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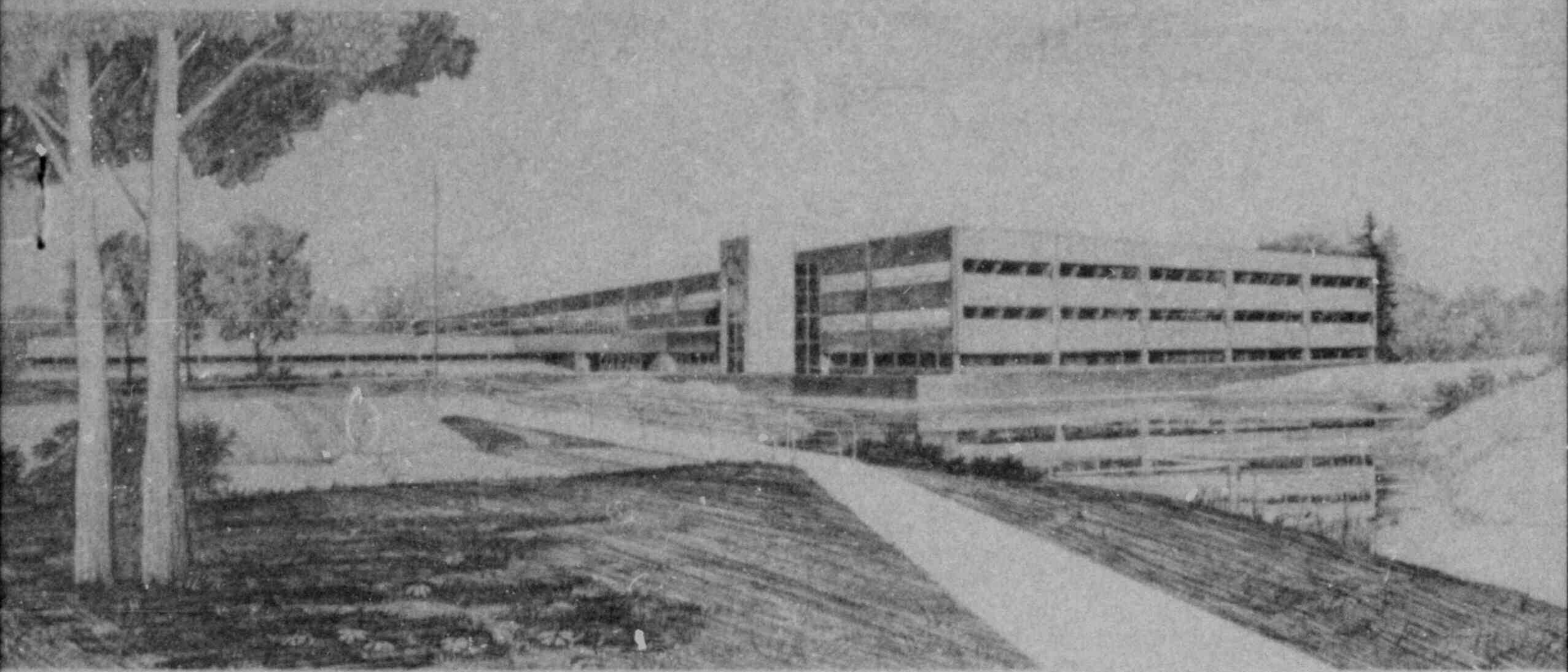

U.S. Department of Energy
Idaho Operations Office • Idaho National Engineering Laboratory

Experiment Data Report For LOFT Anticipated Transient Experiment L6-5

Benjamin D. Stitt
Janice M. Carpenter

July 1980

Prepared for the
U.S. Nuclear Regulatory Commission
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July 8, 1980

Mr. R. E. Tiller, Director
Reactor Operations and Programs Division
Idaho Operations Office - DOE
Idaho Falls, Idaho 83401

EXPERIMENT DATA REPORT FOR LOFT EXPERIMENT L6-5 - Kau-153-80

Dear Mr. Tiller:

This letter transmits the Experiment Data Report (EDR) for the Loss-of-Fluid Test (LOFT) Anticipated Transient Experiment L6-5, Technical Report EGG-2045, NUREG/CR-1520.

Experiment L6-5 was conducted on May 29, 1980 and was the first experiment in the non-Loss-of-Coolant Experiment (LOCE) Test Series (Experiment Series L6). The experiment was successful and the objectives were met. Experiment L6-5 provided data for comparison of a pressurized water reactor to a loss-of-feedwater transient.

The Experiment Data Report (EDR) presents selected thermal hydraulic data from Experiment L6-5 graphically in Standard International Units. The data have been analyzed to ensure that they are reasonable and consistent.

Very truly yours,

N. C. Kaufman
Director, LOFT

JMC:jlb

Enclosure:
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EXPERIMENT DATA REPORT FOR LOFT ANTICIPATED TRANSIENT EXPERIMENT L6-5

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ABSTRACT

Uninterpreted experimental data from the first anticipated transient experiment (Experiment L6-5) conducted in the Loss-of-Fluid Test (LOFT) facility are presented. The LOFT facility is a 50-MW(t) pressurized water reactor (PWR) system with instrumentation to measure and provide data on the thermal-hydraulic conditions throughout the system. Operation of the LOFT system is typical of a large [~ 1000 MW(e)] commercial PWR system. Experiment L6-5 was a loss of secondary feedwater anticipated transient. At experiment initiation, the LOFT system was operating at 36.7 ± 1 MW(t) (yielding a maximum linear heat generation rate of 39.6 ± 2 kW/m) with a primary flow rate of 479.4 ± 6.3 kg/s, hot leg temperature of 568.2 ± 0.5 K, and hot leg pressure of 14.79 ± 0.25 MPa in the primary coolant system. The transient was initiated by turning off the secondary coolant system main feedwater pump. The reactor was scrammed manually when steam generator secondary liquid level dropped to its low setpoint. The liquid levels in the steam generator and pressurizer were recovered through operator action. The experiment ended when the liquid levels in the steam generator and pressurizer reached their normal operating bands. The data presented from Experiment L6-5 show the effect that a loss of secondary feedwater would have on the thermal-hydraulic conditions in an operating PWR system.

NRC FIN No. A6048 - LOFT Experimental Program.

SUMMARY

This report presents experimental data from the first anticipated transient experiment (Experiment L6-5) conducted in the Loss-of-Fluid Test (LOFT) facility. The data are uninterpreted but readily usable for the nuclear community in advance of detailed analysis and interpretation. Experiment L6-5 was a loss of secondary feedwater anticipated transient, and was performed on May 29, 1980, as part of the LOFT Experimental Program conducted by EG&G Idaho, Inc., for the U.S. Nuclear Regulatory Commission. This experiment is part of the LOFT Non-LOCE Test Series L6 which was designed to provide data for investigating the thermal-hydraulic response of the LOFT reactor system from transient initiation to plant restabilization after reactor scram. Experiment L6-5 was conducted at 36.7 ± 1 MW (yielding a maximum linear heat generation rate of 39.6 ± 2 kW/m). The general objectives for Experiment Series L6 are as follows:

1. To provide data required for evaluation of the plant and control systems performance during each of the anticipated transient causing scram (ATCS) tests.

2. To determine the important thermal, hydraulic, operational, and neutronic phenomena during an ATCS at the LOFT facility. Identify and explain any unexpected behavior.

3. Provide data to evaluate reactor transient analysis techniques used to analyze anticipated transients.

4. Provide data to analyze the relationship between LOFT and large pressurized water reactor (PWR) behavior during anticipated transients.

5. To determine the effectiveness of instruments normally provided in large PWRs for identifying anticipated transients and monitoring the resulting plant response.

6. To determine what additional information and/or measurements would assist a plant operator in his diagnosis and/or control of an anticipated transient.

7. Continue development and testing of the Operational Diagnostic and Display System (ODDS) by operation of the ODDS during each test.

The specific objectives for Experiment L6-5 are as follows:

1. Investigate plant response to a transient in which the feedwater flow to the secondary system is stopped.

2. Provide continued evaluation on automatic recovery methods.

3. Provide continued data for assessment of code capabilities to predict secondary system initiated events.

The LOFT integral test facility has been designed to simulate the major components and system responses of a commercial four-loop PWR [~ 1000 MW(e)] during a hypothetical loss-of-coolant accident. The LOFT facility consists of

1. A reactor vessel with a nuclear core (Core 1)

2. An intact loop with active steam generator, pressurizer, and two primary coolant pumps connected in parallel

3. A broken loop with simulated pump, simulated steam generator, and two quick-opening blowdown valve assemblies

4. A blowdown suppression system consisting of a header, suppression tank, and a suppression tank spray system

5. An emergency core coolant (ECC) injection system consisting of two low-pressure injection system pumps, two high-pressure injection system pumps, and two accumulators.

The blowdown suppression system and ECC injection system were not used in Experiment L6-5. The broken loop was stagnant throughout the experiment and, therefore, served only a passive role.

Experiment L6-5 was initiated from primary coolant system initial conditions of: hot leg temperature, 568.2 ± 0.5 K; cold leg temperature, 554.7 ± 3 K; hot leg pressure, 14.79 ± 0.25 MPa; and intact loop flow rate, 479.4 ± 6.3 kg/s. The preexperiment power level was 36.7 ± 1 MW, with a maximum linear heat generation rate of 39.6 ± 2 kW/m. The experiment was initiated by turning the secondary coolant system main feedwater pump off. The reactor was scrammed manually on indication of low liquid level in the steam generator secondary side. The experiment was terminated when the operators refilled the steam generator to its operating range and restored the pressurizer to its normal operating level.

Experiment L6-5 satisfied the specified objectives. This report presents data in the form of graphs in engineering (standard international) units. In conjunction with data obtained from direct measurement, chosen computed variables are included to facilitate the analysis of the system thermal-hydraulic behavior.

ACKNOWLEDGMENTS

Appreciation is expressed to the Data Systems Branch, particularly to J. B. Marlow for the preparation of data plots. Appreciation is also expressed to the LOFT Data Analysis Branch, particularly S. A. Ploger and R. H. Averill for uncertainty analysis and instrument calibration, respectively. Special appreciation is expressed to G. Hammer for the technical editing.

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ACRONYMS

ATCS	Anticipated transient causing scram
BST	Blowdown suppression tank
BWST	Borated water storage tank
DAVDS	Data acquisition and visual display system
DTT	Drag disc turbine transducer
ECC	Emergency core coolant
ECCS	Emergency core cooling system
ESF	Engineered safety features
FM	Frequency modulation
HPIS	High-pressure injection system
LOCA	Loss-of-coolant accident
LOCE	Loss-of-coolant experiment
LOFT	Loss-of-Fluid Test
LPIS	Low-pressure injection system
PCP	Primary coolant pump
PCS	Primary coolant system
PNA	Pulsed neutron activation
PWR	Pressurized water reactor
QOBV	Quick-opening blowdown valve
RABV	Reflood assist bypass valve
RV	Reactor vessel
SCS	Secondary coolant system
SG	Steam generator
TIP	Traversing in-core probe

EXPERIMENT DATA REPORT FOR LOFT ANTICIPATED TRANSIENT EXPERIMENT L6-5

1. INTRODUCTION

This report presents data from Experiment L6-5, which was conducted in the Loss-of-Fluid Test (LOFT) facility on May 29, 1980. The LOFT facility is a 50-MW(t) pressurized water reactor (PWR) with instrumentation to measure and provide data on the thermal-hydraulic conditions throughout the system. Operation of the LOFT system is typical of a large [~1000 MW(e)] commercial PWR. Experiment L6-5 was the first anticipated transient experiment performed in the LOFT facility and simulated a loss of secondary feedwater to a PWR system.

Experiment L6-5 was planned and supervised by the LOFT Experimental Program. The LOFT Experimental Program is one of several water reactor research experimental programs conducted by EG&G Idaho, Inc., for the U.S. Nuclear Regulatory Commission and administered by the U.S. Department of Energy at the Idaho National Engineering Laboratory.

The data presented in this report are from 53 of the 631 instruments that provided data during Experiment L6-5. Only the data considered pertinent to the understanding of this experiment are presented. The data are in an uninterpreted but readily usable form for use by the nuclear community in advance of detailed analysis and interpretation. The data, in the form of graphs in engineering units, have been analyzed only to the extent necessary to ensure that they are reasonable and consistent.

Section 1.1 of this introduction states the LOFT Experimental Program objectives. Section 1.2 presents the Experiment L6-5 objectives and briefly describes the experiment conditions and operation. Section 2 of this report briefly describes the LOFT configuration. Section 3 discusses the LOFT instrumentation system and the methods of obtaining certain measurements. Section 4 summarizes Experiment L6-5 initial conditions and experimental procedure. Section 5 presents the data with supporting information for data interpretation. Appendix A discusses the methods used to verify the consistency and accuracy of the data. Appendix B contains a complete list of LOFT instrumentation available for use during Experiment L6-5.

1.1 LOFT Experimental Program Objectives

The LOFT integral[a] test facility was designed to simulate the major components of a four-loop, commercial PWR, thereby producing data on the thermal, hydraulic, nuclear, and structural processes expected to occur during accidents in a PWR. Reference 1 describes the LOFT facility in detail. The specific objectives of the LOFT Experimental Program are to:

1. Provide data required to evaluate the adequacy of and to improve the analytical methods currently used to predict the response of large PWRs to postulated accident conditions, the performance of engineered safety features (ESF) with particular emphasis on emergency core cooling system (ECCS), and the quantitative margins of safety inherent in the performance of the ESF.

2. Identify and investigate any unexpected event(s) or threshold(s) in the response of either the plant or the ESF and develop analytical techniques that adequately describe and account for the unexpected behavior(s).

3. Evaluate and develop methods to prepare, operate, and recover systems and plant for and from reactor accident conditions.

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a. The term "integral" is used to describe an experiment combining the nuclear, thermal, hydraulic, and structural processes occurring during an accident as distinguished from separate effects, nonnuclear, small-scale, and thermal-hydraulic experiments conducted for accident analysis.

4. Identify and investigate methods by which reactor safety can be enhanced, with emphasis on the interaction of the operator with the plant.

1.2 Experiment Objectives and Brief Description of Experiment L6-5

The LOFT Non-LOCE Test Series L6 was designed to provide large-scale system data for several PWR anticipated transients. The transients to be studied include: loss of steam load, loss of primary coolant system (PCS) flow, excessive load increase, unintentional rod bank withdrawal, loss of feedwater, and uncontrolled boron dilution.

The general objectives for Test Series L6 are as follows:

1. To provide data required for evaluation of the plant and control system performance during each of the anticipated transient causing scram (ATCS) tests.

2. To determine the important thermal, hydraulic, operational, and neutronic phenomena during an ATCS at the LOFT facility. Identify and explain any unexpected behavior.

3. Provide data to evaluate reactor transient analysis techniques used to analyze anticipated transients.

4. Provide data to analyze the relationship between LOFT and large PWR behavior during anticipated transients.

5. To determine the effectiveness of instruments normally provided in large PWRs for identifying anticipated transients and monitoring the resulting plant response.

6. To determine what additional information and/or measurements would assist a plant operator in his diagnosis and/or control of an anticipated transient.

7. Continue development and testing of the Operational Diagnostic and Display System (ODDS) by operation of the ODDS during each test.

The specific objectives for Experiment L6-5 are as follows:

1. Investigate plant response to a transient in which the feedwater flow to the secondary system is stopped.

2. Provide continued evaluation on automatic recovery methods.

3. Provide continued data for assessment of code capabilites to predict secondary system initiated events.

LOFT Experiment L6-5 simulated a loss of secondary feedwater anticipated transient in a commercial PWR. At the time of experiment initiation, the LOFT reactor was operating (a) at a maximum linear heat generation rate of 39.6 ± 2 kW/m and a power of 36.7 ± 1 MW, which is about 75% of the LOFT rated thermal power of 50 MW, (b) at temperatures in the PCS intact loop of 568.2 ± 0.5 and 554.7 ± 3 K in the hot and cold legs, respectively, and (c) a pressure in the PCS intact loop of 14.95 ± 0.34 MPa in the hot leg. The experiment was initiated by turning the secondary coolant system main feedwater pump off. The reactor was scrammed manually at 23.7 ± 0.1 s, when the secondary water level in the steam generator dropped to a level corresponding to a low steam generator water level that would initiate a scram in a commercial PWR. The steam flow control valve received a signal to begin closure at reactor scram. After that signal, the valve was allowed to cycle normally at its predetermined setpoints. The experiment was terminated when the operators restored the liquid levels in the steam generator secondary and pressurizer to their normal operating ranges.

2. SYSTEM CONFIGURATION

The LOFT facility[1] has been designed to simulate the major components and system responses of a commercial PWR during a loss-of-coolant accident (LOCA). The experiment assembly comprises five major subsystems that have been instrumented such that system variables can be measured and recorded during an experiment. The subsystems include: (a) the reactor vessel, (b) the intact loop, (c) the broken loop, (d) the blowdown suppression system, and (e) the ECCS. The LOFT major components are shown in Figure 1, and the LOFT piping configuration is shown in Figure 2.

The LOFT reactor vessel, which simulates the reactor vessel of a commercial PWR, has an annular downcomer, a lower plenum, lower core support plates, a nuclear core, and an upper plenum. The downcomer is connected to the cold legs of the intact and broken loops and contains two instrument stalks. The upper plenum is connected to the hot legs of the intact and broken loops.. The core contains 1300 unpressurized nuclear fuel rods arranged in five square (15 x 15 assemblies) and four triangular (corner) fuel modules, shown in Figure 3 and described in Reference 2. The center assembly is highly instrumented. Two of the corner and one of the square assemblies are not instrumented. The fuel rods have an active length of 1.67 m and an outside diameter of 10.72 mm.

The fuel consists of UO_2 sintered pellets with an a. .rage enrichment of 4.0 wt% fissile uranium (^{235}U) and with a density that is 93% of theoretical density. Fuel pellet diameter and length are 9.29 and 15.24 mm, respectively. Both ends of the pellets are dished with the total dish volume equal to 2% of the pellet volume. Cladding material is zircaloy-4. Cladding inside and outside diameters are 9.48 and 10.72 mm, respectively.

The intact loop simulates the three unbroken loops of a commercial four-loop PWR and contains a steam generator, two circulating coolant pumps in parallel, a pressurizer, a venturi flowmeter, and connecting piping.

The broken loop consists of a hot leg and a cold leg that are connected to the reactor vessel and the blowdown suppression tank (BST) header. Each leg consists of a break plane orifice, a quick-opening blowdown valve (QOBV), a recirculation line, an isolation valve, and connecting piping. The recirculation lines establish a small flow from the broken loop to the intact loop to maintain approximately equal loop temperatures. The broken loop hot leg also contains a simulated steam generator and a simulated pump. The broken loop was connected to the system and was full of water during Experiment L6-5; however, it played only a passive role during the experiment.

The blowdown suppression system, which consists of the BST header, the BST, the nitrogen pressurization system, and the BST spray system, was not used in Experiment L6-5.

The LOFT ECCS simulates the ECCS of a commercial PWR. It consists of two accumulators, a high-pressure injection system (HPIS), and a low-pressure injection system (LPIS). Each system is arranged to inject scaled flow rates of emergency core coolant (ECC) directly into the PCS. The ECCS was not used for Experiment L6-5.

