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**EXPERIMENT DATA REPORT FOR SEMISCALE MOD-1
TESTS S-05-2A AND S-05-2B
(ALTERNATE ECC INJECTION TESTS)**

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April 1977

MASTER

IDAHO NATIONAL ENGINEERING LABORATORY

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

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TESTS S-05-2A AND S-05-2B

(ALTERNATE ECC INJECTION TESTS)

Approved:

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Water Reactor Research

EXPERIMENT DATA REPORT FOR SEMISCALE MOD-1

TESTS S-05-2A AND S-05-2B

(ALTERNATE ECC INJECTION TESTS)

By

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April 1977

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ABSTRACT

Recorded test data are presented for Tests S-05-2A and S-05-2B of the Semiscale Mod-1 alternate ECC injection test series. These tests are among several Semiscale Mod-1 experiments conducted to investigate the thermal and hydraulic phenomena accompanying a hypothesized loss-of-coolant accident in a pressurized water reactor (PWR) system.

Tests S-05-2A and S-05-2B were conducted from initial conditions of 2263 psia and 543°F and 2272 psia and 542°F, respectively, to investigate the response of the Semiscale Mod-1 system to a depressurization and reflood transient following a simulated double-ended offset shear of the cold leg broken loop piping. During the tests, cooling water was injected into the intact loop pump suction and broken loop cold leg to simulate emergency core coolant injection in a PWR with flow rates based on system volume scaling. For Test S-05-2A the intact loop pump speed was held constant throughout the test at the initial blowdown value. During Test S-05-2B the pump speed was reduced and stopped according to a predetermined coastdown schedule.

The purpose of this report is to make available the uninterpreted data from Tests S-05-2A and S-05-2B for future data analysis and test results reporting activities. The data, presented in the form of graphs in engineering units, have been analyzed only to the extent necessary to assure that they are reasonable and consistent.

SUMMARY

Tests S-05-2A and S-05-2B were performed as part of the Semiscale Mod-1 portion of the Semiscale Program conducted by EG&G Idaho, Inc. for the United States Government. These tests were part of the alternate ECC injection test series (Test Series 5), performed to investigate the response of the Semiscale Mod-1 system to specific variations in coolant injection location. The test objective specific to Tests S-05-2A and S-05-2B was to provide data which can be used to assess the influence of pump operation on core cooling and on system response with coolant injection into the intact loop pump suction. Hardware configuration and test parameters were selected to yield a system response that simulates the response of a pressurized water reactor (PWR) to a hypothesized loss-of-coolant accident (LOCA) with subsequent refill and reflood.

Tests S-05-2A and S-05-2B utilized the Semiscale Mod-1 system, equipped with a pressure vessel with a 40-rod electrically heated core; an intact loop with pump, steam generator, and pressurizer; a broken loop with simulated pump, simulated steam generator, and rupture assemblies; and a pressure suppression system with header, pressure suppression tank, and a steam supply system. A low pressure coolant injection pump and a coolant injection accumulator were provided for each system loop. The vessel lower plenum volume, emergency core coolant (ECC) flow rates, and total ECC accumulator nitrogen flow were volumetrically scaled to that of a PWR. In addition, for Tests S-05-2A and S-05-2B, four heater rods were intentionally unpowered to simulate the effects of control rod guide tubes and the power in three heater rods was increased to produce a slightly peaked profile.

Tests S-05-2A and S-05-2B were conducted from initial conditions of 2263 psia and 543°F and 2272 psia and 542°F (temperatures taken at the intact loop cold leg vessel inlet), respectively, by a simulated full-size (200%), double-ended offset shear of the cold leg broken loop piping. The initial core power level was 1.45 MW for Tests S-05-2A and S-05-2B and the initial core inlet flow rate was 143 gpm for Test S-05-2A and 142 gpm for Test S-05-2B. The instantaneous offset shear of the broken loop cold leg piping was simulated by simultaneous (within 10 msec) actuation of the rupture assemblies. After initiation of blowdown, power to the heated core was reduced to simulate the predicted heat flux response of nuclear fuel rods during a LOCA. Blowdown was accompanied by simulated emergency core coolant injected into the intact loop pump suction and broken loop cold leg. For Test S-05-2A the intact loop pump speed was held constant throughout the test at the initial blowdown value. During Test S-05-2B the pump speed was reduced and stopped according to a predetermined coastdown schedule.

Tests S-05-2A and S-05-2B were generally conducted as specified. Conditions which did not conform to the specified test configuration were considered acceptable for analysis purposes within the test objectives. The instrumentation used generally functioned as intended. Of 216 measurements taken on Test S-05-2A, 215 produced usable data. Of 217 measurements taken on Test S-05-2B, 216 produced usable data.

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EXPERIMENT DATA REPORT FOR SEMISCALE MOD-1

TESTS S-05-2A AND S-05-2B

(ALTERNATE ECC INJECTION TESTS)

I. INTRODUCTION

The Semiscale Mod-1 experiments represent the current phase of the Semiscale Program conducted by EG&G Idaho, Inc. for the United States Government. The program, which is sponsored by the Nuclear Regulatory Commission through the Energy Research and Development Administration, is part of the overall program designed to investigate the response of a pressurized water reactor system to a hypothesized loss-of-coolant accident (LOCA). The underlying objectives of the Semiscale project are to quantify the physical processes controlling system behavior during a LOCA and to provide an experimental data base for assessing reactor safety evaluation models. The Semiscale Mod-1 program has the further objective of providing support to other experimental programs in the form of instrumentation assessment, optimization of test series, selection of test parameters, and evaluation of test results.

Tests S-05-2A and S-05-2B were conducted December 9th and 15th, 1976, respectively, in the Semiscale Mod-1 system as part of the alternate ECC injection test series, which was designed to obtain thermal-hydraulic response data from blowdown, refill, and reflood transients in a simulated nuclear reactor with a heated core, to study system response to changes in emergency core coolant injection location. The test objective specific to Tests S-05-2A and S-05-2B was to provide data which can be used to assess the influence of pump operation on core cooling and on system response with coolant injection into the intact loop pump suction.

The purpose of this report is to present the test data in an uninterpreted but readily usable form for use by the nuclear community in advance of detailed analysis and interpretation. Section II briefly describes the system configuration, procedures, initial test conditions, and events that are applicable to Tests S-05-2A and S-05-2B; Section III presents the data graphs and provides comments and supporting information necessary for interpretation of the data. A description of the overall Semiscale program and test series, a more detailed description of the Semiscale Mod-1 system, and a description of the measurement and data processing techniques and uncertainties can be found in Reference 1.

II. SYSTEM, PROCEDURES, CONDITIONS, AND EVENTS FOR TESTS S-05-2A AND S-05-2B

The following system configuration, procedures, initial test conditions, and events are specific to Tests S-05-2A and S-05-2B as indicated.

1. SYSTEM CONFIGURATION AND TEST PROCEDURES

The Semiscale Mod-1 system used for these tests consisted of a pressure vessel with internals, including a 40-rod core with 36 electrically heated rods; an intact loop with steam generator, pump, and pressurizer; a broken loop with simulated steam generator, simulated pump, and two rupture assemblies; coolant injection accumulators for both the intact and broken loops; low pressure injection pumps for the intact and broken loops; and a pressure suppression system with a suppression tank, header, and a heated steam supply system. For Tests S-05-2A and S-05-2B, the volume of the lower plenum was reduced to 0.529 ft³ by the addition of a metal filler piece. The Semiscale Mod-1 experimental system configuration is provided in Reference 1. Figures 1 and 2 provide the system configuration for Tests S-05-2A and S-05-2B.

For Tests S-05-2A and S-05-2B, 33 rods of the 40-rod electrically heated core were operated at a peak power density of approximately 11.5 kW/ft, three rods (Rods D-4, E-4, and E-5) were operated at a peak power density of approximately 12.1 kW/ft to yield a slightly peaked power profile, and four rods (Rods C-3, D-5, F-3, and F-6) were unpowered to simulate the effect of control rod guide tubes. The resulting total core power was approximately 1.45 MW.

In preparation for the tests, the intact and broken loop accumulators were filled with treated demineralized water, drained to the specified initial levels, and pressurized with nitrogen to 600 psig. The system was filled with treated demineralized water and vented at strategic points to assure a liquid full system. Prior to warmup the system was pressurized to check for leakage, system instrumentation was checked, and transducer readings were initialized. Warmup to initial test conditions was accomplished with the heaters in the vessel core. Heatup of the broken loop piping was accomplished with bypass lines which served to allow circulation through the broken loop. During warmup, the purification and sampling systems were valved into the primary system to maintain water chemistry requirements and to provide a water sample at system conditions for subsequent analysis. At 100-°F temperature intervals during warmup, detector readings were sampled to allow the integrity of the measurement instrumentation and the operability of the data acquisition system to be checked.

Prior to the initial core power level being established, the pressure suppression system was pressurized to 35 psia with saturated steam from the steam supply system. After the

Fig. 2 Cross section of vessel with lower plenum filler.

core power was increased to the initial test value (1.45 MW for both tests S-05-2A and S-05-2B), initial test conditions were held for 11 minutes and 12 minutes for Test S-05-2A and Test S-05-2B, respectively, to establish equilibrium in the system. At the end of this period, all auxiliary systems including the bypass lines were isolated to prevent blowdown through those systems.

During each test, the system was successfully subjected to a simulated 200% double-ended cold leg break through two rupture assemblies and two blowdown nozzles, each having a break area of 0.00262 ft². Pressure to operate the rupture assemblies and initiate blowdown was taken from an accumulator system filled with water and pressurized to 2250 psig with gaseous nitrogen. Immediately (within 0.02 sec) after initiation of blowdown, the lines to the accumulator were again isolated. The effluent from the primary system was ejected into the pressure suppression system which was vented to maintain a constant pressure of 35 psia. For Test S-05-2A, primary pump speed was maintained constant throughout the test at the initial blowdown value at 2340 rpm. For Test S-05-2B the primary pump speed was reduced and stopped according to a programmed coastdown schedule. The programmed pump speed reduction in Test S-05-2B began approximately two seconds prior to blowdown. During the blowdown transient, power to the electrically heated core was automatically controlled to simulate the thermal response of the nuclear-heated fuel rods.

For Tests S-05-2A and S-05-2B, the coolant injection systems were arranged to discharge into both system loops at the cold leg injection points (Spools 8, 14 and 42). Coolant injection was initiated from the intact and broken loop accumulators into Spools 8 and 42 respectively, after the system depressurized to 600 psig; injection continued until the accumulators were depleted. At approximately 150 psig, the low pressure injection pumps were also started. Low pressure injection for the intact loop was into Spool 14, and in the broken loop it was into Spool 42. Coolant injection from the low pressure injection pumps continued until the tests were terminated 300 sec after initiation of blowdown.

2. INITIAL TEST CONDITIONS AND SEQUENCE OF EVENTS

Conditions in the Semiscale Mod-1 system at initiation of blowdown are given in Tables I and II; the primary system water chemistry prior to blowdown is given in Table III; and the sequence of events relative to rupture is given in Table IV.

TABLE I
CONDITIONS AT BLOWDOWN INITIATION

	<u>Measured^[a]</u>		<u>Specified</u>
	<u>Test S-05-2A</u>	<u>Test S-05-2B</u>	
Core power (MW)	1.453	1.454	1.444 $\pm$ 0.03
Intact loop cold leg fluid temperature (°F)	543	542	544 $\pm$ 2
Hot leg to cold leg temperature differential (°F)	67.5	67.6	66 $\pm$ 1
Pressurizer pressure (psia)	2263	2272	2263 $\pm$ 25
Pressurizer water level (in.) ^[b]	22.9 ^[c]	23.4 ^[c]	27.1
Steam generator feedwater temperature (°F)	437	445	435 $\pm$ 10
Steam generator liquid level (from bottom of tube sheet) (in.)	115	115	116 $\pm$ 2
Fluid temperature in broken loop (pump side) (°F)	577	572	572
Fluid temperature in broken loop (vessel side) (°F)	540	546	Not Specified
Intact loop cold leg flow (gpm)	143	142	[d]
Pressure suppression tank water level (in.)	47.5	47.5	47.5 $\pm$ 0.5
Pressure suppression tank pressure (psia)	35	35	35.5 $\pm$ 1
Pressure suppression tank water temperature (°F)	62	62 ^[e]	Ambient

[a] Measured initial conditions are taken from process instrumentation read just prior to blowdown. Those measured conditions which did not meet the specified initial conditions were considered acceptable for analysis purposes within the test objectives.

[b] Pressurizer water levels measured down from inside of top head. Levels were specified in terms of differential pressure in the liquid level measuring system.

[c] Levels shown correspond to pressurizer system volumes of 0.66 and 0.67 ft³ (including surge line) for Tests S-05-2A and S-05-2B, respectively.

[d] Flow is not specified, since it must be adjusted to achieve the required differential temperature across the core.

[e] Process instrumentation not used. Data taken from last digital scan 218 and 203 sec prior to rupture for Tests S-05-2A and S-05-2B, respectively.

TABLE II
PRIMARY COOLANT TEMPERATURE DISTRIBUTION PRIOR TO RUPTURE^[a]

	<u>Detector</u>	<u>Temperature (°F)</u>	
		<u>Test S-05-2A</u>	<u>Test S-05-2B</u>
Vessel lower plenum (upper portion above filler block)	TFV-LP-7	544	544
Intact loop hot leg (near vessel)	RBU-2	609	609
Intact loop cold leg (near pump inlet)	TFU-10	541	542
Intact loop cold leg (near vessel)	RBU-14A	542	542
Broken loop cold leg (near nozzle)	TFB-23	540	540
Broken loop hot leg (near vessel)	TFB-30	607	607
Broken loop cold leg (near nozzle)	TFB-42	599	598

[a] Data taken from final digital scan 218 and 203 sec prior to rupture for Tests S-05-2A and S-05-2B, respectively.

TABLE III
WATER CHEMISTRY PRIOR TO BLOWDOWN^[a]

	<u>Test S-05-2A</u>	<u>Test S-05-2B</u>
pH	9.80	10.3
Conductivity (μmhos/cm)	167	204
Lithium (ppm)	10	10
Chlorides (ppm)	3.4	3.3
Fluorides (ppm) ^[b]	<0.4	<0.4
Oxygen (ppm)	0.03	0.04
Total gas (cc/l)	207	94.5
Suspended solids (ppm)	0.74	0.95

[a] Water samples taken at a system pressure of about 2250 psia and a system temperature of about 540°F (cold leg).

[b] Present analytical methods prevent accurate determination of fluorides at concentrations of less than 0.4 ppm.

TABLE IV
SEQUENCE OF EVENTS DURING TEST^[a]

	<u>Time Relative to Rupture</u>	
	<u>Test S-05-2A</u>	<u>Test S-05-2B</u>
Core power level established (min)	-11	-12
Bypass lines valved out of system (sec)	-2.5	-2.5
Blowdown initiated (sec)	0	0
Pump power reduced (sec)	[b]	-2.5
ECC accumulators valved in (sec) ^[c]	0	0
Steam generator feedwater and discharge valves closed (sec)	1	1
Core power decay transient started (sec)	2.7	2.7
Low pressure injection system pumps started (sec) ^[c]	16	18
Core power tripped off (sec) ^[d]	300	300

[a] A time-controlled sequencer was used to control critical events during the test.

[b] For Test S-05-2A pump power was controlled to maintain pump speed constant throughout blowdown at the preblowdown speed.

[c] Injection from ECC accumulators and low pressure injection system pumps does not start until system pressure drops below accumulator or pump pressure, respectively.

[d] Core power tripped manually at termination of test.

III. DATA PRESENTATION

The data from Semiscale Mod-1 Tests S-05-2A and S-05-2B are presented with brief comment. Processing analysis has been performed only to the extent necessary to obtain appropriate engineering units and to assure that the data are reasonable and consistent. In all cases, in converting transducer output to engineering units, a homogeneous fluid was assumed. Further interpretation and analysis should consider that sudden decompression processes such as those occurring during blowdown may have subjected the measurement devices to nonhomogeneous fluid conditions.

The performance of the system during Test S-05-2A was monitored by 216 detectors and for Test S-05-2B by 217 detectors. The data obtained were recorded on both digital and analog data acquisition systems. The digital data were recorded at a sample rate of 57.5 points per sec. Long term plots (-20 to 300 sec) were compressed at a 20 to 1 ratio giving an effective sample rate of 2.875 points per sec. Short term plots (-6 to 42 sec) were compressed at a 3 to 1 ratio giving an effective sample rate of 19.17 points per sec. The analog system was used to provide better resolution capability (needed as input to various data analysis codes) and to provide redundancy.

The data are presented, in most instances, in the form of composite graphs to facilitate comparison of the values of given variables between the two tests. The scales selected for the graphs do not reflect the obtainable resolution of the data (the data processing techniques are described further in Reference 1).

