OAK
RIDGE
NATIONAL
LABORATORY

UNION
CARBIDE

OPERATED BY
UNION CARBIDE CORPORATION
FOR THE UNITED STATES
DEPARTMENT OF ENERGY

NUREG/CR-2525, Vol. 7
ORNL/NUREG/TM-407/V7

ORNL Rod Bundle Heat Transfer Test Data

Volume 7. Thermal-Hydraulic Test
Facility Experimental Data Report
for Test Series 3.07.9—Steady-State
Film Boiling in Upflow

C. B. Mullins
D. K. Felde
A. G. Sutton

S. S. Gould
D. G. Morris
J. J. Robinson

NUREG/CR--2525 Vol. 7

DE82 014871

Prepared for the U.S. Nuclear Regulatory Commission
Office of Nuclear Regulatory Research
Under Interagency Agreements DOE 40-551-75 and 40-552-75

MASTER

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

Printed in the United States of America. Available from
National Technical Information Service
U.S. Department of Commerce
5285 Port Royal Road, Springfield, Virginia 22161

Available from
GPO Sales Program
Division of Technical Information and Document Control
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

NUREG/CR-2525, Vol. 7
ORNL/NUREG/TM-407/V7
Dist. Category R2

Contract No. W-7405-eng-26

Engineering Technology Division

ORNL ROD-BUNDLE HEAT-TRANSFER TEST DATA

**VOLUME 7. THERMAL-HYDRAULIC TEST FACILITY EXPERIMENTAL DATA
REPORT FOR TEST SERIES 3.07.9 - STEADY-STATE
FILM BOILING IN UPFLOW**

C. B. Mullins	S. S. Gould
D. K. Felde	D. G. Morris
A. G. Sutton	J. J. Robinson

Manuscript Completed - May 4, 1982
Date Published - May 1982

DISCLAIMER

This work was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

NOTICE

PORTIONS OF THIS REPORT ARE ILLEGIBLE. It has been reproduced from the best available copy to permit the broadest possible availability.

Prepared for the **MN ONLY**
U.S. Nuclear Regulatory Commission
Office of Nuclear Regulatory Research
Under Interagency Agreements DOE 40-551-75 and 40-552-75

NRC FIN No. B0125

Prepared by the
OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37830
operated by
UNION CARBIDE CORPORATION
for the
DEPARTMENT OF ENERGY

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

CONTENTS

	<u>Page</u>
LIST OF FIGURES	v
ACKNOWLEDGMENTS	vii
ABSTRACT	1
1. INTRODUCTION	1
2. THERMAL-HYDRAULIC TEST FACILITY DESCRIPTION	2
3. DATA PRESENTATION	10
REFERENCES	213
APPENDIX A. TEST PROCEDURE	215
APPENDIX B. MASS FLOW CALCULATIONS	217
APPENDIX C. ROD POWERS	219
APPENDIX D. INSTRUMENT UNCERTAINTY ANALYSIS FOR THE THTF LOOP	231
APPENDIX E. DENSITY OBTAINED FROM THREE-BEAM DENSITOMETER	291

LIST OF FIGURES

<u>Figure</u>		<u>Page</u>
1	THTF system with instrumented spool pieces labeled	3
2	Identification of THTF heater rods, subchannel location, and inactive rods in THTF heater bundle	4
3	Cross section of a typical fuel rod simulator	4
4	Axial location of spacer-grid and fuel rod simulator thermocouples	5
5	Diagram of THTF	6
6	Positions of differential pressure and pressure instrumentation for THTF Test 3.07.9	7
7	THTF instrumentation diagram	8
D.1	Amplifier	233
D.2	Generalized form for a large system	237
D.3	Error due to turbine linearity: characteristic curve	239
D.4	Typical densitometer calibration	242
D.5	Sensitivity calibration	247
D.6	Zero offset calibration	247
D.7	PDE-200 output from test 101 (after 28-Hz notch, original data)	248
D.8	Rod power schematic	251
D.9	Instrument reading as a function of response time assuming first-order lag	254
D.10	Instrument error as a function of DAS sampling assuming first-order lag	255
E.1		291

ACKNOWLEDGMENTS

In the conduct of a large experimental and analytical program, there are always a great many individuals whose contributions should be recognized. The dedicated efforts of the entire Blowdown Heat Transfer Program staff are reflected in this report. The authors express sincere appreciation to the following personnel:

M. C. Adair	D. F. Hunt	R. D. Stulting
T. M. Anklam	C. R. Hyman	J. W. Teague, Jr.
J. L. Bartley	A. F. Johnson	R. E. Textor
D. H. Cook	R. W. McCulloch	M. S. Thompson
W. G. Craddick	D. G. Madewell	H. E. Trammell
R. D. Dabbs	G. S. Mailen	B. J. Veazie
R. L. Durall	R. W. Murphy	J. D. White
R. M. Flanders	L. J. Ott	M. D. White
D. J. Fraysier	H. R. Payne	J. E. Wolfe
R. H. Greene	W. Ragan, Jr.	G. L. Yoder
R. C. Hagar	N. R. Raulston	

ORNL ROD BUNDLE HEAT TRANSFER TEST DATA

VOLUME 7. THERMAL-HYDRAULIC TEST FACILITY EXPERIMENTAL DATA REPORT FOR TEST SERIES 3.07.9 - STEADY-STATE FILM BOILING IN UPFLOW

C. B. Mullins	S. S. Gould
D. K. Felde	D. G. Morris
A. G. Sutton	J. J. Robinson

ABSTRACT

Thermal-Hydraulic Test Facility (THTF) test series 3.07.9 was conducted by members of the Oak Ridge National Laboratory Pressurized-Water Reactor (ORNL-PWR) Blowdown Heat Transfer (BDHT) Separate-Effects Program on September 11, September 18, and October 1, 1980. The objective of the program is to investigate heat transfer phenomena believed to occur in PWRs during accidents, including small- and large-break loss-of-coolant accidents.

Test series 3.07.9 was designed to provide steady-state film boiling data in rod bundle geometry under reactor accident-type conditions. This report presents the reduced instrument responses for THTF test series 3.07.9. Also included are uncertainties in the instrument responses, calculated mass flows, and calculated rod powers.

1. INTRODUCTION

The Oak Ridge National Laboratory (ORNL) Pressurized-Water Reactor (PWR) Blowdown Heat Transfer (BDHT) Program is studying several aspects of heat transfer thought to occur in accident situations in PWRs, including dispersed-flow film boiling. The study involves both experimental and analytical efforts. This report presents reduced instrument responses obtained during test series 3.07.9 in the Thermal-Hydraulic Test Facility (THTF).

Test 3.07.9 data are analyzed in Ref. 1.

2. THERMAL-HYDRAULIC TEST FACILITY DESCRIPTION

The THTF is a heavily instrumented, nonnuclear, pressurized-water loop (Fig. 1) containing 64 full-length rods (of which 60 are normally electrically heated) arranged in an 8 x 8 bundle. Rod diameter and pitch are typical of a PWR with 17 x 17 fuel assemblies. Figure 2 is a schematic diagram of the THTF rod bundle cross section. Figure 3 shows a simplified cross section of a typical fuel rod simulator (FRS). Note that when a rod has thermocouples at axial levels A, B, C, D, E, F, or G, there are three individual thermocouples spaced azimuthally around the rod. In contrast, when a rod has a thermocouple at other axial levels (F1, F2, etc.), there is just one thermocouple per rod at that level. The axial and radial power profile of the THTF bundle is flat. The axial locations of FRS thermocouples are shown schematically in Fig. 4. The heated length of the bundle is 3.66 m (12 ft), and there are six spacer grids in the heated length.

Figure 5 is a simplified diagram of the THTF included to help the reader visualize the facility. In the steady-state mode, fluid flows from the pump through the horizontal inlet (SHI) and vertical inlet (SVI) spool pieces, respectively. From the vertical inlet (SVI) spool piece, fluid enters the external downcomer (BI1) spool piece into the test section lower plenum. Fluid flows from the lower plenum through the heated length of the bundle, into the test section upper plenum, through the outlet spool pieces (BO1, SVO, SHO), into the main heat exchangers, and back to the inlet of the pump.

Figure 6 is a more detailed diagram showing the location of pressure and differential pressure instrumentation for test series 3.07.9. Figure 7 is a detailed diagram of the entire THTF piping system and its associated instrumentation. The THTF is described more completely in Ref. 2. The test procedure is discussed in Appendix A.

Fig. 1. THTF system with instrumented spool pieces labeled.

Fig. 2. Identification of THTF heater rods, subchannel location, and inactive rods in THTF heater bundle.

Fig. 3. Cross section of a typical fuel rod simulator.

ORNL-DWG 80-5646 ETD

Fig. 4. Axial location of spacer-grid and fuel rod simulator thermocouples.

ORNL-DWG 79-4231B ETD

Fig. 5. Diagram of THTF.

Fig. 6. Positions of differential pressure and pressure instrumentation for THTF Test 3.07.9.

Fig. 7. THTF instrumentation diagram.

3. DATA PRESENTATION

The recorded instrument responses for THTF test series 3.07.9 are tabulated on the microfiche in the back of this report. Three types of tables have been constructed to assist in using the data. Tables 1, 2, and 3 list instrumentation in terms of instrument function, type, and location. Included in these tables are headings and subheadings that refer to instrument function, type, and location; a brief description of each instrument; and an instrument application number (IAN). The IAN is a unique identifier that is associated with each instrument. The following example illustrates the format used in these tables:

Example

BUNDLE TEMPERATURE	<u>Heading denoting function</u>
SHEATH THERMOCOUPLE	<u>Heading denoting type</u>
LEVEL A	<u>Subheading denoting location</u>
Instrument application number	Instrument description
<hr/>	
TE-306-AA	SHEATH THERMOCOUPLE, ROD 6, LEVEL A

The tables on microfiche list the time-averaged instrument response and standard deviation. Included are the entry number, IAN, instrument description, instrument range, and comments on the functionality of the instrument. Three types of comments are associated with these tables: "Out of service" means the instrument was not expected to operate during the test. "Instrument failed" means the instrument was expected to function but failed to function properly. "Instrument questionable" implies that the instrument could be functioning properly but the data from such an instrument could be faulty. Each piece of microfiche contains two tables for each test: one in English units and the other in SI units.

Tables 4, 5, and 6 list instruments alphabetically in terms of the IAN. Included are the IAN, corresponding entry number, and instrument type code (discussed in Appendix D). Tables 4, 5, and 6 coordinate the information in Tables 1, 2, and 3 and the tabular data on microfiche. For example, one can look up an instrument by function using Table 1 and then, by using the IAN and Table 4, determine the associated entry number. The appropriate table on microfiche (e.g., test H) can then be used to determine instrument status and average value. Tables 1 and 4 are to be used with the tabular microfiche data for tests H, I, K, L, M, N, O, P, and X. These tests were conducted on September 11, 1980, and the data base describing the THTF instrumentation is unique for the tests run that day. This allows Tables 1 and 4 to be used for all of these tests. Tables 2 and 5 are to be used with the tabular microfiche data for tests Q and R, run on September 18, 1980. Tables 3 and 6 are to be used with the tabular microfiche data for tests B, C, D, E, F, G, J, T, U, V, and W, conducted on October 1, 1980.

Table 7 is a presentation of the nomenclature used in designating thermocouples. This table, together with Figs. 2 and 4, will allow the thermocouples in the THTF test section to be located.

The reduced instrument responses presented in this report were recorded by a computer-controlled digital data acquisition system. Further information on this system can be found in Ref. 2.

Tabular results and a discussion of the calculation of mass flow through the THTF test section are included in Appendix B. Appendix C is a tabular presentation of rod power for THTF test series 3.07.9. Appendix D is devoted to discussion and calculation of uncertainties for THTF instrumentation. Appendix E provides data interpretation from the three-beam densitometer.

Table 1. Thermal-Hydraulic Test Facility Test 3.07.9H, I,
K, L, M, N, O, P, X

SENSOR	DESCRIPTION					

BUNDLE TEMPERATURE						
SHEATH THERMOCOUPLES						
LEVEL A						
TE-306AA	SHEATH	THERMOCOUPLE,	ROD 06,	LEVEL A,	ANGLE A	
TE-323AA	SHEATH	THERMOCOUPLE,	ROD 23,	LEVEL A,	ANGLE A	
TE-325CA	SHEATH	THERMOCOUPLE,	ROD 25,	LEVEL A,	ANGLE C	
TE-327BA	SHEATH	THERMOCOUPLE,	ROD 27,	LEVEL A,	ANGLE B	
TE-340CA	SHEATH	THERMOCOUPLE,	ROD 40,	LEVEL A,	ANGLE C	
TE-343BA	SHEATH	THERMOCOUPLE,	ROD 43,	LEVEL A,	ANGLE B	
TE-355AA	SHEATH	THERMOCOUPLE,	ROD 55,	LEVEL A,	ANGLE A	
TE-357BA	SHEATH	THERMOCOUPLE,	ROD 57,	LEVEL A,	ANGLE B	
LEVEL B						
TE-302AB	SHEATH	THERMOCOUPLE,	ROD 02,	LEVEL B,	ANGLE A	
TE-306AB	SHEATH	THERMOCOUPLE,	ROD 06,	LEVEL B,	ANGLE A	
TE-308CB	SHEATH	THERMOCOUPLE,	ROD 08,	LEVEL B,	ANGLE C	
TE-309CB	SHEATH	THERMOCOUPLE,	ROD 09,	LEVEL B,	ANGLE C	
TE-311AB	SHEATH	THERMOCOUPLE,	ROD 11,	LEVEL B,	ANGLE A	
TE-312CB	SHEATH	THERMOCOUPLE,	ROD 12,	LEVEL B,	ANGLE C	
TE-324AB	SHEATH	THERMOCOUPLE,	ROD 24,	LEVEL B,	ANGLE A	
TE-325CB	SHEATH	THERMOCOUPLE,	ROD 25,	LEVEL B,	ANGLE C	
TE-326BB	SHEATH	THERMOCOUPLE,	ROD 26,	LEVEL B,	ANGLE B	
TE-327CB	SHEATH	THERMOCOUPLE,	ROD 27,	LEVEL B,	ANGLE C	
TE-329CB	SHEATH	THERMOCOUPLE,	ROD 29,	LEVEL B,	ANGLE C	
TE-330CB	SHEATH	THERMOCOUPLE,	ROD 30,	LEVEL B,	ANGLE C	
TE-335BB	SHEATH	THERMOCOUPLE,	ROD 35,	LEVEL B,	ANGLE B	
TE-339BB	SHEATH	THERMOCOUPLE,	ROD 39,	LEVEL B,	ANGLE B	
TE-340CB	SHEATH	THERMOCOUPLE,	ROD 40,	LEVEL B,	ANGLE C	
TE-341AB	SHEATH	THERMOCOUPLE,	ROD 41,	LEVEL B,	ANGLE A	
TE-343BB	SHEATH	THERMOCOUPLE,	ROD 43,	LEVEL B,	ANGLE B	
TE-344CB	SHEATH	THERMOCOUPLE,	ROD 44,	LEVEL B,	ANGLE C	
TE-349CB	SHEATH	THERMOCOUPLE,	ROD 49,	LEVEL B,	ANGLE C	
TE-351AB	SHEATH	THERMOCOUPLE,	ROD 51,	LEVEL B,	ANGLE A	
TE-355CB	SHEATH	THERMOCOUPLE,	ROD 55,	LEVEL B,	ANGLE C	
TE-357CB	SHEATH	THERMOCOUPLE,	ROD 57,	LEVEL B,	ANGLE C	
TE-361AB	SHEATH	THERMOCOUPLE,	ROD 61,	LEVEL B,	ANGLE A	
TE-362BB	SHEATH	THERMOCOUPLE,	ROD 62,	LEVEL B,	ANGLE B	
TE-363CB	SHEATH	THERMOCOUPLE,	ROD 63,	LEVEL B,	ANGLE C	
LEVEL C						
TE-302BC	SHEATH	THERMOCOUPLE,	ROD 02,	LEVEL C,	ANGLE B	
TE-304AC	SHEATH	THERMOCOUPLE,	ROD 04,	LEVEL C,	ANGLE A	
TE-307AC	SHEATH	THERMOCOUPLE,	ROD 07,	LEVEL C,	ANGLE A	

Table 1 (continued)

SENSOR	DESCRIPTION
BUNDLE TEMPERATURE (CONT.)	
SHEATH THERMOCOUPLES (CONT.)	
LEVEL C (CONT.)	
TE-308BC	SHEATH THERMOCOUPLE, ROD 08, LEVEL C, ANGLE B
TE-309AC	SHEATH THERMOCOUPLE, ROD 09, LEVEL C, ANGLE A
TE-310CC	SHEATH THERMOCOUPLE, ROD 10, LEVEL C, ANGLE C
TE-311CC	SHEATH THERMOCOUPLE, ROD 11, LEVEL C, ANGLE C
TE-312BC	SHEATH THERMOCOUPLE, ROD 12, LEVEL C, ANGLE B
TE-313BC	SHEATH THERMOCOUPLE, ROD 13, LEVEL C, ANGLE B
TE-315AC	SHEATH THERMOCOUPLE, ROD 15, LEVEL C, ANGLE A
TE-323BC	SHEATH THERMOCOUPLE, ROD 23, LEVEL C, ANGLE B
TE-324AC	SHEATH THERMOCOUPLE, ROD 24, LEVEL C, ANGLE A
TE-325BC	SHEATH THERMOCOUPLE, ROD 25, LEVEL C, ANGLE B
TE-325CC	SHEATH THERMOCOUPLE, ROD 25, LEVEL C, ANGLE C
TE-326AC	SHEATH THERMOCOUPLE, ROD 26, LEVEL C, ANGLE A
TE-327AC	SHEATH THERMOCOUPLE, ROD 27, LEVEL C, ANGLE A
TE-327CC	SHEATH THERMOCOUPLE, ROD 27, LEVEL C, ANGLE C
TE-328AC	SHEATH THERMOCOUPLE, ROD 28, LEVEL C, ANGLE A
TE-328CC	SHEATH THERMOCOUPLE, ROD 28, LEVEL C, ANGLE C
TE-329AC	SHEATH THERMOCOUPLE, ROD 29, LEVEL C, ANGLE A
TE-329BC	SHEATH THERMOCOUPLE, ROD 29, LEVEL C, ANGLE B
TE-330AC	SHEATH THERMOCOUPLE, ROD 30, LEVEL C, ANGLE A
TE-333AC	SHEATH THERMOCOUPLE, ROD 33, LEVEL C, ANGLE A
TE-339AC	SHEATH THERMOCOUPLE, ROD 39, LEVEL C, ANGLE A
TE-340BC	SHEATH THERMOCOUPLE, ROD 40, LEVEL C, ANGLE B
TE-343BC	SHEATH THERMOCOUPLE, ROD 43, LEVEL C, ANGLE B
TE-344CC	SHEATH THERMOCOUPLE, ROD 44, LEVEL C, ANGLE C
TE-349CC	SHEATH THERMOCOUPLE, ROD 49, LEVEL C, ANGLE C
TE-351BC	SHEATH THERMOCOUPLE, ROD 51, LEVEL C, ANGLE B
TE-353CC	SHEATH THERMOCOUPLE, ROD 53, LEVEL C, ANGLE C
TE-355BC	SHEATH THERMOCOUPLE, ROD 55, LEVEL C, ANGLE B
TE-357AC	SHEATH THERMOCOUPLE, ROD 57, LEVEL C, ANGLE A
TE-357BC	SHEATH THERMOCOUPLE, ROD 57, LEVEL C, ANGLE B
TE-359CC	SHEATH THERMOCOUPLE, ROD 59, LEVEL C, ANGLE C
TE-361AC	SHEATH THERMOCOUPLE, ROD 61, LEVEL C, ANGLE A
TE-362AC	SHEATH THERMOCOUPLE, ROD 62, LEVEL C, ANGLE A
TE-363BC	SHEATH THERMOCOUPLE, ROD 63, LEVEL C, ANGLE B
LEVEL U	
TE-305BU	SHEATH THERMOCOUPLE, ROD 05, LEVEL U, ANGLE B
TE-352AU	SHEATH THERMOCOUPLE, ROD 52, LEVEL U, ANGLE A
TE-352BU	SHEATH THERMOCOUPLE, ROD 52, LEVEL U, ANGLE B
TE-352CU	SHEATH THERMOCOUPLE, ROD 52, LEVEL U, ANGLE C
TE-356BU	SHEATH THERMOCOUPLE, ROD 56, LEVEL U, ANGLE B
LEVEL H	
TE-305BH	SHEATH THERMOCOUPLE, ROD 05, LEVEL H, ANGLE B
TE-348AH	SHEATH THERMOCOUPLE, ROD 48, LEVEL H, ANGLE A

Table 1 (continued)

SENSOR	DESCRIPTION				
BUNDLE TEMPERATURE (CONT.)					
SHEATH THERMOCOUPLES (CONT.)					
LEVEL H (CONT.)					
TE-352AH	SHEATH THERMOCOUPLE,	ROD 52,	LEVEL H,	ANGLE A	
TE-352BH	SHEATH THERMOCOUPLE,	ROD 52,	LEVEL H,	ANGLE B	
TE-352CH	SHEATH THERMOCOUPLE,	ROD 52,	LEVEL H,	ANGLE C	
TE-356CH	SHEATH THERMOCOUPLE,	ROD 56,	LEVEL H,	ANGLE C	
LEVEL S					
TE-305AS	SHEATH THERMOCOUPLE,	ROD 06,	LEVEL S,	ANGLE A	
TE-352AS	SHEATH THERMOCOUPLE,	ROD 52,	LEVEL S,	ANGLE A	
TE-352BS	SHEATH THERMOCOUPLE,	ROD 52,	LEVEL S,	ANGLE B	
TE-352CS	SHEATH THERMOCOUPLE,	ROD 52,	LEVEL S,	ANGLE C	
TE-356BS	SHEATH THERMOCOUPLE,	ROD 56,	LEVEL S,	ANGLE B	
LEVEL Y					
TE-305CY	SHEATH THERMOCOUPLE,	ROD 05,	LEVEL Y,	ANGLE C	
TE-348AY	SHEATH THERMOCOUPLE,	ROD 48,	LEVEL Y,	ANGLE A	
TE-352AY	SHEATH THERMOCOUPLE,	ROD 52,	LEVEL Y,	ANGLE A	
TE-352BY	SHEATH THERMOCOUPLE,	ROD 52,	LEVEL Y,	ANGLE B	
TE-352CY	SHEATH THERMOCOUPLE,	ROD 52,	LEVEL Y,	ANGLE C	
TE-356AY	SHEATH THERMOCOUPLE,	ROD 56,	LEVEL Y,	ANGLE A	
LEVEL D					
TE-302AD	SHEATH THERMOCOUPLE,	ROD 02,	LEVEL D,	ANGLE A	
TE-303CD	SHEATH THERMOCOUPLE,	ROD 03,	LEVEL D,	ANGLE C	
TE-304AD	SHEATH THERMOCOUPLE,	ROD 04,	LEVEL D,	ANGLE A	
TE-308AD	SHEATH THERMOCOUPLE,	ROD 08,	LEVEL D,	ANGLE A	
TE-308CD	SHEATH THERMOCOUPLE,	ROD 08,	LEVEL D,	ANGLE C	
TE-309CD	SHEATH THERMOCOUPLE,	ROD 09,	LEVEL D,	ANGLE C	
TE-310BD	SHEATH THERMOCOUPLE,	ROD 10,	LEVEL D,	ANGLE B	
TE-310CD	SHEATH THERMOCOUPLE,	ROD 10,	LEVEL D,	ANGLE C	
TE-312CD	SHEATH THERMOCOUPLE,	ROD 12,	LEVEL D,	ANGLE C	
TE-313CD	SHEATH THERMOCOUPLE,	ROD 13,	LEVEL D,	ANGLE C	
TE-315AD	SHEATH THERMOCOUPLE,	ROD 15,	LEVEL D,	ANGLE A	
TE-315BD	SHEATH THERMOCOUPLE,	ROD 15,	LEVEL D,	ANGLE B	
TE-316AD	SHEATH THERMOCOUPLE,	ROD 16,	LEVEL D,	ANGLE A	
TE-317BD	SHEATH THERMOCOUPLE,	ROD 17,	LEVEL D,	ANGLE B	
TE-318BD	SHEATH THERMOCOUPLE,	ROD 18,	LEVEL D,	ANGLE B	
TE-318CD	SHEATH THERMOCOUPLE,	ROD 18,	LEVEL D,	ANGLE C	
TE-320AD	SHEATH THERMOCOUPLE,	ROD 20,	LEVEL D,	ANGLE A	
TE-320BD	SHEATH THERMOCOUPLE,	ROD 20,	LEVEL D,	ANGLE B	
TE-320CD	SHEATH THERMOCOUPLE,	ROD 20,	LEVEL D,	ANGLE C	
TE-324BD	SHEATH THERMOCOUPLE,	ROD 24,	LEVEL D,	ANGLE B	
TE-325BD	SHEATH THERMOCOUPLE,	ROD 25,	LEVEL D,	ANGLE B	
TE-325CD	SHEATH THERMOCOUPLE,	ROD 25,	LEVEL D,	ANGLE C	
TE-326AD	SHEATH THERMOCOUPLE,	ROD 26,	LEVEL D,	ANGLE A	
TE-326BD	SHEATH THERMOCOUPLE,	ROD 26,	LEVEL D,	ANGLE B	

Table 1 (continued)

SENSOR	DESCRIPTION
BUNDLE TEMPERATURE (CONT.)	
SHEATH THERMOCOUPLES (CONT.)	
LEVEL D (CONT.)	
TE-326CD	SHEATH THERMOCOUPLE, ROD 26, LEVEL D, ANGLE C
TE-327AD	SHEATH THERMOCOUPLE, ROD 27, LEVEL D, ANGLE A
TE-327BD	SHEATH THERMOCOUPLE, ROD 27, LEVEL D, ANGLE B
TE-327CD	SHEATH THERMOCOUPLE, ROD 27, LEVEL D, ANGLE C
TE-328AD	SHEATH THERMOCOUPLE, ROD 28, LEVEL D, ANGLE A
TE-328BD	SHEATH THERMOCOUPLE, ROD 28, LEVEL D, ANGLE B
TE-328CD	SHEATH THERMOCOUPLE, ROD 28, LEVEL D, ANGLE C
TE-329AD	SHEATH THERMOCOUPLE, ROD 29, LEVEL D, ANGLE A
TE-329BD	SHEATH THERMOCOUPLE, ROD 29, LEVEL D, ANGLE B
TE-329CD	SHEATH THERMOCOUPLE, ROD 29, LEVEL D, ANGLE C
TE-330AD	SHEATH THERMOCOUPLE, ROD 30, LEVEL D, ANGLE A
TE-331CD	SHEATH THERMOCOUPLE, ROD 31, LEVEL D, ANGLE C
TE-332CD	SHEATH THERMOCOUPLE, ROD 32, LEVEL D, ANGLE C
TE-333AD	SHEATH THERMOCOUPLE, ROD 33, LEVEL D, ANGLE A
TE-335BD	SHEATH THERMOCOUPLE, ROD 35, LEVEL D, ANGLE B
TE-339BD	SHEATH THERMOCOUPLE, ROD 39, LEVEL D, ANGLE B
TE-340BD	SHEATH THERMOCOUPLE, ROD 40, LEVEL D, ANGLE B
TE-342BD	SHEATH THERMOCOUPLE, ROD 42, LEVEL D, ANGLE B
TE-343AD	SHEATH THERMOCOUPLE, ROD 43, LEVEL D, ANGLE A
TE-343BD	SHEATH THERMOCOUPLE, ROD 43, LEVEL D, ANGLE B
TE-344CD	SHEATH THERMOCOUPLE, ROD 44, LEVEL D, ANGLE C
TE-345AD	SHEATH THERMOCOUPLE, ROD 45, LEVEL D, ANGLE A
TE-345BD	SHEATH THERMOCOUPLE, ROD 45, LEVEL D, ANGLE B
TE-349CD	SHEATH THERMOCOUPLE, ROD 49, LEVEL D, ANGLE C
TE-351BD	SHEATH THERMOCOUPLE, ROD 51, LEVEL D, ANGLE B
TE-355CD	SHEATH THERMOCOUPLE, ROD 55, LEVEL D, ANGLE C
TE-357BD	SHEATH THERMOCOUPLE, ROD 57, LEVEL D, ANGLE B
TE-357CD	SHEATH THERMOCOUPLE, ROD 57, LEVEL D, ANGLE C
TE-358AD	SHEATH THERMOCOUPLE, ROD 58, LEVEL D, ANGLE A
TE-358CD	SHEATH THERMOCOUPLE, ROD 58, LEVEL D, ANGLE C
TE-359AD	SHEATH THERMOCOUPLE, ROD 59, LEVEL D, ANGLE A
TE-361AD	SHEATH THERMOCOUPLE, ROD 61, LEVEL D, ANGLE A
TE-362AD	SHEATH THERMOCOUPLE, ROD 62, LEVEL D, ANGLE A
TE-364AD	SHEATH THERMOCOUPLE, ROD 64, LEVEL D, ANGLE A
TE-364BD	SHEATH THERMOCOUPLE, ROD 64, LEVEL D, ANGLE B
TE-364CD	SHEATH THERMOCOUPLE, ROD 64, LEVEL D, ANGLE C
LEVEL E	
TE-302AE	SHEATH THERMOCOUPLE, ROD 02, LEVEL E, ANGLE A
TE-303BE	SHEATH THERMOCOUPLE, ROD 03, LEVEL E, ANGLE B
TE-303CE	SHEATH THERMOCOUPLE, ROD 03, LEVEL E, ANGLE C
TE-304BE	SHEATH THERMOCOUPLE, ROD 04, LEVEL E, ANGLE B
TE-307BE	SHEATH THERMOCOUPLE, ROD 07, LEVEL E, ANGLE B
TE-307CE	SHEATH THERMOCOUPLE, ROD 07, LEVEL E, ANGLE C
TE-310BE	SHEATH THERMOCOUPLE, ROD 10, LEVEL E, ANGLE B

Table 1 (continued)

SENSOR	DESCRIPTION
BUNDLE TEMPERATURE (CONT.)	
SHEATH THERMOCOUPLES (CONT.)	
LEVEL E (CONT.)	
TE-312AE	SHEATH THERMOCOUPLE, ROD 12, LEVEL E, ANGLE A
TE-313AE	SHEATH THERMOCOUPLE, ROD 13, LEVEL E, ANGLE A
TE-313CE	SHEATH THERMOCOUPLE, ROD 13, LEVEL E, ANGLE C
TE-315BE	SHEATH THERMOCOUPLE, ROD 15, LEVEL E, ANGLE B
TE-315CE	SHEATH THERMOCOUPLE, ROD 15, LEVEL E, ANGLE C
TE-316BE	SHEATH THERMOCOUPLE, ROD 16, LEVEL E, ANGLE B
TE-316CE	SHEATH THERMOCOUPLE, ROD 16, LEVEL E, ANGLE C
TE-318AE	SHEATH THERMOCOUPLE, ROD 18, LEVEL E, ANGLE A
TE-318BE	SHEATH THERMOCOUPLE, ROD 18, LEVEL E, ANGLE B
TE-318CE	SHEATH THERMOCOUPLE, ROD 18, LEVEL E, ANGLE C
TE-320AE	SHEATH THERMOCOUPLE, ROD 20, LEVEL E, ANGLE A
TE-320BE	SHEATH THERMOCOUPLE, ROD 20, LEVEL E, ANGLE B
TE-320CE	SHEATH THERMOCOUPLE, ROD 20, LEVEL E, ANGLE C
TE-324AE	SHEATH THERMOCOUPLE, ROD 24, LEVEL E, ANGLE A
TE-324CE	SHEATH THERMOCOUPLE, ROD 24, LEVEL E, ANGLE C
TE-326AE	SHEATH THERMOCOUPLE, ROD 26, LEVEL E, ANGLE A
TE-326BE	SHEATH THERMOCOUPLE, ROD 26, LEVEL E, ANGLE B
TE-326CE	SHEATH THERMOCOUPLE, ROD 26, LEVEL E, ANGLE C
TE-328AE	SHEATH THERMOCOUPLE, ROD 28, LEVEL E, ANGLE A
TE-328CE	SHEATH THERMOCOUPLE, ROD 28, LEVEL E, ANGLE C
TE-329AE	SHEATH THERMOCOUPLE, ROD 29, LEVEL E, ANGLE A
TE-329BE	SHEATH THERMOCOUPLE, ROD 29, LEVEL E, ANGLE B
TE-329CE	SHEATH THERMOCOUPLE, ROD 29, LEVEL E, ANGLE C
TE-330AE	SHEATH THERMOCOUPLE, ROD 30, LEVEL E, ANGLE A
TE-330BE	SHEATH THERMOCOUPLE, ROD 30, LEVEL E, ANGLE B
TE-331CE	SHEATH THERMOCOUPLE, ROD 31, LEVEL E, ANGLE C
TE-332AE	SHEATH THERMOCOUPLE, ROD 32, LEVEL E, ANGLE A
TE-332CE	SHEATH THERMOCOUPLE, ROD 32, LEVEL E, ANGLE C
TE-333AE	SHEATH THERMOCOUPLE, ROD 33, LEVEL E, ANGLE A
TE-333BE	SHEATH THERMOCOUPLE, ROD 33, LEVEL E, ANGLE B
TE-333CE	SHEATH THERMOCOUPLE, ROD 33, LEVEL E, ANGLE C
TE-335BE	SHEATH THERMOCOUPLE, ROD 35, LEVEL E, ANGLE B
TE-342BE	SHEATH THERMOCOUPLE, ROD 42, LEVEL E, ANGLE B
TE-344CE	SHEATH THERMOCOUPLE, ROD 44, LEVEL E, ANGLE C
TE-345AE	SHEATH THERMOCOUPLE, ROD 45, LEVEL E, ANGLE A
TE-345BE	SHEATH THERMOCOUPLE, ROD 45, LEVEL E, ANGLE B
TE-349AE	SHEATH THERMOCOUPLE, ROD 49, LEVEL E, ANGLE A
TE-349BE	SHEATH THERMOCOUPLE, ROD 49, LEVEL E, ANGLE B
TE-349CE	SHEATH THERMOCOUPLE, ROD 49, LEVEL E, ANGLE C
TE-351AE	SHEATH THERMOCOUPLE, ROD 51, LEVEL E, ANGLE A
TE-351BE	SHEATH THERMOCOUPLE, ROD 51, LEVEL E, ANGLE B
TE-353AE	SHEATH THERMOCOUPLE, ROD 53, LEVEL E, ANGLE A
TE-353BE	SHEATH THERMOCOUPLE, ROD 53, LEVEL E, ANGLE B
TE-358AE	SHEATH THERMOCOUPLE, ROD 58, LEVEL E, ANGLE A
TE-358BE	SHEATH THERMOCOUPLE, ROD 58, LEVEL E, ANGLE B

Table 1 (continued)

SENSOR	DESCRIPTION
BUNDLE TEMPERATURE (CONT.)	
SHEATH THERMOCOUPLES (CONT.)	
LEVEL E (CONT.)	
TE-359AE	SHEATH THERMOCOUPLE, ROD 59, LEVEL E, ANGLE A
TE-359BF	SHEATH THERMOCOUPLE, ROD 59, LEVEL E, ANGLE B
TE-359CE	SHEATH THERMOCOUPLE, ROD 59, LEVEL E, ANGLE C
TE-361AE	SHEATH THERMOCOUPLE, ROD 61, LEVEL E, ANGLE A
TE-361BE	SHEATH THERMOCOUPLE, ROD 61, LEVEL E, ANGLE B
TE-361CE	SHEATH THERMOCOUPLE, ROD 61, LEVEL E, ANGLE C
TE-362CE	SHEATH THERMOCOUPLE, ROD 62, LEVEL E, ANGLE C
TE-363AE	SHEATH THERMOCOUPLE, ROD 63, LEVEL E, ANGLE A
TE-363BE	SHEATH THERMOCOUPLE, ROD 63, LEVEL E, ANGLE B
TE-364AE	SHEATH THERMOCOUPLE, ROD 64, LEVEL E, ANGLE A
TE-364BE	SHEATH THERMOCOUPLE, ROD 64, LEVEL E, ANGLE B
TE-338E8	SHEATH THERMOCOUPLE, ROD 38, LEVEL E, SUPER LEVEL 8
TE-338E7	SHEATH THERMOCOUPLE, ROD 38, LEVEL E, SUPER LEVEL 7
TE-354E6	SHEATH THERMOCOUPLE, ROD 54, LEVEL E, SUPER LEVEL 6
TE-337E7	SHEATH THERMOCOUPLE, ROD 37, LEVEL E, SUPER LEVEL 7
TE-337E3	SHEATH THERMOCOUPLE, ROD 37, LEVEL E, SUPER LEVEL 3
TE-338E3	SHEATH THERMOCOUPLE, ROD 38, LEVEL E, SUPER LEVEL 3
TE-354E3	SHEATH THERMOCOUPLE, ROD 54, LEVEL E, SUPER LEVEL 3
TE-338E1	SHEATH THERMOCOUPLE, ROD 38, LEVEL E, SUPER LEVEL 1
TE-337E8	SHEATH THERMOCOUPLE, ROD 37, LEVEL E, SUPER LEVEL 8
TE-314E8	SHEATH THERMOCOUPLE, ROD 14, LEVEL E, SUPER LEVEL 8
TE-314E7	SHEATH THERMOCOUPLE, ROD 14, LEVEL E, SUPER LEVEL 7
TE-314E3	SHEATH THERMOCOUPLE, ROD 14, LEVEL E, SUPER LEVEL 3
TE-314E1	SHEATH THERMOCOUPLE, ROD 14, LEVEL E, SUPER LEVEL 1
TE-354E2	SHEATH THERMOCOUPLE, ROD 54, LEVEL E, SUPER LEVEL 2
TE-301E3	SHEATH THERMOCOUPLE, ROD 01, LEVEL E, SUPER LEVEL 3
TE-321E3	SHEATH THERMOCOUPLE, ROD 21, LEVEL E, SUPER LEVEL 3
TE-301E8	SHEATH THERMOCOUPLE, ROD 01, LEVEL E, SUPER LEVEL 8
TE-360E3	SHEATH THERMOCOUPLE, ROD 60, LEVEL E, SUPER LEVEL 3
TE-360E2	SHEATH THERMOCOUPLE, ROD 60, LEVEL E, SUPER LEVEL 2
TE-334E8	SHEATH THERMOCOUPLE, ROD 34, LEVEL E, SUPER LEVEL 8
TE-334E7	SHEATH THERMOCOUPLE, ROD 34, LEVEL E, SUPER LEVEL 7
TE-334E3	SHEATH THERMOCOUPLE, ROD 34, LEVEL E, SUPER LEVEL 3
TE-350E7	SHEATH THERMOCOUPLE, ROD 50, LEVEL E, SUPER LEVEL 7
TE-350E3	SHEATH THERMOCOUPLE, ROD 50, LEVEL E, SUPER LEVEL 3
TE-350E1	SHEATH THERMOCOUPLE, ROD 50, LEVEL E, SUPER LEVEL 1
TE-360E6	SHEATH THERMOCOUPLE, ROD 60, LEVEL E, SUPER LEVEL 6
TE-317E3	SHEATH THERMOCOUPLE, ROD 17, LEVEL E, SUPER LEVEL 3
TE-321E6	SHEATH THERMOCOUPLE, ROD 21, LEVEL E, SUPER LEVEL 6
TE-301E1	SHEATH THERMOCOUPLE, ROD 01, LEVEL E, SUPER LEVEL 1
TE-321E2	SHEATH THERMOCOUPLE, ROD 21, LEVEL E, SUPER LEVEL 2
TE-301E7	SHEATH THERMOCOUPLE, ROD 01, LEVEL E, SUPER LEVEL 7
LEVEL F	
TE-301AF	SHEATH THERMOCOUPLE, ROD 01, LEVEL F, ANGLE A

Table 1 (continued)

SENSOR		DESCRIPTION					
BUNDLE TEMPERATURE (CONT.)							
SHEATH THERMOCOUPLES (CONT.)							
LEVEL F (CONT.)							
TE-303BF	SHEATH THERMOCOUPLE,	ROD 03,	LEVEL F,	ANGLE B			
TE-304AF	SHEATH THERMOCOUPLE,	ROD 04,	LEVEL F,	ANGLE A			
TE-307AF	SHEATH THERMOCOUPLE,	ROD 07,	LEVEL F,	ANGLE A			
TE-307BF	SHEATH THERMOCOUPLE,	ROD 07,	LEVEL F,	ANGLE B			
TE-310AF	SHEATH THERMOCOUPLE,	ROD 10,	LEVEL F,	ANGLE A			
TE-310BF	SHEATH THERMOCOUPLE,	ROD 10,	LEVEL F,	ANGLE B			
TE-310CF	SHEATH THERMOCOUPLE,	ROD 10,	LEVEL F,	ANGLE C			
TE-313BF	SHEATH THERMOCOUPLE,	ROD 13,	LEVEL F,	ANGLE B			
TE-313CF	SHEATH THERMOCOUPLE,	ROD 13,	LEVEL F,	ANGLE C			
TE-314AF	SHEATH THERMOCOUPLE,	ROD 14,	LEVEL F,	ANGLE A			
TE-315AF	SHEATH THERMOCOUPLE,	ROD 15,	LEVEL F,	ANGLE A			
TE-316BF	SHEATH THERMOCOUPLE,	ROD 16,	LEVEL F,	ANGLE B			
TE-317AF	SHEATH THERMOCOUPLE,	ROD 17,	LEVEL F,	ANGLE A			
TE-318AF	SHEATH THERMOCOUPLE,	ROD 18,	LEVEL F,	ANGLE A			
TE-318CF	SHEATH THERMOCOUPLE,	ROD 18,	LEVEL F,	ANGLE C			
TE-320AF	SHEATH THERMOCOUPLE,	ROD 20,	LEVEL F,	ANGLE A			
TE-320BF	SHEATH THERMOCOUPLE,	ROD 20,	LEVEL F,	ANGLE B			
TE-320CF	SHEATH THERMOCOUPLE,	ROD 20,	LEVEL F,	ANGLE C			
TE-321AF	SHEATH THERMOCOUPLE,	ROD 21,	LEVEL F,	ANGLE A			
TE-328AF	SHEATH THERMOCOUPLE,	ROD 28,	LEVEL F,	ANGLE A			
TE-328BF	SHEATH THERMOCOUPLE,	ROD 28,	LEVEL F,	ANGLE B			
TE-328CF	SHEATH THERMOCOUPLE,	ROD 28,	LEVEL F,	ANGLE C			
TE-331BF	SHEATH THERMOCOUPLE,	ROD 31,	LEVEL F,	ANGLE B			
TE-331CF	SHEATH THERMOCOUPLE,	ROD 31,	LEVEL F,	ANGLE C			
TE-332CF	SHEATH THERMOCOUPLE,	ROD 32,	LEVEL F,	ANGLE C			
TE-334AF	SHEATH THERMOCOUPLE,	ROD 34,	LEVEL F,	ANGLE A			
TE-337AF	SHEATH THERMOCOUPLE,	ROD 37,	LEVEL F,	ANGLE A			
TE-338AF	SHEATH THERMOCOUPLE,	ROD 38,	LEVEL F,	ANGLE A			
TE-342BF	SHEATH THERMOCOUPLE,	ROD 42,	LEVEL F,	ANGLE B			
TE-345AF	SHEATH THERMOCOUPLE,	ROD 45,	LEVEL F,	ANGLE A			
TE-345BF	SHEATH THERMOCOUPLE,	ROD 45,	LEVEL F,	ANGLE B			
TE-345CF	SHEATH THERMOCOUPLE,	ROD 45,	LEVEL F,	ANGLE C			
TE-347CF	SHEATH THERMOCOUPLE,	ROD 47,	LEVEL F,	ANGLE C			
TE-353BF	SHEATH THERMOCOUPLE,	ROD 53,	LEVEL F,	ANGLE B			
TE-354AF	SHEATH THERMOCOUPLE,	ROD 54,	LEVEL F,	ANGLE A			
TE-358BF	SHEATH THERMOCOUPLE,	ROD 58,	LEVEL F,	ANGLE A			
TE-359AF	SHEATH THERMOCOUPLE,	ROD 59,	LEVEL F,	ANGLE A			
TE-359BF	SHEATH THERMOCOUPLE,	ROD 59,	LEVEL F,	ANGLE B			
TE-359CF	SHEATH THERMOCOUPLE,	ROD 59,	LEVEL F,	ANGLE C			
TE-360AF	SHEATH THERMOCOUPLE,	ROD 60,	LEVEL F,	ANGLE A			
TE-364AF	SHEATH THERMOCOUPLE,	ROD 64,	LEVEL F,	ANGLE A			
TE-364BF	SHEATH THERMOCOUPLE,	ROD 64,	LEVEL F,	ANGLE B			
TE-364CF	SHEATH THERMOCOUPLE,	ROD 64,	LEVEL F,	ANGLE C			
TE-354F8	SHEATH THERMOCOUPLE,	ROD 54,	LEVEL F,	SUPER LEVEL 8			
TE-354F7	SHEATH THERMOCOUPLE,	ROD 54,	LEVEL F,	SUPER LEVEL 7			

Table 1 (continued)

SENSOR	DESCRIPTION
BUNDLE TEMPERATURE (CONT.)	
SHEATH THERMOCOUPLES (CONT.)	
LEVEL F (CONT.)	
TE-354F6	SHEATH THERMOCOUPLE, ROD 54, LEVEL F, SUPER LEVEL 6
TE-354F5	SHEATH THERMOCOUPLE, ROD 54, LEVEL F, SUPER LEVEL 5
TE-354F1	SHEATH THERMOCOUPLE, ROD 54, LEVEL F, SUPER LEVEL 1
TE-338F1	SHEATH THERMOCOUPLE, ROD 38, LEVEL F, SUPER LEVEL 1
TE-337F8	SHEATH THERMOCOUPLE, ROD 37, LEVEL F, SUPER LEVEL 8
TE-337F7	SHEATH THERMOCOUPLE, ROD 37, LEVEL F, SUPER LEVEL 7
TE-337F6	SHEATH THERMOCOUPLE, ROD 37, LEVEL F, SUPER LEVEL 6
TE-334F7	SHEATH THERMOCOUPLE, ROD 34, LEVEL F, SUPER LEVEL 7
TE-334F6	SHEATH THERMOCOUPLE, ROD 34, LEVEL F, SUPER LEVEL 6
TE-334F3	SHEATH THERMOCOUPLE, ROD 34, LEVEL F, SUPER LEVEL 3
TE-360F6	SHEATH THERMOCOUPLE, ROD 60, LEVEL F, SUPER LEVEL 6
TE-360F5	SHEATH THERMOCOUPLE, ROD 60, LEVEL F, SUPER LEVEL 5
TE-360F4	SHEATH THERMOCOUPLE, ROD 60, LEVEL F, SUPER LEVEL 4
TE-338F2	SHEATH THERMOCOUPLE, ROD 38, LEVEL F, SUPER LEVEL 2
TE-338F6	SHEATH THERMOCOUPLE, ROD 38, LEVEL F, SUPER LEVEL 6
TE-338F7	SHEATH THERMOCOUPLE, ROD 38, LEVEL F, SUPER LEVEL 7
TE-338F3	SHEATH THERMOCOUPLE, ROD 38, LEVEL F, SUPER LEVEL 3
TE-350F6	SHEATH THERMOCOUPLE, ROD 50, LEVEL F, SUPER LEVEL 6
TE-350F2	SHEATH THERMOCOUPLE, ROD 50, LEVEL F, SUPER LEVEL 2
TE-350F1	SHEATH THERMOCOUPLE, ROD 50, LEVEL F, SUPER LEVEL 1
TE-321F7	SHEATH THERMOCOUPLE, ROD 21, LEVEL F, SUPER LEVEL 7
TE-321F6	SHEATH THERMOCOUPLE, ROD 21, LEVEL F, SUPER LEVEL 6
TE-321F4	SHEATH THERMOCOUPLE, ROD 21, LEVEL F, SUPER LEVEL 4
TE-321F3	SHEATH THERMOCOUPLE, ROD 21, LEVEL F, SUPER LEVEL 3
TE-314F2	SHEATH THERMOCOUPLE, ROD 14, LEVEL F, SUPER LEVEL 2
TE-314F8	SHEATH THERMOCOUPLE, ROD 14, LEVEL F, SUPER LEVEL 8
TE-314F7	SHEATH THERMOCOUPLE, ROD 14, LEVEL F, SUPER LEVEL 7
TE-317F2	SHEATH THERMOCOUPLE, ROD 17, LEVEL F, SUPER LEVEL 2
TE-317F8	SHEATH THERMOCOUPLE, ROD 17, LEVEL F, SUPER LEVEL 8
TE-317F7	SHEATH THERMOCOUPLE, ROD 17, LEVEL F, SUPER LEVEL 7
TE-317F6	SHEATH THERMOCOUPLE, ROD 17, LEVEL F, SUPER LEVEL 6
TE-317F3	SHEATH THERMOCOUPLE, ROD 17, LEVEL F, SUPER LEVEL 3
TE-301F1	SHEATH THERMOCOUPLE, ROD 01, LEVEL F, SUPER LEVEL 1
TE-301F6	SHEATH THERMOCOUPLE, ROD 01, LEVEL F, SUPER LEVEL 6
TE-301F3	SHEATH THERMOCOUPLE, ROD 01, LEVEL F, SUPER LEVEL 3
TE-301F2	SHEATH THERMOCOUPLE, ROD 01, LEVEL F, SUPER LEVEL 2
TE-354F4	SHEATH THERMOCOUPLE, ROD 54, LEVEL F, SUPER LEVEL 4
TE-354F3	SHEATH THERMOCOUPLE, ROD 54, LEVEL F, SUPER LEVEL 3
TE-334F8	SHEATH THERMOCOUPLE, ROD 34, LEVEL F, SUPER LEVEL 8
TE-334F2	SHEATH THERMOCOUPLE, ROD 34, LEVEL F, SUPER LEVEL 2
TE-334F1	SHEATH THERMOCOUPLE, ROD 34, LEVEL F, SUPER LEVEL 1
TE-360F8	SHEATH THERMOCOUPLE, ROD 60, LEVEL F, SUPER LEVEL 8
TE-360F7	SHEATH THERMOCOUPLE, ROD 60, LEVEL F, SUPER LEVEL 7
TE-360F3	SHEATH THERMOCOUPLE, ROD 60, LEVEL F, SUPER LEVEL 3
TE-350F8	SHEATH THERMOCOUPLE, ROD 50, LEVEL F, SUPER LEVEL 8

Table 1 (continued)

SENSOR	DESCRIPTION
BUNDLE TEMPERATURE (CONT.)	
SHEATH THERMOCOUPLES (CONT.)	
LEVEL F (CONT.)	
TE-321F1	SHEATH THERMOCOUPLE, ROD 21, LEVEL F, SUPER LEVEL 1
TE-350F7	SHEATH THERMOCOUPLE, ROD 50, LEVEL F, SUPER LEVEL 7
TE-350F3	SHEATH THERMOCOUPLE, ROD 50, LEVEL F, SUPER LEVEL 3
TE-337F1	SHEATH THERMOCOUPLE, ROD 37, LEVEL F, SUPER LEVEL 1
TE-314F6	SHEATH THERMOCOUPLE, ROD 14, LEVEL F, SUPER LEVEL 6
TE-314F3	SHEATH THERMOCOUPLE, ROD 14, LEVEL F, SUPER LEVEL 3
TE-338F8	SHEATH THERMOCOUPLE, ROD 38, LEVEL F, SUPER LEVEL 8
TE-317F1	SHEATH THERMOCOUPLE, ROD 17, LEVEL F, SUPER LEVEL 1
TE-321F8	SHEATH THERMOCOUPLE, ROD 21, LEVEL F, SUPER LEVEL 8
TE-321F5	SHEATH THERMOCOUPLE, ROD 21, LEVEL F, SUPER LEVEL 5
TE-301F7	SHEATH THERMOCOUPLE, ROD 01, LEVEL F, SUPER LEVEL 7
TE-301F8	SHEATH THERMOCOUPLE, ROD 01, LEVEL F, SUPER LEVEL 8
LEVEL G	
TE-301AG	SHEATH THERMOCOUPLE, ROD 01, LEVEL G, ANGLE A
TE-303CG	SHEATH THERMOCOUPLE, ROD 03, LEVEL G, ANGLE C
TE-314AG	SHEATH THERMOCOUPLE, ROD 14, LEVEL G, ANGLE A
TE-316BG	SHEATH THERMOCOUPLE, ROD 16, LEVEL G, ANGLE B
TE-316CG	SHEATH THERMOCOUPLE, ROD 16, LEVEL G, ANGLE C
TE-317AG	SHEATH THERMOCOUPLE, ROD 17, LEVEL G, ANGLE A
TE-318AG	SHEATH THERMOCOUPLE, ROD 18, LEVEL G, ANGLE A
TE-318BG	SHEATH THERMOCOUPLE, ROD 18, LEVEL G, ANGLE B
TE-318CG	SHEATH THERMOCOUPLE, ROD 18, LEVEL G, ANGLE C
TE-320AG	SHEATH THERMOCOUPLE, ROD 20, LEVEL G, ANGLE A
TE-320BG	SHEATH THERMOCOUPLE, ROD 20, LEVEL G, ANGLE B
TE-320CG	SHEATH THERMOCOUPLE, ROD 20, LEVEL G, ANGLE C
TE-321AG	SHEATH THERMOCOUPLE, ROD 21, LEVEL G, ANGLE A
TE-332CG	SHEATH THERMOCOUPLE, ROD 32, LEVEL G, ANGLE C
TE-334AG	SHEATH THERMOCOUPLE, ROD 34, LEVEL G, ANGLE A
TE-337AG	SHEATH THERMOCOUPLE, ROD 37, LEVEL G, ANGLE A
TE-338AG	SHEATH THERMOCOUPLE, ROD 38, LEVEL G, ANGLE A
TE-342BG	SHEATH THERMOCOUPLE, ROD 42, LEVEL G, ANGLE B
TE-342CG	SHEATH THERMOCOUPLE, ROD 42, LEVEL G, ANGLE C
TE-345AG	SHEATH THERMOCOUPLE, ROD 45, LEVEL G, ANGLE A
TE-345BG	SHEATH THERMOCOUPLE, ROD 45, LEVEL G, ANGLE B
TE-345CG	SHEATH THERMOCOUPLE, ROD 45, LEVEL G, ANGLE C
TE-347CG	SHEATH THERMOCOUPLE, ROD 47, LEVEL G, ANGLE C
TE-350AG	SHEATH THERMOCOUPLE, ROD 50, LEVEL G, ANGLE A
TE-354AG	SHEATH THERMOCOUPLE, ROD 54, LEVEL G, ANGLE A
TE-358CG	SHEATH THERMOCOUPLE, ROD 58, LEVEL G, ANGLE C
TE-360AG	SHEATH THERMOCOUPLE, ROD 60, LEVEL G, ANGLE A
TE-364AG	SHEATH THERMOCOUPLE, ROD 64, LEVEL G, ANGLE A
TE-364CG	SHEATH THERMOCOUPLE, ROD 64, LEVEL G, ANGLE C

LEVEL J

Table 1 (continued)

SENSOR	DESCRIPTION
BUNDLE TEMPERATURE (CONT.)	
SHEATH THERMOCOUPLES (CONT.)	
LEVEL J (CONT.)	
TE-361CJ	SHEATH THERMOCOUPLE, ROD 61, LEVEL J, ANGLE C
TE-361BJ	SHEATH THERMOCOUPLE, ROD 61, LEVEL J, ANGLE B
MIDDLE THERMOCOUPLES	
LEVEL A	
TE-306MA	MIDDLE THERMOCOUPLE, ROD 06, LEVEL A
TE-311MA	MIDDLE THERMOCOUPLE, ROD 11, LEVEL A
TE-325MA	MIDDLE THERMOCOUPLE, ROD 25, LEVEL A
TE-340MA	MIDDLE THERMOCOUPLE, ROD 40, LEVEL A
TE-341MA	MIDDLE THERMOCOUPLE, ROD 41, LEVEL A
TE-355MA	MIDDLE THERMOCOUPLE, ROD 55, LEVEL A
TE-357MA	MIDDLE THERMOCOUPLE, ROD 57, LEVEL A
LEVEL B	
TE-302MB	MIDDLE THERMOCOUPLE, ROD 02, LEVEL B
TE-308MB	MIDDLE THERMOCOUPLE, ROD 08, LEVEL B
TE-309MB	MIDDLE THERMOCOUPLE, ROD 09, LEVEL B
TE-312MB	MIDDLE THERMOCOUPLE, ROD 12, LEVEL B
TE-325MB	MIDDLE THERMOCOUPLE, ROD 25, LEVEL B
TE-327MB	MIDDLE THERMOCOUPLE, ROD 27, LEVEL B
TE-329MB	MIDDLE THERMOCOUPLE, ROD 29, LEVEL B
TE-330MB	MIDDLE THERMOCOUPLE, ROD 30, LEVEL B
TE-335MB	MIDDLE THERMOCOUPLE, ROD 35, LEVEL B
TE-339MB	MIDDLE THERMOCOUPLE, ROD 39, LEVEL B
TE-340MB	MIDDLE THERMOCOUPLE, ROD 40, LEVEL B
TE-341MB	MIDDLE THERMOCOUPLE, ROD 41, LEVEL B
TE-344MB	MIDDLE THERMOCOUPLE, ROD 44, LEVEL B
TE-349MB	MIDDLE THERMOCOUPLE, ROD 49, LEVEL B
TE-355MB	MIDDLE THERMOCOUPLE, ROD 55, LEVEL B
TE-357MB	MIDDLE THERMOCOUPLE, ROD 57, LEVEL B
TE-361MB	MIDDLE THERMOCOUPLE, ROD 61, LEVEL B
TE-363MB	MIDDLE THERMOCOUPLE, ROD 63, LEVEL B
LEVEL C	
TE-302MC	MIDDLE THERMOCOUPLE, ROD 02, LEVEL C
TE-304MC	MIDDLE THERMOCOUPLE, ROD 04, LEVEL C
TE-306MC	MIDDLE THERMOCOUPLE, ROD 06, LEVEL C
TE-307MC	MIDDLE THERMOCOUPLE, ROD 07, LEVEL C
TE-308MC	MIDDLE THERMOCOUPLE, ROD 08, LEVEL C
TE-309MC	MIDDLE THERMOCOUPLE, ROD 09, LEVEL C
TE-310MC	MIDDLE THERMOCOUPLE, ROD 10, LEVEL C
TE-311MC	MIDDLE THERMOCOUPLE, ROD 11, LEVEL C
TE-312MC	MIDDLE THERMOCOUPLE, ROD 12, LEVEL C
TE-315MC	MIDDLE THERMOCOUPLE, ROD 15, LEVEL C

Table 1 (continued)

SENSOR	DESCRIPTION
BUNDLE TEMPERATURE (CONT.)	
MIDDLE THERMOCOUPLES (CONT.)	
LEVEL C (CONT.)	
TE-324MC	MIDDLE THERMOCOUPLE, ROD 24, LEVEL C
TE-325MC	MIDDLE THERMOCOUPLE, ROD 25, LEVEL C
TE-326MC	MIDDLE THERMOCOUPLE, ROD 26, LEVEL C
TE-328MC	MIDDLE THERMOCOUPLE, ROD 28, LEVEL C
TE-329MC	MIDDLE THERMOCOUPLE, ROD 29, LEVEL C
TE-330MC	MIDDLE THERMOCOUPLE, ROD 30, LEVEL C
TE-333MC	MIDDLE THERMOCOUPLE, ROD 33, LEVEL C
TE-335MC	MIDDLE THERMOCOUPLE, ROD 35, LEVEL C
TE-339MC	MIDDLE THERMOCOUPLE, ROD 39, LEVEL C
TE-340MC	MIDDLE THERMOCOUPLE, ROD 40, LEVEL C
TE-341MC	MIDDLE THERMOCOUPLE, ROD 41, LEVEL C
TE-344MC	MIDDLE THERMOCOUPLE, ROD 44, LEVEL C
TE-349MC	MIDDLE THERMOCOUPLE, ROD 49, LEVEL C
TE-351MC	MIDDLE THERMOCOUPLE, ROD 51, LEVEL C
TE-353MC	MIDDLE THERMOCOUPLE, ROD 53, LEVEL C
TE-355MC	MIDDLE THERMOCOUPLE, ROD 55, LEVEL C
TE-357MC	MIDDLE THERMOCOUPLE, ROD 57, LEVEL C
TE-359MC	MIDDLE THERMOCOUPLE, ROD 59, LEVEL C
TE-361MC	MIDDLE THERMOCOUPLE, ROD 61, LEVEL C
TE-363MC	MIDDLE THERMOCOUPLE, ROD 63, LEVEL C
LEVEL U	
TE-305MU	MIDDLE THERMOCOUPLE, ROD 05, LEVEL U
TE-348MU	MIDDLE THERMOCOUPLE, ROD 48, LEVEL U
TE-352MU	MIDDLE THERMOCOUPLE, ROD 52, LEVEL U
LEVEL H	
TE-305MH	MIDDLE THERMOCOUPLE, ROD 05, LEVEL H
TE-348MH	MIDDLE THERMOCOUPLE, ROD 48, LEVEL H
TE-352MH	MIDDLE THERMOCOUPLE, ROD 52, LEVEL H
TE-356MH	MIDDLE THERMOCOUPLE, ROD 56, LEVEL H
LEVEL S	
TE-305MS	MIDDLE THERMOCOUPLE, ROD 05, LEVEL S
TE-348MS	MIDDLE THERMOCOUPLE, ROD 48, LEVEL S
TE-352MS	MIDDLE THERMOCOUPLE, ROD 52, LEVEL S
TE-356MS	MIDDLE THERMOCOUPLE, ROD 56, LEVEL S
LEVEL Y	
TE-305MY	MIDDLE THERMOCOUPLE, ROD 05, LEVEL Y
TE-348MY	MIDDLE THERMOCOUPLE, ROD 48, LEVEL Y
TE-352MY	MIDDLE THERMOCOUPLE, ROD 52, LEVEL Y
LEVEL D	
TE-302MD	MIDDLE THERMOCOUPLE, ROD 02, LEVEL D

Table 1 (continued)

SENSOR	DESCRIPTION
BUNDLE TEMPERATURE (CONT.)	
MIDDLE THERMOCOUPLES (CONT.)	
LEVEL D (CONT.)	
TE-303MD	MIDDLE THERMOCOUPLE, ROD 03, LEVEL D
TE-304MD	MIDDLE THERMOCOUPLE, ROD 04, LEVEL D
TE-306MD	MIDDLE THERMOCOUPLE, ROD 06, LEVEL D
TE-307MD	MIDDLE THERMOCOUPLE, ROD 07, LEVEL D
TE-308MD	MIDDLE THERMOCOUPLE, ROD 08, LEVEL D
TE-310MD	MIDDLE THERMOCOUPLE, ROD 10, LEVEL D
TE-311MD	MIDDLE THERMOCOUPLE, ROD 11, LEVEL D
TE-312MD	MIDDLE THERMOCOUPLE, ROD 12, LEVEL D
TE-315MD	MIDDLE THERMOCOUPLE, ROD 15, LEVEL D
TE-316MD	MIDDLE THERMOCOUPLE, ROD 16, LEVEL D
TE-318MD	MIDDLE THERMOCOUPLE, ROD 18, LEVEL D
TE-320MD	MIDDLE THERMOCOUPLE, ROD 20, LEVEL D
TE-324MD	MIDDLE THERMOCOUPLE, ROD 24, LEVEL D
TE-325MD	MIDDLE THERMOCOUPLE, ROD 25, LEVEL D
TE-326MD	MIDDLE THERMOCOUPLE, ROD 26, LEVEL D
TE-328MD	MIDDLE THERMOCOUPLE, ROD 28, LEVEL D
TE-329MD	MIDDLE THERMOCOUPLE, ROD 29, LEVEL D
TE-335MD	MIDDLE THERMOCOUPLE, ROD 35, LEVEL D
TE-339MD	MIDDLE THERMOCOUPLE, ROD 39, LEVEL D
TE-341MD	MIDDLE THERMOCOUPLE, ROD 41, LEVEL D
TE-345MD	MIDDLE THERMOCOUPLE, ROD 45, LEVEL D
TE-347MD	MIDDLE THERMOCOUPLE, ROD 47, LEVEL D
TE-349MD	MIDDLE THERMOCOUPLE, ROD 49, LEVEL D
TE-353MD	MIDDLE THERMOCOUPLE, ROD 53, LEVEL D
TE-355MD	MIDDLE THERMOCOUPLE, ROD 55, LEVEL D
TE-357MD	MIDDLE THERMOCOUPLE, ROD 57, LEVEL D
TE-358MD	MIDDLE THERMOCOUPLE, ROD 58, LEVEL D
TE-361MD	MIDDLE THERMOCOUPLE, ROD 61, LEVEL D
TE-363MD	MIDDLE THERMOCOUPLE, ROD 63, LEVEL D
TE-364MD	MIDDLE THERMOCOUPLE, ROD 64, LEVEL D
LEVEL E	
TE-303ME	MIDDLE THERMOCOUPLE, ROD 03, LEVEL E
TE-304ME	MIDDLE THERMOCOUPLE, ROD 04, LEVEL E
TE-307ME	MIDDLE THERMOCOUPLE, ROD 07, LEVEL E
TE-310ME	MIDDLE THERMOCOUPLE, ROD 10, LEVEL E
TE-312ME	MIDDLE THERMOCOUPLE, ROD 12, LEVEL E
TE-315ME	MIDDLE THERMOCOUPLE, ROD 15, LEVEL E
TE-316ME	MIDDLE THERMOCOUPLE, ROD 16, LEVEL E
TE-318ME	MIDDLE THERMOCOUPLE, ROD 18, LEVEL E
TE-324ME	MIDDLE THERMOCOUPLE, ROD 24, LEVEL E
TE-326ME	MIDDLE THERMOCOUPLE, ROD 26, LEVEL E
TE-328ME	MIDDLE THERMOCOUPLE, ROD 28, LEVEL E
TE-329ME	MIDDLE THERMOCOUPLE, ROD 29, LEVEL E
TE-330ME	MIDDLE THERMOCOUPLE, ROD 30, LEVEL E