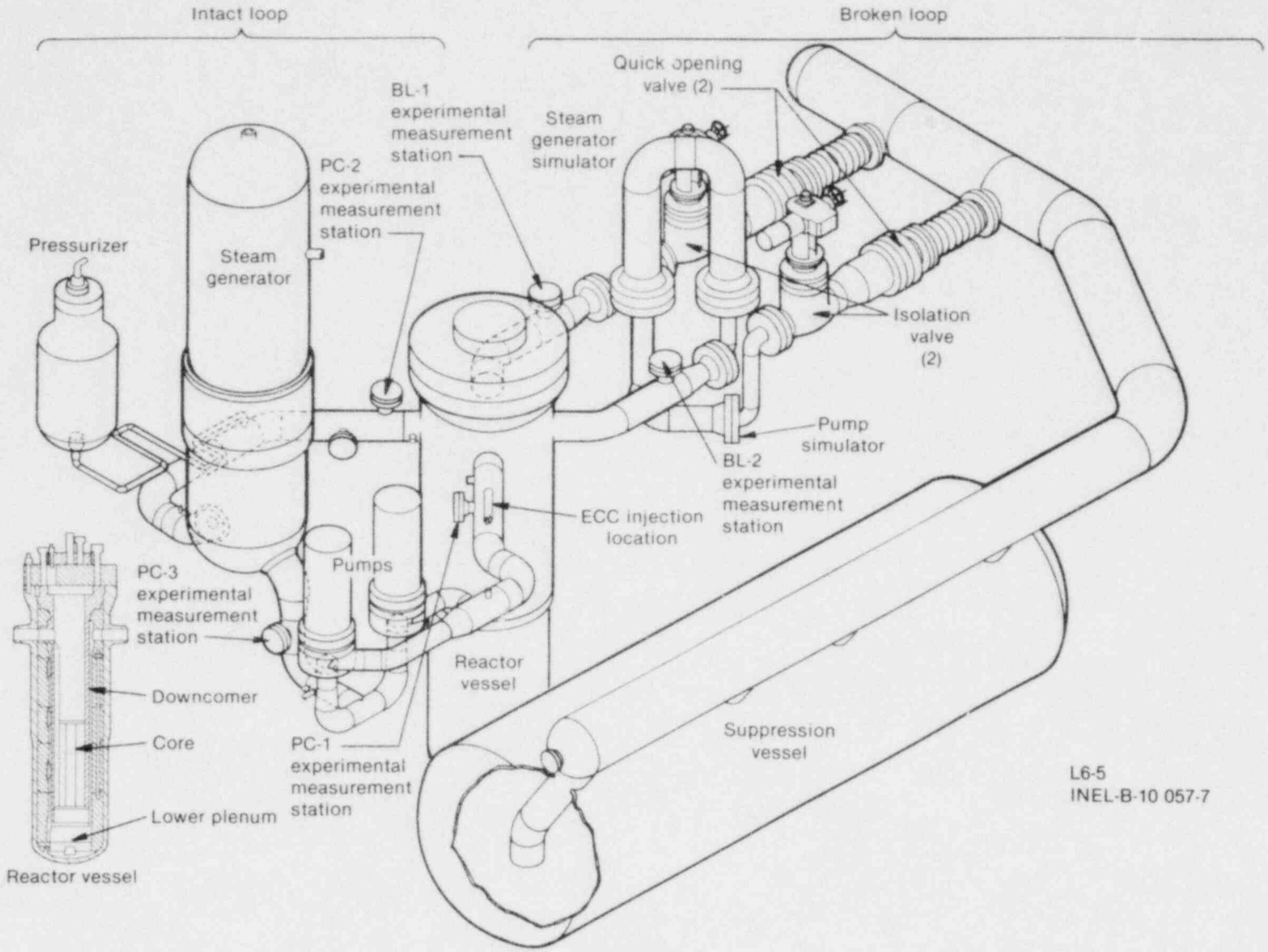
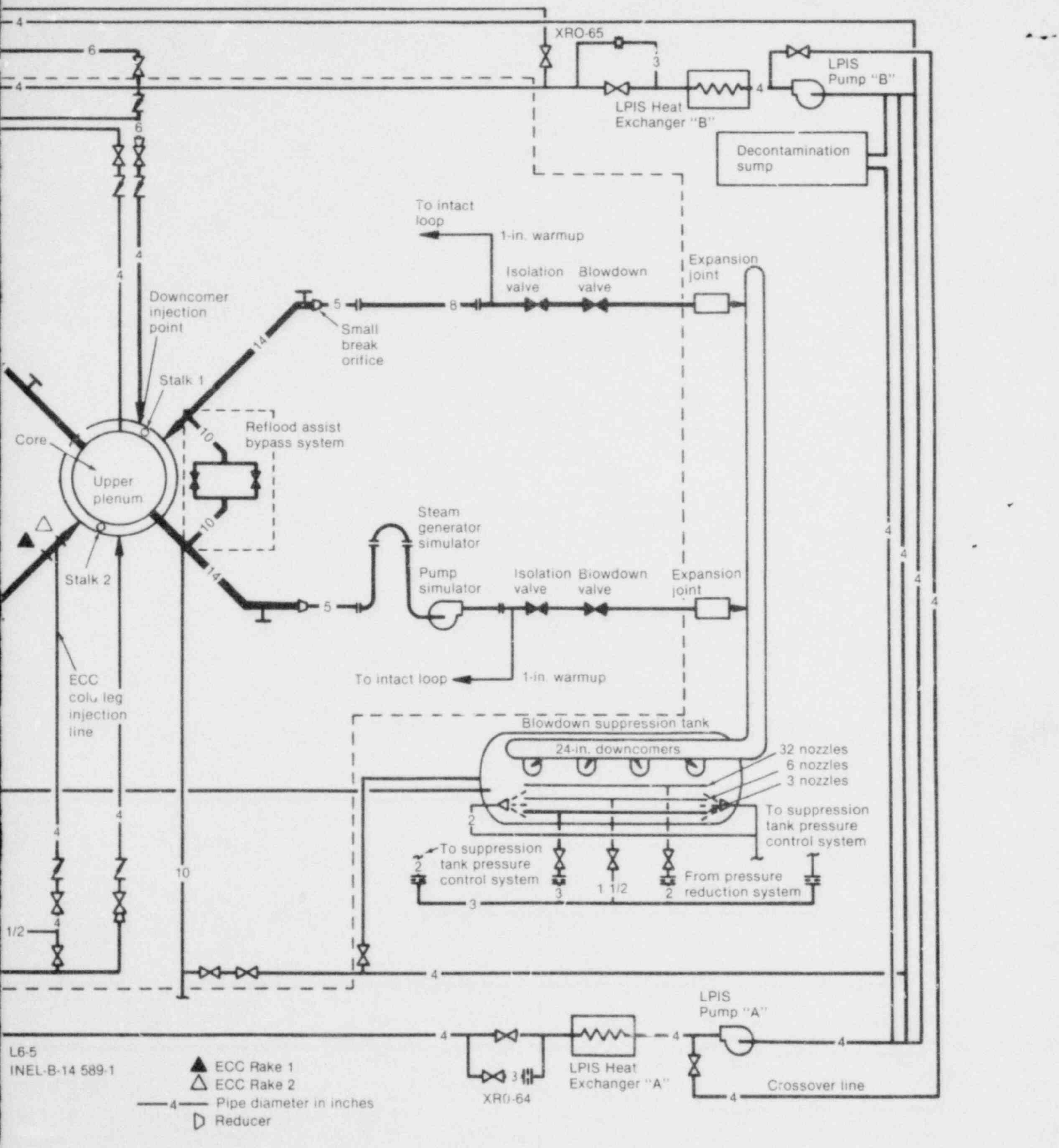


Figure 1. LOFT major components.



LOFT piping schematic.

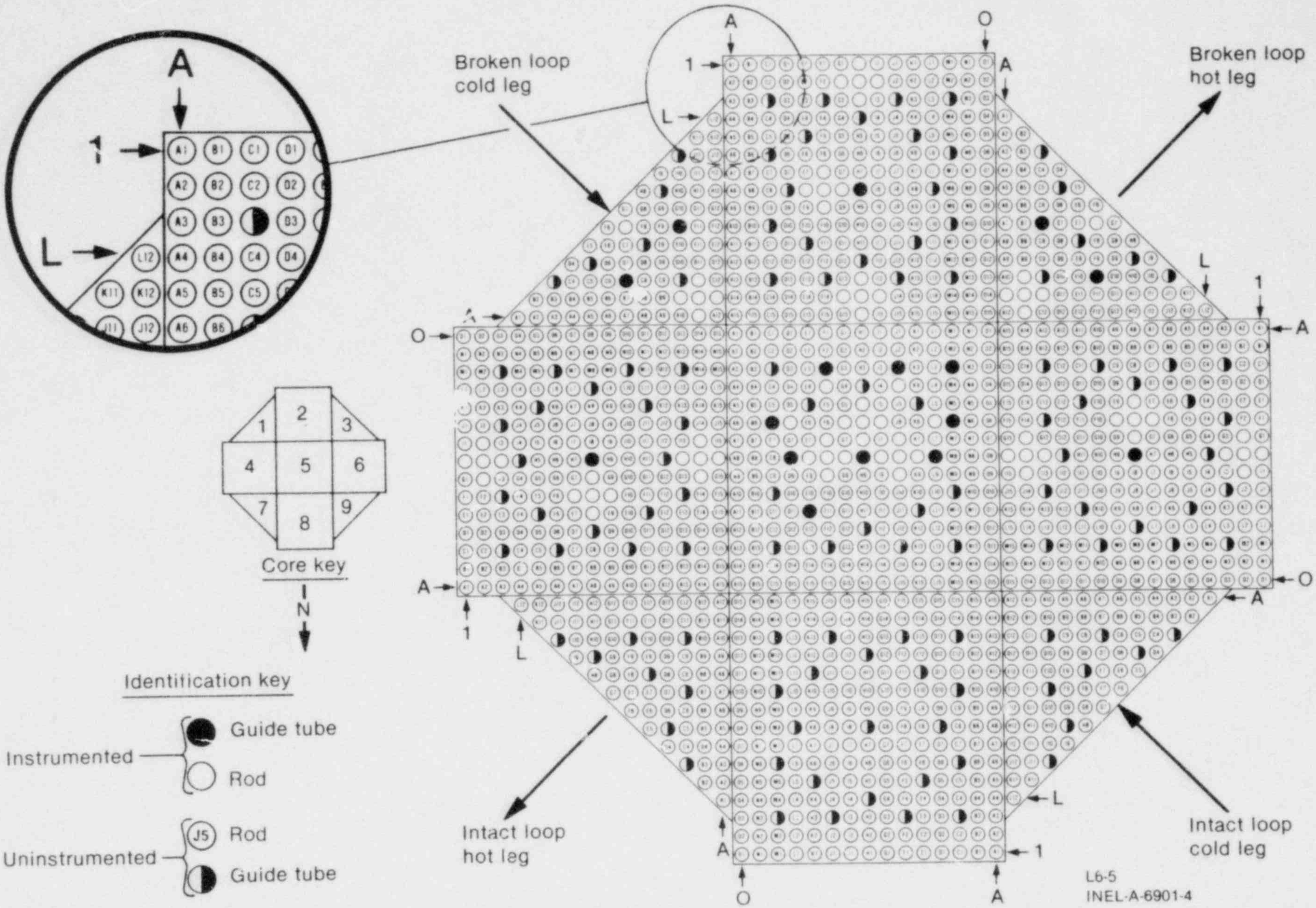
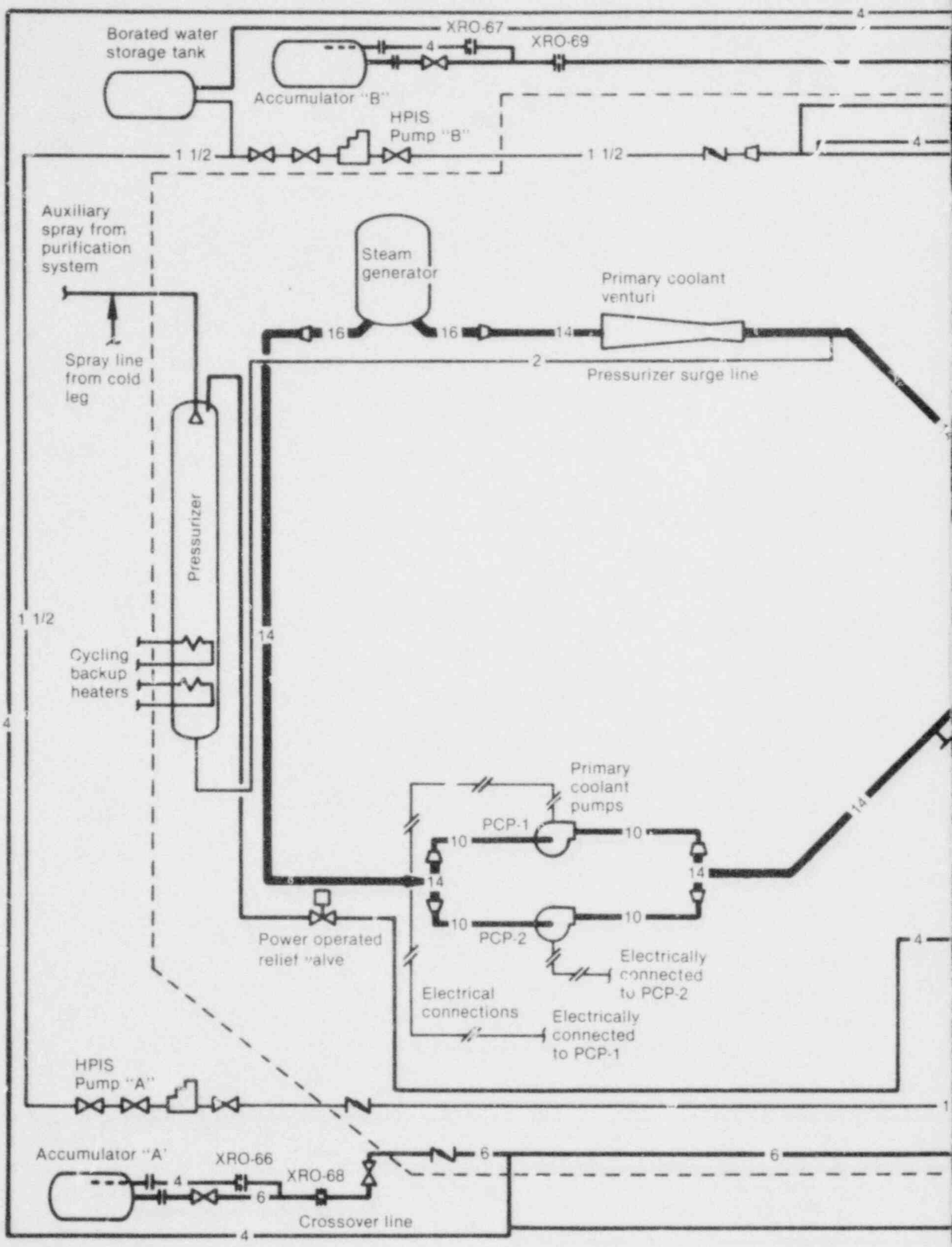


Figure 3. LOFT Core 1 configuration showing rod designations.



XRO-67
Borated water storage tank
4
XRO-69
Accumulator "B"
HPIS Pump "B"
1 1/2
1 1/2
4
Auxiliary spray from purification system
Steam generator
Primary coolant venturi
16
16
14
2
Pressurizer surge line
Spray line from cold leg
Pressurizer
1 1/2
14
Cycling backup heaters
4
Primary coolant pumps
PCP-1
10
10
14
14
10
10
PCP-2
Power operated relief valve
4
Electrically connected to PCP-2
Electrical connections
Electrically connected to PCP-1
HPIS Pump "A"
Accumulator "A"
XRO-66
4
XRO-68
6
6
6
Crossover line
4

Figure 2

3. MEASUREMENTS AND INSTRUMENTATION

The LOFT instrumentation system was designed to measure and record the important parameters and events that occur during an experiment.

Temperatures at all major locations in the system were obtained from thermocouples and resistance temperature detectors.

Pressure measurements were obtained with strain-gage transducers with pressure transmission lines connecting the transducers to the measurement points.

Differential pressures were measured by strain-gage transducers with double chambers. The transducers were externally located and connected to the measurement points with pressure transmission lines.

A turbine flowmeter directly measured fluid velocity in the reactor vessel upper plenum, above Fuel Assembly 5. The data presented for fluid velocity (from the turbine flowmeter) are based on an area of 0.125 m^2.

Fluid density was measured by gamma densitometers, each of which consists of a source and detectors. Three detectors (A, B, and C shown in Figure 4) were aligned with collimated gamma ray beams passing through the pipe; the attenuation of the gamma rays varied inversely with the density of the fluid in the pipe. Each densitometer also had a detector (D) located so that it measured background radiation continuously, except for DE-PC-3, which checked the background by alternately exposing and storing the source. DE-PC-3 was a nonnuclear-hardened densitometer, had a ^{137}Cs source, and was located in a vertical piping section. The rest of the densitometers were nuclear-hardened, had ^{60}Co sources, and were located in horizontal piping. Figure 4 shows the gamma densitometer configuration relative to the piping.

Liquid levels were obtained by means of differential pressure transducers in the pressurizer, steam generator secondary side, and condensate receiver.

Control rod position was indicated by means of proximity switches. The circuitry associated with the proximity switches controls a set of lamps. Each set of lamps consists of a "rod bottom" lamp and four "rod location" lamps. The rod bottom lamp lights only when the control rod is bottomed. Each rod location lamp lights as the leadscrew on the control rod passes its switch position during withdrawal, and it remains lit whenever the leadscrew is above this position.

Valve positions (analog indication from 0 to 100% of opening) were measured by either resistance potentiometers or differential transformers.

Mechanical pump speed was measured by an eddy current displacement transducer which used a slotted metallic target attached to the top of the pump motor shaft. The target contains six asymmetrical slots so that pump speed can be determined. Electrical pump power was measured by a wattmeter.

The steady state local linear heat generation rate was measured by self-powered neutron detectors. Each detector consists of a cylindrical ^{59}Co emitter, a layer of aluminum oxide for electrical insulation, and an outer sheath of Inconel. The cable connected to the detector consists of two Inconel wires in an Inconel sheath with magnesium oxide insulation. One of the wires is connected to the cobalt emitter and the other is open ended. The open-ended wire gives a background subtraction signal to compensate for the radiation sensitivity of the cable.

The steady state linear heat generation rates were also determined from neutron flux measurements taken with a traversing in-core probe (TIP) at four guide tube locations in the core. This instrument consists of a ^{235}U fission chamber attached to a flexible cable and its own data recording system. The probe was withdrawn and stored outside the core prior to experiment initiation.