Figures 3 through 8 and Table V provide supporting information for interpretation of the data graphs shown in Figures 9 through 580 and provide relative locations of all detectors used during Tests S-05-2A and S-05-2B. Table V groups the measurements according to measurement type; identifies the specific measurement location and the range of the detector and actual recording range of the data acquisition system; provides brief comments regarding the data; and references the measurements and comments to the corresponding figure. Figures 9 through 580 present all the blowdown and reflood data obtained. Time zero on the graphs is the time of rupture initiation. Appendix A provides information explaining data adjustments and posttest data processing for data conversion into engineering units.

Fig. 5 Semiscale Mod-1 pressure vessel -- cross section showing instrumentation.

Tests S-05-2A, S-05-2B
INEL-A-1896

Fig. 6 Semiscale Mod-1 pressure vessel -- isometric showing instrumentation.

Tests S-05-2A, S-05-2B
INEL-A-1895

Fig. 7 Semiscale Mod-1 pressure vessel -- penetrations and instrumentation.

Fig. 8 Semiscale Mod-1 heated core -- plan view.

TABLE V
DATA PRESENTATION FOR SEMISCALE MOD-1 TESTS S-05-2A AND S-05-2B

Measurement	Location and Comments [a]	Range [a]		Figure [a]	Measurement Comments [b]
		Detector	Data Acquisition System		
FLUID TEMPERATURE					
Chromel-Alumel thermocouples unless specified otherwise.					
<u>Intact Loop</u>					
RBU-2	Hot leg, Spool 2, 46 in. from vessel center (platinum resistance bulb).	0 to 2300°F	0 to 591°F	9, 10	
TSU-7	Cold leg, Spool 7, 243 in. from vessel center (shielded).		0 to 1017°F	11, 12	
TFU-10	Cold leg, Spool 10, 144 in. from vessel center.			13, 14	
RBU-14A	Cold leg, Spool 14, 43 in. from vessel center, upstream of cold leg injection port (platinum resistance bulb).	0 to 1000°F	0 to 1000°F	15, 16 17, 18	
TFU-14B	Cold leg, Spool 14, 39 in. from vessel center, downstream of cold leg injection port.			19, 20 21, 22	
<u>Broken Loop</u>					
TFB-20	Cold leg, Spool 20, 21 in. from vessel center.	0 to 2300°F	0 to 1017°F	23, 24	
TFB-23	Cold leg, Spool 23, 91 in. from vessel center, upstream of vessel-side nozzle.			25, 26	
TFB-30	Hot leg, Spool 30, 16 in. from vessel center.			27, 28	
TFB-37	Cold leg, Spool 37, 276 in. from vessel center along hot leg, discharge of simulated steam generator.			29, 30	
TFB-42	Cold leg, Spool 42, 414 in. from vessel center along hot leg, upstream of pump-side nozzle.			31, 32 33, 34	
<u>Inlet Annulus</u>					
	4 in. below cold leg centerline, 0.2 in. from vessel wall, Type J iron-constantan thermocouples.	0 to 1400°F	0 to 803°F		
TFV-ANN-4A	0°.			35, 36	
TFV-ANN-4M	180°.			37, 38	
<u>Downcomer Annulus</u>					
	Centered in annulus, Type J iron-constantan thermocouples.	0 to 1400°F	0 to 803°F		
TFV-ANN-35A	35 in. below cold leg centerline, 0°.			39, 40	
TFV-ANN-70A	70 in. below cold leg centerline, 0°.			41, 42	
TFV-ANN-115A	115 in. below cold leg centerline, 0°.			43, 44	
TFV-ANN-156A	156 in. below cold leg centerline, 0°.			45, 46	
<u>Upper Plenum</u>					
TFV-UP+13	In upper plenum, 13.5 in. above cold leg centerline at 180°.	0 to 2300°F	0 to 1017°F	47, 48	
<u>Lower Plenum</u>					
	On fluid thermocouple rack, 1 in. from vessel center, 45°.	0 to 2300°F	0 to 1017°F		
TFV-LP-2	2.0 in. above top of lower plenum filler.			49, 50	
TFV-LP-4	4.0 in. above top of lower plenum filler.			51, 52	
TFV-LP-7	7.0 in. above top of lower plenum filler.			53, 54	
<u>Core</u>					
TFV-CORE-IN	In core flow mixer box, 150 in. below cold leg centerline (a part of FDV CORE IN).	0 to 2300°F	0 to 1017°F	55, 56	

TABLE V (continued)

Measurement	Location and Comments ^[a]	Range ^[a]		Figure ^[a]	Measurement Comments ^[b]
		Detector	Data Acquisition System		
Core Grid Spacers					
<u>Grid Spacer 5</u>	55 in. below cold leg centerline, 21.5 in. above top of heated length.	0 to 2300°F	0 to 2382°F		
TFG-5CD-45	Thermocouple in space defined by Columns C and D, Rows 4 and 5.			57, 58	
<u>Grid Spacer 6</u>	76 in. below cold leg centerline, 1/2 in. above top of heated length.				
TFG-6AB-45	Thermocouple in space defined by Columns A and B, Rows 4 and 5.			59, 60	
TFG-6CD-45	Thermocouple in space defined by Columns C and D, Rows 4 and 5.			61, 62	
Core Barrel Insulation Gap					
TFV-C1G-70A	70 in. below cold leg centerline, 0°.	0 to 1400°F	0 to 803°F	63, 64	
Vessel Filler Insulation Gap					
TFV-F1G-156A	156 in. below cold leg centerline, 0°.	0 to 2300°F	0 to 1017°F	65, 66	
ECC System					
TFU-ECC-8C	In ECC line leading to Spool 8 Tap C.	0 to 2300°F	0 to 591°F	67, 68	
TFU-ECC-14	In ECC line leading to intact loop Spool 14.			69, 70	
TFB-ECC-42	In ECC line leading to broken loop Spool 42.			71, 72	
Steam Generator					
TFU-SGFW	In feedwater line leading to steam generator.	0 to 2300°F	0 to 591°F	73, 74	
TFU-SG1	Secondary side, 12 in. above bottom of tube sheet.			75, 76	
TFU-SG2	Secondary side, 24 in. above bottom of tube sheet.				Thermocouple failed.
TFU-SG3	Secondary side, 40 in. above bottom of tube sheet.			77, 78	
Pressurizer					
TFU-PRIZE	In surge line, near pressurizer exit, between turbine flowmeter and pressurizer.	0 to 2300°F	0 to 1017°F	79, 80	
Pressure Suppression System					
TF-PSS-33	33 in. from bottom of tank.	0 to 2300°F	0 to 591°F	81, 82	
TF-PSS-130	130 in. from bottom of tank.			83, 84	
MATERIAL TEMPERATURE					
Intact Loop					
TMU-1T16	Hot leg, Spool 1, top, 1/16 in. from pipe ID, 29 in. from vessel center.	0 to 2300°F	0 to 591°F	85, 86	
TMU-15T16	Cold leg, Spool 15, top, 1/16 in. from pipe ID, 17 in. from vessel center.			87, 88	Test S-05-2A had noisy thermocouple.
Broken Loop					
TMB-20B16	Cold leg, Spool 20, bottom, 1/16 in. from pipe ID, 21 in. from vessel center.	0 to 2300°F	0 to 591°F	89, 90	
TMB-30T16	Hot leg, Spool 30, top, 1/16 in. from pipe ID, 16 in. from vessel center.		0 to 1017°F	91, 92	

TABLE V (continued)

Measurement	Location and Comments ^[a]	Range ^[a]		Figure ^[a]	Measurement Comments ^[b]
		Detector	Data Acquisition System		
<u>Vessel Filler</u>	Type J iron-constantan.	0 to 1400°F	0 to 803°F		
TMV-FI-4M	4 in. below cold leg centerline, 1/16 in. from filler ID, 180°.			93, 94	Test S-05-28 thermocouple failed at t=268 sec.
TMV-FI-15A	15 in. below cold leg centerline, 1/16 in. from filler ID, 0°.			95, 96	
TMV-FI-35A	35 in. below cold leg centerline, 1/16 in. from filler ID, 0°.			97, 98	
TMV-FI-115A	115 in. below cold leg centerline, 1/16 in. from filler ID, 0°.			99, 100	
TMV-FI-156A	156 in. below cold leg centerline, 1/16 in. from filler ID, 0°.	0 to 2300°F	0 to 1017°F	101, 102	Data questionable due to secondary thermocouple junction or fluid contact (or both) with junction.
TMV-F0-156A	156 in. below cold leg centerline, 0.65 in. from filler OD, 0°.	0 to 2300°F	0 to 1017°F	103, 104	
<u>Vessel Filler Insulator</u>	Outer surface of insulator, Type J iron-constantan thermocouples.	0 to 1400°F	0 to 803°F		
TIV-F0-35A	35 in. below cold leg centerline, 0°.			105, 106	
TIV-F0-35M	35 in. below cold leg centerline, 180°.			107, 108	
TIV-F0-70A	70 in. below cold leg centerline, 0°.			109, 110	
TIV-F0-115A	115 in. below cold leg centerline, 0°.			111, 112	
<u>Core Barrel</u>	Type J iron-constantan thermocouples	0 to 1400°F	0 to 803°F		
TMV-CI-70A	70 in. below cold leg centerline, 1/16 in. from core barrel ID, 0°.			113, 114	
TMV-CI-115A	115 in. below cold leg centerline, 1/16 in. from core barrel ID, 0°.			115, 116	
TMV-CO-70A	70 in. below cold leg centerline, 1/16 in. from core barrel OD, 0°.			117, 118	
TMV-CO-115A	115 in. below cold leg centerline, 1/16 in. from core barrel OD, 0°.			119, 120	
<u>Core Housing Filler</u>		0 to 2300°F	0 to 1017°F		
TMV-HF-115W	On core housing filler, 115 in. below cold leg centerline, 0.20 in. from outer surface, 315°.			121, 122	
TMV-HF-138W	On core housing filler, 138 in. below cold leg centerline, 0.20 in. from outer surface, 315°.			123, 124	
<u>Steam Generator</u>		0 to 2300°F	0 to 591°F		
TMU-SG1	On a steam generator tube, 12 in. above bottom of tube sheet, on tube OD.			125, 126	
TMU-SG2	On a steam generator tube, 24 in. above bottom of tube sheet, on tube OD.			127, 128	
TMU-SG3	On a steam generator tube, 48 in. above bottom of tube sheet, on tube OD.			129, 130	
<u>CORE HEATER CLADDING TEMPERATURES</u>	Chromel-Alumel thermocouples.				
<u>High Power Heaters</u>		0 to 2300°F	0 to 2382°F		
TH-D4-14	Heater at Column D, Row 4. Thermocouples 14 in. (270°) and 29 in. (315°) above bottom of core.			131, 132	
TH-D4-29				133, 134	

TABLE V (continued)

Measurement	Location and Comments ^[a]	Range ^[a]		Figure ^[a]	Measurement Comments ^[b]
		Detector	Data Acquisition System		
High Power Heaters (continued)					
TH-D5-29	Heater at Column D, Row 5. Thermo-couple 29 in. (225°) above bottom of core.			135, 136	
TH-E4-09 TH-E4-28 TH-E4-55	Heater at Column E, Row 4. Thermo-couples 9 in. (180°), 28 in. (90°), and 55 in. (0°) above bottom of core.			137, 138 139, 140 141, 142	
TH-E5-25	Heater at Column E, Row 5. Thermo-couple 25 in. (90°) above bottom of core.			143, 144	
Low Power Heaters		0 to 2300°F	0 to 2382°F		
TH-A1-09 TH-A4-29 TH-A4-39	Heater at Column A, Row 4. Thermo-couples 9 in. (105°), 29 in. (240°) and 39 in. (300°) above bottom of core.			145, 146 147, 148 149, 150	
TH-A5-29 TH-A5-45	Heater at Column A, Row 5. Thermo-couples 29 in. (180°) and 45 in. (255°) above bottom of core.			151, 152 153, 154	
TH-B3-32	Heater at Column B, Row 3. Thermo-couple 32 in. (135°) above bottom of core.			155, 156	
TH-B5-29 TH-B5-33	Heater at Column B, Row 5. Thermo-couples 29 in. (150°) and 33 in. (45°) above bottom of core.			157, 158 159, 160	
TH-B6-29	Heater at Column B, Row 6. Thermo-couple 29 in. (45°) above bottom of core.			161, 162	
TH-C2-38	Heater at Column C, Row 2. Thermo-couple 38 in. (225°) above bottom of core.			163, 164	
TH-C4-20 TH-C4-53	Heater at Column C, Row 4. Thermo-couples 26 in. (75°) and 53 in. (300°) above bottom of core.			165, 166 167, 168	
TH-C5-28	Heater at Column C, Row 5. Thermo-couple 28 in. (315°) above bottom of core.			169, 170	
TH-C7-07 TH-C7-15	Heater at Column C, Row 7. Thermo-couples 7 in. (345°) and 15 in. (255°) above bottom of core.			171, 172 173, 174	
TH-D1-21	Heater at Column D, Row 1. Thermo-couple 21 in. (330°) above bottom of core.			175, 176	
TH-D2-14 TH-D2-61	Heater at Column D, Row 2. Thermo-couple 14 in. (0°) and 61 in. (270°) above bottom of core.			177, 178 179, 180	
TH-D3-29 TH-D3-39	Heater at Column D, Row 3. Thermo-couples 29 in. (150°) and 39 in. (210°) above bottom of core.			181, 182 183, 184	
TH-D6-15 TH-D6-25	Heater at Column D, Row 6. Thermo-couples 15 in. (90°) and 25 in. (255°) above bottom of core.			185, 186 187, 188	
TH-D7-20	Heater at Column D, Row 7. Thermo-couple 20 in. (60°) above bottom of core.			190, 190	
TH-D8-27 TH-D8-57	Heater at Column D, Row 8. Thermo-couples 27 in. (180°) and 57 in. (15°) above bottom of core.			191, 192 193, 194	
TH-E1-33	Heater at Column E, Row 1. Thermo-couple 33 in. (60°) above bottom of core.			195, 196	
TH-E2-20 TH-E2-33	Heater at Column E, Row 2. Thermo-couples 20 in. (210°) and 33 in. (315°) above bottom of core.			197, 198 199, 200	

TABLE V (continued)

Measurement	Location and Comments ^[a]	Range ^[a]		Figure ^[a]	Measurement Comments ^[b]
		Detector	Data Acquisition System		
TH-E3-05 TH-E3-20 TH-E3-24	Heater at Column E, Row 3. Thermocouples 5 in. (15°), 20 in. (165°), and 24 in. (75°) above bottom of core.			201, 202 203, 204 205, 206	Test S-05-2A had noisy thermocouple.
TH-E6-08 TH-E6-28 TH-E6-37	Heater at Column E, Row 6. Thermocouples 8 in. (150°), 28 in. (285°), and 37 in. (330°) above bottom of core.			207, 208 209, 210 211, 212	
TH-E7-44	Heater at Column E, Row 7. Thermocouple 44 in. (195°) above bottom of core.			213, 214	
TH-E8-14 TH-E8-29 TH-E8-45	Heater at Column E, Row 8. Thermocouples 14 in. (150°), 29 in. (225°), and 45 in. (300°) above bottom of core.			215, 216 217, 218 219, 220	
TH-F2-07 TH-F2-22 TH-F2-25	Heater at Column F, Row 2. Thermocouples 7 in. (255°), 22 in. (105°), and 25 in. (0°) above bottom of core.			221, 222 223, 224 225, 226	
TH-F4-14 TH-F4-29 TH-F4-44	Heater at Column F, Row 4. Thermocouples 14 in. (90°), 29 in. (165°), and 44 in. (210°) above bottom of core.			227, 228 229, 230 231, 232	
TH-F5-20 TH-F5-26 TH-F5-33 TH-F5-53	Heater at Column F, Row 5. Thermocouples 20 in. (255°), 26 in. (165°), 33 in. (315°), and 53 in. (30°) above bottom of core.			233, 234 235, 236 237, 238 239, 240	
TH-G3-13	Heater at Column G, Row 3. Thermocouple 13 in. (150°) above bottom of core.			241, 242	
TH-G4-29 TH-G4-33 TH-G4-38	Heater at Column G, Row 4. Thermocouples 29 in. (300°), 33 in. (225°), and 38 in. (30°) above bottom of core.			243, 244 245, 246 247, 248	
TH-G5-14 TH-G5-24	Heater at Column G, Row 5. Thermocouples 14 in. (45°) and 24 in. (330°) above bottom of core.			249, 250 251, 252	
TH-H5-32	Heater at Column H, Row 5. Thermocouple 32 in. (45°) above bottom of core.			253, 254	
PRESSURE					
<u>Intact Loop</u>		0 to 3000 psi			
PU-13	Cold leg, Spool 13, 54 in. from vessel center.		0 to 4597 psia	255, 256	
PU-15L	Cold leg, Spool 15, 16 in. from vessel center, to atmosphere (low range).	0 to 500 psi	0 to 553 psia	257, 258	Data acquisition system or detector saturated between t = -20 sec to t = 18 sec.
<u>Broken Loop</u>		0 to 3000 psi			
PB-23	Cold leg, Spool 23, 92 in. from vessel center, upstream of nozzle (tee off DP tap).		0 to 4319 psia	259, 260	
PB-37	Cold leg, Spool 37, 282 in. from vessel center along hot leg.		0 to 4358 psia	261, 262	
PB-42	Cold leg, Spool 42, 415 in. from vessel center along hot leg, upstream of pump-side nozzle (tee off DP tap).		0 to 4788 psia	263, 264	
PB-HN1	Pump-side nozzle, nozzle throat, 419 in. from vessel center along hot leg (tee off DP tap).		0 to 4623 psia	265, 266	
PB-CN1	Cold leg, Spool 23, vessel-side nozzle, nozzle throat, 96 in. from vessel center along cold leg, 45°.		0 to 2431 psia	267, 268	