Table 1 (continued)

SENSOR	DESCRIPTION				
BUNDLE TEMPERATURE (CONT.)					
MIDDLE THERMOCOUPLES (CONT.)					
LEVEL E (CONT.)					
TE-335ME	MIDDLE THERMOCOUPLE,	ROD 35,	LEVEL E		
TE-339ME	MIDDLE THERMOCOUPLE,	ROD 39,	LEVEL E		
TE-344ME	MIDDLE THERMOCOUPLE,	ROD 44,	LEVEL E		
TE-345ME	MIDDLE THERMOCOUPLE,	ROD 45,	LEVEL E		
TE-347ME	MIDDLE THERMOCOUPLE,	ROD 47,	LEVEL E		
TE-349ME	MIDDLE THERMOCOUPLE,	ROD 49,	LEVEL E		
TE-353ME	MIDDLE THERMOCOUPLE,	ROD 53,	LEVEL E		
TE-358ME	MIDDLE THERMOCOUPLE,	ROD 58,	LEVEL E		
TE-359ME	MIDDLE THERMOCOUPLE,	ROD 59,	LEVEL E		
TE-363ME	MIDDLE THERMOCOUPLE,	ROD 63,	LEVEL E		
LEVEL F					
TE-301MF	MIDDLE THERMOCOUPLE,	ROD 01,	LEVEL F		
TE-303MF	MIDDLE THERMOCOUPLE,	ROD 03,	LEVEL F		
TE-304MF	MIDDLE THERMOCOUPLE,	ROD 04,	LEVEL F		
TE-307MF	MIDDLE THERMOCOUPLE,	ROD 07,	LEVEL F		
TE-314MF	MIDDLE THERMOCOUPLE,	ROD 14,	LEVEL F		
TE-315MF	MIDDLE THERMOCOUPLE,	ROD 15,	LEVEL F		
TE-316MF	MIDDLE THERMOCOUPLE,	ROD 16,	LEVEL F		
TE-317MF	MIDDLE THERMOCOUPLE,	ROD 17,	LEVEL F		
TE-318MF	MIDDLE THERMOCOUPLE,	ROD 18,	LEVEL F		
TE-321MF	MIDDLE THERMOCOUPLE,	ROD 21,	LEVEL F		
TE-328MF	MIDDLE THERMOCOUPLE,	ROD 28,	LEVEL F		
TE-331MF	MIDDLE THERMOCOUPLE,	ROD 31,	LEVEL F		
TE-334MF	MIDDLE THERMOCOUPLE,	ROD 34,	LEVEL F		
TE-337MF	MIDDLE THERMOCOUPLE,	ROD 37,	LEVEL F		
TE-338MF	MIDDLE THERMOCOUPLE,	ROD 38,	LEVEL F		
TE-347MF	MIDDLE THERMOCOUPLE,	ROD 47,	LEVEL F		
TE-350MF	MIDDLE THERMOCOUPLE,	ROD 50,	LEVEL F		
TE-354MF	MIDDLE THERMOCOUPLE,	ROD 54,	LEVEL F		
TE-358MF	MIDDLE THERMOCOUPLE,	ROD 58,	LEVEL F		
TE-359MF	MIDDLE THERMOCOUPLE,	ROD 59,	LEVEL F		
TE-360MF	MIDDLE THERMOCOUPLE,	ROD 60,	LEVEL F		
TE-364MF	MIDDLE THERMOCOUPLE,	ROD 64,	LEVEL F		
TE-301M8	MIDDLE THERMOCOUPLE,	ROD 01,	LEVEL F,	SUPER LEVEL 8	
TE-317M6	MIDDLE THERMOCOUPLE,	ROD 17,	LEVEL F,	SUPER LEVEL 6	
TE-321M3	MIDDLE THERMOCOUPLE,	ROD 21,	LEVEL F,	SUPER LEVEL 3	
TE-321M1	MIDDLE THERMOCOUPLE,	ROD 21,	LEVEL F,	SUPER LEVEL 1	
TE-337M7	MIDDLE THERMOCOUPLE,	ROD 37,	LEVEL F,	SUPER LEVEL 7	
TE-337M6	MIDDLE THERMOCOUPLE,	ROD 37,	LEVEL F,	SUPER LEVEL 6	
TE-338M8	MIDDLE THERMOCOUPLE,	ROD 38,	LEVEL F,	SUPER LEVEL 8	
TE-338M2	MIDDLE THERMOCOUPLE,	ROD 38,	LEVEL F,	SUPER LEVEL 2	
TE-354M6	MIDDLE THERMOCOUPLE,	ROD 54,	LEVEL F,	SUPER LEVEL 6	
TE-354M5	MIDDLE THERMOCOUPLE,	ROD 54,	LEVEL F,	SUPER LEVEL 5	
TE-360M3	MIDDLE THERMOCOUPLE,	ROD 60,	LEVEL F,	SUPER LEVEL 3	

Table 1 (continued)

SENSOR	DESCRIPTION
BUNDLE TEMPERATURE (CONT.)	
MIDDLE THERMOCOUPLES (CONT.)	
LEVEL F (CONT.)	
TE-314M8	MIDDLE THERMOCOUPLE, ROD 14, LEVEL F, SUPER LEVEL 8
TE-314M2	MIDDLE THERMOCOUPLE, ROD 14, LEVEL F, SUPER LEVEL 2
TE-301M2	MIDDLE THERMOCOUPLE, ROD 01, LEVEL F, SUPER LEVEL 2
TE-317M7	MIDDLE THERMOCOUPLE, ROD 17, LEVEL F, SUPER LEVEL 7
TE-334M6	MIDDLE THERMOCOUPLE, ROD 34, LEVEL F, SUPER LEVEL 6
TE-350M7	MIDDLE THERMOCOUPLE, ROD 50, LEVEL F, SUPER LEVEL 7
TE-350M6	MIDDLE THERMOCOUPLE, ROD 50, LEVEL F, SUPER LEVEL 6
LEVEL G	
TE-301MG	MIDDLE THERMOCOUPLE, ROD 01, LEVEL G
TE-303MG	MIDDLE THERMOCOUPLE, ROD 03, LEVEL G
TE-314MG	MIDDLE THERMOCOUPLE, ROD 14, LEVEL G
TE-316MG	MIDDLE THERMOCOUPLE, ROD 16, LEVEL G
TE-317MG	MIDDLE THERMOCOUPLE, ROD 17, LEVEL G
TE-320MG	MIDDLE THERMOCOUPLE, ROD 20, LEVEL G
TE-321MG	MIDDLE THERMOCOUPLE, ROD 21, LEVEL G
TE-337MG	MIDDLE THERMOCOUPLE, ROD 37, LEVEL G
TE-338MG	MIDDLE THERMOCOUPLE, ROD 38, LEVEL G
TE-345MG	MIDDLE THERMOCOUPLE, ROD 45, LEVEL G
TE-347MG	MIDDLE THERMOCOUPLE, ROD 47, LEVEL G
TE-354MG	MIDDLE THERMOCOUPLE, ROD 54, LEVEL G
TE-358MG	MIDDLE THERMOCOUPLE, ROD 58, LEVEL G
TE-360MG	MIDDLE THERMOCOUPLE, ROD 60, LEVEL G
TE-364MG	MIDDLE THERMOCOUPLE, ROD 64, LEVEL G
SHROUD BOX THERMOCOUPLES	
LEVEL A	
TE-181W	SHROUD BOX THERMOCOUPLE, LEVEL A WEST SIDE
LEVEL B	
TE-182E	SHROUD BOX THERMOCOUPLE, LEVEL B EAST SIDE
LEVEL C	
TE-183N	SHROUD BOX THERMOCOUPLE, LEVEL C NORTH SIDE
TE-183W	SHROUD BOX THERMOCOUPLE, LEVEL C WEST SIDE
LEVEL D	
TE-184E	SHROUD BOX THERMOCOUPLE, LEVEL D EAST SIDE
TE-184S	SHROUD BOX THERMOCOUPLE, LEVEL D SOUTH SIDE
LEVEL E	
TE-185W	SHROUD BOX THERMOCOUPLE, LEVEL E WEST SIDE
LEVEL F	

Table 1 (continued)

SENSOR	DESCRIPTION
BUNDLE TEMPERATURE (CONT.)	
SHROUD BOX THERMOCOUPLES (CONT.)	
LEVEL F (CONT.)	
TE-186S	SHROUD BOX THERMOCOUPLE, LEVEL F SOUTH SIDE
LEVEL G	
TE-187N	SHROUD BOX THERMOCOUPLE, LEVEL G NORTH SIDE
TE-187W	SHROUD BOX THERMOCOUPLE, LEVEL G WEST SIDE
TE-186E	SHROUD BOX THERMOCOUPLE, LEVEL G EAST SIDE
LEVEL 0	
TE-270AE	SHROUD BOX THERMOCOUPLE, LEVEL 0, PENETRATION A, EAST SIDE
TE-270BE	SHROUD BOX THERMOCOUPLE, LEVEL 0, PENETRATION B, EAST SIDE
LEVEL 1	
TE-271AE	SHROUD BOX THERMOCOUPLE, LEVEL 1, PENETRATION A, EAST SIDE
TE-271BE	SHROUD BOX THERMOCOUPLE, LEVEL 1, PENETRATION B, EAST SIDE
LEVEL 2	
TE-272AE	SHROUD BOX THERMOCOUPLE, LEVEL 2, PENETRATION A, EAST SIDE
TE-272BE	SHROUD BOX THERMOCOUPLE, LEVEL 2, PENETRATION B, EAST SIDE
TE-272AS	SHROUD BOX THERMOCOUPLE, LEVEL 2, PENETRATION A, SOUTH SIDE
TE-272BS	SHROUD BOX THERMOCOUPLE, LEVEL 2, PENETRATION B, SOUTH SIDE
LEVEL 3	
TE-273AE	SHROUD BOX THERMOCOUPLE, LEVEL 3, PENETRATION A, EAST SIDE
TE-273BE	SHROUD BOX THERMOCOUPLE, LEVEL 3, PENETRATION B, EAST SIDE
LEVEL 5	
TE-275AE	SHROUD BOX THERMOCOUPLE, LEVEL 5, PENETRATION A, EAST SIDE
TE-275AS	SHROUD BOX THERMOCOUPLE, LEVEL 5, PENETRATION A, SOUTH SIDE
TE-275BS	SHROUD BOX THERMOCOUPLE, LEVEL 5, PENETRATION B, SOUTH SIDE
LEVEL 6	
TE-276AE	SHROUD BOX THERMOCOUPLE, LEVEL 6, PENETRATION A, EAST SIDE
TE-276BE	SHROUD BOX THERMOCOUPLE, LEVEL 6, PENETRATION B, EAST SIDE
LEVEL 7	
TE-277AE	SHROUD BOX THERMOCOUPLE, LEVEL 7, PENETRATION A, EAST SIDE
TE-277BE	SHROUD BOX THERMOCOUPLE, LEVEL 7, PENETRATION B, EAST SIDE
LEVEL 8	
TE-278AE	SHROUD BOX THERMOCOUPLE, LEVEL 8, PENETRATION A, EAST SIDE
TE-278BE	SHROUD BOX THERMOCOUPLE, LEVEL 8, PENETRATION B, EAST SIDE
LEVEL 9	
TE-279AE	SHROUD BOX THERMOCOUPLE, LEVEL 9, PENETRATION A, EAST SIDE
TE-279BE	SHROUD BOX THERMOCOUPLE, LEVEL 9, PENETRATION B, EAST SIDE

Table 1 (continued)

SENSOR	DESCRIPTION
BUNDLE TEMPERATURE (CONT.)	
SHROUD BOX THERMOCOUPLES (CONT.)	
LEVEL 9 (CONT.)	
TE-279AS	SHROUD BOX THERMOCOUPLE, LEVEL 9, PENETRATION A, SOUTH SIDE
TE-279BS	SHROUD BOX THERMOCOUPLE, LEVEL 9, PENETRATION B, SOUTH SIDE
THERMOCOUPLE ARRAY ROD	
LEVEL D	
TE-188AD	ARRAY ROD THERMOCOUPLE GRID NUMBER 19 SUBCHANNEL 22 LEVEL D
TE-189AD	ARRAY ROD THERMOCOUPLE GRID NUMBER 22 SUBCHANNEL 25 LEVEL D
TE-189BD	ARRAY ROD THERMOCOUPLE GRID NUMBER 22 SUBCHANNEL 33 LEVEL D
LEVEL E	
TE-188AE	ARRAY ROD THERMOCOUPLE GRID NUMBER 19 SUBCHANNEL 22 LEVEL E
TE-188BE	ARRAY ROD THERMOCOUPLE GRID NUMBER 19 SUBCHANNEL 30 LEVEL E
TE-189AE	ARRAY ROD THERMOCOUPLE GRID NUMBER 22 SUBCHANNEL 25 LEVEL E
TE-189BE	ARRAY ROD THERMOCOUPLE GRID NUMBER 22 SUBCHANNEL 33 LEVEL E
LEVEL F	
TE-188AF	ARRAY ROD THERMOCOUPLE GRID NUMBER 19 SUBCHANNEL 22 LEVEL F
TE-188BF	ARRAY ROD THERMOCOUPLE GRID NUMBER 19 SUBCHANNEL 30 LEVEL F
TE-189AF	ARRAY ROD THERMOCOUPLE GRID NUMBER 22 SUBCHANNEL 25 LEVEL F
TE-189BF	ARRAY ROD THERMOCOUPLE GRID NUMBER 22 SUBCHANNEL 33 LEVEL F
LEVEL G	
TE-188AG	ARRAY ROD THERMOCOUPLE GRID NUMBER 19 SUBCHANNEL 22 LEVEL G
TE-188BG	ARRAY ROD THERMOCOUPLE GRID NUMBER 19 SUBCHANNEL 30 LEVEL G
TE-189AG	ARRAY ROD THERMOCOUPLE GRID NUMBER 22 SUBCHANNEL 25 LEVEL G
TE-189BG	ARRAY ROD THERMOCOUPLE GRID NUMBER 22 SUBCHANNEL 33 LEVEL G
SPACER GRID THERMOCOUPLES	
GRID NO. 2	
TE-291A	SPACER GRID NUMBER 2 THERMOCOUPLE SUBCHANNEL 32
TE-291B	SPACER GRID NUMBER 2 THERMOCOUPLE SUBCHANNEL 43
TE-291C	SPACER GRID NUMBER 2 THERMOCOUPLE SUBCHANNEL 57
TE-291D	SPACER GRID NUMBER 2 THERMOCOUPLE SUBCHANNEL 70
GRID NO. 3	
TE-292A	SPACER GRID NUMBER 3 THERMOCOUPLE SUBCHANNEL 32
TE-292B	SPACER GRID NUMBER 3 THERMOCOUPLE SUBCHANNEL 43
TE-292D	SPACER GRID NUMBER 3 THERMOCOUPLE SUBCHANNEL 70
GRID NO. 4	
TE-293A	SPACER GRID NUMBER 4 THERMOCOUPLE SUBCHANNEL 32
TE-293B	SPACER GRID NUMBER 4 THERMOCOUPLE SUBCHANNEL 43
TE-293C	SPACER GRID NUMBER 4 THERMOCOUPLE SUBCHANNEL 57

Table 1 (continued)

SENSOR	DESCRIPTION
BUNDLE TEMPERATURE (CONT.)	
SPACER GRID THERMOCOUPLES (CONT.)	
GRID NO. 4 (CONT.)	
TE-293D	SPACER GRID NUMBER 4 THERMOCOUPLE SUBCHANNEL 70
TE-293E	SPACER GRID NUMBER 4 THERMOCOUPLE SUBCHANNEL 17
TE-293F	SPACER GRID NUMBER 4 THERMOCOUPLE SUBCHANNEL 38
GRID NO. 5	
TE-294B	SPACER GRID NUMBER 5 THERMOCOUPLE SUBCHANNEL 43
TE-294D	SPACER GRID NUMBER 5 THERMOCOUPLE SUBCHANNEL 70
TE-294E	SPACER GRID NUMBER 5 THERMOCOUPLE SUBCHANNEL 17
TE-294F	SPACER GRID NUMBER 5 THERMOCOUPLE SUBCHANNEL 38
GRID NO. 6	
TE-295A	SPACER GRID NUMBER 6 THERMOCOUPLE SUBCHANNEL 32
TE-295B	SPACER GRID NUMBER 6 THERMOCOUPLE SUBCHANNEL 43
TE-295C	SPACER GRID NUMBER 6 THERMOCOUPLE SUBCHANNEL 57
TE-295D	SPACER GRID NUMBER 6 THERMOCOUPLE SUBCHANNEL 70
GRID NO. 7	
TE-296B	SPACER GRID NUMBER 7 THERMOCOUPLE SUBCHANNEL 43
TE-296D	SPACER GRID NUMBER 7 THERMOCOUPLE SUBCHANNEL 70
SUBCHANNEL THERMOCOUPLES	
TE-1201	SUBCHANNEL NUMBER 1 THERMOCOUPLE
TE-1205	SUBCHANNEL NUMBER 5 THERMOCOUPLE
TE-1207	SUBCHANNEL NUMBER 7 THERMOCOUPLE
TE-1209	SUBCHANNEL NUMBER 9 THERMOCOUPLE
TE-1211	SUBCHANNEL NUMBER 11 THERMOCOUPLE
TE-1213	SUBCHANNEL NUMBER 13 THERMOCOUPLE
TE-1214	SUBCHANNEL NUMBER 14 THERMOCOUPLE
TE-1216	SUBCHANNEL NUMBER 16 THERMOCOUPLE
TE-1217	SUBCHANNEL NUMBER 17 THERMOCOUPLE
TE-1219	SUBCHANNEL NUMBER 19 THERMOCOUPLE
TE-1220	SUBCHANNEL NUMBER 20 THERMOCOUPLE
TE-1221	SUBCHANNEL NUMBER 21 THERMOCOUPLE
TE-1223	SUBCHANNEL NUMBER 23 THERMOCOUPLE
TE-1225	SUBCHANNEL NUMBER 25 THERMOCOUPLE
TE-1226	SUBCHANNEL NUMBER 26 THERMOCOUPLE
TE-1227	SUBCHANNEL NUMBER 27 THERMOCOUPLE
TE-1229	SUBCHANNEL NUMBER 29 THERMOCOUPLE
TE-1230	SUBCHANNEL NUMBER 30 THERMOCOUPLE
TE-1231	SUBCHANNEL NUMBER 31 THERMOCOUPLE
TE-1232	SUBCHANNEL NUMBER 32 THERMOCOUPLE
TE-1234	SUBCHANNEL NUMBER 34 THERMOCOUPLE
TE-1235	SUBCHANNEL NUMBER 35 THERMOCOUPLE
TE-1237	SUBCHANNEL NUMBER 37 THERMOCOUPLE
TE-1238	SUBCHANNEL NUMBER 38 THERMOCOUPLE

Table 1 (continued)

SENSOR	DESCRIPTION
BUNDLE TEMPERATURE (CONT.)	
SUBCHANNEL THERMOCOUPLES (CONT.)	
TE-1239	SUBCHANNEL NUMBER 39 THERMOCOUPLE
TE-1240	SUBCHANNEL NUMBER 40 THERMOCOUPLE
TE-1241	SUBCHANNEL NUMBER 41 THERMOCOUPLE
TE-1242	SUBCHANNEL NUMBER 42 THERMOCOUPLE
TE-1244	SUBCHANNEL NUMBER 44 THERMOCOUPLE
TE-1245	SUBCHANNEL NUMBER 45 THERMOCOUPLE
TE-1247	SUBCHANNEL NUMBER 47 THERMOCOUPLE
TE-1248	SUBCHANNEL NUMBER 48 THERMOCOUPLE
TE-1249	SUBCHANNEL NUMBER 49 THERMOCOUPLE
TE-1250	SUBCHANNEL NUMBER 50 THERMOCOUPLE
TE-1251	SUBCHANNEL NUMBER 51 THERMOCOUPLE
TE-1252	SUBCHANNEL NUMBER 52 THERMOCOUPLE
TE-1255	SUBCHANNEL NUMBER 55 THERMOCOUPLE
TE-1256	SUBCHANNEL NUMBER 56 THERMOCOUPLE
TE-1258	SUBCHANNEL NUMBER 58 THERMOCOUPLE
TE-1259	SUBCHANNEL NUMBER 59 THERMOCOUPLE
TE-1260	SUBCHANNEL NUMBER 60 THERMOCOUPLE
TE-1261	SUBCHANNEL NUMBER 61 THERMOCOUPLE
TE-1263	SUBCHANNEL NUMBER 63 THERMOCOUPLE
TE-1265	SUBCHANNEL NUMBER 65 THERMOCOUPLE
TE-1266	SUBCHANNEL NUMBER 66 THERMOCOUPLE
TE-1268	SUBCHANNEL NUMBER 68 THERMOCOUPLE
TE-1269	SUBCHANNEL NUMBER 69 THERMOCOUPLE
TE-1270	SUBCHANNEL NUMBER 70 THERMOCOUPLE
TE-1271	SUBCHANNEL NUMBER 71 THERMOCOUPLE
TE-1273	SUBCHANNEL NUMBER 73 THERMOCOUPLE
TE-1275	SUBCHANNEL NUMBER 75 THERMOCOUPLE
TE-1277	SUBCHANNEL NUMBER 77 THERMOCOUPLE
TE-1279	SUBCHANNEL NUMBER 79 THERMOCOUPLE
TE-1281	SUBCHANNEL NUMBER 81 THERMOCOUPLE
SPOOL PIECE INSTRUMENTS	
TEMPERATURE	
TE-172	VERTICAL INLET SPOOL TEMPERATURE
TE-208	BUNDLE OUTLET SPOOL TEMPERATURE
TE-24	HORIZONTAL INLET SPOOL TEMPERATURE
TE-222	VERTICAL OUTLET SPOOL TEMPERATURE
TE-40	HORIZONTAL OUTLET SPOOL TEMPERATURE
PRESSURE	
PE-26	HORIZONTAL INLET SPOOL TRANSIENT PRESSURE
PE-42	HORIZONTAL OUTLET SPOOL TRANSIENT PRESSURE
PE-174	VERTICAL INLET SPOOL TRANSIENT PRESSURE
PE-224	VERTICAL OUTLET SPOOL TRANSIENT PRESSURE

Table 1 (continued)

SENSOR	DESCRIPTION
SPOOL PIECE INSTRUMENTS (CONT.)	
PRESSURE (CONT.)	
PE-209	BUNDLE OUTLET SPOOL TRANSIENT PRESSURE
PE-258	BUNDLE INLET UPPER SPOOL PRESSURE
PRESSURE DROP	
PDE-21	HORIZONTAL INLET SPOOL TRANSIENT DIFFERENTIAL PRESSURE
PDE-35	HORIZONTAL OUTLET SPOOL TRANSIENT DIFFERENTIAL PRESSURE
PDE-217	VERTICAL OUTLET SPOOL TRANSIENT DIFFERENTIAL PRESSURE
PDE-251	BUNDLE INLET SPOOL DIFFERENTIAL PRESSURE
VOLUMETRIC FLOW	
FE-166	VERTICAL INLET SPOOL VOLUMETRIC FLOW
FE-34	HORIZONTAL OUTLET SPOOL VOLUMETRIC FLOW
FE-216	VERTICAL OUTLET SPOOL VOLUMETRIC FLOW
MOMENTUM FLUX	
FMFE-22	HORIZONTAL INLET SPOOL DRAG DISC
FMFE-38	HORIZONTAL OUTLET SPOOL DRAG DISC
FMFE-170	VERTICAL INLET SPOOL DRAG DISC
FMFE-220	VERTICAL OUTLET SPOOL DRAG DISC
FMFE-206	BUNDLE OUTLET SPOOL DRAG DISC
FMFE-264	BUNDLE INLET LOWER SPOOL DRAG DISC
FLUID DENSITY	
DE-36	HORIZONTAL OUTLET SPOOL DENSITY
DE-168	VERTICAL INLET SPOOL DENSITY
DE-218	VERTICAL OUTLET SPOOL DENSITY
DE-204A	BUNDLE OUTLET SPOOL DENSITY
DE-204B	BUNDLE OUTLET SPOOL DENSITY
DE-204C	BUNDLE OUTLET SPOOL DENSITY
DE-20	BUNDLE INLET SPOOL DENSITY
TEST SECTION INSTRUMENTS	
TEMPERATURE	
TE-210A	TEST SECTION OUTLET LINE STEADY-STATE TEMPERATURE
TDE-28	DIFFERENTIAL TEMPERATURE TRANSMITTER
TE-4B	BASE PRIMARY STEADY-STATE TEMPERATURE
TE-150	TEST SECTION BOTTOM FLANGE TEMPERATURE SIDE
TE-151	TEST SECTION BOTTOM FLANGE TEMPERATURE SIDE
TE-152	TEST SECTION BOTTOM FLANGE TEMPERATURE SIDE
TE-29	INLET BLOWDOWN PLENUM TEMPERATURE
TE-45	OUTLET BLOWDOWN PLENUM TEMPERATURE
TE-256	TEST SECTION INLET TEMPERATURE
TE-284	OLD DOWNCOMER PURGE LINE RETURN TEMPERATURE
TE-923	UPPER VOLUME PLUG TEMPERATURE

Table 1 (continued)

SENSOR	DESCRIPTION
TEST SECTION INSTRUMENTS (CONT.)	
TEMPERATURE (CONT.)	
TE-924	LOWER VOLUME PLUG TEMPERATURE
TE-920	PURGE LINE RETURN TEMPERATURE
TE-921	INNER SEAL COOLANT SUPPLY TEMPERATURE
TE-922	INNER SEAL COOLANT SUPPLY TEMPERATURE
TE-925	SHROUD BOX COLD LEG TEMPERATURE AT LEVEL D
TE-926	SHROUD BOX COLD LEG TEMPERATURE AT LEVEL G
TE-936	INBUNDLE GAMMA DENSITOMETER UPPER ION CHAMBER TEMPERATURE
PRESSURE	
PE-156	TEST SECTION INLET TRANSIENT PRESSURE
PE-201	TEST SECTION OUTLET TRANSIENT PRESSURE
PE-16	DOWNSTREAM HCV 2 TRANSIENT PRESSURE
PE-27	INLET PLENUM TRANSIENT PRESSURE
PE-43	OUTLET PLENUM TRANSIENT PRESSURE
PE-427	OUTLET BLOWDOWN LINE TRANSIENT PRESSURE
PE-286	SHROUD PLENUM OUTLET PRESSURE
PE-32	TEST SECTION OUTLET STEADY-STATE PRESSURE
PRESSURE DROP	
PDE-180	SHROUD BOX DIFFERENTIAL PRESSURE F/E AT LEVEL E
PDE-181	SHROUD BOX DIFFERENTIAL PRESSURE F AT LEVEL F/G
PDE-182	SHROUD BOX DIFFERENTIAL PRESSURE F/G AT LEVEL F
PDE-183	SHROUD BOX DIFFERENTIAL PRESSURE AT LEVEL 3
PDE-184	SHROUD BOX DIFFERENTIAL PRESSURE AT LEVEL 4
PDE-185	SHROUD BOX DIFFERENTIAL PRESSURE AT LEVEL 5
PDE-186	SHROUD BOX DIFFERENTIAL PRESSURE AT LEVEL 6
PDE-187	SHROUD BOX DIFFERENTIAL PRESSURE LEVEL 7
PDE-188	SHROUD BOX DIFFERENTIAL PRESSURE AT LEVEL 8
PDE-189	SHROUD BOX DIFFERENTIAL PRESSURE AT LEVEL 9
PDE-200	BUNDLE TRANSIENT DIFFERENTIAL PRESSURE
PDE-204	DIFFERENTIAL PRESSURE ACROSS THERMOCOUPLE LEVELS D AND E
PDE-203	TEST SECTION TRANSIENT DIFFERENTIAL PRESSURE
PDE-30	TEST SECTION STEADY-STATE DIFFERENTIAL PRESSURE
PDE-261	DIFFERENTIAL PRESSURE ACROSS THERMOCOUPLE LEVELS E AND F
PDE-271	DIFFERENTIAL PRESSURE ACROSS THERMOCOUPLE LEVELS F AND G
VOLUMETRIC FLOW	
FE-18A	TEST SECTION INLET STEADY-STATE FLOW
FE-238	INNER SEAL COOLANT VOLUMETRIC FLOW
FE-232	INNER SEAL COOLANT VOLUMETRIC FLOW
FE-202	BUNDLE OUTLET LOWER VOLUMETRIC FLOW
FE-250	BUNDLE INLET VOLUMETRIC FLOW NUMBER 2
FE-260	BUNDLE INLET LOWER VOLUMETRIC FLOW
FE-280	PURGE LINE RETURN VOLUMETRIC FLOW

Table 1 (continued)

SENSOR	DESCRIPTION
TEST SECTION INSTRUMENTS (CONT.)	
DENSITY	
DE-336U	INBUNDLE GAMMA DENSITOMETER, ROD 36, POSITION UPPER
DE-346L	INBUNDLE GAMMA DENSITOMETER, ROD 46, POSITION LOWER
ZE-336U	INBUNDLE GAMMA DENSITOMETER VERTICAL POSITIONING ON ROD 36
ZE-346L	INBUNDLE GAMMA DENSITOMETER VERTICAL POSITIONING ON ROD 46
PRESSURIZER INSTRUMENTS	
TEMPERATURE	
TE-101	PRESSURIZER VAPOR STEADY-STATE TEMPERATURE
TE-1	PRESSURIZER VAPOR TEMPERATURE
TE-2	PRESSURIZER WATER TEMPERATURE
TE-116	PRESSURIZER EXIT SPOOL TEMPERATURE
PRESSURE	
PE-106	PRESSURIZER VAPOR TRANSIENT PRESSURE
PE-102	PRESSURIZER STEADY-STATE PRESSURE
LEVEL	
LE-100	PRESSURIZER LIQUID LEVEL INSTRUMENT
MOMENTUM FLUX	
FMFE-114	PRESSURIZER LINE SPOOL DRAG DISC
PRIMARY PUMP INSTRUMENTS	
PDE-78	PRIMARY PUMP TRANSIENT DIFFERENTIAL PRESSURE
FE-1A	PRIMARY PUMP FLOW
PE-76	PRIMARY PUMP SUCTION TRANSIENT PRESSURE
SE-72	PRIMARY PUMP SPEED
EWE-77A	PRIMARY PUMP POWER
PUMP BYPASS INSTRUMENTS	
PE-15	PUMP BYPASS SPOOL PRESSURE
PRESSURE SUPPRESSION SYSTEM INSTRUMENTS	
TE-408B	PRESSURE SUPPRESSION SYSTEM TANK SPRAY TEMPERATURE
TE-901	PRESSURE STEAM KILLER AIR VENT THERMOCOUPLE
DEMINERALIZED WATER SYSTEM INSTRUMENTS	
PE-616	DEMINERALIZED WATER SUPPLY HEADER PRESSURE
TE-615	DEMINERALIZED WATER 6 INCH HEADER STEADY-STATE TEMPERATURE
TE-520B	4 INCH DEMINERALIZED WATER HEADER TEMPERATURE
HEAT EXCHANGER INSTRUMENTS	

Table 1 (continued)

SENSOR	DESCRIPTION
HEAT EXCHANGER INSTRUMENTS (CONT.)	
PRIMARY SIDE	
TEMPERATURE	
TE-5B	HEAT EXCHANGER D OUTLET TEMPERATURE
TE-57	HEAT EXCHANGER A SPOOL TEMPERATURE
TE-62	HEAT EXCHANGER B SPOOL TEMPERATURE
TE-67	HEAT EXCHANGER C SPOOL TEMPERATURE
TE-28B	MAIN HEAT EXCHANGER MIXING TEE STEADY-STATE TEMPERATURE
VOLUMETRIC FLOW	
FE-51	HEAT EXCHANGER A SPOOL VOLUMETRIC FLOW
FE-59	HEAT EXCHANGER B SPOOL VOLUMETRIC FLOW
FE-64	HEAT EXCHANGER C SPOOL VOLUMETRIC FLOW
PRESSURE	
PE-44	UPSTREAM MAIN HEAT EXCHANGER TRANSIENT PRESSURE
PE-58	HEAT EXCHANGER A SPOOL PRESSURE
PE-63	HEAT EXCHANGER B SPOOL PRESSURE
PE-68	HEAT EXCHANGER C SPOOL PRESSURE
PRESSURE DROP	
PDE-46	MAIN HEAT EXCHANGER BYPASS TRANSIENT DIFFERENTIAL PRESSURE
PDE-48	MAIN HEAT EXCHANGER STEADY-STATE DIFFERENTIAL PRESSURE
PDE-53	HEAT EXCHANGER A SPOOL DIFFERENTIAL PRESSURE
PDE-60	HEAT EXCHANGER B SPOOL DIFFERENTIAL PRESSURE
PDE-65	HEAT EXCHANGER C SPOOL DIFFERENTIAL PRESSURE
MOMENTUM FLUX	
FMFE-55	HEAT EXCHANGER A SPOOL DRAG DISC
FMFE-61	HEAT EXCHANGER B SPOOL DRAG DISC
FMFE-66	HEAT EXCHANGER C SPOOL DRAG DISC
SECONDARY SIDE	
TEMPERATURE	
TE-525	HEAT EXCHANGER A SEC DISCHARGE STEADY-STATE TEMPERATURE
TE-627	HEAT EXCHANGER B SEC DISCHARGE STEADY-STATE TEMPERATURE
TE-727	HEAT EXCHANGER C SEC DISCHARGE STEADY-STATE TEMPERATURE
TE-557	HEAT EXCHANGER D SEC DISCHARGE STEADY-STATE TEMPERATURE
VOLUMETRIC FLOW	
FE-522	HEAT EXCHANGER A SEC COOLING WATER FLOW
FE-620	HEAT EXCHANGER B SEC COOLING WATER FLOW
FE-720	HEAT EXCHANGER C SEC COOLING WATER FLOW
FE-550	HEAT EXCHANGER D SEC COOLING WATER FLOW

Table 1 (continued)

SENSOR	DESCRIPTION
HEAT EXCHANGER INSTRUMENTS (CONT.)	
SECONDARY SIDE (CONT.)	
PRESSURE	
PE-526	HEAT EXCHANGER A SECONDARY INLET PRESSURE
GENERATOR POWER	
GENERATOR VOLTAGE	
EEE-9	GENERATOR 9 VOLTAGE
EEE-10	GENERATOR 10 VOLTAGE
EEE-11	GENERATOR 11 VOLTAGE
EEE-12	GENERATOR 12 VOLTAGE
GENERATOR CURRENT	
EIE-9	GENERATOR 9 CURRENT
EIE-10	GENERATOR 10 CURRENT
EIE-11	GENERATOR 11 CURRENT
EIE-12	GENERATOR 12 CURRENT
HEATER ROD POWER	
HEATER CURRENT	
EIE-1301	ROD 01 HEATER CURRENT
EIE-1302	ROD 02 HEATER CURRENT
EIE-1303	ROD 03 HEATER CURRENT
EIE-1304	ROD 04 HEATER CURRENT
EIE-1305	ROD 05 HEATER CURRENT
EIE-1306	ROD 06 HEATER CURRENT
EIE-1307	ROD 07 HEATER CURRENT
EIE-1308	ROD 08 HEATER CURRENT
EIE-1309	ROD 09 HEATER CURRENT
EIE-1310	ROD 10 HEATER CURRENT
EIE-1311	ROD 11 HEATER CURRENT
EIE-1312	ROD 12 HEATER CURRENT
EIE-1313	ROD 13 HEATER CURRENT
EIE-1314	ROD 14 HEATER CURRENT
EIE-1315	ROD 15 HEATER CURRENT
EIE-1316	ROD 16 HEATER CURRENT
EIE-1317	ROD 17 HEATER CURRENT
EIE-1318	ROD 18 HEATER CURRENT
EIE-1320	ROD 20 HEATER CURRENT
EIE-1321	ROD 21 HEATER CURRENT
EIE-1323	ROD 23 HEATER CURRENT
EIE-1324	ROD 24 HEATER CURRENT
EIE-1325	ROD 25 HEATER CURRENT
EIE-1326	ROD 26 HEATER CURRENT
EIE-1327	ROD 27 HEATER CURRENT

Table 1 (continued)

SENSOR	DESCRIPTION
HEATER ROD POWER (CONT.)	
HEATER CURRENT (CONT.)	
EIE-1328	ROD 28 HEATER CURRENT
EIE-1329	ROD 29 HEATER CURRENT
EIE-1330	ROD 30 HEATER CURRENT
EIE-1331	ROD 31 HEATER CURRENT
EIE-1332	ROD 32 HEATER CURRENT
EIE-1333	ROD 33 HEATER CURRENT
EIE-1334	ROD 34 HEATER CURRENT
EIE-1335	ROD 35 HEATER CURRENT
EIE-1337	ROD 37 HEATER CURRENT
EIE-1338	ROD 38 HEATER CURRENT
EIE-1339	ROD 39 HEATER CURRENT
EIE-1340	POD 40 HEATER CURRENT
EIE-1341	ROD 41 HEATER CURRENT
EIE-1342	ROD 42 HEATER CURRENT
EIE-1343	ROD 43 HEATER CURRENT
EIE-1344	ROD 44 HEATER CURRENT
EIE-1345	ROD 45 HEATER CURRENT
EIE-1347	ROD 47 HEATER CURRENT
EIE-1348	ROD 48 HEATER CURRENT
EIE-1349	ROD 49 HEATER CURRENT
EIE-1350	ROD 50 HEATER CURRENT
EIE-1351	ROD 51 HEATER CURRENT
EIE-1352	ROD 52 HEATER CURRENT
EIE-1353	ROD 53 HEATER CURRENT
EIE-1354	ROD 54 HEATER CURRENT
EIE-1355	ROD 55 HEATER CURRENT
EIE-1356	ROD 56 HEATER CURRENT
EIE-1357	ROD 57 HEATER CURRENT
EIE-1358	ROD 58 HEATER CURRENT
EIE-1359	ROD 59 HEATER CURRENT
EIE-1360	ROD 60 HEATER CURRENT
EIE-1361	ROD 61 HEATER CURRENT
EIE-1362	ROD 62 HEATER CURRENT
EIE-1363	ROD 63 HEATER CURRENT
EIE-1364	ROD 64 HEATER CURRENT
GENERAL INSTRUMENTATION (ELECTRICAL)	
BREAKWIRE DETECTORS	
IE-430B	INLET BREAKWIRE DETECTOR
IE-430A	OUTLET BREAKWIRE DETECTOR
RTD POWER	
EIE-1001B	RTD POWER SUPPLY CURRENT

Table 1 (continued)

SENSOR	DESCRIPTION
GENERAL INSTRUMENTATION (ELECTRICAL) (CONT.)	
DATA ACQUISITION	CALIBRATION SIGNALS
EEE-1026AZ	ZERO INPUT CHANNELS 0 TO 127
EEE-1026BZ	ZERO INPUT CHANNELS 128 TO 255
EEE-1026IZ	ZERO INPUT CHANNELS 1024 TO 1151
EEE-1026JZ	ZERO INPUT CHANNELS 1152 TO 1279
EEE-1026KZ	ZERO INPUT CHANNELS 1280 TO 1407
EEE-1026LZ	ZERO INPUT CHANNELS 1408 TO 1535
EEE-1026MZ	ZERO INPUT CHANNELS 1536 TO 1663
EEE-1026NZ	ZERO INPUT CHANNELS 1664 TO 1791
EEE-1026AC	CALIBRATION INPUT CHANNELS 0 TO 127
EEE-1026BC	CALIBRATION INPUT CHANNELS 128 TO 255
EEE-1026IC	CALIBRATION INPUT CHANNELS 1024 TO 1151
EEE-1026JC	CALIBRATION INPUT CHANNELS 1152 TO 1279
EEE-1026KC	CALIBRATION INPUT CHANNELS 1280 TO 1407
EEE-1026LC	CALIBRATION INPUT CHANNELS 1408 TO 1535
EEE-1026MC	CALIBRATION INPUT CHANNELS 1536 TO 1663
EEE-1026NC	CALIBRATION INPUT CHANNELS 1664 TO 1791
MISCELLANEOUS INSTRUMENTS	
TE-521	PURIFICATION COOLING OUTLET THERMOCOUPLE

Table 2. Thermal-Hydraulic Test Facility Test 3.07.9Q, R

SENSOR	DESCRIPTION					
BUNDLE TEMPERATURE						
SHEATH THERMOCOUPLES						
LEVEL A						
TE-306AA	SHEATH	THERMOCOUPLE,	ROD 06,	LEVEL A,	ANGLE A	
TE-323AA	SHEATH	THERMOCOUPLE,	ROD 23,	LEVEL A,	ANGLE A	
TE-325CA	SHEATH	THERMOCOUPLE,	ROD 25,	LEVEL A,	ANGLE C	
TE-327BA	SHEATH	THERMOCOUPLE,	ROD 27,	LEVEL A,	ANGLE B	
TE-340CA	SHEATH	THERMOCOUPLE,	ROD 40,	LEVEL A,	ANGLE C	
TE-343BA	SHEATH	THERMOCOUPLE,	ROD 43,	LEVEL A,	ANGLE B	
TE-355AA	SHEATH	THERMOCOUPLE,	ROD 55,	LEVEL A,	ANGLE A	
TE-357BA	SHEATH	THERMOCOUPLE,	ROD 57,	LEVEL A,	ANGLE B	
LEVEL B						
TE-302AB	SHEATH	THERMOCOUPLE,	ROD 02,	LEVEL B,	ANGLE A	
TE-306AB	SHEATH	THERMOCOUPLE,	ROD 06,	LEVEL B,	ANGLE A	
TE-308CB	SHEATH	THERMOCOUPLE,	ROD 08,	LEVEL B,	ANGLE C	
TE-309CB	SHEATH	THERMOCOUPLE,	ROD 09,	LEVEL B,	ANGLE C	
TE-311AB	SHEATH	THERMOCOUPLE,	ROD 11,	LEVEL B,	ANGLE A	
TE-312CB	SHEATH	THERMOCOUPLE,	ROD 12,	LEVEL B,	ANGLE C	
TE-324AB	SHEATH	THERMOCOUPLE,	ROD 24,	LEVEL B,	ANGLE A	
TE-325CB	SHEATH	THERMOCOUPLE,	ROD 25,	LEVEL B,	ANGLE C	
TE-326BB	SHEATH	THERMOCOUPLE,	ROD 26,	LEVEL B,	ANGLE B	
TE-327CB	SHEATH	THERMOCOUPLE,	ROD 27,	LEVEL B,	ANGLE C	
TE-329CB	SHEATH	THERMOCOUPLE,	ROD 29,	LEVEL B,	ANGLE C	
TE-330CB	SHEATH	THERMOCOUPLE,	ROD 30,	LEVEL B,	ANGLE C	
TE-335BB	SHEATH	THERMOCOUPLE,	ROD 35,	LEVEL B,	ANGLE B	
TE-339BB	SHEATH	THERMOCOUPLE,	ROD 39,	LEVEL B,	ANGLE B	
TE-340CB	SHEATH	THERMOCOUPLE,	ROD 40,	LEVEL B,	ANGLE C	
TE-341AB	SHEATH	THERMOCOUPLE,	ROD 41,	LEVEL B,	ANGLE A	
TE-343BB	SHEATH	THERMOCOUPLE,	ROD 43,	LEVEL B,	ANGLE B	
TE-344CB	SHEATH	THERMOCOUPLE,	ROD 44,	LEVEL B,	ANGLE C	
TE-349CB	SHEATH	THERMOCOUPLE,	ROD 49,	LEVEL B,	ANGLE C	
TE-351AB	SHEATH	THERMOCOUPLE,	ROD 51,	LEVEL B,	ANGLE A	
TE-355CB	SHEATH	THERMOCOUPLE,	ROD 55,	LEVEL B,	ANGLE C	
TE-357CB	SHEATH	THERMOCOUPLE,	ROD 57,	LEVEL B,	ANGLE C	
TE-361AB	SHEATH	THERMOCOUPLE,	ROD 61,	LEVEL B,	ANGLE A	
TE-362BB	SHEATH	THERMOCOUPLE,	ROD 62,	LEVEL B,	ANGLE B	
TE-363CB	SHEATH	THERMOCOUPLE,	ROD 63,	LEVEL B,	ANGLE C	
LEVEL C						
TE-302BC	SHEATH	THERMOCOUPLE,	ROD 02,	LEVEL C,	ANGLE B	
TE-304AC	SHEATH	THERMOCOUPLE,	ROD 04,	LEVEL C,	ANGLE A	
TE-307AC	SHEATH	THERMOCOUPLE,	ROD 07,	LEVEL C,	ANGLE A	

Table 2 (continued)

SENSOR	DESCRIPTION
BUNDLE TEMPERATURE (CONT.)	
SHEATH THERMOCOUPLES (CONT.)	
LEVEL C (CONT.)	
TE-308BC	SHEATH THERMOCOUPLE, ROD 08, LEVEL C, ANGLE B
TE-309AC	SHEATH THERMOCOUPLE, ROD 09, LEVEL C, ANGLE A
TE-310CC	SHEATH THERMOCOUPLE, ROD 10, LEVEL C, ANGLE C
TE-311CC	SHEATH THERMOCOUPLE, ROD 11, LEVEL C, ANGLE C
TE-312BC	SHEATH THERMOCOUPLE, ROD 12, LEVEL C, ANGLE B
TE-313BC	SHEATH THERMOCOUPLE, ROD 13, LEVEL C, ANGLE B
TE-315AC	SHEATH THERMOCOUPLE, ROD 15, LEVEL C, ANGLE A
TE-323BC	SHEATH THERMOCOUPLE, ROD 23, LEVEL C, ANGLE B
TE-324AC	SHEATH THERMOCOUPLE, ROD 24, LEVEL C, ANGLE A
TE-325BC	SHEATH THERMOCOUPLE, ROD 25, LEVEL C, ANGLE B
TE-325CC	SHEATH THERMOCOUPLE, ROD 25, LEVEL C, ANGLE C
TE-326AC	SHEATH THERMOCOUPLE, ROD 26, LEVEL C, ANGLE A
TE-327AC	SHEATH THERMOCOUPLE, ROD 27, LEVEL C, ANGLE A
TE-327CC	SHEATH THERMOCOUPLE, ROD 27, LEVEL C, ANGLE C
TE-328AC	SHEATH THERMOCOUPLE, ROD 28, LEVEL C, ANGLE A
TE-328CC	SHEATH THERMOCOUPLE, ROD 28, LEVEL C, ANGLE C
TE-329AC	SHEATH THERMOCOUPLE, ROD 29, LEVEL C, ANGLE A
TE-329BC	SHEATH THERMOCOUPLE, ROD 29, LEVEL C, ANGLE B
TE-330AC	SHEATH THERMOCOUPLE, ROD 30, LEVEL C, ANGLE A
TE-333AC	SHEATH THERMOCOUPLE, ROD 33, LEVEL C, ANGLE A
TE-339AC	SHEATH THERMOCOUPLE, ROD 39, LEVEL C, ANGLE A
TE-340BC	SHEATH THERMOCOUPLE, ROD 40, LEVEL C, ANGLE B
TE-343BC	SHEATH THERMOCOUPLE, ROD 43, LEVEL C, ANGLE B
TE-344CC	SHEATH THERMOCOUPLE, ROD 44, LEVEL C, ANGLE C
TE-349CC	SHEATH THERMOCOUPLE, ROD 49, LEVEL C, ANGLE C
TE-351BC	SHEATH THERMOCOUPLE, ROD 51, LEVEL C, ANGLE B
TE-353CC	SHEATH THERMOCOUPLE, ROD 53, LEVEL C, ANGLE C
TE-355BC	SHEATH THERMOCOUPLE, ROD 55, LEVEL C, ANGLE B
TE-357AC	SHEATH THERMOCOUPLE, ROD 57, LEVEL C, ANGLE A
TE-357BC	SHEATH THERMOCOUPLE, ROD 57, LEVEL C, ANGLE B
TE-359CC	SHEATH THERMOCOUPLE, ROD 59, LEVEL C, ANGLE C
TE-361AC	SHEATH THERMOCOUPLE, ROD 61, LEVEL C, ANGLE A
TE-362AC	SHEATH THERMOCOUPLE, ROD 62, LEVEL C, ANGLE A
TE-363BC	SHEATH THERMOCOUPLE, ROD 63, LEVEL C, ANGLE B
LEVEL U	
TE-305BU	SHEATH THERMOCOUPLE, ROD 05, LEVEL U, ANGLE B
TE-352AU	SHEATH THERMOCOUPLE, ROD 52, LEVEL U, ANGLE A
TE-352BU	SHEATH THERMOCOUPLE, ROD 52, LEVEL U, ANGLE B
TE-352CU	SHEATH THERMOCOUPLE, ROD 52, LEVEL U, ANGLE C
TE-356BU	SHEATH THERMOCOUPLE, ROD 56, LEVEL U, ANGLE B
LEVEL H	
TE-305BH	SHEATH THERMOCOUPLE, ROD 05, LEVEL H, ANGLE B
TE-348AH	SHEATH THERMOCOUPLE, ROD 48, LEVEL H, ANGLE A

Table 2 (continued)

SENSOR	DESCRIPTION
BUNDLE TEMPERATURE (CONT.)	
SHEATH THERMOCOUPLES (CONT.)	
LEVEL H (CONT.)	
TE-352AH	SHEATH THERMOCOUPLE, ROD 52, LEVEL H, ANGLE A
TE-352BH	SHEATH THERMOCOUPLE, ROD 52, LEVEL H, ANGLE B
TE-352CH	SHEATH THERMOCOUPLE, ROD 52, LEVEL H, ANGLE C
TE-356CH	SHEATH THERMOCOUPLE, ROD 56, LEVEL H, ANGLE C
LEVEL S	
TE-305AS	SHEATH THERMOCOUPLE, ROD 06, LEVEL S, ANGLE A
TE-352AS	SHEATH THERMOCOUPLE, ROD 52, LEVEL S, ANGLE A
TE-352BS	SHEATH THERMOCOUPLE, ROD 52, LEVEL S, ANGLE B
TE-352CS	SHEATH THERMOCOUPLE, ROD 52, LEVEL S, ANGLE C
TE-356BS	SHEATH THERMOCOUPLE, ROD 56, LEVEL S, ANGLE B
LEVEL Y	
TE-305CY	SHEATH THERMOCOUPLE, ROD 05, LEVEL Y, ANGLE C
TE-348AY	SHEATH THERMOCOUPLE, ROD 48, LEVEL Y, ANGLE A
TE-352AY	SHEATH THERMOCOUPLE, ROD 52, LEVEL Y, ANGLE A
TE-352BY	SHEATH THERMOCOUPLE, ROD 52, LEVEL Y, ANGLE B
TE-352CY	SHEATH THERMOCOUPLE, ROD 52, LEVEL Y, ANGLE C
TE-356AY	SHEATH THERMOCOUPLE, ROD 56, LEVEL Y, ANGLE A
LEVEL D	
TE-302AD	SHEATH THERMOCOUPLE, ROD 02, LEVEL D, ANGLE A
TE-303CD	SHEATH THERMOCOUPLE, ROD 03, LEVEL D, ANGLE C
TE-304AD	SHEATH THERMOCOUPLE, ROD 04, LEVEL D, ANGLE A
TE-308AD	SHEATH THERMOCOUPLE, ROD 08, LEVEL D, ANGLE A
TE-308CD	SHEATH THERMOCOUPLE, ROD 08, LEVEL D, ANGLE C
TE-309CD	SHEATH THERMOCOUPLE, ROD 09, LEVEL D, ANGLE C
TE-310BD	SHEATH THERMOCOUPLE, ROD 10, LEVEL D, ANGLE B
TE-310CD	SHEATH THERMOCOUPLE, ROD 10, LEVEL D, ANGLE C
TE-312CD	SHEATH THERMOCOUPLE, ROD 12, LEVEL D, ANGLE C
TE-313CD	SHEATH THERMOCOUPLE, ROD 13, LEVEL D, ANGLE C
TE-315AD	SHEATH THERMOCOUPLE, ROD 15, LEVEL D, ANGLE A
TE-315BD	SHEATH THERMOCOUPLE, ROD 15, LEVEL D, ANGLE B
TE-316AD	SHEATH THERMOCOUPLE, ROD 16, LEVEL D, ANGLE A
TE-317BD	SHEATH THERMOCOUPLE, ROD 17, LEVEL D, ANGLE B
TE-318BD	SHEATH THERMOCOUPLE, ROD 18, LEVEL D, ANGLE B
TE-318CD	SHEATH THERMOCOUPLE, ROD 18, LEVEL D, ANGLE C
TE-320AD	SHEATH THERMOCOUPLE, ROD 20, LEVEL D, ANGLE A
TE-320BD	SHEATH THERMOCOUPLE, ROD 20, LEVEL D, ANGLE B
TE-320CD	SHEATH THERMOCOUPLE, ROD 20, LEVEL D, ANGLE C
TE-324BD	SHEATH THERMOCOUPLE, ROD 24, LEVEL D, ANGLE B
TE-325RD	SHEATH THERMOCOUPLE, ROD 25, LEVEL D, ANGLE B
TE-325CD	SHEATH THERMOCOUPLE, ROD 25, LEVEL D, ANGLE C
TE-326AD	SHEATH THERMOCOUPLE, ROD 26, LEVEL D, ANGLE A
TE-326BD	SHEATH THERMOCOUPLE, ROD 26, LEVEL D, ANGLE B

Table 2 (continued)

SENSOR		DESCRIPTION					

BUNDLE TEMPERATURE (CONT.)							
SHEATH THERMOCOUPLES (CONT.)							
LEVEL D (CONT.)							
TE-326CD	SHEATH THERMOCOUPLE,	ROD 26,	LEVEL D,	ANGLE C			
TE-327AD	SHEATH THERMOCOUPLE,	ROD 27,	LEVEL D,	ANGLE A			
TE-327BD	SHEATH THERMOCOUPLE,	ROD 27,	LEVEL D,	ANGLE B			
TE-327CD	SHEATH THERMOCOUPLE,	ROD 27,	LEVEL D,	ANGLE C			
TE-328AD	SHEATH THERMOCOUPLE,	ROD 28,	LEVEL D,	ANGLE A			
TE-328BD	SHEATH THERMOCOUPLE,	ROD 28,	LEVEL D,	ANGLE B			
TE-328CD	SHEATH THERMOCOUPLE,	ROD 28,	LEVEL D,	ANGLE C			
TE-329AD	SHEATH THERMOCOUPLE,	ROD 29,	LEVEL D,	ANGLE A			
TE-329BD	SHEATH THERMOCOUPLE,	ROD 29,	LEVEL D,	ANGLE B			
TE-329CD	SHEATH THERMOCOUPLE,	ROD 29,	LEVEL D,	ANGLE C			
TE-330AD	SHEATH THERMOCOUPLE,	ROD 30,	LEVEL D,	ANGLE A			
TE-331CD	SHEATH THERMOCOUPLE,	ROD 31,	LEVEL D,	ANGLE C			
TE-332CD	SHEATH THERMOCOUPLE,	ROD 32,	LEVEL D,	ANGLE C			
TE-333AD	SHEATH THERMOCOUPLE,	ROD 33,	LEVEL D,	ANGLE A			
TE-335BD	SHEATH THERMOCOUPLE,	ROD 35,	LEVEL D,	ANGLE B			
TE-339BD	SHEATH THERMOCOUPLE,	ROD 39,	LEVEL D,	ANGLE B			
TE-340BD	SHEATH THERMOCOUPLE,	ROD 40,	LEVEL D,	ANGLE B			
TE-342BD	SHEATH THERMOCOUPLE,	ROD 42,	LEVEL D,	ANGLE B			
TE-343AD	SHEATH THERMOCOUPLE,	ROD 43,	LEVEL D,	ANGLE A			
TE-343BD	SHEATH THERMOCOUPLE,	ROD 43,	LEVEL D,	ANGLE B			
TE-344CD	SHEATH THERMOCOUPLE,	ROD 44,	LEVEL D,	ANGLE C			
TE-345AD	SHEATH THERMOCOUPLE,	ROD 45,	LEVEL D,	ANGLE A			
TE-345BD	SHEATH THERMOCOUPLE,	ROD 45,	LEVEL D,	ANGLE B			
TE-349CD	SHEATH THERMOCOUPLE,	ROD 49,	LEVEL D,	ANGLE C			
TE-351BD	SHEATH THERMOCOUPLE,	ROD 51,	LEVEL D,	ANGLE B			
TE-355CD	SHEATH THERMOCOUPLE,	ROD 55,	LEVEL D,	ANGLE C			
TE-357BD	SHEATH THERMOCOUPLE,	ROD 57,	LEVEL D,	ANGLE B			
TE-357CD	SHEATH THERMOCOUPLE,	ROD 57,	LEVEL D,	ANGLE C			
TE-358AD	SHEATH THERMOCOUPLE,	ROD 58,	LEVEL D,	ANGLE A			
TE-358CD	SHEATH THERMOCOUPLE,	ROD 58,	LEVEL D,	ANGLE C			
TE-359AD	SHEATH THERMOCOUPLE,	ROD 59,	LEVEL D,	ANGLE A			
TE-361AD	SHEATH THERMOCOUPLE,	ROD 61,	LEVEL D,	ANGLE A			
TE-362AD	SHEATH THERMOCOUPLE,	ROD 62,	LEVEL D,	ANGLE A			
TE-364AD	SHEATH THERMOCOUPLE,	ROD 64,	LEVEL D,	ANGLE A			
TE-364BD	SHEATH THERMOCOUPLE,	ROD 64,	LEVEL D,	ANGLE B			
TE-364CD	SHEATH THERMOCOUPLE,	ROD 64,	LEVEL D,	ANGLE C			
LEVEL E							
TE-302AE	SHEATH THERMOCOUPLE,	ROD 02,	LEVEL E,	ANGLE A			
TE-303CE	SHEATH THERMOCOUPLE,	ROD 03,	LEVEL E,	ANGLE C			
TE-304BE	SHEATH THERMOCOUPLE,	ROD 04,	LEVEL E,	ANGLE B			
TE-307BE	SHEATH THERMOCOUPLE,	ROD 07,	LEVEL E,	ANGLE B			
TE-307CE	SHEATH THERMOCOUPLE,	ROD 07,	LEVEL E,	ANGLE C			
TE-310BE	SHEATH THERMOCOUPLE,	ROD 10,	LEVEL E,	ANGLE B			
TE-312AE	SHEATH THERMOCOUPLE,	ROD 12,	LEVEL E,	ANGLE A			

Table 2 (continued)

SENSOR	DESCRIPTION
BUNDLE TEMPERATURE (CONT.)	
SHEATH THERMOCOUPLES (CONT.)	
LEVEL E (CONT.)	
TE-313AE	SHEATH THERMOCOUPLE, ROD 13, LEVEL E, ANGLE A
TE-313CE	SHEATH THERMOCOUPLE, ROD 13, LEVEL E, ANGLE C
TE-315BE	SHEATH THERMOCOUPLE, ROD 15, LEVEL E, ANGLE B
TE-315CE	SHEATH THERMOCOUPLE, ROD 15, LEVEL E, ANGLE C
TE-316BE	SHEATH THERMOCOUPLE, ROD 16, LEVEL E, ANGLE B
TE-316CE	SHEATH THERMOCOUPLE, ROD 16, LEVEL E, ANGLE C
TE-318AE	SHEATH THERMOCOUPLE, ROD 18, LEVEL E, ANGLE A
TE-318BE	SHEATH THERMOCOUPLE, ROD 18, LEVEL E, ANGLE B
TE-318CE	SHEATH THERMOCOUPLE, ROD 18, LEVEL E, ANGLE C
TE-320AE	SHEATH THERMOCOUPLE, ROD 20, LEVEL E, ANGLE A
TE-320BE	SHEATH THERMOCOUPLE, ROD 20, LEVEL E, ANGLE B
TE-320CE	SHEATH THERMOCOUPLE, ROD 20, LEVEL E, ANGLE C
TE-324AE	SHEATH THERMOCOUPLE, ROD 24, LEVEL E, ANGLE A
TE-324CE	SHEATH THERMOCOUPLE, ROD 24, LEVEL E, ANGLE C
TE-326AE	SHEATH THERMOCOUPLE, ROD 26, LEVEL E, ANGLE A
TE-326BE	SHEATH THERMOCOUPLE, ROD 26, LEVEL E, ANGLE B
TE-326CE	SHEATH THERMOCOUPLE, ROD 26, LEVEL E, ANGLE C
TE-328AE	SHEATH THERMOCOUPLE, ROD 28, LEVEL E, ANGLE A
TE-328CE	SHEATH THERMOCOUPLE, ROD 28, LEVEL E, ANGLE C
TE-329AE	SHEATH THERMOCOUPLE, ROD 29, LEVEL E, ANGLE A
TE-329BE	SHEATH THERMOCOUPLE, ROD 29, LEVEL E, ANGLE B
TE-329CE	SHEATH THERMOCOUPLE, ROD 29, LEVEL E, ANGLE C
TE-330AE	SHEATH THERMOCOUPLE, ROD 30, LEVEL E, ANGLE A
TE-330BE	SHEATH THERMOCOUPLE, ROD 30, LEVEL E, ANGLE B
TE-331CE	SHEATH THERMOCOUPLE, ROD 31, LEVEL E, ANGLE C
TE-332AE	SHEATH THERMOCOUPLE, ROD 32, LEVEL E, ANGLE A
TE-332CE	SHEATH THERMOCOUPLE, ROD 32, LEVEL E, ANGLE C
TE-333AE	SHEATH THERMOCOUPLE, ROD 33, LEVEL E, ANGLE A
TE-333BE	SHEATH THERMOCOUPLE, ROD 33, LEVEL E, ANGLE B
TE-333CE	SHEATH THERMOCOUPLE, ROD 33, LEVEL E, ANGLE C
TE-335BE	SHEATH THERMOCOUPLE, ROD 35, LEVEL E, ANGLE B
TE-342BE	SHEATH THERMOCOUPLE, ROD 42, LEVEL E, ANGLE B
TE-344CE	SHEATH THERMOCOUPLE, ROD 44, LEVEL E, ANGLE C
TE-345AE	SHEATH THERMOCOUPLE, ROD 45, LEVEL E, ANGLE A
TE-345BE	SHEATH THERMOCOUPLE, ROD 45, LEVEL E, ANGLE B
TE-349AE	SHEATH THERMOCOUPLE, ROD 49, LEVEL E, ANGLE A
TE-349BE	SHEATH THERMOCOUPLE, ROD 49, LEVEL E, ANGLE B
TE-349CE	SHEATH THERMOCOUPLE, ROD 49, LEVEL E, ANGLE C
TE-351AE	SHEATH THERMOCOUPLE, ROD 51, LEVEL E, ANGLE A
TE-351BE	SHEATH THERMOCOUPLE, ROD 51, LEVEL E, ANGLE B
TE-353AE	SHEATH THERMOCOUPLE, ROD 53, LEVEL E, ANGLE A
TE-353BE	SHEATH THERMOCOUPLE, ROD 53, LEVEL E, ANGLE B
TE-358AE	SHEATH THERMOCOUPLE, ROD 58, LEVEL E, ANGLE A
TE-358BE	SHEATH THERMOCOUPLE, ROD 58, LEVEL E, ANGLE B
TE-359AE	SHEATH THERMOCOUPLE, ROD 59, LEVEL E, ANGLE A