The data acquisition and visual display system (DAVDS) was used to record measured data from the various instrumentation systems on a combination of digital recorders, wide-band frequency modulation (FM) tape recorders, and oscillographic recorders.[3] Redundant records were made where use dictated more than one

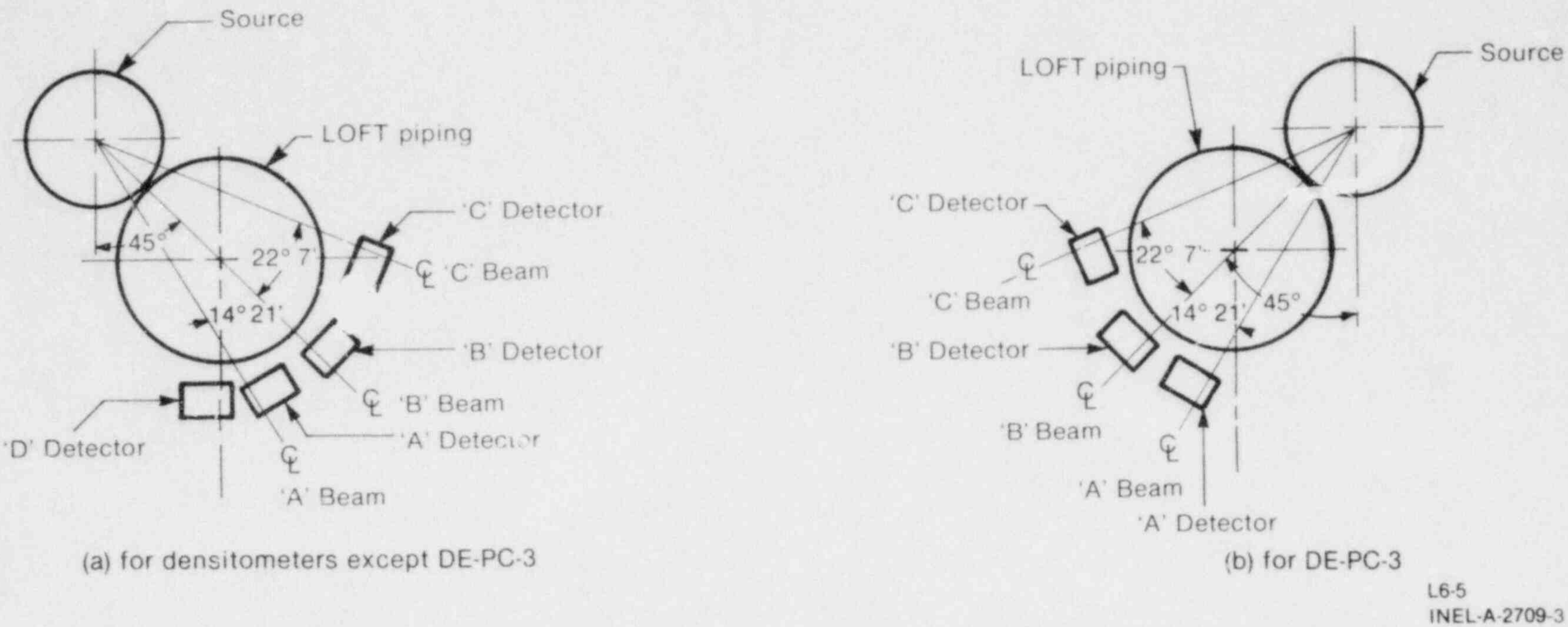


Figure 4. Relation of source and detectors to pipe for gamma densitometers.

recording mode or where an extra measure of assurance was desired for critical measurements.

A digital computer was used to collect the experimental data in a multiplexed format at the LOFT facility and to perform equipment calibrations, posttest data reduction, and plotting.[4] The recorded FM data were converted into digital form and then demultiplexed to be compatible with the CDC CYBER 176 computer system.

The CDC CYBER 176 computer system was used to further reduce the data. Calibration factors were first applied to produce data plots in engineering units so that engineering specialists could examine each channel for discrepancies or unexpected events. Where possible, instrument channel outputs and computed variables were compared with test predictions, previous tests, corresponding parameter channels, and calculated quantities. Instruments were labeled as qualified if the measurement comparisons were determined to be within the accuracy of the particular instrument.

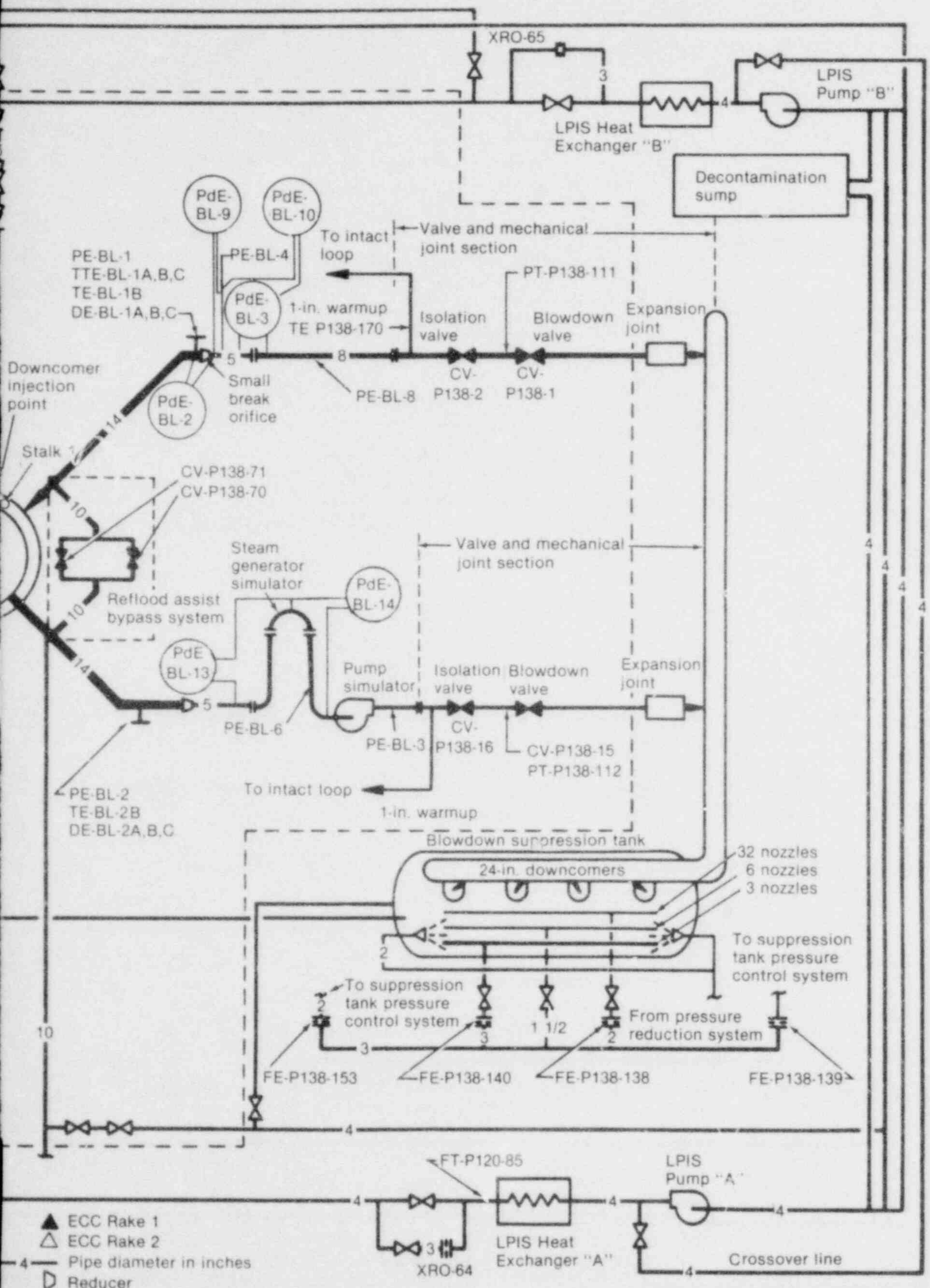
Most transducers were calibrated under laboratory conditions prior to installation in LOFT. Verification of calibration constants was accomplished by special tests performed during heatup and by analysis of initial conditions data. In addition, postexperiment checks were performed to pinpoint questionable data and to verify data consistency. Appendix A discusses the techniques used to perform data consistency checks.

Figures 5 and 6 are piping schematics showing instrument locations in the primary and secondary coolant systems, respectively. Table 1 gives the nomenclature for LOFT experimental and process instrumentation. Both types of instrumentation are included in this report. Thermocouples and neutron flux detectors located in the nuclear core have special identification. Each of these transducers has been given an identification number which identifies the type of transducer and its location within the core as follows:

Transducer location (inches from bottom of fuel rod)
Fuel assembly row
Fuel assembly column
Fuel assembly number
Transducer type

TE-3B11-28

Figures 7 and 8 show isometric views of the major system components with instrument locations indicated, and Figures 9 through 18 give more specific locations for instruments located on individual components. Some of the temperature instruments shown in the figures were not recorded during the experiment. Reference 1 may be consulted if additional details of instrument design and locations are desired.



th instrumentation.

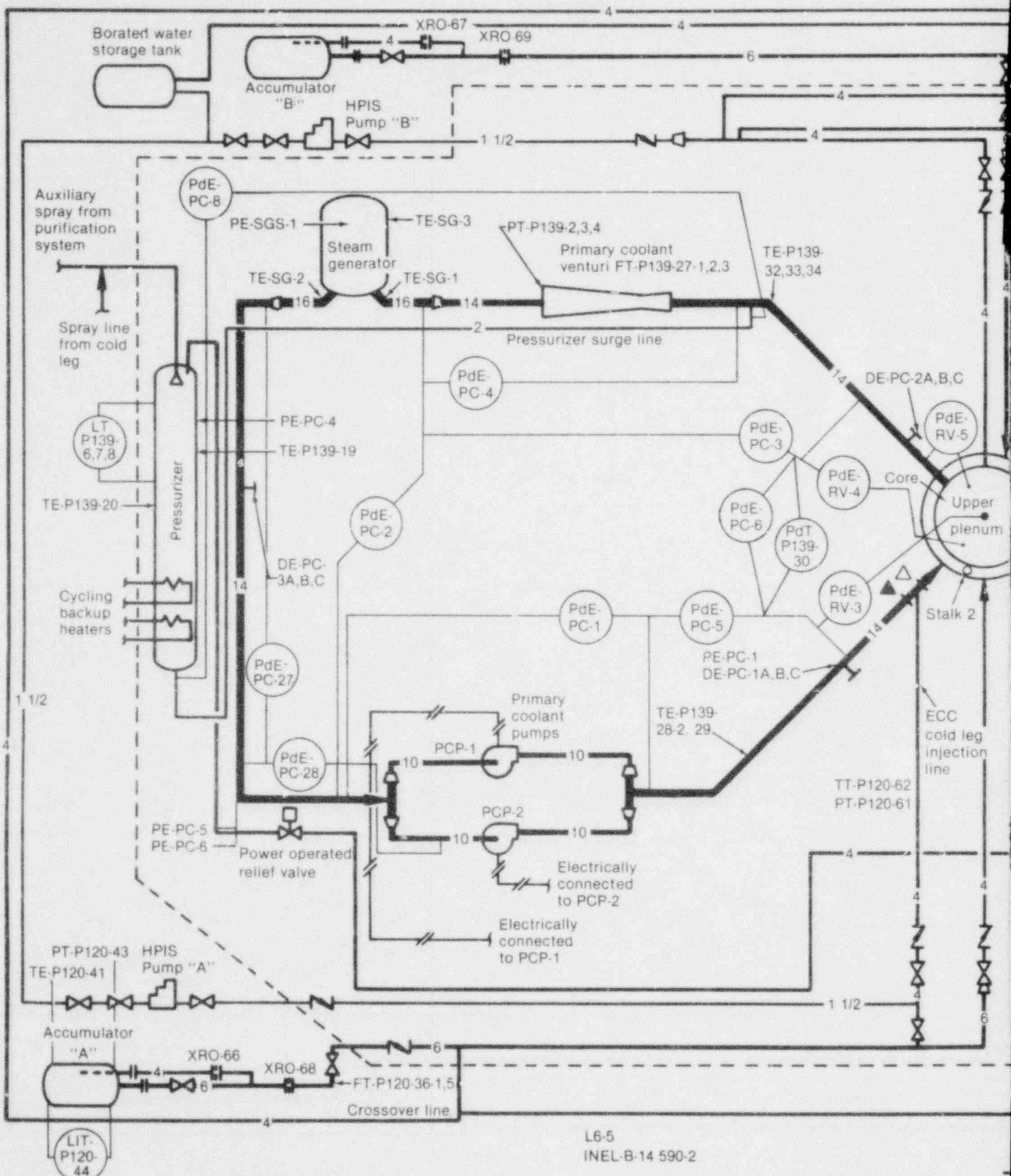


Figure 5. LOFT piping schematic wi

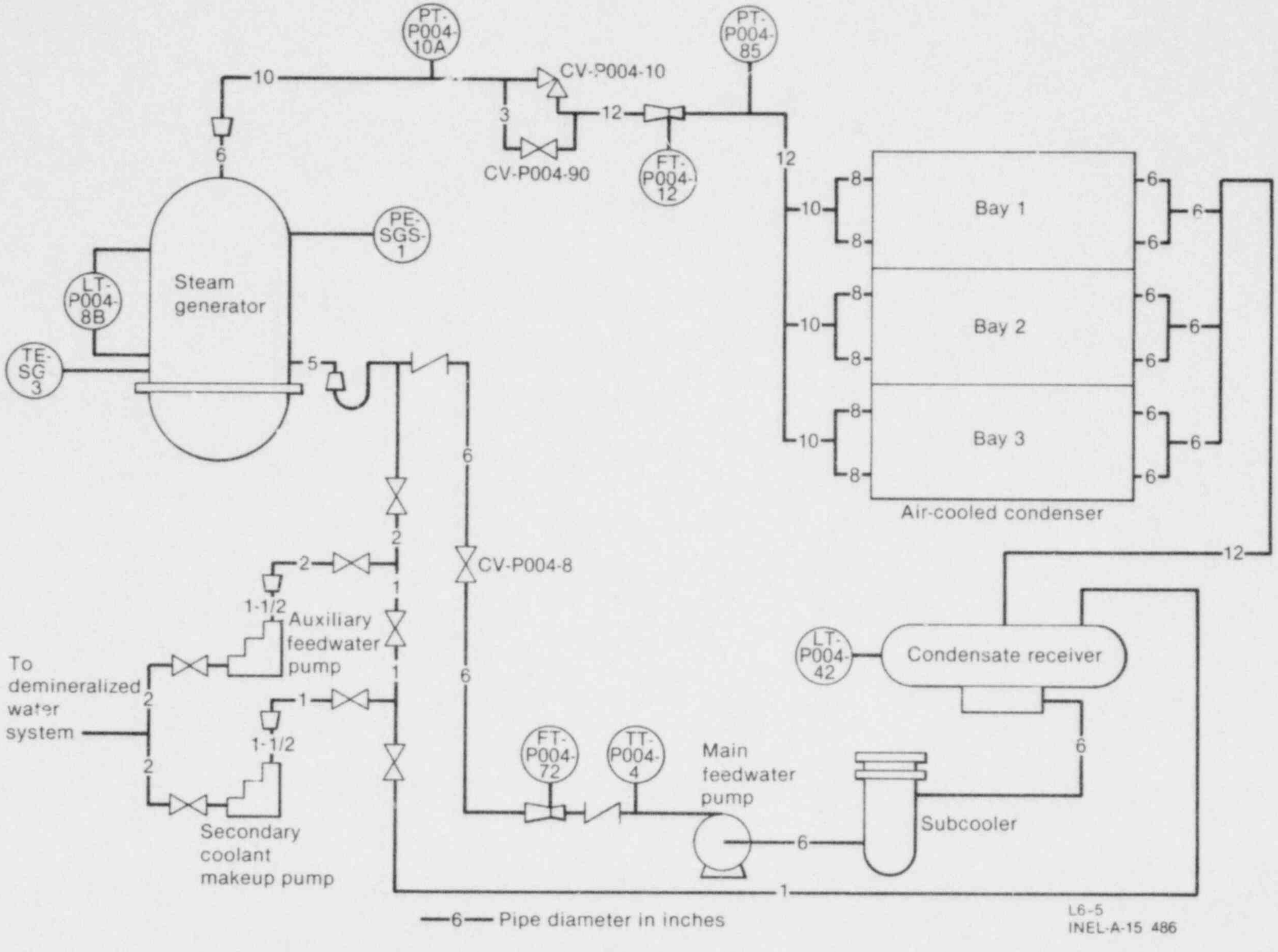


Figure 6. LOFT secondary coolant system with instrumentation.

TABLE 1. NOMENCLATURE FOR LOFT INSTRUMENTATION

Designations for the different types of experimental instruments:

AE	Accelerometer
DE	Densitometer
DIE	Displacement element
FE	Coolant flow element
LE	Coolant level element
ME	Momentum flux detector
NE	Neutron detector
PCP	Primary coolant pump
PdE	Differential pressure element
PE	Pressure element
RPE	Pump speed element
TE	Temperature element

Designations for the different experimental systems except the core:

BL	Broken loop
LP	Lower plenum
PC	Primary coolant intact loop
RV	Reactor vessel
SG	Steam generator
SGS	Steam generator secondary
1ST	Downcomer Stalk 1
2ST	Downcomer Stalk 2
SV	Suppression tank
UP	Upper plenum

TABLE 1. (continued)

Designations for the different types of process instruments:

CV	Control valve
FE	Flow element
FT	Flow transmitter
LIT	Level indicating transmitter
LT	Liquid level transmitter
PdT	Differential pressure transmitter
PT	Absolute pressure transmitter
RE	Radiation element
TE	Temperature element
TT	Temperature transmitter

Designations for the different systems associated with process instruments:

P004	Secondary coolant system
P120	Emergency core cooling system
P128	Primary coolant addition and control system and HPIS
P138	Broken loop and pressure suppression system
P139	Intact loop
P141	Primary component cooling system
T-77, T-87	Power range

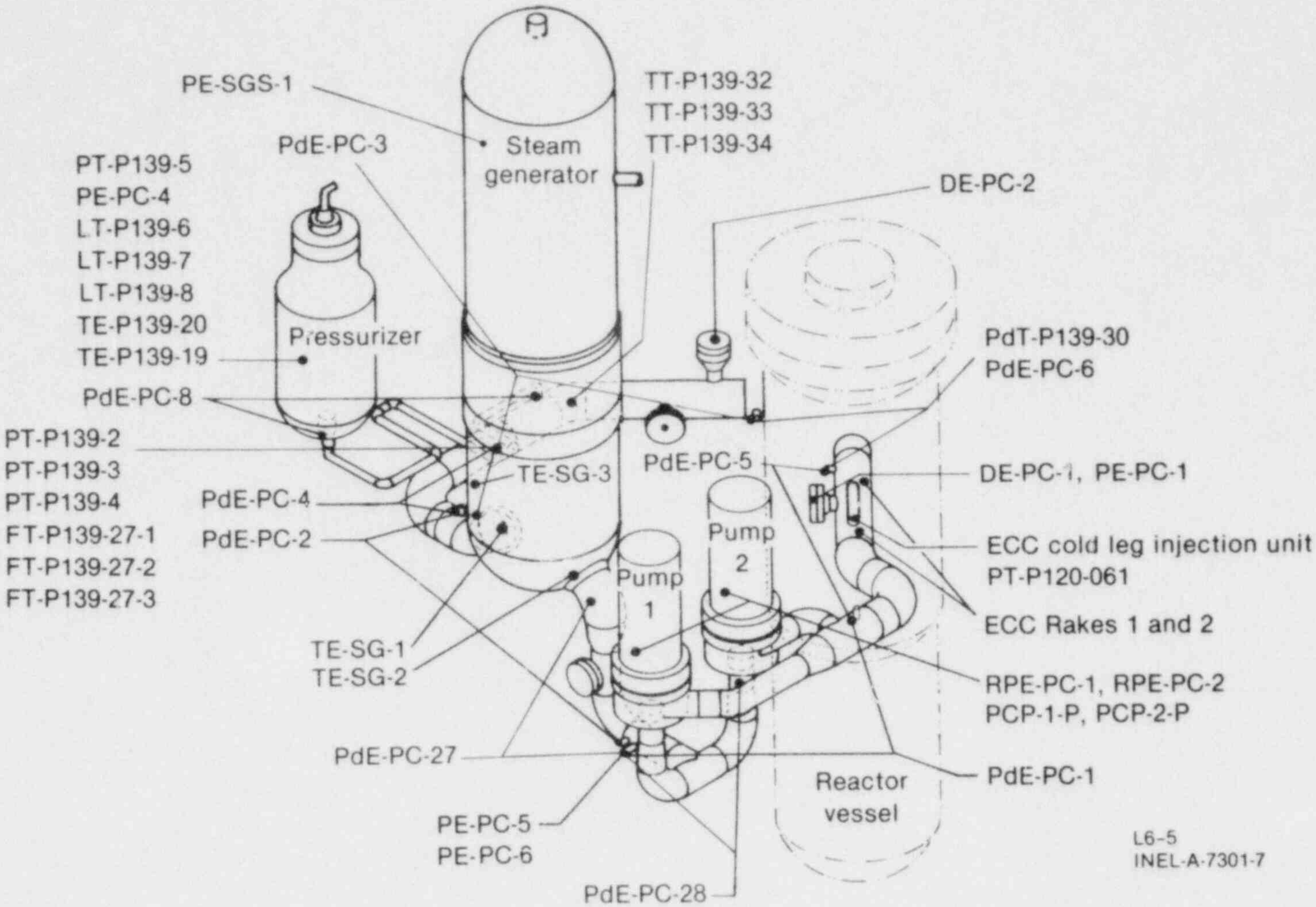


Figure 7. LOFT thermal-hydraulic instrumentation for intact loop.

