have their end tapered to 0.5 mm diameter over a length of 15 mm. The measuring tip is insulated with magnesium oxide. The tapered thermocouple tips are embedded in the external channel wall in inclined grooves (0.5 mm width; 0.7 mm depth) (Fig. 7). The measuring points are located 100 mm upstream of the spacers (centers of the channel flanges) and on the the channel perimeter at the narrowest gaps between the heater rods and the channel wall or between the narrowest gaps.

3.2.4 Reference Thermometers

Two platinum resistance thermometers (type Pt 100) have their measuring tips arranged in the main planes of measurement (ME6 and MP6, respectively) at the following X/Y positions:

Local coordinates	X [mm]	Y[mm]
Resistance thermometer PT3:	5	29
Resistance thermometer PT2:	113	3

The helical measuring resistance of 20 mm length is installed in a protective tube of 2 mm outer diameter running over 35 mm length parallel to the rod axis and is then guided to the outside normal to the rod axis above the bottom of the measuring chamber.

Consequently, the effective mean temperature of these reference thermometers is measured in a cross-sectional plane of the bundle which lies about 10 mm downstream of the measuring plane ME6 (MP6). The accuracy of calibration of the reference thermometers up to temperatures of 500°C is ± 0.2 K according to information received from the manufacturer.

Signal deviations of the thermocouples as a function of the temperature level and time were recorded with the reference thermometers.

3.2.5 Inlet Temperature (Fluid/Wall)

In the TEGENA 1 test series the sodium inlet temperature (TEN) of the rectangular channel preceding the unheated zone of the 4-rod bundle was measured with a thermocouple (NiCr-Ni, external diameter 1.5 mm). The temperature of the rectangular channel in the unheated bundle zone was measured with six wall thermocouples installed in the measuring plane ME0. This measuring plane lies 365 mm upstream of the heated zone. The wall thermocouples were embedded in grooves on the perimeter of the rectangular channel as described in Section 3.2.3 and represented in Fig. 7.

In the TEGENA 2 test series the mean value of signals from the six wall thermocouples measured in the measuring plane MP0 was defined as being the sodium temperature at the bundle inlet (TBI).

3.2.6 Temperature Reference Point

A copper plate (60 x 40 cm, 2.5 cm thick) standing upright beside the test section and whose temperature can undergo variations with the room temperature serves as a temperature reference point for all thermocouples of the test section. The copper plate is surrounded by a thermally insulating housing in order to ensure uniform distribution of the temperature on the plate. The copper plate is made as a plug board with 225 connections where besides the thermocouple plugs all the other measuring lines can be plugged in. In order to determine the mean plate temperature used as the reference temperature the temperature mean value of five thermocouples distributed over the copper plate is determined whose reference temperature 0° is furnished by a Peltier cell.

3.2.7 Power of the Heater Rods

The heater rods are heated with direct current from a mercury-arc rectifier (I_{max} = 10,000 A, V_{max} = 100 V). The positive pole is made of the ends of the current conductor connections of the heater rods above the measuring chamber, whereas the negative pole is connected to the upper bottom of the inlet tank installed in the section of flow development through silver coated copper plates (cf. Fig. A2 in the Annex).

The currents of the four rods were measured as voltage drops at four measuring resistances. The shunts had been calibrated before with a precision shunt (category 0,1). The deviations found during this process were taken into account in the evaluation by application of correction factors. The voltage U was picked up between the possitive pole and the negative pole in the test section and transmitted to the plug board via a voltage divider (100:1). The measured voltage drop in the rectangular channel from the negative pole up to the beginning of the heated zone was 0.2% of the total voltage; it was likewise taken into account in the evaluation.

3.2.8 Volume Flow Rate

The sodium flow rate in the bundle was measured as an induced voltage [mV] with a calibrated induction flowmeter (MSAR Magnetic Flowmeter). The little temperature dependence was taken into account. The accuracy of measurement as indicated by the manufacturer is ± 2%. The sodium density related to the sodium inlet temperature was used to calculate the mass flows MS (TEGENA 1) and MFR (TEGENA 2), respectively.

3.2.9 Data Acquisition System

The temperature signals, the RMS-values, the X/Y coordinates of the mobile measuring probes, rod currents and rod voltage as well as the volume flow rate were measured with an ACUREX data acquisition system (Autodata ten/10). The ACUREX equipment is composed of a scanner with amplifier, a voltmeter with analog to digital converter, and a processor unit. The resolution error is ± 1 µV (± 0.025K) for high resolution (10 measured values per second). Except for the X/Y coordinates and the reference thermometer signals, all measured values were recorded as original data and converted into physical data in the later evalutation only.

The temperature signal T(t) of a thermocouple can be split up into two portions, namely the time averaged mean value of the temperature T and the fluctuation signal $\delta(t)$ which is always superimposed to the mean temperature:

$$T(t) = T + \delta(t)$$

In a number of cases it will be sufficient to record and analyze the mean value of temperature and the RMS-value characterizing the temperature fluctuations instead of the development versus time of the temperature signal.

The mean value of temperatures and the RMS value of the temperature fluctuations are determined as follows:

mean value: $$T = \frac{1}{2t_M} \cdot \int_{-t_M}^{+t_M} T(t)\, dt$$

RMS value: $$RMS = \sqrt{\frac{1}{2t_M} \cdot \int_{-t_M}^{+t_M} \delta^2(t)\, dt}$$

where 2 t_M is the time of averaging needed to calculate with appropriate accuracy the two temperature values. Twenty seconds of averaging time were sufficient to achieve an accuracy of the RMS-values better than 2%.

The RMS-values of the probe signals had been calculated and recorded already in the experiments. In conformity with the approach described in /9/, each of the eight (ten) temperature signals from probes S1 and S2 (from probes P1 and P2) is amplified. Then the mean value is automatically suppressed and, finally, the resulting fluctuation signal is amplified a second time. In an RMS measuring equipment an RMS value is calculated from the fluctuation signal and transmitted to the ACUREX unit.

The X/Y coordinates of the adjustable probes are picked up as voltages of 0 to 5 V at the potentiometers and converted with the ACUREX processor unit into millimeters using linear equations and are subsequently recorded. The equations are determined on the basis of eight measuring points each (measuring voltage at the ACUREX unit expressed in volt as a function of the probe position expressed in millimeter) according to the least squares method.

The reference resistance thermometers are connected to the ACUREX system via a four wire circuit. The changes of the measuring resistance caused by changes in temperature are measured as voltage changes, converted into °C and stored.

Some important data for test operation were calculated directly from the measured values during the experiments using the ACUREX system and after preselection displayed on a screen. Besides, all measured data from the TEGENA 1 test series were recorded on floppy disks by a floppy disk station connected with the ACUREX system. In the TEGENA 2 test series the measured data were not recorded on floppy disks but directly on the hard disk of a personal computer (IBM-PC AT).

3.2.10 Safety System

An electronic safety system served to minimize consequential damage of heater rod defects or heater rod failure. With this protective system the currents of the heater rods are recorded in a continuous mode. If intolerable current peaks occur within limits that can be set (maximum and minimum) power disconnection is released within about 12 ms.

4. VELOCITY MEASUREMENTS IN THE RECTANGULAR CHANNEL

4.1 Distribution of Flow in the Flow Development Section

The actual bundle test section is preceded by a flow development section where defined flow conditions at the test section inlet are generated. The flow development section established for the WÜP II sodium loop was installed with a reproduced feed line into a water loop (cf. Annex A1.2 and Fig. A2). A plexiglass measuring chamber with an adjustable Pitot probe has been provided at the upper end of the rectangular flow development channel in order to measure velocity profiles. The 0.6 mm diameter probe can be adjusted on longitudinal traverses in X-direction and on lateral traverses in Y-direction of the flow cross-section, the error being ± 0.1 mm. The measuring range is $0 \leq X$ mm ≤ 118.5; $6 \leq Y[mm] \leq 26$.

The velocity profiles in the measuring plane (ME) were first measured in the open channel. Moreover, the attempt was made to generate box shaped velocity profiles by installing perforated plates and sieves, respectively, in order to shorten the distance over which the subchannel mass flow in the bundle can be equalized.

The velocity distributions at RE = 58000 measured in the open rectangular flow development channel (1600 mm flow development length, which corresponds to roughly 31 hydraulic diameters DC) are symmetric with respect to the central axes of the channel cross-section (Figs. 8 and 9). The maximum velocities are by 20% higher than the mean channel velocity UC. The maximum variations of the local velocities ($\pm$ 2%) occur on the line of maximum velocities. Thus, the conditions of inlet flow into the four rod bundle can be termed good.

It was not possible to flatten the velocity profile markedly towards a piston profile by installing different inserts in the rectangular flow development channel (perforated plates and sieves, respectively). Moreover, it appeared that all velocity profiles measured with the inserts provided were less symmetric and less uniform than those measured in the open channel. Consequently, the conditions of bundle face flow were not improved by the inserts examined /20/. Therefore, the open flow development channel was used in the TEGENA experiments.

4.2 Sodium Velocities in the Rectangular Channel

Reproducible velocity profiles of sodium flow were measured at different temperature levels in order to test the measuring probe adjusting devices /21/. For this purpose, velocity measuring probes (cf. Section 3.2.2) instead of the temperature probes were clamped into the cross slides. The measurement fields of the two velocity probes GS1 and GS2 in the main plane of measurement ME6 have been represented in Fig. 10.

Velocity profiles in the measuring plane ME6 were measured on longitudinal and transversal traverses within the following range of parameters:

$$115{,}000 \leq RE \leq 420{,}000$$

$$0.85 \leq U[m/s] \leq 3.52$$

$$300 \leq TN[°C] \leq 410$$

Some examples are shown in the following diagrams:

Figure 11 shows the U-profiles measured on serveral days on mean X-traverses (Y = 16.35 mm). The U-profiles of the probes GS1 (o and + symbols) and GS2 (◊ and x symbols) coincide and taken together they show a symmetric course over the channel width which demonstrates the reproducibility of the measurements. The maximum velocity variations of the probe GS1 not moved in the second series of measurements (X = 38.50 mm; Y = 16.35 mm) are indicated by the triangular symbols, the range of variations being ± 2%. The maximum velocities are 1.25·UC, the minimum velocities near the wall (distance to the wall X = 1.5 mm) are

0.77·UC.

Besides the U profiles on the mean longitudinal traverse also the U profiles have been represented on two lateral X traverses each with distances from the wall of 13 and 26%, respectively, of the channel depth in Fig. 12. The measured velocity distribution validates the symmetric flow conditions in the rectangular channel, also in the near-wall zones of the long channel walls. The velocity profiles on the transversal traverses (Y traverses) have been represented in Fig. 13. Close to the short channel walls (distance from the wall X = 3.53 mm) the width of variations of the U profiles in Y direction is about ± 5%.

Summarizing it can be stated that the permanent magnet miniature probes installed in isothermal sodium flow up to temperatures of 410°C furnish velocity profiles of a good quality. The potential of the measuring accuracy of these measuring probes is comparable with that of conventional Pitot probes.

5. TEST PROCEDURE AND PROCESSING OF MEASURED VALUES

The procedure of the main tests and the presentation of measured results break down into three groups:

a) isothermal tests
(inspection and calibration of the thermocouples);
b) wall temperatures (3D) of the rectangular channel
(parameters: Reynolds (Péclet) numbers, heat flux density, uniform load, four cases of flux tilting);
c) sodium temperatures and temperature fluctuations (2D) in the subchannels
(parameters: Reynolds (Péclet) numbers, heat flux density, uniform load, four cases of flux tilting).

The envisaged test program of the TEGENA 1 test series was restricted by defects at the heater rods H2 and H3 which ocurred after nine days of testing. The external rod geometry did not undergo changes so that it was possible to continue the tests while heating the rods H1 and H4 (flux tilting tests). The planned test program of the TEGENA 2 test series was performed in full scope as planned.

All measured variables of the TEGENA 1 test series and processing of the variables have been described in detail in /12/. In this report some essential items will be discussed in order to help understand the measured results. In the experiment all points of measurement approached by the mobile probes were set in probe specific local coordinate systems. The local coordinates of all probe thermocouples were converted uniformly into an X/Y main coordinate system (Figs. 3 and 4) which means that for a given location of measurement the position of each thermocouple of the probe in the coordinates of the X,Y coordinate system is indicated.

The thermocouple positions are denoted in the diagrams and tables by three symbols each, e.g. X23 where "X" means the coordinate, "2" the probe 2, and "3" the thermocouple number 3 of the probe 2 (TE23).

The BASIC computer codes TEGEK1.BAS and TGP1.BAS were used to process the values measured in the TEGENA 1 test series /21/. TEGEK1.BAS is used to convert the measured data into physical data and to calculate reference numbers. The TGP1.BAS code is used to sort the calculated values and to tabulate and plot the results. The reference temperature used to calculate the dimensionless reference numbers (Re,Pr) was a mean bundle temperature TNM. TNM is the arithmetic mean of the measured inlet temperature TEN and the mean sodium temperature TNO calculated in the measuring plane ME6.

The FORTRAN computer codes THEO.FOR, DISDRU.FOR, PLOTHP.FOR, FINT.FOR and FINTEX.FOR were used in measured values processing related to the TEGENA 2 tests series /22/. THEO.FOR was used to convert the measured data into physical data and to calculate reference numbers. The DISDRU.FOR code was used to sort and tabulate the calculated values. The PLOTHP.FOR, FINT.FOR and FINTEX.FOR codes were used to sort and plot the calculated values. Also the mean bundle temperature TBP = 0.5(TBO+TBI) was used as the reference temperatures for calculating the dimensionless reference numbers (Re, Pr).

The signals of all 126 wall thermocouples were monitored in periodical isothermal tests; however, no correction was made of the measured values because the very small relative deviations of measured values were considered insignificant with respect to the evidencing power of the results.

The signals of all probe thermocouples were controlled by referring to the isothermal tests and corrected using the reference thermocouples (Table 2).

The RMS values of the temperature fluctuations calculated during data acquisitions were not corrected.

6. TEST RESULTS

6.1 Generalities

The major results of the two test series, TEGENA 1 and TEGENA 2, are respresented graphically in this report while the measured values together with the test parameters have been tabulated in the Annex. All test results (graphical and tabulated representations) will be contained in more detailed data reports. Part 1 of the TEGENA 1 test series has been documented in /12/.

6.2 Isothermal Tests

The isothermal tests are the basic tests for all experiments involving heated rods. They serve to control the measuring probes and describe possible deviations from the ideal isothermal conditions. In both test series isothermal test were performed at regular intervals over the entire period of testing. For this purpose, the test section was heated to the desired temperature level with the trace heating of the loop system and with a controllable 120 kW heater. The measurements were made at four temperature levels (250, 300, 350 and 400°C) and in the TEGENA 2 test series also at four sodium flow velocities (0.5, 1, 2 and 4 m/s).

The uniformity of the temperature signals recorded depends mainly on:

- the quality of the isothermal conditions prevailing in the test section, both in terms of space and time;
- the quality of the measuring sensors;
- the accuracy of the data acquisition system.

6.2.1 Isothermal Tests - Wall Temperatures

The wall temperatures measured in the isothermal test I01T250 of the TEGENA 1 test series at ~ 300°C have been plotted in Fig. 14 over the channel perimeter CP. The 126 temperature values scatter by ±0.3K at the maximum, with two exceptions in the measuring planes ME1 and ME5. The mean value MIT occurs 1.05 K above the reference temperature TRF = 0.5 (PT3 + PT2). The accuracy of calibration of the resistance thermometers PT3 and PT2 up to 500°C is ±0.2K according to information received from the supplier.

The wavy distribution of the temperatures on the perimeter of the rectangular channel is due to the differences in thermal insulation of the short and long channel walls. The thicker air layer in the center of the long channel walls gives rise to higher temperatures. The width of variation of temperatures on the channel perimeter due to the slight differences in thermal insulation is about ±0.3K in this example.

In Fig. 15 the temperatures of the tests I07T250 and I52T250, measured at different points in time, have been represented in addition to temperatures measured in the test I01T250 described before at ~300°C; the Reynolds numbers are higher by 44% and 24%, respectively. The observed mutual changes of temperatures are <0.1 K on the average. The deviations of the mean values MIT, calculated from 126 measured values each, with respect to the corresponding reference temperatures TRF are - ordered by the sequence of measurements - 1.1K;0.8K,0.4K.

The wall temperatures measured in the TEGENA 2 test series at three different temperature levels (300, 350 and 400°C) and at constant mean flow velocity UB = 0.5 m/s have been represented in Fig. 16. The measurements reveal little differences in temperature on the channel perimeter of about 1 K which slightly increase with increasing temperature level.

The wall temperatures in the five measuring planes, recorded at about 300°C and at four different flow velocities (0.5, 1, 2 and 4 m/s), have been represented in Fig. 17 on a temperature scale enlarged by a factor of 20. The difference in the absolute temperatures at the different velocities is due to the accidental, steady-state isothermal conditions in the test section. The measurements show that the differences in temperature in five planes of measurement amount to 0.5 K. On the perimeter of the rectangular channel the temperatures undergo variations, which are dependent on the flow velocity of sodium, namely between 0.7 and 1.3 K. The maximum temperatures were measured in all zero tests in the center of the long sides of the rectangular channel (B and D). The reason is the annular insulation of the rectangular channel, with differences in the thicknesses of the air layers enclosed, so that a uniform slight disturbance of the temperature field is produced in the cross-section of the rectangular channel. The disturbance of the isothermal temperature field in the cross-section of the rectangular channel depends on the temperature level and on the flow velocity. At 300°C the maximum temperature variations on the channel perimeter are 1.3K for UB = 0.5 m/s and 0.7K for UB = 4 m/s; at 400°C the corresponding values are 1.6 and 1.0K.

When the measurements of 120 wall temperatures were repeated maximum deviations of 0.25K were obtained at the temperature level of 400°C and the mean flow velocity UB = 0.5 m/s. The deviations between two successive measured values were always less than 0.1K. This implies that the relative error of measurement of the data acquisition system is less than 0.1K.

During the test series 2 two failures were observed of 126 wall thermocouples after several days. These failures had no practical impact on the test results because it was possible to replace the two erroneous wall temperatures by averaging the signals received from the respective sensors at neighboring measuring planes.

Summarizing it can be stated:

- With identical thermal insulation in axial direction the scatter band of the wall thermocouples is about 0.5K.
- On account of slight differences in the thermal insulation on the perimeter of the rectangular channel, temperature vari-

ations of the wall thermocouples between 0.7 and 1.3K were obtained dependent on the sodium flow velocity.

When the rods are heated the slight differences in the thermal insulation on the perimeter of the rectangular channel get effective in the same manner as at zero power. Therefore, no correction has been made of the wall temperatures.

6.2.2 Isothermal Tests - Fluid Temperatures

In Fig. 18 the deviations averaged over the three isothermal tests have been plotted as a function of the reference temperature for the eight probe thermocouples. There is a clear dependence on temperature with a linear characteristic. The straight lines drawn through the four points were determined by the least squares method. When evaluating the fluid temperatures measured with the probe thermocouples a correction was made using the equations valid for the straight lines; the error is smaller than 0.1K.

Within the range of temperatures investigated the thermocouples of probes S1 and S2 (TEGENA 1 test series) exhibit mainly negative deviations DTR from the reference temperature TRF. These are miniature thermocouples with boron nitride insulation at the measurement tip. The deviations of the 0.24 mm thick thermocouples of probe S1 from the reference temperature are about twice that of the 0.38 mm thick thermocouples of probe S2 at temperatures >350°C.

The maximum absolute deviation DTR of thermocouple TE14 of probe S1 at 400°C is 3.7K and 1.9K, for the thermocouple TE24 of probe S2. The maximum relative deviation of the thermocouples of probe S1 is 0.7K and 1.2K for probe S2 at 400°C.

The TEGENA 1 experiments were performed in the temperature range of 260 to 380°C. In that range the maximum deviation between two probe thermocouples is about 1 K (TE21 and TE 24). If the correction described above were not made for these thermocouples, an error of ~50% would be produced between the thermocouples TE21 and TE24 (centerline spacing about 2 mm) for the measured mean temperature gradients of e.g. 1 K/mm. This error can be reduced to 5 to 10% by correction of the measured values.

The measured deviations of the inlet thermocouple TEN and outlet thermocouple TAS from the reference temperature have likewise been entered in Fig. 18. The inlet thermocouple TEN has its measurement tip tapered from 3 mm to 1.5 mm and it is insulated from the sheath with magnesia. It shows a clear dependence on temperature with a linear characteristic; in the temperature range investigated the deviations are possitive and increase with rising temperature. The outlet thermocouple TAS is 3 mm in diameter and provided with an MgO insulated measurement tip. The measured deviations in the temperature range investigated are roughly 2.5K above the reference temperature and exhibit a linear course with a slight tendency to decrease. The measured deviations of the 126 wall thermocouples are described by the shaded area in Fig. 18. The temperature dependence is little. The deviations on an average are plus 0.8K, the scatter band is ±0.4K.

For the thermocouples of probes P1 and P2 (TEGENA 2 test series) the isothermal measurements yielded less temperature dependence compared with the probes S1 and S2. The maximum deviation between the five thermocouples of the probe P1 occurred at 400°C and amounted to 1.2K. The maximum deviation between the five thermocouples of probe P2 was 4K at 400°C; however, between the thermocouples in a square arrangement the maximum deviation was not more than 0.6K. The central thermocouple TC25 has clearly smaller dimensions and a measurement joint of a different design which provides the explanation for the deviating characteristic.

Similar to the thermocouples of the probes S1 and S2, a correction of the measured values was also made for the thermocouples of the probes P1 and P2 using equations valid for straight lines. For all probe thermocouples and for the thermocouples TEN and TAS the equations applicable to straight lines and used in the evaluation have been compiled in Table 4.

During the TEGENA 1 test period no changes were observed at the thermocouples of the probes S1 and S2 as a result of the isothermal tests. During the TEGENA 2 test period, however, the following effects were detected inter alia in the isothermal tests:

- The thermocouple TC12 of the probe P1 became defective at the end of four weeks.
- The thermocouple TC21 of the probe P2 did not always work reliably.

Summarizing it can be stated:

- The characteristic of the deviations of the measured values of the probe thermocouples from the platinum resistance thermometers used as reference elements is a linear one and slightly dependent on the temperature within the range of temperatures investigated (250 to 400 °C).
- The changes of the thermocouple characteristics during each test period were negligibly small, with two exceptions.
- When all probe temperatures averaged over time were evaluated, the measured values were corrected on the basis of the isothermal measurements.

6.3. Distributions of Wall Temperatures at Uniform Load

The wall temperatures measured in the structures (rectangular channel) are a necessary boundary condition for judging the temperature distributions measured in the fluid. This is the question of particular relevance: Has the flow in the main measuring plane ME6 (fluid temperature) fully developed thermally under conditions of uniform heating of the four rod bundle?

First, the distributions of wall temperatures measured in five mesuring planes will be described by an example.

For the uniformly heated bundle the distribution of the wall temperatures on the perimeter of the rectangular channel has been represented as a function of the heated length in Fig. 19. The measurements were made for a Reynolds number Re = 60,100 which corresponds to a mean bundle velocity UB = 1.91 m/s. With a total electric power of 396 KW supplied, this gives a mean heat flux density at the rod surface of QH = 50 W/cm^2 and a mean coolant heating of 96K up to the measuring plane ME6. The heat flux densities of the individual rods differ by 1.5% at the maximum. In the non-heated bundle zone the temperatures on the channel perimeter are constant (measuring plane ME0, symbol 0). At the measuring planes of the heated zone (ME1 through ME5) temperature peaks occur in the narrowest gaps between the heater rods and the channel wall where heat removal by the coolant is minimum. All the temperature sinks are located in the center of the subchannel. The maximum temperature differences between the center of the coolant channel and the narrowest gap are between about 5K (ME1) and about 12K (ME5) in this test. Details can be taken from the table of measured values in the Annex. The variation of the temperatures on the perimeter of the rectangular channel heavily increases with the heated length up to the measuring plane ME2 (LH/DH = 60) and thereafter increases only slightly. The difference of temperature variations between the measuring planes ME4 and ME5 is only about 5%. It can be concluded from these wall temperature measurements that the temperature distribution of the flow after a heated length of 60 hydraulic diameters (ME2) is already very similar to that after 195 hydraulic diameters (ME5). For the main measuring plane ME6 (fluid temperatures) this means after a heated length of 201 hydraulic diameters that the flow has been largely developed thermally there, i.e. the heated length of the bundle of approximatly 2.5 m had been sufficiently dimensioned in designing the test section.

To be able to study the influence of the Reynolds (Péclet) number on the thermal development of the flow three test series (WO3A120, WO5A075, WO5B075) were performed within the TEGENA 1 test series with the characteristic test parameters compiled in Table 3. The temperature distributions measured for different heat flux densities and different coolant heatings resemble in their course the distributions represented in Fig. 19. At each measuring plane the maximum temperature differences on the entire channel perimeter ΔT_{CP} were determined and normalized to the mean coolant heating DT. The normalized temperature differences $\Delta T_{CP}/DT$ so obtained have been plotted in Figs. 20, 21 and 22 over the heated length. The parameter is the flow condition characterized by the Reynolds number. Figure 20 shows the situation for a mean coolant heating of DT $\approx$ 95 K. Figures 21 and 22 show the conditions for a mean coolant heating DT $\approx$ 72 K; the results represented in Fig. 22 were obtained from repetition tests.

The plots in Fig. 20 show that the temperature field in the rectangular channel largely develops up to a heated length of approximatly 60 hydraulic diameters (ME2) under all flow conditions studied (24,000 $\leq$ RE $\leq$ 76,000, 140 $\leq$ PE $\leq$ 440). The four heater rods, the sodium flow permeated bundle subchannels and the surrounding rectangular channel make up a thermally coupled system. Therefore, it can be concluded that also the temperature field in the sodium flow has largely developed up to the measuring plane ME2 (60 DH). For smaller Reynolds numbers (RE $\leq$ 30,000) the flow has largely developed thermally at the end of 60 DH. The change in the temperature field up to approximately 200 DH is only about 10%. For higher Reynolds numbers of 76,000 (Pe $\approx$ 440) the temperature field between the measuring planes ME2 and ME5 changes only by 50% and between the measuring planes ME4 and ME5 only by 7%. That means that for this flow condition the flow has largely developed thermally at the end of approximatly 200 DH.

The fluid temperatures at the measuring plane ME6 (= 201 DH) were measured at maximum Reynolds numbers of about 60,000. For this flow condition the temperature field in the rectangular channel changes by about 3% from ME4 to ME5. Assuming that the change of the temperature field in the subchannels with sodium flow resembles that in the rectangular channel, the following holds: With a fully heated bundle all fluid temperatures are measured while the flow has largely developed thermally. The heated length of 2500 mm specified prior to heater rod manufacture in order to achieve thermally developed flow was therefore dimensioned appropriately.

The plots in Figs. 21 and 22 obtained from the test series W05A075 and W05B075 confirm the plots described before and hence lead to the same conclusions as above.

Supplementing this and for the sake of comparison the wall temperature distributions have been represented in Fig. 23 for an example taken from the test series TEGENA 2. For fully turbulent flow with Re = 68,000 (Pe = 366, UB = 1.97 m/s, QH = 51 W/cm^2) the temperature profiles on the perimeter of the rectangular channel are regular again at all five measuring planes. The mean temperature variation on the channel perimeter initially increases clearly up to a heated length of about 100 hydraulic diameters (MP3); thereafter, the increase amounts to only a few percent. Looking at the local temperature distribution one finds asymmetries in the neighborhood of the outer rods H1 and H4. The reason probably is little displacement of the rod away from the ideal position which is indicated by arrows in Fig. 31.

The wall temperature distributions were measured for five different flow conditions in the range of $3700 \leq Re \leq 68,000$ ($21 \leq Pe \leq 366$). The most important test parameters of this test series belonging to TEGENA 2 have been compiled in Table 4. It is evident also here that the major thermal development processes take place along the first 100 hydraulic diameters. In the upper bundle half the temperature profiles resemble much each other; the changes of temperature variations on the channel perimeter are only some percent here.

In a more detailed analysis of the temperature differences measured in the individual subchannels it can be shown that thermal development is fastest where the heating and cooling conditions are symmetric. This is the case in the central wall channels and in the corner channels. In the other bundle zones thermal development is slow with a non-linear dependence on the Re number and the heat flux density, respectively, at constant coolant heating. The following two diagrams will illustrate this by way of example. In Fig. 24 local azimuthal temperature differences (TV) in the zone of the central wall channels have been plotted for different Re numbers as a function of the heated length. TV is a temperature difference between two neighboring wall thermocouples located at the same measuring plane; cf. Fig. 7. The local temperature differences TV have been normalized to the mean coolant heating DTC, and the heated length LH has been normalized to the mean hydraulic diameter DH in the bundle. The points entered in the diagram are mean values of the four local temperature differences (marked in the bundle cross-section) in the zone of the central wall channels. The plots for the three different Re numbers exhibit a continuous rise up to a heated length of about 100 DH and thereafter they become very flat up to 200 DH. Furthermore, it can be taken from the diagram that the normalized temperature differences TV/DTC, above a heated length of about 50 DH, are proportional to the Re number in any subchannel cross-sections.

The respective conditions are completely different for the wall channels in Fig. 25 which are coupled with the corner channels. The points traced in this diagram are mean values of the four temperature differences marked in the bundle cross-section. For Reynolds numbers smaller than 32,000 the normalized temperature differences do no longer undergo changes at the end of about 50 DH and, moreover, they are clearly smaller than in the central wall channel. For heavily turbulent flow with Re = 68,000, on the other hand, the plot takes a steep course in the bottom part of the bundle, attains a maximum at DH 80, and at DH = 200 its tendency is still to decrease. It can be supposed that in this flow condition thermal equilibration between the corner channel and the neighboring wall channel is not yet completed. At medium and small Reynolds numbers the high molecular thermal conductivity brings about thermal equilibrium already after short heated lengths.

The development of the normalized local temperature differences at the measuring plane MP5 has been represented in Fig. 26 as a function of the Re number. The temperature differences TV measured between neighboring wall thermocouples have been given the same numbers for comparable geometric zones in the cross-section of measurement. The curves in the diagram are based on the mean values of similar temperature differences and are designated by the respective numbers. It can be recognized that the normalized temperature differences TV/DTC increase linearly with the Re number for the fully symmetric bundle zones (central wall channels, corner channels) (plots 1 and 5, respectively). For the rest of cases a non-linear dependence on the Re-number (plots 2, 3 and 4) is obtained.

Summarizing, the following conclusions can be drawn from the wall temperature distributions measured under conditions of uniform load:

- From the development of the temperature field in the external bundle structure (rectangular channel) conclusions can be drawn with respect to the development of the temperature field in sodium flow because the system is thermally coupled.

- For the case of uniform load (all four rods heated) sodium flow at the main measuring plane ME6 has largely developed thermally after a heated length of about 200 hydraulic diameters.

- The local analysis provides indications to the effect that for greater Reynolds number thermal equilibrium between coupled subchannels of different sizes (wall channel/corner channel) has not yet been completed after 200 hydraulic diameters.

6.4 Fluid Temperature and RMS Profiles at Uniform Load

In this chapter it is reported about temperature profiles measured with the mobile measuring probes on lateral traverses (Y direction) and on longitudinal traverses (X direction) in the bundle subchannels.

6.4.1 TEGENA 1, Profiles on X/Y Traverses, Uniform Load

The fluid temperature profiles measured in the TEGENA 1 test series have been represented in Figs. 27 to 30. The bundle is heated uniformly at 50 W/cm^2 and the sodium flows through the bundle at a mean velocity of UB $\approx$ 1.90 m/s (Re $\approx$ 60,000). The temperature profiles measured with the probe S2 on Y traverses between the heated rods H3 and H4 have been represented in Fig. 27 (direction of motion A, positive Y direction for probe S2) and in Fig. 28 (direction of motion B, negative Y direction for probe S2). In the test F04Q12A.DAT the probes were moved with increasing measuring coordinate (DIR A), in the test F04Q12B.DAT with decreasing measuring coordinate (DIR B). The directions of motion have been traced also in the diagrams. DIR A means the pushing movement of the measurement slides, DIR B the pulling movement of the measurement slides. The two measuring traverses have constant X coordinates (X21 = 86.96 mm, X22 = 88.79 mm); they run symmetrically with the central line in Y directrion between the rods H3 and H4. The profiles measured with the four probe thermocouples coincide; in the center of the wall channel they proceed steeply and linearly, and in the narrowest gap between the rods (Y = 16.2 mm) they attain a maximum of symmetry. The measured results are practically independent of the direction of motion which is shown by a comparison of the temperature profiles in Figs. 27 and 28. These measurements show that the flow had a symmetric distribution and the power must have been released uniformly. Furthermore, it can be concluded that the probe had been correctly positioned and that the measured values were corrected properly on the basis of the isothermal measurements. Slight temperature differences between the measured plots of the thermocouples TE21/TE22 and those of the thermocouples TE24/TE23 are caused by small changes in the operating parameters because the measured values were recorded at the same locations and at different points in time each.

The temperature profiles measured with the probe S2 on the X traverses parallel to the long channel wall have been represented in Fig. 29 (direction of motion A, negative X direction for probe S2) and in Fig. 30 (direction of motion B, positive X direction for probe S2). The measurement traverses are located on the Y coordinates Y21 = 2.68 mm and Y24 = 0.85 mm; their distances with respect to the heater rods and the duct wall, respectively, are the same. The measurement plots in Fig. 29 and in Fig. 30 exhibit minima each in the centers of the subchannels and maxima in the narrowest gaps. Also in X direction the results of measurement are independent of the direction of motion of the probe. A slight shift by about 1.5 mm in the temperature maxima in the narrowest gap between the rod H4 and the channel wall towards the wall channel can be observed. The maximum temperatures in the narrowest gap for rod H4 are only about 4K above those in the narrowest gap for rod H3 which corresponds to roughly 4% of the coolant enthalpy rise. The mean temperature gradients in Y direction differ by about 12% at the respective locations. A possible explanation is the rod power of rod H4 which is higher by about 4% compared to rod H3 which would imply coolant heating higher by 2.5K. However, this is contradicted by the fact that the cross-sectional surface of the corner channel is larger by 22% than that of half the wall channel and that, consequently, the coolant channel cross-section of rod H4 is larger by 11% than that of rod H3. A further explanation for the temperature differences ocurring in the narrow gaps would be deviations of the rods H3 and H4 from the ideal geometry. An assumed mean eccentric position of 0.1 mm of rod H3 in positive Y direction and of rod H4 in negative Y direction may lead to the measured temperature differences which has been shown by subchannel code based computations; cf. Chapter 7. The vertical spacings between the curve pairs reflect mean temperature gradients in Y direction. In the narrowest gaps maximum values of about 3 K/mm are obtained, in the subchannel centers minimum values of 0.6 K/mm. The maximum temperature gradients of the measured curves are 2.2 K/mm in X direction.

The fluid temperature profiles measured in the TEGENA 1 test series using probe S1 are not described here because the probe shaft got slightly deformed and the measured values were helpful to a limited extent only; the results obtained have been represented in /12/.

6.4.2 TEGENA 2, Profiles on X/Y Traverses, Uniform Load

In the TEGENA 2 test series fluid temperature measurements were repeated on Y and X traverses with the test parameters similar to those used in the TEGENA 1 test series. It should be noted in this context that new heater rods had been installed and modified measuring probes with a slightly different geometry were used.

The temperature profiles measured with the probes P1 and P2 on parallel Y traverses have been represented in Figs. 31 to 34. The RMS values of temperature fluctuations measured at the same time have likewise been entered. The measurement traverses have constant X coordinates. For probe P1 they are X11 = 31.66 mm and X12 = 29.61 mm which means that they run symmetrically between the heated rods H1 and H2; for the probe P2 they are X21 = 86.57 mm and X22 = 89.22 mm which means that they run symmetrically between the heated rods H3 and H4. In the test M332.DAT the probes were moved with increasing measuring coordinate (DIR A), in test M334.DAT with decreasing measuring coordinate (DIR B). The directions of motion have also been traced in the diagram; DIR A means the pushing movement of the measurement slide, DIR B the pulling movement of the measurement slide. These are the findings from the profiles measured on the Y traverses. The temperature profiles measured with the four probe thermocouples coincide for the two probes because the temperature distribution in X direction is symmetric with respect to the parallel measuring traverses. Pronounced temperature maxima occur in the narrowest gaps between the heated rods. Exactly at these points the RMS profiles exhibit pronounced minima. This means that the temperature fluctuations are minimum where the tempeature gradients in the direction of movement of the measuring sensors become zero which is a plausible explanation. Conversely, the RMS profiles have their maxima where the temperature gradients are greatest. The profiles traced in opposite direction each (DIR A/B) (Figs. 31 and 32 for probe P1, Figs. 33 and 34 for probe P2) give the same results. By little change in the test parameters from test M332 to test M334 the temperature levels have changed by a few degrees each. This is expressed by the slight shift in location of the temperature profiles. The RMS profiles, however, fully coincide in the two tests because the temperature gradients have practically not undergone any changes. The conspicuous deviations of the temperature maxima and the RMS minima from the geometric center (Y = 16.2 mm) for probe P2 (Figs. 33 and 34) suggest geometric displacements of the two rods H3 and H4 or of either of them. The differences of the RMS values in the range of maximum temperature gradients suggest that the thermocouple tips of TC21 and TC24 and TC23 and TC22, respectively, have not been shifted exactly on the same Y traverses.

The temperature profiles measured on X traverses for similar test parameters and the related RMS profiles have been represented in the following two diagrams. The thermocouples of probe P1 were shifted between the heater rods H1, H2, H3 and the long channel wall on the X traverses running parallel to the wall with the fixed Y coordinates Y11 = 29.39 mm and Y14 = 31.44 mm (Fig. 35). The thermocouples of probe P2 were shifted between the heater rods H2, H3, H4 and the opposite long channel wall on the X traverses at Y21 = 3.13 mm and Y24 = 0.48 mm distance (Fig. 36). Similar to the measurements belonging to the TEGENA 1 test series (cf. Figs. 29 and 30), also here the mean temperature profiles exhibit pronounced maxima in the narrowest gaps between the heater rods and the channel wall.All the temperature minima occur in-between, in the centers of the subchannels. The maximum temperature variations in X direction are about 22 K. The amplitude difference between the two curve pairs is in each case a measure of the mean temperature gradients in Y direction at a given X position. The mean temperature gradients in Y direction vary approximately between 1 K/mm (subchannel center) and 3 K/mm (narrowest gap). The mean temperature of the wavy temperature profiles decreases towards the center of the bundle. The same tendency was observed in the mesurements belonging to the TEGENA 1 test series (cf. Figs. 29 and 30). The RMS values of the temperature fluctuations recorded at the same time as the mean temperatures, like on the Y traverses, exhibit maxima in the zones with high temperature gradients. The minima of the RMS profiles occur where the temperature gradients become zero.

In the TEGENA 2 test series temperature profiles and related RMS profiles were measured at uniform load (all rods heated) under five different flow conditions in total (Re ≈ 4000, 8000, 16,000, 32,000, 64,000). The profiles measured for Re ≈ 16,000 (Pe ≈ 90) have been represented in Figs. 37 and 38 (Y traverses) and in Figs. 39 and 40 (X traverses). The plots largely correspond to those obtained for high Re numbers although the heat flux densities, the maximum temperature variations, the temperature gradients and the maximum RMS values are smaller by about a factor of 5. The temperature and RMS profiles measured in Y direction greatly resemble those measured for high Re numbers; the maxima and minima are pronounced and occur at the same locations. However, the temperature and RMS profiles measured in X direction, compared to those measured for high Re numbers, exhibit characteristic differences if looked at more closely. The temperature profiles measured with both probes exhibit clearly different maxima in the narrow gaps of the central rods

H3 and H4. This is an unexpected finding, which cannot be explained straightforwardly. It can be supposed that the central rods in this operating condition are shifted slightly from their ideal positions, namely rod H2 in the positive and rod H3 in the negative Y directions. A question which can be clarified solely by further studies would be whether under this flow condition (Re ≈ 16,000, Pe ≈ 90) mixed convection might already be capable of causing the observed irregularities in temperature (cf. Figs. 31 to 36, Re ≈ 68,000). Whereas the RMS plots have still pronounced maxima and minima on the Y traverses, the extremes on the X traverses are still only visible well for the thermocouples TC21 and TC22 of the probe P2 (Fig. 40). The thermocouples TC24 and TC23 moved on the near-wall traverse (distance from the wall Y24 = Y23 = 0.46 mm) practically did not show any longer changes in temperature fluctuations. The same is true for all thermocouples of probe P1 (Fig. 39). The conclusion can be drawn from this that the thermocouples with the non-insulated measuring tips of the probe P2 are more sensitive than the thermocouples with the insulated measuring tips of the probe P1. The differences in RMS values of different thermocouples of similar design (insulated or non-insulated measuring joint) in the range of $0.1 \leq \mathrm{RMS[K]} \leq 0.3$ are probably due to the differences in the geometries of the measuring tips; in that case, they could be largely eliminated by calibration.

For three different Re numbers (Re ≈ 8000, 16,000, 32,000) the temperature profiles measured with the probe P1 and the associated RMS profiles have been represented in Fig. 41. The probe was displaced in Y direction on the line of symmetry between the heater rods H1 and H2. The temperatures measured during displacement with the four thermocouples, TC11, TC12, TC13 and TC14, are largely identical for reasons of symmetry; the same is true for the four RMS profiles. All plots represented in the diagram are mean value plots from four curves recorded by the thermocouples mentioned before. The test parameters for the curves 1 through 3 have been indicated in Fig 41. The temperature plots (top part in the diagram) exhibit a uniform rise towards the center of the bundle over the major part of the wall channel, and in the narrowest gap between the heater rods they pass through a pronounced maximum. Only a few millimeters in front of the non-heated channel wall - the order of magnitude is the gap width of 3.7 mm - the temperature gradients decrease noticeably; the distance of the point of measurement nearest the wall is 1.5 mm. For the temperature plots 1 and 2 a slight shift of the temperature maxima from the geometric center (Y = 16.2 mm) of about -0.5 mm and +0.5 mm, respectively, is observed. The RMS values of the temperature fluctuations recorded at the same time as the mean temperatures have been represented in the bottom part of the diagram. For the examples described here the RMS values occur between 0.2 and 1.3 K. All the RMS plots have a maximum where the temperature gradients in Y direction are maximum. In X direction the temperature gradients are negligibly small at the measuring sensors outside the narrowest gap. Pronounced minima are exhibited by all RMS plots at the point Y = 16.2 mm in the narrowest gap between the rods; a slight shift cannot be recognized here as in the case of the temperature maxima. The RMS values differ here in absolute terms by about 0.2 K because in the zone of the narrowest gap the temperature gradients in X direction cannot be fully neglected. At 1.5 mm distance from the non-heated duct wall the RMS values for the three flow conditions investigated almost agree; this means that the temperature gradients in Y direction differ hardly from each other. The temperature and RMS profiles measured with the probe P2 are largely identical with those described before.

The reproducibility of the measured results will be demonstrated with the following four figures (Figs. 42 to 45). The profiles of two thermocouples each of probe 1 (Figs. 42 and 43) and of probe P2 (Figs. 44 and 45) are those determined in three different tests involving similar test parameters (Tab. 5). The tests were performed at Re $\approx$ 33,000 and QH $\approx$ 21 W/cm^2. Within the accuracy of measurement (cf. Chapter 8) and considering the slight differences in the operating conditions (inlet temperature, power, mass flow) and the minor deviations from the fully steady state condition, the reproducibility of the measurement plots is good. The maxima and minima of the plots occur at the same Y positions for all three tests. The differences in the development of the RMS plots in Figs. 42 and 43 and in Figs. 44 and 45, respectively, are due to the different distances of the respective thermocouples from the long walls of the rectangular channel; see Table 7. It should be mentioned here that the mean temperature variations of the wavy temperature profiles are steady state in X direction although they run in the opposite direction compared to those at higher Reynolds numbers and power (cf. Figs. 35 and 36, Re ≈ 68,000, QH ≈ 51W/cm²). This can be explained probably only by a slightly different rod position in the rectangular channel.

Summarizing, the following can be stated for the fluid temperature and RMS profiles measured at uniform load on the Y and X traverses:

- The measurements at the main measuring plane ME6 were performed in a flow condition which can be termed largely developed thermally.

- Pronounced maxima of the fluid temperature profiles occur in the narrowest gaps of the coolant channels.

- The minima of the fluid temperature profiles occur in the centers of the subchannels on the unheated wall.

- The maximum temperature fluctuations (maxima of the RMS profiles) occur in the zones with the greatest temperature gradients.

- The smallest temperature fluctuations occur where the temperature gradients disappear i.e. at the points of temperature maxima and minima.

- For medium and small Reynolds and Péclet numbers (Re $\leq$ 30,000, Pe $\leq$ 170) the high molecular heat conduction of sodium contributes more intensively to temperature equilibration.

- Comparable results have been obtained with the two temperature probes P1 and P2.

- Different thermocouples provided on the same measurement traverses give the same results.

- The reproducibility of the measured results is good.

- Possibly prevailing mixing convection at low Re numbers (Re $\leq$ 16,000) can be clarified solely in further investigations.

6.5 Distribution of the Wall Temperatures under Flux Tilting Conditions

In the TEGENA 1 test series a number of flux tilting tests were performed with both and single external rods heated (Tab. 6). In Fig. 46 the wall temperature profiles have been represented with the external rods H1 and H4 heated. In the heated zones the temperature variations intensify on the perimeter of the rectangular channel with increasing heated length up to the measuring plane ME4 similar to those with the fully heated bundle. However, at the measuring plane ME5 a clear change of the temperature profile can be observed in the narrowest gaps between the heated rods and the long duct walls. Here a second thermal process of flow development has obviously started.

If for the same Reynolds number (Re $\approx$ 61,000) only one external rod H1 is heated (Fig. 47), the temperature distributions are similar to those with two external rods heated. The mutual influence extending over two unheated rods is therefore negligibly small. However, if the Reynolds number is reduced to half its previous value (Re $\approx$ 30,000), the temperature profiles undergo a marked variation as early as at the measuring plane ME3 (Fig. 48). If the Reynolds number is halved again (Re ≈ 15,000), the temperature profiles undergo variations as early as at the measuring plane ME2 (Fig. 49). Thus, under flux tilting conditions a second thermal flow development process sets in whose beginning and development depend on the flow condition. For small Reynolds numbers the high molecular heat conduction of the fluid produces obviously the effect that this second thermal development starts already for short heated lengths.

In the TEGENA 2 test series the distributions of the wall temperatures were determined systematically for four different heating conditions of the bundle (uniform load as the reference case and three cases of flux tilting, Tab. 6). The wall temperature profiles measured on the perimeter of the rectangular channels at five measuring planes (MP1 to MP5) have been represented in Figs. 50 through 53. In these tests the following parameters were kept constant: the Reynolds number, Re ≈ 30,000 (Péclet number Pe ≈ 180, mean flow velocity in the bundle UB ≈ 1 m/s), the heat flux density on the surface of the heated rods, QH ≈ 21 W/cm^2. The mean coolant heating DTC of about 80, 60 and 40 K was proportional to the electric power generated in the bundle. The temperature variations on the perimeter of the rectangular channel rise with increasing heated length. For the case of uniform load with four heated rods (Fig. 50) the temperature variation on the channel perimeter at the measuring plane MP5 still increases but slightly compared with MP4. This means that the flow after a heated length of about 200 hydraulic diameters has largely developed thermally. On the other hand, for the three cases of flux tilting (Figs. 51 through 53) the temperature profiles undergo variations as early as at the measuring planes MP2 and MP3, respectively. This means that there a second thermal process of flow development starts which is not yet terminated after about 200 hydraulic diameters in the zone of the main measuring plane MP6.

Summarizing, it can be said that the measurements of the wall temperature distributions yield the following results with different bundle heating (flux tilting):

- Under flux tilting conditions the flow has not yet developed at the main measuring plane ME6 after about 200 hydraulic diameters.

- Dependent on the type of heating (1, 2, 3 rods heated) and on the flow condition (Re, Pe), a second thermal flow development process sets in.

6.6 Fluid Temperature and RMS Profiles under Flux Tilting Conditions

In the TEGENA 1 test series the central rods H2 and H3 could no longer be heated after some days of testing; the probe S1 was slightly deformed from the very start. For this reason, extensive flux tilting tests were performed with the probe S2 and exclusive heating of the rod H4. Fluid temperature and RMS profiles were measured on X/Y traverses, diagonal traverses and circular arcs on the perimeter of the rod H4. Characteristic results of these measurements will be described below. During the TEGENA 2 test series all four rods and the two probes continued to function until the end of testing. Therefore, systematic measurements were performed in that test series for four different flux tilting cases and the results will be described.

6.6.1 TEGENA 1, Profiles on X/Y Traverses, Rod H4 Heated

These were the test parameters in the examples below:

Re ≈ 30,000, Pe ≈ 180, QH4 ≈ 7.7 W/cm^2.
The probe S2 was displaced on three Y-traverses, namely
- between the heated rod H4 and the unheated rod H3;
- between the heated rod H4 and the short channel wall;
- in the narrow gap between the heated rod H4 and the long channel wall.

Figure 54 shows the temperature plots on two Y traverses running symmetrically between the rods H3 and H4. The plots coincide pairwise. The temperature maxima occur exactly in the narrowest gap at Y = 16.2 mm. The mean temperature gradient of 0.6 K/mm in X direction between the top and bottom plots is almost constant over the whole measuring path. The RMS values of the temperature fluctuations show pronounced minima in the narrowest gap between the rods because there the temperature gradients are zero. In Fig. 55 the temperature plots are likewise represented on two Y traverses running symmetrically between the heated rod H4 and the short channel wall. A remarkable temperature gradient in X direction exists only in the zone of the narrowest gap; it disappears in the center of the corner channel. The RMS plots exhibit only weak maxima and minima; the absolute RMS values of 0.1 K are very low on account of the proximity to the unheated wall.

On the very short Y traverses in the narrow gap between the heated rod H4 and the long channel wall six points of measurement were obtained with each thermocouple (Fig. 56). The rise in temperature towards the heated rod wall and the temperature drop in X direction are clearly visible from the distance between the curve pairs. This means that at the end of the heated zone (~200 DH) heat continues to flow towards the unheated rods so that thermal development is not completed. The relatively high RMS values measured by the thermocouple TE24 (symbol D) might be due to a higher sensitivity of that thermocouple.

The probe S2 was displaced on three X traverses, namely

- between the rods H2, H3, H4 and the long channel wall,
- in the narrowest gap between the rods H3 and H4,
- between the heated rod H4 and the short channel wall.

The temperature profiles measured on parallel X traverses between the rods and the long channel wall (Fig. 57) coincide in the unheated zone and only around the heated rod H4 two pairs of curve are visible whose vertical distance is a measure of the temperature gradient in Y direction. The temperature maxima occur about 3 mm right of the narrowest gap between the rod H4 and the channel wall which means that heat continues to flow there from the corner channel into the wall channel. The RMS plots traced in parallel exhibit pronounced maxima in the range of the maximum temperature gradients; the thermocouples TE21 and TE22 moved on the same X traverses provide practically identical RMS values.

The temperature and RMS profiles measured on the short X traverses and parallel to the rod center linkage have been represented in Figs. 58 and 59. Again six points of measurement at 0.2 mm spacing each were measured with each thermocouple. The temperature curves coincide pairwise because the flow and cooling conditions are symmetric with respect to the displacement path of the probe axis (rod center linkage). These measurements in the narrowest gaps still give physically reasonable results at the relatively low heat flux densities (~7 W/cm^2).

It should be recalled here that the mean temperatures were corrected on the basis of calibration tests. By contrast, the RMS values have not been corrected and therefore difference of up to 0.2 K are obtained between the different measuring sensors, and these differences originate primarily in the slightly differing geometries of the measuring sensors.

6.6.2 TEGENA 1, Profiles on Radial Traverses, Rod H4 Heated

The probe S2 was displaced from the heated surface of the rod H4 on radial traverses into the wall channel (-45° with respect to the negative Y direction) and into the corner channel (+45°). Two thermocouples each moved together with the probe axis on the 45° traverses and the other two thermocouples on parallel traverses running at 1.29 mm distance. The radial temperature and RMS profiles measured at RE ≈ 30,000 and QH ≈ 7.7 W/cm^2 have been represented in the following four figures.

Figure 60 shows the profiles in the wall channel whose measuring points were recorded with increasing radius (DIR A). The temperature plots exhibit slightly increasing gradients in direction of the heated rod surface which is nearly 1 mm distant from the first point of measurement. By extrapolation a maximum temperature on the rod surface of T ≈ 316°C is obtained. The RMS plots show a broad maximum with a variation of only 0.2 K along the entire path of measurement. The profiles recorded in the opposite direction (decreasing radius, DIR B) practically give the same results (Fig. 61). They are entered separately with a view to demonstrating the reproducibility of the results.

The radial profiles measured in the corner channel with increasing radius (DIR A) are shown in Fig. 62. The temperature gradients near the heated surface are greater than those in the wall channel. However, in the unheated corner the radial temperature gradients approach zero. The temperature determined by extrapolation on the rod surface is T ≈ 321°C. The RMS values are smaller than 0.2 K and practically constant over the entire path of measurement. The profiles recorded with decreasing radius (Fig. 63, DIR B) again give the same results which confirms that the results are reproducible.

6.6.3 TEGENA 1, Azimuthal Profiles, Rod H4 Heated

On semicircular arcs provided at 0.5 and 1.0 mm distance from the heated surface of the rod H4 the temperature and RMS profiles were measured (Figs. 64, 65). In the wall channel (-90°C $\leq$ A $\leq$ 0°) the thermocouple TE22 was moved on the circular arc and the thermocouple TE21 was moved in the corner channel (0° $\leq$ A $\leq$ +90°). The profiles measured on the circular arc with the radius R = 13.0 mm have been represented in Fig. 74. The measured values recorded clockwise (DIR A) have been designated by the symbols 2, 1 (temperatures) and B,A (RMS values).

The measured values recorded clockwise (DIR B) have been designated by the symbols * (temperatures) and + (RMS values). The measured values recorded on the circular arc in opposite directions practically provide the same temperature and RMS profiles which means that the probe had been positioned correctly. The whole temperature variation near the rod surface on the circular arc R = 13.0 mm for this example is 17 K (RE ≈ 30,000, QH ≈ 15 W/cm^2). The variation is by far strongest in the wall channel where it attains about 13 K (75%). The greatest temperature gradient occurs at the angular position A = -30° where also the RMS values of the temperature fluctuations attain a maximum of about 0.6 K. The profiles measured on the circular arc, radius R = 13.5 mm, have been represented in Fig. 74. The whole temperature variation of about 22 K is higher by approximately 30% on this circular arc which is 0.5 mm larger. Hence, also the maximum azimuthal temperature gradients are greater and, consequently, the maximum RMS values which now amount to 0.7 K. If the values measured in the direction DIR A from the two circular arcs are plotted in a diagram (Fig. 75), the following can be stated. The radial temperature gradient which can be read between the plots is about twice as high in the wall channel, namely 2.5 K/mm compared with the corner channel. The RMS values have their maxima at A = -30° in the zone of maximum temperature gradients whereas they are nearly constant in the corner channel.

6.6.4 TEGENA 2, Profiles on X Traverses, 2,3,4 Rods Heated

In the TEGENA 1 test series the situation during heating of an external rod had been comprehensively studied. In the TEGENA 2 test series another four flux tilting cases as well as the uniform load case were studied as a reference test (Tab. 6), namely.

- heating all four rods, reference test,
- heating the rods H1, H3, H4,
- heating the rods H1, H2, H4 (not represented here),
- heating the rods H1, H4,
- heating the rods H2, H3.

In the following four diagrams (Figs. 67-70) the temperature and RMS profiles are represented which were measured on the X-traverses with the probe P2 under the heating conditions mentioned before. For the uniform load case as the reference test (Fig. 67) temperature profiles are obtained at QH ≈ 21 W/cm² and Re ≈ 33,000 which are similar to those for higher heat flux densities (QH ≈ 51 W/cm², Fig. 36). However, the global temperature plot exhibits a tendency to fall with increasing X coordinate in case of the low power and the tendency to rise in case of the higher power. Thus, these results were reproducible several times. The supposed cause of these unexpected differences is a different rod configuration within the limits of spacer tolerances in the rectangular channel with changed radial temperature gradients in the heater rods. Corresponding to the smaller temperature gradients, the RMS values in Fig. 67 are likewise reduced. The RMS profiles of the thermocouples TC21 and TC22 displaced near the heater rods exhibit only one maximum around the subchannel centers at X2 = 60 mm and X2 = 88 mm at the lower power. The RMS profiles of the thermocouples TC24 and TC23 displaced near the channel wall exhibit only very little variation of about 0.1 K. The underlying reasons might be the intensified influence of the high molecular thermal conductivity of sodium at the medium Re numbers as well as an attenuating effect of the unheated wall.

If only three of the four rods are heated (H2 not heated), the profiles shown in Fig. 68 are obtained; the modified scales of the ordinates should be considered. Due to the steep temperature gradients in the neighborhood of the unheated rod H2, the maximum RMS values attain approximately three times the values with uniform heating of the bundle. The RMS values entered in addition for the thinner central thermocouple are again clearly higher than those of the other thermocouples. The explanation might be the higher resolution in case of smaller size of the sensor. If only the rod H3 is not heated, the results obtained are similar to those described before.

The situation prevailing in the case of flux tilting with two heated external rods is described in Fig. 69. It is striking here that the RMS double plots intersect or overlap on the various X traverses around the narrowest gap on the unheated rod H3 at X2 ≈ 74 mm. This means that the temperature gradient in Y direction practically vanishes for X2 ≤ 74 in the wall channel between the unheated rods.

The third case of flux tilting with two heated inner rods has been represented in Fig. 70. In that case the temperature gradients are maximum between the heated rod H3 and the unheated rod H4 and, consequently, the value of about 2.5 K is approximately five times the RMS value of the uniformly heated bundle.

Summarizing, the following statements can be made on the basis of the results of measurement obtained with differences in bundle heating:

- With differences in bundle heating (flux tilting) the flow has not developed thermally after a heated length of 200 DH; this has to be taken into account when the measurements of the fluid temperatures are interpreted.

- The direct relationship existing between the local spatial temperature gradients and the intensity of temperature fluctuations assigned to them gets particularly striking.

- The results measured during the TEGENA 2 test series using the probe P1 resemble largely those measured with the probe P2 and lead to the same conclusions

6.7 Two-dimensional Fields of the Fluid Temperatures and Temperature Fluctuations in Wall Channels, TEGENA 2

For the detailed two-dimensional measurement of the wall channels of the bundle the probes P1 and P2 were displaced stepwise by about 1 mm on 11 parallel X traverses (spacing ≈ 1 mm). In this way, all probe thermocouples were positioned on the mesh points of a network of approximately 1 mm mesh width. The wall channels SC3 and SC5 were measured using the probe P1, whereas the probe P2 was used to measure the wall channels SC6 and SC8 (Fig. 71). The heat flux densities set were 5, 10 and 20 W/cm², the respective Reynolds numbers were 8000, 16,000 and 32,000. The results of measurement with one thermocouple each of the probes P1 and P2 placed in the wall channels SC5 and SC6, respectively, have been represented by way of example; Fig. 72 (TC11) and Fig. 73 (TC21). The data plotted are the fluid temperature and RMS profiles on seven parallel X traverses, equidistant with ΔY = 1.03 mm. It can be recognized from Fig. 72 that the temperature profiles run symmetrically with respect to the line of symmetry of the subchannel. The vertical spacing of the temperature plots on the line of symmetry would have to be approximately of the same size under ideal conditions because the temperature gradient in Y direction between two heated rods is practically linear; cf. Fig. 41. Deviations are caused by deviations of the operating parameters from the ideal steady-state condition. In case of the RMS plots these fluctuations in test operation have but little bearing on the local temperature gradients and therefore a higher uniformity can be found for the RMS profiles. The statements made for Fig. 72 are applicable also to the profiles of the thermocouple TC21 represented in Fig. 73.

The test results described before have been traced as isotherms and as lines of equal RMS values of the temperature fluctuations (isofluctuations) in the following four figures. The X coordinates of the points in the diagram were calculated by interpolation for predefined constant temperature and RMS values, respectively. The isotherms measured with the thermocouples TC11 and TC21 (Figs. 74 and 75) run symmetrically in with respect to the bisecting lines of the wall channels (X = 59.25 mm). The lines of equal RMS values (isofluctuations) in Figs. 76 and 77 develop uniformly and symmetrically; their maxima occur on the bisecting lines of the wall channels at an angle Φ_M = ± 25° in the center. A more detailed evaluation of these field measurements is underway; more detailed results are presented in /23/.

7. DESCRIPTION OF THE BUNDLE GEOMETRY

The bundle geometry is crucial for the velocity and temperature fields. Deviations from the ideal bundle geometry give rise to variations of these fields. Relevant studies were made earlier in connection with a 19-rod bundle experiment with sodium flow /6/. Therefore, geometry control by rod position sensors had been envisaged for the TEGENA experiment /13/. Such a device for measurement of the rod positions during test operation was designed but not materialized later for lack of time. The effects of assumed eccentric bundle positions in the rectangular channel on the mean subchannel temperatures were estimated in a global calculation /24/ (Fig. 78). It is visible from the diagram that e.g. in case of a supposed uniform displacement of the bundle by 0.3 mm mean temperature differences are produced of about 5 K in opposite wall channels. In this case, mean temperature differences of about 3 K result in adjacent corner channels.

The channel segments of the rectangular channel were measured after fabrication; cf. Section 3.1.4. The channel depth T = 32.4 mm showed the greatest tolerance after fabrication, i.e. ±0.08 mm. After completion of the test series TEGENA 1 and TEGENA 2 the channel segments were again measured. The major results are:

- After the TEGENA 1 test series a maximum increase in the channel depth between 0.1 and 0.2 mm was measured for the two top channel segments around the flange in the center of the channel; otherwise the increases in channel depth T and in channel width B amounted to 0.01 and 0.03 mm.

- Following the TEGENA 2 test series no further changes in the channel depth T were found within the accuracy of measurement of ±0.01 mm.

The heater rods are positioned in the rectangular channel by cylindric spacer pins. The tolerances of installation between spacers and heater rods are ± 0.05 mm. The heater rod diameters were measured to be 25.02 ±0.01 mm; verification measurements performed after disassembly did not show any changes. Using calibration pins the narrowest gaps at the main plane of measurement ME6 (MP6) were measured in the cold condition by means of measuring probes. Gap widths between 3.60 and 3.84 mm were obtained; the nominal value is 3.70 mm.

During disassembly of the test section after the TEGENA 2 test series a total of 78 measured values were available for the suporting plane, with 80% of the gap widths between 3.55 and 3.75 mm and 20% between 3.50 and 3.90 mm. Similar values were measured between the supporting planes with the open bundle on a plane surface. The data above are valid for the bundle geometry in the cold condition.

No exact information can be provided about the bundle geometry in the hot condition during testing operation. On the basis of the results measured in the cold condition only estimating assumptions can be made. The experiments provide indications to the effect that the rods, dependent on the radial heat fluxes imposed, have adopted slightly different positions in the rectangular channel. It can be assumed that the irregularities in the layout of the heater rods (cf. Annex A1.5) are the underlying causes. With the heating power remaining unchanged, the measured results were always reproducible.

8. ACCURACIES OF MEASUREMENT

The problems connected with the exact description of the bundle geometry in the hot condition were dealt with in Chapter 7. The uniformity of heat production on the heater rod surface can only be estimated. It is evident from pictures taken of the hot rod surfaces that under conditions of uniform cooling inhomogeneities of about 5% occur in the heat flux. Cross-sectional measurements of a heater rod roughly confirm this value if azimuthal heat balancing in the heater rod cladding and electric insulation are taken into account. In the bundle assembly non-uniform cooling is imposed on the heater rods on their perimeters which leads to a corresponding variation of the heat flux density on the perimeter.

Some measurement accuracies will be indicated below:

• relative measurement accuracy of the data acquisition system	< 0.1 K (< 4 μV)
• reference temperature (PT3, PT2)	± 0.2 K (calibration error)
• wall temperature (relative)	± 0.4 K (not corrected)
• fluid temperatures (relative)	± 0.05 K (corrected)
• accuracy of mechanical probe setting	± 0.02 mm (cold)
• local coordinates of the measuring probes	± 0.2 mm (digital display)
• thermocouple centerline distance of probe S1	1.96 (no verifying measurement)
• thermocouple centerline distance of probe S2	$1.83\,{}^{+0.03}_{-0.01}$ mm
• thermocouple centerline distance of probe P1	2.05 ± 0.04 mm
• thermocouple centerline distance of probe P2	2.65 ± 0.09 mm

9. APPLICATION OF THE TEST RESULTS

The TEGENA experiments have provided a wealth of measurement data on temperature distributions together with the related temperature fluctuations in non-circular liquid metal cooled flow channels. The results of measurement apply to the special geometry P/D = W/D = 1.147. Various flow conditions (Re, Pe) and types of heating (uniform load and several cases of flux tilting) have been investigated. Major boundary conditions such as the distribution of flow upstream of the rod bundle and the temperature distribution in the surrounding structures were determined experimentally. By use of two similar systems of measurement allowing to adjust the measuring probes and with several probe sensors per measuring probe as well as by a great number of repetition measurements the results of measurement have been well validated.

The results of measurement serve for recalculations by suitable computer codes and for verification of the latter codes. Such computer codes should first be validated on the basis of hydraulic experiments (e.g. /7, 14, 15/) because the distribution of flow in systems with coupled subchannels essentially determines the temperature fields.

Further analyses of the experimental data furnished combined with accompanying computations are recommended. Possibly, the velocity fields determined from transit time measurements /16/, together with the temperature fields presented here, will yield further interesting findings and supplementing interpretations.

10. SUMMARY

The precise knowledge of the velocity and temperature distributions is a requirement in fuel element design (rod bundle with longitudinal flow), especially in the non-uniformly cooled bundle zones. In the calculations the currently normally used global codes (subchannel analysis) are necessary whereas, in addition, the detail codes are required in fine analysis. The thermal hydraulics computer codes presently being developed have to be verified experimentally. For this purpose, the distribution of the mean fluid temperatures and the related RMS values of the temperature fluctuations were measured in a heated 4-rod bundle arranged in a row (P/D = W/D = 1.147) with sodium cooling (Pr ≈ 0.005). The temperature distributions in the structures were likewise measured because they are a necessary boundary condition.

In this report the whole layout of the experiment together with the test bench, the TEGENA test section and the measuring device have been described. TEGENA (Temperaturen und Geschwindigkeiten in Natriumströmung) is a German acronym for "temperatures and velocities in sodium flow." Preliminary tests as well as results of flow distribution and component testing are described. In a summarizing representation the major characteristic results of two rather large test series, TEGENA 1 and TEGENA 2, are displayed, described and discussed. The experiments involved are isothermal experiments performed under conditions of uniform load and flux tilting in different flow regimes.

The characteristic features of the TEGENA experiments are:

- mobile miniature measuring probes with four or five thermocouples each;
- dedicated adjustment devices for these probes;
- high-performance heater rods with great dimensions.

The test parameters were varied within the following limits:

· Reynolds number	Re = 3700 ... 76,000
· Péclet number	Pe = 20 ... 440
· mean flow velocity	UB = 0.1 ... 2.4 m/s
· heat flux densities	QH = 0 ... 60 W/cm²
· electric power of the bundle	NB = 0 ... 475 kW
· sodium temperatures	250 ... 400°C
· coolant heating in the bundle	0 ... 120 K
· temperature gradients in the fluid	0 ... 3 K
· temperature fluctuations in the fluid (RMS)	0.01 ... 2.5 K
· number of the heated rods	0,1,2,3 and 4

The following results were obtained in the measurements:

- The velocity distribution in the rectangular flow development channel ahead of the 4-rod bundle is symmetric.

- The performance of the heater rods was demonstrated under aggravated operating conditions (heat flux density: 90 W/cm², sodium temperatures 350/525°C). The inhomogeneity of heat release under uniform cooling was estimated experimentally at about 5%.

- The performance of the probe adjustment devices was demonstrated inter alia by the measurement of the sodium velocities in the open rectangular channel. The potential of the measuring accuracy of the miniature permanent magnet probes used is comparable with that of conventional Pitot probes.

- By regular isothermal measurements all temperature sensors were controlled and some of them calibrated. The rate of failure was less than 3%. The relative accuracy of the data acquisition system was better than 0.1 K.

- The length of thermal development of the sodium flow is a function of heating (uniform load, flux tilting) and a func-

tion of the flow condition (Reynolds number, Péclet number).
Uniform load, Re $\leqq$ 60,000: the flow has largely developed thermally after 200 hydraulic diameters.
Flux tiling, Re $\leqq$ 60,000: the flow has not developed thermally after 200 hydraulic diameters.

- After a heated length of about 200 hydraulic diameters the measured temperature profiles in the sodium flow exhibit pronounced maxima in the narrowest gaps of the subchannels and pronounced minima in the subchannel centers on the unheated wall.

- The RMS profiles of the temperature fluctuations measured parallel to the mean fluid temperatures (order of magnitude of RMS values 1 K) exhibit maxima in the zones of the maximum spatial temperature gradients and minima where the temperature gradients disappear.

- In both test series (TEGENA 1 and TEGENA 2) equal or comparable results were obtained with the two measuring probes (S1/S2 and P1/P2). With different measuring probes identical temperature and RMS profiles were measured on the same measuring traverses. The measurements were always well reproducible under comparable operating conditions.

- Irregularities in the heater rod positioning in the rectangular channel, during heat release on the heater rod surfaces and upon little changes with time of the steady-state operating condition, exert an influence on the measured temperature profiles. An exact quantification of these variables cannot be made which has to be taken into account in the interpretation of some results.

- It might be that at low Reynolds numbers (Re $\lesssim$ 16,000) the observed temperature irregularities are caused by mixing convection. This open question can be clarified solely in further studies.

The TEGENA experiments allow to make available extensive and validated measured data for verification of suitable computer codes. Using such verified computer codes one could improve the thermal hydraulic design of the non-uniformly cooled bundle zones of liquid metal cooled rod bundles.

It should be said in conclusion that parallel to the thermal experiments transit time measurements were performed within the TEGENA 2 test series. Evaluating these experiments one can determine velocity distributions, and combined with the temperature distributions this will provide supplementary information.

11. ACKNOWLEDGEMENT

I would like to thank all colleagues who have contributed to the successful implementation of the TEGENA project. Three colleagues from the Institut für Reaktorbauelemente (Institute for Reactor Components) should be mentioned in particular: Mr. V. Casal was responsible for the development and procurement of the high-performance heater rods. Mr. H.-J. Neitzel prepared the computer codes used in the evaluation and representation. Mr. Tschöke designed the measuring probe adjustment device. Finally, I would like to mention Mr. S.Horanyi, Central Research Institute for Physics Atomenergy, Budapest, who assisted in data acquisition during the TEGENA experiments; he performed the measurements of intensities and transit times of the temperature fluctuations.

12. NOMENCLATURE

A,B,C,D	side walls of the rectangular channel	
B	width of the rectangular channel	[mm]
CP	coordinate of the rectangular channel perimeter	[mm]
D	diameter of the heater rods	[mm]
DC	hydraulic diameter of the rectangular channel (=4FC/U)	[mm]
DH	mean hydraulic diameter of the bundle (=4·FB/U)	[mm]
DT	coolant heating up to ME6 (DT=TNO-TEN)	[K]
DTC	coolant heating up to MP6 (DTC=TBO-TBI)	[K]
FB	free flow cross-section in the bundle	[mm²]
FC	free flow cross-section of the rectangular channel	[mm²]
H	heater rod (H1=heater rod no. 1)	
LC	length of the rectangular channel upstream of the bundle	[mm]
LH	heated length of the rods	[mm]
LH/DH	normalized heated length	[-]
ME(MP)*	measuring plane in the bundle cross-section (ME1=measuring plane no. 1)	
MS(MFR)*	mass flow rate of the coolant	[kg/s]
NB	bundle power	[KW]
P	rod pitch	[mm]
P/D	normalized rod pitch to diameter ratio	[-]
PE(Pe)*	Péclet number (=RE·PR)	[-]
PR(Pr)*	Prandtl number	[-]
PT2,PT3	platimum resistance thermometers nos. 2, 3 (temperature)	[C]
S1,S2(P1,P2)*	measuring probes nos. 1, 2	
QH	heat flux normal to the rod surface	[W/cm²]
RC	corner radius of the rectangular channel	[mm]
RE	Reynolds number (=UB·DH/)	
RMS	root mean square of the temperature fluctuation in the fluid	[K]

* The denotations in brackets apply to the TEGENA 2 test series.

T	depth of the rectangular channel	[mm]
TAS	sodium outlet temperature (measuring chamber)	[C]
TBI	sodium inlet temperature (TEGENA 2,MP0)	[C]
TEGENA	Temperaturen und Geschwindigkeiten in Natrium (German acronym for temperatures and velocities in sodium)	
TEN	sodium temperature at the bundle inlet	[C]
TNM	mean bundle temperature = 0.5(TEN+TNO)	[C]
TNO(TBO)*	bundle temperature at the measuring plane ME6(MP6)*	[C]
TE(TC)*	thermocouple	
TRF	reference temperature = 0.5(PT3+PT2)	[C]
TV	local temperature difference (temperature variation) on the perimeter of the rectangular channel	[K]
TV/DTC	normalized local temperature difference	[-]
ΔT_{CP}	maximum azimuthal temperature difference	[K]
U	flow velocity (water, sodium)	[m/s]
U	wetted perimeter in the flow cross-section in the bundle	[mm]
UB	mean sodium velocity in the bundle	[m/s]
UC	mean flow velocity in the rectangular channel	[m/s]
W	distance of heater rods from the wall	[mm]
W/D	normalized distance from the wall	[-]
X	X coordinate of the thermocouple axis	[mm]
Y	Y coordinate of the thermocouple axis	[mm]
ν	kinematic viscosity	[m^2/s]

* The denotations in brackets apply to the TEGENA 2 test series.

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TABLE 1 Technical Data of the TEGENA Test Section

Heater rods	
- Rod diameter:	D = 25.02 mm
- Wall thickness of the rod cladding:	1.5 mm (1.4541)
- Thickness of the BN layer:	1.0 mm
- Thickness of the current conductor helical strip:	1.5 mm (Ni/Cr 80/20)
- Diameter of the MgO core:	17 mm
Rectangular channel with rod bundle	
- Channel width:	118.5 + 0.05 mm
- Channel depth:	32.4 + 0.05 mm
- Corner radius:	RC = 5 mm
- Mean hydraulic diameter of the bundle:	DH = 12.21 mm (= 4 x FB/U)
- Free flow section in the bundle:	FB = 1854.44 mm
- Wall thickness of the rectangular channel:	6 mm
- Pitch to diameter ratio of the rod:	P/D = 1.147
- Wall distance to diameter ratio:	W/D = 1.147

- Length of the rectangular channel upstream of the bundle: LC = 2064 mm
- Non-heated rod length: LK = 1288 mm (= 105 x DH)
- Heated rod length:

ME1 (MP1):	LH =	185 mm (= 15 x DH)
ME2 (MP2):	LH =	735 mm (= 60 x DH)
ME3 (MP3):	LH =	1285 mm (= 105 x DH)
ME4 (MP4):	LH =	1835 mm (= 150 x DH)
ME5 (MP5):	LH =	2385 mm (= 195 x DH)
ME6 (MP6):	LH =	2456 mm (= 201 x DH)

TABLE 2 Linear equations used for correction of probe thermocouple signals

TEGENA 1					
Probe S1	A	B	Probe S2	A	B
TE 11	-0.01723	+ 3.381	TE 21	-0.01114	+ 3.544
TE 12	-0.01589	+ 3.340	TE 22	-0.01373	+ 3.895
TE 13	-0.01755	+ 3.509	TE 23	-0.01294	+ 3.778
TE 14	-0.01833	+ 3.635	TE 24	-0.01533	+ 4.054
TEN	+ 0.00894	-1.046			
TAS	+ 0.00237	+ 3.268			

TEGENA 2					
Probe P1	A	B	Probe P2	A	B
TC 11	-0.00266	+ 1.19990	TC 21	+ 0.00866	-0.18800
TC 12	-0.00631	+ 1.43781	TC 22	+ 0.00754	+ 0.12422
TC 13	-0.00211	+ 0.31780	TC 23	+ 0.00859	-0.08488
TC 14	-0.00305	+ 1.01600	TC 24	+ 0.00711	-0.08183
TC 15	-0.00243	+ 1.02437	TC 25	-0.00405	+ 0.92145

Linear equation: $Y = A \cdot X + B$

TABLE 3 Wall temperatures at different Re-numbers, TEGENA 1, main parameters

CODE	HEATED + + + + 1 2 3 4	FIG.	TEN (C)	DT (K)	RE	PE	UB (m/s)	NB (kW)	QH (W/cm2)
W 03 A 120	+ + + +	20	257	97	23800	139	0.76	159	20
W 03 A 130	+ + + +		266	95	37600	217	1.18	241	31
W 03 A 140	+ + + +		267	93	48900	282	1.53	308	39
W 03 A 150	+ + + +		271	95	62200	356	1.93	394	50
W 03 A 160	+ + + +		270	93	76100	437	2.37	475	60
W 05 A 075 (EXP.1)	+ + + +	21	255	72	30700	184	1.00	159	20
			260	71	46800	279	1.52	236	30
			264	72	63100	374	2.03	316	40
			264	71	79700	472	2.57	394	50
W 05 B 075 (EXP.2)	+ + + +	22	252	72	30400	184	1.00	157	20
			262	71	47600	283	1.54	239	30
			265	71	63900	377	2.05	316	40
			268	72	80200	471	2.56	398	50

TABLE 4 Wall temperatures at different Re-numbers, TEGENA 2, main parameters

CODE	HEATED + + + + 1 2 3 4	FIG.	TBI (C)	DTC (K)	RE	PE	UB (m/s)	NB (kW)	QH (W/cm2)
M 336	+ + + +	24,25	312	97.1	68100	366	1.97	405	51.4
M 094	+ + + +	24,25	296	78.2	32400	181	0.98	164	20.8
M 080	+ + + +	24,25	293	81.8	16000	89	0.48	84	10.7
M 082	+ + + +		288	88.3	8100	45	0.24	46	5.8
M 085	+ + + +		280	117	3700	21	0.11	28	3.5

TABLE 5 Fluid temperature- and RMS-profiles, main parameters of retests (Figs. 42-45)

CODE	Re	Pe	UB[m/s]	QH [W/cm2]	TBI [C]	DTC [K]
M 063	33100	184	1.0	21.8	295	80.5
M 094	32400	181	0.98	20.8	295	78.1
M 408	32700	181	0.98	20.7	300	78.3

Y-coordinates of X-traverses:

Y 11 = Y 12 = 29.43 mm Y 21 = Y 22 = 3.13 mm
Y 14 = Y 13 = 31.48 mm Y 24 = Y 23 = 0.47 mm

TABLE 6 Wall temperatures with different heating
TEGENA 1/2, main parameters

TEGENA 1									
CODE	HEATED + + + + 1 2 3 4	FIG.	TEN (C)	DT (K)	RE	PE	UB (m/s)	NB (kW)	QH (W/cm2)
F 10 LWSA	+ - - +	46	298	6.8	60900	359	1.95	29	7.4
F 25 LWSA	+ - - -	47	298	7.0	60500	357	1.94	30	15.0
F 26 LWSA	+ - - -	48	298	14.1	30300	178	1.57	29	15.0
F 24 LWSA	+ - - -	49	296	13.8	15300	90	0.49	15	7.4

TEGENA 2									
CODE	HEATED + + + + 1 2 3 4	FIG.	TBI (C)	DTC (K)	Re	Pe	UB (m/s)	NB (kW)	QH (W/cm2)
M 094	+ + + +	50	296	78.2	32400		0.98		20.8
M 198	+ - + +	51	318	59.0	33500		0.99		21.0
M 190	+ - - +	52	334	40.7	33300		0.97		21.3
M 168	- + + -	53	334	41.8	33000		0.96		21.6

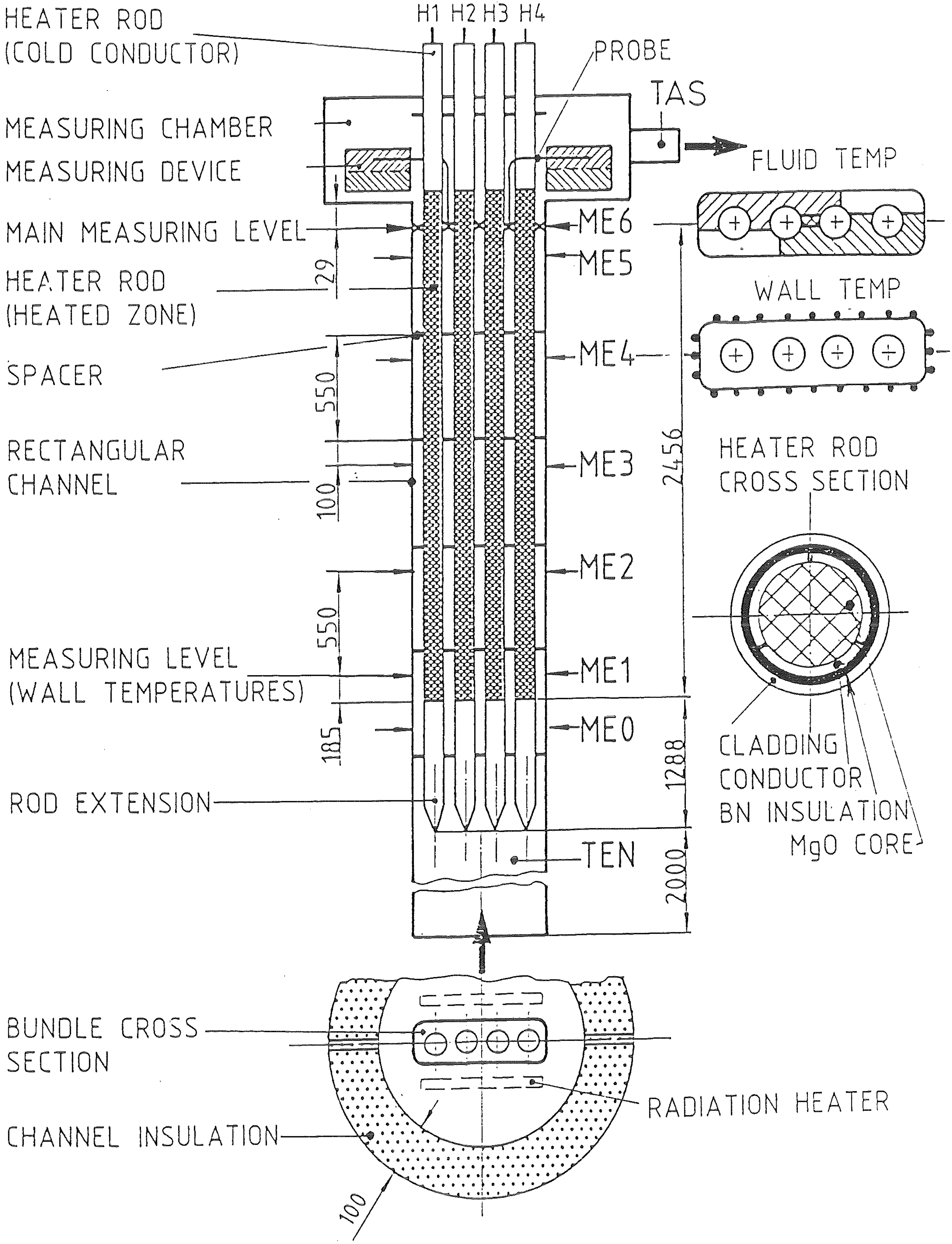
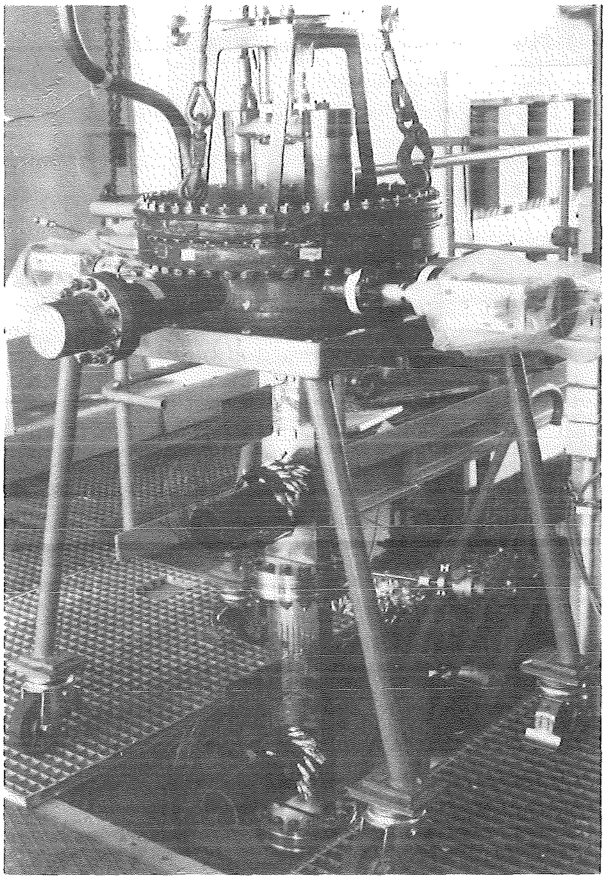
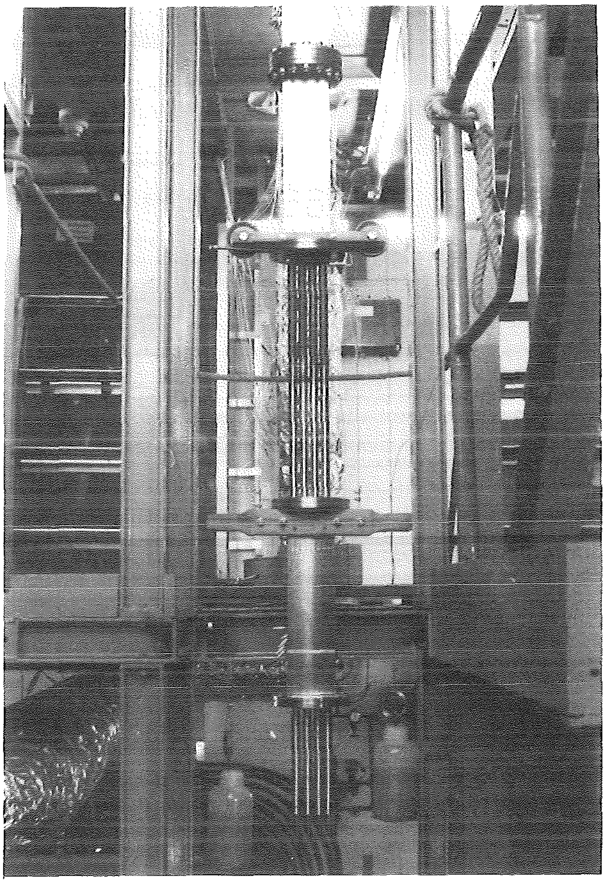


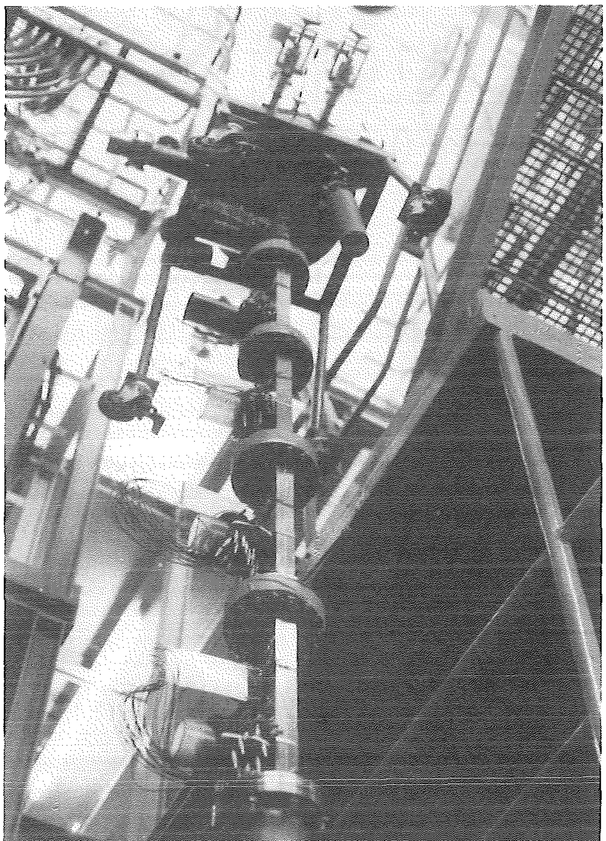
FIG. 1 TEGENA - TEST SECTION



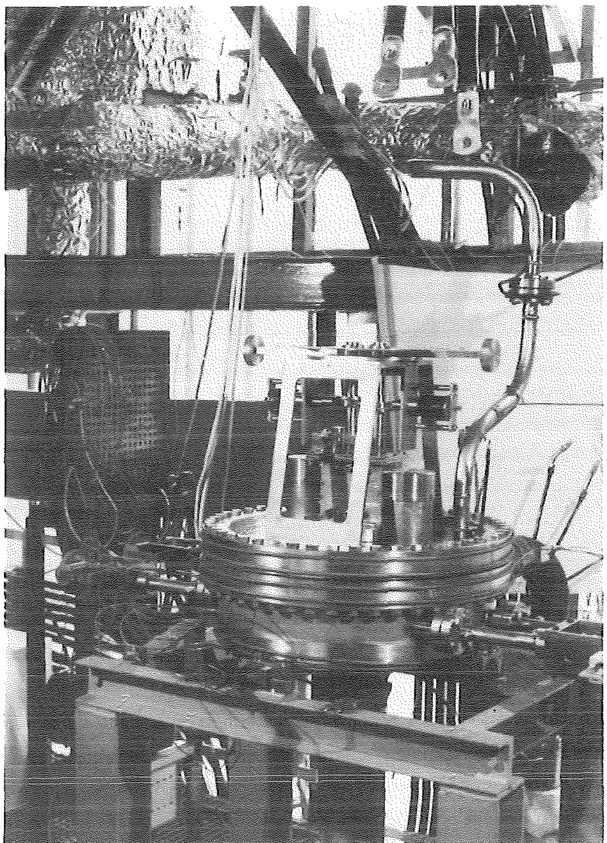
Upper end of the test section



Heater rods and channel segments

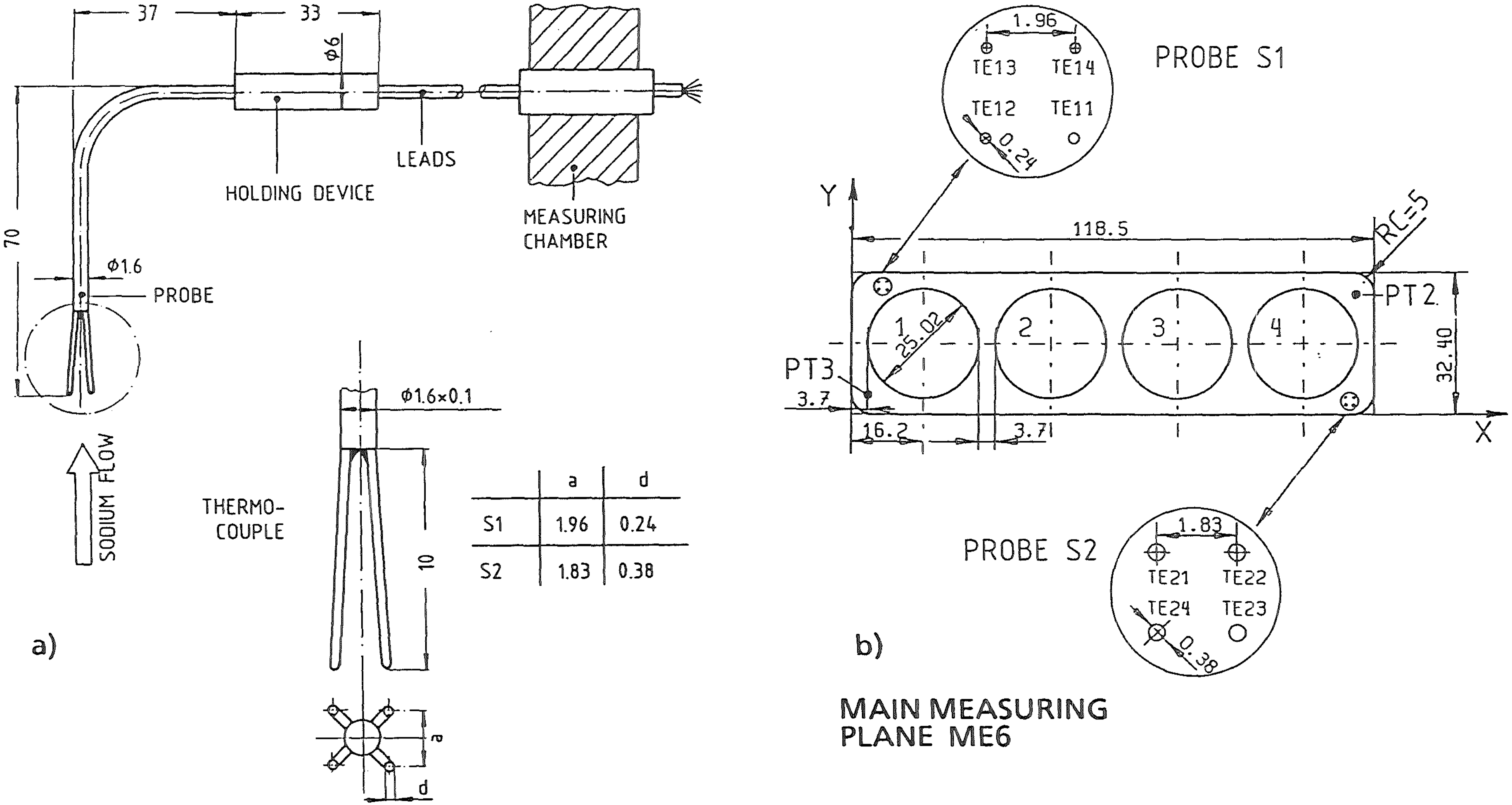


Rectangular channel



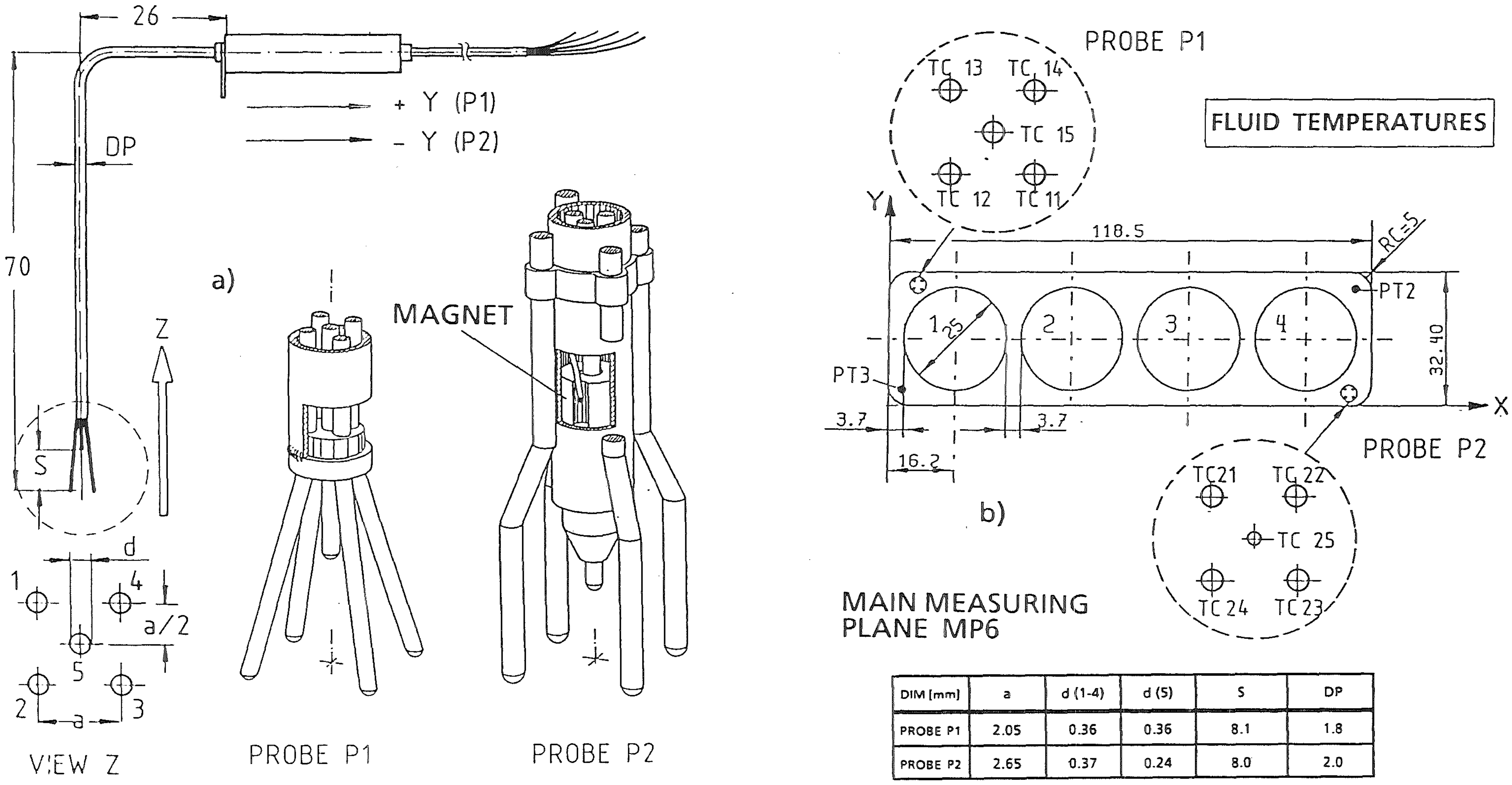
Measuring chamber

FIG. 2 PHOTOS OF THE TEGENA TEST SECTION



	a	d
S1	1.96	0.24
S2	1.83	0.38

FIG.3 TEGENA 1 , MEASURING PROBES AND MEASURING CROSS SECTION



DIM [mm]	a	d (1-4)	d (5)	S	DP
PROBE P1	2.05	0.36	0.36	8.1	1.8
PROBE P2	2.65	0.37	0.24	8.0	2.0