Table 2 (continued)

SENSOR	DESCRIPTION
BUNDLE TEMPERATURE (CONT.)	
SHEATH THERMOCOUPLES (CONT.)	
LEVEL E (CONT.)	
TE-359BE	SHEATH THERMOCOUPLE, ROD 59, LEVEL E, ANGLE B
TE-359CE	SHEATH THERMOCOUPLE, ROD 59, LEVEL E, ANGLE C
TE-361AE	SHEATH THERMOCOUPLE, ROD 61, LEVEL E, ANGLE A
TE-361BE	SHEATH THERMOCOUPLE, ROD 61, LEVEL E, ANGLE B
TE-361CE	SHEATH THERMOCOUPLE, ROD 61, LEVEL E, ANGLE C
TE-362CE	SHEATH THERMOCOUPLE, ROD 62, LEVEL E, ANGLE C
TE-363AE	SHEATH THERMOCOUPLE, ROD 63, LEVEL E, ANGLE A
TE-363BE	SHEATH THERMOCOUPLE, ROD 63, LEVEL E, ANGLE B
TE-364AE	SHEATH THERMOCOUPLE, ROD 64, LEVEL E, ANGLE A
TE-364BE	SHEATH THERMOCOUPLE, ROD 64, LEVEL E, ANGLE B
TE-338E8	SHEATH THERMOCOUPLE, ROD 38, LEVEL E, SUPER LEVEL 8
TE-338E7	SHEATH THERMOCOUPLE, ROD 38, LEVEL E, SUPER LEVEL 7
TE-354E6	SHEATH THERMOCOUPLE, ROD 54, LEVEL E, SUPER LEVEL 6
TE-337E7	SHEATH THERMOCOUPLE, ROD 37, LEVEL E, SUPER LEVEL 7
TE-337E3	SHEATH THERMOCOUPLE, ROD 37, LEVEL E, SUPER LEVEL 3
TE-338E3	SHEATH THERMOCOUPLE, ROD 38, LEVEL E, SUPER LEVEL 3
TE-354E3	SHEATH THERMOCOUPLE, ROD 54, LEVEL E, SUPER LEVEL 3
TE-338E1	SHEATH THERMOCOUPLE, ROD 38, LEVEL E, SUPER LEVEL 1
TE-337E8	SHEATH THERMOCOUPLE, ROD 37, LEVEL E, SUPER LEVEL 8
TE-314E8	SHEATH THERMOCOUPLE, ROD 14, LEVEL E, SUPER LEVEL 8
TE-314E7	SHEATH THERMOCOUPLE, ROD 14, LEVEL E, SUPER LEVEL 7
TE-314E3	SHEATH THERMOCOUPLE, ROD 14, LEVEL E, SUPER LEVEL 3
TE-314E1	SHEATH THERMOCOUPLE, ROD 14, LEVEL E, SUPER LEVEL 1
TE-354E2	SHEATH THERMOCOUPLE, ROD 54, LEVEL E, SUPER LEVEL 2
TE-301E3	SHEATH THERMOCOUPLE, ROD 01, LEVEL E, SUPER LEVEL 3
TE-321E3	SHEATH THERMOCOUPLE, ROD 21, LEVEL E, SUPER LEVEL 3
TE-301E8	SHEATH THERMOCOUPLE, ROD 01, LEVEL E, SUPER LEVEL 8
TE-360E3	SHEATH THERMOCOUPLE, ROD 60, LEVEL E, SUPER LEVEL 3
TE-360E2	SHEATH THERMOCOUPLE, ROD 60, LEVEL E, SUPER LEVEL 2
TE-334E8	SHEATH THERMOCOUPLE, ROD 34, LEVEL E, SUPER LEVEL 8
TE-334E7	SHEATH THERMOCOUPLE, ROD 34, LEVEL E, SUPER LEVEL 7
TE-334E3	SHEATH THERMOCOUPLE, ROD 34, LEVEL E, SUPER LEVEL 3
TE-350E7	SHEATH THERMOCOUPLE, ROD 50, LEVEL E, SUPER LEVEL 7
TE-350E3	SHEATH THERMOCOUPLE, ROD 50, LEVEL E, SUPER LEVEL 3
TE-350E1	SHEATH THERMOCOUPLE, ROD 50, LEVEL E, SUPER LEVEL 1
TE-360E6	SHEATH THERMOCOUPLE, ROD 60, LEVEL E, SUPER LEVEL 6
TE-317E3	SHEATH THERMOCOUPLE, ROD 17, LEVEL E, SUPER LEVEL 3
TE-321E6	SHEATH THERMOCOUPLE, ROD 21, LEVEL E, SUPER LEVEL 6
TE-301E1	SHEATH THERMOCOUPLE, ROD 01, LEVEL E, SUPER LEVEL 1
TE-321E2	SHEATH THERMOCOUPLE, ROD 21, LEVEL E, SUPER LEVEL 2
TE-301E7	SHEATH THERMOCOUPLE, ROD 01, LEVEL E, SUPER LEVEL 7
LEVEL F	
TE-301AF	SHEATH THERMOCOUPLE, ROD 01, LEVEL F, ANGLE A
TE-303BF	SHEATH THERMOCOUPLE, ROD 03, LEVEL F, ANGLE B

Table 2 (continued)

SENSOR	DESCRIPTION
BUNDLE TEMPERATURE (CONT.)	
SHEATH THERMOCOUPLES (CONT.)	
LEVEL F (CONT.)	
TE-304AF	SHEATH THERMOCOUPLE, ROD 04, LEVEL F, ANGLE A
TE-307AF	SHEATH THERMOCOUPLE, ROD 07, LEVEL F, ANGLE A
TE-307BF	SHEATH THERMOCOUPLE, ROD 07, LEVEL F, ANGLE B
TE-310AF	SHEATH THERMOCOUPLE, ROD 10, LEVEL F, ANGLE A
TE-310BF	SHEATH THERMOCOUPLE, ROD 10, LEVEL F, ANGLE B
TE-310CF	SHEATH THERMOCOUPLE, ROD 10, LEVEL F, ANGLE C
TE-313BF	SHEATH THERMOCOUPLE, ROD 13, LEVEL F, ANGLE B
TE-313CF	SHEATH THERMOCOUPLE, ROD 13, LEVEL F, ANGLE C
TE-314AF	SHEATH THERMOCOUPLE, ROD 14, LEVEL F, ANGLE A
TE-315AF	SHEATH THERMOCOUPLE, ROD 15, LEVEL F, ANGLE A
TE-316BF	SHEATH THERMOCOUPLE, ROD 16, LEVEL F, ANGLE B
TE-317AF	SHEATH THERMOCOUPLE, ROD 17, LEVEL F, ANGLE A
TE-318AF	SHEATH THERMOCOUPLE, ROD 18, LEVEL F, ANGLE A
TE-318CF	SHEATH THERMOCOUPLE, ROD 18, LEVEL F, ANGLE C
TE-320AF	SHEATH THERMOCOUPLE, ROD 20, LEVEL F, ANGLE A
TE-320BF	SHEATH THERMOCOUPLE, ROD 20, LEVEL F, ANGLE B
TE-320CF	SHEATH THERMOCOUPLE, ROD 20, LEVEL F, ANGLE C
TE-321AF	SHEATH THERMOCOUPLE, ROD 21, LEVEL F, ANGLE A
TE-328AF	SHEATH THERMOCOUPLE, ROD 28, LEVEL F, ANGLE A
TE-328BF	SHEATH THERMOCOUPLE, ROD 28, LEVEL F, ANGLE B
TE-328CF	SHEATH THERMOCOUPLE, ROD 28, LEVEL F, ANGLE C
TE-331BF	SHEATH THERMOCOUPLE, ROD 31, LEVEL F, ANGLE B
TE-331CF	SHEATH THERMOCOUPLE, ROD 31, LEVEL F, ANGLE C
TE-332CF	SHEATH THERMOCOUPLE, ROD 32, LEVEL F, ANGLE C
TE-334AF	SHEATH THERMOCOUPLE, ROD 34, LEVEL F, ANGLE A
TE-337AF	SHEATH THERMOCOUPLE, ROD 37, LEVEL F, ANGLE A
TE-338AF	SHEATH THERMOCOUPLE, ROD 38, LEVEL F, ANGLE A
TE-342BF	SHEATH THERMOCOUPLE, ROD 42, LEVEL F, ANGLE B
TE-345AF	SHEATH THERMOCOUPLE, ROD 45, LEVEL F, ANGLE A
TE-345BF	SHEATH THERMOCOUPLE, ROD 45, LEVEL F, ANGLE B
TE-345CF	SHEATH THERMOCOUPLE, ROD 45, LEVEL F, ANGLE C
TE-347CF	SHEATH THERMOCOUPLE, ROD 47, LEVEL F, ANGLE C
TE-353BF	SHEATH THERMOCOUPLE, ROD 59, LEVEL F, ANGLE B
TE-354AF	SHEATH THERMOCOUPLE, ROD 54, LEVEL F, ANGLE A
TE-358BF	SHEATH THERMOCOUPLE, ROD 58, LEVEL F, ANGLE B
TE-359AF	SHEATH THERMOCOUPLE, ROD 59, LEVEL F, ANGLE A
TE-359BF	SHEATH THERMOCOUPLE, ROD 59, LEVEL F, ANGLE B
TE-359CF	SHEATH THERMOCOUPLE, ROD 59, LEVEL F, ANGLE C
TE-360AF	SHEATH THERMOCOUPLE, ROD 60, LEVEL F, ANGLE A
TE-364AF	SHEATH THERMOCOUPLE, ROD 64, LEVEL F, ANGLE A
TE-364BF	SHEATH THERMOCOUPLE, ROD 64, LEVEL F, ANGLE B
TE-364CF	SHEATH THERMOCOUPLE, ROD 64, LEVEL F, ANGLE C
TE-354F8	SHEATH THERMOCOUPLE, ROD 54, LEVEL F, SUPER LEVEL 8
TE-354F7	SHEATH THERMOCOUPLE, ROD 54, LEVEL F, SUPER LEVEL 7
TE-354F6	SHEATH THERMOCOUPLE, ROD 54, LEVEL F, SUPER LEVEL 6

Table 2 (continued)

SENSOR	DESCRIPTION
BUNDLE TEMPERATURE (CONT.)	
SHEATH THERMOCOUPLES (CONT.)	
LEVEL F (CONT.)	
TE-354F5	SHEATH THERMOCOUPLE, ROD 54, LEVEL F, SUPER LEVEL 5
TE-354F1	SHEATH THERMOCOUPLE, ROD 54, LEVEL F, SUPER LEVEL 1
TE-337F8	SHEATH THERMOCOUPLE, ROD 37, LEVEL F, SUPER LEVEL 8
TE-337F7	SHEATH THERMOCOUPLE, ROD 37, LEVEL F, SUPER LEVEL 7
TE-337F6	SHEATH THERMOCOUPLE, ROD 37, LEVEL F, SUPER LEVEL 6
TE-334F6	SHEATH THERMOCOUPLE, ROD 34, LEVEL F, SUPER LEVEL 6
TE-334F3	SHEATH THERMOCOUPLE, ROD 34, LEVEL F, SUPER LEVEL 3
TE-360F6	SHEATH THERMOCOUPLE, ROD 60, LEVEL F, SUPER LEVEL 6
TE-360F5	SHEATH THERMOCOUPLE, ROD 60, LEVEL F, SUPER LEVEL 5
TE-360F4	SHEATH THERMOCOUPLE, ROD 60, LEVEL F, SUPER LEVEL 4
TE-338F2	SHEATH THERMOCOUPLE, ROD 38, LEVEL F, SUPER LEVEL 2
TE-338F6	SHEATH THERMOCOUPLE, ROD 38, LEVEL F, SUPER LEVEL 6
TE-338F7	SHEATH THERMOCOUPLE, ROD 38, LEVEL F, SUPER LEVEL 7
TE-350F6	SHEATH THERMOCOUPLE, ROD 50, LEVEL F, SUPER LEVEL 6
TE-350F2	SHEATH THERMOCOUPLE, ROD 50, LEVEL F, SUPER LEVEL 2
TE-350F1	SHEATH THERMOCOUPLE, ROD 50, LEVEL F, SUPER LEVEL 1
TE-321F7	SHEATH THERMOCOUPLE, ROD 21, LEVEL F, SUPER LEVEL 7
TE-321F6	SHEATH THERMOCOUPLE, ROD 21, LEVEL F, SUPER LEVEL 6
TE-321F4	SHEATH THERMOCOUPLE, ROD 21, LEVEL F, SUPER LEVEL 4
TE-321F3	SHEATH THERMOCOUPLE, ROD 21, LEVEL F, SUPER LEVEL 3
TE-314F2	SHEATH THERMOCOUPLE, ROD 14, LEVEL F, SUPER LEVEL 2
TE-314F8	SHEATH THERMOCOUPLE, ROD 14, LEVEL F, SUPER LEVEL 8
TE-314F7	SHEATH THERMOCOUPLE, ROD 14, LEVEL F, SUPER LEVEL 7
TE-317F2	SHEATH THERMOCOUPLE, ROD 17, LEVEL F, SUPER LEVEL 2
TE-317F8	SHEATH THERMOCOUPLE, ROD 17, LEVEL F, SUPER LEVEL 8
TE-317F7	SHEATH THERMOCOUPLE, ROD 17, LEVEL F, SUPER LEVEL 7
TE-317F6	SHEATH THERMOCOUPLE, ROD 17, LEVEL F, SUPER LEVEL 6
TE-317F3	SHEATH THERMOCOUPLE, ROD 17, LEVEL F, SUPER LEVEL 3
TE-301F1	SHEATH THERMOCOUPLE, ROD 01, LEVEL F, SUPER LEVEL 1
TE-301F6	SHEATH THERMOCOUPLE, ROD 01, LEVEL F, SUPER LEVEL 6
TE-301F3	SHEATH THERMOCOUPLE, ROD 01, LEVEL F, SUPER LEVEL 3
TE-301F2	SHEATH THERMOCOUPLE, ROD 01, LEVEL F, SUPER LEVEL 2
TE-354F4	SHEATH THERMOCOUPLE, ROD 54, LEVEL F, SUPER LEVEL 4
TE-354F3	SHEATH THERMOCOUPLE, ROD 54, LEVEL F, SUPER LEVEL 3
TE-334F8	SHEATH THERMOCOUPLE, ROD 34, LEVEL F, SUPER LEVEL 8
TE-334F2	SHEATH THERMOCOUPLE, ROD 34, LEVEL F, SUPER LEVEL 2
TE-334F1	SHEATH THERMOCOUPLE, ROD 34, LEVEL F, SUPER LEVEL 1
TE-360F8	SHEATH THERMOCOUPLE, ROD 60, LEVEL F, SUPER LEVEL 8
TE-360F7	SHEATH THERMOCOUPLE, ROD 60, LEVEL F, SUPER LEVEL 7
TE-360F3	SHEATH THERMOCOUPLE, ROD 60, LEVEL F, SUPER LEVEL 3
TE-350F8	SHEATH THERMOCOUPLE, ROD 50, LEVEL F, SUPER LEVEL 8
TE-321F1	SHEATH THERMOCOUPLE, ROD 21, LEVEL F, SUPER LEVEL 1
TE-350F7	SHEATH THERMOCOUPLE, ROD 50, LEVEL F, SUPER LEVEL 7
TE-350F3	SHEATH THERMOCOUPLE, ROD 50, LEVEL F, SUPER LEVEL 3
TE-337F1	SHEATH THERMOCOUPLE, ROD 37, LEVEL F, SUPER LEVEL 1

Table 2 (continued)

SENSOR	DESCRIPTION					
BUNDLE TEMPERATURE (CONT.)						
SHEATH THERMOCOUPLES (CONT.)						
LEVEL F (CONT.)						
TE-314F6	SHEATH THERMOCOUPLE,	ROD 14,	LEVEL F,	SUPER LEVEL	6	
TE-314F3	SHEATH THERMOCOUPLE,	ROD 14,	LEVEL F,	SUPER LEVEL	3	
TE-338F8	SHEATH THERMOCOUPLE,	ROD 38,	LEVEL F,	SUPER LEVEL	8	
TE-317F1	SHEATH THERMOCOUPLE,	ROD 17,	LEVEL F,	SUPER LEVEL	1	
TE-321F8	SHEATH THERMOCOUPLE,	ROD 21,	LEVEL F,	SUPER LEVEL	8	
TE-321F5	SHEATH THERMOCOUPLE,	ROD 21,	LEVEL F,	SUPER LEVEL	5	
TE-301F7	SHEATH THERMOCOUPLE,	ROD 01,	LEVEL F,	SUPER LEVEL	7	
TE-301F8	SHEATH THERMOCOUPLE,	ROD 01,	LEVEL F,	SUPER LEVEL	8	
LEVEL G						
TE-301AG	SHEATH THERMOCOUPLE,	ROD 01,	LEVEL G,	ANGLE A		
TE-303CG	SHEATH THERMOCOUPLE,	ROD 03,	LEVEL G,	ANGLE C		
TE-314AG	SHEATH THERMOCOUPLE,	ROD 14,	LEVEL G,	ANGLE A		
TE-316BG	SHEATH THERMOCOUPLE,	ROD 16,	LEVEL G,	ANGLE B		
TE-316CG	SHEATH THERMOCOUPLE,	ROD 16,	LEVEL G,	ANGLE C		
TE-317AG	SHEATH THERMOCOUPLE,	ROD 17,	LEVEL G,	ANGLE A		
TE-318AG	SHEATH THERMOCOUPLE,	ROD 18,	LEVEL G,	ANGLE A		
TE-318BG	SHEATH THERMOCOUPLE,	ROD 18,	LEVEL G,	ANGLE B		
TE-318CG	SHEATH THERMOCOUPLE,	ROD 18,	LEVEL G,	ANGLE C		
TE-320AG	SHEATH THERMOCOUPLE,	ROD 20,	LEVEL G,	ANGLE A		
TE-320BG	SHEATH THERMOCOUPLE,	ROD 20,	LEVEL G,	ANGLE B		
TE-320CG	SHEATH THERMOCOUPLE,	ROD 20,	LEVEL G,	ANGLE C		
TE-321AG	SHEATH THERMOCOUPLE,	ROD 21,	LEVEL G,	ANGLE A		
TE-332CG	SHEATH THERMOCOUPLE,	ROD 32,	LEVEL G,	ANGLE C		
TE-334AG	SHEATH THERMOCOUPLE,	ROD 34,	LEVEL G,	ANGLE A		
TE-337AG	SHEATH THERMOCOUPLE,	ROD 37,	LEVEL G,	ANGLE A		
TE-338AG	SHEATH THERMOCOUPLE,	ROD 38,	LEVEL G,	ANGLE A		
TE-342BG	SHEATH THERMOCOUPLE,	ROD 42,	LEVEL G,	ANGLE B		
TE-342CG	SHEATH THERMOCOUPLE,	ROD 42,	LEVEL G,	ANGLE C		
TE-345AG	SHEATH THERMOCOUPLE,	ROD 45,	LEVEL G,	ANGLE A		
TE-345BG	SHEATH THERMOCOUPLE,	ROD 45,	LEVEL G,	ANGLE B		
TE-345CG	SHEATH THERMOCOUPLE,	ROD 45,	LEVEL G,	ANGLE C		
TE-347CG	SHEATH THERMOCOUPLE,	ROD 47,	LEVEL G,	ANGLE C		
TE-350AG	SHEATH THERMOCOUPLE,	ROD 50,	LEVEL G,	ANGLE A		
TE-354AG	SHEATH THERMOCOUPLE,	ROD 54,	LEVEL G,	ANGLE A		
TE-358CG	SHEATH THERMOCOUPLE,	ROD 58,	LEVEL G,	ANGLE C		
TE-360AG	SHEATH THERMOCOUPLE,	ROD 60,	LEVEL G,	ANGLE A		
TE-364AG	SHEATH THERMOCOUPLE,	ROD 64,	LEVEL G,	ANGLE A		
TE-364CG	SHEATH THERMOCOUPLE,	ROD 64,	LEVEL G,	ANGLE C		
LEVEL J						
TE-361CJ	SHEATH THERMOCOUPLE,	ROD 61,	LEVEL J,	ANGLE C		
TE-361BJ	SHEATH THERMOCOUPLE,	ROD 61,	LEVEL J,	ANGLE B		
MIDDLE THERMOCOUPLES						

Table 2 (continued)

SENSOR	DESCRIPTION			

BUNDLE TEMPERATURE (CONT.)				
MIDDLE THERMOCOUPLES (CONT.)				
LEVEL A				
TE-306MA	MIDDLE THERMOCOUPLE,	ROD 06,	LEVEL A	
TE-311MA	MIDDLE THERMOCOUPLE,	ROD 11,	LEVEL A	
TE-325MA	MIDDLE THERMOCOUPLE,	ROD 25,	LEVEL A	
TE-340MA	MIDDLE THERMOCOUPLE,	ROD 40,	LEVEL A	
TE-341MA	MIDDLE THERMOCOUPLE,	ROD 41,	LEVEL A	
TE-355MA	MIDDLE THERMOCOUPLE,	ROD 55,	LEVEL A	
TE-357MA	MIDDLE THERMOCOUPLE,	ROD 57,	LEVEL A	
LEVEL B				
TE-302MB	MIDDLE THERMOCOUPLE,	ROD 02,	LEVEL B	
TE-308MB	MIDDLE THERMOCOUPLE,	ROD 08,	LEVEL B	
TE-309MB	MIDDLE THERMOCOUPLE,	ROD 09,	LEVEL B	
TE-312MB	MIDDLE THERMOCOUPLE,	ROD 12,	LEVEL B	
TE-325MB	MIDDLE THERMOCOUPLE,	ROD 25,	LEVEL B	
TE-327MB	MIDDLE THERMOCOUPLE,	ROD 27,	LEVEL B	
TE-329MB	MIDDLE THERMOCOUPLE,	ROD 29,	LEVEL B	
TE-330MB	MIDDLE THERMOCOUPLE,	ROD 30,	LEVEL B	
TE-335MB	MIDDLE THERMOCOUPLE,	ROD 35,	LEVEL B	
TE-339MB	MIDDLE THERMOCOUPLE,	ROD 39,	LEVEL B	
TE-340MB	MIDDLE THERMOCOUPLE,	ROD 40,	LEVEL B	
TE-341MB	MIDDLE THERMOCOUPLE,	ROD 41,	LEVEL B	
TE-344MB	MIDDLE THERMOCOUPLE,	ROD 44,	LEVEL B	
TE-349MB	MIDDLE THERMOCOUPLE,	ROD 49,	LEVEL B	
TE-355MB	MIDDLE THERMOCOUPLE,	ROD 55,	LEVEL B	
TE-357MB	MIDDLE THERMOCOUPLE,	ROD 57,	LEVEL B	
TE-361MB	MIDDLE THERMOCOUPLE,	ROD 61,	LEVEL B	
TE-363MB	MIDDLE THERMOCOUPLE,	ROD 63,	LEVEL B	
LEVEL C				
TE-302MC	MIDDLE THERMOCOUPLE,	ROD 02,	LEVEL C	
TE-304MC	MIDDLE THERMOCOUPLE,	ROD 04,	LEVEL C	
TE-306MC	MIDDLE THERMOCOUPLE,	ROD 06,	LEVEL C	
TE-307MC	MIDDLE THERMOCOUPLE,	ROD 07,	LEVEL C	
TE-308MC	MIDDLE THERMOCOUPLE,	ROD 08,	LEVEL C	
TE-309MC	MIDDLE THERMOCOUPLE,	ROD 09,	LEVEL C	
TE-310MC	MIDDLE THERMOCOUPLE,	ROD 10,	LEVEL C	
TE-311MC	MIDDLE THERMOCOUPLE,	ROD 11,	LEVEL C	
TE-312MC	MIDDLE THERMOCOUPLE,	ROD 12,	LEVEL C	
TE-315MC	MIDDLE THERMOCOUPLE,	ROD 15,	LEVEL C	
TE-324MC	MIDDLE THERMOCOUPLE,	ROD 24,	LEVEL C	
TE-325MC	MIDDLE THERMOCOUPLE,	ROD 25,	LEVEL C	
TE-326MC	MIDDLE THERMOCOUPLE,	ROD 26,	LEVEL C	
TE-328MC	MIDDLE THERMOCOUPLE,	ROD 28,	LEVEL C	
TE-329MC	MIDDLE THERMOCOUPLE,	ROD 29,	LEVEL C	

Table 2 (continued)

SENSOR	DESCRIPTION
BUNDLE TEMPERATURE (CONT.)	
MIDDLE THERMOCOUPLES (CONT.)	
LEVEL C (CONT.)	
TE-330MC	MIDDLE THERMOCOUPLE, ROD 30, LEVEL C
TE-333MC	MIDDLE THERMOCOUPLE, ROD 33, LEVEL C
TE-335MC	MIDDLE THERMOCOUPLE, ROD 35, LEVEL C
TE-339MC	MIDDLE THERMOCOUPLE, ROD 39, LEVEL C
TE-340MC	MIDDLE THERMOCOUPLE, ROD 40, LEVEL C
TE-341MC	MIDDLE THERMOCOUPLE, ROD 41, LEVEL C
TE-344MC	MIDDLE THERMOCOUPLE, ROD 44, LEVEL C
TE-349MC	MIDDLE THERMOCOUPLE, ROD 49, LEVEL C
TE-351MC	MIDDLE THERMOCOUPLE, ROD 51, LEVEL C
TE-353MC	MIDDLE THERMOCOUPLE, ROD 53, LEVEL C
TE-355MC	MIDDLE THERMOCOUPLE, ROD 55, LEVEL C
TE-357MC	MIDDLE THERMOCOUPLE, ROD 57, LEVEL C
TE-359MC	MIDDLE THERMOCOUPLE, ROD 59, LEVEL C
TE-361MC	MIDDLE THERMOCOUPLE, ROD 61, LEVEL C
TE-363MC	MIDDLE THERMOCOUPLE, ROD 63, LEVEL C
LEVEL U	
TE-305MU	MIDDLE THERMOCOUPLE, ROD 05, LEVEL U
TE-348MU	MIDDLE THERMOCOUPLE, ROD 48, LEVEL U
TE-352MU	MIDDLE THERMOCOUPLE, ROD 52, LEVEL U
LEVEL H	
TE-305MH	MIDDLE THERMOCOUPLE, ROD 05, LEVEL H
TE-348MH	MIDDLE THERMOCOUPLE, ROD 48, LEVEL H
TE-352MH	MIDDLE THERMOCOUPLE, ROD 52, LEVEL H
TE-356MH	MIDDLE THERMOCOUPLE, ROD 56, LEVEL H
LEVEL S	
TE-305MS	MIDDLE THERMOCOUPLE, ROD 05, LEVEL S
TE-348MS	MIDDLE THERMOCOUPLE, ROD 48, LEVEL S
TE-352MS	MIDDLE THERMOCOUPLE, ROD 52, LEVEL S
TE-356MS	MIDDLE THERMOCOUPLE, ROD 56, LEVEL S
LEVEL Y	
TE-305MY	MIDDLE THERMOCOUPLE, ROD 05, LEVEL Y
TE-348MY	MIDDLE THERMOCOUPLE, ROD 48, LEVEL Y
TE-352MY	MIDDLE THERMOCOUPLE, ROD 52, LEVEL Y
LEVEL D	
TE-302MD	MIDDLE THERMOCOUPLE, ROD 02, LEVEL D
TE-303MD	MIDDLE THERMOCOUPLE, ROD 03, LEVEL D
TE-304MD	MIDDLE THERMOCOUPLE, ROD 04, LEVEL D
TE-306MD	MIDDLE THERMOCOUPLE, ROD 06, LEVEL D
TE-307MD	MIDDLE THERMOCOUPLE, ROD 07, LEVEL D
TE-308MD	MIDDLE THERMOCOUPLE, ROD 08, LEVEL D

Table 2 (continued)

SENSOR	DESCRIPTION			

BUNDLE TEMPERATURE (CONT.)				
MIDDLE THERMOCOUPLES (CONT.)				
LEVEL D (CONT.)				
TE-310MD	MIDDLE THERMOCOUPLE,	ROD 10,	LEVEL D	
TE-311MD	MIDDLE THERMOCOUPLE,	ROD 11,	LEVEL D	
TE-312MD	MIDDLE THERMOCOUPLE,	ROD 12,	LEVEL D	
TE-315MD	MIDDLE THERMOCOUPLE,	ROD 15,	LEVEL D	
TE-316MD	MIDDLE THERMOCOUPLE,	ROD 16,	LEVEL D	
TE-318MD	MIDDLE THERMOCOUPLE,	ROD 18,	LEVEL D	
TE-320MD	MIDDLE THERMOCOUPLE,	ROD 20,	LEVEL D	
TE-324MD	MIDDLE THERMOCOUPLE,	ROD 24,	LEVEL D	
TE-325MD	MIDDLE THERMOCOUPLE,	ROD 25,	LEVEL D	
TE-326MD	MIDDLE THERMOCOUPLE,	ROD 26,	LEVEL D	
TE-328MD	MIDDLE THERMOCOUPLE,	ROD 28,	LEVEL D	
TE-329MD	MIDDLE THERMOCOUPLE,	ROD 29,	LEVEL D	
TE-335MD	MIDDLE THERMOCOUPLE,	ROD 35,	LEVEL D	
TE-339MD	MIDDLE THERMOCOUPLE,	ROD 39,	LEVEL D	
TE-341MD	MIDDLE THERMOCOUPLE,	ROD 41,	LEVEL D	
TE-345MD	MIDDLE THERMOCOUPLE,	ROD 45,	LEVEL D	
TE-347MD	MIDDLE THERMOCOUPLE,	ROD 47,	LEVEL D	
TE-349MD	MIDDLE THERMOCOUPLE,	ROD 49,	LEVEL D	
TE-353MD	MIDDLE THERMOCOUPLE,	ROD 53,	LEVEL D	
TE-355MD	MIDDLE THERMOCOUPLE,	ROD 55,	LEVEL D	
TE-357MD	MIDDLE THERMOCOUPLE,	ROD 57,	LEVEL D	
TE-358MD	MIDDLE THERMOCOUPLE,	ROD 58,	LEVEL D	
TE-361MD	MIDDLE THERMOCOUPLE,	ROD 61,	LEVEL D	
TE-363MD	MIDDLE THERMOCOUPLE,	ROD 63,	LEVEL D	
TE-364MD	MIDDLE THERMOCOUPLE,	ROD 64,	LEVEL D	
LEVEL E				
TE-303ME	MIDDLE THERMOCOUPLE,	ROD 03,	LEVEL E	
TE-304ME	MIDDLE THERMOCOUPLE,	ROD 04,	LEVEL E	
TE-307ME	MIDDLE THERMOCOUPLE,	ROD 07,	LEVEL E	
TE-310ME	MIDDLE THERMOCOUPLE,	ROD 10,	LEVEL E	
TE-312ME	MIDDLE THERMOCOUPLE,	ROD 12,	LEVEL E	
TE-315ME	MIDDLE THERMOCOUPLE,	ROD 15,	LEVEL E	
TE-316ME	MIDDLE THERMOCOUPLE,	ROD 16,	LEVEL E	
TE-318ME	MIDDLE THERMOCOUPLE,	ROD 18,	LEVEL E	
TE-324ME	MIDDLE THERMOCOUPLE,	ROD 24,	LEVEL E	
TE-326ME	MIDDLE THERMOCOUPLE,	ROD 26,	LEVEL E	
TE-328ME	MIDDLE THERMOCOUPLE,	ROD 28,	LEVEL E	
TE-329ME	MIDDLE THERMOCOUPLE,	ROD 29,	LEVEL E	
TE-330ME	MIDDLE THERMOCOUPLE,	ROD 30,	LEVEL E	
TE-335ME	MIDDLE THERMOCOUPLE,	ROD 35,	LEVEL E	
TE-339ME	MIDDLE THERMOCOUPLE,	ROD 39,	LEVEL E	
TE-344ME	MIDDLE THERMOCOUPLE,	ROD 44,	LEVEL E	
TE-345ME	MIDDLE THERMOCOUPLE,	ROD 45,	LEVEL E	
TE-347ME	MIDDLE THERMOCOUPLE,	ROD 47,	LEVEL E	

Table 2 (continued)

SENSOR	DESCRIPTION
BUNDLE TEMPERATURE (CONT.)	
MIDDLE THERMOCOUPLES (CONT.)	
LEVEL E (CONT.)	
TE-349ME	MIDDLE THERMOCOUPLE, ROD 49, LEVEL E
TE-353ME	MIDDLE THERMOCOUPLE, ROD 53, LEVEL E
TE-358ME	MIDDLE THERMOCOUPLE, ROD 58, LEVEL E
TE-359ME	MIDDLE THERMOCOUPLE, ROD 59, LEVEL E
TE-363ME	MIDDLE THERMOCOUPLE, ROD 63, LEVEL E
LEVEL F	
TE-301MF	MIDDLE THERMOCOUPLE, ROD 01, LEVEL F
TE-303MF	MIDDLE THERMOCOUPLE, ROD 03, LEVEL F
TE-304MF	MIDDLE THERMOCOUPLE, ROD 04, LEVEL F
TE-307MF	MIDDLE THERMOCOUPLE, ROD 07, LEVEL F
TE-314MF	MIDDLE THERMOCOUPLE, ROD 14, LEVEL F
TE-315MF	MIDDLE THERMOCOUPLE, ROD 15, LEVEL F
TE-316MF	MIDDLE THERMOCOUPLE, ROD 16, LEVEL F
TE-317MF	MIDDLE THERMOCOUPLE, ROD 17, LEVEL F
TE-318MF	MIDDLE THERMOCOUPLE, ROD 18, LEVEL F
TE-321MF	MIDDLE THERMOCOUPLE, ROD 21, LEVEL F
TE-328MF	MIDDLE THERMOCOUPLE, ROD 28, LEVEL F
TE-331MF	MIDDLE THERMOCOUPLE, ROD 31, LEVEL F
TE-334MF	MIDDLE THERMOCOUPLE, ROD 34, LEVEL F
TE-337MF	MIDDLE THERMOCOUPLE, ROD 37, LEVEL F
TE-338MF	MIDDLE THERMOCOUPLE, ROD 38, LEVEL F
TE-347MF	MIDDLE THERMOCOUPLE, ROD 47, LEVEL F
TE-350MF	MIDDLE THERMOCOUPLE, ROD 50, LEVEL F
TE-354MF	MIDDLE THERMOCOUPLE, ROD 54, LEVEL F
TE-358MF	MIDDLE THERMOCOUPLE, ROD 58, LEVEL F
TE-359MF	MIDDLE THERMOCOUPLE, ROD 59, LEVEL F
TE-360MF	MIDDLE THERMOCOUPLE, ROD 60, LEVEL F
TE-364MF	MIDDLE THERMOCOUPLE, ROD 64, LEVEL F
TE-301M8	MIDDLE THERMOCOUPLE, ROD 01, LEVEL F, SUPER LEVEL 8
TE-317M6	MIDDLE THERMOCOUPLE, ROD 17, LEVEL F, SUPER LEVEL 6
TE-321M3	MIDDLE THERMOCOUPLE, ROD 21, LEVEL F, SUPER LEVEL 3
TE-321M1	MIDDLE THERMOCOUPLE, ROD 21, LEVEL F, SUPER LEVEL 1
TE-337M7	MIDDLE THERMOCOUPLE, ROD 37, LEVEL F, SUPER LEVEL 7
TE-337M6	MIDDLE THERMOCOUPLE, ROD 37, LEVEL F, SUPER LEVEL 6
TE-338M8	MIDDLE THERMOCOUPLE, ROD 38, LEVEL F, SUPER LEVEL 8
TE-338M2	MIDDLE THERMOCOUPLE, ROD 38, LEVEL F, SUPER LEVEL 2
TE-354M6	MIDDLE THERMOCOUPLE, ROD 54, LEVEL F, SUPER LEVEL 6
TE-354M5	MIDDLE THERMOCOUPLE, ROD 54, LEVEL F, SUPER LEVEL 5
TE-360M3	MIDDLE THERMOCOUPLE, ROD 60, LEVEL F, SUPER LEVEL 3
TE-314M8	MIDDLE THERMOCOUPLE, ROD 14, LEVEL F, SUPER LEVEL 8
TE-314M2	MIDDLE THERMOCOUPLE, ROD 14, LEVEL F, SUPER LEVEL 2
TE-301M2	MIDDLE THERMOCOUPLE, ROD 01, LEVEL F, SUPER LEVEL 2
TE-317M7	MIDDLE THERMOCOUPLE, ROD 17, LEVEL F, SUPER LEVEL 7
TE-334M6	MIDDLE THERMOCOUPLE, ROD 34, LEVEL F, SUPER LEVEL 6

Table 2 (continued)

SENSOR	DESCRIPTION
BUNDLE TEMPERATURE (CONT.)	
MIDDLE THERMOCOUPLES (CONT.)	
LEVEL F (CONT.)	
TE-350M7	MIDDLE THERMOCOUPLE, ROD 50, LEVEL F, SUPER LEVEL 7
TE-350M6	MIDDLE THERMOCOUPLE, ROD 50, LEVEL F, SUPER LEVEL 6
LEVEL G	
TE-301MG	MIDDLE THERMOCOUPLE, ROD 01, LEVEL G
TE-303MG	MIDDLE THERMOCOUPLE, ROD 03, LEVEL G
TE-314MG	MIDDLE THERMOCOUPLE, ROD 14, LEVEL G
TE-316MG	MIDDLE THERMOCOUPLE, ROD 16, LEVEL G
TE-317MG	MIDDLE THERMOCOUPLE, ROD 17, LEVEL G
TE-320MG	MIDDLE THERMOCOUPLE, ROD 20, LEVEL G
TE-321MG	MIDDLE THERMOCOUPLE, ROD 21, LEVEL G
TE-337MG	MIDDLE THERMOCOUPLE, ROD 37, LEVEL G
TE-338MG	MIDDLE THERMOCOUPLE, ROD 38, LEVEL G
TE-345MG	MIDDLE THERMOCOUPLE, ROD 45, LEVEL G
TE-347MG	MIDDLE THERMOCOUPLE, ROD 47, LEVEL G
TE-354MG	MIDDLE THERMOCOUPLE, ROD 54, LEVEL G
TE-358MG	MIDDLE THERMOCOUPLE, ROD 58, LEVEL G
TE-360MG	MIDDLE THERMOCOUPLE, ROD 60, LEVEL G
TE-364MG	MIDDLE THERMOCOUPLE, ROD 64, LEVEL G
SHROUD BOX THERMOCOUPLES	
LEVEL A	
TE-181W	SHROUD BOX THERMOCOUPLE, LEVEL A WEST SIDE
LEVEL B	
TE-182E	SHROUD BOX THERMOCOUPLE, LEVEL B EAST SIDE
LEVEL C	
TE-183N	SHROUD BOX THERMOCOUPLE, LEVEL C NORTH SIDE
TE-183W	SHROUD BOX THERMOCOUPLE, LEVEL C WEST SIDE
LEVEL D	
TE-184E	SHROUD BOX THERMOCOUPLE, LEVEL D EAST SIDE
TE-184S	SHROUD BOX THERMOCOUPLE, LEVEL D SOUTH SIDE
LEVEL E	
TE-185W	SHROUD BOX THERMOCOUPLE, LEVEL E WEST SIDE
LEVEL F	
TE-186S	SHROUD BOX THERMOCOUPLE, LEVEL F SOUTH SIDE
LEVEL G	
TE-187N	SHROUD BOX THERMOCOUPLE, LEVEL G NORTH SIDE
TE-187W	SHROUD BOX THERMOCOUPLE, LEVEL G WEST SIDE

Table 2 (continued)

SENSOR	DESCRIPTION
BUNDLE TEMPERATURE (CONT.)	
SHROUD BOX THERMOCOUPLES (CONT.)	
LEVEL G (CONT.)	
TE-186E	SHROUD BOX THERMOCOUPLE, LEVEL G EAST SIDE
LEVEL 0	
TE-270AE	SHROUD BOX THERMOCOUPLE, LEVEL 0, PENETRATION A, EAST SIDE
TE-270BE	SHROUD BOX THERMOCOUPLE, LEVEL 0, PENETRATION B, EAST SIDE
LEVEL 1	
TE-271AE	SHROUD BOX THERMOCOUPLE, LEVEL 1, PENETRATION A, EAST SIDE
TE-271BE	SHROUD BOX THERMOCOUPLE, LEVEL 1, PENETRATION B, EAST SIDE
LEVEL 2	
TE-272AE	SHROUD BOX THERMOCOUPLE, LEVEL 2, PENETRATION A, SIDE EAST
TE-272BE	SHROUD BOX THERMOCOUPLE, LEVEL 2, PENETRATION B, EAST SIDE
TE-272AS	SHROUD BOX THERMOCOUPLE, LEVEL 2, PENETRATION A, SOUTH SIDE
TE-272BS	SHROUD BOX THERMOCOUPLE, LEVEL 2, PENETRATION B, SOUTH SIDE
LEVEL 3	
TE-273AE	SHROUD BOX THERMOCOUPLE, LEVEL 3, PENETRATION A, EAST SIDE
TE-273BE	SHROUD BOX THERMOCOUPLE, LEVEL 3, PENETRATION B, EAST SIDE
LEVEL 5	
TE-275AE	SHROUD BOX THERMOCOUPLE, LEVEL 5, PENETRATION A, EAST SIDE
TE-275AS	SHROUD BOX THERMOCOUPLE, LEVEL 5, PENETRATION A, SOUTH SIDE
TE-275BS	SHROUD BOX THERMOCOUPLE, LEVEL 5, PENETRATION B, SOUTH SIDE
LEVEL 6	
TE-276AE	SHROUD BOX THERMOCOUPLE, LEVEL 6, PENETRATION A, EAST SIDE
TE-276BE	SHROUD BOX THERMOCOUPLE, LEVEL 6, PENETRATION B, EAST SIDE
LEVEL 7	
TE-277AE	SHROUD BOX THERMOCOUPLE, LEVEL 7, PENETRATION A, EAST SIDE
TE-277BE	SHROUD BOX THERMOCOUPLE, LEVEL 7, PENETRATION B, EAST SIDE
LEVEL 8	
TE-278AE	SHROUD BOX THERMOCOUPLE, LEVEL 8, PENETRATION A, EAST SIDE
TE-278BE	SHROUD BOX THERMOCOUPLE, LEVEL 8, PENETRATION B, EAST SIDE
LEVEL 9	
TE-279AE	SHROUD BOX THERMOCOUPLE, LEVEL 9, PENETRATION A, EAST SIDE
TE-279BE	SHROUD BOX THERMOCOUPLE, LEVEL 9, PENETRATION B, EAST SIDE
TE-279AS	SHROUD BOX THERMOCOUPLE, LEVEL 9, PENETRATION A, SOUTH SIDE
TE-279BS	SHROUD BOX THERMOCOUPLE, LEVEL 9, PENETRATION B, SOUTH SIDE
THERMOCOUPLE ARRAY ROD	

Table 2 (continued)

SENSOR	DESCRIPTION									
BUNDLE TEMPERATURE (CONT.)										
THERMOCOUPLE ARRAY ROD (CONT.)										
LEVEL D										
TE-188AD	ARRAY	ROD	THERMOCOUPLE	GRID	NUMBER	19	SUBCHANNEL	22	LEVEL	D
TE-189AD	ARRAY	ROD	THERMOCOUPLE	GRID	NUMBER	22	SUBCHANNEL	25	LEVEL	D
TE-189BD	ARRAY	ROD	THERMOCOUPLE	GRID	NUMBER	22	SUBCHANNEL	33	LEVEL	D
LEVEL E										
TE-188AE	ARRAY	ROD	THERMOCOUPLE	GRID	NUMBER	19	SUBCHANNEL	22	LEVEL	E
TE-188BE	ARRAY	ROD	THERMOCOUPLE	GRID	NUMBER	19	SUBCHANNEL	30	LEVEL	E
TE-189AE	ARRAY	ROD	THERMOCOUPLE	GRID	NUMBER	22	SUBCHANNEL	25	LEVEL	E
TE-189BE	ARRAY	ROD	THERMOCOUPLE	GRID	NUMBER	22	SUBCHANNEL	33	LEVEL	E
LEVEL F										
TE-188AF	ARRAY	ROD	THERMOCOUPLE	GRID	NUMBER	19	SUBCHANNEL	22	LEVEL	F
TE-188BF	ARRAY	ROD	THERMOCOUPLE	GRID	NUMBER	19	SUBCHANNEL	30	LEVEL	F
TE-189AF	ARRAY	ROD	THERMOCOUPLE	GRID	NUMBER	22	SUBCHANNEL	25	LEVEL	F
TE-189BF	ARRAY	ROD	THERMOCOUPLE	GRID	NUMBER	22	SUBCHANNEL	33	LEVEL	F
LEVEL G										
TE-188AG	ARRAY	ROD	THERMOCOUPLE	GRID	NUMBER	19	SUBCHANNEL	22	LEVEL	G
TE-188BG	ARRAY	ROD	THERMOCOUPLE	GRID	NUMBER	19	SUBCHANNEL	30	LEVEL	G
TE-189AG	ARRAY	ROD	THERMOCOUPLE	GRID	NUMBER	22	SUBCHANNEL	25	LEVEL	G
TE-189BG	ARRAY	ROD	THERMOCOUPLE	GRID	NUMBER	22	SUBCHANNEL	33	LEVEL	G
SPACER GRID THERMOCOUPLES										
GRID NO. 2										
TE-291A	SPACER	GRID	NUMBER	2	THERMOCOUPLE	SUBCHANNEL	32			
TE-291B	SPACER	GRID	NUMBER	2	THERMOCOUPLE	SUBCHANNEL	43			
TE-291C	SPACER	GRID	NUMBER	2	THERMOCOUPLE	SUBCHANNEL	57			
TE-291D	SPACER	GRID	NUMBER	2	THERMOCOUPLE	SUBCHANNEL	70			
GRID NO. 3										
TE-292A	SPACER	GRID	NUMBER	3	THERMOCOUPLE	SUBCHANNEL	32			
TE-292B	SPACER	GRID	NUMBER	3	THERMOCOUPLE	SUBCHANNEL	43			
TE-292D	SPACER	GRID	NUMBER	3	THERMOCOUPLE	SUBCHANNEL	70			
GRID NO. 4										
TE-293A	SPACER	GRID	NUMBER	4	THERMOCOUPLE	SUBCHANNEL	32			
TE-293B	SPACER	GRID	NUMBER	4	THERMOCOUPLE	SUBCHANNEL	43			
TE-293C	SPACER	GRID	NUMBER	4	THERMOCOUPLE	SUBCHANNEL	57			
TE-293D	SPACER	GRID	NUMBER	4	THERMOCOUPLE	SUBCHANNEL	70			
TE-293E	SPACER	GRID	NUMBER	4	THERMOCOUPLE	SUBCHANNEL	17			
TE-293F	SPACER	GRID	NUMBER	4	THERMOCOUPLE	SUBCHANNEL	38			
GRID NO. 5										

Table 2 (continued)

SENSOR	DESCRIPTION
BUNDLE TEMPERATURE (CONT.)	
SPACER GRID THERMOCOUPLES (CONT.)	
GRID NO. 5 (CONT.)	
TE-294B	SPACER GRID NUMBER 5 THERMOCOUPLE SUBCHANNEL 43
TE-294D	SPACER GRID NUMBER 5 THERMOCOUPLE SUBCHANNEL 70
TE-294E	SPACER GRID NUMBER 5 THERMOCOUPLE SUBCHANNEL 17
TE-294F	SPACER GRID NUMBER 5 THERMOCOUPLE SUBCHANNEL 38
GRID NO. 6	
TE-295A	SPACER GRID NUMBER 6 THERMOCOUPLE SUBCHANNEL 32
TE-295B	SPACER GRID NUMBER 6 THERMOCOUPLE SUBCHANNEL 43
TE-295C	SPACER GRID NUMBER 6 THERMOCOUPLE SUBCHANNEL 57
TE-295D	SPACER GRID NUMBER 6 THERMOCOUPLE SUBCHANNEL 70
GRID NO. 7	
TE-296B	SPACER GRID NUMBER 7 THERMOCOUPLE SUBCHANNEL 43
TE-296D	SPACER GRID NUMBER 7 THERMOCOUPLE SUBCHANNEL 70
SUBCHANNEL THERMOCOUPLES	
TE-1201	SUBCHANNEL NUMBER 1 THERMOCOUPLE
TE-1205	SUBCHANNEL NUMBER 5 THERMOCOUPLE
TE-1207	SUBCHANNEL NUMBER 7 THERMOCOUPLE
TE-1209	SUBCHANNEL NUMBER 9 THERMOCOUPLE
TE-1211	SUBCHANNEL NUMBER 11 THERMOCOUPLE
TE-1213	SUBCHANNEL NUMBER 13 THERMOCOUPLE
TE-1214	SUBCHANNEL NUMBER 14 THERMOCOUPLE
TE-1216	SUBCHANNEL NUMBER 16 THERMOCOUPLE
TE-1217	SUBCHANNEL NUMBER 17 THERMOCOUPLE
TE-1219	SUBCHANNEL NUMBER 19 THERMOCOUPLE
TE-1220	SUBCHANNEL NUMBER 20 THERMOCOUPLE
TE-1221	SUBCHANNEL NUMBER 21 THERMOCOUPLE
TE-1223	SUBCHANNEL NUMBER 23 THERMOCOUPLE
TE-1225	SUBCHANNEL NUMBER 25 THERMOCOUPLE
TE-1226	SUBCHANNEL NUMBER 26 THERMOCOUPLE
TE-1227	SUBCHANNEL NUMBER 27 THERMOCOUPLE
TE-1229	SUBCHANNEL NUMBER 29 THERMOCOUPLE
TE-1230	SUBCHANNEL NUMBER 30 THERMOCOUPLE
TE-1231	SUBCHANNEL NUMBER 31 THERMOCOUPLE
TE-1232	SUBCHANNEL NUMBER 32 THERMOCOUPLE
TE-1234	SUBCHANNEL NUMBER 34 THERMOCOUPLE
TE-1235	SUBCHANNEL NUMBER 35 THERMOCOUPLE
TE-1237	SUBCHANNEL NUMBER 37 THERMOCOUPLE
TE-1238	SUBCHANNEL NUMBER 38 THERMOCOUPLE
TE-1239	SUBCHANNEL NUMBER 39 THERMOCOUPLE
TE-1240	SUBCHANNEL NUMBER 40 THERMOCOUPLE
TE-1241	SUBCHANNEL NUMBER 41 THERMOCOUPLE
TE-1242	SUBCHANNEL NUMBER 42 THERMOCOUPLE
TE-1244	SUBCHANNEL NUMBER 44 THERMOCOUPLE

Table 2 (continued)

SENSOR	DESCRIPTION
BUNDLE TEMPERATURE (CONT.)	
SUBCHANNEL THERMOCOUPLES (CONT.)	
TE-1245	SUBCHANNEL NUMBER 45 THERMOCOUPLE
TE-1247	SUBCHANNEL NUMBER 47 THERMOCOUPLE
TE-1248	SUBCHANNEL NUMBER 48 THERMOCOUPLE
TE-1249	SUBCHANNEL NUMBER 49 THERMOCOUPLE
TE-1250	SUBCHANNEL NUMBER 50 THERMOCOUPLE
TE-1251	SUBCHANNEL NUMBER 51 THERMOCOUPLE
TE-1252	SUBCHANNEL NUMBER 52 THERMOCOUPLE
TE-1255	SUBCHANNEL NUMBER 55 THERMOCOUPLE
TE-1256	SUBCHANNEL NUMBER 56 THERMOCOUPLE
TE-1258	SUBCHANNEL NUMBER 58 THERMOCOUPLE
TE-1259	SUBCHANNEL NUMBER 59 THERMOCOUPLE
TE-1260	SUBCHANNEL NUMBER 60 THERMOCOUPLE
TE-1261	SUBCHANNEL NUMBER 61 THERMOCOUPLE
TE-1263	SUBCHANNEL NUMBER 63 THERMOCOUPLE
TE-1265	SUBCHANNEL NUMBER 65 THERMOCOUPLE
TE-1266	SUBCHANNEL NUMBER 66 THERMOCOUPLE
TE-1268	SUBCHANNEL NUMBER 68 THERMOCOUPLE
TE-1269	SUBCHANNEL NUMBER 69 THERMOCOUPLE
TE-1270	SUBCHANNEL NUMBER 70 THERMOCOUPLE
TE-1271	SUBCHANNEL NUMBER 71 THERMOCOUPLE
TE-1273	SUBCHANNEL NUMBER 73 THERMOCOUPLE
TE-1275	SUBCHANNEL NUMBER 75 THERMOCOUPLE
TE-1277	SUBCHANNEL NUMBER 77 THERMOCOUPLE
TE-1279	SUBCHANNEL NUMBER 79 THERMOCOUPLE
TE-1281	SUBCHANNEL NUMBER 81 THERMOCOUPLE
SPOOL PIECE INSTRUMENTS	
TEMPERATURE	
TE-172	VERTICAL INLET SPOOL TEMPERATURE
TE-208	BUNDLE OUTLET SPOOL TEMPERATURE
TE-24	HORIZONTAL INLET SPOOL TEMPERATURE
TE-222	VERTICAL OUTLET SPOOL TEMPERATURE
TE-40	HORIZONTAL OUTLET SPOOL TEMPERATURE
PRESSURE	
PE-26	HORIZONTAL INLET SPOOL TRANSIENT PRESSURE
PE-42	HORIZONTAL OUTLET SPOOL TRANSIENT PRESSURE
PE-174	VERTICAL INLET SPOOL TRANSIENT PRESSURE
PE-224	VERTICAL OUTLET SPOOL TRANSIENT PRESSURE
PE-209	BUNDLE OUTLET SPOOL TRANSIENT PRESSURE
PE-258	BUNDLE INLET UPPER SPOOL PRESSURE
PRESSURE DROP	
PDE-21	HORIZONTAL INLET SPOOL TRANSIENT DIFFERENTIAL PRESSURE

Table 2 (continued)

SENSOR	DESCRIPTION
SPOOL PIECE INSTRUMENTS (CONT.)	
PRESSURE DROP (CONT.)	
PDE-35	HORIZONTAL OUTLET SPOOL TRANSIENT DIFFERENTIAL PRESSURE
PDE-217	VERTICAL OUTLET SPOOL TRANSIENT DIFFERENTIAL PRESSURE
PDE-251	BUNDLE INLET SPOOL DIFFERENTIAL PRESSURE
VOLUMETRIC FLOW	
FE-19	HORIZONTAL INLET SPOOL VOLUMETRIC FLOW
FE-166	VERTICAL INLET SPOOL VOLUMETRIC FLOW
FE-34	HORIZONTAL OUTLET SPOOL VOLUMETRIC FLOW
FE-216	VERTICAL OUTLET SPOOL VOLUMETRIC FLOW
MOMENTUM FLUX	
FMFE-22	HORIZONTAL INLET SPOOL DRAG DISC
FMFE-38	HORIZONTAL OUTLET SPOOL DRAG DISC
FMFE-170	VERTICAL INLET SPOOL DRAG DISC
FMFE-220	VERTICAL OUTLET SPOOL DRAG DISC
FMFE-206	BUNDLE OUTLET SPOOL DRAG DISC
FMFE-264	BUNDLE INLET LOWER SPOOL DRAG DISC
FLUID DENSITY	
DE-36	HORIZONTAL OUTLET SPOOL DENSITY
DE-168	VERTICAL INLET SPOOL DENSITY
DE-218	VERTICAL OUTLET SPOOL DENSITY
DE-204A	BUNDLE OUTLET SPOOL DENSITY
DE-204B	BUNDLE OUTLET SPOOL DENSITY
DE-204C	BUNDLE OUTLET SPOOL DENSITY
DE-20	BUNDLE INLET SPOOL DENSITY
TEST SECTION INSTRUMENTS	
TEMPERATURE	
TE-210A	TEST SECTION OUTLET LINE STEADY-STATE TEMPERATURE
TE-28	DIFFERENTIAL TEMPERATURE TRANSMITTER
TE-4B	BASE PRIMARY STEADY-STATE TEMPERATURE
TE-150	TEST SECTION BOTTOM FLANGE TEMPERATURE SIDE
TE-151	TEST SECTION BOTTOM FLANGE TEMPERATURE SIDE
TE-152	TEST SECTION BOTTOM FLANGE TEMPERATURE SIDE
TE-29	INLET BLOWDOWN PLENUM TEMPERATURE
TE-45	OUTLET BLOWDOWN PLENUM TEMPERATURE
TE-256	TEST SECTION INLET TEMPERATURE
TE-284	OLD DOWNCOMER PURGE LINE RETURN TEMPERATURE
TE-923	UPPER VOLUME PLUG TEMPERATURE
TE-924	LOWER VOLUME PLUG TEMPERATURE
TE-920	PURGE LINE RETURN TEMPERATURE
TE-921	INNER SEAL COOLANT SUPPLY TEMPERATURE
TE-922	INNER SEAL COOLANT SUPPLY TEMPERATURE

Table 2 (continued)

SENSOR	DESCRIPTION
TEST SECTION INSTRUMENTS (CONT.)	
TEMPERATURE (CONT.)	
TE-925	SHROUD BOX COLD LEG TEMPERATURE AT LEVEL D
TE-926	SHROUD BOX COLD LEG TEMPERATURE AT LEVEL G
TE-936	INBUNDLE GAMMA DENSITOMETER UPPER ION CHAMBER TEMPERATURE
PRESSURE	
PE-156	TEST SECTION INLET TRANSIENT PRESSURE
PE-201	TEST SECTION OUTLET TRANSIENT PRESSURE
PE-16	DOWNSTREAM HCV 2 TRANSIENT PRESSURE
PE-27	INLET PLENUM TRANSIENT PRESSURE
PE-43	OUTLET PLENUM TRANSIENT PRESSURE
PE-427	OUTLET BLOWDOWN LINE TRANSIENT PRESSURE
PE-286	SHROUD PLENUM OUTLET PRESSURE
PE-32	TEST SECTION OUTLET STEADY-STATE PRESSURE
PRESSURE DROP	
PDE-180	SHROUD BOX DIFFERENTIAL PRESSURE FROM LEVEL A TO B
PDE-181	SHROUD BOX DIFFERENTIAL PRESSURE FROM LEVEL B TO C
PDE-182	SHROUD BOX DIFFERENTIAL PRESSURE FROM LEVEL C TO D
PDE-183	SHROUD BOX DIFFERENTIAL PRESSURE FROM LEVEL D TO D/E
PDE-184	SHROUD BOX DIFFERENTIAL PRESSURE FROM LEVEL D/E TO E
PDE-185	SHROUD BOX DIFFERENTIAL PRESSURE FROM LEVEL E TO E/F
PDE-186	SHROUD BOX DIFFERENTIAL PRESSURE FROM LEVEL E/F TO F
PDE-187	SHROUD BOX DIFFERENTIAL PRESSURE LEVEL F TO F/G
PDE-188	SHROUD BOX DIFFERENTIAL PRESSURE LEVEL F/G TO G
PDE-189	SHROUD BOX DIFFERENTIAL PRESSURE FROM LEVEL G TO UPPER TAP
PDE-200	BUNDLE TRANSIENT DIFFERENTIAL PRESSURE
PDE-204	DIFFERENTIAL PRESSURE ACROSS THERMOCOUPLE LEVELS D AND E
PDE-203	TEST SECTION TRANSIENT DIFFERENTIAL PRESSURE
PDE-30	TEST SECTION STEADY-STATE DIFFERENTIAL PRESSURE
PDE-261	DIFFERENTIAL PRESSURE ACROSS THERMOCOUPLE LEVELS E AND F
PDE-271	DIFFERENTIAL PRESSURE ACROSS THERMOCOUPLE LEVELS F AND G
VOLUMETRIC FLOW	
FE-18A	TEST SECTION INLET STEADY-STATE FLOW
FE-238	INNER SEAL COOLANT VOLUMETRIC FLOW
FE-232	INNER SEAL COOLANT VOLUMETRIC FLOW
FE-202	BUNDLE OUTLET LOWER VOLUMETRIC FLOW
FE-250	BUNDLE INLET VOLUMETRIC FLOW NUMBER 2
FE-260	BUNDLE INLET LOWER VOLUMETRIC FLOW
FE-280	PURGE LINE RETURN VOLUMETRIC FLOW
DENSITY	
DE-336U	INBUNDLE GAMMA DENSITOMETER, ROD 36, POSITION UPPER
DE-346L	INBUNDLE GAMMA DENSITOMETER, ROD 46, POSITION LOWER
ZE-336U	INBUNDLE GAMMA DENSITOMETER VERTICAL POSITIONING ON ROD 36

Table 2 (continued)

SENSOR	DESCRIPTION
TEST SECTION INSTRUMENTS (CONT.)	
DENSITY (CONT.) ZE-346L	INBUNDLE GAMMA DENSITOMETER VERTICAL POSITIONING ON ROD 46
PRESSURIZER INSTRUMENTS	
TEMPERATURE	
TE-101	PRESSURIZER VAPOR STEADY-STATE TEMPERATURE
TE-1	PRESSURIZER VAPOR TEMPERATURE
TE-2	PRESSURIZER WATER TEMPERATURE
TE-116	PRESSURIZER EXIT SPOOL TEMPERATURE
PRESSURE	
PE-106	PRESSURIZER VAPOR TRANSIENT PRESSURE
PE-102	PRESSURIZER STEADY-STATE PRESSURE
LEVEL	
LE-100	PRESSURIZER LIQUID LEVEL INSTRUMENT
MOMENTUM FLUX	
FMFE-114	PRESSURIZER LINE SPOOL DRAG DISC
PRIMARY PUMP INSTRUMENTS	
PDE-78	PRIMARY PUMP TRANSIENT DIFFERENTIAL PRESSURE
PE-1A	PRIMARY PUMP FLOW
PE-76	PRIMARY PUMP SUCTION TRANSIENT PRESSURE
SE-72	PRIMARY PUMP SPEED
EME-77A	PRIMARY PUMP POWER
PUMP BYPASS INSTRUMENTS	
PE-15	PUMP BYPASS SPOOL PRESSURE
PRESSURE SUPPRESSION SYSTEM INSTRUMENTS	
TE-408B	PRESSURE SUPPRESSION SYSTEM TANK SPRAY TEMPERATURE
TE-901	PRESSURE STEAM KILLER AIR VENT THERMOCOUPLE
DEMINERALIZED WATER SYSTEM INSTRUMENTS	
PE-616	DEMINERALIZED WATER SUPPLY HEADER PRESSURE
TE-615	DEMINERALIZED WATER 6 INCH HEADER STEADY-STATE TEMPERATURE
TE-520B	4 INCH DEMINERALIZED WATER HEADER TEMPERATURE
HEAT EXCHANGER INSTRUMENTS	
PRIMARY SIDE	
TEMPERATURE	
TE-5B	HEAT EXCHANGER D OUTLET TEMPERATURE

Table 2 (continued)

SENSOR	DESCRIPTION
HEAT EXCHANGER INSTRUMENTS (CONT.)	
PRIMARY SIDE (CONT.)	
TEMPERATURE (CONT.)	
TE-57	HEAT EXCHANGER A SPOOL TEMPERATURE
TE-62	HEAT EXCHANGER B SPOOL TEMPERATURE
TE-67	HEAT EXCHANGER C SPOOL TEMPERATURE
TE-28B	MAIN HEAT EXCHANGER MIXING TEE STEADY-STATE TEMPERATURE
VOLUMETRIC FLOW	
FE-51	HEAT EXCHANGER A SPOOL VOLUMETRIC FLOW
FE-59	HEAT EXCHANGER B SPOOL VOLUMETRIC FLOW
FE-64	HEAT EXCHANGER C SPOOL VOLUMETRIC FLOW
PRESSURE	
PE-44	UPSTREAM MAIN HEAT EXCHANGER TRANSIENT PRESSURE
PE-58	HEAT EXCHANGER A SPOOL PRESSURE
PE-63	HEAT EXCHANGER B SPOOL PRESSURE
PE-68	HEAT EXCHANGER C SPOOL PRESSURE
PRESSURE DROP	
PDE-46	MAIN HEAT EXCHANGER BYPASS TRANSIENT DIFFERENTIAL PRESSURE
PDE-48	MAIN HEAT EXCHANGER STEADY-STATE DIFFERENTIAL PRESSURE
PDE-53	HEAT EXCHANGER A SPOOL DIFFERENTIAL PRESSURE
PDE-60	HEAT EXCHANGER B SPOOL DIFFERENTIAL PRESSURE
PDE-65	HEAT EXCHANGER C SPOOL DIFFERENTIAL PRESSURE
MOMENTUM FLUX	
FMFE-55	HEAT EXCHANGER A SPOOL DRAG DISC
FMFE-61	HEAT EXCHANGER B SPOOL DRAG DISC
FMFE-66	HEAT EXCHANGER C SPOOL DRAG DISC
SECONDARY SIDE	
TEMPERATURE	
TE-525	HEAT EXCHANGER A SECONDARY DISCHARGE STEADY-STATE TEMPERATURE
TE-627	HEAT EXCHANGER B SECONDARY DISCHARGE STEADY-STATE TEMPERATURE
TE-727	HEAT EXCHANGER C SECONDARY DISCHARGE STEADY-STATE TEMPERATURE
TE-557	HEAT EXCHANGER D SECONDARY DISCHARGE STEADY-STATE TEMPERATURE
VOLUMETRIC FLOW	
FE-522	HEAT EXCHANGER A SECONDARY COOLING WATER FLOW
FE-620	HEAT EXCHANGER B SECONDARY COOLING WATER FLOW
FE-720	HEAT EXCHANGER C SECONDARY COOLING WATER FLOW
FE-550	HEAT EXCHANGER D SECONDARY COOLING WATER FLOW
PRESSURE	
PE-526	HEAT EXCHANGER A SECONDARY INLET PRESSURE