TABLE V (continued)

Measurement	Location and Comments [a]	Range [a]		Figure [a]	Measurement Comments [b]
		Detector	Data Acquisition System		
<u>Vessel</u>					
PV-UP+10	In upper plenum, 10 in. above cold leg centerline, mounted on standoff, 30°.	0 to 2500 psi	0 to 3106 psia	269, 270	
PV-LP-166	In upper part of lower plenum, 166 in. below cold leg centerline, mounted on standoff, 225°.	0 to 3000 psi	0 to 2492 psia	271, 272	
<u>ECC System</u>					
PU-ACC	In intact loop accumulator.	0 to 750 psi	0 to 777 psia	273, 274	
PB-ACC	In broken loop accumulator.		0 to 746 psia	275, 276	
<u>Steam Generator</u>					
PU-SGSD	Secondary side steam dome.	0 to 3000 psi	0 to 2024 psia	277, 278	
<u>Pressurizer</u>					
PU-PRIZE	Pressurizer steam dome.	0 to 2500 psi	0 to 3180 psia	279, 280	
<u>Pressure Suppression System</u>					
P-PSS	Suppression tank top.	0 to 250 psi	0 to 347 psia	281, 282	
<u>DIFFERENTIAL PRESSURE</u>					
<u>Intact Loop</u>					
NPII-IIP-3	Upper plenum 10.5 in. above cold leg centerline at 30° to hot leg, Spool 3, 62 in. from vessel center. Upper plenum tap is approximately 2 in. above Spool 3 tap.	+50 in. water	+2.4 psid	283, 284 285, 286	Data acquisition system or detector for Test S-05-2A saturated near t=0 sec, t=33 sec, and t=42 sec.
DPU-3-7	Across steam generator, hot leg Spool 3, 62 in. from vessel center to cold leg Spool 7, 231 in. from vessel center. Spool 3 tap is approximately 18 in. above Spool 7 tap.	+500 in. water	+25 psid	287, 288	
DPU-7-8C	Steam generator outlet, cold leg Spool 7, 231 in. from vessel center, to cold leg Spool 8 Tap C, 197 in. from vessel center. Spool 7 tap is 37 in. above Spool 8 Tap C.	+50 in. water	+2.5 psid	289, 290	Test S-05-2B only.
DPU-7-10	Across steam generator, hot leg inlet, cold leg Spool 7, 231 in. from vessel center, to cold leg Spool 10, 141 in. from vessel center.	+50 in. water	+2.4 psid	291, 292 293, 294	Data acquisition system or detector for Test S-05-2A saturated near t=6 sec, and intermittently between t=22 sec, and t=42 sec.
DPU-12-10	Pump outlet to pump inlet, cold leg Spool 12, 75 in. from vessel center, to cold leg Spool 10, 141 in. from vessel center. Spool 10 tap is 10 in. below Spool 12 tap.	+50 psi	+ 50 psid	295, 296 297, 298	
DPU-12-10L	Pump outlet to pump inlet, cold leg Spool 12, 75 in. from vessel center, to cold leg Spool 10, 141 in. from vessel center. Spool 10 tap is 10 in. below Spool 12 tap (low range).	+100 in. water	+4.9 psid	299, 300 301, 302	Data acquisition system saturated in t=7 sec, and intermittently from t=22 sec to t=63 sec for Test S-05-2A, and to t=7 sec for Test S-05-2B.
DPU-12-15	Across cold leg injection point, cold leg Spool 12, 75 in. from vessel center, to cold leg Spool 15, 16 in. from vessel center.	+100 in. water	+4.8 psid	303, 304 305, 306	Data acquisition system for Test S-05-2A saturated near t=5 sec.
DPU-15-1	Cold leg to hot leg; cold leg Spool 15, 16 in. from vessel center, to hot leg Spool 1, 31 in. from vessel center. Spool 15 tap is 8.5 in. below Spool 1 tap.	+500 in. water	+25 psid	307, 308 309, 310	
DPU-15-1L	Cold leg to hot leg, cold leg Spool 15, 16 in. from vessel center, to hot leg Spool 1, 31 in. from vessel center. Spool 15 tap is 8.5 in. below Spool 1 tap (low range).	+100 in. water	+4.8 psid	311, 312 313, 314	Data acquisition system saturated intermittently from t=20 sec to t=59 sec for Test S-05-2A, and from t=20 sec to t=2.5 sec for Test S-05-2B.

TABLE V (continued)

		Range ^[a]			
Measurement	Location and Comments ^[a]	Detector	Data Acquisition System	Figure ^[a]	Measurement Comments ^[b]
<u>Intact Loop (continued)</u>					
DPU-15-IANN	Cold leg Spool 15, 16 in. from vessel center, to inlet annulus, 9 in. below cold leg centerline at 225°. Spool 15 tap is 9 in. above inlet annulus tap.	+100 in. water	+4.9 psid	315, 316 317, 318	
DPU-PRESLL	Pressurizer water level. Elevation difference between taps is 53 in. Lower tap is 3.5 in. above pressurizer exit.	+50 in. water	+2.5 psid	319, 320	
DPU-PR-4	Pressurizer bottom to Spool 4: Elevation difference between taps is 62 in. Spool 4 tap is 55 in. below pressurizer exit.	+1000 psi	+1357 psid	321, 322	
<u>Broken Loop</u>					
DPB-UP-30	Vessel upper plenum, 10.5 in. above cold leg centerline at 30°, to hot leg Spool 30, 18 in. from vessel center. Upper plenum tap is 2 in. above Spool 30 tap.	+100 in. water	+2.4 psid	323, 324 325, 326	
DPB-21-IANN	Cold leg Spool 21, 49 in. from vessel center, to vessel inlet annulus, 9 in. below cold leg centerline at 225°. Inlet annulus tap is 9 in. below Spool 21 tap.	+100 in. water	+4.8 psid	327, 328 329, 330	
DPB-30-36L	Across entire simulated steam generator assembly, hot leg Spool 30, 18 in. from vessel center, to cold leg Spool 36 lower tap, 242 in. from vessel center. Spool 30 tap is 19 in. below Spool 36 lower tap.	+500 psi	+500 psid	331, 332	
DPB-32U-36L	Across simulated steam generator orifice assembly, hot leg Spool 32 upper tap, 73 in. from vessel center, to Spool 36 lower tap, 242 in. from vessel center. Spool 32 upper tap is 16 in. above Spool 36 lower tap.	+500 psi	+500 psid	333, 334	
DPB-36L-37	Across nozzle assembly, Spool 36 lower tap, 242 in. from vessel center along hot leg, to Spool 37, 282 in. from vessel center along hot leg. Spool 37 tap is 40 in. below Spool 36 lower tap.	+50 psi	+50 psid	335, 336	Uncertainty for the data from Test S-05-28 is increased due to an offset observed in the data prior to blowdown initiation. The offset appears to be variable and to decrease with time after blowdown initiation.
DPB-37-38	Across turbine flowmeter and drag disc, cold leg Spool 37, 282 in. from vessel center along hot leg, to cold leg Spool 38, 305 in. from vessel center along hot leg. Spool 37 tap is 23 in. above Spool 38 tap.	+50 in. water	+3.2 psid	337, 338	
DPB-38-40	Across simulated pump, cold leg Spool 38, 305 in. from vessel center along hot leg, to cold leg Spool 40, 365 in. from vessel center along hot leg.	+1000 psi	+1353 psid	339, 340	
DPB-40-42	Across elbow leading to spool upstream of pump-side nozzle. Cold leg Spool 40, 365 in. from vessel center along hot leg, to Spool 42, 415 in. from vessel center along hot leg. Spool 40 tap is 40 in. below Spool 42 tap.	+50 in. water	+2.5 psid	341, 342	For Test S-05-28, data acquisition system electronic gain appears to have resulted in a multiplication of the data by a factor of 2.
<u>Vessel</u>					
DPV-UP-IANN	Upper plenum, 10.5 in. above cold leg centerline at 30° to inlet annulus, 9 in. below cold leg centerline at 225°. Elevation difference between taps is 19 in.	+300 in. water	+14.7 psid	343, 344 345, 346	
DPV-0-9GQ	Inlet annulus cold leg centerline at 90°, to 9 in. below cold leg centerline at 225°. Elevation difference between taps is 9 in.	+50 in. water	+2.6 psid	347, 348 349, 350	
DPV-9-26QQ	Inlet annulus, 9 in. below cold leg centerline at 225°, to downcomer gap, 26 in. below cold leg centerline at 225°. Elevation difference between taps is 17 in.	+50 in. water	+2.4 psid	351, 352 353, 354	

TABLE V (continued)

Measurement	Location and Comments ^[a]	Range ^[a]		Figure ^[a]	Measurement Comments ^[b]
		Detector	Data Acquisition System		
<u>Vessel (continued)</u>					
DPV-9-166QQ	Inlet annulus, 9 in. below cold leg centerline at 225°, to lower plenum, 166 in. below cold leg centerline at 225°. Elevation difference between taps is 157 in.	+300 in. water	+14.5 psid	355, 356 357, 358	
DPV-26-55QM	Across part of downcomer, 26 in. (225°), to 55 in. (180°), below cold leg centerline. Elevation difference between taps is 29 in.	+50 in. water	+2.8 psid	359, 360 361, 362	
DPV-55-110MM	Across part of downcomer, 55 in. (180°), to 110 in. (100°), below cold leg centerline. Elevation difference between taps is 55 in.	+100 in. water	+4.9 psid	363, 364 365, 366	
DPV-110-156MQ	Across part of downcomer, 110 in. (180°), to 156 in. (225°), below cold leg centerline. Elevation difference between taps is 46 in.	+100 in. water	+4.9 psid	367, 368 369, 370	
DPV-166-173QQ	Across part of lower plenum, 166 in. (225°), to 173 in. (225°), below cold leg centerline. Elevation difference between taps is 7 in.	+20 in. water	+0.98 psid	371, 372 373, 374	
DPV-166Q-UP	Lower plenum, 166 in. below cold leg centerline at 225°, to upper plenum, 10.5 in. above cold leg centerline at 30°. Elevation difference between taps is 177 in.	+300 in. water	+14.7 psid	375, 376 377, 378	
<u>Vessel Core</u>					
DPVC-89W-UP	Upper segment of active core region, 89 in. below cold leg centerline (315°), to upper plenum core tube, 10.5 in. above cold leg centerline (30°). Elevation difference between taps is 100 in.	+500 in. water	+25 psid	379, 380 381, 382	
DPVC-89-106WQ	In active core region, upper segment, 89 in. below cold leg centerline (315°), to 106 in. below cold leg centerline (225°). Elevation difference between taps is 17 in.	+50 in. water	+2.5 psid	383, 384 385, 386	Detector saturated intermittently for Test S-05-2A from t=1 sec to t=65 sec.
<u>ECC SYSTEM</u>					
DPU-ACC-TB	Top to bottom of intact loop accumulator. Elevation difference between taps is 108 in.	+500 in. water	+25 psid	387, 388	
DPB-ACC-TB	Top to bottom of broken loop accumulator tank. Elevation difference between taps is 84 in.	+50 in. water	+5.3 psid	389, 390	
<u>Steam Generator</u>					
DPU-SG-SEC	Secondary side, differential pressure taps at 45 in. and 126 in. above bottom of tube sheet. Elevation difference between taps is 81 in.	+100 in. water	+4.8 psid	391, 392	
DPU-SG-DISC	Across venturi tube, 66 in. downstream from steam generator discharge.	+500 in. water	+24.5 psid	393, 394	
VOLUMETRIC FLOW RATE	Turbine flowmeter, bidirectional.				Data acquisition system range may exceed rated detector range; however, turbine response is linear to flow rates well beyond the rated range.
<u>Intact Loop</u>					
FTU-1	Hot leg, Spool 1, 18 in. from vessel center.	+20 to +400 gpm	+1200 gpm	395, 396 397, 398	Data acquisition system saturated intermittently for Test S-05-2A from t=27 sec to t=63 sec.
FTU-9	Cold leg, Spool 9, 154 in. from vessel center.	+80 to +800 gpm	+1200 gpm	399, 400 401, 402	
FTU-13	Cold leg, Spool 13, 64 in. from vessel center.	+20 to +800 gpm	+1200 gpm	403, 404	
FTU-15	Cold leg, Spool 15, 29 in. from vessel center.	+20 to +800 gpm	+1000 gpm	407, 408 409, 410	

TABLE V (continued)

Measurement	Location and Comments ^[a]	Range ^[a]		Figure ^[a]	Measurement Comments ^[b]
		Detector	Data Acquisition System		
Broken Loop					
Schedule 160 pipe.					
FTB-21	Cold leg, Spool 21, 58 in. from vessel center; 3-in. pipe.	+20 to ±400 gpm	±1200 gpm	411, 412 413, 414	Flow indicated for Test S-05-28 prior to blowdown is not representative of physical conditions and should be zero. Data appear valid after t=0 sec.
FTB-30	Hot leg, Spool 30, 25 in. from vessel center; 3-in. pipe.	+20 to ±400 gpm	±800 gpm	415, 416 417, 418	
FTB-37	Cold leg, Spool 37, 290 in. from vessel center along hot leg; 2-in. pipe.	+20 to ±800 gpm	±800 gpm	419, 420 421, 422	
Core					
FTV-CORE-IN	Entrance to core, ~158 in. below cold leg centerline.	+20 to ±200 gpm	±900 gpm	423, 424 425, 426	Data acquisition system for Test S-05-2A saturated near t=28 sec.
ECC System					
FTU-LPIS	In line leading from LPIS pump for intact loop, 1/2-in. line.	+0.75 to ±7.5 gpm	±10 gpm	427, 428	Data acquisition system for both tests saturated from t=70 to t=88 sec.
FTB-LPIS	In line leading from LPIS pump for broken loop, 3/4-in. line.	+0.75 to ±7.5 gpm	±2 gpm	429, 430	
FTU-ACC	In line leading from intact loop accumulator, 1-in. line.	±5 to ±50 gpm	±75 gpm	431, 432	
FTB-ACC	In line leading from broken loop accumulator, 1-in. line.	±2 to ±20 gpm	±25 gpm	433, 434	
Pressurizer					
FTU-PRIZE	Surge line.	+2 to ±20 gpm	±100 gpm	435, 436	
FLUID VELOCITY					
Turbine flowmeter, bidirectional.					
Downcomer					
FTV-40A	40 in. below cold leg centerline, 0°.	+2.5 to 50 ft/sec	±50 ft/sec	437, 438 439, 440	
FTV-40M	40 in. below cold leg centerline, 180°.	+2.5 to 50 ft/sec	±50 ft/sec	441, 442 443, 444	
MOMENTUM FLUX					
Drag disc, bidirectional.					
Momentum flux reported only for -6 to 42 sec, except as noted. Drag disc data may exhibit significant temperature dependence. Drag disc data should be used only for short-term transient response.					
Intact Loop					
3-in. pipe.					
FDU-1	Hot leg, Spool 1, 29 in. from vessel center; target size 0.875 in.	±200 to ±11,500 lbm/ft-sec ²	±17,800 lbm/ft-sec ²	445, 446	Detector saturated prior to t=2 sec.
FDU-5	Hot leg, Spool 5, 100 in. from vessel center; target size 1.0 in.	±1 to ±2000 lbm/ft-sec ²	±4700 lbm/ft-sec ²	447, 448	
FDU-10	Cold leg, Spool 10, 137 in. from vessel center; target size 0.875 in.	±200 to ±104,000 lbm/ft-sec ²	±23,750 lbm/ft-sec ²	449, 450	
FDU-13	Cold leg, Spool 13, 54 in. from vessel center; target size 0.875 in.	±200 to ±14,800 lbm/ft-sec ²	±19,170 lbm/ft-sec ²	451, 452	
FDU-15	Cold leg, Spool 15, 19 in. from vessel center; target size 0.875 in.	±200 to ±14,500 lbm/ft-sec ²	±20,700 lbm/ft-sec ²	453, 454	
Broken Loop					
FDB-21	Cold leg, Spool 21, 53 in. from vessel center, 3-in. pipe; target size 0.875 in.	±200 to ±70,500 lbm/ft-sec ²	±25,000 lbm/ft-sec ²	455, 456	
FDB-23	Cold leg, Spool 23, 93 in. from vessel center, upstream of vessel side nozzle, 2-in. pipe; target size 0.406 in.	±200 to ±121,000 lbm/ft-sec ²	±144,030 lbm/ft-sec ²	457, 458	