FIG.4 TEGENA 2 , MEASURING PROBES AND MEASURING CROSS SECTION

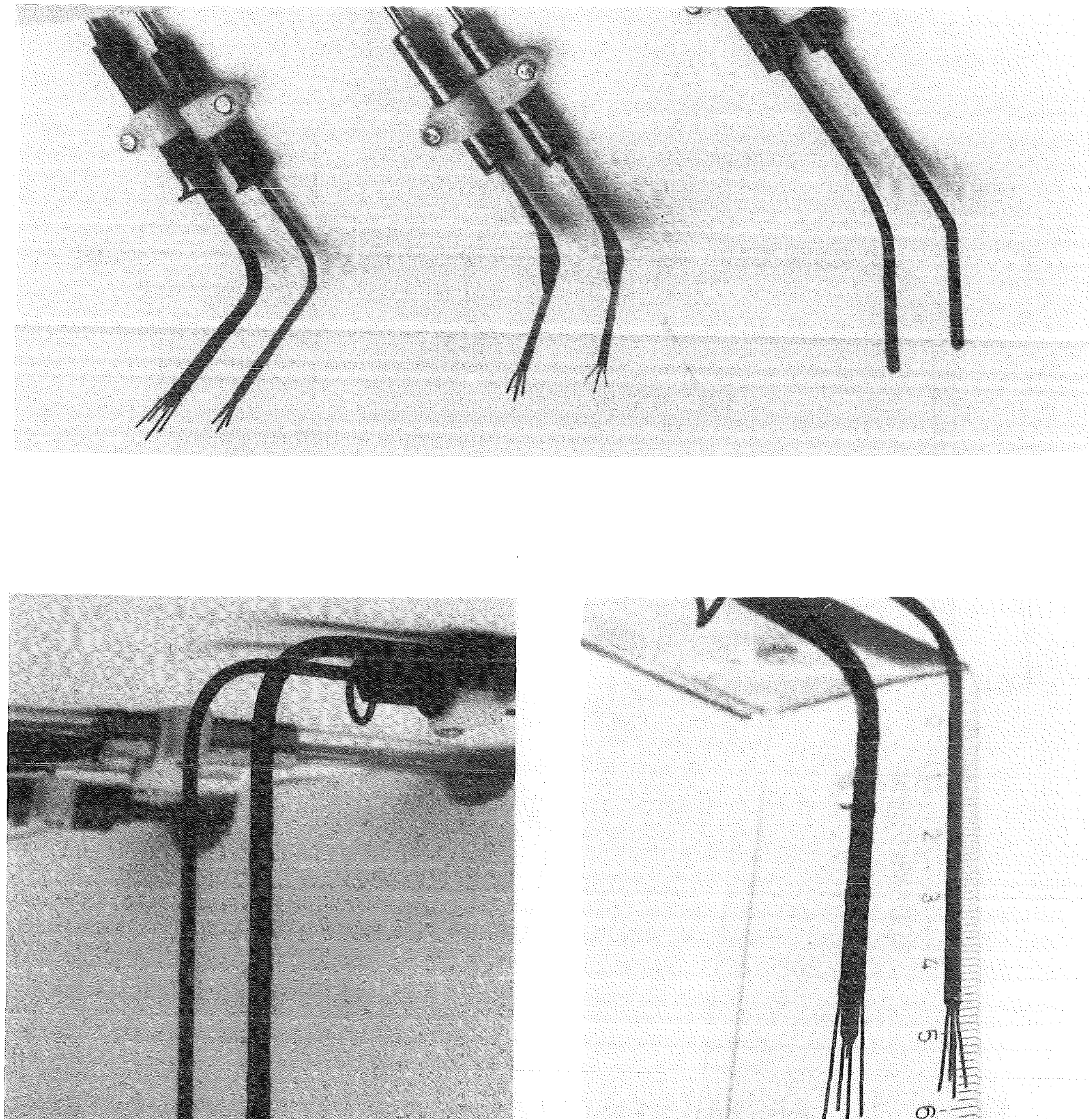


FIG. 5 PHOTOS OF THE MEASURING PROBES

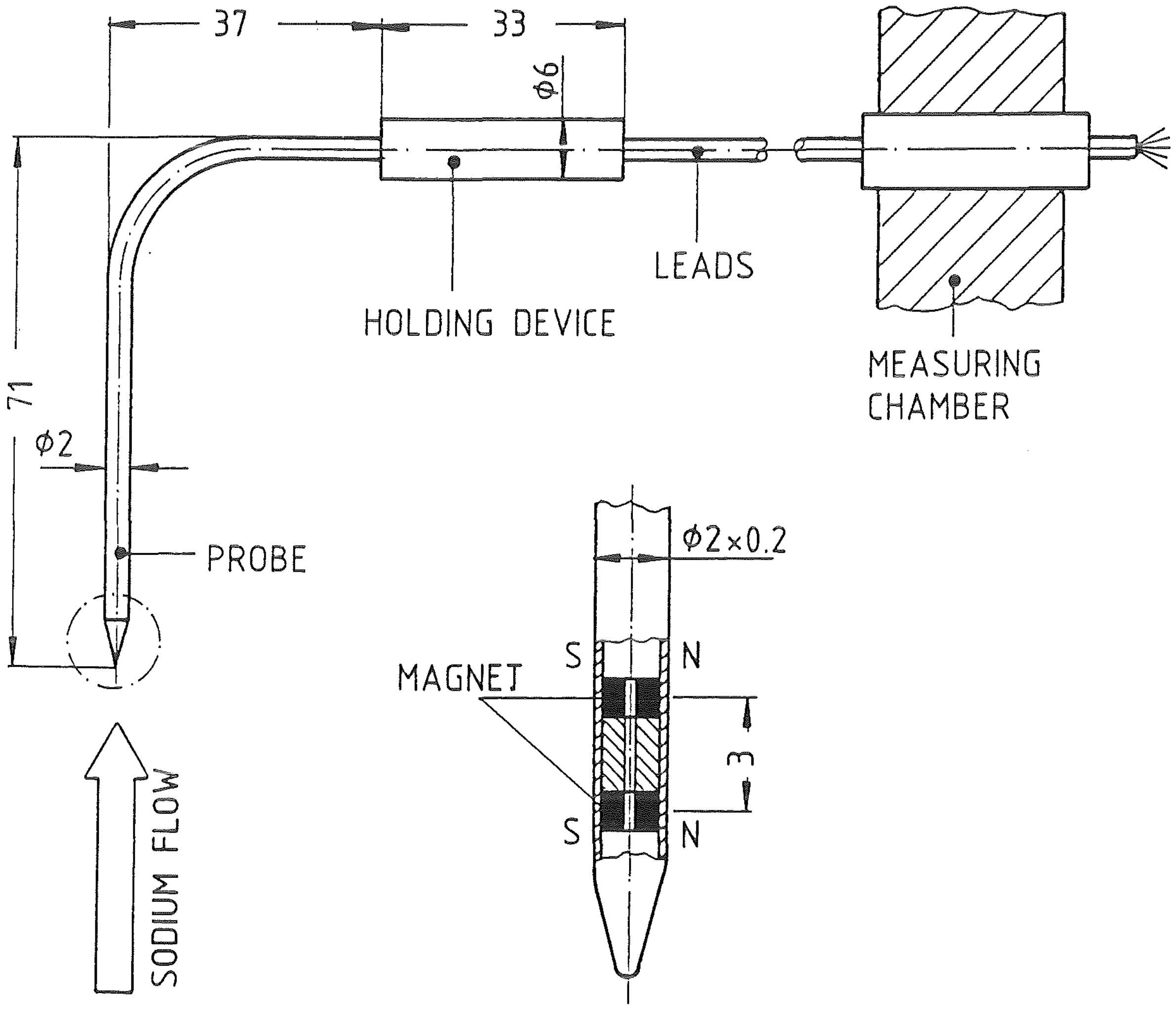
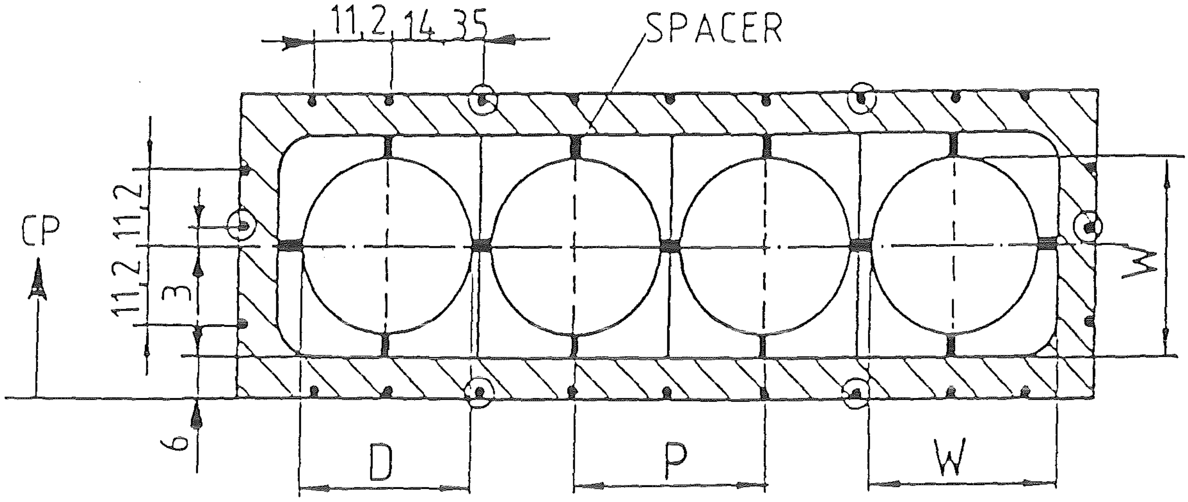


FIG.6 PERMANENT MAGNETIC VELOCITY PROBE



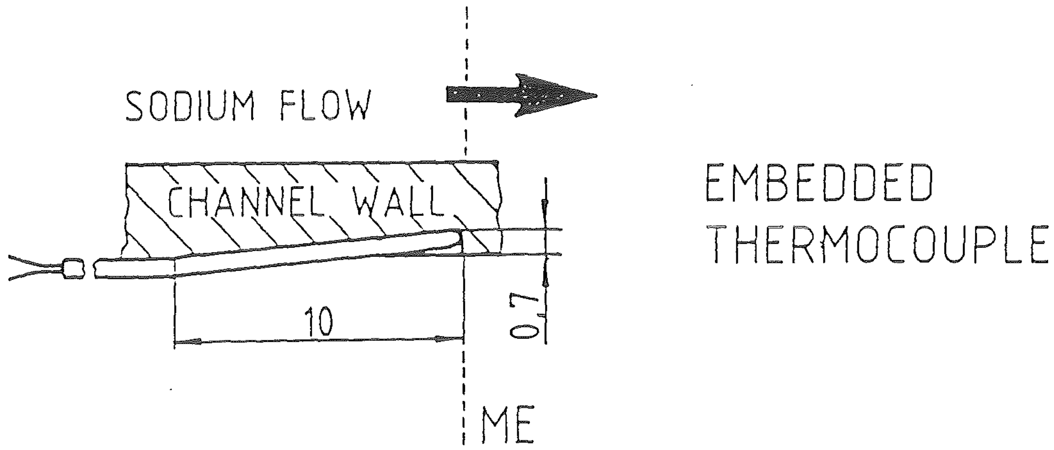


FIG.7 MEASURING CROSS SECTIONS FOR WALL TEMPERATURES

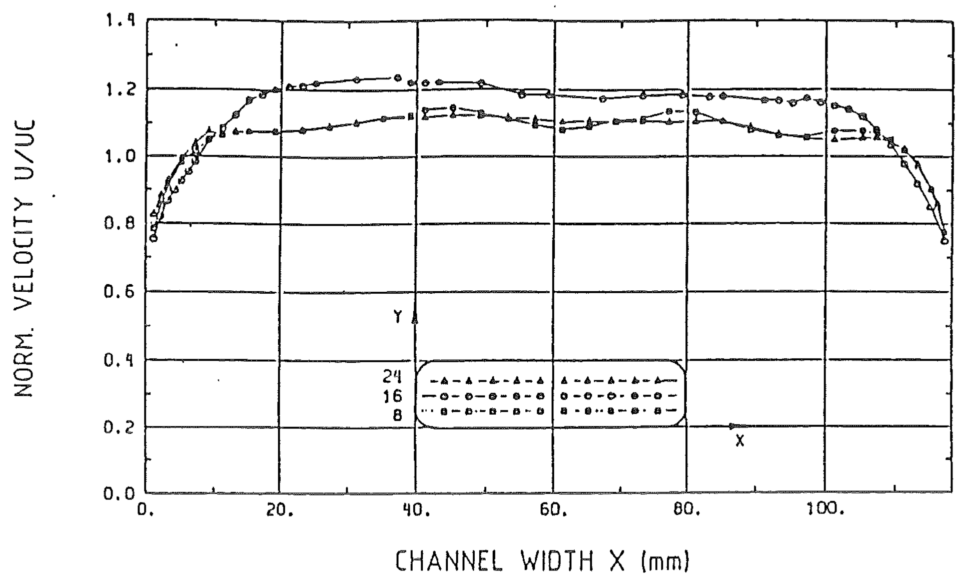


FIG. 8 PITOT PROBE MEASUREMENTS IN WATER FLOW OPEN CHANNEL, X-TRAVERSES, INLET POS. 1

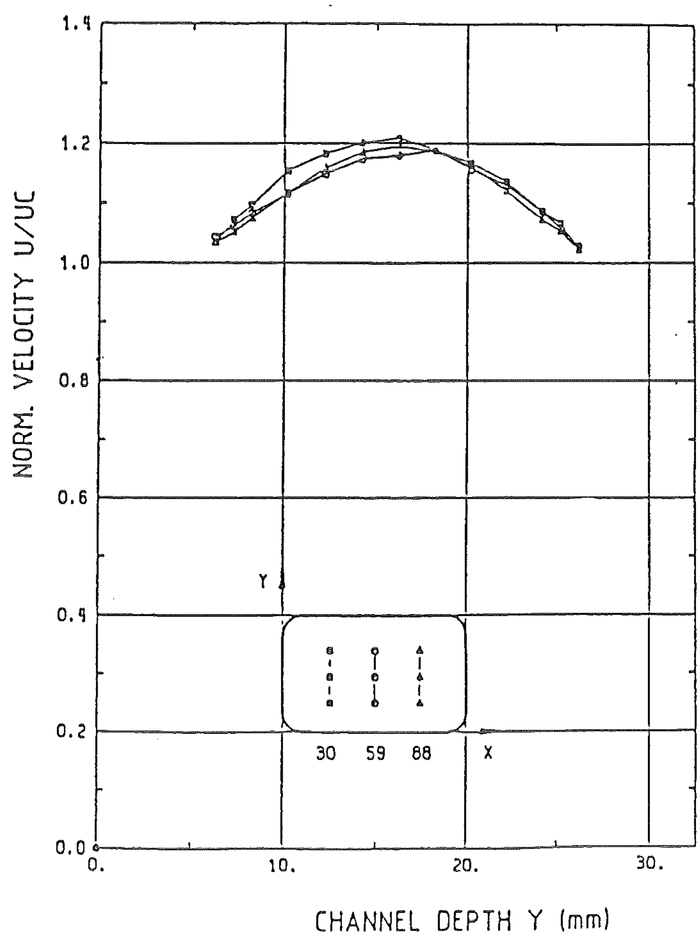


FIG. 9 PITOT PROBE MEASUREMENTS IN WATER FLOW, OPEN CHANNEL, Y-TRAVERSES

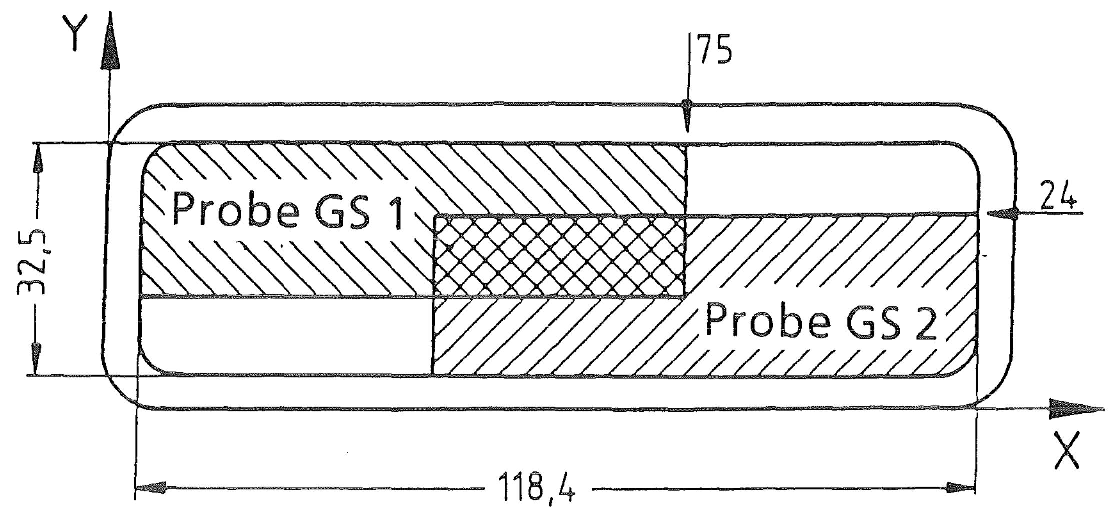


Abb.10 Measuring fields of the velocity probes

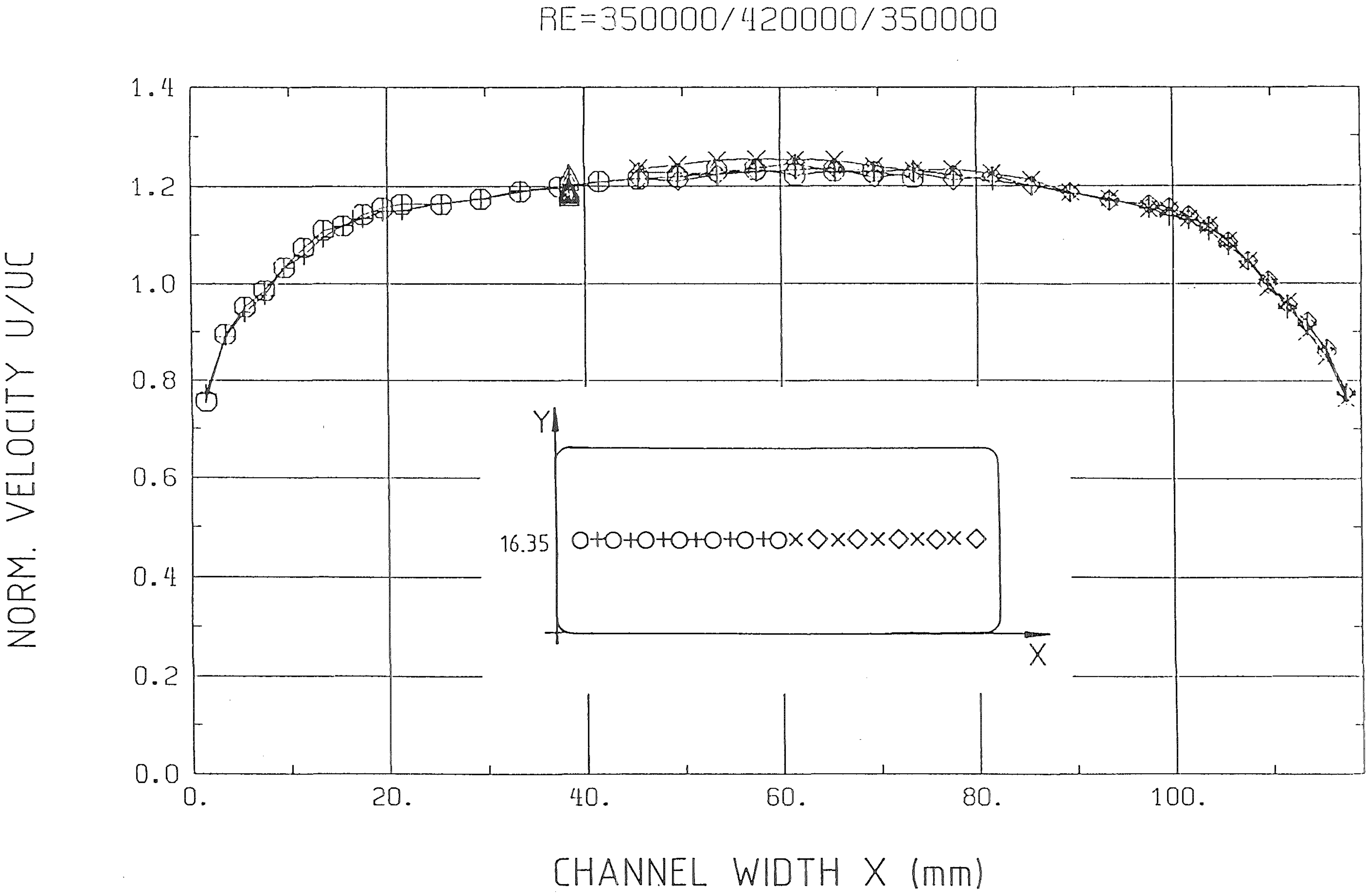


FIG. **11** SODIUM VELOCITY, OPEN CHANNEL, X-TRAVERSE

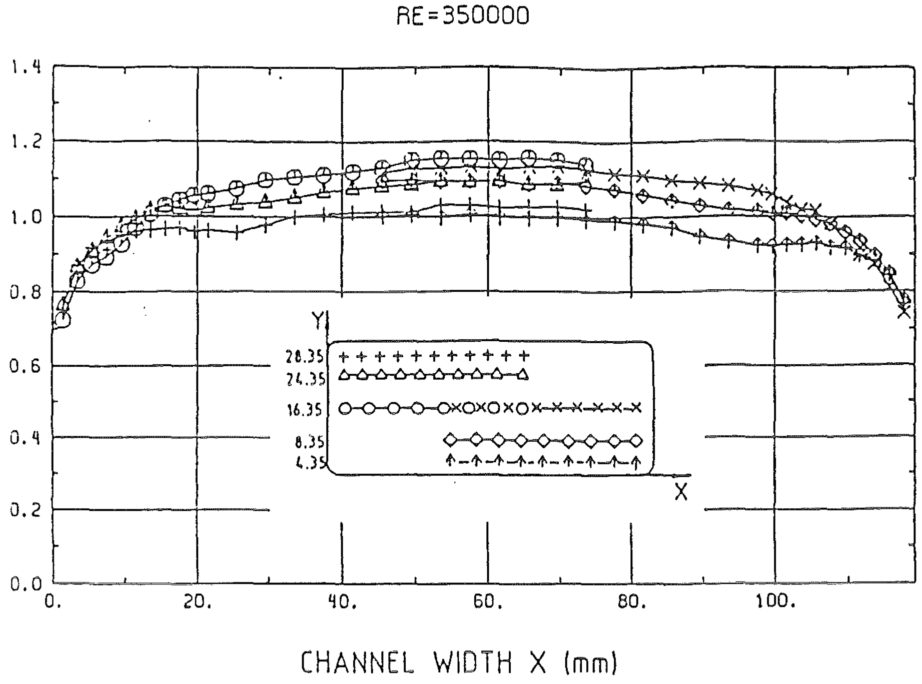


FIG. 12 SODIUM VELOCITY, OPEN CHANNEL, X-TRAVERSES

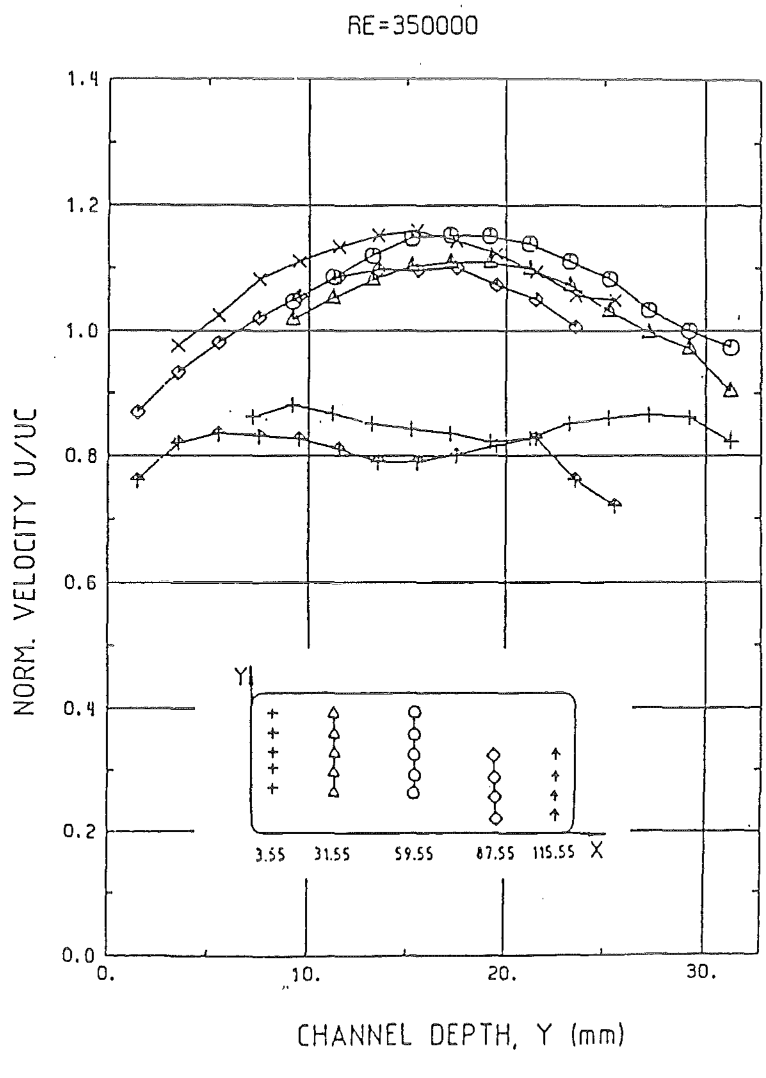
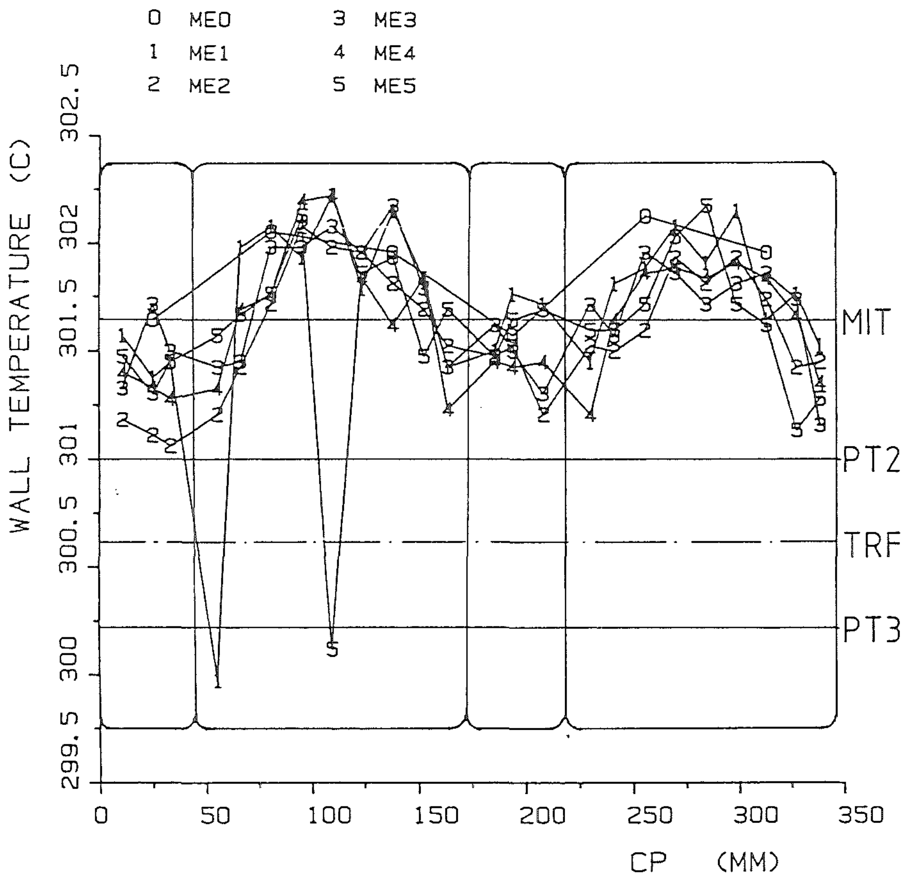
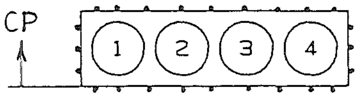


FIG. 13 SODIUM VELOCITY, Y-TRAVERSES



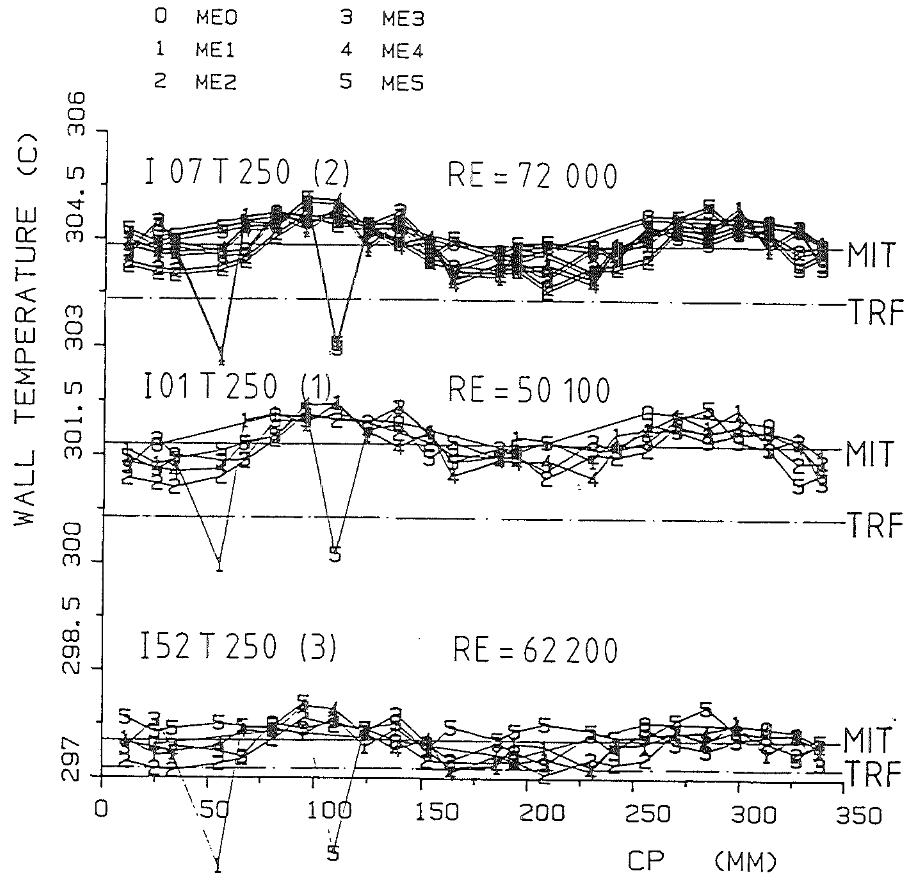
I01T250. DAT



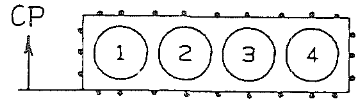
RE = 50100	QH1 = 0 (W/CM^2)	TEN = 302. 39(C)
PE = 294. 91	QH2 = 0 (W/CM^2)	TAS = 303. 7 (C)
MS = 2. 61 (KG/S)	QH3 = 0 (W/CM^2)	PT3 = 300. 2 DEG C
UB = 1. 6 (M/S)	QH4 = 0 (W/CM^2)	PT2 = 301 DEG C

FIG. 14 TEGENA 1 WALL TEMPERATURE

ISOTHERMAL EXP AT 300 (C)



I01T250. DAT



RE = 50100	QH1 = 0 (W/CM^2)	TEN = 302. 39(C)
PE = 294. 91	QH2 = 0 (W/CM^2)	TAS = 303. 7 (C)
MS = 2. 61 (KG/S)	QH3 = 0 (W/CM^2)	PT3 = 300. 2 DEG C
UB = 1. 6 (M/S)	QH4 = 0 (W/CM^2)	PT2 = 301 DEG C

FIG. 15 TEGENA 1 WALL TEMPERATURE

ISOTH EXP AT 300 (C) COMPAR

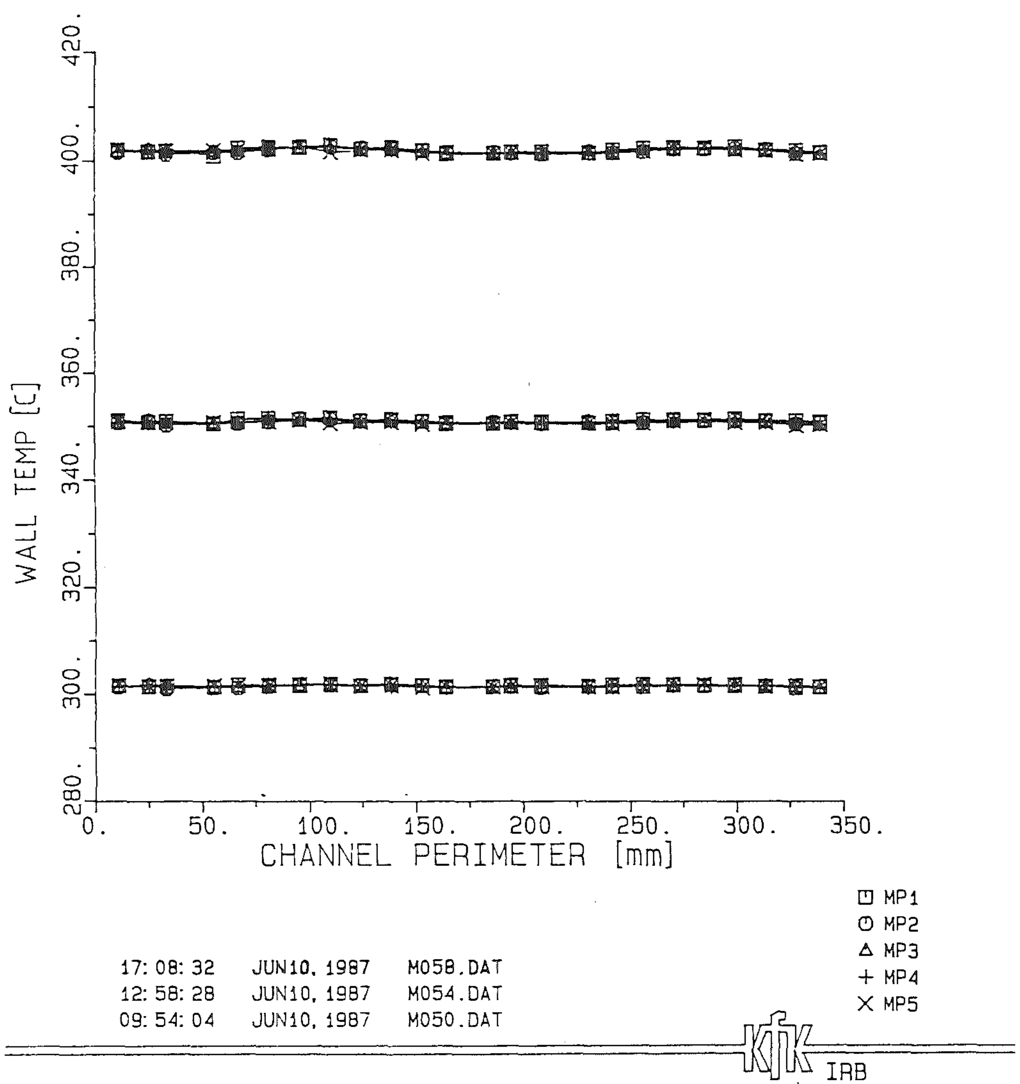


FIG. **16** TEGENA 2 - WALL TEMPERATURES

ISOTH EXP UB=0.5 m/s

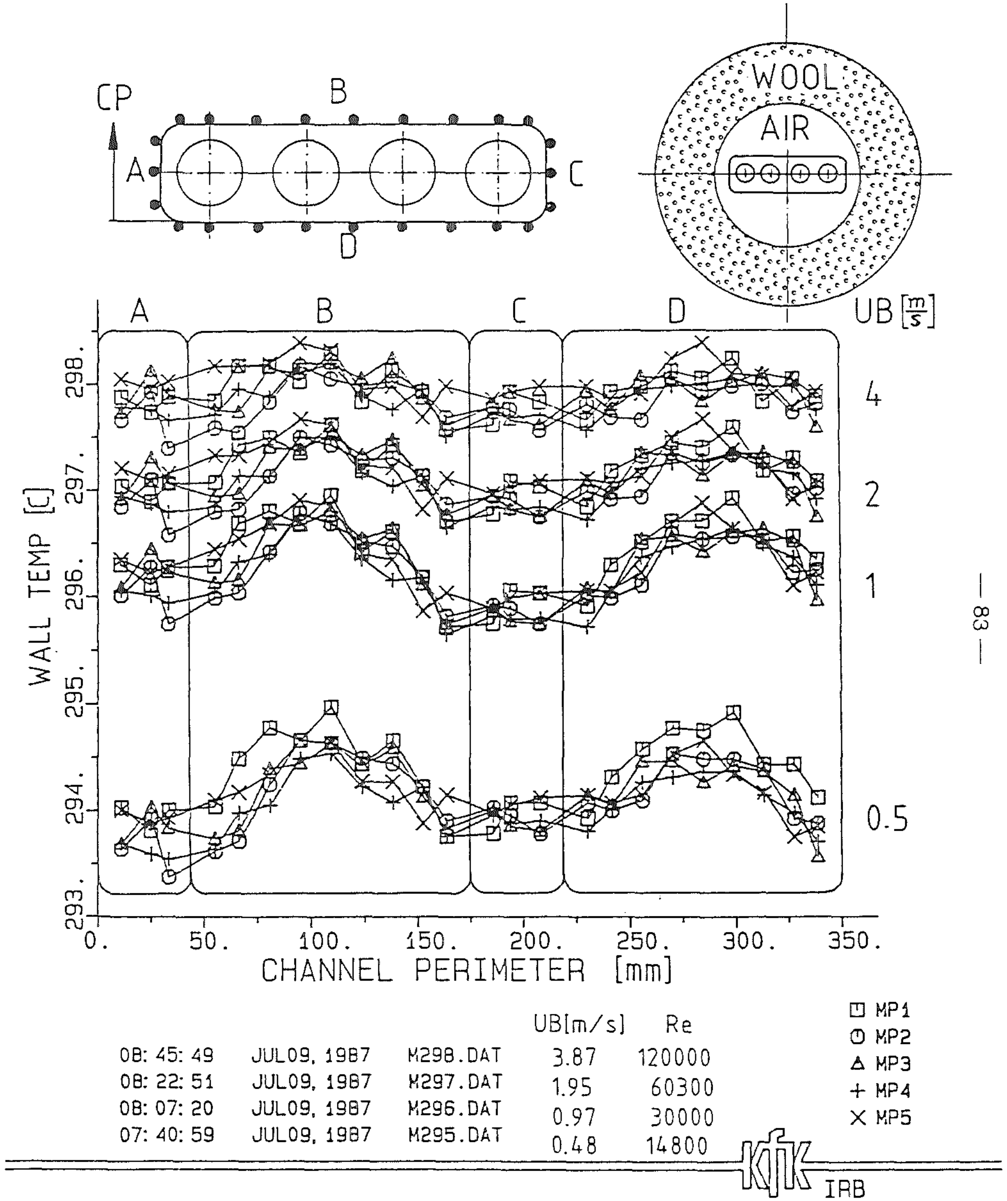


FIG. **17** TEGENA 2 - WALL TEMPERATURES

ISOTH EXP PAR: VELOCITY

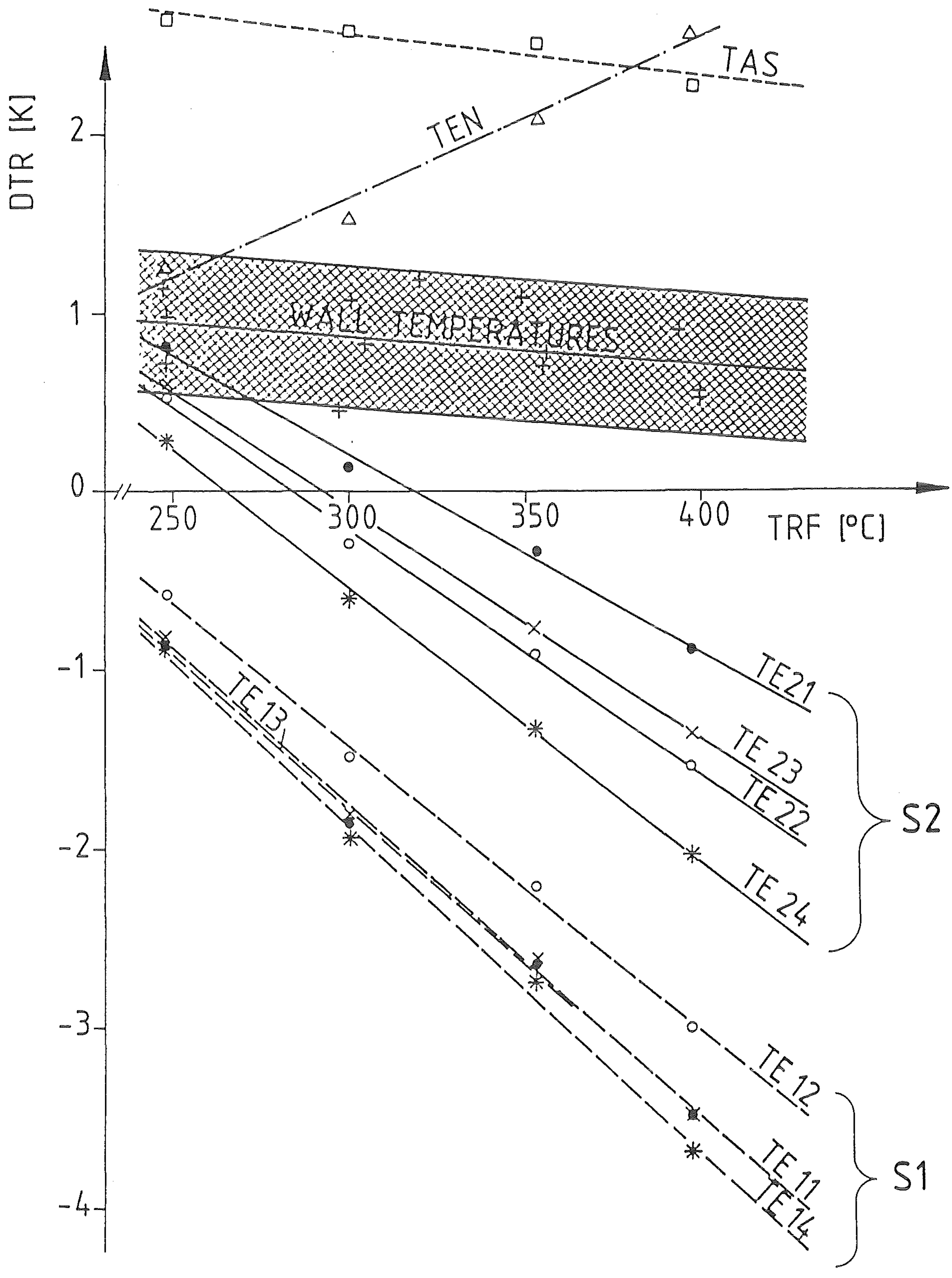
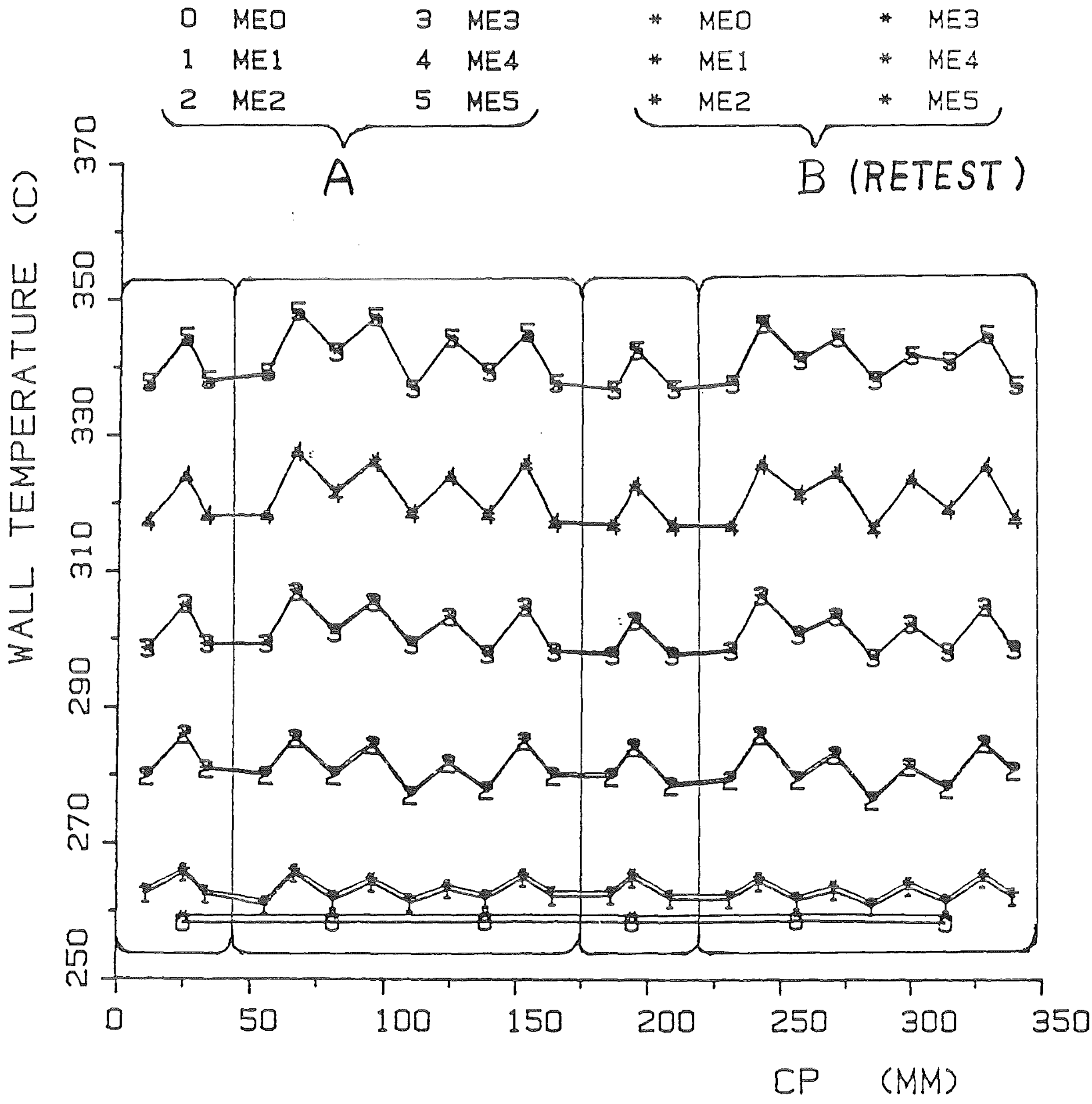
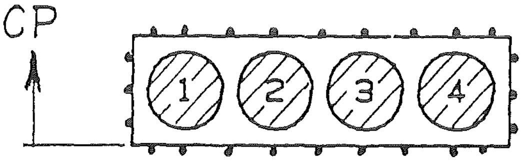


FIG. 18 TEGENA 1, ISOTHERMAL MEASUREMENTS, TC-DEVIATION VERSUS REFERENCE TEMPERATURE



F04Q12A.DAT
F04Q12B.DAT



RE = 60100

PE = 352.36

MS = 3.12 (KG/S)

UB = 1.91 (M/S)

QH1 = 50.35 (W/CM^2)

QH2 = 49.96 (W/CM^2)

QH3 = 49.36 (W/CM^2)

QH4 = 50.71 (W/CM^2)

NB = 395.5 (KW)

TEN = 256.67(C)

TAS = 353.11(C)

TNM = 304.26(C)

FIG. 19 TEGENA 1 WALL TEMPERATURE

A/B RE=60100/60200

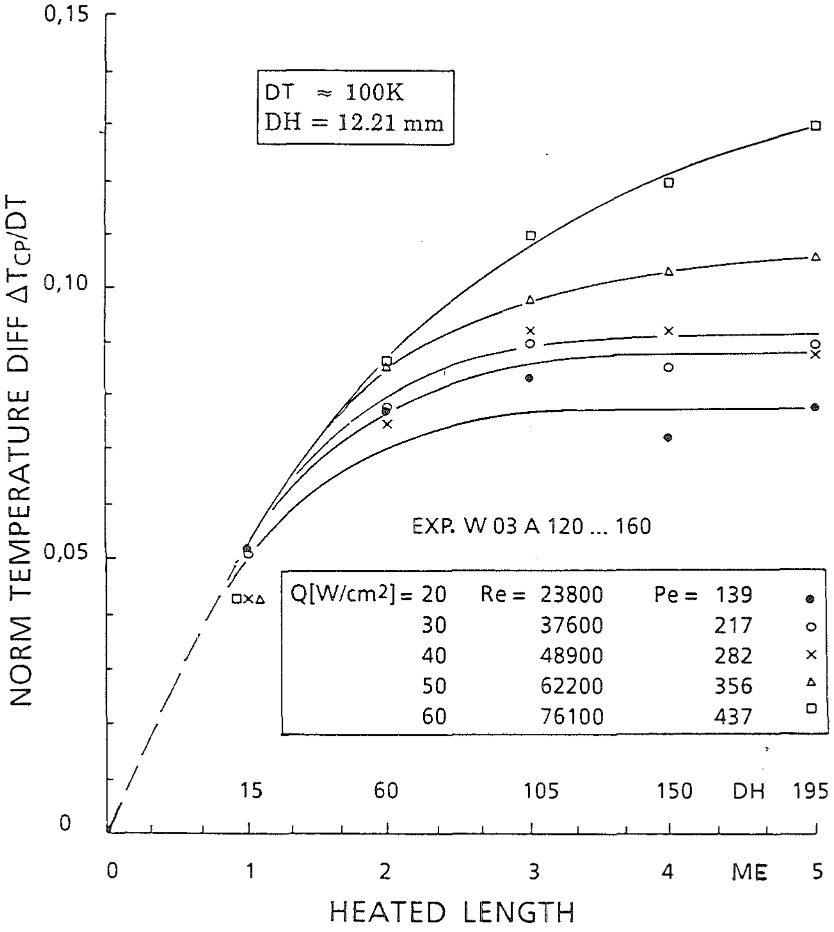


FIG. 20 DEVELOPEMENT OF THE TEMPERATURE FIELD

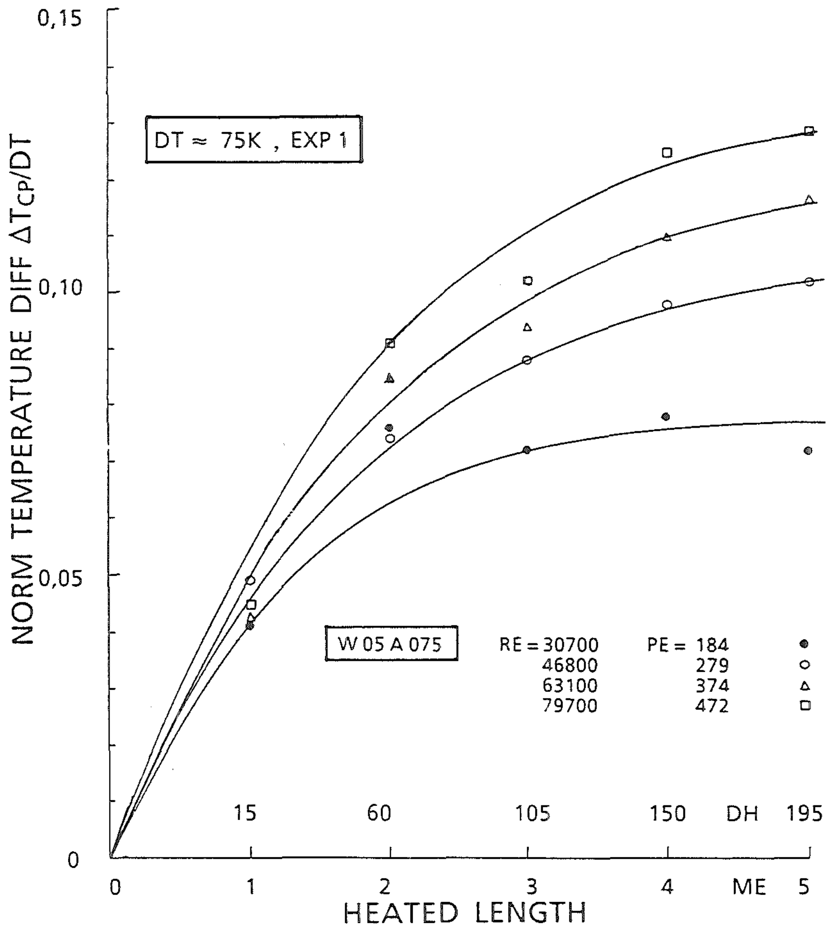


FIG. 21 DEVELOPEMENT OF THE TEMPERATURE FIELD

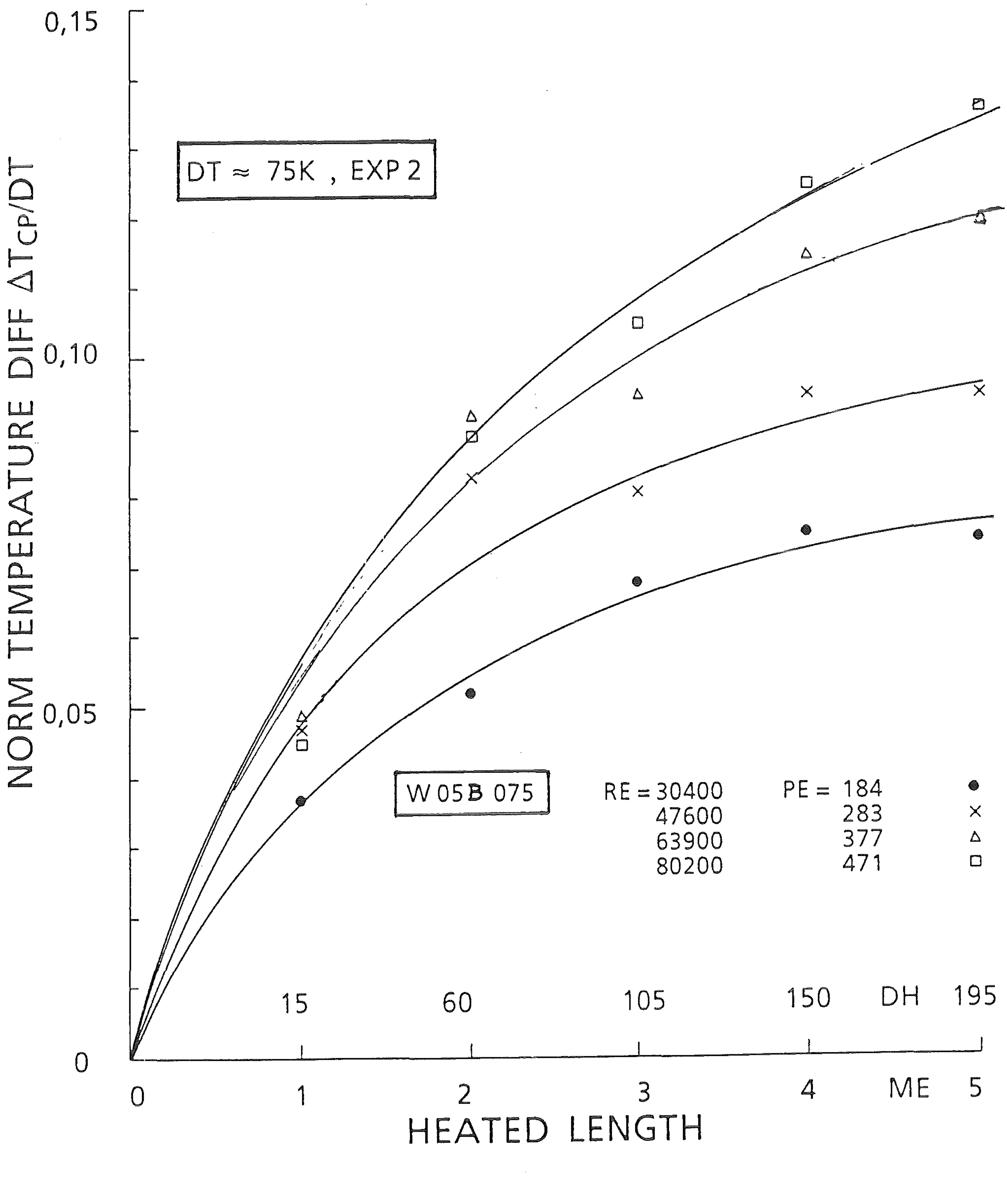
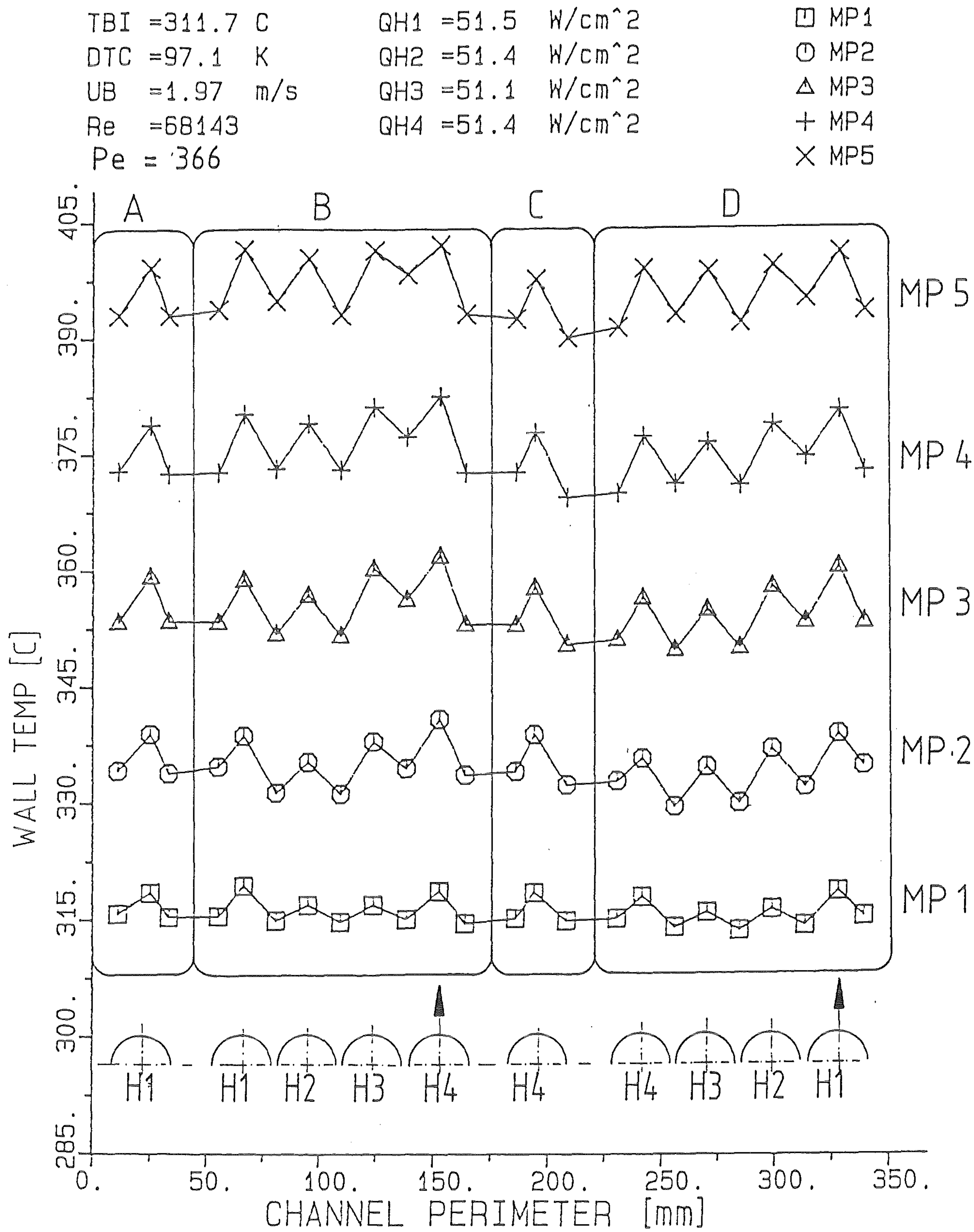


FIG. 22 DEVELOPEMENT OF THE TEMPERATURE FIELD



17: 25: 17 JUL 10, 1987 M336.DAT

KfK IRB

FIG. **23** TEGENA 2 - WALL TEMPERATURES

CHANNEL PERIMETER MP1/2/3/4/5

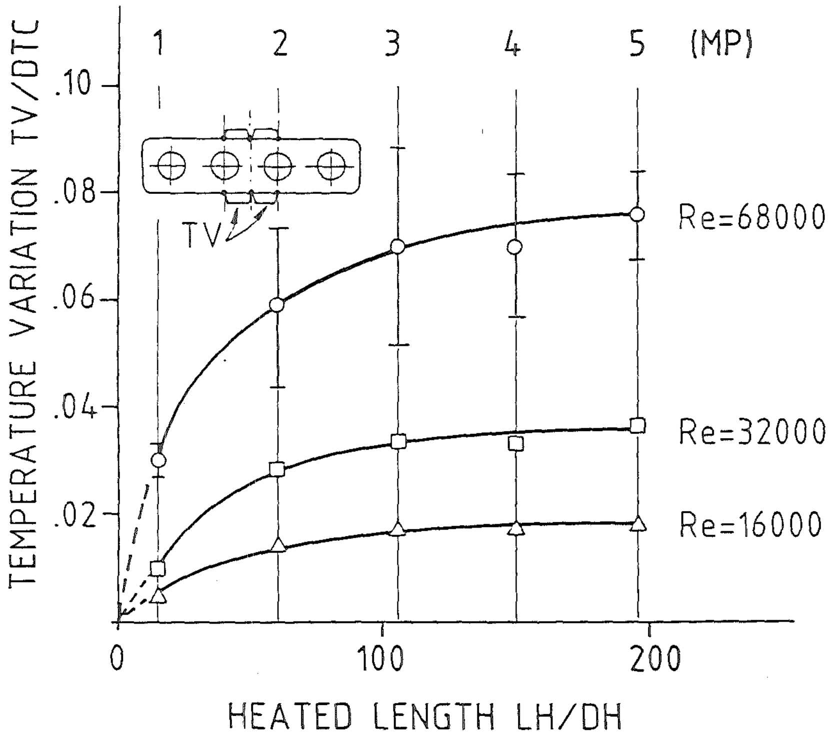


FIG: 24 THERMAL DEVELOPMENT OF THE FLOW
CENTRAL WALL REGION

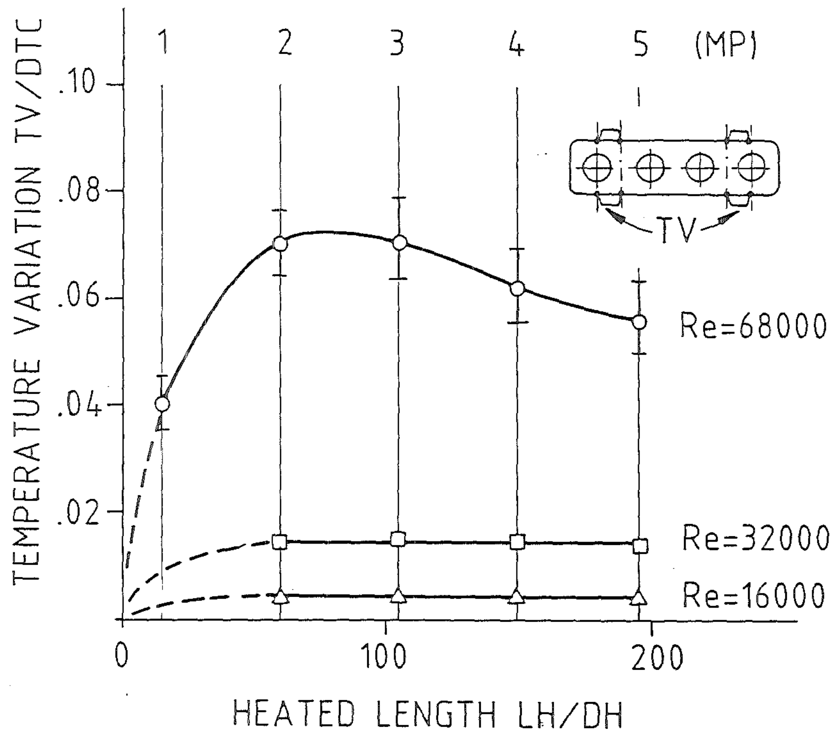


FIG: 25 THERMAL DEVELOPMENT OF THE FLOW
WALL/CORNER REGION

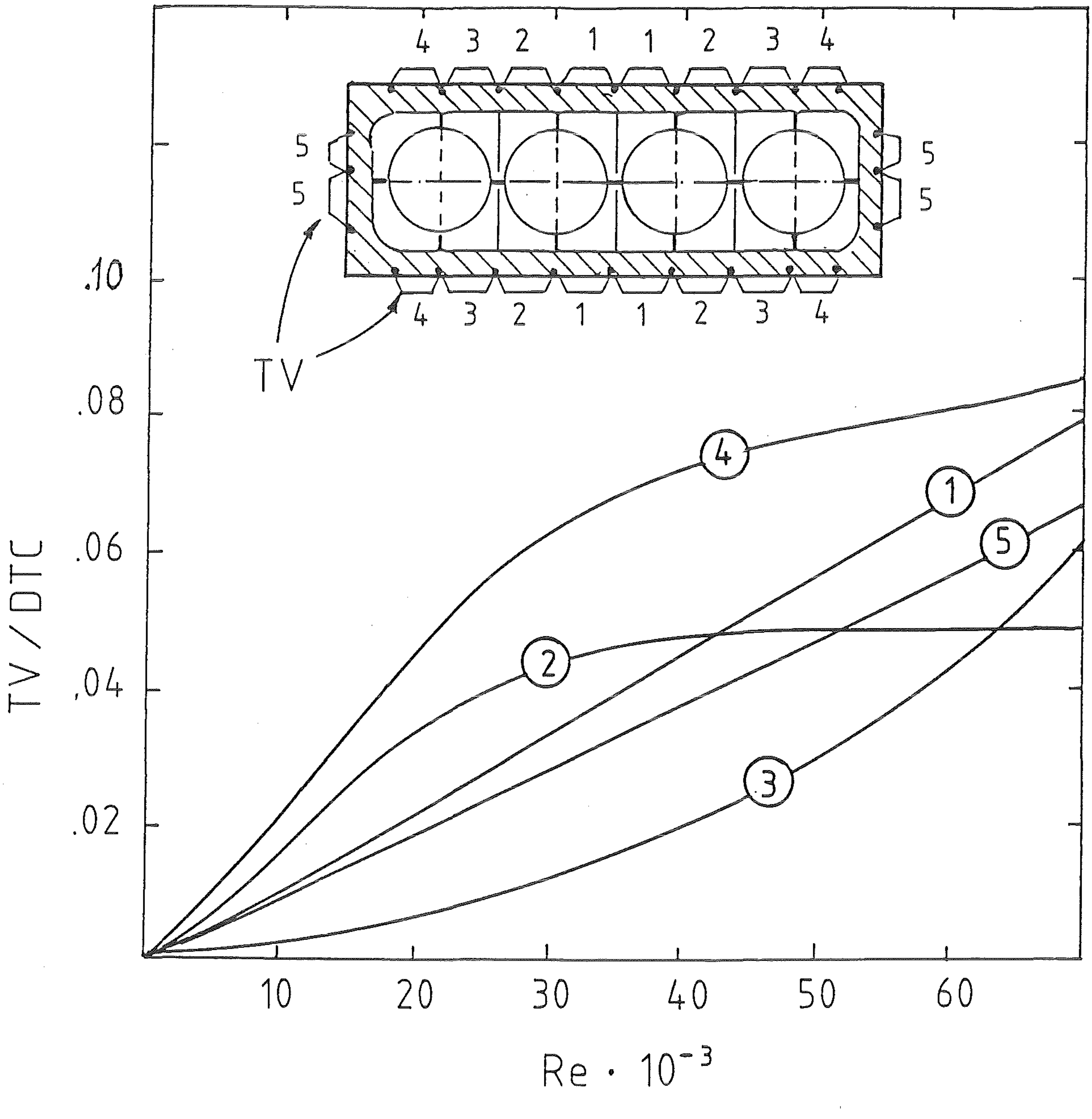
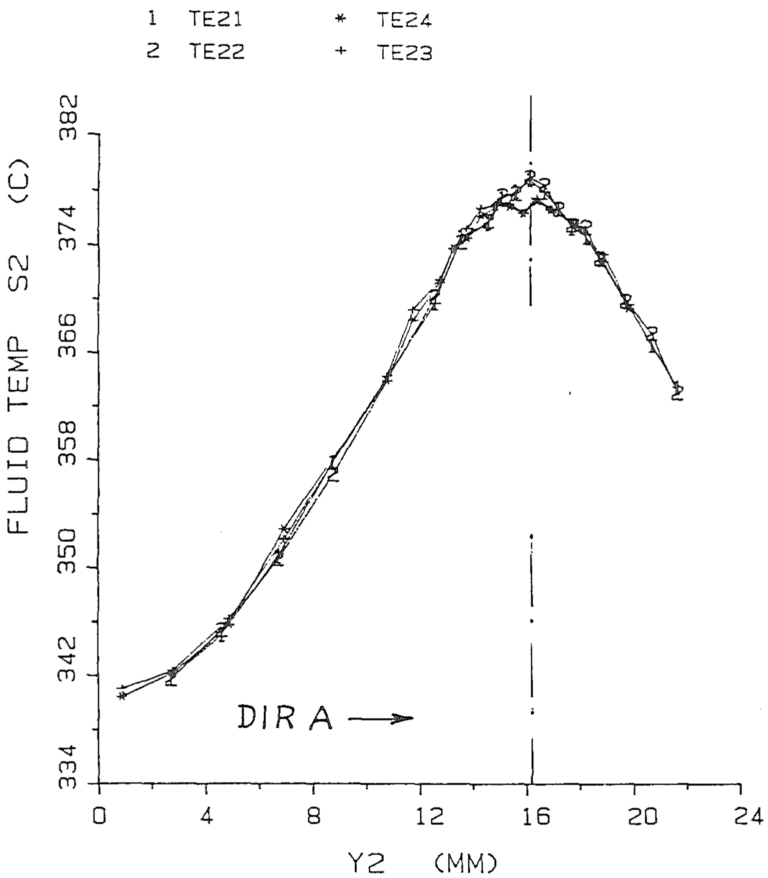
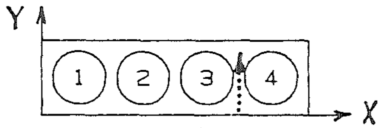


FIG. 26 NORMALIZED LOCAL TEMPERATURE DIFFERENCES VERSUS Re-NUMBER IN MEASURING PLANE MP 5



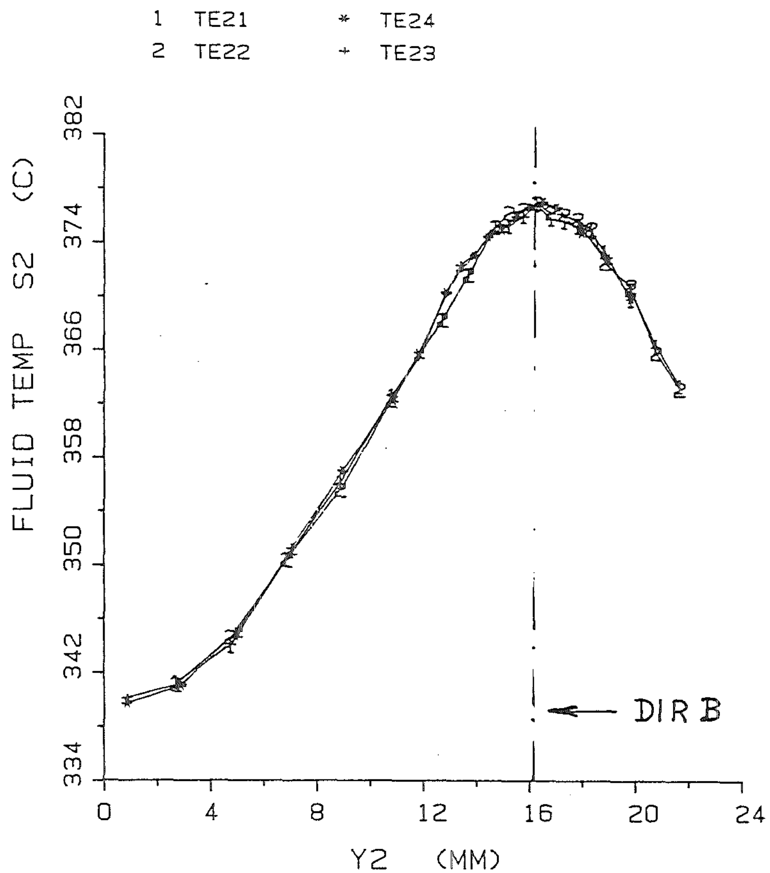
F04Q12A. DAT
F04Q12A. DAT



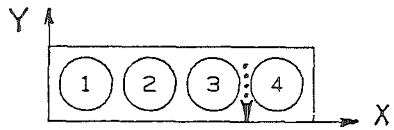
RE = 60400	QH1 = 50. 23 (W/CM^2)	NB = 394. 56(KW)
PE = 354. 08	QH2 = 49. 84 (W/CM^2)	TEN = 257. 63(C)
MS = 3. 13 (KG/S)	QH3 = 49. 24 (W/CM^2)	X21 = 86. 96 (MM)
UB = 1. 92 (M/S)	QH4 = 50. 59 (W/CM^2)	X22 = 88. 79 (MM)

FIG. 27 TEGENA 1 FLUID TEMPERATURE

DIR A PROBE 2



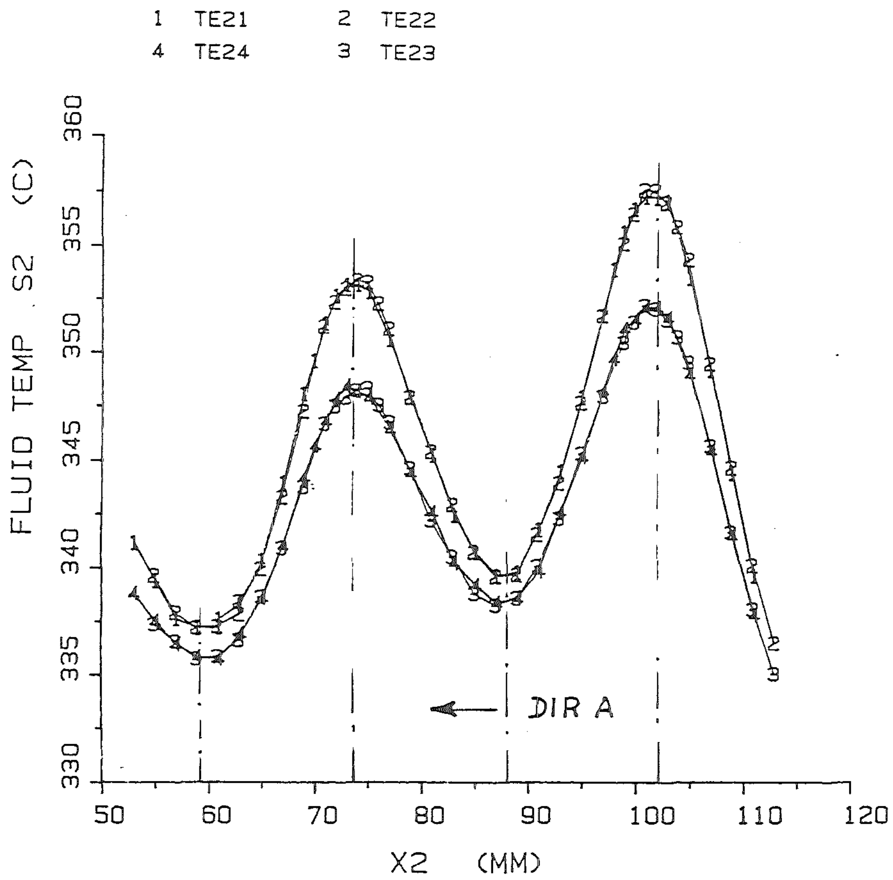
F04Q12B. DAT
F04Q12B. DAT



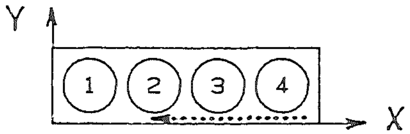
RE = 60100	QH1 = 49. 38 (W/CM^2)	NB = 387. 95(KW)
PE = 352. 52	QH2 = 49 (W/CM^2)	TEN = 257. 98(C)
MS = 3. 12 (KG/S)	QH3 = 48. 42 (W/CM^2)	X21 = 86. 97 (MM)
UB = 1. 91 (M/S)	QH4 = 49. 74 (W/CM^2)	X22 = 88. 8 (MM)

FIG. 28 TEGENA 1 FLUID TEMPERATURE

DIR B PROBE 2



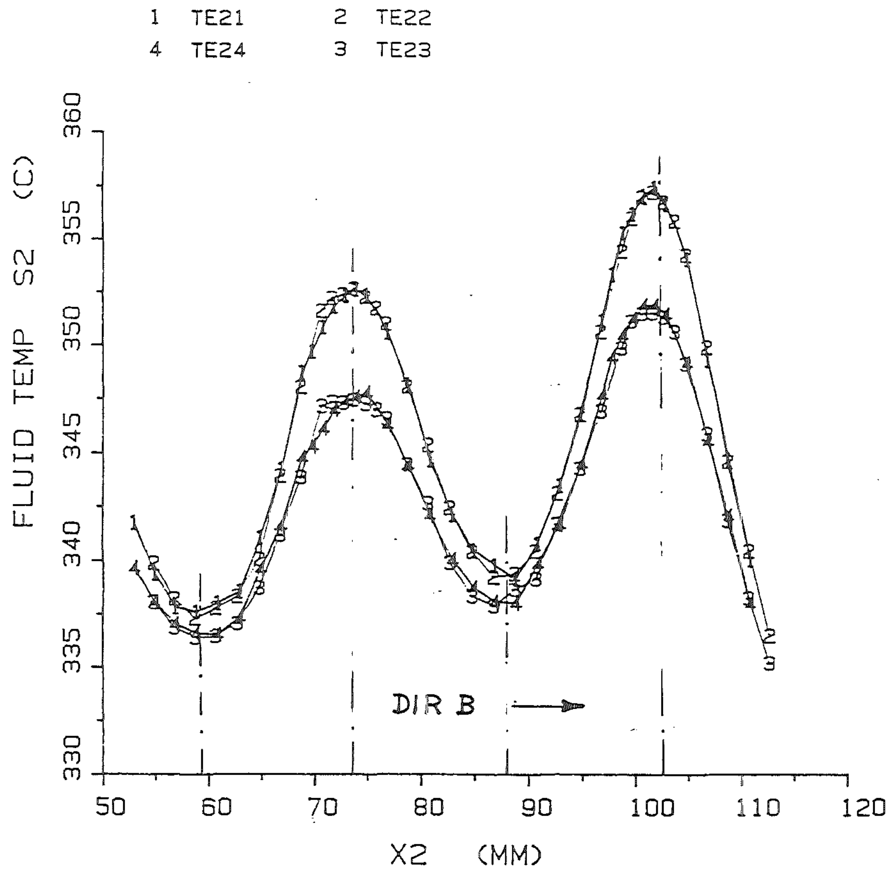
FO6LWSA.DAT
FO6LWSA.DAT



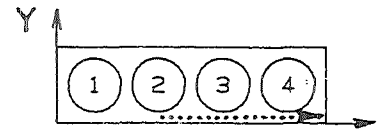
RE = 61300	QH1 = 51.01 (W/CM^2)	NB = 400.67(KW)
PE = 360.31	QH2 = 50.59 (W/CM^2)	TEN = 256.55(C)
MS = 3.19 (KG/S)	QH3 = 50.02 (W/CM^2)	Y21 = 2.68 (MM)
UB = 1.96 (M/S)	QH4 = 51.37 (W/CM^2)	Y24 = .85 (MM)

FIG. 29 TEGENA 1 FLUID TEMPERATURE

DIR A PROBE S2



FO6LWSB.DAT
FO6LWSB.DAT

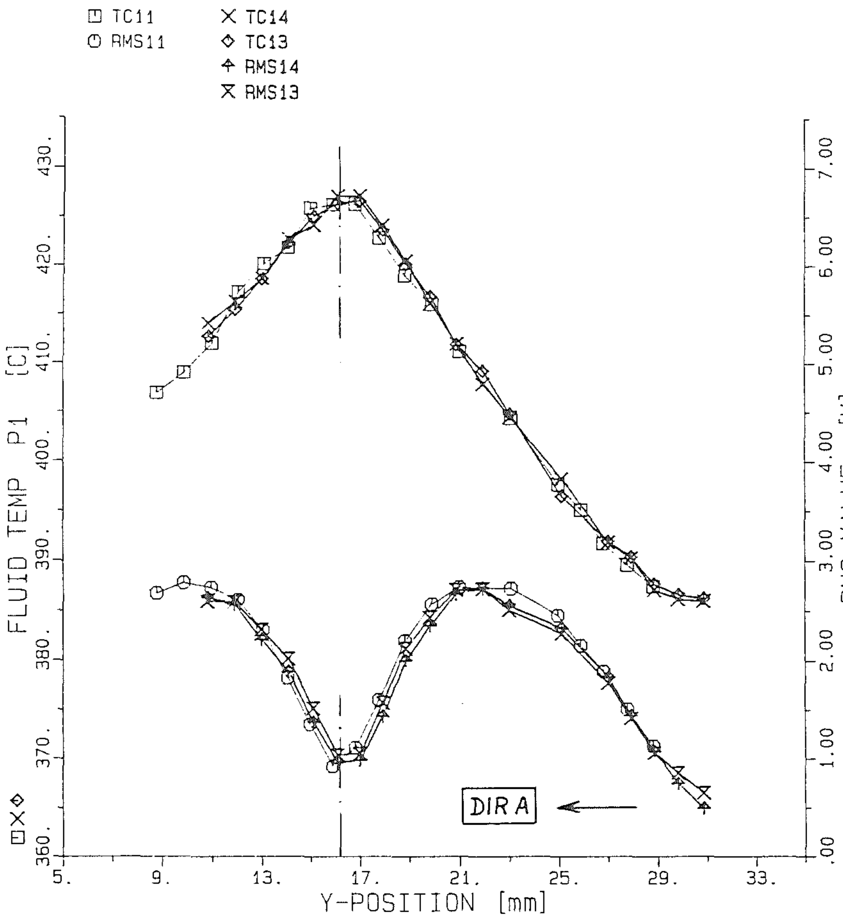


RE = 61000	QH1 = 50.48 (W/CM^2)	NB = 396.5 (KW)
PE = 358.29	QH2 = 50.06 (W/CM^2)	TEN = 256.41(C)
MS = 3.17 (KG/S)	QH3 = 49.49 (W/CM^2)	Y21 = 2.68 (MM)
UB = 1.95 (M/S)	QH4 = 50.84 (W/CM^2)	Y24 = .85 (MM)

FIG. 30 TEGENA 1 FLUID TEMPERATURE

DIR B PROBE S2

X11 =31.66 mm QH1 =50.82 W/cm^2 NB =399.1 kW Re =66569
X12 =29.61 mm QH2 =50.68 W/cm^2 MFR =3.13 kg/s Pe =361.0
TBI =304.7 C QH3 =50.37 W/cm^2 DTC =96.6 K
TBO =401.3 C QH4 =50.70 W/cm^2 UB =1.94 m/s

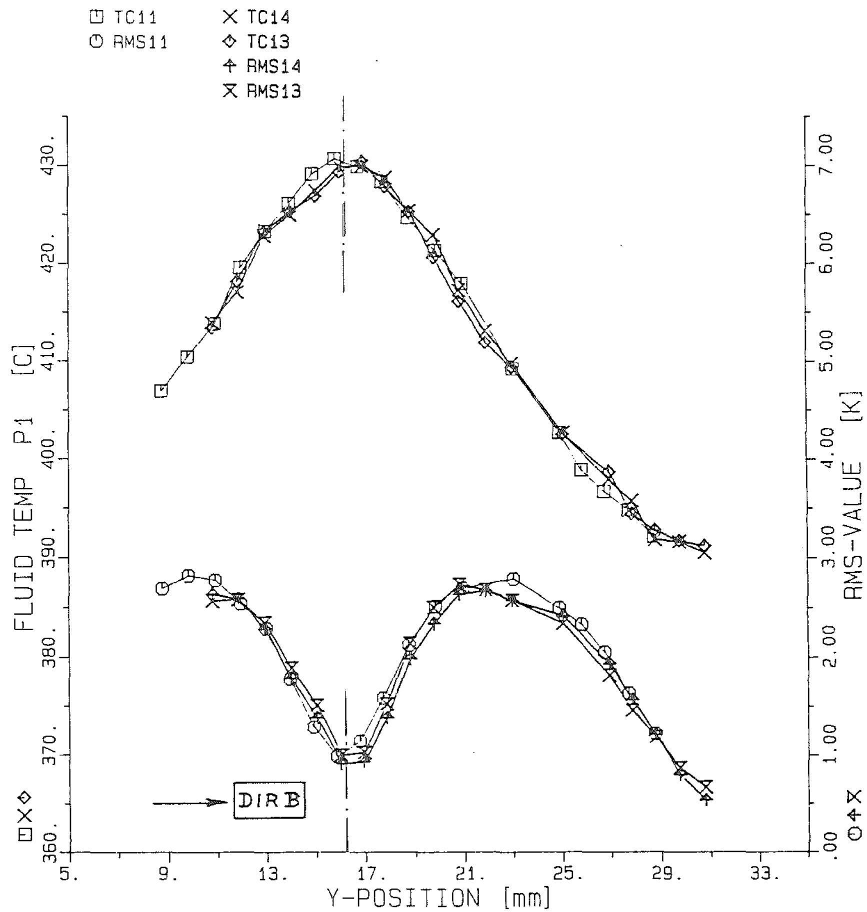


15: 19: 25 JUL10, 1987 M332.DAT
15: 19: 25 JUL10, 1987 M332.DAT

KfK IRB

FIG. 31 TEGENA 2 - FLUID TEMPERATURES
PROBE 1 TEMP FLUCTUATIONS

X11 =31.66 mm QH1 =51.04 W/cm^2 NB =400.7 kW Re =67344
X12 =29.61 mm QH2 =50.87 W/cm^2 MFR =3.15 kg/s Pe =363.7
TBI =307.8 C QH3 =50.57 W/cm^2 DTC =96.5 K
TBO =404.3 C QH4 =50.89 W/cm^2 UB =1.96 m/s