Table 2 (continued)

SENSOR	DESCRIPTION
GENERATOR POWER	
GENERATOR VOLTAGE	
EEE-9	GENERATOR 9 VOLTAGE
EEE-10	GENERATOR 10 VOLTAGE
EEE-11	GENERATOR 11 VOLTAGE
EEE-12	GENERATOR 12 VOLTAGE
GENERATOR CURRENT	
EIE-9	GENERATOR 9 CURRENT
EIE-10	GENERATOR 10 CURRENT
EIE-11	GENERATOR 11 CURRENT
EIE-12	GENERATOR 12 CURRENT
HEATER ROD POWER	
HEATER CURRENT	
EIE-1301	ROD 01 HEATER CURRENT
EIE-1302	ROD 02 HEATER CURRENT
EIE-1303	ROD 03 HEATER CURRENT
EIE-1304	ROD 04 HEATER CURRENT
EIE-1305	ROD 05 HEATER CURRENT
EIE-1306	ROD 06 HEATER CURRENT
EIE-1307	ROD 07 HEATER CURRENT
EIE-1308	ROD 08 HEATER CURRENT
EIE-1309	ROD 09 HEATER CURRENT
EIE-1310	ROD 10 HEATER CURRENT
EIE-1311	ROD 11 HEATER CURRENT
EIE-1312	ROD 12 HEATER CURRENT
EIE-1313	ROD 13 HEATER CURRENT
EIE-1314	ROD 14 HEATER CURRENT
EIE-1315	ROD 15 HEATER CURRENT
EIE-1316	ROD 16 HEATER CURRENT
EIE-1317	ROD 17 HEATER CURRENT
EIE-1318	ROD 18 HEATER CURRENT
EIE-1320	ROD 20 HEATER CURRENT
EIE-1321	ROD 21 HEATER CURRENT
EIE-1323	ROD 23 HEATER CURRENT
EIE-1324	ROD 24 HEATER CURRENT
EIE-1325	ROD 25 HEATER CURRENT
EIE-1326	ROD 26 HEATER CURRENT
EIE-1327	ROD 27 HEATER CURRENT
EIE-1328	ROD 28 HEATER CURRENT
EIE-1329	ROD 29 HEATER CURRENT
EIE-1330	ROD 30 HEATER CURRENT

Table 2 (continued)

SENSOR	DESCRIPTION
HEATER ROD POWER (CONT.)	
HEATER CURRENT (CONT.)	
EIE-1331	ROD 31 HEATER CURRENT
EIE-1332	ROD 32 HEATER CURRENT
EIE-1333	ROD 33 HEATER CURRENT
EIE-1334	ROD 34 HEATER CURRENT
EIE-1335	ROD 35 HEATER CURRENT
EIE-1337	ROD 37 HEATER CURRENT
EIE-1338	ROD 38 HEATER CURRENT
EIE-1339	ROD 39 HEATER CURRENT
EIE-1340	ROD 40 HEATER CURRENT
EIE-1341	ROD 41 HEATER CURRENT
EIE-1342	ROD 42 HEATER CURRENT
EIE-1343	ROD 43 HEATER CURRENT
EIE-1344	ROD 44 HEATER CURRENT
EIE-1345	ROD 45 HEATER CURRENT
EIE-1347	ROD 47 HEATER CURRENT
EIE-1348	ROD 48 HEATER CURRENT
EIE-1349	ROD 49 HEATER CURRENT
EIE-1350	ROD 50 HEATER CURRENT
EIE-1351	ROD 51 HEATER CURRENT
EIE-1352	ROD 52 HEATER CURRENT
EIE-1353	ROD 53 HEATER CURRENT
EIE-1354	ROD 54 HEATER CURRENT
EIE-1355	ROD 55 HEATER CURRENT
EIE-1356	ROD 56 HEATER CURRENT
EIE-1357	ROD 57 HEATER CURRENT
EIE-1358	ROD 58 HEATER CURRENT
EIE-1359	ROD 59 HEATER CURRENT
EIE-1360	ROD 60 HEATER CURRENT
EIE-1361	ROD 61 HEATER CURRENT
EIE-1362	ROD 62 HEATER CURRENT
EIE-1363	ROD 63 HEATER CURRENT
EIE-1364	ROD 64 HEATER CURRENT
GENERAL INSTRUMENTATION (ELECTRICAL)	
BREAKWIRE DETECTORS	
XE-430B	INLET BREAKWIRE DETECTOR
XE-430A	OUTLET BREAKWIRE DETECTOR
RTD POWER	
EIE-1001B	RTD POWER SUPPLY CURRENT
DATA ACQUISITION CALIBRATION SIGNALS	
EEE-1026AZ	ZERO INPUT CHANNELS 0 TO 127
EEE-1026BZ	ZERO INPUT CHANNELS 128 TO 255

Table 2 (continued)

SENSOR	DESCRIPTION
GENERAL INSTRUMENTATION (ELECTRICAL) (CONT.)	
DATA ACQUISITION CALIBRATION SIGNALS (CONT.)	
EEE-1026IZ	ZERO INPUT CHANNELS 1024 TO 1151
EEE-1026JZ	ZERO INPUT CHANNELS 1152 TO 1279
EEE-1026KZ	ZERO INPUT CHANNELS 1280 TO 1407
EEE-1026LZ	ZERO INPUT CHANNELS 1408 TO 1535
EEE-1026MZ	ZERO INPUT CHANNELS 1536 TO 1663
EEE-1026NZ	ZERO INPUT CHANNELS 1664 TO 1791
EEE-1026AC	CALIBRATION INPUT CHANNELS 0 TO 127
EEE-1026BC	CALIBRATION INPUT CHANNELS 128 TO 255
EEE-1026IC	CALIBRATION INPUT CHANNELS 1024 TO 1151
EEE-1026JC	CALIBRATION INPUT CHANNELS 1152 TO 1279
EEE-1026KC	CALIBRATION INPUT CHANNELS 1280 TO 1407
EEE-1026LC	CALIBRATION INPUT CHANNELS 1408 TO 1535
EEE-1026MC	CALIBRATION INPUT CHANNELS 1536 TO 1663
EEE-1026NC	CALIBRATION INPUT CHANNELS 1664 TO 1791
MISCELLANEOUS INSTRUMENTS	
TE-521	PURIFICATION COOLING OUTLET THERMOCOUPLE

64

**Table 3. Thermal-Hydraulic Test Facility Test 3.07.9B,
C, D, E, F, G, J, T, U, V, W**

SENSOR		DESCRIPTION			
BUNDLE TEMPERATURE					
SHEATH THERMOCOUPLES					
LEVEL A					
TE-306AA	SHEATH THERMOCOUPLE,	ROD 06,	LEVEL A,	ANGLE A	
TE-323AA	SHEATH THERMOCOUPLE,	ROD 23,	LEVEL A,	ANGLE A	
TE-325CA	SHEATH THERMOCOUPLE,	ROD 25,	LEVEL A,	ANGLE C	
TE-327BA	SHEATH THERMOCOUPLE,	ROD 27,	LEVEL A,	ANGLE B	
TE-340CA	SHEATH THERMOCOUPLE,	ROD 40,	LEVEL A,	ANGLE C	
TE-343BA	SHEATH THERMOCOUPLE,	ROD 43,	LEVEL A,	ANGLE B	
TE-355AA	SHEATH THERMOCOUPLE,	ROD 55,	LEVEL A,	ANGLE A	
TE-357BA	SHEATH THERMOCOUPLE,	ROD 57,	LEVEL A,	ANGLE B	
LEVEL B					
TE-302AB	SHEATH THERMOCOUPLE,	ROD 02,	LEVEL B,	ANGLE A	
TE-306AB	SHEATH THERMOCOUPLE,	ROD 06,	LEVEL B,	ANGLE A	
TE-308CB	SHEATH THERMOCOUPLE,	ROD 08,	LEVEL B,	ANGLE C	
TE-309CB	SHEATH THERMOCOUPLE,	ROD 09,	LEVEL B,	ANGLE C	
TE-311AB	SHEATH THERMOCOUPLE,	ROD 11,	LEVEL B,	ANGLE A	
TE-312CB	SHEATH THERMOCOUPLE,	ROD 12,	LEVEL B,	ANGLE C	
TE-324AB	SHEATH THERMOCOUPLE,	ROD 24,	LEVEL B,	ANGLE A	
TE-325CB	SHEATH THERMOCOUPLE,	ROD 25,	LEVEL B,	ANGLE C	
TE-326BB	SHEATH THERMOCOUPLE,	ROD 26,	LEVEL B,	ANGLE B	
TE-327CB	SHEATH THERMOCOUPLE,	ROD 27,	LEVEL B,	ANGLE C	
TE-329CB	SHEATH THERMOCOUPLE,	ROD 29,	LEVEL B,	ANGLE C	
TE-330CB	SHEATH THERMOCOUPLE,	ROD 30,	LEVEL B,	ANGLE C	
TE-335BB	SHEATH THERMOCOUPLE,	ROD 35,	LEVEL B,	ANGLE B	
TE-339BB	SHEATH THERMOCOUPLE,	ROD 39,	LEVEL B,	ANGLE B	
TE-340CB	SHEATH THERMOCOUPLE,	ROD 40,	LEVEL B,	ANGLE C	
TE-341AB	SHEATH THERMOCOUPLE,	ROD 41,	LEVEL B,	ANGLE A	
TE-343BB	SHEATH THERMOCOUPLE,	ROD 43,	LEVEL B,	ANGLE B	
TE-344CB	SHEATH THERMOCOUPLE,	ROD 44,	LEVEL B,	ANGLE C	
TE-349CB	SHEATH THERMOCOUPLE,	ROD 49,	LEVEL B,	ANGLE C	
TE-351AB	SHEATH THERMOCOUPLE,	ROD 51,	LEVEL B,	ANGLE A	
TE-355CB	SHEATH THERMOCOUPLE,	ROD 55,	LEVEL B,	ANGLE C	
TE-357CB	SHEATH THERMOCOUPLE,	ROD 57,	LEVEL B,	ANGLE C	
TE-361AB	SHEATH THERMOCOUPLE,	ROD 61,	LEVEL B,	ANGLE A	
TE-362BB	SHEATH THERMOCOUPLE,	ROD 62,	LEVEL B,	ANGLE B	
TE-363CB	SHEATH THERMOCOUPLE,	ROD 63,	LEVEL B,	ANGLE C	
LEVEL C					
TE-302BC	SHEATH THERMOCOUPLE,	ROD 02,	LEVEL C,	ANGLE B	
TE-304AC	SHEATH THERMOCOUPLE,	ROD 04,	LEVEL C,	ANGLE A	
TE-307AC	SHEATH THERMOCOUPLE,	ROD 07,	LEVEL C,	ANGLE A	

Table 3 (continued)

SENSOR	DESCRIPTION
BUNDLE TEMPERATURE (CONT.)	
SHEATH THERMOCOUPLES (CONT.)	
LEVEL C (CONT.)	
TE-308BC	SHEATH THERMOCOUPLE, ROD 08, LEVEL C, ANGLE B
TE-309AC	SHEATH THERMOCOUPLE, ROD 09, LEVEL C, ANGLE A
TE-310CC	SHEATH THERMOCOUPLE, ROD 10, LEVEL C, ANGLE C
TE-311CC	SHEATH THERMOCOUPLE, ROD 11, LEVEL C, ANGLE C
TE-312BC	SHEATH THERMOCOUPLE, ROD 12, LEVEL C, ANGLE B
TE-313BC	SHEATH THERMOCOUPLE, ROD 13, LEVEL C, ANGLE B
TE-315AC	SHEATH THERMOCOUPLE, ROD 15, LEVEL C, ANGLE A
TE-323BC	SHEATH THERMOCOUPLE, ROD 23, LEVEL C, ANGLE B
TE-324AC	SHEATH THERMOCOUPLE, ROD 24, LEVEL C, ANGLE A
TE-325BC	SHEATH THERMOCOUPLE, ROD 25, LEVEL C, ANGLE B
TE-325CC	SHEATH THERMOCOUPLE, ROD 25, LEVEL C, ANGLE C
TE-326AC	SHEATH THERMOCOUPLE, ROD 26, LEVEL C, ANGLE A
TE-327AC	SHEATH THERMOCOUPLE, ROD 27, LEVEL C, ANGLE A
TE-327CC	SHEATH THERMOCOUPLE, ROD 27, LEVEL C, ANGLE C
TE-328AC	SHEATH THERMOCOUPLE, ROD 28, LEVEL C, ANGLE A
TE-328CC	SHEATH THERMOCOUPLE, ROD 28, LEVEL C, ANGLE C
TE-329AC	SHEATH THERMOCOUPLE, ROD 29, LEVEL C, ANGLE A
TE-329BC	SHEATH THERMOCOUPLE, ROD 29, LEVEL C, ANGLE B
TE-330AC	SHEATH THERMOCOUPLE, ROD 30, LEVEL C, ANGLE A
TE-333AC	SHEATH THERMOCOUPLE, ROD 33, LEVEL C, ANGLE A
TE-339AC	SHEATH THERMOCOUPLE, ROD 39, LEVEL C, ANGLE A
TE-340BC	SHEATH THERMOCOUPLE, ROD 40, LEVEL C, ANGLE B
TE-343BC	SHEATH THERMOCOUPLE, ROD 43, LEVEL C, ANGLE B
TE-344CC	SHEATH THERMOCOUPLE, ROD 44, LEVEL C, ANGLE C
TE-349CC	SHEATH THERMOCOUPLE, ROD 49, LEVEL C, ANGLE C
TE-351BC	SHEATH THERMOCOUPLE, ROD 51, LEVEL C, ANGLE B
TE-353CC	SHEATH THERMOCOUPLE, ROD 53, LEVEL C, ANGLE C
TE-355BC	SHEATH THERMOCOUPLE, ROD 55, LEVEL C, ANGLE B
TE-357AC	SHEATH THERMOCOUPLE, ROD 57, LEVEL C, ANGLE A
TE-357BC	SHEATH THERMOCOUPLE, ROD 57, LEVEL C, ANGLE B
TE-359CC	SHEATH THERMOCOUPLE, ROD 59, LEVEL C, ANGLE C
TE-361AC	SHEATH THERMOCOUPLE, ROD 61, LEVEL C, ANGLE A
TE-362AC	SHEATH THERMOCOUPLE, ROD 62, LEVEL C, ANGLE A
TE-363BC	SHEATH THERMOCOUPLE, ROD 63, LEVEL C, ANGLE B
LEVEL U	
TE-305BU	SHEATH THERMOCOUPLE, ROD 05, LEVEL U, ANGLE B
TE-352AU	SHEATH THERMOCOUPLE, ROD 52, LEVEL U, ANGLE A
TE-352BU	SHEATH THERMOCOUPLE, ROD 52, LEVEL U, ANGLE B
TE-352CU	SHEATH THERMOCOUPLE, ROD 52, LEVEL U, ANGLE C
TE-356BU	SHEATH THERMOCOUPLE, ROD 56, LEVEL U, ANGLE B
LEVEL H	
TE-305BH	SHEATH THERMOCOUPLE, ROD 05, LEVEL H, ANGLE B
TE-348AH	SHEATH THERMOCOUPLE, ROD 48, LEVEL H, ANGLE A

Table 3 (continued)

SENSOR	DESCRIPTION				
BUNDLE TEMPERATURE (CONT.)					
SHEATH THERMOCOUPLES (CONT.)					
LEVEL H (CONT.)					
TE-352AH	SHEATH THERMOCOUPLE,	ROD 52,	LEVEL H,	ANGLE A	
TE-352BH	SHEATH THERMOCOUPLE,	ROD 52,	LEVEL H,	ANGLE B	
TE-352CH	SHEATH THERMOCOUPLE,	ROD 52,	LEVEL H,	ANGLE C	
TE-356CH	SHEATH THERMOCOUPLE,	ROD 56,	LEVEL H,	ANGLE C	
LEVEL S					
TE-305AS	SHEATH THERMOCOUPLE,	ROD 06,	LEVEL S,	ANGLE A	
TE-352AS	SHEATH THERMOCOUPLE,	ROD 52,	LEVEL S,	ANGLE A	
TE-352BS	SHEATH THERMOCOUPLE,	ROD 52,	LEVEL S,	ANGLE B	
TE-352CS	SHEATH THERMOCOUPLE,	ROD 52,	LEVEL S,	ANGLE C	
TE-356BS	SHEATH THERMOCOUPLE,	ROD 56,	LEVEL S,	ANGLE B	
LEVEL Y					
TE-305CY	SHEATH THERMOCOUPLE,	ROD 05,	LEVEL Y,	ANGLE C	
TE-348AY	SHEATH THERMOCOUPLE,	ROD 48,	LEVEL Y,	ANGLE A	
TE-352AY	SHEATH THERMOCOUPLE,	ROD 52,	LEVEL Y,	ANGLE A	
TE-352BY	SHEATH THERMOCOUPLE,	ROD 52,	LEVEL Y,	ANGLE B	
TE-352CY	SHEATH THERMOCOUPLE,	ROD 52,	LEVEL Y,	ANGLE C	
TE-356AY	SHEATH THERMOCOUPLE,	ROD 56,	LEVEL Y,	ANGLE A	
LEVEL D					
TE-302AD	SHEATH THERMOCOUPLE,	ROD 02,	LEVEL D,	ANGLE A	
TE-303CD	SHEATH THERMOCOUPLE,	ROD 03,	LEVEL D,	ANGLE C	
TE-304AD	SHEATH THERMOCOUPLE,	ROD 04,	LEVEL D,	ANGLE A	
TE-308AD	SHEATH THERMOCOUPLE,	ROD 08,	LEVEL D,	ANGLE A	
TE-308CD	SHEATH THERMOCOUPLE,	ROD 08,	LEVEL D,	ANGLE C	
TE-309CD	SHEATH THERMOCOUPLE,	ROD 09,	LEVEL D,	ANGLE C	
TE-310BD	SHEATH THERMOCOUPLE,	ROD 10,	LEVEL D,	ANGLE B	
TE-310CD	SHEATH THERMOCOUPLE,	ROD 10,	LEVEL D,	ANGLE C	
TE-312CD	SHEATH THERMOCOUPLE,	ROD 12,	LEVEL D,	ANGLE C	
TE-313CD	SHEATH THERMOCOUPLE,	ROD 13,	LEVEL D,	ANGLE C	
TE-315AD	SHEATH THERMOCOUPLE,	ROD 15,	LEVEL D,	ANGLE A	
TE-315BD	SHEATH THERMOCOUPLE,	ROD 15,	LEVEL D,	ANGLE B	
TE-316AD	SHEATH THERMOCOUPLE,	ROD 16,	LEVEL D,	ANGLE A	
TE-317BD	SHEATH THERMOCOUPLE,	ROD 17,	LEVEL D,	ANGLE B	
TE-318BD	SHEATH THERMOCOUPLE,	ROD 18,	LEVEL D,	ANGLE B	
TE-318CD	SHEATH THERMOCOUPLE,	ROD 18,	LEVEL D,	ANGLE C	
TE-320AD	SHEATH THERMOCOUPLE,	ROD 20,	LEVEL D,	ANGLE A	
TE-320BD	SHEATH THERMOCOUPLE,	ROD 20,	LEVEL D,	ANGLE B	
TE-320CD	SHEATH THERMOCOUPLE,	ROD 20,	LEVEL D,	ANGLE C	
TE-324BD	SHEATH THERMOCOUPLE,	ROD 24,	LEVEL D,	ANGLE B	
TE-325BD	SHEATH THERMOCOUPLE,	ROD 25,	LEVEL D,	ANGLE B	
TE-325CD	SHEATH THERMOCOUPLE,	ROD 25,	LEVEL D,	ANGLE C	
TE-326AD	SHEATH THERMOCOUPLE,	ROD 26,	LEVEL D,	ANGLE A	
TE-326CD	SHEATH THERMOCOUPLE,	ROD 26,	LEVEL D,	ANGLE C	

Table 3 (continued)

SENSOR	DESCRIPTION
BUNDLE TEMPERATURE (CONT.)	
SHEATH THERMOCOUPLES (CONT.)	
LEVEL D (CONT.)	
TE-327AD	SHEATH THERMOCOUPLE, ROD 27, LEVEL D, ANGLE A
TE-327BD	SHEATH THERMOCOUPLE, ROD 27, LEVEL D, ANGLE B
TE-327CD	SHEATH THERMOCOUPLE, ROD 27, LEVEL D, ANGLE C
TE-328AD	SHEATH THERMOCOUPLE, ROD 28, LEVEL D, ANGLE A
TE-328BD	SHEATH THERMOCOUPLE, ROD 28, LEVEL D, ANGLE B
TE-328CD	SHEATH THERMOCOUPLE, ROD 28, LEVEL D, ANGLE C
TE-329AD	SHEATH THERMOCOUPLE, ROD 29, LEVEL D, ANGLE A
TE-329BD	SHEATH THERMOCOUPLE, ROD 29, LEVEL D, ANGLE B
TE-329CD	SHEATH THERMOCOUPLE, ROD 29, LEVEL D, ANGLE C
TE-330AD	SHEATH THERMOCOUPLE, ROD 30, LEVEL D, ANGLE A
TE-331CD	SHEATH THERMOCOUPLE, ROD 31, LEVEL D, ANGLE C
TE-332CD	SHEATH THERMOCOUPLE, ROD 32, LEVEL D, ANGLE C
TE-333AD	SHEATH THERMOCOUPLE, ROD 33, LEVEL D, ANGLE A
TE-335BD	SHEATH THERMOCOUPLE, ROD 35, LEVEL D, ANGLE E
TE-339BD	SHEATH THERMOCOUPLE, ROD 39, LEVEL D, ANGLE B
TE-340BD	SHEATH THERMOCOUPLE, ROD 40, LEVEL D, ANGLE B
TE-342BD	SHEATH THERMOCOUPLE, ROD 42, LEVEL D, ANGLE B
TE-343AD	SHEATH THERMOCOUPLE, ROD 43, LEVEL D, ANGLE A
TE-343BD	SHEATH THERMOCOUPLE, ROD 43, LEVEL D, ANGLE B
TE-344CD	SHEATH THERMOCOUPLE, ROD 44, LEVEL D, ANGLE C
TE-345AD	SHEATH THERMOCOUPLE, ROD 45, LEVEL D, ANGLE A
TE-345BD	SHEATH THERMOCOUPLE, ROD 45, LEVEL D, ANGLE B
TE-349CD	SHEATH THERMOCOUPLE, ROD 49, LEVEL D, ANGLE C
TE-351BD	SHEATH THERMOCOUPLE, ROD 51, LEVEL D, ANGLE B
TE-355CD	SHEATH THERMOCOUPLE, ROD 55, LEVEL D, ANGLE C
TE-357BD	SHEATH THERMOCOUPLE, ROD 57, LEVEL D, ANGLE B
TE-357CD	SHEATH THERMOCOUPLE, ROD 57, LEVEL D, ANGLE C
TE-358AD	SHEATH THERMOCOUPLE, ROD 58, LEVEL D, ANGLE A
TE-358CD	SHEATH THERMOCOUPLE, ROD 58, LEVEL D, ANGLE C
TE-359AD	SHEATH THERMOCOUPLE, ROD 59, LEVEL D, ANGLE A
TE-361AD	SHEATH THERMOCOUPLE, ROD 61, LEVEL D, ANGLE A
TE-362AD	SHEATH THERMOCOUPLE, ROD 62, LEVEL D, ANGLE A
TE-364AD	SHEATH THERMOCOUPLE, ROD 64, LEVEL D, ANGLE A
TE-364BD	SHEATH THERMOCOUPLE, ROD 64, LEVEL D, ANGLE B
TE-364CD	SHEATH THERMOCOUPLE, ROD 64, LEVEL D, ANGLE C
TE-326BD	SHEATH THERMOCOUPLE, ROD 26, LEVEL D, ANGLE B
LEVEL E	
TE-302AE	SHEATH THERMOCOUPLE, ROD 02, LEVEL E, ANGLE A
TE-303CE	SHEATH THERMOCOUPLE, ROD 03, LEVEL E, ANGLE C
TE-304BE	SHEATH THERMOCOUPLE, ROD 04, LEVEL E, ANGLE B
TE-307BE	SHEATH THERMOCOUPLE, ROD 07, LEVEL E, ANGLE B
TE-307CE	SHEATH THERMOCOUPLE, ROD 07, LEVEL E, ANGLE C
TE-310BE	SHEATH THERMOCOUPLE, ROD 10, LEVEL E, ANGLE B
TE-312AE	SHEATH THERMOCOUPLE, ROD 12, LEVEL E, ANGLE A

Table 3 (continued)

SENSOR	DESCRIPTION
BUNDLE TEMPERATURE (CONT.)	
SHEATH THERMOCOUPLES (CONT.)	
LEVEL E (CONT.)	
TE-313AE	SHEATH THERMOCOUPLE, ROD 13, LEVEL E, ANGLE A
TE-313CE	SHEATH THERMOCOUPLE, ROD 13, LEVEL E, ANGLE C
TE-315BE	SHEATH THERMOCOUPLE, ROD 15, LEVEL E, ANGLE B
TE-315CE	SHEATH THERMOCOUPLE, ROD 15, LEVEL E, ANGLE C
TE-316BE	SHEATH THERMOCOUPLE, ROD 16, LEVEL E, ANGLE B
TE-316CE	SHEATH THERMOCOUPLE, ROD 16, LEVEL E, ANGLE C
TE-318AE	SHEATH THERMOCOUPLE, ROD 18, LEVEL E, ANGLE A
TE-318BE	SHEATH THERMOCOUPLE, ROD 18, LEVEL E, ANGLE B
TE-318CE	SHEATH THERMOCOUPLE, ROD 18, LEVEL E, ANGLE C
TE-320AE	SHEATH THERMOCOUPLE, ROD 20, LEVEL E, ANGLE A
TE-320BE	SHEATH THERMOCOUPLE, ROD 20, LEVEL E, ANGLE B
TE-320CE	SHEATH THERMOCOUPLE, ROD 20, LEVEL E, ANGLE C
TE-324AE	SHEATH THERMOCOUPLE, ROD 24, LEVEL E, ANGLE A
TE-324CE	SHEATH THERMOCOUPLE, ROD 24, LEVEL E, ANGLE C
TE-326AE	SHEATH THERMOCOUPLE, ROD 26, LEVEL E, ANGLE A
TE-326BE	SHEATH THERMOCOUPLE, ROD 26, LEVEL E, ANGLE B
TE-326CE	SHEATH THERMOCOUPLE, ROD 26, LEVEL E, ANGLE C
TE-328AE	SHEATH THERMOCOUPLE, ROD 28, LEVEL E, ANGLE A
TE-328CE	SHEATH THERMOCOUPLE, ROD 28, LEVEL E, ANGLE C
TE-329AE	SHEATH THERMOCOUPLE, ROD 29, LEVEL E, ANGLE A
TE-329BE	SHEATH THERMOCOUPLE, ROD 29, LEVEL E, ANGLE B
TE-329CE	SHEATH THERMOCOUPLE, ROD 29, LEVEL E, ANGLE C
TE-330AE	SHEATH THERMOCOUPLE, ROD 30, LEVEL E, ANGLE A
TE-330BE	SHEATH THERMOCOUPLE, ROD 30, LEVEL E, ANGLE B
TE-331CE	SHEATH THERMOCOUPLE, ROD 31, LEVEL E, ANGLE C
TE-332AE	SHEATH THERMOCOUPLE, ROD 32, LEVEL E, ANGLE A
TE-332CE	SHEATH THERMOCOUPLE, ROD 32, LEVEL E, ANGLE C
TE-333AE	SHEATH THERMOCOUPLE, ROD 33, LEVEL E, ANGLE A
TE-333BE	SHEATH THERMOCOUPLE, ROD 33, LEVEL E, ANGLE B
TE-333CE	SHEATH THERMOCOUPLE, ROD 33, LEVEL E, ANGLE C
TE-335BE	SHEATH THERMOCOUPLE, ROD 35, LEVEL E, ANGLE B
TE-342BE	SHEATH THERMOCOUPLE, ROD 42, LEVEL E, ANGLE B
TE-344CE	SHEATH THERMOCOUPLE, ROD 44, LEVEL E, ANGLE C
TE-345AE	SHEATH THERMOCOUPLE, ROD 45, LEVEL E, ANGLE A
TE-345BE	SHEATH THERMOCOUPLE, ROD 45, LEVEL E, ANGLE B
TE-349AE	SHEATH THERMOCOUPLE, ROD 49, LEVEL E, ANGLE A
TE-349BE	SHEATH THERMOCOUPLE, ROD 49, LEVEL E, ANGLE B
TE-349CE	SHEATH THERMOCOUPLE, ROD 49, LEVEL E, ANGLE C
TE-351AE	SHEATH THERMOCOUPLE, ROD 51, LEVEL E, ANGLE A
TE-351BE	SHEATH THERMOCOUPLE, ROD 51, LEVEL E, ANGLE B
TE-353AE	SHEATH THERMOCOUPLE, ROD 53, LEVEL E, ANGLE A
TE-353BE	SHEATH THERMOCOUPLE, ROD 53, LEVEL E, ANGLE B
TE-358AE	SHEATH THERMOCOUPLE, ROD 58, LEVEL E, ANGLE A
TE-358BE	SHEATH THERMOCOUPLE, ROD 58, LEVEL E, ANGLE B
TE-359AE	SHEATH THERMOCOUPLE, ROD 59, LEVEL E, ANGLE A

Table 3 (continued)

SENSOR	DESCRIPTION
BUNDLE TEMPERATURE (CONT.)	
SHEATH THERMOCOUPLES (CONT.)	
LEVEL E (CONT.)	
TE-359BE	SHEATH THERMOCOUPLE, ROD 59, LEVEL E, ANGLE B
TE-359CE	SHEATH THERMOCOUPLE, ROD 59, LEVEL E, ANGLE C
TE-361AE	SHEATH THERMOCOUPLE, ROD 61, LEVEL E, ANGLE A
TE-361BE	SHEATH THERMOCOUPLE, ROD 61, LEVEL E, ANGLE B
TE-361CE	SHEATH THERMOCOUPLE, ROD 61, LEVEL E, ANGLE C
TE-362CE	SHEATH THERMOCOUPLE, ROD 62, LEVEL E, ANGLE C
TE-363AE	SHEATH THERMOCOUPLE, ROD 63, LEVEL E, ANGLE A
TE-363BE	SHEATH THERMOCOUPLE, ROD 63, LEVEL E, ANGLE B
TE-364AE	SHEATH THERMOCOUPLE, ROD 64, LEVEL E, ANGLE A
TE-364BE	SHEATH THERMOCOUPLE, ROD 64, LEVEL E, ANGLE B
TE-338E8	SHEATH THERMOCOUPLE, ROD 38, LEVEL E, SUPER LEVEL 8
TE-338E7	SHEATH THERMOCOUPLE, ROD 38, LEVEL E, SUPER LEVEL 7
TE-337E7	SHEATH THERMOCOUPLE, ROD 37, LEVEL E, SUPER LEVEL 7
TE-337E3	SHEATH THERMOCOUPLE, ROD 37, LEVEL E, SUPER LEVEL 3
TE-338E3	SHEATH THERMOCOUPLE, ROD 38, LEVEL E, SUPER LEVEL 3
TE-354E3	SHEATH THERMOCOUPLE, ROD 54, LEVEL E, SUPER LEVEL 3
TE-338E1	SHEATH THERMOCOUPLE, ROD 38, LEVEL E, SUPER LEVEL 1
TE-337E8	SHEATH THERMOCOUPLE, ROD 37, LEVEL E, SUPER LEVEL 8
TE-314E8	SHEATH THERMOCOUPLE, ROD 14, LEVEL E, SUPER LEVEL 8
TE-314E7	SHEATH THERMOCOUPLE, ROD 14, LEVEL E, SUPER LEVEL 7
TE-314E3	SHEATH THERMOCOUPLE, ROD 14, LEVEL E, SUPER LEVEL 3
TE-314E1	SHEATH THERMOCOUPLE, ROD 14, LEVEL E, SUPER LEVEL 1
TE-354E2	SHEATH THERMOCOUPLE, ROD 54, LEVEL E, SUPER LEVEL 2
TE-321E3	SHEATH THERMOCOUPLE, ROD 21, LEVEL E, SUPER LEVEL 3
TE-301E8	SHEATH THERMOCOUPLE, ROD 01, LEVEL E, SUPER LEVEL 8
TE-360E3	SHEATH THERMOCOUPLE, ROD 60, LEVEL E, SUPER LEVEL 3
TE-360E2	SHEATH THERMOCOUPLE, ROD 60, LEVEL E, SUPER LEVEL 2
TE-334E8	SHEATH THERMOCOUPLE, ROD 34, LEVEL E, SUPER LEVEL 8
TE-334E7	SHEATH THERMOCOUPLE, ROD 34, LEVEL E, SUPER LEVEL 7
TE-334E3	SHEATH THERMOCOUPLE, ROD 34, LEVEL E, SUPER LEVEL 3
TE-350E7	SHEATH THERMOCOUPLE, ROD 50, LEVEL E, SUPER LEVEL 7
TE-350E3	SHEATH THERMOCOUPLE, ROD 50, LEVEL E, SUPER LEVEL 3
TE-350E1	SHEATH THERMOCOUPLE, ROD 50, LEVEL E, SUPER LEVEL 1
TE-360E6	SHEATH THERMOCOUPLE, ROD 60, LEVEL E, SUPER LEVEL 6
TE-317E3	SHEATH THERMOCOUPLE, ROD 17, LEVEL E, SUPER LEVEL 3
TE-321E6	SHEATH THERMOCOUPLE, ROD 21, LEVEL E, SUPER LEVEL 6
TE-314E8	MIDDLE THERMOCOUPLE, ROD 14, LEVEL F, SUPER LEVEL 8
TE-314E2	MIDDLE THERMOCOUPLE, ROD 14, LEVEL F, SUPER LEVEL 2
TE-301E1	SHEATH THERMOCOUPLE, ROD 01, LEVEL E, SUPER LEVEL 1
TE-301E2	MIDDLE THERMOCOUPLE, ROD 01, LEVEL F, SUPER LEVEL 2
TE-321E2	SHEATH THERMOCOUPLE, ROD 21, LEVEL E, SUPER LEVEL 2
TE-301E7	SHEATH THERMOCOUPLE, ROD 01, LEVEL E, SUPER LEVEL 7
TE-354E6	SHEATH THERMOCOUPLE, ROD 54, LEVEL E, SUPER LEVEL 6
LEVEL F	

Table 3 (continued)

SENSOR	DESCRIPTION
BUNDLE TEMPERATURE (CONT.)	
SHEATH THERMOCOUPLES (CONT.)	
LEVEL F (CONT.)	
TE-301AF	SHEATH THERMOCOUPLE, ROD 01, LEVEL F, ANGLE A
TE-303BF	SHEATH THERMOCOUPLE, ROD 03, LEVEL F, ANGLE B
TE-304AF	SHEATH THERMOCOUPLE, ROD 04, LEVEL F, ANGLE A
TE-307AF	SHEATH THERMOCOUPLE, ROD 07, LEVEL F, ANGLE A
TE-307BF	SHEATH THERMOCOUPLE, ROD 07, LEVEL F, ANGLE B
TE-310AF	SHEATH THERMOCOUPLE, ROD 10, LEVEL F, ANGLE A
TE-310BF	SHEATH THERMOCOUPLE, ROD 10, LEVEL F, ANGLE B
TE-310CF	SHEATH THERMOCOUPLE, ROD 10, LEVEL F, ANGLE C
TE-313BF	SHEATH THERMOCOUPLE, ROD 13, LEVEL F, ANGLE B
TE-313CF	SHEATH THERMOCOUPLE, ROD 13, LEVEL F, ANGLE C
TE-314AF	SHEATH THERMOCOUPLE, ROD 14, LEVEL F, ANGLE A
TE-315AF	SHEATH THERMOCOUPLE, ROD 15, LEVEL F, ANGLE A
TE-316BF	SHEATH THERMOCOUPLE, ROD 16, LEVEL F, ANGLE B
TE-317AF	SHEATH THERMOCOUPLE, ROD 17, LEVEL F, ANGLE A
TE-318AF	SHEATH THERMOCOUPLE, ROD 18, LEVEL F, ANGLE A
TE-318CF	SHEATH THERMOCOUPLE, ROD 18, LEVEL F, ANGLE C
TE-320AF	SHEATH THERMOCOUPLE, ROD 20, LEVEL F, ANGLE A
TE-320BF	SHEATH THERMOCOUPLE, ROD 20, LEVEL F, ANGLE B
TE-320CF	SHEATH THERMOCOUPLE, ROD 20, LEVEL F, ANGLE C
TE-321AF	SHEATH THERMOCOUPLE, ROD 21, LEVEL F, ANGLE A
TE-328AF	SHEATH THERMOCOUPLE, ROD 28, LEVEL F, ANGLE A
TE-328BF	SHEATH THERMOCOUPLE, ROD 28, LEVEL F, ANGLE B
TE-328CF	SHEATH THERMOCOUPLE, ROD 28, LEVEL F, ANGLE C
TE-331BF	SHEATH THERMOCOUPLE, ROD 31, LEVEL F, ANGLE B
TE-331CF	SHEATH THERMOCOUPLE, ROD 31, LEVEL F, ANGLE C
TE-332CF	SHEATH THERMOCOUPLE, ROD 32, LEVEL F, ANGLE C
TE-334AF	SHEATH THERMOCOUPLE, ROD 34, LEVEL F, ANGLE A
TE-337AF	SHEATH THERMOCOUPLE, ROD 37, LEVEL F, ANGLE A
TE-338AF	SHEATH THERMOCOUPLE, ROD 38, LEVEL F, ANGLE A
TE-342BF	SHEATH THERMOCOUPLE, ROD 42, LEVEL F, ANGLE B
TE-345AF	SHEATH THERMOCOUPLE, ROD 45, LEVEL F, ANGLE A
TE-345BF	SHEATH THERMOCOUPLE, ROD 45, LEVEL F, ANGLE B
TE-345CF	SHEATH THERMOCOUPLE, ROD 45, LEVEL F, ANGLE C
TE-347CF	SHEATH THERMOCOUPLE, ROD 47, LEVEL F, ANGLE C
TE-353BF	SHEATH THERMOCOUPLE, ROD 59, LEVEL F, ANGLE B
TE-354AF	SHEATH THERMOCOUPLE, ROD 54, LEVEL F, ANGLE A
TE-358BF	SHEATH THERMOCOUPLE, ROD 58, LEVEL F, ANGLE B
TE-359AF	SHEATH THERMOCOUPLE, ROD 59, LEVEL F, ANGLE A
TE-359BF	SHEATH THERMOCOUPLE, ROD 59, LEVEL F, ANGLE B
TE-359CF	SHEATH THERMOCOUPLE, ROD 59, LEVEL F, ANGLE C
TE-360AF	SHEATH THERMOCOUPLE, ROD 60, LEVEL F, ANGLE A
TE-364AF	SHEATH THERMOCOUPLE, ROD 64, LEVEL F, ANGLE A
TE-364BF	SHEATH THERMOCOUPLE, ROD 64, LEVEL F, ANGLE B
TE-364CF	SHEATH THERMOCOUPLE, ROD 64, LEVEL F, ANGLE C
TE-354F8	SHEATH THERMOCOUPLE, ROD 54, LEVEL F, SUPER LEVEL 8

Table 3 (continued)

SENSOR	DESCRIPTION
BUNDLE TEMPERATURE (CONT.)	
SHEATH THERMOCOUPLES (CONT.)	
LEVEL F (CONT.)	
TE-354F7	SHEATH THERMOCOUPLE, ROD 54, LEVEL F, SUPER LEVEL 7
TE-354F6	SHEATH THERMOCOUPLE, ROD 54, LEVEL F, SUPER LEVEL 6
TE-354F5	SHEATH THERMOCOUPLE, ROD 54, LEVEL F, SUPER LEVEL 5
TE-354F1	SHEATH THERMOCOUPLE, ROD 54, LEVEL F, SUPER LEVEL 1
TE-337F8	SHEATH THERMOCOUPLE, ROD 37, LEVEL F, SUPER LEVEL 8
TE-337F7	SHEATH THERMOCOUPLE, ROD 37, LEVEL F, SUPER LEVEL 7
TE-337F6	SHEATH THERMOCOUPLE, ROD 37, LEVEL F, SUPER LEVEL 6
TE-334F7	SHEATH THERMOCOUPLE, ROD 34, LEVEL F, SUPER LEVEL 7
TE-334F6	SHEATH THERMOCOUPLE, ROD 34, LEVEL F, SUPER LEVEL 6
TE-334F3	SHEATH THERMOCOUPLE, ROD 34, LEVEL F, SUPER LEVEL 3
TE-360F6	SHEATH THERMOCOUPLE, ROD 60, LEVEL F, SUPER LEVEL 6
TE-360F5	SHEATH THERMOCOUPLE, ROD 60, LEVEL F, SUPER LEVEL 5
TE-360F4	SHEATH THERMOCOUPLE, ROD 60, LEVEL F, SUPER LEVEL 4
TE-338F2	SHEATH THERMOCOUPLE, ROD 38, LEVEL F, SUPER LEVEL 2
TE-338F6	SHEATH THERMOCOUPLE, ROD 38, LEVEL F, SUPER LEVEL 6
TE-338F7	SHEATH THERMOCOUPLE, ROD 38, LEVEL F, SUPER LEVEL 7
TE-350F6	SHEATH THERMOCOUPLE, ROD 50, LEVEL F, SUPER LEVEL 6
TE-350F2	SHEATH THERMOCOUPLE, ROD 50, LEVEL F, SUPER LEVEL 2
TE-350F1	SHEATH THERMOCOUPLE, ROD 50, LEVEL F, SUPER LEVEL 1
TE-321F7	SHEATH THERMOCOUPLE, ROD 21, LEVEL F, SUPER LEVEL 7
TE-321F6	SHEATH THERMOCOUPLE, ROD 21, LEVEL F, SUPER LEVEL 6
TE-321F4	SHEATH THERMOCOUPLE, ROD 21, LEVEL F, SUPER LEVEL 4
TE-321F3	SHEATH THERMOCOUPLE, ROD 21, LEVEL F, SUPER LEVEL 3
TE-314F8	SHEATH THERMOCOUPLE, ROD 14, LEVEL F, SUPER LEVEL 8
TE-314F7	SHEATH THERMOCOUPLE, ROD 14, LEVEL F, SUPER LEVEL 7
TE-317F2	SHEATH THERMOCOUPLE, ROD 17, LEVEL F, SUPER LEVEL 2
TE-301F3	SHEATH THERMOCOUPLE, ROD 01, LEVEL F, SUPER LEVEL 3
TE-317F8	SHEATH THERMOCOUPLE, ROD 17, LEVEL F, SUPER LEVEL 8
TE-317F7	SHEATH THERMOCOUPLE, ROD 17, LEVEL F, SUPER LEVEL 7
TE-317F6	SHEATH THERMOCOUPLE, ROD 17, LEVEL F, SUPER LEVEL 6
TE-317F3	SHEATH THERMOCOUPLE, ROD 17, LEVEL F, SUPER LEVEL 3
TE-301F1	SHEATH THERMOCOUPLE, ROD 01, LEVEL F, SUPER LEVEL 1
TE-301F6	SHEATH THERMOCOUPLE, ROD 01, LEVEL F, SUPER LEVEL 6
TE-301F3	SHEATH THERMOCOUPLE, ROD 01, LEVEL F, SUPER LEVEL 3
TE-301F2	SHEATH THERMOCOUPLE, ROD 01, LEVEL F, SUPER LEVEL 2
TE-354F4	SHEATH THERMOCOUPLE, ROD 54, LEVEL F, SUPER LEVEL 4
TE-354F3	SHEATH THERMOCOUPLE, ROD 54, LEVEL F, SUPER LEVEL 3
TE-334F8	SHEATH THERMOCOUPLE, ROD 34, LEVEL F, SUPER LEVEL 8
TE-334F2	SHEATH THERMOCOUPLE, ROD 34, LEVEL F, SUPER LEVEL 2
TE-334F1	SHEATH THERMOCOUPLE, ROD 34, LEVEL F, SUPER LEVEL 1
TE-360F8	SHEATH THERMOCOUPLE, ROD 60, LEVEL F, SUPER LEVEL 8
TE-360F7	SHEATH THERMOCOUPLE, ROD 60, LEVEL F, SUPER LEVEL 7
TE-360F3	SHEATH THERMOCOUPLE, ROD 60, LEVEL F, SUPER LEVEL 3
TE-350F8	SHEATH THERMOCOUPLE, ROD 50, LEVEL F, SUPER LEVEL 8
TE-321F1	SHEATH THERMOCOUPLE, ROD 21, LEVEL F, SUPER LEVEL 1

Table 3 (continued)

SENSOR	DESCRIPTION
BUNDLE TEMPERATURE (CONT.)	
SHEATH THERMOCOUPLES (CONT.)	
LEVEL F (CONT.)	
TE-350F7	SHEATH THERMOCOUPLE, ROD 50, LEVEL F, SUPER LEVEL 7
TE-350F3	SHEATH THERMOCOUPLE, ROD 50, LEVEL F, SUPER LEVEL 3
TE-337F1	SHEATH THERMOCOUPLE, ROD 37, LEVEL F, SUPER LEVEL 1
TE-314F6	SHEATH THERMOCOUPLE, ROD 14, LEVEL F, SUPER LEVEL 6
TE-314F3	SHEATH THERMOCOUPLE, ROD 14, LEVEL F, SUPER LEVEL 3
TE-338F8	SHEATH THERMOCOUPLE, ROD 38, LEVEL F, SUPER LEVEL 8
TE-317F1	SHEATH THERMOCOUPLE, ROD 17, LEVEL F, SUPER LEVEL 1
TE-321F8	SHEATH THERMOCOUPLE, ROD 21, LEVEL F, SUPER LEVEL 8
TE-321F5	SHEATH THERMOCOUPLE, ROD 21, LEVEL F, SUPER LEVEL 5
TE-301F7	SHEATH THERMOCOUPLE, ROD 01, LEVEL F, SUPER LEVEL 7
TE-301F8	SHEATH THERMOCOUPLE, ROD 01, LEVEL F, SUPER LEVEL 8
TE-314F2	SHEATH THERMOCOUPLE, ROD 14, LEVEL F, SUPER LEVEL 2
LEVEL G	
TE-301AG	SHEATH THERMOCOUPLE, ROD 01, LEVEL G, ANGLE A
TE-303CG	SHEATH THERMOCOUPLE, ROD 03, LEVEL G, ANGLE C
TE-314AG	SHEATH THERMOCOUPLE, ROD 14, LEVEL G, ANGLE A
TE-316BG	SHEATH THERMOCOUPLE, ROD 16, LEVEL G, ANGLE B
TE-316CG	SHEATH THERMOCOUPLE, ROD 16, LEVEL G, ANGLE C
TE-317AG	SHEATH THERMOCOUPLE, ROD 17, LEVEL G, ANGLE A
TE-318AG	SHEATH THERMOCOUPLE, ROD 18, LEVEL G, ANGLE A
TE-318BG	SHEATH THERMOCOUPLE, ROD 18, LEVEL G, ANGLE B
TE-318CG	SHEATH THERMOCOUPLE, ROD 18, LEVEL G, ANGLE C
TE-320AG	SHEATH THERMOCOUPLE, ROD 20, LEVEL G, ANGLE A
TE-320BG	SHEATH THERMOCOUPLE, ROD 20, LEVEL G, ANGLE B
TE-320CG	SHEATH THERMOCOUPLE, ROD 20, LEVEL G, ANGLE C
TE-321AG	SHEATH THERMOCOUPLE, ROD 21, LEVEL G, ANGLE A
TE-332CG	SHEATH THERMOCOUPLE, ROD 32, LEVEL G, ANGLE C
TE-337AG	SHEATH THERMOCOUPLE, ROD 37, LEVEL G, ANGLE A
TE-338AG	SHEATH THERMOCOUPLE, ROD 38, LEVEL G, ANGLE A
TE-342BG	SHEATH THERMOCOUPLE, ROD 42, LEVEL G, ANGLE B
TE-342CG	SHEATH THERMOCOUPLE, ROD 42, LEVEL G, ANGLE C
TE-345AG	SHEATH THERMOCOUPLE, ROD 45, LEVEL G, ANGLE A
TE-345BG	SHEATH THERMOCOUPLE, ROD 45, LEVEL G, ANGLE B
TE-345CG	SHEATH THERMOCOUPLE, ROD 45, LEVEL G, ANGLE C
TE-347CG	SHEATH THERMOCOUPLE, ROD 47, LEVEL G, ANGLE C
TE-354AG	SHEATH THERMOCOUPLE, ROD 54, LEVEL G, ANGLE A
TE-358CG	SHEATH THERMOCOUPLE, ROD 58, LEVEL G, ANGLE C
TE-360AG	SHEATH THERMOCOUPLE, ROD 60, LEVEL G, ANGLE A
TE-364AG	SHEATH THERMOCOUPLE, ROD 64, LEVEL G, ANGLE A
TE-364CG	SHEATH THERMOCOUPLE, ROD 64, LEVEL G, ANGLE C
TE-334AG	SHEATH THERMOCOUPLE, ROD 34, LEVEL G, ANGLE A
TE-350AG	SHEATH THERMOCOUPLE, ROD 50, LEVEL G, ANGLE A

LEVEL J

Table 3 (continued)

SENSOR	DESCRIPTION
BUNDLE TEMPERATURE (CONT.)	
SHEATH THERMOCOUPLES (CONT.)	
LEVEL J (CONT.)	
TE-361CJ	SHEATH THERMOCOUPLE, ROD 61, LEVEL J, ANGLE C
TE-361BJ	SHEATH THERMOCOUPLE, ROD 61, LEVEL J, ANGLE B
MIDDLE THERMOCOUPLES	
LEVEL A	
TE-306MA	MIDDLE THERMOCOUPLE, ROD 06, LEVEL A
TE-311MA	MIDDLE THERMOCOUPLE, ROD 11, LEVEL A
TE-325MA	MIDDLE THERMOCOUPLE, ROD 25, LEVEL A
TE-340MA	MIDDLE THERMOCOUPLE, ROD 40, LEVEL A
TE-341MA	MIDDLE THERMOCOUPLE, ROD 41, LEVEL A
TE-355MA	MIDDLE THERMOCOUPLE, ROD 55, LEVEL A
TE-357MA	MIDDLE THERMOCOUPLE, ROD 57, LEVEL A
LEVEL B	
TE-302MB	MIDDLE THERMOCOUPLE, ROD 02, LEVEL B
TE-308MB	MIDDLE THERMOCOUPLE, ROD 08, LEVEL B
TE-309MB	MIDDLE THERMOCOUPLE, ROD 09, LEVEL B
TE-312MB	MIDDLE THERMOCOUPLE, ROD 12, LEVEL B
TE-325MB	MIDDLE THERMOCOUPLE, ROD 25, LEVEL B
TE-327MB	MIDDLE THERMOCOUPLE, ROD 27, LEVEL B
TE-329MB	MIDDLE THERMOCOUPLE, ROD 29, LEVEL B
TE-330MB	MIDDLE THERMOCOUPLE, ROD 30, LEVEL B
TE-335MB	MIDDLE THERMOCOUPLE, ROD 35, LEVEL B
TE-339MB	MIDDLE THERMOCOUPLE, ROD 39, LEVEL B
TE-340MB	MIDDLE THERMOCOUPLE, ROD 40, LEVEL B
TE-341MB	MIDDLE THERMOCOUPLE, ROD 41, LEVEL B
TE-344MB	MIDDLE THERMOCOUPLE, ROD 44, LEVEL B
TE-349MB	MIDDLE THERMOCOUPLE, ROD 49, LEVEL B
TE-355MB	MIDDLE THERMOCOUPLE, ROD 55, LEVEL B
TE-357MB	MIDDLE THERMOCOUPLE, ROD 57, LEVEL B
TE-361MB	MIDDLE THERMOCOUPLE, ROD 61, LEVEL B
TE-363MB	MIDDLE THERMOCOUPLE, ROD 63, LEVEL B
LEVEL C	
TE-302MC	MIDDLE THERMOCOUPLE, ROD 02, LEVEL C
TE-304MC	MIDDLE THERMOCOUPLE, ROD 04, LEVEL C
TE-306MC	MIDDLE THERMOCOUPLE, ROD 06, LEVEL C
TE-307MC	MIDDLE THERMOCOUPLE, ROD 07, LEVEL C
TE-308MC	MIDDLE THERMOCOUPLE, ROD 08, LEVEL C
TE-309MC	MIDDLE THERMOCOUPLE, ROD 09, LEVEL C
TE-310MC	MIDDLE THERMOCOUPLE, ROD 10, LEVEL C
TE-311MC	MIDDLE THERMOCOUPLE, ROD 11, LEVEL C
TE-312MC	MIDDLE THERMOCOUPLE, ROD 12, LEVEL C
TE-315MC	MIDDLE THERMOCOUPLE, ROD 15, LEVEL C

Table 3 (continued)

SENSOR	DESCRIPTION			
BUNDLE TEMPERATURE (CONT.)				
MIDDLE THERMOCOUPLES (CONT.)				
LEVEL C (CONT.)				
TE-324MC	MIDDLE THERMOCOUPLE,	ROD 24,	LEVEL C	
TE-325MC	MIDDLE THERMOCOUPLE,	ROD 25,	LEVEL C	
TE-326MC	MIDDLE THERMOCOUPLE,	ROD 26,	LEVEL C	
TE-328MC	MIDDLE THERMOCOUPLE,	ROD 28,	LEVEL C	
TE-329MC	MIDDLE THERMOCOUPLE,	ROD 29,	LEVEL C	
TE-330MC	MIDDLE THERMOCOUPLE,	ROD 30,	LEVEL C	
TE-333MC	MIDDLE THERMOCOUPLE,	ROD 33,	LEVEL C	
TE-335MC	MIDDLE THERMOCOUPLE,	ROD 35,	LEVEL C	
TE-339MC	MIDDLE THERMOCOUPLE,	ROD 39,	LEVEL C	
TE-340MC	MIDDLE THERMOCOUPLE,	ROD 40,	LEVEL C	
TE-341MC	MIDDLE THERMOCOUPLE,	ROD 41,	LEVEL C	
TE-344MC	MIDDLE THERMOCOUPLE,	ROD 44,	LEVEL C	
TE-349MC	MIDDLE THERMOCOUPLE,	ROD 49,	LEVEL C	
TE-351MC	MIDDLE THERMOCOUPLE,	ROD 51,	LEVEL C	
TE-353MC	MIDDLE THERMOCOUPLE,	ROD 53,	LEVEL C	
TE-355MC	MIDDLE THERMOCOUPLE,	ROD 55,	LEVEL C	
TE-357MC	MIDDLE THERMOCOUPLE,	ROD 57,	LEVEL C	
TE-359MC	MIDDLE THERMOCOUPLE,	ROD 59,	LEVEL C	
TE-361MC	MIDDLE THERMOCOUPLE,	ROD 61,	LEVEL C	
TE-363MC	MIDDLE THERMOCOUPLE,	ROD 63,	LEVEL C	
LEVEL U				
TE-305MU	MIDDLE THERMOCOUPLE,	ROD 05,	LEVEL U	
TE-348MU	MIDDLE THERMOCOUPLE,	ROD 48,	LEVEL U	
TE-352MU	MIDDLE THERMOCOUPLE,	ROD 52,	LEVEL U	
LEVEL H				
TE-305MH	MIDDLE THERMOCOUPLE,	ROD 05,	LEVEL H	
TE-348MH	MIDDLE THERMOCOUPLE,	ROD 48,	LEVEL H	
TE-352MH	MIDDLE THERMOCOUPLE,	ROD 52,	LEVEL H	
TE-356MH	MIDDLE THERMOCOUPLE,	ROD 56,	LEVEL H	
LEVEL S				
TE-305MS	MIDDLE THERMOCOUPLE,	ROD 05,	LEVEL S	
TE-348MS	MIDDLE THERMOCOUPLE,	ROD 48,	LEVEL S	
TE-352MS	MIDDLE THERMOCOUPLE,	ROD 52,	LEVEL S	
TE-356MS	MIDDLE THERMOCOUPLE,	ROD 56,	LEVEL S	
LEVEL Y				
TE-305MY	MIDDLE THERMOCOUPLE,	ROD 05,	LEVEL Y	
TE-348MY	MIDDLE THERMOCOUPLE,	ROD 48,	LEVEL Y	
TE-352MY	MIDDLE THERMOCOUPLE,	ROD 52,	LEVEL Y	
LEVEL D				
TE-302MD	MIDDLE THERMOCOUPLE,	ROD 02,	LEVEL D	

Table 3 (continued)

SENSOR	DESCRIPTION
BUNDLE TEMPERATURE (CONT.)	
MIDDLE THERMOCOUPLES (CONT.)	
LEVEL D (CONT.)	
TE-303MD	MIDDLE THERMOCOUPLE, ROD 03, LEVEL D
TE-304MD	MIDDLE THERMOCOUPLE, ROD 04, LEVEL D
TE-306MD	MIDDLE THERMOCOUPLE, ROD 06, LEVEL D
TE-307MD	MIDDLE THERMOCOUPLE, ROD 07, LEVEL D
TE-308MD	MIDDLE THERMOCOUPLE, ROD 08, LEVEL D
TE-310MD	MIDDLE THERMOCOUPLE, ROD 10, LEVEL D
TE-311MD	MIDDLE THERMOCOUPLE, ROD 11, LEVEL D
TE-312MD	MIDDLE THERMOCOUPLE, ROD 12, LEVEL D
TE-315MD	MIDDLE THERMOCOUPLE, ROD 15, LEVEL D
TE-316MD	MIDDLE THERMOCOUPLE, ROD 16, LEVEL D
TE-318MD	MIDDLE THERMOCOUPLE, ROD 18, LEVEL D
TE-320MD	MIDDLE THERMOCOUPLE, ROD 20, LEVEL D
TE-324MD	MIDDLE THERMOCOUPLE, ROD 24, LEVEL D
TE-325MD	MIDDLE THERMOCOUPLE, ROD 25, LEVEL D
TE-326MD	MIDDLE THERMOCOUPLE, ROD 26, LEVEL D
TE-328MD	MIDDLE THERMOCOUPLE, ROD 28, LEVEL D
TE-329MD	MIDDLE THERMOCOUPLE, ROD 29, LEVEL D
TE-335MD	MIDDLE THERMOCOUPLE, ROD 35, LEVEL D
TE-339MD	MIDDLE THERMOCOUPLE, ROD 39, LEVEL D
TE-341MD	MIDDLE THERMOCOUPLE, ROD 41, LEVEL D
TE-345MD	MIDDLE THERMOCOUPLE, ROD 45, LEVEL D
TE-347MD	MIDDLE THERMOCOUPLE, ROD 47, LEVEL D
TE-349MD	MIDDLE THERMOCOUPLE, ROD 49, LEVEL D
TE-353MD	MIDDLE THERMOCOUPLE, ROD 53, LEVEL D
TE-355MD	MIDDLE THERMOCOUPLE, ROD 55, LEVEL D
TE-357MD	MIDDLE THERMOCOUPLE, ROD 57, LEVEL D
TE-358MD	MIDDLE THERMOCOUPLE, ROD 58, LEVEL D
TE-361MD	MIDDLE THERMOCOUPLE, ROD 61, LEVEL D
TE-363MD	MIDDLE THERMOCOUPLE, ROD 63, LEVEL D
TE-364MD	MIDDLE THERMOCOUPLE, ROD 64, LEVEL D
LEVEL E	
TE-303ME	MIDDLE THERMOCOUPLE, ROD 03, LEVEL E
TE-304ME	MIDDLE THERMOCOUPLE, ROD 04, LEVEL E
TE-307ME	MIDDLE THERMOCOUPLE, ROD 07, LEVEL E
TE-310ME	MIDDLE THERMOCOUPLE, ROD 10, LEVEL E
TE-312ME	MIDDLE THERMOCOUPLE, ROD 12, LEVEL E
TE-315ME	MIDDLE THERMOCOUPLE, ROD 15, LEVEL E
TE-316ME	MIDDLE THERMOCOUPLE, ROD 16, LEVEL E
TE-318ME	MIDDLE THERMOCOUPLE, ROD 18, LEVEL E
TE-324ME	MIDDLE THERMOCOUPLE, ROD 24, LEVEL E
TE-326ME	MIDDLE THERMOCOUPLE, ROD 26, LEVEL E
TE-328ME	MIDDLE THERMOCOUPLE, ROD 28, LEVEL E
TE-329ME	MIDDLE THERMOCOUPLE, ROD 29, LEVEL E
TE-330ME	MIDDLE THERMOCOUPLE, ROD 30, LEVEL E

Table 3 (continued)

SENSOR	DESCRIPTION
BUNDLE TEMPERATURE (CONT.)	
MIDDLE THERMOCOUPLES (CONT.)	
LEVEL E (CONT.)	
TE-335ME	MIDDLE THERMOCOUPLE, ROD 35, LEVEL E
TE-339ME	MIDDLE THERMOCOUPLE, ROD 39, LEVEL E
TE-344ME	MIDDLE THERMOCOUPLE, ROD 44, LEVEL E
TE-345ME	MIDDLE THERMOCOUPLE, ROD 45, LEVEL E
TE-347ME	MIDDLE THERMOCOUPLE, ROD 47, LEVEL E
TE-349ME	MIDDLE THERMOCOUPLE, ROD 49, LEVEL E
TE-353ME	MIDDLE THERMOCOUPLE, ROD 53, LEVEL E
TE-358ME	MIDDLE THERMOCOUPLE, ROD 58, LEVEL E
TE-359ME	MIDDLE THERMOCOUPLE, ROD 59, LEVEL E
TE-363ME	MIDDLE THERMOCOUPLE, ROD 63, LEVEL E
LEVEL F	
TE-301MF	MIDDLE THERMOCOUPLE, ROD 01, LEVEL F
TE-303MF	MIDDLE THERMOCOUPLE, ROD 03, LEVEL F
TE-304MF	MIDDLE THERMOCOUPLE, ROD 04, LEVEL F
TE-307MF	MIDDLE THERMOCOUPLE, ROD 07, LEVEL F
TE-314MF	MIDDLE THERMOCOUPLE, ROD 14, LEVEL F
TE-315MF	MIDDLE THERMOCOUPLE, ROD 15, LEVEL F
TE-316MF	MIDDLE THERMOCOUPLE, ROD 16, LEVEL F
TE-317MF	MIDDLE THERMOCOUPLE, ROD 17, LEVEL F
TE-318MF	MIDDLE THERMOCOUPLE, ROD 18, LEVEL F
TE-321MF	MIDDLE THERMOCOUPLE, ROD 21, LEVEL F
TE-328MF	MIDDLE THERMOCOUPLE, ROD 28, LEVEL F
TE-331MF	MIDDLE THERMOCOUPLE, ROD 31, LEVEL F
TE-334MF	MIDDLE THERMOCOUPLE, ROD 34, LEVEL F
TE-337MF	MIDDLE THERMOCOUPLE, ROD 37, LEVEL F
TE-338MF	MIDDLE THERMOCOUPLE, ROD 38, LEVEL F
TE-347MF	MIDDLE THERMOCOUPLE, ROD 47, LEVEL F
TE-350MF	MIDDLE THERMOCOUPLE, ROD 50, LEVEL F
TE-354MF	MIDDLE THERMOCOUPLE, ROD 54, LEVEL F
TE-358MF	MIDDLE THERMOCOUPLE, ROD 58, LEVEL F
TE-359MF	MIDDLE THERMOCOUPLE, ROD 59, LEVEL F
TE-360MF	MIDDLE THERMOCOUPLE, ROD 60, LEVEL F
TE-364MF	MIDDLE THERMOCOUPLE, ROD 64, LEVEL F
TE-301M8	MIDDLE THERMOCOUPLE, ROD 01, LEVEL F, SUPER LEVEL 8
TE-317M6	MIDDLE THERMOCOUPLE, ROD 17, LEVEL F, SUPER LEVEL 6
TE-321M3	MIDDLE THERMOCOUPLE, ROD 21, LEVEL F, SUPER LEVEL 3
TE-321M1	MIDDLE THERMOCOUPLE, ROD 21, LEVEL F, SUPER LEVEL 1
TE-337M7	MIDDLE THERMOCOUPLE, ROD 37, LEVEL F, SUPER LEVEL 7
TE-337M6	MIDDLE THERMOCOUPLE, ROD 37, LEVEL F, SUPER LEVEL 6
TE-338M8	MIDDLE THERMOCOUPLE, ROD 38, LEVEL F, SUPER LEVEL 8
TE-338M2	MIDDLE THERMOCOUPLE, ROD 38, LEVEL F, SUPER LEVEL 2
TE-354M6	MIDDLE THERMOCOUPLE, ROD 54, LEVEL F, SUPER LEVEL 6
TE-354M5	MIDDLE THERMOCOUPLE, ROD 54, LEVEL F, SUPER LEVEL 5
TE-360M3	MIDDLE THERMOCOUPLE, ROD 60, LEVEL F, SUPER LEVEL 3