TABLE V (continued)

		Range ^[a]			
Measurement	Location and Comments ^[a]	Detector	Data Acquisition System	Figure ^[a]	Measurement Comments ^[b]
Broken Loop (continued)					
FDB-30	Hot leg, Spool 30, 21 in. from vessel center, 3-in. pipe; target size 0.656 in.	+200 to +60,000 1bm/ft-sec ²	+47,500 1bm/ft-sec ²	459, 460	
FDB-37	Cold leg, Spool 37, 284 in. from vessel center along hot leg, steam generator outlet, vertical pipe, 2-in. pipe; target size 0.486 in.	+200 to +121,000 1bm/ft-sec ²	+248,000 1bm/ft-sec ²	461, 462	
FDB-42	Cold leg, Spool 42, 416 in. from vessel center along hot leg, upstream of pump-side nozzle, downstream of injection point, 2-in. pipe; target size 0.400 in.	+200 to +116,000 1bm/ft-sec ²	+100,500 1bm/ft-sec ²	463, 464	
Vessel					
FDV-CORE-1N	In core flow mixer box 150 in. below cold leg centerline; target size 1.0 in.	+1 to +2000 1bm/ft-sec ²	+2054 1bm/ft-sec ²	465, 466 467, 468	Figures 465 and 467 are long-term (-20 to 300 sec) plots.
DENSITY					
Intact Loop		0.1 to 100 1bm/ft ³	0 to 100 1bm/ft ³		
GU-1VR	Hot leg, Spool 1, 24 in. from vessel center, vertical.			469, 470 471, 472	
GU-1HZ	Hot leg, Spool 1, 26 in. from vessel center, horizontal.			473, 474 475, 476	
GU-5VR	Hot leg, Spool 5, 96 in. from vessel center, vertical.			477, 478 479, 480	
GU-10VR	Cold leg, Spool 10, 141 in. from vessel center, vertical.			481, 482 483, 484	
GU-13VR	Cold leg, Spool 13, 59 in. from vessel center, vertical.			485, 486 487, 488	Data values above 62.4 lbm/ft ³ do not reflect actual system density and were the result of detector photomultiplier tube nonlinearity.
GU-16VN	Cold leg, Spool 16, 22 in. from vessel center, vertical.			489, 490 491, 492	
GU-17HZ	Cold leg, Spool 17, 10 in. from vessel center, horizontal.			493, 494 495, 496	
Broken Loop		0.1 to 100 1bm/ft ³	0 to 100 1bm/ft ³		
GB-21VR	Cold leg, Spool 21, 49 in. from vessel center, vertical.			497, 498 499, 500	
GB-23VR	Cold leg, Spool 23, 92 in. from vessel center, vertical.			501, 502 503, 504	
GB-30VR	Hot leg, Spool 30, 18 in. from vessel center, vertical.			505, 506 507, 508	
GB-42VR	Cold leg, Spool 42, 415 in. from vessel center along hot leg, vertical.			509, 510 511, 512	
Vessel		0.1 to 100 1bm/ft ³	0 to 100 1bm/ft ³		
GV-COR-150HZ	Core flow mixer box, 152 in. below cold leg centerline, horizontal, 0 to 180°.			513, 514 515, 516	
GVLP-165HZ	Upper part of lower plenum, 165 in. below cold leg centerline, 1.724 in. below downcomer exit, horizontal, 0 to 100°.			517, 518 519, 520	
GVLP-172HZ	Lower plenum, 172 in. below cold leg centerline, 8.729 in. below downcomer exit, horizontal, 90 to 270°.			521, 522 523, 524	
Pressurizer					
GU-PRIZE	Surge line.	0.1 to 100 1bm/ft ³	0 to 100 1bm/ft ³	525, 526 527, 528	

TABLE V (continued)

Measurement	Location and Comments ^[a]	Range ^[a]		Figure ^[a]	Measurement Comments ^[b]
		Detector	Data Acquisition System		
MASS FLOW RATE	Mass flow rate obtained by combining density (gamma attenuation technique) with volumetric flow rate (turbine flowmeter) or momentum flux (drag disc).	Range for mass flow is determined from range of individual detectors used in calculation.			Mass flow rate reported only for -6 to 42 sec for all drag discs except FDV-CORE-IN.
<u>Intact Loop</u>					
FDU-1, GU-1VR FTU-1, GU-1VR	Hot leg, Spool 1.			529, 530 531, 532	
FDU-5, GU-5VR	Hot leg, Spool 5.			533, 534	The drag disc transducer saturated prior to t=2 sec.
FTU-9, GU-10VR	Cold leg, Spool 9.			535, 536	
FDU-10, GU-10VR	Cold leg, Spool 10.			537, 538	
FDU-13, GU-13VR FTU-13, GU-13VR	Cold leg, Spool 13.			539, 540 541, 542	Nonlinearity in the density detector system caused density data near 62.4 lbm/ft ³ to be greater than 62.4 lbm/ft ³ .
FDU-15, GU-15VR FTU-15, GU-15VR	Cold leg, Spool 15.			543, 544 545, 546	
<u>Broken Loop</u>					
FDB-21, GB-21VR FTB-21, GB-21VR	Cold leg, Spool 21.			547, 548 549, 550	
FDB-23, GB-23VR	Cold leg, Spool 23.			551, 552	
FDB-30, GB-30VR FTB-30, GB-30VR	Hot leg, Spool 30.			553, 554 555, 556	Flow prior to t=0 sec should be zero. Flow indicated by FTB-30 for Test S-05-28 is not representative of system physical conditions. Data after t=0 sec appear not to be offset.
FDB-42, GB-42VR	Cold leg, Spool 42.			557, 558	
<u>Vessel</u>					
FDV-CORE-IN, GV-COR-150HZ	Entrance to core.			559, 560 561, 562	Long-term (-20 to 300 sec) plots are also included for vessel core mass flow measurements.
FTV-CORE-IN, GV-COR-150HZ	Entrance to core.			563, 564 565, 566	Data acquisition for FTV-CORE-IN saturated intermittently near t=28 sec.
<u>Pressurizer</u>					
FTU-PRIZE GU-PRIZE	Pressurizer surge line.			567, 568	
<u>CORE CHARACTERISTICS</u>					
PWRCOR 1-1	Core power.		1600 kW	569, 570	
PWRCOR T-2	Core power.		1600 kW	571, 572	
VOLTCOR-T	Core voltage.		0 to 200 Vdc	573, 574	
AMPCOR-T	Core current.		0 to 10,000 A	575, 576	
<u>PUMP CHARACTERISTICS</u>					
PUMP-U-RPM	Pump speed.		0 to 3600 rpm	577, 578	
PUMP-U-CUR	Pump current.		0 to 25 A	579, 580	

[a] Statements at the beginning of a measurement category regarding location and comments, range, and figure apply to all subsequent measurements within the given category unless specified otherwise.

[b] Detectors which were subjected to overrange conditions during portions of the test were capable of withstanding these conditions without change in operating or measuring characteristics when the physical conditions were again within the detector range.

Fig. 9 Fluid temperature in intact loop hot leg (RBU-2), from -20 to 300 sec.

Fig. 10 Fluid temperature in intact loop hot leg (RBU-2), from -6 to 42 sec.

Fig. 11 Fluid temperature in intact loop cold leg (TSU-7), from -20 to 300 sec.

Fig. 12 Fluid temperature in intact loop cold leg (TSU-7), from -6 to 42 sec.

Fig. 13 Fluid temperature in intact loop cold leg (TFU-10), from -20 to 300 sec.

Fig. 14 Fluid temperature in intact loop cold leg (TFU-10), from -6 to 42 sec.

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Fig. 15 Fluid temperature in intact loop cold leg, Test S-05-2A (RBU-14A), from -20 to 300 sec.

Fig. 16 Fluid temperature in intact loop cold leg, Test S-05-2A (RBU-14A), from -6 to 42 sec.

Fig. 17 Fluid temperature in intact loop cold leg, Test S-05-2B (RBU-14A), from -20 to 300 sec.

Fig. 18 Fluid temperature in intact loop cold leg, Test S-05-2B (RBU-14A), from -6 to 42 sec.

Fig. 19 Fluid temperature in intact loop cold leg, Test S-05-2A (TFU-14B), from -20 to 300 sec.

Fig. 20 Fluid temperature in intact loop cold leg, Test S-05-2A (TFU-14B), from -6 to 42 sec.

Fig. 21 Fluid temperature in intact loop cold leg, Test S-05-2B (TFU-14B), from -20 to 300 sec.

Fig. 22 Fluid temperature in intact loop cold leg, Test S-05-2B (TFU-14B), from -6 to 42 sec.

Fig. 23 Fluid temperature in broken loop, vessel side (TFB-20), from -20 to 300 sec.

Fig. 24 Fluid temperature in broken loop, vessel side (TFB-20), from -6 to 42 sec.

Fig. 25 Fluid temperature in broken loop, vessel side (TFB-23), from -20 to 300 sec.

Fig. 26 Fluid temperature in broken loop, vessel side (TFB-23), from -6 to 42 sec.

Fig. 27 Fluid temperature in broken loop, pump side (TFB-30), from -20 to 300 sec.

Fig. 28 Fluid temperature in broken loop, pump side (TFB-30), from -6 to 42 sec.

Fig. 29 Fluid temperature in broken loop, pump side (TFB-37), from -20 to 300 sec.

Fig. 30 Fluid temperature in broken loop, pump side (TFB-37), from -6 to 42 sec.

Fig. 31 Fluid temperature in broken loop, pump side, Test S-05-2A (TFB-42), from -20 to 300 sec.

Fig. 32 Fluid temperature in broken loop, pump side, Test S-05-2A (TFB-42), from -6 to 42 sec.

Fig. 33 Fluid temperature in broken loop, pump side, Test S-05-2B (TFB-42), from -20 to 300 sec.

Fig. 34 Fluid temperature in broken loop, pump side, Test S-05-2B (TFB-42), from -6 to 42 sec.

Fig. 35 Fluid temperature in inlet annulus (TFV-ANN-4A), from -20 to 300 sec.

Fig. 36 Fluid temperature in inlet annulus (TFV-ANN-4A), from -6 to 42 sec.

Fig. 37 Fluid temperature in inlet annulus (TFV-ANN-4M), from -20 to 300 sec.

Fig. 38 Fluid temperature in inlet annulus (TFV-ANN-4M), from -6 to 42 sec.

Fig. 39 Fluid temperature in downcomer annulus (TFV-ANN-35A), from -20 to 300 sec.

Fig. 40 Fluid temperature in downcomer annulus (TFV-ANN-35A), from -6 to 42 sec.

Fig. 41 Fluid temperature in downcomer annulus (TFV-ANN-70A), from -20 to 300 sec.

Fig. 42 Fluid temperature in downcomer annulus (TFV-ANN-70A), from -6 to 42 sec.

Fig. 43 Fluid temperature in downcomer annulus (TFV-ANN-115A), from -20 to 300 sec.

Fig. 44 Fluid temperature in downcomer annulus (TFV-ANN-115A), from -6 to 42 sec.

Fig. 45 Fluid temperature in downcomer annulus (TFV-ANN-156A), from -20 to 300 sec.

Fig. 46 Fluid temperature in downcomer annulus (TFV-ANN-156A), from -6 to 42 sec.

Fig. 47 Fluid temperature in upper plenum (TFV-UP+13), from -20 to 300 sec.

Fig. 48 Fluid temperature in upper plenum (TFV-UP+13), from -6 to 42 sec.

Fig. 49 Fluid temperature in lower plenum (TFV-LP-2), from -20 to 300 sec.

Fig. 50 Fluid temperature in lower plenum (TFV-LP-2), from -6 to 42 sec.

Fig. 51 Fluid temperature in lower plenum (TFV-LP-4), from -20 to 300 sec.

Fig. 52 Fluid temperature in lower plenum (TFV-LP-4), from -6 to 42 sec.

Fig. 53 Fluid temperature in lower plenum (TFV-LP-7), from -20 to 300 sec.

Fig. 54 Fluid temperature in lower plenum (TFV-LP-7), from -6 to 42 sec.

Fig. 55 Fluid temperature in core inlet (TFV-CORE-IN), from -20 to 300 sec.

Fig. 56 Fluid temperature in core inlet (TFV-CORE-IN), from -6 to 42 sec.

Fig. 57 Fluid temperature in core, Grid Spacer 5 (TFG-5CD-45), from -20 to 300 sec.

Fig. 58 Fluid temperature in core, Grid Spacer 5 (TFG-5CD-45), from -6 to 42 sec.

Fig. 59 Fluid temperature in core, Grid Spacer 6 (TFG-6AB-45), from -20 to 300 sec.

Fig. 60 Fluid temperature in core, Grid Spacer 6 (TFG-6AB-45), from -6 to 42 sec.

Fig. 61 Fluid temperature in core, Grid Spacer 6 (TFG-6CD-45), from -20 to 300 sec.

Fig. 62 Fluid temperature in core, Grid Spacer 6 (TFG-6CD-45), from -6 to 42 sec.

Fig. 63 Fluid temperature in core insulation gap (TFV-CIG-70A), from -20 to 300 sec.

Fig. 64 Fluid temperature in core insulation gap (TFV-CIG-70A), from -6 to 42 sec.

Fig. 65 Fluid temperature in vessel filler insulation gap (TFV-FIG-156A), from -20 to 300 sec.

Fig. 66 Fluid temperature in vessel filler insulation gap (TFV-FIG-156A), from -6 to 42 sec.

Fig. 67 Fluid temperature in intact loop ECC injection line (TFU-ECC-8C), from -20 to 300 sec.

Fig. 68 Fluid temperature in intact loop ECC injection line (TFU-ECC-8C), from -6 to 42 sec.

Fig. 69 Fluid temperature in intact loop ECC injection line (TFU-ECC-14), from -20 to 300 sec.

Fig. 70 Fluid temperature in intact loop ECC injection line (TFU-ECC-14), from -6 to 42 sec.

Fig. 71 Fluid temperature in broken loop ECC injection line (TFB-ECC-42), from -20 to 300 sec.

Fig. 72 Fluid temperature in broken loop ECC injection line (TFB-ECC-42), from -6 to 42 sec.

Fig. 73 Fluid temperature in steam generator (TFU-SGFW), from -20 to 300 sec.

Fig. 74 Fluid temperature in steam generator (TFU-SGFW), from -6 to 42 sec.

Fig. 75 Fluid temperature in steam generator, secondary side (TFU-SG1), from -20 to 300 sec.

Fig. 76 Fluid temperature in steam generator, secondary side (TFU-SG1), from -6 to 42 sec.

Fig. 77 Fluid temperature in steam generator, secondary side (TFU-SG3), from -20 to 300 sec.

Fig. 78 Fluid temperature in steam generator, secondary side (TFU-SG3), from -6 to 42 sec.

Fig. 79 Fluid temperature in pressurizer surge line (TFU-PRIZE), from -20 to 300 sec.

Fig. 80 Fluid temperature in pressurizer surge line (TFU-PRIZE), from -6 to 42 sec.

Fig. 81 Fluid temperature in pressure suppression tank (TF-PSS-33), from -20 to 300 sec.

Fig. 82 Fluid temperature in pressure suppression tank (TF-PSS-33), from -6 to 42 sec.

Fig. 83 Fluid temperature in pressure suppression tank (TF-PSS-130), from -20 to 300 sec.

Fig. 84 Fluid temperature in pressure suppression tank (TF-PSS-130), from -6 to 42 sec.

Fig. 85 Material temperature in intact loop (TMU-1T16), from -20 to 300 sec.

Fig. 86 Material temperature in intact loop (TMU-1T16), from -6 to 42 sec.

Fig. 87 Material temperature in intact loop (TMU-15T16), from -20 to 300 sec.

Fig. 88 Material temperature in intact loop (TMU-15T16), from -6 to 42 sec.

Fig. 89 Material temperature in broken loop (TMB-20B16), from -20 to 300 sec.

Fig. 90 Material temperature in broken loop (TMB-20B16), from -6 to 42 sec.

Fig. 91 Material temperature in broken loop (TMB-30T16), from -20 to 300 sec.

Fig. 92 Material temperature in broken loop (TMB-30T16), from -6 to 42 sec.

Fig. 93 Material temperature in vessel filler (TMV-FI-4M), from -20 to 300 sec.

Fig. 94 Material temperature in vessel filler (TMV-FI-4M), from -6 to 42 sec.

Fig. 95 Material temperature in vessel filler (TMV-FI-15A), from -20 to 300 sec.

Fig. 96 Material temperature in vessel filler (TMV-FI-15A), from -6 to 42 sec.

Fig. 97 Material temperature in vessel filler (TMV-FI-35A), from -20 to 300 sec.

Fig. 98 Material temperature in vessel filler (TMV-FI-35A), from -6 to 42 sec.