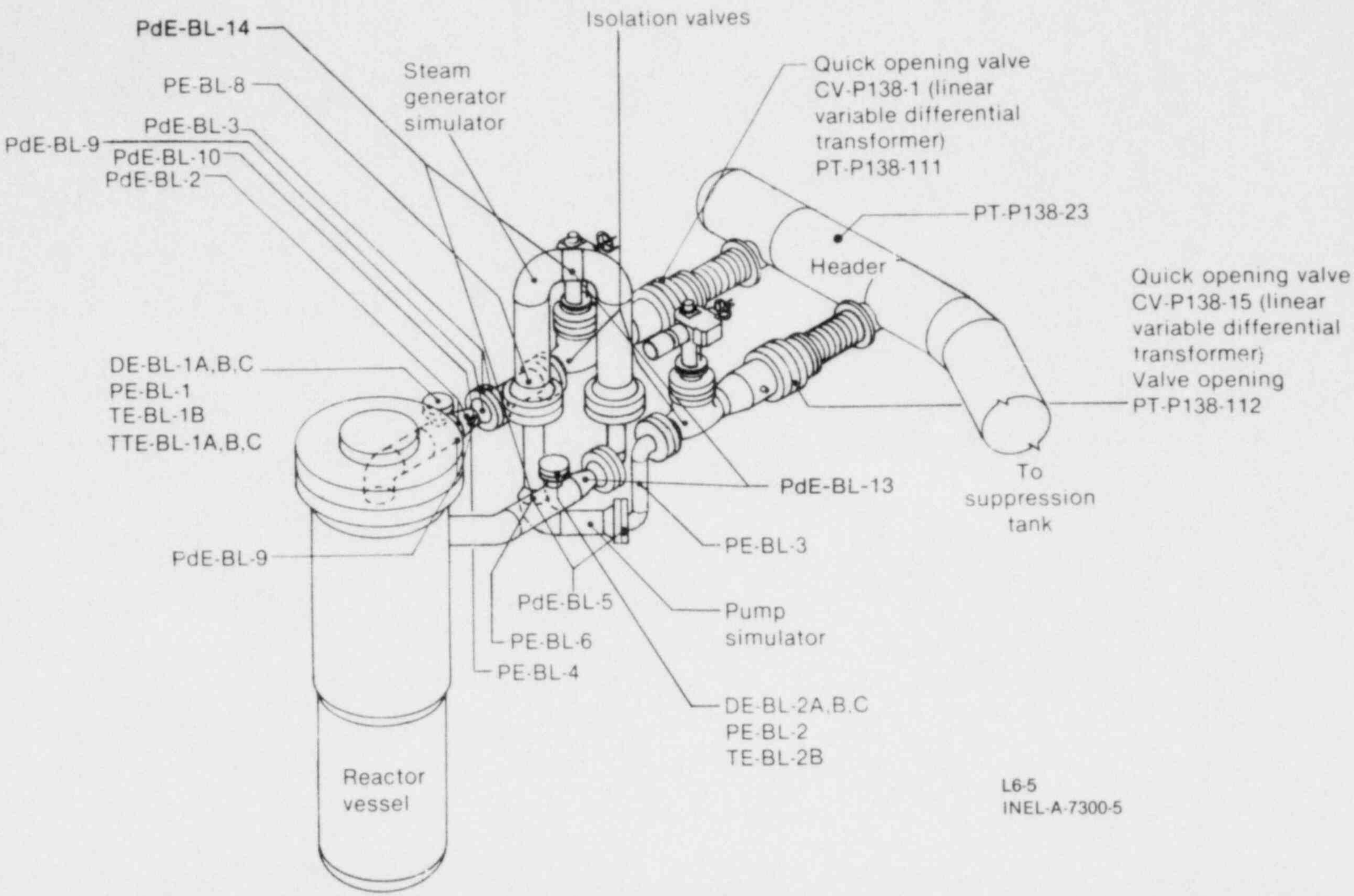
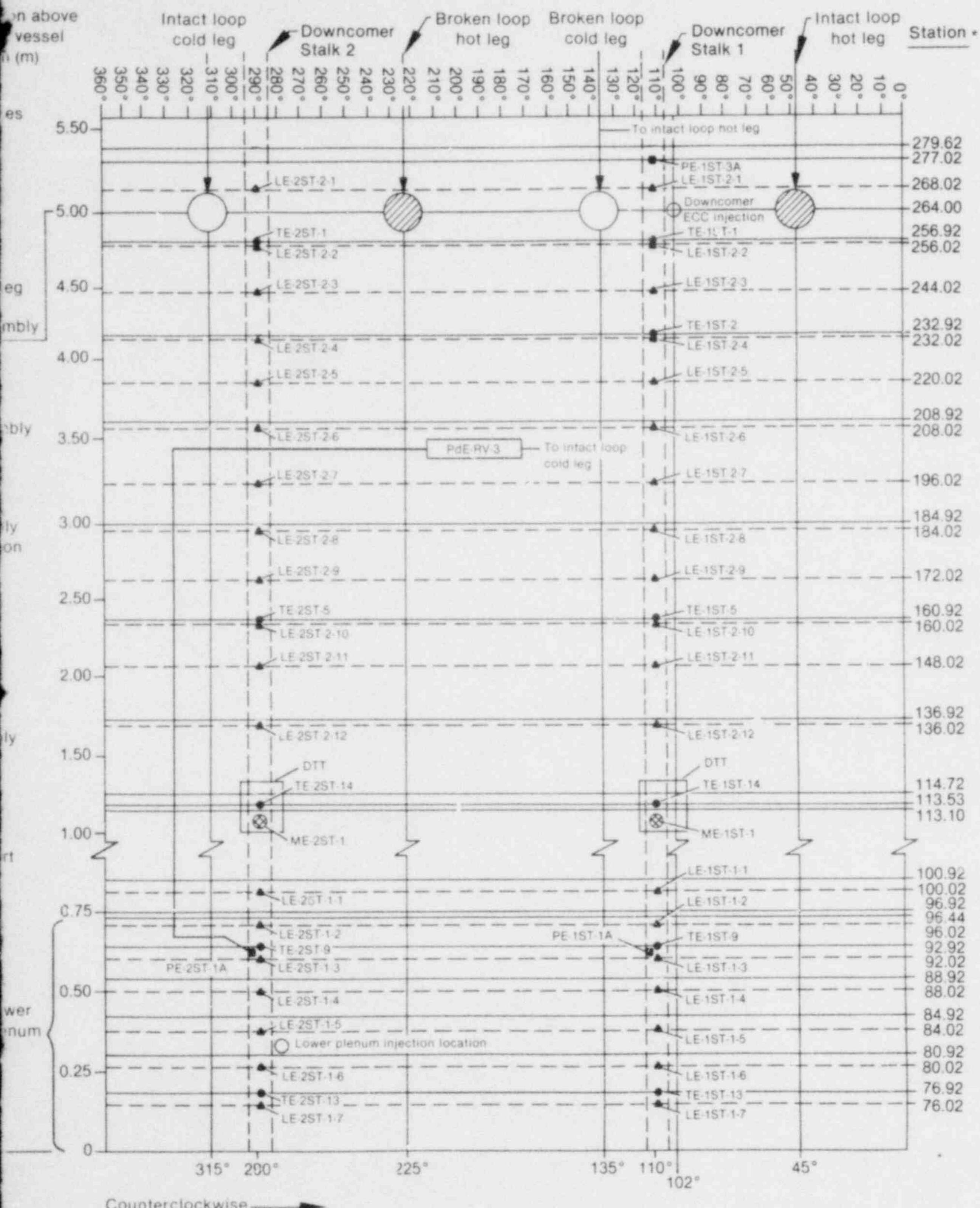


Figure 8. LOFT thermal-hydraulic instrumentation for broken loop.



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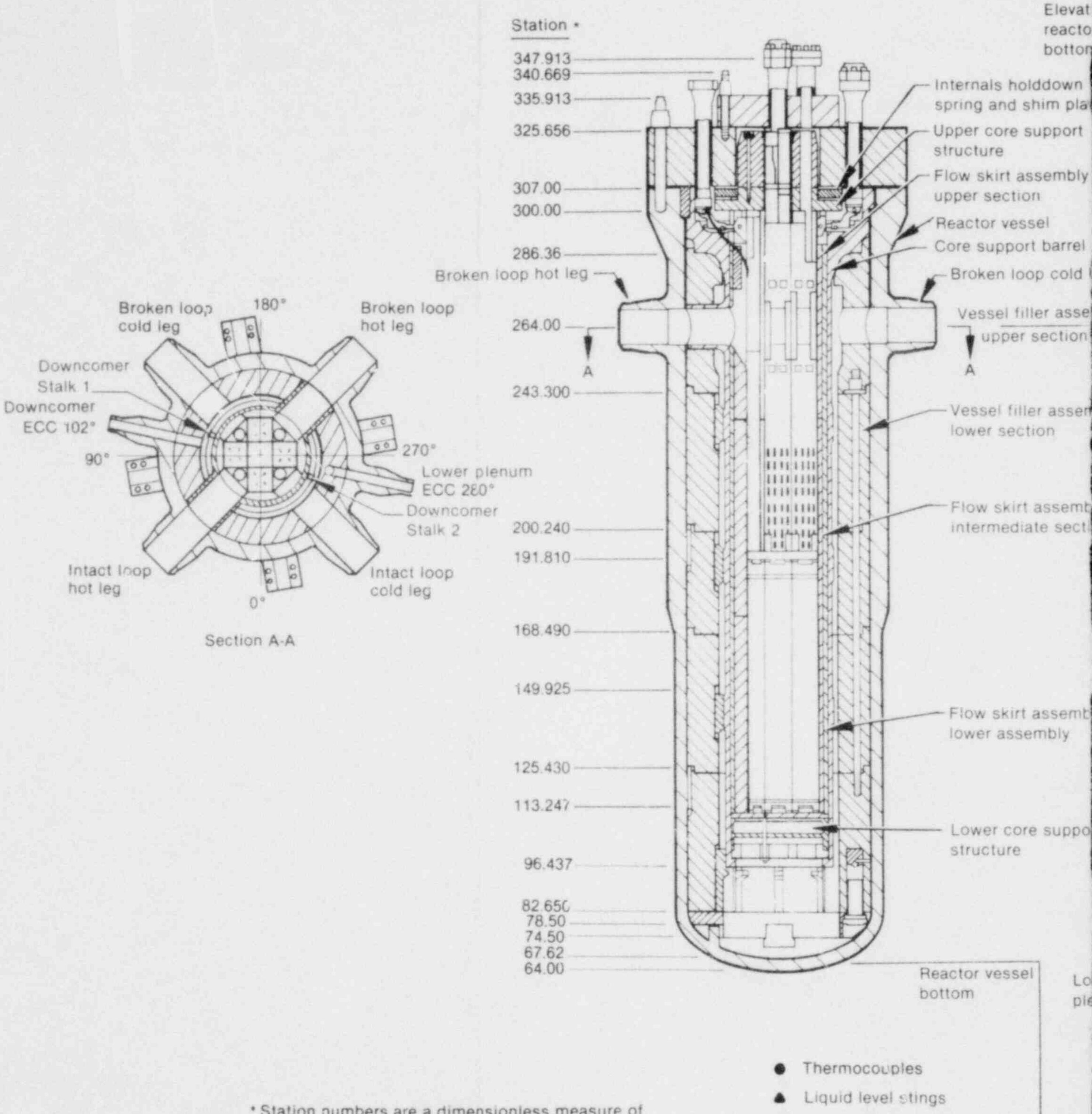
nstrumentation.



* Station numbers are a dimensionless measure of relative elevation within the reactor vessel. They are assigned in increments of 2.54 centimeters with station 300.00 defined at the core barrel support ledge inside the reactor vessel flange.

Figure 9. LOFT reactor vessel i

* Station numbers are a dimensionless measure of relative elevation within the reactor vessel. They are assigned in increments of 25.4 mm with Station 300.00 defined at the core barrel support ledge inside the reactor vessel flange.

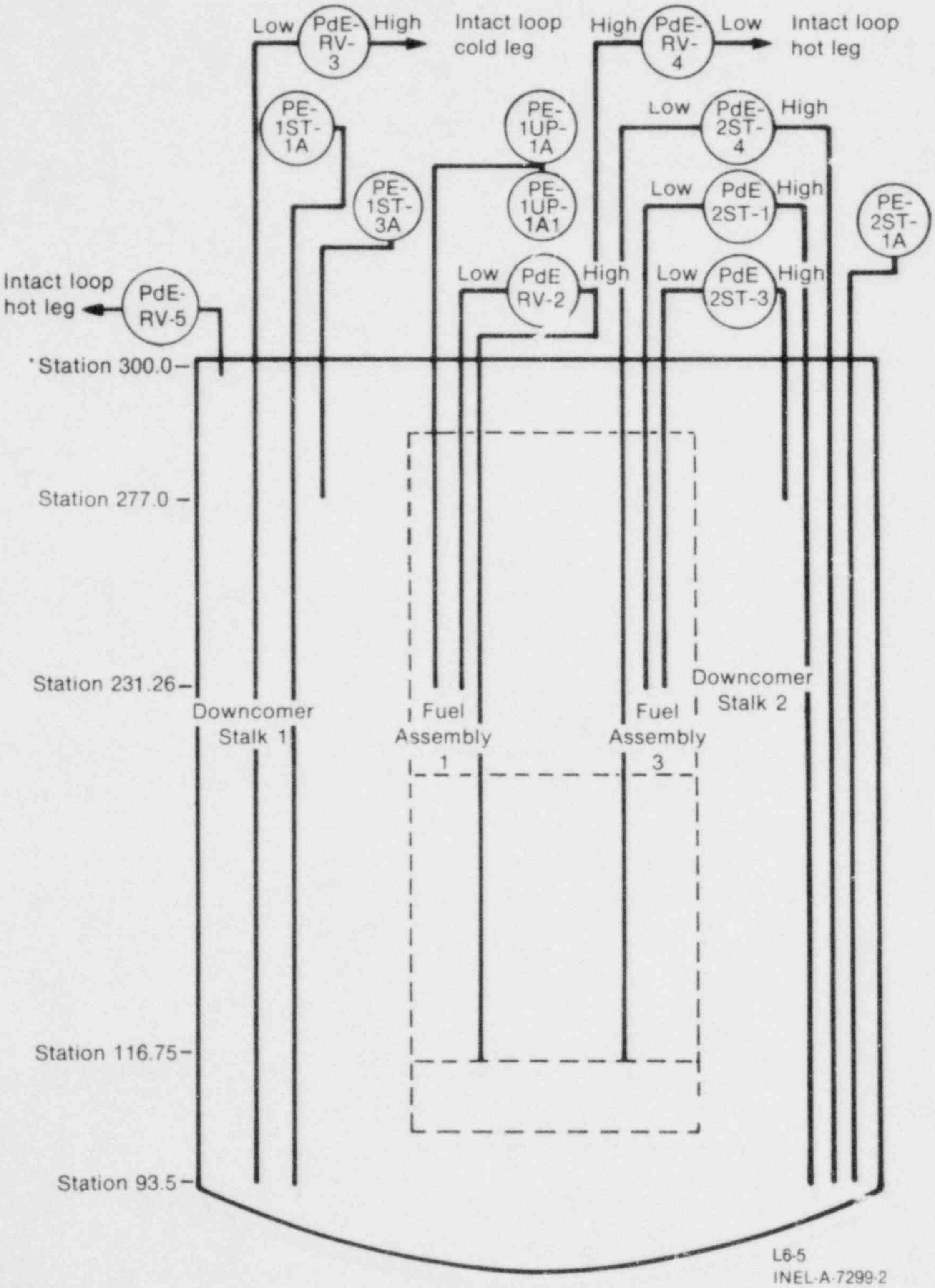
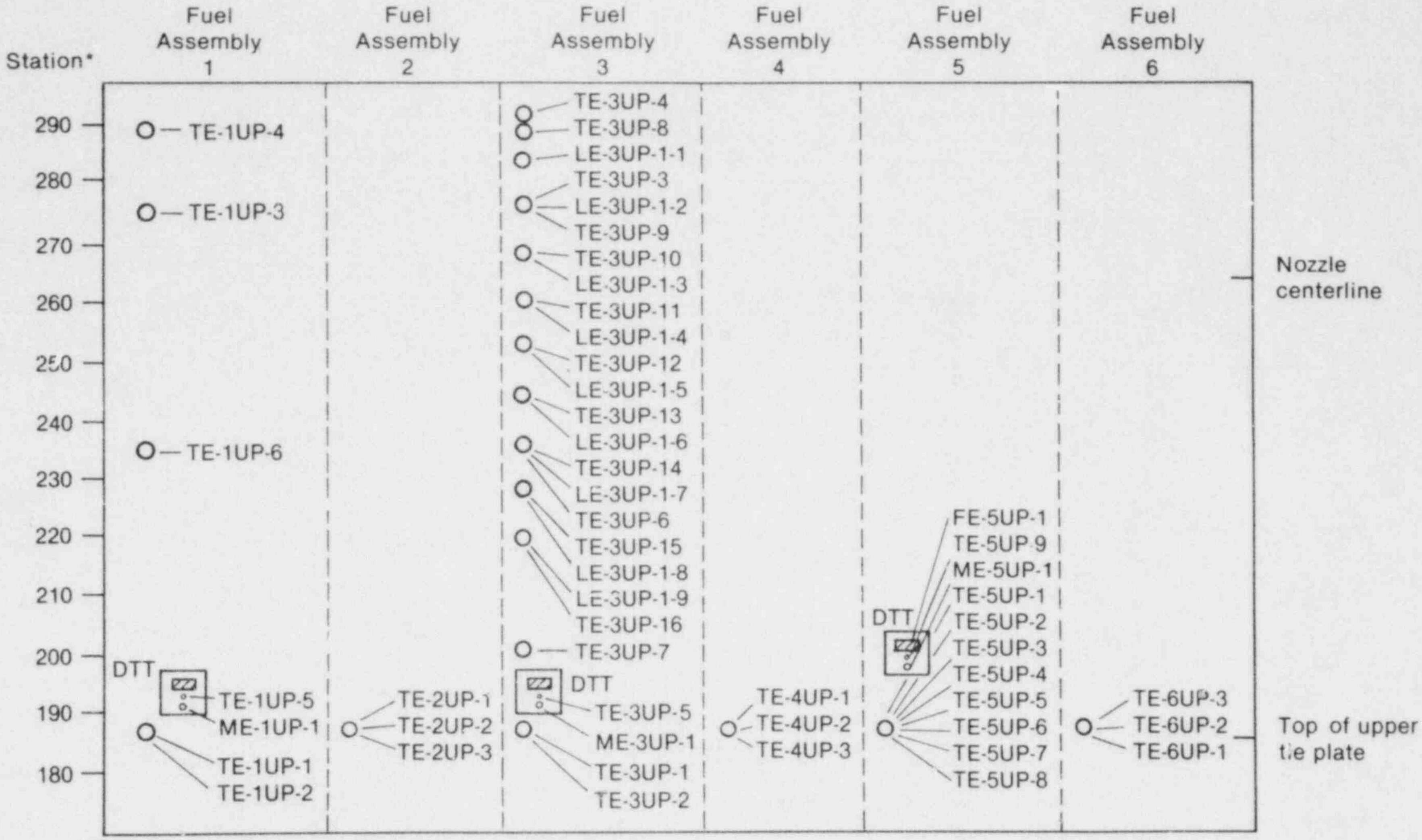


Figure 10. LOFT reactor vessel pressure and differential pressure instrumentation.