Table 3 (continued)

SENSOR	DESCRIPTION
BUNDLE TEMPERATURE (CONT.)	
MIDDLE THERMOCOUPLES (CONT.)	
LEVEL F (CONT.)	
TE-317M7	MIDDLE THERMOCOUPLE, ROD 17, LEVEL F, SUPER LEVEL 7
TE-334M6	MIDDLE THERMOCOUPLE, ROD 34, LEVEL F, SUPER LEVEL 6
TE-350M7	MIDDLE THERMOCOUPLE, ROD 50, LEVEL F, SUPER LEVEL 7
TE-350M6	MIDDLE THERMOCOUPLE, ROD 50, LEVEL F, SUPER LEVEL 6
LEVEL G	
TE-301MG	MIDDLE THERMOCOUPLE, ROD 01, LEVEL G
TE-303MG	MIDDLE THERMOCOUPLE, ROD 03, LEVEL G
TE-314MG	MIDDLE THERMOCOUPLE, ROD 14, LEVEL G
TE-316MG	MIDDLE THERMOCOUPLE, ROD 16, LEVEL G
TE-317MG	MIDDLE THERMOCOUPLE, ROD 17, LEVEL G
TE-320MG	MIDDLE THERMOCOUPLE, ROD 20, LEVEL G
TE-321MG	MIDDLE THERMOCOUPLE, ROD 21, LEVEL G
TE-337MG	MIDDLE THERMOCOUPLE, ROD 37, LEVEL G
TE-338MG	MIDDLE THERMOCOUPLE, ROD 38, LEVEL G
TE-345MG	MIDDLE THERMOCOUPLE, ROD 45, LEVEL G
TE-347MG	MIDDLE THERMOCOUPLE, ROD 47, LEVEL G
TE-354MG	MIDDLE THERMOCOUPLE, ROD 54, LEVEL G
TE-358MG	MIDDLE THERMOCOUPLE, ROD 58, LEVEL G
TE-360MG	MIDDLE THERMOCOUPLE, ROD 60, LEVEL G
TE-364MG	MIDDLE THERMOCOUPLE, ROD 64, LEVEL G
SHROUD BOX THERMOCOUPLES	
LEVEL A	
TE-181W	SHROUD BOX THERMOCOUPLE, LEVEL A WEST SIDE
LEVEL B	
TE-182E	SHROUD BOX THERMOCOUPLE, LEVEL B EAST SIDE
LEVEL D	
TE-183N	SHROUD BOX THERMOCOUPLE, LEVEL C NORTH SIDE
TE-183W	SHROUD BOX THERMOCOUPLE, LEVEL C WEST SIDE
LEVEL D	
TE-184E	SHROUD BOX THERMOCOUPLE, LEVEL D EAST SIDE
TE-184S	SHROUD BOX THERMOCOUPLE, LEVEL D SOUTH SIDE
LEVEL E	
TE-185W	SHROUD BOX THERMOCOUPLE, LEVEL E WEST SIDE
LEVEL F	
TE-186S	SHROUD BOX THERMOCOUPLE, LEVEL F SOUTH SIDE
LEVEL G	

Table 3 (continued)

SENSOR	DESCRIPTION
BUNDLE TEMPERATURE (CONT.)	
SHROUD BOX THERMOCOUPLES (CONT.)	
LEVEL G (CONT.)	
TE-187N	SHROUD BOX THERMOCOUPLE, LEVEL G NORTH SIDE
TE-187W	SHROUD BOX THERMOCOUPLE, LEVEL G WEST SIDE
TE-186E	SHROUD BOX THERMOCOUPLE, LEVEL G EAST SIDE
LEVEL 0	
TE-270AE	SHROUD BOX THERMOCOUPLE, LEVEL 0, PENETRATION A, EAST SIDE
TE-270BE	SHROUD BOX THERMOCOUPLE, LEVEL 0, PENETRATION B, EAST SIDE
LEVEL 1	
TE-271AE	SHROUD BOX THERMOCOUPLE, LEVEL 1, PENETRATION A, EAST SIDE
TE-271BE	SHROUD BOX THERMOCOUPLE, LEVEL 1, PENETRATION B, EAST SIDE
LEVEL 2	
TE-272AE	SHROUD BOX THERMOCOUPLE, LEVEL 2, PENETRATION A, EAST SIDE
TE-272BE	SHROUD BOX THERMOCOUPLE, LEVEL 2, PENETRATION B, EAST SIDE
TE-272AS	SHROUD BOX THERMOCOUPLE, LEVEL 2, PENETRATION A, SOUTH SIDE
TE-272BS	SHROUD BOX THERMOCOUPLE, LEVEL 2, PENETRATION B, SOUTH SIDE
LEVEL 3	
TE-273AE	SHROUD BOX THERMOCOUPLE, LEVEL 3, PENETRATION A, EAST SIDE
TE-273BE	SHROUD BOX THERMOCOUPLE, LEVEL 3, PENETRATION B, EAST SIDE
LEVEL 5	
TE-275AE	SHROUD BOX THERMOCOUPLE, LEVEL 5, PENETRATION A, EAST SIDE
TE-275AS	SHROUD BOX THERMOCOUPLE, LEVEL 5, PENETRATION A, SOUTH SIDE
TE-275BS	SHROUD BOX THERMOCOUPLE, LEVEL 5, PENETRATION B, SOUTH SIDE
LEVEL 6	
TE-276AE	SHROUD BOX THERMOCOUPLE, LEVEL 6, PENETRATION A, EAST SIDE
TE-276BE	SHROUD BOX THERMOCOUPLE, LEVEL 6, PENETRATION B, EAST SIDE
LEVEL 7	
TE-277AE	SHROUD BOX THERMOCOUPLE, LEVEL 7, PENETRATION A, EAST SIDE
TE-277BE	SHROUD BOX THERMOCOUPLE, LEVEL 7, PENETRATION B, EAST SIDE
LEVEL 8	
TE-278AE	SHROUD BOX THERMOCOUPLE, LEVEL 8, PENETRATION A, EAST SIDE
TE-278BE	SHROUD BOX THERMOCOUPLE, LEVEL 8, PENETRATION B, EAST SIDE
LEVEL 9	
TE-279AE	SHROUD BOX THERMOCOUPLE, LEVEL 9, PENETRATION A, EAST SIDE
TE-279BE	SHROUD BOX THERMOCOUPLE, LEVEL 9, PENETRATION B, EAST SIDE
TE-279AS	SHROUD BOX THERMOCOUPLE, LEVEL 9, PENETRATION A, SOUTH SIDE
TE-279BS	SHROUD BOX THERMOCOUPLE, LEVEL 9, PENETRATION B, SOUTH SIDE

Table 3 (continued)

SENSOR	DESCRIPTION						

BUNDLE TEMPERATURE (CONT.)							
THERMOCOUPLE ARRAY ROD							
LEVEL D							
TE-188AD	ARRAY	ROD	THERMOCOUPLE	GRID NUMBER 19	SUBCHANNEL 22	LEVEL D	
TE-189AD	ARRAY	ROD	THERMOCOUPLE	GRID NUMBER 22	SUBCHANNEL 25	LEVEL D	
TE-189BD	ARRAY	ROD	THERMOCOUPLE	GRID NUMBER 22	SUBCHANNEL 33	LEVEL D	
LEVEL E							
TE-188AE	ARRAY	ROD	THERMOCOUPLE	GRID NUMBER 19	SUBCHANNEL 22	LEVEL E	
TE-188BE	ARRAY	ROD	THERMOCOUPLE	GRID NUMBER 19	SUBCHANNEL 30	LEVEL E	
TE-189AE	ARRAY	ROD	THERMOCOUPLE	GRID NUMBER 22	SUBCHANNEL 25	LEVEL E	
TE-189BE	ARRAY	ROD	THERMOCOUPLE	GRID NUMBER 22	SUBCHANNEL 33	LEVEL E	
LEVEL F							
TE-188AF	ARRAY	ROD	THERMOCOUPLE	GRID NUMBER 19	SUBCHANNEL 22	LEVEL F	
TE-188BF	ARRAY	ROD	THERMOCOUPLE	GRID NUMBER 19	SUBCHANNEL 30	LEVEL F	
TE-189AF	ARRAY	ROD	THERMOCOUPLE	GRID NUMBER 22	SUBCHANNEL 25	LEVEL F	
TE-189BF	ARRAY	ROD	THERMOCOUPLE	GRID NUMBER 22	SUBCHANNEL 33	LEVEL F	
LEVEL G							
TE-188AG	ARRAY	ROD	THERMOCOUPLE	GRID NUMBER 19	SUBCHANNEL 22	LEVEL G	
TE-188BG	ARRAY	ROD	THERMOCOUPLE	GRID NUMBER 19	SUBCHANNEL 30	LEVEL G	
TE-189AG	ARRAY	ROD	THERMOCOUPLE	GRID NUMBER 22	SUBCHANNEL 25	LEVEL G	
TE-189BG	ARRAY	ROD	THERMOCOUPLE	GRID NUMBER 22	SUBCHANNEL 33	LEVEL G	
SPACER GRID THERMOCOUPLES							
GRID NO. 2							
TE-291A	SPACER	GRID	NUMBER 2	THERMOCOUPLE	SUBCHANNEL 32		
TE-291B	SPACER	GRID	NUMBER 2	THERMOCOUPLE	SUBCHANNEL 43		
TE-291C	SPACER	GRID	NUMBER 2	THERMOCOUPLE	SUBCHANNEL 57		
TE-291D	SPACER	GRID	NUMBER 2	THERMOCOUPLE	SUBCHANNEL 70		
GRID NO. 3							
TE-292A	SPACER	GRID	NUMBER 3	THERMOCOUPLE	SUBCHANNEL 32		
TE-292B	SPACER	GRID	NUMBER 3	THERMOCOUPLE	SUBCHANNEL 43		
TE-292D	SPACER	GRID	NUMBER 3	THERMOCOUPLE	SUBCHANNEL 70		
GRID NO. 4							
TE-293A	SPACER	GRID	NUMBER 4	THERMOCOUPLE	SUBCHANNEL 32		
TE-293B	SPACER	GRID	NUMBER 4	THERMOCOUPLE	SUBCHANNEL 43		
TE-293C	SPACER	GRID	NUMBER 4	THERMOCOUPLE	SUBCHANNEL 57		
TE-293D	SPACER	GRID	NUMBER 4	THERMOCOUPLE	SUBCHANNEL 70		
TE-293E	SPACER	GRID	NUMBER 4	THERMOCOUPLE	SUBCHANNEL 17		
TE-293F	SPACER	GRID	NUMBER 4	THERMOCOUPLE	SUBCHANNEL 38		

Table 3 (continued)

SENSOR	DESCRIPTION
BUNDLE TEMPERATURE (CONT.)	
SPACER GRID THERMOCOUPLES (CONT.)	
GRID NO. 5	
TE-294B	SPACER GRID NUMBER 5 THERMOCOUPLE SUBCHANNEL 43
TE-294D	SPACER GRID NUMBER 5 THERMOCOUPLE SUBCHANNEL 70
TE-294E	SPACER GRID NUMBER 5 THERMOCOUPLE SUBCHANNEL 17
TE-294F	SPACER GRID NUMBER 5 THERMOCOUPLE SUBCHANNEL 38
GRID NO. 6	
TE-295A	SPACER GRID NUMBER 6 THERMOCOUPLE SUBCHANNEL 32
TE-295B	SPACER GRID NUMBER 6 THERMOCOUPLE SUBCHANNEL 43
TE-295C	SPACER GRID NUMBER 6 THERMOCOUPLE SUBCHANNEL 57
TE-295D	SPACER GRID NUMBER 6 THERMOCOUPLE SUBCHANNEL 70
GRID NO. 7	
TE-296B	SPACER GRID NUMBER 7 THERMOCOUPLE SUBCHANNEL 43
TE-296D	SPACER GRID NUMBER 7 THERMOCOUPLE SUBCHANNEL 70
SUBCHANNEL THERMOCOUPLES	
TE-1201	SUBCHANNEL NUMBER 1 THERMOCOUPLE
TE-1205	SUBCHANNEL NUMBER 5 THERMOCOUPLE
TE-1207	SUBCHANNEL NUMBER 7 THERMOCOUPLE
TE-1209	SUBCHANNEL NUMBER 9 THERMOCOUPLE
TE-1211	SUBCHANNEL NUMBER 11 THERMOCOUPLE
TE-1213	SUBCHANNEL NUMBER 13 THERMOCOUPLE
TE-1214	SUBCHANNEL NUMBER 14 THERMOCOUPLE
TE-1216	SUBCHANNEL NUMBER 16 THERMOCOUPLE
TE-1217	SUBCHANNEL NUMBER 17 THERMOCOUPLE
TE-1219	SUBCHANNEL NUMBER 19 THERMOCOUPLE
TE-1220	SUBCHANNEL NUMBER 20 THERMOCOUPLE
TE-1221	SUBCHANNEL NUMBER 21 THERMOCOUPLE
TE-1223	SUBCHANNEL NUMBER 23 THERMOCOUPLE
TE-1225	SUBCHANNEL NUMBER 25 THERMOCOUPLE
TE-1226	SUBCHANNEL NUMBER 26 THERMOCOUPLE
TE-1227	SUBCHANNEL NUMBER 27 THERMOCOUPLE
TE-1229	SUBCHANNEL NUMBER 29 THERMOCOUPLE
TE-1230	SUBCHANNEL NUMBER 30 THERMOCOUPLE
TE-1231	SUBCHANNEL NUMBER 31 THERMOCOUPLE
TE-1232	SUBCHANNEL NUMBER 32 THERMOCOUPLE
TE-1234	SUBCHANNEL NUMBER 34 THERMOCOUPLE
TE-1235	SUBCHANNEL NUMBER 35 THERMOCOUPLE
TE-1237	SUBCHANNEL NUMBER 37 THERMOCOUPLE
TE-1238	SUBCHANNEL NUMBER 38 THERMOCOUPLE
TE-1239	SUBCHANNEL NUMBER 39 THERMOCOUPLE
TE-1240	SUBCHANNEL NUMBER 40 THERMOCOUPLE
TE-1241	SUBCHANNEL NUMBER 41 THERMOCOUPLE
TE-1242	SUBCHANNEL NUMBER 42 THERMOCOUPLE

Table 3 (continued)

SENSOR	DESCRIPTION
BUNDLE TEMPERATURE (CONT.)	
SUBCHANNEL THERMOCOUPLES (CONT.)	
TE-1244	SUBCHANNEL NUMBER 44 THERMOCOUPLE
TE-1245	SUBCHANNEL NUMBER 45 THERMOCOUPLE
TE-1247	SUBCHANNEL NUMBER 47 THERMOCOUPLE
TE-1248	SUBCHANNEL NUMBER 48 THERMOCOUPLE
TE-1249	SUBCHANNEL NUMBER 49 THERMOCOUPLE
TE-1250	SUBCHANNEL NUMBER 50 THERMOCOUPLE
TE-1251	SUBCHANNEL NUMBER 51 THERMOCOUPLE
TE-1252	SUBCHANNEL NUMBER 52 THERMOCOUPLE
TE-1255	SUBCHANNEL NUMBER 55 THERMOCOUPLE
TE-1256	SUBCHANNEL NUMBER 56 THERMOCOUPLE
TE-1258	SUBCHANNEL NUMBER 58 THERMOCOUPLE
TE-1259	SUBCHANNEL NUMBER 59 THERMOCOUPLE
TE-1260	SUBCHANNEL NUMBER 60 THERMOCOUPLE
TE-1261	SUBCHANNEL NUMBER 61 THERMOCOUPLE
TE-1263	SUBCHANNEL NUMBER 63 THERMOCOUPLE
TE-1265	SUBCHANNEL NUMBER 65 THERMOCOUPLE
TE-1266	SUBCHANNEL NUMBER 66 THERMOCOUPLE
TE-1268	SUBCHANNEL NUMBER 68 THERMOCOUPLE
TE-1269	SUBCHANNEL NUMBER 69 THERMOCOUPLE
TE-1270	SUBCHANNEL NUMBER 70 THERMOCOUPLE
TE-1271	SUBCHANNEL NUMBER 71 THERMOCOUPLE
TE-1273	SUBCHANNEL NUMBER 73 THERMOCOUPLE
TE-1275	SUBCHANNEL NUMBER 75 THERMOCOUPLE
TE-1277	SUBCHANNEL NUMBER 77 THERMOCOUPLE
TE-1279	SUBCHANNEL NUMBER 79 THERMOCOUPLE
TE-1281	SUBCHANNEL NUMBER 81 THERMOCOUPLE
SPOOL PIECE INSTRUMENTS	
TEMPERATURE	
TE-172	VERTICAL INLET SPOOL TEMPERATURE
TE-208	BUNDLE OUTLET SPOOL TEMPERATURE
TE-24	HORIZONTAL INLET SPOOL TEMPERATURE
TE-222	VERTICAL OUTLET SPOOL TEMPERATURE
TE-40	HORIZONTAL OUTLET SPOOL TEMPERATURE
PRESSURE	
PE-26	HORIZONTAL INLET SPOOL TRANSIENT PRESSURE
PE-42	HORIZONTAL OUTLET SPOOL TRANSIENT PRESSURE
PE-174	VERTICAL INLET SPOOL TRANSIENT PRESSURE
PE-224	VERTICAL OUTLET SPOOL TRANSIENT PRESSURE
PE-209	BUNDLE OUTLET SPOOL TRANSIENT PRESSURE
PE-258	BUNDLE INLET UPPER SPOOL PRESSURE
PRESSURE DROP	

Table 3 (continued)

SENSOR	DESCRIPTION
SPOOL PIECE INSTRUMENTS (CONT.)	
PRESSURE DROP (CONT.)	
PDE-21	HORIZONTAL INLET SPOOL TRANSIENT DIFFERENTIAL PRESSURE
PDE-35	HORIZONTAL OUTLET SPOOL TRANSIENT DIFFERENTIAL PRESSURE
PDE-217	VERTICAL OUTLET SPOOL TRANSIENT DIFFERENTIAL PRESSURE
PDE-251	BUNDLE INLET SPOOL DIFFERENTIAL PRESSURE
VOLUMETRIC FLOW	
FE-19	HORIZONTAL INLET SPOOL VOLUMETRIC FLOW
FE-166	VERTICAL INLET SPOOL VOLUMETRIC FLOW
FE-34	HORIZONTAL OUTLET SPOOL VOLUMETRIC FLOW
FE-216	VERTICAL OUTLET SPOOL VOLUMETRIC FLOW
MOMENTUM FLUX	
FMFE-22	HORIZONTAL INLET SPOOL DRAG DISC
FMFE-38	HORIZONTAL OUTLET SPOOL DRAG DISC
FMFE-170	VERTICAL INLET SPOOL DRAG DISC
FMFE-220	VERTICAL OUTLET SPOOL DRAG DISC
FMFE-206	BUNDLE OUTLET SPOOL DRAG DISC
FMFE-264	BUNDLE INLET LOWER SPOOL DRAG DISC
FLUID DENSITY	
DE-36	HORIZONTAL OUTLET SPOOL DENSITY
DE-168	VERTICAL INLET SPOOL DENSITY
DE-218	VERTICAL OUTLET SPOOL DENSITY
DE-204A	BUNDLE OUTLET SPOOL DENSITY
DE-204B	BUNDLE OUTLET SPOOL DENSITY
DE-204C	BUNDLE OUTLET SPOOL DENSITY
DE-20	BUNDLE INLET SPOOL DENSITY
TEST SECTION INSTRUMENTS	
TEMPERATURE	
TE-210A	TEST SECTION OUTLET LINE STEADY-STATE TEMPERATURE
TDE-28	DIFFERENTIAL TEMPERATURE TRANSMITTER
TE-4B	BASE PRIMARY STEADY-STATE TEMPERATURE
TE-150	TEST SECTION BOTTOM FLANGE TEMPERATURE SIDE
TE-151	TEST SECTION BOTTOM FLANGE TEMPERATURE SIDE
TE-152	TEST SECTION BOTTOM FLANGE TEMPERATURE SIDE
TE-29	INLET BLOWDOWN PLENUM TEMPERATURE
TE-45	OUTLET BLOWDOWN PLENUM TEMPERATURE
TE-256	TEST SECTION INLET TEMPERATURE
TE-284	OLD DOWNCOMER PURGE LINE RETURN TEMPERATURE
TE-923	UPPER VOLUME PLUG TEMPERATURE
TE-924	LOWER VOLUME PLUG TEMPERATURE
TE-920	PURGE LINE RETURN TEMPERATURE
TE-921	INNER SEAL COOLANT SUPPLY TEMPERATURE

Table 3 (continued)

SENSOR	DESCRIPTION
TEST SECTION INSTRUMENTS (CONT.)	
TEMPERATURE (CONT.)	
TE-922	INNER SEAL COOLANT SUPPLY TEMPERATURE
TE-925	SHROUD BOX COLD LEG TEMPERATURE AT LEVEL D
TE-926	SHROUD BOX COLD LEG TEMPERATURE AT LEVEL G
TE-936	INBUNDLE GAMMA DENSITOMETER UPPER ION CHAMBER TEMPERATURE
PRESSURE	
PE-156	TEST SECTION INLET TRANSIENT PRESSURE
PE-201	TEST SECTION OUTLET TRANSIENT PRESSURE
PE-16	DOWNSTREAM HCV 2 TRANSIENT PRESSURE
PE-27	INLET PLENUM TRANSIENT PRESSURE
PE-43	OUTLET PLENUM TRANSIENT PRESSURE
PE-427	OUTLET BLOWDOWN LINE TRANSIENT PRESSURE
PE-286	SHROUD PLENUM OUTLET PRESSURE
PE-32	TEST SECTION OUTLET STEADY-STATE PRESSURE
PRESSURE DROP	
PDE-180	SHROUD BOX DIFFERENTIAL PRESSURE F/E AT LEVEL E
PDE-181	SHROUD BOX DIFFERENTIAL PRESSURE F AT LEVEL F/G
PDE-182	SHROUD BOX DIFFERENTIAL PRESSURE F/G AT LEVEL F
PDE-183	SHROUD BOX DIFFERENTIAL PRESSURE AT LEVEL 3
PDE-184	SHROUD BOX DIFFERENTIAL PRESSURE AT LEVEL 4
PDE-185	SHROUD BOX DIFFERENTIAL PRESSURE AT LEVEL 5
PDE-186	SHROUD BOX DIFFERENTIAL PRESSURE AT LEVEL 6
PDE-187	SHROUD BOX DIFFERENTIAL PRESSURE AT LEVEL 7
PDE-188	SHROUD BOX DIFFERENTIAL PRESSURE AT LEVEL 8
PDE-189	SHROUD BOX DIFFERENTIAL PRESSURE AT LEVEL 9
PDE-200	BUNDLE TRANSIENT DIFFERENTIAL PRESSURE
PDE-204	DIFFERENTIAL PRESSURE ACROSS THERMOCOUPLE LEVELS D AND E
PDE-203	TEST SECTION TRANSIENT DIFFERENTIAL PRESSURE
PDE-30	TEST SECTION STEADY-STATE DIFFERENTIAL PRESSURE
PDE-261	DIFFERENTIAL PRESSURE ACROSS THERMOCOUPLE LEVELS E AND F
PDE-271	DIFFERENTIAL PRESSURE ACROSS THERMOCOUPLE LEVELS F AND G
VOLUMETRIC FLOW	
FE-18A	TEST SECTION INLET STEADY-STATE FLOW
FE-238	INNER SEAL COOLANT VOLUMETRIC FLOW
FE-232	INNER SEAL COOLANT VOLUMETRIC FLOW
FE-202	BUNDLE OUTPUT LOWER VOLUMETRIC FLOW
FE-250	BUNDLE INLET VOLUMETRIC FLOW NUMBER 2
FE-260	BUNDLE INLET LOWER VOLUMETRIC FLOW
FE-280	PURGE LINE RETURN VOLUMETRIC FLOW
DENSITY	
DE-336U	INBUNDLE GAMMA DENSITOMETER, ROD 36, POSITION UPPER
DE-346L	INBUNDLE GAMMA DENSITOMETER, ROD 46, POSITION LOWER

Table 3 (continued)

SENSOR	DESCRIPTION
TEST SECTION INSTRUMENTS (CONT.)	
DENSITY (CONT.)	
ZE-336U	INBUNDLE GAMMA DENSITOMETER VERTICAL POSITIONING ON ROD 36
ZE-346L	INBUNDLE GAMMA DENSITOMETER VERTICAL POSITIONING ON ROD 46
PRESSURIZER INSTRUMENTS	
TEMPERATURE	
TE-101	PRESSURIZER VAPOR STEADY-STATE TEMPERATURE
TE-1	PRESSURIZER VAPOR TEMPERATURE
TE-2	PRESSURIZER WATER TEMPERATURE
TE-116	PRESSURIZER EXIT SPOOL TEMPERATURE
PRESSURE	
PE-106	PRESSURIZER VAPOR TRANSIENT PRESSURE
PE-102	PRESSURIZER STEADY-STATE PRESSURE
LEVEL	
LE-100	PRESSURIZER LIQUID LEVEL INSTRUMENT
MOMENTUM FLUX	
FMFE-114	PRESSURIZER LINE SPOOL DRAG DISC
PRIMARY PUMP INSTRUMENTS	
PDE-78	PRIMARY PUMP TRANSIENT DIFFERENTIAL PRESSURE
FE-1A	PRIMARY PUMP FLOW
PE-76	PRIMARY PUMP SUCTION TRANSIENT PRESSURE
SE-72	PRIMARY PUMP SPEED
EWE-77A	PRIMARY PUMP POWER
PUMP BYPASS INSTRUMENTS	
PE-15	PUMP BYPASS SPOOL PRESSURE
PRESSURE SUPPRESSION SYSTEM INSTRUMENTS	
TE-408B	PRESSURE SUPPRESSION SYSTEM TANK SPRAY TEMPERATURE
TE-901	PRESSURE STEAM KILLER AIR VENT THERMOCOUPLE
DEMINERALIZED WATER SYSTEM INSTRUMENTS	
PE-616	DEMINERALIZED WATER SUPPLY HEADER PRESSURE
TE-615	DEMINERALIZED WATER 6 INCH HEADER STEADY-STATE TEMPERATURE
TE-520B	4 INCH DEMINERALIZED WATER HEADER TEMPERATURE
HEAT EXCHANGER INSTRUMENTS	
PRIMARY SIDE	
TEMPERATURE	

Table 3 (continued)

SENSOR	DESCRIPTION
HEAT EXCHANGER INSTRUMENTS (CONT.)	
PRIMARY SIDE (CONT.)	
TEMPERATURE (CONT.)	
TE-5B	HEAT EXCHANGER D OUTLET TEMPERATURE
TE-57	HEAT EXCHANGER A SPOOL TEMPERATURE
TE-62	HEAT EXCHANGER B SPOOL TEMPERATURE
TE-67	HEAT EXCHANGER C SPOOL TEMPERATURE
TE-28B	MAIN HEAT EXCHANGER MIXING TEE STEADY-STATE TEMPERATURE
VOLUMETRIC FLOW	
FE-51	HEAT EXCHANGER A SPOOL VOLUMETRIC FLOW
FE-59	HEAT EXCHANGER B SPOOL VOLUMETRIC FLOW
FE-64	HEAT EXCHANGER C SPOOL VOLUMETRIC FLOW
PRESSURE	
PE-44	UPSTREAM MAIN HEAT EXCHANGER TRANSIENT PRESSURE
PE-58	HEAT EXCHANGER A SPOOL PRESSURE
PE-63	HEAT EXCHANGER B SPOOL PRESSURE
PE-68	HEAT EXCHANGER C SPOOL PRESSURE
PRESSURE DROP	
PDE-46	MAIN HEAT EXCHANGER BYPASS TRANSIENT DIFFERENTIAL PRESSURE
PDE-48	MAIN HEAT EXCHANGER STEADY-STATE DIFFERENTIAL PRESSURE
PDE-53	HEAT EXCHANGER A SPOOL DIFFERENTIAL PRESSURE
PDE-60	HEAT EXCHANGER B SPOOL DIFFERENTIAL PRESSURE
PDE-65	HEAT EXCHANGER C SPOOL DIFFERENTIAL PRESSURE
MOMENTUM FLUX	
FMFE-55	HEAT EXCHANGER A SPOOL DRAG DISC
FMFE-61	HEAT EXCHANGER B SPOOL DRAG DISC
FMFE-66	HEAT EXCHANGER C SPOOL DRAG DISC
SECONDARY SIDE	
TEMPERATURE	
TE-627	HEAT EXCHANGER B SECONDARY DISCHARGE STEADY-STATE TEMPERATURE
TE-727	HEAT EXCHANGER C SECONDARY DISCHARGE STEADY-STATE TEMPERATURE
TE-557	HEAT EXCHANGER D SECONDARY DISCHARGE STEADY-STATE TEMPERATURE
VOLUMETRIC FLOW	
FE-522	HEAT EXCHANGER A SECONDARY COOLING WATER FLOW
FE-620	HEAT EXCHANGER B SECONDARY COOLING WATER FLOW
FE-720	HEAT EXCHANGER C SECONDARY COOLING WATER FLOW
FE-550	HEAT EXCHANGER D SECONDARY COOLING WATER FLOW
PRESSURE	
PE-526	HEAT EXCHANGER A SECONDARY INLET PRESSURE

Table 3 (continued)

SENSOR	DESCRIPTION
GENERATOR POWER	
GENERATOR VOLTAGE	
EEE-9	GENERATOR 9 VOLTAGE
EEE-10	GENERATOR 10 VOLTAGE
EEE-11	GENERATOR 11 VOLTAGE
EEE-12	GENERATOR 12 VOLTAGE
GENERATOR CURRENT	
EIE-9	GENERATOR 9 CURRENT
EIE-10	GENERATOR 10 CURRENT
EIE-11	GENERATOR 11 CURRENT
EIE-12	GENERATOR 12 CURRENT
HEATER ROD POWER	
HEATER CURRENT	
EIE-1301	ROD 01 HEATER CURRENT
EIE-1302	ROD 02 HEATER CURRENT
EIE-1303	ROD 03 HEATER CURRENT
EIE-1304	ROD 04 HEATER CURRENT
EIE-1305	ROD 05 HEATER CURRENT
EIE-1306	ROD 06 HEATER CURRENT
EIE-1307	ROD 07 HEATER CURRENT
EIE-1308	ROD 08 HEATER CURRENT
EIE-1309	ROD 09 HEATER CURRENT
EIE-1310	ROD 10 HEATER CURRENT
EIE-1311	ROD 11 HEATER CURRENT
EIE-1312	ROD 12 HEATER CURRENT
EIE-1313	ROD 13 HEATER CURRENT
EIE-1314	ROD 14 HEATER CURRENT
EIE-1315	ROD 15 HEATER CURRENT
EIE-1316	ROD 16 HEATER CURRENT
EIE-1317	ROD 17 HEATER CURRENT
EIE-1318	ROD 18 HEATER CURRENT
EIE-1320	ROD 20 HEATER CURRENT
EIE-1321	ROD 21 HEATER CURRENT
EIE-1323	ROD 23 HEATER CURRENT
EIE-1324	ROD 24 HEATER CURRENT
EIE-1325	ROD 25 HEATER CURRENT
EIE-1326	ROD 26 HEATER CURRENT
EIE-1327	ROD 27 HEATER CURRENT
EIE-1328	ROD 28 HEATER CURRENT
EIE-1329	ROD 29 HEATER CURRENT
EIE-1330	ROD 30 HEATER CURRENT

Table 3 (continued)

SENSOR	DESCRIPTION
HEATER ROD POWER (CONT.)	
HEATER CURRENT (CONT.)	
EIE-1331	ROD 31 HEATER CURRENT
EIE-1332	ROD 32 HEATER CURRENT
EIE-1333	ROD 33 HEATER CURRENT
EIE-1334	ROD 34 HEATER CURRENT
EIE-1335	ROD 35 HEATER CURRENT
EIE-1337	ROD 37 HEATER CURRENT
EIE-1338	ROD 38 HEATER CURRENT
EIE-1339	ROD 39 HEATER CURRENT
EIE-1340	ROD 40 HEATER CURRENT
EIE-1341	ROD 41 HEATER CURRENT
EIE-1342	ROD 42 HEATER CURRENT
EIE-1343	ROD 43 HEATER CURRENT
EIE-1344	ROD 44 HEATER CURRENT
EIE-1345	ROD 45 HEATER CURRENT
EIE-1347	ROD 47 HEATER CURRENT
EIE-1348	ROD 48 HEATER CURRENT
EIE-1349	ROD 49 HEATER CURRENT
EIE-1350	ROD 50 HEATER CURRENT
EIE-1351	ROD 51 HEATER CURRENT
EIE-1352	ROD 52 HEATER CURRENT
EIE-1353	ROD 53 HEATER CURRENT
EIE-1354	ROD 54 HEATER CURRENT
EIE-1355	ROD 55 HEATER CURRENT
EIE-1356	ROD 56 HEATER CURRENT
EIE-1357	ROD 57 HEATER CURRENT
EIE-1358	ROD 58 HEATER CURRENT
EIE-1359	ROD 59 HEATER CURRENT
EIE-1360	ROD 60 HEATER CURRENT
EIE-1361	ROD 61 HEATER CURRENT
EIE-1362	ROD 62 HEATER CURRENT
EIE-1363	ROD 63 HEATER CURRENT
EIE-1364	ROD 64 HEATER CURRENT
GENERAL INSTRUMENTATION (ELECTRICAL)	
BREAKWIRE DETECTORS	
XE-430B	INLET BREAKWIRE DETECTOR
XE-430A	OUTLET BREAKWIRE DETECTOR
RTD POWER	
EIE-1001B	RTD POWER SUPPLY CURRENT
DATA ACQUISITION CALIBRATION SIGNALS	
EEE-1026AZ	ZERO INPUT CHANNELS 0 TO 127
EEE-1026BZ	ZERO INPUT CHANNELS 128 TO 255

Table 3 (continued)

SENSOR	DESCRIPTION
GENERAL INSTRUMENTATION (ELECTRICAL) (CONT.)	
DATA ACQUISITION CALIBRATION SIGNALS (CONT.)	
EEE-1026IZ	ZERO INPUT CHANNELS 1024 TO 1151
EEE-1026JZ	ZERO INPUT CHANNELS 1152 TO 1279
EEE-1026KZ	ZERO INPUT CHANNELS 1280 TO 1407
EEE-1026LZ	ZERO INPUT CHANNELS 1408 TO 1535
EEE-1026MZ	ZERO INPUT CHANNELS 1536 TO 1663
EEE-1026NZ	ZERO INPUT CHANNELS 1664 TO 1791
FEE-1026AC	CALIBRATION INPUT CHANNELS 0 TO 127
EEE-1026BC	CALIBRATION INPUT CHANNELS 128 TO 255
EEE-1026IC	CALIBRATION INPUT CHANNELS 1024 TO 1151
EEE-1026JC	CALIBRATION INPUT CHANNELS 1152 TO 1279
EEE-1026KC	CALIBRATION INPUT CHANNELS 1280 TO 1407
EEE-1026LC	CALIBRATION INPUT CHANNELS 1408 TO 1535
EEE-1026MC	CALIBRATION INPUT CHANNELS 1536 TO 1663
EEE-1026NC	CALIBRATION INPUT CHANNELS 1664 TO 1791
MISCELLANEOUS INSTRUMENTS	
TE-521	PURIFICATION COOLING OUTLET THERMOCOUPLE

**Table 4. Thermal-Hydraulic Test Facility Test 3.07.9H,
I, K, L, M, N, O, P, X**

TABLE		
NAME	ENTRY NUMBER	TYPE CODE
DE-168	143	106
DE-20	168	106
DE-204A	162	106
DE-204B	163	106
DE-204C	164	106
DE-218	144	106
DE-336U	165	111
DE-346L	166	111
DE-36	142	106
EEE-10	98	33
EEE-1026AC	2	39
EEE-1026AZ	1	38
EEE-1026BC	116	39
EEE-1026BZ	115	38
EEE-1026IC	190	39
EEE-1026IZ	189	38
EEE-1026JC	313	39
EEE-1026JZ	312	38
EEE-1026KC	429	39
EEE-1026KZ	428	38
EEE-1026LC	553	39
EEE-1026LZ	552	38
EEE-1026MC	679	39

Table 4 (continued)

NAME	ENTRY NUMBER	TYPE CODE
EEE-1026MZ	678	38
EEE-1026NC	794	39
EEE-1026NZ	793	38
EEE-11	99	33
EEE-12	100	33
EEE-9	97	33
EIE-10	94	32
EIE-1001B	102	30
EIE-11	95	32
EIE-12	96	32
EIE-1301	60	31
EIE-1302	90	31
EIE-1303	71	31
EIE-1304	92	31
EIE-1305	72	31
EIE-1306	36	31
EIE-1307	38	31
EIE-1308	35	31
EIE-1309	57	31
EIE-1310	91	31
EIE-1311	73	31
EIE-1312	37	31
EIE-1313	34	31

Table 4 (continued)

NAME	ENTRY NUMBER	TYPE CODE
EIE-1314	33	31
EIE-1315	80	31
EIE-1316	40	31
EIE-1317	58	31
EIE-1318	61	31
EIE-1320	70	31
EIE-1321	39	31
EIE-1323	82	31
EIE-1324	41	31
EIE-1325	55	31
EIE-1326	63	31
EIE-1327	87	31
EIE-1328	59	31
EIE-1329	83	31
EIE-1330	81	31
EIE-1331	32	31
EIE-1332	48	31
EIE-1333	64	31
EIE-1334	62	31
EIE-1335	56	31
EIE-1337	85	31
EIE-1338	47	31
EIE-1339	31	31

Table 4 (continued)

NAME	ENTRY NUMBER	TYPE CODE
EIE-1340	49	31
EIE-1341	88	31
EIE-1342	89	31
EIE-1343	67	31
EIE-1344	66	31
EIE-1345	53	31
EIE-1347	46	31
EIE-1348	50	31
EIE-1349	54	31
EIE-1350	65	31
EIE-1351	69	31
EIE-1352	68	31
EIE-1353	77	31
EIE-1354	52	31
EIE-1355	51	31
EIE-1356	84	31
EIE-1357	74	31
EIE-1358	75	31
EIE-1359	76	31
EIE-1360	86	31
EIE-1361	43	31
EIE-1362	42	31
EIE-1363	45	31

Table 4 (continued)

NAME	ENTRY NUMBER	TYPE CODE
EIE-1364	44	31
EIE-9	93	32
EWE-77A	108	34
FE-1A	147	107
FE-166	109	109
FE-18A	25	108
FE-202	184	109
FE-216	141	109
FE-232	183	109
FE-238	121	108
FE-250	185	109
FE-260	186	109
FE-280	187	109
FE-34	140	109
FE-51	180	109
FE-522	111	95
FE-550	112	96
FE-59	181	109
FE-620	113	95
FE-64	182	109
FE-720	114	95
FMFE-114	125	40
FMFE-170	23	35

Table 4 (continued)

NAME	ENTRY NUMBER	TYPE CODE
FMFE-206	78	35
FMFE-22	21	35
FMFE-220	24	35
FMFE-264	126	40
FMFE-38	22	35
FMFE-55	122	40
FMFE-61	123	40
FMFE-66	124	40
LE-100	152	105
PDE-180	3	75
PDE-181	4	75
PDE-182	5	75
PDE-183	6	75
PDE-184	7	75
PDE-185	8	75
PDE-186	117	75
PDE-187	118	75
PDE-188	119	75
PDE-189	120	75
PDE-200	20	28
PDE-203	138	28
PDE-204	134	43
PDE-21	26	26

Table 4 (continued)

NAME	ENTRY NUMBER	TYPE CODE
PDE-217	28	26
PDE-251	139	28
PDE-261	160	43
PDE-271	161	43
PDE-30	149	98
PDE-35	27	26
PDE-46	18	26
PDE-48	151	97
PDE-53	135	28
PDE-60	136	26
PDE-65	137	28
PDE-78	19	27
PE-102	153	24
PE-106	13	23
PE-15	127	23
PE-156	14	23
PE-16	105	23
PE-174	29	23
PE-201	15	23
PE-209	131	23
PE-224	30	23
PE-258	132	23
PE-26	9	23

Table 4 (continued)

NAME	ENTRY NUMBER	TYPE CODE
PE-27	106	23
PE-286	133	23
PE-32	150	24
PE-42	10	23
PE-427	110	23
PE-43	107	23
PE-44	11	23
PE-526	16	29
PE-58	128	23
PE-616	17	29
PE-63	129	23
PE-68	130	23
PE-76	12	23
SE-72	79	36
TDE-28	148	99
TE-1	390	6
TE-101	158	110
TE-116	392	6
TE-1201	362	3
TE-1205	355	3
TE-1207	667	3
TE-1209	236	3
TE-1211	359	3

Table 4 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-1213	178	3
TE-1214	357	3
TE-1216	514	3
TE-1217	237	3
TE-1219	414	3
TE-1220	413	3
TE-1221	360	3
TE-1223	356	3
TE-1225	240	3
TE-1226	238	3
TE-1227	242	3
TE-1229	644	3
TE-1230	369	3
TE-1231	361	3
TE-1232	358	3
TE-1234	212	3
TE-1235	179	3
TE-1237	370	3
TE-1238	371	3
TE-1239	372	3
TE-1240	368	3
TE-1241	379	3
TE-1242	232	3

Table 4 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-1244	235	3
TE-1245	233	3
TE-1247	177	3
TE-1248	174	3
TE-1249	239	3
TE-1250	380	3
TE-1251	363	3
TE-1252	220	3
TE-1255	668	3
TE-1256	367	3
TE-1258	234	3
TE-1259	175	3
TE-1260	373	3
TE-1261	377	3
TE-1263	255	3
TE-1265	366	3
TE-1266	173	3
TE-1268	176	3
TE-1269	862	3
TE-1270	374	3
TE-1271	378	3
TE-1273	365	3
TE-1275	872	3

Table 4 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-1277	376	3
TE-1279	856	3
TE-1281	382	3
TE-150	387	6
TE-151	388	6
TE-152	389	6
TE-172	169	6
TE-181W	323	4
TE-182E	383	4
TE-183N	385	4
TE-183W	624	4
TE-184E	386	4
TE-184S	623	4
TE-185W	324	4
TE-186E	647	4
TE-186S	626	4
TE-187N	384	4
TE-187W	625	4
TE-188AD	457	8
TE-188AE	461	8
TE-188AF	462	8
TE-188AG	638	8
TE-188BE	454	8

Table 4 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-188BF	464	8
TE-188BG	466	8
TE-189AD	459	8
TE-189AE	458	8
TE-189AF	465	8
TE-189AG	456	8
TE-189BD	455	8
TE-189BE	460	8
TE-189BF	463	8
TE-189BG	452	8
TE-2	391	6
TE-208	170	6
TE-210A	101	110
TE-222	394	6
TE-24	393	6
TE-256	406	6
TE-270AE	191	10
TE-270BE	192	10
TE-271AE	193	10
TE-271BE	194	10
TE-272AE	195	10
TE-272AS	680	10
TE-272BE	196	10

Table 4 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-272BS	681	10
TE-273AE	314	10
TE-273BE	315	10
TE-275AE	318	10
TE-275AS	682	10
TE-275BE	431	10
TE-275BS	683	10
TE-276AE	430	10
TE-277AE	432	10
TE-277BE	433	10
TE-278AE	556	10
TE-278BE	557	10
TE-279AE	558	10
TE-279AS	684	10
TE-279BE	559	10
TE-279BS	685	10
TE-28B	156	71
TE-284	407	6
TE-29	396	6
TE-291A	325	7
TE-291B	321	7
TE-291C	320	7
TE-291D	304	7

Table 4 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-292A	319	7
TE-292B	300	7
TE-292D	301	7
TE-293A	309	7
TE-293B	332	7
TE-293C	326	7
TE-293D	331	7
TE-293E	330	7
TE-293F	322	7
TE-294B	327	7
TE-294D	329	7
TE-294E	328	7
TE-294F	305	7
TE-295A	311	7
TE-295B	302	7
TE-295C	310	7
TE-295D	303	7
TE-296B	333	7
TE-296D	334	7
TE-301AF	577	1
TE-301AG	850	1
TE-301E1	810	1
TE-301E3	506	1

Table 4 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-301E7	899	1
TE-301E8	545	1
TE-301F1	542	1
TE-301F2	580	1
TE-301F3	568	1
TE-301F6	544	1
TE-301F7	851	1
TE-301F8	884	1
TE-301MF	820	2
TE-301MG	526	2
TE-301M2	819	2
TE-301M8	522	2
TE-302AB	571	1
TE-302AD	570	1
TE-302AE	572	1
TE-302BC	573	1
TE-302MB	863	2
TE-302MC	861	2
TE-302MD	864	2
TE-303BE	549	1
TE-303BP	551	1
TE-303CD	548	1
TE-303CE	566	1

Table 4 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-303CG	550	1
TE-303MD	844	2
TE-303ME	841	2
TE-303MF	843	2
TE-303MG	842	2
TE-304AC	565	1
TE-304AD	889	1
TE-304AF	546	1
TE-304BE	564	1
TE-304MC	902	2
TE-304MD	901	2
TE-304ME	903	2
TE-304MF	904	2
TE-305AS	449	1
TE-305BH	450	1
TE-305BU	448	1
TE-305CY	451	1
TE-305MH	771	2
TE-305MS	770	2
TE-305MU	769	2
TE-305MY	772	2
TE-306AA	484	1
TE-306AB	485	1

Table 4 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-306MA	753	2
TE-306MC	756	2
TE-306MD	754	2
TE-307AC	436	1
TE-307AF	438	1
TE-307BE	482	1
TE-307BF	480	1
TE-307CE	439	1
TE-307MC	775	2
TE-307MD	776	2
TE-307ME	774	2
TE-307MF	773	2
TE-308AD	297	1
TE-308BC	489	1
TE-308CB	487	1
TE-308CD	453	1
TE-308MB	806	2
TE-308MC	809	2
TE-308MD	808	2
TE-309AC	538	1
TE-309CB	547	1
TE-309CD	537	1
TE-309MB	852	2

Table 4 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-309MC	849	2
TE-310AF	561	1
TE-310BD	891	1
TE-310BE	563	1
TE-310BF	574	1
TE-310CC	562	1
TE-310CD	560	1
TE-310CF	575	1
TE-310MC	857	2
TE-310MD	860	2
TE-310ME	859	2
TE-311AB	541	1
TE-311CC	539	1
TE-311MA	896	2
TE-311MC	893	2
TE-311MD	894	2
TE-312AE	283	1
TE-312BC	282	1
TE-312CB	284	1
TE-312CD	567	1
TE-312MB	876	2
TE-312MC	875	2
TE-312MD	874	2

Table 4 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-312ME	873	2
TE-313AE	605	1
TE-313BC	409	1
TE-313BF	411	1
TE-313CD	408	1
TE-313CE	410	1
TE-313CF	256	1
TE-314AF	470	1
TE-314AG	752	1
TE-314E1	474	1
TE-314E3	473	1
TE-314E7	472	1
TE-314E8	471	1
TE-314F2	444	1
TE-314F3	665	1
TE-314F6	664	1
TE-314F7	468	1
TE-314F8	467	1
TE-314MF	475	2
TE-314MG	748	2
TE-314M2	750	2
TE-314M8	749	2
TE-315AC	732	1

Table 4 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-315AD	481	1
TE-315AF	723	1
TE-315BD	733	1
TE-315BE	479	1
TE-315CE	469	1
TE-315MC	766	2
TE-315MD	768	2
TE-315ME	767	2
TE-315MF	781	2
TE-316AD	492	1
TE-316BE	662	1
TE-316BF	490	1
TE-316BG	440	1
TE-316CE	491	1
TE-316CG	493	1
TE-316MD	799	2
TE-316ME	798	2
TE-316MF	800	2
TE-316MG	801	2
TE-317AF	735	1
TE-317AG	502	1
TE-317BD	666	1
TE-317E3	671	1

Table 4 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-317F1	734	1
TE-317F2	504	1
TE-317F3	513	1
TE-317F6	512	1
TE-317F7	511	1
TE-317F8	510	1
TE-317MF	784	2
TE-317MG	554	2
TE-317M6	555	2
TE-317M7	826	2
TE-318AE	446	1
TE-318AF	528	1
TE-318AG	443	1
TE-318BD	831	1
TE-318BE	529	1
TE-318BG	527	1
TE-318CD	669	1
TE-318CE	825	1
TE-318CF	765	1
TE-318CG	483	1
TE-318MD	870	2
TE-318ME	869	2
TE-318MF	871	2

Table 4 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-320AD	520	1
TE-320AE	657	1
TE-320AF	660	1
TE-320AG	670	1
TE-320BD	661	1
TE-320BE	656	1
TE-320BF	521	1
TE-320BG	518	1
TE-320CD	658	1
TE-320CE	655	1
TE-320CF	659	1
TE-320CG	519	1
TE-320MD	886	2
TE-320MG	887	2
TE-321AF	495	1
TE-321AG	832	1
TE-321E2	829	1
TE-321E3	540	1
TE-321E6	746	1
TE-321F1	643	1
TE-321F3	419	1
TE-321F4	418	1
TE-321F5	777	1

Table 4 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-321F6	417	1
TE-321F7	416	1
TE-321F8	751	1
TE-321MF	295	2
TE-321MG	478	2
TE-321M1	673	2
TE-321M3	672	2
TE-323AA	415	1
TE-323BC	412	1
TE-324AB	711	1
TE-324AC	496	1
TE-324AE	447	1
TE-324BD	497	1
TE-324CE	494	1
TE-324MC	787	2
TE-324MD	788	2
TE-324ME	786	2
TE-325BC	674	1
TE-325BD	676	1
TE-325CA	525	1
TE-325CB	675	1
TE-325CC	523	1
TE-325CD	524	1

Table 4 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-325MA	840	2
TE-325MB	839	2
TE-325MC	837	2
TE-325MD	838	2
TE-326AC	348	1
TE-326AD	288	1
TE-326AE	637	1
TE-326BB	350	1
TE-326BD	639	1
TE-326BE	645	1
TE-326CD	422	1
TE-326CE	347	1
TE-326MC	898	2
TE-326MD	897	2
TE-326ME	900	2
TE-327AC	290	1
TE-327AD	619	1
TE-327BA	427	1
TE-327BD	650	1
TE-327CB	421	1
TE-327CC	426	1
TE-327CD	425	1
TE-327MB	883	2

Table 4 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-328AC	677	1
TE-328AD	785	1
TE-328AE	853	1
TE-328AF	807	1
TE-328BD	516	1
TE-328BF	804	1
TE-328CC	888	1
TE-328CD	654	1
TE-328CE	877	1
TE-328CF	517	1
TE-328MC	694	2
TE-328MD	697	2
TE-328ME	695	2
TE-328MF	696	2
TE-329AC	364	1
TE-329AD	590	1
TE-329AE	199	1
TE-329BC	197	1
TE-329BD	198	1
TE-329BE	589	1
TE-329CB	586	1
TE-329CD	585	1
TE-329CE	587	1

Table 4 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-329MB	701	2
TE-329MC	699	2
TE-329MD	700	2
TE-329ME	698	2
TE-330AC	229	1
TE-330AD	375	1
TE-330AE	230	1
TE-330BE	308	1
TE-330CB	231	1
TE-330MB	745	2
TE-330MC	744	2
TE-330ME	747	2
TE-331BF	259	1
TE-331CD	215	1
TE-331CE	214	1
TE-331CF	213	1
TE-331MF	757	2
TE-332AE	693	1
TE-332CD	442	1
TE-332CE	437	1
TE-332CF	441	1
TE-332CG	445	1
TE-333AC	508	1

Table 4 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-333AD	509	1
TE-333AE	827	1
TE-333BE	828	1
TE-333CE	507	1
TE-333MC	830	2
TE-334AF	612	1
TE-334AG	275	1
TE-334E3	618	1
TE-334E7	617	1
TE-334E8	616	1
TE-334F1	611	1
TE-334F2	610	1
TE-334F3	278	1
TE-334F6	277	1
TE-334F7	276	1
TE-334F8	609	1
TE-334MF	576	2
TE-334M6	854	2
TE-335BB	503	1
TE-335BD	755	1
TE-335BE	505	1
TE-335MB	881	2
TE-335MC	879	2

Table 4 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-335MD	880	2
TE-335ME	878	2
TE-337AF	420	1
TE-337AG	476	1
TE-337E3	292	1
TE-337E7	271	1
TE-337E8	424	1
TE-337F1	653	1
TE-337F6	274	1
TE-337F7	273	1
TE-337F8	272	1
TE-337MF	689	2
TE-337MG	686	2
TE-337M6	688	2
TE-337M7	687	2
TE-338AF	205	1
TE-338AG	486	1
TE-338E1	423	1
TE-338E3	349	1
TE-338E7	207	1
TE-338E8	206	1
TE-338F1	228	1
TE-338F2	291	1

Table 4 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-338F3	317	1
TE-338F6	306	1
TE-338F7	316	1
TE-338F8	728	1
TE-338MF	705	2
TE-338MG	702	2
TE-338M2	704	2
TE-338M8	703	2
TE-339AC	203	1
TE-339BB	202	1
TE-339BD	201	1
TE-339MB	743	2
TE-339MC	742	2
TE-339MD	740	2
TE-339ME	741	2
TE-340BC	227	1
TE-340BD	226	1
TE-340CA	225	1
TE-340CB	224	1
TE-340MA	780	2
TE-340MB	779	2
TE-340MC	778	2
TE-341AB	293	1

Table 4 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-341MA	833	2
TE-341MB	835	2
TE-341MC	836	2
TE-341MD	834	2
TE-342BD	299	1
TE-342BE	171	1
TE-342BF	298	1
TE-342BG	307	1
TE-342CG	296	1
TE-343AD	294	1
TE-343BA	289	1
TE-343BB	286	1
TE-343BC	287	1
TE-343BD	569	1
TE-344CB	500	1
TE-344CC	499	1
TE-344CD	498	1
TE-344CE	501	1
TE-344MB	712	2
TE-344MC	710	2
TE-344ME	713	2
TE-345AD	381	1
TE-345AE	594	1

Table 4 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-345AF	597	1
TE-345AG	219	1
TE-345BD	592	1
TE-345BE	595	1
TE-345BF	593	1
TE-345BG	596	1
TE-345CF	218	1
TE-345CG	598	1
TE-345MD	692	2
TE-345ME	690	2
TE-345MG	691	2
TE-347CF	591	1
TE-347CG	217	1
TE-347MD	763	2
TE-347ME	762	2
TE-347MF	764	2
TE-347MG	761	2
TE-348AH	257	1
TE-348AY	258	1
TE-348MH	812	2
TE-348MS	813	2
TE-348MU	811	2
TE-348MY	814	2

Table 4 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-349AE	285	1
TE-349BE	340	1
TE-349CB	343	1
TE-349CC	345	1
TE-349CD	344	1
TE-349CE	346	1
TE-349MB	824	2
TE-349MC	823	2
TE-349MD	822	2
TE-349ME	821	2
TE-350AG	635	1
TE-350E1	642	1
TE-350E3	641	1
TE-350E7	640	1
TE-350F1	342	1
TE-350F2	341	1
TE-350F3	649	1
TE-350F6	339	1
TE-350F7	648	1
TE-350F8	636	1
TE-350MF	868	2
TE-350M6	867	2
TE-350M7	866	2

Table 4 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-351AB	354	1
TE-351AE	353	1
TE-351BC	351	1
TE-351BD	172	1
TE-351BE	646	1
TE-351MC	892	2
TE-352AH	632	1
TE-352AS	629	1
TE-352AU	335	1
TE-352AY	634	1
TE-352BH	631	1
TE-352BS	336	1
TE-352BU	627	1
TE-352BY	633	1
TE-352CH	337	1
TE-352CS	630	1
TE-352CU	628	1
TE-352CY	338	1
TE-352HH	738	2
TE-352HS	737	2
TE-352HU	736	2
TE-352HY	739	2
TE-353AE	241	1

Table 4 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-353BE	204	1
TE-353BF	602	1
TE-353CC	243	1
TE-353MC	718	2
TE-353MD	719	2
TE-353ME	720	2
TE-354AF	603	1
TE-354AG	200	1
TE-354E2	488	1
TE-354E3	352	1
TE-354E6	223	1
TE-354F1	216	1
TE-354F3	588	1
TE-354F4	584	1
TE-354F5	211	1
TE-354F6	210	1
TE-354F7	209	1
TE-354F8	208	1
TE-354HF	717	2
TE-354HG	714	2
TE-354H5	716	2
TE-354H6	715	2
TE-355AA	261	1

Table 4 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-355BC	263	1
TE-355CB	260	1
TE-355CD	663	1
TE-355MA	706	2
TE-355MB	707	2
TE-355MC	708	2
TE-355MD	709	2
TE-356AY	267	1
TE-356BS	265	1
TE-356BU	266	1
TE-356CH	264	1
TE-356MH	783	2
TE-356MS	782	2
TE-357AC	855	1
TE-357BA	578	1
TE-357BC	543	1
TE-357BD	865	1
TE-357CB	579	1
TE-357CD	582	1
TE-357MA	818	2
TE-357MB	816	2
TE-357MC	815	2
TE-357MD	817	2

Table 4 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-358AD	858	1
TE-358AE	882	1
TE-358BE	535	1
TE-358BF	885	1
TE-358CD	534	1
TE-358CG	536	1
TE-358MD	846	2
TE-358ME	847	2
TE-358MF	845	2
TE-358MG	848	2
TE-359AD	531	1
TE-359AE	530	1
TE-359AF	581	1
TE-359BE	895	1
TE-359BF	583	1
TE-359CC	533	1
TE-359CE	515	1
TE-359CF	532	1
TE-359MC	731	2
TE-359ME	729	2
TE-359MF	730	2
TE-360AF	651	1
TE-360AG	613	1

Table 4 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-360E2	615	1
TE-360E3	614	1
TE-360E6	652	1
TE-360F3	622	1
TE-360F4	281	1
TE-360F5	280	1
TE-360F6	279	1
TE-360F7	621	1
TE-360F8	620	1
TE-360MF	724	2
TE-360MG	721	2
TE-360M3	722	2
TE-361AB	245	1
TE-361AC	246	1
TE-361AD	247	1
TE-361AE	222	1
TE-361BE	221	1
TE-361BJ	600	9
TE-361CE	244	1
TE-361CJ	599	9
TE-361MB	726	2
TE-361MC	725	2
TE-361MD	727	2

Table 4 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-362AC	262	1
TE-362AD	270	1
TE-362BB	269	1
TE-362CE	268	1
TE-363AE	890	1
TE-363BC	253	1
TE-363BE	252	1
TE-363CB	254	1
TE-363MB	791	2
TE-363MC	792	2
TE-363MD	789	2
TE-363ME	790	2
TE-364AD	250	1
TE-364AE	477	1
TE-364AF	604	1
TE-364AG	248	1
TE-364BD	601	1
TE-364BE	249	1
TE-364BF	251	1
TE-364CD	607	1
TE-364CF	606	1
TE-364CG	608	1
TE-364MD	805	2

Table 4 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-364MF	803	2
TE-364MG	802	2
TE-4B	157	110
TE-40	395	6
TE-408B	402	5
TE-45	397	6
TE-5B	398	5
TE-520B	403	5
TE-521	404	5
TE-525	103	110
TE-557	155	110
TE-57	399	6
TE-615	159	110
TE-62	400	6
TE-627	104	110
TE-67	401	6
TE-727	154	110
TE-901	405	5
TE-920	758	5
TE-921	759	5
TE-922	760	5
TE-923	434	5
TE-926	796	5

Table 4 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-925	795	5
TE-924	435	5
TE-936	797	5
XE-430A	146	37
XE-430B	145	37
ZE-336U	167	76
ZE-346L	188	76

Table 5. Thermal-Hydraulic Test Facility Test 3.07.9Q, R

NAME	ENTRY NUMBER	TYPE CODE
DE-168	144	106
DE-20	169	106
DE-204A	163	106
DE-204B	164	106
DE-204C	165	106
DE-218	145	106
DE-336U	166	111
DE-346L	167	111
DE-36	143	106
EEE-10	98	33
EEE-1026AC	2	39
EEE-1026AZ	1	38
EEE-1026BC	117	39
EEE-1026BZ	116	38
EEE-1026IC	191	39
EEE-1026IZ	190	38
EEE-1026JC	313	39
EEE-1026JZ	312	38
EEE-1026KC	428	39
EEE-1026KZ	427	38
EEE-1026LC	551	39
EEE-1026LZ	550	38
EEE-1026MC	677	39

Table 5 (continued)

NAME	ENTRY NUMBER	TYPE CODE
EEE-1026MZ	676	38
EEE-1026NC	792	39
EEE-1026NZ	791	38
EEE-11	99	33
EEE-12	100	33
EEE-9	97	33
EIE-10	94	32
EIE-1001B	102	30
EIE-11	95	32
EIE-12	96	32
EIE-1301	60	31
EIE-1302	90	31
EIE-1303	71	31
EIE-1304	92	31
EIE-1305	72	31
EIE-1306	36	31
EIE-1307	38	31
EIE-1308	35	31
EIE-1309	57	31
EIE-1310	91	31
EIE-1311	73	31
EIE-1312	37	31
EIE-1313	34	31

Table 5 (continued)

NAME	ENTRY NUMBFR	TYPE CODE
EIE-1314	33	31
EIE-1315	80	31
EIE-1316	40	31
EIE-1317	58	31
EIE-1318	61	31
EIE-1320	70	31
EIE-1321	39	31
EIE-1323	82	31
EIE-1324	41	31
EIE-1325	55	31
EIE-1326	63	31
EIE-1327	87	31
EIE-1328	59	31
EIE-1329	83	31
EIE-1330	81	31
EIE-1331	32	31
EIE-1332	48	31
EIE-1333	64	31
EIE-1334	62	31
EIE-1335	56	31
EIE-1337	85	31
EIE-1338	47	31
EIE-1339	31	31

Table 5 (continued)

NAME	ENTRY NUMBER	TYPE CODE
EIE-1340	49	31
EIE-1341	88	31
EIE-1342	89	31
EIE-1343	67	31
EIE-1344	66	31
EIE-1345	53	31
EIE-1347	46	31
EIE-1348	50	31
EIE-1349	54	31
EIE-1350	65	31
EIE-1351	69	31
EIE-1352	68	31
EIE-1353	77	31
EIE-1354	52	31
EIE-1355	51	31
EIE-1356	84	31
EIE-1357	74	31
EIE-1358	75	31
EIE-1359	76	31
EIE-1360	86	31
EIE-1361	43	31
EIE-1362	42	31
EIE-1363	45	31

Table 5 (continued)

NAME	ENTRY NUMBER	TYPE CODE
EIE-1364	44	31
LIE-9	93	32
EWE-77A	108	34
FE-1A	148	107
FE-166	110	109
FE-18A	25	108
FE-19	109	109
FE-202	185	109
FE-216	142	109
FE-232	184	109
FE-238	122	108
FE-250	186	109
FE-260	187	109
FE-280	188	109
FE-34	141	109
FE-51	181	109
FE-522	112	95
FE-550	113	96
FE-59	182	109
FE-620	114	95
FE-64	183	109
FE-720	115	95
FME-114	126	40