Fig. 99 Material temperature in vessel filler (TMV-FI-115A), from -20 to 300 sec.

Fig. 100 Material temperature in vessel filler (TMV-FI-115A), from -6 to 42 sec.

Fig. 101 Material temperature in vessel filler (TMV-FI-156A), from -20 to 300 sec.

Fig. 102 Material temperature in vessel filler (TMV-FI-156A), from -6 to 42 sec.

Fig. 103 Material temperature in vessel filler (TMV-F0-156A), from -20 to 300 sec.

Fig. 104 Material temperature in vessel filler (TMV-F0-156A), from -6 to 42 sec.

Fig. 105 Material temperature in vessel filler insulator (TIV-F0-35A), from -20 to 300 sec.

Fig. 106 Material temperature in vessel filler insulator (TIV-F0-35A), from -6 to 42 sec.

Fig. 107 Material temperature in vessel filler insulator (TIV-F0-35M), from -20 to 300 sec.

Fig. 108 Material temperature in vessel filler insulator (TIV-F0-35M), from -6 to 42 sec.

Fig. 109 Material temperature in vessel filler insulator (TIV-F0-70A), from -20 to 300 sec.

Fig. 110 Material temperature in vessel filler insulator (TIV-F0-70A), from -6 to 42 sec.

Fig. 111 Material temperature in vessel filler insulator (TIV-F0-115A), from -20 to 300 sec.

Fig. 112 Material temperature in vessel filler insulator (TIV-F0-115A), from -6 to 42 sec.

Fig. 113 Material temperature in core barrel (TMV-CI-70A), from -20 to 300 sec.

Fig. 114 Material temperature in core barrel (TMV-CI-70A), from -6 to 42 sec.

Fig. 115 Material temperature in core barrel (TMV-CI-115A), from -20 to 300 sec.

Fig. 116 Material temperature in core barrel (TMV-CI-115A), from -6 to 42 sec.

Fig. 117 Material temperature in core barrel (TMV-CO-70A), from -20 to 300 sec.

Fig. 118 Material temperature in core barrel (TMV-CO-70A), from -6 to 42 sec.

Fig. 119 Material temperature in core barrel (TMV-CO-115A), from -20 to 300 sec.

Fig. 120 Material temperature in core barrel (TMV-CO-115A), from -6 to 42 sec.

Fig. 121 Material temperature in core housing filler (TMV-HF-115W), from -20 to 300 sec.

Fig. 122 Material temperature in core housing filler (TMV-HF-115W), from -6 to 42 sec.

Fig. 123 Material temperature in core housing filler (TMV-HF-138W), from -20 to 300 sec.

Fig. 124 Material temperature in core housing filler (TMV-HF-138W), from -6 to 42 sec.

Fig. 125 Material temperature in steam generator, secondary side (TMU-SG1), from -20 to 300 sec.

Fig. 126 Material temperature in steam generator, secondary side (TMU-SG1), from -6 to 42 sec.

Fig. 127 Material temperature in steam generator, secondary side (TMU-SG2), from -20 to 300 sec.

Fig. 128 Material temperature in steam generator, secondary side (TMU-SG2), from -6 to 42 sec.

Fig. 129 Material temperature in steam generator, secondary side (TMU-SG3), from -20 to 300 sec.

Fig. 130 Material temperature in steam generator, secondary side (TMU-SG3), from -6 to 42 sec.

Fig. 131 Core heater temperature, Rod D-4 (TH-D4-14), from -20 to 300 sec.

Fig. 132 Core heater temperature, Rod D-4 (TH-D4-14), from -6 to 42 sec.

Fig. 133 Core heater temperature, Rod D-4 (TH-D4-29), from -20 to 300 sec.

Fig. 134 Core heater temperature, Rod D-4 (TH-D4-29), from -6 to 42 sec.

Fig. 135 Core heater temperature, Rod D-5 (TH-D5-29), from -20 to 300 sec.

Fig. 136 Core heater temperature, Rod D-5 (TH-D5-29), from -6 to 42 sec.

Fig. 137 Core heater temperature, Rod E-4 (TH-E4-09), from -20 to 300 sec.

Fig. 138 Core heater temperature, Rod E-4 (TH-E4-09), from -6 to 42 sec.

Fig. 139 Core heater temperature, Rod E-4 (TH-E4-28G), from -20 to 300 sec.

Fig. 140 Core heater temperature, Rod E-4 (TH-E4-28G), from -6 to 42 sec.

Fig. 141 Core heater temperature, Rod E-4 (TH-E4-55), from -20 to 300 sec.

Fig. 142 Core heater temperature, Rod E-4 (TH-E4-55), from -6 to 42 sec.

Fig. 143 Core heater temperature, Rod E-5 (TH-E5-25), from -20 to 300 sec.

Fig. 144 Core heater temperature, Rod E-5 (TH-E5-25), from -6 to 42 sec.

Fig. 145 Core heater temperature, Rod A-4 (TH-A4-09), from -20 to 300 sec.

Fig. 146 Core heater temperature, Rod A-4 (IH-A4-09), from -6 to 42 sec.

Fig. 147 Core heater temperature, Rod A-4 (TH-A4-29), from -20 to 300 sec.

Fig. 148 Core heater temperature, Rod A-4 (TH-A4-29), from -6 to 42 sec.

Fig. 149 Core heater temperature, Rod A-4 (TH-A4-39), from -20 to 300 sec.

Fig. 150 Core heater temperature, Rod A-4 (TH-A4-39), from -6 to 42 sec.

Fig. 151 Core heater temperature, Rod A-5 (TH-A5-29), from -20 to 300 sec.

Fig. 152 Core heater temperature, Rod A-5 (TH-A5-29), from -6 to 42 sec.

Fig. 153 Core heater temperature, Rod A-5 (TH-A5-45), from -20 to 300 sec.

Fig. 154 Core heater temperature, Rod A-5 (TH-A5-45), from -6 to 42 sec.

Fig. 155 Core heater temperature, Rod B-3 (TH-B3-32), from -20 to 300 sec.

Fig. 156 Core heater temperature, Rod B-3 (TH-B3-32), from -6 to 42 sec.

Fig. 157 Core heater temperature, Rod B-5 (TH-B5-29), from -20 to 300 sec.

Fig. 158 Core heater temperature, Rod B-5 (TH-B5-29), from -6 to 42 sec.

Fig. 159 Core heater temperature, Rod B-5 (TH-B5-33), from -20 to 300 sec.

Fig. 160 Core heater temperature, Rod B-5 (TH-B5-33), from -6 to 42 sec.

Fig. 161 Core heater temperature, Rod B-6 (TH-B6-29), from -20 to 300 sec.

Fig. 162 Core heater temperature, Rod B-6 (TH-B6-29), from -6 to 42 sec.

Fig. 163 Core heater temperature, Rod C-2 (TH-C2-38), from -20 to 300 sec.

Fig. 164 Core heater temperature, Rod C-2 (TH-C2-38), from -6 to 42 sec.

Fig. 165 Core heater temperature, Rod C-4 (TH-C4-26), from -20 to 300 sec.

Fig. 166 Core heater temperature, Rod C-4 (TH-C4-26), from -6 to 42 sec.

Fig. 167 Core heater temperature, Rod C-4 (TH-C4-53), from -20 to 300 sec.

Fig. 168 Core heater temperature, Rod C-4 (TH-C4-53), from -6 to 42 sec.

Fig. 169 Core heater temperature, Rod C-5 (TH-C5-28), from -20 to 300 sec.

Fig. 170 Core heater temperature, Rod C-5 (TH-C5-28), from -6 to 42 sec.

Fig. 171 Core heater temperature, Rod C-7 (TH-C7-07), from -20 to 300 sec.

Fig. 172 Core heater temperature, Rod C-7 (TH-C7-07), from -6 to 42 sec.

Fig. 173 Core heater temperature, Rod C-7 (TH-C7-15), from -20 to 300 sec.

Fig. 174 Core heater temperature, Rod C-7 (TH-C7-15), from -6 to 42 sec.

Fig. 175 Core heater temperature, Rod D-1 (TH-D1-21), from -20 to 300 sec.

Fig. 176 Core heater temperature, Rod D-1 (TH-D1-21), from -6 to 42 sec.

Fig. 177 Core heater temperature, Rod D-2 (TH-D2-14), from -20 to 300 sec.

Fig. 178 Core heater temperature, Rod D-2 (TH-D2-14), from -6 to 42 sec.

Fig. 179 Core heater temperature, Rod D-2 (TH-D2-61), from -20 to 300 sec.

Fig. 180 Core heater temperature, Rod D-2 (TH-D2-61), from -6 to 42 sec.

Fig. 181 Core heater temperature, Rod D-3 (TH-D3-29), from -20 to 300 sec.

Fig. 182 Core heater temperature, Rod D-3 (TH-D3-29), from -6 to 42 sec.

Fig. 183 Core heater temperature, Rod D-3 (TH-D3-39), from -20 to 300 sec.

Fig. 184 Core heater temperature, Rod D-3 (TH-D3-39), from -6 to 42 sec.

Fig. 185 Core heater temperature, Rod D-6 (TH-D6-15), from -20 to 300 sec.

Fig. 186 Core heater temperature, Rod D-6 (TH-D6-15), from -6 to 42 sec.

Fig. 187 Core heater temperature, Rod D-6 (TH-D6-25), from -20 to 300 sec.

Fig. 188 Core heater temperature, Rod D-6 (TH-D6-25), from -6 to 42 sec.

Fig. 189 Core heater temperature, Rod D-7 (TH-D7-20), from -20 to 300 sec.

Fig. 190 Core heater temperature, Rod D-7 (TH-D7-20), from -6 to 42 sec.

Fig. 191 Core heater temperature, Rod D-8 (TH-D8-27), from -20 to 300 sec.

Fig. 192 Core heater temperature, Rod D-8 (TH-D8-27), from -6 to 42 sec.

Fig. 193 Core heater temperature, Rod D-8 (TH-D8-57), from -20 to 300 sec.

Fig. 194 Core heater temperature, Rod D-8 (TH-D8-57), from -6 to 42 sec.

Fig. 195 Core heater temperature, Rod E-1 (TH-E1-33), from -20 to 300 sec.

Fig. 196 Core heater temperature, Rod E-1 (TH-E1-33), from -6 to 42 sec.

Fig. 197 Core heater temperature, Rod E-2 (TH-E2-20), from -20 to 300 sec.

Fig. 198 Core heater temperature, Rod E-2 (TH-E2-20), from -6 to 42 sec.

Fig. 199 Core heater temperature, Rod E-2 (TH-E2-33), from -20 to 300 sec.

Fig. 200 Core heater temperature, Rod E-2 (TH-E2-33), from -6 to 42 sec.

Fig. 201 Core heater temperature, Rod E-3 (TH-E3-05), from -20 to 300 sec.

Fig. 202 Core heater temperature, Rod E-3 (TH-E3-05), from -6 to 42 sec.

Fig. 203 Core heater temperature, Rod E-3 (TH-E3-20), from -20 to 300 sec.

Fig. 204 Core heater temperature, Rod E-3 (TH-E3-20), from -6 to 42 sec.

Fig. 205 Core heater temperature, Rod E-3 (TH-E3-24), from -20 to 300 sec.

Fig. 206 Core heater temperature, Rod E-3 (TH-E3-24), from -6 to 42 sec.

Fig. 207 Core heater temperature, Rod E-6 (TH-E6-08), from -20 to 300 sec.

Fig. 208 Core heater temperature, Rod E-6 (TH-E6-08), from -6 to 42 sec.

Fig. 209 Core heater temperature, Rod E-6 (TH-E6-28), from -20 to 300 sec.

Fig. 210 Core heater temperature, Rod E-6 (TH-E6-28), from -6 to 42 sec.

Fig. 211 Core heater temperature, Rod E-6 (TH-E6-37), from -20 to 300 sec.

Fig. 212 Core heater temperature, Rod E-6 (TH-E6-37), from -6 to 42 sec.

Fig. 213 Core heater temperature, Rod E-7 (TH-E7-44), from -20 to 300 sec.

Fig. 214 Core heater temperature, Rod E-7 (TH-E7-44), from -6 to 42 sec.

Fig. 215 Core heater temperature, Rod E-8 (TH-E8-14), from -20 to 300 sec.

Fig. 216 Core heater temperature, Rod E-8 (TH-E8-14), from -6 to 42 sec.

Fig. 217 Core heater temperature, Rod E-8 (TH-E8-29), from -20 to 300 sec.

Fig. 218 Core heater temperature, Rod E-8 (TH-E8-29), from -6 to 42 sec.

Fig. 219 Core heater temperature, Rod E-8 (TH-E8-45), from -20 to 300 sec.

Fig. 220 Core heater temperature, Rod E-8 (TH-E8-45), from -6 to 42 sec.

Fig. 221 Core heater temperature, Rod P-2 (TH-P2-07), from -20 to 300 sec.

Fig. 222 Core heater temperature, Rod F-2 (TH-F2-07), from -6 to 42 sec.

Fig. 223 Core heater temperature, Rod F-2 (TH-F2-22), from -20 to 300 sec.

Fig. 224 Core heater temperature, Rod F-2 (TH-F2-22), from -6 to 42 sec.

Fig. 225 Core heater temperature, Rod P-2 (TH-F2-25), from -20 to 300 sec.

Fig. 226 Core heater temperature, Rod P-2 (TH-F2-25), from -6 to 42 sec.

Fig. 227 Core heater temperature, Rod F-4 (TH-F4-14), from -20 to 300 sec.

Fig. 228 Core heater temperature, Rod F-4 (TH-F4-14), from -6 to 42 sec.

Fig. 229 Core heater temperature, Rod P-4 (TH-P4-29), from -20 to 300 sec.

Fig. 230 Core heater temperature, Rod P-4 (TH-P4-29), from -6 to 42 sec.

Fig. 231 Core heater temperature, Rod P-4 (TH-P4-44), from -20 to 300 sec.

Fig. 232 Core heater temperature, Rod P-4 (TH-P4-44), from -6 to 42 sec.

Fig. 233 Core heater temperature, Rod P-5 (TH-P5-20), from -20 to 300 sec.

Fig. 234 Core heater temperature, Rod F-5 (TH-F5-20), from -6 to 42 sec.

Fig. 235 Core heater temperature, Rod P-5 (TH-P5-26), from -20 to 300 sec.

Fig. 236 Core heater temperature, Rod P-5 (TH-P5-26), from -6 to 42 sec.

Fig. 237 Core heater temperature, Rod P-5 (TH-P5-33), from -20 to 300 sec.

Fig. 238 Core heater temperature, Rod P-5 (TH-P5-33), from -6 to 42 sec.

Fig. 239 Core heater temperature, Rod P-5 (TH-P5-53), from -20 to 300 sec.

Fig. 240 Core heater temperature, Rod P-5 (TH-P5-53), from -6 to 42 sec.

Fig. 241 Core heater temperature, Rod G-3 (TH-G3-13), from -20 to 300 sec.

Fig. 242 Core heater temperature, Rod G-3 (TH-G3-13), from -6 to 42 sec.

Fig. 243 Core heater temperature, Rod G-4 (TH-G4-29), from -20 to 300 sec.

Fig. 244 Core heater temperature, Rod G-4 (TH-G4-29), from -6 to 42 sec.

Fig. 245 Core heater temperature, Rod G-4 (TH-G4-33), from -20 to 300 sec.

Fig. 246 Core heater temperature, Rod G-4 (TH-G4-33), from -6 to 42 sec.

Fig. 247 Core heater temperature, Rod G-4 (TH-G4-38), from -20 to 300 sec.

Fig. 248 Core heater temperature, Rod G-4 (TH-G4-38), from -6 to 42 sec.

Fig. 249 Core heater temperature, Rod G-5 (TH-G5-14), from -20 to 300 sec.

Fig. 250 Core heater temperature, Rod G-5 (TH-G5-14), from -6 to 42 sec.

Fig. 251 Core heater temperature, Rod G-5 (TH-G5-24), from -20 to 300 sec.

Fig. 252 Core heater temperature, Rod G-5 (TH-G5-24), from -6 to 42 sec.

Fig. 253 Core heater temperature, Rod H-5 (TH-H5-32), from -20 to 300 sec.

Fig. 254 Core heater temperature, Rod H-5 (TH-H5-32), from -6 to 42 sec.

Fig. 255 Pressure in intact loop, Spool 13 (PU-13), from -20 to 300 sec.

Fig. 256 Pressure in intact loop, Spool 13 (PU-13), from -6 to 42 sec.

Fig. 257 Pressure in intact loop, Spool 15 (PU-15L), from -20 to 300 sec.

Fig. 258 Pressure in intact loop, Spool 15 (PU-15L), from -6 to 42 sec.

Fig. 259 Pressure in broken loop, Spool 23 (PB-23), from -20 to 300 sec.

Fig. 260 Pressure in broken loop, Spool 23 (PB-23), from -6 to 42 sec.

Fig. 261 Pressure in broken loop, near break (PB-37), from -20 to 300 sec.

Fig. 262 Pressure in broken loop, near break (PB-37), from -6 to 42 sec.