*Station numbers are a dimensionless measure of relative elevation within the reactor vessel. They are assigned in increments of 25.4 mm with station 300.00 defined at the core barrel support ledge inside the reactor vessel flange.

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Figure 11. LOFT reactor vessel upper plenum DTT, LE, and TE elevations.

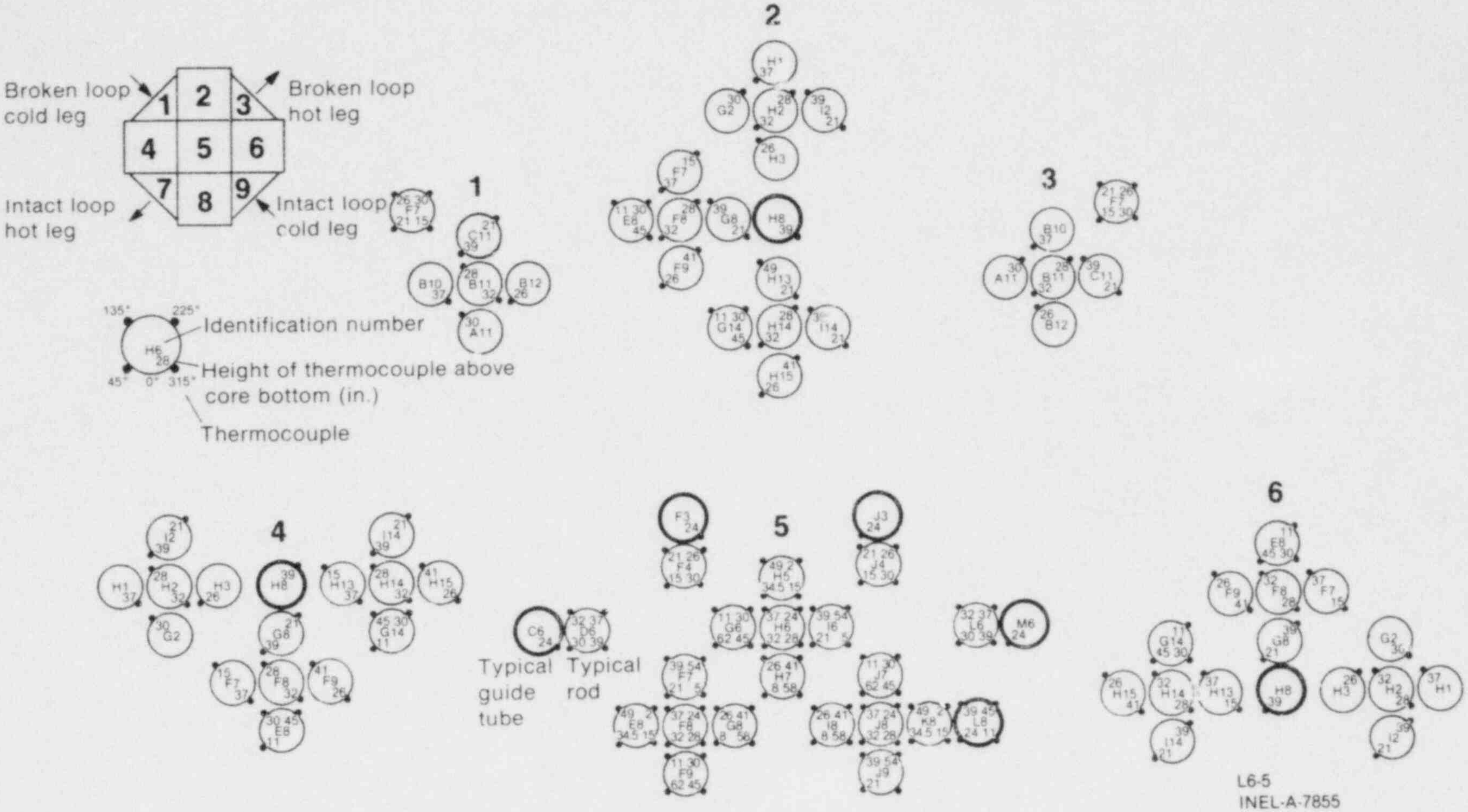


Figure 12. In-core thermocouple locations for LOFT Core 1.

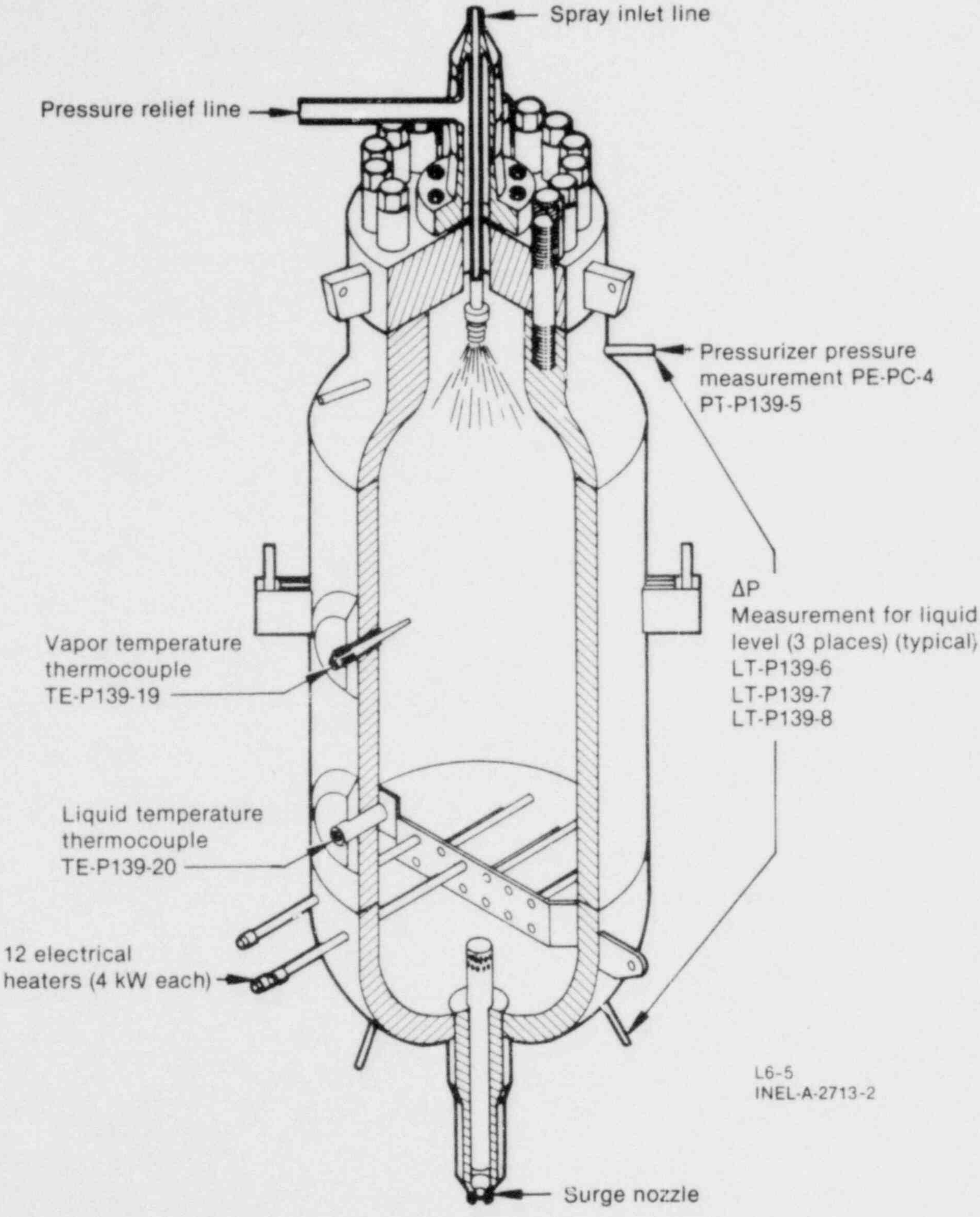


Figure 13. LOFT pressurizer instrumentation.

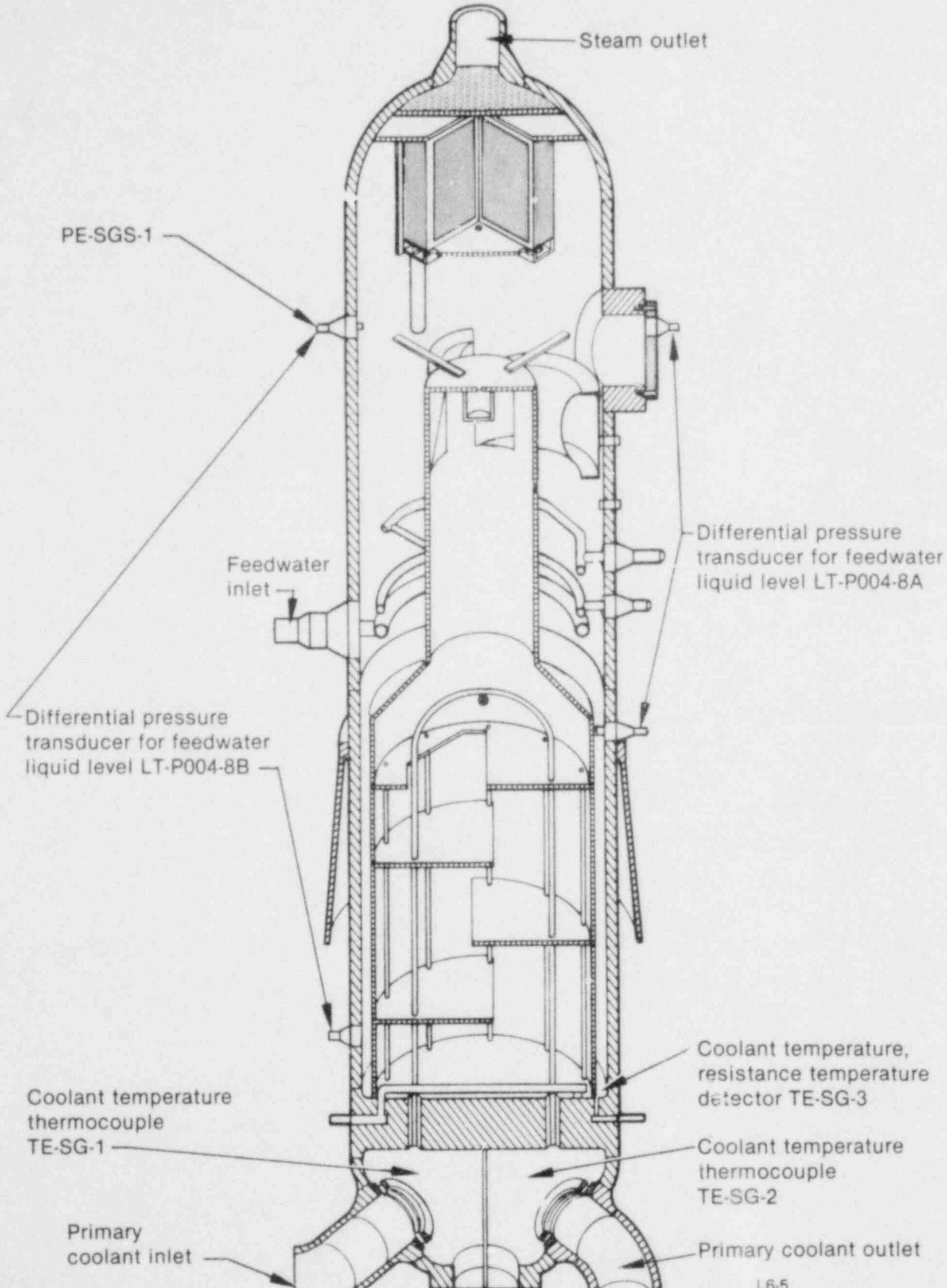


Figure 14. LOFT steam generator instrumentation.

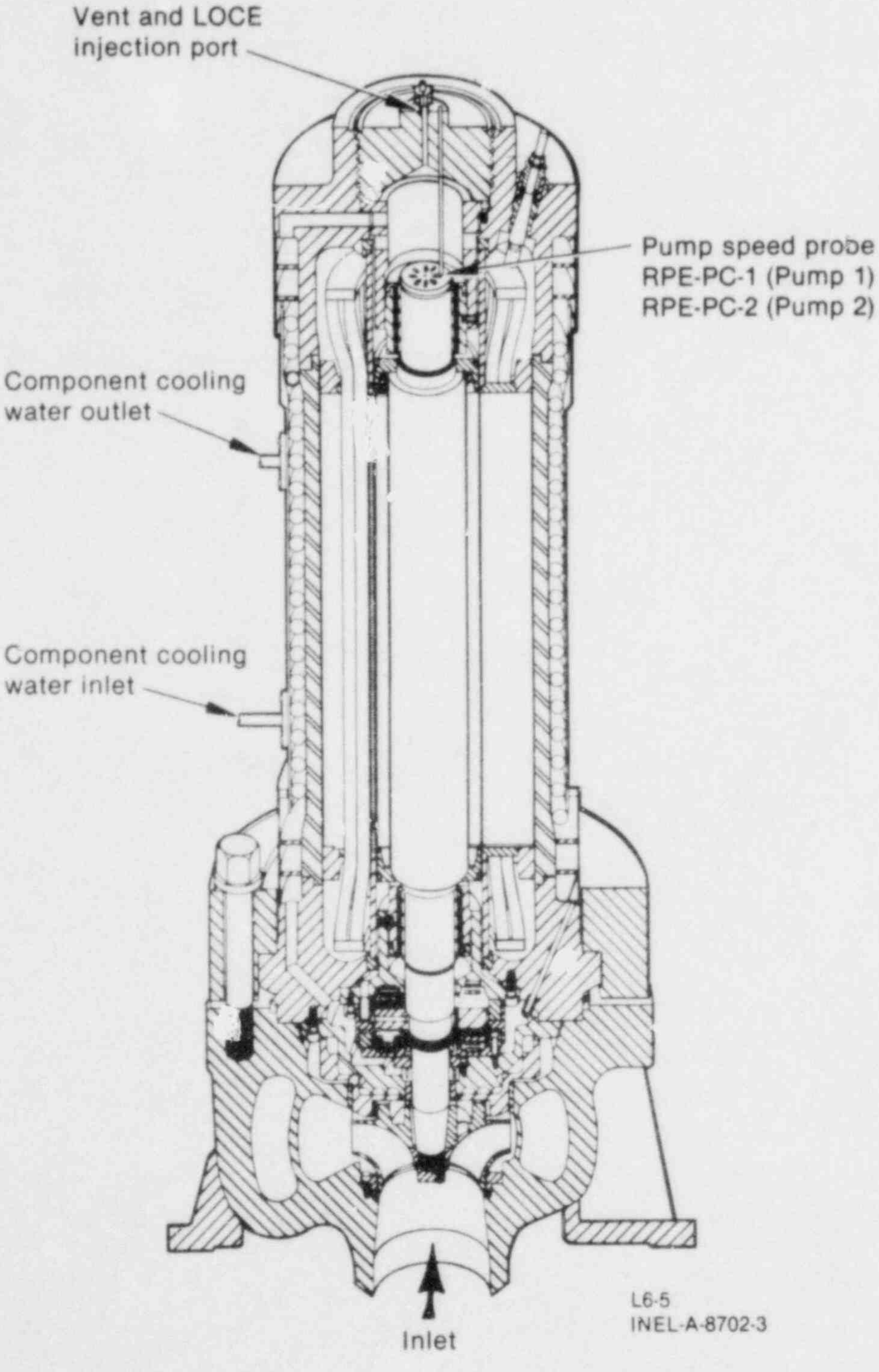
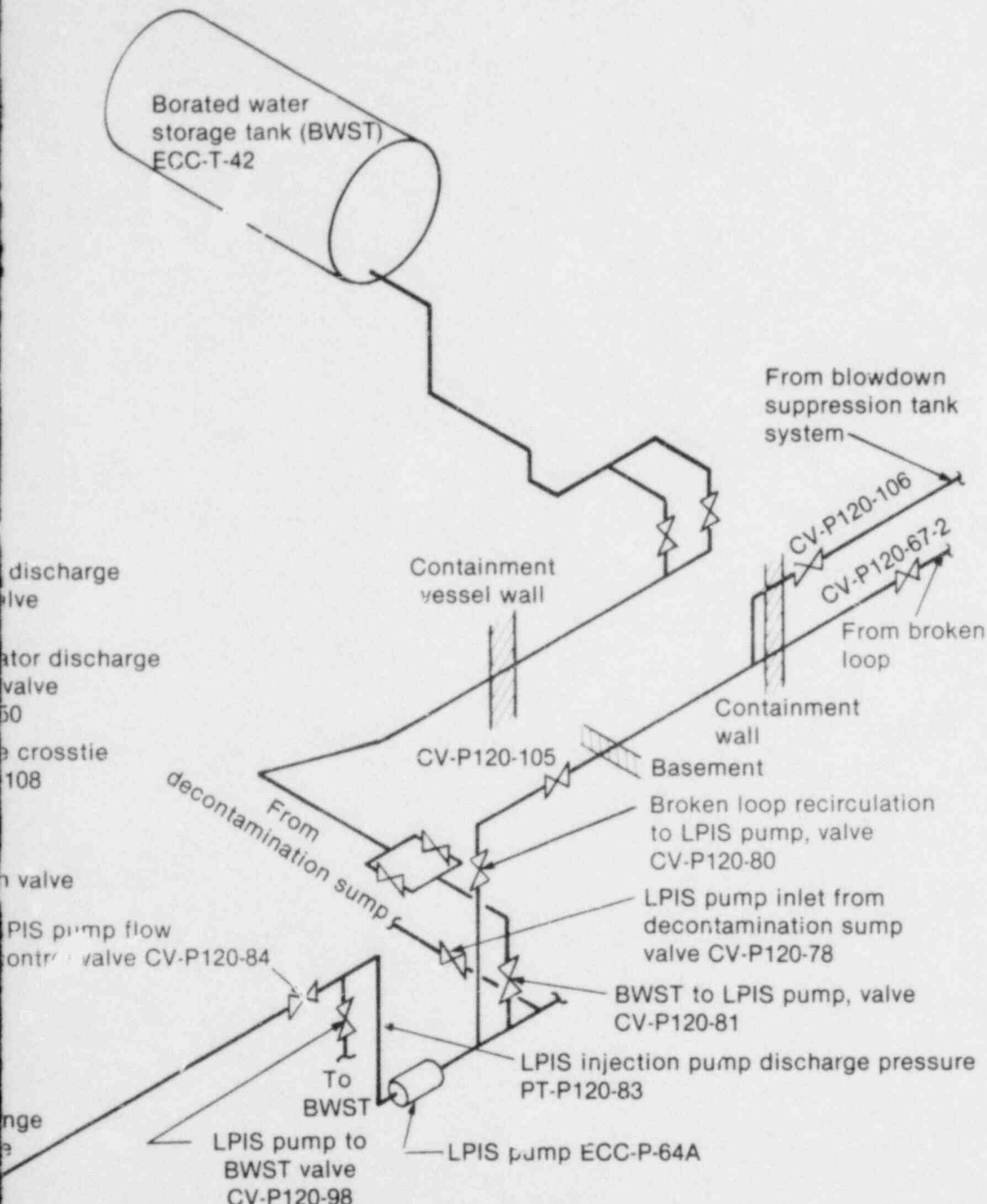


Figure 15. LOFT intact loop pump instrumentation.