16: 02: 22 JUL10, 1987 M334.DAT
16: 02: 22 JUL10, 1987 M334.DAT

KfK IRB

FIG. 32 TEGENA 2 - FLUID TEMPERATURES
PROBE 1 TEMP FLUCTUATIONS

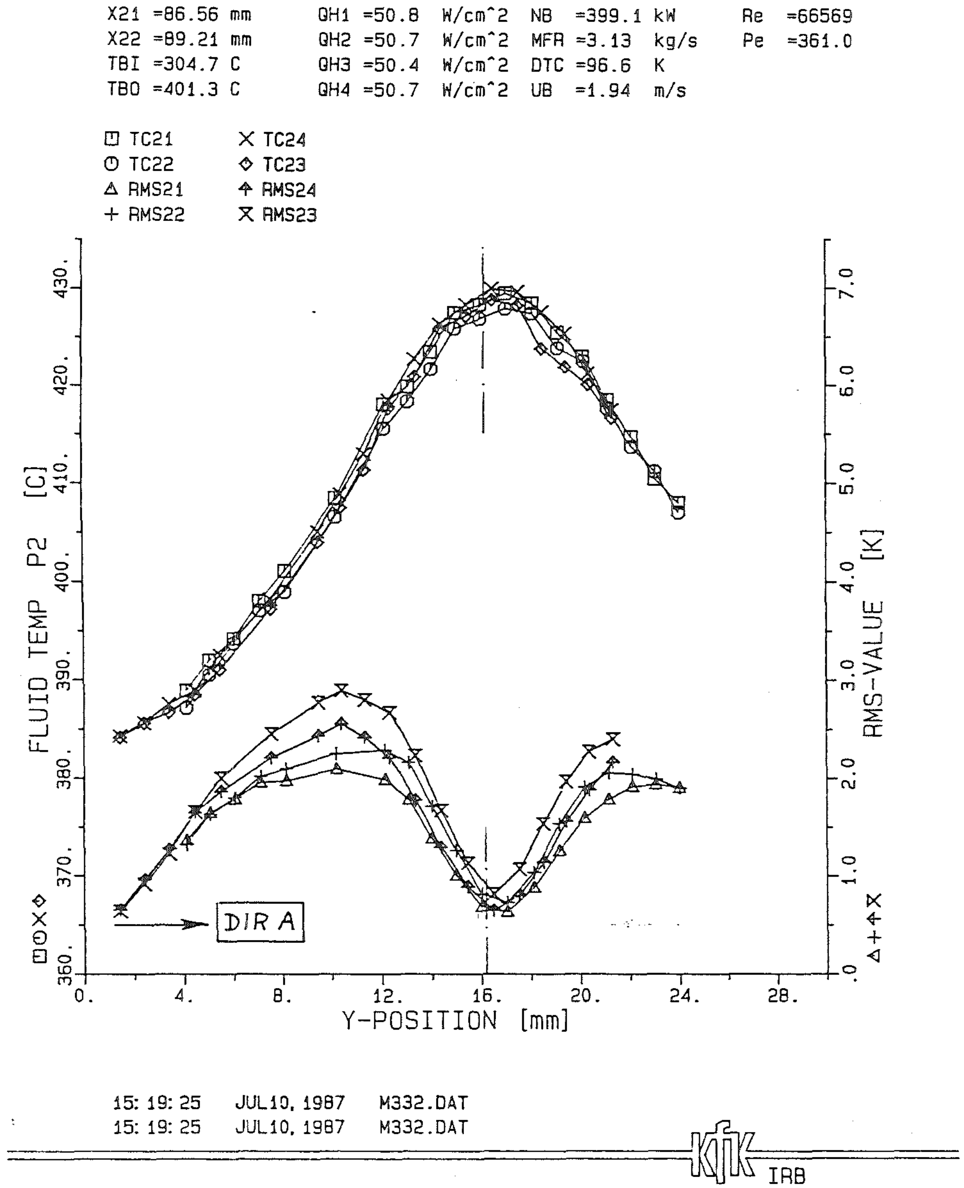


FIG. 33 TEGENA 2 - FLUID TEMPERATURES

PROBE 2 TEMP FLUCTUATIONS

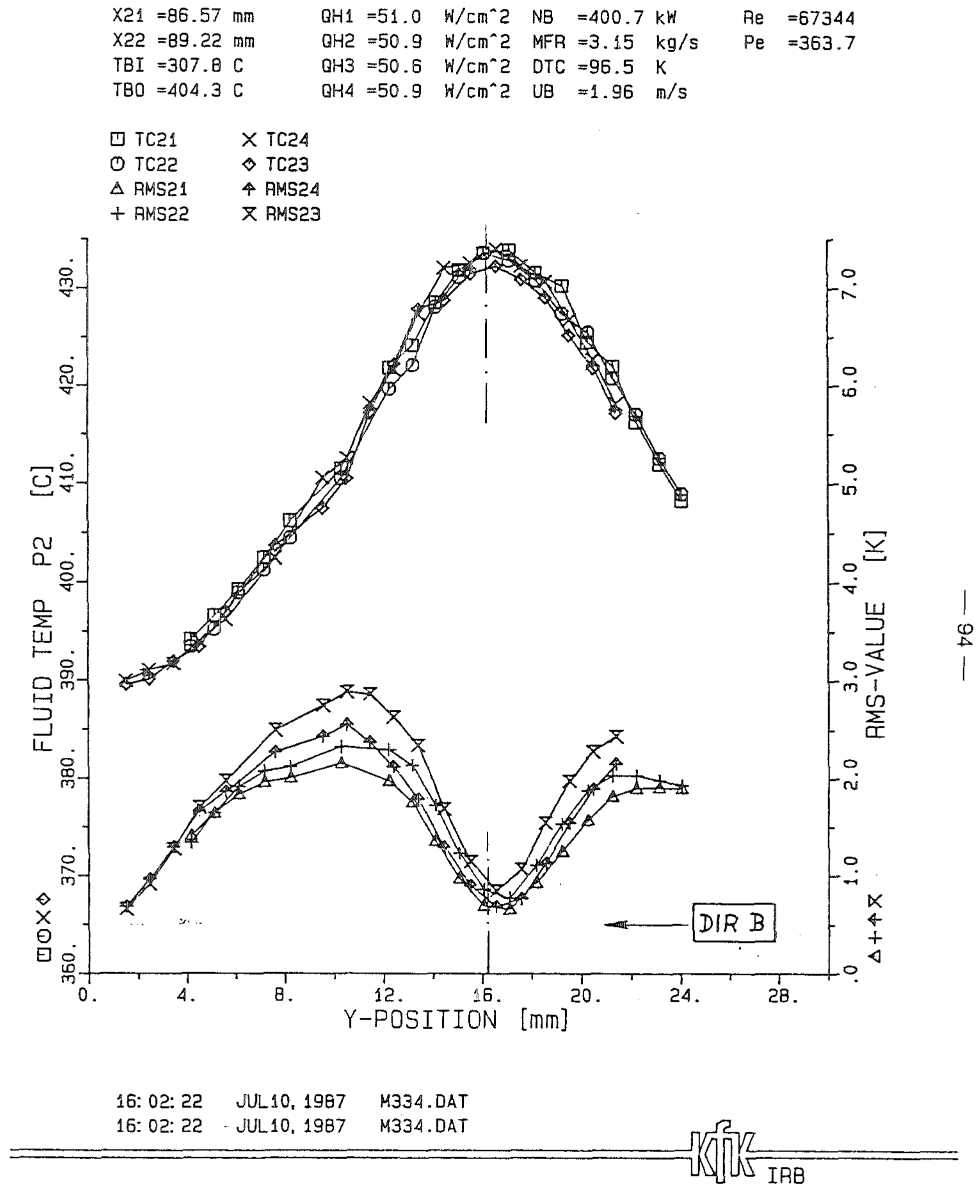


FIG. 34 TEGENA 2 - FLUID TEMPERATURES

PROBE 2 TEMP FLUCTUATIONS

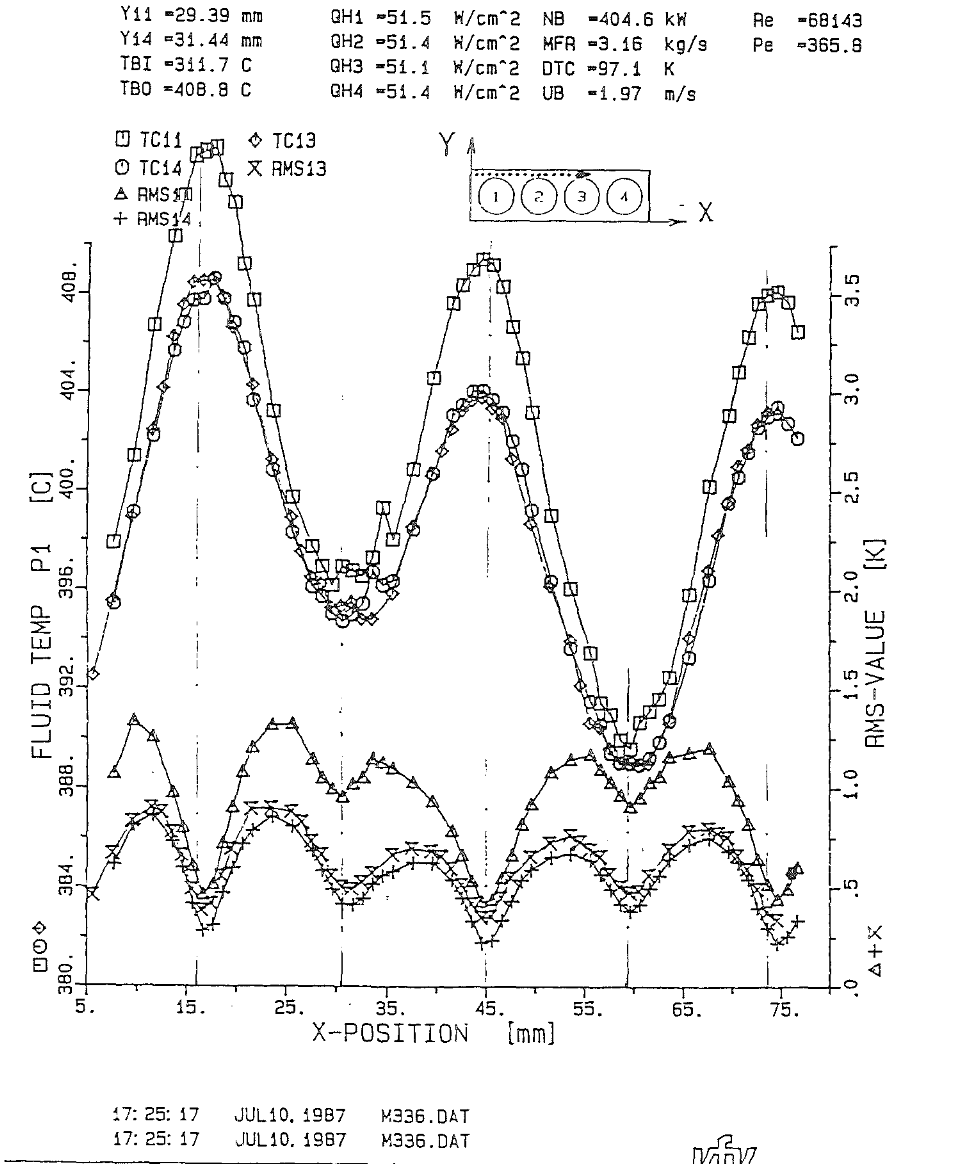


FIG. 35 TEGENA 2 - FLUID TEMPERATURES

PROBE 1 RMS VALUES

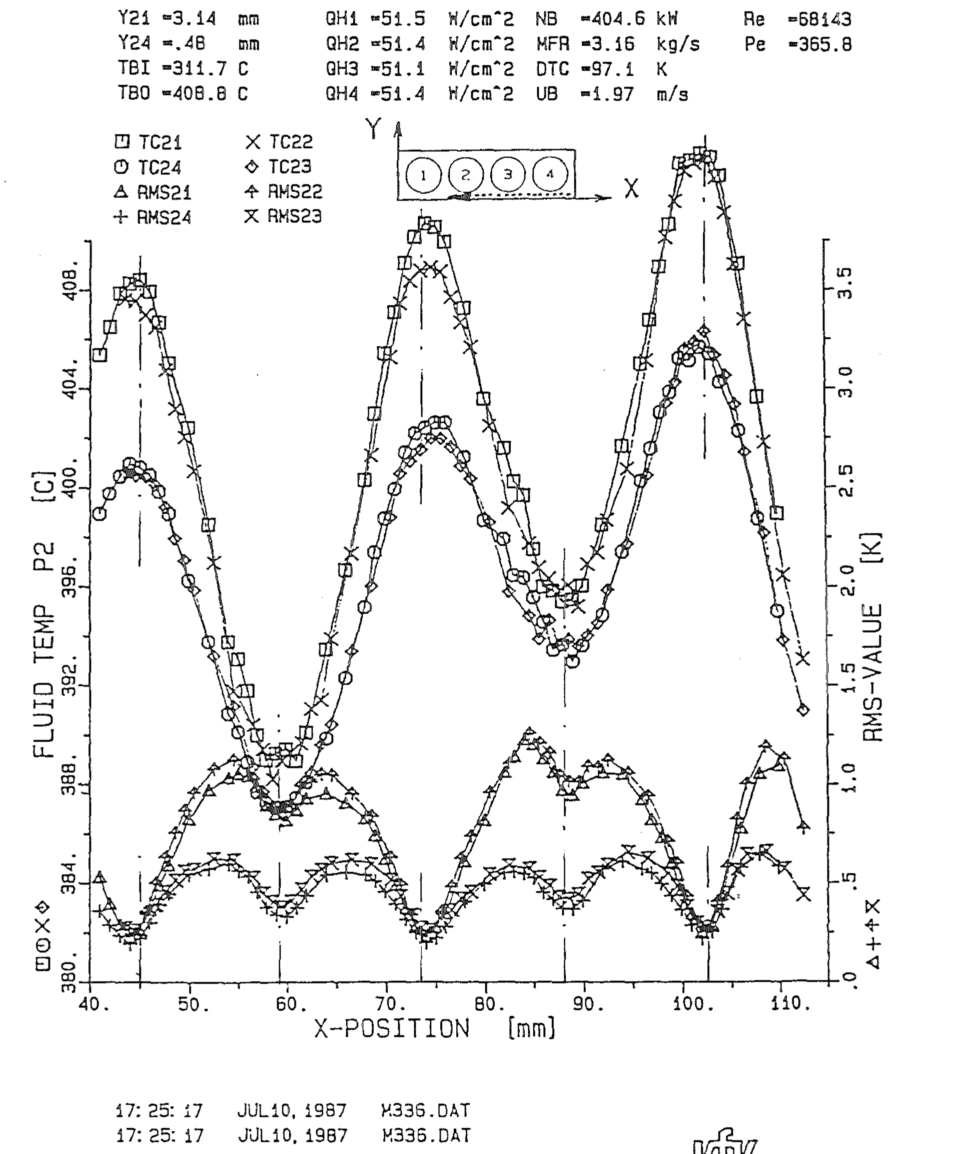


FIG. 36 TEGENA 2 - FLUID TEMPERATURES

PROBE 2 RMS VALUES

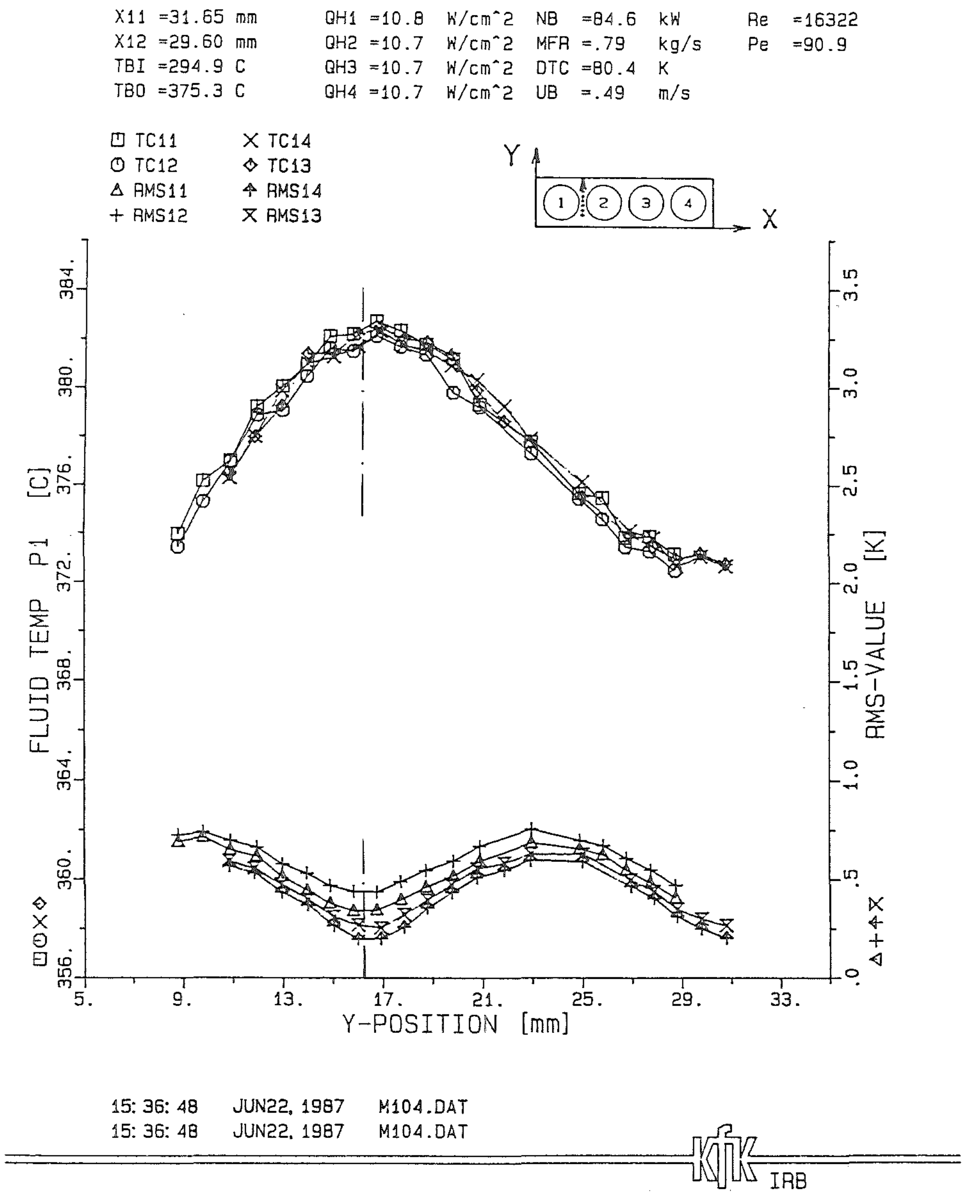


FIG. 37 TEGENA 2 - FLUID TEMPERATURES

PROBE 1 RMS VALUES

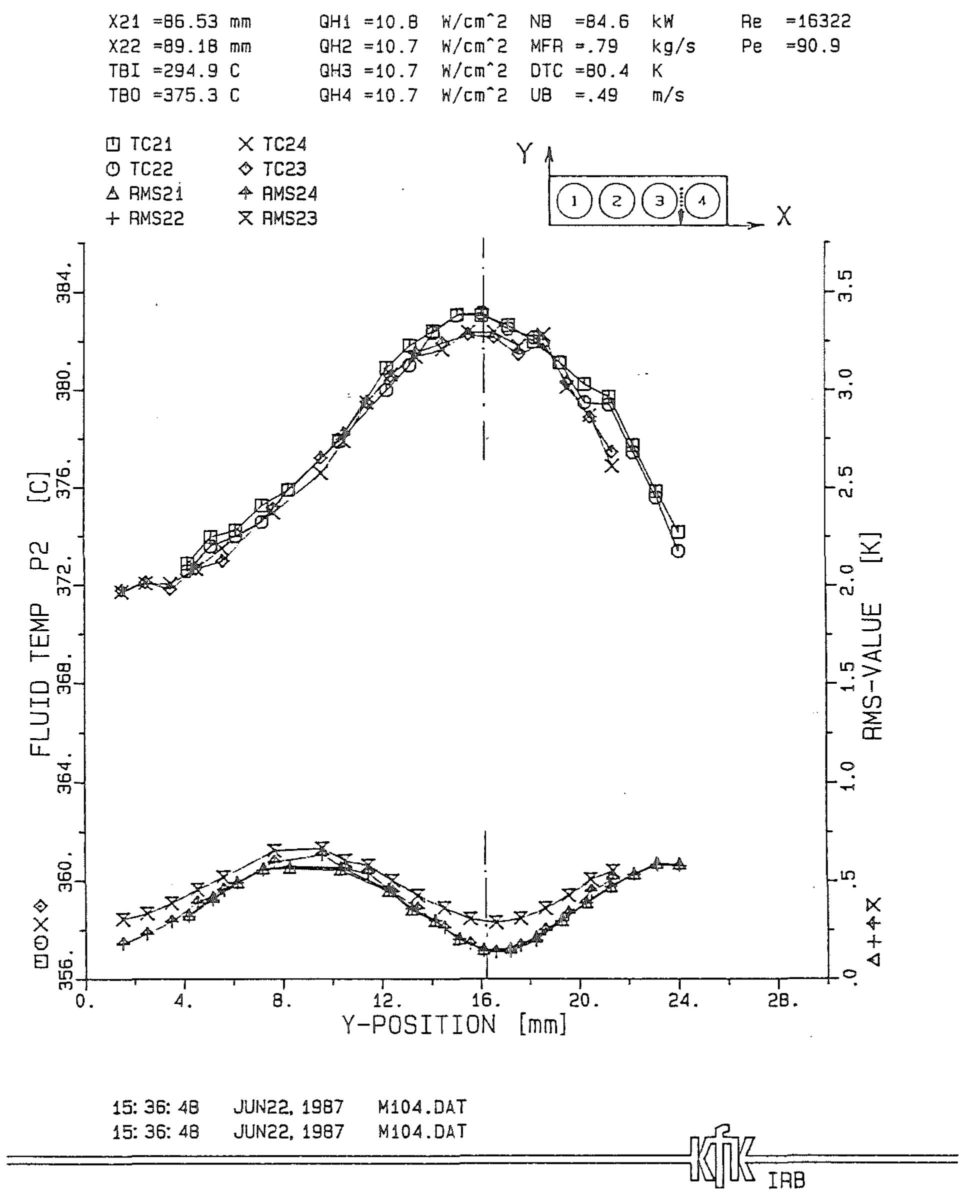
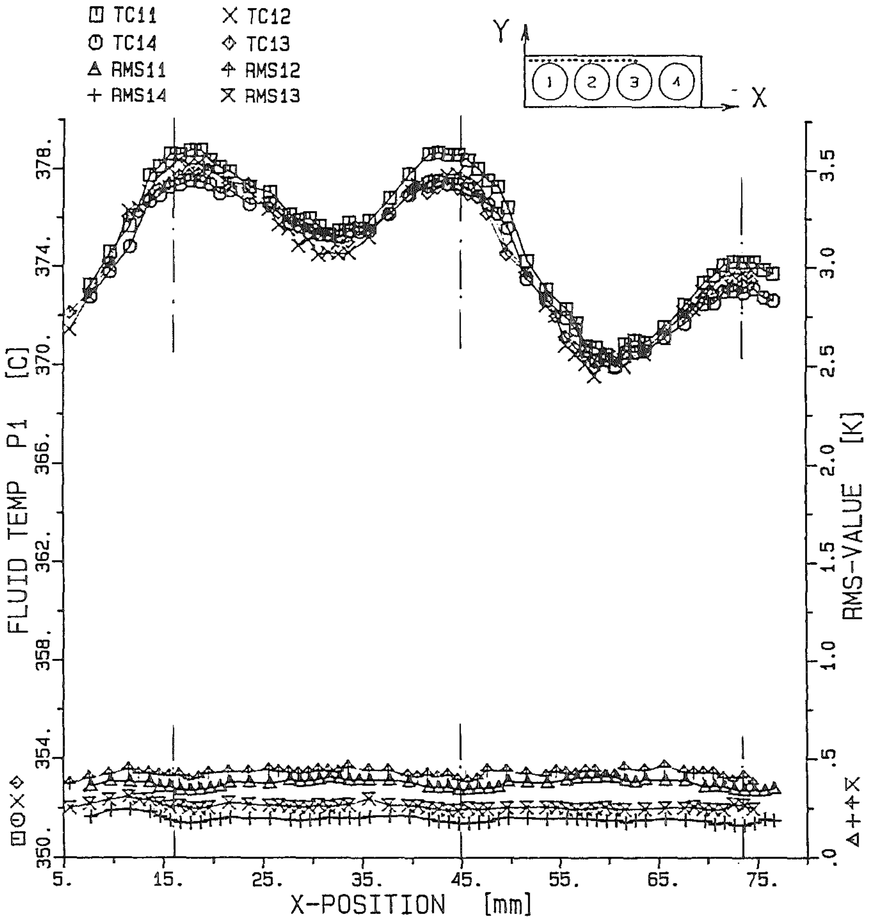


FIG. 38 TEGENA 2 - FLUID TEMPERATURES

PROBE 2 TEMP FLUCTUATIONS

Y11 =29.43 mm QH1 =10.8 W/cm^2 NB =84.4 kW Re =15958
Y14 =31.48 mm QH2 =10.7 W/cm^2 MFR =.78 kg/s Pe =89.0
TBI =293.3 C QH3 =10.7 W/cm^2 DTC =81.8 K
TBO =375.1 C QH4 =10.7 W/cm^2 UB =.48 m/s

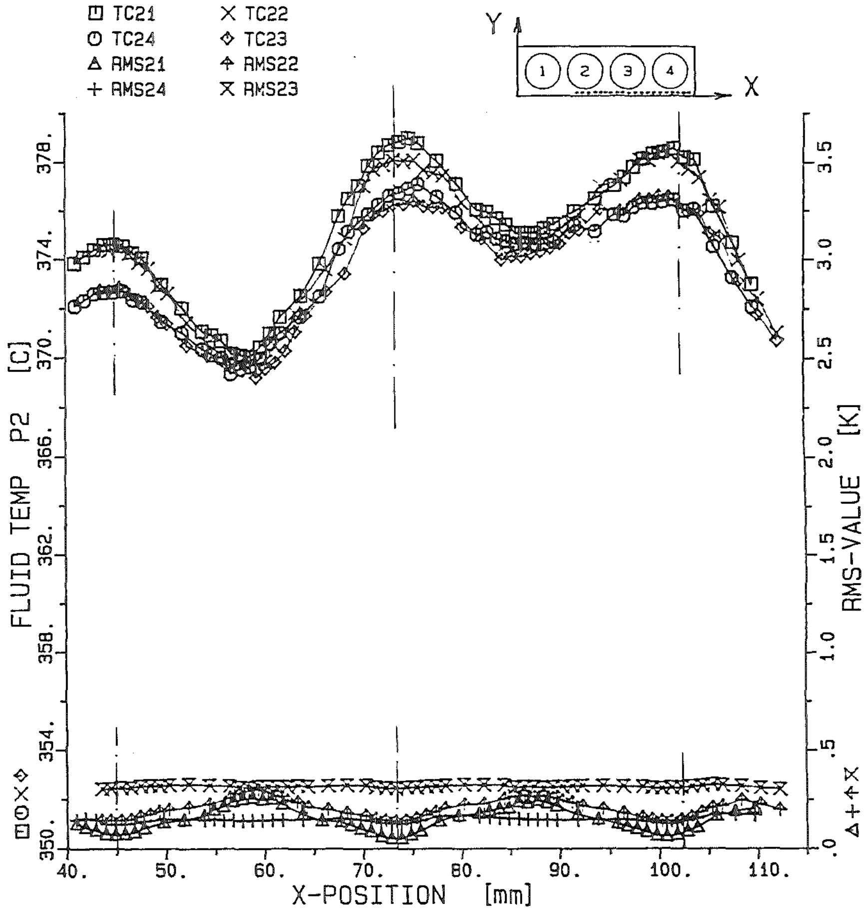


10: 31: 07 JUN15, 1987 M080.DAT
10: 31: 07 JUN15, 1987 M080.DAT

KfK IRB

FIG. 39 TEGENA 2 - FLUID TEMPERATURES
PROBE 1 RMS VALUES

Y21 =3.12 mm QH1 =10.8 W/cm^2 NB =84.4 kW Re =15958
Y24 =.46 mm QH2 =10.7 W/cm^2 MFR =.78 kg/s Pe =89.0
TBI =293.3 C QH3 =10.7 W/cm^2 DTC =81.8 K
TBO =375.1 C QH4 =10.7 W/cm^2 UB =.48 m/s



10: 31: 07 JUN15, 1987 M080.DAT
10: 31: 07 JUN15, 1987 M080.DAT

KfK IRB

FIG. 40 TEGENA 2 - FLUID TEMPERATURES
PROBE 2 RMS VALUES

CURVE	CODE	Re	Pe	UB,m/s	QH,W/cm²	TBI,C	DTC,K
1	M 102	32000	179	0.97	20.3	294	77
2	M 104	16300	91	0.49	10.7	295	80
3	M 106	8100	45	0.24	5.6	291	84

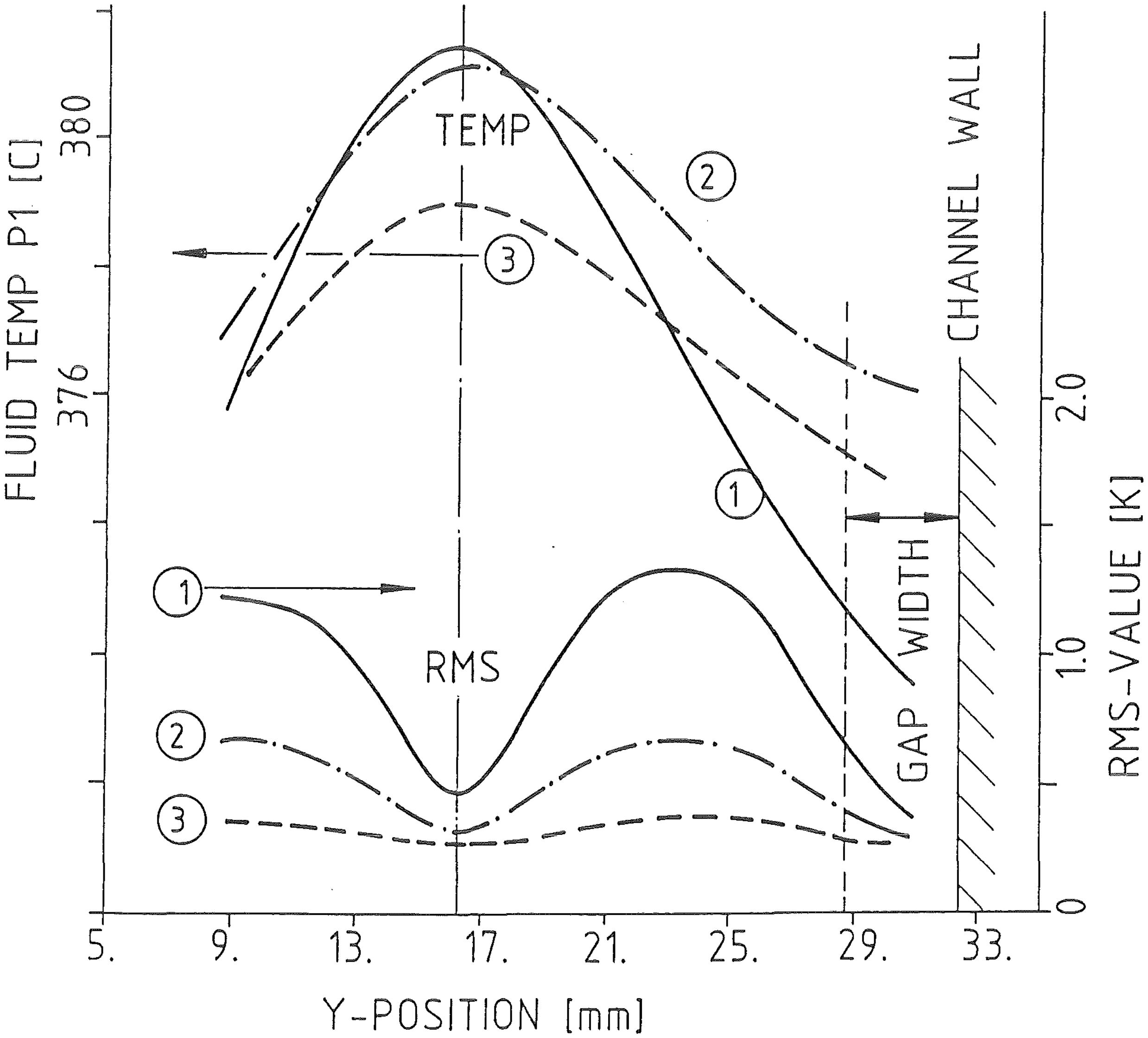


FIG. 41 TEGENA 2 - FLUID TEMPERATURES
PROBE 1 TEMP FLUCTUATIONS

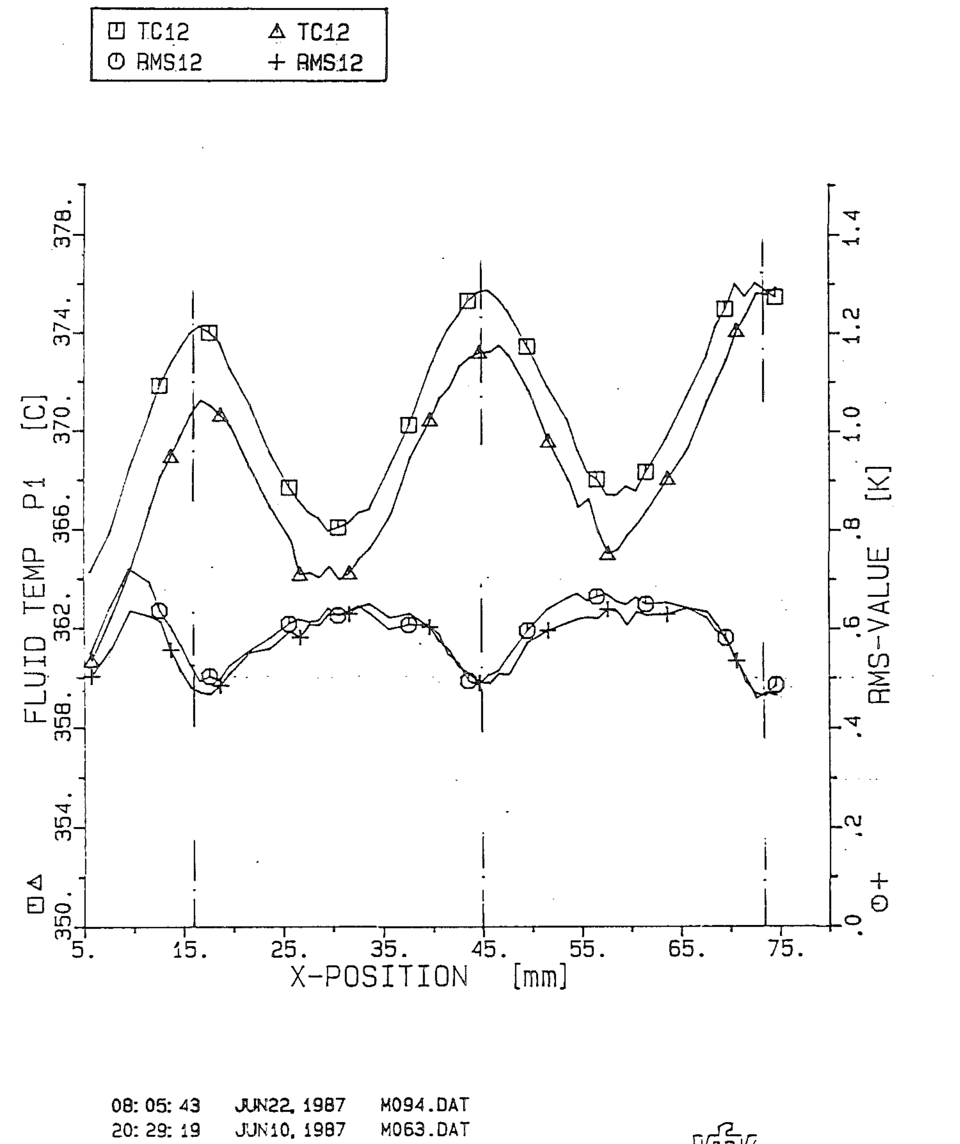


FIG. 42 TEGENA 2 - FLUID TEMPERATURES

PROBE 1 TEMP FLUCTUATIONS

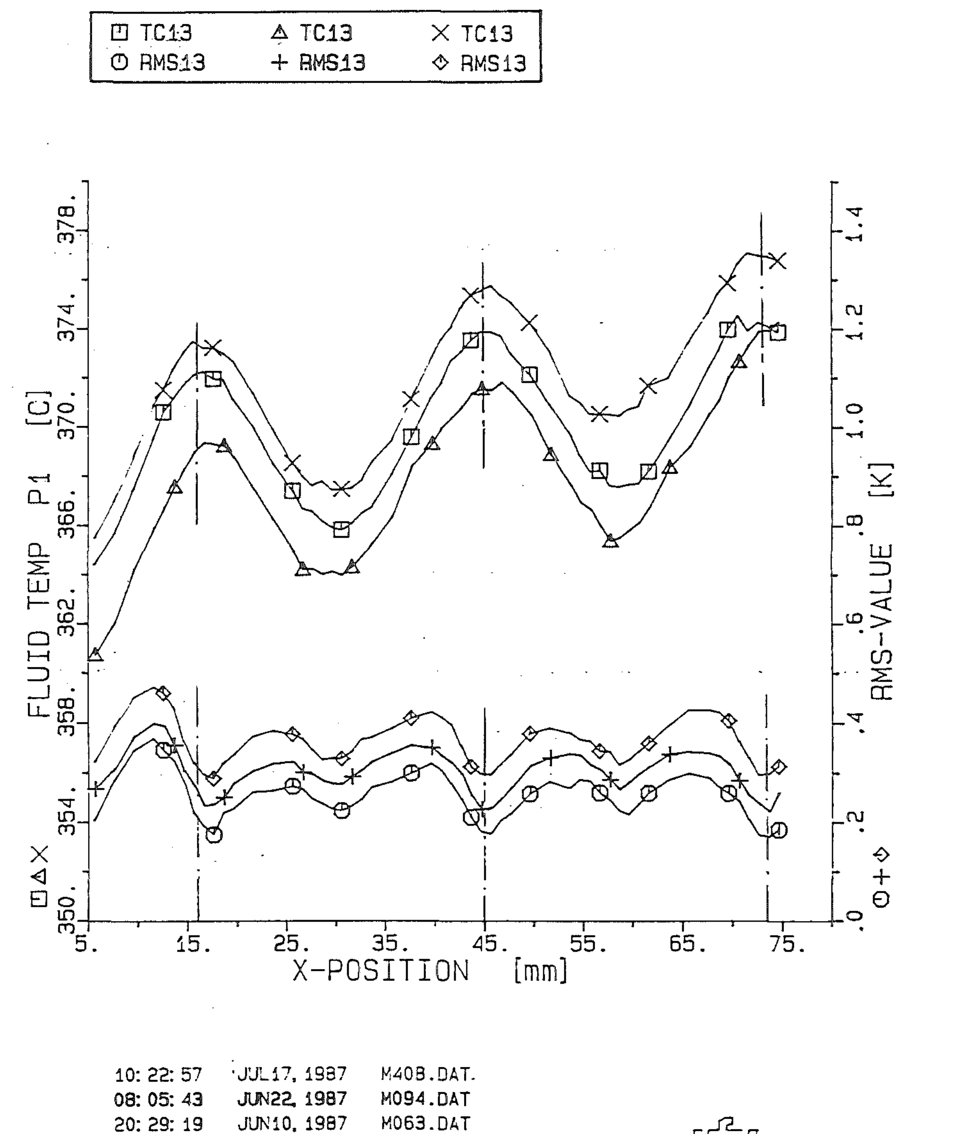


FIG. 43 TEGENA 2 - FLUID TEMPERATURES

PROBE 1 TEMP FLUCTUATIONS

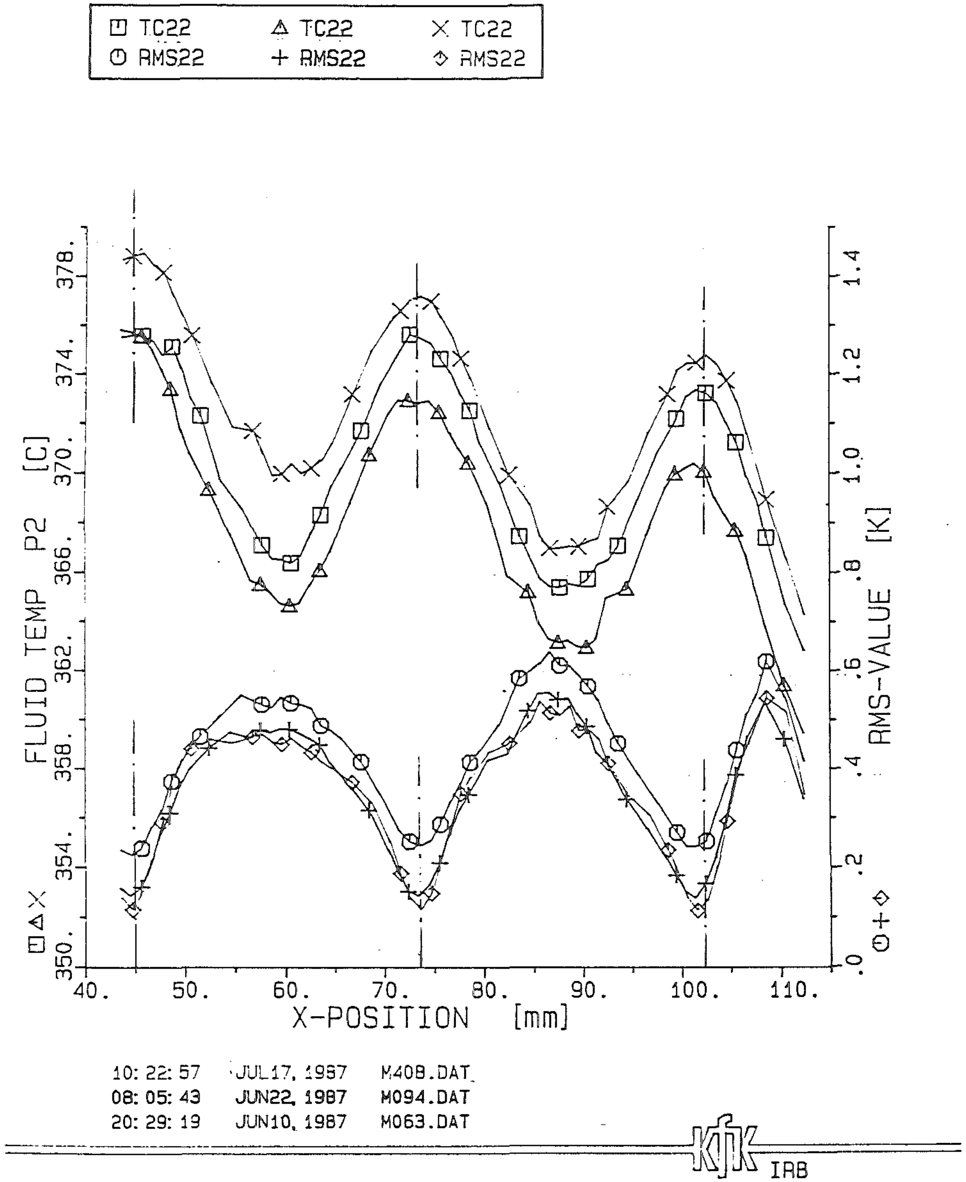


FIG. 44 TEGENA 2 - FLUID TEMPERATURES

PROBE 2 TEMP FLUCTUATIONS

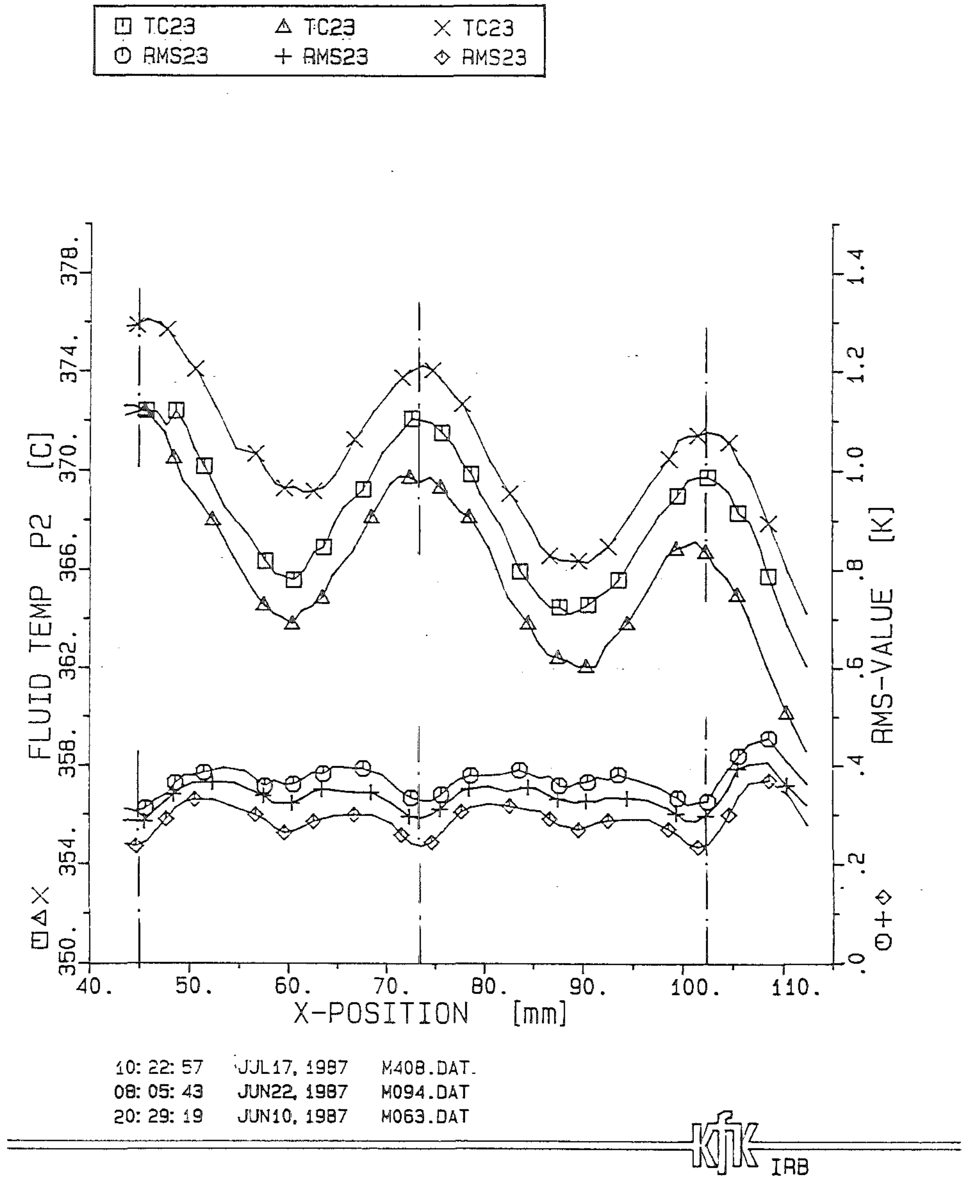
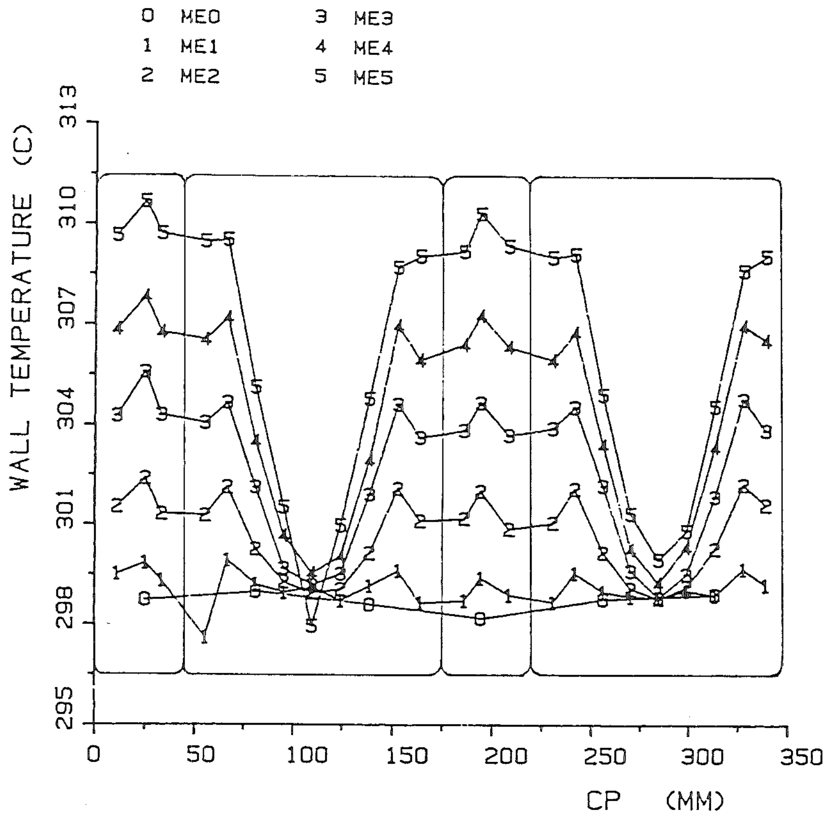
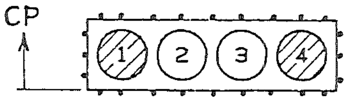


FIG. 45 TEGENA 2 - FLUID TEMPERATURES

PROBE 2 TEMP FLUCTUATIONS



F10LWSA.DAT



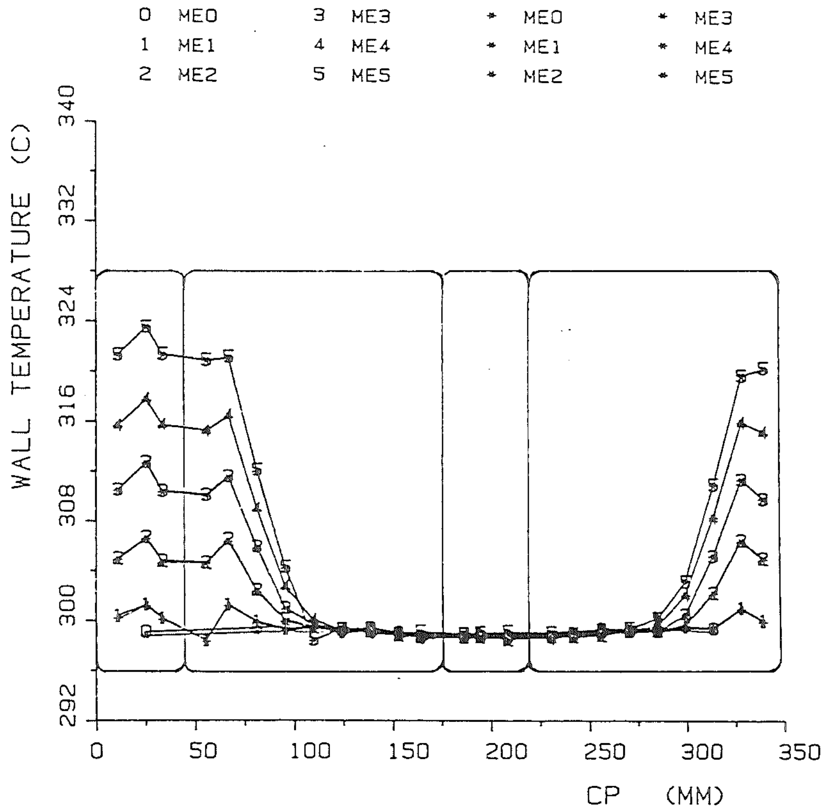
RE = 60900
PE = 359.22
MS = 3.18 (KG/S)
UB = 1.95 (M/S)

QH1 = 7.36 (W/CM^2)
QH2 = 0 (W/CM^2)
QH3 = 0 (W/CM^2)
QH4 = 7.42 (W/CM^2)

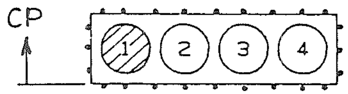
NB = 29.05 (KW)
TEN = 297.91(C)
TNO = 304.75(C)
TNM = 301.33(C)

FIG. 46 TEGENA 1 WALL TEMPERATURE

OUTER RODS HEATED DIR A



F25LWSA.DAT
F25LWSB.DAT



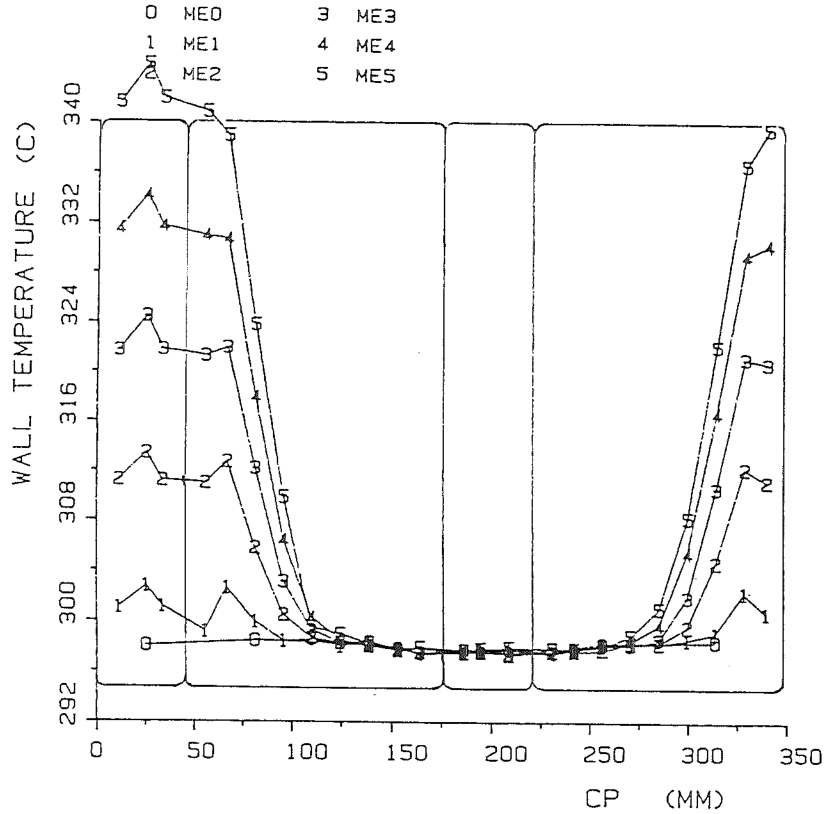
RE = 60500
PE = 356.85
MS = 3.16 (KG/S)
UB = 1.94 (M/S)

QH1 = 14.98 (W/CM^2)
QH2 = 0 (W/CM^2)
QH3 = 0 (W/CM^2)
QH4 = 0 (W/CM^2)

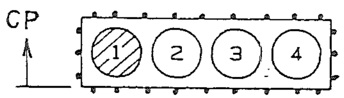
NB = 29.5 (KW)
TEN = 298.23(C)
TNO = 305.22(C)
TNM = 301.73(C)

FIG. 47 TEGENA 1 WALL TEMPERATURE

ROD 1 HEATED DIR A/B(*)



F26LWSA. DAT



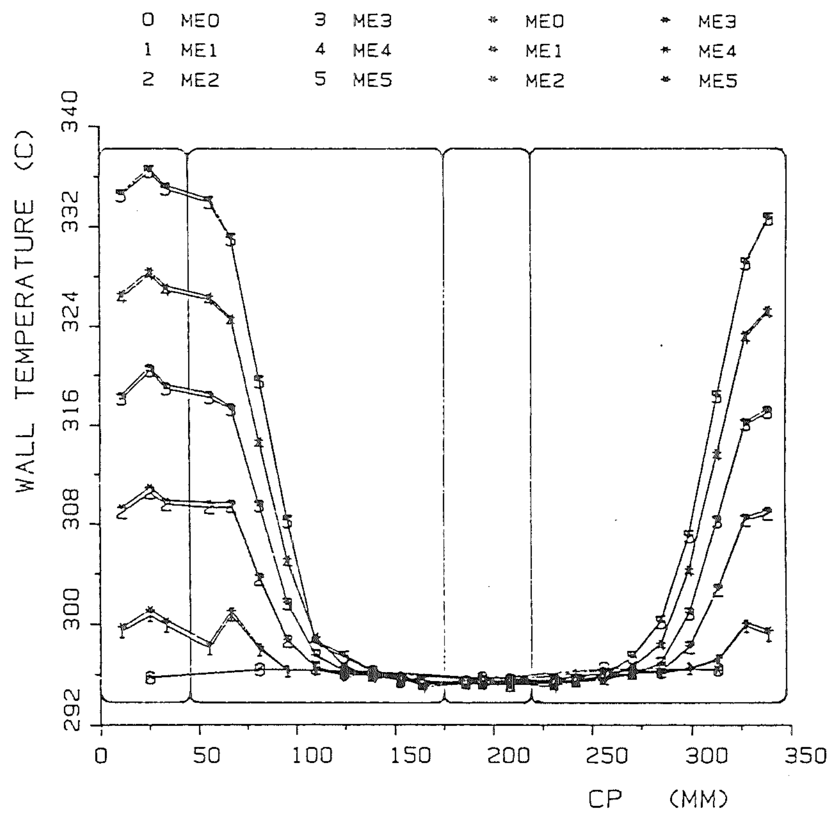
RE = 30300
PE = 177. 55
MS = 1. 57 (KG/S)
UB = . 96 (M/S)

QH1 = 14. 96 (W/CM^2)
QH2 = 0 (W/CM^2)
QH3 = 0 (W/CM^2)
QH4 = 0 (W/CM^2)

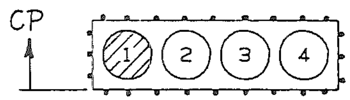
NB = 29. 46 (KW)
TEN = 297. 51(C)
TNO = 311. 58(C)
TNM = 304. 54(C)

FIG. 48 TEGENA 1 WALL TEMPERATURE

ROD 1 HEATED DIR A/B



F24LWSA. DAT
F24LWSB. DAT



RE = 15300
PE = 89. 94
MS = . 8 (KG/S)
UB = . 49 (M/S)

QH1 = 7. 44 (W/CM^2)
QH2 = 0 (W/CM^2)
QH3 = 0 (W/CM^2)
QH4 = 0 (W/CM^2)

NB = 14. 66 (KW)
TEN = 295. 79(C)
TNO = 309. 59(C)
TNM = 302. 69(C)

FIG. 49 TEGENA 1 WALL TEMPERATURE

ROD 1 HEATED DIR A/B(*)

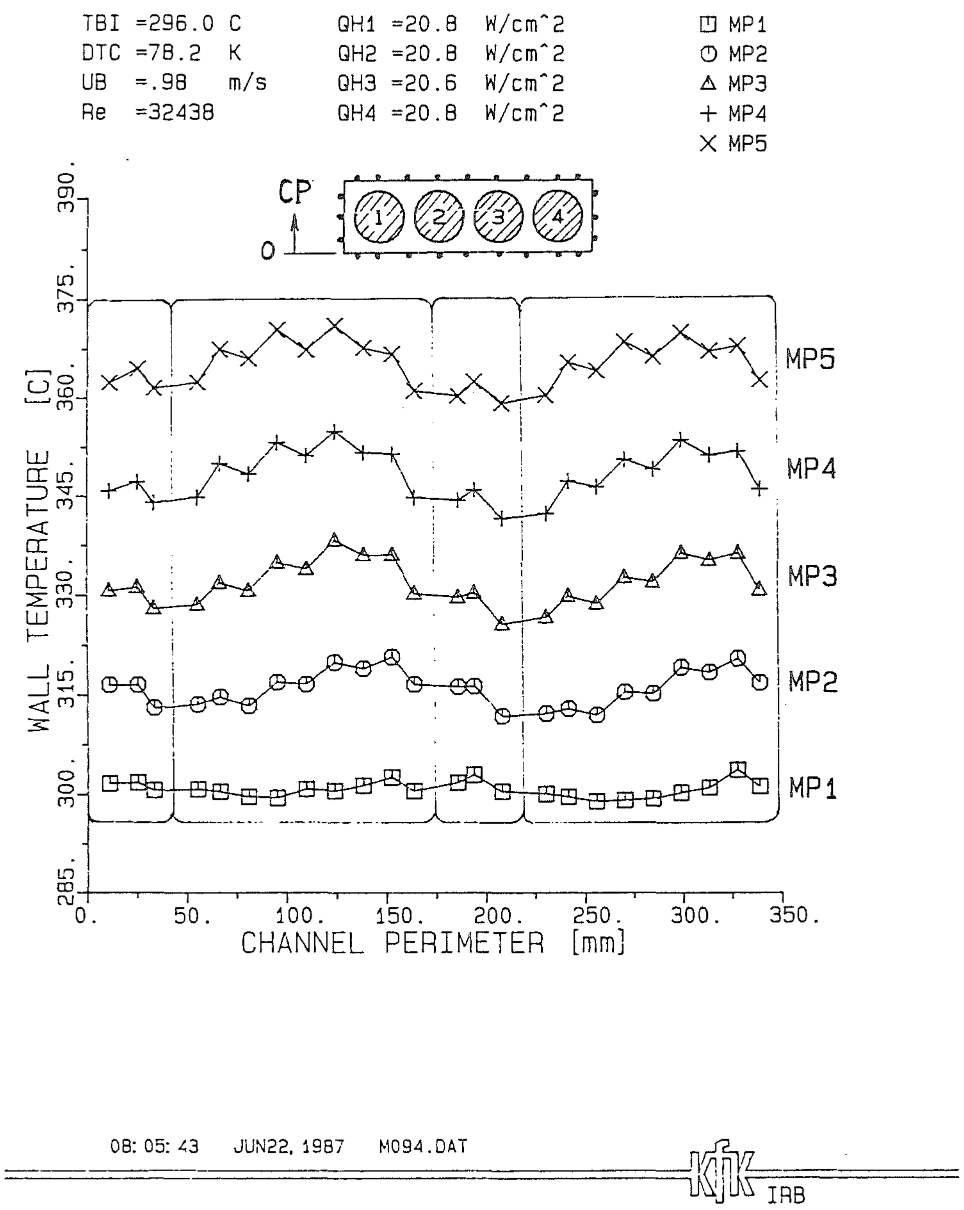


FIG. 50 TEGENA 2 - WALL TEMPERATURES
CHANNEL PERIMERTER MP1/2/3/4/5

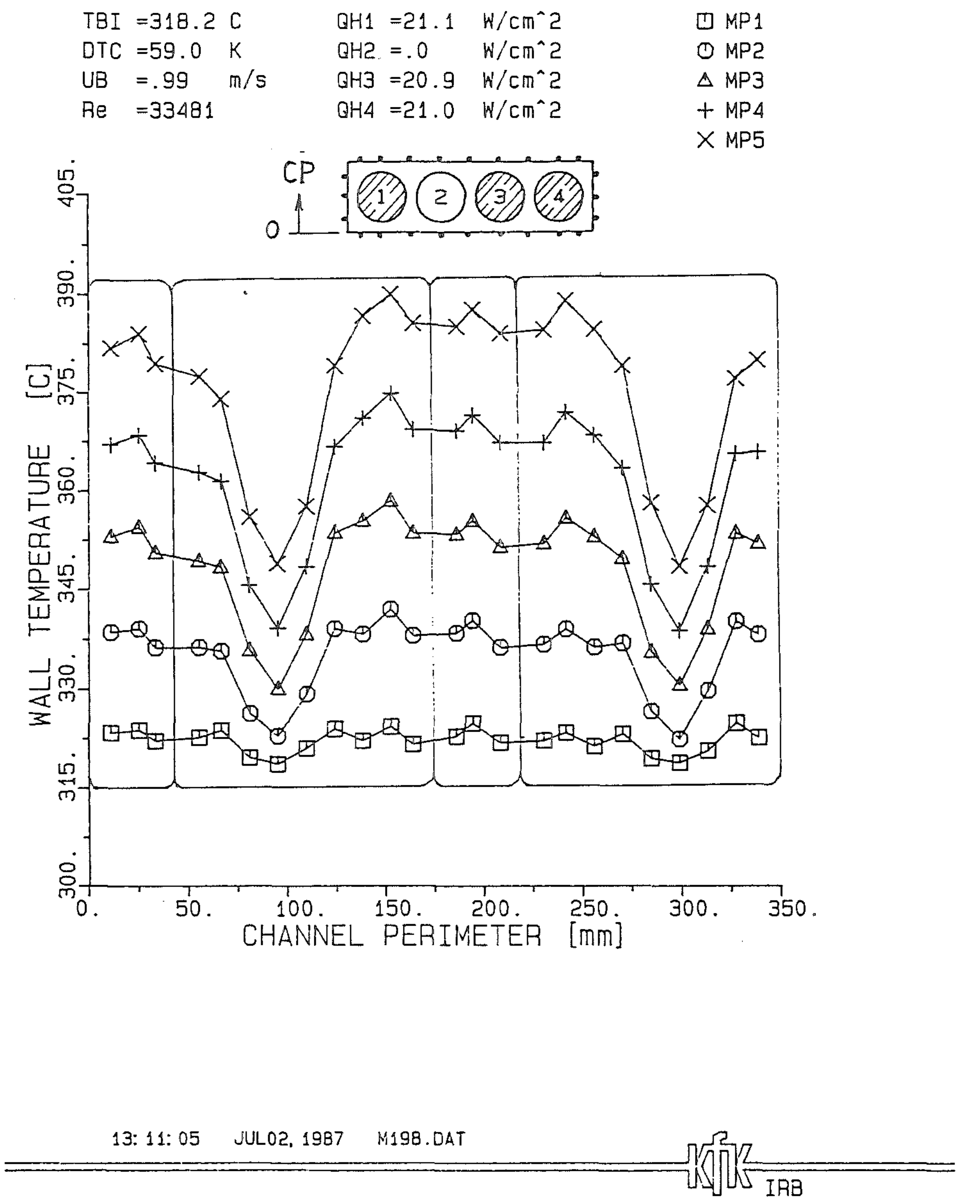
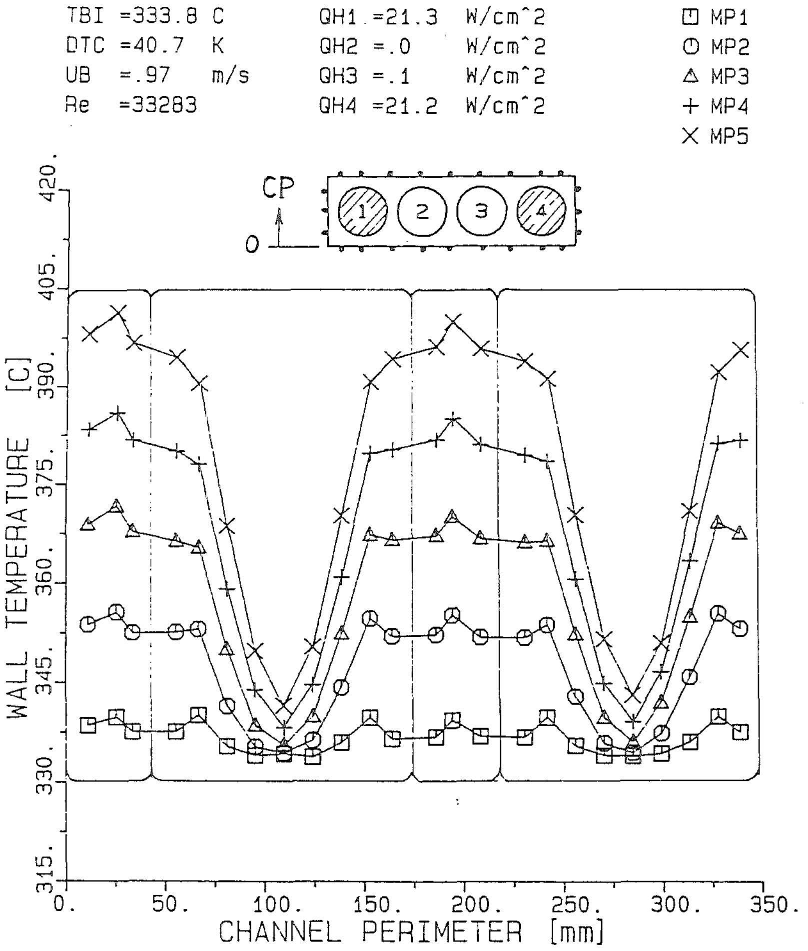


FIG. 51 TEGENA 2 - WALL TEMPERATURES
CHANNEL PERIMERTER MP1/2/3/4/5

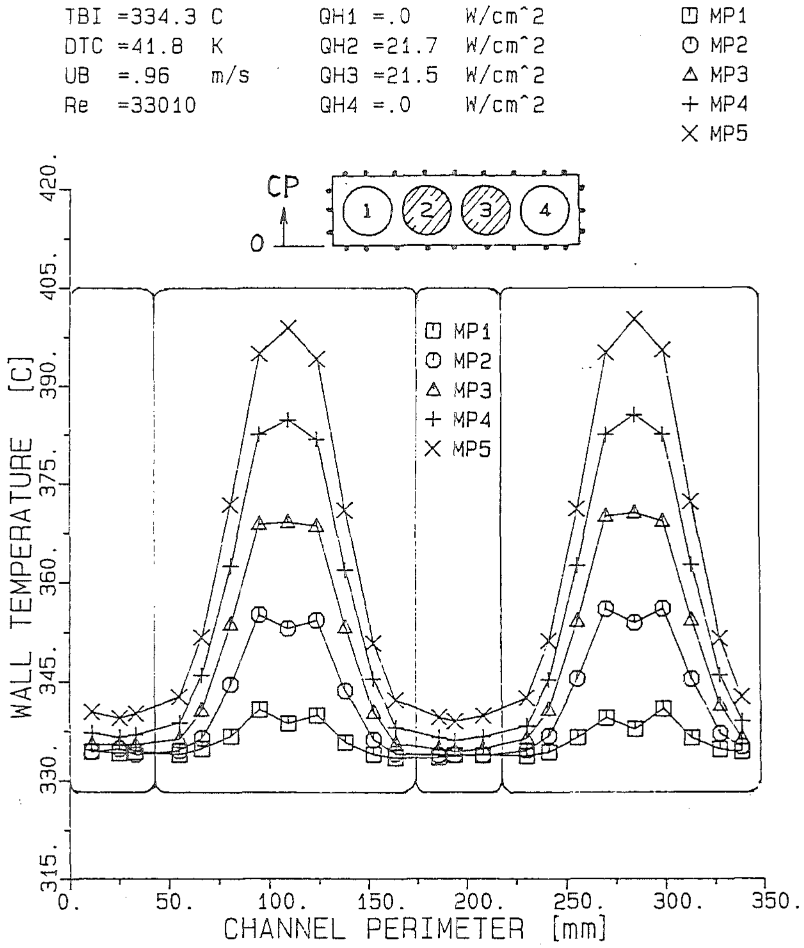


15: 59: 57 JUL01, 1987 M190.DAT

KfK IRB

FIG. 52 TEGENA 2 - WALL TEMPERATURES

CHANNEL PERIMERTER MP1/2/3/4/5

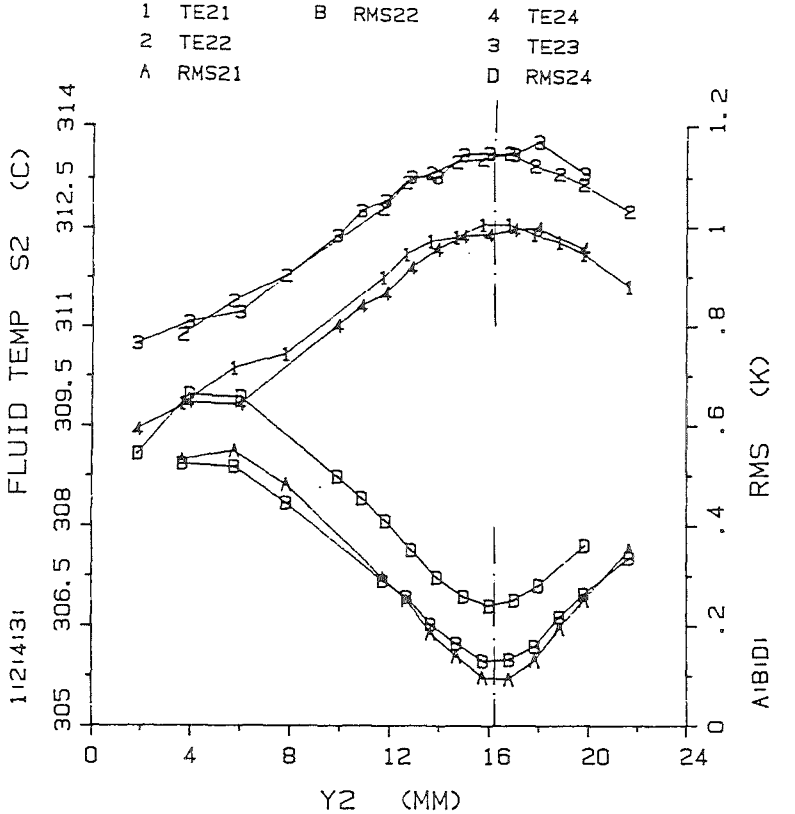


12: 20: 38 JUN29, 1987 M168.DAT

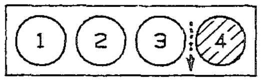
KfK IRB

FIG. 53 TEGENA 2 - WALL TEMPERATURES

CHANNEL PERIMERTER MP1/2/3/4/5



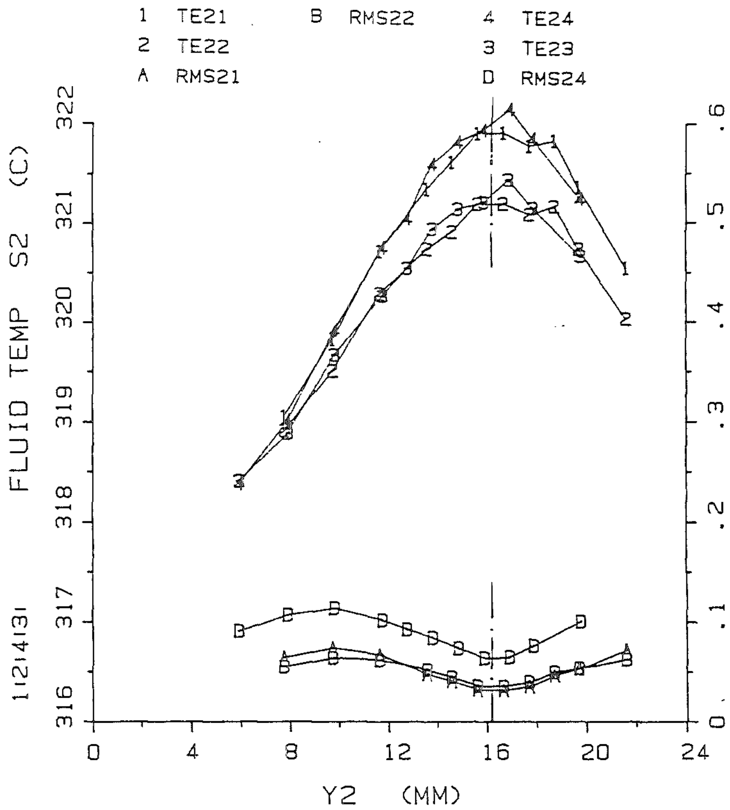
F31Q12B.DAT
F31Q12B.DAT



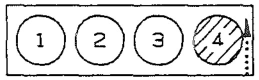
RE = 30300		QH1 = 0	(W/CM^2)	NB = 15.29 (KW)
PE = 178.82		QH2 = 0	(W/CM^2)	TEN = 296.64(C)
MS = 1.59	(KG/S)	QH3 = 0	(W/CM^2)	X21 = 86.96 (MM)
UB = .97	(M/S)	QH4 = 7.79	(W/CM^2)	X22 = 88.79 (MM)

FIG. 54 TEGENA 1 FLUID TEMPERATURE

DIR B



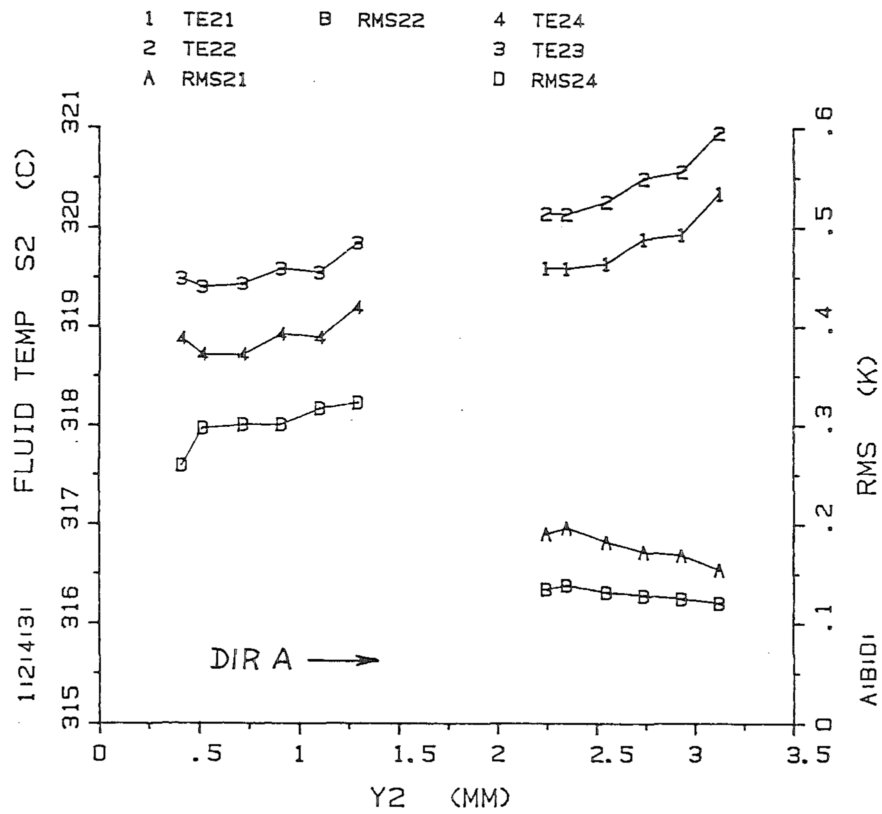
F37QWSA.DAT
F37QWSA.DAT



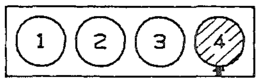
RE = 30100		QH1 = 0	(W/CM^2)	NB = 14.88 (KW)
PE = 178.18		QH2 = 0	(W/CM^2)	TEN = 296.19(C)
MS = 1.58	(KG/S)	QH3 = 0	(W/CM^2)	X21 = 115.78(MM)
UB = .97	(M/S)	QH4 = 7.58	(W/CM^2)	X22 = 117.61(MM)

FIG. 55 TEGENA 1 FLUID TEMPERATURE

DIR A



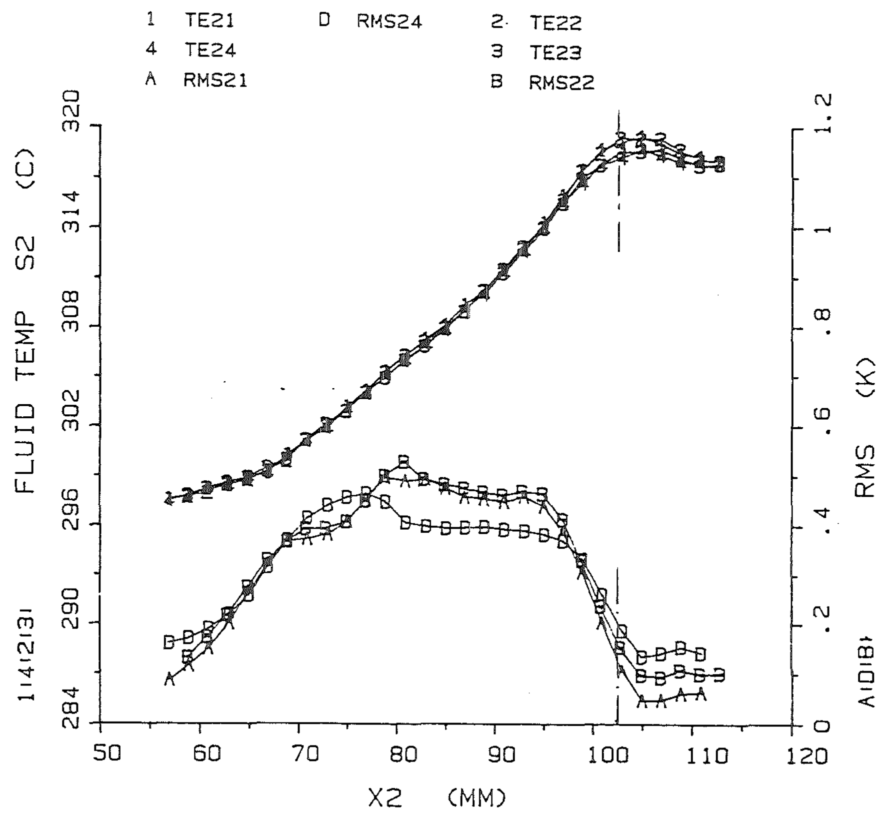
F35QW4A.DAT
F35QW4A.DAT



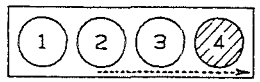
RE = 30300	QH1 = 0	(W/CM^2)	NB = 15.27 (KW)	
PE = 179.07	QH2 = 0	(W/CM^2)	TEN = 296.68(C)	
MS = 1.59 (KG/S)	QH3 = 0	(W/CM^2)	X21 = 101.38(MM)	
UB = .97 (M/S)	QH4 = 7.78	(W/CM^2)	X22 = 103.21(MM)	

FIG. 56 TEGENA 1 FLUID TEMPERATURE

DIR A



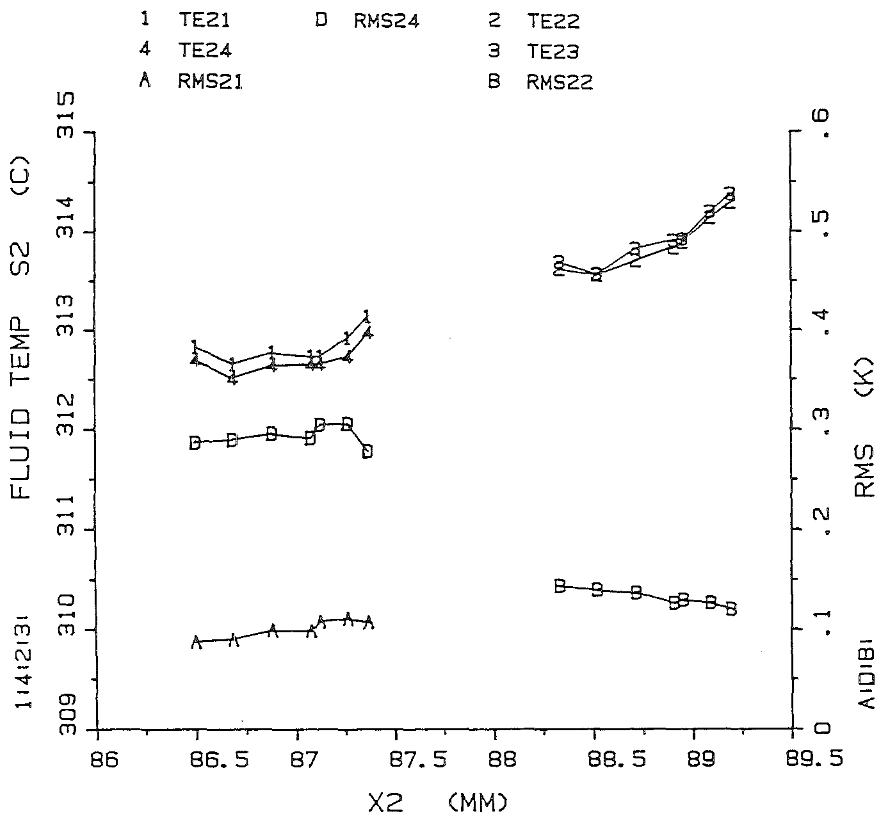
F30LWSB.DAT
F30LWSB.DAT



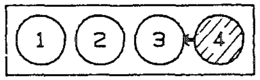
RE = 30000	QH1 = 0	(W/CM^2)	NB = 14.5 (KW)		
PE = 177.37	QH2 = 0	(W/CM^2)	TEN = 296.71(C)		
MS = 1.57 (KG/S)	QH3 = 0	(W/CM^2)	Y21 = 2.71 (MM)		
UB = .96 (M/S)	QH4 = 7.39	(W/CM^2)	Y24 = .88 (MM)		

FIG. 57 TEGENA 1 FLUID TEMPERATURE

DIR B



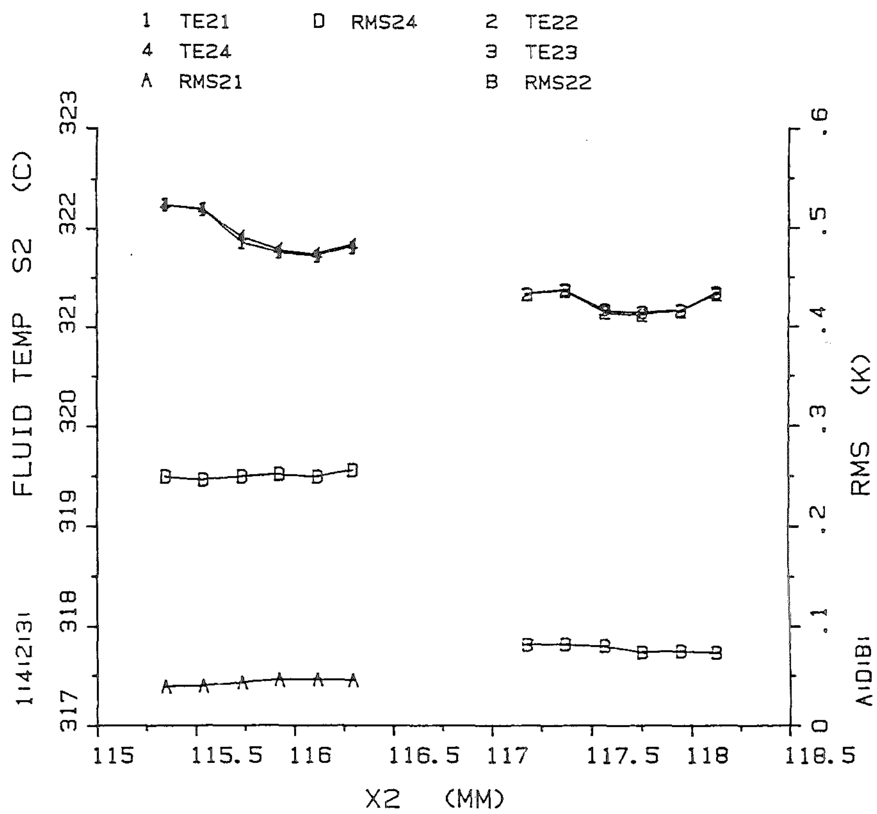
F32L43A.DAT
F32L43A.DAT



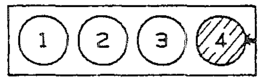
RE = 30400	QH1 = 0	(W/CM^2)	NB = 15.44 (KW)
PE = 179.55	QH2 = 0	(W/CM^2)	TEN = 296.32(C)
MS = 1.59 (KG/S)	QH3 = 0	(W/CM^2)	Y21 = 17.11 (MM)
UB = .98 (M/S)	QH4 = 7.86	(W/CM^2)	Y24 = 15.28 (MM)

FIG. 58 TEGENA 1 FLUID TEMPERATURE

DIR A



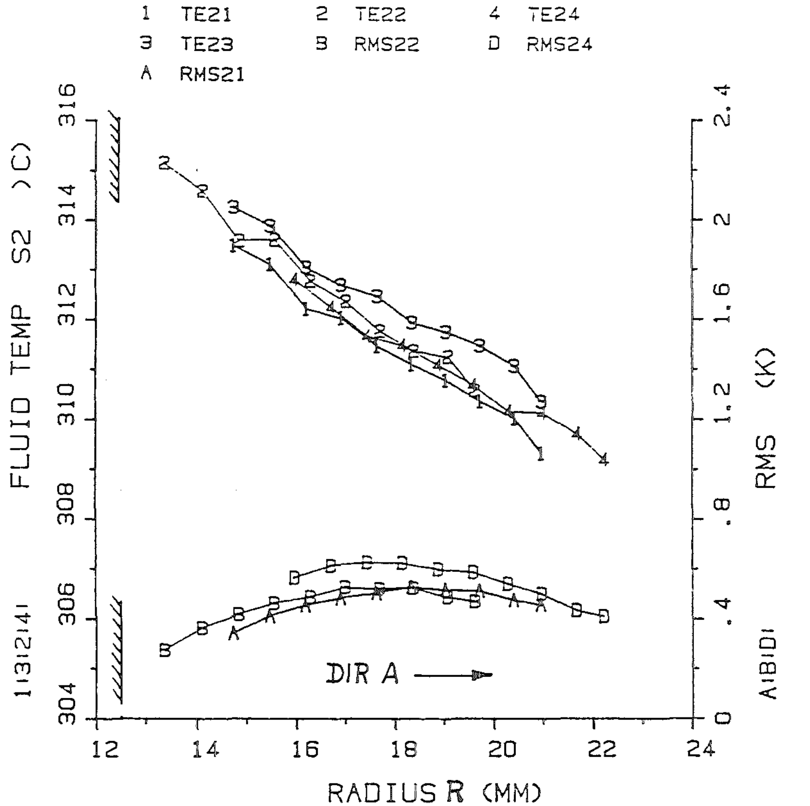
F38LW4A.DAT
F38LW4A.DAT



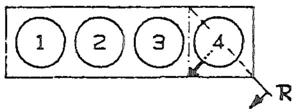
RE = 30200	QH1 = 0	(W/CM^2)	NB = 14.98 (KW)
PE = 178.43	QH2 = 0	(W/CM^2)	TEN = 296.39(C)
MS = 1.58 (KG/S)	QH3 = 0	(W/CM^2)	Y21 = 17.11 (MM)
UB = .97 (M/S)	QH4 = 7.63	(W/CM^2)	Y24 = 15.28 (MM)

FIG. 59 TEGENA 1 FLUID TEMPERATURE

DIR A



F33D43A.DAT
F33D43A.DAT
F33D43A.DAT



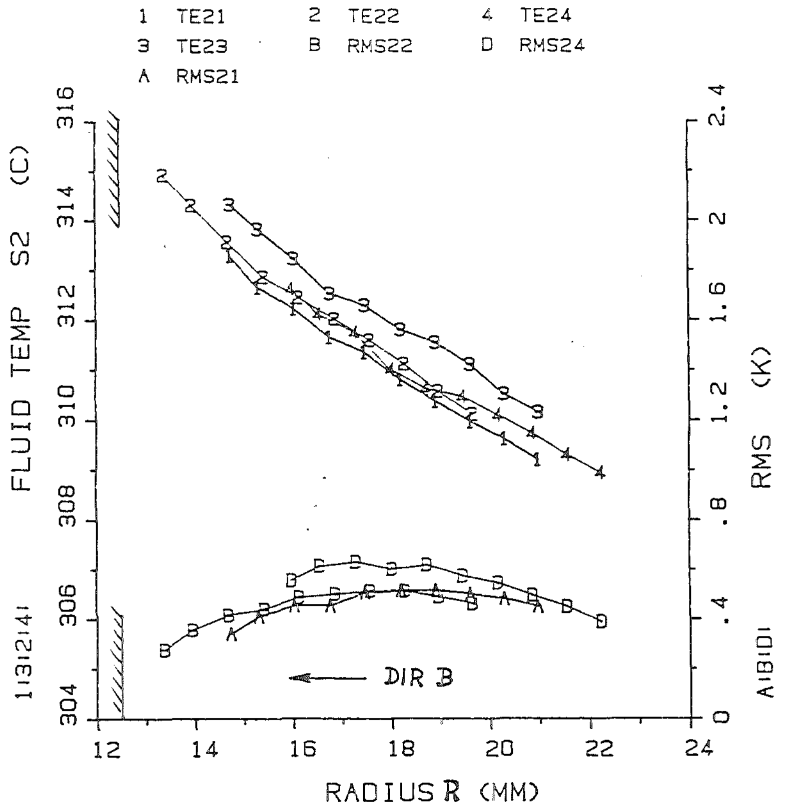
RE = 30500
PE = 180.13
MS = 1.6 (KG/S)
UB = .98 (M/S)

QH1 = 0 (W/CM^2)
QH2 = 0 (W/CM^2)
QH3 = 0 (W/CM^2)
QH4 = 7.88 (W/CM^2)

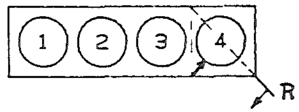
NB = 15.47 (KW)
TEN = 296.6 (C)
A22 = 44.97 (DEG)
A21 = 48.51 (DEG)

FIG. 60 TEGENA 1 FLUID TEMPERATURE

DIR A



F33D43B.DAT
F33D43B.DAT
F33D43B.DAT



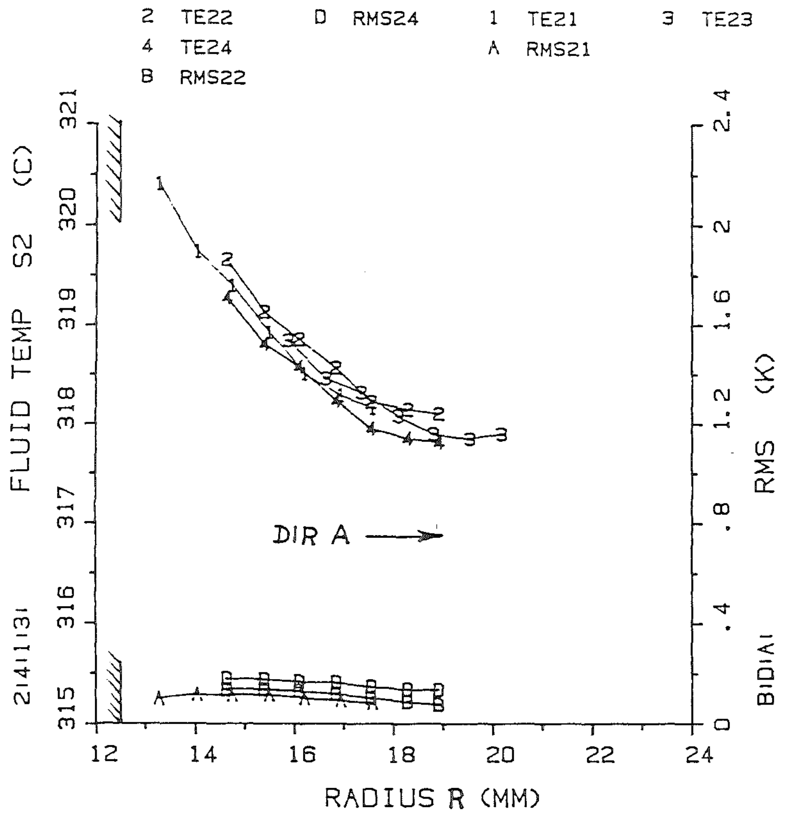
RE = 30100
PE = 177.9
MS = 1.58 (KG/S)
UB = .97 (M/S)

QH1 = 0 (W/CM^2)
QH2 = 0 (W/CM^2)
QH3 = 0 (W/CM^2)
QH4 = 7.73 (W/CM^2)

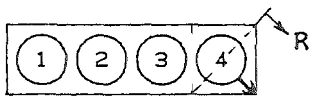
NB = 15.17 (KW)
TEN = 296.31 (C)
A22 = 45.44 (DEG)
A21 = 50.44 (DEG)

FIG. 61 TEGENA 1 FLUID TEMPERATURE

DIR B



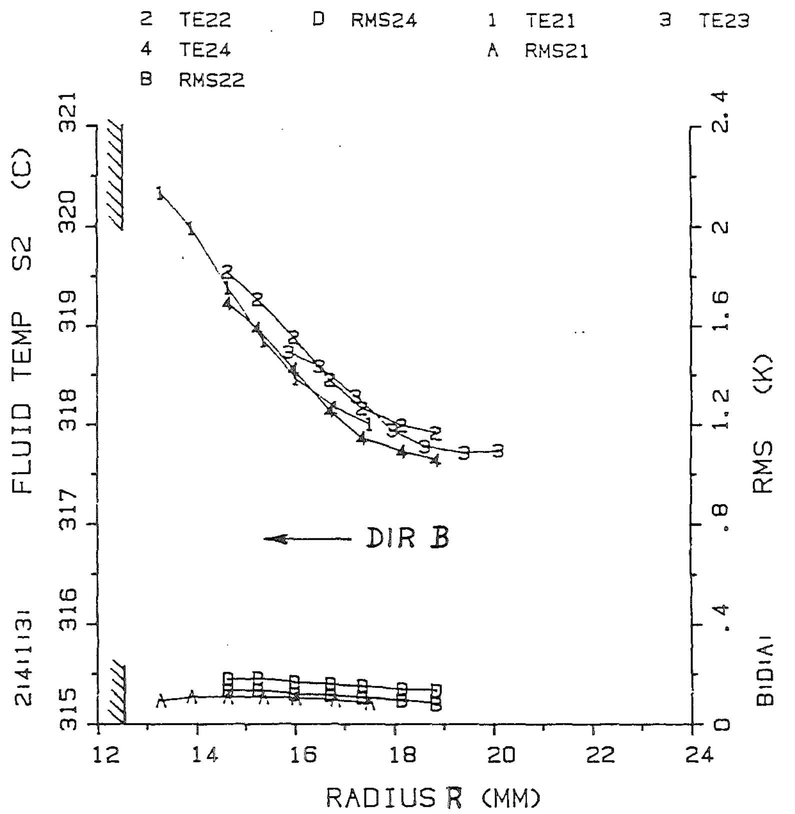
F36D44A. DAT
F36D44A. DAT
F36D44A. DAT



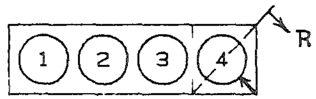
RE = 30400	QH1 = 0	(W/CM^2)	NB = 15.1	(KW)
PE = 179.6	QH2 = 0	(W/CM^2)	TEN = 296.21(C)	
MS = 1.59 (KG/S)	QH3 = 0	(W/CM^2)	A21 = 44.72	(DEG)
UB = .98 (M/S)	QH4 = 7.69	(W/CM^2)	A22 = 48.66	(DEG)