Fig. 263 Pressure in broken loop, near break (PB-42), from -20 to 300 sec.

Fig. 264 Pressure in broken loop, near break (PB-42), from -6 to 42 sec.

Fig. 265 Pressure in broken loop, pump-side nozzle (PB-HN1), from -20 to 300 sec.

Fig. 266 Pressure in broken loop, pump-side nozzle (PB-HN1), from -6 to 42 sec.

Fig. 267 Pressure in broken loop, vessel-side nozzle (PB-CN1), from -20 to 300 sec.

Fig. 268 Pressure in broken loop, vessel-side nozzle (PB-CN1), from -6 to 42 sec.

Fig. 269 Pressure in vessel (PV-UP+10), from -20 to 300 sec.

Fig. 270 Pressure in vessel (PV-UP+10), from -6 to 42 sec.

Fig. 271 Pressure in vessel (PV-LP-166), from -20 to 300 sec.

Fig. 272 Pressure in vessel (PV-LP-166), from -6 to 42 sec.

Fig. 273 Pressure in intact loop accumulator (PU-ACC), from -20 to 300 sec.

Fig. 274 Pressure in intact loop accumulator (PU-ACC), from -6 to 42 sec.

Fig. 275 Pressure in broken loop accumulator (PB-ACC), from -20 to 300 sec.

Fig. 276 Pressure in broken loop accumulator (PB-ACC), from -6 to 42 sec.

Fig. 277 Pressure in steam generator, secondary side (PU-SGSD), from -20 to 300 sec.

Fig. 278 Pressure in steam generator, secondary side (PU-SGSD), from -6 to 42 sec.

Fig. 279 Pressure in pressurizer (PU-PRIZE), from -20 to 300 sec.

Fig. 280 Pressure in pressurizer (PU-PRIZE), from -6 to 42 sec.

Fig. 281 Pressure in pressure suppression tank (P-PSS), from -20 to 300 sec.

Fig. 282 Pressure in pressure suppression tank (P-PSS), from -6 to 42 sec.

Fig. 283 Differential pressure in intact loop, Test S-05-2A (DPU-UP-3), from -20 to 300 sec.

Fig. 284 Differential pressure in intact loop, Test S-05-2A (DPU-UP-3), from -6 to 42 sec.

Fig. 285 Differential pressure in intact loop, Test S-05-2B (DPU-UP-3), from -20 to 300 sec.

Fig. 286 Differential pressure in intact loop, Test S-05-2B (DPU-UP-3), from -6 to 42 sec.

Fig. 287 Differential pressure in intact loop (DPU-3-7), from -20 to 300 sec.

Fig. 288 Differential pressure in intact loop (DPU-3-7), from -6 to 42 sec.

Fig. 289 Differential pressure in intact loop, Test S-05-2B (DPU-7-8C), from -20 to 300 sec.

Fig. 290 Differential pressure in intact loop, Test S-05-2B (DPU-7-8C), from -6 to 42 sec.

Fig. 291 Differential pressure in intact loop, Test S-05-2A (DPU-7-10), from -20 to 300 sec.

Fig. 292 Differential pressure in intact loop, Test S-05-2A (DPU-7-10), from -6 to 42 sec.

Fig. 293 Differential pressure in intact loop, Test S-05-2B (DPU-7-10), from -20 to 300 sec.

Fig. 294 Differential pressure in intact loop, Test S-05-2B (DPU-7-10), from -6 to 42 sec.

Fig. 295 Differential pressure in intact loop, Test S-05-2A (DPU-12-10), from -20 to 300 sec.

Fig. 296 Differential pressure in intact loop, Test S-05-2A (DPU-12-10), from -6 to 42 sec.

Fig. 297 Differential pressure in intact loop, Test S-05-2B (DPU-12-10), from -20 to 300 sec.

Fig. 298 Differential pressure in intact loop, Test S-05-2B (DPU-12-10), from -6 to 42 sec.

Fig. 299 Differential pressure in intact loop, low range, Test S-05-2A (DPU-12-10L), from -20 to 300 sec.

Fig. 300 Differential pressure in intact loop, low range, Test S-05-2A (DPU-12-10L), from -6 to 42 sec.

Fig. 301 Differential pressure in intact loop, low range, Test S-05-2B (DPU-12-10L), from -20 to 300 sec.

Fig. 302 Differential pressure in intact loop, low range, Test S-05-2B (DPU-12-10L), from -6 to 42 sec.

Fig. 303 Differential pressure in intact loop, Test S-05-2A (DPU-12-15), from -20 to 300 sec.

Fig. 304 Differential pressure in intact loop, Test S-05-2A (DPU-12-15), from -6 to 42 sec.

Fig. 305 Differential pressure in intact loop, Test S-05-2B (DPU-12-15), from -20 to 300 sec.

Fig. 306 Differential pressure in intact loop, Test S-05-2B (DPU-12-15), from -6 to 42 sec.

Fig. 307 Differential pressure in intact loop, Test S-05-2A (DPU-15-1), from -20 to 300 sec.

Fig. 308 Differential pressure in intact loop, Test S-05-2A (DPU-15-1), from -6 to 42 sec.

Fig. 309 Differential pressure in intact loop, Test S-05-2B (DPU-15-1), from -20 to 300 sec.

Fig. 310 Differential pressure in intact loop, Test S-05-2B (DPU-15-1), from -6 to 42 sec.

Fig. 311 Differential pressure in intact loop, low range, Test S-05-2A (DPU-15-1L), from -20 to 300 sec.

Fig. 312 Differential pressure in intact loop, low range, Test S-05-2A (DPU-15-1L), from -6 to 42 sec.

Fig. 313 Differential pressure in intact loop, low range, Test S-05-2B (DPU-15-1L), from -20 to 300 sec.

Fig. 314 Differential pressure in intact loop, low range, Test S-05-2B (DPU-15-1L), from -6 to 42 sec.

Fig. 315 Differential pressure in intact loop, Test S-05-2A (DPU-15-IANN), from -20 to 300 sec.

Fig. 316 Differential pressure in intact loop, Test S-05-2A (DPU-15-IANN), from -6 to 42 sec.

Fig. 317 Differential pressure in intact loop, Test S-05-2B (DPU-15-IANN), from -20 to 300 sec.

Fig. 318 Differential pressure in intact loop, Test S-05-2B (DPU-15-IANN), from -6 to 42 sec.

Fig. 319 Differential pressure in intact loop (DPU-PRESLL), from -20 to 300 sec.

Fig. 320 Differential pressure in intact loop (DPU-PRESLL), from -6 to 42 sec.

Fig. 321 Differential pressure in intact loop (DPU-PR-4), from -20 to 300 sec.

Fig. 322 Differential pressure in intact loop (DPU-PR-4), from -6 to 42 sec.

Fig. 323 Differential pressure in broken loop, Test S-05-2A (DPB-UP-30), from -20 to 300 sec.

Fig. 324 Differential pressure in broken loop, Test S-05-2A (DPB-UP-30), from -6 to 42 sec.

Fig. 325 Differential pressure in broken loop, Test S-05-2B (DPB-UP-30), from -20 to 300 sec.

Fig. 326 Differential pressure in broken loop, Test S-05-2B (DPB-UP-30), from -6 to 42 sec.

Fig. 327 Differential pressure in broken loop, Test S-05-2A (DPB-21-IANN), from -20 to 300 sec.

Fig. 328 Differential pressure in broken loop, Test S-05-2A (DPB-21-IANN), from -6 to 42 sec.

Fig. 329 Differential pressure in broken loop, Test S-05-2B (DPB-21-IANN), from -20 to 300 sec.

Fig. 330 Differential pressure in broken loop, Test S-05-2B (DPB-21-IANN), from -6 to 42 sec.

Fig. 331 Differential pressure in broken loop (DPB-30-36L), from -20 to 300 sec.

Fig. 332 Differential pressure in broken loop (DPB-30-36L), from -6 to 42 sec.

Fig. 333 Differential pressure in broken loop (DPB-32U-36L), from -20 to 300 sec.

Fig. 334 Differential pressure in broken loop (DPB-32U-36L), from -6 to 42 sec.

Fig. 335 Differential pressure in broken loop (DPB-36L-37), from -20 to 300 sec.

Fig. 336 Differential pressure in broken loop (DPB-36L-37), from -6 to 42 sec.

Fig. 337 Differential pressure in broken loop (DPB-37-38), from -20 to 300 sec.

Fig. 338 Differential pressure in broken loop (DPB-37-38), from -6 to 42 sec.

Fig. 339 Differential pressure in broken loop (DPB-38-40), from -20 to 300 sec.

Fig. 340 Differential pressure in broken loop (DPB-38-40), from -6 to 42 sec.

Fig. 341 Differential pressure in broken loop (DPB-40-42), from -20 to 300 sec.

Fig. 342 Differential pressure in broken loop (DPB-40-42), from -6 to 42 sec.

Fig. 343 Differential pressure in vessel, Test S-05-2A (DPV-UP-IANN), from -20 to 300 sec.

Fig. 344 Differential pressure in vessel, Test S-05-2A (DPV-UP-IANN), from -6 to 42 sec.

Fig. 345 Differential pressure in vessel, Test S-05-2B (DPV-UP-IANN), from -20 to 300 sec.

Fig. 346 Differential pressure in vessel, Test S-05-2B (DPV-UP-IANN), from -6 to 42 sec.

Fig. 347 Differential pressure in vessel, Test S-05-2A (DPV-0-9GQ), from -20 to 300 sec.

Fig. 348 Differential pressure in vessel, Test S-05-2A (DPV-0-9GQ), from -6 to 42 sec.

Fig. 349 Differential pressure in vessel, Test S-05-2B (DPV-0-9GQ), from -20 to 300 sec.

Fig. 350 Differential pressure in vessel, Test S-05-2B (DPV-0-9GQ), from -6 to 42 sec.

Fig. 351 Differential pressure in vessel, Test S-05-2A (DPV-9-26QQ), from -20 to 300 sec.

Fig. 352 Differential pressure in vessel, Test S-05-2A (DPV-9-26QQ), from -6 to 42 sec.

Fig. 353 Differential pressure in vessel, Test S-05-2B (DPV-9-26QQ), from -20 to 300 sec.

Fig. 354 Differential pressure in vessel, Test S-05-2B (DPV-9-26QQ), from -6 to 42 sec.

Fig. 355 Differential pressure in vessel, Test S-05-2A (DPV-9-166QQ), from -20 to 300 sec.

Fig. 356 Differential pressure in vessel, Test S-05-2A (DPV-9-166QQ), from -6 to 42 sec.

Fig. 357 Differential pressure in vessel, Test S-05-2B (DPV-9-166QQ), from -20 to 300 sec.

Fig. 358 Differential pressure in vessel, Test S-05-2B (DPV-9-166QQ), from -6 to 42 sec.

Fig. 359 Differential pressure in vessel, Test S-05-2A (DPV-26-55QM), from -20 to 300 sec.

Fig. 360 Differential pressure in vessel, Test S-05-2A (DPV-26-55QM), from -6 to 42 sec.

Fig. 361 Differential pressure in vessel, Test S-05-2B (DPV-26-55QM), from -20 to 300 sec.

Fig 362 Differential pressure in vessel, Test S-05-2B (DPV-26-55QM), from -6 to 42 sec.

Fig. 363 Differential pressure in vessel, Test S-05-2A (DPV-55-110MM), from -20 to 300 sec.

Fig. 364 Differential pressure in vessel, Test S-05-2A (DPV-55-110MM), from -6 to 42 sec.

Fig. 365 Differential pressure in vessel, Test S-05-2B (DPV-55-110MM), from -20 to 300 sec.

Fig. 366 Differential pressure in vessel, Test S-05-2B (DPV-55-110MM), from -6 to 42 sec.

Fig. 367 Differential pressure in vessel, Test S-05-2A (DPV-110-156MQ), from -20 to 300 sec.

Fig. 368 Differential pressure in vessel, Test S-05-2A (DPV-110-156MQ), from -6 to 42 sec.

Fig. 369 Differential pressure in vessel, Test S-05-2B (DPV-110-156MQ), from -20 to 300 sec.

Fig. 370 Differential pressure in vessel, Test S-05-2B (DPV-110-156MQ), from -6 to 42 sec.

Fig. 371 Differential pressure in vessel, Test S-05-2A (DPV-166-17300), from -20 to 300 sec.

Fig. 372 Differential pressure in vessel, Test S-05-2A (DPV-166-17300), from -6 to 42 sec.

Fig. 373 Differential pressure in vessel, Test S-05-2B (DPV-166-173QQ), from -20 to 300 sec.

Fig. 374 Differential pressure in vessel, Test S-05-2B (DPV-166-173QQ), from -6 to 42 sec.

Fig. 375 Differential pressure in vessel, Test S-05-2A (DPV-166Q-UP), from -20 to 300 sec.

Fig. 376 Differential pressure in vessel, Test S-05-2A (DPV-166Q-UP), from -6 to 42 sec.

Fig. 377 Differential pressure in vessel, Test S-05-2B (DPV-166Q-UP), from -20 to 300 sec.

Fig. 378 Differential pressure in vessel, Test S-05-2B (DPV-166Q-UP), from -6 to 42 sec.

Fig. 379 Differential pressure in vessel core, Test S-05-2A (DPVC-89W-UP), from -20 to 300 sec.

Fig. 380 Differential pressure in vessel core, Test S-05-2A (DPVC-89W-UP), from -6 to 42 sec.

Fig. 381 Differential pressure in vessel core, Test S-05-2B (DPVC-89W-UP), from -20 to 300 sec.

Fig. 382 Differential pressure in vessel core, Test S-05-2B (DPVC-89W-UP), from -6 to 42 sec.

Fig. 383 Differential pressure in vessel core, Test S-05-2A (DPVC-89-106WQ), from -20 to 300 sec.

Fig. 384 Differential pressure in vessel core, Test S-05-2A (DPVC-89-106WQ), from -6 to 42 sec.

Fig. 385 Differential pressure in vessel core, Test S-05-2B (DPVC-89-106WQ), from -20 to 300 sec.

Fig. 386 Differential pressure in vessel core, Test S-05-2B (DPVC-89-106WQ), from -6 to 42 sec.

Fig. 387 Differential pressure in intact loop accumulator (DPU-ACC-TB), from -20 to 300 sec.

Fig. 388 Differential pressure in intact loop accumulator (DPU-ACC-TB), from -6 to 42 sec.

Fig. 389 Differential pressure in broken loop accumulator (DPB-ACC-TB), from -20 to 300 sec.

Fig. 390 Differential pressure in broken loop accumulator (DPB-ACC-TB), from -6 to 42 sec.

Fig. 391 Differential pressure in steam generator secondary (DPU-SG-SEC), from -20 to 300 sec.

Fig. 392 Differential pressure in steam generator secondary (DPU-SG-SEC), from -6 to 42 sec.

Fig. 393 Differential pressure across steam generator outlet orifice (DPU-SG-DISC), from -20 to 300 sec.

Fig. 394 Differential pressure across steam generator outlet orifice (DPU-SG-DISC), from -6 to 42 sec.

Fig. 395 Volumetric flow in intact loop, Test S-05-2A (FTU-1), from -20 to 300 sec.

Fig. 396 Volumetric flow in intact loop, Test S-05-2A (FTU-1), from -6 to 42 sec.

Fig. 397 Volumetric flow in intact loop, Test S-05-2B (FTU-1), from -20 to 300 sec.

Fig. 398 Volumetric flow in intact loop, Test S-05-2B (FTU-1), from -6 to 42 sec.

Fig. 399 Volumetric flow in intact loop, Test S-05-2A (FTU-9), from -20 to 300 sec.

Fig. 400 Volumetric flow in intact loop, Test S-05-2A (FTU-9), from -6 to 42 sec.

Fig. 401 Volumetric flow in intact loop, Test S-05-2B (FTU-9), from -20 to 300 sec.

Fig. 402 Volumetric flow in intact loop, Test S-05-2B (FTU-9), from -6 to 42 sec.

Fig. 403 Volumetric flow in intact loop, Test S-05-2A (FTU-13), from -20 to 300 sec.

Fig. 404 Volumetric flow in intact loop, Test S-05-2A (FTU-13), from -6 to 42 sec.

Fig. 405 Volumetric flow in intact loop, Test S-05-2B (FTU-13), from -20 to 300 sec.

Fig. 406 Volumetric flow in intact loop, Test S-05-2B (FTU-13), from -6 to 42 sec.

Fig. 407 Volumetric flow in intact loop, Test S-05-2A (FTU-15), from -20 to 300 sec.

Fig. 408 Volumetric flow in intact loop, Test S-05-2A (FTU-15), from -6 to 42 sec.

Fig. 409 Volumetric flow in intact loop, Test S-05-2B (FTU-15), from -20 to 300 sec.

Fig. 410 Volumetric flow in intact loop, Test S-05-2B (FTU-15), from -6 to 42 sec.

Fig. 411 Volumetric flow in broken loop, Test S-05-2A (FTB-21), from -20 to 300 sec.