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tation.

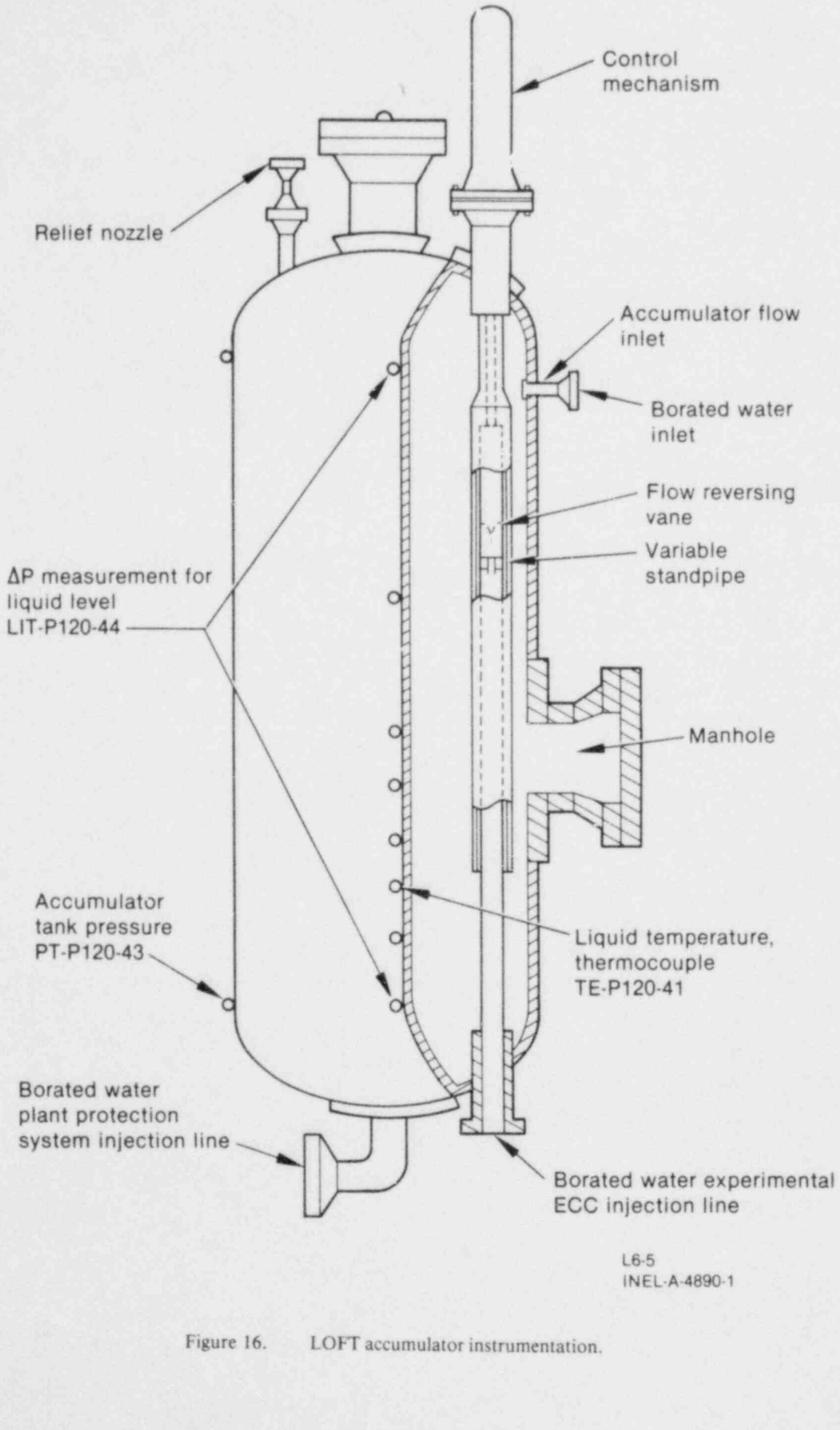


Figure 16. LOFT accumulator instrumentation.

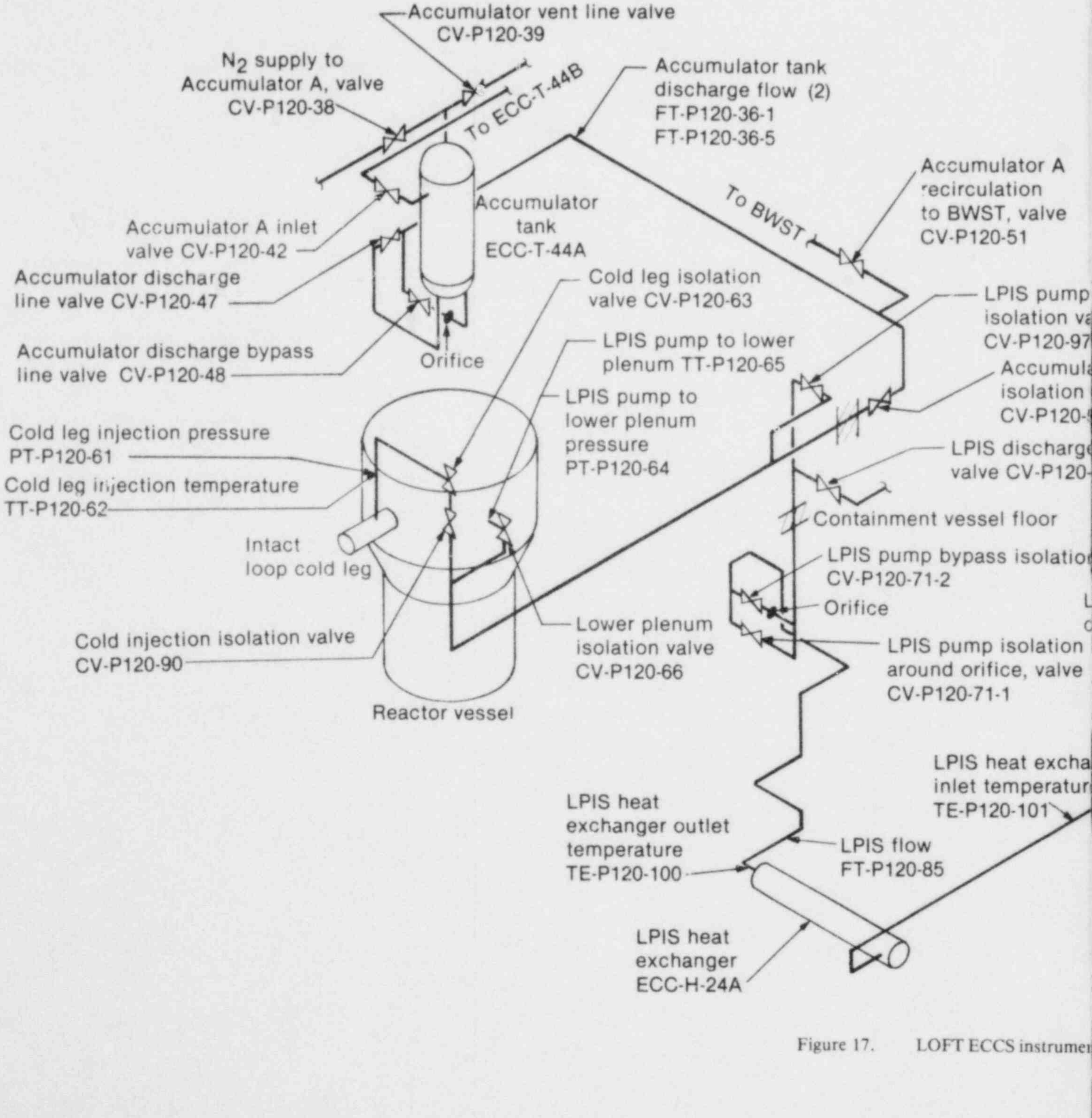
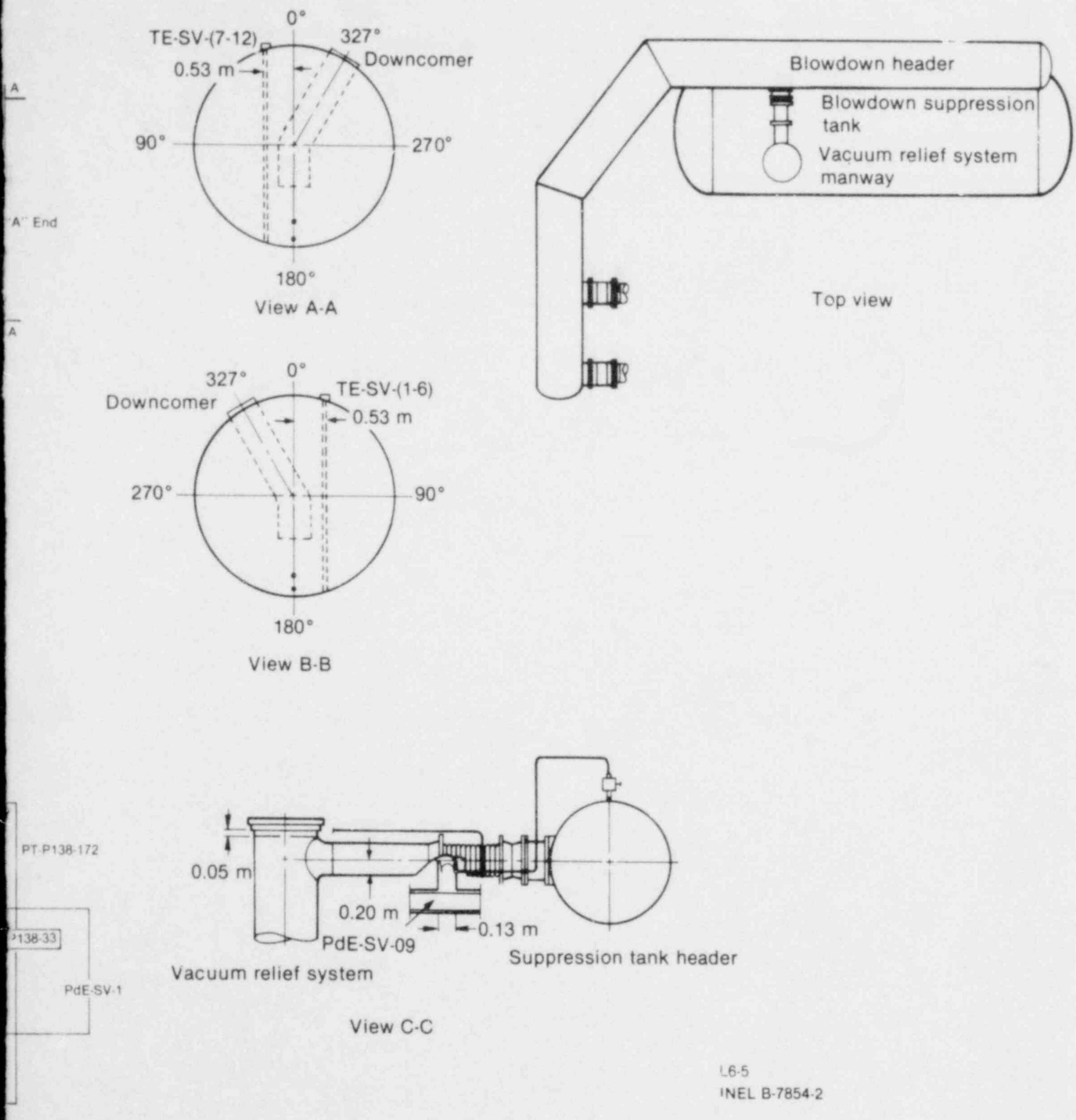


Figure 17. LOFT ECCS instrumen



LOFT blowdown suppression tank instrumentation.

4. EXPERIMENTAL PROCEDURE AND INITIAL CONDITIONS

This section summarizes the experimental procedure, initial conditions, and the significant events recorded during the experiment.

4.1 Experimental Procedure

In preparation for Experiment L6-5, the PCS was filled and vented and the specified system water chemistry was established. Prior to the primary system heatup, the following tests were performed on the LOFT system: plant requalification tests, pump coastdown runs, and operational verification of newly installed instrumentation. Selected system process instrumentation was calibrated and an electrical calibration was performed on the DAVDS.

The PCS pressure was hydrostatically increased to 1.46, 3.53, 6.98, 10.43, 13.87, and 15.60 MPa at cold plant temperature and zero flow conditions. The pressure was then decreased through these same pressure plateaus. The DAVDS recorded 20 s of data at each pressure plateau in both the increasing and decreasing directions to determine the degree of sensitivity of the pressure sensing instruments. The system was concurrently inspected for leakage at the various test pressures. The pumps were operated at 15, 20, 30, 40, 50, and 60 Hz with 20 s of data taken at each frequency.

The plant was stabilized at 383 and 555 K during heatup. At each of these temperatures, 20 to 30 s of data were recorded for calibration checks and to determine the degree of instrument temperature sensitivity. At the 555-K stabilization point, the pumps were stopped and 20 s of data were recorded during flow coastdown and zero flow conditions. With the pumps off at the 555-K stabilization point, the pressure in the system was again increased, and then decreased. The DAVDS recorded 20 s of data at the 14.95-, 13.87-, 12.50-, 11.12-, and 9.74-MPa pressure plateaus in both the increasing and decreasing directions. Frequency tests were performed by varying the primary coolant pump frequency from 20 to 60 Hz in 10-Hz increments at 555 K. Before the reactor was brought critical, the DAVDS was calibrated.

Initial reactor criticality occurred approximately 71 h prior to experiment initiation. Following this time, there were two periods of time when the reactor was at zero power. At approximately 28 h prior to the experiment, the reactor was brought to criticality for the last time. At 7 h prior to the experiment, the power level reached $\sim$37 MW and was maintained at that level until experiment initiation. (A plot of the power level versus time for the 80-hr period prior to the experiment is given in Figure 19.) During the 80-hr period, measurements of power level were performed using a secondary calorimetric calculation and the following specified initial conditions were established: The PCS flow rate was set at the specified 478.8 ± 8.8 kg/s and adjustment of the secondary coolant system (SCS) was made to maintain the specified power level. The PCS boron concentration was adjusted to establish a specified reactor vessel inlet temperature of 552.6 ± 2.2 K at a hot leg pressure of 14.95 ± 0.34 MPa.

Prior to experiment initiation, a DAVDS calibration and a data integrity check were performed. During this period, the initial-condition water samples were taken from the PCS and SCS. The intact loop conditions were checked, and adjusted as necessary, to ensure the specified conditions were met at experiment initiation.

The DAVDS was activated and data recording was started 1 min prior to experiment initiation. The reactor was scrammed manually at 23.7 ± 0.1 s after experiment initiation when the steam generator liquid level dropped to -0.126 m (all steam generator levels are based on a zero power reference liquid level which is 2.94 m above the top of the tube sheet). This level corresponds to the automatic low steam generator liquid level scram in a commercial PWR. The normal operating liquid level for the steam generator at 75% power is 0.194 ± 0.05 m. The top of the tubes in the steam generator are at approximately -0.816 m. The primary coolant pumps were allowed to run normally throughout the transient. The operators used charging pumps to recover the liquid levels in the pressurizer and steam generator beginning approximately 15 min after experiment initiation. The experiment terminated approximately 45 min after initiation. The sequence of events for the experiment is provided in Table 2.