FIG. 62 TEGENA 1 FLUID TEMPERATURE

DIR A



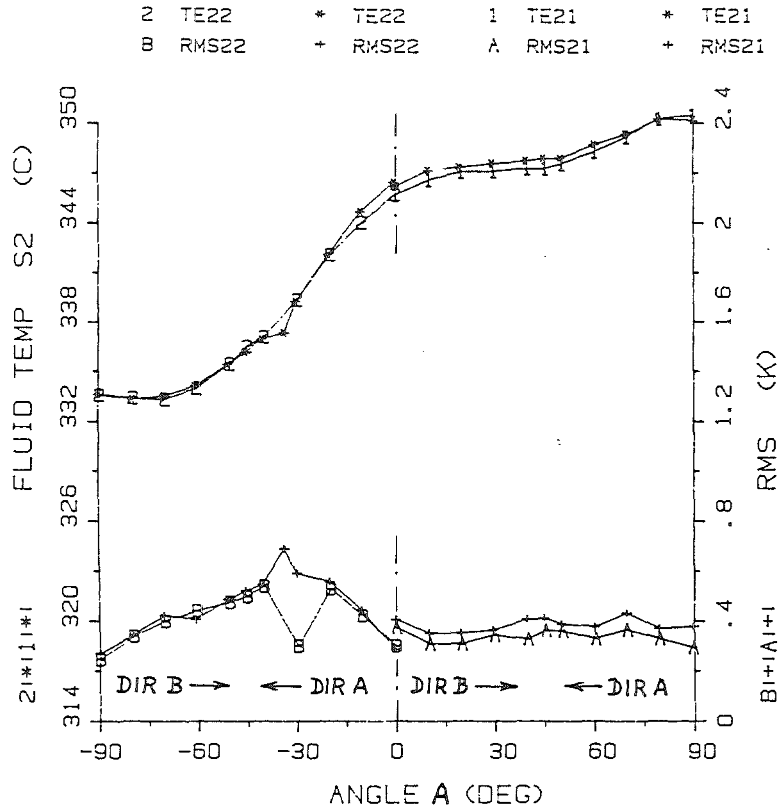
F36D44B. DAT
F36D44B. DAT
F36D44B. DAT



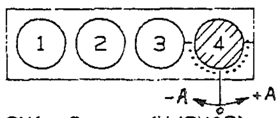
RE = 30200	QH1 = 0	(W/CM^2)	NB = 14.97	(KW)
PE = 178.67	QH2 = 0	(W/CM^2)	TEN = 296.24(C)	
MS = 1.58 (KG/S)	QH3 = 0	(W/CM^2)	A21 = 45.07	(DEG)
UB = .97 (M/S)	QH4 = 7.63	(W/CM^2)	A22 = 50.14	(DEG)

FIG. 63 TEGENA 1 FLUID TEMPERATURE

DIR B



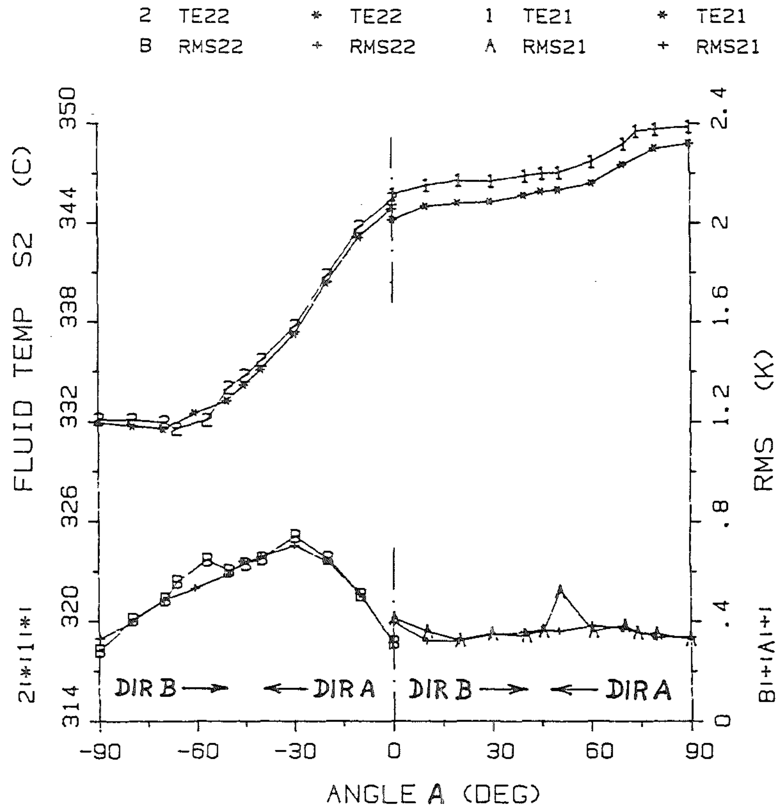
F70K43A.DAT
F70K43B.DAT
F70K44A.DAT
F70K44B.DAT



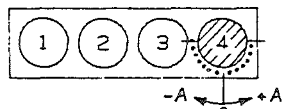
RE = 30400	QH1 = 0 (W/CM^2)	NB = 29.32 (KW)
PE = 177.41	QH2 = 0 (W/CM^2)	TEN = 299.42(C)
MS = 1.57 (KG/S)	QH3 = 0 (W/CM^2)	R22 = 13.04 (MM)
UB = .96 (M/S)	QH4 = 14.93 (W/CM^2)	R24 = 14.98 (MM)

FIG. 64 TEGENA 1 FLUID TEMPERATURE

DIR A DIR B(*+) TE22-21



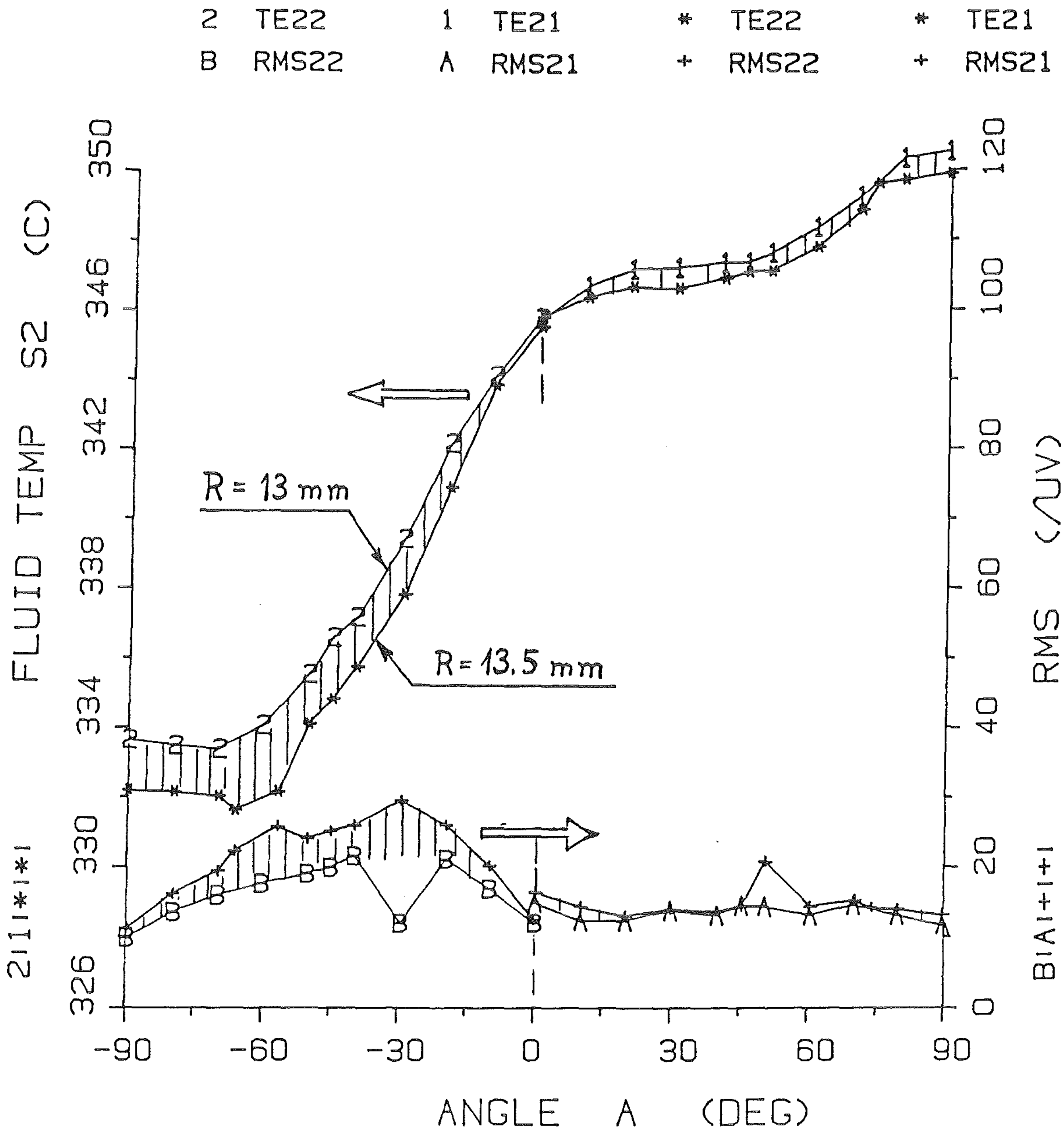
F71K43A.DAT
F71K43B.DAT
F71K44A.DAT
F71K44B.DAT



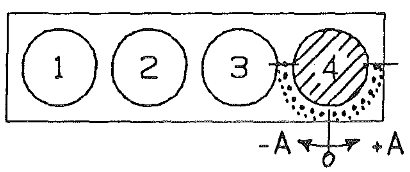
RE = 30800	QH1 = 0 (W/CM^2)	NB = 30.42 (KW)
PE = 180.34	QH2 = 0 (W/CM^2)	TEN = 298.75(C)
MS = 1.59 (KG/S)	QH3 = 0 (W/CM^2)	R22 = 13.51 (MM)
UB = .98 (M/S)	QH4 = 15.49 (W/CM^2)	R24 = 15.45 (MM)

FIG. 65 TEGENA 1 FLUID TEMPERATURE

DIR A DIR B(*+) TE22-21



K70K43A.DAT
K70K44A.DAT
K71K43A.DAT
K71K44A.DAT



RE = 29900
PE = 176.91
MS = 1.57 (KG/S)
UB = .96 (M/S)

QH1 = 0 (W/CM^2)
QH2 = 0 (W/CM^2)
QH3 = 0 (W/CM^2)
QH4 = 14.93 (W/CM^2)

NB = 29.32 (KW)
TEN = 299.52(C)
R22 = 13.04 (MM)
R21 = 13.16 (MM)

FIG. 66 TEGENA SODIUM TEMPERATURES

ONE ROD HEATED

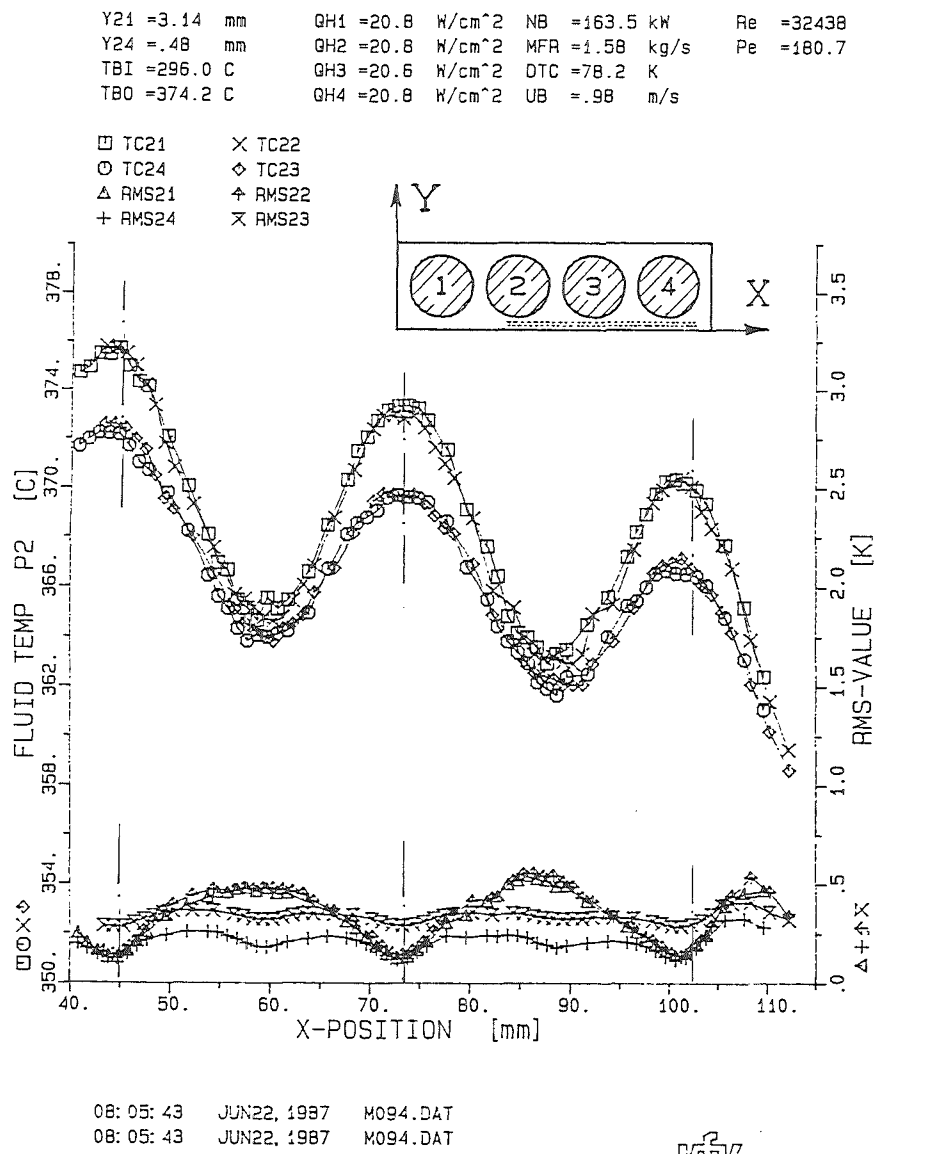


FIG. 67 TEGENA 2 - FLUID TEMPERATURES
PROBE 2 RMS VALUES

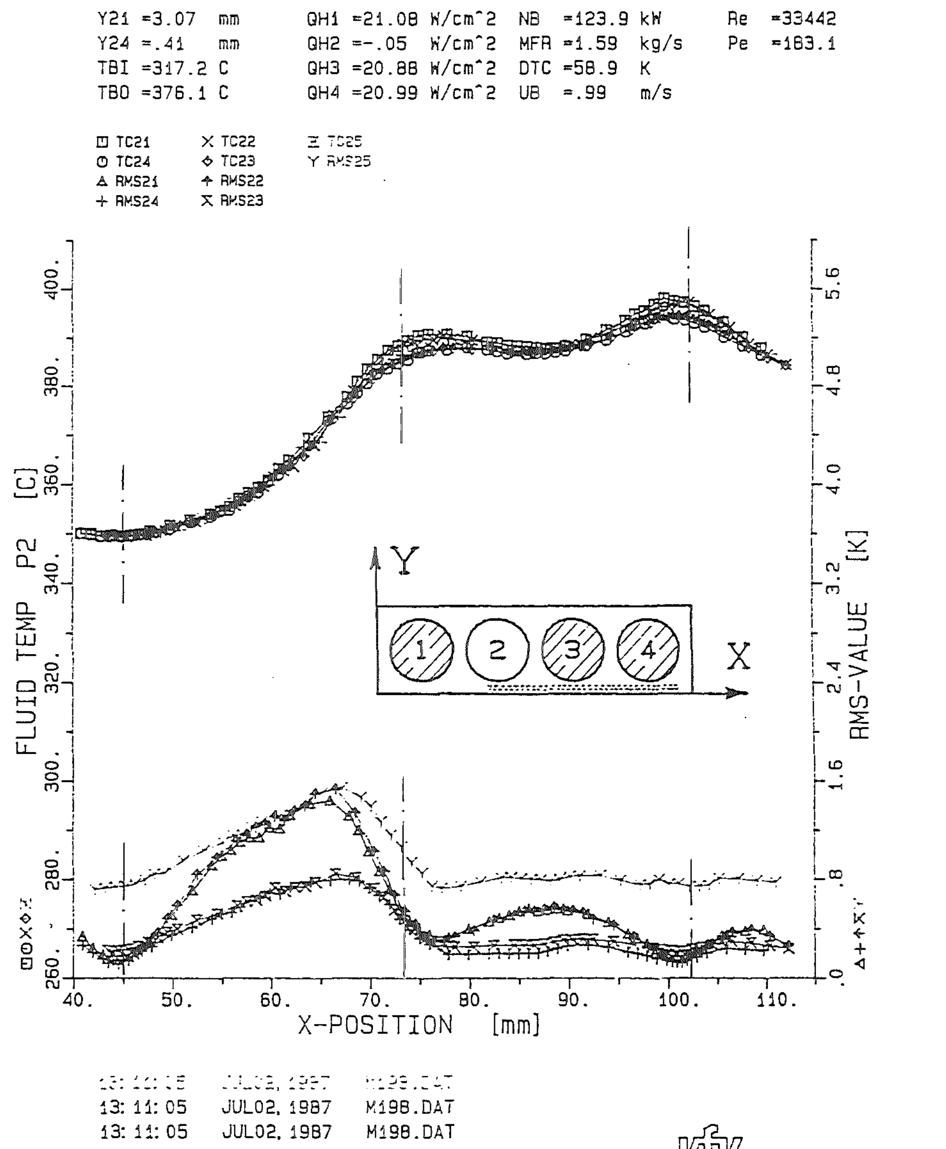


FIG. 68 TEGENA 2 - FLUID TEMPERATURES
PROBE 2

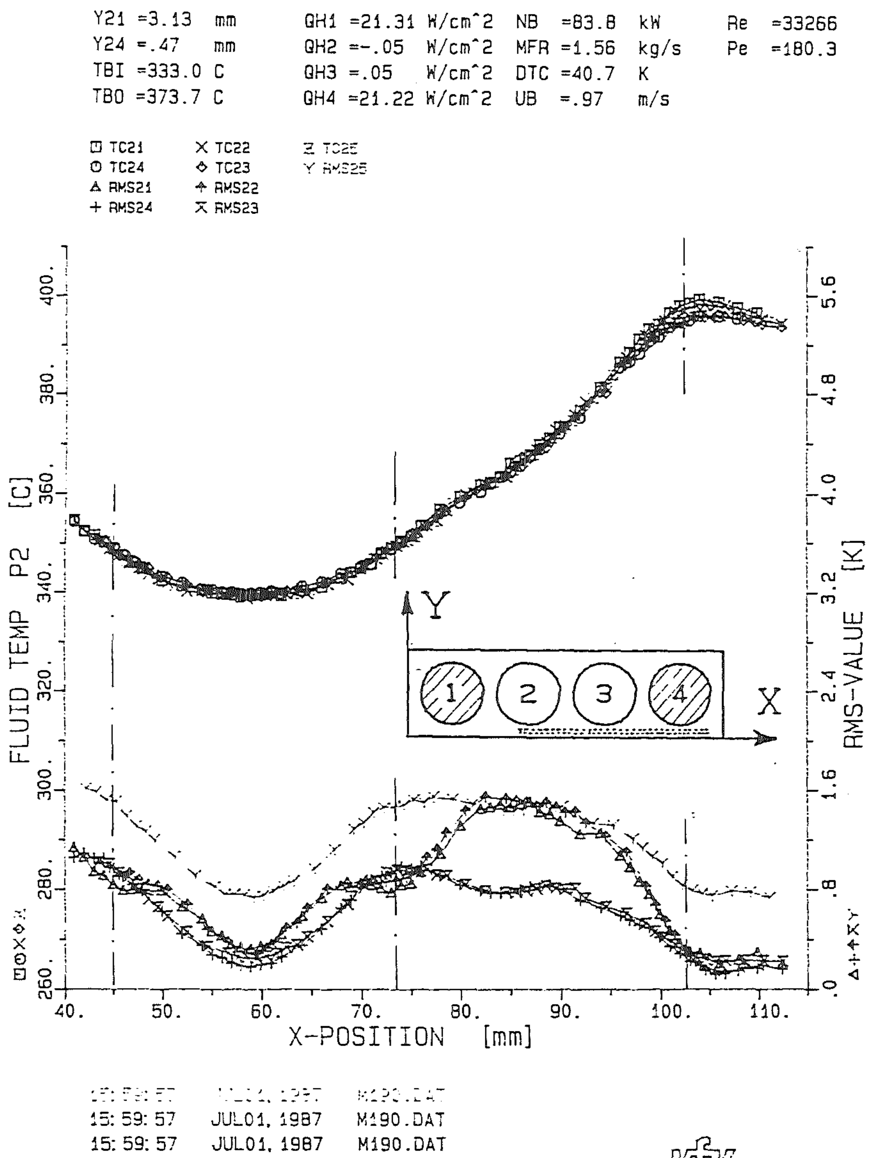


FIG. 69 TEGENA 2 - FLUID TEMPERATURES
PROBE 2

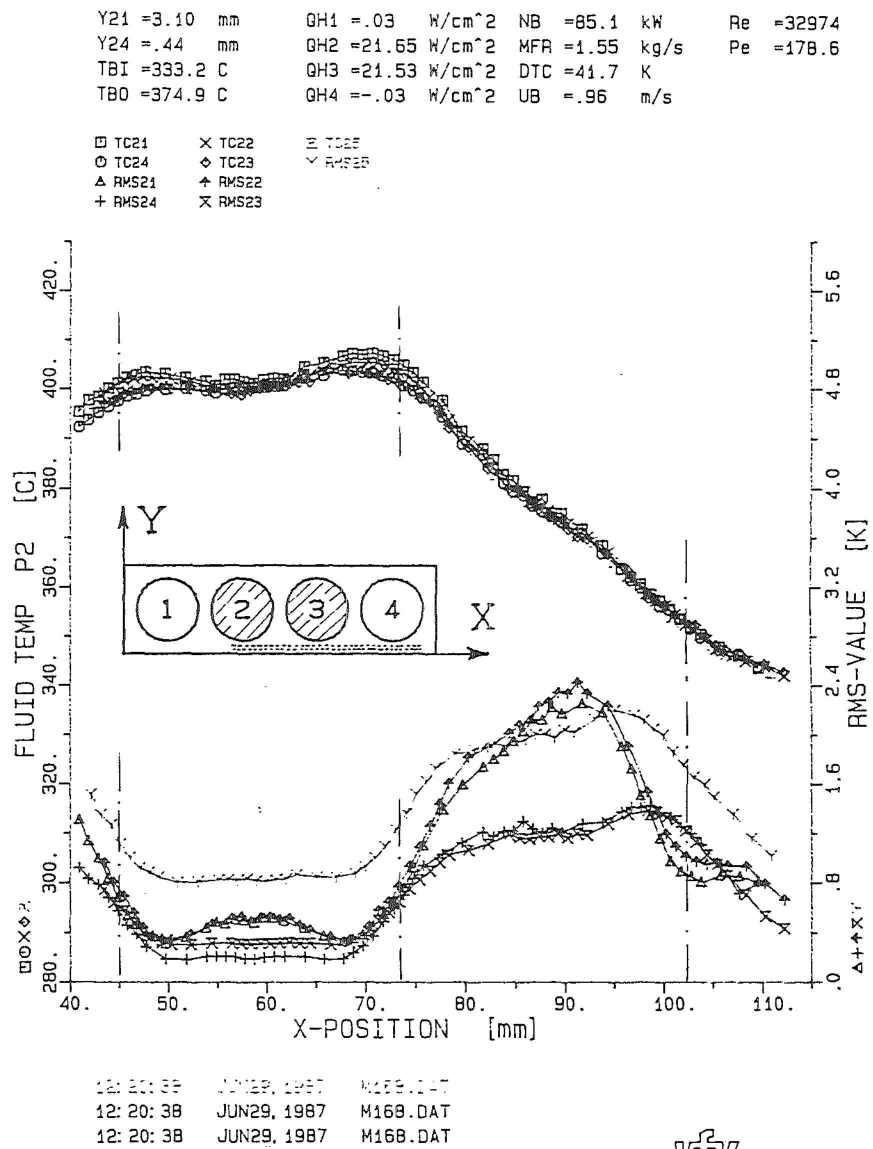


FIG. 70 TEGENA 2 - FLUID TEMPERATURES
PROBE 2

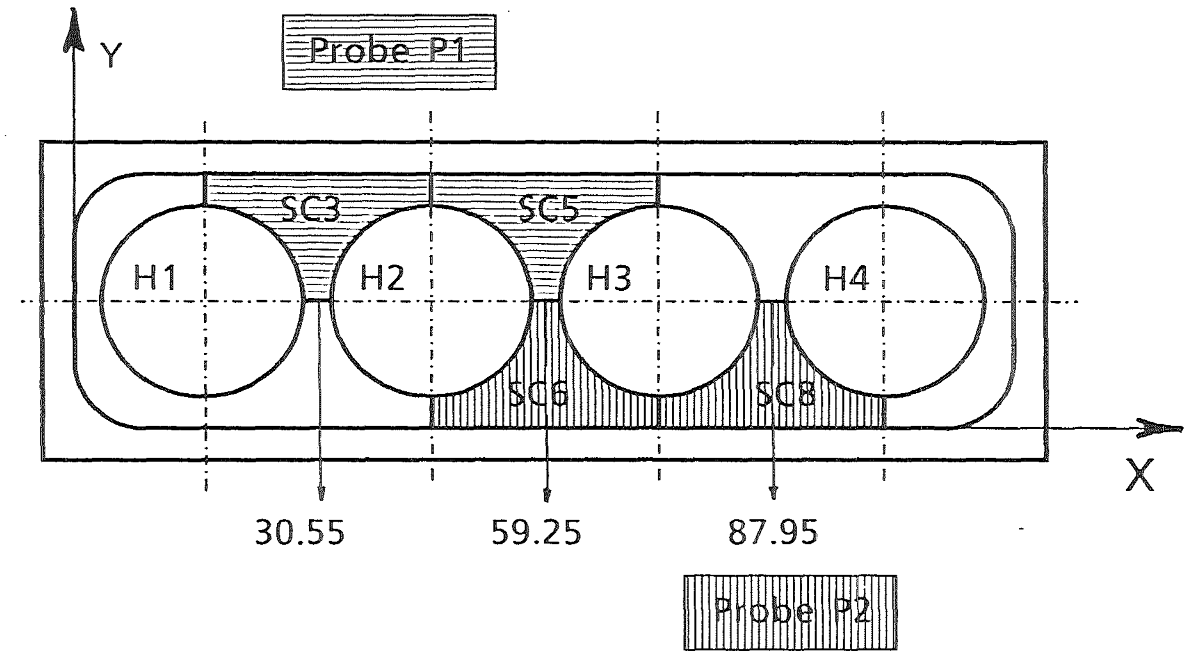


Fig. 71 Indication of subchannels for 2D-measurements

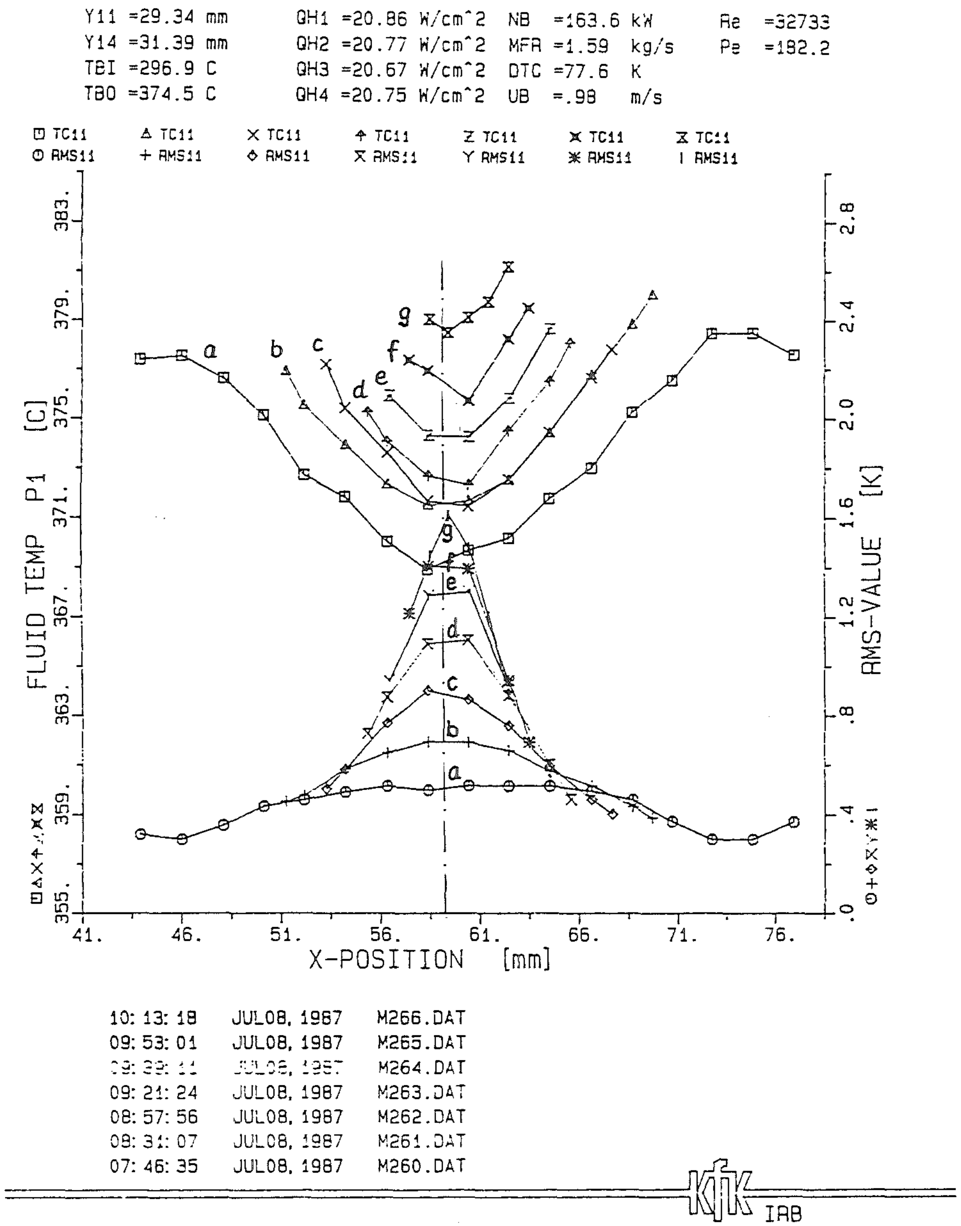


FIG. 72 TEGENA 2 - FLUID TEMPERATURES

PROBE 1 SUBCHANNEL 5

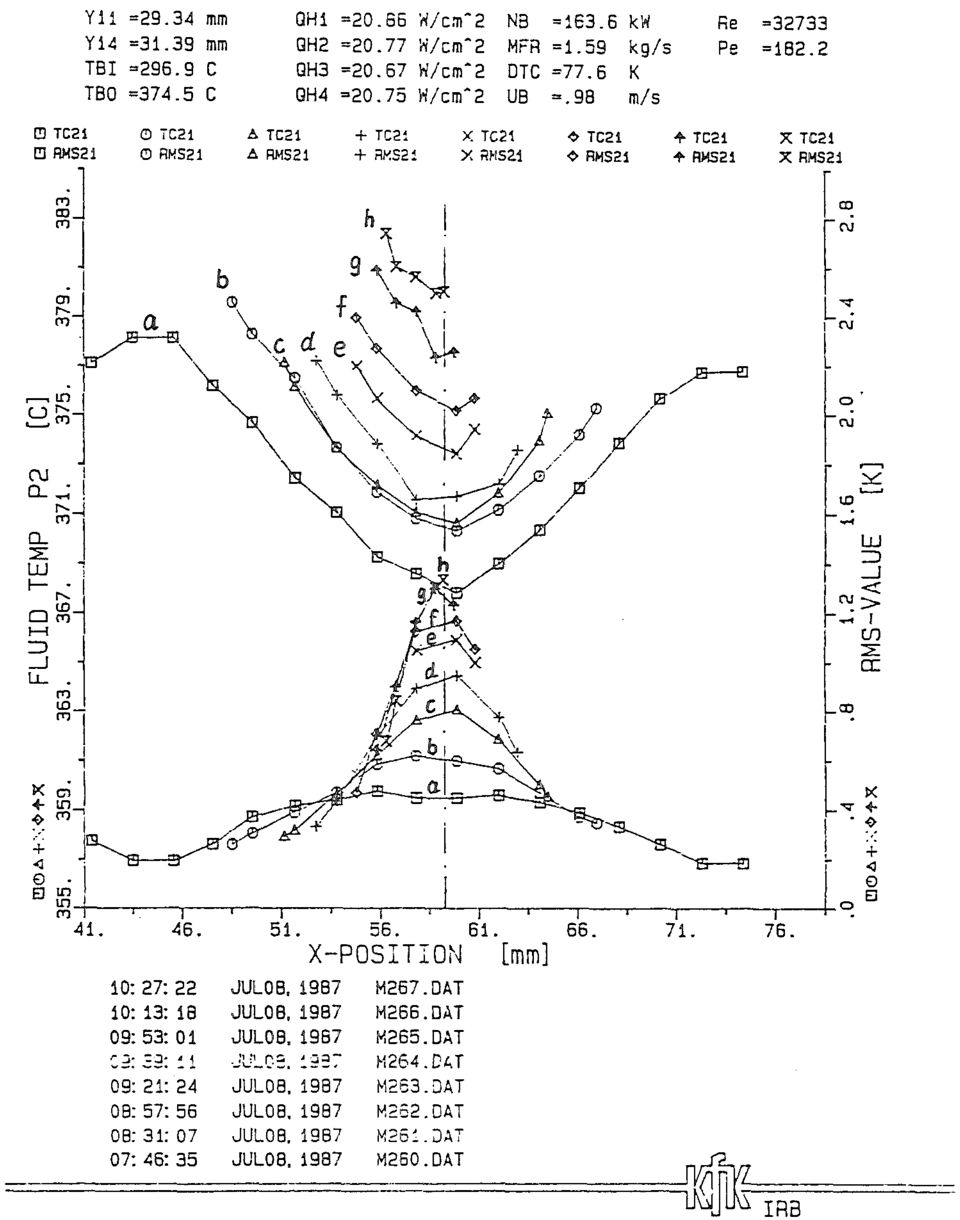


FIG. 73 TEGENA 2 - FLUID TEMPERATURES

PROBE 2 SUBCHANNEL 6

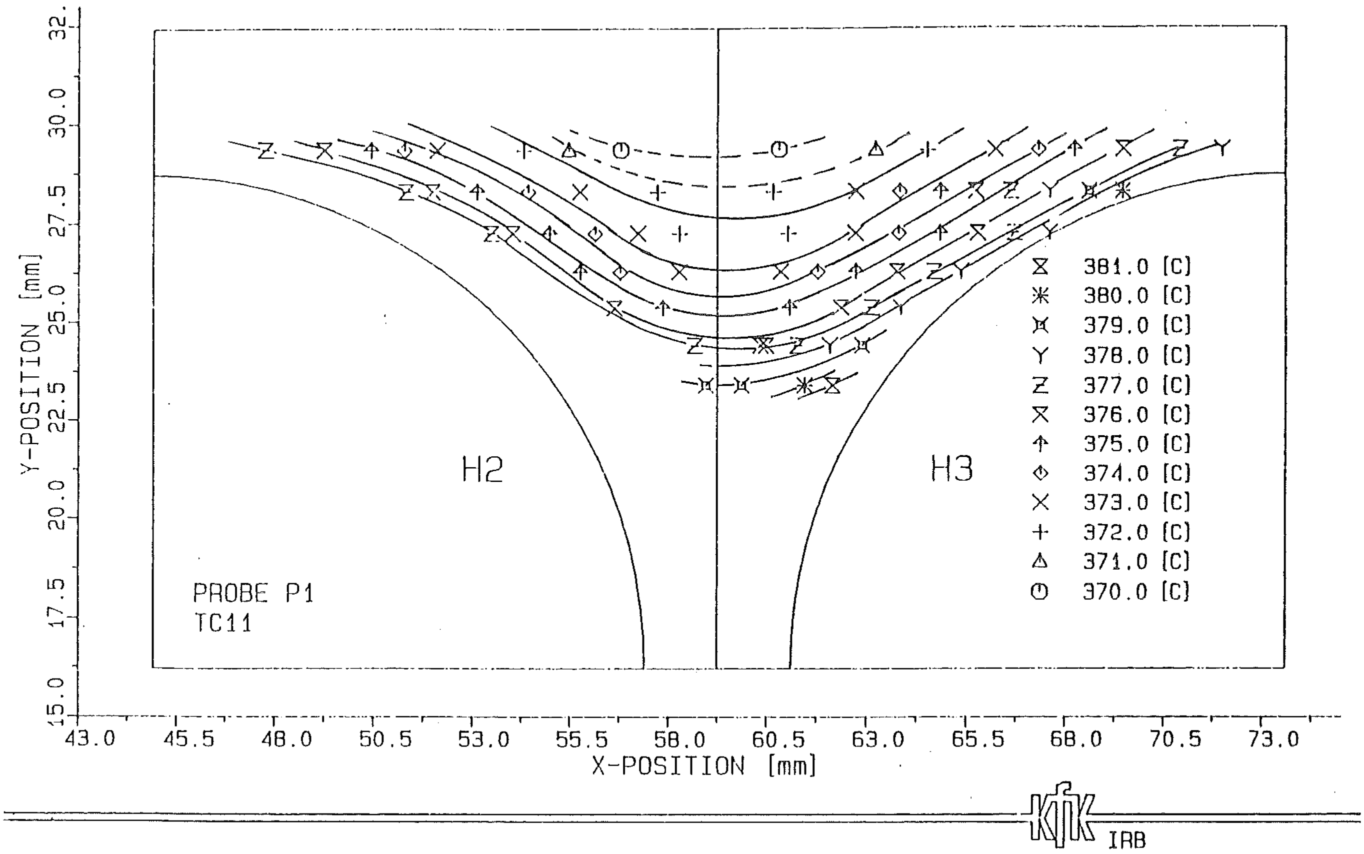


FIG.74 ISOTHERMS, SC5, P1, TC11, Re=33000, QH=21 W/cm^2

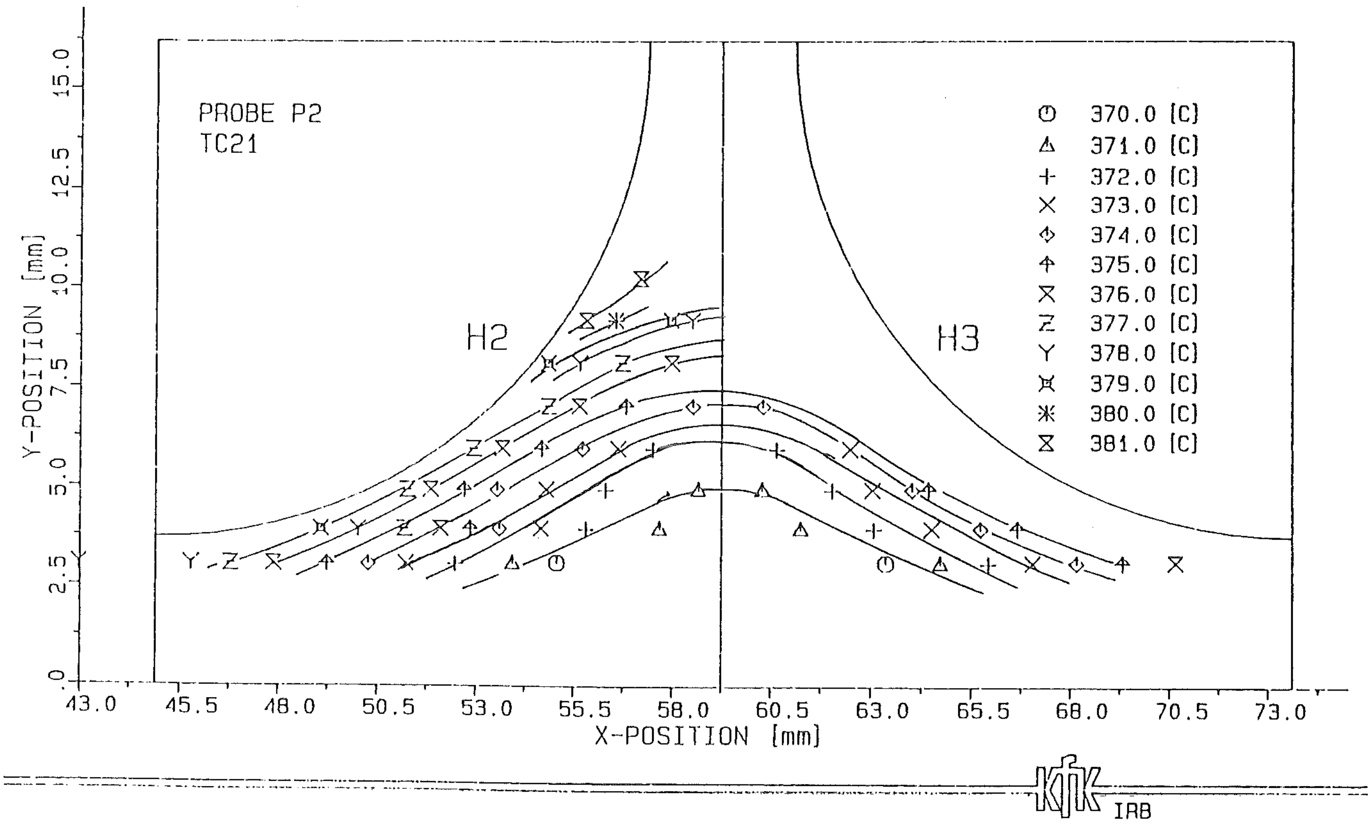


FIG.75 ISOTHERMS, SC6, P2, TC21, Re=33000, QH=21 W/cm^2

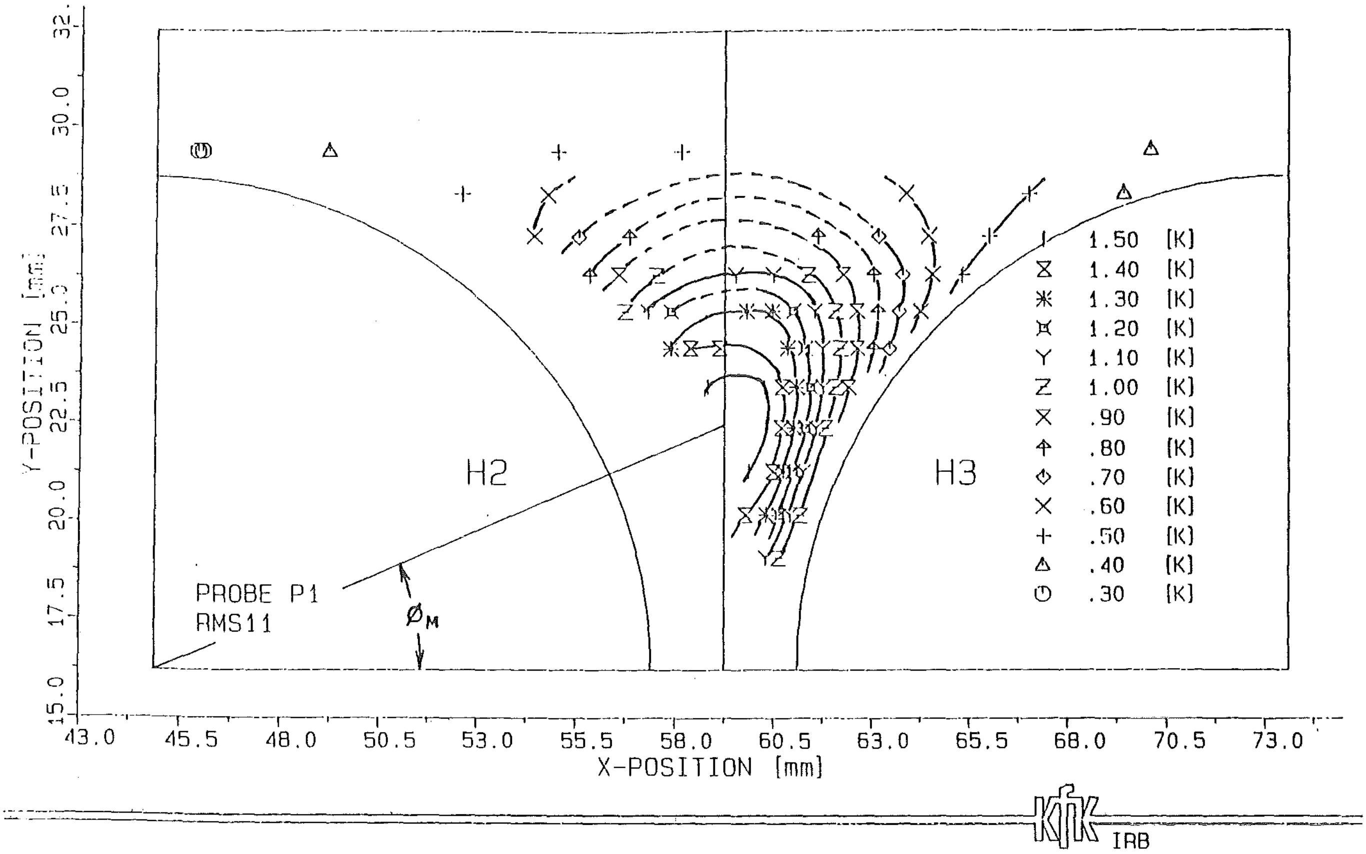


FIG.76 ISOFLUCTUATIONS, SC5, P1, RMS11, Re=33000, QH=21 W/cm^2

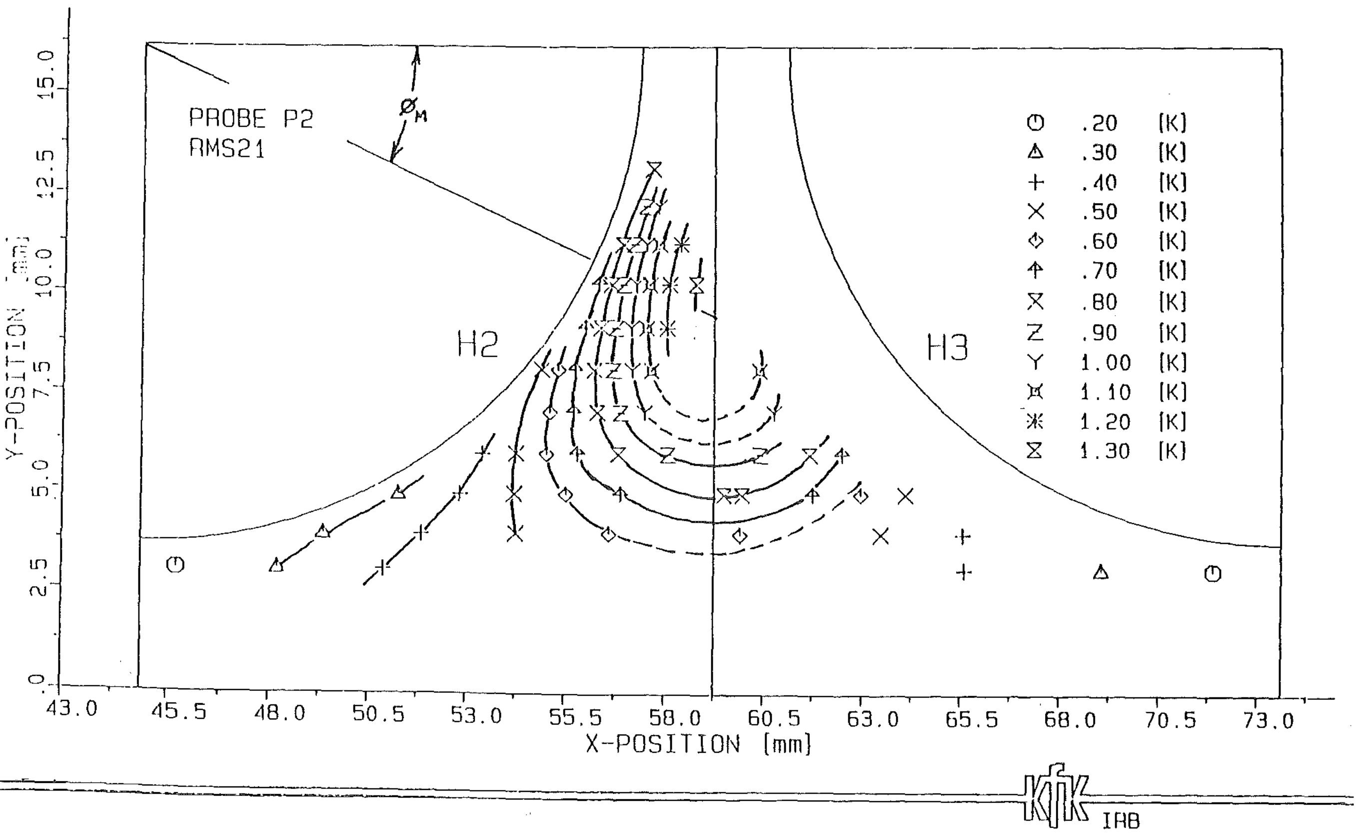
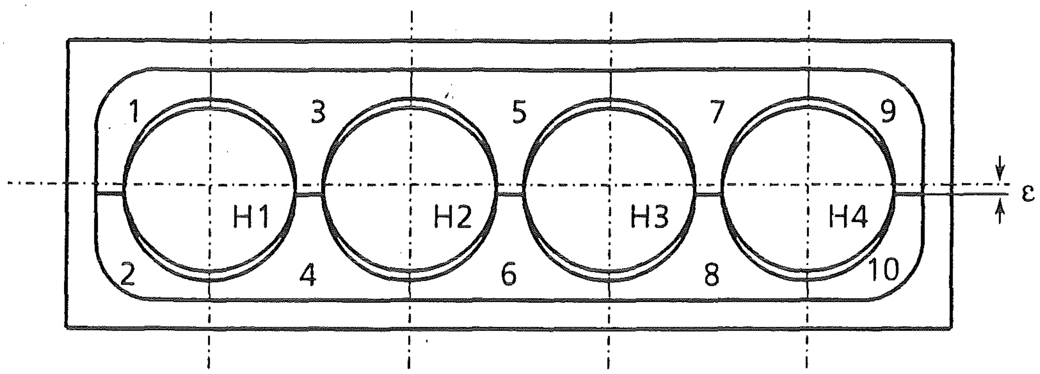


FIG.77 ISOFLUCTUATIONS, SC6, P2, RMS21, Re=33000, QH=21 W/cm^2



Bundle geometry

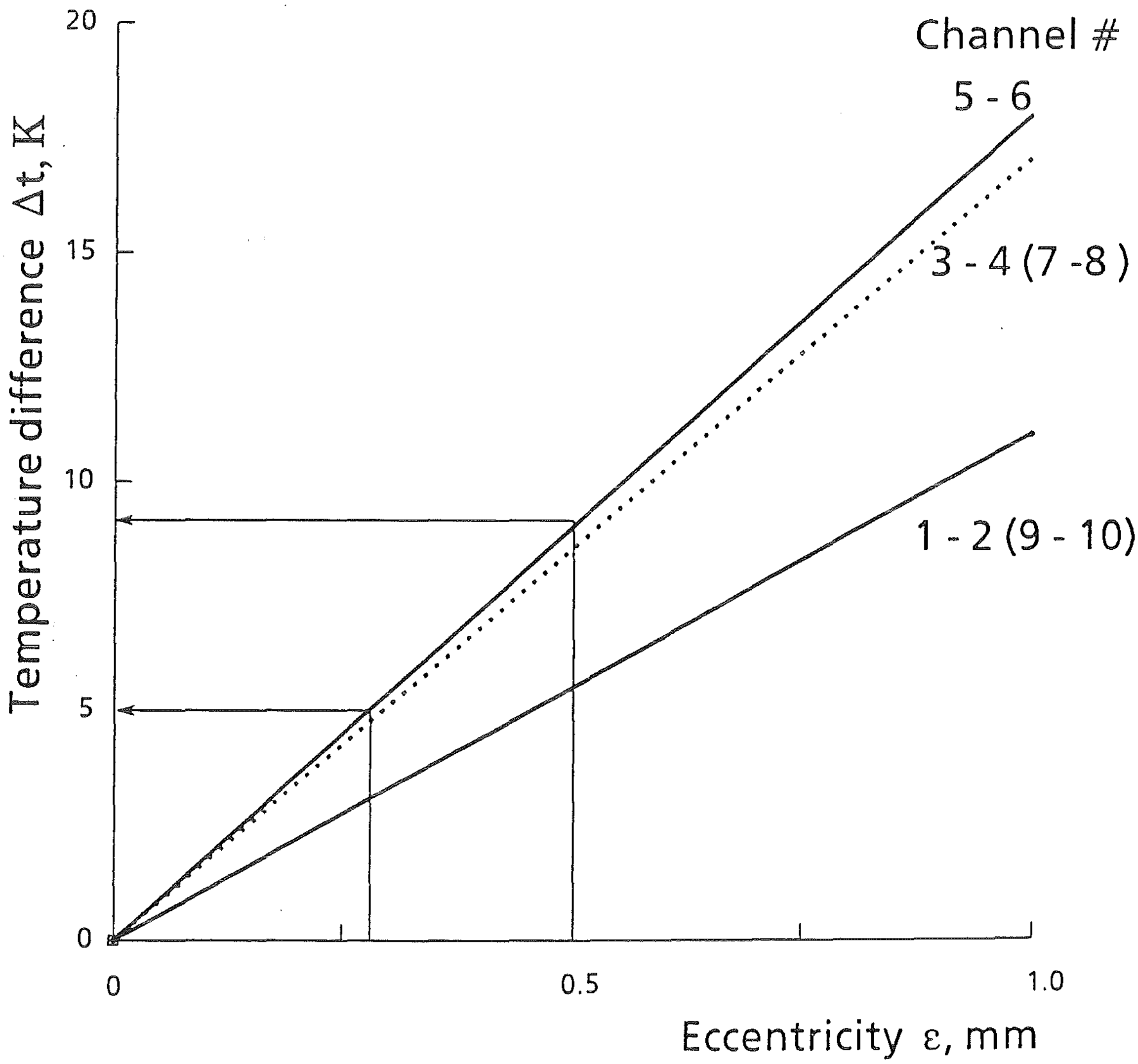


Fig. 78 Calculated subchannel temperature differences for eccentric bundle positions

ANNEX

CONTENTS

A1 EXPERIMENTAL FACILITY

A1.1 Sodium Test Rig WÜP II

The experiments were performed in the WÜP II sodium test bed. This is a closed loop (Fig. A1) with the following major components:

(1) test section;;
(2) electromagnetic pump with a maximum delivery of 60 m^3/h and a delivery head of 3.8 bar;
(3) heater with 120 kW power;
(4) inductive volume flowmeter;
(5) bypass line;
(6) two sodium air/heat exchangers connected in parallel, with a maximum cooling power of 325 kW each at 320°C sodium inlet temperature;
(7) sodium storage tank of 2 m^3 volume ;
(8) equalizing tank for compensation of sodium volume change and for garanteeing gas free sodium flow in the whole loop;
- the liquid metal specific auxiliary loops (sodium purification, inert gas system, etc.).

A1.2 Flow Development Section

The test section accommodating the 4-rod bundle is preceded by a flow development section where defined flow conditions at the test section inlet are generated. The flow development section (Fig. A2), which runs vertically, consists of a thermal compensator of 80 mm nominal width (1), an entrance tank (2) for flow tranquilization, and a rectangular flow development channel of about 1600 mm length (=31 hydraulic diameters DC; DC is defined as the four times free flow cross-section of the rectangular channel, divided by the wetted perimeter) with a flow straightener at its bottom end. The flow to the flow development section passes a U-shaped feed tube. The measured flow distributions at the outlet cross-section of the flow development section without and with internals (perforated plates and sieves, respectively) have been described in Section 4.1.

A1.3 Flow Channel (Rectangular Channel) and Spacers

The flow channel surrounds the four heater rods arranged in series; it is about 4 m long with a rectangular cross-section (Fig. A3). The rectangular channel is flanged together from 550 mm long segments. A spacer, which can be replaced, is provided in each flange connection. It consists of a frame with the spacer pins of 2 mm dia. and the three web plates of 0.5 mm wall thickness and 10 mm height. The latter are provided in the gaps between the heater rods. The spacer is so designed that it causes but negligible flow disturbances. The inner cross-section of the spacer frame is identical with the cross-section of the flow channel. This means that only the three spacer pins and the three web plates are unavoidable obstructions in the flow between the rods.

The channel segments were welded together from milled U-shaped half-shells. The rounded parts of the channel corners have 5 mm radii. The quality of the longitudinal weld decisively influences the tolerance of the channel segments. Minimum tolerances have been achieved by electron beam welding with the joint showing the shoulder sketched in Fig. A3 (detail "a"). The duct segments and the spacers are described in /25/.

The measurement of the channel segments after fabrication yielded the following mean values (actual values) for the channel widths and the channel depths in [mm]:

	External Dimensions		Internal Dimensions	
	Width	Depth	Width B	Depth T
Nominal values	130.5	44.4	118.5$\pm$0.05	32.4$\pm$0.05
Actual values	130.47$\pm$0.03	44.39+0.05 -0.07	118.5$\pm$0.04	32.4+0.07 -0.08

A1.4 Trace Heating and Thermal Insulation

The test section is provided with a trace heating consisting of electric heater rods 6 mm in diameter. At the rotation symmetric components (measuring chamber and flanges of flow channel segments) the heater rods are provided as concentric rings on the perimeter as well as on the bottom of the measuring chamber. In order to achieve the most uniform possible heating of the channel segments between the flanges meander shaped bent heater rods are installed at 20 mm distance from the large channel surfaces. This trace heating allows the test bed to be heated to about 500°C. This is necessary to eliminate by distillation the sodium residues out of the narrow gaps or pits before disassembly of the test bed. Before the test bed is filled with liquid sodium it has to be heated to about 150 to 200°C. The uniformity of radiation induced heating up to 500°C was tested in a preliminary test.

The thermal insulation of the test section makes up a 100 mm thick layer of glass wool. Around the rectangular channel flanged together from the eight segments the glass wool is enclosed in 16 concentric sheet metal half-shells, each of them suspended at the segment flanges so as to be flush. The meander shaped radiating heater rods mentioned before are attached to these half-shells, too (cf. Fig. 1, bottom).

In this way, layers of air of different thicknesses develop between the flanges of the channel segments, more particularly between the inner half-shells and the rectangular channel. The layer thicknesses range from 40 to 80 mm so that small differences result in the thermal insulation on the perimeter of the rectangular channel which has been demonstrated in isothermal measurements (cf. 6.2).

A1.5 Heater Rods

In the 4-rod bundle electric heater rods simulate the fuel rods. The heater rod diameter was chosen to be 25 mm, i.e. the greatest possible diameter achievable with the swaging machines available. Hence, upscaling against the fuel rods of breeder reactors is about 3:1. By this, detailed measurements can performed of the temperature profiles existing between the rods. The specified heated length of 2500 mm was considered sufficient to obtain a flow largely developed thermally under conditions of uniform load. The maximum heat flux density to be attained at the heater rod surface should be 85 W/cm² during permanent loading in test operation. To adapt the heater rods to an existing rectifier/high current system a current voltage ratio of 1850 A/90 V should be achieved which corresponds to an ohmic resistance of only 47 mΩ at 20°C.

As high performance heater rods of these sizes, satisfying the requirements described before, have not yet been fabricated until this day, two different heater rod concepts should be implemented with equal priority and independent of each other.

A modified development of the concept I (boron nitride heater rods with flexible current conductors and MgO core) has been successful. A heater rod specifically developed earlier for liquid metal experiments could be used /26/. The heater rods were fabricated by Interatom according to a technique developed by KfK. The layout of the heater rod has been represented schematically in Fig. A4. The heat is generated by ohmic heating in the current conductor, a three threaded helical strip. It flows through an approximately 1 mm thick insulating layer of powdered boron nitride to the cladding. The helical strip is filled with MgO powder as a mechanical support. The helical strip is extended on the rod ends by nickel and copper bolts in order to keep low the heat release from the so-called cold ends.

The concept II (Al_2O_3 heater rods received from EIR Würenlingen) has not been successful. The problems arising and the results of prototype measurements are described in /27/. Besides this heater rod concept, also the plan had to be abandoned to measure the azimuthal distribution of the heat flux density in the heater rod cladding.

A1.6 Measuring Chamber and Probe Adjusting Device

The cylindric measuring chamber arranged at the head of the test section (Figs. 1, 2) is 500 mm in inner diameter and 130 mm in height. The rectangular channel is flanged from the bottom such that it ends in the bottom of the measuring chamber. Air cooled freezing glands are flanged to the removable lid of the measuring chamber. This allows two heater rods to be rotated during test operation. Originally, it was planned to measure under the test program azimuthal temperature profiles of the cladding walls in the measuring planes ME1 through ME5 using a rod rotating device. However, the necessary instrumentation of the rod claddings by thermocouples was renounced later so that this program topic was not performed. Two identical measuring probe adjusting devices are arranged in the measuring chamber beside the long edges of the rectangular channel. They serve to position measuring probes in the main measuring plane ME6. Each measuring probe adjusting device consists of a cross slide with tolerance free ball bearing. The slide spindles are rotated by loosely coupled driving shafts by means of handwheels provided outside the measuring chamber. The driving shafts are sealed against escaping sodium by air cooled sodium freezing glands. To be able to determine the position of the slide and hence the position of the probe, full rotations of the slide spindle are indicated by a counter and the angular position of the slide spindle is indicated by a grading beside the handwheels. In parallel, the number of rotations and the angular positions of the spindle are scanned by a potentiometer as variable voltage values. The potentiometer is coupled to the driving shaft via a mechanical gear box. The potentiometer voltages are digitally displayed by the data acquisition system and recorded. The X and Y coordinates of the probe positions are displayed in units of mm; this serves to control manual probe setting at the test section with the handwheels; the readout on the grading disk is likewise expressed in mm. Views of the measuring chamber and the measuring probe adjusting device are shown in Fig. A5.

A2 PRELIMINARY TESTS

A.2.1 Heater Rod Testing

Prior to series fabrication of ten heater rods three prototype heater rods were tested for their reliability of operation /25/.

These were the requirements made:
- heat flux density on the rod surface QH ≈ 90 W/cm²;
- coolant temperatures 300 to 500°C.

In a first test series the rods were heated to about 880°C temperature level in stagnant air under steady-state conditions and the heat radiation emitted by the heater rods was recorded by a plate camera. The film pictures were measured with a densitometer; this provided a measure of the axial temperature constancy on the heater rod surface. Figure A6 shows as an example the densitometer evaluation of a film picture shot along 920 mm of heater rod length. It is visible from the traced isolines of temperature that there are local temperature deviations less than 10 K. The maximum inhomogeneity determined for a rod was 15 K which may be caused by an inhomogeneity of about 5% of the heat flux. Consequently, undesired local variations in power seem to be small. The determined power constancy can be considered good.

In a second test series the three prototype heater rods were tested in the sodium test bed WÜP II under tighter operating conditions. The rods were operated for 24 hours at full power with 90 W/cm² heat flux. The sodium inlet temperatures were about 350°C and the outlet temperatures about 520°C. In addition, the heater rods were disconnected ten times at full power. Towards the end of the period of testing the heat flux was temporarily increased to 140 W/cm² (~50% overload) at a mean sodium outlet temperature of 550°C. Also the central temperature (temperature of current conductor) was measured at one of the three rods. At the end of the heated zone it was 800°C at

134 W/cm² (sodium inlet temperature = 370°C, sodium outlet temperature = 550°C). These results confirm that the heater rods investigated are functionning under aggravated operating conditions.

Separate testing of the ten heater rods subsequently fabricated in series was initially restricted to the examinations of the first test series (heating in stagnant air to 880°C). The results were comparable with those obtained with the prototype heater rods. In Table A1 measured characteristic data of the ten series fabricated heater rods have been compiled. Four of the ten rods (H1, H2, H3, H4) were selected for the TEGENA 1 experiment. Single rod testing under aggravated operating conditions in sodium was dispensed with. During the TEGENA 1 test series the rods H2 and H3 became defective so that they could no longer be heated. Therefore, four new heater rods were selected for the TEGENA 2 test series (see Table A1) and tested individually under maximum operating conditions (100 W/cm², 500°C) with 20% overload in the sodium loop. These rods performed perfectly in the following main test.

Measured data of two cross-sections of the heater rod H2 from the TEGENA 1 test series have been compiled in Table A2. The maximum deviations of the different layer thicknesses from the respective mean value range from 2 to 9%.

Figure A7 is a photograph of a cross-section of the heater rod H2 from the TEGENA 1 test series. The current conducting three-thread helical strip can be recognized well.

A2.2 Testing the Measuring Chamber

The measuring chamber is provided with a number of openings for removable connections. In order to inspect all sealing points as well as the performance of the air cooled sodium freezing glands and the performance of the two probe adjusting devices, the measuring chamber was tested under operating conditions in flowing sodium up to 500°C over sixteen days in total. On seven days sodium velocity profiles were measured in the cross-section ME6 of the open rectangular channel (see Section 4.2). The essential test results and the measures derived from them have been described in detail in /27/.

Detailed information on the preliminary tests mentioned before are given in the reports /12, 18, 20, 27/.

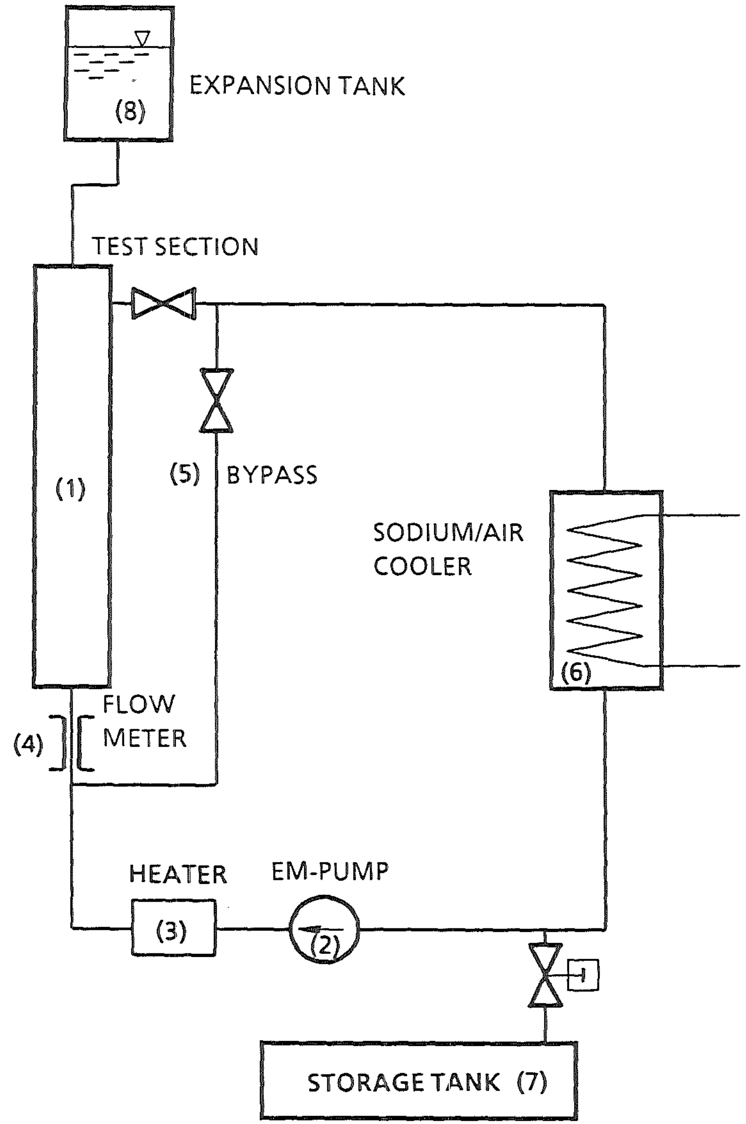


FIG.A1 SODIUM TEST RIG WÜP II

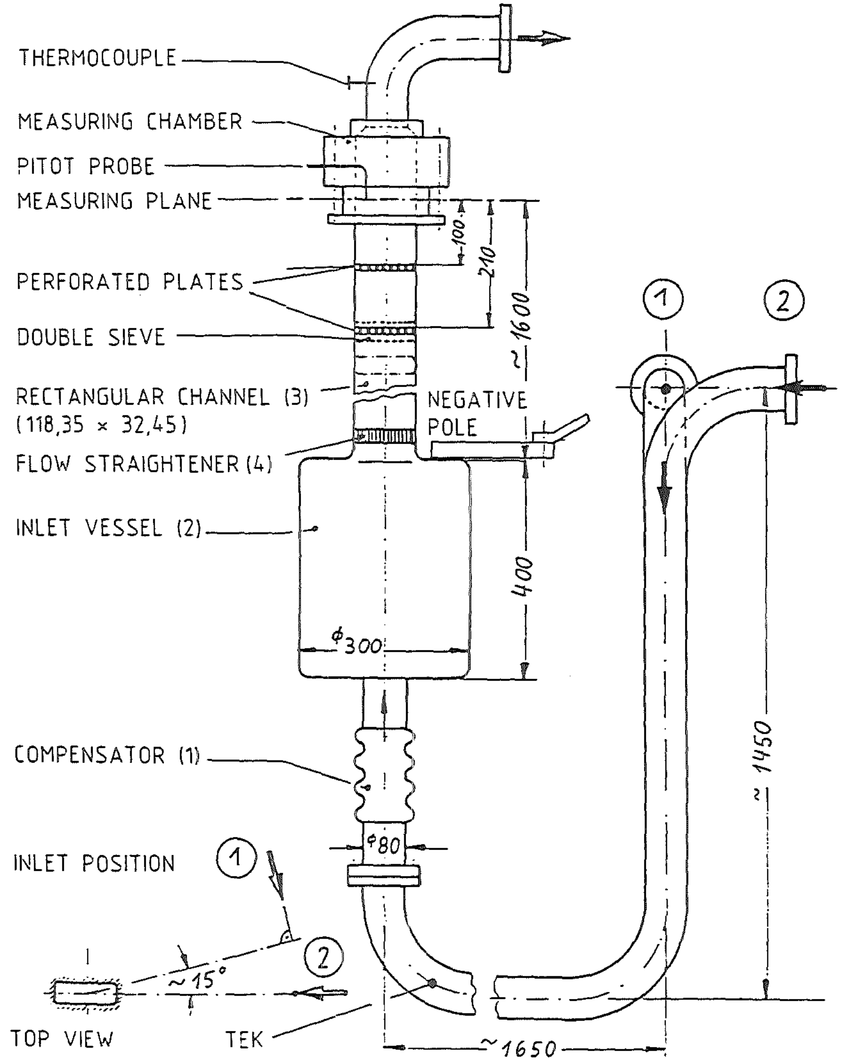


FIG. A2 ENTRANCE SECTION

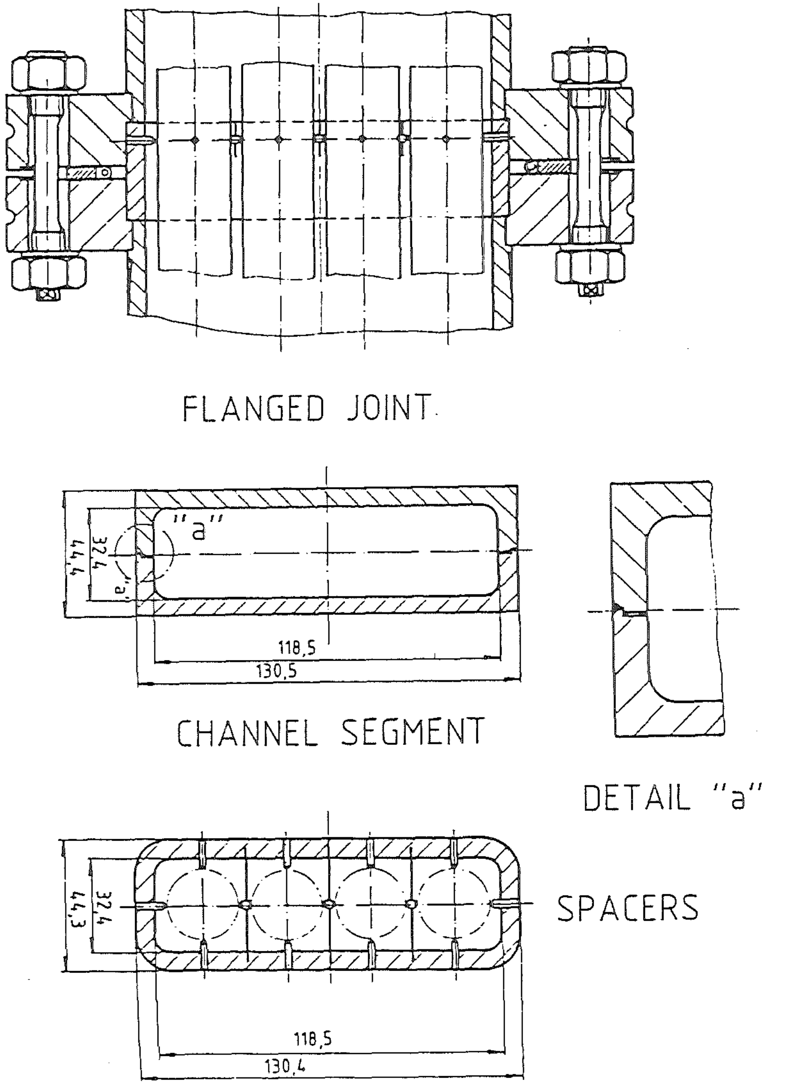


FIG. A3 RECTANGULAR FLOW CHANNEL

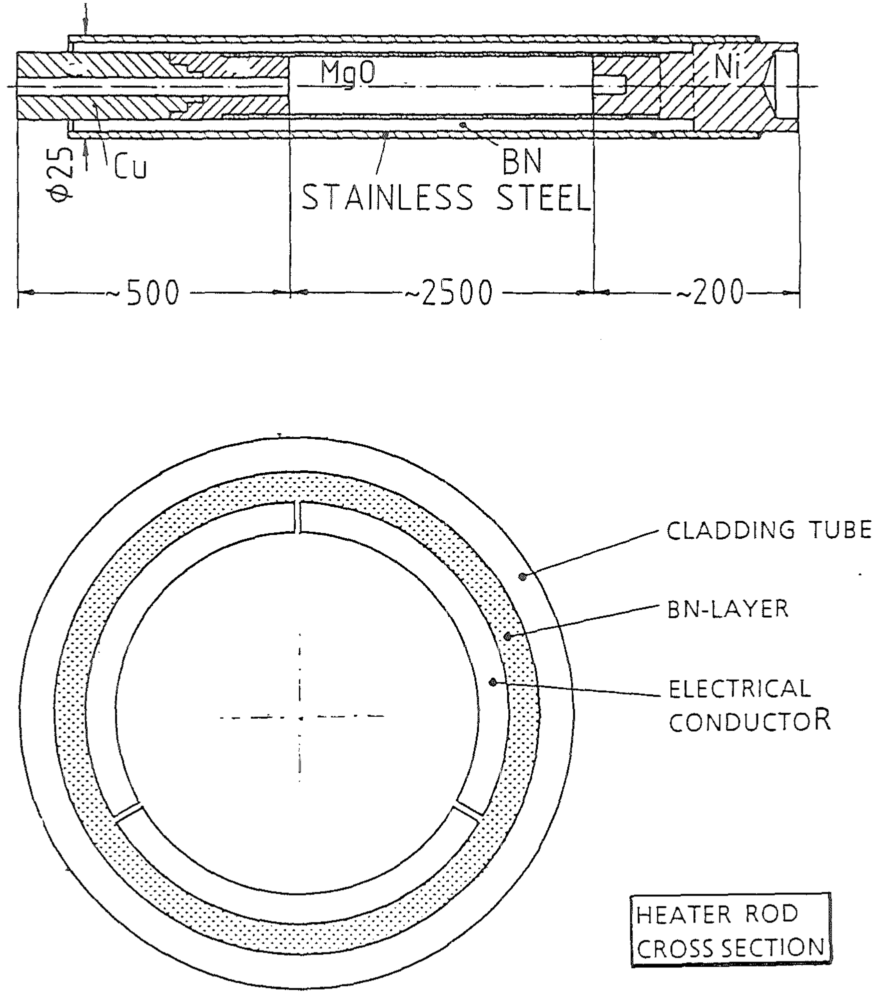
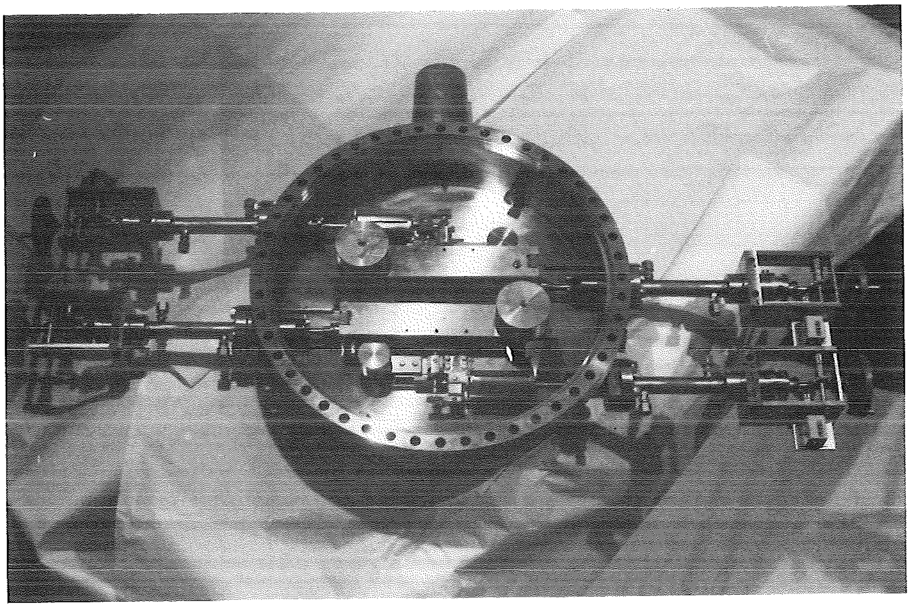
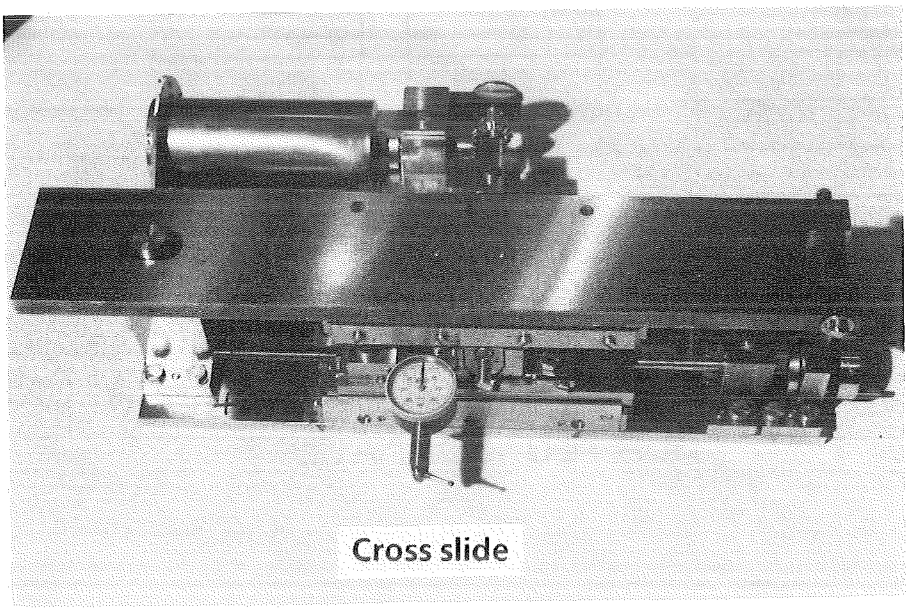


FIG. A4 HEATER ROD (SCHEMATIC)





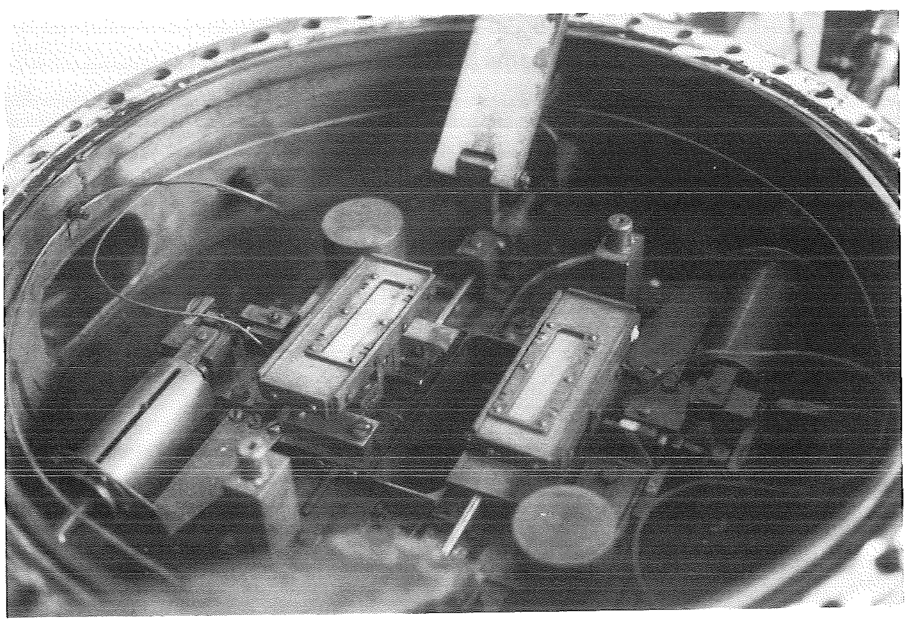


FIG. A5 PHOTOS OF THE MEASURING CHAMBER

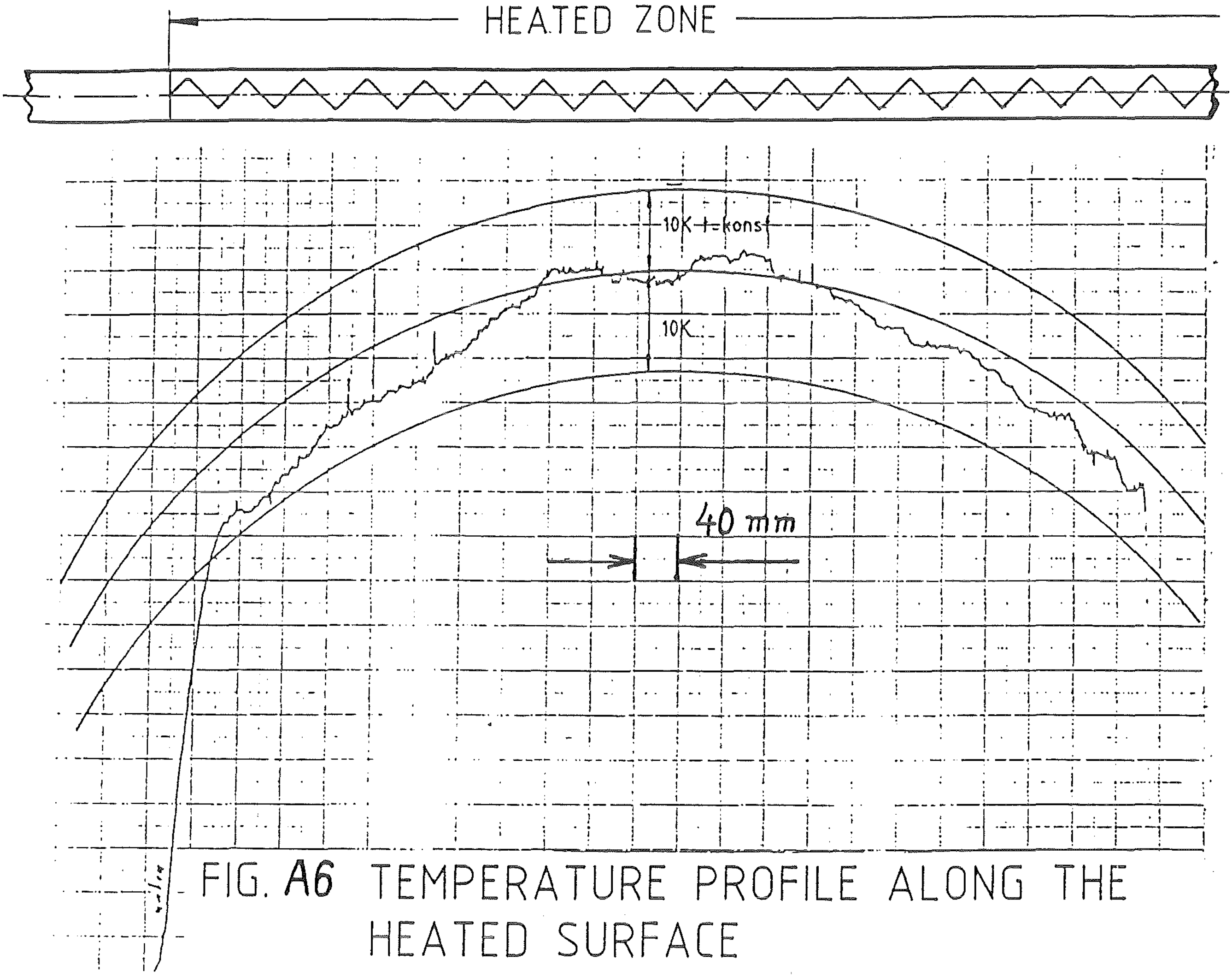


FIG. A6 TEMPERATURE PROFILE ALONG THE HEATED SURFACE

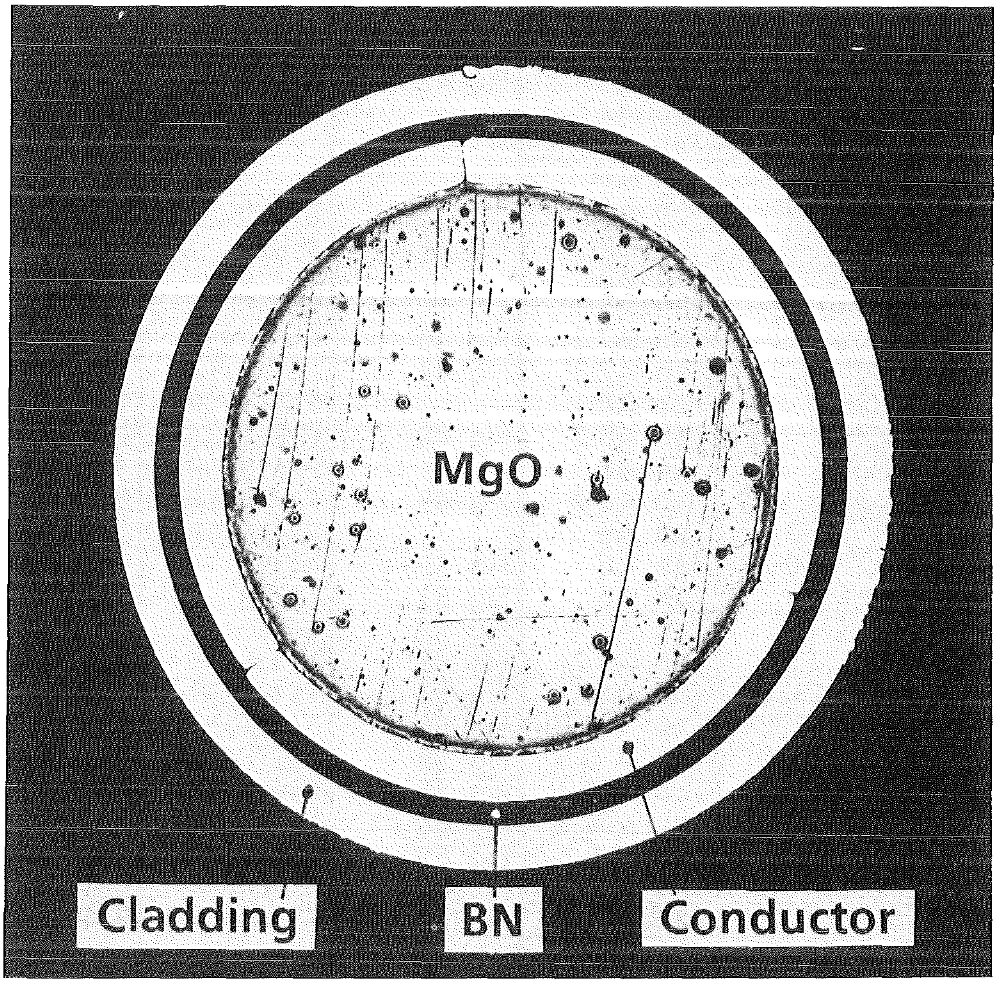


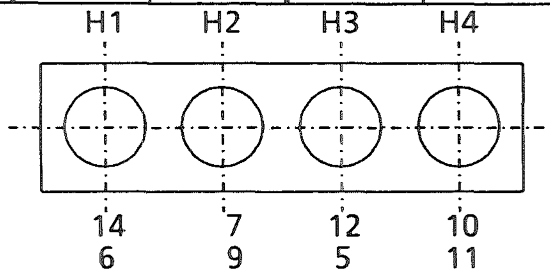
FIG. A7 PHOTO OF THE HEATER ROD CROSS SECTION

Zuordnung: Diagramme (Hauptteil) / Meßwerte-Tabellen (Anhang)

MAIN PART	CODE	ANNEX	MAIN PART	CODE	ANNEX
Fig. 11		Tab. A3.1-6	Fig. 42,43	M063	Tab. A25.1
Fig. 12		Tab. A4.1-6		M094	Tab. A26.1
Fig. 13		Tab. A5.1-6			
Fig. 14	I01T250	Tab. A6			
Fig. 15	I01T250	Tab. A6	—	M408	A27.1
	I07T250	Tab. A6	Fig. 44,45	M063	Tab. A25.2
	I52T250	Tab. A6		M094	Tab. A26.2
Fig. 16	M050	Tab. A7.1		M408	Tab. A27.2
	M054	Tab. A7.2	Fig. 46	F10LWSA	Tab. A28
	M058	Tab. A7.3	Fig. 47	F25LWSA	Tab. A29.1
Fig. 17	M295	Tab. A8.1		F25LWSB	Tab. A29.2
	M296	Tab. A8.2	Fig. 48	F26LWSA	Tab. A30.1
	M297	Tab. A8.3	—	F26LWSB	Tab. A30.2
	M298	Tab. A8.4	Fig. 49	F24LWSA	Tab. A31.1
Fig. 18	I01T250	Tab. A6		F24LWSB	Tab. A31.2
	I07T250	Tab. A6	Fig. 50	M094	Tab. A13.2
	I52T250	Tab. A6	Fig. 51	M198	Tab. A32
Fig. 19	F04Q12A	Tab. A9.1	Fig. 52	M190	Tab. A33
	F04Q12B	Tab. A9.2	Fig. 53	M168	Tab. A34
Fig. 20	W03A120	Tab. A10.1	Fig. 54	F31Q12B	Tab. A35
	W03A130	Tab. A10.2	Fig. 55	F37QWSA	Tab. A36
	W03A140	Tab. A10.3	Fig. 56	F35QW4A	Tab. A37
	W03A150	Tab. A10.4	Fig. 57	F30LWSB	Tab. A38
	W03A160	Tab. A10.5	Fig. 58	F32L43A	Tab. A39
Fig. 21	W05A075	Tab A11.1-4	Fig. 59	F38LW4A	Tab. A40
Fig. 22	W05B075	Tab A12.1-4	Fig. 60	F33D43A	Tab. A41
Fig. 23	M336	Tab. A13.1	Fig. 61	F33D43B	Tab. A42
Fig. 24,25,26	M336	Tab. A13.1	Fig. 62	F36D44A	Tab. A43
	M094	Tab. A13.2	Fig. 63	F36D44B	Tab. A44
	M080	Tab. A13.3	Fig. 64	F70K43A	Tab. A45
	M082	Tab. A13.4		F70K43B	Tab. A46
	M085	Tab. A13.5		F70K44A	Tab. A47
Fig. 27	F04Q12A	Tab. A14		F70K44B	Tab. A48
Fig. 28	F04Q12B	Tab. A15	Fig. 65	F71K43A	Tab. A49
Fig. 29	F06LWSA	Tab. A16		F71K43B	Tab. A50
Fig. 30	F06LWSB	Tab. A17		F71K44A	Tab. A51
Fig. 31	M332	Tab. A18.1		F71K44B	Tab. A52
Fig. 32	M334	Tab. A19.1	Fig. 66	s.Fig.64,65	
Fig. 33	M332	Tab. A18.2	Fig 67	M094	Tab. 26.2
Fig. 34	M334	Tab. A19.2	Fig. 68	M198	Tab. A53
Fig. 35	M336	Tab. A20.1	Fig. 69	M190	Tab. A54
Fig. 36	M336	Tab. A20.2	Fig. 70	M168	Tab. A55
Fig. 37	M104	Tab. A21.1	Fig. 72-77	M260	Tab. A56a
Fig. 38	M104	Tab. A21.2		M261	Tab. A56b
Fig. 39	M080	Tab. A22.1		M262	Tab. A56c
Fig. 40	M080	Tab. A22.2		M263	Tab. A56d
Fig. 41	M104	Tab. A21.1		M264	Tab. A56e
	M102	Tab. A23		M265	Tab. A56f
	M106	Tab. A24		M266	Tab. A56g

TABLE A1 TEGENA HEATER RODS (JUNE 1984)

MANUF. ROD N° (IA)	CURRENT-FLOW RESISTANCE R				IRB - EXPERIMENT				HEATED LENGTH L (IA)		R / LH
	INTERATOM		IRB(THOMSON-B)		~ 400°C		~880°C				
	COLD [mΩ]	NORM.	COLD [mΩ]	NORM.	[mΩ]	NORM.	[mΩ]	NORM.	[mm]	NORM.	
5	42.56	1.001	40.59	0.989	44.6	1.015	42.8	0.991	2499	0.995	17.13
6	42.08	0.990	40.5	0.987	43.8	0.996	42.7	0.989	2502	0.997	17.07
7	42.86	1.008	42.0	1.023	43.7	0.994	43.4	1.005	2516	1.002	17.25
8	42.54	1.001	41.4	1.009	43.2	0.983	43.1	0.998	2520	1.004	17.10
9	42.35	0.996	40.7	0.992	42.9	0.976	42.8	0.991	2505	0.998	17.09
10	42.20	0.993	40.8	0.994	44.0	1.000	43.2	1.000	2498	0.995	17.29
11	42.07	0.990	40.44	0.985	44.4	1.010	42.8	0.991	2512	1.000	17.04
12	42.50	1.000	41.02	1.000	43.5	0.990	43.4	1.005	2526	1.006	17.18
14	42.38	0.997	40.85	0.995	43.5	0.990	43.2	1.000	2505	0.998	17.25
16	43.60	1.026	42.07	1.025	46.0	1.046	44.3	1.026	2522	1.005	17.57
Ø	42.51		41.03		43.96		43.17		2510.5		17.2