Fig. 412 Volumetric flow in broken loop, Test S-05-2A (FTB-21), from -6 to 42 sec.

Fig. 413 Volumetric flow in broken loop, Test S-05-2B (FTB-21), from -20 to 300 sec.

Fig. 414 Volumetric flow in broken loop, Test S-05-2B (FTB-21), from -6 to 42 sec.

Fig. 415 Volumetric flow in broken loop, Test S-05-2A (FTB-30), from -20 to 300 sec.

Fig. 416 Volumetric flow in broken loop, Test S-05-2A (FTB-30), from -6 to 42 sec.

Fig. 417 Volumetric flow in broken loop, Test S-05-2B (FTB-30), from -20 to 300 sec.

Fig. 418 Volumetric flow in broken loop, Test S-05-2B (FTB-30), from -6 to 42 sec.

Fig. 419 Volumetric flow in broken loop, Test S-05-2A (FTB-37), from -20 to 300 sec.

Fig. 420 Volumetric flow in broken loop, Test S-05-2A (FTB-37), from -6 to 42 sec.

Fig. 421 Volumetric flow in broken loop, Test S-05-2B (FTB-37), from -20 to 300 sec.

Fig. 422 Volumetric flow in broken loop, Test S-05-2B (FTB-37), from -6 to 42 sec.

Fig. 423 Volumetric flow in core entrance, Test S-05-2A (FTV-CORE-IN), from -20 to 300 sec.

Fig. 424 Volumetric flow in core entrance, Test S-05-2A (FTV-CORE-IN), from -6 to 42 sec.

Fig. 425 Volumetric flow in core entrance, Test S-05-2B (FTV-CORE-IN), from -20 to 300 sec.

Fig. 426 Volumetric flow in core entrance, Test S-05-2B (FTV-CORE-IN), from -6 to 42 sec.

Fig. 427 Volumetric flow in intact loop low pressure injection line (FTU-LPIS), from -20 to 300 sec.

Fig. 428 Volumetric flow in intact loop low pressure injection line (FTU-LPIS), from -6 to 42 sec.

Fig. 429 Volumetric flow in broken loop low pressure injection line (FTB-LPIS), from -20 to 300 sec.

Fig. 430 Volumetric flow in broken loop low pressure injection line (FTB-LPIS), from -6 to 42 sec.

Fig. 431 Volumetric flow in intact loop accumulator discharge line (FTU-ACC), from -20 to 300 sec.

Fig. 432 Volumetric flow in intact loop accumulator discharge line (FTU-ACC), from -6 to 42 sec.

Fig. 433 Volumetric flow in broken loop accumulator discharge line (FTB-ACC), from -20 to 300 sec.

Fig. 434 Volumetric flow in broken loop accumulator discharge line (FTB-ACC), from -6 to 42 sec.

Fig. 435 Volumetric flow from pressurizer (FTU-PRIZE), from -20 to 300 sec.

Fig. 436 Volumetric flow from pressurizer (FTU-PRIZE), from -6 to 42 sec.

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Fig. 437 Fluid velocity in vessel, Test S-05-2A (FTV-40A), from -20 to 300 sec.

Fig. 438 Fluid velocity in vessel, Test S-05-2A (FTV-40A), from -6 to 42 sec.

Fig. 439 Fluid velocity in vessel, Test S-05-2B (FTV-40A), from -20 to 300 seconds.

Fig. 440 Fluid velocity in vessel, Test S-05-2B (FTV-40A), from -6 to 42 sec.

Fig. 441 Fluid velocity in vessel, Test S-05-2A (FTV-40M), from -20 to 300 sec.

Fig. 442 Fluid velocity in vessel, Test S-05-2A (FTV-40M), from -6 to 42 sec.

Fig. 443 Fluid velocity in vessel, Test S-05-2B (FTV-40M), from -20 to 300 sec.

Fig. 444 Fluid velocity in vessel, Test S-05-2B (FTV-40M), from -6 to 42 sec.

Fig. 445 Momentum flux in intact loop, Test S-05-2A (FDU-1), from -6 to 42 sec.

Fig. 446 Momentum flux in intact loop, Test S-05-2B (FDU-1), from -6 to 42 sec.

Fig. 447 Momentum flux in intact loop, Test S-05-2A (FDU-5), from -6 to 42 sec.

Fig. 448 Momentum flux in intact loop, Test S-05-2B (FDU-5), from -6 to 42 sec.

Fig. 449 Momentum flux in intact loop, Test S-05-2A (FDU-10), from -6 to 42 sec.

Fig. 450 Momentum flux in intact loop, Test S-05-2B (FDU-10), from -6 to 42 sec.

Fig. 451 Momentum flux in intact loop, Test S-05-2A (FDU-13), from -6 to 42 sec.

Fig. 452 Momentum flux in intact loop, Test S-05-2B (FDU-13), from -6 to 42 sec.

Fig. 453 Momentum flux in intact loop, Test S-05-2A (FDU-15), from -6 to 42 sec.

Fig. 454 Momentum flux in intact loop, Test S-05-2B (FDU-15), from -6 to 42 sec.

Fig. 455 Momentum flux in broken loop, Test S-05-2A (FDB-21), from -6 to 42 sec.

Fig. 456 Momentum flux in broken loop, Test S-05-2B (FDB-21), from -6 to 42 sec.

Fig. 457 Momentum flux in broken loop, Test S-05-2A (FDB-23), from -6 to 42 sec.

Fig. 458 Momentum flux in broken loop, Test S-05-2B (FDB-23), from -6 to 42 sec.

Fig. 459 Momentum flux in broken loop, Test S-05-2A (FDB-30), from -6 to 42 sec.

Fig. 460 Momentum flux in broken loop, Test S-05-2B (FDB-30), from -6 to 42 sec.

Fig. 461 Momentum flux in broken loop, Test S-05-2A (FDB-37), from -6 to 42 sec.

Fig. 462 Momentum flux in broken loop, Test S-05-2B (FDB-37), from -6 to 42 sec.

Fig. 463 Momentum flux in broken loop, Test S-05-2A (FDB-42), from -6 to 42 sec.

Fig. 464 Momentum flux in broken loop, Test S-05-2B (FDB-42), from -6 to 42 sec.

Fig. 465 Momentum flux in core entrance, Test S-05-2A (FDV-CORE-IN), from -20 to 300 sec.

Fig. 466 Momentum flux in core entrance, Test S-05-2A (FDV-CORE-IN), from -6 to 42 sec.

Fig. 467 Momentum flux in core entrance, Test S-05-2B (FDV-CORE-IN), from -20 to 300 sec.

Fig. 468 Momentum flux in core entrance, Test S-05-2B (FDV-CORE-IN), from -6 to 42 sec.

Fig. 469 Density in intact loop, Test S-05-2A (GU-1VR), from -20 to 300 sec.

Fig. 470 Density in intact loop, Test S-05-2A (GU-1VR), from -6 to 42 sec.

Fig. 471 Density in intact loop, Test S-05-2B (GU-1VR), from -20 to 300 sec.

Fig. 472 Density in intact loop, Test S-05-2B (GU-1VR), from -6 to 42 sec.

Fig. 473 Density in intact loop, Test S-05-2A (GU-1HZ), from -20 to 300 sec.

Fig. 474 Density in intact loop, Test S-05-2A (GU-1HZ), from -6 to 42 sec.

Fig. 475 Density in intact loop, Test S-05-2B (GU-1HZ), from -20 to 300 sec.

Fig. 476 Density in intact loop, Test S-05-2B (GU-1HZ), from -6 to 42 sec.

Fig. 477 Density in intact loop, Test S-05-2A (GU-5VR), from -20 to 300 sec.

Fig. 478 Density in intact loop, Test S-05-2A (GU-5VR), from -6 to 42 sec.

Fig. 479 Density in intact loop, Test S-05-2B (GU-5VR), from -20 to 300 sec.

Fig. 480 Density in intact loop, Test S-05-2B (GU-5VR), from -6 to 42 sec.

Fig. 481 Density in intact loop, Test S-05-2A (GU-10VR), from -20 to 300 sec.

Fig. 482 Density in intact loop, Test S-05-2A (GU-10VR), from -6 to 42 sec.

Fig. 483 Density in intact loop, Test S-05-2B (GU-10VR), from -20 to 300 sec.

Fig. 484 Density in intact loop, Test S-05-2B (GU-10VR), from -6 to 42 sec.

Fig. 485 Density in intact loop, Test S-05-2A (GU-13VR), from -20 to 300 sec.

Fig. 486 Density in intact loop, Test S-05-2A (GU-13VR), from -6 to 42 sec.

Fig. 487 Density in intact loop, Test S-05-2B (GU-13VR), from -20 to 300 sec.

Fig. 488 Density in intact loop, Test S-05-2B (GU-13VR), from -6 to 42 sec.

Fig. 489 Density in intact loop, Test S-05-2A (GU-15VR), from -20 to 300 sec.

Fig. 490 Density in intact loop, Test S-05-2A (GU-15VR), from -6 to 42 sec.

Fig. 491 Density in intact loop, Test S-05-2B (GU-15VR), from -20 to 300 sec.

Fig. 492 Density in intact loop, Test S-05-2B (GU-15VR), from -6 to 42 sec.

Fig. 493 Density in intact loop, Test S-05-2A (GU-15HZ), from -20 to 300 sec.

Fig. 494 Density in intact loop, Test S-05-2A (GU-15HZ), from -6 to 42 sec.

Fig. 495 Density in intact loop, Test S-05-2B (GU-15HZ), from -20 to 300 sec.

Fig. 496 Density in intact loop, Test S-05-2B (GU-15HZ), from -6 to 42 sec.

Fig. 497 Density in broken loop, Test S-05-2A (GB-21VR), from -20 to 300 sec.

Fig. 498 Density in broken loop, Test S-05-2A (GB-21VR), from -6 to 42 sec.

Fig. 499 Density in broken loop, Test S-05-2B (GB-21VR), from -20 to 300 sec.

Fig. 500 Density in broken loop, Test S-05-2B (GB-21VR), from -6 to 42 sec.

Fig. 501 Density in broken loop, Test S-05-2A (GB-23VR), from -20 to 300 sec.

Fig. 502 Density in broken loop, Test S-05-2A (GB-23VR), from -6 to 42 sec.

Fig. 503 Density in broken loop, Test S-05-2B (GB-23VR), from -20 to 300 sec.

Fig. 504 Density in broken loop, Test S-05-2B (GB-23VR), from -6 to 42 sec.

Fig. 505 Density in broken loop, Test S-05-2A (GB-30VR), from -20 to 300 sec.

Fig. 506 Density in broken loop, Test S-05-2A (GB-30VR), from -6 to 42 sec.

Fig. 507 Density in broken loop, Test S-05-2B (GB-30VR), from -20 to 300 sec.

Fig. 508 Density in broken loop, Test S-05-2B (GB-30VR), from -6 to 42 seconds.

Fig. 509 Density in broken loop, Test S-05-2A (GB-42VR), from -20 to 300 seconds.

Fig. 510 Density in broken loop, Test S-05-2A (GB-42VR), from -6 to 42 sec.

Fig. 511 Density in broken loop, Test S-05-2B (GB-42VR), from -20 to 300 sec.

Fig. 512 Density in broken loop, Test S-05-2B (GB-42VR), from -6 to 42 sec.

Fig. 513 Density in vessel, Test S-05-2A (GV-COR-150HZ), from -20 to 300 sec.

Fig. 514 Density in vessel, Test S-05-2A (GV-COR-150HZ), from -6 to 42 sec.

Fig. 515 Density in vessel, Test S-05-2B (GV-COR-150HZ), from -20 to 300 sec.

Fig. 516 Density in vessel, Test S-05-2B (GV-COR-150HZ), from -6 to 42 sec.

Fig. 517 Density in vessel, Test S-05-2A (GVLP-165HZ); from -20 to 300 sec.

Fig. 518 Density in vessel, Test S-05-2A (GVLP-165HZ), from -6 to 42 sec.

Fig. 519 Density in vessel, Test S-05-2B (GVLP-165HZ), from -20 to 300 sec.

Fig. 520 Density in vessel, Test S-05-2B (GVLP-165HZ), from -6 to 42 sec.

Fig. 521 Density in vessel, Test S-05-2A (GVLP-172HZ), from -20 to 300 sec.

Fig. 522 Density in vessel, Test S-05-2A (GVLP-172HZ), from -6 to 42 sec.

Fig. 523 Density in vessel, Test S-05-2B (GVLP-172HZ), from -20 to 300 sec.

Fig. 524 Density in vessel, Test S-05-2B (GVLP-172HZ), from -6 to 42 sec.

Fig. 525 Density in pressurizer, Test S-05-2A (GU-PRIZE), from -20 to 300 sec.

Fig. 526 Density in pressurizer, Test S-05-2A (GU-PRIZE), from -6 to 42 sec.

Fig. 527 Density in pressurizer, Test S-05-2B (GU-PRIZE), from -20 to 300 sec.

Fig. 528 Density in pressurizer, Test S-05-2B (GU-PRIZE), from -6 to 42 sec.

Fig. 529 Mass flow in intact loop, Test S-05-2A (FDU-1, GU-1VR), from -6 to 42 sec.

Fig. 530 Mass flow in intact loop, Test S-05-2B (FDU-1, GU-1VR), from -6 to 42 sec.

Fig. 531 Mass flow in intact loop, Test S-05-2A (FTU-1, GU-1VR), from -6 to 42 sec.

Fig. 532 Mass flow in intact loop, Test S-05-2B (FTU-1, GU-1VR), from -6 to 42 sec.

Fig. 533 Mass flow in intact loop, Test S-05-2A (FDU-5, GU-5VR), from -6 to 42 sec.

Fig. 534 Mass flow in intact loop, Test S-05-2B (FDU-5, GU-5VR), from -6 to 42 sec.

Fig. 535 Mass flow in intact loop, Test S-05-2A (FTU-9, GU-10VR) from -6 to 42 sec.

Fig. 536 Mass flow in intact loop, Test S-05-2B (FTU-9, GU-10VR), from -6 to 42 sec.

Fig. 537 Mass flow in intact loop, Test S-05-2A (FDU-10, GU-10VR), from -6 to 42 sec.

Fig. 538 Mass flow in intact loop, Test S-05-2B (FDU-10, GU-10VR), from -6 to 42 sec.

Fig. 539 Mass flow in intact loop, Test S-05-2A (FDU-13, GU-13VR), from -6 to 42 sec.

Fig. 540 Mass flow in intact loop, Test S-05-2B (FDU-13, GU-13VR), from -6 to 42 sec.

Fig. 541 Mass flow in intact loop, Test S-05-2A (FTU-13, GU-13VR), from -6 to 42 sec.

Fig. 542 Mass flow in intact loop, Test S-05-2B (FTU-13, GU-13VR), from -6 to 42 sec.

Fig. 543 Mass flow in intact loop, Test S-05-2A (FDU-15, GU-15VR), from -6 to 42 sec.

Fig. 544 Mass flow in intact loop, Test S-05-2B (FDU-15, GU-15VR), from -6 to 42 sec.

Fig. 545 Mass flow in intact loop, Test S-05-2A (FTU-15, GU-15VR), from -6 to 42 sec.

Fig. 546 Mass flow in intact loop, Test S-05-2B (FTU-15, GU-15VR), from -6 to 42 sec.

Fig. 547 Mass flow in broken loop, Test S-05-2B (FDB-21, GB-21VR), from -6 to 42 sec.

Fig. 548 Mass flow in broken loop, Test S-05-2B (FDB-21, GB-21VR), from -6 to 42 sec.

Fig. 549 Mass flow in broken loop, Test S-05-2A (FTB-21, GB-21VR), from -6 to 42 sec.

Fig. 550 Mass flow in broken loop, Test S-05-2B (FTB-21, GB-21VR), from -6 to 42 sec.

Fig. 551 Mass flow in broken loop, Test S-05-2A (FDB-23, GB-23VR), from -6 to 42 sec.

Fig. 552 Mass flow in broken loop, Test S-05-2B (FDB-23, GB-23VR), from -6 to 42 sec.

Fig. 553 Mass flow in broken loop, Test S-05-2A (FDB-30, GB-30VR), from -6 to 42 sec.

Fig. 554 Mass flow in broken loop, Test S-05-2B (FDB-30, GB-30VR), from -6 to 42 sec.

Fig. 555 Mass flow in broken loop, Test S-05-2A (FTB-30, GB-30VR), from -6 to 42 sec.

Fig. 556 Mass flow in broken loop, Test S-05-2B (FTB-30, GB-30VR), from -6 to 42 sec.

Fig. 557 Mass flow in broken loop, Test S-05-2A (FDB-42, GB-42VR), from -6 to 42 sec.

Fig. 558 Mass flow in broken loop, Test S-05-2B (FDB-42, GB-42VR), from -6 to 42 sec.

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Fig. 559 Mass flow in vessel, Test S-05-2A (FDV-CORE-IN, GV-COR-150HZ), from -20 to 300 sec.