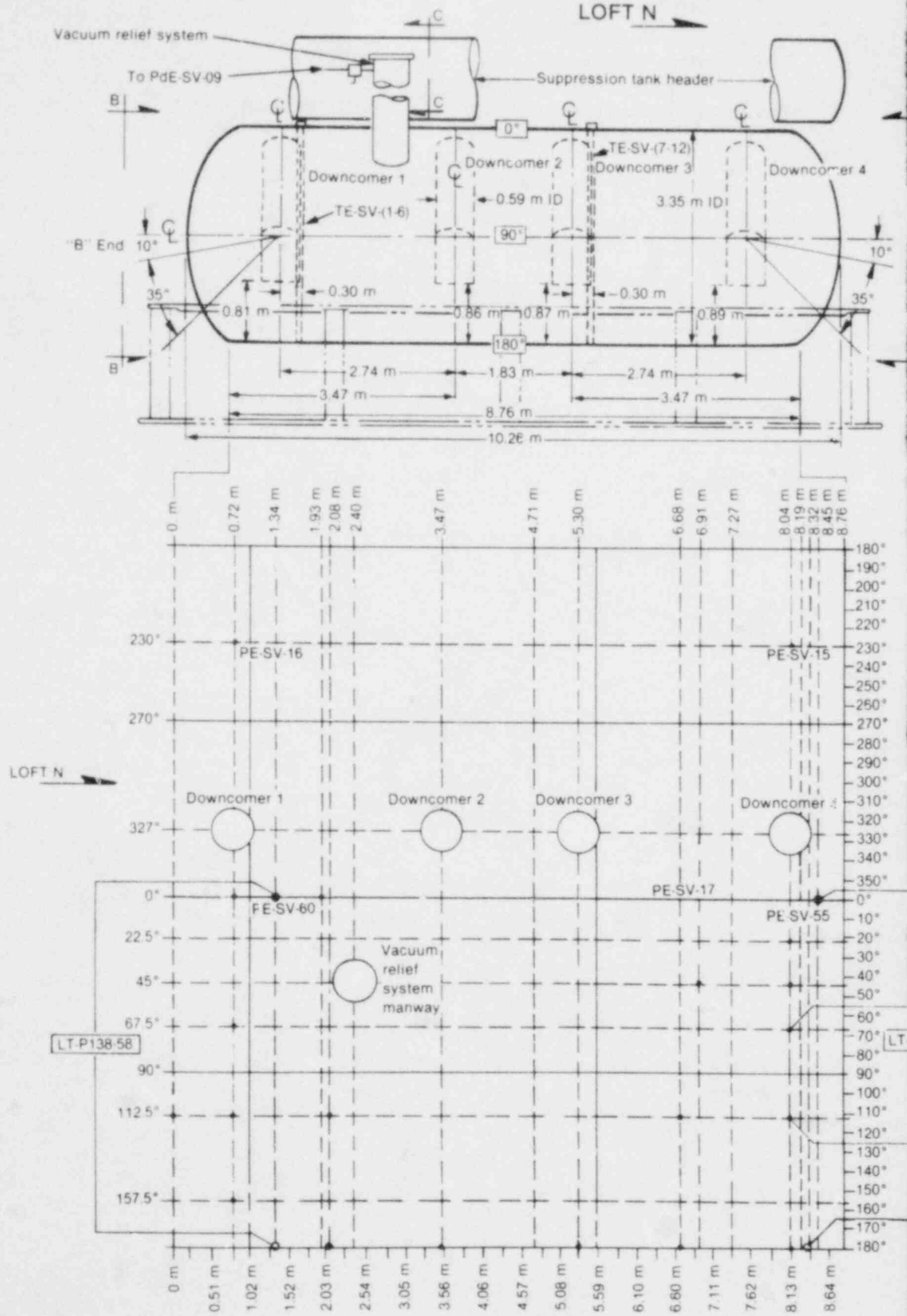

LOFT N
Vacuum relief system
To PdE-SV-09
Suppression tank header
Downcomer 1
Downcomer 2
Downcomer 3
Downcomer 4
TE-SV-(1-6)
TE-SV-(7-12)
0.59 m ID
3.35 m ID
"B" End
0.30 m
0.81 m
0.86 m
0.87 m
0.89 m
2.74 m
1.83 m
3.47 m
8.76 m
10.26 m
PE-SV-16
PE-SV-15
PE-SV-17
PE-SV-55
FE-SV-60
Vacuum relief system manway
LT-P138-58

Figure 18.

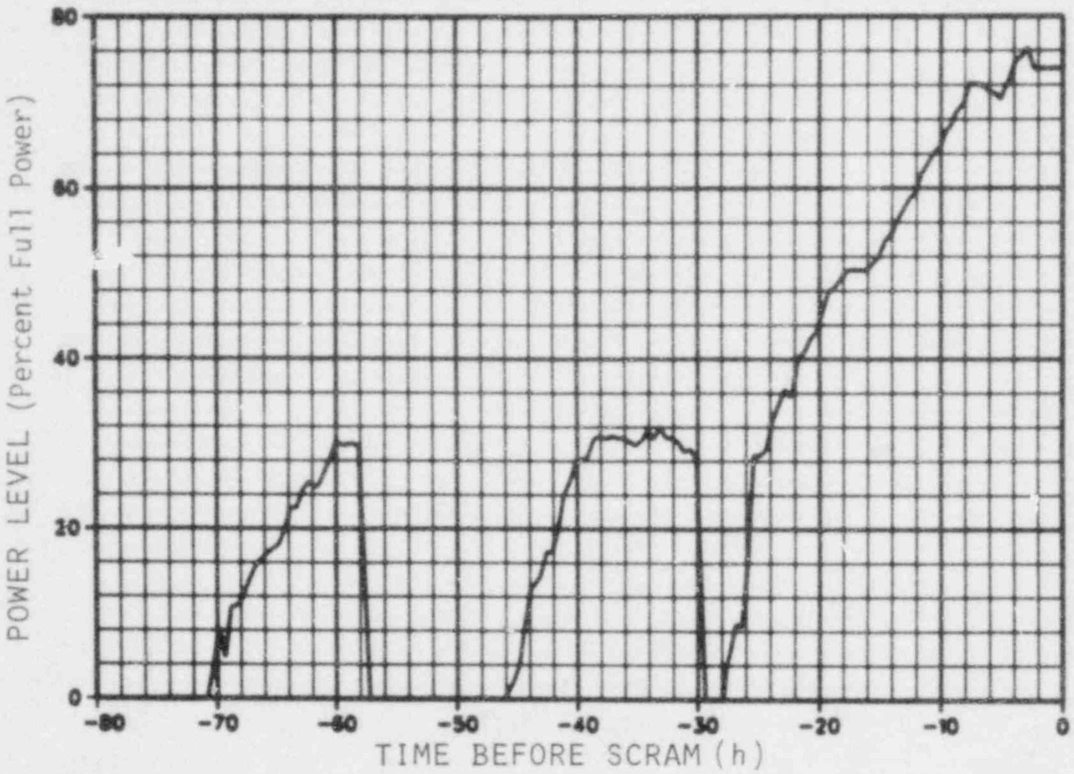


Figure 19. LOFT power history prior to Experiment L6-5 reactor scram [full power = 50 MW(t)]

TABLE 2. SEQUENCE OF EVENTS FOR EXPERIMENT L6-5

Event	Time after Experiment Initiation (s)
Experiment initiated	0
Main feedwater pump shut down	0.128 ± 0.1
Reactor scrammed	23.7 ± 0.1
Control rods on bottom	25.8 ± 0.1
Main feedwater isolation valve (CV-P004-73) closed	27.6 ± 0.1
Steam flow control valve (CV-P004-10) closed	35.4 ± 0.2
Steam flow control valve (CV-P004-10) opened	767.6 ± 0.2
Steam flow control valve (CV-P004-10) closed	791.1 ± 0.2
PCS charging initiated	937.2 ± 0.1
Steam generator fill initiated	954.8 ± 0.1
PCS charging terminated	1112.7 ± 0.1
Steam flow bypass valve (CV-P004-90) opened	2142 ± 2
Steam flow bypass valve (CV-P004-90) closed	2200 ± 2
PCS charging initiated	2377.3 ± 0.1
PCS charging terminated	2511.3 ± 0.1
Experiment completed	3100 ± 10

Figure 20 shows the calculated decay heat for the experiment using the American Nuclear Society Standard 5.1.[5]

The steam flow control valve automatically regulated steam generator pressure and steam flow after reactor scram. It operates on the following setpoints: at 7.03 ± 0.18 MPa the valve begins to open at 5% per second, at 6.96 ± 0.18 MPa it stops opening, at 6.34 ± 0.18 MPa it begins to close at 5% per second, and at 6.41 ± 0.18 MPa it stops closing. The pressurizer was also allowed to cycle at normal setpoints. Pressurizer sprayers turn on at 15.3 ± 0.12 MPa and turn off at 15.16 ± 0.12 MPa. The main pressurizer heaters turn on at 14.85 ± 0.12 MPa and turn off at 15.05 ± 0.12 MPa. The pressurizer backup heaters turn on at 14.81 ± 0.12 MPa and turn off at 14.92 ± 0.12 MPa.

The DAVDS recorded approximately 52 min of data during the transient. An electrical calibration of the DAVDS was performed following the experiment.

4.2 Initial Conditions

The specified initial conditions (except for the linear heat generation rate conditions) and tolerance bands for Experiment L6-5 are presented in Table 3 along with the values measured immediately prior to experiment initiation. All initial conditions were within specified tolerances except the water level in the steam generator secondary side which did not impair the results of the experiment. Table 4 gives the linear heat generation rate versus height above the bottom of the core for three fuel assemblies prior to experiment initiation. The data for Table 4 were obtained from the TIP system.

Table 5 gives the measured fluid temperatures of the PCS immediately prior to experiment initiation.

Table 6 specifies the required water chemistry for the PCS and the SCS. In addition, the results of the water chemistry analyses for these systems are presented for preexperiment conditions.

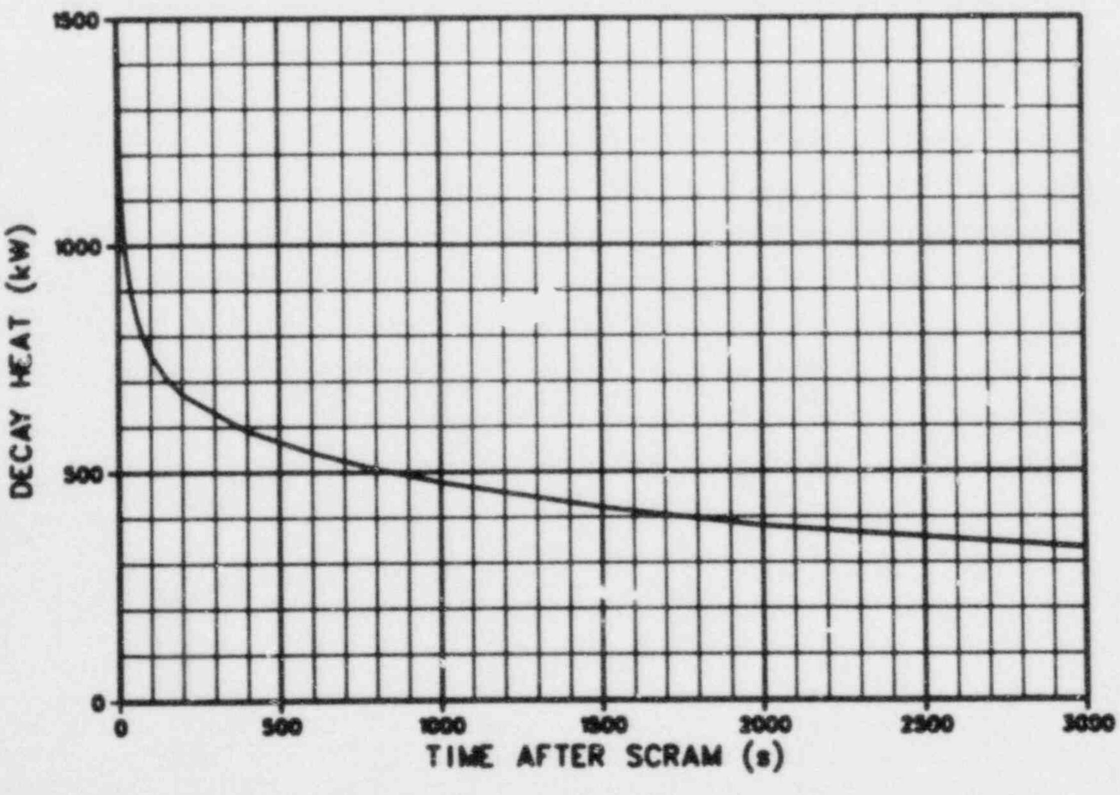


Figure 20. LOFT decay heat following Experiment L6-5 reactor scram.

TABLE 3. INITIAL CONDITIONS FOR EXPERIMENT L6-5

Parameter	Specified Value	Measured Value
Primary Coolant System		
Mass flow rate (kg/s)	478.8 ± 8.8	479.4 ± 6.3
Hot leg pressure (MPa)	14.95 ± 0.34	14.79 ± 0.25
Cold leg temperature (K)	557.6 ± 2.2	554.7 ± 3
Hot leg temperature (K)	--	568.2 ± 0.5
Boron concentration (ppm)	As required to maintain temperature	1054 ± 15
Reactor Vessel		
Power level (MW)	37.5 ± 2	36.7 ± 1
Maximum linear heat generation rate (kWm)	39.37 ± 2	39.6 ± 2
Control rod position (above full-in position) (m)	1.372 ± 0.013	1.372 ± 0.01
Pressurizer		
Steam volume (m^3)	0.32 ± 0.1	0.36 ± 0.02
Liquid volume (m^3)	0.61 ± 0.1	0.57 ± 0.02
Water temperature (K)	--	614.1 ± 1.3
Pressure (MPa)	14.95 ± 0.34	14.79 ± 0.25
Level (m)	1.13 ± 0.18	1.06 ± 0.04
Broken Loop		
Cold leg temperature near reactor vessel (K)	--	554.2 ± 2.5
Hot leg temperature near reactor vessel (K)	--	558.8 ± 2.5
Steam Generator Secondary Side		
Water level (m)[a]	0.19 ± 0.05	0.27 ± 0.06
Water temperature (K)	--	554.0 ± 0.2
Pressure (MPa)	--	5.58 ± 0.012
Mass flow rate (kg/s)	--	20.6 ± 0.4

a. Out of specification, but did not impair results.

TABLE 4. LINEAR HEAT GENERATION RATE PRIOR TO EXPERIMENT L6-5
(Reading Uncertainty ± 7.6%)

Height Above Core Bottom (m)	Linear Heat Generation Rate for Core Position (kW/m)		
	1C7	5H8	5M3
0.152	7.88	13.41	13.41
0.305	16.82	27.39	27.41
0.406	19.62	31.08	31.48
0.460	19.03	30.15	30.54
0.508	19.77	32.20	32.23
0.559	22.12	35.04	35.49
0.660	23.13	36.64	37.11
0.762	23.01	36.44	36.91
0.838	21.85	34.62	35.07
0.891	19.34	30.64	31.03
0.940	20.03	31.73	32.15
1.067	18.75	29.70	30.08
1.219	15.24	23.10	23.37
1.270	13.03	19.74	19.98
1.303	10.39	16.46	16.68
1.372	9.17	14.53	14.72
1.524	4.46	7.44	6.98
1.626	2.29	3.81	3.58
1.676	1.44	2.40	2.25

TABLE 5. PRIMARY COOLANT TEMPERATURES AT EXPERIMENT L6-5 INITIATION

Location	Detector	Temperature (K)
Intact loop hot leg (near vessel)	TE-P139-32-1	570.8 ± 1.4
Intact loop steam generator inlet	TE-SG-001	569.8 ± 2.7
Intact loop steam generator outlet	TE-SG-002	555.6 ± 2.7
Intact loop cold leg (near vessel)	TE-PC-004	556.0 ± 3.0
Reactor vessel downcomer:		
Instrument Stalk 1	TE-1ST-001	557.6 ± 2.7
Instrument Stalk 2	TE-2ST-001	559.3 ± 2.7
Reactor vessel lower plenum	TE-1LP-001	558.1 ± 2.7
Reactor vessel upper plenum	TE-1UP-001	578.1 ± 2.7
	TE-5UP-001	580.2 ± 2.7
Intact loop pressurizer (from saturation pressure)	PE-PC-004	614.1 ± 1.3

TABLE 6. WATER CHEMISTRY RESULTS FOR EXPERIMENT L6-5

Parameter	Primary Coolant System: Specified	Primary Coolant System: Preexperiment[a]	Secondary Coolant System: Specified	Secondary Coolant System: Preexperiment
pH (each at 298 K)	4.2 to 10.5	5.57	9.0 to 10.2	10.18
Conductivity (μmho/cm^3) (each at 298 K)	60 maximum	3.06	2 maximum[b]	--
Total gas (cm^3/kg)	100 maximum	41.6	--	--
Dissolved oxygen (ppm)	--	--	0.005 maximum	0.020
Chloride (ppm)	0.15 maximum	<0.1	0.15 maximum	<0.1
Undissolved solids (ppm)	1.0 maximum	<0.5	1.0 maximum	2.5
Boron (ppm)	--	1054	--	--
Fluoride (ppm)	0.1 maximum	<0.02	--	--
Hydrogen (cm^3/kg)	10 to 60	17.2	--	--
Total gross activity (μc/mL)	375 maximum	0.025	--	--
Gross beta and gamma (μc/mL)	--	0.025	--	--
^{131}I (μc/mL)	0.37 maximum	0	9 x 10^{-4} maximum	0
^{135}I (μc/mL)	0.76 maximum	0	--	0

a. Sample taken upstream of the primary coolant system ion exchanger.

b. Cation conductivity.

5. DATA PRESENTATION

The data presented in this report include selected pertinent thermal-hydraulic and nuclear data from LOFT Experiment L6-5.

The selected data have been divided into two categories, "Qualified" and "Failed." The qualified designation was applied to measurements that have been found to be within the uncertainty of the instrument. The absence of a comment following the qualified designation indicates that the data are valid, within specified uncertainty bands, over the entire time span presented. Restrictive statements accompany data that are invalid over a portion of the presented time span. Instrument channels were not presented if the data were in the instrument dead band or showed a similar response to nearby like instruments (such as the core thermocouples). These data are available from EG&G Idaho, Inc., upon special request. The checks on data consistency and instrument performance are discussed in detail in Appendix A.

The data were processed and are presented in graphical form in SI units. Measurements were combined to produce computed variables, and graphs of similar variables at several locations were overlaid to facilitate comparison. The number of data points shown for each instrument have been reduced to 4000 for ease of plotting. To accomplish this reduction, the data were passed through a low-pass filter and then decimated.

Computed parameter data from the turbine flowmeter were filtered with a 4-Hz, low-pass filter prior to presentation.

The 2-σ confidence intervals have been determined from knowledge of the systematic and random errors of the sensors, data system, calibration procedures, and the channel random noise during preexperiment calibrations. These are presented as functions of output level so that the user may determine the approximate uncertainty over each range of interest for a given variable.

Table 7 lists Experiment L6-5 instrumentation providing data presented in this report and gives the detector location, range, initial condition uncertainty, uncertainty at specific readings, and recording frequency along with the figure numbers. This table also contains a "Comments" column which gives information relative to the usability of the data. A complete list of the LOFT instrumentation available for use during Experiment L6-5 is contained in Appendix B.

Table 8 lists the variables that were computed from the transducer outputs and other factors, such as geometrical constants. This table also gives the equations used to compute these variables, the figure number, and comments which may reflect on the usefulness of the data.

The data are divided into four major sections, with the individual plots in each section being presented in alphanumeric order to facilitate comparison and location of desired variables. These data sections include

1. Experiment L6-5 Measured Variables, Short-Term Plots (-10 to 30 s), Figures 21 through 25
2. Experiment L6-5 Measured Variables, Medium-Term Plots (-50 to 200 s), Figures 26 through 67
3. Experiment L6-5 Measured Variables, Long-Term Plots (0 to 3000 s), Figures 68 through 85
4. Experiment L6-5 Computed Variables, Figures 86 and 87.

TABLE 7. MEASURED VARIABLES FOR EXPERIMENT L6-5

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation: Reading	After Experiment Initiation: Uncertainty (±)	Figure	Comments
VALVE OPENING								
Intact Loop								
CV-P004-008	Main feedwater control valve.	0 to 100%	1 Hz	3.2%	0% 25% 50% 100%	3.0% 3.13% 3.47% 4.61%	21	Qualified.
CV-P004-010	Main steam control valve.	0 to 100%	1 Hz	3.9%	0% 25% 50% 100%	3.0% 3.13% 3.47% 4.61%	26,68	Qualified.
FLUID VELOCITY								
Reactor Vessel								
FE-5UP-001	Above upper end box of Fuel Assembly 5.	0.5 to 10.0 m/s	1 Hz	0.23 m/s	1 m/s 5 m/s 10 m/s	0.06 m/s[b] 0.28 m/s 0.56 m/s	27	Qualified.
FLOW RATE								
Intact Loop								
FT-P004-012	Inlet to air-cooled condenser inlet header.	0 to 40 kg/s	1 Hz	0.8 kg/s	--	0.8 kg/s	28,69	Qualified, magnitude uncertain after scram.
FT-P004-072A	Main feedwater pump discharge flow.	0 to 25 kPa	Hz	0.17 kPa	--	0.17 kPa	22	Qualified.
Emergency Core Cooling System								
FT-P128-085	Charging pump AC-P-48 discharge.	0 to 1.89 L/s	1 Hz	0.02 L/s	--	0.02 L/s	70	Qualified.
Intact Loop								
FT-P139-27-3	Intact loop hot leg venturi flowmeter [left side facing steam generator (SG)].	0 to 630.0 kg/s	1 Hz	17 kg/s	--	17 kg/s	29,71	Qualified.