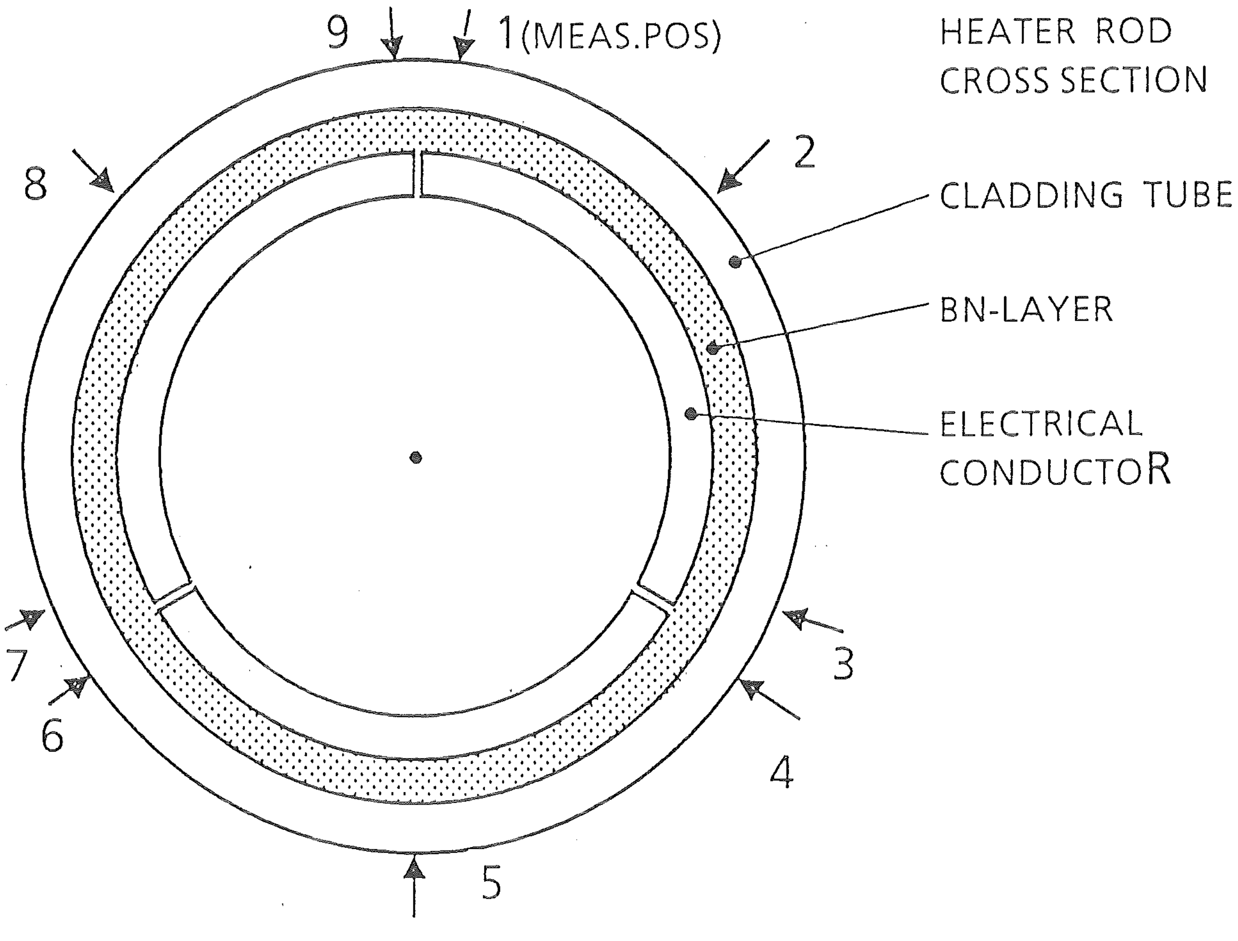
(HEATER ROD No)

(MANUF. ROD N°, TEGENA 1)
(MANUF. ROD N°, TEGENA 2)

TABLE A2 TEGENA 1, GEOMETRY OF HEATER ROD CROSS SECTION (HEATER ROD H2, PROBE A/N)

Meas. Pos.	Cladding Tube		BN-Layer		Electrical Conductor	
	A	N	A	N	A	N
1	1.48	1.36	0.62	0.72	1.35	1.39
2	1.38	1.41	0.67	0.73	1.47	1.39
3	1.35	1.41	0.71	0.75	1.46	1.37
4	1.43	1.39	0.59	0.70	1.35	1.37
5	1.41	1.39	0.69	0.73	1.37	1.39
6	1.43	1.47	0.71	0.76	1.36	1.39
7	1.41	1.46	0.62	0.75	1.34	1.40
8	1.47	1.49	0.67	0.73	1.38	1.42
9	1.49	1.45	0.69	0.73	1.35	1.40
∅	1.43	1.43	0.66	0.73	1.38	1.39
DAV	+0.06 -0.08	+0.06 -0.07	+0.05 -0.07	+0.03 -0.03	+0.09 -0.04	+0.03 -0.02

DAV = MAXIMUM DIVITATION OF AVERAGE VALUE ∅



TAB. A3.1 GS1, Y = 16.35 mm

T = 350 C, UC = 2.51 m/s, RE = 350 000

MS	X (MM)	SSP (MKV)	U (M/S)	U /UC
1	1.50	23.51	1.90	0.76
2	3.50	27.82	2.25	0.89
3	5.50	29.57	2.39	0.95
4	7.50	30.66	2.48	0.99
5	9.50	32.13	2.59	1.03
6	11.50	33.40	2.70	1.07
7	13.50	34.51	2.79	1.11
8	15.50	34.81	2.81	1.12
9	17.50	35.51	2.87	1.14
10	19.50	35.95	2.90	1.16
11	21.50	36.19	2.92	1.16
12	25.50	36.19	2.92	1.16
13	29.50	36.50	2.95	1.17
14	33.50	36.95	2.98	1.19
15	37.50	37.30	3.01	1.20
16	41.50	37.58	3.03	1.21
17	45.50	37.76	3.05	1.21
18	49.50	37.89	3.06	1.22
19	53.50	38.27	3.09	1.23
20	57.50	38.35	3.10	1.23
21	61.50	38.01	3.07	1.22
22	65.50	38.24	3.09	1.23
23	69.50	38.18	3.08	1.23
24	73.50	37.85	3.06	1.22

TAB. A3.2 GS1, Y = 16.35 mm

T = 420 C, UC = 2.51 m/s, RE = 420 000

MS	X (MM)	SSP (MKV)	U' (M/S)	U /UC
1	38.50	37.45	3.02	1.20
2	38.50	36.77	2.97	1.18
3	38.50	36.83	2.97	1.18
4	38.50	36.99	2.99	1.19
5	38.50	36.72	2.96	1.18
6	38.50	36.78	2.97	1.18
7	38.50	36.69	2.96	1.18
8	38.50	37.05	2.99	1.19
9	38.50	36.48	2.95	1.17
10	38.50	36.86	2.98	1.19
11	38.50	36.90	2.98	1.19
12	38.50	36.66	2.96	1.18
13	38.50	36.80	2.97	1.18
14	38.50	36.78	2.97	1.18
15	38.50	36.85	2.98	1.19
16	38.50	36.69	2.96	1.18
17	38.50	37.85	3.06	1.22
18	38.50	36.63	2.96	1.18
19	38.50	36.75	2.97	1.18
20	38.50	36.87	2.98	1.19
21	38.50	36.67	2.96	1.18
22	38.50	37.05	2.99	1.19
23	38.50	36.86	2.98	1.19
24	38.50	36.87	2.98	1.19

TAB. A3.3 GS1, Y = 16.35 mm

T = 350 C, UC = 2.51 m/s, RE = 350 000

MS	X (MM)	SSP (MKV)	U (M/S)	U /UC
1	1.50	24.01	1.94	0.77
2	3.50	27.68	2.23	0.89
3	5.50	29.22	2.36	0.94
4	7.50	30.36	2.45	0.98
5	9.50	32.09	2.59	1.03
6	11.50	32.93	2.66	1.06
7	13.50	34.07	2.75	1.10
8	15.50	34.82	2.81	1.12
9	17.50	35.28	2.85	1.13
10	19.50	35.72	2.88	1.15
11	21.50	35.80	2.89	1.15
12	25.50	36.22	2.92	1.17
13	29.50	36.54	2.95	1.18
14	33.50	37.05	2.99	1.19
15	37.50	37.17	3.00	1.20
16	41.50	37.57	3.03	1.21
17	45.50	37.79	3.05	1.22
18	49.50	37.90	3.06	1.22
19	53.50	38.08	3.07	1.22
20	57.50	38.23	3.09	1.23
21	61.50	38.33	3.09	1.23
22	65.50	38.44	3.10	1.24
23	69.50	38.23	3.09	1.23
24	73.50	38.27	3.09	1.23

TAB. A3.4 GS2, Y = 16.35 mm
T = 350 C, UC = 2.51 m/s, RE = 350 000

MS	X (MM)	SSP (MKV)	U (M/S)	U/UC
1	117.60	23.67	1.91	0.76
2	115.60	26.40	2.13	0.85
3	113.60	27.94	2.26	0.90
4	111.60	29.96	2.42	0.96
5	109.60	30.83	2.49	0.99
6	107.60	32.56	2.63	1.05
7	105.60	33.85	2.73	1.09
8	103.60	34.79	2.81	1.12
9	101.60	35.24	2.85	1.13
10	99.60	35.77	2.89	1.15
11	97.60	35.85	2.89	1.15
12	93.60	36.51	2.95	1.17
13	89.60	36.90	2.98	1.19
14	85.60	37.70	3.04	1.21
15	81.60	38.10	3.08	1.23
16	77.60	38.35	3.10	1.23
17	73.60	38.26	3.09	1.23
18	69.60	38.55	3.11	1.24
19	65.60	38.93	3.14	1.25
20	61.60	38.97	3.15	1.25
21	57.60	38.99	3.15	1.25
22	53.60	38.94	3.14	1.25
23	49.60	38.65	3.12	1.24
24	45.60	38.42	3.10	1.24

TAB. A3.5 GS2, Y = 16.35 mm
T = 420 C, UC = 2.51 m/s, RE = 420 000

MS	X (MM)	SSP (MKV)	U (M/S)	U/UC
1	117.60	24.12	1.95	0.78
2	115.60	26.65	2.15	0.86
3	113.60	28.66	2.31	0.92
4	111.60	29.75	2.40	0.96
5	109.60	31.07	2.51	1.00
6	107.60	32.53	2.63	1.05
7	105.60	33.77	2.73	1.09
8	103.60	34.74	2.80	1.12
9	101.60	35.43	2.86	1.14
10	99.60	35.92	2.90	1.16
11	97.60	36.14	2.92	1.16
12	93.60	36.34	2.93	1.17
13	89.60	36.91	2.98	1.19
14	85.60	37.33	3.01	1.20
15	81.60	37.93	3.06	1.22
16	77.60	37.66	3.04	1.21
17	73.60	38.13	3.08	1.23
18	69.60	37.81	3.05	1.22
19	65.60	38.37	3.10	1.23
20	61.60	38.37	3.10	1.23
21	57.60	38.18	3.08	1.23
22	53.60	38.03	3.07	1.22
23	49.60	37.63	3.04	1.21
24	45.60	37.77	3.05	1.21

TAB. A3.6 GS2, Y = 16.35 mm
T = 350 C, UC = 2.51 m/s, RE = 350 000

MS	X (MM)	SSP (MKV)	U (M/S)	U/UC
1	117.60	23.92	1.93	0.77
2	115.60	26.91	2.17	0.87
3	113.60	28.35	2.29	0.91
4	111.60	29.46	2.38	0.95
5	109.60	31.31	2.53	1.01
6	107.60	32.52	2.63	1.05
7	105.60	33.48	2.70	1.08
8	103.60	34.45	2.78	1.11
9	101.60	35.15	2.84	1.13
10	99.60	35.39	2.86	1.14
11	97.60	35.88	2.90	1.15
12	93.60	36.45	2.94	1.17
13	89.60	36.86	2.98	1.19
14	85.60	37.36	3.02	1.20
15	81.60	37.64	3.04	1.21
16	77.60	38.01	3.07	1.22
17	73.60	38.25	3.09	1.23
18	69.60	38.23	3.09	1.23
19	65.60	38.14	3.08	1.23
20	61.60	38.71	3.13	1.25
21	57.60	38.46	3.11	1.24
22	53.60	38.09	3.08	1.23
23	49.60	38.17	3.08	1.23
24	45.60	38.18	3.08	1.23

TAB. A4.1 GS1 Y=16.35mm
T=350 C, UC=2.51m/s, RE=350000

MS	X (MM)	SSP (MKV)	U: (M/S)	U:/UC
1	1.50	22.53	1.82	0.72
2	3.50	25.75	2.08	0.83
3	5.50	27.10	2.19	0.87
4	7.50	27.75	2.24	0.89
5	9.50	28.80	2.33	0.93
6	11.50	30.16	2.44	0.97
7	13.50	31.31	2.53	1.01
8	15.50	31.99	2.58	1.03
9	17.50	32.46	2.62	1.04
10	19.50	32.85	2.65	1.06
11	21.50	32.99	2.66	1.06
12	25.50	33.41	2.70	1.07
13	29.50	34.13	2.76	1.10
14	33.50	34.37	2.78	1.11
15	37.50	34.56	2.79	1.11
16	41.50	34.85	2.81	1.12
17	45.50	35.14	2.84	1.13
18	49.50	35.77	2.89	1.15
19	53.50	35.90	2.90	1.15
20	57.50	35.84	2.89	1.15
21	61.50	35.78	2.89	1.15
22	65.50	35.94	2.90	1.16
23	69.50	35.76	2.89	1.15
24	73.50	35.44	2.86	1.14

TAB. A4.2 GS1 Y=24.35mm
T=350 C, UC=2.51m/s, RE=350000

MS	X (MM)	SSP (MKV)	U: (M/S)	U:/UC
1	1.50	23.74	1.92	0.76
2	3.50	26.92	2.17	0.87
3	5.50	28.26	2.28	0.91
4	7.50	29.32	2.37	0.94
5	9.50	30.24	2.44	0.97
6	11.50	30.92	2.50	0.99
7	13.50	31.57	2.55	1.02
8	15.50	31.92	2.58	1.03
9	17.50	31.73	2.56	1.02
10	19.50	31.58	2.55	1.02
11	21.50	31.84	2.57	1.02
12	25.50	32.09	2.59	1.03
13	29.50	32.26	2.60	1.04
14	33.50	32.65	2.64	1.05
15	37.50	33.12	2.67	1.07
16	41.50	33.42	2.70	1.08
17	45.50	33.60	2.71	1.08
18	49.50	33.76	2.73	1.09
19	53.50	34.04	2.75	1.09
20	57.50	33.96	2.74	1.09
21	61.50	34.01	2.75	1.09
22	65.50	33.74	2.72	1.09
23	69.50	33.71	2.72	1.08
24	73.50	34.08	2.75	1.10

TAB. A4.3 GS1 Y=28.35mm
T=350 C, UC=2.51m/s, RE=350000

MS	X (MM)	SSP (MKV)	U: (M/S)	U:/UC
1	1.50	23.53	1.90	0.76
2	3.50	27.04	2.18	0.87
3	5.50	28.49	2.30	0.92
4	7.50	29.08	2.35	0.94
5	9.50	29.58	2.39	0.95
6	11.50	29.88	2.41	0.96
7	13.50	29.97	2.42	0.96
8	15.50	30.08	2.43	0.97
9	17.50	30.17	2.44	0.97
10	19.50	29.82	2.41	0.96
11	21.50	29.97	2.42	0.96
12	25.50	29.75	2.40	0.96
13	29.50	30.40	2.45	0.98
14	33.50	31.08	2.51	1.00
15	37.50	31.31	2.53	1.01
16	41.50	31.43	2.54	1.01
17	45.50	31.51	2.54	1.01
18	49.50	31.49	2.54	1.01
19	53.50	32.03	2.59	1.03
20	57.50	32.00	2.58	1.03
21	61.50	31.81	2.57	1.02
22	65.50	31.88	2.57	1.03
23	69.50	31.90	2.58	1.03
24	73.50	31.72	2.56	1.02

TAB. A4.4 GS2 Y=16.35mm
T=350 C, UC=2.51m/s, RE=350000

MS	X (MM)	SSP (MKV)	U' (M/S)	U'/UC
1	117.60	23.05	1.86	0.74
2	115.60	25.21	2.04	0.81
3	113.60	27.13	2.19	0.87
4	111.60	27.91	2.25	0.90
5	109.60	29.14	2.35	0.94
6	107.60	30.49	2.46	0.98
7	105.60	31.64	2.55	1.02
8	103.60	31.70	2.56	1.02
9	101.60	32.28	2.61	1.04
10	99.60	32.94	2.66	1.06
11	97.60	33.21	2.68	1.07
12	93.60	33.59	2.71	1.08
13	89.60	33.84	2.73	1.09
14	85.60	34.12	2.75	1.10
15	81.60	34.53	2.79	1.11
16	77.60	34.70	2.80	1.12
17	73.60	35.04	2.83	1.13
18	69.60	35.22	2.84	1.13
19	65.60	35.18	2.84	1.13
20	61.60	34.98	2.82	1.13
21	57.60	35.18	2.84	1.13
22	53.60	35.11	2.83	1.13
23	49.60	35.11	2.83	1.13
24	45.60	34.79	2.81	1.12

TAB. A4.5 GS2 Y=8.35mm
T=350 C, UC=2.51m/s, RE=350000

MS	X (MM)	SSP (MKV)	U' (M/S)	U'/UC
1	117.60	24.09	1.95	0.77
2	115.60	26.42	2.13	0.85
3	113.60	27.88	2.25	0.90
4	111.60	29.07	2.35	0.94
5	109.60	29.82	2.41	0.96
6	107.60	30.48	2.46	0.98
7	105.60	30.84	2.49	0.99
8	103.60	31.17	2.52	1.00
9	101.60	31.36	2.53	1.01
10	99.60	31.32	2.53	1.01
11	97.60	31.55	2.55	1.01
12	93.60	31.59	2.55	1.02
13	89.60	31.99	2.58	1.03
14	85.60	32.48	2.62	1.04
15	81.60	32.91	2.66	1.06
16	77.60	33.40	2.70	1.07
17	73.60	33.65	2.72	1.08
18	69.60	33.95	2.74	1.09
19	65.60	33.71	2.72	1.08
20	61.60	34.01	2.75	1.09
21	57.60	33.97	2.74	1.09
22	53.60	34.02	2.75	1.09
23	49.60	34.19	2.76	1.10
24	45.60	34.06	2.75	1.10

TAB. A4.6 GS2 Y=4.35mm
T=350 C, UC=2.51m/s, RE=350000

MS	X (MM)	SSP (MKV)	U' (M/S)	U'/UC
1	117.60	23.80	1.92	0.77
2	115.60	26.15	2.11	0.84
3	113.60	27.46	2.22	0.88
4	111.60	27.88	2.25	0.90
5	109.60	28.48	2.30	0.92
6	107.60	28.59	2.31	0.92
7	105.60	28.90	2.33	0.93
8	103.60	28.80	2.33	0.93
9	101.60	28.78	2.32	0.93
10	99.60	28.65	2.31	0.92
11	97.60	28.70	2.32	0.92
12	93.60	29.00	2.34	0.93
13	89.60	29.43	2.38	0.95
14	85.60	30.22	2.44	0.97
15	81.60	30.47	2.46	0.98
16	77.60	30.76	2.48	0.99
17	73.60	30.83	2.49	0.99
18	69.60	30.98	2.50	1.00
19	65.60	30.98	2.50	1.00
20	61.60	31.02	2.50	1.00
21	57.60	31.26	2.52	1.01
22	53.60	31.03	2.51	1.00
23	49.60	31.26	2.52	1.01
24	45.60	31.14	2.51	1.00

TAB. A5.1 GS1 X=59.55mm
T=350 C, UC=2.51m/s, RE=350000

MS	Y (MM)	SSP (MKV)	U' (M/S)	U'/UC
1	31.20	30.25	2.44	0.97
2	29.20	31.10	2.51	1.00
3	27.20	32.13	2.59	1.03
4	25.20	33.70	2.72	1.08
5	23.20	34.55	2.79	1.11
6	21.20	35.43	2.86	1.14
7	19.20	35.82	2.89	1.15
8	17.20	35.84	2.89	1.15
9	15.20	35.72	2.89	1.15
10	13.20	34.87	2.82	1.12
11	11.20	33.78	2.73	1.09
12	9.20	32.57	2.63	1.05
13	9.20	32.57	2.63	1.05

TAB. A5.2 GS1 X=31.55mm
T=350 C, UC=2.51m/s, RE=350000

MS	Y (MM)	SSP (MKV)	U' (M/S)	U'/UC
1	31.20	28.06	2.27	0.90
2	29.20	30.21	2.44	0.97
3	27.20	31.01	2.50	1.00
4	25.20	32.09	2.59	1.03
5	23.20	33.35	2.69	1.07
6	21.20	34.17	2.76	1.10
7	19.20	34.52	2.79	1.11
8	17.20	34.51	2.79	1.11
9	15.20	34.33	2.77	1.10
10	13.20	33.62	2.71	1.08
11	11.20	32.73	2.64	1.05
12	9.20	31.65	2.56	1.02
13	9.20	31.65	2.56	1.02

TAB. A5.3 GS1 X=3.55mm
T=350 C, UC=2.51m/s, RE=350000

MS	Y (MM)	SSP (MKV)	U' (M/S)	U'/UC
1	31.20	25.55	2.05	0.82
2	29.20	26.79	2.16	0.86
3	27.20	26.90	2.17	0.87
4	25.20	26.76	2.16	0.86
5	23.20	26.47	2.14	0.85
6	21.20	25.75	2.08	0.83
7	19.20	25.55	2.05	0.82
8	17.20	25.97	2.10	0.84
9	15.20	26.19	2.11	0.84
10	13.20	26.45	2.14	0.85
11	11.20	26.95	2.13	0.87
12	9.20	27.38	2.21	0.88
13	7.20	26.80	2.16	0.86

TAB. A5.4 GS2 X=59.55mm
T=350 C, UC=2.51m/s, RE=350000

MS	Y (MM)	SSP (MKV)	U' (M/S)	U'/UC
1	3.50	30.37	2.45	0.98
2	3.50	30.37	2.45	0.98
3	5.50	31.97	2.57	1.03
4	7.50	33.68	2.72	1.08
5	9.50	34.57	2.79	1.11
6	11.50	35.29	2.85	1.14
7	13.50	35.85	2.89	1.15
8	15.50	36.07	2.91	1.16
9	17.50	35.58	2.87	1.14
10	19.50	34.95	2.82	1.12
11	21.50	34.02	2.75	1.09
12	23.50	32.86	2.65	1.06
13	25.50	32.63	2.63	1.05

TAB. A5.5 GS2 X=87.55mm
T=350 C, UC=2.51m/s, RE=350000

MS	Y (MM)	SSP (MKV)	U' (M/S)	U'/UC
1	1.50	27.03	2.18	0.87
2	3.50	29.04	2.34	0.93
3	5.50	30.51	2.46	0.98
4	7.50	31.75	2.56	1.02
5	9.50	32.80	2.65	1.05
6	11.50	33.79	2.73	1.09
7	13.50	34.16	2.76	1.10
8	15.50	34.13	2.76	1.10
9	17.50	34.24	2.76	1.10
10	19.50	33.39	2.70	1.07
11	21.50	32.67	2.64	1.05
12	23.50	31.28	2.53	1.01
13	23.50	31.28	2.53	1.01

TAB. A5.6 GS2 X=115.55mm
T=350 C, UC=2.51m/s, RE=350000

MS	Y (MM)	SSP (MKV)	U' (M/S)	U'/UC
1	1.50	23.67	1.91	0.76
2	3.50	25.51	2.06	0.82
3	5.50	25.96	2.10	0.84
4	7.50	25.96	2.09	0.83
5	9.50	25.70	2.08	0.83
6	11.50	25.21	2.04	0.81
7	13.50	24.57	1.98	0.79
8	15.50	24.56	1.98	0.79
9	17.50	24.91	2.01	0.80
10	19.50	25.36	2.05	0.82
11	21.50	25.75	2.08	0.83
12	23.50	23.69	1.91	0.76
13	25.50	22.41	1.81	0.72

TAB. A6 TEGENA 1, ISOTHERMAL MEASUREMENTS, TC-DEVIATIONS OF REFERENCE TEMPERATURE

I01T250.DAT

L	MIT(L)	PT2	ABW2	PT3	ABW3	ABW0(L) /	ABWU(L)	$\overline{ABW}$	TRF
1.00	247.37	248.40	-1.03	247.70	-0.33	0.22	0.12	-0.68	248.1
2.00	248.60	248.40	0.20	247.70	0.90	0.27	0.27	0.55	248.1
3.00	249.02	248.40	0.62	247.70	1.32	0.45	1.15	0.97	248.1
1.00	299.07	301.00	-1.93	300.20	-1.13	0.28	0.13	-1.53	300.6
2.00	300.54	301.00	-0.46	300.20	0.34	0.40	0.40	-0.06	300.6
3.00	301.65	301.00	0.65	300.20	1.45	0.57	1.68	1.05	300.6
1.00	346.18	348.70	-2.52	348.10	-1.92	0.33	0.17	-2.22	348.4
2.00	347.75	348.70	-0.95	348.10	-0.35	0.51	0.47	-0.65	348.4
3.00	349.49	348.70	0.79	348.10	1.39	0.77	2.02	1.09	348.4
1.00	390.50	394.00	-3.50	393.20	-2.70	0.41	0.22	-3.10	393.6
2.00	392.31	394.00	-1.69	393.20	-0.89	0.57	0.53	-1.29	393.6
3.00	394.49	394.00	0.49	393.20	1.29	0.98	2.50	0.89	393.6

I07T250.DAT

L	MIT(L)	PT2	ABW2	PT3	ABW3	ABW0(L) /	ABWU(L)	$\overline{ABW}$	TRF
1.00	247.26	248.50	-1.24	247.90	-0.64	0.23	0.14	-0.94	248.2
2.00	248.63	248.50	0.13	247.90	0.73	0.23	0.21	0.43	248.2
3.00	248.91	248.50	0.41	247.90	1.01	0.42	1.13	0.71	248.2
1.00	301.85	303.80	-1.95	303.40	-1.55	0.30	0.21	-1.75	303.6
2.00	303.44	303.80	-0.36	303.40	0.04	0.38	0.34	-0.16	303.6
3.00	304.42	303.80	0.62	303.40	1.02	0.59	1.58	0.82	303.6
1.00	353.33	356.10	-2.77	355.80	-2.47	0.36	0.24	-2.62	356.0
2.00	355.11	356.10	-0.99	355.80	-0.69	0.50	0.48	-0.84	356.0
3.00	356.71	356.10	0.61	355.80	0.91	0.76	2.00	0.76	356.0
1.00	395.84	399.80	-3.96	399.20	-3.36	0.42	0.31	-3.66	399.5
2.00	398.00	399.80	-1.80	399.20	-1.20	0.56	0.54	-1.50	399.5
3.00	400.06	399.80	0.26	399.20	0.86	0.92	2.68	0.56	399.5

I52T250.DAT

L	MIT(L)	PT2	ABW2	PT3	ABW3	ABW0(L) /	ABWU(L)	$\overline{ABW}$	TRF
1.00	246.49	247.30	-0.81	247.10	-0.61	0.18	0.09	-0.71	247.2
2.00	247.94	247.30	0.64	247.10	0.84	0.26	0.33	0.74	247.2
3.00	248.33	247.30	1.03	247.10	1.23	0.53	1.07	1.13	247.2
1.00	317.59	320.10	-2.51	319.60	-2.01	0.25	0.14	-2.26	319.9
2.00	319.81	320.10	-0.29	319.60	0.21	0.46	0.51	-0.25	319.9
3.00	321.03	320.10	0.93	319.60	1.43	0.78	1.89	1.18	319.9
1.00	351.93	354.90	-2.97	354.40	-2.47	0.36	0.19	-2.72	354.7
2.00	353.72	354.90	-1.18	354.40	-0.68	0.46	0.51	-0.93	354.7
3.00	355.35	354.90	0.45	354.40	0.95	0.69	2.29	0.70	354.7
1.00	395.74	399.60	-3.86	399.20	-3.46	0.43	0.29	-3.66	399.4
2.00	397.62	399.60	-1.98	399.20	-1.58	0.58	0.64	-1.78	399.4
3.00	399.91	399.60	0.31	399.20	0.71	0.83	2.60	0.51	399.4
1.00	295.06	297.20	-2.14	296.90	-1.84	0.28	0.15	-1.99	297.1
2.00	296.63	297.20	-0.57	296.90	-0.27	0.31	0.37	-0.42	297.1
3.00	297.50	297.20	0.30	296.90	0.60	0.55	1.72	0.45	297.1

L = 1 : 4 Thermocouples of Probe S1
L = 2 : 4 Thermocouples of Probe S2
L = 3 : 126 Wall Thermocouples
MIT(L) : Average Value of TC-Group
ABW(L): Devitation of MIT(L) from PT2 or PT3
TRF = 0.5 × (PT2 + PT3)
$\overline{ABW}$ = 0.5 × (ABW(2) + ABW(3))

09:54:04 JUN10,1987 M050.DAT **TAB. A7.1**

TEGENA 2 - WALL TEMPERATURES
CHANNEL PERIMERTER MP1/2/3/4/5

TBI =	301.8 C	DTC =	.0 K
UB =	.48 m/s	Re =	15142.
QH1 =	.0 W/cm^2	QH2 =	.0 W/cm^2
QH3 =	.0 W/cm^2	QH4 =	.0 W/cm^2

C P mm	MP1 C	MP2 C	MP3 C	MP4 C	MP5 C
11.00	301.56	301.297	301.42	301.49	301.6
25.20	301.35	301.575	301.80	301.44	301.5
33.40	301.49	300.983	301.61	301.37	301.6
55.40	301.38	301.225	301.42	301.44	301.7
66.60	301.78	301.176	301.35	301.64	301.6
81.00	301.80	301.490	301.78	301.56	301.6
95.30	301.61	301.853	301.73	301.88	301.9
109.70	301.97	301.780	301.85	301.88	301.8
124.00	301.61	301.732	301.73	301.56	301.5
138.40	301.95	301.805	302.00	301.47	301.6
152.70	301.73	301.660	301.59	301.64	301.2
163.90	301.37	301.442	301.32	301.20	301.5
185.90	301.47	301.490	301.49	301.42	301.4
194.10	301.76	301.515	301.37	301.35	301.5
208.30	301.76	301.321	301.37	301.37	301.5
230.30	301.54	301.539	301.66	301.22	301.5
241.50	301.88	301.466	301.49	301.47	301.4
255.90	301.90	301.442	301.85	301.68	301.5
270.20	301.95	301.805	301.76	301.68	301.8
284.60	301.76	301.611	301.49	301.68	301.9
298.90	301.93	301.660	301.71	301.76	301.7
313.30	301.54	301.611	301.68	301.64	301.6
327.60	301.73	301.273	301.66	301.66	301.3
338.80	301.56	301.466	301.20	301.49	301.4

12:58:28 JUN10,1987 M054.DAT **TAB. A7.2**

TEGENA 2 - WALL TEMPERATURES
CHANNEL PERIMERTER MP1/2/3/4/5

TBI =	351.4 C	DTC =	.0 K
UB =	.49 m/s	Re =	16635.
QH1 =	.0 W/cm^2	QH2 =	.0 W/cm^2
QH3 =	.0 W/cm^2	QH4 =	.0 W/cm^2

C P mm	MP1 C	MP2 C	MP3 C	MP4 C	MP5 C
11.00	351.01	350.584	350.63	350.63	350.8
25.20	350.75	350.918	351.08	350.51	350.6
33.40	350.94	350.250	350.85	350.47	350.7
55.40	350.43	350.537	350.66	350.56	350.8
66.60	351.42	350.584	350.66	350.89	350.8
81.00	351.58	351.013	351.28	350.89	350.9
95.30	351.35	351.466	351.16	351.28	351.2
109.70	351.70	351.347	351.32	351.28	350.7
124.00	351.08	351.228	351.13	350.89	350.8
138.40	351.39	351.204	351.39	350.77	350.8
152.70	351.01	351.061	350.89	350.97	350.4
163.90	350.56	350.799	350.63	350.44	350.8
185.90	350.63	350.894	350.87	350.70	350.6
194.10	351.01	350.894	350.70	350.63	350.8
208.30	351.01	350.679	350.66	350.63	350.8
230.30	350.80	350.942	351.01	350.51	350.8
241.50	351.20	350.799	350.82	350.73	350.7
255.90	351.39	350.823	351.28	350.99	350.7
270.20	351.49	351.299	351.18	351.01	351.1
284.60	351.42	351.204	350.94	351.04	351.3
298.90	351.66	351.275	351.18	351.08	350.9
313.30	351.30	351.228	351.18	350.99	350.8
327.60	351.32	350.727	351.06	350.89	350.4
338.80	351.11	350.870	350.47	350.63	350.6

17:08:32 JUN10,1987 M058.DAT **TAB. A7.3**

TEGENA 2 - WALL TEMPERATURES
CHANNEL PERIMERTER MP1/2/3/4/5

TBI =	402.3 C	DTC =	.0 K
UB =	.48 m/s	Re =	17545.
QH1 =	.0 W/cm^2	QH2 =	.0 W/cm^2
QH3 =	.0 W/cm^2	QH4 =	.0 W/cm^2

C P mm	MP1 C	MP2 C	MP3 C	MP4 C	MP5 C
11.00	402.13	401.662	401.80	401.80	402.1
25.20	401.69	401.991	402.30	401.73	401.9
33.40	401.97	401.286	402.04	401.64	402.0
55.40	401.01	401.662	401.85	401.78	402.1
66.60	402.56	401.662	401.90	402.20	402.2
81.00	402.72	402.250	402.65	402.30	402.4
95.30	402.65	402.837	402.60	402.81	402.7
109.70	403.10	402.767	402.79	402.79	401.8
124.00	402.41	402.579	402.53	402.30	402.2
138.40	402.67	402.414	402.74	402.04	402.2
152.70	402.18	402.156	402.01	402.11	401.6
163.90	401.52	401.803	401.59	401.40	401.8
185.90	401.66	401.780	401.80	401.66	401.7
194.10	401.97	401.803	401.62	401.59	401.8
208.30	402.09	401.568	401.54	401.59	401.8
230.30	401.80	401.897	402.06	401.50	401.8
241.50	402.37	401.803	401.94	401.83	401.8
255.90	402.67	401.991	402.58	402.27	402.0
270.20	402.88	402.602	402.63	402.44	402.6
284.60	402.77	402.532	402.39	402.53	402.8
298.90	403.03	402.579	402.57	402.56	402.4
313.30	402.39	402.438	402.56	402.37	402.3
327.60	402.37	401.803	402.34	402.20	401.7
338.80	402.06	401.944	401.62	401.85	401.8

07:40:59 JUL09,1987 M295.DAT **TAB. A8.1**

TEGENA 2 - WALL TEMPERATURES
CHANNEL PERIMERTER MP1/2/3/4/5

TBI	= 294.5 C		DTC	= .0 K	
UB	= .48 m/s		Re	= 14813.	
QH1	= .0 W/cm^2		QH2	= .0 W/cm^2	
QH3	= .0 W/cm^2		QH4	= .0 W/cm^2	

C P mm	MP1 C	MP2 C	MP3 C	MP4 C	MP5 C
11.00	294.02	293.636	293.69	293.69	294.0
25.20	293.81	293.915	294.02	293.59	293.9
33.40	294.00	293.370	293.83	293.54	293.9
55.40	294.04	293.612	293.73	293.64	294.1
66.60	294.48	293.709	293.81	293.98	294.2
81.00	294.78	294.242	294.39	294.05	294.3
95.30	294.65	294.655	294.44	294.48	294.7
109.70	294.97	294.630	294.63	294.53	294.6
124.00	294.44	294.485	294.41	294.22	294.3
138.40	294.65	294.436	294.58	294.07	294.3
152.70	294.22	294.218	294.12	294.22	293.9
163.90	293.76	293.903	293.83	293.76	294.1
185.90	293.78	294.024	294.00	293.95	294.0
194.10	294.07	293.952	293.85	293.88	294.0
208.30	294.07	293.782	293.81	293.90	294.1
230.30	293.93	294.073	294.15	293.81	294.1
241.50	294.32	294.000	294.05	294.02	294.1
255.90	294.58	294.097	294.46	294.27	294.1
270.20	294.78	294.533	294.46	294.32	294.5
284.60	294.75	294.485	294.27	294.36	294.7
298.90	294.92	294.485	294.42	294.36	294.3
313.30	294.44	294.388	294.36	294.15	294.2
327.60	294.44	293.927	294.15	293.98	293.8
338.80	294.12	293.879	293.56	293.71	293.9

08:07:20 JUL09,1987 M296.DAT **TAB. A8.2**

TEGENA 2 - WALL TEMPERATURES
CHANNEL PERIMERTER MP1/2/3/4/5

TBI	= 296.4 C		DTC	= .0 K	
UB	= .97 m/s		Re	= 29859.	
QH1	= .0 W/cm^2		QH2	= .0 W/cm^2	
QH3	= .0 W/cm^2		QH4	= .0 W/cm^2	

C P mm	MP1 C	MP2 C	MP3 C	MP4 C	MP5 C
11.00	296.30	296.008	296.08	296.06	296.3
25.20	296.10	296.274	296.44	296.01	296.2
33.40	296.27	295.742	296.23	295.94	296.3
55.40	296.29	295.984	296.13	296.03	296.4
66.60	296.69	296.032	296.15	296.32	296.5
81.00	296.81	296.419	296.69	296.40	296.7
95.30	296.69	296.783	296.66	296.76	296.9
109.70	296.95	296.686	296.81	296.71	296.9
124.00	296.42	296.517	296.54	296.35	296.4
138.40	296.61	296.468	296.64	296.15	296.3
152.70	296.18	296.177	296.10	296.18	295.9
163.90	295.72	295.814	295.74	295.64	296.0
185.90	295.74	295.911	295.89	295.81	295.9
194.10	296.06	295.887	295.77	295.79	296.0
208.30	296.03	295.742	295.74	295.79	296.0
230.30	295.91	296.008	296.08	295.72	296.1
241.50	296.30	295.984	296.03	296.03	296.1
255.90	296.52	296.105	296.54	296.37	296.2
270.20	296.71	296.589	296.56	296.47	296.7
284.60	296.71	296.541	296.42	296.54	296.9
298.90	296.93	296.565	296.60	296.64	296.6
313.30	296.52	296.565	296.64	296.49	296.5
327.60	296.56	296.226	296.52	296.37	296.1
338.80	296.35	296.250	295.96	296.10	296.2

08:22:51 JUL09,1987 M297.DAT **TAB. A8.3**

TEGENA 2 - WALL TEMPERATURES
CHANNEL PERIMERTER MP1/2/3/4/5

TBI	= 297.2 C	DTC	=	.0 K	
UB	= 1.95 m/s	Re	= 60287.		
QH1	= .0 W/cm^2	QH2	=	.0 W/cm^2	
QH3	= .0 W/cm^2	QH4	=	.0 W/cm^2	

C P mm	MP1 C	MP2 C	MP3 C	MP4 C	MP5 C
11.00	297.04	296.842	296.92	296.94	297.2
25.20	296.89	297.097	297.30	296.87	297.1
33.40	297.06	296.576	297.06	296.79	297.2
55.40	297.07	296.794	296.94	296.84	297.3
66.60	297.42	296.818	296.96	297.13	297.3
81.00	297.50	297.133	297.40	297.13	297.4
95.30	297.35	297.496	297.38	297.50	297.7
109.70	297.62	297.424	297.52	297.50	297.6
124.00	297.18	297.278	297.33	297.16	297.2
138.40	297.42	297.303	297.47	297.04	297.2
152.70	297.13	297.133	297.04	297.13	296.8
163.90	296.70	296.867	296.77	296.65	297.1
185.90	296.77	296.939	296.94	296.84	297.0
194.10	297.08	296.915	296.82	296.82	297.0
208.30	297.04	296.746	296.75	296.84	297.1
230.30	296.84	296.988	297.08	296.72	297.1
241.50	297.18	296.915	296.96	296.96	297.1
255.90	297.33	296.939	297.35	297.21	297.1
270.20	297.45	297.351	297.33	297.25	297.5
284.60	297.40	297.254	297.13	297.28	297.7
298.90	297.59	297.327	297.34	297.35	297.4
313.30	297.18	297.278	297.35	297.21	297.3
327.60	297.30	296.963	297.25	297.16	296.9
338.80	297.08	297.012	296.75	296.92	297.1

08:45:49 JUL09,1987 M298.DAT **TAB. A8.4**

TEGENA 2 - WALL TEMPERATURES
CHANNEL PERIMERTER MP1/2/3/4/5

TBI	= 297.9 C	DTC	=	.0 K	
UB	= 3.87 m/s	Re	=120048.		
QH1	= .0 W/cm^2	QH2	=	.0 W/cm^2	
QH3	= .0 W/cm^2	QH4	=	.0 W/cm^2	

C P mm	MP1 C	MP2 C	MP3 C	MP4 C	MP5 C
11.00	297.88	297.660	297.73	297.78	298.0
25.20	297.73	297.926	298.12	297.76	298.0
33.40	297.88	297.394	297.90	297.66	298.0
55.40	297.84	297.588	297.76	297.71	298.2
66.60	298.17	297.539	297.73	297.95	298.2
81.00	298.17	297.830	298.14	297.88	298.2
95.30	298.02	298.168	298.10	298.19	298.4
109.70	298.29	298.047	298.19	298.19	298.3
124.00	297.83	297.975	298.05	297.88	298.0
138.40	298.12	298.023	298.24	297.76	298.0
152.70	297.93	297.926	297.85	297.95	297.7
163.90	297.56	297.684	297.61	297.51	298.0
185.90	297.61	297.781	297.78	297.71	297.9
194.10	297.93	297.757	297.66	297.68	297.9
208.30	297.83	297.563	297.61	297.71	298.0
230.30	297.66	297.805	297.93	297.56	298.0
241.50	297.93	297.684	297.76	297.76	297.9
255.90	297.97	297.660	298.07	297.95	297.9
270.20	298.12	298.047	298.05	297.97	298.2
284.60	298.05	297.926	297.83	298.00	298.4
298.90	298.24	297.975	298.01	298.05	298.1
313.30	297.83	297.999	298.10	297.97	298.1
327.60	298.05	297.733	298.05	297.97	297.8
338.80	297.88	297.805	297.59	297.76	297.9

TEGENA 1 WALL TEMPERATURE

TAB. A9.1

F04Q12A.DAT

RE	= 60.1E+03		PE	=352.36		MS	= 3.12	(KG/S)
UB	= 1.91	(M/S)	QH1	= 50.35	(W/CM^2)	QH2	= 49.96	(W/CM^2)
QH3	= 49.36	(W/CM^2)	QH4	= 50.71	(W/CM^2)	NB	=395.50	(KW)
TEN	=256.67	(C)	TAS	=353.11	(C)	TNM	=304.26	(C)

CP (MM)	ME0 (C)	ME1 (C)	ME2 (C)	ME3 (C)	ME4 (C)	ME5 (C)
11.00		262.63	279.86	298.67	317.35	337.84
25.20	258.32	265.74	286.03	305.22	324.06	344.58
33.40		262.53	280.93	299.32	318.21	338.20
55.40		260.87	279.95	299.35	318.31	339.25
66.60		265.59	285.40	306.96	327.54	348.25
80.95	258.37	261.63	279.91	300.94	321.46	342.24
95.30		264.22	284.36	305.39	326.05	347.42
109.65		261.21	277.03	299.18	318.53	336.88
124.00		263.27	281.73	303.26	323.91	344.29
138.35	258.52	261.85	277.74	297.75	318.29	339.27
152.70		264.95	284.96	304.74	325.67	345.10
163.90		262.26	279.88	298.18	317.11	337.62
185.90		262.39	279.74	297.60	316.75	336.62
194.10	258.42	264.93	284.11	302.73	322.49	342.48
208.30		261.85	278.45	297.60	316.60	336.76
230.30		261.80	279.30	298.30	316.60	337.50
241.50		264.37	285.91	306.40	325.64	346.32
255.85	258.66	261.63	279.32	300.70	321.24	340.97
270.20		263.07	282.97	303.33	324.34	344.29
284.55		260.72	276.25	297.26	316.22	338.01
298.90		263.68	281.24	302.22	323.50	341.74
313.25	258.27	261.24	277.98	298.13	319.10	340.85
327.60		264.81	284.60	304.69	325.38	344.84
338.80		262.14	280.64	298.47	317.68	337.31

TEGENA 1 WALL TEMPERATURE

TAB. A9.2

F04Q12B.DAT

RE	= 60.2E+03		PE	=353.01		MS	= 3.12	(KG/S)
UB	= 1.92	(M/S)	QH1	= 49.39	(W/CM^2)	QH2	= 49.01	(W/CM^2)
QH3	= 48.43	(W/CM^2)	QH4	= 49.75	(W/CM^2)	NB	=388.00	(KW)
TEN	=257.76	(C)	TAS	=352.72	(C)	TNM	=304.36	(C)

CP (MM)	ME0 (C)	ME1 (C)	ME2 (C)	ME3 (C)	ME4 (C)	ME5 (C)
11.00		263.45	280.36	298.80	317.22	337.43
25.20	259.42	266.34	286.17	305.12	323.86	344.19
33.40		263.14	281.14	299.41	318.13	337.88
55.40		261.57	280.41	299.56	318.21	338.91
66.60		266.24	285.86	307.26	327.53	348.08
80.95	259.46	262.52	280.65	301.61	322.03	342.61
95.30		264.95	285.05	305.86	326.47	347.41
109.65		262.04	277.71	299.72	318.74	337.21
124.00		263.92	282.19	303.52	323.95	344.33
138.35	259.59	262.57	278.22	298.03	318.54	339.43
152.70		265.65	285.37	304.83	325.85	344.81
163.90		263.04	280.43	298.42	317.36	337.52
185.90		263.09	280.29	298.13	316.98	336.85
194.10	259.44	265.68	284.67	303.38	322.75	342.83
208.30		262.60	278.97	298.05	316.96	336.99
230.30		262.55	279.83	298.61	316.86	338.02
241.50		265.12	286.51	306.61	325.71	346.98
255.85	259.71	262.33	280.00	301.10	321.41	341.27
270.20		263.89	283.64	303.79	324.72	344.76
284.55		261.47	276.95	297.57	316.69	338.41
298.90		264.43	281.65	302.26	323.47	341.94
313.25	259.37	261.99	278.54	298.20	318.86	340.65
327.60		265.68	285.18	304.80	325.23	344.64
338.80		262.84	281.26	298.90	317.75	337.21

TEGENA 1 WALL TEMPERATURE
DT=100(K)

TAB. A10.1

W03A120.DAT

RE = 23.8E+03 PE =139.39 MS = 1.23 (KG/S)
UB = 0.76 (M/S) QH1 = 20.23 (W/CM^2) QH2 = 20.07 (W/CM^2)
QH3 = 19.86 (W/CM^2) QH4 = 20.37 (W/CM^2) NB =158.95 (KW)
TEN =256.55 (C) TAS =354.27 (C) TNM =304.92 (C)

CP (MM)	ME0 (C)	ME1 (C)	ME2 (C)	ME3 (C)	ME4 (C)	ME5 (C)
11.00		265.83	286.42	305.82	325.45	346.68
25.20	257.54	267.03	287.90	308.55	328.30	349.92
33.40		265.32	285.21	305.60	325.64	347.08
55.40		264.41	285.57	305.97	326.17	347.49
66.60		266.15	288.00	309.64	330.68	351.44
80.95	257.78	264.14	284.45	305.80	326.77	347.65
95.30		264.83	284.04	305.60	327.63	348.89
109.65		261.67	279.22	300.48	322.61	341.33
124.00		263.12	283.02	304.76	326.41	347.44
138.35	257.41	262.63	282.12	303.60	324.80	345.77
152.70		265.81	286.64	307.08	328.57	348.18
163.90		263.78	283.55	302.92	323.41	344.46
185.90		264.29	283.38	302.66	323.02	344.12
194.10	257.17	266.03	285.23	305.00	325.42	347.01
208.30		263.36	281.73	302.15	322.35	344.15
230.30		263.34	282.48	302.95	322.61	344.81
241.50		264.19	285.52	306.86	327.27	348.99
255.85	257.58	262.11	281.87	303.79	324.58	345.65
270.20		263.85	283.67	304.52	325.86	347.58
284.55		261.48	279.66	300.09	321.53	343.12
298.90		263.95	283.67	304.59	326.50	347.32
313.25	257.76	263.63	283.50	304.73	325.86	346.77
327.60		267.17	288.92	309.25	329.67	349.87
338.80		265.07	286.61	305.73	325.62	346.58

TEGENA 1 WALL TEMPERATURE
DT=100(K)

TAB. A10.2

W03A130.DAT

RE = 37.6E+03 PE =217.20 MS = 1.91 (KG/S)
UB = 1.18 (M/S) QH1 = 30.63 (W/CM^2) QH2 = 30.40 (W/CM^2)
QH3 = 30.04 (W/CM^2) QH4 = 30.82 (W/CM^2) NB =240.61 (KW)
TEN =266.41 (C) TAS =361.91 (C) TNM =313.66 (C)

CP (MM)	ME0 (C)	ME1 (C)	ME2 (C)	ME3 (C)	ME4 (C)	ME5 (C)
11.00		274.06	293.48	312.19	330.92	351.21
25.20	267.59	275.62	296.00	316.02	335.25	356.25
33.40		272.91	292.10	311.85	331.37	352.06
55.40		272.16	292.61	312.24	331.71	352.42
66.60		275.52	295.86	317.64	338.27	358.59
80.95	267.74	272.03	291.83	313.25	333.70	353.92
95.30		274.25	294.28	314.91	335.49	355.85
109.65		270.96	286.98	306.98	328.42	346.49
124.00		272.94	291.25	311.81	333.00	354.07
138.35	267.37	272.08	289.77	310.05	330.65	351.47
152.70		275.33	295.35	315.30	336.14	355.16
163.90		272.23	290.96	309.80	329.41	349.90
185.90		272.81	291.01	309.39	328.93	349.32
194.10	267.15	274.79	293.89	312.96	332.67	353.54
208.30		272.08	289.53	309.18	328.52	349.49
230.30		272.33	290.60	310.02	328.95	350.13
241.50		273.86	295.03	315.93	335.83	356.45
255.85	267.54	271.52	290.50	312.14	332.55	352.57
270.20		273.38	293.48	313.73	334.61	355.45
284.55		270.77	288.12	307.71	328.45	348.97
298.90		273.33	291.52	311.69	333.34	353.52
313.25	267.71	271.94	289.43	309.18	330.39	351.54
327.60		276.30	296.73	315.90	335.80	355.78
338.80		273.33	293.63	311.98	331.06	351.21

TEGENA 1 WALL TEMPERATURE
DT=100(K)

TAB. A10.3

W03A140.DAT

RE = 48.9E+03		PE =282.39		MS = 2.49	(KG/S)
UB = 1.53	(M/S)	QH1 = 39.22	(W/CM^2)	QH2 = 38.96	(W/CM^2)
QH3 = 38.48	(W/CM^2)	QH4 = 39.50	(W/CM^2)	NB =308.24	(KW)
TEN =266.62	(C)	TAS =360.66	(C)	TNM =313.16	(C)

CP (MM)	ME0 (C)	ME1 (C)	ME2 (C)	ME3 (C)	ME4 (C)	ME5 (C)
11.00		273.87	292.01	309.93	328.14	347.88
25.20	268.06	274.80	293.90	313.67	332.94	353.69
33.40		272.14	289.68	308.63	328.00	348.36
55.40		271.63	290.68	309.48	328.43	348.67
66.60		274.60	294.12	316.08	336.65	356.50
80.95	268.21	271.65	290.48	311.82	332.17	352.10
95.30		274.34	294.56	315.24	335.12	354.95
109.65		271.14	286.96	306.46	326.90	344.28
124.00		272.65	290.56	310.80	331.48	352.45
138.35	268.38	271.87	287.98	307.42	327.76	348.83
152.70		275.24	294.70	314.13	334.42	353.19
163.90		272.04	289.83	308.27	327.09	347.14
185.90		272.56	289.97	307.64	326.58	346.59
194.10	268.16	274.97	293.54	311.96	331.21	351.67
208.30		271.97	288.64	307.76	326.49	346.76
230.30		272.19	289.85	308.68	326.82	347.40
241.50		274.17	295.26	315.72	334.90	355.00
255.85	268.53	271.60	289.88	311.07	331.05	350.60
270.20		273.34	293.15	313.12	333:59	353.72
284.55		270.85	287.09	305.98	326.32	346.14
298.90		273.34	290.46	309.84	331.31	350.98
313.25	268.09	272.04	288.91	307.18	327.54	348.50
327.60		276.11	296.71	315.19	334.16	353.74
338.80		272.92	291.96	309.79	328.50	348.16

TEGENA 1 WALL TEMPERATURE
DT=100(K)

TAB. A10.4

W03A150.DAT

RE = 62.2E+03		PE =356.43		MS = 3.14	(KG/S)
UB = 1.93	(M/S)	QH1 = 50.14	(W/CM^2)	QH2 = 49.76	(W/CM^2)
QH3 = 49.13	(W/CM^2)	QH4 = 50.46	(W/CM^2)	NB =393.77	(KW)
TEN =270.72	(C)	TAS =365.91	(C)	TNM =317.97	(C)

CP (MM)	ME0 (C)	ME1 (C)	ME2 (C)	ME3 (C)	ME4 (C)	ME5 (C)
11.00		277.06	294.74	312.99	331.37	351.21
25.20	272.01	278.54	297.70	317.83	337.43	358.23
33.40		275.40	292.46	311.66	331.33	351.71
55.40		274.47	293.73	312.39	331.33	351.99
66.60		278.42	297.99	320.14	340.68	361.15
80.95	272.06	274.86	292.71	314.51	335.30	355.71
95.30		278.01	298.45	319.25	339.39	359.42
109.65		274.67	290.31	309.97	330.46	348.04
124.00		276.86	294.69	315.32	335.95	357.02
138.35	272.01	275.30	291.25	310.96	331.40	352.61
152.70		278.66	298.42	318.45	338.96	357.78
163.90		275.35	292.88	311.47	330.37	350.23
185.90		275.69	292.76	310.53	329.58	349.63
194.10	271.91	278.35	297.12	315.66	335.04	355.64
208.30		275.23	291.40	310.58	329.26	349.59
230.30		275.18	292.59	311.42	329.82	350.49
241.50		277.69	299.13	319.63	339.25	359.39
255.85	272.25	275.01	292.56	313.88	334.58	354.40
270.20		276.72	296.61	317.08	338.27	358.59
284.55		274.21	290.45	309.93	330.39	350.28
298.90		277.06	294.60	313.88	335.59	355.35
313.25	272.03	275.11	291.28	309.66	330.34	351.54
327.60		279.30	300.14	318.57	338.03	357.63
338.80		276.08	294.86	312.77	331.59	351.35

TEGENA 1 WALL TEMPERATURE
DT=100(K)

TAB. A10.5

W03A160.DAT

RE = 76.1E+03 PE =437.15 MS = 3.85 (KG/S)
UB = 2.37 (M/S) QH1 = 60.49 (W/CM^2) QH2 = 59.94 (W/CM^2)
QH3 = 59.23 (W/CM^2) QH4 = 60.88 (W/CM^2) NB =474.78 (KW)
TEN =269.63 (C) TAS =364.15 (C) TNM =316.02 (C)

CP (MM)	ME0 (C)	ME1 (C)	ME2 (C)	ME3 (C)	ME4 (C)	ME5 (C)
11.00		275.28	292.17	310.05	328.11	347.82
25.20	271.18	277.32	296.85	316.41	335.61	356.14
33.40		274.16	290.50	309.42	328.71	348.85
55.40		272.96	291.37	310.07	328.76	349.23
66.60		277.37	297.38	319.34	339.54	359.73
80.95	271.28	273.77	290.91	312.55	333.31	353.85
95.30		276.23	297.00	317.01	337.38	357.35
109.65		273.25	288.41	307.68	327.90	345.27
124.00		275.60	293.60	314.00	334.37	355.52
138.35	271.25	273.96	289.19	308.82	329.07	350.23
152.70		277.06	296.51	316.24	337.24	355.57
163.90		274.28	291.16	309.15	327.73	347.27
185.90		274.13	290.48	308.16	326.70	346.37
194.10	271.18	276.91	295.25	313.61	332.67	352.90
208.30		273.96	289.36	308.00	326.31	346.30
230.30		273.64	290.28	308.96	327.11	347.44
241.50		276.47	297.60	317.80	337.31	357.11
255.85	271.45	273.86	290.38	311.20	331.69	351.47
270.20		275.11	294.26	314.46	335.64	356.16
284.55		272.84	288.17	307.20	327.39	347.16
298.90		275.55	292.71	311.69	333.29	352.71
313.25	271.21	273.64	288.85	307.01	327.49	348.63
327.60		277.40	297.58	316.36	336.14	355.35
338.80		274.25	291.98	309.76	328.54	348.11

TEGENA 1 WALL TEMPERATURE
DT=75(K) EXP 1

TAB. A11.1

W05A075.DAT

RE = 30.7E+03 PE =184.46 MS = 1.64 (KG/S)
UB = 1.00 (M/S) QH1 = 20.22 (W/CM^2) QH2 = 20.02 (W/CM^2)
QH3 = 19.79 (W/CM^2) QH4 = 20.33 (W/CM^2) NB =158.62 (KW)
TEN =254.92 (C) TAS =327.21 (C) TNM =291.07 (C)

CP (MM)	ME0 (C)	ME1 (C)	ME2 (C)	ME3 (C)	ME4 (C)	ME5 (C)
11.00		260.47	274.83	289.26	303.81	319.60
25.20	255.89	261.06	276.69	292.05	306.71	322.87
33.40		259.44	274.03	289.16	304.03	320.04
55.40		259.03	274.42	289.48	304.49	320.57
66.60		261.40	277.00	293.50	309.32	324.99
80.95	256.11	259.56	274.61	290.96	306.57	322.30
95.30		261.01	275.91	292.22	308.30	324.41
109.65		258.44	271.57	288.07	303.84	317.85
124.00		259.81	274.42	290.66	306.78	322.80
138.35	255.67	259.47	273.05	288.77	304.61	320.64
152.70		261.42	276.78	291.95	308.06	322.75
163.90		259.32	273.69	288.07	303.11	318.98
185.90		259.86	273.96	287.99	302.89	318.54
194.10	255.42	261.28	275.98	290.54	305.55	321.62
208.30		259.56	273.13	288.26	303.04	319.00
230.30		259.76	274.20	289.11	303.26	319.36
241.50		261.08	277.64	293.33	308.21	323.95
255.85	255.91	259.52	274.66	290.96	306.11	321.26
270.20		260.62	275.76	291.32	307.07	322.82
284.55		258.29	271.25	287.17	302.63	319.24
298.90		260.62	274.69	290.35	306.64	321.77
313.25	256.11	259.25	273.64	289.26	305.09	321.09
327.60		262.04	277.90	292.75	308.09	323.02
338.80		259.83	274.93	289.04	303.88	319.36

TEGENA 1 WALL TEMPERATURE
DT=75(K) EXP 1

TAB. A11.2

W05A075.DAT

RE = 46.8E+03 PE =279.06 MS = 2.48 (KG/S)
UB = 1.52 (M/S) QH1 = 30.06 (W/CM^2) QH2 = 29.80 (W/CM^2)
QH3 = 29.46 (W/CM^2) QH4 = 30.23 (W/CM^2) NB =235.99 (KW)
TEN =260.06 (C) TAS =331.87 (C) TNM =295.72 (C)

CP (MM)	ME0 (C)	ME1 (C)	ME2 (C)	ME3 (C)	ME4 (C)	ME5 (C)
11.00		264.68	277.90	292.07	306.16	321.62
25.20	261.16	266.56	281.63	296.24	310.40	325.92
33.40		264.26	277.95	292.22	306.57	321.91
55.40		263.04	277.73	292.39	306.76	322.71
66.60		266.78	281.68	297.72	313.06	328.78
80.95	261.33	264.07	278.17	294.28	309.75	325.40
95.30		265.93	280.83	296.70	312.40	328.52
109.65		263.58	275.42	292.17	307.17	320.93
124.00		265.02	279.17	295.08	310.93	326.67
138.35	261.33	264.17	277.15	292.51	307.92	323.69
152.70		266.05	281.00	296.31	312.00	326.50
163.90		263.58	276.83	290.74	305.24	320.97
185.90		264.21	277.51	290.76	305.12	320.28
194.10	261.08	265.80	279.92	294.16	308.84	324.24
208.30		263.82	275.93	290.52	304.97	320.54
230.30		263.99	277.34	291.51	305.21	321.05
241.50		265.24	281.31	296.97	311.78	327.27
255.85	261.52	263.77	277.59	293.91	309.27	324.24
270.20		265.27	280.63	296.14	311.75	326.91
284.55		263.28	276.42	292.29	307.03	323.11
298.90		265.93	280.51	295.73	311.51	325.47
313.25	261.28	263.72	277.22	292.61	308.14	324.34
327.60		266.61	281.87	296.48	311.78	326.24
338.80		264.07	278.29	291.83	306.25	321.24

TEGENA 1 WALL TEMPERATURE
DT=75(K) EXP 1

TAB. A11.3

W05A075.DAT

RE = 63.1E+03 PE =373.63 MS = 3.31 (KG/S)
UB = 2.03 (M/S) QH1 = 40.22 (W/CM^2) QH2 = 39.91 (W/CM^2)
QH3 = 39.46 (W/CM^2) QH4 = 40.47 (W/CM^2) NB =315.93 (KW)
TEN =263.89 (C) TAS =335.94 (C) TNM =299.64 (C)

CP (MM)	ME0 (C)	ME1 (C)	ME2 (C)	ME3 (C)	ME4 (C)	ME5 (C)
11.00		267.98	280.70	294.93	308.96	324.32
25.20	265.07	270.37	285.69	300.21	314.31	329.50
33.40		267.95	281.29	295.30	309.51	324.51
55.40		266.32	280.53	295.08	309.37	325.54
66.60		270.35	285.06	301.37	316.91	332.93
80.95	265.29	267.52	281.14	297.36	313.06	328.83
95.30		269.52	284.62	300.50	316.28	332.62
109.65		267.34	278.76	295.81	310.24	323.96
124.00		269.08	283.02	298.83	314.45	330.22
138.35	265.22	267.66	280.12	295.47	310.98	326.69
152.70		269.88	284.52	300.02	315.73	330.10
163.90		266.93	279.56	293.43	307.75	323.45
185.90		267.64	280.46	293.50	307.80	322.78
194.10	265.05	269.35	283.55	297.82	312.53	327.63
208.30		267.25	278.86	293.33	307.58	322.95
230.30		267.39	280.34	294.23	307.80	323.57
241.50		268.96	284.99	300.57	315.35	330.87
255.85	265.41	267.15	280.32	296.61	312.05	327.13
270.20		268.98	284.16	299.63	315.47	330.63
284.55		266.78	279.39	295.56	310.07	326.33
298.90		269.40	283.84	299.27	315.13	328.44
313.25	265.22	267.17	280.17	295.32	310.82	327.08
327.60		270.10	285.33	299.92	315.23	329.64
338.80		267.52	281.24	294.57	308.93	323.64

TEGENA 1 WALL TEMPERATURE
DT=75(K) EXP 1

TAB. A11.4

W05A075.DAT

RE = 79.7E+03 PE =472.15 MS = 4.19 (KG/S)
UB = 2.57 (M/S) QH1 = 50.21 (W/CM^2) QH2 = 49.79 (W/CM^2)
QH3 = 49.22 (W/CM^2) QH4 = 50.52 (W/CM^2) NB =394.25 (KW)
TEN =263.58 (C) TAS =335.22 (C) TNM =298.86 (C)

CP (MM)	ME0 (C)	ME1 (C)	ME2 (C)	ME3 (C)	ME4 (C)	ME5 (C)
11.00		267.41	279.29	293.16	307.07	322.32
25.20	264.85	269.86	284.86	298.95	312.84	327.84
33.40		267.49	280.41	293.70	307.51	322.13
55.40		265.68	279.19	293.45	307.58	323.52
66.60		269.66	283.72	300.02	315.51	331.61
80.95	264.95	266.97	279.51	294.95	310.62	326.62
95.30		268.78	283.06	298.81	314.55	330.86
109.65		266.85	277.98	294.98	308.83	322.15
124.00		268.56	282.77	298.25	313.73	329.09
138.35	264.87	266.97	279.07	294.28	309.53	325.08
152.70		269.39	283.91	299.19	315.10	328.73
163.90		266.49	278.29	292.00	306.13	321.24
185.90		266.88	279.36	292.07	305.72	320.66
194.10	264.73	268.95	282.99	296.89	310.96	326.04
208.30		266.61	277.68	291.85	305.72	320.78
230.30		266.75	279.19	292.80	306.15	321.57
241.50		268.44	284.30	299.63	314.35	329.57
255.85	265.02	266.71	278.80	294.76	310.19	325.03
270.20		268.27	283.01	298.18	313.99	328.85
284.55		266.27	278.12	294.16	308.40	324.70
298.90		268.88	283.38	298.68	314.52	327.34
313.25	264.85	266.66	279.46	294.86	310.09	326.26
327.60		269.32	284.35	299.46	314.67	328.54
338.80		267.07	280.19	293.28	307.29	321.45

TEGENA 1 WALL TEMPERATURE
DT=75(K) EXP 2

TAB. A12.1

W05D075.DAT

RE = 30.4E+03 PE =184.16 MS = 1.64 (KG/S)
UB = 1.00 (M/S) QH1 = 20.06 (W/CM^2) QH2 = 19.85 (W/CM^2)
QH3 = 19.62 (W/CM^2) QH4 = 20.16 (W/CM^2) NB =157.31 (KW)
TEN =252.04 (C) TAS =324.46 (C) TNM =287.88 (C)

CP (MM)	ME0 (C)	ME1 (C)	ME2 (C)	ME3 (C)	ME4 (C)	ME5 (C)
11.00		258.13	271.89	286.09	300.49	316.34
25.20	253.35	258.40	273.41	288.59	303.17	319.30
33.40		256.95	270.82	285.60	300.44	316.46
55.40		256.51	271.16	286.01	300.92	317.06
66.60		258.47	273.48	289.87	305.80	321.51
80.95	253.52	256.90	271.36	287.57	303.27	319.04
95.30		258.06	273.55	289.92	305.85	321.66
109.65		256.44	270.28	286.55	302.06	315.52
124.00		258.01	272.87	288.90	304.60	320.31
138.35	253.32	256.98	270.39	286.14	301.77	317.69
152.70		259.43	274.31	289.17	305.10	319.69
163.90		257.44	271.58	285.55	300.27	315.98
185.90		257.54	271.55	285.43	300.12	315.59
194.10	253.13	259.16	273.48	287.81	302.61	318.51
208.30		256.76	270.23	285.19	299.81	315.81
230.30		256.93	270.97	285.84	300.00	316.24
241.50		258.33	274.41	290.02	304.84	320.70
255.85	253.50	256.59	271.36	287.69	302.78	318.00
270.20		257.88	272.87	288.22	303.99	319.81
284.55		256.05	268.60	284.41	299.88	316.44
298.90		258.13	272.50	287.91	303.99	319.04
313.25	253.47	256.90	271.70	287.11	302.54	318.29
327.60		259.53	275.23	290.04	305.20	319.93
338.80		257.35	271.94	285.89	300.68	316.08

TEGENA 1 WALL TEMPERATURE
DT=75(K) EXP 2

TAB. A12.2

W05D075.DAT

RE = 47.6E+03 PE =282.82 MS = 2.51 (KG/S)
UB = 1.54 (M/S) QH1 = 30.40 (W/CM^2) QH2 = 30.14 (W/CM^2)
QH3 = 29.80 (W/CM^2) QH4 = 30.58 (W/CM^2) NB =238.68 (KW)
TEN =261.81 (C) TAS =334.22 (C) TNM =297.43 (C)

CP (MM)	ME0 (C)	ME1 (C)	ME2 (C)	ME3 (C)	ME4 (C)	ME5 (C)
11.00		266.78	280.09	294.23	308.40	323.98
25.20	262.70	268.47	283.67	298.42	312.62	328.27
33.40		266.19	279.92	294.33	308.79	324.15
55.40		265.07	279.78	294.37	308.88	324.89
66.60		268.59	283.48	299.63	315.25	330.94
80.95	262.75	265.83	279.88	296.12	311.73	327.55
95.30		267.66	282.72	298.83	314.60	330.62
109.65		265.44	277.59	294.47	309.41	322.85
124.00		267.32	281.70	297.57	313.30	328.97
138.35	263.04	266.12	279.19	294.81	310.35	326.11
152.70		268.83	283.65	298.88	314.50	328.95
163.90		266.02	279.46	293.43	307.85	323.50
185.90		266.41	279.78	293.28	307.77	322.92
194.10	262.97	268.10	282.36	296.65	311.39	326.88
208.30		265.80	278.24	292.92	307.31	322.99
230.30		265.97	279.39	293.70	307.60	323.43
241.50		267.46	283.50	299.05	313.90	329.38
255.85	263.21	265.58	279.29	295.56	310.93	326.04
270.20		267.10	282.36	297.52	313.37	328.78
284.55		264.82	277.61	293.45	308.39	324.72
298.90		267.51	281.75	297.01	312.93	327.15
313.25	262.70	265.41	279.07	294.28	309.78	325.99
327.60		268.42	284.03	298.66	313.85	328.11
338.80		266.05	280.29	293.94	308.47	323.38

TEGENA 1 WALL TEMPERATURE
DT=75(K) EXP 2

TAB. A12.3

W05B075.DAT

RE = 63.9E+03 PE =377.09 MS = 3.34 (KG/S)
UB = 2.05 (M/S) QH1 = 40.16 (W/CM^2) QH2 = 39.86 (W/CM^2)
QH3 = 39.40 (W/CM^2) QH4 = 40.43 (W/CM^2) NB =315.52 (KW)
TEN =265.39 (C) TAS =336.97 (C) TNM =300.78 (C)

CP (MM)	ME0 (C)	ME1 (C)	ME2 (C)	ME3 (C)	ME4 (C)	ME5 (C)
11.00		269.63	282.11	296.18	310.06	325.48
25.20	266.67	271.95	286.97	301.44	315.41	330.62
33.40		269.53	282.67	296.48	310.61	325.51
55.40		267.87	281.89	296.28	310.52	326.54
66.60		271.85	286.38	302.50	317.96	333.95
80.95	266.77	269.04	282.47	298.56	314.18	329.85
95.30		270.92	286.02	301.90	317.60	333.71
109.65		268.56	280.14	297.25	311.65	325.08
124.00		270.19	284.49	300.15	315.77	331.31
138.35	266.58	268.92	281.30	296.67	312.13	327.69
152.70		271.68	286.12	301.36	316.85	331.14
163.90		268.51	281.18	295.00	309.07	324.62
185.90		268.87	281.79	294.85	309.12	323.97
194.10	266.36	270.83	285.05	299.14	313.72	328.75
208.30		268.48	280.21	294.66	308.71	323.99
230.30		268.63	281.45	295.29	308.80	324.48
241.50		270.46	286.29	301.61	316.23	331.50
255.85	266.77	268.46	281.35	297.42	312.83	327.79
270.20		270.27	285.29	300.37	316.28	331.26
284.55		268.17	280.40	296.40	310.83	327.04
298.90		270.75	284.78	300.11	315.94	329.28
313.25	266.77	268.63	281.50	296.40	311.77	328.08
327.60		271.68	286.82	301.12	316.32	330.45
338.80		269.04	282.54	295.75	310.01	324.64

TEGENA 1 WALL TEMPERATURE
DT=75(K) EXP 2

TAB. A12.4

W05B075.DAT

RE = 80.2E+03 PE =471.12 MS = 4.17 (KG/S)
UB = 2.56 (M/S) QH1 = 50.62 (W/CM^2) QH2 = 50.25 (W/CM^2)
QH3 = 49.61 (W/CM^2) QH4 = 50.95 (W/CM^2) NB =397.59 (KW)
TEN =267.70 (C) TAS =339.83 (C) TNM =303.47 (C)

CP (MM)	ME0 (C)	ME1 (C)	ME2 (C)	ME3 (C)	ME4 (C)	ME5 (C)
11.00		271.92	284.02	297.51	311.50	326.75
25.20	268.97	272.68	288.10	302.83	317.23	332.70
33.40		270.65	283.46	297.34	311.65	326.75
55.40		269.97	283.54	297.80	311.98	328.02
66.60		273.21	287.76	304.72	320.60	336.79
80.95	269.06	270.99	284.00	300.42	316.39	332.41
95.30		273.04	288.83	304.79	320.46	336.67
109.65		270.65	282.37	299.76	313.81	327.28
124.00		272.53	287.04	303.05	318.46	333.97
138.35	269.02	270.99	282.76	298.17	313.79	329.70
152.70		273.58	288.23	303.20	319.13	333.61
163.90		270.80	283.25	296.66	310.75	325.98
185.90		270.75	283.07	296.42	310.58	325.38
194.10	268.82	272.94	286.96	301.09	315.91	331.24
208.30		270.58	281.98	296.13	310.32	325.43
230.30		270.53	282.95	296.91	310.10	325.86
241.50		272.80	288.76	303.95	318.65	333.92
255.85	269.14	270.70	283.15	299.08	314.54	329.46
270.20		272.04	286.96	302.01	318.00	333.03
284.55		270.14	282.03	297.71	312.15	328.67
298.90		272.63	286.40	301.53	317.57	330.97
313.25	268.92	270.72	283.03	297.80	312.95	329.58
327.60		273.07	289.25	303.68	318.32	332.24
338.80		270.94	283.93	297.22	311.36	325.82

17:25:17 JUL10,1987 M336.DAT **TAB. A13.1**

TEGENA 2 - WALL TEMPERATURES
CHANNEL PERIMERTER MP1/2/3/4/5

TBI	=	311.7 C	DTC	=	97.1 K
UB	=	1.97 m/s	Re	=	68143.
QH1	=	51.5 W/cm^2	QH2	=	51.4 W/cm^2
QH3	=	51.1 W/cm^2	QH4	=	51.4 W/cm^2

C P mm	MP1 C	MP2 C	MP3 C	MP4 C	MP5 C
11.00	315.80	334.169	353.39	372.86	393.0
25.20	318.52	338.917	359.31	378.87	399.2
33.40	315.34	333.834	353.49	372.50	393.0
55.40	315.43	334.672	353.34	372.67	393.8
66.60	319.36	338.620	358.82	380.20	401.5
81.00	314.91	331.318	351.84	373.12	394.8
95.30	316.91	335.270	356.82	379.01	400.4
109.70	314.72	331.150	351.61	372.95	393.1
124.00	316.88	337.855	360.19	381.12	401.4
138.40	315.10	334.456	356.25	377.26	398.3
152.70	318.69	340.796	361.86	382.53	402.1
163.90	314.55	333.594	353.03	372.58	393.1
185.90	315.20	334.049	352.99	372.65	392.5
194.10	318.47	338.763	357.75	377.73	397.6
208.30	314.88	332.300	350.37	369.38	390.0
230.30	315.17	332.780	351.08	369.92	391.4
241.50	317.99	335.725	356.49	377.31	399.0
255.90	314.09	329.544	349.75	371.15	393.1
270.20	315.97	334.648	354.91	376.50	398.7
284.60	313.68	329.951	350.03	370.94	392.0
298.90	316.42	336.946	357.92	378.89	399.4
313.30	314.33	332.085	353.37	374.68	395.3
327.60	318.73	338.883	360.48	380.74	401.1
338.80	315.51	334.815	353.32	372.84	393.6

08:05:43 JUN22,1987 M094.DAT **TAB. A13.2**

TEGENA 2 - WALL TEMPERATURES
CHANNEL PERIMERTER MP1/2/3/4/5

TBI	=	296.0 C	DTC	=	78.2 K
UB	=	.98 m/s	Re	=	32438.
QH1	=	20.8 W/cm^2	QH2	=	20.8 W/cm^2
QH3	=	20.6 W/cm^2	QH4	=	20.8 W/cm^2

C P mm	MP1 C	MP2 C	MP3 C	MP4 C	MP5 C
11.00	301.64	316.550	330.80	345.82	362.4
25.20	301.76	316.529	331.30	347.20	364.5
33.40	300.60	313.057	328.11	344.05	361.5
55.40	300.78	313.587	328.61	344.88	362.4
66.60	300.41	314.672	331.87	349.99	367.4
81.00	299.63	313.347	330.68	348.42	366.0
95.30	299.44	316.935	335.01	353.25	370.4
109.70	300.79	316.646	334.03	351.28	367.4
124.00	300.50	319.943	338.29	354.90	371.1
138.40	301.35	319.029	336.09	351.68	367.7
152.70	302.58	320.760	336.14	351.49	366.8
163.90	300.53	316.622	330.27	344.84	361.1
185.90	301.78	316.285	329.74	344.43	360.3
194.10	302.94	316.357	330.41	346.03	362.5
208.30	300.45	311.828	325.73	341.68	359.2
230.30	300.09	312.238	326.77	342.43	360.5
241.50	299.66	312.961	329.93	347.39	365.5
255.90	298.95	311.973	328.81	346.51	364.3
270.20	299.15	315.466	332.76	350.66	368.6
284.60	299.39	315.250	332.07	349.20	366.4
298.90	300.28	319.245	336.46	353.68	370.1
313.30	301.06	318.523	335.42	351.37	367.3
327.60	303.72	320.568	336.45	351.97	368.1
338.80	301.23	316.911	330.92	346.22	362.8

10:31:07 JUN15,1987 M080.DAT

TEGENA 2 - WALL TEMPERATURES
CHANNEL PERIMERTER MP1/2/3/4/5

TAB. A13.3

TBI = 293.3 C DTC = 81.8 K
UB = .48 m/s Re = 15958.
QH1 = 10.8 W/cm^2 QH2 = 10.7 W/cm^2
QH3 = 10.7 W/cm^2 QH4 = 10.7 W/cm^2

C P mm	MP1 C	MP2 C	MP3 C	MP4 C	MP5 C
11.00	302.26	313.990	329.54	346.98	365.9
25.20	300.28	315.713	331.15	348.74	367.5
33.40	298.80	311.725	329.71	347.48	366.1
55.40	297.99	312.689	330.45	348.31	366.8
66.60	297.54	314.761	333.74	352.18	369.8
81.00	297.42	314.954	333.95	351.91	369.3
95.30	298.15	318.300	336.61	354.75	371.9
109.70	299.41	318.180	335.70	353.13	369.5
124.00	300.01	319.334	336.87	354.06	371.0
138.40	301.49	316.712	333.78	350.96	368.6
152.70	302.99	314.400	331.72	350.34	367.9
163.90	300.91	311.363	327.58	345.86	364.8
185.90	300.16	311.508	327.53	345.52	364.2
194.10	299.46	312.304	329.04	347.07	365.7
208.30	297.35	310.929	328.29	346.07	364.7
230.30	296.77	312.183	329.64	346.67	365.5
241.50	296.84	314.376	332.85	350.29	368.6
255.90	297.16	314.448	332.92	350.39	368.1
270.20	297.93	317.025	335.12	352.91	370.9
284.60	298.73	316.784	334.31	351.72	369.5
298.90	300.18	319.094	336.32	353.56	370.8
313.30	300.28	317.939	334.62	351.39	368.7
327.60	303.16	317.674	333.83	351.17	369.0
338.80	302.55	314.809	329.71	347.38	366.2

09:53:43 JUN16,1987 M082.DAT

TEGENA 2 - WALL TEMPERATURES
CHANNEL PERIMERTER MP1/2/3/4/5

TAB. A13.4

TBI = 288.2 C DTC = 88.3 K
UB = .24 m/s Re = 7983.
QH1 = 5.8 W/cm^2 QH2 = 5.8 W/cm^2
QH3 = 5.8 W/cm^2 QH4 = 5.8 W/cm^2

C P mm	MP1 C	MP2 C	MP3 C	MP4 C	MP5 C
11.00	295.14	311.069	329.44	348.81	368.9
25.20	294.68	312.756	330.83	349.67	369.6
33.40	294.07	310.972	330.04	348.88	368.7
55.40	293.92	311.696	330.38	349.36	369.1
66.60	294.22	313.310	332.27	351.43	370.3
81.00	294.17	313.335	332.41	351.00	369.6
95.30	295.50	314.876	333.49	352.50	370.9
109.70	296.47	313.840	332.65	351.43	369.1
124.00	296.45	313.720	333.30	352.10	370.3
138.40	295.67	312.130	332.03	350.74	369.5
152.70	294.44	311.358	331.43	351.29	369.6
163.90	293.23	309.356	329.03	348.88	368.4
185.90	293.13	309.694	328.86	348.71	368.1
194.10	293.35	310.755	329.54	349.36	369.0
208.30	292.43	310.707	329.10	348.36	368.4
230.30	292.55	311.623	329.90	348.48	368.7
241.50	293.69	313.286	331.62	350.34	370.1
255.90	294.17	313.214	331.81	350.14	369.3
270.20	295.04	314.804	332.94	351.31	370.7
284.60	294.97	314.033	332.15	350.43	369.6
298.90	295.70	314.683	333.12	351.55	370.2
313.30	295.24	313.503	332.15	350.45	369.3
327.60	296.16	313.117	331.93	350.86	369.9
338.80	295.29	311.454	329.44	349.02	368.9

20:02:16 JUN16,1987 M085.DAT

TEGENA 2 - WALL TEMPERATURES
CHANNEL PERIMERTER MP1/2/3/4/5

TAB. A13.5

TBI = 280.2 C DTC = 116.8 K
UB = .11 m/s Re = 3732.
QH1 = 3.6 W/cm^2 QH2 = 3.5 W/cm^2
QH3 = 3.5 W/cm^2 QH4 = 3.5 W/cm^2

C P mm	MP1 C	MP2 C	MP3 C	MP4 C	MP5 C
11.00	286.41	311.194	335.99	360.19	385.6
25.20	286.78	311.883	336.99	360.67	385.9
33.40	286.70	311.483	336.39	360.14	385.4
55.40	287.15	312.110	336.46	360.43	385.6
66.60	288.33	312.881	337.23	361.66	385.9
81.00	288.91	312.640	337.04	360.95	385.1
95.30	289.76	313.773	337.49	361.83	385.6
109.70	290.49	313.267	337.09	361.09	384.0
124.00	290.76	314.014	337.78	361.45	385.0
138.40	290.90	313.556	337.52	360.76	384.7
152.70	290.64	313.387	337.61	361.47	384.9
163.90	289.76	311.965	336.42	360.05	384.5
185.90	289.86	311.941	336.39	360.22	384.3
194.10	290.30	312.303	336.49	360.64	384.9
208.30	289.57	311.724	335.70	360.17	384.6
230.30	289.32	312.206	336.18	360.22	384.9
241.50	289.62	312.857	336.58	361.09	385.6
255.90	289.18	312.496	336.37	360.64	384.9
270.20	288.82	313.267	336.85	361.14	385.7
284.60	288.26	312.447	336.23	360.52	385.1
298.90	288.06	312.857	337.05	361.24	385.4
313.30	287.16	312.255	336.82	360.64	385.0
327.60	286.87	312.230	337.18	361.24	385.6
338.80	286.22	311.387	335.79	360.26	385.4

TEGENA 1 FLUID TEMPERATURE
DIR A PROBE 2

TAB. A14

F04B12A.DAT

```
RE  = 60.4E+03          PE  =354.08                 MS  =  3.13   (KG/S)
UB  =  1.92  (M/S)      QH1 = 50.23  (W/CM^2)       QH2 = 49.84   (W/CM^2)
QH3 = 49.24  (W/CM^2)   QH4 = 50.59  (W/CM^2)       NB  =394.56   (KW)
TEN =257.63  (C)        X21 = 86.96  (MM)           X22 = 88.79   (MM)
```

Y21 (MM)	Y24 (MM)	TE21 (C)	TE22 (C)	TE23 (C)	TE24 (C)	QH1 (W/CM^2)	QH2 (W/CM^2)	QH3 (W/CM^2)	QH4 (W/CM^2)	UB (M/S)	PE
2.71	0.88	341.78	341.72	341.02	340.44	50.23	49.84	49.24	50.59	1.92	354.08
4.60	2.77	345.04	345.39	342.36	342.16	50.41	50.02	49.41	50.77	1.93	354.95
6.70	4.67	350.86	350.65	346.21	345.78	50.60	50.21	49.59	50.95	1.93	355.99
8.74	6.91	357.82	356.93	352.13	352.90	51.01	50.62	50.01	51.38	1.94	356.51
12.57	10.74	369.74	370.21	364.23	363.90	50.20	49.80	49.20	50.54	1.93	354.72
13.56	11.73	374.63	374.24	369.20	368.44	50.55	50.16	49.56	50.91	1.93	355.91
14.57	12.74	375.63	375.81	371.45	371.24	49.99	49.60	49.00	50.35	1.92	354.34
15.09	13.26	377.45	377.64	373.73	373.79	50.26	49.85	49.25	50.60	1.92	353.62
15.61	13.78	377.99	377.81	375.22	374.54	50.33	49.94	49.34	50.69	1.93	355.07
16.13	14.30	378.82	378.99	376.72	376.18	50.48	50.09	49.47	50.83	1.92	354.18
16.67	14.84	377.92	378.42	377.01	376.89	50.44	50.05	49.44	50.79	1.93	355.18
17.19	15.36	376.68	376.68	377.07	376.85	49.65	49.26	48.66	49.99	1.91	351.87
17.70	15.87	375.30	375.49	376.39	376.35	49.41	49.02	48.43	49.75	1.91	351.61
18.21	16.38	374.62	375.34	377.47	377.26	49.42	49.04	48.45	49.77	1.91	351.72
18.72	16.89	372.97	373.04	376.70	376.62	49.21	48.83	48.24	49.56	1.91	351.33
19.69	17.86	369.85	369.87	375.28	375.63	49.10	48.72	48.13	49.45	1.90	350.76
20.67	18.84	366.60	367.47	373.33	372.80	49.12	48.74	48.16	49.47	1.91	351.90
21.62	19.79	363.41	363.03	369.62	369.33	49.20	48.82	48.23	49.54	1.91	351.11

TEGENA 1 FLUID TEMPERATURE
DIR B PROBE 2

TAB. A15

F04B12B.DAT

```
RE  = 60.1E+03          PE  =352.52                 MS  =  3.12   (KG/S)
UB  =  1.91  (M/S)      QH1 = 49.38  (W/CM^2)       QH2 = 49.00   (W/CM^2)
QH3 = 48.42  (W/CM^2)   QH4 = 49.74  (W/CM^2)       NB  =387.95   (KW)
TEN =257.98  (C)        X21 = 86.97  (MM)           X22 = 88.80   (MM)
```

Y21 (MM)	Y24 (MM)	TE21 (C)	TE22 (C)	TE23 (C)	TE24 (C)	QH1 (W/CM^2)	QH2 (W/CM^2)	QH3 (W/CM^2)	QH4 (W/CM^2)	UB (M/S)	PE
21.65	19.82	363.33	363.09	370.15	369.85	49.38	49.00	48.42	49.74	1.91	352.52
20.76	18.93	366.29	365.77	372.45	372.91	49.37	48.99	48.40	49.72	1.91	352.30
19.80	17.97	370.46	370.54	375.11	375.04	49.42	49.02	48.44	49.77	1.92	353.23
19.81	17.98	369.77	370.78	375.33	374.68	49.40	49.01	48.41	49.73	1.91	352.61
18.84	17.01	373.30	372.48	376.59	376.66	49.39	49.01	48.42	49.74	1.91	351.52
18.32	16.49	374.85	375.00	376.96	377.07	49.48	49.09	48.50	49.83	1.91	352.28
17.81	15.98	375.20	375.71	376.68	376.65	49.29	48.91	48.32	49.64	1.91	351.31
17.30	15.47	375.56	376.05	375.98	375.96	49.28	48.90	48.31	49.63	1.92	353.58
16.79	14.96	375.75	376.19	375.13	374.83	49.32	48.94	48.35	49.67	1.92	354.13
16.26	14.43	376.82	376.94	374.48	374.39	49.29	48.91	48.32	49.64	1.92	353.18
15.74	13.91	375.94	376.42	373.13	373.06	49.23	48.85	48.26	49.58	1.91	351.16
15.21	13.38	375.21	376.18	372.36	371.97	49.41	49.02	48.43	49.75	1.91	351.54
14.68	12.85	375.14	375.10	370.18	370.33	49.33	48.95	48.36	49.68	1.91	352.26
13.66	11.83	371.56	371.59	365.44	365.81	49.17	48.79	48.21	49.51	1.91	352.69
12.68	10.85	368.24	368.21	362.54	362.18	49.21	48.81	48.24	49.55	1.91	351.54
10.79	8.96	362.54	362.20	356.97	357.04	49.27	48.88	48.30	49.62	1.92	353.16
8.86	7.03	356.12	355.55	351.28	350.79	49.36	48.97	48.39	49.70	1.92	352.78
6.83	5.00	350.43	350.35	344.66	345.11	49.53	49.14	48.56	49.88	1.92	352.80
4.72	2.89	343.99	344.60	341.18	341.00	49.63	49.24	48.66	49.98	1.92	353.64
2.69	0.86	341.28	341.10	340.13	339.72	49.57	49.19	48.60	49.92	1.92	353.27

TEGENA 1 FLUID TEMPERATURE
DIR A PROBE S2

TAB. A16

F06LWSA.DAT

```
RE  = 61.3E+03          PE  =360.31              MS  =  3.19   (KG/S)
UB  =  1.96  (M/S)      QH1 = 51.01  (W/CM^2)    QH2 = 50.59   (W/CM^2)
QH3 = 50.02  (W/CM^2)   QH4 = 51.37  (W/CM^2)    NB  =400.67   (KW)
TEN =256.55  (C)        Y21 =  2.68  (MM)        Y24 =  0.85   (MM)
```

X21 (MM)	X22 (MM)	TE21 (C)	TE22 (C)	TE23 (C)	TE24 (C)	QH1 (W/CM^2)	QH2 (W/CM^2)	QH3 (W/CM^2)	QH4 (W/CM^2)	TNO (C)	TNM (C)	UB (M/S)	PE
110.98	112.81	339.65	336.50	335.04	337.84	51.01	50.59	50.02	51.37	350.80	303.67	1.96	360.31
108.95	110.78	344.39	340.12	338.06	341.50	51.11	50.68	50.11	51.47	350.96	303.73	1.96	360.14
106.98	108.81	349.14	344.64	341.63	345.43	51.07	50.65	50.08	51.44	350.85	303.59	1.95	359.78
105.04	106.87	353.47	349.43	345.62	348.94	50.99	50.57	49.99	51.34	350.71	303.59	1.96	360.15
103.03	104.86	357.05	354.32	349.48	351.58	51.09	50.67	50.09	51.45	351.19	303.90	1.95	359.64
102.01	103.84	357.24	355.86	350.67	352.09	51.08	50.65	50.08	51.44	351.29	304.07	1.96	360.10
100.99	102.82	357.29	356.98	351.48	352.13	50.94	50.52	49.95	51.30	350.41	303.44	1.96	360.89
99.96	101.79	356.71	357.55	352.01	351.52	51.04	50.62	50.05	51.41	350.93	303.77	1.96	360.32
98.95	100.78	355.62	357.57	352.16	351.09	51.19	50.77	50.19	51.55	350.76	303.53	1.96	360.73
97.96	99.79	353.87	356.48	351.39	349.70	51.19	50.77	50.20	51.55	350.36	303.17	1.96	361.04
96.99	98.82	351.69	355.08	350.43	348.19	51.15	50.74	50.16	51.52	351.17	303.83	1.95	359.71
95.04	96.87	347.89	351.70	347.92	345.17	51.20	50.78	50.21	51.57	351.03	303.71	1.96	360.17
93.03	94.86	344.46	347.63	345.28	342.62	51.26	50.84	50.27	51.63	350.94	303.58	1.96	360.23
90.99	92.82	341.77	343.94	342.28	339.89	51.21	50.79	50.22	51.58	350.95	303.60	1.96	360.05
88.95	90.78	339.80	341.55	340.06	338.60	51.25	50.82	50.25	51.61	350.78	303.43	1.96	360.26
86.99	88.82	339.65	339.68	338.58	338.39	51.37	50.94	50.36	51.73	350.88	303.53	1.96	361.10
85.03	86.86	340.75	339.62	338.26	339.21	51.37	50.95	50.38	51.74	350.85	303.52	1.96	361.26
83.02	84.85	342.46	340.73	338.80	340.26	51.09	50.67	50.10	51.46	350.45	303.26	1.96	360.35
80.98	82.81	345.24	342.92	340.51	342.58	51.11	50.69	50.11	51.47	351.06	303.84	1.96	360.33
78.94	80.77	347.90	345.40	342.21	344.41	51.01	50.59	50.02	51.38	350.95	303.72	1.95	359.49
76.97	78.80	350.58	347.89	344.60	346.43	50.93	50.51	49.94	51.30	350.35	303.31	1.96	360.35
75.02	76.85	352.81	351.07	346.72	347.87	51.00	50.58	50.01	51.36	350.95	303.75	1.95	359.69
74.02	75.85	353.15	352.26	347.52	348.16	51.12	50.70	50.12	51.48	350.75	303.58	1.96	360.69
73.02	74.85	353.13	353.26	348.28	348.40	51.06	50.64	50.06	51.42	350.59	303.37	1.95	359.89
72.00	73.83	352.64	353.35	348.18	347.80	51.03	50.61	50.03	51.39	350.47	303.30	1.95	359.97
70.97	72.80	351.34	352.96	347.86	346.82	51.11	50.69	50.12	51.47	350.64	303.50	1.96	360.86
69.94	71.77	349.58	352.33	347.48	345.68	51.20	50.78	50.20	51.56	350.82	303.57	1.96	360.65
68.93	70.76	348.05	351.20	346.66	344.22	51.00	50.58	50.01	51.36	350.33	303.19	1.95	360.01
66.97	68.80	343.94	347.24	343.74	341.02	51.09	50.66	50.08	51.44	350.48	303.33	1.96	360.51
65.01	66.84	340.35	343.27	340.90	338.62	51.13	50.71	50.14	51.50	350.59	303.36	1.96	360.25
63.01	64.84	338.33	339.95	338.63	336.93	51.16	50.74	50.16	51.51	350.76	303.45	1.95	359.90
60.96	62.79	337.62	338.41	336.62	335.75	51.07	50.65	50.08	51.43	350.26	303.12	1.96	360.52
60.96	62.79	337.23	337.84	336.59	335.80	51.14	50.72	50.13	51.49	350.59	303.42	1.96	360.77
58.93	60.76	337.21	337.26	335.84	335.84	51.03	50.61	50.04	51.39	350.51	303.24	1.95	359.24
56.97	58.80	337.60	337.20	335.74	336.44	51.08	50.66	50.09	51.45	350.52	303.37	1.96	360.58
55.02	56.85	339.38	337.87	336.54	337.53	51.03	50.60	50.03	51.38	350.82	303.54	1.95	359.19
53.01	54.84	341.13	339.60	337.36	338.83	51.12	50.70	50.13	51.49	350.52	303.25	1.95	359.89