Table 5 (continued)

NAME	ENTRY NUMBER	TYPE CODE
FMFE-170	23	35
FMFE-206	78	35
FMFE-22	21	35
FMFE-220	24	35
FMFE-264	127	40
FMFE-38	22	35
FMFE-55	123	40
FMFE-61	124	40
FMFE-66	125	40
LE-100	153	105
PDE-180	3	75
PDE-181	4	75
PDE-182	5	75
PDE-183	6	75
PDE-184	7	75
PDE-185	8	75
PDE-186	118	75
PDE-187	119	75
PDE-188	120	75
PDE-189	121	75
PDE-200	20	28
PDE-203	139	28
PDE-204	135	43

Table 5 (continued)

NAME	ENTRY NUMBER	TYPE CODE
PDE-21	26	26
PDE-217	28	26
PDE-251	140	28
PDE-261	161	43
PDE-271	162	43
PDE-30	150	98
PDE-35	27	26
PDE-46	18	26
PDE-48	152	97
PDE-53	136	28
PDE-60	137	26
PDE-65	138	28
PDE-78	19	27
PE-102	154	24
PE-106	13	23
PE-15	128	23
PE-156	14	23
PE-16	105	23
PE-174	29	23
PE-201	15	23
PE-209	132	23
PE-224	30	23
PE-258	133	23

Table 5 (continued)

NAME	ENTRY NUMBER	TYPE CODE
PE-26	9	23
PE-27	106	23
PE-286	134	23
PE-32	151	24
PE-42	10	23
PE-427	111	23
PE-43	107	23
PE-44	11	23
PE-526	16	29
PE-58	129	23
PE-616	17	29
PE-63	130	23
PE-68	131	23
PE-76	12	23
SE-72	79	36
TDE-28	149	99
TE-1	389	6
TE-101	159	110
TE-116	391	6
TE-1201	361	3
TE-1205	354	3
TE-1207	665	3
TE-1209	236	3

Table 5 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-1211	358	3
TE-1213	179	3
TE-1214	356	3
TE-1216	513	3
TE-1217	237	3
TE-1219	413	3
TE-1220	412	3
TE-1221	359	3
TE-1223	355	3
TE-1225	240	3
TE-1226	238	3
TE-1227	242	3
TE-1229	642	3
TE-1230	368	3
TE-1231	360	3
TE-1232	357	3
TE-1234	213	3
TE-1235	180	3
TE-1237	369	3
TE-1238	370	3
TE-1239	371	3
TE-1240	367	3
TE-1241	378	3

Table 5 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-1242	232	3
TE-1244	235	3
TE-1245	233	3
TE-1247	178	3
TE-1248	175	3
TE-1249	239	3
TE-1250	379	3
TE-1251	362	3
TE-1252	221	3
TE-1255	666	3
TE-1256	366	3
TE-1258	234	3
TE-1259	176	3
TE-1260	372	3
TE-1261	376	3
TE-1263	255	3
TE-1265	365	3
TE-1266	174	3
TE-1268	177	3
TE-1269	860	3
TE-1270	373	3
TE-1271	377	3
TE-1273	364	3

Table 5 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-1275	870	3
TE-1277	375	3
TE-1279	854	3
TE-1281	381	3
TE-150	386	6
TE-151	387	6
TE-152	388	6
TE-172	170	6
TE-181W	322	4
TE-182E	382	4
TE-183N	384	4
TE-183W	622	4
TE-184E	385	4
TE-184S	621	4
TE-185W	323	4
TE-186E	645	4
TE-186S	624	4
TE-187N	383	4
TE-187W	623	4
TE-188AD	456	8
TE-188AE	460	8
TE-188AF	461	8
TE-188AG	636	8

Table 5 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-188BE	453	8
TE-188BF	463	8
TE-188BG	465	8
TE-189AD	458	8
TE-189AE	457	8
TE-189AF	464	8
TE-189AG	455	8
TE-189BD	454	8
TE-189BE	459	8
TE-189BF	462	8
TE-189BG	451	8
TE-2	390	6
TE-208	171	6
TE-210A	101	110
TE-222	393	6
TE-24	392	6
TE-256	405	6
TE-270AE	192	10
TE-270BE	193	10
TE-271AE	194	10
TE-271BE	195	10
TE-272AE	196	10
TE-272AS	678	10

Table 5 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-272BE	197	10
TE-272BS	679	10
TE-273AE	314	10
TE-273BE	315	10
TE-275AE	317	10
TE-275AS	680	10
TE-275BS	681	10
TE-276AE	429	10
TE-276BE	430	10
TE-277AE	431	10
TE-277BE	432	10
TE-278AE	554	10
TE-278BE	555	10
TE-279AE	556	10
TE-279AS	682	10
TE-279BE	557	10
TE-279BS	683	10
TE-28B	157	71
TE-284	406	6
TE-29	395	6
TE-291A	324	7
TE-291B	320	7
TE-291C	319	7

Table 5 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-291D	304	7
TE-292A	318	7
TE-292B	300	7
TE-292D	301	7
TE-293A	309	7
TE-293B	331	7
TE-293C	325	7
TE-293D	330	7
TE-293E	329	7
TE-293F	321	7
TE-294B	326	7
TE-294D	328	7
TE-294E	327	7
TE-294F	305	7
TE-295A	311	7
TE-295B	302	7
TE-295C	310	7
TE-295D	303	7
TE-296B	332	7
TE-296D	333	7
TE-301AF	575	1
TE-301AG	848	1
TE-301E1	808	1

Table 5 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-301E3	505	1
TE-301E7	897	1
TE-301E8	544	1
TE-301F1	541	1
TE-301F2	578	1
TE-301F3	566	1
TE-301F6	543	1
TE-301F7	849	1
TE-301F8	882	1
TE-301MF	818	2
TE-301MG	525	2
TE-301M2	817	2
TE-301M8	521	2
TE-302AB	569	1
TE-302AD	568	1
TE-302AE	570	1
TE-302BC	571	1
TE-302MB	861	2
TE-302MC	859	2
TE-302MD	862	2
TE-303BF	549	1
TE-303CD	547	1
TE-303CE	564	1

Table 5 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-303CG	548	1
TE-303ND	842	2
TE-303NE	839	2
TE-303MF	841	2
TE-303MG	840	2
TE-304AC	563	1
TE-304AD	887	1
TE-304AF	545	1
TE-304BE	562	1
TE-304MC	900	2
TE-304MD	899	2
TE-304ME	901	2
TE-304MF	902	2
TE-305AS	448	1
TE-305BH	449	1
TE-305BU	447	1
TE-305CY	450	1
TE-305MH	769	2
TE-305MS	768	2
TE-305MU	767	2
TE-305MY	770	2
TE-306AA	483	1
TE-306AB	484	1

Table 5 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-306MA	751	2
TE-306MC	754	2
TE-306MD	752	2
TE-307AC	435	1
TE-307AF	437	1
TE-307BF	481	1
TE-307BF	479	1
TE-307CE	438	1
TE-307MC	773	2
TE-307MD	774	2
TE-307ME	772	2
TE-307MF	771	2
TE-308AD	297	1
TE-308BC	488	1
TE-308CB	486	1
TE-308CD	452	1
TE-308MB	804	2
TE-308MC	807	2
TE-308MD	806	2
TE-309AC	537	1
TE-309CB	546	1
TE-309CD	536	1
TE-309MB	850	2

Table 5 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-309MC	847	2
TE-310AF	559	1
TE-310BD	889	1
TE-310BE	561	1
TE-310BF	572	1
TE-310CC	560	1
TE-310CD	558	1
TE-310CF	573	1
TE-310MC	855	2
TE-310MD	858	2
TE-310ME	857	2
TE-311AB	540	1
TE-311CC	538	1
TE-311MA	894	2
TE-311MC	891	2
TE-311MD	892	2
TE-312AE	283	1
TE-312BC	282	1
TE-312CB	284	1
TE-312CD	565	1
TE-312MB	874	2
TE-312MC	873	2
TE-312MD	872	2

Table 5 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-312ME	871	2
TE-313AF	603	1
TE-313BC	408	1
TE-313BF	410	1
TE-313CD	407	1
TE-313CE	409	1
TE-313CF	256	1
TE-314AF	469	1
TE-314AG	750	1
TE-314E1	473	1
TE-314E3	472	1
TE-314E7	471	1
TE-314E8	470	1
TE-314F2	443	1
TE-314F3	663	1
TE-314F6	662	1
TE-314F7	467	1
TE-314F8	466	1
TE-314MF	474	2
TE-314MG	746	2
TE-314M2	748	2
TE-314M8	747	2
TE-315AC	730	1

Table 5 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-315AD	480	1
TE-315AF	721	1
TE-315BD	731	1
TE-315BE	478	1
TE-315CE	468	1
TE-315MC	764	2
TE-315MD	766	2
TE-315ME	765	2
TE-315MF	779	2
TE-316AD	491	1
TE-316BE	660	1
TE-316BF	489	1
TE-316BG	439	1
TE-316CE	490	1
TE-316CG	492	1
TE-316MD	797	2
TE-316ME	796	2
TE-316MF	798	2
TE-316MG	799	2
TE-317AF	733	1
TE-317AG	501	1
TE-317BD	664	1
TE-317E3	669	1

Table 5 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-317F1	732	1
TE-317F2	503	1
TE-317F3	512	1
TE-317F6	511	1
TE-317F7	510	1
TE-317F8	509	1
TE-317MF	782	2
TE-317MG	552	2
TE-317M6	553	2
TE-317M7	824	2
TE-318AE	445	1
TE-318AF	527	1
TE-318AG	442	1
TE-318BD	829	1
TE-318BE	528	1
TE-318BG	526	1
TE-318CD	667	1
TE-318CE	823	1
TE-318CF	763	1
TE-318CG	482	1
TE-318MD	868	2
TE-318ME	867	2
TE-318MF	869	2

Table 5 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-320AD	519	1
TE-320AE	655	1
TE-320AF	658	1
TE-320AG	668	1
TE-320BD	659	1
TE-320BE	654	1
TE-320BF	520	1
TE-320BG	517	1
TE-320CD	656	1
TE-320CE	653	1
TE-320CF	657	1
TE-320CG	518	1
TE-320MD	884	2
TE-320MG	385	2
TE-321AF	494	1
TE-321AG	830	1
TE-321E2	827	1
TE-321E3	539	1
TE-321E6	744	1
TE-321F1	641	1
TE-321F3	418	1
TE-321F4	417	1
TE-321F5	775	1

Table 5 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-321F6	416	1
TE-321F7	415	1
TE-321F8	749	1
TE-321MF	295	2
TE-321MG	477	2
TE-321M1	671	2
TE-321M3	670	2
TE-323AA	414	1
TE-323BC	411	1
TE-324AB	709	1
TE-324AC	495	1
TE-324AE	446	1
TE-324BD	496	1
TE-324CE	493	1
TE-324MC	785	2
TE-324MD	786	2
TE-324ME	784	2
TE-325BC	672	1
TE-325BD	674	1
TE-325CA	524	1
TE-325CB	673	1
TE-325CC	522	1
TE-325CD	523	1

Table 5 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-325MA	838	2
TE-325MB	837	2
TE-325MC	835	2
TE-325MD	836	2
TE-326AC	347	1
TE-326AD	288	1
TE-326AE	635	1
TE-326BB	349	1
TE-326BD	637	1
TE-326BE	643	1
TE-326CD	421	1
TE-326CE	346	1
TE-326MC	896	2
TE-326MD	895	2
TE-326ME	898	2
TE-327AC	290	1
TE-327AD	617	1
TE-327BA	426	1
TE-327BD	648	1
TE-327CB	420	1
TE-327CC	425	1
TE-327CD	424	1
TE-327MB	881	2

Table 5 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-328AC	675	1
TE-328AD	783	1
TE-328AE	851	1
TE-328AF	805	1
TE-328BD	515	1
TE-328BF	802	1
TE-328CC	886	1
TE-328CD	652	1
TE-328CE	875	1
TE-328CF	516	1
TE-328MC	692	2
TE-328MD	695	2
TE-328ME	693	2
TE-328MF	694	2
TE-329AC	363	1
TE-329AD	588	1
TE-329AE	200	1
TE-329BC	198	1
TE-329BD	199	1
TE-329BE	587	1
TE-329CB	584	1
TE-329CD	583	1
TE-329CE	585	1

Table 5 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-329MB	699	2
TE-329MC	697	2
TE-329MD	698	2
TE-329ME	696	2
TE-330AC	229	1
TE-330AD	374	1
TE-330AE	230	1
TE-330BE	308	1
TE-330CB	231	1
TE-330MB	743	2
TE-330MC	742	2
TE-330ME	745	2
TE-331BF	259	1
TE-331CD	216	1
TE-331CE	215	1
TE-331CF	214	1
TE-331MF	755	2
TE-332AE	691	1
TE-332CD	441	1
TE-332CE	436	1
TE-332CF	440	1
TE-332CG	444	1
TE-333AC	507	1

Table 5 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-333AD	508	1
TE-333AE	825	1
TE-333BE	826	1
TE-333CE	506	1
TE-333MC	828	2
TE-334AF	610	1
TE-334AG	275	1
TE-334E3	616	1
TE-334E7	615	1
TE-334E8	614	1
TE-334F1	609	1
TE-334F2	608	1
TE-334F3	278	1
TE-334F6	277	1
TE-334F7	276	1
TE-334F8	607	1
TE-334MF	574	2
TE-334M6	852	2
TE-335BB	502	1
TE-335BD	753	1
TE-335BE	504	1
TE-335MB	879	2
TE-335MC	877	2

Table 5 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-335MD	878	2
TE-335ME	876	2
TE-337AF	419	1
TE-337AG	475	1
TE-337E3	292	1
TE-337E7	271	1
TE-337E8	423	1
TE-337F1	651	1
TE-337F6	274	1
TE-337F7	273	1
TE-337F8	272	1
TE-337MF	687	2
TE-337MG	684	2
TE-337M6	686	2
TE-337M7	685	2
TE-338AF	206	1
TE-338AG	485	1
TE-338E1	422	1
TE-338E3	348	1
TE-338E7	208	1
TE-338E8	207	1
TE-338F2	291	1
TE-338F6	306	1

Table 5 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-338F7	316	1
TE-338F8	726	1
TE-338MF	703	2
TE-338MG	700	2
TE-338M2	702	2
TE-338M8	701	2
TE-339AC	204	1
TE-339BB	203	1
TE-339BD	202	1
TE-339MB	741	2
TE-339MC	740	2
TE-339MD	738	2
TE-339ME	739	2
TE-340BC	228	1
TE-340BD	227	1
TE-340CA	226	1
TE-340CB	225	1
TE-340MA	778	2
TE-340MB	777	2
TE-340MC	776	2
TE-341AB	293	1
TE-341MA	831	2
TE-341MB	833	2

Table 5 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-341MC	834	2
TE-341MD	832	2
TE-342BD	299	1
TE-342BE	172	1
TE-342BF	298	1
TE-342BG	307	1
TE-342CG	296	1
TE-343AD	294	1
TE-343BA	289	1
TE-343BB	286	1
TE-343BC	287	1
TE-343BD	567	1
TE-344CB	499	1
TE-344CC	498	1
TE-344CD	497	1
TE-344CE	500	1
TE-344MB	710	2
TE-344MC	708	2
TE-344ME	711	2
TE-345AD	380	1
TE-345AE	592	1
TE-345AF	595	1
TE-345AG	220	1

Table 5 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-345BD	590	1
TE-345BE	593	1
TE-345BF	591	1
TE-345BG	594	1
TE-345CF	219	1
TE-345CG	596	1
TE-345MD	690	2
TE-345ME	688	2
TE-345MG	689	2
TE-347CF	589	1
TE-347CG	218	1
TE-347MD	761	2
TE-347ME	760	2
TE-347MF	762	2
TE-347MG	759	2
TE-348AH	257	1
TE-348AY	258	1
TE-348MH	810	2
TE-348MS	811	2
TE-348MU	809	2
TE-348MY	812	2
TE-349AE	285	1
TE-349BE	339	1

Table 5 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-349CB	342	1
TE-349CC	344	1
TE-349CD	343	1
TE-349CE	345	1
TE-349MB	822	2
TE-349MC	821	2
TE-349MD	820	2
TE-349ME	819	2
TE-350AG	633	1
TE-350E1	640	1
TE-350E3	639	1
TE-350E7	638	1
TE-350F1	341	1
TE-350F2	340	1
TE-350F3	647	1
TE-350F6	338	1
TE-350F7	646	1
TE-350F8	634	1
TE-350MF	866	2
TE-350M6	865	2
TE-350M7	864	2
TE-351AB	353	1
TE-351AE	352	1

Table 5 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-351BC	350	1
TE-351BD	173	1
TE-351BE	644	1
TE-351MC	890	2
TE-352AH	630	1
TE-352AS	627	1
TE-352AU	334	1
TE-352AY	632	1
TE-352BH	629	1
TE-352BS	335	1
TE-352BU	625	1
TE-352BY	631	1
TE-352CH	336	1
TE-352CS	628	1
TE-352CU	626	1
TE-352CY	337	1
TE-352MH	736	2
TE-352MS	735	2
TE-352MU	734	2
TE-352MY	737	2
TE-353AE	241	1
TE-353BE	205	1
TE-353BF	600	1

Table 5 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-353CC	243	1
TE-353MC	716	2
TE-353MD	717	2
TE-353ME	718	2
TE-354AF	601	1
TE-354AG	201	1
TE-354E2	487	1
TE-354E3	351	1
TE-354E6	224	1
TE-354F1	217	1
TE-354F3	586	1
TE-354F4	582	1
TE-354F5	212	1
TE-354F6	211	1
TE-354F7	210	1
TE-354F8	209	1
TE-354MF	715	2
TE-354MG	712	2
TE-354M5	714	2
TE-354M6	713	2
TE-355AA	261	1
TE-355BC	263	1
TE-355CB	260	1

Table 5 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-355CD	661	1
TE-355MA	704	2
TE-355MB	705	2
TE-355MC	706	2
TE-355MD	707	2
TE-356AY	267	1
TE-356BS	265	1
TE-356BU	266	1
TE-356CH	264	1
TE-356MH	781	2
TE-356MS	780	2
TE-357AC	853	1
TE-357BA	576	1
TE-357BC	542	1
TE-357BD	863	1
TE-357CB	577	1
TE-357CD	580	1
TE-357MA	816	2
TE-357MB	814	2
TE-357MC	813	2
TE-357MD	815	2
TE-358AD	856	1
TE-358AE	880	1

Table 5 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-358BE	534	1
TE-358BF	883	1
TE-358CD	533	1
TE-358CG	535	1
TE-358MD	844	2
TE-358ME	845	2
TE-358MF	843	2
TE-358MG	846	2
TE-359AD	530	1
TE-359AE	529	1
TE-359AF	579	1
TE-359BE	893	1
TE-359BF	581	1
TE-359CC	532	1
TE-359CE	514	1
TE-359CF	531	1
TE-359MC	729	2
TE-359ME	727	2
TE-359MF	728	2
TE-360AF	649	1
TE-360AG	611	1
TE-360E2	613	1
TE-360E3	612	1

Table 5 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-360E6	650	1
TE-360F3	620	1
TE-360F4	281	1
TE-360F5	280	1
TE-360F6	279	1
TE-360F7	619	1
TE-360F8	618	1
TE-360MF	722	2
TE-360MG	719	2
TE-360M3	720	2
TE-361AB	245	1
TE-361AC	246	1
TE-361AD	247	1
TE-361AE	223	1
TE-361BE	222	1
TE-361BJ	598	9
TE-361CE	244	1
TE-361CJ	597	9
TE-361MB	724	2
TE-361MC	723	2
TE-361MD	725	2
TE-362AC	262	1
TE-362AD	270	1

Table 5 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-362BB	269	1
TE-362CE	268	1
TE-363AE	888	1
TE-363BC	253	1
TE-363BE	252	1
TE-363CB	254	1
TE-363MB	789	2
TE-363MC	790	2
TE-363MD	787	2
TE-363ME	788	2
TE-364AD	250	1
TE-364AE	476	1
TE-364AF	602	1
TE-364AG	248	1
TE-364BD	599	1
TE-364BE	249	1
TE-364BF	251	1
TE-364CD	605	1
TE-364CF	604	1
TE-364CG	606	1
TE-364MD	803	2
TE-364MF	801	2
TE-364MG	800	2

Table 5 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-4B	158	110
TE-40	394	6
TE-408B	401	5
TE-45	396	6
TE-5B	397	5
TE-520B	402	5
TE-521	403	5
TE-525	103	110
TE-557	156	110
TE-57	398	6
TE-615	160	110
TE-62	399	6
TE-627	104	110
TE-67	400	6
TE-727	155	110
TE-901	404	5
TE-920	756	5
TE-921	757	5
TE-922	758	5
TE-926	794	5
TE-925	793	5
TE-923	433	5
TE-924	434	5

Table 5 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-936	795	5
XE-430A	147	37
XE-430B	146	37
ZE-336U	168	76
ZE-346L	189	76

**Table 6. Thermal-Hydraulic Test Facility Test 3.07.9B,
C, D, E, F, G, J, T, U, V, W**

NAME	ENTRY NUMBER	TYPE CODE
DE-168	143	106
DE-20	168	106
DE-204A	162	106
DE-204B	163	106
DE-204C	164	106
DE-218	144	106
DE-330U	165	111
DE-346L	166	111
DE-36	142	106
EEE-10	98	33
EEE-1026AC	2	39
EEE-1026AZ	1	38
EEE-1026BC	116	39
EEE-1026BZ	115	38
EEE-1026IC	190	39
EEE-1026IZ	189	38
EEE-1026JC	312	39
EEE-1026JZ	311	38
EEE-1026KC	427	39
EEE-1026KZ	426	38
EEE-1026LC	550	39
EEE-1026LZ	549	38
EEE-1026MC	676	39

Table 6 (continued)

NAME	ENTRY NUMBER	TYPE CODE
EEE-1026MZ	675	38
EEE-1026NC	791	39
EEE-1026NZ	790	38
EEE-11	99	33
EEE-12	100	33
EEE-9	97	33
EIE-10	94	32
EIE-1001B	102	30
EIE-11	95	32
EIE-12	96	32
EIE-1301	60	31
EIE-1302	90	31
EIE-1303	71	31
EIE-1304	92	31
EIE-1305	72	31
EIE-1306	36	31
EIE-1307	38	31
EIE-1308	35	31
EIE-1309	57	31
EIE-1310	91	31
EIE-1311	73	31
EIE-1312	37	31
EIE-1313	34	31

Table 6 (continued)

NAME	ENTRY NUMBER	TYPE CODE
EIE-1314	33	31
EIE-1315	80	31
EIE-1316	40	31
EIE-1317	58	31
EIE-1318	61	31
EIE-1320	70	31
EIE-1321	39	31
EIE-1323	82	31
EIE-1324	41	31
EIE-1325	55	31
EIE-1326	63	31
EIE-1327	87	31
EIE-1328	59	31
EIE-1329	83	31
EIE-1330	81	31
EIE-1331	32	31
EIE-1332	48	31
EIE-1333	64	31
EIE-1334	62	31
EIE-1335	56	31
EIE-1337	85	31
EIE-1338	47	31
EIE-1339	31	31

Table 6 (continued)

NAME	ENTRY NUMBER	TYPE CODE
EIE-1340	49	31
EIE-1341	88	31
EIE-1342	89	31
EIE-1343	67	31
EIE-1344	66	31
EIE-1345	53	31
EIE-1347	46	31
EIE-1348	50	31
EIE-1349	54	31
EIE-1350	65	31
EIE-1351	69	31
EIE-1352	68	31
EIE-1353	77	31
EIE-1354	52	31
EIE-1355	51	31
EIE-1356	84	31
EIE-1357	74	31
EIE-1358	75	31
EIE-1359	76	31
EIE-1360	86	31
EIE-1361	43	31
EIE-1362	42	31
EIE-1363	45	31

Table 6 (continued)

NAME	ENTRY NUMBER	TYPE CODE
EIE-1364	44	31
EIE-9	93	32
EWE-77A	107	34
FE-1A	147	107
FE-166	109	109
FE-18A	25	108
FE-19	108	109
FE-202	184	109
FE-216	141	109
FE-232	183	109
FE-238	121	108
FE-250	185	109
FE-260	186	109
FE-280	187	109
FE-34	140	109
FE-51	180	109
FE-522	111	95
FE-550	112	96
FE-59	181	109
FE-620	113	95
FE-64	182	109
FE-720	114	95
FMFE-114	125	40

Table 6 (continued)

NAME	ENTRY NUMBER	TYPE CODE
FMFE-170	23	35
FMFE-206	78	35
FMFE-22	21	35
FMFE-220	24	35
FMFE-264	126	40
FMFE-38	22	35
FMFE-55	122	40
FMFE-61	123	40
FMFE-66	124	40
LE-100	152	105
PDE-180	3	75
PDE-181	4	75
PDE-182	5	75
PDE-183	6	75
PDE-184	7	75
PDE-185	8	75
PDE-186	117	75
PDE-187	118	75
PDE-188	119	75
PDE-189	120	75
PDE-200	20	28
PDE-203	138	28
PDE-204	134	43

Table 6 (continued)

NAME	ENTRY NUMBER	TYPE CODE
PDE-21	26	26
PDE-217	28	26
PDE-251	139	28
PDE-261	160	43
PDE-271	161	43
PDE-30	149	98
PDE-35	27	26
PDE-46	18	26
PDE-48	151	97
PDE-53	135	28
PDE-60	136	26
PDE-65	137	28
PDE-78	19	27
PE-102	153	24
PE-106	13	23
PE-15	127	23
PE-156	14	23
PE-16	104	23
PE-174	29	23
PE-201	15	23
PE-209	131	23
PE-224	30	23
PE-258	132	23

Table 6 (continued)

NAME	ENTRY NUMBER	TYPE CODE
PE-26	9	23
PE-27	105	23
PE-286	133	23
PE-32	150	24
PE-42	10	23
PE-427	110	23
PE-43	106	23
PE-44	11	23
PE-526	16	29
PE-58	128	23
PE-616	17	29
PE-63	129	23
PE-68	130	23
PE-76	12	23
SE-72	79	36
TDE-28	146	99
TE-1	388	6
TE-101	158	110
TE-116	390	6
TE-1201	360	3
TE-1205	353	3
TE-1207	664	3
TE-1209	235	3

Table 6 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-1211	357	3
TE-1213	178	3
TE-1214	355	3
TE-1216	512	3
TE-1217	236	3
TE-1219	412	3
TE-1220	411	3
TE-1221	358	3
TE-1223	354	3
TE-1225	239	3
TE-1226	237	3
TE-1227	241	3
TE-1229	641	3
TE-1230	367	3
TE-1231	359	3
TE-1232	356	3
TE-1234	212	3
TE-1235	179	3
TE-1237	368	3
TE-1238	369	3
TE-1239	370	3
TE-1240	366	3
TE-1241	377	3

Table 6 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-1242	231	3
TE-1244	234	3
TE-1245	232	3
TE-1247	177	3
TE-1248	174	3
TE-1249	238	3
TE-1250	378	3
TE-1251	361	3
TE-1252	220	3
TE-1255	665	3
TE-1256	365	3
TE-1258	233	3
TE-1259	175	3
TE-1260	371	3
TE-1261	375	3
TE-1263	254	3
TE-1265	364	3
TE-1266	173	3
TE-1268	176	3
TE-1269	859	3
TE-1270	372	3
TE-1271	376	3
TE-1273	363	3

Table 6 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-1275	869	3
TE-1277	374	3
TE-1279	853	3
TE-1281	380	3
TE-150	385	6
TE-151	386	6
TE-152	387	6
TE-172	169	6
TE-181W	321	4
TE-182E	381	4
TE-183N	383	4
TE-183W	621	4
TE-184E	384	4
TE-184S	620	4
TE-185W	322	4
TE-186E	644	4
TE-186S	623	4
TE-187N	382	4
TE-187W	622	4
TE-188AD	455	8
TE-188AE	459	8
TE-188AF	460	8
TE-188AG	635	8

Table 6 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-188BE	452	8
TE-188BF	462	8
TE-188BG	464	8
TE-189AD	457	8
TE-189AE	456	8
TE-189AF	463	8
TE-189AG	454	8
TE-189BD	453	8
TE-189BE	458	8
TE-189BF	461	8
TE-189BG	450	8
TE-2	389	6
TE-208	170	6
TE-210A	101	110
TE-222	392	6
TE-24	391	6
TE-256	404	6
TE-270AE	191	10
TE-270BE	192	10
TE-271AE	193	10
TE-271BE	194	10
TE-272AE	195	10
TE-272AS	677	10

Table 6 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-272BE	196	10
TE-272BS	678	10
TE-273AE	313	10
TE-273BE	314	10
TE-275AE	316	10
TE-275AS	679	10
TE-275BS	680	10
TE-276AE	428	10
TE-276BE	429	10
TE-277AE	430	10
TE-277BE	431	10
TE-278AE	553	10
TE-278BE	554	10
TE-279AE	555	10
TE-279AS	681	10
TE-279BE	556	10
TE-279BS	682	10
TE-28B	156	71
TE-284	405	6
TE-29	394	6
TE-291A	323	7
TE-291B	319	7
TE-291C	318	7

Table 6 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-291D	303	7
TE-292A	317	7
TE-292B	299	7
TE-292D	300	7
TE-293A	308	7
TE-293B	330	7
TE-293C	324	7
TE-293D	329	7
TE-293E	328	7
TE-293F	320	7
TE-294B	325	7
TE-294D	327	7
TE-294E	326	7
TE-294F	304	7
TE-295A	310	7
TE-295B	301	7
TE-295C	309	7
TE-295D	302	7
TE-296B	331	7
TE-296D	332	7
TE-301AF	574	1
TE-301AG	847	1
TE-301E1	807	1

Table 6 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-301E3	504	1
TE-301E7	896	1
TE-301E8	543	1
TE-301F1	540	1
TE-301F2	577	1
TE-301F3	565	1
TE-301F6	542	1
TE-301F7	848	1
TE-301F8	881	1
TE-301MF	817	2
TE-301MG	524	2
TE-301M2	816	2
TE-301M8	520	2
TE-302AB	568	1
TE-302AD	567	1
TE-302AE	569	1
TE-302BC	570	1
TE-302MB	860	2
TE-302MC	858	2
TE-302ND	861	2
TE-303BF	548	1
TE-303CD	546	1
TE-303CE	563	1

Table 6 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-303CG	547	1
TE-303MD	841	2
TE-303ME	838	2
TE-303MF	840	2
TE-303MG	839	2
TE-304AC	562	1
TE-304AD	886	1
TE-304AF	544	1
TE-304BE	561	1
TE-304MC	899	2
TE-304MD	898	2
TE-304ME	900	2
TE-304MF	901	2
TE-305AS	447	1
TE-305BH	448	1
TE-305BU	446	1
TE-305CY	449	1
TE-305MH	768	2
TE-305MS	767	2
TE-305MU	766	2
TE-305MY	769	2
TE-306AA	482	1
TE-306AB	483	1

Table 6 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-306MA	750	2
TE-306MC	753	2
TE-306MD	751	2
TE-307AC	434	1
TE-307AF	436	1
TE-307BE	480	1
TE-307BF	478	1
TE-307CE	437	1
TE-307MC	772	2
TE-307MD	773	2
TE-307ME	771	2
TE-307MF	770	2
TE-308AD	296	1
TE-308BC	487	1
TE-308CB	485	1
TE-308CD	451	1
TE-308MB	803	2
TE-308MC	806	2
TE-308MD	805	2
TE-309AC	536	1
TE-309CB	545	1
TE-309CD	535	1
TE-309MB	849	2

Table 6 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-309MC	846	2
TE-310AF	558	1
TE-310BD	888	1
TE-310BE	560	1
TE-310BF	571	1
TE-310CC	559	1
TE-310CD	557	1
TE-310CF	572	1
TE-310MC	854	2
TE-310MD	857	2
TE-310ME	856	2
TE-311AB	539	1
TE-311CC	537	1
TE-311MA	893	2
TE-311MC	890	2
TE-311MD	891	2
TE-312AE	282	1
TE-312BC	281	1
TE-312CB	283	1
TE-312CD	564	1
TE-312MB	873	2
TE-312MC	972	2
TE-312MD	871	2

Table 6 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-312ME	870	2
TE-313AE	602	1
TE-313BC	407	1
TE-313BF	409	1
TE-313CD	406	1
TE-313CE	408	1
TE-313CF	255	1
TE-314AF	468	1
TE-314AG	749	1
TE-314E1	472	1
TE-314E3	471	1
TE-314E7	470	1
TE-314E8	469	1
TE-314F2	442	1
TE-314F3	662	1
TE-314F6	661	1
TE-314F7	466	1
TE-314F8	465	1
TE-314MF	473	2
TE-314MG	745	2
TE-314M2	747	2
TE-314M8	746	2
TE-315AC	729	1

Table 6 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-315AD	479	1
TE-315AF	720	1
TE-315BD	730	1
TE-315BE	477	1
TE-315CE	467	1
TE-315MC	763	2
TE-315MD	765	2
TE-315ME	764	2
TE-315MF	778	2
TE-316AD	490	1
TE-316BE	659	1
TE-316BF	488	1
TE-316BG	438	1
TE-316CE	489	1
TE-316CG	491	1
TE-316MD	796	2
TE-316ME	795	2
TE-316MF	797	2
TE-316MG	798	2
TE-317AF	732	1
TE-317AG	500	1
TE-317BD	663	1
TE-317E3	668	1

Table 6 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-317F1	731	1
TE-317F2	502	1
TE-317F3	511	1
TE-317F6	510	1
TE-317F7	509	1
TE-317F8	508	1
TE-317MF	781	2
TE-317MG	551	2
TE-317M6	552	2
TE-317M7	823	2
TE-318AE	444	1
TE-318AF	526	1
TE-318AG	441	1
TE-318BD	828	1
TE-318BE	527	1
TE-318BG	525	1
TE-318CD	666	1
TE-318CE	822	1
TE-318CF	762	1
TE-318CG	481	1
TE-318MD	867	2
TE-318ME	866	2
TE-318MF	868	2

Table 6 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-320AD	518	1
TE-320AE	654	1
TE-320AF	657	1
TE-320AG	667	1
TE-320BD	658	1
TE-320BE	653	1
TE-320BF	519	1
TE-320BG	516	1
TE-320CD	655	1
TE-320CE	652	1
TE-320CF	656	1
TE-320CG	517	1
TE-320AD	883	2
TE-320MG	884	2
TE-321AF	493	1
TE-321AG	829	1
TE-321E2	826	1
TE-321E3	538	1
TE-321E6	743	1
TE-321F1	640	1
TE-321F3	417	1
TE-321F4	416	1
TE-321F5	774	1

Table 6 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-321F6	415	1
TE-321F7	414	1
TE-321F8	748	1
TE-321MF	294	2
TE-321MG	476	2
TE-321M1	670	2
TE-321M3	669	2
TE-323AA	413	1
TE-323BC	410	1
TE-324AB	708	1
TE-324AC	494	1
TE-324AE	445	1
TE-324BD	495	1
TE-324CE	492	1
TE-324MC	784	2
TE-324MD	785	2
TE-324ME	783	2
TE-325BC	671	1
TE-325BD	673	1
TE-325CA	523	1
TE-325CB	672	1
TE-325CC	521	1
TE-325CD	522	1

Table 6 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-325MA	837	2
TE-325MB	836	2
TE-325MC	834	2
TE-325MD	835	2
TE-326AC	346	1
TE-326AD	287	1
TE-326AE	634	1
TE-326BB	348	1
TE-326BD	636	1
TE-326BE	642	1
TE-326CD	420	1
TE-326CE	345	1
TE-326MC	895	2
TE-326MD	894	2
TE-326ME	897	2
TE-327AC	289	1
TE-327AD	616	1
TE-327BA	425	1
TE-327BD	647	1
TE-327CB	419	1
TE-327CC	424	1
TE-327CD	423	1
TE-327MB	880	2

Table 6 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-328AC	674	1
TE-328AD	782	1
TE-328AE	850	1
TE-328AF	804	1
TE-328BD	514	1
TE-328BF	801	1
TE-328CC	885	1
TE-328CD	651	1
TE-328CE	874	1
TE-328CF	515	1
TE-328MC	691	2
TE-328MD	694	2
TE-328ME	692	2
TE-328MF	693	2
TE-329AC	362	1
TE-329AD	587	1
TE-329AE	199	1
TE-329BC	197	1
TE-329BD	198	1
TE-329BE	586	1
TE-329CB	583	1
TE-329CD	582	1
TE-329CE	584	1

Table 6 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-329MB	698	2
TE-329MC	696	2
TE-329MD	697	2
TE-329ME	695	2
TE-330AC	228	1
TE-330AD	373	1
TE-330AE	229	1
TE-330BE	307	1
TE-330CB	230	1
TE-330MB	742	2
TE-330MC	741	2
TE-330ME	744	2
TE-331BF	258	1
TE-331CD	215	1
TE-331CE	214	1
TE-331CF	213	1
TE-331MF	754	2
TE-332AE	690	1
TE-332CD	440	1
TE-332CE	435	1
TE-332CF	439	1
TE-332CG	443	1
TE-333AC	506	1

Table 6 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-333AD	507	1
TE-333AE	824	1
TE-333BE	825	1
TE-333CE	505	1
TE-333HC	827	2
TE-334AF	609	1
TE-334AG	274	1
TE-334E3	615	1
TE-334E7	614	1
TE-334E8	613	1
TE-334F1	608	1
TE-334F2	607	1
TE-334F3	277	1
TE-334F6	276	1
TE-334F7	275	1
TE-334F8	606	1
TE-334MF	573	2
TE-334M6	851	2
TE-335BB	501	1
TE-335BD	752	1
TE-335BE	503	1
TE-335MB	878	2
TE-335MC	876	2

Table 6 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-335MD	877	2
TE-335ME	875	2
TE-337AF	418	1
TE-337AG	474	1
TE-337E3	291	1
TE-337E7	270	1
TE-337E8	422	1
TE-337F1	650	1
TE-337F6	273	1
TE-337F7	272	1
TE-337F8	271	1
TE-337MF	686	2
TE-337MG	683	2
TE-337M6	685	2
TE-337M7	684	2
TE-338AF	205	1
TE-338AG	484	1
TE-338E1	421	1
TE-338E3	347	1
TE-338E7	207	1
TE-338E8	206	1
TE-338F2	290	1
TE-338F6	305	1

Table 6 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-338F7	315	1
TE-338F8	725	1
TE-338MF	702	2
TE-338MG	699	2
TE-338M2	701	2
TE-338M8	700	2
TE-339AC	203	1
TE-339BB	202	1
TE-339BD	201	1
TE-339MB	740	2
TE-339MC	739	2
TE-339MD	737	2
TE-339ME	738	2
TE-340BC	227	1
TE-340BD	226	1
TE-340CA	225	1
TE-340CB	224	1
TE-340MA	777	2
TE-340MB	776	2
TE-340MC	775	2
TE-341AB	292	1
TE-341MA	830	2
TE-341MB	832	2

Table 6 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-341MC	833	2
TE-341MD	831	2
TE-342BD	298	1
TE-342BE	171	1
TE-342BF	297	1
TE-342BG	306	1
TE-342CG	295	1
TE-343AD	293	1
TE-343BA	288	1
TE-343BB	285	1
TE-343BC	286	1
TE-343BD	566	1
TE-344CB	498	1
TE-344CC	497	1
TE-344CD	496	1
TE-344CE	499	1
TE-344MB	709	2
TE-344MC	707	2
TE-344ME	710	2
TE-345AD	379	1
TE-345AE	591	1
TE-345AF	594	1
TE-345AG	219	1

Table 6 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-345BD	589	1
TE-345BE	592	1
TE-345BF	590	1
TE-345BG	593	1
TE-345CF	218	1
TE-345CG	595	1
TE-345MD	689	2
TE-345ME	687	2
TE-345MG	688	2
TE-347CF	588	1
TE-347CG	217	1
TE-347MD	760	2
TE-347ME	759	2
TE-347MF	761	2
TE-347MG	758	2
TE-348AH	256	1
TE-348AY	257	1
TE-348MH	809	2
TE-348MS	810	2
TE-348MU	808	2
TE-348MY	811	2
TE-349AE	284	1
TE-349BE	338	1

Table 6 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-349CB	341	1
TE-349CC	343	1
TE-349CD	342	1
TE-349CE	344	1
TE-349MB	821	2
TE-349MC	820	2
TE-349MD	819	2
TE-349ME	818	2
TE-350AG	632	1
TE-350E1	639	1
TE-350E3	638	1
TE-350E7	637	1
TE-350F1	340	1
TE-350F2	339	1
TE-350F3	646	1
TE-350F6	337	1
TE-350F7	645	1
TE-350F8	633	1
TE-350MF	865	2
TE-350M6	864	2
TE-350M7	863	2
TE-351AB	352	1
TE-351AE	351	1

Table 6 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-351BC	349	1
TE-351BD	172	1
TE-351BE	643	1
TE-351MC	889	2
TE-352AH	629	1
TE-352AS	626	1
TE-352AU	333	1
TE-352AY	631	1
TE-352BH	628	1
TE-352BS	334	1
TE-352BU	624	1
TE-352BY	630	1
TE-352CH	335	1
TE-352CS	627	1
TE-352CU	625	1
TE-352CY	336	1
TE-352MH	735	2
TE-352MS	734	2
TE-352MU	733	2
TE-352MY	736	2
TE-353AE	240	1
TE-353BE	204	1
TE-353BF	599	1

Table 6 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-353CC	242	1
TE-353MC	715	2
TE-353MD	716	2
TE-353ME	717	2
TE-354AF	600	1
TE-354AG	200	1
TE-354E2	486	1
TE-354E3	350	1
TE-354E6	223	1
TE-354F1	216	1
TE-354F3	585	1
TE-354F4	581	1
TE-354F5	211	1
TE-354F6	210	1
TE-354F7	209	1
TE-354F8	208	1
TE-354HF	714	2
TE-354HG	711	2
TE-354H5	713	2
TE-354H6	712	2
TE-355AA	260	1
TE-355BC	262	1
TE-355CB	259	1

Table 6 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-355CD	660	1
TE-355MA	703	2
TE-355MB	704	2
TE-355MC	705	2
TE-355MD	706	2
TE-356AY	266	1
TE-356BS	264	1
TE-356BU	265	1
TE-356CH	263	1
TE-356MH	780	2
TE-356MS	779	2
TE-357AC	852	1
TE-357BA	575	1
TE-357BC	541	1
TE-357BD	862	1
TE-357CB	576	1
TE-357CD	579	1
TE-357MA	815	2
TE-357MB	813	2
TE-357MC	812	2
TE-357MD	814	2
TE-358AD	855	1
TE-358AE	879	1

Table 6 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-358BE	533	1
TE-358BF	882	1
TE-358CD	532	1
TE-358CG	534	1
TE-358MD	843	2
TE-358ME	844	2
TE-358MF	842	2
TE-358MG	845	2
TE-359AD	529	1
TE-359AE	528	1
TE-359AF	578	1
TE-359BE	892	1
TE-359BF	580	1
TE-359CC	531	1
TE-359CE	513	1
TE-359CF	530	1
TE-359MC	728	2
TE-359ME	726	2
TE-359MF	727	2
TE-360AF	648	1
TE-360AG	610	1
TE-360E2	612	1
TE-360E3	611	1

Table 6 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-360E6	649	1
TE-360F3	619	1
TE-360F4	280	1
TE-360F5	279	1
TE-360F6	278	1
TE-360F7	618	1
TE-360F8	617	1
TE-360MF	721	2
TE-360MG	718	2
TE-360M3	719	2
TE-361AB	244	1
TE-361AC	245	1
TE-361AD	246	1
TE-361AE	222	1
TE-361BE	221	1
TE-361BJ	597	9
TE-361CE	243	1
TE-361CJ	596	9
TE-361MB	723	2
TE-361MC	722	2
TE-361MD	724	2
TE-362AC	261	1
TE-362AD	269	1

Table 6 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-362BB	268	1
TE-362CE	267	1
TE-363AE	887	1
TE-363BC	252	1
TE-363BE	251	1
TE-363CB	253	1
TE-363MB	788	2
TE-363MC	789	2
TE-363MD	786	2
TE-363ME	787	2
TE-364AD	249	1
TE-364AE	475	1
TE-364AF	601	1
TE-364AG	247	1
TE-364BD	598	1
TE-364BE	248	1
TE-364BF	250	1
TE-364CD	604	1
TE-364CF	603	1
TE-364CG	605	1
TE-364MD	802	2
TE-364MF	800	2
TE-364MG	799	2

Table 6 (continued)

NAME	ENTRY NUMBER	TYPE CODE
TE-4B	157	110
TE-40	393	6
TE-408B	400	5
TE-45	395	6
TE-5B	396	5
TE-520B	401	5
TE-521	402	5
TE-557	155	110
TE-57	397	6
TE-615	159	110
TE-62	398	6
TE-627	103	110
TE-67	399	6
TE-727	154	110
TE-901	403	5
TE-920	755	5
TE-921	756	5
TE-922	757	5
TE-923	432	5
TE-924	433	5
TE-925	792	5
TE-926	793	5
TE-936	794	5

Table 6 (continued)

NAME	ENTRY NUMBER	TYPE CODE
XE-430A	146	37
XE-430B	145	37
ZE-336U	167	76
ZE-346L	188	76

Table 7. Thermocouple nomenclature

Fuel rod simulator thermocouples: TE-3nnal

Rod sheath thermocouples are designated according to one of the following two schemes:

1. TE - 3 17 A D
- ↑ ↑ ↑
- rod number axial thermocouple level
- azimuthal thermocouple location

This designation refers to the sheath thermocouple in rod 17 at level D, azimuthal location A.

2. TE - 3 54 F8
- ↑ ↑
- rod number axial thermocouple level

This designation refers to the sheath thermocouple in rod 54 at level F8.

Spacer grid thermocouples: TE-29na

n - a number 1-6 designating the spacer grid level as follows:

Number	Between T/C levels
1	A&B
2	B&C
3	C&D
4	D&E
5	E&F
6	F&G

a - a letter A-F designating the subchannel into which the thermocouple is projecting as follows:

Letter	Subchannel
A	32
B	43
C	57
D	70
E	17
F	38

The spacer grids numbered 1, 2, 5, and 6 above have four thermocouples in subchannels designated A-D. The spacer grids numbered 3 and 4 above have six thermocouples in subchannels designated A-F.

Shroud-box thermocouples: TE-18na

n - a number 1-7 designating the level of the thermocouple in the shroud box as follows:

Number	T/C Level
1	A
2	B
3	C
4	D
5	E
6	F
7	G

a - a letter designating the side of the box through which the thermocouple protrudes N, E, S, W (being the compass direction most closely matching the direction the side faces).

Table 7 (continued)

Shroud-box wall thermocouples: TE-27nab

n - a number 0-9 designating the level of the thermocouple in the shroud box as follows:

<u>n</u>	<u>T/C level</u>
0	A
1	B
2	C
3	D
4	N/A
5	E
6	E3
7	F
8	F3
9	G

a - a letter designating the thermocouple position depth

<u>n</u>	<u>Position</u>
A	At edge of inner shroud wall
B	At edge of outer shroud wall

b - a letter designating wall orientation

<u>b</u>	<u>Position</u>
E	East wall
S	South wall

Subchannel thermocouples: TE-12nn

nn - a number 01-81 equal to the number of the subchannel in which it is located.

Thermocouple-array rod thermocouples: TE-18nal

n - the number 8 or 9 designating in which bundle site the T/C array rod is located.

8 - grid position No. 19
9 - grid position No. 36

a - a letter A or B designating which of two subchannels associated with that rod the thermocouple protrudes into.

<u>Position</u>	<u>A subchannel No.</u>	<u>B subchannel No.</u>
19	22	30
36	41	49

l - the thermocouple level A-G (same as FRS thermocouple level designations).

REFERENCES

1. G. L. Yoder et al., *Dispersed Flow Film Boiling in Rod Bundle Geometry - Steady State Heat Transfer Data and Correlation Comparisons*, ORNL-5822 (to be published).
2. D. K. Felde et al., *Thermal Hydraulic Test Facility (THTF) MOD 3, ORNL Blowdown Heat Transfer Program*, ORNL/TM-7842 (to be published).

Appendix A

TEST PROCEDURE

During steady-state operation of the THTF, fluid flows from the pump (Fig. 5) through two flow control valves, through the horizontal inlet spool piece, past the inlet rupture disk assembly, and through a vertical spool piece before it enters the external downcomer. Fluid then passes through two spool pieces in the downcomer before it enters the test section, where it is heated as it flows past the rods. The fluid leaves the test section from the upper plenum, passes through the three outlet spool pieces, proceeds through the heat exchangers, and returns to the pump.

Inlet flow for each steady-state test was established, and the loop was adjusted to provide the designed inlet fluid temperature and pressure. The bundle power was then increased until the dryout point was at the desired position in the bundle. The steady-state operating point was assumed to have been reached when operating pressure and rod surface temperatures stabilized. Instruments were scanned for 20 s during each experiment.

Appendix B

MASS FLOW CALCULATIONS

This appendix presents the time-averaged mass flow rates for the 22 steady-state experiments and associated uncertainties. Table B.1 contains the mass flow rates calculated from measurements made at the inlet to the test section. The fluids at the inlet were subcooled during the steady-state tests, thus enabling accurate determination of the flow rates. The mass flow rate ($\dot{m}$) is calculated from a turbine flowmeter-measured velocity (V) and a fluid temperature- and pressure-deduced density (ρ),

$$\dot{m} = \rho VA , \quad (B.1)$$

where A = flow area. Since the tests are steady state, the mass flow rate at the inlet is also the mass flow rate through the test section and through the outlet spool pieces.

It should be noted that the primary inlet flow measurement instruments in the steady-state test configuration are the 2-in. turbine flowmeters, FE-250 and FE-260. The larger 4-in. inlet turbine flowmeters, FE-19 and FE-166, approach or fall below the lower limits of their calibrated range over many of the tests.

Table B.1

TEST	MASS FLOW	
	LBM/H	KG/S
B	3.49E+04	4.40
C	1.64E+04	2.07
D	2.53E+04	3.19
E	2.91E+04	3.67
F	1.25E+04	1.58
G	1.22E+04	1.54
H	1.26E+04	1.59
I	1.78E+04	2.24
J	3.59E+04	4.52
K	1.10E+04	1.39
L	2.59E+04	3.26
M	3.22E+04	4.06
N	3.92E+04	4.94
O	1.50E+04	1.89
P	2.55E+04	3.21
Q	1.60E+04	2.02
R	1.80E+04	2.27
T	1.18E+04	1.49
U	1.18E+04	1.49
V	1.22E+04	1.54
W	1.26E+04	1.59
X	1.66E+04	2.09

The mass flow uncertainty may be estimated by the standard propagation-of-errors method [Eq. (D.4)] using individual instrument uncertainties as stated in Tables D.5 and D.6. The variance of the mass flow is given in an analogous form to Eq. (D.4).

$$\text{Variance (m)} = \sigma_{\dot{m}}^2 = \left(\frac{\partial \dot{m}}{\partial \rho} \right)^2 \sigma_{\rho}^2 + \left(\frac{\partial \dot{m}}{\partial V} \right)^2 \sigma_V^2 . \quad (\text{B.2})$$

Expressed in terms of the standard deviation σ , this equation becomes

$$\sigma_{\dot{m}} = \sqrt{(V\sigma_{\rho})^2 + (\rho\sigma_V)^2} A , \quad (\text{B.3})$$

where

σ_{ρ} = density measurement uncertainty,
 σ_V = velocity measurement uncertainty.

Since the uncertainties for the turbine flowmeter are stated in terms of percent of reading, it is convenient to express the mass flow uncertainty in a similar manner. Equation (B.3) may be restated as

$$\sigma_{\dot{m}}(\%) = \sqrt{\sigma_{\rho}(\%)^2 + \sigma_V(\%)^2} A . \quad (\text{B.4})$$

The 2σ (95% confidence) bands for the turbine flowmeter ($2\sigma_{\rho}$) are stated as 4.1% of reading V (Tables D.5 and D.6). A 2σ estimate for the density is based on uncertainties generated from water properties assuming 2σ deviations of temperature (T) and pressure (p) from measured values. The 2σ uncertainties from Tables D.5 and D.6 are

$$2\sigma_T = 3.7 \text{ K } (6.7^{\circ}\text{F})$$

and

$$2\sigma_p = 200 \text{ kPa } (29 \text{ psi}).$$

For the pressures and temperatures of interest, the 2σ variation in temperature is the dominant effect and results in an estimated $2\sigma_{\rho}$ of 1.0% of reading. Substituting the 2σ measurement uncertainties into Eq. (B.5) results in a 2σ mass flow uncertainty for subcooled flow of 4.22% of reading.

Appendix C

ROD POWERS

The calculated rod powers for each steady-state test are shown in Tables C.1-C.22. Rods 19, 22, 36, and 46 are unheated. In tests B, C, D, E, and J, rod 32 failed and the power generated in the rod is at or near zero. Section 6 of Appendix D is devoted to a discussion of rod power uncertainty. As shown there, one standard deviation in power is 0.55% of reading.

Table C.1

TEST B					
ROD NO.	POWER(KW)	ROD NO.	POWER(KW)	ROD NO.	POWER(KW)
1	102.14	2	102.31	3	103.43
4	103.06	5	102.45	6	101.86
7	100.82	8	97.60	9	101.59
10	101.87	11	102.40	12	102.54
13	102.25	14	101.01	15	104.34
16	101.08	17	100.95	18	101.18
20	102.03	21	101.53	23	102.05
24	101.32	25	101.27	26	101.71
27	102.01	28	100.87	29	101.24
30	101.10	31	101.66	32	0.00
33	102.10	34	102.47	35	102.02
37	102.09	38	102.29	39	101.52
40	103.12	41	99.11	42	101.38
43	103.43	44	102.52	45	102.60
47	102.08	48	104.96	49	101.48
50	100.87	51	102.29	52	101.27
53	103.82	54	99.27	55	102.53
56	103.12	57	102.20	58	102.59
59	102.03	60	101.79	61	101.62
62	102.08	63	102.79	64	101.92

Table C.2

TEST C					
ROD NO.	POWER(KW)	ROD NO.	POWER(KW)	ROD NO.	POWER(KW)
1	63.59	2	63.33	3	64.07
4	63.73	5	63.46	6	63.63
7	62.75	8	60.78	9	63.38
10	63.10	11	63.39	12	64.04
13	63.86	14	63.06	15	65.28
16	62.99	17	63.03	18	63.16
20	63.11	21	63.38	23	63.79
24	63.31	25	63.21	26	63.48
27	63.70	28	62.96	29	63.24
30	63.14	31	63.47	32	0.18
33	63.69	34	63.94	35	63.73
37	64.05	38	64.11	39	63.40
40	64.78	41	61.83	42	63.22
43	64.04	44	63.47	45	64.42
47	64.01	48	65.85	49	63.28
50	62.89	51	63.35	52	62.67
53	64.31	54	62.19	55	64.36
56	64.74	57	63.15	58	63.46
59	63.09	60	63.82	61	63.68
62	64.08	63	64.53	64	63.91

Table C.3

TEST D

ROD NO.	POWER(KW)	ROD NO.	POWER(KW)	ROD NO.	POWER(KW)
1	77.92	2	77.45	3	78.36
4	77.97	5	77.56	6	78.00
7	77.11	8	74.97	9	77.57
10	77.16	11	77.51	12	78.47
13	78.28	14	77.51	15	79.59
16	77.25	17	77.16	18	77.33
20	78.09	21	77.68	23	78.20
24	77.64	25	77.39	26	77.69
27	78.11	28	77.11	29	77.50
30	77.42	31	77.84	32	0.01
33	78.03	34	78.23	35	78.04
37	78.57	38	78.68	39	77.65
40	79.48	41	75.76	42	77.40
43	78.27	44	77.63	45	79.02
47	78.48	48	80.75	49	77.47
50	76.96	51	77.45	52	76.65
53	78.56	54	76.30	55	78.96
56	79.39	57	77.28	58	77.60
59	77.15	60	78.27	61	78.11
62	78.56	63	79.13	64	78.40

Table C.4

TEST E

ROD NO.	POWER(KW)	ROD NO.	POWER(KW)	ROD NO.	POWER(KW)
1	79.85	2	80.30	3	81.27
4	80.91	5	80.47	6	79.77
7	78.87	8	76.49	9	79.49
10	80.04	11	80.41	12	80.23
13	80.04	14	79.34	15	81.60
16	79.05	17	79.02	18	79.26
20	80.22	21	79.45	23	79.96
24	79.42	25	79.27	26	79.64
27	80.08	28	79.01	29	79.32
30	79.13	31	79.64	32	0.00
33	79.92	34	80.17	35	79.99
37	80.03	38	80.12	39	79.42
40	80.95	41	77.61	42	79.34
43	81.23	44	80.53	45	80.48
47	79.54	48	82.35	49	79.38
50	78.88	51	80.29	52	79.48
53	81.49	54	77.73	55	80.40
56	80.95	57	80.19	58	80.51
59	80.06	60	79.75	61	79.57
62	80.03	63	80.66	64	79.92

Table C.5

TEST F					
ROD NO.	POWER(KW)	ROD NO.	POWER(KW)	ROD NO.	POWER(KW)
1	42.92	2	42.78	3	43.30
4	43.12	5	42.88	6	42.80
7	42.12	8	41.61	9	42.79
10	42.61	11	42.86	12	43.11
13	43.00	14	42.43	15	43.22
16	42.34	17	42.49	18	42.60
20	42.82	21	42.65	23	42.91
24	42.54	25	42.67	26	42.86
27	43.05	28	42.45	29	42.55
30	42.47	31	42.73	32	43.64
33	42.99	34	43.19	35	43.06
37	42.86	38	42.90	39	42.68
40	43.31	41	41.73	42	42.68
43	43.35	44	42.94	45	43.17
47	42.84	48	44.11	49	42.72
50	42.45	51	42.85	52	42.36
53	43.54	54	41.63	55	43.10
56	43.39	57	42.69	58	42.95
59	42.68	60	42.76	61	42.63
62	42.90	63	43.24	64	42.77

Table C.6

TEST G					
ROD NO.	POWER(KW)	ROD NO.	POWER(KW)	ROD NO.	POWER(KW)
1	36.15	2	36.12	3	36.53
4	36.39	5	36.19	6	36.09
7	35.49	8	35.12	9	36.06
10	35.98	11	36.18	12	36.37
13	36.28	14	35.81	15	36.45
16	35.72	17	35.82	18	35.95
20	36.09	21	36.02	23	36.21
24	35.89	25	35.95	26	36.13
27	36.27	28	35.81	29	35.93
30	35.87	31	36.04	32	36.71
33	36.25	34	36.40	35	36.26
37	35.09	38	36.10	39	36.03
40	36.46	41	35.20	42	35.95
43	36.57	44	36.23	45	36.34
47	36.69	48	37.15	49	36.01
50	35.80	51	36.15	52	35.75
53	36.75	54	35.05	55	36.29
56	36.55	57	36.04	58	36.22
59	36.03	60	36.03	61	35.91
62	36.15	63	36.46	64	36.06

Table C.7

TEST H					
ROD NO.	POWER(KW)	ROD NO.	POWER(KW)	ROD NO.	POWER(KW)
1	47.12	2	47.43	3	47.97
4	47.78	5	47.60	6	46.70
7	46.07	8	45.39	9	47.02
10	47.22	11	47.47	12	47.06
13	46.92	14	46.30	15	47.20
16	46.25	17	46.72	18	46.73
20	47.24	21	46.54	23	46.84
24	46.46	25	46.87	26	47.07
27	47.24	28	46.65	29	46.45
30	46.37	31	46.61	32	46.51
33	47.26	34	47.42	35	47.27
37	45.96	38	46.03	39	46.55
40	46.44	41	45.89	42	46.87
43	48.01	44	47.58	45	46.28
47	45.94	48	47.41	49	46.94
50	46.62	51	47.47	52	46.96
53	48.18	54	44.71	55	46.24
56	46.59	57	47.31	58	47.60
59	47.29	60	45.87	61	45.75
62	46.04	63	46.42	64	45.96

Table C.8

TEST I					
ROD NO.	POWER(KW)	ROD NO.	POWER(KW)	ROD NO.	POWER(KW)
1	62.76	2	62.97	3	63.74
4	63.49	5	63.29	6	62.17
7	61.39	8	59.76	9	62.46
10	62.79	11	63.02	12	62.54
13	62.36	14	61.54	15	63.37
16	61.50	17	62.08	18	62.10
20	62.72	21	61.99	23	62.27
24	61.78	25	62.27	26	62.50
27	62.71	28	61.95	29	61.76
30	61.61	31	61.96	32	61.98
33	62.77	34	62.94	35	62.75
37	61.21	38	61.35	39	61.88
40	61.91	41	60.90	42	62.26
43	63.72	44	63.15	45	61.66
47	61.19	48	63.11	49	62.35
50	61.88	51	62.99	52	62.33
53	63.95	54	59.59	55	61.59
56	62.02	57	62.88	58	63.18
59	62.76	60	51.05	61	60.95
62	61.35	63	61.83	64	61.26

Table C.9

TEST J					
ROD NO.	POWER(KW)	ROD NO.	POWER(KW)	ROD NO.	POWER(KW)
1	86.12	2	86.36	3	87.44
4	87.01	5	86.61	6	85.90
7	84.89	8	82.16	9	85.66
10	86.11	11	86.53	12	86.39
13	86.22	14	85.44	15	88.11
16	85.25	17	85.08	18	85.34
20	86.24	21	85.62	23	86.13
24	85.56	25	85.35	26	85.79
27	86.23	28	85.07	29	85.38
30	85.17	31	85.72	32	86.00
33	86.04	34	86.48	35	86.14
37	86.22	38	86.40	39	85.52
40	87.17	41	83.58	42	85.48
43	87.43	44	86.62	45	86.60
47	86.16	48	88.78	49	85.58
50	85.07	51	86.42	52	85.57
53	87.78	54	83.73	55	86.59
56	87.16	57	86.29	58	86.62
59	86.12	60	85.84	61	85.83
62	86.21	63	86.80	64	86.02

Table C.10

TEST K					
ROD NO.	POWER(KW)	ROD NO.	POWER(KW)	ROD NO.	POWER(KW)
1	50.25	2	50.45	3	51.11
4	50.95	5	50.75	6	49.67
7	49.01	8	49.39	9	49.98
10	50.36	11	50.51	12	49.96
13	49.81	14	49.16	15	49.08
16	49.18	17	49.64	18	49.63
20	50.24	21	49.41	23	49.76
24	49.38	25	49.83	26	49.96
27	50.13	28	49.54	29	49.34
30	49.25	31	49.51	32	49.44
33	50.21	34	50.33	35	50.15
37	48.85	38	48.93	39	49.44
40	49.44	41	48.76	42	49.77
43	51.05	44	50.59	45	49.19
47	48.85	48	50.43	49	49.91
50	49.48	51	50.47	52	49.96
53	51.22	54	47.50	55	49.14
56	49.58	57	50.39	58	50.63
59	50.28	60	48.77	61	48.65
62	48.96	63	49.36	64	48.92

Table C.11

TEST L

ROD NO.	POWER(KW)	ROD NO.	POWER(KW)	ROD NO.	POWER(KW)
1	87.73	2	87.90	3	89.06
4	88.69	5	88.41	6	86.98
7	86.07	8	86.46	9	87.19
10	87.71	11	88.03	12	87.44
13	87.18	14	86.16	15	85.90
16	86.10	17	86.70	18	86.69
20	87.59	21	86.58	23	87.08
24	86.32	25	86.93	26	87.19
27	87.53	28	86.51	29	86.34
30	86.15	31	86.59	32	86.72
33	87.65	34	87.80	35	87.57
37	85.77	38	86.06	39	86.45
40	86.63	41	85.05	42	86.85
43	88.91	44	88.18	45	86.28
47	85.77	48	88.35	49	87.04
50	86.32	51	87.87	52	86.98
53	89.22	54	83.41	55	86.25
56	86.82	57	87.84	58	88.14
59	87.62	60	85.50	61	85.39
62	85.94	63	86.46	64	85.77