Fig. 560 Mass flow in vessel, Test S-05-2A (FDV-CORE-IN, GV-COR-150HZ), from -6 to 42 sec.

Fig. 561 Mass flow in vessel, Test S-05-2B (FDV-CORE-IN, GV-COR-150HZ), from -20 to 300 sec.

Fig. 562 Mass flow in vessel, Test S-05-2B (FDV-CORE-IN, GV-COR-150HZ) from -6 to 42 sec.

Fig. 563 Mass flow in vessel, Test S-05-2A (FTV-CORE-IN, GV-COR-150HZ), from -20 to 300 sec.

Fig. 564 Mass flow in vessel, Test S-05-2A (FTV-CORE-IN, GV-COR-150HZ), from -6 to 42 sec.

Fig. 565 Mass flow in vessel, Test S-05-2B (FTV-CORE-IN, GV-COR-150HZ), from -20 to 300 sec.

Fig. 566 Mass flow in vessel, Test S-05-2B (FTV-CORE-IN, GV-COR-150HZ), from -6 to 42 sec.

Fig. 567 Mass flow in pressurizer surge line, Test S-05-2A (FTU-PRIZE, GU-PRIZE) from -6 to 42 sec.

Fig. 568 Mass flow in pressurizer surge line, Test S-05-2B (FTU-PRIZE, GU-PRIZE) from -6 to 42 sec.

Fig. 569 Core heater rod total power (PWRCOR T-1), from -20 to 300 sec.

Fig. 570 Core heater rod total power (PWRCOR T-1), from -6 to 42 sec.

Fig. 571 Core heater rod total power (PWRCOR T-2), from -20 to 300 sec.

Fig. 572 Core heater rod total power (PWRCOR T-2), from -6 to 42 sec.

Fig. 573 Core heater voltage (VOLT COR-T), from -20 to 300 sec.

Fig. 574 Core heater voltage (VOLT COR-T), from -6 to 42 sec.

Fig. 575 Core heater current (AMPCOR-T), from -20 to 300 sec.

Fig. 576 Core heater current (AMPCOR-T), from -6 to 42 sec.

Fig. 577 Primary pump speed (PUMPU-RPM), from -20 to 300 sec.

Fig. 578 Primary pump speed (PUMPU-RPM), from -6 to 42 sec.

Fig. 579 Primary pump current (PUMPU-CUR), from -20 to 300 sec.

Fig. 580 Primary pump current (PUMPU-CUR), from -6 to 42 sec.

IV. REFERENCE

1. E. M. Feldman and D. J. Olson, *Semiscale Mod-1 Program and System Description for the Blowdown Heat Transfer Tests (Test Series 2)*, ANCR-1230 (August 1975).

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APPENDIX A

POSTTEST ADJUSTMENTS TO DATA FROM

SEMISCALE MOD-1 TESTS S-05-2A AND S-05-2B

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APPENDIX A

POSTTEST ADJUSTMENTS TO DATA FROM

SEMISCALE MOD-1 TESTS S-05-2A AND S-05-2B

Many of the transducers used in the Semiscale Mod-1 system exhibit significant sensitivity to one or more spurious inputs. Strain gage bridge circuits used in pressure transducers, differential pressure transducers, and drag discs are sensitive to changes in ambient temperature. Differential pressure cells are also sensitive to changes in system pressure. Photomultiplier tubes used as gamma ray detectors in the density transducers are sensitive to temperature changes, as well as to random variations in the locations of the radiation sources. Core power measurements depend on a calibrated resistor, which changes in value as a function of time and power level as it heats up.

Although the errors introduced into the data by spurious secondary inputs generally do not exceed the specified error ranges of the transducers, significant improvement in measurement accuracy can be achieved if the secondary sensitivity can be identified and removed. In the case of the drag discs, corrections are absolutely necessary because the signal due to temperature fluctuations can exceed that due to flow by several hundred percent. Since the exact values of the spurious inputs to which different transducers might be sensitive cannot often be easily predicted and are sometimes inconvenient to measure, secondary effects have been accounted for by correcting the data after the test rather than by using elaborate real time programs in the data acquisition system computer. The methods and results of the posttest data correction analysis for Tests S-05-2A and S-05-2B are presented in the following paragraphs and tables.

1. PRESSURE MEASUREMENTS

Corrections to pressure transducer measurements in the main system loop are based on data taken from the standard reference (Heise) gage at Spool 4, taken 15 sec before initiation of blowdown and 300 sec after initiation of blowdown. The pressure readings are adjusted to account for pressure variations around the main loop, using the readings of nearby differential pressure cells. A linear correction is then applied to the pressure data to match the data to the calculated reference data at the two specified time points.

Correction of the steam generator secondary pressure (PU-SGSD) measurement is done in the same manner as for the main loop pressures using a Heise gage installed expressly for this purpose.

Pressure measurement corrections are performed using the data acquisition system (DAS) computer using the following equation:

$$F'(t) = C_0 + C_1 [F(t)]$$

where

$F'(t)$ = corrected data

$F(t)$ = raw data

C_0 = offset

C_1 = scaling factor.

The exact values of C_0 and C_1 are given in Table A-I.

TABLE A-1
CONSTANTS FOR PRESSURE MEASUREMENT CORRECTIONS

Detector Identification	Test S-05-2A		Test S-05-2B	
	C_0	C_1	C_0	C_1
PU-13	20.4	0.9746	9.3	0.9983
PU-SGSD	-13.8	0.9928	-81.6	1.039
PV UP+10	8.0	0.9971	10.6	0.9988
PU-PRIZE	1.2	0.9991	13.1	0.9976
PB-CN1	1.5	0.9973		
PB-23	-4.3	1.0026		
PR-42	11.1	0.9977		
PB-HN1	8.6	0.9964	10.8	0.9990
PB-37	3.8	0.9981		
PV-LP-166	7.1	0.9970		

2. DIFFERENTIAL PRESSURE MEASUREMENTS

Pressure sensitivity in the differential pressure cells in the main system loop is determined from the pretest system pressure check. Digital data are recorded for all measurements at ambient temperature, with no system flow, at pressures of ambient, 200, 500, 1000, 1500, 2000, and 2250 psig. The output of the differential pressure cells is plotted against system pressure, with the resulting plots used to describe the pressure response of the transducers.

The response of the differential pressure cells due to ambient temperature is determined from a digital data scan taken at 500°F and 1750 psig, with no system flow. The measured transducer outputs are corrected for pressure and compared with the values calculated due only to the density difference between the water inside the loop (500°F) and outside the loop in the sense lines (80 to 100°F).

The difference between the measured pressure corrected value and the calculated value is the thermal drift. After the data scan at 500°F is made, no more opportunities exist to obtain data with the pump stopped and the system full of liquid; therefore, for lack of later data, the thermal drift calculated from the 500°F is assumed to be constant throughout the test.

For some differential pressure measurements, the data scan at 500°F cannot be used as a reference for thermal drift, so other references are used. The liquid level measurements in the intact loop accumulator (DPU-ACC-TB), broken loop accumulator (DPB-ACC-TB), and pressurizer (DPU-PRESLL) are referenced to calculated values based on geometrical considerations at the time when gas flow from the respective vessel is first noted. The reading from the steam generator discharge venturi (DPU-SGDISC) is shifted to read zero after flow is stopped. The steam generator secondary liquid level measurement (DPU-SG-SEC) is shifted to match the output of the process instrumentation prior to blowdown.

In correcting differential pressure data for pressure sensitivity, the corrections are calculated for various times during the test by referring to nearby system pressure transducers. The thermal drift correction is then added to each pressure sensitivity correction and the combined value is added to the raw data using a computer program that linearly interpolates the corrections between the specified time points. The corrections are performed according to the following equations:

$$F'(t) = KF(t) + C_i \text{ for } t < t_i \text{ or when no } t_i \text{ are listed}$$

for time points t , where $t \leq t \leq t_n$

$$F'(t) = KF(t) + C_i + \frac{t - t_i}{t_{i+1} - t_i} (C_{i+1} - C_i) \text{ for } t_i \leq t \leq t_{i+1}$$

and where i takes on values 1 to $n-1$

$$F'(t) = KF(t) + C_n \text{ for } t > t_n$$

where

t = time

$F'(t)$ = corrected data

$F(t)$ = raw data

K = scaling factor

C_i and t_i = corrections and time points.

The exact values of the constants are given in Table A-II.

TABLE A-II
CONSTANTS FOR DIFFERENTIAL PRESSURE
MEASUREMENT CORRECTIONS

(TEST S-05-2A)

Detector Identification	K	C_1	t_1	C_2	t_2	C_3	t_3
DPB-ACC-TB	1	0.058					
DPU-ACC-TB	1	0.580					
DPU-SG-DISC	1	-0.5					
DPB-30-36L	1	2.441	0	1.191	0.01	-1.910	30
DPU-PRESLL	1	-0.075					
DPU-SG-SEC	1	0.050					
DPB-32U-36L	1	2.588	0	1.438	0.01	-1.812	30
DPV-UP-IANN	1	2.202	0	0.125	0.01	-0.015	30
DPB-37-38	1	-0.182	0	-0.174	0.01	-0.174	30
DPB-38-40	-1[a]						
DPB-40-42	1	-0.075	0	-0.064	0.01	-0.037	30
DPU-PR-4	1	-2.888	0	-1.438	0.01	1.112	30
DPV-26-55QM	1	-0.112	0	-0.037	0.01	0.098	30
DPU-7-10	1	0.051	0	0.057	0.01	0.070	30
DPVC-89W-UP	1	-0.967	0	-0.976	0.01	-0.938	30
DPVC-89-106WQ	1	0.080	0	0.110	0.01	0.700	30
DPV-166Q-UP	1	-0.484	0	-0.498	0.01	-0.498	30

TABLE A-II (continued)

(TEST S-05-2B)

Detector Identification	K	C_1	t_1	C_2	t_2	C_3	t_3
DPB-ACC-TB	1	0.600					
DPU-ACC-TB	1	-0.030					
DPB-30-36L	1	2.340	0	1.240	0.01	-1.810	30
DPU-PRESLL	1	0.005					
DPU-SG-SEC	1	-0.563					
DPB-32U-36L	1	3.630	0	1.230	0.01	-2.370	30
DPV-UP-IANN	1	0.300	0	0.185	0.01	0.035	30
DPB-37-38	1	-0.156	0	-0.148	0.01	-0.131	30
DPB-38-40	-1[a]						
DPB-40-42	1	-0.089	0	-0.078	0.01	-0.062	30
DPB-PR-4	1	-6.270	0	-4.770	0.01	-2.770	30
DPV-26-55QM	1	-0.112	0	-0.037	0.01	0.098	30
DPU-7-10	1	0.066	0	0.073	0.01	0.089	30
DPVC-89W-UP	1	-0.943	0	-1.052	0.01	-1.267	30
DPVC-9-166QQ	1	0.318	0	0.188	0.01	-0.172	30
DPVC-89-106WQ	1	0.074	0	0.079	0.01	0.039	30
DPV-166Q-UP	1	-0.390					

[a] Patch panel connections were reversed.

3. MOMENTUM FLUX MEASUREMENTS (DRAG DISCS)

The temperature sensitivity of drag discs is determined from pretest warmup data taken at 200 and 500°F with no system flow. The temperature sensitivity is removed from the data before the data are converted to momentum flux. The temperature of each transducer is taken from the signal of a nearby fluid or metal temperature thermocouple. Slight corrections for errors in setting the transducer output to zero at ambient conditions are also made at this time. Corrections are made using the following equation:

$$F'(t) = F(t) + D_0 - D_1 T(t)$$

where

$F'(t)$ = corrected data

$F(t)$ = raw data

$T(t)$ = temperature data from the transducer used for temperature sensitivity correction

D_0 = ambient offset

D_1 = temperature sensitivity.

Values of the constants are given in Table A-III.

The drag discs, FDB-30 and FDB-37, were partially filled with subcooled water during blowdown which affects the temperature sensitivity.

TABLE A-III
CONSTANTS FOR MOMENTUM FLUX
MEASUREMENT CORRECTIONS

<u>Detector Identification</u>	<u>T(t)[a]</u>	<u>Test S-05-2A</u>		<u>Test S-05-2B</u>	
		<u>D₀</u>	<u>D₁</u>	<u>D₀</u>	<u>D₁</u>
FDV-CORE-IN				0.320	
FDU-5	TMU-1T16			-0.018	-0.000119
FDU-10	TMU-1T16		0.000228	0.045	0.000253
FDU-13	TMU-15T16	0.110	0.000982	0.075	0.000856
FDB-30	TFB-30	-0.185	-0.000895	-0.204	-0.000936
FDB-21	TMB-20B16	-0.098	-0.000747	-0.042	-0.000605
FDB-23	TMB-20B16	0.107	0.000745	0.048	0.000653
FDB-37	TFB-37	-0.104	0.000293	-0.116	0.000273
FDB-42	TFB-42	-0.092	-0.000754	-0.112	-0.000837
FDU-1	TMU-1T16	0.219	-0.000130	-0.091	-0.000551
FDU-15	TMU-15T16	0.061	-0.001221	-0.132	-0.001177

[a] T(t) is the temperature data used for temperature sensitivity correction. The symbols listed identify the thermocouples from which the data were obtained.

4. DENSITY MEASUREMENTS

Density calculations are based on the voltage output of the photomultiplier tubes in the gamma-attenuation densitometer assemblies. The equation used for converting voltage to density is as follows

$$\rho = (1/C) \ln \left\{ D / [A F(t) + B] \right\}$$

where

- ρ = density in lbm/ft³
- C = constant based on the length of the gamma beam path
- D = theoretical voltage for zero attenuation inside the vessel
- A = amplification factor
- B = biasing factor
- F(t) = transducer voltage output.

Constants A and B are adjusted to match the final data to density values calculated from measured pressure and temperature values at the preblowdown and postdrain conditions, effectively giving the data an in place calibration. The values of the constants for various transducers are given in Table A-IV.

The density measurement GVLP-172HZ uses an amplifier which precalculates the logarithm function, and hence has a simpler conversion formula

$$\rho = -30.8 - 1.37 F(t)$$

for Test S-05-2A, and the formula

$$\rho = -35.97 - 1.461 F(t)$$

for Test S-05-2B.

TABLE A-IV

CONSTANTS FOR DENSITY MEASUREMENT CONVERSIONS TO
ENGINEERING UNITS (TESTS S-05-2A AND S-05-2B)

(TEST S-05-2A)

<u>Detector Identification</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>
GV-COR-150HZ	0.9877	0.0762	0.014	3.59
GB-30VR	1.043	-0.2465	0.0095	6.52
GB-42VR	0.9434	0.3307	0.006	5.60
GU-1VR	1.064	-0.1980	0.0095	3.34
GU-1HZ	1.039	-0.2765	0.0095	8.06
GU-5VR	1.124	-0.672	0.0095	5.63
GU-10VR	1.074	-0.480	0.0095	7.05
GU-13VR	1.274	-0.730	0.0095	2.74
GU-15VR	1.048	-0.302	0.0095	7.17
GU-15HZ	1.145	-0.250	0.0095	1.79
GB-21VR	1.037	-0.151	0.0095	4.68
GB-23VR	0.9540	0.3496	0.0095	6.91
GU-PRIZE	1.240	-0.289	0.0095	1.25
GVLP-165HZ	1.049	-0.300	0.024	7.70

TABLE A-IV (continued)

(TEST S-05-2B)

<u>Detector Identification</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>
GV-COR-150HZ	0.9878	0.0557	0.014	3.57
GB-30VR	1.0580	-0.3665	0.0095	6.52
GB-42VR	0.9315	0.3936	0.006	5.55
GU-1VR	1.0746	-0.2433	0.0095	3.34
GU-1HZ	1.0424	-0.3289	0.0095	8.21
GU-5VR	1.1119	-0.6200	0.0095	5.67
GU-10VR	1.0789	-0.5362	0.0095	7.08
GU-13VR	1.2759	-0.7332	0.0095	2.69
GU-15VR	1.1150	-0.7964	0.0095	7.13
GU-15HZ	1.1370	-0.2296	0.0095	1.74
GB-21VR	1.0330	-0.1396	0.0095	4.66
GB-23VR	0.9540	0.3210	0.0095	6.91
GU-PRIZE	1.0562	-0.0542	0.0095	1.363
GVLP-165HZ	1.0377	-0.2973	0.024	7.71

5. CORE POWER MEASUREMENTS

Corrections to core power readings are determined from the core voltage and core current readings, with a slight adjustment for the power lost in setting the core radial peaking factor. The adjustments for Test S-05-2A are as follows:

$$\text{PWRCOR T-1: } F'(t) = 0.9917 F(t) - 1.505 = [(\text{Voltage}) (\text{Current}) (0.974)]$$

$$\text{PWRCOR T-2: } F'(t) = 0.9917 F(t) + 3.960 = [(\text{Voltage}) (\text{Current}) (0.974)]$$

where

$F'(t)$ = core power in kilowatts

$F(t)$ = raw core power reading.

No adjustments were required for Test S-05-2B.

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