TEGENA 1   FLUID TEMPERATURE
DIR B   PROBE S2

TAB. A17

F06LWSB.DAT

RE = 61.0E+03		PE =358.29		MS = 3.17	(KG/S)
UB = 1.95	(M/S)	QH1 = 50.48	(W/CM^2)	QH2 = 50.06	(W/CM^2)
QH3 = 49.49	(W/CM^2)	QH4 = 50.84	(W/CM^2)	NB =396.50	(KW)
TEN =256.41	(C)	Y21 = 2.68	(MM)	Y24 = 0.85	(MM)

X21 (MM)	X22 (MM)	TE21 (C)	TE22 (C)	TE23 (C)	TE24 (C)	QH1 (W/CM^2)	QH2 (W/CM^2)	QH3 (W/CM^2)	QH4 (W/CM^2)	TNO (C)	TNM (C)	UB (M/S)	PE
53.00	54.83	341.76	339.89	338.07	339.68	50.48	50.06	49.49	50.84	350.18	303.29	1.95	358.29
54.94	56.77	339.41	338.24	336.88	338.09	50.49	50.07	49.49	50.84	349.70	302.81	1.95	358.23
56.89	58.72	337.84	337.29	336.39	337.07	50.58	50.16	49.58	50.93	349.86	302.97	1.95	358.92
58.84	60.67	337.62	337.78	336.45	336.60	50.55	50.13	49.55	50.91	349.77	302.86	1.95	358.51
60.87	62.70	338.03	338.34	337.06	336.53	50.64	50.22	49.64	50.99	350.00	303.01	1.95	358.48
62.95	64.78	338.57	340.06	338.73	337.35	50.62	50.19	49.62	50.97	350.07	303.11	1.95	358.64
64.93	66.76	341.05	343.92	341.18	339.62	50.61	50.19	49.61	50.96	349.86	302.96	1.95	359.01
66.89	68.72	344.22	348.01	343.84	341.62	50.71	50.29	49.71	51.07	350.12	303.02	1.95	358.24
68.85	70.68	348.71	351.58	347.12	344.76	50.90	50.48	49.90	51.25	350.28	303.19	1.95	359.69
69.85	71.68	349.67	352.19	347.32	345.30	50.92	50.50	49.93	51.29	350.30	303.24	1.96	360.07
70.86	72.69	350.84	352.37	347.29	346.12	50.84	50.42	49.85	51.20	350.37	303.32	1.95	359.54
71.90	73.73	351.81	352.63	347.41	346.98	50.82	50.41	49.83	51.18	349.95	302.84	1.95	358.93
72.96	74.79	352.30	352.22	347.23	347.36	50.88	50.47	49.90	51.25	350.23	303.05	1.95	358.88
73.96	75.79	352.59	351.69	346.94	347.57	50.86	50.44	49.87	51.22	350.49	303.39	1.95	359.30
74.94	76.77	352.33	350.96	346.53	347.76	50.97	50.54	49.97	51.32	349.90	302.87	1.96	360.56
76.89	78.72	350.57	348.02	344.42	346.27	51.01	50.59	50.03	51.38	350.57	303.28	1.95	359.02
78.85	80.68	348.12	345.33	342.62	344.40	51.08	50.65	50.07	51.43	350.89	303.54	1.95	359.02
80.87	82.70	344.65	342.42	339.89	342.09	50.74	50.32	49.75	51.10	350.21	303.22	1.95	359.37
82.96	84.79	342.12	340.41	338.34	340.04	50.91	50.49	49.93	51.28	350.11	303.06	1.96	360.10
84.96	86.79	340.47	339.23	337.88	338.74	51.03	50.60	50.03	51.38	350.51	303.33	1.95	359.95
86.90	88.73	339.77	339.38	338.66	338.08	51.21	50.78	50.21	51.57	350.69	303.49	1.96	361.04
88.86	90.69	339.14	340.44	339.16	338.02	50.78	50.36	49.79	51.13	349.94	302.96	1.95	359.62
90.88	92.71	340.78	343.10	341.68	339.84	50.92	50.49	49.92	51.27	350.11	302.98	1.95	359.41
92.96	94.79	343.46	346.74	344.24	341.66	50.81	50.39	49.82	51.17	350.00	302.96	1.95	359.38
94.96	96.79	346.76	350.58	346.89	344.47	50.79	50.37	49.80	51.15	349.83	302.90	1.96	360.04
96.90	98.73	351.10	354.37	349.81	347.64	50.88	50.46	49.89	51.24	350.24	303.17	1.95	359.78
97.87	99.70	353.29	355.92	351.08	349.41	50.92	50.50	49.93	51.28	350.64	303.55	1.95	359.87
98.86	100.69	355.25	356.90	351.45	350.44	50.91	50.50	49.93	51.29	349.97	302.94	1.96	360.29
99.86	101.69	356.14	357.15	351.46	351.20	51.11	50.68	50.11	51.46	350.19	303.07	1.96	360.89
100.88	102.71	357.00	356.69	351.26	351.84	51.02	50.59	50.02	51.37	350.31	303.26	1.96	360.75
101.91	103.74	357.37	355.78	350.58	351.84	51.13	50.70	50.13	51.49	350.78	303.56	1.96	360.35
102.96	104.79	356.59	354.18	349.06	351.39	51.04	50.62	50.05	51.40	350.70	303.49	1.95	359.85
104.94	106.77	354.01	349.84	345.81	349.12	51.13	50.71	50.14	51.49	350.31	303.18	1.96	361.06
106.89	108.72	349.24	344.56	341.83	345.50	51.25	50.83	50.25	51.61	350.54	303.24	1.96	360.56
108.85	110.68	344.67	340.42	338.23	342.05	51.25	50.83	50.26	51.61	350.62	303.33	1.96	360.68
110.87	112.70	340.04	336.47	335.18	338.00	51.18	50.75	50.18	51.53	350.29	303.15	1.96	361.17

X11 = 31.66 mm   X12 = 29.61 mm   15:19:25 JUL10,1987 M332.DAT

TAB. A18.1

TBI = 304.7 C   TBO = 401.3 C
QH1 = 50.82 W/cm^2   QH2 = 50.68 W/cm^2
QH3 = 50.37 W/cm^2   QH4 = 50.70 W/cm^2
NB = 399.1 kW   MFR = 3.13 kg/s
DTC = 96.6 K   UB = 1.94 m/s
Re = 66569.   Pe = 361.0

TEGENA 2 - FLUID TEMPERATURES
PROBE 1   TEMP FLUCTUATIONS

Y11 mm	TC11 C	RMS11 K	TC12 C	RMS12 K	Y13 mm	TC13 C	RMS13 K	TC14 C	RMS14 K	Y15 mm	TC15 C	RMS15 K	TBI C	MFR kg/s	DTC K	QH1 W/cm^2	QH2 W/cm^2	QH3 W/cm^2	QH4 W/cm^2
28.81	387.45	1.13	396.15	.82	30.86	386.19	.65	385.94	.49	29.84	386.83	.70	304.73	3.13	96.59	50.82	50.68	50.37	50.70
27.78	389.59	1.51	397.16	.78	29.83	386.56	.85	386.13	.74	28.81	388.59	.99	305.03	3.12	95.82	50.30	50.17	49.84	50.17
26.80	391.73	1.89	396.95	.82	28.85	387.62	1.05	387.05	1.07	27.83	389.23	1.31	304.97	3.11	95.90	50.15	50.02	49.71	50.03
25.88	395.12	2.15	396.25	.83	27.93	390.34	1.41	390.25	1.44	26.91	392.19	1.61	305.23	3.12	95.77	50.20	50.06	49.77	50.09
24.96	397.65	2.45	397.30	.85	27.01	391.89	1.76	391.79	1.83	25.99	395.33	1.93	305.22	3.12	95.94	50.28	50.15	49.84	50.16
23.06	404.41	2.72	396.62	.80	25.11	396.43	2.27	398.20	2.32	24.09	401.13	2.33	305.19	3.13	95.59	50.30	50.17	49.86	50.18
20.97	411.25	2.74	395.77	.80	23.02	404.80	2.50	404.45	2.55	22.00	406.95	2.54	304.96	3.11	96.03	50.28	50.14	49.84	50.16
19.88	416.06	2.57	396.27	.84	21.93	409.18	2.71	407.82	2.72	20.91	411.12	2.64	304.82	3.12	96.01	50.42	50.27	49.96	50.29
18.81	418.99	2.20	396.63	.84	20.86	411.89	2.70	411.96	2.66	19.84	413.67	2.53	304.95	3.12	96.04	50.48	50.33	50.01	50.33
17.77	422.82	1.60	395.91	.89	19.82	416.80	2.43	416.07	2.35	18.80	418.49	2.10	305.12	3.13	95.71	50.41	50.27	49.98	50.30
16.80	426.26	1.11	396.50	.89	18.85	420.10	2.12	420.44	1.99	17.83	421.18	1.60	305.32	3.13	95.95	50.57	50.43	50.11	50.43
15.88	426.25	.92	397.46	1.00	17.93	423.60	1.57	424.05	1.43	16.91	424.46	1.08	305.43	3.14	95.96	50.63	50.49	50.18	50.50
14.95	425.83	1.35	397.76	.81	17.00	426.58	1.04	427.08	.98	15.98	424.57	1.07	305.61	3.13	96.18	50.66	50.52	50.22	50.54
14.04	421.82	1.82	398.01	.83	16.09	426.28	1.03	427.05	.95	15.07	424.98	1.51	305.61	3.14	96.21	50.81	50.66	50.31	50.63
13.05	420.17	2.31	398.05	.83	15.10	424.98	1.51	424.10	1.37	14.08	421.00	2.04	305.58	3.14	96.41	50.88	50.74	50.43	50.75
12.03	417.28	2.61	398.96	.84	14.08	422.24	2.01	422.63	1.88	13.06	417.69	2.38	305.63	3.15	96.31	50.99	50.85	50.54	50.86
10.96	411.95	2.72	398.41	.84	13.01	418.56	2.30	418.63	2.20	11.99	414.01	2.49	305.85	3.15	96.22	50.98	50.83	50.53	50.84
9.86	409.02	2.77	397.00	1.44	11.91	415.42	2.58	416.24	2.56	10.89	410.91	2.59	306.16	3.14	96.33	50.91	50.76	50.46	50.79
8.79	406.94	2.67	393.38	1.29	10.84	412.61	2.58	413.95	2.62	9.82	407.75	2.48	306.55	3.16	96.35	51.21	51.06	50.76	51.07

X21 = 86.56 mm   X22 = 89.21 mm   15:19:25 JUL10,1987 M332.DAT

TAB. 18.2

TBI = 304.7 C   TBO = 401.3 C
QH1 = 50.8 W/cm^2   QH2 = 50.7 W/cm^2
QH3 = 50.4 W/cm^2   QH4 = 50.7 W/cm^2
NB = 399.1 kW   MFR = 3.13 kg/s
DTC = 96.6 K   UB = 1.94 m/s
Re = 66569.   Pe = 361.0