Table C.12

TEST M

ROD NO.	POWER(KW)	ROD NO.	POWER(KW)	ROD NO.	POWER(KW)
1	99.13	2	99.23	3	100.49
4	100.08	5	99.75	6	98.27
7	97.28	8	97.69	9	98.52
10	99.02	11	99.36	12	98.79
13	98.47	14	97.42	15	97.05
16	97.30	17	98.00	18	97.99
20	98.86	21	97.81	23	98.41
24	97.54	25	98.22	26	98.52
27	98.93	28	97.81	29	97.55
30	97.36	31	97.85	32	97.93
33	99.04	34	99.23	35	98.51
37	96.97	38	97.31	39	97.70
40	97.94	41	96.09	42	98.14
43	100.33	44	97.48	45	97.51
47	96.93	48	99.87	49	98.31
50	97.53	51	99.16	52	98.21
53	100.68	54	94.30	55	97.43
56	98.11	57	99.17	58	99.52
59	98.92	60	96.62	61	96.52
62	97.13	63	97.73	64	96.93

Table C.13

TEST N					
ROD NO.	POWER(KW)	ROD NO.	POWER(KW)	ROD NO.	POWER(KW)
1	106.39	2	106.52	3	107.91
4	107.39	5	107.03	6	105.52
7	104.50	8	105.01	9	105.72
10	106.22	11	106.67	12	106.07
13	105.75	14	104.69	15	104.26
16	104.61	17	105.10	18	105.13
20	106.12	21	105.07	23	105.71
24	104.91	25	105.41	26	105.73
27	106.15	28	104.89	29	104.76
30	104.56	31	105.08	32	105.26
33	106.31	34	106.47	35	106.15
37	104.13	38	104.42	39	104.91
40	105.33	41	103.11	42	105.33
43	107.69	44	106.75	45	104.72
47	104.11	48	107.35	49	105.53
50	104.74	51	106.46	52	105.40
53	108.13	54	101.39	55	104.74
56	105.44	57	106.54	58	106.87
59	106.23	60	103.89	61	103.79
62	104.42	63	105.08	64	104.32

Table C.14

TEST O					
ROD NO.	POWER(KW)	ROD NO.	POWER(KW)	ROD NO.	POWER(KW)
1	60.26	2	60.36	3	61.18
4	61.00	5	60.73	6	59.58
7	58.84	8	59.24	9	59.91
10	60.26	11	60.42	12	59.88
13	59.71	14	58.94	15	58.85
16	59.00	17	59.51	18	59.49
20	60.12	21	59.24	23	59.63
24	59.22	25	59.72	26	59.87
27	60.06	28	59.37	29	59.13
30	59.04	31	59.32	32	59.37
33	60.21	34	60.30	35	60.13
37	58.63	38	58.77	39	59.26
40	59.36	41	58.46	42	59.64
43	61.11	44	60.54	45	58.99
47	58.59	48	60.55	49	59.83
50	59.30	51	60.38	52	59.76
53	61.29	54	57.02	55	58.95
56	59.50	57	60.45	58	60.58
59	60.20	60	58.51	61	58.41
62	58.76	63	59.21	64	58.74

Table C.15

TEST P

ROD NO.	POWER(KW)	ROD NO.	POWER(KW)	ROD NO.	POWER(KW)
1	92.11	2	92.15	3	93.38
4	93.06	5	92.70	6	91.25
7	90.25	8	90.78	9	91.50
10	92.01	11	92.25	12	91.59
13	91.32	14	90.32	15	90.00
16	90.35	17	90.95	18	90.93
20	91.83	21	90.73	23	91.28
24	90.67	25	91.17	26	91.35
27	91.71	28	90.70	29	90.44
30	90.30	31	90.70	32	90.99
33	91.94	34	92.03	35	91.75
37	89.89	38	90.20	39	90.60
40	91.03	41	89.17	42	91.02
43	93.10	44	92.36	45	90.37
47	89.84	48	92.81	49	91.24
50	90.47	51	92.07	52	91.17
53	93.46	54	87.41	55	90.33
56	91.05	57	92.20	58	92.41
59	91.90	60	89.70	61	89.57
62	90.12	63	90.73	64	90.06

Table C.16

TEST Q

ROD NO.	POWER(KW)	ROD NO.	POWER(KW)	ROD NO.	POWER(KW)
1	63.30	2	63.53	3	64.37
4	64.15	5	62.84	6	63.49
7	62.68	8	63.10	9	62.90
10	63.42	11	63.60	12	63.81
13	63.62	14	62.80	15	62.69
16	62.75	17	62.49	18	62.49
20	63.28	21	63.15	23	63.53
24	63.01	25	62.68	26	62.82
27	63.06	28	62.32	29	63.00
30	62.90	31	63.21	32	63.65
33	63.20	34	63.30	35	63.13
37	62.89	38	63.05	39	63.14
40	63.61	41	61.33	42	62.58
43	64.26	44	63.60	45	63.29
47	62.88	48	64.77	49	62.79
50	62.24	51	63.52	52	62.87
53	64.44	54	61.16	55	63.21
56	63.69	57	63.47	58	63.69
59	63.29	60	62.72	61	62.61
62	63.01	63	63.45	64	62.94

Table C.17

TEST R					
ROD NO.	POWER(KW)	ROD NO.	POWER(KW)	ROD NO.	POWER(KW)
1	71.76	2	71.82	3	72.82
4	72.57	5	71.06	6	71.91
7	71.00	8	71.43	9	71.27
10	71.73	11	71.91	12	72.22
13	72.00	14	71.10	15	70.53
16	71.03	17	70.82	18	70.81
20	71.57	21	71.43	23	71.90
24	71.30	25	71.05	26	71.18
27	71.45	28	70.64	29	71.28
30	71.17	31	71.49	32	71.98
33	71.62	34	71.74	35	71.54
37	71.19	38	71.38	39	71.41
40	71.97	41	69.52	42	70.90
43	72.68	44	72.06	45	71.61
47	71.14	48	73.35	49	71.15
50	70.50	51	71.83	52	71.08
53	72.88	54	69.20	55	71.54
56	72.05	57	71.79	58	72.07
59	71.59	60	71.01	61	70.84
62	71.32	63	71.79	64	71.19

Table C.18

TEST T					
ROD NO.	POWER(KW)	ROD NO.	POWER(KW)	ROD NO.	POWER(KW)
1	35.80	2	35.78	3	36.18
4	36.04	5	35.85	6	35.78
7	35.18	8	34.91	9	35.69
10	35.64	11	35.82	12	36.04
13	35.94	14	35.48	15	36.01
16	35.41	17	35.44	18	35.57
20	35.67	21	35.68	23	35.87
24	35.56	25	35.60	26	35.75
27	35.88	28	35.43	29	35.60
30	35.54	31	35.71	32	36.33
33	35.87	34	36.03	35	35.87
37	35.71	38	35.71	39	35.68
40	36.08	41	34.83	42	35.58
43	36.21	44	35.88	45	35.96
47	35.71	48	36.77	49	35.63
50	35.43	51	35.80	52	35.42
53	36.41	54	34.67	55	35.91
56	36.19	57	35.69	58	35.88
59	35.68	60	35.65	61	35.53
62	35.77	63	36.08	64	35.69

Table C.19

TEST U					
ROD NO.	POWER(KW)	ROD NO.	POWER(KW)	ROD NO.	POWER(KW)
1	35.81	2	35.76	3	36.17
4	36.03	5	35.84	6	35.79
7	35.19	8	34.92	9	35.69
10	35.62	11	35.81	12	36.25
13	35.95	14	35.49	15	36.22
16	35.42	17	35.45	18	35.57
20	35.67	21	35.69	23	35.87
24	35.57	25	35.62	26	35.75
27	35.90	28	35.44	29	35.61
30	35.55	31	35.71	32	36.28
33	35.87	34	36.04	35	35.88
37	35.71	38	35.74	39	35.69
40	36.07	41	34.84	42	35.58
43	36.21	44	35.88	45	35.96
47	35.71	48	36.77	49	35.63
50	35.44	51	35.78	52	35.41
53	36.39	54	34.67	55	35.92
56	36.17	57	35.68	58	35.87
59	35.67	60	35.65	61	35.52
62	35.77	63	36.07	64	35.70

Table C.20

TEST V					
ROD NO.	POWER(KW)	ROD NO.	POWER(KW)	ROD NO.	POWER(KW)
1	36.19	2	36.17	3	36.59
4	36.44	5	36.24	6	36.11
7	35.52	8	35.50	9	36.06
10	36.03	11	36.22	12	36.39
13	36.30	14	35.82	15	36.09
16	35.74	17	35.82	18	35.94
20	36.08	21	36.22	23	36.22
24	35.90	25	36.00	26	36.13
27	36.31	28	35.82	29	35.95
30	35.89	31	36.05	32	36.71
33	36.25	34	36.43	35	36.30
37	36.15	38	36.13	39	36.03
40	36.46	41	35.21	42	35.98
43	36.60	44	36.27	45	36.40
47	36.09	48	37.20	49	36.01
50	35.82	51	36.19	52	35.80
53	36.80	54	35.11	55	36.34
56	36.58	57	36.08	58	36.26
59	36.07	60	36.03	61	35.91
62	36.15	63	36.46	64	36.09

Table C.21

TEST W					
ROD NO.	POWER(KW)	ROD NO.	POWER(KW)	ROD NO.	POWER(KW)
1	42.92	2	42.81	3	43.33
4	43.13	5	42.91	6	42.81
7	42.14	8	41.49	9	42.79
10	42.65	11	42.88	12	43.12
13	43.01	14	42.44	15	43.36
16	42.34	17	42.52	18	42.63
20	42.69	21	42.68	23	42.92
24	42.54	25	42.72	26	42.87
27	43.05	28	42.45	29	42.57
30	42.49	31	42.74	32	43.52
33	43.02	34	43.20	35	43.05
37	42.86	38	42.86	39	42.69
40	43.31	41	41.77	42	42.70
43	43.35	44	42.94	45	43.17
47	42.84	48	44.11	49	42.73
50	42.45	51	42.86	52	42.38
53	43.55	54	41.63	55	43.10
56	43.41	57	42.71	58	42.96
59	42.70	60	42.77	61	42.63
62	42.90	63	43.24	64	42.77

Table C.22

TEST X					
ROD NO.	POWER(KW)	ROD NO.	POWER(KW)	ROD NO.	POWER(KW)
1	67.22	2	67.32	3	68.23
4	68.02	5	67.76	6	66.45
7	65.64	8	66.08	9	66.76
10	67.22	11	67.39	12	66.74
13	66.53	14	65.70	15	65.56
16	65.74	17	66.34	18	66.32
20	67.07	21	66.02	23	66.47
24	66.03	25	66.52	26	66.69
27	66.92	28	66.17	29	65.89
30	65.80	31	66.07	32	66.22
33	67.08	34	67.17	35	67.00
37	65.38	38	65.59	39	66.04
40	66.21	41	65.09	42	66.42
43	68.07	44	67.51	45	65.79
47	65.38	48	67.53	49	66.66
50	66.06	51	67.31	52	66.64
53	68.31	54	63.62	55	65.72
56	66.29	57	67.38	58	67.56
59	67.16	60	65.30	61	65.18
62	65.57	63	66.04	64	65.54

Appendix D

INSTRUMENT UNCERTAINTY ANALYSIS FOR THE THTF LOOP

Summary of Results

Two standard deviation uncertainty bands are described for critical instrumentation in the Thermal Hydraulic Test Facility (THTF). The analyzed instruments and their minimum, steady-state, 2σ error bands [root sum square (RSS), 95% confidence interval] include:

1. Turbine flowmeter	4.1% reading
2. Gamma densitometer	10.4% FS*
3. Strain gage pressure cell	1.0% FS*
4. Differential pressure cell	2.0% FS* min to 9.9% FS* max
5. Thermocouples	3.7°C min to 10.3°C max
6. Rod power instrumentation	1.1% reading
7. Strain gage drag disk	56% reading below 10% FS* 19% reading above 10% FS*

Summary of Theory

The measure of the value of a group of n data points (x_i) with statistical significance is the mean ($\bar{x}$) or expected value given by

$$\bar{x} = \sum \frac{x_i}{n}, \quad (D.1)$$

where Σ is the usual sum from data point 1 to data point n . The standard measure of the dispersion of the data is the variance [σ^2 or $V(x)$] defined by

$$\sigma^2 = \sum \frac{(x_i - \bar{x})^2}{n}. \quad (D.2)$$

However, $V(x)$ has dimensions of engineering units squared, which may be inconvenient. The square root of $V(x)$, the standard deviation (σ), is usually reported. Furthermore, in normally distributed data with mean $\bar{x}$ and variance σ^2 (a good approximation for much variation in physical data),

*Full-scale values are found in Tables D.5–D.8 under instrument range.

statistical inferences may be drawn in terms of probabilities based on the measured values of $\bar{x}$ and σ as follows:

68% probability that $\bar{x} - \sigma < x_t < \bar{x} + \sigma$,

95% probability that $\bar{x} - 2\sigma < x_t < \bar{x} + 2\sigma$,

and

99.7% probability that $\bar{x} - 3\sigma < x_t < \bar{x} + 3\sigma$,

where x_t is the true value of the variable.

Brownlee has shown¹ that the variance of a linear function

$$Z = A_0 + A_1X_1 + A_2X_2 = \dots A_nX_n$$

is a linear function of the variance of the variables as long as the correlation coefficients are zero, i.e., as long as they are physically unrelated. (Linearly independent variables have zero correlation coefficients, but linear independence is not a requirement.) That is,

$$V(Z) = A_1V(X_1) + A_2V(X_2) + \dots A_nV(X_n) , \quad (D.3)$$

where the A_1 's are constants and the X_1 's are independent variables.

Similarly, Scarborough has shown² that an analogous relation holds for a system where the independent variables are not linear:

$$Z = F(Y_1, Y_2, \dots, Y_n) .$$

The variance of Z is given by

$$V(Z) = \left(\frac{\partial Z}{\partial Y_1}\right)^2 V(Y_1) + \left(\frac{\partial Z}{\partial Y_2}\right)^2 V(Y_2) + \dots + \left(\frac{\partial Z}{\partial Y_n}\right)^2 V(Y_n) , \quad (D.4)$$

where the correlation coefficients of the Y_i 's are zero and the value of $V(Y)$ is small compared to $(\partial Z/\partial Y_i)^2$. Notice that in situations where the standard deviation can be expressed legitimately as a percentage of the value of $\partial Z/\partial Y_i$, Eq. (D.4) can be rewritten as

$$\sigma\%(Z) = \sqrt{(\sigma\%Y_1)^2 + (\sigma\%Y_2)^2 + \dots + (\sigma\%Y_n)^2} . \quad (D.5)$$

The above equations can best be understood through the use of an illustrative example. Consider the amplifier of Fig. D.1. The uncertainty in the input voltage can be derived from the function $V_{in} = F(V_{out}, V_{offset}, GAIN)$, given the measured values for V_{out} , $V(V_{out})$, V_{offset} , $V(V_{offset})$, and $GAIN$, $V(GAIN)$, when V_{in} is the input voltage, $GAIN$ is the amplifier gain, and V_{offset} is the offset voltage.

Assuming the following data, the value of V_{in} is given by

$$V_{in} = \frac{V_{out} - V_{offset}}{GAIN},$$

and the variance in the input voltage can be found by applying Eq. (D.4) or (D.5):

$$V(V_{in}) = \frac{V(V_{out})}{GAIN^2} + \frac{V(V_{offset})}{GAIN^2} + \frac{V(GAIN) (V_{offset} - V_{out})^2}{GAIN^4}, \quad (D.6)$$

where

$$V_{out \text{ max}} = 20.0 \text{ volts},$$

$$V_{out} = 10.0 \text{ volts},$$

$$V(V_{out}) = (0.2 \text{ volts})^2 = (2\%)^2 \text{ reading},$$

$$V_{offset} = 0.5 \text{ volts},$$

$$V(V_{offset}) = (0.05 \text{ volts})^2 = (0.5\%)^2 \text{ reading},$$

$$GAIN = 200 \text{ volts/volt},$$

$$V(GAIN) = (1 \text{ volt/volt})^2 = (0.5\%)^2 \text{ reading},$$

$$V_{in} = \frac{(10.0 \text{ volts} - 0.5 \text{ volts})}{200} = 0.0475 \text{ volts},$$

Fig. D.1. Amplifier.

$$V(V_{in}) = \frac{(0.2)^2}{(200)^2} + \frac{(0.05)^2}{(200)^2} + 1^2 \frac{(-9.5)^2}{(200)^4}$$

and

$$\sigma(V_{in}) = 10^{-3} \text{ volts or } 2.1\% \text{ reading .}$$

Because V_{in} is a function of V_{out} , V_{offset} , and GAIN in the form given above, it is reasonable to assume that stating the variances as percentages of the readings is equivalent to stating the variances as percentages of the respective partial differentials. In fact, this will always be reasonable as long as the variables are of the first order. The arithmetic for computing $\sigma(V_{in})$ becomes simply

$$\sigma(V_{in}) = (2\%)^2 + (0.5\%)^2 + (0.5\%)^2 = 2.1\% \text{ reading .}$$

Equation (D.4) or (D.5) applied to each major component of a complex information loop is often the only method available to arrive at an uncertainty value. However, in the case of the gamma densitometer and the strain gage pressure cell, in situ standards are available that allow direct measurement of the uncertainty. Heise gages are used as in situ standards for strain gage pressure cells. Pressure and temperature measurements in subcooled water can be used to determine density with steam tables for comparison with the gamma densitometers. Such a comparison is made using a linear regression analysis based on the method of Gauss.

The equation of a line in slope-intercept form is given by

$$y = Ax + B ,$$

where A is the slope ($\Delta y / \Delta x$) and B is the value of the y intercept.

The best-fit values of A and B can be found by minimizing the sum of the distances between the experimentally determined points and the best-fit line.

The pertinent equations are

$$A = \frac{\sum x_i \sum y_i - n \sum (x_i y_i)}{(\sum x_i)^2 - n \sum (x_i)^2} \quad (D.7)$$

and

$$B = \frac{\sum (x_i y_i) \sum x_i - \sum y_i \sum (x_i)^2}{(\sum x_i)^2 - n \sum (x_i)^2} , \quad (D.8)$$

where the x_i 's are the values determined by the instrument under discussion and the y_i 's are the corresponding values determined by the in situ standard. The uncertainty of the instrument values can then be defined analogously to Eq. (D.2):

$$\sigma = \sqrt{\sum \frac{(Y_i - y_i)^2}{n}}, \quad (D.9)$$

where the Y_i 's are computed from the best-fit equation and the instrument values are y_i . A perfectly calibrated and properly operating instrument will have $A = 1.0$, $B = 0$, and $\sigma \ll \text{reading}$.

Although the slope-intercept form of an equation is one of the easiest to interpret, it does have a disadvantage: A and B are not linearly independent variables, so drawing statistical inferences about A and B in terms of their variances is hindered. A solution to this problem is to solve for the best-fit line equation in the form

$$Y = a(x - \bar{x}) + \beta. \quad (D.10)$$

The variances of a and β are then known to be

$$V(a) = \frac{\sigma^2}{n} \quad (D.11)$$

and

$$V(\beta) = \frac{\sigma^2}{\sum (x_i - \bar{x})^2}, \quad (D.12)$$

as shown by Brownlee,³ where σ is defined as in Eq. (D.9). We can still arrive at an estimate of $V(A)$ and $V(B)$ by modifying Eq. (D.10) to show

$$Y = ax - a\bar{x} + \beta,$$

which implies $a = A$ and $B = (-a\bar{x} + \beta)$. Applying Eq. (D.4) yields

$$V(A) = \frac{\sigma^2}{n} \quad (D.13)$$

and

$$V(B) = \frac{\sigma^2}{n} \bar{x}^2 + \frac{\sigma^2}{\sum (x_i - \bar{x})^2} = \sigma^2 \frac{x^2}{n} + \frac{1}{\sum (x_i - \bar{x})^2} . \quad (D.14)$$

Equations (D.2)–(D.5) and (D.9) should be applied with caution for several reasons.

Definitions for variance assume perfect knowledge. However, actual sampling procedures are limited to finite sample sizes, and formulas impose limits on the degrees of freedom by imposing constraints. To adjust for the limits to the number of degrees of freedom, Eq. (D.2) is modified to provide an estimator for the standard deviation denoted S such that

$$S = \sqrt{\frac{\sum (x_i - \bar{x})^2}{(n - 1)}} . \quad (D.15)$$

Equation (D.9) becomes

$$S = \sqrt{\frac{\sum (Y_i - y_i)^2}{(n - 2)}} . \quad (D.16)$$

Equations (D.15) and (D.16) are the proper equations to use in all sampling situations where the standard deviation is to be used as the measure of the uncertainty. Furthermore, the value for S should be substituted for the value of σ and S^2 for $V(X)$ or $V(Y)$ in each of the other equations where σ appears. Because of the common association between the standard deviation defined by Eqs. (D.15) and (D.16) with the symbol σ , the symbol σ will be used for S in the balance of this report. In a practical sense, where the standard deviation is reported as two significant figures, there is essentially no difference between σ and S [Eqs. (D.4) and (D.9) versus Eqs. (D.15) and (D.16)] as long as the number of data points is large.

A class of practical problems that arises in the actual error analysis is centered around the interpretation placed on uncertainties supplied by manufacturers. These uncertainties are often supplied as percentages in such a manner that it is difficult to determine whether it is reasonable to apply Eq. (D.5). Either it is difficult to determine how the stated error relates to the standard deviation, or it is difficult to determine whether the error can be applied as a percentage of the partial differentials required by Eq. (D.5). Furthermore, it is seldom stated whether the given uncertainties meet the required criterion of zero correlation coefficient. It is common for manufacturers to quote error bands as 2σ (95% confidence) or 3σ (99% confidence) though sometimes without assigning confidence limits. In this report it is conservatively assumed that the error reported by instrument manufacturers is 2σ . Unless otherwise stated, it is also assumed that a statement of error as a percent

with respect to the partial differentials of Eq. (D.5) is reasonable and that the correlation coefficient is zero for all variables.

The second class of problems relating to the uncertainty analysis dealt with multiple estimates of σ for a class of instruments where σ varied widely from instrument-to-instrument and from trial-to-trial. The method of choice was to use a value of σ large enough to include about 95% of the measured values. This was accomplished by using

$$\sigma \approx \bar{\sigma} + \sigma(\sigma) .$$

That is, the value of the standard deviation used was the average value for all instruments and files read plus one standard deviation of σ . This is different from the probability statements above because σ is a span that includes zero to σ . Such a distribution cannot be normal in the sense that the probability statements require.

A generalized procedure for data analysis follows:

A common form for a large system is generalized in Fig. D.2. This system consists of a number of transducers (T_i), their associated signal conditioning equipment (S_i), and the data acquisition system (DAS). The DAS is understood to include both the hardware and the software. The standard deviations of the output signals are measured by reading the information from the magnetic tape written by the DAS and applying Eq. (D.2) or D.14) over an arbitrary length of time where the process is defined as being in a steady state. The measured value of the DAS output can then be incorporated with other measures of uncertainty using Eq. (D.5). If an in situ standard is going to be used to develop the total uncertainty directly, the data for the secondary standard need to be accessed and correlated in time and space with the instruments under consideration.

The development of software to perform the above estimates may be the most time-consuming part of the analysis. The software has to be able to perform the following functions for a magnetic-tape-based system:

1. Confirm that the tape is at the beginning.
2. Confirm that the tape density and number of tracks are system compatible.
3. Locate the instrument data base (IDB) and transfer the IDB to disk or core in a rapid access format.
4. Extract certain system constants from the IDB (record length, etc.).
5. Locate the scan table.
6. Use the scan table and instrument identifier code to determine the location of the desired instrument data in data records.

Fig. D.2. Generalized form for a large system.

7. Locate the first data file of the type desired.
8. Read a fixed number of records from the data file.
9. Store data in arrays or keep running totals for averaging.
10. Compute averages and standard deviations for steady-state data in the file.
11. Write the desired combinations of data, averages, and standard deviations to arrays.
12. Locate the next data file of the type desired and repeat steps 8-12 until end-of-tape is detected.
13. At end-of-tape, write the arrays to disk for later analysis.
14. At each tape operation, check for proper positioning.
15. Analyze data written to disk as required.

The following sections provide a detailed analysis of the critical instrumentation in the THTF loop. As stated above, the exact nature of the uncertainties is not always known. The RSS value of the uncertainty is the statistically defined one if variables are unrelated (correlation coefficient = 0) and the percentage uncertainty is given as a percent of partials required for Eq. (D.5). However, to the extent that the uncertainties stated do not comply with the assumptions, the more conservative strict sum of errors may need to be applied. Both the RSS value and the strict sum value are given in the text. The RSS values are reported in tabular form at the end of this Appendix. The superscript (*) is used to denote manufacturer derived data.

D.1 Turbine Flowmeter

The turbine flowmeter channel consists of a turbine flowmeter with integral magnetic pickup, an electronics package that conditions the signal to provide an output voltage proportional to flow rate, and the DAS, which converts the analog signal in volts to digital information and writes it onto magnetic tape. In operation, the turbine blade generates an electrical pulse as it passes the magnetic pickup. The ORNL electronics package senses this pulse and with 250 μ s resets the count registers and begins accumulating the count until the next pulse disables the count. During the disabled period the count is passed to the digital-to-analog converter where it is converted to millivolt reading. The voltage divider then inverts the millivolt signal and outputs a voltage proportional to the angular velocity of the turbine blade, with 10-V full scale (FS) corresponding to 1200-Hz input signal from the flowmeter pickup. The DAS then converts the output of the ORNL electronics to a digital value and writes it onto magnetic tape. The identified sources of error in the turbine flowmeter are:

Channel noise (blade angle tolerance)	3.2%
Calibration uncertainty	2.4%
Inherent turbine linearity*	0.5%
ORNL electronics package	0.4%
A/D conversion at DAS*	0.3%
Effect of bearing change each run*	0.3%
Strict sum, 2σ error band	7.1%
RSS, 2σ error band	4.1%

The following items need to be considered when applying the above error bands to THTF data:

1. The above uncertainties are all reasonably expressed as a percent of reading. However, the value of turbine linearity quoted applies only over the range 10% rated FS through 100% rated FS. Below 10% rated FS, error bands increase rapidly (see Fig. D.3) as frictional drag becomes more significant, with a cutoff of useful information occurring near 6% of rated FS flow due to signal-to-noise problems in the electronics.

2. Random noise was measured for 30 records of data taken during Reactor Simulation Test 3.05.5B. When the standard deviation was computed for each of the 10 flowmeters without excessive channel noise, the average value (1.53% of reading) was found to agree very well with the predicted channel noise because of blade manufacturing tolerances ($72^\circ \pm 1.56\%$). It would be optimistic, however, to conclude that this is the only source of random error. Data taken over a much wider range of flows would be needed to confirm this conclusion.

3. The calibration uncertainty was estimated from two different calibration laboratories (Flow Technology, Inc., and Measurements, Inc.) independently calibrating the same turbine flowmeters. The results of those calibrations indicated approximately 1.2% (as 1σ) differences from laboratory-to-laboratory. The supposed calibration uncertainty according to the laboratories was an order of magnitude smaller based on their NBS traceability standards. The reasons for the large difference were never satisfactorily determined. This comment applies solely to turbine meters located at the SVO, SVI, SHI, and SHO spool pieces.

4. The most troublesome problems of interpreting flowmeter error are those that occur during two-phase flow. In a 1977 report⁴ MPA Associates, Inc., investigated the possible errors due to slug flow, annular flow regimes, steam-water ratios, and differential two-phase velocities. This

Fig. D.3. Error due to turbine linearity: characteristic curve.

investigation was strictly theoretical, based on momentum exchange between the blade and the fluid. These analyses were based on steady-state flow, balancing the transverse momentum of one phase against that of the second. Assuming no net momentum exchange with the rotor, the turbine response was interpreted in light of the point effective radius (established as the calibration constant) in the presence of two phases with different flow regimes and different velocity profiles. The conclusion reached was that errors up to $\pm 25\%$ might be expected.

By assuming equal probabilities for the parameters investigated, it was determined that a 1σ error band of 10% might reasonably be expected. However, until experimental verification of both model and results can be obtained, it would only be prudent to use the above figures in a qualitative manner.

D.2 Gamma Densitometer

The gamma densitometers consist of a nearly monoenergetic ^{137}Cs gamma source, an ionization chamber to detect the gamma rays, an instrument amplifier, and the DAS. In use, the gamma rays pass through the steel pipe, through the water (in whatever phase) in the pipe, and into the ionization chamber. In the ionization chamber the gamma rays are converted into an electric current such that the current is proportional to the intensity of the impinging gamma rays. The instrument amplifier takes this current and converts it into a voltage that is proportional to the input current. At the DAS the voltage is converted to a digital value and stored on magnetic tape.

Given that the source approximates a point source, the density of the water (ρ_w) in the pipe should be given by

$$\rho_w = \text{KFACTR} \ln \left(\frac{V_p - V_o}{V - V_o} \right),$$

where KFACTR is an experimentally determined constant that includes the effect of pipe diameter and the mass absorption coefficient of the water (including any dissolved salts), V_p is the output voltage when the pipe is empty, V_o is the output voltage with the source shielded (dark voltage or zero offset), and V is the output voltage when there is water in the pipe.

Due to the strong theoretical dependence of density error as a function of density, the 1σ error band was investigated as a statistical function of the density reading compared to an in situ standard based on the physical properties of the water in the pipe under known conditions of temperature and pressure and a steady-state, one-phase flow. Ten gamma densitometers in service during Test 3.05.5B were used as a basis of the study. The output voltage of each instrument was sampled 150 times in each of ten 3-s files. The output voltage was then used to compute the water density using values of KFACTR, V_p , and V_o measured in a recent calibration run. Those densities were then compared to the expected densities

based on water properties derived from the temperature and pressure instruments located adjacent to each gamma densitometer.

The measured uncertainty expressed as 1σ in kg/m^3 (and lb/ft^3) is shown in Table D.1. It was discovered, however, that at least part of the large variation in the uncertainties resulted from a systematic error that varied from instrument to instrument (see Fig. D.4, where the densitometer density is plotted against the water property density for DE-204B). Furthermore, the expected strong dependence of error on total density is not obvious over the range of data compared. Not all densitometers showed positive deviations from the standard as did DE-204B.

Table D.1. Absolute error analysis

Densitometer	σ (kg/m^3)	σ (lb/ft^3)
DE-20	18.9	1.18
DE-36	199.0	12.42
DE-168	3.6	0.22
DE-218	87.5	5.46
DE-204A	4.4	0.27
DE-204B	57.7	3.60
DE-204C	33.6	2.10
DE-262A ^a		
DE-262B	22.9	1.43
DE-262C	37.5	2.34
Average	52.0	3.20

^a Probable equipment failure during test.

The data for each densitometer were fit to a straight line, densitometer calculated density to water property density, using linear regression analysis. The random error, expressed as 1σ , was then calculated for each gamma densitometer using Eq. (D.16), but Y_i is the best average value from the linear regression equation. The value of uncertainty was much more uniform from densitometer to densitometer (see Table D.2). A preliminary analysis of the calibration procedure indicates that it may be possible to recalibrate the densitometers analytically to remove the systematic error. Since the analysis performed on the experimental data does not use the densitometer responses, it was not deemed worthwhile to expend the effort required to perform this recalibration.

Since the density of water at room temperature is approximately $1 \times 10^{-3} \text{ kg/m}^3$ (62.4 lb/ft^3), the above results can be summarized as follows:

2σ error band under current operating procedures 10.4% FS

Fig. D.4. Typical densitometer calibration.

Table D.2. Least-squares best-fit line
($\text{RHO} = A \times \text{DERHO} + B$)

Densitometer	A	B	σ (kg/m ³)	σ (lb/ft ³)
DE-20	0.945	64.9	8.6	0.54
DE-36	0.131	745.0	9.7	0.61
DE-168	1.000	-0.4	0.9	0.06
DE-218	0.711	176.0	2.5	0.16
DE-204A	0.981	14.0	4.4	0.27
DE-204B	1.190	-85.9	6.0	0.37
DE-204C	1.010	24.8	12.4	0.77
DE-262A ^a				
DE-262B	0.740	246.0	5.3	0.33
DE-262C	1.160	-100.0	4.5	0.28
Average			5.8	0.36

^aProbable equipment failure during test.

The following items need to be considered when applying the above error bands to THTF data analysis:

1. An analysis of data scatter indicates an average σ of 31 kg/m³ or 3.1% FS over 150 point data files. Therefore, individual points within a file have much higher uncertainties than those stated for files as a whole.
2. No other factor has been identified which would degrade the error bands beyond the steady-state, one-phase flow values listed above. However, it should be understood that the densities computed from densitometer voltages during transients and two-phase flow are time-and-path averaged values. Furthermore, a direct application of the above data to transient, two-phase flow is done at the risk of the data user until experimental verification can be obtained.

D.3 Strain Gage Pressure Cells

The pressure channel investigated consists of a strain gage pressure cell, an instrument amplifier, and the DAS. In operation, pressure on the diaphragm of the pressure cell causes a change of resistance in the foil strain gages attached to the diaphragm. The change in resistance in the gages causes a voltage output from the cell that is proportional to the applied pressure. This output is amplified by the instrument amplifier. The DAS converts the amplifier output to digital format and writes it onto magnetic tape.

The following errors were identified as contributing to the pressure cell uncertainty:

Nonlinearity (P-sensor)*	0.3% FS
Repeatability (P-sensor)*	0.1% FS
Hysteresis (P-sensor)*	0.1% FS
Tempco, gage factor (P-sensor)*	0.5% Reading
Tempco, zero offset (P-sensor)*	0.5% FS
Gain instability (instrument amplifier)* ...	0.1% Reading
Output offset (instrument amplifier)*	0.1% FS
DAS calibration*	0.3% Reading
Location of calibration standards	0.4% FS
Strict sum 2σ error band	2.5% FS
RSS 2σ error band	1.0% FS

The following items need to be considered when applying the above error bands to THTF data:

It is fairly obvious that the results of the in situ calibration run (see item 2 below) agree respectably with the 2σ error band determined above. The probable reason that in situ calibration errors are smaller than the theoretically determined value can be attributed primarily to smaller than estimated temperature changes in actual operation for both gages and amplifiers. In the absence of contradictory experimental evidence, the 2σ error band for the strain gage pressure cells should be set at 1.0% FS or 200 kPa (29 psi).

1. The temperature effects were assumed to be operable over a range of only 56°C (100°F) in actual use. This seems like a reasonable assumption since the sensors themselves are installed at the end of a connecting tube ensuring cooling by ambient air flow and the instrument amplifier is mounted where ambient air flow should keep the temperature change within the 56°C (100°F) range. Channel noise was measured during Test 3.05.5B using Y_1 [see Eq. (D.16)] as the average within a data file. Five instruments were sampled with 30 points per data file, 10 data files each. The 1σ value measured in this manner was quite variable, so that it was deemed expedient to select a value of σ large enough to include about 95% of the data.

2. The strain gage pressure cell does have a usable in situ standard for comparison. With data from a recent pressure cell calibration run, the standard deviation for system pressure was determined for six strain gage pressure instruments by comparing P-cell output converted to pressure using the measured calibration constants with the average reading of two Heise bourdon tube gages accurate to 20 kPa (3 psi). The results of that comparison are:

Instrument	σ (kPa)	σ (psi)	σ (% FS)
PE-26	37.2	5.4	0.18
PE-42	66.2	9.6	0.32
PE-44	18.6	2.7	0.09
PE-76	43.4	6.3	0.21
PE-106	47.6	6.9	0.23
PE-156	91.0	13.2	0.44
Average	51.0	7.4	0.24
Plus location of calibration standard	40.0	5.8	0.18
Total 2σ value	130.0	18.9	0.6

3. The in situ calibration uses the average reading of two Heise gages as system pressure. These gages may be separated by 8.53 m (26 ft) vertically. The result of the difference in static water pressure can produce an offset of ~40 kPa (5.8 psi) (1σ) depending on the location of the specific instrument.

4. The DAS seems to be the limiting factor in instrument response time, including the response time of the transducer itself since pressure waves should reach the diaphragm much faster than the normal sample rate. No other source of error has been identified to degrade the error band established for steady-state, one-phase flow. However, the application of the above error bands to transient or two-phase flow without corroborating data might be overly optimistic, and any such use is the responsibility of the data user.

D.4 Differential Pressure (dp) Cells

The strain gage dp cell (A, B, C) instruments are very similar to the strain gage pressure cells above, except that they have lower full-scale capability.

- A. The identified sources of error in the BLH strain gage (1380 and 6870 kPa or 200 and 1000 psi, respectively) dp cell are

Bench calibration (note 1)	2.4% FS
Tempco, gage factor (P-sensor)*	0.1% FS
Tempco, zero offset (P-sensor)*	0.1% FS
Gain instability (instrument amplifier)* ...	0.1% FS
Output offset (instrument amplifier)*	0.1% FS
A/D inaccuracy (DAS)*	0.3% FS
Random noise (note 2)	2.0% FS
Strict sum 2σ error band	5.1% FS
RMS 2σ error band	3.1% FS

- B. The identified sources of error in the BLH strain gage (1380 kPa or 200 psi) (pit) dp cell are

Bench calibration (note 1)	2.4% FS
Tempco, gage factor (P-sensor)*	0.5% Reading
Tempco, zero offset (P-sensor)*	0.5% FS
Gain instability (instrument amplifier)* ...	0.1% Reading
Output offset (instrument amplifier)*	0.1% FS
A/D inaccuracy (DAS)*	0.3% Reading
Random noise (note 2)	9.6% FS
Strict sum 2σ error band	13.5% FS
RMS 2σ error band	9.9% FS

- C. The identified sources of error in the GENISCO (41 kPa or 6 psi) strain gage dp cell

Static pressure offset	2.6% FS
Zero balance*	2.0% FS
Linearity, hysteresis*	0.4% FS
Tempco, sensitivity*	0.3% FS
Tempco, zero offset*	0.3% FS
Noise (note 1)	2.0% FS
A/D conversion DAS*	0.3% FS
Strict sum 2σ error band	7.9% FS
RSS 2σ error band	3.9% FS

- D. The identified sources of error in the ITT Barton (25 kPa or 100 in.) dp cell are

Transduction accuracy*	0.25% FS
Static pressure effect*	0.4% FS
Tempco, zero offset*	0.2% FS

Tempco, sensitivity*	0.2% FS
Noise	2.0% FS
DAS*	0.3% FS
Strict sum 2 σ error band	3.4% FS
RSS 2 σ error band	2.1% FS

E. The identified sources of error in the Rosemount Capacitance dp cell are (see note 4)

	6.2 and 7.4 kPa (25 and 30 in.)	37 and 50 kPa (150 and 200 in.)
Transduction accuracy	0.25% FS	0.25% FS
Tempco, combined*	0.95% FS	0.14% FS
Static pressure offset	1.0% FS	1.0% FS
Stability*	0.25% FS	0.25% FS
Noise	0.2% FS	0.2% FS
DAS*	0.3% FS	0.3% FS
Strict sum 2 σ error band	3.0% FS	2.1% FS
RSS 2 σ error band	1.5% FS	1.1% FS

F. The identified sources of error in the FOXBORO force balance dp cell are

Transduction accuracy*	0.25% FS
Noise	2.0% FS
DAS	0.3% FS
Strict sum 2 σ error band	2.6% FS
RSS 2 σ error band	2.0% FS

The following items need to be considered in evaluating the above 2 σ error bands:

1. Bench calibration data were substituted for the values of nonlinearity, repeatability, and hysteresis since bench data were available and indicated significantly larger error bands for strain gage. The dp sensors in use show a dependence on system pressure for both gain and offset (see Figs. D.5 and D.6). The approach has been to use a calibration equation based on a linear regression calibration of both gain and zero offset in the form

$$P_{dp} = (PA_g + B_g)[V - (PA_z + B_z)] ,$$

where P_{dp} is the differential pressure measured by the dp cell; A_g , B_g , A_z , and B_z are the calibration coefficients; V is the sensor output voltage; and P is the system pressure. However, the linear correlation of system pressure and constants A_g , B_g , A_z , and B_z is not high enough to make the correlation better than 1.2% (as 1 σ) overall.

2. When the error band was checked using digital data from Reactor Simulation Test 3.05.5B, an average value of σ equivalent to 1.0% FS was measured using 13 PDE's in service prior to blowdown. The average output was used as the standard.

Fig. D.5. Sensitivity calibration.

Fig. D.6. Zero offset calibration.

3. When the strain gage dp cells are used as pit dp cells, they are connected to different parts of the system by long lines of small diameter tubing. Analysis of Test 101 showed that resonant ringing could account for an increase in the noise level (as 1σ) to 4.8% FS just prior to blow-down and up to 65% FS after blowdown when the 28-Hz (the measured resonant frequency) notch filter is used as a standard (see Fig. D.7).

4. An in situ calibration was made during steady-state scans for the Small Break LOCA II tests of October and November 1980. The uncertainty estimate used water properties as a basis of known differential pressure. The results indicated an average 1σ uncertainty of ± 0.05 kPa (0.2 in.) (0.8% FS).

5. Temperature coefficients were applied over a range of 15°C (27°F).

6. No parameter was identified that would degrade error bands beyond those listed above during two-phase flow. However, extension of the stated error bands to two-phase flow or transient conditions without supporting experimental evidence is done at the data user's risk.

Fig. D.7. PDE-200 output from test 101.

D.5 Thermocouple Temperature Instruments

The thermocouple instruments consist of Chromel-Alumel thermocouples, a "cold-junction" reference box, and the DAS.

The following error sources were identified for thermocouple instruments:

	Minimum value (°C) (°F)		Above 350°C (660°F)
Thermocouple material*	2.2	4.0	0.76%
Random noise	0.5	1.0	
DAS calibration	1.8	3.2	0.46%
Reference junction calibration	2.2	4.0	2.2°C (4.0°F)
Reference junction controller	0.16	0.3	0.16°F (0.3°F)
Strict sum 2σ error band	6.9	12.4	(See below)
RSS 2σ error band	3.7	6.7	(See below)

Conversion of the above percentage values to degrees centigrade above 350°C (660°F) results in the following:

Temperature (°C) (°F)		2σ Error band (°C) (°F)		2σ Error band strict sum (°C) (°F)	
350	662	3.7	6.7	7.4	13.3
400	752	4.2	7.6	8.3	14.9
450	842	4.7	8.5	9.1	16.4
500	932	5.1	9.2	10.0	18.0
550	1022	5.6	10.1	10.8	19.4
600	1112	6.1	11.0	11.7	21.1
650	1202	6.6	11.9	12.5	22.5
700	1292	7.1	12.8	13.4	24.1
750	1382	7.6	13.7	14.2	25.6
800	1472	8.0	14.4	15.1	27.8
850	1562	8.5	15.3	15.9	28.6
900	1652	9.0	16.2	16.8	30.2

The following items need to be considered when applying the above error band estimates to THTF data:

1. The reference junction box calibration error was determined by analyzing long-term calibration data from February 4, 1976, to February 10, 1981, and includes any offset from the mean set-point value of 2.666 mV. Reference junction box anomalies were discovered during a 7-day steady-state period. Controller errors up to 0.08°C (0.14°F) were observed for periods of approximately 1-h duration. Operating four units continuously over 7 days, the average error was determined to be less than 0.006°C (0.01°F).

2. Random noise was determined by analyzing the data from Reactor Simulation Test 3.05.5B for five Type Code = 6 and nine Type Code = 1 thermocouples in operation during that test for steady-state, one-phase flow conditions. Because of considerable scatter from instrument-to-instrument and file-to-file, a value of σ large enough to include approximately 95% of all data was chosen. In an effort to provide a conservative estimate, it was assumed that the noise at higher temperatures would be proportional to the millivolt signal above 350°C (660°F).

3. Data Acquisition System calibration was checked after a test calibration with the voltage output compared with a 32.0-mV input signal.

4. A thermocouple that had been in service at the THTF facility was analyzed by R. L. Anderson⁵ of the I&C standards lab to determine the effect of nickel crystal reordering. The results indicate that errors from 1.2°C (2.2°F) [near 150°C (300°F)] to 16.3°C (29.3°F) [near 900°C (1650°F)] may be expected in addition to the above values. However, the recent history of a specific thermocouple coupled with its end-to-end temperature gradient makes it difficult to extrapolate to all THTF thermocouples. The effect of crystal reordering would be to produce readings higher than actually experienced at the junction.

5. An isothermal scan taken during Test 3.06.6B was used to compare the output of 615 thermocouples believed to be operational. The measured standard (2σ) deviation of 4.0°C (7.2°F) agrees closely with the RSS estimated value of 3.7°C (6.7°F) (2σ).

D.6 Rod Power Instrumentation

The rod power instrumentation consists of two operational amplifiers, a calibrated low resistance shunt, and the DAS (see Fig. D.8). Amplifier 1 reads the voltage across the rod itself. V_1 is the output from the voltage divider. Amplifier 2 reads the voltage across the shunt. The current in the rod is then inferred using Ohm's law such that

$$I = V_2 / R_s ,$$

where I is the current in amps, V_2 is the potential across the shunt in volts, and R_s is the resistance of the shunt in ohms.

The following items were identified as probable sources of error when determining rod power:

R_s	Calibration inaccuracy*	0.26% Reading
R_s	Temperature coefficient*	0.2% Reading
V_2	Nonlinearity*	0.01% Reading
V_2	Channel noise	0.72% Reading
V_2	Tempco, gain*	0.02% Reading
V_2	Tempco, offset*	0.03% FS

Fig. D.8. Rod power schematic.

V_2	DAS calibration inaccuracy*	0.30% Reading
V_1	Nonlinearity*	0.01% Reading
V_1	Channel noise	0.7% Reading
V_1	Tempco, gain*	0.02% Reading
V_1	Tempco, offset*	0.03% Reading
V_1	DAS calibration inaccuracy*	0.30% Reading
	Strict sum 2σ error band	2.6% Reading
	RSS sum 2σ error band	1.1% Reading

The following items need to be considered when applying the above error bands to THTF rod power data:

1. Temperature changes at the amplifiers were assumed to be less than or equal to 20°C (36°F). The temperature changes at the shunt were

assumed to be less than or equal to 40°C (72°F). The temperature changes chosen may be excessively large resulting in larger than necessary error bands.

2. Power determined using IV (amps times volts) above does not always agree well with an I^2R (amps squared times rod resistance) power calculation. No adequate explanation for the difference is known. Since both methods should yield the same value of power to the rods, actual error bands may be larger than stated.

3. No error source was identified that would degrade the steady-state, 2σ error band beyond those listed above.

4. Because of matched voltage divider temperature coefficients and the current calibration procedures, the error contributed by the voltage dividers is considered negligible. However, channel noise was measured at low power, so that the values used might be unnecessarily conservative. Furthermore, the resistance of the shunt is very much less than the rod, so that the voltage drop across the rod is essentially unaffected by the shunt.

D.7 Strain Gage Drag Disks

An analysis of steady-state, single-phase drag disk uncertainties based on subcooled flow calibrations from four THTF tests is presented. The data are from pretest drag disk calibrations performed on the same day of the test during heatup to blowdown conditions for Tests 3.04.7, 3.05.5B, 3.06.6B, and 3.08.6C.

The drag disks are calibrated using the turbine flowmeters (velocity, V) and pressure- and temperature-deduced density (ρ) to obtain an in situ standard momentum flux $[(\rho V^2)_{std}]$. A calibration equation is generated from a least-squares fit to the drag disk signal corresponding to the momentum flux over a range of momentum fluxes. The measured momentum flux $[(\rho V^2)_{meas}]$ is obtained by applying the calibration equation to the instrument signal. The calibration equation takes the form:

$$(\rho V^2)_{meas} = A(IS - Z)^E,$$

where IS is the instrument signal in millivolts and A, Z, and E are calibration parameters determined by the least-squares fit. The value of E is generally near 1.0.

An estimate of the uncertainty in the drag disk instrument is made by comparing the in situ standard to the instrument-measured momentum flux. The errors are formulated in terms of percent of actual momentum flux, which is approximately equivalent to percent of reading. For each data point, the percent error is calculated from

$$\% \text{ error} = \frac{(\rho V^2)_{std} - (\rho V^2)_{meas}}{(\rho V^2)_{std}}.$$

Two different drag disk instrument ranges and two different geometries (2-in. and 4-in. spool piece configurations) resulted in three different instrument measurement ranges. It was observed that values of σ for the three different types of drag disks (target and geometry) agree well with each other. It would appear reasonable to combine the data for all three types and to report average uncertainties. However, separate uncertainty estimates are made for instrument signals below 10% of maximum range due to a pronounced temperature effect that is especially noticeable at the lower readings. This effect is caused by the strain gage elements being in intimate contact with the fluid. The value of Z is the average of values taken at two different temperatures. The attempted temperature compensation is not very accurate at low signal values.

The resulting uncertainty bands for strain gage drag disks are:

2 σ error band below 10% FS		56% reading
2 σ error band above 10% FS		19% reading

The following items need to be considered when applying the above error bands to THTF data:

1. Percentage error estimates for the drag disks were compared with the subcooled data immediately preceding blowdown for the tests from which the calibration data were obtained. Average error values of 9.2% of readings (1σ) above 10% FS and 30% of readings (1σ) below 10% FS tend to support the uncertainty bands derived from calibration runs.

2. The strain gage transducer elements are exposed to the temperature environment of the loop. Temperatures significantly outside of the temperature range used during calibration will degrade the accuracy of the instrument further, especially below 10% FS.

D.8 Transient Response and Transient Errors

It is generally understood that no instrument responds infinitely fast to changes in the physical parameters being measured. That is, if the environment were to change suddenly from 200 arbitrary units to 400 arbitrary units, an instrument would initially read some value near 200 units and would approach a reading of 400 units asymptotically. A good approximation for many instruments is first-order lag (see Fig. D.9) defined by

$$V_r = V_o + (1 - e^{-T/\tau})(V_f - V_o) .$$

That is, the value indicated by the instrument (V_r) is equal to the original value (V_o) plus the value of the step function ($V_f - V_o$) multiplied by an exponential delay factor, where T is the elapsed time and τ is the 63.2% instrument response time, and V_f is the final value of the step function. Instrument error as a function of time would be represented by the area between V_f and the instrument reading line.

Fig. D.9. Instrument reading as a function of response time assuming first-order lag.

An additional problem in the THTF uncertainty analysis is introduced because the signal is sampled over discrete time intervals instead of continuously. It may be difficult to identify the exact starting point of a step function. If the step change in physical parameter occurs very near in time to the DAS sample (relative to the instrument response time), the instrument reading at that point will be in error by the total value of the change. If the DAS samples five or more response times after the step function, less than a one percent error (expressed as percent of the step function) will result.

Some arbitrariness is required, therefore, to provide a consistent definition of transient error. The method chosen was to assume that the step function occurred midway between two DAS sampling intervals (n and $n + 1$ in Fig. D.10). The error is measured at each sample point as the distance in engineering units between the modeled instrument reading and the assumed final value of the physical parameter V_f (vertical dashed lines in Fig. D.10). The uncertainty is expressed as the average of all the errors observed during an averaging interval (typically, 150 or 500 ms). The size of the step function and the length of the averaging interval were chosen with test conditions in mind.

As an example, let us consider the errors in the reading of a gamma densitometer (Sect. D.2) as a function of time. The response time on the ionization chamber is estimated at 16 ms. Assuming that the observed density decreases instantly from 750 kg/m (46.8 lb/ft) to 0 (a worst-case, blowdown situation), the errors observed at the DAS and the average error for a 100-ms averaging interval reported are shown in Table D.3.

The following items need to be considered when applying transient uncertainty values in the appendices to THTF data:

1. Although first-order lag modeling is appropriate for most instruments, it is at best a close approximation to the true instrument response.

Fig. D.10. Instrument error as a function of DAS sampling assuming first-order lag.

Table D.3

DAS interval $n + 1n =$ 0.01 s	Error (kg/m ³)	Error (lb/ft ³)
1	549	34.2
2	249	18.3
3	157	9.8
4	84	5.3
5	45	2.8
6	24	1.5
7	13	0.8
8	7	0.4
9	4	0.2
10	2	0.1
Average	118	7.4

2. The instrument response times are estimates. When these estimates are known from averages, the standard deviation is large, indicating wide variation from instrument-to-instrument. As a result, a particularly slow instrument of a given type might show errors a factor of 2 or more worse than the average would indicate.

3. The average uncertainty values noted in the tables are extremely sensitive to the averaging interval chosen. Average errors that appear

insignificant over a 500-ms averaging interval may well become significant over a 150-ms interval. A careful analysis of Table D.3 is illustrative in this light.

4. Step functions were chosen that were thought to be either representative or worst-case possibilities on a test-by-test basis. It is possible, however, that steps more severe than those chosen may have occurred.

D.9 General Comments

1. All of the above error bands were derived assuming that the specified instrument was in nominal working condition and had been recently calibrated using normal THTF calibration techniques. The error bands will not apply to defective instruments.

2. The error bands stated apply only to those items covered in the above discussion. Although every attempt has been made for the examination to be exhaustive and for the results to be conservatively stated, there is always the possibility that excessive instrument noise or out-of-spec components will cause actual readings to be outside of the given error limits (stated as 2σ).

3. The error bands given herein represent the experimenter's best judgment of the applicable uncertainties. Two points should be noted, however. First, the estimation of transient contributions to the uncertainty involves a number of assumptions and judgments. These have been documented in Sect. D.8, and the steady-state and transient contributions to the uncertainty have been listed separately in the tables to facilitate the reader who wishes to use his own estimates of the transient contribution to uncertainty if he chooses. Second, most of the data available on specific sources of instrument errors were obtained in single-phase flow. Thus, the experimenters had to rely primarily on engineering judgment to combine and extrapolate this data to two-phase flow. In most cases there is no experimental, two-phase flow data that can be used to verify the resulting uncertainty estimates.

D.10 Steady-State and Transient Instrument Uncertainties

Table D.4 provides a cross reference for instrument application numbers (IAN) and type codes. The first column provides the type code as an integer between 1 and 113, the second column lists the form of the IAN, and the "Remarks" column provides additional information to properly correlate type code to IAN for all instruments.

Tables D.5-D.8 provide a summary listing of steady-state and transient error bands by test. Tables D.5 and D.7 have values stated in SI units. Table D.6 is the English unit version of Table D.5; Table D.8 is the English unit version of Table D.7. Nominal step function refers to a step size that is characteristic of transient phenomena that occur during the period when film boiling data are analyzed (from 4 to 17 s). Extreme step functions apply to severe transient phenomena outside the period where film boiling data are being used.

Table D.4. Type Code - Instrument Application Number Table

Type Code	I.A.N	Remarks
1	TE-3nnal	Special FRS Sheath Thermocouples [0.38 mm//0.015 inch] nn = 01, 14, 17, 21, 34, 37, 38, 50, 54, or 60 a = A, E, or F 1 = 1, 2, 3, 4, 5, 6, 7, 8; or E, F, or G
1	TE-3nnal	Regular FRS Sheath Thermocouples [0.51 mm//0.020 inch] nn = 01-64 (except 19,22,36,46) and (excluding 01, 14, 17, 21, 34, 37, 38, 50, 54, 60 for tests 3.06.6B, 3.08.6C, 3.07.9, 3.09.10I-X and Mothball) a = A, B, or C 1 = A, B, C, D, E, F, G, H, U, or Y
2	TE-3nnM1	Special FRS Middle Thermocouples [0.38 mm//0.015 inch] nn = 01, 14, 17, 21, 34, 37, 38, 50, 54, or 60 M = M 1 = 1, 2, 3, 4, 5, 6, 7, 8; or E, F, or G
2	TE-3nnM1	Regular FRS Middle Thermocouples [0.51 mm//0.020 inch] nn = 01-64 (except 19, 22, 36, 46) and (excluding 01, 14, 17, 21, 34, 37, 38, 50, 54, 60 for tests 3.06.6B, 3.08.6C, 3.07.9, 3.09.10I-X and Mothball) M = M 1 = A, B, C, D, E, F, or G
3	TE-12nn	Subchannel Thermocouples nn = 01-81
4	TE-18na	Shroud Wall Thermocouples n = 1, 2, 3, 4, 5, 6, or 7 a = N, E, S, or W
5	TE-xxx	Miscellaneous and Process Thermocouples xxx = 5B, 408B, 520B, 521, 901, 920, 921, 922, 923, 924, 925, 926, 927, or 936
6	TE-xxx	Loop and Process Thermocouples xxx = 1, 2, 6, 24, 29, 40, 45, 57, 62, 67, 116, 150, 151, 152, 153, 172, 208, 212, 222, 228, 256, 266, 281, 282, 284
7	TE-29na	Spacer Grid Thermocouples n = 1, 2, 3, 4, 5, or 6 a = A, B, C, D, E, or F

Table D.4 (continued)

Type Code	I.A.N	Remarks
8	TE-18na1	Array Rod Thermocouples n = 8 or 9 a = A or B 1 = A, B, C, D, E, F, or G
9	TE-361-aJ	O-ring Area Thermocouples a = A, B, or C J = J
10	TE-nab	Shroud Box Thermocouples n = 0, 1, 2, 3, 4, 5, 6, 7, 8, or 9 a = A or B b = E or S
23	PE-xxx	Strain Gage Pressure Cells [20700 kPa//3000 psi] xxx = 15, 16, 26, 27, 42, 43, 44, 58, 63, 68, 76, 88, 106, 118, 156, 174, 201, 209, 224, 258, 268, 276, 281, 282, 283, 286, 425, 427, 454, 474
24	PE-32	Force Balance Pressure Cell [both ranges]
25	PE-102	Strain Gage Pressure Cell [1380 kPa//200 psi]
26	PDE-xxx	Strain Gage dP Cell [$\pm$ 1380 kPa// $\pm$ 200 psi] xxx = 35, 46, 167, 217 21 except for tests 3.09.10I-X and 3.10.10 60 except for test 3.05.5B
27	PDE-78	Strain Gage dP Cell [+ 6900 kPa//1000 psi]
28	PDE-xxx	Strain Gage dP cell [$\pm$ 345 kPa// $\pm$ 50 psi] xxx = 7, 53, 65, 111, 203 21 only for tests 3.09.10I-X and 3.10.10 60 only for test 3.05.5B 200 except for 3.02.10C-H and Mothball 251 except for 3.02.10C-H and 3.09.10I-X
29	PE-nnn	Strain Gage Pressure Cell [2400 kPa//350 psi] nnn = 526 or 616
31	EIE-13nn	FRS Heater Rod Currents nn = 01-64 (excluding 19, 22, 36, 46)
32	EIE-xx	Generator Currents xx = 9, 10, 11, 12

Table D.4 (continued)

Type Code	I.A.N	Remarks
33	EEE-xx	Generator Voltage xx = 9, 10, 11, 12
34	EWE-77A	Primary Pump Power
35	FMFE-xxxx	Momentum Flux Flow (Drag Disk) [9 cm//3.5 inch spool piece] xxx = 22, 38, 170, 220 206 except for 3.09.10I-X 254, 264 only for 3.05.5B
36	SE-72	Primary Pump Speed
37	XE-430a	Break Wire Detector a = A or B
40	FMFE-xxx	Momentum Flux Flow (Drag Disk) [5 cm//2 inch spool piece] xxx = 14, 55, 61, 66, 114, 154, 155 206 only for 3.09.10I-X 254, 264 except for 3.04.5B
41	PDE-200	Strain Gage dP Cell [± 25 kPa// ± 100 inches water] only for tests 3.02.10C-H
42	PDE-204 PDE-261	Strain Gage dP Cell [± 125 kPa// ± 500 inches water] only for test 3.05.5B except for 3.08.6C, 3.07.9, 3.09.10I-X, and Mothball
43	PDE-nnn	Strain Gage dP Cell [± 41 kPa// ± 6 psi] nnn = 199, 271 204 except for 3.05.5B 251 only for 2.02.10C-H 261 only for 3.08.6C, 3.07.9, 3.09.10I-X, Mothball
50	LE-14nn	Experimental INEL Level Prone nn = 01 through 19
71	TE-28B	Linearized Resistance Thermometer Device
75	PDE-nnn	Capacitive dP Cell nnn = 180 through 188 189 except on 3.09.10I-X and Mothball set at 0-6.2 kPa (0-30 inches) except for 3.05.5B set at 0-37.5 kPa (0-150 inches) only for 3.05.5B

Table D.4 (continued)

Type Code	I.A.N	Remarks
76	ZE-336U ZE-346L	Inbundle Gamma Densitometer Position Indicator except for 3.09.10I-X and Mothball
77	ZE-346L	Inbundle Gamma Densitometer Position Indicator only for 3.09.10I-X and Mothball
78	PDE-251	Capacitance dP Cell [25 kPa//100 inches] only for 3.09.10I-X
79	PDE-200	Capacitance dP Cell [50 kPa//200 inches] only for Mothball
80	PDE-189	Capacitance dP Cell [7.5 kPa//30 inches] only for 3.09.10I-X and Mothball
95	FE-nnn	Turbine Flowmeter-Heat Exchanger Secondary Flow nnn = 522, 620, 720
96	FE-550	Turbine Flowmeter-Heat Exchanger Secondary Flow
97	PDE-48	Force Balance dP Cell [166 kPa//24 psi]
98	PDE-30	Force Balance dp Cell [345 kPa//50 psi]
99	TDE-28	Differential Temperature
105	PDE-761 LE-100	Force Balance dP Cell
106	DE-xxx	Single Beam Gamma Densitometer xxx = 20, 36, 168, 218 Triple Beam Gamma Densitometer xxx = 204A, 204B, 204C, 252A, 252B, 252C, 262A, 262B, 262C
107	FE-xxx	Orifice Place/Force Balance Flowmeter xxx = 1A [0-5.0E-2 m ³ /s or 0-800 gpm] 238 [0-1.0E-4 m ³ /s or 0-1.6 gpm] only 3.09.10I-X Orifice Place/Capacitance Flowmeter xxx = 282 [0-2.5E-3 m ³ /s or 0-39.3 gpm] 283 [0-3.3E-4 m ³ /s or 0-5.2 gpm] 927 [0-1.4E-4 m ³ /s or 0-2.1 gpm]

Table D.4 (continued)

Type Code	I.A.N	Remarks
108	FE-18A	Orifice Plate/Force Balance Flowmeter [4.4E-2 m ³ /s or 700 gpm] except for 3.01.10C-H, 3.09.10I-X and Mothball
	FE-18A	[1.7E-4 m ³ /s or 2.7 gpm] only for 3.01.10C-H, 3.09.10I-X and Mothball
	FE-238	except for 3.09.10I-X
109	FE-xxx	Instrument Spool Piece Turbine Flowmeter [3E-4 m ³ /s or 5 gpm] xxx = 250, 260 only for tests 3.01.10C-H, 3.09.10I-X, and Mothball [6E-4 m ³ /s or 10 gpm] xxx = 232, 280 [1.4E-2 m ³ /s or 225 gpm] xxx = 3, 51, 59, 64, 110, [1.4E-2 m ³ /s or 225 gpm] xxx = 250, 260 except for 3.01.10C-H, 3.05.5B, 3.09.10I-X, and Mothball [1.4E-2 m ³ /s or 225 gpm] xxx = 202 only for tests 3.01.10C-H, 3.09.10I-X [6E-2 m ³ /s or 1000 gpm] xxx = 19,34,166,216,440,460 [6E-2 m ³ /s or 1000 gpm] xxx = 250, 260 for 3.05.5B [6E-2 m ³ /s or 1000 gpm] xxx = 202 except for tests 3.01.10C-H, 3.09.10I-X
110	TE-xxx	Resistance Thermometer Device xxx = 4B, 101, 210A, 525, 557, 615, 627, 727
111	DE-xxx	Inbundle Gamma Densitometer xxx = 336U, 346L
112	FE-238	Orifice Plate/Force Balance Flowmeter same as type code 107 FE-238
113	LE-760	Force Balance dP Cell

Table D.5. Test 3.07.9

THTF Instrument Error Bands						
Instrument Description	Type Code	Instrument Range	Steady State Error	Transient Error	Estimated Response Time	Assumed Value of Step Fm.
Rod Sheath Thermocouple 0.38 mm OD	1	273 K 1309 K	3.7K < 623 K 10.3 K	0.8 K ^a	7 ms	300 K
Rod Sheath Thermocouple 0.51 mm OD	1	273 K 1309 K	3.7K < 623 K 10.3 K	3.8 K ^a	12 ms	300 K
Rod Middle Thermocouple 0.36 mm OD	2	273 K 1309 K	3.7K < 623 K 10.3 K	0.8 K ^a	7 ms	300 K
Rod Middle Thermocouple 0.51 mm OD	2	273 K 1309 K	3.7K < 623 K 10.3 K	3.8 K ^a	12 ms	300 K
Bundle Subcnn Thermocouple 1.02 mm OD	3	273 K 1309 K	3.7K < 623 K 10.3 K	2.7 K	140 ms	10 K
Shroud Box Thermocouple 1.57 mm OD	4	273 K 1309 K	3.7K < 623 K 10.3 K	5.3 K	350 ms	10 K
System Thermocouple 3.2 mm OD	5	273 K 1309 K	3.7K < 623 K 10.3 K	7.6 K	870 ms	10 K
System (Nanmac) Thermocouple 6.4 mm OD	6	273 K 1309 K	3.7K < 623 K 10.3 K	0.3 K	18 ms	10 K
Spacer Grid Thermocouple 1.02 mm OD	7	273 K 1309 K	3.7K < 623 K 10.3 K	2.7 K	140 ms	10 K
Array Rod Thermocouple 1.02 mm OD	8	273 K 1309 K	3.7K < 623 K 10.3 K	2.7 K	140 ms	10 K

Table D.5 (continued)

THIF Instrument Error Bands						
Instrument Description	Type Code	Instrument Range	Steady State Error	Transient Error	Estimated Response Time	Assumed Value of Step Fn.
Rod Sheath Thermocouple 0.51 mm OD	9	273 K 1309 K	3.7K < 623 K 10.3 K	3.8 K ^a	12 ms	300 K
Shroud Box Thermocouple 1.57 mm OD	10	273 K 1309 K	3.7K < 623 K 10.3 K	5.3 K	350 ms	10 K
Strain Gage Pressure Cell	23	20700 kPa	200 kPa	N.S. ^j	0.16 ms	200 kPa
Force Balance Pressure Cell	24	3400 kPa 17000 kPa	100 kPa	157 kPa	300 ms	200 kPa
Force Balance Pressure Cell	24	3400 kPa 27000 kPa	160 kPa	157 kPa	300 ms	200 kPa
Strain Gage Pressure Cell	25	1380 kPa	17 kPa	N.S.	0.32 ms	200 kPa
Strain Gage D.P. Cell	26	±1380 kPa	43 kPa	N.S.	0.32 ms	200 kPa
Strain Gage D.P. Cell	27	±6900 kPa	210 kPa	N.S.	0.32 ms	1.7 kPa
Strain Gage ^g D.P. Cell	28	±345 kPa	11 kPa	N.S.	0.32 ms	1.7 kPa
Strain Gage Pressure Cell	29	2400 kPa	24 kPa	N.S.	0.16 ms	200 kPa
Rod Heater Current	31	800 amp	0.85% Rdg	4.7 amp	50 ms	15 amp
Generator Current	32	1000 amp	0.85% Rdg	32 amp	50 ms	100 amp
Generator Voltage	33	300 volt	0.76% Rdg	3.8 volt	50 ms	12 volt

Table D.5 (continued)

THTF Instrument Error Bands						
Instrument Description	Type Code	Instrument Range	Steady State Error	Transient Error	Estimated Response Time	Assumed Value of Step Fn.
Primary Pump Power	34	750 kW	greater of 0.5 kW or 0.3% Rdg	6.3 kW	150 ms	10 kW
Strain Gage Drag Disk	35	$\pm 0.1E5$ kg/ms ² $\pm 1.0E5$ kg/ms ²	56% Rdg 19% Rdg	157 kg/ms ²	16 ms	150 kg/ms
Primary Pump Speed	36	100 rpm 5400 rpm	20 rpm	13 rpm	150 ms	20 rpm
Breakwire Detector	37	5 volt	30 ms	N.A. ^k	20 ms	N.A.
Strain Gage Drag Disk	40	$\pm 0.3E4$ kg/ms ² $\pm 3.0E4$ kg/ms ²	56% Rdg 17% Rdg	47 kg/ms ²	16 ms	1500 kg/ms ²
Strain Gage D.P. Cell	41	± 25 kPa	0.8 kPa	N.S.	0.32 ms	1.7 kPa
Strain Gage D.P. Cell	42	± 125 kPa	4 kPa	N.S.	0.32 ms	1.7 kPa
Strain Gage D.P. Cell	43	± 41 kPa	2 kPa	N.S.	0.32 ms	1.7 kPa
Level ⁱ Indicator	50	± 10 volt	***	***	***	***
RTD	71	273 K 700 K	1.1 K 2.7 K	9.9 K	10 sec	10 K
Capacitive D.P. Cell	75	6.2 kPa	0.1 kPa	0.15 kPa	131 ms	0.25 kPa
Capacitive D.P. Cell	75	37.5 kPa	0.4 kPa	0.11 kPa	74 ms	0.25 kPa
Position Indicator	76	3.92 m	0.5% Rdg	N.A.	N.A.	N.A.
Position Indicator	77	3.33 m	0.5% Rdg	N.A.	N.A.	N.A.