TEGENA 2 - FLUID TEMPERATURES
PROBE 2   TEMP FLUCTUATIONS

Y21 mm	TC21 C	RMS21 K	TC22 C	RMS22 K	Y23 mm	TC23 C	RMS23 K	TC24 C	RMS24 K	Y25 mm	TC25 C	RMS25 K	NH1 kW	NH2 kW	NH3 kW	NH4 kW	NB kW	UB m/s	TBO C
4.10	388.90	1.36	387.14	1.32	1.44	384.14	.64	384.31	.65	2.77	385.39	1.29	99.92	99.92	99.06	100.20	399.09	1.94	401.32
5.05	391.97	1.65	390.47	1.63	2.39	385.60	.92	385.64	.96	3.72	387.53	1.67	98.90	98.91	98.02	99.14	394.97	1.94	400.85
6.06	394.18	1.78	393.69	1.80	3.40	386.68	1.23	387.55	1.27	4.73	389.40	2.06	98.61	98.62	97.76	98.86	393.85	1.93	400.87
7.10	398.04	1.96	397.08	2.02	4.44	388.46	1.66	388.90	1.65	5.77	392.22	2.49	98.69	98.71	97.87	98.99	394.26	1.94	401.00
8.15	401.11	1.97	398.96	2.10	5.49	391.01	2.00	392.50	1.87	6.82	394.85	2.74	98.86	98.87	98.01	99.12	394.86	1.94	401.16
10.21	408.47	2.09	406.56	2.25	7.55	397.19	2.45	398.22	2.21	8.88	400.70	3.18	98.89	98.91	98.05	99.17	395.02	1.94	400.78
12.15	418.05	1.99	415.57	2.29	9.49	403.95	2.77	405.06	2.43	10.82	407.71	3.50	98.86	98.87	98.02	99.12	394.88	1.94	401.00
13.08	419.86	1.78	418.35	2.16	10.42	407.49	2.89	408.86	2.56	11.75	413.26	3.57	99.13	99.12	98.26	99.37	395.89	1.94	400.83
14.01	423.46	1.38	421.67	1.71	11.35	411.32	2.80	412.98	2.42	12.68	415.32	3.30	99.25	99.24	98.36	99.46	396.31	1.94	400.99
14.99	427.50	1.00	425.85	1.26	12.33	417.62	2.67	418.50	2.21	13.66	420.73	2.87	99.11	99.12	98.29	99.39	395.92	1.95	400.83
16.01	428.32	.69	426.84	.82	13.35	420.89	2.23	422.75	1.78	14.68	423.69	2.16	99.42	99.42	98.55	99.66	397.06	1.95	401.26
17.04	429.49	.63	427.92	.73	14.38	425.88	1.67	426.30	1.29	15.71	425.87	1.50	99.55	99.55	98.69	99.80	397.59	1.95	401.39
18.11	428.48	.88	427.42	1.04	15.45	427.15	1.13	428.32	.89	16.78	425.62	1.26	99.61	99.62	98.76	99.87	397.86	1.95	401.79
19.15	425.44	1.26	423.82	1.54	16.49	428.82	.82	429.97	.65	17.82	425.78	1.66	99.91	99.89	98.93	100.05	398.77	1.95	401.82
20.18	422.97	1.59	422.48	1.91	17.52	428.23	1.07	429.64	.80	18.85	423.43	2.29	100.03	100.04	99.18	100.28	399.53	1.95	401.99
21.16	418.49	1.79	417.65	2.06	18.50	423.77	1.54	427.55	1.14	19.83	419.84	2.74	100.25	100.26	99.40	100.50	400.41	1.96	401.95
22.11	414.73	1.92	413.70	2.05	19.45	421.85	1.97	425.33	1.56	20.78	416.93	3.01	100.23	100.22	99.37	100.46	400.28	1.96	402.07
23.04	410.43	1.94	411.19	2.00	20.38	420.07	2.28	421.21	1.88	21.71	414.51	3.04	100.10	100.09	99.24	100.37	399.80	1.95	402.50
24.00	408.00	1.90	407.01	1.90	21.34	416.62	2.40	417.45	2.16	22.67	411.60	3.02	100.68	100.68	99.82	100.92	402.10	1.97	402.90

```
X11  =  31.66 mm       X12  =  29.61 mm
TBI  =  307.8 C        TBO  =  404.3 C
QH1  =  51.04 W/cm^2   QH2  =  50.87 W/cm^2
QH3  =  50.57 W/cm^2   QH4  =  50.89 W/cm^2
NB   =  400.7 kW       MFR  =   3.15 kg/s
DTC  =   96.5 K        UB   =   1.96 m/s
Re   = 67344.          Pe   =  363.7
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TAB. A19.1

TEGENA 2 - FLUID TEMPERATURES
PROBE 1 TEMP FLUCTUATIONS

Y11 mm	TC11 C	RMS11 K	TC12 C	RMS12 K	Y13 mm	TC13 C	RMS13 K	TC14 C	RMS14 K	Y15 mm	TC15 C	RMS15 K	TBI C	MFR kg/s	DTC K	QH1 W/cm^2	QH2 W/cm^2	QH3 W/cm^2	QH4 W/cm^2
8.76	406.93	2.69	397.32	1.07	10.81	413.33	2.56	413.90	2.63	9.79	409.51	2.47	307.79	3.15	96.46	51.04	50.87	50.57	50.89
9.82	410.46	2.82	400.96	1.23	11.87	418.11	2.57	417.00	2.58	10.85	414.21	2.61	308.08	3.15	96.24	50.99	50.86	50.56	50.88
10.91	413.82	2.77	402.44	.82	12.96	423.16	2.34	422.77	2.28	11.94	417.10	2.56	308.30	3.14	96.49	50.93	50.78	50.48	50.80
11.97	419.57	2.54	401.90	.82	14.02	425.24	1.89	424.94	1.78	13.00	422.05	2.30	308.51	3.14	96.76	51.05	50.91	50.61	50.91
13.00	423.29	2.29	402.46	.80	15.05	426.81	1.50	427.39	1.37	14.03	424.26	2.04	308.61	3.15	96.32	51.03	50.90	50.60	50.92
13.97	426.15	1.78	402.11	.81	16.02	429.27	.99	429.87	.90	15.00	426.95	1.44	308.79	3.13	96.78	50.90	50.76	50.45	50.78
14.90	429.15	1.29	403.00	.82	16.95	430.39	1.02	429.98	.92	15.93	427.84	1.01	309.00	3.13	97.08	51.11	50.96	50.64	50.93
15.83	430.69	.98	402.52	.83	17.88	427.78	1.52	428.74	1.38	16.86	429.69	1.08	308.95	3.13	97.04	51.09	50.96	50.65	50.96
16.77	429.91	1.14	402.22	.85	18.82	425.23	2.14	425.31	1.98	17.80	427.46	1.61	309.02	3.15	96.40	51.08	50.93	50.63	50.95
17.73	428.37	1.58	401.51	.84	19.78	420.56	2.50	422.87	2.34	18.76	423.95	2.10	308.98	3.14	96.78	51.10	50.96	50.66	50.97
18.76	424.67	2.12	401.32	.81	20.81	416.07	2.73	417.22	2.63	19.79	421.15	2.50	309.05	3.13	96.85	50.91	50.76	50.46	50.78
19.83	421.34	2.51	401.23	.83	21.88	411.86	2.67	413.03	2.66	20.86	416.77	2.63	308.99	3.15	96.23	50.89	50.74	50.45	50.76
20.92	417.94	2.69	401.90	.81	22.97	409.36	2.57	409.71	2.57	21.95	413.66	2.59	309.15	3.13	96.45	50.78	50.64	50.34	50.65
23.01	409.23	2.79	402.69	.83	25.06	402.50	2.34	402.62	2.41	24.04	406.37	2.40	309.18	3.13	96.58	50.82	50.68	50.39	50.69
24.90	402.71	2.50	402.26	.77	26.95	398.66	1.81	397.89	1.93	25.93	399.19	1.98	308.97	3.13	96.56	50.83	50.70	50.39	50.72
25.81	398.86	2.33	401.97	.80	27.86	394.39	1.45	395.71	1.56	26.84	397.72	1.75	308.96	3.14	96.57	50.90	50.77	50.47	50.81
26.74	396.70	2.05	402.10	.79	28.79	392.75	1.18	391.78	1.20	27.77	394.22	1.44	309.00	3.15	96.44	51.05	50.91	50.60	50.92
27.72	394.80	1.63	401.42	.81	29.77	391.67	.86	391.60	.79	28.75	391.91	1.05	309.03	3.14	96.77	51.02	50.88	50.58	50.89
28.74	392.15	1.22	401.70	.83	30.79	391.15	.66	390.49	.53	29.77	392.12	.75	309.18	3.13	96.72	50.94	50.79	50.49	50.79

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X21  =  86.57 mm       X22  =  89.22 mm
TBI  =  307.8 C        TBO  =  404.3 C
QH1  =   51.0 W/cm^2   QH2  =   50.9 W/cm^2
QH3  =   50.6 W/cm^2   QH4  =   50.9 W/cm^2
NB   =  400.7 kW       MFR  =   3.15 kg/s
DTC  =   96.5 K        UB   =   1.96 m/s
Re   = 67344.          Pe   =  363.7
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TAB. 19.2

TEGENA 2 - FLUID TEMPERATURES
PROBE 2 TEMP FLUCTUATIONS

Y21 mm	TC21 C	RMS21 K	TC22 C	RMS22 K	Y23 mm	TC23 C	RMS23 K	TC24 C	RMS24 K	Y25 mm	TC25 C	RMS25 K	NH1 kW	NH2 kW	NH3 kW	NH4 kW	NB kW	UB m/s	TBO C
24.04	408.29	1.88	408.91	1.93	21.58	417.16	2.43	418.12	2.15	22.71	411.52	3.04	100.35	100.31	99.45	100.55	400.66	1.96	404.25
23.13	411.97	1.91	412.54	1.98	20.47	421.75	2.28	422.68	1.89	21.80	416.68	3.06	100.26	100.28	99.43	100.54	400.51	1.96	404.32
22.18	416.23	1.80	417.04	2.05	19.53	425.19	1.98	426.76	1.54	20.86	418.68	3.00	100.14	100.13	99.27	100.38	399.91	1.95	404.79
21.23	421.99	1.81	420.75	2.03	18.57	429.04	1.54	430.68	1.12	19.90	423.74	2.78	100.37	100.37	99.52	100.61	400.87	1.95	405.27
20.25	424.45	1.57	425.48	1.88	17.59	430.88	1.06	432.24	.76	18.92	426.28	2.27	100.34	100.36	99.50	100.63	400.83	1.96	404.92
19.23	430.26	1.24	427.42	1.53	16.57	432.26	.84	434.02	.68	17.90	429.59	1.71	100.07	100.07	99.22	100.34	399.71	1.95	405.57
18.18	431.58	.92	430.82	1.10	15.52	431.46	1.14	432.57	.90	16.85	431.02	1.31	100.49	100.47	99.59	100.65	401.20	1.95	406.08
17.11	433.85	.65	432.81	.77	14.45	428.74	1.68	432.06	1.29	15.78	429.52	1.50	100.46	100.47	99.61	100.71	401.25	1.95	405.99
16.06	433.58	.69	433.62	.86	13.40	427.85	2.34	427.36	1.79	14.73	429.09	2.22	100.43	100.43	99.57	100.68	401.11	1.96	405.42
15.06	431.85	.97	431.14	1.23	12.40	422.13	2.63	421.64	2.12	13.73	426.08	2.81	100.47	100.47	99.62	100.73	401.30	1.96	405.76
14.10	428.52	1.35	428.09	1.72	11.44	417.17	2.86	418.17	2.37	12.77	422.33	3.31	100.09	100.09	99.24	100.34	399.76	1.95	405.90
13.17	424.15	1.76	422.08	2.13	10.51	410.45	2.88	412.53	2.55	11.84	416.87	3.56	100.05	100.05	99.21	100.30	399.61	1.96	405.22
12.22	421.80	1.97	419.61	2.29	9.56	407.44	2.74	410.54	2.43	10.89	413.28	3.51	99.85	99.85	99.00	100.09	398.80	1.95	405.60
10.29	411.49	2.15	410.49	2.33	7.63	403.68	2.49	402.43	2.26	8.96	405.01	3.26	99.93	99.93	99.09	100.17	399.12	1.95	405.75
8.24	406.18	2.00	404.44	2.12	5.58	396.92	1.98	396.21	1.86	6.91	400.03	2.74	99.94	99.96	99.09	100.22	399.21	1.95	405.53
7.17	402.44	1.96	401.18	2.07	4.51	393.39	1.70	393.98	1.66	5.84	397.52	2.53	100.08	100.10	99.26	100.40	399.84	1.95	405.54
6.12	399.26	1.83	398.93	1.91	3.46	391.91	1.27	391.68	1.29	4.79	394.13	2.13	100.38	100.37	99.50	100.63	400.88	1.96	405.44
5.12	396.61	1.64	395.18	1.64	2.46	390.08	.91	391.03	.96	3.79	391.45	1.68	100.32	100.31	99.47	100.55	400.65	1.95	405.80
4.17	394.16	1.41	393.38	1.34	1.51	389.54	.65	389.91	.68	2.84	390.90	1.31	100.16	100.15	99.30	100.37	399.99	1.95	405.90

TAB. A20.1

Y11 = 29.39 mm   Y14 = 31.44 mm
TBI = 311.7 C   TBO = 408.8 C
QB1 = 51.5 W/cm^2   QB2 = 51.4 W/cm^2
QB3 = 51.1 W/cm^2   QB4 = 51.4 W/cm^2
NB = 404.6 kW   MFR = 3.16 kg/s
DTC = 97.1 K   UB = 1.97 m/s
Re = 68143.   Pe = 365.8

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TEGENA 2 - FLUID TEMPERATURES
PROBE 1 TEMP FLUCTUATIONS

X11 mm	TC11 C	RMS11 K	TC14 C	RMS14 K	X12 mm	TC12 C	RMS12 K	TC13 C	RMS13 K	X15 mm	TC15 C	RMS15 K	TBI C	MFR kg/s	DTC K	QB1 W/cm^2	QB2 W/cm^2	QB3 W/cm^2	QB4 W/cm^2
7.69	397.87	1.07	395.41	.61	5.64	406.02	.78	392.51	.46	6.67	394.66	.63	311.65	3.16	97.11	51.52	51.38	51.09	51.39
9.67	401.39	1.33	399.12	.81	7.62	405.96	.80	395.53	.67	8.65	397.99	.94	311.52	3.14	97.55	51.37	51.22	50.94	51.24
11.64	406.70	1.25	402.18	.86	9.59	406.07	.78	398.92	.83	10.62	402.25	1.07	311.84	3.15	97.48	51.52	51.37	51.06	51.37
13.63	410.34	.97	405.66	.73	11.58	405.80	.78	402.44	.90	12.61	406.29	1.00	311.89	3.16	97.17	51.52	51.38	51.09	51.39
14.64	412.00	.79	406.81	.60	12.59	405.75	.79	404.13	.88	13.62	407.75	.90	312.00	3.16	97.37	51.62	51.47	51.18	51.47
15.66	413.47	.60	407.71	.42	13.61	405.80	.80	406.23	.78	14.64	409.19	.71	312.11	3.16	97.35	51.73	51.58	51.29	51.60
16.67	413.63	.46	407.78	.28	14.62	406.93	.83	407.53	.66	15.65	410.27	.52	312.25	3.15	97.85	51.73	51.59	51.30	51.60
17.68	413.75	.51	408.60	.31	15.63	406.79	.80	408.44	.49	16.66	410.98	.35	312.38	3.16	97.80	51.84	51.69	51.40	51.70
18.67	412.56	.72	407.77	.47	16.62	406.03	.82	408.53	.39	17.65	410.55	.42	312.31	3.15	97.93	51.75	51.57	51.30	51.60
19.66	411.72	.90	406.80	.60	17.61	407.00	.82	408.56	.42	18.64	410.03	.59	312.48	3.15	97.94	51.79	51.63	51.34	51.65
20.65	409.21	1.08	405.78	.72	18.60	406.52	.85	407.87	.56	19.63	408.84	.78	312.39	3.15	97.68	51.60	51.46	51.17	51.47
21.62	407.72	1.20	403.65	.78	19.57	404.29	.84	406.61	.69	20.60	407.09	.91	312.53	3.15	97.54	51.57	51.42	51.12	51.43
23.62	403.22	1.32	400.85	.86	21.57	405.30	.83	404.28	.89	22.60	404.10	1.05	312.42	3.15	97.75	51.73	51.57	51.29	51.60
25.65	399.75	1.32	398.32	.81	23.60	405.11	.81	401.26	.90	24.63	400.77	1.03	312.46	3.16	97.70	51.77	51.61	51.33	51.63
27.68	397.75	1.14	396.13	.68	25.63	406.04	.81	398.93	.88	26.66	397.84	.92	312.59	3.15	97.71	51.75	51.60	51.31	51.63
28.67	396.94	1.05	395.73	.58	26.62	406.38	.84	397.54	.83	27.65	396.74	.84	312.67	3.16	97.57	51.78	51.64	51.34	51.65
29.66	396.17	.99	395.03	.49	27.61	406.72	.86	396.51	.73	28.64	396.35	.73	312.82	3.16	97.69	51.78	51.63	51.34	51.65
30.64	396.94	.95	394.73	.42	28.59	406.92	.84	396.23	.67	29.62	395.70	.66	312.98	3.15	97.77	51.77	51.61	51.33	51.63
31.63	396.78	1.02	395.00	.41	29.58	406.90	.84	395.28	.56	30.61	395.94	.60	313.08	3.15	97.91	51.83	51.69	51.41	51.71
32.62	396.55	1.05	395.43	.44	30.57	406.21	.92	395.33	.50	31.60	396.31	.60	313.20	3.17	97.62	51.91	51.78	51.49	51.77
33.61	397.29	1.14	396.69	.52	31.56	406.36	.86	395.51	.49	32.59	396.91	.67	313.34	3.14	95.88	50.57	50.40	50.11	50.38
34.63	399.31	1.13	396.19	.56	32.58	406.04	.85	394.82	.52	33.61	395.58	.72	313.44	3.12	96.43	50.55	50.41	50.13	50.43
35.66	398.03	1.10	396.35	.58	33.61	404.24	.84	394.81	.57	34.64	396.16	.75	312.93	3.13	96.52	50.68	50.53	50.23	50.52
37.68	400.89	1.03	398.45	.63	35.63	405.14	.81	395.85	.66	36.66	398.45	.79	312.37	3.13	96.49	50.66	50.51	50.24	50.54
39.66	404.58	.93	400.70	.62	37.61	405.77	.84	398.55	.70	38.64	401.48	.78	312.36	3.14	96.53	50.82	50.68	50.40	50.69
41.63	407.63	.78	403.07	.54	39.58	404.63	.77	400.64	.68	40.61	403.55	.74	312.14	3.11	96.29	50.29	50.13	49.86	50.15
42.61	408.39	.66	403.50	.45	40.56	404.70	.78	401.63	.66	41.59	404.44	.66	311.88	3.10	96.34	50.23	50.08	49.80	50.10
43.62	409.01	.53	404.05	.33	41.57	404.83	.79	402.51	.60	42.60	405.56	.56	311.66	3.12	96.10	50.30	50.19	49.92	50.22
44.63	409.43	.43	404.07	.22	42.58	403.69	.81	403.28	.52	43.61	406.21	.42	311.30	3.13	95.89	50.37	50.23	49.95	50.24
45.65	409.21	.44	403.71	.23	43.60	403.45	.89	403.68	.42	44.63	406.30	.31	310.88	3.12	96.40	50.45	50.30	50.03	50.32
46.66	408.33	.55	403.20	.34	44.61	403.12	.83	403.78	.35	45.64	405.82	.33	310.69	3.11	96.66	50.48	50.33	50.06	50.35
47.67	406.69	.66	402.03	.43	45.62	402.28	.82	403.36	.35	46.65	405.09	.44	310.45	3.13	96.04	50.47	50.32	50.04	50.33
48.66	405.40	.82	400.89	.54	46.61	402.86	.84	402.98	.45	47.64	403.98	.59	310.41	3.12	96.19	50.42	50.28	49.99	50.28
49.64	403.21	.92	399.24	.59	47.59	402.67	.82	401.33	.55	48.62	402.80	.69	310.11	3.11	96.00	50.23	50.09	49.82	50.11
51.62	399.02	1.08	396.35	.65	49.57	401.21	.90	398.70	.66	50.60	398.71	.80	309.84	3.13	95.59	50.29	50.14	49.87	50.17
53.60	396.08	1.14	393.66	.67	51.55	402.42	.83	396.15	.73	52.58	395.60	.86	309.84	3.12	96.06	50.36	50.21	49.94	50.23
55.63	393.47	1.17	391.50	.64	53.58	402.62	.94	393.97	.76	54.61	393.84	.88	309.58	3.13	96.01	50.50	50.36	50.08	50.37
56.66	391.46	1.10	390.57	.57	54.61	402.08	.90	392.17	.73	55.64	391.17	.82	309.51	3.14	95.62	50.51	50.37	50.10	50.39
57.66	390.98	1.03	389.43	.49	55.61	399.48	.91	390.63	.69	56.64	390.80	.77	309.51	3.13	96.13	50.49	50.35	50.07	50.36
58.66	389.96	.96	389.02	.42	56.61	401.15	.84	390.46	.66	57.64	390.33	.69	309.41	3.13	96.04	50.58	50.44	50.16	50.46
59.63	389.62	.91	389.03	.38	57.58	400.19	.94	389.62	.57	58.61	389.42	.61	309.28	3.12	96.60	50.67	50.52	50.24	50.53
60.62	390.68	.95	388.97	.42	58.57	400.88	.90	389.02	.50	59.60	389.76	.58	309.29	3.13	96.17	50.56	50.41	50.13	50.43
61.61	391.11	1.03	389.23	.50	59.56	401.74	.95	388.98	.48	60.59	389.55	.61	309.20	3.11	96.64	50.57	50.43	50.15	50.45
62.59	391.61	1.06	389.87	.56	60.54	401.27	.90	388.93	.48	61.57	390.16	.66	309.30	3.13	96.23	50.61	50.46	50.17	50.46
63.60	392.50	1.16	390.74	.64	61.55	400.77	.95	389.00	.56	62.58	391.15	.77	309.19	3.12	96.48	50.54	50.40	50.12	50.42
65.63	395.83	1.18	393.30	.72	63.58	401.79	.97	390.80	.69	64.61	393.47	.68	309.21	3.12	96.50	50.62	50.47	50.20	50.48
67.65	400.23	1.20	396.42	.75	65.60	401.05	.98	394.08	.78	66.63	396.38	.94	309.15	3.12	96.59	50.72	50.57	50.29	50.57
69.63	403.09	1.04	399.54	.68	67.58	400.35	.98	396.80	.80	68.61	400.13	.91	309.18	3.14	95.79	50.59	50.44	50.17	50.46
70.62	404.85	.94	400.60	.63	68.57	399.61	.95	398.26	.77	69.60	401.35	.87	309.11	3.13	96.34	50.65	50.50	50.22	50.52
71.61	406.28	.82	401.61	.54	69.56	398.38	1.00	399.55	.75	70.59	402.03	.81	309.02	3.14	96.03	50.60	50.46	50.18	50.47
72.60	407.65	.64	402.60	.40	70.55	399.35	.97	401.03	.66	71.58	403.78	.66	309.04	3.12	96.42	50.61	50.47	50.20	50.49
73.60	407.99	.51	403.03	.30	71.55	398.44	.98	401.70	.60	72.58	404.87	.53	308.94	3.14	95.93	50.53	50.41	50.15	50.43
74.61	408.11	.44	403.41	.22	72.56	398.91	.92	402.74	.49	73.59	405.62	.38	308.86	3.12	96.43	50.64	50.49	50.21	50.50
75.64	407.72	.49	402.78	.26	73.59	399.89	.91	403.22	.38	74.62	405.07	.30	308.77	3.14	95.96	50.64	50.49	50.23	50.52
76.67	406.50	.60	402.18	.33	74.62	397.34	.97	403.14	.34	75.65	405.03	.36	308.69	3.12	96.62	50.69	50.54	50.28	50.58

Y21 = 3.14 mm   Y24 = .48 mm
TBI = 311.7 C   DTC = 97.1 K
QH1 = 51.5 W/cm^2   QH2 = 51.4 W/cm^2
QH3 = 51.1 W/cm^2   QH4 = 51.4 W/cm^2
WB = 404.6 kW   UB = 1.97 m/s
Re = 68143.   Pe = 365.8

17:25:17 JUL10,1987 M336.DAT

TEGENA 2 - FLUID TEMPERATURES
PROBE 2 TEMP FLUCTUATIONS

TAB. A20.2

Y21 mm	TC21 C	RMS21 K	TC24 C	RMS24 K	Y22 mm	TC22 C	RMS22 K	TC23 C	RMS23 K	Y25 mm	TC25 C	RMS25 K	WH1 kW	WH2 kW	WH3 kW	WH4 kW	WB kW	UB m/s	TBO C
109.85	398.92	1.09	394.98	.58	112.50	393.02	.77	390.95	.44	111.17	393.68	1.17	101.31	101.30	100.47	101.55	404.62	1.97	408.76
107.85	403.64	1.05	398.73	.64	110.50	396.44	1.13	393.81	.57	109.17	397.70	1.40	101.00	101.00	100.17	101.26	403.42	1.95	409.06
105.93	409.02	.77	402.25	.58	108.58	401.78	1.19	398.14	.66	107.25	402.14	1.41	101.31	101.29	100.42	101.51	404.53	1.96	409.32
103.95	412.62	.43	404.25	.37	106.60	406.76	1.00	401.39	.64	105.27	405.10	1.22	101.30	101.30	100.47	101.56	404.62	1.97	409.05
102.95	413.41	.29	405.38	.25	105.60	408.99	.82	403.31	.56	104.27	406.58	1.04	101.50	101.48	100.65	101.71	405.34	1.97	409.37
101.94	413.55	.25	405.64	.22	104.59	411.09	.58	404.48	.44	103.26	407.85	.87	101.72	101.71	100.87	101.97	406.27	1.97	409.47
100.92	413.27	.34	405.11	.29	103.57	412.49	.41	405.32	.35	102.24	408.30	.82	101.71	101.71	100.88	101.97	406.28	1.96	410.11
99.87	413.13	.46	405.20	.37	102.52	413.26	.26	406.27	.28	101.19	408.13	.86	101.92	101.92	101.08	102.16	407.07	1.97	410.19
98.86	410.63	.60	403.82	.44	101.51	413.12	.29	405.85	.30	100.18	407.56	.98	101.74	101.69	100.89	101.96	406.28	1.96	410.24
97.87	408.91	.73	403.00	.50	100.52	412.81	.43	405.57	.38	99.19	406.38	1.08	101.82	101.79	100.96	102.06	406.63	1.96	410.42
96.89	406.76	.82	401.55	.55	99.54	411.57	.60	404.21	.48	98.21	405.27	1.16	101.45	101.45	100.62	101.70	405.23	1.96	410.07
95.93	404.98	.92	400.26	.57	98.58	410.09	.71	403.37	.55	97.25	403.66	1.22	101.40	101.39	100.54	101.63	404.96	1.96	410.07
93.97	401.65	1.05	397.39	.61	96.62	405.10	.94	400.45	.62	95.29	400.57	1.26	101.70	101.69	100.87	101.98	406.24	1.96	410.16
91.95	398.50	1.06	394.86	.57	94.60	400.71	1.06	397.70	.66	93.27	398.17	1.27	101.79	101.76	100.94	102.03	406.52	1.97	410.16
89.89	396.03	1.00	393.61	.41	92.54	398.69	1.12	395.84	.59	91.21	394.78	1.15	101.76	101.74	100.92	102.02	406.44	1.97	410.30
88.87	395.49	.94	392.97	.37	91.52	397.37	1.09	394.51	.55	90.19	394.56	1.07	101.81	101.81	100.97	102.07	406.66	1.97	410.24
87.87	395.40	.97	393.65	.37	90.52	396.89	1.09	394.00	.52	89.19	394.22	1.03	101.81	101.79	100.96	102.06	406.62	1.97	410.51
86.91	395.83	1.06	393.43	.42	89.56	395.17	1.01	393.57	.44	88.23	394.11	1.02	101.79	101.76	100.95	102.03	406.53	1.97	410.75
85.96	396.00	1.13	394.58	.45	88.61	396.04	1.01	393.85	.42	87.28	394.64	1.06	101.91	101.92	101.10	102.18	407.11	1.97	410.99
84.98	397.53	1.20	395.57	.52	87.63	395.82	1.05	393.59	.43	86.30	395.40	1.12	102.06	102.09	101.26	102.30	407.71	1.97	410.82
83.98	399.70	1.22	396.37	.55	86.63	396.30	1.16	394.62	.49	85.30	396.21	1.19	99.43	99.38	98.54	99.56	396.90	1.96	409.22
82.98	400.26	1.14	396.46	.56	85.63	396.76	1.21	393.87	.53	84.30	395.88	1.20	99.40	99.40	98.59	99.66	397.04	1.95	409.67
81.97	401.60	1.06	397.94	.55	84.62	397.75	1.26	394.82	.57	83.29	397.00	1.22	99.64	99.64	98.79	99.83	397.89	1.95	409.45
79.90	403.58	.82	398.69	.50	82.55	399.18	1.11	395.80	.59	81.22	396.94	1.18	99.61	99.58	98.79	99.87	397.85	1.95	408.86
77.89	407.28	.61	401.23	.41	80.54	402.48	.96	398.61	.54	79.21	402.00	1.12	99.93	99.93	99.11	100.17	399.14	1.95	408.89
75.96	409.95	.35	402.62	.28	78.61	405.67	.74	400.35	.45	77.28	403.45	.96	98.87	98.85	98.05	99.11	394.88	1.94	408.43
74.98	410.56	.27	402.62	.22	77.63	406.67	.63	400.86	.42	76.30	403.95	.91	98.76	98.74	97.94	98.99	394.43	1.93	408.22
73.98	410.71	.22	402.42	.20	76.63	407.69	.48	401.62	.36	75.30	404.91	.82	98.90	98.95	98.17	99.23	395.26	1.94	407.75
72.97	410.14	.28	402.18	.25	75.62	408.73	.36	401.96	.31	74.29	404.85	.81	99.04	99.03	98.24	99.28	395.58	1.95	407.19
71.97	409.09	.37	401.41	.32	74.62	408.91	.25	401.98	.26	73.29	404.61	.83	99.19	99.19	98.39	99.44	396.21	1.94	407.28
70.94	407.09	.49	399.95	.39	73.59	408.78	.25	401.52	.28	72.26	403.46	.91	99.24	99.24	98.44	99.49	396.42	1.94	407.35
69.90	405.42	.62	398.77	.46	72.55	408.35	.34	401.04	.34	71.22	402.01	1.02	99.23	99.22	98.42	99.47	396.33	1.95	406.49
68.88	402.97	.74	397.38	.51	71.53	407.45	.49	400.54	.43	70.20	400.96	1.14	99.14	99.13	98.31	99.36	395.94	1.94	406.59
67.89	400.31	.82	395.16	.54	70.54	405.26	.63	398.79	.52	69.21	399.16	1.22	98.76	98.76	97.97	99.02	394.52	1.94	406.11
65.97	396.66	.90	392.30	.55	68.62	401.28	.84	396.00	.60	67.29	396.22	1.25	98.88	98.87	98.08	99.14	394.97	1.95	405.44
63.99	393.45	.95	389.85	.54	66.64	397.33	.95	393.37	.62	65.31	392.31	1.23	99.01	99.01	98.21	99.26	395.49	1.94	405.89
61.96	390.10	.93	388.08	.44	64.61	393.87	1.05	390.40	.60	63.28	390.43	1.16	99.30	99.29	98.49	99.54	396.62	1.95	405.58
60.93	388.95	.86	387.44	.38	63.58	391.38	1.05	389.59	.57	62.25	388.91	1.10	99.31	99.32	98.53	99.57	396.72	1.96	405.13
59.90	389.43	.81	387.09	.33	62.55	391.05	1.01	388.47	.53	61.22	388.03	1.06	99.27	99.27	98.47	99.52	396.52	1.95	405.64
58.88	389.26	.85	387.06	.34	61.53	389.67	.99	387.95	.47	60.20	387.55	1.00	99.46	99.46	98.65	99.72	397.28	1.95	405.45
57.88	388.99	.89	387.23	.38	60.53	389.28	.89	387.05	.41	59.20	387.37	.97	99.63	99.62	98.80	99.86	397.91	1.94	405.88
56.93	390.00	.98	387.68	.46	59.58	388.94	.86	387.04	.38	58.25	387.66	1.01	99.41	99.39	98.58	99.65	397.04	1.95	405.46
55.97	391.80	1.04	388.92	.54	58.62	388.20	.88	386.97	.41	57.29	388.06	1.09	99.43	99.43	98.63	99.70	397.18	1.94	405.84
55.00	393.08	1.05	390.13	.56	57.65	389.41	.94	387.69	.45	56.32	389.48	1.14	99.51	99.49	98.67	99.72	397.39	1.95	405.54
53.99	393.76	1.03	390.86	.60	56.64	390.39	1.03	388.69	.53	55.31	390.14	1.22	99.38	99.37	98.57	99.63	396.95	1.94	405.67
51.97	398.52	.97	393.78	.57	54.62	391.77	1.12	391.15	.62	53.29	393.24	1.26	99.52	99.51	98.71	99.75	397.50	1.94	405.70
49.92	402.42	.82	396.24	.54	52.57	396.96	1.08	393.19	.62	51.24	396.34	1.28	99.72	99.71	98.90	99.94	398.28	1.94	405.74
47.91	405.06	.59	398.96	.45	50.56	400.66	.96	395.86	.57	49.23	399.47	1.19	99.47	99.45	98.66	99.71	397.29	1.96	404.98
46.94	406.71	.49	399.84	.39	49.59	402.03	.87	397.04	.56	48.26	400.38	1.16	99.59	99.57	98.76	99.83	397.76	1.95	405.45
45.98	407.96	.36	400.51	.30	48.63	403.19	.75	397.94	.51	47.30	401.65	1.05	99.49	99.49	98.69	99.74	397.41	1.95	405.05
45.01	408.46	.26	400.82	.22	47.66	404.76	.63	399.23	.46	46.33	402.51	.96	99.51	99.51	98.72	99.77	397.51	1.94	405.46
44.01	408.30	.23	400.97	.19	46.66	406.49	.50	400.10	.39	45.33	403.24	.88	99.35	99.39	98.62	99.66	397.02	1.95	404.88
43.01	407.88	.29	400.46	.24	45.66	407.00	.35	400.42	.32	44.33	402.84	.82	99.57	99.54	98.74	99.79	397.65	1.94	405.28
41.98	406.52	.39	399.77	.29	44.63	407.58	.24	400.48	.26	43.30	402.81	.84	99.58	99.55	98.79	99.84	397.75	1.95	404.73
40.96	405.39	.53	398.96	.36	43.61	407.63	.27	400.60	.28	42.28	402.18	.89	99.67	99.65	98.88	99.96	398.16	1.94	405.31

X11 = 31.65 mm   X12 = 29.60 mm
TBI = 294.9 C   TBO = 375.3 C
QH1 = 10.79 W/cm^2   QH2 = 10.72 W/cm^2
QH3 = 10.68 W/cm^2   QH4 = 10.74 W/cm^2
NB = 84.6 kW   MFR = .79 kg/s
DTC = 80.4 K   UB = .49 m/s
Re = 16322.   Pe = 90.9

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TEGENA 2 - FLUID TEMPERATURES
PROBE 1 TEMP FLUCTUATIONS

TAB. A21.1

Y11 mm	TC11 C	RMS11 K	TC12 C	RMS12 K	Y13 mm	TC13 C	RMS13 K	TC14 C	RMS14 K	Y15 mm	TC15 C	RMS15 K	TBI C	MFR kg/s	DTC K	QH1 W/cm^2	QH2 W/cm^2	QH3 W/cm^2	QH4 W/cm^2
8.81	373.96	.69	373.42	.72	10.86	376.41	.59	376.28	.57	9.84	375.18	.48	294.94	.79	80.35	10.79	10.72	10.68	10.74
9.82	376.16	.71	375.29	.74	11.87	377.97	.55	378.01	.53	10.85	377.03	.47	294.78	.81	81.06	11.05	10.99	10.95	11.00
10.90	377.00	.65	376.95	.70	12.95	379.23	.47	379.86	.43	11.93	378.46	.42	295.03	.81	81.39	11.13	11.06	11.02	11.08
11.95	379.20	.62	378.85	.66	14.00	381.39	.40	381.01	.37	12.98	380.03	.39	295.58	.81	81.60	11.21	11.14	11.10	11.16
12.98	380.04	.51	379.04	.58	15.03	381.45	.31	381.27	.27	14.01	380.41	.30	295.58	.80	80.86	10.94	10.87	10.83	10.89
13.96	380.94	.44	380.45	.53	16.01	382.18	.27	381.70	.20	14.99	381.27	.24	295.64	.81	80.86	11.05	10.98	10.94	10.99
14.87	382.10	.38	381.60	.47	16.92	382.47	.25	382.32	.20	15.90	382.12	.18	295.66	.81	81.13	11.08	11.02	10.97	11.03
15.81	382.20	.34	381.49	.44	17.86	382.03	.32	381.76	.26	16.84	382.08	.18	295.93	.80	81.40	11.03	10.96	10.92	10.98
16.74	382.71	.34	382.12	.44	18.79	381.88	.40	381.54	.36	17.77	382.33	.23	296.16	.81	81.21	11.08	11.01	10.97	11.03
17.72	382.35	.40	381.68	.49	19.77	381.35	.47	380.91	.44	18.75	381.89	.30	296.52	.81	81.15	11.07	11.00	10.96	11.02
18.74	381.79	.46	381.36	.55	20.79	379.88	.56	380.33	.51	19.77	381.12	.37	296.63	.80	81.15	11.02	10.96	10.92	10.97
19.84	381.19	.52	379.80	.59	21.89	378.62	.58	379.24	.55	20.87	379.91	.41	296.63	.81	80.90	11.04	10.97	10.93	10.98
20.90	379.31	.59	379.19	.67	22.95	377.78	.63	377.91	.60	21.93	379.21	.46	296.84	.81	80.89	11.03	10.97	10.93	10.98
22.97	377.78	.69	377.30	.76	25.02	375.52	.63	376.14	.59	24.00	376.85	.48	296.94	.81	80.76	11.04	10.97	10.93	10.98
24.90	375.66	.65	375.44	.70	26.95	373.94	.50	374.11	.47	25.93	374.97	.42	297.11	.80	81.26	11.05	10.98	10.94	11.00
25.84	375.48	.62	374.59	.67	27.89	373.45	.44	373.82	.40	26.87	374.41	.38	297.08	.81	81.35	11.07	11.01	10.96	11.02
26.77	373.82	.55	373.45	.61	28.82	372.96	.35	372.68	.31	27.80	373.89	.31	297.20	.81	81.21	11.09	11.02	10.98	11.03
27.75	373.88	.48	373.27	.55	29.80	373.18	.30	373.07	.25	28.78	373.43	.26	297.58	.81	81.24	11.08	11.01	10.97	11.03
28.75	373.15	.40	372.49	.47	30.80	372.76	.27	372.68	.20	29.78	372.79	.21	297.59	.81	80.78	11.00	10.93	10.88	10.94

X21 = 86.53 mm   X22 = 89.18 mm
TBI = 294.9 C   TBO = 375.3 C
QH1 = 10.8 W/cm^2   QH2 = 10.7 W/cm^2
QH3 = 10.7 W/cm^2   QH4 = 10.7 W/cm^2
NB = 84.6 kW   MFR = .79 kg/s
DTC = 80.4 K   UB = .49 m/s
Re = 16322.   Pe = 90.9

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TEGENA 2 - FLUID TEMPERATURES
PROBE 2 TEMP FLUCTUATIONS

TAB. A21.2

Y21 mm	TC21 C	RMS21 K	TC22 C	RMS22 K	Y23 mm	TC23 C	RMS23 K	TC24 C	RMS24 K	Y25 mm	TC25 C	RMS25 K	NH1 kW	NH2 kW	NH3 kW	NH4 kW	NB kW	UB m/s	TBO C
24.06	374.18	.58	373.40	.58	21.40	377.46	.55	376.89	.51	22.73	375.09	1.14	21.22	21.14	21.00	21.22	84.58	.49	375.29
23.15	375.86	.59	375.60	.58	20.49	378.88	.51	378.95	.45	21.82	376.89	1.14	21.73	21.67	21.53	21.74	86.67	.50	375.84
22.23	377.73	.53	377.45	.53	19.57	380.28	.43	380.10	.34	20.90	379.29	1.10	21.89	21.81	21.68	21.89	87.27	.50	376.42
21.28	379.71	.47	379.38	.47	18.62	381.89	.36	382.27	.25	19.95	380.36	1.06	22.04	21.97	21.84	22.05	87.90	.50	377.18
20.27	380.22	.39	379.48	.39	17.61	381.45	.31	381.81	.17	18.94	380.99	1.00	21.51	21.44	21.30	21.51	85.76	.50	376.45
19.27	381.12	.29	381.12	.30	16.61	382.16	.29	382.37	.14	17.94	381.66	.98	21.72	21.65	21.51	21.73	86.60	.50	376.50
18.22	381.98	.21	382.15	.20	15.56	382.28	.31	382.38	.18	16.89	382.27	.96	21.79	21.72	21.58	21.79	86.89	.50	376.79
17.18	382.64	.15	382.50	.14	14.52	381.94	.36	381.66	.26	15.85	382.28	.96	21.69	21.62	21.48	21.69	86.48	.50	377.33
16.10	383.05	.15	383.15	.14	13.44	381.53	.43	381.37	.36	14.77	382.18	.99	21.79	21.71	21.58	21.79	86.87	.50	377.37
15.10	383.06	.20	383.07	.20	12.44	380.56	.50	380.64	.45	13.77	381.74	1.03	21.77	21.69	21.56	21.77	86.79	.50	377.67
14.13	382.42	.29	382.33	.30	11.47	379.50	.58	379.48	.54	12.80	380.37	1.07	21.68	21.61	21.47	21.69	86.44	.50	377.78
13.19	381.82	.35	381.01	.36	10.53	378.21	.60	377.91	.56	11.86	380.05	1.09	21.71	21.62	21.49	21.70	86.52	.50	377.54
12.26	380.91	.45	379.98	.46	9.60	377.22	.67	376.60	.63	10.93	378.14	1.11	21.69	21.62	21.49	21.70	86.50	.50	377.73
10.33	377.92	.55	377.87	.57	7.67	375.14	.65	374.97	.60	9.00	376.57	1.14	21.70	21.63	21.49	21.70	86.53	.50	377.70
8.28	375.91	.56	375.90	.57	5.62	372.97	.52	373.50	.46	6.95	374.13	1.10	21.73	21.65	21.52	21.73	86.63	.50	378.37
7.21	375.27	.56	374.58	.56	4.55	372.68	.46	372.67	.39	5.88	373.55	1.06	21.77	21.70	21.56	21.78	86.82	.50	378.43
6.16	374.24	.49	373.99	.49	3.50	371.84	.39	372.06	.29	4.83	372.74	1.04	21.80	21.73	21.59	21.80	86.92	.50	378.41
5.16	373.97	.41	373.58	.40	2.50	372.11	.33	372.07	.23	3.83	372.56	1.00	21.78	21.71	21.57	21.79	86.85	.50	378.82
4.19	372.87	.32	372.56	.32	1.53	371.79	.30	371.73	.18	2.86	372.26	.95	21.62	21.54	21.41	21.62	86.19	.50	378.37

Y11 = 29.43 mm   Y14 = 31.48 mm
TBI = 293.3 C   TBO = 375.1 C
QH1 = 10.8 W/cm^2   QH2 = 10.7 W/cm^2
QH3 = 10.7 W/cm^2   QH4 = 10.7 W/cm^2
NB = 84.4 kW   MFR = .78 kg/s
DTC = 81.8 K   UB = .48 m/s
Re = 15958.   Pe = 89.0

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TAB. A22.1

TEGENA 2 - FLUID TEMPERATURES
PROBE 1 TEMP FLUCTUATIONS

X11 mm	TC11 C	RMS11 K	TC14 C	RMS14 K	X12 mm	TC12 C	RMS12 K	TC13 C	RMS13 K	X15 mm	TC15 C	RMS15 K	TBI C	MFR kg/s	DTC K	QH1 W/cm^2	QH2 W/cm^2	QH3 W/cm^2	QH4 W/cm^2
76.67	373.74	.35	372.65	.19	74.62	373.89	.37	373.44	.25	75.65	373.52	.15	293.30	.78	81.84	10.77	10.70	10.66	10.71
75.73	373.89	.34	372.78	.20	73.68	373.78	.41	373.31	.27	74.71	373.60	.15	293.06	.78	81.94	10.78	10.71	10.67	10.72
74.70	374.22	.34	373.12	.18	72.65	373.70	.39	373.21	.27	73.68	373.86	.14	293.12	.78	82.30	10.80	10.74	10.70	10.75
73.67	374.21	.34	372.95	.16	71.62	373.60	.40	373.06	.24	72.65	373.62	.15	292.89	.78	82.09	10.79	10.72	10.68	10.73
72.67	374.21	.34	373.02	.17	70.62	373.22	.43	372.92	.24	71.65	373.54	.16	293.05	.77	82.10	10.76	10.69	10.65	10.70
71.68	374.08	.36	372.99	.18	69.63	373.02	.43	372.79	.25	70.66	373.32	.16	293.17	.77	82.05	10.74	10.68	10.64	10.68
70.71	373.67	.36	372.53	.17	68.66	372.32	.43	372.33	.26	69.69	372.77	.18	293.08	.78	81.72	10.73	10.66	10.62	10.67
69.72	373.39	.36	372.51	.19	67.67	372.18	.44	372.05	.25	68.70	372.69	.18	292.90	.78	82.21	10.80	10.73	10.69	10.74
67.74	372.48	.39	371.71	.19	65.69	371.14	.46	371.37	.25	66.72	371.90	.18	293.04	.78	82.12	10.77	10.71	10.66	10.72
65.71	371.57	.39	371.14	.20	63.66	370.50	.44	370.61	.25	64.69	371.04	.18	292.86	.78	82.08	10.81	10.74	10.70	10.75
63.68	370.94	.39	370.61	.19	61.63	369.98	.45	370.24	.24	62.66	370.87	.18	293.00	.78	82.19	10.84	10.78	10.74	10.79
62.68	371.03	.38	370.58	.19	60.63	370.19	.41	370.38	.24	61.66	370.65	.17	293.01	.78	82.77	10.95	10.89	10.85	10.90
61.69	370.87	.39	370.54	.18	59.64	370.11	.41	370.51	.25	60.67	370.56	.18	293.02	.78	82.24	10.91	10.84	10.80	10.85
60.70	369.99	.40	369.94	.19	58.65	369.58	.44	369.91	.25	59.68	370.08	.18	293.09	.78	81.76	10.76	10.69	10.65	10.70
59.73	370.45	.41	370.23	.19	57.68	370.06	.44	370.44	.25	58.71	370.52	.18	293.20	.78	82.15	10.80	10.72	10.69	10.74
58.75	370.74	.40	370.19	.19	56.70	370.45	.42	370.75	.24	57.73	370.74	.18	293.39	.78	82.40	10.85	10.78	10.74	10.80
57.76	370.80	.40	370.63	.20	55.71	370.82	.43	371.17	.25	56.74	371.15	.18	293.43	.78	82.45	10.89	10.82	10.78	10.83
56.74	371.74	.40	371.48	.20	54.69	372.03	.44	372.02	.25	55.72	372.09	.18	293.43	.79	82.83	11.03	10.96	10.92	10.97
55.71	372.30	.39	371.94	.20	53.66	372.44	.41	372.83	.25	54.69	372.53	.18	294.00	.79	82.67	11.03	10.96	10.92	10.97
53.69	373.09	.38	372.66	.20	51.64	373.81	.43	373.79	.25	52.67	373.53	.18	294.20	.79	82.40	10.95	10.89	10.85	10.90
51.69	374.26	.38	373.52	.20	49.64	374.84	.44	374.51	.25	50.67	374.59	.18	294.29	.78	82.56	10.95	10.88	10.84	10.88
49.74	376.46	.39	375.60	.20	47.69	376.81	.44	376.21	.25	48.72	376.52	.18	294.56	.79	83.35	11.18	11.11	11.07	11.12
48.75	377.32	.36	376.20	.20	46.70	377.46	.40	376.88	.24	47.73	377.31	.16	294.96	.79	83.41	11.17	11.11	11.06	11.12
47.76	377.58	.35	376.58	.18	45.71	377.67	.39	377.00	.25	46.74	377.43	.15	295.09	.79	83.24	11.10	11.03	10.98	11.04
46.75	378.06	.35	376.92	.18	44.70	377.85	.39	377.22	.24	45.73	377.75	.14	295.48	.79	83.28	11.10	11.03	10.99	11.04
45.73	378.41	.35	377.22	.17	43.68	377.79	.42	377.35	.24	44.71	377.95	.15	295.82	.79	82.54	11.06	10.99	10.94	11.00
44.71	378.62	.34	377.41	.17	42.66	377.63	.41	377.26	.25	43.69	378.09	.15	295.98	.79	82.64	11.03	10.96	10.92	10.98
43.69	378.62	.35	377.42	.18	41.64	377.44	.42	377.05	.25	42.67	377.95	.16	296.23	.79	82.72	11.04	10.98	10.93	10.99
42.69	378.72	.35	377.56	.18	40.64	377.41	.41	377.31	.26	41.67	377.98	.16	296.47	.79	83.05	11.08	11.02	10.98	11.03
41.71	378.64	.36	377.51	.19	39.66	377.27	.42	376.93	.26	40.69	377.83	.17	296.70	.79	82.94	11.10	11.04	10.99	11.05
39.74	377.81	.38	376.95	.21	37.69	376.33	.44	376.16	.27	38.72	377.18	.19	296.86	.79	82.91	11.09	11.02	10.98	11.03
37.77	376.84	.39	376.18	.21	35.72	375.22	.44	375.60	.30	36.75	376.34	.20	297.14	.79	83.12	11.10	11.03	10.99	11.05
35.73	375.91	.39	375.48	.21	33.68	374.57	.46	375.02	.27	34.71	375.36	.19	297.28	.79	82.77	11.06	11.00	10.96	11.02
34.71	375.58	.39	375.44	.20	32.66	374.53	.43	375.05	.26	33.69	375.58	.19	297.51	.79	82.96	11.09	11.02	10.98	11.04
33.70	375.82	.39	375.46	.20	31.65	374.59	.44	375.28	.26	32.68	375.60	.18	297.93	.79	82.92	11.08	11.02	10.97	11.03
32.70	375.50	.40	375.23	.20	30.65	374.49	.44	375.39	.27	31.68	375.56	.19	298.01	.79	83.24	11.12	11.05	11.00	11.06
31.71	375.34	.41	375.26	.20	29.66	375.11	.43	375.54	.25	30.69	375.59	.17	298.16	.79	82.96	11.12	11.05	11.01	11.07
30.72	375.68	.39	375.32	.19	28.67	374.86	.43	375.64	.26	29.70	375.79	.17	298.33	.79	83.21	11.15	11.08	11.03	11.08
29.75	376.01	.39	375.39	.19	27.70	375.55	.43	375.97	.26	28.73	375.74	.17	298.42	.79	83.08	11.13	11.06	11.01	11.07
28.76	375.91	.38	375.63	.19	26.71	375.71	.43	376.21	.26	27.74	376.00	.17	298.32	.79	83.03	11.14	11.07	11.03	11.08
27.77	376.14	.39	375.75	.19	25.72	376.37	.44	376.48	.26	26.75	376.25	.18	298.31	.79	83.52	11.15	11.08	11.04	11.10
25.72	377.07	.37	376.64	.20	23.67	377.14	.43	377.41	.27	24.70	377.30	.17	298.48	.79	83.14	11.15	11.09	11.04	11.10
23.69	377.30	.38	376.56	.20	21.64	377.44	.43	377.45	.28	22.67	377.22	.19	298.54	.78	82.53	10.89	10.82	10.78	10.83
21.71	377.91	.38	377.13	.20	19.66	378.15	.43	377.97	.25	20.69	377.90	.18	298.51	.79	82.43	10.96	10.90	10.85	10.91
20.72	378.10	.36	377.00	.19	18.67	378.26	.40	377.82	.25	19.70	377.95	.16	298.56	.78	82.39	10.91	10.85	10.81	10.86
19.74	378.38	.35	377.39	.19	17.69	378.17	.39	377.75	.25	18.72	378.31	.15	298.15	.79	82.54	10.98	10.91	10.87	10.92
18.77	378.80	.34	377.49	.18	16.72	378.37	.41	377.74	.26	17.75	378.39	.15	298.07	.79	82.40	10.99	10.93	10.88	10.94
17.78	378.77	.34	377.51	.18	15.73	378.04	.41	377.41	.25	16.76	378.20	.14	297.85	.79	82.76	11.03	10.96	10.92	10.98
16.75	378.61	.34	377.35	.18	14.70	377.71	.42	377.20	.27	15.73	377.99	.15	297.99	.79	82.51	11.02	10.95	10.91	10.96
15.74	378.64	.36	377.26	.19	13.69	377.10	.43	376.73	.29	14.72	377.76	.18	297.78	.79	83.10	11.07	10.99	10.95	11.01
14.71	378.12	.35	376.91	.21	12.66	376.41	.42	376.21	.29	13.69	377.10	.19	297.61	.79	82.92	11.09	11.02	10.98	11.03
13.71	377.76	.38	376.67	.23	11.66	376.29	.45	376.04	.31	12.69	377.05	.22	297.72	.80	82.94	11.14	11.07	11.03	11.09
11.71	375.65	.38	374.79	.24	9.66	374.02	.42	374.17	.29	10.69	375.05	.21	297.55	.79	82.75	10.99	10.92	10.88	10.93
9.75	374.58	.39	373.78	.24	7.70	372.81	.40	372.94	.27	8.73	373.87	.20	297.64	.79	82.59	10.97	10.90	10.86	10.91
7.78	373.23	.36	372.75	.21	5.73	371.43	.37	372.11	.25	6.76	372.49	.16	297.49	.79	82.39	11.01	10.94	10.90	10.95

Y21	= 3.12 mm	Y24	= .46 mm		
TBI	= 293.3 C	DTC	= 81.8 K		
QH1	= 10.8 W/cm^2	QH2	= 10.7 W/cm^2		
QH3	= 10.7 W/cm^2	QH4	= 10.7 W/cm^2		
WB	= 84.4 kW	UB	= .48 m/s		
Re	= 15958.	Pe	= 89.0		

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TAB. A22.2

TEGENA 2 - FLUID TEMPERATURES
PROBE 2 TEMP FLUCTUATIONS

Y21 mm	TC21 C	RMS21 K	TC24 C	RMS24 K	Y22 mm	TC22 C	RMS22 K	TC23 C	RMS23 K	Y25 mm	TC25 C	RMS25 K	WB1 kW	WB2 kW	WB3 kW	WB4 kW	WB kW	UB m/s	TBO C
40.94	373.80	.13	372.07	.15	43.59	374.41	.15	372.74	.30	42.26	373.28	.92	21.17	21.10	20.96	21.16	84.39	.48	375.13
41.84	374.10	.11	372.32	.15	44.49	374.35	.14	372.71	.31	43.16	373.24	.94	21.19	21.12	20.99	21.19	84.50	.48	375.00
42.88	374.39	.09	372.59	.15	45.53	374.53	.14	372.84	.31	44.20	373.59	.94	21.24	21.17	21.04	21.24	84.70	.48	375.42
43.89	374.60	.07	372.64	.13	46.54	374.22	.15	372.55	.31	45.21	373.44	.96	21.22	21.14	21.01	21.21	84.58	.48	374.99
44.85	374.62	.07	372.66	.12	47.50	373.86	.17	372.36	.32	46.17	373.30	.99	21.15	21.08	20.95	21.15	84.33	.48	375.15
45.82	374.54	.07	372.70	.13	48.47	373.62	.17	372.10	.32	47.14	373.24	.97	21.12	21.05	20.92	21.10	84.19	.48	375.22
46.77	374.27	.08	372.36	.13	49.42	372.91	.19	371.67	.32	48.09	372.54	.97	21.10	21.02	20.89	21.09	84.11	.48	374.80
47.75	374.06	.10	372.26	.14	50.40	372.60	.20	371.38	.32	49.07	372.54	.98	21.23	21.15	21.02	21.22	84.61	.48	375.11
49.73	372.98	.13	371.48	.15	52.38	371.42	.21	370.48	.33	51.05	371.54	1.02	21.18	21.11	20.97	21.18	84.44	.48	375.17
51.80	372.01	.14	371.01	.15	54.45	370.59	.23	370.08	.32	53.12	370.84	.99	21.25	21.18	21.05	21.25	84.74	.48	374.94
53.85	371.08	.17	370.36	.15	56.50	369.92	.26	369.72	.32	55.17	370.21	.98	21.32	21.25	21.12	21.32	85.02	.48	375.18
54.82	370.94	.20	370.12	.15	57.47	370.13	.28	369.67	.31	56.14	370.21	.94	21.54	21.47	21.33	21.54	85.87	.48	375.78
55.79	370.71	.21	370.01	.14	58.44	370.14	.29	369.74	.31	57.11	370.17	.92	21.45	21.37	21.24	21.45	85.51	.49	375.26
56.77	370.19	.24	369.35	.15	59.42	369.78	.30	369.20	.31	58.09	369.52	.96	21.15	21.08	20.94	21.14	84.32	.48	374.85
57.74	370.13	.25	369.54	.14	60.39	369.86	.28	369.56	.32	59.06	369.70	.97	21.24	21.15	21.02	21.23	84.62	.48	375.35
58.72	370.07	.26	369.64	.14	61.37	370.50	.27	369.82	.31	60.04	370.04	.96	21.33	21.26	21.13	21.33	85.05	.48	375.79
59.73	370.45	.25	369.99	.14	62.38	370.93	.24	370.28	.31	61.05	370.33	.97	21.41	21.34	21.20	21.41	85.36	.48	375.88
60.75	371.01	.25	370.61	.15	63.40	371.79	.24	371.07	.32	62.07	371.09	.99	21.68	21.61	21.47	21.68	86.44	.49	376.26
61.80	371.67	.23	371.02	.15	64.45	372.58	.21	371.71	.32	63.12	371.67	.95	21.68	21.61	21.47	21.68	86.43	.49	376.68
63.86	372.52	.18	371.68	.15	66.51	373.59	.20	372.68	.32	65.18	372.53	.98	21.54	21.47	21.34	21.54	85.88	.49	376.60
65.79	373.82	.14	372.49	.15	68.44	374.85	.18	373.40	.32	67.11	373.37	1.00	21.52	21.45	21.31	21.50	85.79	.49	376.86
67.74	375.78	.14	374.41	.16	70.39	377.02	.17	375.26	.32	69.06	375.34	1.01	21.98	21.91	21.77	21.98	87.63	.49	377.91
68.72	376.49	.12	375.12	.15	71.37	377.72	.15	375.83	.31	70.04	376.32	.96	21.97	21.90	21.76	21.97	87.60	.49	378.37
69.73	377.04	.10	375.50	.15	72.38	377.90	.14	375.97	.31	71.05	376.48	.95	21.82	21.75	21.60	21.82	86.98	.49	378.33
70.75	377.87	.09	375.86	.14	73.40	378.10	.14	376.24	.30	72.07	376.97	.96	21.83	21.75	21.61	21.82	87.01	.49	378.76
71.81	378.42	.06	376.25	.13	74.46	378.04	.14	376.25	.31	73.13	377.17	.98	21.74	21.67	21.52	21.73	86.66	.49	378.36
72.85	378.72	.05	376.62	.13	75.50	378.11	.16	376.42	.31	74.17	377.41	.96	21.70	21.62	21.48	21.70	86.49	.49	378.62
73.87	378.84	.05	376.72	.13	76.52	377.70	.17	376.19	.32	75.19	377.34	.97	21.71	21.64	21.50	21.71	86.57	.49	378.95
74.84	379.00	.07	376.93	.13	77.49	377.58	.19	376.14	.32	76.16	377.44	.95	21.79	21.72	21.59	21.80	86.90	.49	379.51
75.81	378.81	.09	377.12	.14	78.46	377.46	.20	376.11	.32	77.13	377.34	.96	21.83	21.76	21.62	21.83	87.04	.49	379.64
77.74	378.08	.14	376.59	.16	80.39	376.34	.22	375.31	.32	79.06	376.52	.99	21.80	21.73	21.59	21.80	86.92	.49	379.78
79.72	377.11	.17	375.92	.17	82.37	375.55	.23	374.85	.32	81.04	375.77	.98	21.83	21.76	21.62	21.83	87.04	.49	380.26
81.80	376.06	.18	375.02	.16	84.45	374.44	.25	373.97	.32	83.12	374.88	1.00	21.75	21.68	21.55	21.77	86.76	.49	380.05
82.86	375.97	.19	375.12	.16	85.51	374.47	.26	374.12	.31	84.18	374.98	.96	21.81	21.73	21.60	21.81	86.95	.49	380.47
83.86	375.69	.20	374.83	.15	86.51	374.58	.27	374.11	.31	85.18	374.81	.97	21.79	21.73	21.58	21.79	86.89	.49	380.85
84.82	375.42	.21	374.75	.15	87.47	374.71	.26	374.24	.31	86.14	374.82	.98	21.85	21.78	21.64	21.85	87.13	.49	381.24
85.79	375.10	.24	374.64	.15	88.44	374.88	.27	374.32	.31	87.11	374.81	.96	21.87	21.79	21.65	21.87	87.18	.49	381.12
86.76	375.11	.23	374.67	.15	89.41	374.94	.26	374.47	.31	88.08	374.72	.97	21.91	21.85	21.69	21.90	87.36	.49	381.55
87.73	375.10	.24	374.62	.15	90.38	375.19	.24	374.63	.31	89.05	374.79	.99	21.88	21.80	21.66	21.88	87.22	.49	381.50
88.70	375.29	.23	374.62	.15	91.35	375.54	.23	375.07	.32	90.02	375.00	1.00	21.91	21.83	21.69	21.90	87.33	.49	381.35
89.71	375.47	.21	374.70	.14	92.36	375.84	.22	375.20	.32	91.03	375.06	1.00	21.92	21.85	21.71	21.93	87.41	.49	381.83
91.80	375.99	.17	375.42	.15	94.45	377.02	.20	376.08	.32	93.12	375.88	1.00	21.93	21.86	21.72	21.93	87.45	.49	381.62
93.85	376.52	.15	375.15	.15	96.50	377.30	.18	376.00	.32	95.17	376.15	.98	21.40	21.34	21.20	21.41	85.35	.48	381.07
95.79	377.06	.13	375.85	.15	98.44	378.13	.16	376.49	.31	97.11	376.84	1.00	21.55	21.48	21.34	21.55	85.93	.49	380.94
96.75	377.41	.12	375.80	.15	99.40	378.08	.15	376.48	.31	98.07	376.86	.97	21.45	21.39	21.25	21.45	85.55	.49	380.95
97.72	377.83	.10	376.15	.15	100.37	378.37	.14	376.63	.31	99.04	377.22	.97	21.58	21.51	21.37	21.58	86.05	.49	380.68
98.70	378.17	.09	376.33	.14	101.35	378.40	.14	376.59	.31	100.02	377.40	1.00	21.61	21.54	21.40	21.62	86.17	.49	380.47
99.70	378.38	.07	376.33	.13	102.35	378.03	.15	376.24	.31	101.02	377.23	.99	21.69	21.62	21.48	21.69	86.47	.49	380.61
100.73	378.45	.06	376.38	.13	103.38	377.73	.16	375.94	.32	102.05	377.16	.98	21.67	21.60	21.45	21.66	86.38	.49	380.49
101.79	378.58	.07	376.45	.13	104.44	377.38	.19	375.90	.32	103.11	377.12	.97	21.77	21.68	21.54	21.75	86.74	.49	380.89
102.84	378.23	.09	376.01	.14	105.49	376.44	.21	375.08	.33	104.16	376.41	.96	21.80	21.73	21.59	21.79	86.90	.49	380.52
103.84	378.13	.11	376.08	.15	106.49	376.16	.22	374.91	.32	105.16	376.62	.97	21.91	21.84	21.70	21.91	87.35	.49	380.67
105.78	376.20	.17	374.53	.18	108.43	373.97	.25	373.13	.32	107.10	374.48	.96	21.60	21.53	21.39	21.60	86.12	.49	380.30
107.70	374.68	.19	373.26	.18	110.35	372.40	.22	371.77	.31	109.02	373.03	.96	21.56	21.49	21.35	21.56	85.96	.49	380.23
109.70	373.00	.20	372.09	.17	112.35	371.02	.20	370.71	.30	111.02	371.60	.95	21.64	21.57	21.43	21.64	86.27	.49	379.88

TAB. A23

Y11	= 31.66 mm	Y12	= 29.61 mm		11:08:52 JUN22,1987 M102.DAT
TBI	= 294.3 C	TBO	= 371.5 C		
QH1	= 20.37 W/cm^2	QH2	= 20.27 W/cm^2		
QH3	= 20.16 W/cm^2	QH4	= 20.29 W/cm^2		TEGENA 2 - FLUID TEMPERATURES
WB	= 159.8 kW	MFR	= 1.56 kg/s		PROBE 1 TEMP FLUCTUATIONS
DTC	= 77.2 K	UB	= .97 m/s		
Re	= 31952.	Pe	= 178.6		

Y11 mm	TC11 C	RMS11 K	TC12 C	RMS12 K	Y13 mm	TC13 C	RMS13 K	TC14 C	RMS14 K	Y15 mm	TC15 C	RMS15 K	TBI C	MFR kg/s	DTC K	QH1 W/cm^2	QH2 W/cm^2	QH3 W/cm^2	QH4 W/cm^2
28.77	364.43	.63	363.75	.68	30.82	363.35	.32	363.09	.28	29.80	363.66	.31	294.32	1.56	77.16	20.37	20.27	20.16	20.29
27.79	365.91	.85	365.15	.89	29.84	364.43	.44	364.38	.44	28.82	365.41	.44	294.78	1.57	77.67	20.59	20.49	20.38	20.51
26.81	367.56	.99	366.88	1.06	28.86	366.34	.60	365.73	.56	27.84	366.58	.53	295.16	1.57	77.72	20.61	20.51	20.40	20.53
25.86	368.96	1.18	368.73	1.21	27.91	366.62	.77	366.50	.77	26.89	367.81	.67	294.75	1.57	77.87	20.62	20.53	20.41	20.54
24.94	370.89	1.27	370.18	1.32	26.99	367.84	.96	367.25	.94	25.97	369.06	.75	294.93	1.58	77.65	20.68	20.58	20.47	20.60
23.05	373.97	1.39	374.36	1.41	25.10	371.37	1.24	371.28	1.25	24.08	373.06	.90	294.99	1.58	77.76	20.78	20.68	20.57	20.70
20.99	377.09	1.17	376.51	1.25	23.04	373.50	1.29	373.41	1.24	22.02	375.28	.89	294.96	1.56	76.67	20.16	20.07	19.96	20.08
19.88	379.01	1.07	378.04	1.15	21.93	375.16	1.28	375.32	1.27	20.91	376.59	.89	294.78	1.56	77.04	20.27	20.16	20.05	20.18
18.83	380.68	.86	379.81	.96	20.88	377.82	1.18	377.24	1.14	19.86	379.27	.76	294.76	1.56	77.29	20.35	20.26	20.15	20.29
17.78	381.86	.62	381.52	.74	19.83	379.40	1.00	379.49	.97	18.81	380.63	.60	294.63	1.56	76.74	20.19	20.08	19.98	20.11
16.80	382.92	.45	382.23	.59	18.85	381.07	.77	381.01	.73	17.83	381.83	.43	294.80	1.56	76.93	20.28	20.18	20.07	20.19
15.87	382.89	.41	382.18	.56	17.92	382.17	.52	382.14	.50	16.90	382.60	.27	294.95	1.56	76.97	20.26	20.17	20.06	20.19
14.93	382.08	.55	381.77	.67	16.98	382.97	.35	382.84	.30	15.96	382.41	.30	294.76	1.55	76.76	20.15	20.07	19.95	20.08
14.00	381.94	.75	381.96	.86	16.05	383.60	.37	383.38	.34	15.03	382.66	.44	294.50	1.58	77.29	20.60	20.51	20.40	20.53
13.05	381.16	.93	380.58	1.02	15.10	383.53	.55	382.98	.51	14.08	381.46	.58	294.93	1.57	77.55	20.60	20.50	20.39	20.52
12.00	378.91	1.09	378.63	1.16	14.05	382.07	.77	381.68	.73	13.03	380.54	.73	295.08	1.57	77.34	20.47	20.37	20.26	20.39
10.95	377.27	1.16	376.79	1.20	13.00	380.68	.89	380.34	.87	11.98	378.43	.77	295.09	1.55	77.47	20.34	20.24	20.13	20.26
9.85	374.56	1.23	374.59	1.24	11.90	378.46	1.03	378.49	1.03	10.88	376.40	.83	295.15	1.56	76.98	20.29	20.20	20.09	20.22
8.82	371.79	1.25	371.84	1.26	10.87	375.89	1.12	375.37	1.13	9.85	373.62	.84	294.60	1.55	76.83	20.18	20.08	19.97	20.10

TAB. A24

Y11	= 31.66 mm	Y12	= 29.61 mm		19:41:27 JUN22,1987 M106.DAT
TBI	= 290.8 C	TBO	= 375.2 C		
QH1	= 5.64 W/cm^2	QH2	= 5.60 W/cm^2		
QH3	= 5.59 W/cm^2	QH4	= 5.60 W/cm^2		TEGENA 2 - FLUID TEMPERATURES
WB	= 44.2 kW	MFR	= .40 kg/s		PROBE 1 TEMP FLUCTUATIONS
DTC	= 84.3 K	UB	= .24 m/s		
Re	= 8086.	Pe	= 45.2		

Y11 mm	TC11 C	RMS11 K	TC12 C	RMS12 K	Y13 mm	TC13 C	RMS13 K	TC14 C	RMS14 K	Y15 mm	TC15 C	RMS15 K	TBI C	MFR kg/s	DTC K	QH1 W/cm^2	QH2 W/cm^2	QH3 W/cm^2	QH4 W/cm^2
28.80	369.74	.33	368.97	.39	30.85	369.59	.24	369.53	.17	29.83	369.81	.16	290.82	.40	84.33	5.64	5.60	5.59	5.60
27.79	370.55	.34	370.02	.40	29.84	370.26	.24	370.12	.18	28.82	370.52	.17	291.14	.39	84.82	5.64	5.59	5.59	5.60
26.80	371.07	.36	370.55	.42	28.85	370.64	.26	370.67	.19	27.83	371.16	.19	291.76	.39	84.76	5.65	5.60	5.59	5.61
25.88	371.91	.38	371.22	.45	27.93	371.24	.28	371.01	.21	26.91	371.72	.22	292.24	.40	84.39	5.65	5.61	5.60	5.62
24.96	372.90	.40	372.23	.48	27.01	372.03	.30	372.23	.23	25.99	372.54	.23	292.42	.40	84.30	5.65	5.60	5.59	5.61
23.05	373.97	.39	373.76	.47	25.10	373.36	.33	373.13	.27	24.08	373.89	.24	292.48	.40	84.45	5.67	5.62	5.61	5.63
20.96	375.62	.37	375.23	.45	23.01	374.71	.33	374.55	.28	21.99	375.33	.24	292.54	.39	84.74	5.65	5.61	5.60	5.61
19.87	376.35	.37	375.80	.43	21.92	375.27	.32	375.26	.28	20.90	376.09	.22	292.56	.40	84.52	5.67	5.62	5.62	5.64
18.82	377.07	.34	376.83	.41	20.87	376.30	.30	376.07	.24	19.85	376.85	.20	292.72	.40	84.66	5.67	5.62	5.62	5.63
17.79	377.92	.32	377.42	.39	19.84	377.39	.28	377.09	.23	18.82	377.80	.18	292.76	.39	85.28	5.69	5.64	5.63	5.65
16.81	377.95	.31	377.36	.38	18.86	377.51	.27	377.48	.20	17.84	378.02	.17	292.97	.40	84.95	5.69	5.64	5.64	5.65
15.88	377.87	.31	377.49	.37	17.93	377.86	.25	377.68	.18	16.91	378.05	.15	293.12	.40	84.17	5.69	5.65	5.64	5.65
14.96	378.08	.32	377.61	.40	17.01	378.30	.24	378.27	.17	15.99	378.50	.15	293.36	.39	84.95	5.68	5.63	5.62	5.64
14.03	377.92	.35	377.49	.46	16.08	378.55	.24	378.44	.17	15.06	378.29	.18	293.11	.39	85.39	5.67	5.63	5.62	5.63
13.05	377.12	.35	376.52	.43	15.10	378.03	.24	377.95	.18	14.08	377.84	.18	292.38	.39	84.96	5.66	5.61	5.60	5.62
12.02	375.98	.36	375.47	.43	14.07	377.17	.26	376.97	.19	13.05	376.78	.20	291.03	.39	85.84	5.66	5.61	5.61	5.62
10.95	374.76	.37	374.65	.44	13.00	376.10	.27	375.92	.22	11.98	375.47	.21	290.43	.39	84.94	5.66	5.61	5.61	5.62
9.87	373.60	.39	373.21	.46	11.92	375.04	.29	374.79	.24	10.90	374.55	.23	290.11	.39	85.48	5.64	5.59	5.59	5.60
8.83	372.57	.38	372.12	.45	10.88	374.26	.31	373.66	.24	9.86	373.23	.23	289.70	.39	86.40	5.64	5.60	5.59	5.61

Y11	= 29.44 mm	Y14	= 31.49 mm		
TBI	= 295.8 C	TBO	= 376.5 C		
QH1	= 21.9 W/cm^2	QH2	= 21.8 W/cm^2		
QH3	= 21.7 W/cm^2	QH4	= 21.8 W/cm^2		
NB	= 171.8 kW	MFR	= 1.61 kg/s		
DTC	= 80.6 K	UB	= 1.00 m/s		
Re	= 33123.	Pe	= 184.2		

20:29:19 JUN10,1987 M063.DAT

TAB. A25.1

TEGENA 2 - FLUID TEMPERATURES

PROBE 1 TEMP FLUCTUATIONS

X11 mm	TC11 C	RMS11 K	TC14 C	RMS14 K	X12 mm	TC12 C	RMS12 K	TC13 C	RMS13 K	X15 mm	TC15 C	RMS15 K	TBI C	MFR kg/s	DTC K	QH1 W/cm^2	QH2 W/cm^2	QH3 W/cm^2	QH4 W/cm^2
7.69	366.69	.48	365.52	.30	5.64	364.28	.55	364.42	.20	6.67	365.17	.25	295.82	1.61	80.64	21.91	21.82	21.69	21.82
9.67	368.64	.58	367.45	.37	7.62	365.84	.64	365.66	.28	8.65	366.83	.35	295.87	1.62	80.07	21.88	21.79	21.66	21.79
11.62	370.98	.56	369.34	.39	9.57	368.45	.72	367.48	.34	10.60	369.17	.39	295.76	1.61	80.25	21.87	21.77	21.65	21.78
13.61	373.05	.48	371.22	.36	11.56	370.60	.69	369.53	.37	12.59	371.36	.38	295.65	1.61	80.41	21.89	21.80	21.67	21.80
14.63	374.13	.40	372.06	.30	12.58	371.85	.64	370.61	.35	13.61	372.20	.33	295.63	1.62	80.12	21.88	21.78	21.66	21.79
15.64	374.43	.35	372.10	.24	13.59	372.65	.61	371.14	.33	14.62	372.83	.28	295.40	1.61	80.43	21.93	21.84	21.71	21.84
16.67	374.51	.31	372.25	.20	14.62	373.35	.57	371.69	.28	15.65	373.20	.22	295.22	1.61	80.48	21.94	21.85	21.72	21.86
17.68	374.38	.31	372.07	.20	15.63	373.98	.53	372.11	.22	16.66	373.24	.17	295.04	1.62	80.47	21.96	21.86	21.74	21.87
18.67	374.04	.32	371.83	.21	16.62	374.29	.49	372.25	.19	17.65	373.09	.17	295.04	1.61	80.44	21.90	21.80	21.67	21.81
19.66	373.25	.37	371.44	.24	17.61	374.02	.50	371.96	.17	18.64	372.87	.19	295.17	1.62	80.22	21.94	21.85	21.72	21.85
20.64	372.46	.41	370.75	.28	18.59	373.63	.50	371.93	.22	19.62	372.15	.23	294.96	1.62	80.23	21.98	21.89	21.76	21.89
21.61	371.46	.43	369.96	.29	19.56	372.60	.52	371.14	.23	20.59	371.38	.26	294.68	1.62	80.32	21.96	21.87	21.74	21.87
23.61	369.49	.45	368.63	.31	21.57	371.12	.55	370.05	.26	22.59	370.03	.28	294.58	1.62	80.64	22.02	21.92	21.80	21.93
25.64	368.15	.48	367.22	.30	23.59	369.16	.58	368.55	.26	24.62	368.19	.28	294.60	1.62	80.37	21.96	21.86	21.73	21.86
27.67	366.94	.51	366.31	.28	25.62	367.70	.61	367.40	.27	26.65	367.10	.28	294.68	1.62	80.46	21.96	21.86	21.74	21.87
28.67	366.59	.52	366.11	.27	26.62	367.17	.62	366.70	.27	27.65	366.70	.29	294.61	1.62	79.96	21.94	21.85	21.72	21.85
29.66	366.35	.51	365.87	.26	27.61	366.71	.61	366.58	.25	28.64	366.54	.27	294.65	1.62	80.20	21.97	21.88	21.75	21.88
30.64	366.49	.52	365.79	.25	28.59	366.47	.62	366.19	.24	29.62	366.13	.27	294.66	1.61	80.52	21.93	21.84	21.71	21.84
31.62	366.37	.54	366.11	.27	29.57	365.95	.64	365.94	.23	30.60	366.25	.27	294.69	1.62	80.24	21.91	21.81	21.69	21.82
32.61	366.62	.53	366.33	.28	30.56	366.10	.63	365.82	.22	31.59	366.33	.27	294.59	1.62	80.22	21.90	21.81	21.69	21.82
33.61	367.50	.52	366.55	.29	31.56	366.27	.63	366.07	.23	32.59	366.59	.28	294.60	1.61	80.30	21.85	21.76	21.63	21.76
34.62	367.76	.53	367.16	.31	32.57	366.69	.65	366.49	.25	33.60	367.21	.29	294.60	1.62	80.09	21.90	21.81	21.68	21.81
35.65	368.91	.51	367.57	.31	33.60	366.82	.63	366.74	.27	34.63	367.60	.31	294.52	1.61	80.24	21.83	21.74	21.62	21.74
37.68	370.37	.49	369.25	.33	35.63	368.53	.60	368.06	.28	36.66	368.99	.30	294.50	1.61	80.14	21.86	21.77	21.64	21.77
39.66	372.57	.50	371.17	.35	37.61	370.24	.61	369.59	.30	38.64	371.16	.32	294.51	1.61	80.60	21.95	21.86	21.73	21.87
41.62	374.45	.43	372.57	.32	39.57	372.39	.61	371.17	.32	40.60	372.81	.32	294.50	1.62	80.42	22.00	21.90	21.78	21.91
42.60	375.39	.37	373.15	.28	40.55	373.35	.59	371.74	.31	41.58	373.53	.29	294.49	1.62	80.43	22.00	21.91	21.78	21.92
43.62	375.77	.32	373.51	.23	41.57	374.14	.55	372.70	.28	42.60	374.27	.25	294.39	1.62	80.38	21.97	21.88	21.75	21.88
44.63	375.97	.29	373.64	.21	42.58	374.70	.53	373.06	.25	43.61	374.54	.20	294.45	1.62	80.44	21.97	21.87	21.74	21.87
45.64	376.05	.28	373.77	.20	43.59	375.30	.49	373.54	.21	44.62	374.83	.17	294.49	1.62	80.41	21.96	21.86	21.74	21.87
46.67	375.82	.31	373.64	.21	44.62	375.65	.49	373.89	.18	45.65	374.98	.17	294.53	1.61	80.49	21.90	21.81	21.68	21.81
47.67	375.50	.36	373.37	.25	45.62	375.73	.50	373.88	.18	46.65	374.72	.19	294.54	1.61	80.48	21.93	21.84	21.71	21.84
48.66	375.04	.40	372.88	.27	46.61	375.39	.51	373.73	.20	47.64	374.37	.23	294.58	1.62	80.29	21.91	21.82	21.69	21.82
49.65	373.72	.44	372.15	.29	47.60	374.88	.54	373.03	.22	48.63	373.77	.25	294.45	1.61	80.30	21.85	21.76	21.63	21.76
51.61	371.97	.47	370.90	.30	49.56	373.45	.60	372.13	.26	50.59	372.37	.29	294.40	1.61	80.28	21.90	21.80	21.68	21.81
53.59	370.58	.51	369.86	.32	51.54	371.83	.64	370.92	.28	52.57	370.76	.31	294.52	1.62	80.13	21.93	21.84	21.71	21.85
55.63	369.35	.54	368.54	.31	53.58	370.46	.66	369.77	.27	54.61	369.42	.31	294.57	1.62	80.06	21.88	21.79	21.66	21.80
56.65	368.60	.55	368.00	.30	54.60	369.25	.67	368.85	.29	55.63	369.02	.32	294.54	1.61	80.37	21.90	21.81	21.68	21.81
57.66	368.26	.53	367.57	.27	55.61	368.34	.66	368.21	.28	56.64	368.28	.30	294.47	1.61	80.50	21.96	21.87	21.74	21.87
58.65	367.80	.52	367.56	.25	56.60	368.05	.66	368.24	.26	57.63	367.87	.28	294.42	1.61	80.55	21.97	21.88	21.75	21.88
59.64	368.01	.54	367.43	.26	57.59	367.42	.67	367.64	.25	58.62	367.91	.27	294.26	1.62	80.24	21.93	21.84	21.71	21.84
60.63	367.70	.54	367.77	.27	58.58	367.40	.65	367.57	.22	59.61	367.93	.27	294.27	1.61	80.49	21.93	21.83	21.71	21.84
61.59	368.69	.53	367.97	.29	59.54	367.77	.65	367.68	.22	60.57	367.73	.27	294.33	1.63	79.80	21.94	21.85	21.72	21.85
62.58	368.66	.55	368.25	.31	60.53	367.57	.66	367.72	.24	61.56	368.27	.30	294.37	1.62	80.26	21.96	21.87	21.74	21.87
63.58	369.85	.54	369.23	.34	61.53	368.34	.65	368.21	.26	62.56	368.97	.31	294.49	1.62	80.58	22.03	21.94	21.81	21.95
65.62	371.75	.53	370.58	.34	63.57	369.67	.65	369.46	.29	64.60	370.74	.33	294.33	1.62	80.71	22.07	21.98	21.85	21.98
67.66	373.34	.52	371.91	.33	65.61	371.36	.64	370.81	.30	66.64	372.24	.33	294.39	1.62	80.50	22.03	21.94	21.81	21.95
69.64	375.44	.43	373.66	.29	67.59	372.98	.62	372.37	.29	68.62	373.90	.31	294.56	1.63	80.08	22.04	21.94	21.82	21.95
70.61	376.15	.40	374.53	.28	68.56	374.24	.60	373.08	.27	69.59	374.67	.28	294.54	1.62	80.62	22.06	21.97	21.84	21.98
71.60	376.81	.35	374.74	.24	69.55	374.97	.58	373.97	.26	70.58	375.31	.26	294.52	1.62	80.41	22.05	21.95	21.83	21.97
72.59	377.31	.31	375.20	.20	70.54	376.00	.54	374.55	.24	71.57	375.93	.21	294.52	1.62	80.48	22.08	21.98	21.87	21.99
73.60	376.33	.28	374.12	.19	71.55	375.49	.49	373.92	.21	72.58	375.11	.17	294.54	1.60	79.49	21.46	21.37	21.24	21.37
74.62	376.28	.29	374.17	.20	72.57	376.04	.47	374.26	.17	73.60	375.35	.15	294.54	1.59	79.83	21.50	21.41	21.28	21.42
75.64	375.73	.33	373.54	.22	73.59	375.74	.46	374.10	.17	74.62	374.96	.17	294.45	1.60	79.65	21.52	21.43	21.30	21.43
76.65	374.95	.37	373.12	.26	74.60	375.46	.49	373.87	.19	75.63	374.44	.21	294.17	1.61	79.41	21.55	21.45	21.33	21.46
76.65	375.02	.38	373.08	.26	74.60	375.85	.48	373.95	.16	75.63	374.52	.21	294.15	1.60	79.72	21.55	21.46	21.33	21.46

Y21 = 3.11 mm Y24 = .45 mm
TBI = 295.8 C DTC = 80.6 K
QH1 = 21.9 W/cm^2 QH2 = 21.8 W/cm^2
QH3 = 21.7 W/cm^2 QH4 = 21.8 W/cm^2
NB = 171.8 kW UB = 1.00 m/s
Re = 33123. Pe = 184.2

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TAB. A25.2

TEGENA 2 - FLUID TEMPERATURES
PROBE 2 TEMP FLUCTUATIONS

X21 mm	TC21 C	RMS21 K	TC24 C	RMS24 K	X22 mm	TC22 C	RMS22 K	TC23 C	RMS23 K	X25 mm	TC25 C	RMS25 K	NB1 kW	NB2 kW	NB3 kW	NB4 kW	NB kW	UB m/s	TBO C
109.76	366.21	.50	364.60	.32	112.41	362.82	.41	362.08	.36	111.08	363.48	.37	43.07	43.01	42.65	43.11	171.85	1.00	376.46
107.82	368.65	.50	366.46	.35	110.47	364.68	.54	363.71	.41	109.14	365.62	.48	43.02	42.96	42.60	43.07	171.66	1.00	375.94
105.91	371.29	.42	368.61	.36	108.56	367.40	.62	365.76	.46	107.23	367.92	.54	42.99	42.93	42.58	43.03	171.53	1.00	376.00
104.93	372.68	.31	369.04	.29	107.58	368.98	.55	367.04	.45	106.25	369.09	.46	43.05	42.98	42.62	43.08	171.72	1.00	376.06
103.93	373.23	.24	369.57	.25	106.58	369.88	.51	367.99	.44	105.25	369.72	.41	43.01	42.94	42.59	43.06	171.61	1.00	375.75
102.92	373.92	.17	370.05	.18	105.57	371.23	.44	368.33	.42	104.24	370.69	.33	43.12	43.06	42.69	43.16	172.03	1.00	375.83
101.91	374.07	.13	370.03	.15	104.56	372.02	.37	369.16	.39	103.23	371.07	.23	43.14	43.09	42.72	43.20	172.15	1.00	375.69
100.90	373.85	.11	369.96	.14	103.55	372.85	.31	369.53	.36	102.22	371.33	.15	43.17	43.11	42.75	43.21	172.24	1.00	375.51
99.87	373.21	.16	369.65	.15	102.52	373.22	.25	369.76	.33	101.19	371.13	.11	43.05	42.98	42.62	43.09	171.75	1.00	375.49
98.86	372.76	.19	369.17	.19	101.51	373.36	.24	369.75	.32	100.18	370.86	.16	43.14	43.08	42.72	43.17	172.11	1.00	375.38
97.86	371.81	.22	368.67	.22	100.51	373.07	.24	369.62	.32	99.18	370.38	.20	43.21	43.15	42.79	43.25	172.40	1.00	375.19
96.89	370.59	.27	367.77	.23	99.54	372.17	.27	369.01	.33	98.21	369.54	.25	43.17	43.12	42.76	43.22	172.27	1.00	375.00
94.97	368.69	.32	366.47	.24	97.62	370.86	.33	368.21	.36	96.29	368.21	.29	43.29	43.23	42.86	43.34	172.71	1.00	375.22
92.96	367.04	.41	365.39	.24	95.61	368.95	.39	366.98	.37	94.28	366.63	.32	43.18	43.10	42.74	43.20	172.23	1.00	374.98
90.92	365.93	.47	364.51	.23	93.57	367.07	.45	365.59	.38	92.24	365.72	.33	43.17	43.11	42.75	43.21	172.24	1.00	375.14
89.89	365.78	.53	364.26	.22	92.54	366.49	.49	365.21	.37	91.21	365.04	.34	43.14	43.08	42.71	43.18	172.10	1.00	374.58
88.87	365.82	.55	364.38	.22	91.52	366.32	.54	364.92	.38	90.19	365.06	.35	43.21	43.14	42.77	43.24	172.35	1.00	374.85
87.87	366.10	.56	364.56	.23	90.52	365.73	.57	364.59	.37	89.19	365.08	.35	43.12	43.06	42.70	43.16	172.04	1.00	375.19
86.91	366.06	.57	364.59	.24	89.56	365.45	.59	364.36	.36	88.23	364.66	.35	43.08	43.01	42.65	43.11	171.85	1.00	374.92
85.95	365.92	.58	364.98	.25	88.60	365.53	.61	364.20	.36	87.27	364.62	.37	43.06	43.01	42.65	43.11	171.83	1.00	374.82
84.98	366.58	.56	365.33	.27	87.63	365.39	.61	364.49	.36	86.30	365.05	.38	42.96	42.90	42.54	43.01	171.41	1.00	374.90
83.97	366.98	.55	365.85	.28	86.62	365.43	.64	364.48	.38	85.29	365.41	.41	43.06	43.00	42.63	43.10	171.79	1.00	374.68
82.97	367.93	.46	366.44	.27	85.62	365.75	.61	364.87	.37	84.29	366.18	.38	42.93	42.87	42.52	42.97	171.28	1.00	374.76
80.93	369.58	.42	367.99	.27	83.58	367.46	.58	365.94	.39	82.25	367.55	.38	42.99	42.92	42.57	43.02	171.50	1.00	374.65
78.88	372.22	.36	369.50	.27	81.53	369.66	.49	367.83	.38	80.20	369.42	.37	43.15	43.10	42.74	43.21	172.20	1.00	375.11
76.91	373.92	.28	370.97	.24	79.56	371.21	.44	369.04	.38	78.23	370.83	.36	43.26	43.19	42.83	43.30	172.58	1.00	374.91
75.95	374.77	.23	371.40	.21	78.60	372.51	.41	369.86	.38	77.27	371.88	.33	43.26	43.20	42.84	43.31	172.60	1.00	374.91
74.97	375.31	.17	371.62	.18	77.62	373.17	.37	370.31	.37	76.29	372.27	.28	43.19	43.14	42.77	43.23	172.33	1.00	374.77
73.98	375.67	.15	371.93	.15	76.63	374.05	.33	371.07	.36	75.30	372.82	.21	43.19	43.13	42.76	43.23	172.30	1.00	374.89
72.97	375.78	.16	371.91	.14	75.62	374.62	.29	371.53	.34	74.29	373.26	.14	43.17	43.10	42.75	43.21	172.23	1.00	374.90
71.96	375.58	.17	371.81	.16	74.61	375.27	.25	371.91	.33	73.28	373.41	.12	43.07	43.00	42.64	43.10	171.80	1.00	375.01
70.93	375.12	.21	371.66	.20	73.58	375.49	.24	372.02	.33	72.25	373.38	.15	43.12	43.06	42.70	43.17	172.05	1.00	375.02
69.89	374.50	.26	371.15	.23	72.54	375.62	.25	372.08	.33	71.21	373.11	.22	43.09	43.02	42.66	43.12	171.89	1.00	374.87
68.87	373.22	.28	370.27	.24	71.52	374.95	.27	371.60	.35	70.19	372.10	.27	42.97	42.90	42.54	43.01	171.41	1.00	374.75
66.89	371.19	.35	369.15	.25	69.54	373.57	.35	370.71	.38	68.21	370.79	.33	43.06	42.99	42.64	43.11	171.79	1.00	374.68
64.95	369.08	.40	368.00	.26	67.60	371.70	.41	369.24	.39	66.27	369.04	.34	43.12	43.05	42.69	43.18	172.05	1.00	374.64
62.93	368.41	.46	366.78	.25	65.58	370.18	.46	368.52	.40	64.25	368.09	.35	43.02	42.96	42.60	43.07	171.66	1.00	374.63
61.93	367.53	.46	366.58	.23	64.58	369.49	.48	367.87	.40	63.25	367.37	.34	43.06	43.00	42.64	43.11	171.80	1.00	374.90
60.90	366.89	.46	366.13	.21	63.55	368.31	.49	366.91	.38	62.22	366.46	.33	43.17	43.11	42.75	43.22	172.25	1.00	374.96
59.88	367.21	.47	365.77	.21	62.53	367.61	.52	366.71	.38	61.20	366.45	.32	43.20	43.14	42.78	43.24	172.37	1.00	374.97
58.84	366.50	.47	365.83	.20	61.49	366.67	.53	365.95	.37	60.16	366.04	.30	43.12	43.07	42.70	43.17	172.06	1.00	374.51
57.87	366.99	.50	365.76	.22	60.52	366.36	.53	365.58	.36	59.19	365.99	.31	43.11	43.05	42.69	43.15	172.00	1.00	374.76
56.89	367.47	.51	366.11	.25	59.54	366.52	.55	365.73	.36	58.21	366.10	.32	43.13	43.08	42.72	43.18	172.11	1.01	374.13
55.94	367.93	.48	366.80	.28	58.59	366.56	.52	365.84	.37	57.26	366.57	.33	43.18	43.11	42.75	43.21	172.25	1.00	374.63
54.96	368.93	.48	367.45	.28	57.61	367.09	.53	366.34	.36	56.28	367.39	.37	43.32	43.26	42.90	43.37	172.85	1.00	375.08
52.95	371.27	.44	368.95	.29	55.60	368.58	.55	367.51	.39	54.27	368.78	.39	43.39	43.33	42.97	43.44	173.13	1.00	375.04
50.91	372.63	.39	370.55	.27	53.56	369.69	.51	368.49	.39	52.23	369.93	.38	43.32	43.26	42.90	43.37	172.85	1.00	374.89
48.86	374.95	.33	372.12	.26	51.51	372.29	.46	370.16	.38	50.18	371.85	.37	43.33	43.26	42.90	43.37	172.86	1.01	374.64
47.87	375.85	.29	372.74	.23	50.52	372.96	.44	370.83	.38	49.19	372.98	.36	43.38	43.32	42.95	43.43	173.09	1.00	375.16
46.90	376.36	.20	373.12	.20	49.55	374.20	.41	371.81	.38	48.22	373.38	.32	43.35	43.29	42.93	43.41	172.98	1.00	374.93
45.96	377.03	.20	373.59	.16	48.61	375.10	.37	372.38	.36	47.28	374.00	.26	43.41	43.34	43.00	43.46	173.22	1.00	375.00
44.99	376.05	.16	372.64	.14	47.64	374.73	.31	371.78	.34	46.31	373.45	.19	42.20	42.14	41.78	42.23	168.35	.99	374.02
43.99	376.13	.15	372.67	.15	46.64	375.35	.28	372.35	.33	45.31	373.90	.13	42.27	42.20	41.85	42.32	168.65	.99	374.37
42.98	375.53	.19	372.07	.17	45.63	375.55	.24	372.39	.31	44.30	373.68	.12	42.31	42.25	41.89	42.35	168.80	.99	374.10
41.95	374.83	.23	371.79	.20	44.60	375.57	.22	372.32	.30	43.27	373.35	.17	42.37	42.30	41.96	42.41	169.04	.99	373.57
40.94	373.85	.25	371.11	.20	43.59	375.49	.23	372.18	.31	42.26	373.00	.22	42.37	42.31	41.95	42.41	169.03	.99	373.87

Y11 = 29.42 mm Y14 = 31.47 mm
TBI = 296.0 C TBO = 374.2 C
QH1 = 20.8 W/cm^2 QH2 = 20.8 W/cm^2
QH3 = 20.6 W/cm^2 QH4 = 20.8 W/cm^2
NB = 163.5 kW MFR = 1.58 kg/s
DTC = 78.2 K UB = .98 m/s
Re = 32438. Pe = 180.7

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TAB. A26.1

TEGENA 2 - FLUID TEMPERATURES
PROBE 1 TEMP FLUCTUATIONS

X11 mm	TC11 C	RMS11 K	TC14 C	RMS14 K	X12 mm	TC12 C	RMS12 K	TC13 C	RMS13 K	X15 mm	TC15 C	RMS15 K	TBI C	MFR kg/s	DTC K	QH1 W/cm^2	QH2 W/cm^2	QH3 W/cm^2	QH4 W/cm^2
76.72	375.15	.40	373.27	.24	74.67	375.83	.47	374.28	.26	75.70	374.74	.23	296.01	1.58	78.16	20.84	20.75	20.63	20.76
75.74	375.40	.38	373.26	.22	73.69	375.58	.47	373.94	.22	74.72	374.68	.19	295.89	1.57	78.25	20.70	20.61	20.49	20.62
74.71	375.84	.34	373.73	.18	72.66	375.62	.46	373.88	.24	73.69	374.79	.17	295.76	1.57	77.91	20.72	20.62	20.50	20.64
73.68	375.63	.33	373.40	.18	71.63	374.76	.50	373.34	.25	72.66	374.41	.18	295.73	1.57	77.84	20.61	20.51	20.40	20.53
72.68	375.35	.35	373.24	.18	70.63	374.08	.53	372.66	.28	71.66	373.99	.22	295.70	1.57	77.90	20.63	20.54	20.42	20.55
71.69	374.67	.39	372.70	.21	69.64	372.92	.57	372.05	.32	70.67	373.15	.26	295.47	1.57	77.58	20.54	20.45	20.33	20.46
70.71	373.90	.43	372.07	.25	68.66	372.10	.61	371.11	.33	69.69	372.14	.29	295.27	1.56	77.74	20.55	20.45	20.33	20.46
69.73	373.36	.47	371.75	.29	67.68	371.23	.63	370.55	.34	68.71	371.86	.31	295.21	1.57	78.09	20.73	20.63	20.52	20.65
67.75	371.54	.52	370.54	.31	65.70	369.27	.64	369.23	.34	66.73	370.40	.32	295.17	1.57	77.98	20.68	20.59	20.46	20.60
65.72	370.33	.54	369.05	.32	63.67	368.06	.63	368.38	.34	64.70	368.76	.32	295.09	1.57	78.22	20.73	20.64	20.52	20.66
63.69	368.19	.53	367.28	.29	61.64	366.82	.63	366.76	.31	62.67	366.81	.31	295.12	1.57	77.94	20.68	20.58	20.47	20.60
62.68	366.80	.55	366.56	.28	60.63	366.23	.63	366.15	.30	61.66	366.70	.30	294.81	1.57	77.74	20.64	20.55	20.43	20.56
61.70	366.58	.54	366.12	.27	59.65	365.80	.61	365.84	.28	60.68	365.94	.28	294.76	1.57	77.56	20.58	20.49	20.38	20.51
60.71	366.54	.54	365.55	.25	58.66	365.20	.63	365.53	.27	59.69	365.53	.27	294.73	1.56	77.75	20.54	20.45	20.33	20.46
59.74	366.07	.54	365.11	.23	57.69	365.02	.64	365.37	.29	58.72	365.43	.27	294.60	1.56	77.69	20.54	20.44	20.33	20.46
58.76	365.74	.53	365.42	.23	56.71	365.90	.62	365.99	.31	57.74	365.88	.28	294.74	1.56	77.80	20.56	20.47	20.36	20.48
57.76	366.17	.53	365.81	.25	55.71	367.25	.62	366.66	.32	56.74	366.07	.29	294.79	1.57	77.71	20.57	20.47	20.36	20.49
56.75	366.41	.55	366.02	.26	54.70	366.91	.62	366.95	.34	55.73	366.71	.31	294.73	1.57	77.74	20.57	20.48	20.36	20.49
55.73	367.11	.54	366.08	.28	53.68	367.99	.61	367.64	.34	54.71	367.08	.31	294.72	1.56	77.87	20.57	20.48	20.36	20.49
53.69	368.37	.52	367.42	.29	51.64	369.58	.60	368.89	.33	52.67	368.46	.31	294.68	1.56	78.07	20.60	20.50	20.38	20.51
51.69	370.24	.49	368.65	.29	49.64	371.67	.57	370.52	.31	50.67	370.14	.29	294.77	1.57	77.63	20.58	20.49	20.37	20.50
49.74	371.98	.44	370.25	.27	47.69	373.08	.51	371.45	.27	48.72	371.62	.26	294.96	1.57	77.83	20.60	20.50	20.39	20.52
48.75	372.76	.42	370.79	.25	46.70	373.50	.51	371.82	.25	47.73	372.23	.23	295.00	1.57	77.78	20.60	20.50	20.39	20.52
47.76	373.06	.38	370.83	.22	45.71	373.21	.49	371.51	.23	46.74	372.28	.20	294.82	1.57	77.40	20.52	20.43	20.31	20.44
46.75	373.34	.36	371.20	.20	44.70	373.18	.49	371.55	.23	45.73	372.37	.18	294.73	1.56	77.63	20.52	20.42	20.31	20.44
45.74	373.71	.34	371.50	.17	43.69	372.98	.51	371.37	.25	44.72	372.64	.18	294.83	1.57	77.41	20.51	20.42	20.30	20.43
44.71	373.67	.34	371.43	.17	42.66	372.63	.52	370.81	.30	43.69	372.29	.21	294.60	1.57	77.84	20.62	20.52	20.41	20.54
43.70	373.38	.38	371.19	.21	41.65	371.76	.55	370.38	.32	42.68	371.78	.25	294.65	1.57	77.66	20.66	20.57	20.45	20.58
42.70	372.99	.41	370.75	.25	40.65	371.33	.57	369.99	.33	41.68	371.30	.27	294.67	1.58	77.83	20.77	20.67	20.55	20.68
41.71	372.60	.45	370.67	.29	39.66	370.43	.60	369.31	.35	40.69	370.91	.31	294.62	1.58	78.14	20.91	20.81	20.70	20.84
39.74	371.34	.52	369.72	.32	37.69	368.93	.63	368.43	.36	38.72	369.65	.33	294.74	1.59	78.25	20.96	20.87	20.75	20.88
37.77	368.58	.53	367.44	.32	35.72	366.59	.62	366.39	.34	36.75	367.37	.31	294.85	1.56	77.63	20.49	20.39	20.28	20.41
35.74	367.07	.54	365.88	.30	33.69	365.26	.65	365.28	.32	34.72	366.00	.31	295.02	1.56	77.70	20.55	20.45	20.34	20.47
34.72	366.47	.55	365.34	.30	32.67	364.82	.64	364.75	.31	33.70	365.30	.30	294.95	1.55	77.44	20.31	20.22	20.10	20.23
33.70	365.69	.55	364.71	.28	31.65	364.23	.63	364.30	.29	32.68	364.59	.29	294.90	1.55	77.34	20.27	20.17	20.06	20.19
32.70	364.97	.55	364.36	.26	30.65	363.98	.63	363.98	.28	31.68	364.44	.27	294.83	1.56	77.03	20.30	20.20	20.09	20.22
31.71	364.80	.56	364.03	.25	29.66	364.51	.63	364.13	.28	30.69	364.23	.28	294.75	1.55	77.51	20.34	20.25	20.14	20.27
30.72	364.12	.53	363.66	.23	28.67	364.06	.61	364.01	.28	29.70	364.04	.26	294.61	1.55	77.46	20.29	20.20	20.08	20.21
29.75	364.10	.54	363.50	.23	27.70	364.26	.61	364.23	.30	28.73	364.14	.27	294.49	1.55	77.04	20.21	20.12	20.01	20.14
28.76	364.05	.53	363.37	.24	26.71	364.18	.58	364.21	.30	27.74	364.14	.27	294.43	1.55	77.04	20.12	20.03	19.92	20.04
27.77	364.82	.54	364.19	.27	25.72	365.60	.59	364.95	.32	26.75	365.00	.30	294.24	1.56	78.09	20.62	20.53	20.41	20.54
25.72	365.67	.50	364.99	.27	23.67	366.91	.56	366.23	.32	24.70	366.04	.29	294.20	1.56	77.75	20.55	20.45	20.33	20.47
23.70	367.46	.48	366.29	.28	21.65	368.50	.55	367.48	.30	22.68	367.65	.28	294.43	1.56	77.93	20.54	20.44	20.33	20.46
21.71	369.30	.45	367.65	.26	19.66	370.19	.51	368.77	.28	20.69	369.01	.26	294.73	1.56	77.85	20.50	20.40	20.28	20.42
20.72	369.81	.42	367.98	.24	18.67	370.64	.48	369.23	.25	19.70	369.47	.23	294.53	1.56	77.99	20.50	20.41	20.29	20.42
19.74	370.41	.38	368.51	.22	17.69	371.03	.47	369.31	.24	18.72	369.91	.21	294.43	1.56	77.82	20.51	20.41	20.30	20.43
18.76	371.21	.36	368.92	.19	16.71	371.25	.47	369.37	.23	17.74	370.33	.18	294.65	1.56	77.54	20.51	20.41	20.30	20.43
17.78	371.23	.34	369.01	.16	15.73	370.70	.48	369.01	.27	16.76	370.06	.19	294.42	1.55	77.76	20.43	20.34	20.23	20.35
16.75	371.01	.35	368.71	.19	14.70	369.84	.51	368.32	.30	15.73	369.63	.21	294.29	1.56	77.75	20.45	20.34	20.23	20.36
15.74	370.54	.37	368.28	.22	13.69	368.96	.56	367.56	.36	14.72	368.99	.27	294.40	1.55	77.59	20.36	20.27	20.16	20.29
14.71	370.42	.43	368.16	.28	12.66	368.17	.61	366.73	.39	13.69	368.42	.32	294.44	1.56	77.95	20.54	20.45	20.33	20.46
13.71	369.41	.46	367.31	.31	11.66	366.90	.62	365.93	.40	12.69	367.70	.35	294.41	1.56	77.58	20.49	20.40	20.28	20.41
11.71	367.33	.54	365.90	.36	9.66	364.35	.63	364.23	.37	10.69	365.38	.37	294.67	1.56	77.67	20.52	20.42	20.31	20.45
9.76	365.03	.55	363.96	.33	7.71	362.45	.56	362.05	.31	8.74	363.36	.31	294.44	1.56	77.83	20.55	20.46	20.34	20.47
7.78	362.72	.52	362.17	.30	5.73	360.65	.50	360.71	.27	6.76	361.58	.26	294.56	1.56	77.76	20.52	20.43	20.31	20.44

Y21 = 3.14 mm Y24 = .48 mm
TBI = 296.0 C DTC = 78.2 K
QH1 = 20.8 W/cm^2 QH2 = 20.8 W/cm^2
QH3 = 20.6 W/cm^2 QH4 = 20.8 W/cm^2
WB = 163.5 kW UB = .98 m/s
Re = 32438. Pe = 180.7

08:05:43 JUN22,1987 M094.DAT

TAB. A26.2

TEGENA 2 - FLUID TEMPERATURES
PROBE 2 TEMP FLUCTUATIONS

Y21 mm	TC21 C	RMS21 K	TC24 C	RMS24 K	Y22 mm	TC22 C	RMS22 K	TC23 C	RMS23 K	Y25 mm	TC25 C	RMS25 K	WH1 kW	WH2 kW	WH3 kW	WH4 kW	WB kW	UB m/s	TBO C
40.84	374.70	.25	371.68	.20	43.49	375.80	.16	372.58	.29	42.16	373.43	.95	40.98	40.91	40.58	41.03	163.50	.98	374.17
41.81	374.92	.20	371.97	.17	44.46	375.71	.14	372.57	.29	43.13	373.44	.95	40.71	40.63	40.29	40.75	162.39	.97	374.14
42.87	375.50	.16	372.23	.15	45.52	375.52	.16	372.40	.29	44.19	373.72	.92	40.74	40.66	40.32	40.78	162.50	.97	373.66
43.87	375.46	.12	372.21	.12	46.52	375.03	.21	371.96	.31	45.19	373.34	.94	40.52	40.44	40.11	40.57	161.64	.97	373.58
44.83	375.72	.12	372.16	.12	47.48	374.21	.26	371.54	.32	46.15	373.06	.96	40.57	40.49	40.16	40.61	161.84	.97	373.60
45.81	374.98	.16	371.70	.15	48.46	373.36	.31	370.50	.34	47.13	372.17	.99	40.39	40.31	39.98	40.44	161.12	.97	373.05
46.76	374.33	.21	371.03	.19	49.41	371.82	.36	369.54	.35	48.08	371.42	1.01	40.40	40.32	39.99	40.44	161.14	.97	373.01
47.74	374.13	.25	370.71	.22	50.39	370.82	.40	369.11	.36	49.06	370.62	1.03	40.75	40.68	40.35	40.80	162.59	.97	373.30
49.72	372.08	.33	369.78	.24	52.37	369.32	.44	368.01	.36	51.04	369.41	1.04	40.67	40.59	40.24	40.70	162.20	.97	373.15
51.80	370.06	.39	368.23	.26	54.45	367.56	.47	366.49	.36	53.12	367.94	1.02	40.76	40.69	40.36	40.82	162.63	.97	373.32
53.84	368.09	.43	366.44	.26	56.49	365.67	.46	365.10	.35	55.16	366.03	1.02	40.66	40.59	40.26	40.71	162.22	.97	373.06
54.82	366.95	.45	365.60	.26	57.47	365.50	.48	364.57	.34	56.14	365.49	1.02	40.59	40.51	40.17	40.63	161.90	.97	372.55
55.79	366.66	.45	365.13	.24	58.44	365.19	.47	364.23	.32	57.11	364.80	1.00	40.46	40.40	40.07	40.52	161.45	.97	372.32
56.76	365.46	.47	364.33	.22	59.41	364.76	.48	364.05	.32	58.08	364.51	1.01	40.38	40.31	39.98	40.43	161.11	.97	372.48
57.73	365.15	.47	363.82	.20	60.38	364.63	.48	363.80	.32	59.05	364.17	1.00	40.38	40.30	39.98	40.43	161.08	.97	372.29
58.71	364.65	.46	364.06	.18	61.36	364.75	.47	364.32	.33	60.03	364.26	.99	40.43	40.36	40.03	40.48	161.30	.97	372.54
59.72	365.55	.47	363.97	.18	62.37	365.44	.46	364.51	.34	61.04	364.56	1.00	40.45	40.37	40.04	40.49	161.35	.97	372.50
60.74	365.13	.45	364.11	.19	63.39	366.07	.45	364.86	.35	62.06	364.72	1.00	40.44	40.37	40.04	40.49	161.34	.97	372.47
61.80	365.46	.45	364.23	.21	64.45	366.83	.41	365.76	.35	63.12	365.23	1.00	40.45	40.37	40.05	40.50	161.37	.97	372.60
63.85	366.60	.41	364.95	.22	66.50	368.77	.36	366.73	.34	65.17	366.26	1.00	40.50	40.42	40.08	40.54	161.53	.97	372.75
65.79	368.47	.36	366.70	.24	68.44	370.74	.31	368.13	.34	67.11	368.04	1.01	40.47	40.39	40.06	40.51	161.43	.97	372.40
67.73	370.33	.31	368.10	.23	70.38	372.39	.23	369.46	.32	69.05	369.62	.99	40.50	40.43	40.10	40.56	161.58	.97	372.79
68.72	371.50	.27	368.56	.22	71.37	372.94	.19	369.78	.31	70.04	370.32	.99	40.50	40.42	40.09	40.54	161.56	.97	372.77
69.72	372.06	.23	368.79	.20	72.37	372.92	.15	369.73	.30	71.04	370.60	.97	40.35	40.27	39.94	40.39	160.95	.97	372.22
70.75	372.73	.18	369.07	.17	73.40	372.82	.14	369.54	.29	72.07	370.79	.95	40.34	40.27	39.94	40.39	160.93	.97	372.36
71.80	373.16	.14	369.60	.14	74.45	372.92	.17	369.73	.30	73.12	371.06	.95	40.32	40.25	39.92	40.38	160.88	.97	372.23
72.85	373.33	.12	369.70	.12	75.50	372.43	.21	369.34	.31	74.17	370.85	.93	40.54	40.46	40.13	40.58	161.71	.97	372.44
73.86	373.35	.13	369.62	.13	76.51	371.65	.26	368.86	.33	75.18	370.56	.94	40.62	40.55	40.22	40.67	162.06	.97	372.31
74.83	373.25	.16	369.59	.16	77.48	370.99	.31	368.36	.34	76.15	370.22	.96	40.84	40.76	40.42	40.87	162.90	.98	372.49
75.79	372.74	.20	369.41	.19	78.44	370.41	.35	368.14	.35	77.11	369.92	.99	41.12	41.04	40.71	41.18	164.05	.98	372.76
77.73	371.55	.30	368.64	.24	80.38	368.77	.42	366.92	.36	79.05	368.62	1.02	41.21	41.14	40.81	41.27	164.43	.98	372.99
79.71	369.13	.34	366.80	.23	82.36	365.87	.43	364.90	.35	81.03	366.49	.99	40.28	40.20	39.88	40.33	160.69	.97	372.48
81.80	367.64	.41	365.52	.24	84.45	365.20	.52	363.82	.36	83.12	365.12	1.00	40.40	40.32	39.99	40.44	161.15	.97	372.73
82.84	366.43	.44	364.45	.24	85.49	363.97	.55	363.04	.35	84.16	364.23	1.00	39.94	39.86	39.54	39.98	159.32	.96	372.39
83.84	364.84	.50	363.82	.24	86.49	363.32	.55	362.55	.34	85.16	363.33	.99	39.85	39.77	39.44	39.89	158.96	.96	372.24
84.82	364.17	.52	363.39	.24	87.47	363.14	.54	362.42	.33	86.14	362.92	1.00	39.91	39.83	39.51	39.95	159.21	.96	371.86
85.79	363.99	.54	362.94	.23	88.44	363.24	.54	362.31	.33	87.11	362.94	.99	40.00	39.92	39.60	40.05	159.57	.96	372.26
86.75	363.59	.52	362.17	.20	89.40	363.01	.51	362.08	.32	88.07	362.61	.99	39.89	39.82	39.49	39.94	159.15	.96	372.07
87.72	362.94	.51	361.91	.19	90.37	362.94	.49	362.06	.33	89.04	362.19	.98	39.74	39.67	39.35	39.79	158.55	.96	371.53
88.70	363.33	.48	361.65	.18	91.35	363.31	.43	362.08	.33	90.02	362.45	.97	39.56	39.49	39.17	39.61	157.82	.96	371.47
89.70	363.51	.49	362.39	.19	92.35	364.95	.41	362.93	.33	91.02	363.15	.98	40.55	40.47	40.14	40.59	161.76	.97	372.33
91.79	364.51	.41	362.50	.20	94.44	365.32	.34	363.82	.33	93.11	363.86	.97	40.40	40.32	39.99	40.44	161.14	.97	371.95
93.84	365.61	.35	364.00	.21	96.49	367.52	.28	365.18	.33	95.16	365.40	.98	40.38	40.31	39.97	40.43	161.09	.96	372.36
95.78	367.23	.28	365.27	.21	98.43	369.40	.22	366.57	.31	97.10	366.71	.96	40.30	40.22	39.89	40.34	160.75	.96	372.59
96.74	368.23	.25	365.45	.20	99.39	369.96	.18	366.86	.30	98.06	367.30	.95	40.31	40.24	39.91	40.36	160.82	.96	372.53
97.71	368.94	.23	366.00	.19	100.36	370.18	.15	366.99	.29	99.03	367.76	.92	40.32	40.25	39.93	40.38	160.87	.96	372.25
98.69	369.78	.19	366.53	.16	101.34	370.40	.14	367.16	.29	100.01	368.10	.93	40.32	40.24	39.92	40.37	160.85	.97	372.19
99.70	370.29	.16	366.67	.13	102.35	370.06	.17	366.73	.30	101.02	368.00	.91	40.17	40.10	39.78	40.22	160.27	.96	372.19
100.73	370.36	.14	366.55	.12	103.38	369.06	.22	366.10	.32	102.05	367.93	.91	40.20	40.11	39.79	40.23	160.33	.96	372.04
101.78	370.22	.14	366.53	.13	104.43	368.35	.29	365.70	.35	103.10	367.57	.93	40.04	39.97	39.64	40.09	159.74	.96	371.98
102.83	369.93	.19	366.43	.18	105.48	367.69	.39	365.00	.39	104.15	367.12	.97	40.39	40.31	39.99	40.44	161.14	.96	372.39
103.84	369.39	.24	366.07	.23	106.49	366.72	.44	364.16	.40	105.16	366.30	.99	40.28	40.21	39.88	40.33	160.70	.97	371.99
105.77	367.66	.38	364.76	.32	108.42	363.88	.53	362.08	.41	107.09	364.35	1.04	40.35	40.27	39.95	40.40	160.97	.97	372.35
107.70	365.18	.45	363.08	.32	110.35	361.39	.46	360.19	.36	109.02	362.20	1.01	40.41	40.33	40.01	40.45	161.20	.97	372.26
109.68	362.40	.46	361.07	.28	112.33	359.46	.34	358.63	.32	111.00	360.02	.98	40.35	40.28	39.95	40.40	160.98	.97	372.32

Y11 = 29.43 mm Y14 = 31.48 mm
TBI = 299.9 C TBO = 378.2 C
QH1 = 20.9 W/cm^2 QH2 = 20.7 W/cm^2
QH3 = 20.6 W/cm^2 QH4 = 20.7 W/cm^2
WB = 163.5 kW MFR = 1.58 kg/s
DTC = 78.3 K UB = .98 m/s
Re = 32659. Pe = 180.8

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TEGENA 2 - FLUID TEMPERATURES
PROBE 1 TEMP FLUCTUATIONS

TAB. A27.1

X11 mm	TC11 C	RMS11 K	TC14 C	RMS14 K	X12 mm	TC12 C	RMS12 K	TC13 C	RMS13 K	X15 mm	TC15 C	RMS15 K	TBI C	MFR kg/s	DTC K	QH1 W/cm^2	QH2 W/cm^2	QH3 W/cm^2	QH4 W/cm^2
7.73	368.06	.53	367.44	.29	5.68	373.10	.52	365.48	.32	6.71	366.82	.32	299.91	1.58	78.29	20.87	20.71	20.65	20.74
9.67	370.27	.61	368.89	.36	7.62	373.12	.52	366.96	.39	8.65	368.53	.41	299.85	1.57	78.32	20.85	20.69	20.63	20.71
11.65	372.63	.58	371.18	.37	9.60	372.83	.51	368.75	.45	10.63	370.82	.46	299.79	1.58	78.35	20.88	20.71	20.65	20.74
13.63	375.19	.47	372.74	.31	11.58	372.85	.55	370.86	.47	12.61	373.07	.43	299.72	1.57	78.28	20.84	20.68	20.61	20.70
14.64	375.43	.41	373.19	.26	12.59	372.65	.51	371.50	.46	13.62	373.86	.39	299.76	1.57	78.15	20.78	20.62	20.56	20.64
15.66	375.97	.35	373.65	.19	13.61	372.42	.52	372.33	.43	14.64	374.40	.32	299.69	1.57	78.23	20.81	20.65	20.58	20.67
16.67	376.08	.32	373.65	.13	14.62	372.54	.52	372.98	.36	15.65	374.60	.24	299.64	1.58	78.02	20.82	20.65	20.59	20.67
17.68	376.06	.32	373.75	.12	15.63	372.50	.58	373.48	.32	16.66	375.01	.19	299.41	1.57	78.17	20.82	20.65	20.59	20.67
18.67	375.39	.35	373.11	.16	16.62	372.04	.53	373.22	.30	17.65	374.46	.20	299.36	1.57	78.11	20.79	20.62	20.56	20.65
19.66	374.85	.39	372.85	.20	17.61	372.26	.54	373.23	.29	18.64	374.20	.24	299.49	1.57	78.20	20.75	20.59	20.52	20.61
20.65	373.94	.43	372.51	.24	18.60	372.30	.49	373.00	.32	19.63	373.98	.28	299.45	1.58	78.12	20.82	20.66	20.60	20.68
21.62	373.04	.46	371.66	.25	19.57	372.21	.50	372.68	.33	20.60	373.16	.31	299.40	1.57	78.11	20.74	20.59	20.53	20.61
23.62	371.42	.49	370.35	.27	21.57	372.13	.54	371.39	.37	22.60	371.61	.34	299.34	1.57	78.27	20.79	20.63	20.57	20.65
25.64	370.45	.50	369.18	.26	23.59	371.94	.49	369.91	.38	24.62	370.47	.34	299.25	1.57	78.01	20.78	20.62	20.55	20.62
27.67	368.87	.51	367.96	.22	25.62	372.05	.55	368.53	.38	26.65	368.96	.32	299.15	1.57	78.00	20.75	20.59	20.52	20.61
28.67	368.51	.51	367.72	.20	26.62	371.88	.52	368.00	.37	27.65	368.55	.32	299.17	1.58	77.72	20.74	20.57	20.52	20.60
29.66	368.35	.53	367.68	.19	27.61	371.84	.50	367.61	.35	28.64	367.97	.30	299.15	1.57	77.92	20.73	20.57	20.50	20.59
30.65	368.28	.53	367.68	.19	28.60	371.91	.51	367.79	.33	29.63	367.99	.30	299.06	1.58	77.73	20.74	20.58	20.52	20.60
31.63	368.50	.54	367.69	.21	29.58	371.99	.56	367.45	.33	30.61	368.00	.30	299.04	1.57	78.05	20.71	20.55	20.49	20.57
32.63	368.65	.55	368.10	.23	30.58	371.55	.51	367.47	.33	31.61	368.24	.31	299.16	1.57	77.90	20.70	20.54	20.48	20.57
33.63	369.10	.55	368.20	.25	31.58	371.38	.50	367.50	.34	32.61	368.41	.33	298.93	1.57	77.95	20.69	20.52	20.46	20.55
34.63	369.84	.56	369.01	.28	32.58	371.58	.52	367.81	.37	33.61	369.29	.36	298.89	1.58	78.15	20.91	20.75	20.68	20.77
35.65	371.17	.54	369.83	.28	33.60	372.07	.50	368.54	.37	34.63	369.88	.36	299.12	1.58	78.35	20.91	20.75	20.69	20.78
37.68	372.35	.53	371.20	.31	35.63	371.73	.53	369.41	.39	36.66	371.20	.37	298.99	1.58	78.18	20.84	20.68	20.61	20.70
39.66	374.26	.52	372.48	.32	37.61	371.87	.51	371.12	.41	38.64	372.74	.39	299.04	1.58	78.24	20.89	20.73	20.66	20.75
41.62	376.22	.45	374.08	.28	39.57	371.78	.52	372.76	.42	40.60	374.72	.38	299.11	1.58	78.20	20.85	20.68	20.62	20.70
42.61	377.27	.40	375.07	.23	40.56	371.79	.52	373.54	.41	41.59	375.40	.35	299.26	1.57	78.20	20.83	20.66	20.60	20.69
43.62	377.52	.35	375.26	.17	41.57	371.99	.60	374.05	.40	42.60	376.07	.30	299.11	1.58	77.90	20.82	20.66	20.60	20.69
44.63	378.12	.32	375.65	.12	42.58	371.76	.51	374.86	.35	43.61	376.71	.23	299.33	1.58	78.12	20.81	20.65	20.59	20.68
45.65	378.15	.32	375.78	.11	43.60	371.32	.53	375.37	.31	44.63	376.91	.19	299.36	1.57	78.38	20.85	20.68	20.62	20.71
46.66	378.10	.35	375.68	.15	44.61	371.67	.52	375.55	.30	45.64	377.19	.20	299.37	1.58	78.17	20.89	20.72	20.66	20.75
47.67	377.44	.38	375.35	.19	45.62	371.79	.53	375.77	.30	46.65	376.89	.22	299.35	1.58	77.92	20.85	20.68	20.61	20.70
48.66	376.68	.42	374.75	.24	46.61	371.91	.55	375.36	.32	47.64	376.29	.27	299.24	1.58	78.28	20.86	20.70	20.64	20.73
49.65	376.02	.46	374.36	.26	47.60	371.60	.54	375.10	.34	48.63	376.06	.31	299.43	1.58	78.30	20.89	20.73	20.66	20.75
51.62	374.82	.49	373.06	.27	49.57	371.78	.52	374.24	.38	50.60	374.51	.34	299.48	1.59	78.20	20.97	20.80	20.74	20.83
53.60	373.04	.51	371.73	.27	51.55	372.04	.52	373.12	.39	52.58	373.11	.35	299.45	1.58	78.35	20.95	20.78	20.72	20.80
55.63	371.60	.51	370.69	.24	53.58	371.64	.51	371.28	.38	54.61	371.83	.34	299.45	1.58	78.17	20.91	20.74	20.68	20.77
56.66	370.99	.49	370.32	.20	54.61	371.63	.54	371.00	.37	55.64	371.48	.31	299.47	1.58	78.30	20.92	20.75	20.69	20.78
57.66	370.99	.50	370.23	.19	55.61	371.85	.55	370.53	.36	56.64	371.23	.31	299.55	1.58	78.38	20.96	20.79	20.73	20.82
58.66	371.06	.50	370.39	.18	56.61	372.23	.59	370.53	.34	57.64	371.18	.29	299.74	1.58	78.41	20.99	20.82	20.76	20.85
59.65	371.47	.49	370.76	.18	57.60	372.97	.54	370.51	.34	58.63	371.26	.29	299.72	1.59	78.36	21.07	20.90	20.84	20.93
60.64	371.56	.50	370.98	.20	58.59	372.68	.54	370.45	.32	59.62	371.15	.28	299.72	1.59	78.71	21.11	20.95	20.88	20.97
61.61	372.09	.53	371.11	.25	59.56	372.49	.50	370.72	.33	60.59	371.39	.31	299.75	1.59	78.77	21.13	20.96	20.89	20.99
62.59	372.54	.54	372.01	.28	60.54	373.02	.52	370.84	.34	61.57	371.84	.33	299.90	1.59	78.89	21.15	20.99	20.93	21.02
63.60	373.85	.55	372.83	.30	61.55	372.95	.51	371.68	.36	62.58	372.92	.35	300.14	1.59	79.20	21.29	21.13	21.06	21.15
65.63	374.71	.55	373.40	.31	63.58	371.98	.51	371.99	.39	64.61	373.44	.38	300.18	1.57	78.11	20.77	20.61	20.54	20.63
67.66	376.35	.56	374.93	.33	65.61	372.06	.50	373.40	.43	66.64	374.92	.41	300.14	1.57	77.98	20.77	20.61	20.54	20.62
69.64	378.08	.48	376.11	.28	67.59	371.79	.48	374.63	.43	68.62	376.29	.39	300.14	1.57	77.91	20.71	20.54	20.48	20.57
70.62	378.87	.43	377.00	.24	68.57	371.47	.49	375.42	.42	69.60	377.33	.36	299.98	1.56	77.60	20.52	20.36	20.30	20.39
71.61	379.31	.38	377.20	.20	69.56	371.44	.52	375.86	.40	70.59	377.79	.32	300.14	1.57	77.83	20.64	20.48	20.42	20.51
72.60	379.79	.33	377.68	.13	70.55	371.28	.50	376.65	.36	71.58	378.44	.25	300.01	1.57	77.87	20.67	20.50	20.44	20.53
73.60	379.86	.32	377.62	.10	71.55	371.24	.52	377.09	.33	72.58	378.75	.20	299.89	1.57	77.91	20.71	20.55	20.48	20.57
74.61	379.46	.33	377.25	.12	72.56	370.89	.54	376.98	.29	73.59	378.57	.18	299.81	1.56	77.86	20.60	20.44	20.38	20.46
75.65	379.00	.36	376.77	.17	73.60	370.63	.52	376.93	.30	74.63	378.26	.21	299.79	1.57	77.39	20.52	20.36	20.30	20.39
76.66	378.13	.40	376.21	.22	74.61	370.12	.58	376.76	.31	75.64	377.81	.26	299.78	1.57	77.61	20.54	20.38	20.33	20.42

Y21 = 3.07 mm Y24 = .41 mm
TBI = 299.9 C DTC = 78.3 K
QH1 = 20.9 W/cm^2 QH2 = 20.7 W/cm^2
QH3 = 20.6 W/cm^2 QH4 = 20.7 W/cm^2
NB = 163.5 kW UB = .98 m/s
Re = 32659. Pe = 180.8

10:22:57 JUL17,1987 M408.DAT

TEGENA 2 - FLUID TEMPERATURES
PROBE 2 TEMP FLUCTUATIONS

TAB. A27.2

X21	TC21	RMS21	TC24	RMS24	X22	TC22	RMS22	TC23	RMS23	X25	TC25	RMS25	NH1	NH2	NH3	NH4	NB	UB	TBO
mm	C	K	C	K	mm	C	K	C	K	mm	C	K	kW	kW	kW	kW	kW	m/s	C
109.76	367.84	.48	366.40	.30	112.41	364.30	.35	364.26	.28	111.08	365.37	.81	41.03	40.83	40.61	40.98	163.45	.98	378.20
107.85	370.09	.53	368.12	.35	110.50	366.60	.52	365.93	.34	109.17	367.18	.88	41.00	40.79	40.56	40.92	163.28	.98	378.17
105.93	372.54	.41	370.20	.31	108.58	368.94	.54	367.91	.37	107.25	370.05	.88	41.06	40.84	40.62	40.98	163.50	.98	378.14
103.95	374.44	.26	371.54	.22	106.60	371.59	.47	369.84	.36	105.27	371.69	.83	40.97	40.77	40.54	40.90	163.19	.97	377.99
102.95	375.02	.19	371.72	.17	105.60	372.88	.38	370.33	.34	104.27	372.35	.78	40.86	40.66	40.43	40.79	162.75	.97	377.91
101.94	375.28	.16	371.89	.14	104.59	373.73	.29	371.15	.30	103.26	372.66	.75	40.92	40.71	40.47	40.84	162.94	.97	377.92
100.92	374.96	.16	371.71	.15	103.57	374.42	.20	371.49	.27	102.24	372.79	.74	40.93	40.72	40.49	40.86	162.99	.98	377.66
99.87	374.47	.19	371.36	.17	102.52	374.77	.13	371.58	.24	101.19	372.72	.74	40.93	40.72	40.49	40.85	163.00	.97	377.59
98.87	373.34	.23	370.79	.19	101.52	374.46	.11	371.44	.23	100.19	372.22	.76	40.88	40.67	40.44	40.81	162.79	.97	377.48
97.87	372.91	.26	370.33	.20	100.52	374.42	.14	371.42	.24	99.19	371.82	.76	40.80	40.59	40.36	40.73	162.49	.97	377.69
96.89	372.10	.30	369.82	.22	99.54	374.15	.19	371.25	.26	98.21	371.41	.78	40.94	40.73	40.51	40.87	163.05	.98	377.57
95.94	371.10	.31	369.15	.22	98.59	373.18	.23	370.50	.27	97.26	370.61	.77	40.78	40.59	40.37	40.73	162.46	.97	377.51
93.98	369.49	.37	368.23	.23	96.63	371.62	.31	369.49	.29	95.30	369.22	.81	40.87	40.67	40.45	40.81	162.80	.97	377.61
91.95	368.06	.41	366.77	.21	94.60	369.67	.34	368.20	.29	93.27	367.60	.80	40.85	40.65	40.41	40.75	162.67	.97	377.26
89.89	367.07	.48	366.31	.20	92.54	368.65	.41	366.97	.29	91.21	366.78	.81	40.80	40.60	40.36	40.72	162.49	.97	377.15
88.87	367.25	.52	366.19	.20	91.52	367.37	.46	366.65	.28	90.19	366.63	.82	40.78	40.57	40.35	40.71	162.40	.98	376.90
87.87	366.62	.53	366.08	.21	90.52	367.24	.48	366.31	.28	89.19	366.17	.80	40.77	40.55	40.32	40.69	162.34	.97	377.08
86.92	367.28	.53	366.45	.22	89.57	367.05	.48	366.38	.27	88.24	366.61	.80	40.79	40.58	40.35	40.71	162.43	.98	376.79
85.97	367.59	.55	366.79	.24	88.62	367.06	.53	366.39	.28	87.29	366.39	.82	40.73	40.52	40.29	40.66	162.20	.97	377.10
84.98	368.07	.50	367.24	.24	87.63	366.97	.51	366.42	.28	86.30	367.04	.82	40.70	40.50	40.28	40.66	162.14	.97	377.07
83.98	368.96	.47	367.69	.25	86.63	366.98	.51	366.59	.29	85.30	367.13	.83	40.68	40.47	40.24	40.61	162.00	.97	376.88
82.98	370.00	.47	368.69	.26	85.63	367.47	.54	366.99	.31	84.30	367.95	.85	41.11	40.91	40.67	41.03	163.72	.98	377.04
81.96	370.56	.43	369.52	.26	84.61	368.76	.49	367.80	.31	83.28	368.68	.82	41.12	40.92	40.69	41.06	163.79	.98	377.46
79.90	372.45	.41	370.81	.26	82.55	369.93	.45	369.09	.32	81.22	370.55	.84	40.98	40.77	40.54	40.91	163.20	.98	377.17
77.89	374.39	.34	372.12	.26	80.54	371.80	.43	370.37	.32	79.21	372.07	.85	41.07	40.87	40.63	41.00	163.57	.98	377.28
75.96	376.18	.24	373.21	.20	78.61	373.83	.38	371.95	.31	77.28	373.45	.83	41.00	40.78	40.55	40.91	163.24	.98	377.32
74.98	376.90	.20	373.79	.17	77.63	374.64	.35	372.70	.31	76.30	374.30	.80	40.95	40.74	40.51	40.88	163.07	.97	377.47
73.98	377.05	.16	373.89	.14	76.63	375.66	.28	373.12	.29	75.30	374.57	.78	40.94	40.74	40.52	40.89	163.09	.98	377.01
72.98	377.22	.16	373.87	.14	75.63	376.32	.22	373.60	.26	74.30	375.03	.77	40.92	40.71	40.49	40.86	162.98	.98	377.46
71.97	376.93	.18	373.86	.17	74.62	376.99	.15	374.05	.24	73.29	375.11	.76	40.99	40.78	40.55	40.93	163.26	.97	377.73
70.94	376.47	.22	373.52	.20	73.59	377.20	.12	374.26	.24	72.26	375.08	.77	41.08	40.86	40.63	41.00	163.57	.98	377.54
69.90	375.87	.29	373.01	.23	72.55	377.07	.14	374.03	.24	71.22	374.66	.79	41.00	40.78	40.54	40.90	163.21	.98	377.28
68.89	374.99	.32	372.56	.23	71.54	376.61	.19	373.75	.26	70.21	373.85	.80	41.02	40.81	40.59	40.97	163.39	.98	377.52
67.89	374.15	.34	372.00	.25	70.54	376.16	.25	373.33	.28	69.21	373.52	.81	41.07	40.87	40.64	41.01	163.58	.98	377.73
65.97	372.22	.36	370.86	.24	68.62	374.98	.33	372.38	.30	67.29	372.08	.82	41.23	41.02	40.79	41.16	164.19	.98	377.69
63.99	371.07	.41	369.74	.23	66.65	373.17	.37	371.25	.30	65.32	370.82	.82	41.18	40.98	40.75	41.10	164.01	.98	377.80
61.97	369.55	.44	368.82	.21	64.62	371.21	.40	369.80	.30	63.29	369.63	.81	41.11	40.90	40.67	41.04	163.72	.98	377.63
60.93	369.19	.45	368.62	.20	63.58	370.54	.41	369.34	.29	62.25	369.24	.81	41.13	40.92	40.70	41.07	163.81	.98	377.77
59.91	369.56	.45	368.86	.19	62.56	370.21	.43	369.18	.29	61.23	369.15	.81	41.22	41.00	40.77	41.15	164.13	.98	377.92
58.89	369.77	.46	368.88	.19	61.54	370.00	.44	369.13	.27	60.21	369.14	.81	41.27	41.06	40.83	41.20	164.35	.98	378.15
57.89	370.18	.48	369.62	.21	60.54	370.38	.46	369.35	.27	59.21	369.39	.80	41.42	41.21	40.98	41.36	164.98	.98	378.08
56.93	370.68	.47	369.77	.23	59.58	369.97	.45	369.29	.26	58.25	369.26	.79	41.51	41.30	41.07	41.44	165.32	.98	378.44
55.97	371.00	.48	370.18	.26	58.62	369.91	.45	369.46	.27	57.29	369.72	.81	41.55	41.32	41.09	41.47	165.43	.98	378.52
55.00	372.26	.47	371.07	.27	57.65	370.80	.47	370.00	.29	56.32	370.69	.82	41.59	41.38	41.15	41.53	165.66	.98	378.78
53.99	373.14	.44	372.35	.27	56.64	371.70	.46	370.67	.30	55.31	371.54	.82	41.86	41.65	41.41	41.79	166.71	.98	379.34
51.97	374.62	.43	372.61	.28	54.62	371.86	.45	370.88	.31	53.29	372.23	.84	40.84	40.63	40.40	40.77	162.65	.97	378.29
49.91	376.22	.41	374.31	.28	52.56	373.61	.46	372.56	.33	51.23	373.85	.85	40.84	40.63	40.39	40.76	162.61	.98	378.12
47.91	378.00	.32	375.40	.25	50.56	375.60	.44	374.07	.33	49.23	375.13	.82	40.72	40.51	40.28	40.64	162.15	.97	378.05
46.94	378.90	.27	375.89	.21	49.59	376.41	.42	374.53	.33	48.26	376.02	.79	40.36	40.15	39.92	40.29	160.71	.97	377.58
45.99	379.03	.21	376.16	.18	48.64	377.23	.36	375.11	.31	47.31	376.34	.78	40.59	40.38	40.16	40.52	161.65	.97	377.96
45.01	379.48	.16	376.47	.15	47.66	378.15	.29	375.70	.29	46.33	377.02	.77	40.63	40.42	40.20	40.57	161.83	.97	377.88
44.01	379.32	.16	376.29	.15	46.66	378.46	.22	375.97	.27	45.33	377.29	.75	40.73	40.51	40.29	40.65	162.18	.97	377.80
43.01	378.91	.19	375.88	.17	45.66	378.94	.15	376.12	.24	44.33	377.08	.75	40.51	40.30	40.08	40.44	161.33	.97	377.67
41.99	378.07	.24	375.24	.20	44.64	378.81	.11	375.88	.23	43.31	376.82	.76	40.35	40.14	39.92	40.29	160.69	.97	377.18
40.97	377.32	.28	374.77	.22	43.62	378.67	.14	375.81	.24	42.29	376.41	.76	40.39	40.19	39.97	40.34	160.90	.97	377.38

TEGENA 1 WALL TEMPERATURE
OUTER RODS HEATED DIR A

TAB. A28

F10LWSA.DAT

RE = 60.9E+03		PE =359.22		MS = 3.18	(KG/S)
UB = 1.95	(M/S)	QH1 = 7.36	(W/CM^2)	QH2 = 0.00	(W/CM^2)
QH3 = 0.00	(W/CM^2)	QH4 = 7.42	(W/CM^2)	NB = 29.05	(KW)
TEN =297.91	(C)	TNO =304.75	(C)	TNM =301.33	(C)

CP (MM)	ME0 (C)	ME1 (C)	ME2 (C)	ME3 (C)	ME4 (C)	ME5 (C)
11.00		299.51	301.54	304.27	306.86	309.66
25.20	298.73	299.85	302.39	305.58	307.82	310.67
33.40		299.32	301.32	304.30	306.76	309.70
55.40		297.60	301.28	304.06	306.54	309.46
66.60		299.92	302.12	304.66	307.20	309.51
80.95	298.98	299.19	300.26	302.12	303.50	305.12
95.30		298.95	299.27	299.68	300.67	301.52
109.65		299.10	298.93	299.17	299.53	297.94
124.00		298.71	299.05	299.51	300.04	300.96
138.35	298.59	299.15	300.14	301.90	302.94	304.78
152.70		299.61	302.07	304.61	306.95	308.69
163.90		298.64	301.11	303.62	305.94	309.03
185.90		298.71	301.18	303.84	306.40	309.17
194.10	298.18	299.39	302.00	304.66	307.27	310.31
208.30		298.88	300.86	303.69	306.33	309.34
230.30		298.66	301.06	303.91	305.94	309.01
241.50		299.53	302.07	304.54	306.76	309.10
255.85	298.76	298.98	300.16	302.17	303.40	304.90
270.20		298.83	299.07	299.61	300.26	301.32
284.55		298.78	298.78	298.81	299.24	299.95
298.90		299.03	299.12	299.51	300.33	300.82
313.25	298.90	298.88	300.28	301.86	303.35	304.56
327.60		299.68	302.22	304.78	306.98	308.62
338.80		299.19	301.61	303.86	306.54	309.05

TEGENA 1 WALL TEMPERATURE
ROD 1 HEATED DIR A

TAB. A29.1

F25LWSA.DAT

RE = 60.5E+03 PE =356.85 MS = 3.16 (KG/S)
UB = 1.94 (M/S) QH1 = 14.98 (W/CM^2) QH2 = 0.00 (W/CM^2)
QH3 = 0.00 (W/CM^2) QH4 = 0.00 (W/CM^2) NB = 29.50 (KW)
TEN =298.23 (C) TNO =305.22 (C) TNM =301.73 (C)

CP (MM)	ME0 (C)	ME1 (C)	ME2 (C)	ME3 (C)	ME4 (C)	ME5 (C)
11.00		300.41	305.01	310.51	315.69	321.30
25.20	299.08	301.28	306.70	312.73	317.74	323.51
33.40		300.17	304.79	310.39	315.69	321.30
55.40		298.40	304.64	310.08	315.23	320.84
66.60		301.26	306.53	311.57	316.46	321.08
80.95	299.40	299.90	302.44	305.92	308.99	312.08
95.30		299.30	300.07	300.99	302.71	304.28
109.65		299.52	299.40	299.64	300.05	298.43
124.00		299.01	299.28	299.28	299.25	299.35
138.35	299.15	299.30	299.08	299.45	298.94	299.25
152.70		298.99	298.79	299.03	299.01	298.82
163.90		298.65	298.70	298.72	298.48	299.11
185.90		298.62	298.67	298.91	298.72	298.94
194.10	298.77	299.03	298.67	298.79	298.65	299.01
208.30		298.89	298.45	298.62	298.70	299.11
230.30		298.67	298.74	299.03	298.50	299.01
241.50		299.01	298.72	298.86	298.89	298.96
255.85	299.35	299.15	298.82	299.25	299.15	299.06
270.20		299.18	299.20	299.08	299.23	299.42
284.55		299.15	299.18	299.15	299.61	300.20
298.90		299.49	299.71	300.49	302.06	303.15
313.25	299.35	299.42	302.25	305.20	308.29	310.92
327.60		301.02	306.48	311.33	315.91	319.64
338.80		299.98	305.03	309.79	315.14	320.24

TEGENA 1 WALL TEMPERATURE
ROD 1 HEATED DIR B

TAB. A29.2

F25LWSB.DAT

RE = 60.2E+03 PE =355.16 MS = 3.15 (KG/S)
UB = 1.93 (M/S) QH1 = 14.98 (W/CM^2) QH2 = 0.00 (W/CM^2)
QH3 = 0.00 (W/CM^2) QH4 = 0.00 (W/CM^2) NB = 29.49 (KW)
TEN =298.13 (C) TNO =305.16 (C) TNM =301.65 (C)

CP (MM)	ME0 (C)	ME1 (C)	ME2 (C)	ME3 (C)	ME4 (C)	ME5 (C)
11.00		300.17	304.89	310.41	315.62	321.22
25.20	298.77	301.19	306.58	312.61	317.66	323.44
33.40		300.05	304.62	310.27	315.59	321.22
55.40		298.28	304.55	309.93	315.14	320.74
66.60		301.16	306.33	311.40	316.32	320.96
80.95	299.06	299.78	302.30	305.73	308.82	311.91
95.30		299.15	299.88	300.85	302.57	304.14
109.65		299.40	299.28	299.49	299.95	298.31
124.00		298.89	299.15	299.15	299.15	299.25
138.35	299.06	299.15	298.96	299.32	298.89	299.15
152.70		298.86	298.67	298.91	298.99	298.72
163.90		298.50	298.60	298.60	298.40	298.99
185.90		298.57	298.55	298.82	298.65	298.82
194.10	298.77	298.79	298.60	298.67	298.57	298.94
208.30		298.82	298.36	298.50	298.65	299.01
230.30		298.55	298.65	298.91	298.45	298.94
241.50		298.89	298.62	298.77	298.84	298.89
255.85	299.30	298.94	298.74	299.15	299.06	299.01
270.20		299.20	299.13	299.03	299.15	299.35
284.55		299.03	299.08	299.08	299.54	300.12
298.90		299.40	299.59	300.44	302.03	303.12
313.25	299.08	299.32	302.15	305.13	308.29	310.82
327.60		300.94	306.38	311.26	315.88	319.61
338.80		299.88	304.91	309.74	315.06	320.14

TEGENA 1 WALL TEMPERATURE
ROD 1 HEATED DIR A

TAB. A30.1

F26LWSA.DAT

RE	= 30.3E+03	PE	=177.55		MS	= 1.57	(KG/S)
UB	= 0.96 (M/S)	QH1	= 14.96	(W/CM^2)	QH2	= 0.00	(W/CM^2)
QH3	= 0.00 (W/CM^2)	QH4	= 0.00	(W/CM^2)	NB	= 29.46	(KW)
TEN	=297.51 (C)	TNO	=311.58	(C)	TNM	=304.54	(C)

CP (MM)	ME0 (C)	ME1 (C)	ME2 (C)	ME3 (C)	ME4 (C)	ME5 (C)
11.00		301.04	311.23	321.73	331.50	341.55
25.20	298.04	302.74	313.40	324.49	334.16	344.58
33.40		301.14	311.19	321.80	331.69	341.88
55.40		299.16	310.97	321.30	330.92	340.81
66.60		302.59	312.70	321.95	330.66	338.92
80.95	298.45	299.91	305.78	312.17	317.93	323.80
95.30		298.41	300.46	303.10	306.38	309.81
109.65		298.53	298.62	299.25	300.24	299.47
124.00		297.97	298.26	298.28	298.50	298.91
138.35	298.04	298.24	297.99	298.36	297.90	298.24
152.70		297.80	297.63	297.82	297.90	297.66
163.90		297.41	297.51	297.49	297.32	297.90
185.90		297.44	297.49	297.68	297.53	297.70
194.10	297.49	297.73	297.51	297.56	297.46	297.80
208.30		297.73	297.29	297.39	297.51	297.90
230.30		297.51	297.58	297.82	297.36	297.82
241.50		297.90	297.58	297.68	297.75	297.80
255.85	298.24	298.02	297.75	298.14	298.09	298.02
270.20		298.28	298.21	298.09	298.41	298.84
284.55		298.19	298.26	298.53	299.69	300.99
298.90		298.58	299.57	301.89	305.44	308.22
313.25	298.41	299.11	304.69	310.63	316.75	322.14
327.60		302.30	312.27	321.18	329.49	336.74
338.80		300.70	311.21	320.77	330.35	339.61

TEGENA 1 WALL TEMPERATURE
ROD 1 HEATED DIR B

TAB. A30.2

F26LWSB.DAT

RE	= 29.9E+03	PE	=175.67		MS	= 1.55	(KG/S)
UB	= 0.95 (M/S)	QH1	= 14.96	(W/CM^2)	QH2	= 0.00	(W/CM^2)
QH3	= 0.00 (W/CM^2)	QH4	= 0.00	(W/CM^2)	NB	= 29.46	(KW)
TEN	=297.05 (C)	TNO	=311.27	(C)	TNM	=304.16	(C)

CP (MM)	ME0 (C)	ME1 (C)	ME2 (C)	ME3 (C)	ME4 (C)	ME5 (C)
11.00		300.97	311.18	321.75	331.64	341.76
25.20	297.75	302.63	313.40	324.49	334.27	344.82
33.40		301.01	311.09	321.87	331.85	342.12
55.40		299.05	310.92	321.29	330.99	341.02
66.60		302.44	312.63	321.89	330.78	339.06
80.95	298.16	299.71	305.65	312.07	317.95	323.84
95.30		298.40	300.34	302.97	306.43	309.76
109.65		298.38	298.47	299.15	300.19	299.42
124.00		297.94	298.14	298.18	298.40	298.81
138.35	297.94	298.14	297.89	298.26	297.80	298.16
152.70		297.77	297.55	297.72	297.84	297.60
163.90		297.29	297.41	297.41	297.24	297.82
185.90		297.41	297.41	297.60	297.48	297.63
194.10	297.46	297.55	297.41	297.51	297.38	297.75
208.30		297.63	297.19	297.34	297.46	297.84
230.30		297.41	297.48	297.77	297.29	297.77
241.50		297.80	297.48	297.63	297.68	297.75
255.85	298.18	297.94	297.65	298.06	298.01	297.94
270.20		298.11	298.06	298.01	298.28	298.79
284.55		298.06	298.14	298.43	299.59	300.97
298.90		298.40	299.44	301.81	305.46	308.26
313.25	298.18	299.01	304.59	310.60	316.82	322.21
327.60		302.08	312.24	321.17	329.58	336.91
338.80		300.55	311.16	320.79	330.46	339.87

TEGENA 1 WALL TEMPERATURE
ROD 1 HEATED DIR A

TAB. A31.1

F24LWSA.DAT

RE = 15.3E+03		PE = 89.94		MS = 0.80	(KG/S)		
UB = 0.49	(M/S)	QH1 = 7.44	(W/CM^2)	QH2 = 0.00	(W/CM^2)		
QH3 = 0.00	(W/CM^2)	QH4 = 0.00	(W/CM^2)	NB = 14.65	(KW)		
TEN =295.79	(C)	TNO =309.59	(C)	TNM =302.69	(C)		

CP (MM)	ME0 (C)	ME1 (C)	ME2 (C)	ME3 (C)	ME4 (C)	ME5 (C)
11.00		299.43	308.92	318.11	326.32	334.48
25.20	295.75	300.71	310.52	320.37	328.17	336.41
33.40		299.86	309.55	318.92	326.90	334.98
55.40		298.05	309.29	318.20	326.11	333.90
66.60		300.71	309.41	317.22	324.43	330.91
80.95	296.38	297.95	303.54	309.43	314.49	319.45
95.30		296.28	298.63	301.58	304.89	308.15
109.65		296.38	296.50	297.49	298.80	298.41
124.00		295.92	296.09	296.23	296.62	297.35
138.35	296.23	296.23	295.87	296.19	295.70	296.14
152.70		295.77	295.51	295.58	295.65	295.36
163.90		295.39	295.34	295.22	294.97	295.51
185.90		295.36	295.31	295.41	295.19	295.31
194.10	295.72	295.77	295.34	295.29	295.12	295.43
208.30		295.65	295.09	295.12	295.17	295.53
230.30		295.51	295.41	295.58	295.00	295.48
241.50		295.94	295.46	295.46	295.46	295.53
255.85	296.48	296.09	295.68	295.99	295.92	295.97
270.20		296.33	296.09	296.09	296.55	297.37
284.55		296.14	296.28	296.91	298.39	300.15
298.90		296.50	298.19	300.83	304.26	306.99
313.25	296.38	297.13	302.74	308.20	313.63	318.32
327.60		299.86	308.32	316.08	323.13	329.06
338.80		299.16	308.85	317.09	325.15	332.66

TEGENA 1 WALL TEMPERATURE
ROD 1 HEATED DIR B

TAB. A31.2

F24LWSB.DAT

RE = 15.2E+03		PE = 89.58		MS = 0.79	(KG/S)
UB = 0.49	(M/S)	QH1 = 7.42	(W/CM^2)	QH2 = 0.00	(W/CM^2)
QH3 = 0.00	(W/CM^2)	QH4 = 0.00	(W/CM^2)	NB = 14.61	(KW)
TEN =295.65	(C)	TNO =309.46	(C)	TNM =302.55	(C)

CP (MM)	ME0 (C)	ME1 (C)	ME2 (C)	ME3 (C)	ME4 (C)	ME5 (C)
11.00		299.82	309.34	318.47	326.64	334.72
25.20	295.85	301.17	310.98	320.73	328.49	336.70
33.40		300.30	309.89	319.26	327.21	335.29
55.40		298.49	309.72	318.56	326.40	334.19
66.60		301.08	309.75	317.50	324.67	331.22
80.95	296.40	298.22	303.81	309.63	314.74	319.79
95.30		296.33	298.78	301.73	305.16	308.47
109.65		296.31	296.55	297.54	298.95	298.66
124.00		295.77	296.04	296.28	296.72	297.54
138.35	296.11	295.99	295.75	296.16	295.80	296.31
152.70		295.56	295.44	295.63	295.80	295.61
163.90		295.19	295.34	295.31	295.17	295.80
185.90		295.22	295.29	295.53	295.41	295.63
194.10	295.44	295.51	295.29	295.39	295.31	295.73
208.30		295.51	295.10	295.24	295.39	295.82
230.30		295.29	295.39	295.65	295.19	295.80
241.50		295.68	295.39	295.46	295.58	295.77
255.85	296.33	295.80	295.53	295.94	295.97	296.11
270.20		296.11	296.02	296.07	296.65	297.52
284.55		296.02	296.26	296.96	298.51	300.30
298.90		296.55	298.32	300.98	304.41	307.19
313.25	296.36	297.32	302.94	308.44	313.82	318.52
327.60		300.13	308.61	316.35	323.44	329.25
338.90		299.53	309.19	317.41	325.44	332.87

13:11:05 JUL02,1987 M198.DAT **TAB. A32**

TEGENA 2 - WALL TEMPERATURES
CHANNEL PERIMERTER MP1/2/3/4/5

TBI = 318.2 C DTC = 59.0 K
UB = .99 m/s Re = 33481.
QH1 = 21.1 W/cm^2 QH2 = .0 W/cm^2
QH3 = 20.9 W/cm^2 QH4 = 21.0 W/cm^2

C P mm	MP1 C	MP2 C	MP3 C	MP4 C	MP5 C
11.00	323.34	338.586	353.05	367.04	381.8
25.20	323.72	339.089	354.45	368.47	384.0
33.40	322.12	336.241	350.55	364.24	379.4
55.40	322.62	336.265	349.28	362.77	377.4
66.60	323.65	335.667	348.33	361.40	373.9
81.00	319.57	326.222	335.83	345.68	356.0
95.30	318.60	322.860	329.99	339.18	348.9
109.70	320.99	329.222	338.28	348.42	357.6
124.00	323.92	339.064	353.60	366.67	379.0
138.40	322.14	338.251	355.43	371.03	386.7
152.70	324.28	341.956	358.47	374.81	389.9
163.90	321.61	338.060	353.57	369.32	385.6
185.90	322.79	338.418	353.36	369.08	385.1
194.10	324.76	340.284	355.40	371.50	387.6
208.30	321.85	336.289	351.45	367.33	384.0
230.30	322.16	336.768	352.00	367.31	384.6
241.50	323.36	339.040	355.88	371.95	389.0
255.90	321.32	336.337	353.02	368.44	384.6
270.20	323.27	337.007	349.81	363.53	379.1
284.60	319.52	326.655	335.67	345.85	358.2
298.90	318.82	322.428	330.64	338.85	348.6
313.30	320.67	329.797	339.14	348.52	357.9
327.60	324.85	340.236	353.60	365.67	377.2
338.80	322.64	338.275	352.10	365.95	380.0

15:59:57 JUL01,1987 M190.DAT **TAB. A33**

TEGENA 2 - WALL TEMPERATURES
CHANNEL PERIMERTER MP1/2/3/4/5

TBI = 333.8 C DTC = 40.7 K
UB = .97 m/s Re = 33283.
QH1 = 21.3 W/cm^2 QH2 = .0 W/cm^2
QH3 = .1 W/cm^2 QH4 = 21.2 W/cm^2

C P mm	MP1 C	MP2 C	MP3 C	MP4 C	MP5 C
11.00	338.40	353.789	368.85	383.25	398.0
25.20	339.64	355.643	371.65	385.83	401.2
33.40	337.54	352.551	367.81	381.74	396.7
55.40	337.56	352.694	366.38	380.08	394.5
66.60	340.07	353.146	365.41	378.10	390.5
81.00	335.43	341.482	350.12	359.19	368.7
95.30	334.04	335.383	338.57	343.97	349.9
109.70	334.31	334.426	335.67	338.28	341.5
124.00	333.83	336.364	339.93	344.78	350.5
138.40	336.01	344.348	352.53	361.02	370.3
152.70	339.78	354.813	367.43	379.83	390.9
163.90	336.58	352.146	366.69	380.43	394.4
185.90	336.87	352.408	367.33	381.96	396.3
194.10	339.43	355.360	370.22	385.20	400.1
208.30	336.99	352.051	366.93	381.20	396.0
230.30	336.84	352.003	366.34	379.59	394.1
241.50	339.88	353.908	366.60	378.69	391.4
255.90	335.60	343.035	352.53	360.83	370.5
270.20	334.16	336.005	339.88	345.09	351.8
284.60	334.04	334.569	336.17	339.23	343.2
298.90	334.43	337.489	342.16	346.83	351.2
313.30	336.20	346.043	355.22	363.58	371.1
327.60	340.05	355.670	369.37	381.44	392.5
338.80	337.70	353.408	367.74	381.96	395.8

12:20:38 JUN29,1987 M168.DAT **TAB. A34**

TEGENA 2 - WALL TEMPERATURES
CHANNEL PERIMERTER MP1/2/3/4/5

TBI = 334.3 C DTC = 41.8 K
UB = .96 m/s Re = 33010.
QH1 = .0 W/cm^2 QH2 = 21.7 W/cm^2
QH3 = 21.5 W/cm^2 QH4 = .0 W/cm^2

C P mm	MP1 C	MP2 C	MP3 C	MP4 C	MP5 C
11.00	334.37	334.344	335.47	337.22	340.4
25.20	334.10	334.799	335.49	336.57	339.4
33.40	334.32	333.889	335.42	336.91	340.1
55.40	333.92	334.536	336.28	338.75	342.7
66.60	334.80	336.403	340.64	345.99	351.8
81.00	336.69	344.554	353.73	362.46	371.8
95.30	340.73	355.137	368.84	382.49	394.9
109.70	338.60	353.066	369.12	384.70	398.8
124.00	339.85	354.304	368.53	381.71	394.1
138.40	335.76	343.599	353.26	361.89	370.9
152.70	333.94	336.188	340.30	345.44	350.9
163.90	333.41	334.057	335.57	338.08	342.2
185.90	333.48	333.865	334.78	336.55	339.6
194.10	333.87	333.841	334.44	336.09	339.0
208.30	333.87	333.841	334.85	336.67	339.9
230.30	333.75	334.608	336.43	338.34	342.5
241.50	334.32	336.810	340.80	345.34	351.3
255.90	336.55	345.508	354.26	362.60	371.2
270.20	339.54	356.065	370.12	382.51	395.1
284.60	337.84	354.018	370.62	385.54	400.2
298.90	340.95	356.136	369.35	382.56	395.5
313.30	336.55	345.485	354.45	362.77	372.3
327.60	334.80	337.193	341.52	346.10	351.7
338.80	334.39	335.158	336.40	339.06	342.7

TESENA 1   FLUID TEMPERATURE
DIR B

TAB. A35

F31012B.DAT

RE = 30.3E+03   PE =178.82   MS = 1.59 (KG/S)
UB = 0.97 (M/S)   QH1 = 0.00 (W/CM^2)   QH2 = 0.00 (W/CM^2)
QH3 = 0.00 (W/CM^2)   QH4 = 7.79 (W/CM^2)   NB = 15.29 (KW)
TEN =296.64 (C)   X21 = 86.96 (MM)   X22 = 88.79 (MM)

Y21 (MM)	Y22 (MM)	TE21 (C)	TE22 (C)	TE23 (C)	TE24 (C)	RMS21 (K)	RMS22 (K)	RMS24 (K)	F2 MV	TEN (C)	QH4 (W/CM^2)
21.66	21.66	311.60	312.75	313.32	312.18	0.35	0.34	0.36	2.01	296.64	7.79
19.79	19.79	312.10	313.15	313.78	312.50	0.25	0.26	0.28	2.01	296.59	7.80
18.82	18.82	312.28	313.31	313.60	312.47	0.20	0.22	0.25	2.01	296.65	7.78
17.81	17.81	312.40	313.43	313.62	312.40	0.13	0.16	0.24	2.01	296.47	7.77
16.79	16.79	312.55	313.62	313.60	312.38	0.09	0.13	0.26	2.01	296.60	7.78
15.73	15.73	312.54	313.53	313.28	312.18	0.10	0.13	0.30	2.01	296.51	7.78
14.68	14.68	312.36	313.50	313.28	311.90	0.14	0.17	0.35	2.01	296.40	7.78
13.65	13.65	312.29	313.33	312.92	311.51	0.19	0.20	0.41	2.01	296.50	7.78
12.68	12.68	312.10	313.19	312.76	311.32	0.25	0.26	0.46	2.01	296.37	7.77
11.72	11.72	311.74	312.79	312.38	311.02	0.30	0.29	0.50	2.01	296.40	7.78
7.83	7.83	310.58	311.77	311.22	309.83	0.48	0.45	0.66	2.01	296.61	7.79
5.76	5.76	310.37	311.39	311.08	309.86	0.55	0.52	0.66	2.01	296.46	7.78
3.68	3.68	309.84	310.88	310.75	309.45	0.53	0.52	0.54	2.01	296.39	7.79

TESENA 1   FLUID TEMPERATURE
DIR A

TAB. A36

F370W5A.DAT

RE = 30.1E+03   PE =178.18   MS = 1.58 (KG/S)
UB = 0.97 (M/S)   QH1 = 0.00 (W/CM^2)   QH2 = 0.00 (W/CM^2)
QH3 = 0.00 (W/CM^2)   QH4 = 7.58 (W/CM^2)   NB = 14.88 (KW)
TEN =296.19 (C)   X21 =115.78 (MM)   X22 =117.61 (MM)

Y21 (MM)	Y22 (MM)	TE21 (C)	TE22 (C)	TE23 (C)	TE24 (C)	RMS21 (K)	RMS22 (K)	RMS24 (K)	F2 MV	TEN (C)	QH4 (W/CM^2)
7.73	7.73	319.05	318.91	318.41	318.38	0.06	0.06	0.09	2.01	296.19	7.58
9.72	9.72	319.83	319.51	318.89	319.02	0.07	0.06	0.11	2.01	296.22	7.58
11.61	11.61	320.72	320.29	319.67	319.92	0.07	0.06	0.11	2.01	296.55	7.60
13.56	13.56	321.34	320.74	320.26	320.75	0.05	0.05	0.10	2.01	296.49	7.62
14.57	14.57	321.62	320.91	320.55	321.05	0.04	0.04	0.09	2.02	296.22	7.64
15.61	15.61	321.90	321.19	320.94	321.60	0.03	0.04	0.08	2.02	296.54	7.66
16.65	16.65	321.91	321.20	321.14	321.81	0.03	0.04	0.07	2.02	296.36	7.67
17.69	17.69	321.78	321.08	321.21	321.94	0.04	0.04	0.06	2.02	296.54	7.68
18.71	18.71	321.83	321.17	321.43	322.15	0.05	0.05	0.06	2.03	296.24	7.72
19.69	19.69	321.36	320.74	321.14	321.84	0.05	0.05	0.08	2.02	296.70	7.67
21.58	21.58	320.55	320.03	320.66	321.24	0.07	0.06	0.10	2.02	295.59	7.68

TESENA 1   FLUID TEMPERATURE
DIR A

TAB. A37

F350W4A.DAT

RE = 30.3E+03   PE =179.07   MS = 1.59 (KG/S)
UB = 0.97 (M/S)   QH1 = 0.00 (W/CM^2)   QH2 = 0.00 (W/CM^2)
QH3 = 0.00 (W/CM^2)   QH4 = 7.78 (W/CM^2)   NB = 15.27 (KW)
TEN =296.68 (C)   X21 =101.38 (MM)   X22 =103.21 (MM)

Y21 (MM)	Y24 (MM)	TE21 (C)	TE22 (C)	TE23 (C)	TE24 (C)	RMS21 (K)	RMS22 (K)	RMS24 (K)	TEN (C)	QH4 (W/CM^2)	MS (KG/S)
2.24	0.41	319.59	320.14	319.49	318.88	0.19	0.13	0.25	296.68	7.78	1.59
2.35	0.52	319.59	320.13	319.40	318.72	0.20	0.14	0.30	296.40	7.77	1.59
2.55	0.72	319.64	320.26	319.43	318.72	0.18	0.13	0.30	296.54	7.79	1.59
2.74	0.91	319.88	320.49	319.59	318.93	0.17	0.13	0.30	296.61	7.79	1.59
2.93	1.10	319.93	320.56	319.55	318.89	0.17	0.12	0.32	296.69	7.78	1.59
3.12	1.29	320.34	320.95	319.84	319.20	0.15	0.12	0.32	296.73	7.79	1.59

TAB. A38

TAB.2 TESENA 1 FLUID TEMPERATURE
DIR B

F30LWSB.DAT

RE = 30.0E+03   PE =177.37   MS = 1.57 (KG/S)
UB = 0.96 (M/S)   QH1 = 0.00 (W/CM^2)   QH2 = 0.00 (W/CM^2)
QH3 = 0.00 (W/CM^2)   QH4 = 7.39 (W/CM^2)   NB = 14.50 (KW)
TEN =296.71 (C)   Y21 = 2.71 (MM)   Y24 = 0.98 (MM)

X21 (MM)	X22 (MM)	TE21 (C)	TE22 (C)	TE23 (C)	TE24 (D)	RMS21 (K)	RMS22 (K)	RMS24 (K)	QH4 (W/CM^2)	TNO (C)	TNM (C)
56.94	58.77	297.60	297.72	297.84	297.51	0.09	0.13	0.16	7.39	303.63	300.17
58.88	60.71	297.82	298.01	298.27	297.80	0.12	0.17	0.17	7.39	303.59	300.14
60.89	62.72	298.22	298.49	298.63	298.20	0.15	0.22	0.19	7.39	303.65	300.19
62.96	64.79	298.45	298.76	298.94	298.41	0.20	0.28	0.22	7.37	303.64	300.18
64.96	66.79	298.81	299.33	299.52	298.93	0.27	0.33	0.26	7.38	303.47	300.02
66.89	68.72	299.21	299.92	300.04	299.21	0.32	0.37	0.32	7.36	303.45	300.00
68.85	70.68	300.28	301.18	301.22	300.27	0.37	0.39	0.37	7.32	303.69	300.25
70.86	72.69	301.20	302.00	302.17	301.17	0.37	0.39	0.41	7.33	303.69	300.24
72.96	74.79	302.07	302.93	302.94	301.90	0.38	0.41	0.44	7.31	303.33	299.90
74.95	76.78	303.21	304.06	304.06	303.08	0.41	0.45	0.46	7.32	303.21	299.77
76.89	78.72	304.20	305.30	304.95	304.04	0.45	0.50	0.46	7.30	303.56	300.11
78.85	80.68	305.36	306.32	306.06	305.05	0.50	0.53	0.45	7.31	303.38	299.95
80.88	82.71	306.35	307.14	306.89	306.00	0.49	0.49	0.41	7.31	303.23	299.79
82.97	84.80	307.32	307.99	307.96	306.95	0.49	0.48	0.40	7.33	303.44	300.00
84.96	86.79	308.16	308.97	308.99	307.84	0.48	0.48	0.39	7.32	303.77	300.33
86.91	88.74	309.37	310.25	310.21	309.13	0.46	0.47	0.40	7.31	303.67	300.24
88.86	90.69	310.25	311.52	311.31	309.98	0.45	0.46	0.40	7.31	303.46	300.03
90.89	92.72	311.51	312.89	312.77	311.32	0.45	0.47	0.39	7.37	303.39	299.93
92.97	94.80	312.71	314.07	314.01	312.62	0.46	0.47	0.39	7.36	303.60	300.15
94.97	96.80	314.36	315.72	315.50	313.95	0.44	0.41	0.38	7.37	303.56	300.11
96.91	98.74	315.99	317.49	316.97	315.56	0.39	0.33	0.37	7.37	303.56	300.11
98.86	100.69	317.37	318.51	317.78	316.70	0.31	0.24	0.33	7.38	303.15	299.69
100.89	102.72	318.71	319.41	318.58	317.81	0.20	0.15	0.26	7.37	303.52	300.06
102.97	104.80	319.15	319.34	318.60	318.23	0.11	0.10	0.19	7.35	303.42	299.97
104.96	106.79	319.47	319.37	318.73	318.68	0.05	0.09	0.14	7.35	303.33	299.88
106.90	108.73	319.00	318.70	318.19	318.34	0.05	0.11	0.14	7.35	303.68	300.23
108.86	110.69	318.46	318.13	317.76	317.93	0.06	0.10	0.15	7.34	303.58	300.13
110.87	112.70	318.28	318.01	317.84	317.92	0.06	0.10	0.14	7.36	303.52	300.07

TAB. A39

TESENA 1 FLUID TEMPERATURE
DIR A

F32L43A.DAT

RE = 30.4E+03   PE =179.55   MS = 1.59 (KG/S)
UB = 0.98 (M/S)   QH1 = 0.00 (W/CM^2)   QH2 = 0.00 (W/CM^2)
QH3 = 0.00 (W/CM^2)   QH4 = 7.86 (W/CM^2)   NB = 15.44 (KW)
TEN =296.32 (C)   Y21 = 17.11 (MM)   Y24 = 15.28 (MM)

X21 (MM)	X22 (MM)	TE21 (C)	TE22 (C)	TE23 (C)	TE24 (C)	RMS21 (K)	RMS22 (K)	RMS24 (K)	TEN (C)	QH4 (W/CM^2)	MS (KG/S)
87.36	89.19	313.14	314.29	314.38	312.98	0.11	0.12	0.28	296.32	7.86	1.59
87.26	89.09	312.92	314.14	314.20	312.73	0.11	0.13	0.31	296.50	7.88	1.60
87.12	88.95	312.73	313.89	313.92	312.65	0.11	0.13	0.30	296.69	7.88	1.59
87.08	88.91	312.73	313.84	313.91	312.65	0.10	0.13	0.29	296.67	7.88	1.59
86.88	88.71	312.77	313.71	313.83	312.64	0.10	0.14	0.30	296.82	7.89	1.59
86.69	88.52	312.65	313.56	313.57	312.51	0.09	0.14	0.29	296.97	7.88	1.60
86.50	88.33	312.83	313.62	313.69	312.70	0.09	0.14	0.29	296.61	7.88	1.59

TAB. A40

TESENA 1 FLUID TEMPERATURE
DIR A

F32LW4A.DAT

RE = 30.2E+03   PE =178.43   MS = 1.58 (KG/S)
UB = 0.97 (M/S)   QH1 = 0.00 (W/CM^2)   QH2 = 0.00 (W/CM^2)
QH3 = 0.00 (W/CM^2)   QH4 = 7.63 (W/CM^2)   NB = 14.98 (KW)
TEN =296.39 (C)   Y21 = 17.11 (MM)   Y24 = 15.28 (MM)

X21 (MM)	X22 (MM)	TE21 (C)	TE22 (C)	TE23 (C)	TE24 (C)	RMS21 (K)	RMS22 (K)	RMS24 (K)	TEN (C)	QH4 (W/CM^2)	MS (KG/S)
116.30	118.13	321.81	321.32	321.35	321.84	0.05	0.07	0.26	296.39	7.63	1.58
116.12	117.95	321.72	321.16	321.17	321.74	0.05	0.08	0.25	296.50	7.63	1.58
115.92	117.75	321.76	321.12	321.14	321.79	0.05	0.07	0.25	296.52	7.62	1.58
115.74	117.57	321.86	321.14	321.17	321.92	0.04	0.08	0.25	296.44	7.61	1.58
115.54	117.37	322.20	321.36	321.38	322.20	0.04	0.08	0.25	296.45	7.61	1.58
115.35	117.18	322.25	321.32	321.33	322.24	0.04	0.08	0.25	296.25	7.61	1.58

TAB. A41

```
RE  = 30.5E+03          PE  =180.13              MS  =  1.60   (KG/S)        TEGENA 1   FLUID TEMPERATURE
UB  =  0.98  (M/S)      QH1 =  0.00   (W/CM^2)   QH2 =  0.00   (W/CM^2)      DIR A
QH3 =  0.00  (W/CM^2)   QH4 =  7.88   (W/CM^2)   NB  = 15.47   (KW)
TEN =296.60  (C)        A22 =-44.97   (DEG)      A21 =-48.51   (DEG)      F33D43A.DAT
```

R22 (MM)	A22 (DEG)	R21 (MM)	A21 (DEG)	R24 (MM)	TE21 (C)	TE22 (C)	TE23 (C)	TE24 (C)	RMS21 (K)	RMS22 (K)	RMS24 (K)
19.62	-44.97	20.95	-48.51	22.20	309.33	310.58	310.36	309.19	0.46	0.47	0.41
19.07	-45.02	20.40	-48.66	21.66	310.02	311.25	311.07	309.71	0.48	0.49	0.43
18.37	-45.02	19.71	-48.78	20.96	310.37	311.38	311.48	310.14	0.51	0.53	0.50
17.69	-45.06	19.03	-48.95	20.28	310.79	311.77	311.76	310.16	0.52	0.52	0.54
16.99	-45.08	18.33	-49.12	19.58	311.11	312.37	311.95	310.69	0.53	0.53	0.59
16.28	-45.20	17.63	-49.39	18.87	311.47	312.78	312.48	311.10	0.50	0.49	0.60
15.55	-45.25	16.90	-49.62	18.14	312.03	313.60	312.70	311.49	0.48	0.46	0.62
14.84	-45.32	16.19	-49.88	17.42	312.23	313.58	313.06	311.67	0.46	0.42	0.63
14.10	-45.38	15.46	-50.15	16.69	313.12	314.59	313.89	312.25	0.41	0.36	0.61
13.37	-45.43	14.73	-50.44	15.96	313.49	315.15	314.27	312.81	0.34	0.27	0.56

TAB. A42

```
RE  = 30.1E+03          PE  =177.90              MS  =  1.58   (KG/S)        TEGENA 1   FLUID TEMPERATURE
UB  =  0.97  (M/S)      QH1 =  0.00   (W/CM^2)   QH2 =  0.00   (W/CM^2)      DIR B
QH3 =  0.00  (W/CM^2)   QH4 =  7.73   (W/CM^2)   NB  = 15.17   (KW)
TEN =296.31  (C)        A22 =-45.44   (DEG)      A21 =-50.44   (DEG)      F33D43B.DAT
```

R22 (MM)	A22 (DEG)	R21 (MM)	A21 (DEG)	R24 (MM)	TE21 (C)	TE22 (C)	TE23 (C)	TE24 (C)	RMS21 (K)	RMS22 (K)	RMS24 (K)
13.37	-45.44	14.73	-50.44	15.96	313.29	314.92	314.32	312.62	0.34	0.28	0.56
13.94	-45.31	15.29	-50.14	16.53	312.66	314.30	313.82	312.11	0.41	0.36	0.61
14.67	-45.26	16.02	-49.87	17.26	312.23	313.56	313.23	311.74	0.46	0.42	0.63
15.41	-45.22	16.76	-49.63	17.99	311.66	312.86	312.53	311.00	0.45	0.44	0.60
16.11	-45.15	17.46	-49.39	18.70	311.35	312.45	312.30	310.63	0.51	0.49	0.62
16.85	-45.12	18.19	-49.19	19.43	310.80	312.02	311.80	310.46	0.52	0.50	0.57
17.56	-45.01	18.90	-48.93	20.15	310.38	311.59	311.55	310.10	0.52	0.51	0.55
18.26	-44.98	19.59	-48.76	20.84	309.98	311.12	311.12	309.73	0.50	0.51	0.50
18.95	-44.97	20.29	-48.63	21.54	309.62	310.57	310.52	309.31	0.48	0.49	0.45
19.63	-44.98	20.96	-48.52	22.22	309.21	310.12	310.16	308.95	0.45	0.46	0.39

TAB. A43

```
RE  = 30.4E+03          PE  =179.60              MS  =  1.59   (KG/S)        TEGENA 1   FLUID TEMPERATURE
UB  =  0.98  (M/S)      QH1 =  0.00   (W/CM^2)   QH2 =  0.00   (W/CM^2)      DIR A
QH3 =  0.00  (W/CM^2)   QH4 =  7.69   (W/CM^2)   NB  = 15.10   (KW)
TEN =296.21  (C)        A21 = 44.72   (DEG)      A22 = 48.66   (DEG)      F36D44A.DAT
```

R21 (MM)	A21 (DEG)	R22 (MM)	A22 (DEG)	R23 (MM)	TE21 (C)	TE22 (C)	TE23 (C)	TE24 (C)	RMS21 (K)	RMS22 (K)	RMS24 (K)
17.58	44.72	18.91	48.66	20.16	318.17	318.10	317.90	317.82	0.09	0.08	0.14
16.94	44.92	18.28	48.99	19.53	318.29	318.15	317.85	317.86	0.10	0.09	0.14
16.21	44.91	17.55	49.15	18.79	318.51	318.23	317.90	317.96	0.11	0.11	0.15
15.49	45.01	16.84	49.41	18.08	318.93	318.57	318.08	318.24	0.12	0.12	0.17
14.75	45.01	16.09	49.62	17.34	319.40	318.85	318.32	318.57	0.12	0.13	0.17
14.04	45.08	15.39	49.90	16.63	319.74	319.14	318.46	318.81	0.12	0.14	0.18
13.28	45.07	14.63	50.14	15.86	320.41	319.66	318.84	319.28	0.10	0.14	0.18

TAB. A44