Table D.5 (continued)

THTF Instrument Error Bands						
Instrument Description	Type Code	Instrument Range	Steady State Error	Transient Error	Estimated Response Time	Assumed Value of Step Fn.
Capacitive D.P. Cell	78	25 kPa	1.3 kPa	0.9 kPa	110 ms	1.7 kPa
Capacitive D.P. Cell	79	50 kPa	0.5 kPa	0.7 kPa	68 ms	1.7 kPa
Capacitive D.P. Cell	80	7.5 kPa	0.1 kPa	0.15 kPa	125 ms	0.25 kPa
Turbine ^f Flowmeter	95	0.9E-3 m ³ /s 9.5E-3 m ³ /s	4.1% Rdg	1.3E-4 m ³ /s	11 ms 1.2 ms	6.3E-4 m ³ /s
Turbine ^f Flowmeter	96	0.3E-3 m ³ /s 3.2E-3 m ³ /s	4.1% Rdg	1.3E-4 m ³ /s	8 ms 1 ms	6.3E-4 m ³ /s
Force Balance D.P. Cell	97	166 kPa	1 kPa	1.3 kPa	300 ms	1.7 kPa
Capacitive D.P. Cell	98	345 kPa	0.1 kPa	0.4 kPa	38 ms	1.7 kPa
Differential Temperature	99	228 K 283 K	3.8 K	9.9 K	10 sec	10 K
Liquid Level	105	3.81 m	0.023 m	0.16 m	300 ms	0.2 m
Liquid Level	105	1408 m	8 .5 m	0.16 m	300 ms	0.2 m
Gamma Densitometer	106	1000 kg/m ³	104 kg/m ³	5 kg/m ³	16 ms	50 kg/m ³
Orifice ^c Flowmeter	107	1.0E-4 m ³ /s	2.5E-6 m ³ /s	7.9E-6 m ³ /s	300 ms	1E-5 m ³ /s
Orifice ^c Flowmeter	107	1.35E-4 m ³ /s	3.4E-6 m ³ /s	1.1E-5 m ³ /s	300 ms	1.4E-5 m ³ /s
Orifice ^c Flowmeter	107	3.32E-4 m ³ /s	8.3E-6 m ³ /s	2.6E-5 m ³ /s	300 ms	3.3E-5 m ³ /s

Table D.5 (continued)

THTF Instrument Error Bands						
Instrument Description	Type Code	Instrument Range	Steady State Error	Transient Error	Estimated Response Time	Assumed Value of Step Fn.
Orifice ^c Flowmeter	107	2.48E-3 m ³ /s	6.2E-5 m ³ /s	2.0E-4 m ³ /s	300 ms	2.5E-4 m ³ /s
Orifice ^c Flowmeter	107	5.0E-2 m ³ /s	1.3E-3 m ³ /s	3.9E-3 m ³ /s	300 ms	5E-3 m ³ /s
Orifice ^d Flowmeter	108	1.7E-4 m ³ /s	4.2E-6 m ³ /s	1.3E-5 m ³ /s	300 ms	1.7E-5 m ³ /s
Orifice ^e Flowmeter	108	4.4E-2 m ³ /s	1.1E-3 m ³ /s	3.5E-3 m ³ /s	300 ms	4.4E-3 m ³ /s
Turbine ^{f,h} Flowmeter	109	$\pm 0.3E-4$ m ³ /s $\pm 3.0E-4$ m ³ /s	4.1% Rdg	3.1E-6 m ³ /s	8 ms 1 ms	1.5E-4 m ³ /s
Turbine ^{f,h,b} Flowmeter	109	$\pm 0.6E-4$ m ³ /s $\pm 6.1E-4$ m ³ /s	2.5% Rdg	N.A.	8 ms 1 ms	N.A.
Turbine ^{f,h,l} Flowmeter	109	$\pm 1.3E-3$ m ³ /s $\pm 1.4E-2$ m ³ /s	4.1% Rdg	1.3E-4 m ³ /s	13 ms 2 ms	6.3E-4 m ³ /s
Turbine ^{f,h,l} Flowmeter	109	$\pm 0.6E-2$ m ³ /s $\pm 6.1E-2$ m ³ /s	4.1% Rdg	1.3E-4 m ³ /s	18 ms 2 ms	1.3E-3 m ³ /s
RTD	110	273 K 700 K	1.1 K 2.7 K	9.9 K	10 sec	10 K
Inbundle Gamma Densitometer	111	1000 kg/m ³	104 kg/m ³	5 kg/m ³	16 ms	50 kg/m ³
Orifice ^c Flowmeter	112	1.0E-4 m ³ /s	2.5E-6 m ³ /s	7.9E-6 m ³ /s	300 ms	1E-5 m ³ /s
Liquid Level	113	1.18 m	0.007 m	0.16 m	300 ms	0.20 m

Table D.5 (continued)

Documentation of Steady-State and Transient Error Bands

Steady-State Error Bands: Two-standard deviations compared to in-situ standard or twice the root-sum-square of uncertainties, whichever is applicable.

Transient Error Bands: Assuming first-order lag function, response times (TAU), and step function ($V_f - V_o$) indicated—the average error seen by the DAS assuming the step function occurred midway between DAS samples. The averaging interval is 500 ms for thermocouples and 150 ms for all other instruments.

Total Error: The total error due to steady state error and transient error is the sum of the steady state and transient error bands.

Footnotes:

- a. Error bands apply to the environment as sensed at the surface of the thermocouple sheath. Larger errors may occur when data is modelled to provide temperatures at other points. Transient response is estimated by using the response time (25 ms or less) prior to swaging the sheath (0.71 mm swaged to 0.51 mm OD), then scaling using the rule: response time is inversely proportional to the outside diameter squared (OD**2 scaling). An additional 7% improvement in response time was allowed for packing of the boron nitride during swaging. The smaller thermocouples (0.51 mm swaged to 0.38 mm OD) were estimated from the values of the larger thermocouples by first scaling the 25 ms response time to the unswaged 0.51 mm diameter using OD**2 scaling, then applying OD**2 scaling and the 7% improvement for packing to the swaged 0.38 mm OD.
- b. This instrument is fitted with Flow Technology electronics that time 10-blade passings. Averaging improves the steady-state error bands but degrades transient response.
- c. Range applies specifically to instruments calibrated in subcooled liquid at a density of 1000 kg/m**3.
- d. Range applies specifically to instruments calibrated in subcooled liquid at a density of 860 kg/m**3.
- e. Range applies specifically to instruments calibrated in subcooled liquid at a density of 750 kg/m**3.
- f. Error bands apply specifically to instruments calibrated in subcooled liquid. Extended range electronics provide readings out to 0.227 m³/s for the 8.89E-2 meter diameter models; 0.028 m³/s for the 5.08E-2 meter diameter models, but the error bands apply only to 150% of nominal maximum range.
- g. Strain gage D.P. Cells used as pit cells are connected to different segments of the test section by long lines. These long lines induce resonant oscillations in the instrument that increase the steady-state errors bands to 35 kPa, and the transient error bands to 400 kPa.
- h. The turbine flowmeters (type code 109) have a flow range such that:
 $-3.0E-4 < \text{Flow} < -0.3E-4$.OR. $0.3E-4 < \text{Flow} < 3.0E-4$,
 $-6.1E-4 < \text{Flow} < -0.6E-4$.OR. $0.6E-4 < \text{Flow} < 6.1E-4$,
 $-1.4E-3 < \text{Flow} < -0.1E-3$.OR. $0.1E-3 < \text{Flow} < 1.4E-3$,
 $-6.1E-2 < \text{Flow} < -0.6E-2$.OR. $0.6E-2 < \text{Flow} < 6.1E-2$,
- i. The INEL level probe is an experimental device, and as such, does not have well documented error bands.
- j. No significant error over a 500 ms averaging interval.
- k. N.A. implies not applicable.
- l. Flow Technology supplies calibration constants over the ranges 6.3E-4 to 1.9E-2 m³/s and 5.0E-33 to 6.3E-2 m³/s respectively. The uncertainty bands for these instruments should approach the quoted values for these ranges, but special care may be required. See the section on turbine flowmeters in the critical instruments section.

Table D.5 (continued)

Basis for Steady-State and Transient Error Bands by Type Code		
Type Code	Steady State	Transient
1	Critical instrument	Manufacturer's spec, OD**2 scaling
2	Critical instrument	Manufacturer's spec, OD**2 scaling
3	Critical instrument	Work of Carroll and Sheppard
4	Critical instrument	Work of Carroll and Sheppard
5	Critical instrument	Work of Carroll and Sheppard
6	Critical instrument	Manufacturer's spec
7	Critical instrument	Work of Carroll and Sheppard
8	Critical instrument	Work of Carroll and Sheppard
9	Critical instrument	Manufacturer's spec, OD**2 scaling
10	Critical instrument	Work of Carroll and Sheppard
23	Critical instrument	Table B.2
24	Manufacturer's spec	Table B.2
25	Bench Cal. + DAS	Table B.2 (inferred)
26	Critical instrument	Table B.2
27	Critical instrument	Table B.2
28	Critical instrument	Table B.2
29	Critical instrument	Table B.2 (inferred)
31	Critical instrument	Table B.2 (inferred)
32	Inferred (type code 31)	Table B.2 (inferred)
33	Critical instrument	Table B.2 (inferred)
34	Manufacturer's spec	Manufacturer's spec
35	Critical instrument	Table B.2
36	Bench Cal. + DAS	Inferred (type code 34)
37	From test 3.03.6AR	From test 3.03.6AR
40	Critical instrument	Table B.2
43	Critical instrument	Table B.2 (inferred)
50	*****	*****
71	Bench Cal. & specs	Table B.2
75	Critical instrument	Manufacturer's spec
76	Engineering judgement	N.A.
77	Engineering judgement	N.A.
78	Critical instrument	Inferred (type code 75)
79	Inferred (type code 75)	Inferred (type code 75)
80	Inferred (type code 75)	Inferred (type code 75)
95	Inferred (type code 109)	Work of N. Chen
96	Inferred (type code 109)	Work of N. Chen
97	Critical instrument	Table B.2
98	Critical instrument	Inferred (typed code 75)
99	Inferred (type code 71)	Inferred (type code 71)
105	Manufacturer's spec	Table B.2 (inferred)
106	Critical instrument	Work of R. Shipp (manufacturer's spec)
107	In-situ calibration	Table B.2 (inferred)
108	Inferred (type code 107)	Table B.2 (inferred)
109	Critical instrument	Work of N. Chen
110	Bench Cal. & specs	Table B.2
111	Inferred (type code 106)	Inferred (type code 109)
112	Inferred (type code 107)	Table B.2 (inferred)
113	Manufacturer's spec	Table B.2 (inferred)

Table D.6. Test 3.07.9

THTF Instrument Error Bands						
Instrument Description	Type Code	Instrument Range	Steady State Error	Transient Error	Estimated Response Time	Assumed Value of Step Fn.
Rod Sheath Thermocouple 0.015 inch OD	1	32 F 1900 F	6.7F < 662 F 18.5 F	1.4 F ^a	7 ms	540 F
Rod Sheath Thermocouple 0.020 inch OD	1	32 F 1900 F	6.7F < 662 F 18.5 F	6.8 F ^a	12 ms	540 F
Rod Middle Thermocouple 0.015 inch OD	2	32 F 1900 F	6.7F < 662 F 18.5 F	1.4 F ^a	7 ms	540 F
Rod Middle Thermocouple 0.020 inch OD	2	32 F 1900 F	6.7F < 662 F 18.5 F	6.8 F ^a	12 ms	540 F
Bundle Subchn Thermocouple 0.040 inch OD	3	32 F 1900 F	6.7F < 662 F 18.5 F	4.9 F	140 ms	18 F
Shroud Box Thermocouple 0.062 inch OD	4	32 F 1900 F	6.7F < 662 F 18.5 F	9.5 F	350 ms	18 F
System Thermocouple 0.125 inch OD	5	32 F 1900 F	6.7F < 662 F 18.5 F	13.7 F	870 ms	18 F
System (Nanmac) Thermocouple 0.25 inch OD	6	32 F 1900 F	6.7F < 662 F 18.5 F	0.5 F	18 ms	18 F
Spacer Grid Thermocouple 0.040 inch OD	7	32 F 1900 F	6.7F < 662 F 18.5 F	4.9 F	140 ms	18 F
Array Rod Thermocouple 0.040 inch OD	8	32 F 1900 F	6.7F < 662 F 18.5 F	4.9 F	140 ms	18 F

Table D.6 (continued)

THTF Instrument Error Bands						
Instrument Description	Type Code	Instrument Range	Steady State Error	Transient Error	Estimated Response Time	Assumed Value of Step Fn.
Rod Sheath Thermocouple 0.020 inch OD	9	32 F 1900 F	6.7F < 662 F 18.5 F	6.8 F ^a	12 ms	540 F
Shroud Box Thermocouple 0.062 inch OD	10	32 F 1900 F	6.7F < 662 F 18.5 F	9.5 F	350 ms	18 F
Strain Gage Pressure Cell	23	3000 psi	29 psi	N.S. ^j	0.16 ms	30 psi
Force Balance Pressure Cell	24	500 psi 2500 psi	15 psi	23 psi	300 ms	30 psi
Force Balance Pressure Cell	24	500 psi 3900 psi	23 psi	23 psi	300 ms	30 psi
Strain Gage Pressure Cell	25	200 psi	2.5 psi	N.S.	0.32 ms	30 psi
Strain Gage D.P. Cell	26	±200 psi	6.2 psi	N.S.	0.32 ms	30 psi
Strain Gage D.P. Cell	27	±1000 psi	30 psi	N.S.	0.32 ms	0.25 psi
Strain Gage ^g D.P. Cell	28	±50 psi	1.6 psi	N.S.	0.32 ms	0.25 psi
Strain Gage Pressure Cell	29	350 psi	3.5 psi	N.S.	0.16 ms	30 psi
Rod Heater Current	31	800 amp	0.85% Rdg	24 amp	50 ms	75 amp
Generator Current	32	1000 amp	0.85% Rdg	95 amp	50 ms	300 amp
Generator Voltage	33	300 volt	0.76% Rdg	32 volt	50 ms	100 volt

Table D.6 (continued)

THTF Instrument Error Bands						
Instrument Description	Type Code	Instrument Range	Steady State Error	Transient Error	Estimated Response Time	Assumed Value of Step Fn.
Primary Pump Power	34	750 kW	greater of 0.5 kW or 0.3% Rdg	6.3 kW	150 ms	10 kW
Strain Gage Drag Disk	35	$\pm 0.7E4$ lb/fts ² $\pm 7.0E4$ lb/fts ²	56% Rdg 19% Rdg	106 lb/fts ²	16 ms	1000 lb/fts ²
Primary Pump Speed	36	100 rpm 5400 rpm	20 rpm	13 rpm	150 ms	20 rpm
Breakwire Detector	37	5 volt	30 ms	N.A. ^k	20 ms	N.A.
Strain Gage Drag Disk	40	$\pm 1.4E4$ lb/fts ² $\pm 1.4E5$ lb/fts ²	56% Rdg 19% Rdg	106 lb/fts ²	16 ms	1000 lb/fts ²
Strain Gage D.P. Cell	41	± 100 inch	3.2 inch	N.S.	0.32 ms	6.8 inch
Strain Gage D.P. Cell	42	± 500 inch	16 inch	N.S.	0.32 ms	6.8 inch
Strain Gage D.P. Cell	43	± 6 psi	0.3 psi	N.S.	0.32 ms	0.25 psi
Level ⁱ Indicator	50	± 10 volt	***	***	***	***
RTD	71	32 F 800 F	2.0 F 4.9 F	17.8 F	10 sec	18 F
Capacitive D.P. Cell	75	25 inch	0.4 inch	0.6 inch	131 ms	1.0 inch
Capacitive D.P. Cell	75	150 inch	16 inch	0.4 inch	74 ms	1.0 inch
Position Indicator	76	155 inch	0.5% Rdg	N.A.	N.A.	N.A.
Position Indicator	77	131 inch	0.5% Rdg	N.A.	N.A.	N.A.

Table D.6 (continued)

THIF Instrument Error Bands						
Instrument Description	Type Code	Instrument Range	Steady State Error	Transient Error	Estimated Response Time	Assumed Value of Step Fn.
Capacitive D.P. Cell	78	± 100 inch	5.2 inch	3.6 inch	110 ms	6.8 inch
Capacitive D.P. Cell	79	200 inch	2.0 inch	2.8 inch	68 ms	6.8 inch
Capacitive D.P. Cell	80	30 inch	0.4 inch	0.6 inch	125 ms	1.0 inch
Turbine ^f Flowmeter	95	15 gpm 150 gpm	4.1% Rdg	2.0 gpm	11 ms 1.2 ms	100 gpm
Turbine ^f Flowmeter	96	5 gpm 50 gpm	4.1% Rdg	2.0 gpm	8 ms 1 ms	100 gpm
Force Balance D.P. Cell	97	24 psi	0.15 psi	0.2 psi	300 ms	0.25 psi
Capacitive D.P. Cell	98	50 psi	2.6 psi	0.06 psi	38 ms	0.25 psi
Differential Temperature	99	± 50 F	6.8 F	17.8 F	10 sec	18 F
Liquid Level	105	150 inch	0.9 inch	6.2 inch	300 ms	7.9 inch
Liquid Level	105	5.5E4 inch	336 inch	6.2 inch	300 ms	7.9 inch
Gamma Densitometer	106	62.4 lb/ft ³	6.5 lb/ft ³	0.33 lb/ft ³	16 ms	3 lb/ft ³
Orifice ^c Flowmeter	107	1.6 gpm	4E-2 gpm	0.13 gpm	300 ms	0.16 gpm
Orifice ^c Flowmeter	107	2.1 gpm	0.054 gpm	0.17 gpm	300 ms	0.22 gpm
Orifice ^c Flowmeter	107	5.3 gpm	0.13 gpm	0.41 gpm	300 ms	0.52 gpm

Table D.6 (continued)

THTF Instrument Error Bands						
Instrument Description	Type Code	Instrument Range	Steady State Error	Transient Error	Estimated Response Time	Assumed Value of Step Fn.
Orifice ^c Flowmeter	107	39.3 gpm	9.8 gpm	3.2 gpm	300 ms	4.0 gpm
Orifice ^c Flowmeter	107	800 gpm	21 gpm	62 gpm	300 ms	80 gpm
Orifice ^d Flowmeter	108	2.7 gpm	0.067 gpm	0.21 gpm	300 ms	0.27 gpm
Orifice ^e Flowmeter	108	700 gpm	17.4 gpm	0.55 gpm	300 ms	70 gpm
Turbine ^{f,h} Flowmeter	109	+0.5 gpm +5.0 gpm	4.1% Rdg	0.05 gpm	8 ms 1 ms	2.4 gpm
Turbine ^{f,h,b} Flowmeter	109	+1.0 gpm +10 gpm	2.5% Rdg	N.A.	8 ms 1 ms	N.A.
Turbine ^{f,h,l} Flowmeter	109	+22 gpm +225 gpm	4.1% Rdg	0.2 gpm	13 ms 2 ms	10 gpm
Turbine ^{f,h,l} Flowmeter	109	+100 gpm +1000 gpm	4.1% Rdg	0.2 gpm	18 ms 2 ms	10 gpm
RTD	110	32 F 800 F	2.0 F 4.9 F	17.8 F	10 sec	18 F
In-bundle Gamma Densitometer	111	62.4 lb/ft ³	6.5 lb/ft ³	0.3 lb/ft ³	16 ms	3 lb/ft ³
Orifice ^c Flowmeter	112	1.6 gpm	0.04 gpm	0.13 gpm	300 ms	0.16 gpm
Liquid Level	113	46 inch	0.3 inch	6.2 inch	300 ms	7.9 inch

Table D.6 (continued)

Documentation of Steady-State and Transient Error Bands

Steady-State Error Bands: Two-standard deviations compared to in-situ standard or twice the root-sum-square of uncertainties, whichever is applicable.

Transient Error Bands: Assuming first-order lag function, response times (TAU), and step function ($V_f - V_o$) indicated—the average error seen by the DAS assuming the step function occurred midway between DAS samples. The averaging interval is 500 ms for thermocouples and 150 ms for all other instruments.

Total Error: The total error due to steady state error and transient error is the sum of the steady state and transient error bands.

Footnotes:

- a. Error bands apply to the environment as sensed at the surface of the thermocouple sheath. Larger errors may occur when data is modelled to provide temperatures at other points. Transient response is estimated by using the response time (25 ms or less) prior to swaging the sheath (0.028 inch swaged to 0.020 inch OD), then scaling using the rule: response time is inversely proportional to the outside diameter squared (OD**2 scaling). An additional 7% improvement in response time was allowed for packing of the boron nitride during swaging. The smaller thermocouples (0.020 inch swaged to 0.015 inch) were estimated from the values of the larger thermocouples by first scaling the 25 ms response time to the unswaged 0.020 inch diameter using OD**2 scaling, then applying OD**2 scaling and the 7% improvement for packing to the swaged 0.015 inch OD.
- b. This instrument is fitted with Flow Technology electronics that time 10-blade passings. Averaging improves the steady-state error bands but degrades transient response.
- c. Range applies specifically to instruments calibrated in subcooled liquid at a density of 62.4 lb/ft**3.
- d. Range applies specifically to instruments calibrated in subcooled liquid at a density of 53.7 lb/ft**3.
- e. Range applies specifically to instruments calibrated in subcooled liquid at a density of 46.8 lb/ft**3.
- f. Error bands apply specifically to instruments calibrated in subcooled liquid. Extended range electronics provide readings out to 3600 gpm for the 3.5 inch diameter models; 445 gpm for the two inch diameter models, but the error bands apply only to 150% of nominal maximum range.
- g. Strain gage D.P. Cells used as pit cells are connected to different segments of the test section by long lines. These long lines induce resonant oscillations in the instrument that increase the steady-state errors bands to 5 psi, and the transient error bands to 60 psi in the interval immediately following blowdown.
- h. The turbine flowmeters (type code 109) have a flow range such that:
 -5.0<Flow<-0.5 .OR. 0.5<Flow<5.0,
 -10.0<Flow<-1.0 .OR. 1.0<Flow<10.0,
 -225<Flow<-22 .OR. 22<Flow<225,
 -1000<Flow<-100 .OR. 100<Flow<1000.
- i. The INEL level probe is an experimental device, and as such, does not have well documented error bands.
- j. No significant error over the averaging interval.
- k. N.A. implies not applicable.
- l. Flow Technology supplies calibration constants over the ranges 10 to 300 gpm and 80 to 1000 gpm respectively. The uncertainty bands for these instruments should approach the quoted values for these ranges, but special care may be required. See the section on turbine flowmeters in the critical instruments section.

Table D.6 (continued)

Basis for Steady-State and Transient Error Bands by Type Code		
Type Code	Steady State	Transient
1	Critical instrument	Manufacturer's spec, OD**2 scaling
2	Critical instrument	Manufacturer's spec, OD**2 scaling
3	Critical instrument	Work of Carroll and Sheppard
4	Critical instrument	Work of Carroll and Sheppard
5	Critical instrument	Work of Carroll and Sheppard
6	Critical instrument	Manufacturer's spec
7	Critical instrument	Work of Carroll and Sheppard
8	Critical instrument	Work of Carroll and Sheppard
9	Critical instrument	Manufacturer's spec, OD**2 scaling
10	Critical instrument	Work of Carroll and Sheppard
23	Critical instrument	Table B.2
24	Manufacturer's spec	Table B.2
25	Bench Cal. + DAS	Table B.2 (inferred)
26	Critical instrument	Table B.2
27	Critical instrument	Table B.2
28	Critical instrument	Table B.2
29	Critical instrument	Table B.2 (inferred)
31	Critical instrument	Table B.2 (inferred)
32	Inferred (type code 31)	Table B.2 (inferred)
33	Critical instrument	Table B.2 (inferred)
34	Manufacturer's spec	Manufacturer's spec
35	Critical instrument	Table B.2
36	Bench Cal. + DAS	Inferred (type code 34)
37	From test 3.03.6AR	From test 3.03.6AR
40	Critical instrument	Table B.2
43	Critical instrument	Table B.2 (inferred)
50	*****	*****
71	Bench Cal. & specs	Table B.2
75	Critical instrument	Manufacturer's spec
76	Engineering judgement	N.A.
77	Engineering judgement	N.A.
78	Critical instrument	Inferred (type code 75)
79	Inferred (type code 75)	Inferred (type code 75)
80	Inferred (type code 75)	Inferred (type code 75)
95	Inferred (type code 109)	Work of N. Chen
96	Inferred (type code 109)	Work of N. Chen
97	Critical instrument	Table B.2
98	Critical instrument	Inferred (typed code 75)
99	Inferred (type code 71)	Inferred (type code 71)
105	Manufacturer's spec	Table B.2 (inferred)
106	Critical instrument	Work of R. Shipp (manufacturer's spec)
107	In-situ calibration	Table B.2 (inferred)
108	Inferred (type code 107)	Table B.2 (inferred)
109	Critical instrument	Work of N. Chen
110	Bench Cal. & specs	Table B.2
111	Inferred (type code 106)	Inferred (type code 109)
112	Inferred (type code 107)	Table B.2 (inferred)
113	Manufacturer's spec	Table B.2 (inferred)

Table D.7. Test 3.07.9

THTF Instrument Error Bands						
Instrument Description	Type Code	Instrument Range	Steady State Error	Transient Error	Estimated Response Time	Assumed Value of Step Fn.
Rod Sheath Thermocouple 0.38 mm OD	1	273 K 1309 K	3.7K < 623 K 10.3 K	0.8 K ^a	7 ms	300 K
Rod Sheath Thermocouple 0.51 mm OD	1	273 K 1309 K	3.7K < 623 K 10.3 K	3.8 K ^a	12 ms	300 K
Rod Middle Thermocouple 0.38 mm OD	2	273 K 1309 K	3.7K < 623 K 10.3 K	0.8 K ^a	7 ms	300 K
Rod Middle Thermocouple 0.51 mm OD	2	273 K 1309 K	3.7K < 623 K 10.3 K	3.8 K ^a	12 ms	300 K
Bundle Subchn Thermocouple 1.02 mm OD	3	273 K 1309 K	3.7K < 623 K 10.3 K	4.1 K	140 ms	15 K
Shroud Box Thermocouple 1.57 mm OD	4	273 K 1309 K	3.7K < 623 K 10.3 K	8.0 K	350 ms	15 K
System Thermocouple 3.2 mm OD	5	273 K 1309 K	3.7K < 623 K 10.3 K	11.4 K	870 ms	15 K
System (Nanmac) Thermocouple 6.4 mm OD	6	273 K 1309 K	3.7K < 623 K 10.3 K	0.4 K	18 ms	15 K
Spacer Grid Thermocouple 1.02 mm OD	7	273 K 1309 K	3.7K < 623 K 10.3 K	4.1 K	140 ms	15 K
Array Rod Thermocouple 1.02 mm OD	8	273 K 1309 K	3.7K < 623 K 10.3 K	4.1 K	140 ms	15 K

Table D.7 (continued)

THTF Instrument Error Bands						
Instrument Description	Type Code	Instrument Range	Steady State Error	Transient Error	Estimated Response Time	Assumed Value of Step Fn.
Rod Sheath Thermocouple 0.51 mm OD	9	273 K 1309 K	3.7K < 623 K 10.3 K	3.8 K ^a	12 ms	300 K
Shroud Box Thermocouple 1.57 mm OD	10	273 K 1309 K	3.7K < 623 K 10.3 K	8.0 K	350 ms	15 K
Strain Gage Pressure Cell	23	20700 kPa	200 kPa	N.S. ^j	0.16 ms	700 kPa
Force Balance Pressure Cell	24	3400 kPa 17000 kPa	100 kPa	550 kPa	300 ms	700 kPa
Force Balance Pressure Cell	24	3400 kPa 27000 kPa	160 kPa	550 kPa	300 ms	700 kPa
Strain Gage Pressure Cell	25	1380 kPa	17 kPa	N.S.	0.32 ms	700 kPa
Strain Gage D.P. Cell	26	+1380 kPa	43 kPa	N.S.	0.32 ms	5.1 kPa
Strain Gage D.P. Cell	27	+6900 kPa	210 kPa	N.S.	0.32 ms	5.1 kPa
Strain Gage ^g D.P. Cell	28	+345 kPa	11 kPa	N.S.	0.32 ms	5.1 kPa
Strain Gage Pressure Cell	29	2400 kPa	24 kPa	N.S.	0.16 ms	700 kPa
Rod Heater Current	31	800 amp	0.85% Rdg	4.7 amp	50 ms	15 amp
Generator Current	32	1000 amp	0.85% Rdg	32 amp	50 ms	100 amp
Generator Voltage	33	300 volt	0.76% Rdg	3.8 volt	50 ms	12 volt

Table D.7 (continued)

THTF Instrument Error Bands						
Instrument Description	Type Code	Instrument Range	Steady State Error	Transient Error	Estimated Response Time	Assumed Value of Step Fn.
Primary Pump Power	34	750 kW	greater of 0.5 kW or 0.3% Rdg	6.3 kW	150 ms	10 kW
Strain Gage Drag Disk	35	$\pm 0.1E5$ kg/ms ² $\pm 1.0E5$ kg/ms ²	56% Rdg 19% Rdg	157 kg/ms ²	16 ms	1500 kg/ms ²
Primary Pump Speed	36	100 rpm 5400 rpm	20 rpm	13 rpm	150 ms	20 rpm
Breakwire Detector	37	5 volt	30 ms	N.A. ^k	20 ms	N.A.
Strain Gage Drag Disk	40	$\pm 0.2E5$ kg/ms ² $\pm 2.1E5$ kg/ms ²	56% Rdg 19% Rdg	157 kg/ms ²	16 ms	1500 kg/ms ²
Strain Gage D.P. Cell	41	± 25 kPa	0.8 kPa	N.S.	0.32 ms	5.1 kPa
Strain Gage D.P. Cell	42	± 125 kPa	4 kPa	N.S.	0.32 ms	5.1 kPa
Strain Gage D.P. Cell	43	± 41 kPa	2 kPa	N.S.	0.32 ms	5.1 kPa
Level ⁱ Indicator	50	± 10 volt	***	***	***	***
RTD	71	273 K 700 K	1.1 K 2.7 K	14.9 K	10 sec	15 K
Capacitive D.P. Cell	75	6.2 kPa	0.1 kPa	0.5 kPa	131 ms	0.75 kPa
Capacitive D.P. Cell	75	37.5 kPa	0.4 kPa	0.3 kPa	74 ms	0.75 kPa
Position Indicator	76	3.92 m	0.5% Rdg	N.A.	N.A.	N.A.
Position Indicator	77	3.33 m	0.5% Rdg	N.A.	N.A.	N.A.

Table D.7 (continued)

THIF Instrument Error Bands						
Instrument Description	Type Code	Instrument Range	Steady State Error	Transient Error	Estimated Response Time	Assumed Value of Step Fn.
Capacitive D.P. Cell	78	25 kPa	1.3 kPa	2.7 kPa	110 ms	5.1 kPa
Capacitive D.P. Cell	79	50 kPa	0.5 kPa	2.1 kPa	68 ms	5.1 kPa
Capacitive D.P. Cell	80	7.5 kPa	0.1 kPa	0.4 kPa	125 ms	0.75 kPa
Turbine ^f Flowmeter	95	0.9E-3 m ³ /s 9.5E-3 m ³ /s	4.1% Rdg	1.3E-6 m ³ /s	11 ms 1.2 ms	6.3E-4 m ³ /s
Turbine ^f Flowmeter	96	0.3E-3 m ³ /s 3.2E-3 m ³ /s	4.1% Rdg	1.3E-6 m ³ /s	8 ms 1 ms	6.3E-4 m ³ /s
Force Balance D.P. Cell	97	166 kPa	1 kPa	4 kPa	300 ms	5.1 kPa
Capacitive D.P. Cell	98	345 kPa	0.1 kPa	1.3 kPa	38 ms	5.1 kPa
Differential Temperature	99	228 K 283 K	3.8 K	9.9 K	10 sec	10 K
Liquid Level	105	3.81 m	0.023 m	0.16 m	300 ms	0.2 m
Liquid Level	105	1408 m	8.5 m	0.16 m	300 ms	0.2 m
Gamma Densitometer	106	1000 kg/m ³	104 kg/m ³	8 kg/m ³	16 ms	80 kg/m ³
Orifice ^c Flowmeter	107	1.0E-4 m ³ /s	2.5E-6 m ³ /s	7.9E-6 m ³ /s	300 ms	1E-5 m ³ /s
Orifice ^c Flowmeter	107	1.35E-4 m ³ /s	3.4E-6 m ³ /s	1.1E-5 m ³ /s	300 ms	1.4E-5 m ³ /s
Orifice ^c Flowmeter	107	3.32E-4 m ³ /s	8.3E-6 m ³ /s	2.6E-5 m ³ /s	300 ms	3.3E-5 m ³ /s

Table D.7 (continued)

THTF Instrument Error Bands						
Instrument Description	Type Code	Instrument Range	Steady State Error	Transient Error	Estimated Response Time	Assumed Value of Step Fn.
Orifice ^c Flowmeter	107	2.48E-3 m ³ /s	6.2E-5 m ³ /s	2.0E-4 m ³ /s	300 ms	2.5E-4 m ³ /s
Orifice ^c Flowmeter	107	5.0E-2 m ³ /s	1.3E-3 m ³ /s	3.9E-3 m ³ /s	300 ms	5E-3 m ³ /s
Orifice ^d Flowmeter	108	1.7E-4 m ³ /s	4.2E-6 m ³ /s	1.3E-5 m ³ /s	300 ms	1.7E-5 m ³ /s
Orifice ^e Flowmeter	108	4.4E-2 m ³ /s	1.1E-3 m ³ /s	3.5E-3 m ³ /s	300 ms	4.4E-3 m ³ /s
Turbine ^{f,h} Flowmeter	109	$\pm 0.3E-4$ m ³ /s $\pm 3.0E-4$ m ³ /s	4.1% Rdg	3.1E-6 m ³ /s	8 ms 1 ms	1.5E-4 m ³ /s
Turbine ^{f,h,b} Flowmeter	109	$\pm 0.6E-4$ m ³ /s $\pm 6.1E-4$ m ³ /s	2.5% Rdg	N.A.	8 ms 1 ms	N.A.
Turbine ^{f,h,l} Flowmeter	109	$\pm 1.3E-3$ m ³ /s $\pm 1.4E-2$ m ³ /s	4.1% Rdg	2.7E-5 m ³ /s	13 ms 2 ms	1.3E-3 m ³ /s
Turbine ^{f,h,l} Flowmeter	109	$\pm 0.6E-2$ m ³ /s $\pm 6.1E-2$ m ³ /s	4.1% Rdg	6.7E-5 m ³ /s	18 ms 2 ms	3.2E-3 m ³ /s
RTD	110	273 K 700 K	1.1 K 2.7 K	14.9 K	10 sec	15 K
In-bundle Gamma Densitometer	111	1000 kg/m ³	104 kg/m ³	8 kg/m ³	16 ms	80 kg/m ³
Orifice ^c Flowmeter	112	1.0E-4 m ³ /s	2.5E-6 m ³ /s	7.9E-6 m ³ /s	300 ms	1E-5 m ³ /s
Liquid Level	113	1.18 m	0.007 m	0.16 m	300 ms	0.20 m

Table D.7 (continued)

Documentation of Steady-State and Transient Error Bands

Steady-State Error Bands: Two-standard deviations compared to in-situ standard or twice the root-sum-square of uncertainties, whichever is applicable.

Transient Error Bands: Assuming first-order lag function, response times (TAU), and step function ($V_f - V_o$) indicated—the average error seen by the DAS assuming the step function occurred midway between DAS samples. The averaging interval is 500 ms for thermocouples and 150 ms for all other instruments.

Total Error: The total error due to steady state error and transient error is the sum of the steady state and error bands.

Footnotes:

- a. Error bands apply to the environment as sensed at the surface of the thermocouple sheath. Larger errors may occur when data is modelled to provide temperatures at other points. Transient response is estimated by using the response time (25 ms or less) prior to swaging the sheath (0.71 mm swaged to 0.51 mm OD), then scaling using the rule: response time is inversely proportional to the outside diameter squared (OD**2 scaling). An additional 7% improvement in response time was allowed for packing of the boron nitride during swaging. The smaller thermocouples (0.51 mm swaged to 0.38 mm OD) were estimated from the values of the larger thermocouples by first scaling the 25 ms response time to the unswaged 0.51 mm diameter using OD**2 scaling, then applying OD**2 scaling and the 7% improvement for packing to the swaged 0.38 mm OD.
- b. This instrument is fitted with Flow Technology electronics that time 10-blade passings. Averaging improves the steady-state error bands but degrades transient response.
- c. Range applies specifically to instruments calibrated in subcooled liquid at a density of 1000 kg/m**3.
- d. Range applies specifically to instruments calibrated in subcooled liquid at a density of 860 kg/m**3.
- e. Range applies specifically to instruments calibrated in subcooled liquid at a density of 750 kg/m**3.
- f. Error bands apply specifically to instruments calibrated in subcooled liquid. Extended range electronics provide readings out to 0.227 m³/s for the 8.89E-2 meter diameter models; 0.028 m³/s for the 5.08E-2 meter diameter models, but the error bands apply only to 150% of nominal maximum range.
- g. Strain gage D.P. Cells used as pit cells are connected to different segments of the test section by long lines. These long lines induce resonant oscillations in the instrument that increase the steady-state errors bands to 35 kPa, and the transient error bands to 400 kPa.
- h. The turbine flowmeters (type code 109) have a flow range such that:
 $-3.0E-4 < \text{Flow} < 0.3E-4$.OR. $0.3E-4 < \text{Flow} < 3.0E-4$,
 $-6.1E-4 < \text{Flow} < 0.6E-4$.OR. $0.6E-4 < \text{Flow} < 6.1E-4$,
 $-1.4E-3 < \text{Flow} < 0.1E-3$.OR. $0.1E-3 < \text{Flow} < 1.4E-3$,
 $-6.1E-2 < \text{Flow} < 0.6E-2$.OR. $0.6E-2 < \text{Flow} < 6.1E-2$
- i. The INEL level probe is an experimental device, and as such, does not have well documented error bands.
- j. No significant error over a 500 ms averaging interval.
- k. N.A. implies not applicable.
- l. Flow Technology supplies calibration constants over the ranges 6.3E-4 to 1.9E-2 m³/s and 5.0E-3 to 6.3E-2 m³/s respectively. The uncertainty bands for these instruments should approach the quoted values for these ranges, but special care may be required. See the section on turbine flowmeters in the critical instruments section.

Table D.7 (continued)

Basis for Steady-State and Transient Error Bands by Type Code		
Type Code	Steady State	Transient
1	Critical instrument	Manufacturer's spec, OD**2 scaling
2	Critical instrument	Manufacturer's spec, OD**2 scaling
3	Critical instrument	Work of Carroll and Sheppard
4	Critical instrument	Work of Carroll and Sheppard
5	Critical instrument	Work of Carroll and Sheppard
6	Critical instrument	Manufacturer's spec
7	Critical instrument	Work of Carroll and Sheppard
8	Critical instrument	Work of Carroll and Sheppard
9	Critical instrument	Manufacturer's spec, OD**2 scaling
10	Critical instrument	Work of Carroll and Sheppard
23	Critical instrument	Table B.2
24	Manufacturer's spec	Table B.2
25	Bench Cal. + DAS	Table B.2 (inferred)
26	Critical instrument	Table B.2
27	Critical instrument	Table B.2
28	Critical instrument	Table B.2
29	Critical instrument	Table B.2 (inferred)
31	Critical instrument	Table B.2 (inferred)
32	Inferred (type code 31)	Table B.2 (inferred)
33	Critical instrument	Table B.2 (inferred)
34	Manufacturer's spec	Manufacturer's spec
35	Critical instrument	Table B.2
36	Bench Cal. + DAS	Inferred (type code 34)
37	From test 3.03.6AR	From test 3.03.6AR
40	Critical instrument	Table B.2
43	Critical instrument	Table B.2 (inferred)
50	*****	*****
71	Bench Cal. & specs	Table B.2
75	Critical instrument	Manufacturer's spec
76	Engineering judgement	N.A.
77	Engineering judgement	N.A.
78	Critical instrument	Inferred (type code 75)
79	Inferred (type code 75)	Inferred (type code 75)
80	Inferred (type code 75)	Inferred (type code 75)
95	Inferred (type code 109)	Work of N. Chen
96	Inferred (type code 109)	Work of N. Chen
97	Critical instrument	Table B.2
98	Critical instrument	Inferred (typed code 75)
99	Inferred (type code 71)	Inferred (type code 71)
105	Manufacturer's spec	Table B.2 (inferred)
106	Critical instrument	Work of R. Shipp (manufacturer's spec)
107	In-situ calibration	Table B.2 (inferred)
108	Inferred (type code 107)	Table B.2 (inferred)
109	Critical instrument	Work of N. Chen
110	Bench Cal. & specs	Table B.2
111	Inferred (type code 106)	Inferred (type code 109)
112	Inferred (type code 107)	Table B.2 (inferred)
113	Manufacturer's spec	Table B.2 (inferred)

Table D.8. Test 3.07.9

THTF Instrument Error Bands						
Instrument Description	Type Code	Instrument Range	Steady State Error	Transient Error	Estimated Response Time	Assumed Value of Step Fn.
Rod Sheath Thermocouple 0.015 inch OD	1	32 F 1900 F	6.7F < 662 F 18.5 F	1.4 F ^a	7 ms	540 F
Rod Sheath Thermocouple 0.020 inch OD	1	32 F 1900 F	6.7F < 662 F 18.5 F	6.8 F ^a	12 ms	540 F
Rod Middle Thermocouple 0.015 inch OD	2	32 F 1900 F	6.7F < 662 F 18.5 F	1.4 F ^a	7 ms	540 F
Rod Middle Thermocouple 0.020 inch OD	2	32 F 1900 F	6.7F < 662 F 18.5 F	6.8 F ^a	12 ms	540 F
Bundle Subchn Thermocouple 0.040 inch OD	3	32 F 1900 F	6.7F < 662 F 18.5 F	7.4 F	140 ms	27 F
Shroud Box Thermocouple 0.062 inch OD	4	32 F 1900 F	6.7F < 662 F 18.5 F	14.4 F	350 ms	27 F
System Thermocouple 0.125 inch OD	5	32 F 1900 F	6.7F < 662 F 18.5 F	20.5 F	870 ms	27 F
System (Nanmac) Thermocouple 0.25 inch OD	6	32 F 1900 F	6.7F < 662 F 18.5 F	0.7 F	18 ms	27 F
Spacer Grid Thermocouple 0.040 inch OD	7	32 F 1900 F	6.7F < 662 F 18.5 F	7.4 F	140 ms	27 F
Array Rod Thermocouple 0.040 inch OD	8	32 F 1900 F	6.7F < 662 F 18.5 F	7.4 F	140 ms	27 F

Table D.8 (continued)

THTF Instrument Error Bands						
Instrument Description	Type Code	Instrument Range	Steady State Error	Transient Error	Estimated Response Time	Assumed Value of Step Fn.
Rod Sheath Thermocouple 0.020 inch OD	9	32 F 1900 F	6.7F < 662 F 18.5 F	6.8 F ^a	12 ms	540 F
Shroud Box Thermocouple 0.062 inch OD	10	32 F 1900 F	6.7F < 662 F 18.5 F	14.4 F	350 ms	27 F
Strain Gage Pressure Cell	23	3000 psi	29 psi	N.S. ^j	0.16 ms	100 psi
Force Balance Pressure Cell	24	500 psi 2500 psi	15 psi	79 psi	300 ms	100 psi
Force Balance Pressure Cell	24	500 psi 3900 psi	23 psi	79 psi	300 ms	100 psi
Strain Gage Pressure Cell	25	200 psi	2.5 psi	N.S.	0.32 ms	100 psi
Strain Gage D.P. Cell	26	±200 psi	6.2 psi	N.S.	0.32 ms	100 psi
Strain Gage D.P. Cell	27	±1000 psi	30 psi	N.S.	0.32 ms	0.7 psi
Strain Gage ^g D.P. Cell	28	±50 psi	1.6 psi	N.S.	0.32 ms	0.7 psi
Strain Gage Pressure Cell	29	350 psi	3.5 psi	N.S.	0.16 ms	100 psi
Rod Heater Current	31	800 amp	0.85% Rdg	24 amp	50 ms	75 amp
Generator Current	32	1000 amp	0.85% Rdg	95 amp	50 ms	300 amp
Generator Voltage	33	300 volt	0.76% Rdg	32 volt	50 ms	100 volt

Table D.8 (continued)

THIF Instrument Error Bands						
Instrument Description	Type Code	Instrument Range	Steady State Error	Transient Error	Estimated Response Time	Assumed Value of Step Fn.
Primary Pump Power	34	750 kW	greater of 0.5 kW or 0.3% Rdg	6.3 kW	150 ms	10 kW
Strain Gage Drag Disk	35	$\pm 0.7E4$ lb/fts ² $\pm 7.0E4$ lb/fts ²	56% Rdg 19% Rdg	106 lb/fts ²	16 ms	1000 lb/fts ²
Primary Pump Speed	36	100 rpm 5400 rpm	20 rpm	13 rpm	150 ms	20 rpm
Breakwire Detector	37	5 volt	30 ms	N.A. ^k	20 ms	N.A.
Strain Gage Drag Disk	40	$\pm 1.4E4$ lb/fts ² $\pm 1.4E5$ lb/fts ²	56% Rdg 19% Rdg	106 lb/fts ²	16 ms	1000 lb/fts ²
Strain Gage D.P. Cell	41	± 100 inch	3.2 inch	N.S.	0.32 ms	20.5 inch
Strain Gage D.P. Cell	42	± 500 inch	16 inch	N.S.	0.32 ms	20.5 inch
Strain Gage D.P. Cell	43	± 6 psi	0.3 psi	N.S.	0.32 ms	0.7 psi
Level ⁱ Indicator	50	± 10 volt	***	***	***	***
RTD	71	32 F 800 F	2.0 F 4.9 F	26.8 F	10 sec	27 F
Capacitive D.P. Cell	75	25 inch	0.4 inch	2.0 inch	131 ms	3 inch
Capacitive D.P. Cell	75	150 inch	1.6 inch	1.2 inch	74 ms	3 inch
Position Indicator	76	155 inch	0.5% Rdg	N.A.	N.A.	N.A.
Position Indicator	77	131 inch	0.5% Rdg	N.A.	N.A.	N.A.

Table D.8 (continued)

THTF Instrument Error Bands						
Instrument Description	Type Code	Instrument Range	Steady State Error	Transient Error	Estimated Response Time	Assumed Value of Step Fn.
Capacitive D.P. Cell	78	± 100 inch	5.2 inch	10.9 inch	110 ms	20.5 inch
Capacitive D.P. Cell	79	200 inch	2.0 inch	8.4 inch	68 ms	20.5 inch
Capacitive D.P. Cell	80	30 inch	0.4 inch	1.6 inch	125 ms	3 inch
Turbine ^f Flowmeter	95	15 gpm 150 gpm	4.1% Rdg	2.0 gpm	11 ms 1.2 ms	100 gpm
Turbine ^f Flowmeter	96	5 gpm 50 gpm	4.1% Rdg	2.0 gpm	8 ms 1 ms	100 gpm
Force Balance D.P. Cell	97	24 psi	0.15 psi	0.6 psi	300 ms	0.7 psi
Capacitive D.P. Cell	98	50 psi	2.6 psi	0.2 psi	38 ms	0.7 psi
Differential Temperature	99	± 50 F	6.8 F	17.8 F	10 sec	18 F
Liquid Level	105	150 inch	0.9 inch	6.2 inch	300 ms	7.9 inch
Liquid Level	105	5.5E4 inch	336 inch	6.2 inch	300 ms	7.9 inch
Gamma Densitometer	106	62.4 lb/ft ³	6.5 lb/ft ³	0.5 lb/ft ³	16 ms	5 lb/ft ³
Orifice ^c Flowmeter	107	1.6 gpm	4E-2 gpm	0.13 gpm	300 ms	0.16 gpm
Orifice ^c Flowmeter	107	2.1 gpm	0.054 gpm	0.17 gpm	300 ms	0.22 gpm
Orifice ^c Flowmeter	107	5.3 gpm	0.13 gpm	0.41 gpm	300 ms	0.52 gpm

Table D.8 (continued)

THIF Instrument Error Bands						
Instrument Description	Type Code	Instrument Range	Steady State Error	Transient Error	Estimated Response Time	Assumed Value of Step Fn.
Orifice ^c Flowmeter	107	39.3 gpm	9.8 gpm	3.2 gpm	300 ms	4.0 gpm
Orifice ^c Flowmeter	107	800 gpm	21 gpm	62 gpm	300 ms	80 gpm
Orifice ^d Flowmeter	108	2.7 gpm	0.067 gpm	0.21 gpm	300 ms	0.27 gpm
Orifice ^e Flowmeter	108	700 gpm	17.4 gpm	0.55 gpm	300 ms	70 gpm
Turbine ^{f,h} Flowmeter	109	± 0.5 gpm ± 5.0 gpm	4.1% Rdg	0.05 gpm	8 ms 1 ms	2.4 gpm
Turbine ^{f,h,b} Flowmeter	109	± 1.0 gpm ± 10 gpm	2.5% Rdg	N.A.	8 ms 1 ms	N.A.
Turbine ^{f,h,l} Flowmeter	109	± 22 gpm ± 225 gpm	4.1% Rdg	0.4 gpm	13 ms 2 ms	21 gpm
Turbine ^{f,h,l} Flowmeter	109	± 100 gpm ± 1000 gpm	4.1% Rdg	1.1 gpm	18 ms 2 ms	50 gpm
RTD	110	32 F 800 F	2.0 F 4.9 F	26.8 F	10 sec	27 F
In-bundle Gamma Densitometer	111	62.4 lb/ft ³	6.5 lb/ft ³	0.5 lb/ft ³	16 ms	5 lb/ft ³
Orifice ^c Flowmeter	112	1.6 gpm	0.04 gpm	0.13 gpm	300 ms	0.16 gpm
Liquid Level	113	46 inch	0.3 inch	6.2 inch	300 ms	7.9 inch

Table D.8 (continued)

Documentation of Steady-State and Transient Error Bands

Steady-State Error Bands: Two-standard deviations compared to in-situ standard or twice the root-sum-square of uncertainties, whichever is applicable.

Transient Error Bands: Assuming first-order lag function, response times (TAU), and step function ($V_f - V_o$) indicated—the average error seen by the DAS assuming the step function occurred midway between DAS samples. The averaging interval is 500 ms for thermocouples and 150 ms for all other instruments.

Total Error: The total error due to steady state error and transient error is the sum of the steady state and transient error bands.

Footnotes:

- a. Error bands apply to the environment as sensed at the surface of the thermocouple sheath. Larger errors may occur when data is modelled to provide temperatures at other points. Transient response is estimated by using the response time (25 ms or less) prior to swaging the sheath (0.028 inch swaged to 0.020 inch OD), then scaling using the rule: response time is inversely proportional to the outside diameter squared (OD**2 scaling). An additional 7% improvement in response time was allowed for packing of the boron nitride during swaging. The smaller thermocouples (0.020 inch swaged to 0.015 inch) were estimated from the values of the larger thermocouples by first scaling the 25 ms response time to the unswaged 0.020 inch diameter using OD**2 scaling, then applying OD**2 scaling and the 7% improvement for packing to the swaged 0.015 inch OD.
- b. This instrument is fitted with Flow Technology electronics that time 10-blade passings. Averaging improves the steady-state error bands but degrades transient response.
- c. Range applies specifically to instruments calibrated in subcooled liquid at a density of 62.4 lb/ft**3.
- d. Range applies specifically to instruments calibrated in subcooled liquid at a density of 53.7 lb/ft**3.
- e. Range applies specifically to instruments calibrated in subcooled liquid at a density of 46.8 lb/ft**3.
- f. Error bands apply specifically to instruments calibrated in subcooled liquid. Extended range electronics provide readings out to 3600 gpm for the 3.5 inch diameter models; 445 gpm for the two inch diameter models, but the error bands apply only to 150% of nominal maximum range.
- g. Strain gage D.P. Cells used as pit cells are connected to different segments of the test section by long lines. These long lines induce resonant oscillations in the instrument that increase the steady-state errors bands to 5 psi, and the transient error bands to 60 psi in the interval immediately following blowdown.
- h. The turbine flowmeters (type code 109) have a flow range such that:
 $-5.0 < \text{Flow} < -0.5$.OR. $0.5 < \text{Flow} < 5.0$,
 $-10.0 < \text{Flow} < -1.0$.OR. $1.0 < \text{Flow} < 10.0$,
 $-225 < \text{Flow} < -22$.OR. $22 < \text{Flow} < 225$,
 $-1000 < \text{Flow} < -100$.OR. $100 < \text{Flow} < 1000$.
- i. The INEL level probe is an experimental device, and as such, does not have well documented error bands.
- j. No significant error over the averaging interval.
- k. N.A. implies not applicable.
- l. Flow Technology supplies calibration constants over the ranges 10 to 300 gpm and 80 to 1000 gpm respectively. The uncertainty bands for these instruments should approach the quoted values for these ranges, but special care may be required. See the section on turbine flowmeters in the critical instruments section.

Table D.8 (continued)

Basis for Steady-State and Transient Error Bands by Type Code		
Type Code	Steady State	Transient
1	Critical instrument	Manufacturer's spec, OD**2 scaling
2	Critical instrument	Manufacturer's spec, OD**2 scaling
3	Critical instrument	Work of Carroll and Sheppard
4	Critical instrument	Work of Carroll and Sheppard
5	Critical instrument	Work of Carroll and Sheppard
6	Critical instrument	Manufacturer's spec
7	Critical instrument	Work of Carroll and Sheppard
8	Critical instrument	Work of Carroll and Sheppard
9	Critical instrument	Manufacturer's spec, OD**2 scaling
10	Critical instrument	Work of Carroll and Sheppard
23	Critical instrument	Table B.2
24	Manufacturer's spec	Table B.2
25	Bench Cal. + DAS	Table B.2 (inferred)
26	Critical instrument	Table B.2
27	Critical instrument	Table B.2
28	Critical instrument	Table B.2
29	Critical instrument	Table B.2 (inferred)
31	Critical instrument	Table B.2 (inferred)
32	Inferred (type code 31)	Table B.2 (inferred)
33	Critical instrument	Table B.2 (inferred)
34	Manufacturer's spec	Manufacturer's spec
35	Critical instrument	Table B.2
36	Bench Cal. + DAS	Inferred (type code 34)
37	From test 3.03.6AR	From test 3.03.6AR
40	Critical instrument	Table B.2
43	Critical instrument	Table B.2 (inferred)
50	*****	*****
71	Bench Cal. & specs	Table B.2
75	Critical instrument	Manufacturer's spec
76	Engineering judgement	N.A.
77	Engineering judgement	N.A.
78	Critical instrument	Inferred (type code 75)
79	Inferred (type code 75)	Inferred (type code 75)
80	Inferred (type code 75)	Inferred (type code 75)
95	Inferred (type code 109)	Work of N. Chen
96	Inferred (type code 109)	Work of N. Chen
97	Critical instrument	Table B.2
98	Critical instrument	Inferred (typed code 75)
99	Inferred (type code 71)	Inferred (type code 71)
105	Manufacturer's spec	Table B.2 (inferred)
106	Critical instrument	Work of R. Shipp (manufacturer's spec)
107	In-situ calibration	Table B.2 (inferred)
108	Inferred (type code 107)	Table B.2 (inferred)
109	Critical instrument	Work of N. Chen
110	Bench Cal. & specs	Table B.2
111	Inferred (type code 106)	Inferred (type code 109)
112	Inferred (type code 107)	Table B.2 (inferred)
113	Manufacturer's spec	Table B.2 (inferred)

The first column in each table gives a brief instrument description. The second column provides the instrument type code. (Use Table D.4 to cross reference to IANs.) The third column provides the nominal instrument range. The fourth and fifth columns give the steady-state and transient error bands, respectively. The sixth and seventh columns provide the estimated response time and step function values used to estimate the transient uncertainty value.

The English version tables are intended for reference only. Exact correspondence of entries will be limited by significant figure rounding.

The values quoted for both steady-state and transient errors are estimates based on several assumptions. It is the responsibility of the data user to ascertain the appropriateness of these assumptions when using the included error bands for THTF data analysis.

References

1. K. A. Brownlee, *Statistical Theory and Methodology in Science and Engineering*, p. 80, John Wiley and Sons, Inc., New York, 1965.
2. J. B. Scarborough, *Numerical Mathematical Analysis*, 3rd Ed., p. 429, The John Hopkins Press, Baltimore, 1955.
3. K. A. Brownlee, *Statistical Theory and Methodology in Science and Engineering*, p. 340, John Wiley and Sons, Inc., New York, 1965.
4. Unpublished report, *Summary Two and Three Dimensional Analysis of Turbine Flowmeter Response in Two-Phase Flow*, MPR Associates, Inc. (October 11, 1977).
5. Internal memo from R. L. Anderson, I&C Division ORNL, to B. J. Veazie, *Error in BDHT Thermocouple*, June 18, 1980.

Appendix E

DENSITY OBTAINED FROM THREE-BEAM DENSITOMETER

An annular model¹ is used for obtaining composite density from the three-beam gamma densitometers installed on selected THTF spool pieces. The model solves for a uniform density for each region shown in Fig. E.1 using the density indicated by each of the three beams and the length of each beam within each region. The composite pipe density is then calculated as an area-weighted average of the three region densities. This results in the following equation for the composite density:

$$\bar{\rho} = 0.3784\rho_A + 0.5117\rho_B + 0.1099\rho_C ,$$

where $\bar{\rho}$ is the composite average pipe density, and ρ_A , ρ_B , and ρ_C are the measured beam densities. The calculated bundle outlet spool-piece composite density is shown in Table E.1 for each of the steady-state tests.

Fig. E.1

Table E.1

TEST	OUTLET COMPOSITE DENSITY LBM/FT**3	KG/M**3
B	5.41	86.7
C	3.72	59.6
D	5.18	83.0
E	6.03	96.6
F	4.30	68.9
G	5.20	83.3
H	2.60	41.6
I	2.84	45.5
J	6.74	108.
K	1.39	22.3
L	2.92	46.8
M	3.38	54.1
N	3.76	60.2
O	1.75	28.0
P	1.87	30.0
Q	2.42	38.8
R	2.44	39.1
T	5.03	80.6
U	5.44	87.1
V	6.79	109.
W	4.95	79.3
X	1.56	25.0

An uncertainty estimate for homogeneous flows may be obtained using a standard propagation-of-errors method and the uncertainty estimates for the individual beams. The standard deviation may be estimated as:

$$\rho = [(0.3784\sigma_A)^2 + (0.5117\sigma_B)^2 + (0.1099\sigma_C)^2]^{0.5} .$$

Substituting the reported 2σ single-beam values of 104 kg/m³ (6.5 lb_m/ft³) into the above equation gives a 2σ value of 67 kg/m³ (4.2 lb_m/ft³) for the composite three-beam densitometer measurements.

Reference

1. K. G. Turnage et al., *Advanced Two-Phase Instrumentation Program Quarterly Progress Report for April-June 1978*, ORNL/NUREG/TM-279 (January 1979).

NUREG/CR-2525, Vol. 7
ORNL/NUREG/TM-407/V7
Dist. Category R2

Internal Distribution

1-2. W. G. Craddick	29. T. W. Robinson, Jr.
3-7. D. K. Felde	30. A. G. Sutton
8. S. S. Gould	31. H. E. Trammell
9. H. W. Hoffman	32. ORNL Patent Office
10. A. L. Lotts	33. Central Research Library
11-15. D. G. Morris	34. Document Reference Section
16-20. C. B. Mullins	35-36. Laboratory Records Department
21-23. L. J. Ott	37. Laboratory Records, RC
24-28. J. J. Robinson	

External Distribution

- 38-42. Director, Division of Reactor Safety Research, Nuclear Regulatory Commission, Washington, DC 20555
43. Office of Assistant Manager for Energy Research and Development, Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN 37830
- 44-45. Technical Information Center, Department of Energy, Oak Ridge, TN 37830
- 46-410. Given distribution as shown under category R2 (10-NTIS)