```
RE  = 30.2E+03          PE  =178.67              MS  =  1.58   (KG/S)        TEGENA 1   FLUID TEMPERATURE
UB  =  0.97  (M/S)      QH1 =  0.00   (W/CM^2)   QH2 =  0.00   (W/CM^2)      DIR B
QH3 =  0.00  (W/CM^2)   QH4 =  7.63   (W/CM^2)   NB  = 14.97   (KW)
TEN =296.24  (C)        A21 = 45.07   (DEG)      A22 = 50.14   (DEG)      F36D44B.DAT
```

R21 (MM)	A21 (DEG)	R22 (MM)	A22 (DEG)	R23 (MM)	TE21 (C)	TE22 (C)	TE23 (C)	TE24 (C)	RMS21 (K)	RMS22 (K)	RMS24 (K)
13.28	45.07	14.63	50.14	15.86	320.34	319.55	318.73	319.23	0.10	0.14	0.18
13.89	45.10	15.24	49.96	16.48	319.98	319.27	318.59	318.98	0.11	0.14	0.18
14.63	45.04	15.98	49.68	17.22	319.39	318.88	318.29	318.55	0.11	0.12	0.17
15.36	45.03	16.70	49.47	17.95	318.85	318.45	317.95	318.14	0.11	0.12	0.16
16.01	44.71	17.35	49.01	18.60	318.47	318.17	317.78	317.87	0.11	0.11	0.15
16.81	44.91	18.15	49.01	19.40	318.17	318.00	317.72	317.73	0.10	0.10	0.14
17.50	44.97	18.83	48.82	20.09	319.01	317.92	317.75	317.65	0.09	0.08	0.13

TEGENA 1   FLUID TEMPERATURE
DIR A

TAB. A45

F70K43A.DAT

```
RE  = 30.4E+03         PE  =177.41              MS  =  1.57  (KG/S)
UB  =  0.96  (M/S)     QH1 =  0.00  (W/CM^2)    QH2 =  0.00  (W/CM^2)
QH3 =  0.00  (W/CM^2)  QH4 = 14.93  (W/CM^2)    NB  = 29.32  (KW)
TEN =299.42  (C)       R22 = 13.04  (MM)        R21 = 13.16  (MM)
```

A22 (DEG)	R22 (MM)	A24 (DEG)	R24 (MM)	TE21 (C)	TE22 (C)	TE23 (C)	TE24 (C)	RMS21 (K)	RMS22 (K)	RMS23 (K)	RMS24 (K)
0.02	13.04	-6.99	14.98	344.20	345.68	344.07	341.08	0.54	0.30	0.44	0.60
-9.99	13.07	-15.57	15.26	341.41	344.01	342.57	338.64	0.65	0.42	0.63	0.77
-19.64	13.06	-23.76	15.43	338.96	342.08	340.83	336.25	0.77	0.53	0.88	1.00
-29.63	13.00	-32.16	15.51	335.94	339.34	338.19	333.05	0.42	0.30	0.55	0.61
-39.86	12.96	-40.72	15.54	334.06	337.08	336.02	331.31	0.79	0.54	1.10	1.21
-44.99	12.95	-44.99	15.54	333.06	336.50	335.11	330.39	0.76	0.50	1.06	1.19
-50.20	12.96	-49.34	15.53	332.47	335.45	334.68	329.75	0.74	0.48	0.97	1.15
-60.27	12.98	-57.75	15.49	330.86	333.99	333.54	328.78	0.73	0.44	0.78	1.03
-69.79	13.03	-65.75	15.41	330.78	333.32	333.09	328.27	0.67	0.40	0.68	0.96
-79.53	13.00	-73.99	15.21	330.96	333.43	332.74	328.57	0.50	0.34	0.62	0.80
-89.83	12.98	-82.81	14.93	331.22	333.59	333.70	329.71	0.37	0.25	0.43	0.49

A21 (DEG)	R21 (MM)	A22 (DEG)	R22 (MM)	A23 (DEG)	R23 (MM)	A24 (DEG)	R24 (MM)	TEN (C)	TND (C)	QH4 (W/CM^2)	MS (KG/S)
-7.96	13.16	0.02	13.04	0.01	14.87	-6.99	14.98	299.42	313.45	14.93	1.57
-17.66	13.51	-9.99	13.07	-8.76	14.87	-15.57	15.26	299.46	313.51	14.95	1.57
-26.82	13.78	-19.64	13.06	-17.25	14.79	-23.76	15.43	299.58	313.83	15.35	1.59
-36.16	14.00	-29.63	13.00	-26.08	14.62	-32.16	15.51	299.58	313.81	15.33	1.59
-45.54	14.20	-39.86	12.96	-35.20	14.41	-40.72	15.54	299.69	313.93	15.36	1.59
-50.18	14.31	-44.99	12.95	-39.80	14.31	-44.99	15.54	299.77	314.01	15.35	1.59
-54.66	14.41	-50.20	12.96	-44.52	14.20	-49.34	15.53	299.57	313.78	15.31	1.59
-63.83	14.60	-60.27	12.98	-53.74	13.98	-57.75	15.49	299.27	313.49	15.37	1.59
-72.24	14.76	-69.79	13.03	-62.62	13.77	-65.75	15.41	299.52	313.73	15.38	1.60
-80.81	14.81	-79.53	13.00	-71.84	13.46	-73.99	15.21	299.49	313.72	15.37	1.59
-89.85	14.81	-89.83	12.98	-81.81	13.12	-82.81	14.93	299.49	313.73	15.37	1.59

TEGENA 1   FLUID TEMPERATURE
DIR B

TAB. A46

F70K43B.DAT

```
RE  = 30.7E+03         PE  =179.23              MS  =  1.58  (KG/S)
UB  =  0.97  (M/S)     QH1 =  0.00  (W/CM^2)    QH2 =  0.00  (W/CM^2)
QH3 =  0.00  (W/CM^2)  QH4 = 15.24  (W/CM^2)    NB  = 29.92  (KW)
TEN =299.71  (C)       R22 = 13.04  (MM)        R21 = 14.87  (MM)
```

A22 (DEG)	R22 (MM)	A24 (DEG)	R24 (MM)	TE21 (C)	TE22 (C)	TE23 (C)	TE24 (C)	RMS21 (K)	RMS22 (K)	RMS23 (K)	RMS24 (K)
-90.05	13.04	-83.03	14.98	331.33	333.65	333.79	329.56	0.41	0.27	0.44	0.50
-79.78	13.06	-74.23	15.26	330.80	333.38	332.97	328.62	0.52	0.35	0.61	0.79
-70.17	13.10	-66.09	15.48	330.86	333.56	333.07	328.34	0.71	0.42	0.70	0.97
-60.67	13.04	-58.09	15.55	331.17	334.15	333.50	328.96	0.69	0.41	0.77	1.00
-50.79	12.99	-49.82	15.57	332.19	335.43	334.63	329.95	0.77	0.49	0.96	1.12
-45.52	12.97	-45.43	15.56	332.91	336.17	334.89	330.42	0.80	0.52	1.05	1.18
-40.39	12.95	-41.16	15.53	333.82	336.97	335.82	331.14	0.81	0.55	1.09	1.19
-33.67	13.51	-35.48	16.06	334.06	337.34	336.17	331.54	0.90	0.69	1.15	1.20
-29.93	12.98	-32.42	15.49	336.08	339.25	337.95	333.38	0.84	0.59	1.10	1.20
-20.10	13.03	-24.15	15.42	338.83	342.10	340.42	336.04	0.81	0.56	0.92	1.03
-10.32	13.04	-15.86	15.24	342.02	344.68	342.97	339.13	0.70	0.45	0.65	0.80
-0.38	13.03	-7.35	14.98	344.91	346.44	344.93	341.60	0.51	0.29	0.44	0.57

A21 (DEG)	R21 (MM)	A22 (DEG)	R22 (MM)	A23 (DEG)	R23 (MM)	A24 (DEG)	R24 (MM)	TEN (C)	TND (C)	QH4 (W/CM^2)	MS (KG/S)
-90.04	14.87	-90.05	13.04	-82.06	13.17	-83.03	14.98	299.71	313.88	15.24	1.58
-81.03	14.87	-79.78	13.06	-72.12	13.51	-74.23	15.26	299.65	313.83	15.29	1.59
-72.57	14.83	-70.17	13.10	-63.02	13.82	-66.09	15.48	299.44	313.64	15.30	1.59
-64.17	14.67	-60.67	13.04	-54.14	14.03	-58.09	15.55	299.67	313.87	15.30	1.59
-55.38	14.46	-50.79	12.99	-45.06	14.22	-49.82	15.57	299.43	313.61	15.28	1.59
-50.65	14.33	-45.52	12.97	-40.28	14.31	-45.43	15.56	299.49	313.69	15.29	1.59
-46.02	14.20	-40.39	12.95	-35.66	14.39	-41.16	15.53	299.26	313.47	15.29	1.59
-39.65	14.60	-33.67	13.51	-29.81	15.07	-35.48	16.06	299.33	313.54	15.31	1.59
-36.45	13.98	-29.93	12.98	-26.34	14.59	-32.42	15.49	299.38	313.60	15.34	1.59
-27.27	13.77	-20.10	13.03	-17.65	14.76	-24.15	15.42	299.53	313.75	15.35	1.59
-17.99	13.49	-10.32	13.04	-9.05	14.64	-15.86	15.24	299.55	313.77	15.35	1.59
-8.37	13.17	-0.38	13.03	-0.33	14.26	-7.35	14.98	299.47	313.66	15.31	1.59

TEGENA 1 FLUID TEMPERATURE
DIR A

TAB. A47

F70K44A.DAT

RE = 30.5E+03		PE =178.40		MS = 1.58	(KG/S)		
UB = 0.97	(M/S)	QH1 = 0.00	(W/CM^2)	QH2 = 0.00	(W/CM^2)		
QH3 = 0.00	(W/CM^2)	QH4 = 15.11	(W/CM^2)	NB = 29.68	(KW)		
TEN =299.51	(C)	R22 = 14.91	(MM)	R21 = 13.08	(MM)		

A21 (DEG)	R21 (MM)	A23 (DEG)	R23 (MM)	TE21 (C)	TE22 (C)	TE23 (C)	TE24 (C)	RMS21 (K)	RMS22 (K)	RMS23 (K)	RMS24 (K)
89.83	13.08	82.85	15.03	350.47	348.54	348.65	349.15	0.30	0.17	0.25	0.23
79.67	13.09	74.15	15.29	350.26	348.32	347.73	347.98	0.33	0.20	0.32	0.28
70.02	13.09	65.97	15.47	349.17	347.33	346.21	346.33	0.37	0.27	0.37	0.34
60.51	13.02	57.95	15.53	348.28	346.24	345.05	345.01	0.33	0.28	0.39	0.34
50.52	12.98	49.60	15.56	347.55	345.69	344.32	344.27	0.36	0.28	0.37	0.33
45.44	12.97	45.37	15.56	347.28	345.50	344.17	343.88	0.37	0.27	0.35	0.31
40.05	13.00	40.87	15.58	347.27	345.60	344.19	343.84	0.33	0.24	0.34	0.30
29.90	13.01	32.39	15.52	347.11	345.69	344.23	343.60	0.35	0.24	0.33	0.27
20.01	13.06	24.07	15.45	347.07	345.99	344.57	343.66	0.31	0.21	0.29	0.21
10.26	13.05	15.81	15.25	346.59	346.23	344.78	343.27	0.31	0.18	0.25	0.23
0.23	13.04	7.22	14.99	345.66	346.33	344.73	342.48	0.38	0.19	0.29	0.42

A21 (DEG)	R21 (MM)	A22 (DEG)	R22 (MM)	A23 (DEG)	R23 (MM)	A24 (DEG)	R24 (MM)	TEN (C)	TND (C)	QH4 (W/CM^2)	MS (KG/S)
89.83	13.08	89.85	14.91	82.85	15.03	81.87	13.21	299.51	313.64	15.11	1.58
79.67	13.09	80.94	14.89	74.15	15.29	72.03	13.54	299.49	313.56	15.05	1.58
70.02	13.09	72.44	14.82	65.97	15.47	62.87	13.82	299.33	313.41	15.05	1.58
60.51	13.02	64.03	14.65	57.95	15.53	53.98	14.02	299.24	313.32	15.02	1.57
50.52	12.98	55.14	14.44	49.60	15.56	44.82	14.21	299.13	313.22	15.01	1.57
45.44	12.97	50.58	14.33	45.37	15.56	40.22	14.31	299.34	313.38	14.95	1.57
40.05	13.00	45.70	14.24	40.87	15.58	35.38	14.45	299.43	313.50	15.01	1.57
29.90	13.01	36.40	14.01	32.39	15.52	26.32	14.62	299.48	313.60	15.03	1.57
20.01	13.06	27.17	13.80	24.07	15.45	17.59	14.79	299.43	313.50	15.00	1.57
10.26	13.05	17.92	13.50	15.81	15.25	9.00	14.86	299.56	313.60	14.93	1.57
0.23	13.04	8.22	13.17	7.22	14.99	0.20	14.87	299.48	313.56	14.97	1.57

TEGENA 1 FLUID TEMPERATURE
DIR B

TAB. A48

F70K44B.DAT

RE = 30.7E+03		PE =179.18		MS = 1.58	(KG/S)		
UB = 0.97	(M/S)	QH1 = 0.00	(W/CM^2)	QH2 = 0.00	(W/CM^2)		
QH3 = 0.00	(W/CM^2)	QH4 = 15.26	(W/CM^2)	NB = 29.97	(KW)		
TEN =299.51	(C)	R22 = 13.15	(MM)	R21 = 13.03	(MM)		

A21 (DEG)	R21 (MM)	A23 (DEG)	R23 (MM)	TE21 (C)	TE22 (C)	TE23 (C)	TE24 (C)	RMS21 (K)	RMS22 (K)	RMS23 (K)	RMS24 (K)
-0.07	13.03	6.95	14.97	346.18	346.93	345.29	342.91	0.41	0.20	0.30	0.39
10.00	13.07	15.59	15.26	347.19	346.77	345.31	343.76	0.35	0.20	0.27	0.23
19.66	13.06	23.77	15.44	347.38	346.30	344.87	343.82	0.35	0.23	0.32	0.24
29.47	13.00	32.03	15.51	347.60	346.11	344.68	344.02	0.37	0.24	0.34	0.30
39.71	12.94	40.59	15.52	347.76	346.03	344.70	344.15	0.41	0.27	0.35	0.31
44.96	12.95	44.96	15.53	347.89	346.05	344.66	344.34	0.41	0.28	0.36	0.31
50.19	12.94	49.32	15.52	347.91	346.00	344.74	344.55	0.39	0.28	0.37	0.33
60.28	12.99	57.76	15.50	348.72	346.62	345.46	345.39	0.38	0.29	0.39	0.34
69.78	13.03	65.74	15.42	349.34	347.29	346.31	346.21	0.43	0.29	0.40	0.35
79.53	13.02	74.00	15.23	350.24	348.31	347.71	347.80	0.37	0.24	0.37	0.32
89.84	12.99	82.82	14.94	350.18	348.20	348.37	348.65	0.38	0.19	0.30	0.25

A21 (DEG)	R21 (MM)	A22 (DEG)	R22 (MM)	A23 (DEG)	R23 (MM)	A24 (DEG)	R24 (MM)	TEN (C)	TND (C)	QH4 (W/CM^2)	MS (KG/S)
-0.07	13.03	7.91	13.15	6.95	14.97	-0.06	14.86	299.51	313.72	15.26	1.58
10.00	13.07	17.67	13.51	15.59	15.26	8.78	14.87	299.53	313.69	15.27	1.59
19.66	13.06	26.54	13.78	23.77	15.44	17.27	14.79	299.36	313.53	15.24	1.58
29.47	13.00	36.00	13.99	32.03	15.51	25.94	14.62	299.55	313.72	15.22	1.58
39.71	12.94	45.41	14.18	40.59	15.52	35.05	14.40	299.60	313.72	15.19	1.59
44.96	12.95	50.13	14.30	44.96	15.53	39.77	14.30	299.54	313.67	15.17	1.58
50.19	12.94	54.96	14.40	49.32	15.52	44.50	14.19	299.40	313.54	15.17	1.58
60.28	12.99	63.94	14.60	57.76	15.50	53.75	13.98	299.25	313.38	15.17	1.59
69.78	13.03	72.23	14.75	65.74	15.42	62.61	13.77	299.41	313.51	15.10	1.58
79.53	13.02	80.82	14.83	74.00	15.23	71.86	13.48	299.34	313.45	15.08	1.58
89.84	12.99	89.56	14.82	82.82	14.94	81.53	13.13	299.12	313.16	15.00	1.58

TEGENA 1 FLUID TEMPERATURE
DIR A

TAB. A49

F71K43A.DAT

```
RE  = 30.8E+03          PE  =180.34               MS  =  1.59  (KG/S)
UB  =  0.98  (M/S)      QH1 =  0.00   (W/CM^2)    QH2 =  0.00  (W/CM^2)
QH3 =  0.00  (W/CM^2)   QH4 = 15.49   (W/CM^2)    NB  = 30.42  (KW)
TEN =298.75  (C)        R22 = 13.51   (MM)        R21 = 13.63  (MM)
```

A22 (DEG)	R22 (MM)	A24 (DEG)	R24 (MM)	TE21 (C)	TE22 (C)	TE23 (C)	TE24 (C)	RMS21 (K)	RMS22 (K)	RMS23 (K)	RMS24 (K)
-0.01	13.51	-6.81	15.45	344.00	345.43	344.19	340.95	0.55	0.32	0.41	0.53
-9.93	13.56	-15.35	15.75	341.34	343.76	342.79	338.66	0.73	0.51	0.59	0.69
-19.63	13.55	-23.62	15.92	337.48	340.82	339.68	335.26	0.88	0.65	0.86	0.94
-29.67	13.52	-32.11	16.03	334.62	337.75	336.62	331.89	0.95	0.74	1.16	1.22
-39.83	13.48	-40.66	16.06	332.27	335.68	334.45	329.65	0.88	0.65	1.19	1.24
-45.04	13.47	-45.04	16.06	331.71	334.76	333.79	328.88	0.87	0.63	1.16	1.25
-50.16	13.46	-49.33	16.04	330.82	334.05	333.23	328.15	0.86	0.60	1.11	1.27
-56.76	13.99	-54.93	16.53	329.31	332.11	331.52	327.21	0.93	0.65	1.10	1.28
-66.17	13.87	-62.88	16.31	328.94	331.57	331.23	326.70	0.82	0.56	0.91	1.14
-69.78	13.52	-65.87	15.91	329.20	331.98	331.70	326.73	0.74	0.49	0.80	1.02
-79.60	13.52	-74.23	15.72	329.94	332.11	331.65	327.46	0.52	0.41	0.71	0.79
-89.82	13.48	-83.03	15.42	330.26	332.15	332.34	328.57	0.38	0.28	0.51	0.47

A21 (DEG)	R21 (MM)	A22 (DEG)	R22 (MM)	A23 (DEG)	R23 (MM)	A24 (DEG)	R24 (MM)	TEN (C)	TND (C)	QH4 (W/CM^2)	MS (KG/S)
-7.72	13.63	-0.01	13.51	-0.01	15.34	-6.81	15.45	298.75	313.07	15.49	1.59
-17.34	13.99	-9.93	13.56	-8.76	15.36	-15.35	15.75	298.87	313.16	15.51	1.60
-26.57	14.27	-19.63	13.55	-17.33	15.28	-23.62	15.92	298.96	313.26	15.46	1.59
-35.96	14.51	-29.67	13.52	-26.24	15.14	-32.11	16.03	298.78	313.06	15.49	1.60
-45.31	14.72	-39.83	13.48	-35.33	14.93	-40.66	16.06	298.77	313.07	15.50	1.60
-50.05	14.82	-45.04	13.47	-40.03	14.82	-45.04	16.06	298.84	313.14	15.50	1.60
-54.67	14.91	-50.16	13.46	-44.68	14.70	-49.33	16.04	298.77	313.06	15.45	1.59
-60.46	15.55	-56.76	13.99	-50.93	15.07	-54.93	16.53	298.72	312.98	15.46	1.60
-68.89	15.56	-66.17	13.87	-59.63	14.71	-62.88	16.31	298.65	312.93	15.52	1.60
-72.16	15.25	-69.78	13.52	-62.86	14.26	-65.87	15.91	298.66	312.95	15.49	1.60
-80.84	15.32	-79.60	13.52	-72.19	13.97	-74.23	15.72	298.64	312.92	15.48	1.60
-89.84	15.31	-89.82	13.48	-82.09	13.61	-83.03	15.42	298.54	312.85	15.52	1.60

TEGENA 1 FLUID TEMPERATURE
DIR B

TAB. A50

F71K43B.DAT

```
RE  = 31.0E+03          PE  =181.48               MS  =  1.61  (KG/S)
UB  =  0.99  (M/S)      QH1 =  0.00   (W/CM^2)    QH2 =  0.00  (W/CM^2)
QH3 =  0.00  (W/CM^2)   QH4 = 15.57   (W/CM^2)    NB  = 30.58  (KW)
TEN =298.31  (C)        R22 = 13.48   (MM)        R21 = 15.31  (MM)
```

A22 (DEG)	R22 (MM)	A24 (DEG)	R24 (MM)	TE21 (C)	TE22 (C)	TE23 (C)	TE24 (C)	RMS21 (K)	RMS22 (K)	RMS23 (K)	RMS24 (K)
-89.83	13.48	-83.04	15.43	330.13	331.96	332.25	328.27	0.45	0.33	0.51	0.47
-79.64	13.55	-74.28	15.75	329.42	331.73	331.50	326.95	0.52	0.40	0.71	0.78
-70.17	13.56	-66.21	15.94	328.91	331.56	331.16	326.86	0.73	0.49	0.80	1.02
-60.70	13.52	-58.20	16.03	329.23	332.52	331.92	327.23	0.85	0.53	0.95	1.17
-50.71	13.51	-49.80	16.08	330.15	333.27	332.47	327.50	0.85	0.59	1.10	0.64
-45.52	13.49	-45.44	16.08	331.28	334.23	333.35	328.61	0.89	0.64	1.16	1.27
-40.26	13.49	-41.02	16.07	332.24	335.13	334.32	329.51	0.88	0.66	1.19	0.63
-29.91	13.50	-32.32	16.01	333.74	337.25	336.07	331.30	0.91	0.70	1.14	1.18
-20.03	13.54	-23.96	15.92	337.23	340.35	339.43	334.71	0.87	0.64	0.86	0.94
-10.33	13.54	-15.70	15.73	340.55	343.14	342.04	338.11	0.74	0.51	0.59	0.69
-0.36	13.51	-7.11	15.46	343.41	344.84	343.62	340.42	0.55	0.32	0.43	0.53

A21 (DEG)	R21 (MM)	A22 (DEG)	R22 (MM)	A23 (DEG)	R23 (MM)	A24 (DEG)	R24 (MM)	TEN (C)	TND (C)	QH4 (W/CM^2)	MS (KG/S)
-89.85	15.31	-89.83	13.48	-82.11	13.61	-83.04	15.43	298.31	312.61	15.57	1.61
-80.86	15.36	-79.64	13.55	-72.25	14.00	-74.28	15.75	298.33	312.65	15.54	1.60
-72.50	15.30	-70.17	13.56	-63.25	14.29	-66.21	15.94	298.33	312.60	15.49	1.60
-64.09	15.14	-60.70	13.52	-54.38	14.50	-58.20	16.03	298.47	312.75	15.49	1.60
-55.15	14.97	-50.71	13.51	-45.20	14.73	-49.80	16.08	295.20	312.53	15.56	1.60
-50.47	14.85	-45.52	13.49	-40.47	14.83	-45.44	16.08	298.21	312.52	15.56	1.60
-45.70	14.74	-40.26	13.49	-35.72	14.93	-41.02	16.07	298.38	312.66	15.52	1.60
-36.19	14.50	-29.91	13.50	-26.45	15.11	-32.32	16.01	297.72	312.03	15.53	1.60
-26.95	14.27	-20.03	13.54	-17.67	15.27	-23.96	15.92	298.11	312.42	15.56	1.60
-17.73	13.96	-10.33	13.54	-9.10	15.34	-15.70	15.73	298.08	312.42	15.59	1.60
-8.06	13.64	-0.36	13.51	-0.31	15.34	-7.11	15.46	297.94	312.31	15.65	1.61

TEBENA 1 FLUID TEMPERATURE
DIR A

TAB. A51

F71K44A.DAT

RE = 30.9E+03 PE =180.48 MS = 1.60 (KG/S)
UB = 0.98 (M/S) QH1 = 0.00 (W/CM^2) QH2 = 0.00 (W/CM^2)
QH3 = 0.00 (W/CM^2) QH4 = 15.37 (W/CM^2) NB = 30.18 (KW)
TEN =298.99 (C) R22 = 15.30 (MM) R21 = 13.47 (MM)

A21 (DEG)	R21 (MM)	A23 (DEG)	R23 (MM)	TE21 (C)	TE22 (C)	TE23 (C)	TE24 (C)	RMS21 (K)	RMS22 (K)	RMS23 (K)	RMS24 (K)
89.85	13.47	83.05	15.41	349.83	348.26	348.46	348.37	0.33	0.17	0.29	0.26
79.85	13.57	74.46	15.76	349.64	348.11	347.65	347.32	0.35	0.19	0.34	0.34
73.99	13.26	69.37	15.58	349.55	347.71	346.91	346.69	0.36	0.23	0.39	0.35
70.24	13.54	66.26	15.92	348.78	347.13	346.14	345.77	0.38	0.27	0.38	0.37
60.58	13.50	58.09	16.01	347.72	346.00	344.91	344.55	0.36	0.28	0.40	0.37
50.53	13.47	49.64	16.05	347.04	345.34	344.18	343.77	0.52	0.34	0.38	0.33
45.43	13.46	45.36	16.05	347.01	345.30	344.19	343.67	0.36	0.27	0.36	0.35
40.23	13.47	41.00	16.05	346.82	345.24	344.03	343.49	0.34	0.26	0.34	0.30
29.98	13.50	32.30	16.01	346.53	345.26	344.08	343.26	0.35	0.24	0.32	0.27
20.01	13.54	23.95	15.92	346.57	345.57	344.45	343.35	0.33	0.22	0.31	0.24
10.27	13.52	15.65	15.71	346.27	345.87	344.77	343.16	0.36	0.20	0.28	0.22
0.21	13.51	6.99	15.45	345.71	346.14	344.96	342.67	0.41	0.22	0.31	0.37

A21 (DEG)	R21 (MM)	A22 (DEG)	R22 (MM)	A23 (DEG)	R23 (MM)	A24 (DEG)	R24 (MM)	TEN (C)	TNO (C)	QH4 (W/CM^2)	MS (KG/S)
89.85	13.47	89.87	15.30	83.05	15.41	82.11	13.60	298.99	313.19	15.37	1.60
79.85	13.57	81.05	15.37	74.46	15.76	72.46	14.01	299.02	313.27	15.37	1.59
73.99	13.26	75.92	15.03	69.37	15.58	66.71	13.88	299.04	313.26	15.37	1.59
70.24	13.54	72.56	15.29	66.26	15.92	63.31	14.27	298.87	313.08	15.37	1.59
60.58	13.50	63.99	15.12	58.09	16.01	54.26	14.49	299.02	313.25	15.41	1.60
50.53	13.47	54.99	14.93	49.64	16.05	45.01	14.71	299.15	313.39	15.42	1.60
45.43	13.46	50.40	14.82	45.36	16.05	40.38	14.80	299.12	313.35	15.42	1.60
40.23	13.47	45.68	14.72	41.00	16.05	35.69	14.92	299.13	313.36	15.42	1.60
29.88	13.50	36.17	14.50	32.30	16.01	26.42	15.11	299.10	313.36	15.42	1.59
20.01	13.54	26.93	14.27	23.95	15.92	17.66	15.27	298.95	313.18	15.39	1.59
10.27	13.52	17.68	13.96	15.65	15.71	9.05	15.32	299.16	313.41	15.42	1.59
0.21	13.51	7.93	13.64	6.99	15.45	0.19	15.34	298.99	313.25	15.44	1.60

TEBENA 1 FLUID TEMPERATURE
DIR B

TAB. A52

F71K44B.DAT

RE = 30.7E+03 PE =179.85 MS = 1.59 (KG/S)
UB = 0.98 (M/S) QH1 = 0.00 (W/CM^2) QH2 = 0.00 (W/CM^2)
QH3 = 0.00 (W/CM^2) QH4 = 15.38 (W/CM^2) NB = 30.20 (KW)
TEN =297.77 (C) R22 = 13.63 (MM) R21 = 13.51 (MM)

A21 (DEG)	R21 (MM)	A23 (DEG)	R23 (MM)	TE21 (C)	TE22 (C)	TE23 (C)	TE24 (C)	RMS21 (K)	RMS22 (K)	RMS23 (K)	RMS24 (K)
-0.04	13.51	6.76	15.45	344.19	344.77	343.54	341.15	0.40	0.20	0.30	0.35
9.98	13.57	15.38	15.76	345.02	344.72	343.69	341.95	0.32	0.18	0.28	0.22
19.64	13.55	23.63	15.93	345.20	344.17	343.20	342.00	0.32	0.21	0.32	0.23
29.46	13.50	31.95	16.01	345.30	343.95	342.79	341.94	0.35	0.24	0.33	0.28
39.73	13.46	40.58	16.04	345.66	344.05	342.94	342.18	0.36	0.25	0.36	0.31
44.93	13.45	44.94	16.04	345.91	344.25	343.08	342.50	0.37	0.26	0.37	0.32
50.19	13.47	49.35	16.05	346.01	344.14	343.11	342.60	0.36	0.28	0.37	0.33
60.25	13.47	57.81	15.99	346.42	344.71	343.69	343.16	0.38	0.28	0.40	0.37
69.85	13.49	65.93	15.88	347.54	345.87	344.99	344.50	0.37	0.26	0.41	0.37
79.57	13.48	74.20	15.68	348.52	346.90	346.40	345.98	0.34	0.19	0.35	0.33
89.82	13.47	83.02	15.41	348.84	347.19	347.41	347.19	0.34	0.22	0.31	0.23

A21 (DEG)	R21 (MM)	A22 (DEG)	R22 (MM)	A23 (DEG)	R23 (MM)	A24 (DEG)	R24 (MM)	TEN (C)	TNO (C)	QH4 (W/CM^2)	MS (KG/S)
-0.04	13.51	7.67	13.63	6.76	15.45	-0.03	15.34	297.77	312.01	15.38	1.59
9.98	13.57	17.37	14.00	15.38	15.76	8.79	15.38	297.59	311.86	15.46	1.60
19.64	13.55	26.58	14.27	23.63	15.93	17.34	15.29	297.52	311.78	15.46	1.60
29.46	13.50	35.78	14.49	31.95	16.01	26.05	15.12	297.65	311.91	15.44	1.60
39.73	13.46	45.22	14.70	40.58	16.04	35.23	14.92	297.79	312.07	15.48	1.60
44.93	13.45	49.95	14.80	44.94	16.04	39.92	14.80	297.58	311.84	15.50	1.60
50.19	13.47	54.69	14.92	49.35	16.05	44.70	14.71	297.58	311.82	15.42	1.60
60.25	13.47	63.70	15.09	57.81	15.99	53.95	14.47	297.60	311.86	15.47	1.60
69.85	13.49	72.23	15.23	65.93	15.88	62.92	14.23	297.61	311.91	15.52	1.60
79.57	13.48	80.81	15.29	74.20	15.68	72.15	13.93	297.69	311.98	15.51	1.60
89.82	13.47	89.85	15.30	83.02	15.41	82.09	13.60	297.33	311.60	15.56	1.61

Y21 = 3.07 mm Y24 = .41 mm
TBI = 318.2 C DTC = 59.0 K
QH1 = 21.1 W/cm^2 QH2 = .0 W/cm^2
QH3 = 20.9 W/cm^2 QH4 = 21.0 W/cm^2
NB = 123.9 kW UB = .99 m/s
Re = 33481. Pe = 183.0

13:11:05 JUL02,1987 M198.DAT

TAB. A53

TEGENA 2 - FLUID TEMPERATURES
PROBE 2 TEMP FLUCTUATIONS

X21 mm	TC21 C	RMS21 K	TC24 C	RMS24 K	X22 mm	TC22 C	RMS22 K	TC23 C	RMS23 K	X25 mm	TC25 C	RMS25 K	NH1 kW	NH2 kW	NH3 kW	NH4 kW	NB kW	UB m/s	TBO C
109.78	387.96	.39	386.60	.22	112.43	385.13	.26	384.46	.24	111.10	385.81	.77	41.45	-.10	41.05	41.49	123.90	.99	377.25
107.84	390.24	.38	388.58	.23	110.49	387.08	.33	385.95	.26	109.16	387.69	.79	41.23	-.10	40.84	41.27	123.25	.98	377.58
105.93	393.29	.34	390.41	.24	108.58	389.46	.39	388.16	.28	107.25	390.19	.80	41.18	-.09	40.79	41.21	123.09	.98	377.89
103.95	395.65	.27	392.45	.20	106.60	392.82	.37	390.61	.29	105.27	392.56	.80	41.68	-.10	41.27	41.71	124.57	.99	378.37
102.95	396.61	.22	393.28	.17	105.60	394.25	.34	391.69	.28	104.27	393.63	.75	41.61	-.09	41.22	41.65	124.38	.99	378.40
101.94	397.39	.19	393.96	.14	104.59	395.54	.27	392.84	.27	103.26	394.67	.74	41.55	-.09	41.16	41.58	124.19	.99	378.69
100.91	397.62	.17	394.10	.13	103.56	396.53	.22	393.47	.25	102.23	395.33	.74	41.58	-.09	41.17	41.61	124.26	.99	378.94
99.87	398.21	.19	394.83	.14	102.52	398.05	.16	394.83	.23	101.19	396.31	.76	42.25	-.09	41.84	42.28	126.28	1.00	379.62
98.85	396.98	.23	394.28	.16	101.50	398.03	.12	394.81	.22	100.17	395.94	.76	41.27	-.10	40.87	41.29	123.34	.98	379.27
97.86	395.67	.28	393.24	.19	100.51	397.18	.13	394.22	.22	99.18	395.03	.80	41.33	-.09	40.92	41.35	123.50	.99	378.97
96.89	395.01	.32	392.89	.20	99.54	397.25	.17	394.24	.23	98.21	394.65	.75	41.42	-.09	41.03	41.46	123.82	.98	379.28
95.93	393.69	.36	391.59	.22	98.58	396.06	.23	393.27	.24	97.25	393.48	.76	41.41	-.09	41.01	41.43	123.76	.99	378.84
93.97	391.71	.45	389.79	.25	96.62	394.01	.33	391.87	.27	95.29	391.75	.79	41.43	-.10	41.04	41.47	123.84	.99	378.71
91.94	389.77	.51	388.62	.27	94.59	392.17	.43	390.30	.30	93.26	390.47	.83	41.39	-.09	40.99	41.42	123.71	.99	378.62
89.89	388.39	.54	387.56	.26	92.54	390.59	.47	389.13	.31	91.21	388.79	.83	41.35	-.09	40.95	41.31	123.52	.99	378.84
88.87	387.95	.56	387.24	.24	91.52	389.43	.53	388.51	.32	90.19	388.30	.82	41.63	-.10	41.24	41.67	124.44	.99	379.20
87.87	387.94	.55	386.97	.22	90.52	389.38	.54	388.19	.31	89.19	387.96	.80	41.56	-.09	41.23	41.66	124.37	.99	379.32
86.92	388.11	.54	387.07	.21	89.57	388.77	.55	387.90	.30	88.24	387.85	.79	41.61	-.10	41.24	41.66	124.42	.99	379.65
85.96	388.30	.56	386.88	.20	88.61	388.45	.57	387.50	.29	87.28	387.80	.80	41.55	-.10	41.17	41.60	124.22	.98	379.79
84.98	388.45	.54	387.53	.20	87.63	388.13	.56	387.40	.27	86.30	387.74	.80	41.62	-.10	41.22	41.65	124.40	.99	379.53
83.98	388.59	.50	386.94	.20	86.63	388.01	.54	387.02	.26	85.30	387.38	.81	41.71	-.10	41.31	41.74	124.66	.99	379.26
82.98	389.09	.48	387.46	.20	85.63	388.14	.54	387.10	.26	84.30	387.89	.82	41.86	-.09	41.45	41.88	125.09	.99	379.58
81.96	389.18	.45	387.77	.20	84.61	388.05	.51	387.13	.26	83.28	387.96	.81	41.56	-.09	41.15	41.58	124.20	.99	379.76
79.90	390.39	.39	388.21	.19	82.55	389.49	.47	387.77	.26	81.22	388.97	.78	41.98	-.09	41.57	42.00	125.46	.99	379.86
77.89	390.77	.32	387.66	.19	80.54	390.22	.38	387.85	.25	79.21	388.86	.74	41.56	-.09	41.15	41.58	124.19	.99	379.53
75.96	390.83	.35	387.62	.27	78.61	390.56	.33	388.03	.25	77.28	389.46	.72	41.88	-.10	41.48	41.90	125.16	.99	379.82
74.98	390.56	.38	387.12	.32	77.63	391.18	.30	388.06	.25	76.30	388.86	.74	41.85	-.10	41.45	41.88	125.09	.99	380.07
73.98	389.53	.45	385.64	.39	76.63	390.40	.30	387.56	.27	75.30	388.34	.85	41.58	-.10	41.17	41.61	124.26	.99	379.50
72.98	388.32	.55	384.85	.48	75.63	390.47	.34	387.12	.32	74.30	387.58	.94	41.65	-.10	41.25	41.66	124.47	.99	379.86
71.97	387.45	.71	383.75	.60	74.62	390.00	.44	386.49	.39	73.29	386.75	1.06	41.79	-.10	41.40	41.81	124.90	.99	380.09
70.92	385.53	.86	382.73	.67	73.57	389.57	.54	385.85	.47	72.24	385.89	1.16	41.84	-.09	41.44	41.86	125.04	.99	380.24
69.90	383.59	1.02	380.65	.73	72.55	388.26	.67	384.75	.55	71.22	383.67	1.27	42.04	-.10	41.62	42.05	125.61	.99	380.66
68.88	380.96	1.20	378.72	.78	71.53	386.28	.86	383.61	.65	70.20	382.44	1.39	42.24	-.09	41.82	42.25	126.22	1.00	380.55
67.89	377.69	1.31	376.48	.80	70.54	384.36	1.02	381.58	.72	69.21	380.09	1.47	41.69	-.10	41.29	41.70	124.58	.99	380.64
65.97	373.66	1.44	373.03	.79	68.62	379.70	1.34	377.62	.81	67.29	374.75	1.55	41.29	-.10	40.88	41.30	123.38	.99	380.05
63.99	369.31	1.41	367.95	.78	66.64	374.72	1.53	373.29	.84	65.31	369.75	1.51	41.13	-.10	40.72	41.15	122.91	.99	379.96
61.97	364.91	1.32	363.96	.73	64.62	368.54	1.49	368.43	.77	63.29	366.69	1.40	41.27	-.09	40.87	41.29	123.34	.99	380.04
60.94	363.23	1.21	362.13	.68	63.59	367.21	1.40	365.85	.74	62.26	364.65	1.32	41.30	-.09	40.91	41.34	123.45	.99	379.98
59.91	360.86	1.21	360.59	.69	62.56	364.28	1.36	364.90	.73	61.23	363.33	1.32	41.34	-.09	40.94	41.36	123.55	.98	379.96
58.87	359.34	1.13	358.45	.65	61.52	363.49	1.27	363.03	.70	60.19	361.03	1.25	41.30	-.10	40.90	41.31	123.42	.99	379.66
57.89	358.27	1.14	357.76	.62	60.54	362.16	1.31	361.63	.73	59.21	359.73	1.27	41.41	-.10	41.03	41.45	123.79	.99	379.81
56.91	357.09	1.10	356.63	.57	59.56	360.18	1.24	359.91	.66	58.23	357.79	1.22	41.36	-.09	40.94	41.36	123.57	.99	379.77
55.97	355.45	1.03	354.81	.53	58.62	358.81	1.22	358.52	.63	57.29	356.74	1.16	41.29	-.09	40.91	41.33	123.44	.99	379.54
54.99	354.61	.98	354.52	.52	57.65	357.86	1.16	357.01	.62	56.31	356.30	1.16	41.44	-.09	41.04	41.46	123.85	.99	379.64
53.99	353.91	.91	353.46	.48	56.64	356.22	1.11	355.95	.58	55.31	355.04	1.10	41.48	-.09	41.09	41.50	123.98	.99	379.50
51.97	352.79	.71	352.38	.41	54.62	354.71	.98	353.79	.52	53.29	353.26	1.03	41.36	-.10	40.97	41.39	123.63	.99	379.57
49.92	351.69	.51	351.11	.35	52.57	353.05	.84	352.48	.47	51.24	351.97	.95	41.42	-.10	41.03	41.44	123.80	.99	379.93
47.91	350.57	.32	350.21	.26	50.56	352.07	.59	351.39	.40	49.23	350.70	.85	41.47	-.09	41.07	41.49	123.94	.99	379.67
46.94	349.92	.25	350.01	.22	49.59	351.14	.48	350.98	.37	48.26	350.31	.84	41.43	-.09	41.03	41.45	123.82	.99	379.88
45.99	349.71	.20	349.63	.17	48.64	350.66	.37	350.24	.32	47.31	349.92	.79	41.51	-.09	41.12	41.54	124.08	.99	379.79
45.01	349.44	.18	349.39	.14	47.66	350.12	.27	349.81	.29	46.33	349.53	.76	41.50	-.10	41.11	41.53	124.04	.99	379.70
44.01	349.75	.18	349.60	.14	46.66	350.02	.19	349.83	.26	45.33	349.70	.74	41.62	-.10	41.22	41.64	124.39	.99	379.85
43.01	349.58	.19	349.69	.16	45.66	349.85	.14	349.65	.23	44.33	349.63	.74	41.68	-.09	41.29	41.71	124.58	.99	380.04
41.99	350.06	.24	349.98	.21	44.64	349.95	.11	349.74	.22	43.31	349.80	.73	41.68	-.10	41.28	41.71	124.58	.99	380.41
40.96	350.07	.34	350.20	.27	43.61	349.75	.12	349.68	.22	42.28	349.81	.72	41.72	-.09	41.32	41.74	124.69	.99	380.05

Y21 = 3.13 mm   Y24 = .47 mm
TBI = 333.8 C   DTC = 40.7 K
QH1 = 21.3 W/cm^2   QH2 = .0 W/cm^2
QH3 = .1 W/cm^2   QH4 = 21.2 W/cm^2
WB = 83.8 kW   UB = .97 m/s
Re = 33283.   Pe = 180.2

15:59:57 JUL01,1987 M190.DAT

TAB. A54

TEGENA 2 - FLUID TEMPERATURES
PROBE 2 TEMP FLUCTUATIONS

X21 mm	TC21 C	RMS21 K	TC24 C	RMS24 K	X22 mm	TC22 C	RMS22 K	TC23 C	RMS23 K	X25 mm	TC25 C	RMS25 K	WH1 kW	WH2 kW	WH3 kW	WH4 kW	WB kW	UB m/s	TBO C
109.83	396.73	.30	395.35	.17	112.48	395.35	.16	394.25	.23	111.15	395.32	.74	41.89	-.10	.10	41.93	83.82	.97	374.53
107.85	397.86	.23	395.81	.15	110.50	396.27	.19	394.68	.24	109.17	396.07	.78	42.00	-.09	.10	42.03	84.04	.98	374.10
105.93	398.97	.21	396.27	.15	108.58	397.43	.17	395.52	.24	107.25	397.01	.79	41.90	-.09	.10	41.92	83.83	.98	373.52
103.95	399.58	.29	396.34	.19	106.60	399.09	.13	396.46	.23	105.27	397.81	.75	41.98	-.10	.10	41.99	83.98	.98	374.22
102.95	398.84	.30	395.42	.23	105.60	398.89	.12	396.02	.23	104.27	397.40	.77	42.20	-.10	.10	42.22	84.43	.98	373.86
101.95	398.33	.37	395.06	.29	104.60	399.35	.15	396.18	.24	103.27	397.20	.80	42.21	-.10	.10	42.24	84.46	.98	374.16
100.92	396.76	.47	394.03	.35	103.57	399.36	.22	396.10	.26	102.24	396.96	.84	42.31	-.10	.10	42.37	84.68	.98	374.04
99.88	394.52	.60	392.11	.42	102.53	398.03	.31	394.86	.30	101.20	395.02	.91	42.37	-.10	.10	42.38	84.76	.98	374.08
98.86	393.66	.76	391.16	.49	101.51	398.02	.44	394.56	.37	100.18	394.65	1.02	42.48	-.10	.10	42.50	84.99	.98	374.39
97.87	391.52	.86	388.62	.52	100.52	396.03	.55	393.12	.42	99.19	392.76	1.07	42.31	-.10	.10	42.35	84.67	.98	374.11
96.90	388.80	.98	386.96	.56	99.55	394.22	.68	391.77	.47	98.22	390.69	1.14	42.42	-.10	.10	42.46	84.88	.98	374.17
95.94	386.71	1.07	385.71	.59	98.59	393.06	.83	390.24	.53	97.26	388.52	1.21	42.52	-.10	.10	42.55	85.07	.98	374.29
93.98	381.61	1.25	381.03	.66	96.63	388.43	1.10	386.43	.61	95.30	384.38	1.32	42.60	-.10	.10	42.64	85.25	.99	374.11
91.95	376.82	1.24	375.55	.71	94.60	382.33	1.23	380.60	.66	93.27	379.69	1.34	42.46	-.10	.10	42.49	84.95	.98	374.18
89.89	373.54	1.35	372.35	.80	92.54	379.44	1.34	377.90	.73	91.21	375.06	1.40	42.48	-.10	.10	42.51	84.98	.98	374.13
88.88	371.36	1.40	371.02	.84	91.53	376.61	1.43	375.84	.81	90.20	373.52	1.47	42.54	-.10	.10	42.57	85.11	.98	373.67
87.88	370.03	1.42	369.21	.82	90.53	374.65	1.42	373.83	.80	89.20	371.64	1.45	42.59	-.10	.10	42.61	85.20	.99	374.23
86.92	367.95	1.51	367.80	.83	89.57	373.66	1.46	372.14	.81	88.24	369.72	1.47	42.70	-.10	.10	42.73	85.43	.99	374.11
85.97	366.80	1.48	365.83	.80	88.62	371.25	1.50	369.73	.83	87.29	368.34	1.48	42.65	-.10	.10	42.66	85.31	.99	373.84
84.99	366.35	1.46	364.58	.77	87.64	369.74	1.47	369.02	.81	86.31	367.57	1.44	42.70	-.10	.10	42.74	85.45	.99	373.97
83.99	363.59	1.48	363.63	.77	86.64	368.18	1.51	366.64	.79	85.31	365.28	1.44	42.39	-.09	.10	42.43	84.83	.99	373.83
82.99	362.51	1.46	362.32	.77	85.63	366.80	1.51	365.89	.77	84.30	364.22	1.45	42.52	-.10	.10	42.55	85.08	.99	374.00
81.97	361.96	1.45	360.65	.79	84.62	364.20	1.53	364.02	.78	83.29	362.87	1.46	42.40	-.10	.10	42.44	84.83	.99	373.85
79.90	359.62	1.31	358.48	.84	82.55	362.78	1.55	361.92	.79	81.22	360.67	1.49	42.65	-.10	.10	42.67	85.33	.99	374.03
77.90	357.09	1.08	356.31	.91	80.55	360.79	1.44	359.62	.84	79.22	358.50	1.53	42.61	-.10	.10	42.63	85.24	.99	374.27
75.97	353.71	.93	353.89	.99	78.62	357.38	1.26	356.88	.92	77.29	354.91	1.55	42.66	-.10	.10	42.68	85.35	.99	374.43
74.99	351.53	.84	351.95	.97	77.64	355.37	1.13	355.70	.92	76.31	353.78	1.51	42.21	-.10	.10	42.27	84.48	.98	373.64
73.98	350.57	.83	350.28	.98	76.63	354.36	1.06	354.01	.96	75.30	351.68	1.53	42.26	-.10	.10	42.29	84.55	.99	373.53
72.98	349.13	.77	349.10	.93	75.63	352.90	.94	352.12	.94	74.30	350.66	1.48	42.32	-.10	.10	42.35	84.67	.98	373.76
71.98	348.14	.81	347.94	.91	74.63	351.20	.90	351.51	.95	73.30	349.96	1.47	42.32	-.10	.10	42.35	84.68	.98	373.48
70.94	345.88	.83	345.93	.88	73.59	350.14	.87	349.72	.96	72.26	348.12	1.46	42.30	-.10	.10	42.34	84.64	.99	373.68
69.90	345.00	.85	345.41	.82	72.55	349.15	.86	348.92	.94	71.22	347.16	1.43	42.39	-.10	.10	42.39	84.78	.98	373.76
68.89	344.23	.81	344.33	.72	71.54	347.53	.84	347.46	.87	70.21	345.95	1.34	42.41	-.10	.10	42.43	84.85	.98	373.97
67.90	343.02	.83	343.99	.65	70.55	346.19	.87	346.25	.83	69.22	344.65	1.29	42.31	-.10	.10	42.33	84.64	.98	373.82
65.98	341.17	.72	342.26	.48	68.63	343.28	.85	344.02	.68	67.30	342.87	1.12	42.37	-.10	.10	42.40	84.76	.99	373.70
64.00	340.54	.58	341.49	.36	66.65	342.20	.80	342.31	.54	65.32	340.90	.97	42.41	-.10	.10	42.43	84.84	.98	373.91
61.97	339.40	.44	339.94	.26	64.62	340.39	.65	340.81	.42	63.29	340.09	.87	42.36	-.10	.10	42.40	84.76	.98	373.61
60.94	339.94	.36	340.46	.21	63.59	340.67	.53	341.14	.36	62.26	340.52	.83	42.43	-.10	.10	42.46	84.89	.98	374.19
59.91	339.51	.34	340.10	.20	62.56	340.20	.49	340.54	.34	61.23	340.09	.79	42.44	-.10	.10	42.47	84.91	.98	373.99
58.90	339.38	.32	340.00	.18	61.55	339.95	.38	340.25	.29	60.22	339.89	.75	42.44	-.10	.10	42.49	84.94	.98	374.04
57.90	339.09	.33	339.82	.19	60.55	339.82	.33	339.98	.27	59.22	339.71	.74	42.51	-.10	.10	42.54	85.05	.99	373.53
56.94	339.60	.36	340.19	.21	59.59	339.74	.28	340.16	.25	58.26	339.77	.76	42.37	-.09	.10	42.45	84.83	.98	373.85
55.98	339.67	.43	340.21	.25	58.63	339.32	.29	339.80	.26	57.30	339.67	.76	42.54	-.10	.10	42.56	85.10	.99	373.69
55.00	339.96	.46	340.64	.28	57.65	339.89	.30	340.23	.26	56.32	340.21	.76	42.56	-.10	.10	42.59	85.15	.99	373.63
54.00	340.43	.56	340.81	.35	56.65	339.91	.38	339.93	.29	55.32	340.11	.83	42.55	-.10	.10	42.57	85.12	.99	373.93
51.98	341.35	.66	342.06	.44	54.63	340.54	.48	340.89	.34	53.30	341.13	.91	42.52	-.10	.10	42.54	85.07	.99	374.26
49.93	342.51	.78	343.34	.62	52.58	340.76	.68	341.72	.46	51.25	341.76	1.07	42.52	-.10	.10	42.54	85.06	.98	373.79
47.92	344.69	.79	345.24	.78	50.57	342.47	.80	343.31	.59	49.24	343.95	1.20	42.52	-.10	.10	42.54	85.07	.99	373.99
46.95	346.01	.79	346.44	.84	49.60	343.18	.83	343.59	.66	48.27	345.26	1.27	42.65	-.10	.10	42.69	85.34	.99	374.02
46.00	347.50	.79	347.72	.90	48.65	344.19	.84	345.17	.72	47.32	346.15	1.31	42.51	-.10	.10	42.53	85.04	.99	374.23
45.02	348.83	.83	349.17	.97	47.67	345.48	.87	346.01	.80	46.34	346.66	1.39	42.66	-.10	.10	42.70	85.37	.99	374.17
44.02	350.29	.91	350.21	1.05	46.67	346.52	.93	347.33	.90	45.34	348.62	1.51	42.42	-.10	.10	42.45	84.87	.99	373.91
43.02	351.61	.94	350.90	1.05	45.67	348.20	.91	347.68	.93	44.34	350.03	1.52	42.32	-.10	.10	42.36	84.68	.98	373.77
42.00	352.53	1.05	352.59	1.09	44.65	349.33	.97	349.66	1.01	43.32	350.29	1.59	42.39	-.10	.10	42.40	84.79	.98	373.99
40.97	354.79	1.13	354.49	1.05	43.62	350.99	1.00	350.80	1.02	42.29	352.43	1.61	42.36	-.10	.10	42.40	84.76	.98	373.77

Y21 = 3.10 mm Y24 = .44 mm
TBI = 334.3 C DTC = 41.8 K
QH1 = .0 W/cm^2 QH2 = 21.7 W/cm^2
QH3 = 21.5 W/cm^2 QH4 = .0 W/cm^2
WB = 85.1 kW UB = .96 m/s
Re = 33010. Pe = 178.5

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TAB. A55

TEGENA 2 - FLUID TEMPERATURES
PROBE 2 TEMP FLUCTUATIONS

X21 mm	TC21 C	RMS21 K	TC24 C	RMS24 K	X22 mm	TC22 C	RMS22 K	TC23 C	RMS23 K	X25 mm	TC25 C	RMS25 K	WH1 kW	WH2 kW	WH3 kW	WH4 kW	WB kW	UB m/s	TBO C
40.90	395.46	1.31	392.54	.92	43.55	399.89	.96	397.13	.74	42.22	396.16	1.51	.07	42.70	42.34	-.05	85.06	.96	376.03
41.86	397.74	1.13	393.91	.83	44.51	401.23	.80	397.80	.64	43.18	397.36	1.35	.07	42.66	42.31	-.05	84.99	.96	375.41
42.89	398.45	.99	395.39	.78	45.54	402.59	.69	399.09	.57	44.21	398.43	1.26	.07	42.48	42.16	-.05	84.65	.96	375.06
43.89	400.22	.83	396.68	.68	46.54	403.11	.55	399.21	.47	45.21	399.23	1.11	.07	42.66	42.32	-.05	84.99	.96	375.00
44.87	401.20	.67	397.82	.57	47.52	403.39	.44	400.14	.39	46.19	400.39	1.00	.07	42.91	42.57	-.05	85.49	.97	374.55
45.83	402.45	.53	398.80	.46	48.48	403.30	.37	400.38	.34	47.15	401.33	.92	.07	42.90	42.55	-.05	85.48	.97	374.50
46.79	402.88	.46	399.18	.38	49.44	403.32	.35	400.47	.32	48.11	401.20	.86	.07	42.87	42.52	-.05	85.41	.96	374.49
47.77	403.51	.37	399.81	.29	50.42	403.09	.34	400.26	.30	49.09	401.41	.84	.07	42.88	42.52	-.05	85.42	.97	373.90
49.74	403.24	.31	400.15	.19	52.39	402.29	.39	400.09	.30	51.06	401.19	.80	.07	42.76	42.41	-.05	85.19	.96	374.43
51.82	402.39	.36	400.33	.18	54.47	401.58	.46	399.69	.31	53.14	400.82	.81	.07	42.61	42.27	-.05	84.90	.96	374.71
53.87	401.65	.43	399.93	.21	56.52	400.44	.51	399.22	.31	55.19	400.21	.82	.07	42.63	42.30	-.05	84.95	.96	374.52
54.85	400.68	.48	399.43	.21	57.50	400.07	.52	398.95	.31	56.17	399.85	.82	.07	42.55	42.20	-.05	84.77	.96	374.31
55.80	402.01	.46	400.27	.21	58.45	401.01	.49	399.87	.31	57.12	400.77	.82	.07	42.56	42.21	-.05	84.79	.96	375.68
56.78	402.04	.50	400.51	.21	59.43	401.63	.52	400.32	.31	58.10	400.73	.83	.07	42.53	42.19	-.05	84.74	.96	376.03
57.75	401.53	.49	400.30	.19	60.40	401.91	.52	400.50	.31	59.07	400.73	.81	.07	42.50	42.17	-.05	84.69	.96	376.28
58.74	401.19	.47	400.47	.19	61.39	401.86	.50	400.65	.31	60.06	401.09	.81	.07	42.39	42.05	-.05	84.45	.96	376.15
59.74	401.95	.51	400.56	.20	62.39	402.72	.51	401.20	.32	61.06	401.37	.82	.07	42.36	42.01	-.05	84.39	.96	376.25
60.76	402.26	.51	400.78	.21	63.41	403.34	.46	401.54	.31	62.08	401.52	.83	.07	42.38	42.04	-.05	84.44	.96	376.62
61.82	402.04	.49	400.81	.21	64.47	403.49	.42	401.66	.31	63.14	401.79	.86	.07	42.17	41.82	-.05	84.01	.96	376.45
63.87	404.63	.43	403.26	.21	66.52	405.94	.37	403.74	.30	65.19	404.22	.84	.07	43.36	43.01	-.05	86.39	.97	377.36
65.81	405.39	.37	402.97	.19	68.46	406.32	.34	403.40	.32	67.13	404.42	.85	.07	43.31	42.95	-.05	86.27	.97	377.20
67.75	406.85	.33	404.16	.19	70.40	406.46	.45	403.42	.40	69.07	405.03	.87	.07	43.46	43.10	-.05	86.57	.97	378.34
68.73	407.34	.35	403.90	.24	71.38	406.29	.58	403.09	.49	70.05	405.24	.93	.07	43.31	42.95	-.05	86.27	.97	378.27
69.73	407.12	.38	403.73	.29	72.38	405.57	.65	402.23	.56	71.05	404.43	1.00	.07	43.31	42.96	-.05	86.29	.97	378.63
70.76	407.36	.45	403.50	.37	73.41	404.45	.77	401.53	.65	72.08	404.39	1.09	.07	43.29	42.94	-.05	86.24	.97	378.69
71.82	406.87	.54	402.92	.49	74.47	403.36	.93	400.49	.75	73.14	403.57	1.23	.07	43.27	42.92	-.05	86.21	.97	379.00
72.87	406.15	.64	402.69	.59	75.52	401.54	1.08	398.48	.82	74.19	401.47	1.36	.07	43.33	42.98	-.05	86.32	.97	379.36
73.88	404.97	.75	400.94	.70	76.53	399.30	1.26	397.67	.89	75.20	401.02	1.52	.07	43.11	42.76	-.05	85.90	.97	379.98
74.85	403.46	.91	399.97	.83	77.50	397.85	1.44	395.58	.96	76.17	398.82	1.62	.07	43.19	42.84	-.05	86.05	.97	380.37
75.82	401.41	1.09	398.41	.94	78.47	394.60	1.60	392.39	1.02	77.14	396.93	1.72	.07	43.12	42.77	-.05	85.91	.97	380.42
77.75	397.77	1.39	394.64	1.03	80.40	390.16	1.81	388.47	1.06	79.07	392.60	1.84	.07	43.08	42.73	-.05	85.83	.97	380.34
79.72	391.50	1.59	389.13	1.12	82.38	386.36	1.90	384.29	1.11	81.04	387.83	1.87	.07	43.01	42.65	-.05	85.68	.96	381.02
81.82	388.05	1.73	387.08	1.21	84.47	381.90	2.01	380.21	1.18	83.14	383.09	1.92	.07	43.08	42.74	-.05	85.85	.97	381.04
82.87	385.89	1.80	384.52	1.17	85.52	380.23	2.08	379.80	1.16	84.19	382.11	1.91	.07	43.02	42.68	-.05	85.72	.96	380.86
83.87	382.89	1.86	381.35	1.21	86.52	378.13	2.11	378.03	1.15	85.19	379.83	1.94	.07	43.12	42.77	-.05	85.91	.96	381.06
84.84	381.68	1.94	379.58	1.22	87.49	378.30	2.23	376.14	1.17	86.16	379.72	1.96	.07	43.12	42.77	-.05	85.91	.96	381.53
85.80	379.50	2.03	378.93	1.30	88.45	376.31	2.26	374.58	1.17	87.12	377.47	2.00	.07	43.02	42.67	-.05	85.70	.97	381.32
86.77	377.23	2.12	376.82	1.24	89.42	374.50	2.34	373.68	1.19	88.09	375.28	2.00	.07	43.25	42.90	-.05	86.17	.97	381.65
87.74	378.02	2.12	375.68	1.20	90.39	373.62	2.33	371.96	1.16	89.06	374.93	1.97	.07	43.25	42.90	-.05	86.17	.97	381.72
88.72	375.17	2.22	374.55	1.24	91.37	371.20	2.42	370.55	1.20	90.04	373.08	2.04	.07	43.34	42.99	-.05	86.34	.97	381.90
89.72	375.03	2.17	373.44	1.21	92.37	370.85	2.33	370.08	1.18	91.04	372.17	2.02	.07	43.24	42.89	-.05	86.15	.97	382.04
91.80	371.90	2.25	371.15	1.28	94.45	367.57	2.23	366.97	1.27	93.12	369.35	2.13	.07	43.23	42.88	-.05	86.13	.97	381.87
93.85	368.47	2.17	367.01	1.29	96.51	363.00	1.90	363.77	1.35	95.18	365.30	2.20	.07	43.25	42.90	-.05	86.16	.97	380.52
95.79	363.92	1.90	363.89	1.37	98.44	359.38	1.53	359.23	1.38	97.11	361.92	2.16	.07	43.20	42.85	-.06	86.06	.97	380.35
96.75	362.16	1.72	361.63	1.41	99.40	357.80	1.35	357.68	1.37	98.07	360.13	2.12	.07	43.22	42.87	-.06	86.10	.97	380.19
97.72	360.73	1.50	360.15	1.41	100.37	356.89	1.19	356.58	1.33	99.04	358.59	2.04	.07	43.23	42.87	-.05	86.11	.97	380.42
98.70	358.68	1.34	358.12	1.42	101.35	355.09	1.09	354.60	1.30	100.02	356.34	1.99	.07	43.22	42.87	-.06	86.11	.97	380.21
99.71	357.30	1.15	356.15	1.37	102.36	352.95	1.01	353.26	1.22	101.03	354.15	1.86	.07	43.17	42.83	-.05	86.01	.97	379.73
100.74	355.57	.97	355.55	1.32	103.39	351.79	.97	352.50	1.12	102.06	353.09	1.75	.07	43.21	42.86	-.06	86.08	.97	380.09
101.80	353.51	.89	353.72	1.25	104.45	350.03	.95	350.27	1.02	103.12	351.86	1.65	.07	43.19	42.84	-.05	86.05	.97	379.60
102.83	352.00	.85	351.69	1.20	105.48	347.98	.96	348.41	.95	104.15	349.74	1.59	.07	43.14	42.79	-.05	85.94	.97	379.20
103.85	350.41	.80	349.81	1.11	106.50	347.00	.94	347.45	.85	105.17	348.44	1.49	.07	43.25	42.91	-.05	86.17	.97	379.50
105.77	347.90	.85	347.30	.94	108.42	345.40	.93	345.72	.70	107.09	346.17	1.35	.07	43.29	42.95	-.05	86.26	.97	379.18
107.70	345.93	.85	346.50	.71	110.35	344.47	.79	344.62	.53	109.02	345.06	1.16	.07	43.32	42.96	-.05	86.29	.97	378.96
109.68	343.51	.81	343.87	.80	112.33	342.45	.66	342.84	.43	111.00	342.75	1.02	.07	43.28	42.94	-.05	86.24	.97	378.50

TAB. A56a

TBI = 298.3 C   DTC = 77.7 K   07:46:35 JUL08,1987 M260.DAT
UB = .98 m/s   Re = 32801.
QH1 = 20.9 W/cm^2   QH2 = 20.8 W/cm^2
QH3 = 20.7 W/cm^2   QH4 = 20.8 W/cm^2

TEGENA 2 - FLUID TEMPERATURES
PROBE P1 SUBCHANNEL

Y11 mm	X11 mm	TC11 C	RMS11 K	X12 mm	TC12 C	RMS12 K	Y14 mm	X14 mm	TC14 C	RMS14 K	X13 mm	TC13 C	RMS13 K	Y15 mm	X15 mm	TC15 C	RMS15 K	MFR kg/s	DTC K
29.34	43.94	377.62	.32	41.89	373.43	.55	31.39	43.94	375.23	.14	41.89	374.27	.34	30.37	42.92	375.91	.25	1.59	77.71
29.33	46.03	377.78	.30	43.98	373.04	.55	31.38	46.03	375.31	.09	43.98	375.30	.27	30.36	45.01	376.54	.17	1.58	78.03
29.34	48.11	376.86	.36	46.06	372.90	.60	31.39	48.11	374.79	.18	46.06	375.45	.27	30.37	47.09	376.31	.22	1.58	77.89
29.33	50.13	375.36	.43	48.08	373.14	.48	31.38	50.13	373.53	.24	48.08	374.57	.31	30.36	49.11	375.09	.29	1.58	77.76
29.34	52.14	372.94	.46	50.09	373.19	.55	31.39	52.14	372.09	.25	50.09	373.17	.33	30.37	51.12	373.48	.31	1.58	77.69
29.34	54.22	372.07	.49	52.17	373.23	.56	31.39	54.22	370.85	.26	52.17	372.01	.36	30.37	53.20	371.97	.34	1.58	78.02
29.34	56.33	370.25	.51	54.28	372.98	.58	31.39	56.33	369.55	.23	54.28	370.31	.34	30.37	55.31	370.55	.33	1.58	77.85
29.34	58.39	369.13	.50	56.34	372.05	.54	31.39	58.39	369.03	.18	56.34	369.38	.33	30.37	57.37	369.53	.30	1.57	77.81
29.34	60.43	369.91	.52	58.38	371.45	.48	31.39	60.43	369.26	.20	58.38	369.23	.29	30.37	59.41	369.43	.29	1.58	77.96
29.34	62.45	370.40	.51	60.40	372.51	.63	31.39	62.45	369.63	.25	60.40	368.99	.32	30.37	61.43	369.59	.32	1.58	78.09
29.34	64.52	372.00	.51	62.47	372.62	.60	31.39	64.52	371.12	.28	62.47	369.52	.35	30.37	63.50	370.83	.35	1.58	77.60
29.34	66.62	373.24	.49	64.57	371.55	.58	31.39	66.62	372.16	.28	64.57	370.61	.37	30.37	65.60	372.19	.36	1.57	77.79
29.34	68.69	375.49	.46	66.64	370.52	.70	31.39	68.69	374.04	.26	66.64	372.51	.51	30.37	67.67	374.23	.38	1.57	77.89
29.34	70.72	376.80	.37	68.67	370.75	.53	31.39	70.72	374.74	.21	68.67	373.73	.35	30.37	69.70	375.30	.31	1.56	77.56
29.34	72.75	378.72	.30	70.70	372.49	.65	31.39	72.75	376.47	.11	70.70	375.96	.32	30.37	71.73	377.36	.23	1.59	78.46
29.34	74.84	378.76	.30	72.79	372.69	.64	31.39	74.84	376.39	.12	72.79	376.66	.26	30.37	73.82	377.66	.17	1.59	78.78
29.34	76.95	377.86	.37	74.90	370.97	.68	31.39	76.95	375.82	.21	74.90	376.61	.27	30.37	75.93	377.31	.24	1.59	78.93

TBI = 298.3 C   DTC = 77.7 K   07:46:35 JUL08,1987 M260.DAT
UB = .98 m/s   Re = 32801.
QH1 = 20.9 W/cm^2   QH2 = 20.8 W/cm^2
QH3 = 20.7 W/cm^2   QH4 = 20.8 W/cm^2

TEGENA 2 - FLUID TEMPERATURES
PROBE P2 SUBCHANNEL

Y21 mm	X21 mm	TC21 C	RMS21 K	X22 mm	TC22 C	RMS22 K	Y24 mm	X24 mm	TC24 C	RMS24 K	X23 mm	TC23 C	RMS23 K	Y25 mm	X25 mm	TC25 C	RMS25 K	QB W/cm^2	TBI C
3.05	74.35	376.89	.18	77.00	375.15	.28	.39	74.35	373.52	.15	77.00	372.62	.27	1.72	75.67	374.41	.76	20.76	298.30
3.06	72.27	376.83	.19	74.92	376.59	.17	.40	72.27	373.44	.15	74.92	373.38	.23	1.73	73.59	374.85	.74	20.68	298.28
3.05	70.16	375.76	.26	72.81	376.83	.13	.39	70.16	372.88	.20	72.81	373.67	.22	1.72	71.48	374.41	.77	20.73	298.29
3.06	68.08	373.95	.33	70.73	376.01	.23	.40	68.08	371.66	.23	70.73	373.03	.25	1.73	69.40	373.40	.79	20.67	298.20
3.06	66.09	372.15	.39	68.74	374.06	.31	.40	66.09	370.34	.24	68.74	371.77	.27	1.73	67.41	371.72	.79	20.61	298.27
3.05	64.06	370.46	.43	66.71	372.47	.36	.39	64.06	368.84	.23	66.71	370.59	.27	1.72	65.38	370.46	.76	20.68	298.33
3.05	61.97	369.09	.46	64.62	370.72	.42	.39	61.97	367.96	.22	64.62	369.20	.29	1.72	63.29	369.26	.78	20.64	298.11
3.05	59.84	367.91	.45	62.49	368.97	.46	.39	59.84	367.22	.19	62.49	367.90	.27	1.72	61.16	367.80	.77	20.60	298.07
3.05	57.78	368.68	.45	60.43	368.95	.44	.39	57.78	367.88	.21	60.43	367.71	.24	1.72	59.10	368.04	.76	20.72	298.11
3.05	55.80	369.35	.48	58.45	368.40	.46	.39	55.80	368.39	.25	58.45	367.58	.25	1.72	57.12	368.26	.76	20.68	298.11
3.05	53.75	371.15	.44	56.40	369.23	.46	.39	53.75	369.65	.26	56.40	368.28	.28	1.72	55.07	369.39	.78	20.60	298.16
3.05	51.66	372.53	.42	54.31	370.67	.46	.39	51.66	371.10	.26	54.31	369.54	.30	1.72	52.98	370.89	.77	20.57	298.08
3.05	49.54	374.76	.37	52.19	372.55	.43	.39	49.54	372.58	.25	52.19	371.00	.30	1.72	50.86	372.49	.77	20.56	298.25
3.05	47.51	376.27	.26	50.16	374.25	.36	.39	47.51	373.60	.20	50.16	372.09	.28	1.72	48.83	373.66	.75	20.40	298.12
3.05	45.53	378.23	.19	48.18	376.87	.30	.39	45.53	375.06	.15	48.18	374.34	.27	1.72	46.85	375.80	.73	20.97	297.85
3.05	43.47	378.25	.20	46.12	377.94	.17	.39	43.47	375.09	.16	46.12	375.03	.22	1.72	44.79	376.33	.70	21.10	297.71
3.05	41.37	377.20	.28	44.02	378.41	.14	.39	41.37	374.46	.20	44.02	375.33	.21	1.72	42.69	376.22	.71	21.07	297.77

TAB. A56b

TBI = 298.5 C DTC = 78.7 K
UB = .99 m/s Re = 32940.
QH1 = 21.2 W/cm^2 QH2 = 21.1 W/cm^2
QH3 = 21.0 W/cm^2 QH4 = 21.1 W/cm^2

08:31:07 JUL08,1987 M261.DAT

TEGENA 2 - FLUID TEMPERATURES
PROBE P1 SUBCHANNEL

Y11 mm	X11 mm	TC11 C	RMS11 K	X12 mm	TC12 C	RMS12 K	Y14 mm	X14 mm	TC14 C	RMS14 K	X13 mm	TC13 C	RMS13 K	Y15 mm	X15 mm	TC15 C	RMS15 K	MFR kg/s	DTC K
28.28	51.23	377.13	.45	49.18	373.58	.54	30.33	51.23	374.26	.34	49.18	375.46	.39	29.31	50.21	376.72	.33	1.59	78.65
28.28	52.15	375.74	.48	50.10	373.57	.54	30.33	52.15	373.37	.34	50.10	375.11	.39	29.31	51.13	375.57	.35	1.59	78.87
28.28	54.23	374.14	.58	52.18	374.43	.64	30.33	54.23	372.24	.36	52.18	373.77	.42	29.31	53.21	374.11	.40	1.59	79.09
28.28	56.33	372.55	.65	54.28	373.15	.64	30.33	56.33	371.19	.34	54.28	372.09	.43	29.31	55.31	372.26	.42	1.60	79.21
28.28	58.40	371.72	.69	56.35	374.27	.59	30.33	58.40	370.89	.30	56.35	371.21	.43	29.31	57.38	371.72	.43	1.60	79.17
28.28	60.43	371.91	.69	58.38	373.91	.67	30.33	60.43	370.83	.30	58.38	370.95	.40	29.31	59.41	371.66	.42	1.60	79.10
28.28	62.44	372.74	.66	60.39	373.99	.57	30.33	62.44	372.00	.37	60.39	370.90	.41	29.31	61.42	372.07	.44	1.59	79.22
28.28	64.52	374.64	.57	62.47	374.24	.67	30.33	64.52	372.93	.38	62.47	371.68	.44	29.31	63.50	373.02	.43	1.60	78.78
28.28	66.62	376.99	.51	64.57	374.25	.63	30.33	66.62	374.90	.38	64.57	373.09	.46	29.31	65.60	375.04	.42	1.59	78.95
28.28	68.69	379.08	.43	66.64	373.85	.64	30.33	68.69	376.52	.36	66.64	374.92	.46	29.31	67.67	376.89	.39	1.59	78.98
28.28	69.71	380.30	.39	67.66	373.61	.56	30.33	69.71	377.21	.32	67.66	375.73	.45	29.31	68.69	377.89	.36	1.59	78.98

TBI = 298.5 C DTC = 78.7 K
UB = .99 m/s Re = 32940.
QH1 = 21.2 W/cm^2 QH2 = 21.1 W/cm^2
QH3 = 21.0 W/cm^2 QH4 = 21.1 W/cm^2

08:31:07 JUL08,1987 M261.DAT

TEGENA 2 - FLUID TEMPERATURES
PROBE P2 SUBCHANNEL

Y21 mm	X21 mm	TC21 C	RMS21 K	X22 mm	TC22 C	RMS22 K	Y24 mm	X24 mm	TC24 C	RMS24 K	X23 mm	TC23 C	RMS23 K	Y25 mm	X25 mm	TC25 C	RMS25 K	QB W/cm^2	TBI C
3.93	66.96	375.40	.35	69.61	378.09	.21	1.27	66.96	371.72	.33	69.61	373.66	.33	2.60	68.28	374.61	.81	21.07	298.50
3.93	66.09	374.30	.37	68.74	376.97	.25	1.27	66.09	371.26	.32	68.74	373.01	.35	2.60	67.41	373.79	.81	21.10	298.60
3.93	64.06	372.65	.47	66.71	375.20	.34	1.27	64.06	370.31	.33	66.71	371.85	.35	2.60	65.38	372.18	.83	21.18	298.51
3.93	61.97	371.29	.57	64.62	373.34	.44	1.27	61.97	369.27	.30	64.62	370.65	.37	2.60	63.29	370.75	.84	21.27	298.54
3.93	59.84	370.45	.60	62.49	371.68	.53	1.27	59.84	368.88	.26	62.49	369.62	.35	2.60	61.16	369.73	.83	21.22	298.57
3.93	57.78	370.94	.62	60.43	370.57	.65	1.27	57.78	369.20	.29	60.43	368.96	.33	2.60	59.10	369.63	.85	21.24	298.60
3.93	55.80	372.00	.59	58.45	370.53	.65	1.27	55.80	370.05	.36	58.45	369.29	.33	2.60	57.12	370.64	.87	21.20	298.69
3.93	53.75	373.78	.47	56.40	371.28	.59	1.27	53.75	371.27	.35	56.40	369.78	.37	2.60	55.07	371.37	.87	21.16	298.87
3.92	51.66	376.59	.39	54.31	373.10	.51	1.26	51.66	373.25	.36	54.31	371.24	.40	2.59	52.98	373.24	.85	21.15	298.93
3.93	49.55	378.40	.31	52.20	376.10	.43	1.27	49.55	374.68	.35	52.20	372.86	.39	2.60	50.87	375.21	.84	21.12	298.95
3.93	48.51	379.71	.26	51.16	376.62	.38	1.27	48.51	375.51	.32	51.16	373.85	.39	2.60	49.83	376.18	.82	21.17	298.84

TBI = 298.8 C DTC = 79.6 K 08:57:56 JUL08,1987 M262.DAT

UB = .99 m/s Re = 33089.

QH1 = 21.5 W/cm^2 QH2 = 21.4 W/cm^2

QH3 = 21.3 W/cm^2 QH4 = 21.4 W/cm^2

TAB. A56c

TEGENA 2 - FLUID TEMPERATURES

PROBE P1 SUBCHANNEL

Y11 mm	X11 mm	TC11 C	RMS11 K	X12 mm	TC12 C	RMS12 K	Y14 mm	X14 mm	TC14 C	RMS14 K	X13 mm	TC13 C	RMS13 K	Y15 mm	X15 mm	TC15 C	RMS15 K	MFR kg/s	DTC K
27.25	53.26	377.41	.50	51.21	374.63	.56	29.30	53.26	374.35	.40	51.21	376.36	.45	28.28	52.24	377.03	.37	1.60	79.64
27.25	54.22	375.63	.58	52.17	373.79	.59	29.30	54.22	372.92	.43	52.17	374.58	.47	28.28	53.20	375.41	.42	1.58	78.20
27.25	56.33	373.83	.77	54.28	373.67	.55	29.30	56.33	371.45	.45	54.28	373.10	.49	28.28	55.31	373.56	.50	1.58	77.81
27.25	58.39	371.89	.90	56.34	374.20	.59	29.30	58.39	370.75	.45	56.34	371.31	.52	28.28	57.37	372.05	.56	1.58	76.09
27.25	60.43	371.68	.86	58.38	373.01	.57	29.30	60.43	370.37	.43	58.38	370.70	.51	28.28	59.41	371.48	.56	1.58	78.03
27.25	62.45	372.76	.76	60.40	372.38	.61	29.30	62.45	370.93	.45	60.40	370.26	.52	28.28	61.43	371.78	.56	1.58	78.11
27.25	64.52	374.66	.59	62.47	372.89	.62	29.30	64.52	372.62	.43	62.47	371.09	.52	28.28	63.50	373.07	.50	1.58	78.17
27.25	66.62	376.89	.46	64.57	371.91	.56	29.30	66.62	374.21	.43	64.57	372.25	.52	28.28	65.60	375.13	.43	1.58	77.96
27.25	67.66	378.05	.40	65.61	372.45	.59	29.30	67.66	374.92	.41	65.61	373.75	.52	28.28	66.64	375.77	.40	1.58	77.69

TBI = 298.8 C DTC = 79.6 K 08:57:56 JUL08,1987 M262.DAT

UB = .99 m/s Re = 33089.

QH1 = 21.5 W/cm^2 QH2 = 21.4 W/cm^2

QH3 = 21.3 W/cm^2 QH4 = 21.4 W/cm^2

TEGENA 2 - FLUID TEMPERATURES

PROBE P2 SUBCHANNEL

Y21 mm	X21 mm	TC21 C	RMS21 K	X22 mm	TC22 C	RMS22 K	Y24 mm	X24 mm	TC24 C	RMS24 K	X23 mm	TC23 C	RMS23 K	Y25 mm	X25 mm	TC25 C	RMS25 K	QB W/cm^2	TBI C
4.92	64.48	375.18	.46	67.13	378.51	.24	2.26	64.48	371.88	.38	67.13	373.98	.40	3.59	65.80	374.96	.79	21.40	298.80
4.93	64.06	374.06	.50	66.71	376.86	.27	2.27	64.06	370.59	.41	66.71	372.22	.42	3.60	65.38	373.27	.79	20.82	298.86
4.93	61.97	371.94	.69	64.62	374.63	.44	2.27	61.97	369.29	.40	64.62	370.81	.43	3.60	63.29	371.23	.85	20.72	299.08
4.92	59.84	370.75	.81	62.49	371.96	.66	2.26	59.84	369.06	.38	62.49	369.34	.44	3.59	61.16	370.45	.90	20.70	299.01
4.93	57.78	371.18	.76	60.43	371.08	.82	2.27	57.78	368.69	.40	60.43	368.62	.44	3.60	59.10	369.62	.93	20.68	298.74
4.92	55.80	372.27	.62	58.45	370.62	.82	2.26	55.80	369.46	.42	58.45	368.30	.42	3.59	57.12	369.75	.90	20.69	298.49
4.93	53.76	373.73	.46	56.41	372.03	.72	2.27	53.76	371.11	.43	56.41	369.20	.47	3.60	55.08	371.64	.86	20.73	298.36
4.93	51.66	376.23	.32	54.31	373.51	.52	2.27	51.66	372.61	.42	54.31	370.37	.45	3.60	52.98	372.96	.82	20.74	298.29
4.92	51.15	377.23	.29	53.80	374.28	.48	2.26	51.15	372.64	.43	53.80	370.53	.47	3.59	52.47	373.32	.82	20.67	298.27

TAB. A56d

TBI = 298.3 C   DTC = 78.1 K   09:21:24 JUL08,1987 M263.DAT
QB = .99 m/s   Re = 32913.
QH1 = 21.0 W/cm^2   QH2 = 20.9 W/cm^2
QH3 = 20.9 W/cm^2   QH4 = 20.9 W/cm^2

TEGENA 2 - FLUID TEMPERATURES
PROBE P1 SUBCHANNEL

Y11 mm	X11 mm	TC11 C	RMS11 K	X12 mm	TC12 C	RMS12 K	Y14 mm	X14 mm	TC14 C	RMS14 K	X13 mm	TC13 C	RMS13 K	Y15 mm	X15 mm	TC15 C	RMS15 K	MFR kg/s	DTC K
26.27	55.35	375.49	.73	53.30	372.79	.52	28.32	55.35	372.81	.54	53.30	374.51	.51	27.30	54.33	375.23	.48	1.59	78.14
26.27	56.32	374.29	.87	54.27	372.04	.58	28.32	56.32	371.75	.58	54.27	373.43	.55	27.30	55.30	374.36	.57	1.58	78.72
26.27	58.39	372.92	1.09	56.34	373.01	.62	28.32	58.39	371.13	.63	56.34	371.91	.66	27.30	57.37	372.70	.72	1.59	78.49
26.27	60.43	372.55	1.11	58.38	372.87	.59	28.32	60.43	370.98	.64	58.38	370.74	.71	27.30	59.41	371.79	.77	1.58	78.20
26.27	62.45	374.73	.88	60.40	372.21	.63	28.32	62.45	372.02	.59	60.40	371.20	.71	27.30	61.43	373.11	.72	1.59	78.53
26.27	64.52	376.75	.60	62.47	373.31	.55	28.32	64.52	373.49	.50	62.47	372.20	.63	27.30	63.50	374.99	.56	1.59	78.56
26.27	65.58	378.32	.46	63.53	372.47	.59	28.32	65.58	374.46	.44	63.53	373.21	.58	27.30	64.56	375.83	.46	1.59	78.10

TBI = 298.3 C   DTC = 78.1 K   09:21:24 JUL08,1987 M263.DAT
QB = .99 m/s   Re = 32913.
QH1 = 21.0 W/cm^2   QH2 = 20.9 W/cm^2
QH3 = 20.9 W/cm^2   QH4 = 20.9 W/cm^2

TEGENA 2 - FLUID TEMPERATURES
PROBE P2 SUBCHANNEL

Y21 mm	X21 mm	TC21 C	RMS21 K	X22 mm	TC22 C	RMS22 K	Y24 mm	X24 mm	TC24 C	RMS24 K	X23 mm	TC23 C	RMS23 K	Y25 mm	X25 mm	TC25 C	RMS25 K	QB W/cm^2	TBI C
5.95	62.94	373.68	.64	65.59	376.84	.28	3.29	62.94	370.40	.49	65.59	372.01	.44	4.62	64.26	372.92	.91	20.94	298.29
5.95	61.97	372.31	.78	64.62	375.66	.40	3.29	61.97	369.02	.53	64.62	371.22	.48	4.62	63.29	372.14	.97	20.93	298.23
5.95	59.84	371.82	.95	62.49	373.33	.72	3.29	59.84	369.28	.53	62.49	369.65	.55	4.62	61.16	370.67	1.07	20.93	298.19
5.95	57.79	371.67	.89	60.44	371.85	.96	3.29	57.79	368.78	.52	60.44	368.68	.58	4.62	59.11	370.14	1.11	20.82	298.18
5.95	55.80	373.91	.70	58.45	372.05	1.04	3.29	55.80	370.70	.53	58.45	369.07	.60	4.62	57.12	371.20	1.08	21.02	298.17
5.95	53.75	375.88	.43	56.40	372.69	.83	3.29	53.75	372.14	.47	56.40	369.94	.57	4.62	55.07	372.11	.95	20.94	298.23
5.95	52.73	377.29	.33	55.38	374.62	.68	3.29	52.73	372.90	.47	55.38	370.59	.54	4.62	54.05	373.76	.89	20.85	298.47

TAB. A56e

TBI = 298.5 C   DTC = 78.3 K   09:39:11 JUL08,1987 M264.DAT
QB = .98 m/s   Re = 32848.
QH1 = 21.0 W/cm^2   QH2 = 20.9 W/cm^2
QH3 = 20.8 W/cm^2   QH4 = 20.9 W/cm^2

TEGENA 2 - FLUID TEMPERATURES
PROBE P1 SUBCHANNEL

Y11 mm	X11 mm	TC11 C	RMS11 K	X12 mm	TC12 C	RMS12 K	Y14 mm	X14 mm	TC14 C	RMS14 K	X13 mm	TC13 C	RMS13 K	Y15 mm	X15 mm	TC15 C	RMS15 K	MFR kg/s	DTC K
25.34	56.41	376.17	.94	54.36	372.36	.58	27.39	56.41	373.47	.74	54.36	375.45	.59	26.37	55.39	376.43	.61	1.59	78.33
25.33	58.39	374.56	1.29	56.34	372.85	.59	27.38	58.39	372.32	.89	56.34	373.45	.79	26.36	57.37	374.86	.85	1.59	77.92
25.34	60.43	374.50	1.31	58.38	370.75	.53	27.39	60.43	372.01	.89	58.38	372.43	.94	26.37	59.41	373.53	.97	1.58	78.43
25.34	62.45	376.07	.93	60.40	373.37	.67	27.39	62.45	373.41	.70	60.40	372.67	.90	26.37	61.43	374.43	.82	1.59	78.29
25.34	64.52	378.91	.55	62.47	372.01	.59	27.39	64.52	375.81	.51	62.47	373.90	.75	26.37	63.50	376.33	.59	1.59	78.29

TBI = 298.5 C   DTC = 78.3 K   09:39:11 JUL08,1987 M264.DAT
QB = .98 m/s   Re = 32848.
QH1 = 21.0 W/cm^2   QH2 = 20.9 W/cm^2
QH3 = 20.8 W/cm^2   QH4 = 20.9 W/cm^2

TEGENA 2 - FLUID TEMPERATURES
PROBE P2 SUBCHANNEL

Y21 mm	X21 mm	TC21 C	RMS21 K	X22 mm	TC22 C	RMS22 K	Y24 mm	X24 mm	TC24 C	RMS24 K	X23 mm	TC23 C	RMS23 K	Y25 mm	X25 mm	TC25 C	RMS25 K	QB W/cm^2	TBI C
7.02	60.78	374.52	1.00	63.43	376.67	.56	4.36	60.78	370.23	.75	63.43	372.22	.64	5.69	62.10	373.27	1.15	20.94	298.47
7.02	59.84	373.53	1.09	62.49	375.75	.75	4.36	59.84	370.18	.75	62.49	371.06	.69	5.69	61.16	372.24	1.23	20.82	298.45
7.02	57.79	374.25	1.05	60.44	374.20	1.12	4.36	57.79	369.92	.72	60.44	369.98	.82	5.69	59.11	372.31	1.35	20.67	298.52
7.02	55.80	375.76	.71	58.45	373.85	1.19	4.36	55.80	371.07	.61	58.45	370.49	.80	5.69	57.12	372.74	1.21	20.66	298.48
7.02	54.76	377.10	.54	57.43	373.88	1.06	4.36	54.76	372.71	.57	57.43	370.45	.76	5.69	56.10	373.52	1.09	20.68	298.55

TAB. A56f

TBI = 298.5 C DTC = 78.3 K 09:53:01 JUL08,1987 M265.DAT
UB = .98 m/s Re = 32799.
QH1 = 21.0 W/cm^2 QH2 = 20.9 W/cm^2
QH3 = 20.8 W/cm^2 QH4 = 20.9 W/cm^2

TEGENA 2 - FLUID TEMPERATURES
PROBE P1 SUBCHANNEL

Y11 mm	X11 mm	TC11 C	RMS11 K	X12 mm	TC12 C	RMS12 K	Y14 mm	X14 mm	TC14 C	RMS14 K	X13 mm	TC13 C	RMS13 K	Y15 mm	X15 mm	TC15 C	RMS15 K	MFR kg/s	DTC K
24.38	57.45	377.61	1.21	55.40	373.13	.53	26.43	57.45	374.26	1.02	55.40	376.01	.75	25.41	56.43	377.34	.79	1.59	78.27
24.38	58.39	377.16	1.40	56.34	372.16	.54	26.43	58.39	373.68	1.10	56.34	375.16	.88	25.41	57.37	375.67	.93	1.59	78.05
24.38	60.43	375.94	1.39	58.38	372.65	.57	26.43	60.43	373.52	1.06	58.38	373.63	1.14	25.41	59.41	375.18	1.10	1.59	78.31
24.38	62.45	378.47	.94	60.40	372.38	.56	26.43	62.45	374.63	.82	60.40	373.26	1.13	25.41	61.43	376.16	.92	1.59	78.09
24.38	63.49	379.74	.69	61.44	372.22	.59	26.43	63.49	376.40	.67	61.44	374.92	1.00	25.41	62.47	377.60	.75	1.59	78.58

TBI = 298.5 C DTC = 78.3 K 09:53:01 JUL08,1987 M265.DAT
UB = .98 m/s Re = 32799.
QH1 = 21.0 W/cm^2 QH2 = 20.9 W/cm^2
QH3 = 20.8 W/cm^2 QH4 = 20.9 W/cm^2

TEGENA 2 - FLUID TEMPERATURES
PROBE P2 SUBCHANNEL

Y21 mm	X21 mm	TC21 C	RMS21 K	X22 mm	TC22 C	RMS22 K	Y24 mm	X24 mm	TC24 C	RMS24 K	X23 mm	TC23 C	RMS23 K	Y25 mm	X25 mm	TC25 C	RMS25 K	QB W/cm^2	TBI C
8.10	60.79	375.77	1.05	63.44	378.68	.47	5.44	60.79	372.00	.90	63.44	373.28	.67	6.77	62.11	374.83	1.18	20.89	298.50
8.10	59.84	375.27	1.17	62.49	377.61	.70	5.44	59.84	370.86	.93	62.49	373.10	.79	6.77	61.16	373.98	1.31	20.89	298.35
8.10	57.78	376.07	1.13	60.43	375.51	1.21	5.44	57.78	371.22	.92	60.43	371.52	1.04	6.77	59.10	373.11	1.54	20.92	298.42
8.10	55.80	377.80	.71	58.45	374.79	1.32	5.44	55.80	372.74	.74	58.45	371.58	1.04	6.77	57.12	373.93	1.35	20.88	298.52
8.10	54.78	379.07	.47	57.43	375.86	1.15	5.44	54.78	374.59	.61	57.43	371.83	.94	6.77	56.10	375.18	1.18	21.04	298.55

TAB. A56g

TBI = 298.7 C DTC = 78.8 K 10:13:18 JUL08,1987 M266.DAT
UB = .99 m/s Re = 33101.
QH1 = 21.3 W/cm^2 QH2 = 21.2 W/cm^2
QH3 = 21.1 W/cm^2 QH4 = 21.2 W/cm^2

TEGENA 2 - FLUID TEMPERATURES
PROBE P1 SUBCHANNEL

Y11 mm	X11 mm	TC11 C	RMS11 K	X12 mm	TC12 C	RMS12 K	Y14 mm	X14 mm	TC14 C	RMS14 K	X13 mm	TC13 C	RMS13 K	Y15 mm	X15 mm	TC15 C	RMS15 K	MFR kg/s	DTC K
23.39	58.48	379.28	1.44	56.43	373.59	.59	25.44	58.48	375.77	1.23	56.43	377.51	.94	24.42	57.46	378.87	.97	1.60	78.78
23.38	59.42	378.72	1.61	57.37	373.35	.55	25.43	59.42	375.50	1.35	57.37	376.39	1.18	24.41	58.40	378.43	1.17	1.60	79.43
23.38	60.43	379.35	1.48	58.38	372.84	.65	25.43	60.43	375.91	1.26	58.38	375.97	1.32	24.41	59.41	378.35	1.21	1.60	79.08
23.38	61.44	379.99	1.20	59.39	373.11	.58	25.43	61.44	376.45	1.08	59.39	376.03	1.36	24.41	60.42	378.29	1.13	1.60	79.03
23.38	62.45	381.43	.88	60.40	372.45	.61	25.43	62.45	377.62	.90	60.40	375.95	1.29	24.41	61.43	378.94	.96	1.60	78.76

TBI = 298.7 C DTC = 78.8 K 10:13:18 JUL08,1987 M266.DAT
UB = .99 m/s Re = 33101.
QH1 = 21.3 W/cm^2 QH2 = 21.2 W/cm^2
QH3 = 21.1 W/cm^2 QH4 = 21.2 W/cm^2

TEGENA 2 - FLUID TEMPERATURES
PROBE P2 SUBCHANNEL

Y21 mm	X21 mm	TC21 C	RMS21 K	X22 mm	TC22 C	RMS22 K	Y24 mm	X24 mm	TC24 C	RMS24 K	X23 mm	TC23 C	RMS23 K	Y25 mm	X25 mm	TC25 C	RMS25 K	QB W/cm^2	TBI C
9.17	59.72	377.66	1.23	62.37	380.06	.65	6.51	59.72	372.74	1.14	62.37	374.82	.89	7.84	61.04	376.67	1.42	21.20	298.65
9.18	58.79	377.45	1.30	61.44	379.15	.95	6.52	58.79	373.49	1.17	61.44	374.62	1.07	7.85	60.11	376.73	1.62	21.31	298.67
9.17	57.79	379.32	1.16	60.44	377.85	1.23	6.51	57.79	374.56	1.11	60.44	373.55	1.23	7.84	59.11	375.91	1.70	21.29	298.69
9.18	56.78	379.68	.90	59.43	377.68	1.40	6.52	56.78	374.45	.95	59.43	373.29	1.29	7.85	58.10	375.52	1.62	21.25	298.82
9.17	55.80	381.02	.64	58.45	376.27	1.39	6.51	55.80	375.21	.81	58.45	374.11	1.25	7.84	57.12	377.31	1.43	21.20	298.87