TABLE 7. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation: Reading	After Experiment Initiation: Uncertainty (±)	Figure	Comments
LIQUID LEVEL								
Secondary Coolant System								
LT-P004-008B	SG feedwater level (wide range).	-3.6 to 1.4 m[c]	1 Hz	0.05 m	--	0.05 m	23 30 72	Qualified, data not density compensated.
Intact Loop								
LT-P004-042	Condensate receiver level, 183 m south of condensate receiver centerline.	0 to 1.2 m	1 Hz	0.02 m	--	0.02 m	73	Qualified.
LT-P139-007	Pressurizer level on southwest side.	0 to 1.9 m	1 Hz	0.04 m	--	0.04 m	31,74	Qualified for relative changes only.
NEUTRON DETECTION								
Reactor Vessel								
NE-2H8-26	Neutron detector in Fuel Assembly 2.	0 to 52.5 kW/m (local)	1 Hz	2.03 kW/m	--	2.03 kW/m[d]	24	Qualified through reactor scram, relative changes only.
DIFFERENTIAL PRESSURE								
Intact Loop								
PdE-PC-001	Intact loop cold leg across primary coolant pumps (PCPs).	±700 kPa (differential)	1 Hz	1.8 kPa	0 kPa 350 kPa 700 kPa	1.7 kPa 1.7 kPa 1.9 kPa	32	Qualified.
PdE-PC-008	Intact loop across pressurizer surge line.	±10.34 kPa (differential)	1 Hz	0.025 kPa	0 kPa 5 kPa 10 kPa	0.025 kPa 0.026 kPa 0.028 kPa	33	Qualified.
PdT-P139-030	Across reactor vessel (RV) just beyond intact loop inlet and outlet nozzles.	0 to 300 kPa (differential)	1 Hz	3 kPa	--	3 kPa	34	Qualified.

TABLE 7. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation: Reading	After Experiment Initiation: Uncertainty (±)	Figure	Comments
PRESSURE[e]								
Intact Loop								
PE-PC-001	Intact loop cold leg at drag disc turbine transducer (DTT) flange.	0.1 to 20.8 MPa[e]	1 Hz	0.251 MPa	0 MPa 10 MPa 20 MPa	0.199 MPa 0.223 MPa 0.282 MPa	35	Qualified.
PE-PC-004	Intact loop pressurizer vapor space.	0.1 to 20.8 MPa	1 Hz	0.251 MPa	0.1 MPa 10 MPa 20 MPa	0.199 MPa 0.223 MPa 0.282 MPa	36,75	Qualified.
PE-PC-006	Intact loop reference pressure between SG outlet and pump inlet.	0.1 to 17.0 MPa	1 Hz	0.028 MPa	--	0.028 MPa	37,76	Qualified.
PE-SGS-001	SG dome pressure.	0.1 to 7.0 MPa	1 Hz	0.012 MPa	--	0.012 MPa	38,77	Qualified.
Reactor Vessel								
PE-1ST-001A	Downcomer Stalk 1, 0.62 m above RV bottom, wide range (0 to 20.8 MPa).	0.1 to 20.8 MPa	1 Hz	0.200 MPa	0.1 MPa 10.0 MPa 20.5 MPa	0.199 MPa 0.199 MPa 0.200 MPa	39	Qualified.
PE-1UP-001A1	Above Fuel Assembly 1 upper end box, high range.	0.1 to 20.8 MPa	1 Hz	0.25 MPa	0.1 MPa 10 MPa 20 MPa	0.2 MPa 0.22 MPa 0.28 MPa	40,78	Qualified.
Secondary Coolant System								
PT-P004-010A	In 10-in. line from SG.	0.1 to 8.4 MPa	1 Hz	0.110 MPa	--	0.110 MPa	41	Qualified.
PT-P004-085	Upstream of inlet to air-cooled condenser header.	0 to 2.8 MPa	1 Hz	0.075 MPa	--	0.075 MPa	42	Qualified.
Intact Loop								
PT-P139-003	Intact loop hot leg at venturi on left side when looking toward SG.	0.1 to 20.8 MPa	1 Hz	0.25 MPa	--	0.25 MPa	43	Qualified.
PT-P139-005	1.88 m above pressurizer bottom (vapor space).	10.3 to 17.2 MPa	1 Hz	0.12 MPa	--	0.12 MPa	44	Qualified.

TABLE 7. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation Reading	After Experiment Initiation Uncertainty (±)	Figure	Comments
REACTIVITY								
Reactor Vessel								
RE-T-77-2A2	Power range, Channel B level.	0 to 100% power	1 Hz	3%	--	3%	25	Qualified.
TEMPERATURE								
Intact Loop								
TE-PC-004	Bottom of emergency core coolant (ECC) Rake 1 (between PdE-PC-014 and PdE-PC-018).	270 to 1530 K	1 Hz	3.1 K	350 K 450 K 550 K 650 K	2.8 K 2.9 K [illegible].0 K 3.6 K	45,79	Qualified.
TE-P139-019	Pressurizer vapor space, 0.86 m above the heater rods.	588.6 to 644.1 K	1 Hz	0.5 K	--	0.5 K	46,80	Qualified.
TE-P139-020	Pressurizer liquid volume, 0.36 m above heater rods.	283 to 644.1 K	1 Hz	3.0 K	--	3.0 K	47,81	Qualified.
TE-P139-029	Intact loop cold leg.	280 to 620 K	1 Hz	2.1 K	--	2.1 K	45,79	Qualified, process instrument, slow response time.
TE-P139-32-1	Intact loop hot leg.	280 to 620 K	1 Hz	1.43 K	--	1.43 K	48	Qualified, process instrument, slow response time.
TE-SG-001	Intact loop cold leg SG outlet.	253.2 to 977.4 K	1 Hz	2.8 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.7 K 3.3 K	49,82	Qualified.
TE-SG-002	Intact loop hot leg SG inlet.	253.2 to 977.4 K	1 Hz	2.8 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.7 K 3.3 K	50,83	Qualified.
Secondary Coolant System								
TE-SG-003	SG secondary side.	253.2 to 588.6 K	1 Hz	2.5 K	350 K 450 K 550 K 650 K	2.4 K 2.5 K 2.5 K 3.2 K	51,84	Qualified.

TABLE 7. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation: Reading	After Experiment Initiation: Uncertainty (±)	Figure	Comments
TEMPERATURE (continued)								
Reactor Vessel								
TE-1LP-001	Fuel Assembly 1 lower end box.	311 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	52	Qualified.
TE-1ST-013	Downcomer Stalk 1, 0.24 m from RV bottom.	253.2 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.7 K 3.3 K	53	Qualified.
TE-1UP-001	Fuel Assembly 1 upper end box.	311 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	54	Qualified.
TE-2ST-014	Downcomer Stalk 2, 1.17 m from RV bottom.	253.2 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.7 K 3.3 K	55	Qualified.
TE-2UP-003	Fuel Assembly 2 upper end box.	311 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	56	Qualified.
TE-3LP-001	Fuel Assembly 3 lower end box.	311 to 977.4 K	1 Hz	2.6 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	57	Qualified.
TE-3UP-001	Fuel Assembly 3 upper end box.	311 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	58	Qualified.
TE-4LP-003	Fuel Assembly 4 lower end box.	311 to 977.4 K	1 Hz	2.6 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	59	Qualified.
TE-4UP-001	Fuel Assembly 4 upper end box.	311 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	60	Qualified.

TABLE 7. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation: Reading	After Experiment Initiation: Uncertainty (±)	Figure	Comments
TEMPERATURE (continued)								
Reactor Vessel (continued)								
TE-5D6-030	Cladding on Fuel Assembly 5, Row D, Column 6 at 0.76 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	61	Qualified.
TE-5F9-045	Cladding on Fuel Assembly 5, Row F, Column 9 at 1.14 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	62	Qualified.
TE-5F9-062	Cladding on Fuel Assembly 5, Row F, Column 9 at 1.57 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	61	Qualified.
TE-5G8-008	Cladding on Fuel Assembly 5, Row G, Column 8 at 0.20 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	61	Qualified.
TE-5G8-026	Cladding on Fuel Assembly 5, Row G, Column 8 at 0.66 m above bottom of fuel rod.	410 to 1620 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	3.8 K 4.2 K 5.2 K 6.7 K	63	Qualified.
TE-5LP-001	Fuel Assembly 5 lower end box.	311 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	64,85	Qualified.
TE-5UP-001	Fuel Assembly 5 upper end box.	311 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	64 65 85	Qualified.
TE-5UP-005	Fuel Assembly 5 upper end box.	311 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	65	Qualified.

TABLE 7. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation Reading	After Experiment Initiation Uncertainty (±)	Figure	Comments
TEMPERATURE (continued)								
Reactor Vessel (continued)								
TE-5UP-008	Fuel Assembly 5 upper end box.	311 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	65	Qualified.
TE-6LP-001	Fuel Assembly 6 lower end box.	311 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	66	Qualified.
TE-6UP-001	Fuel Assembly 6 upper end box.	311 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	67	Qualified.

a. Recording frequency is the measurement channel bandwidth at the ± 3 dB level.

b. Reference 6.

c. The steam generator level is defined as 0 at 2.95 m above the top of the tube sheet.

d. Reference 7.

e. Pressure measurements are presented as absolute values.

TABLE 8. COMPUTED VARIABLES FOR EXPERIMENT L6-5

Variable, Location, and Detector	Units	Uncertainty	Calculation Method	Figure	Comments
FLUID SUBCOOLING					
Upper Plenum					
PE-1UP-001A1	K	6 K	The subcooling is defined as $T_{sat} - T$. The saturation temperature is calculated from the pressure reading of PE-1UP-001A1 using the following curve fits of steam table data: for $P < 1.4$ MPa, $T_{sat} = 348.225 - 290.13P + 399.543P^2 + 298.730P^3 - 84.196P^4$ for $1.4 \text{ MPa} \leq P \leq 12$ MPa, $T_{sat} = 419.024 + 42.6705P - 5.63957P^2 + 0.433108P^3 - 0.0130329P^4$ for $P > 12$ MPa, $T_{sat} = 508.252 + 8.84806P - 0.114572P^2$.	86,87	Qualified.
TE-5UP-1 through TE-5UP-8			The measured temperature is an average of TE-5UP-1 through TE-5UP-8.		

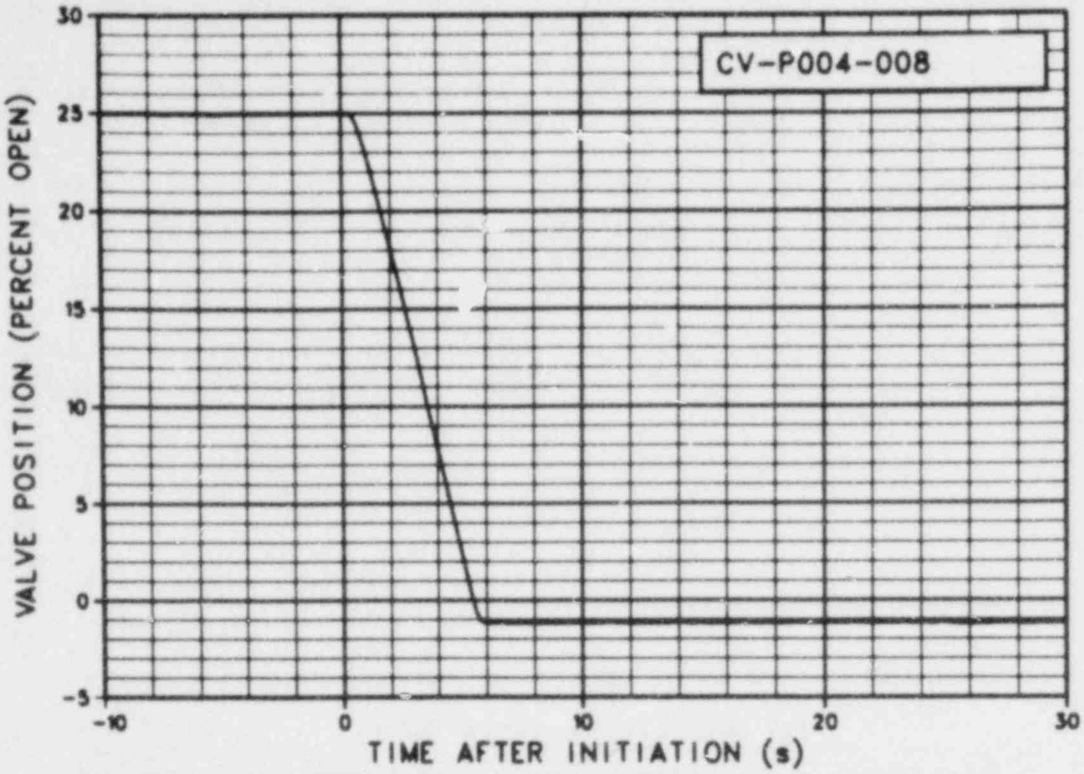


Figure 21. Valve position for secondary feedwater flow control valve (CV-P004-008) (Qualified).

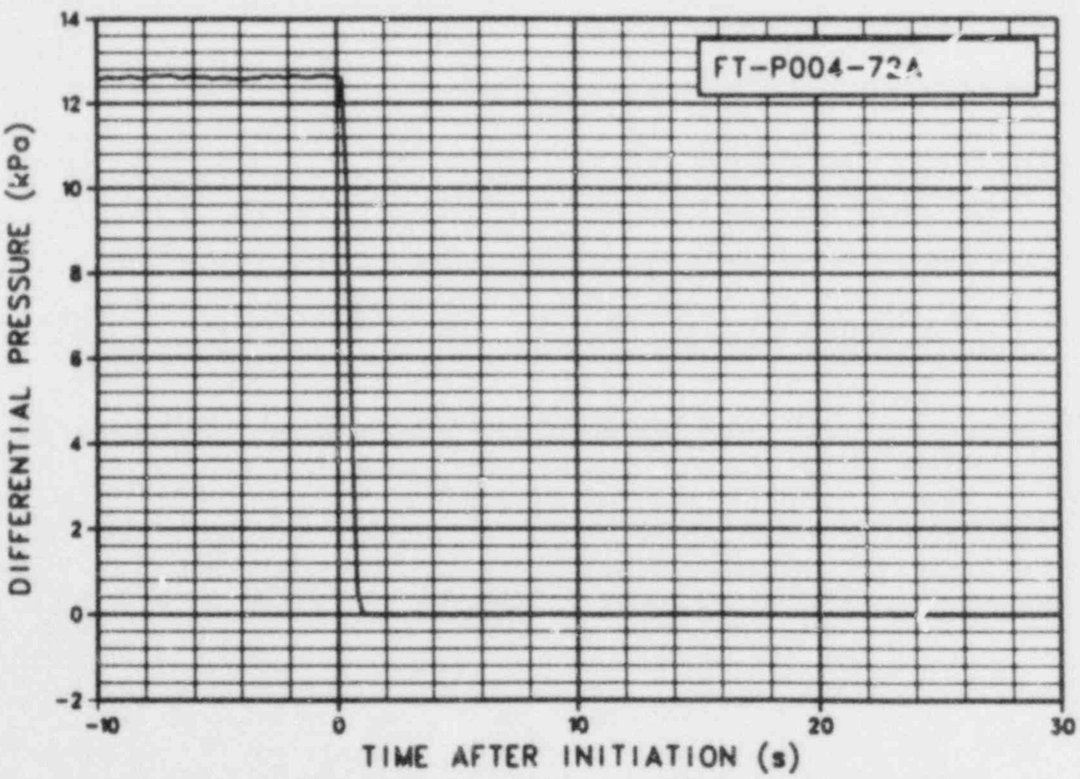


Figure 22. Differential pressure across venturi flowmeter at secondary coolant system main feedwater pump discharge (FT-P004-72A) (Qualified).

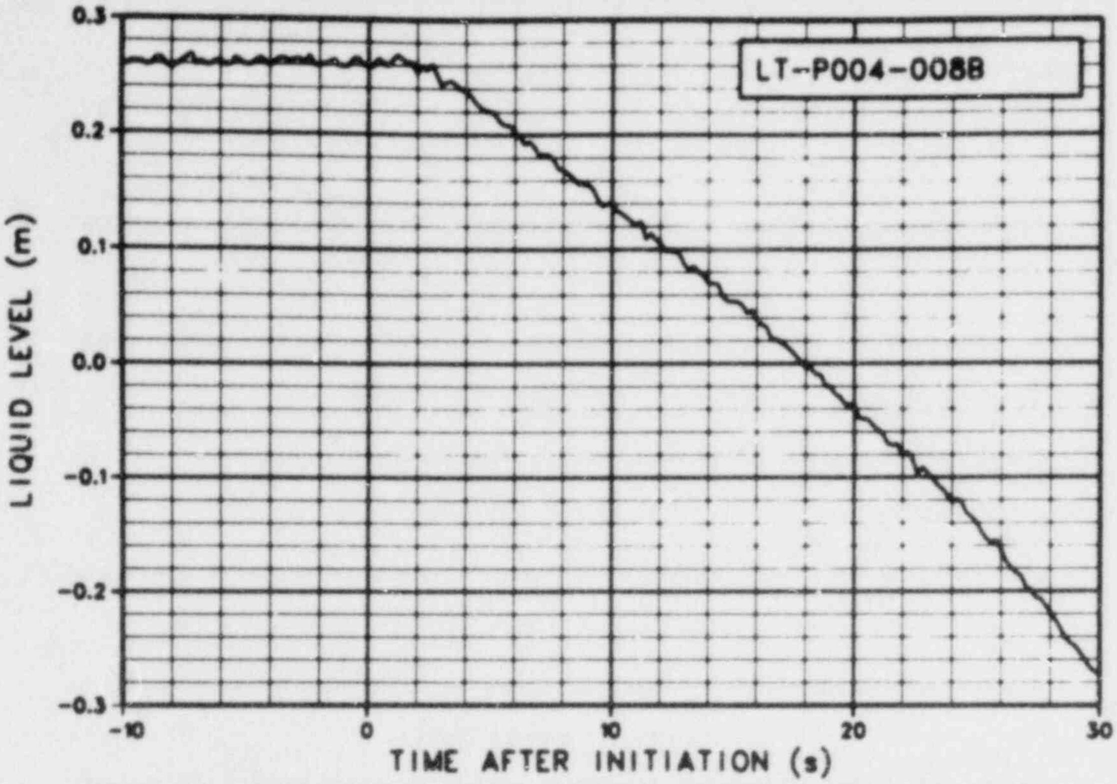


Figure 23. Liquid level in steam generator secondary side, wide range (LT-P004-008B) (Qualified, data not density compensated).

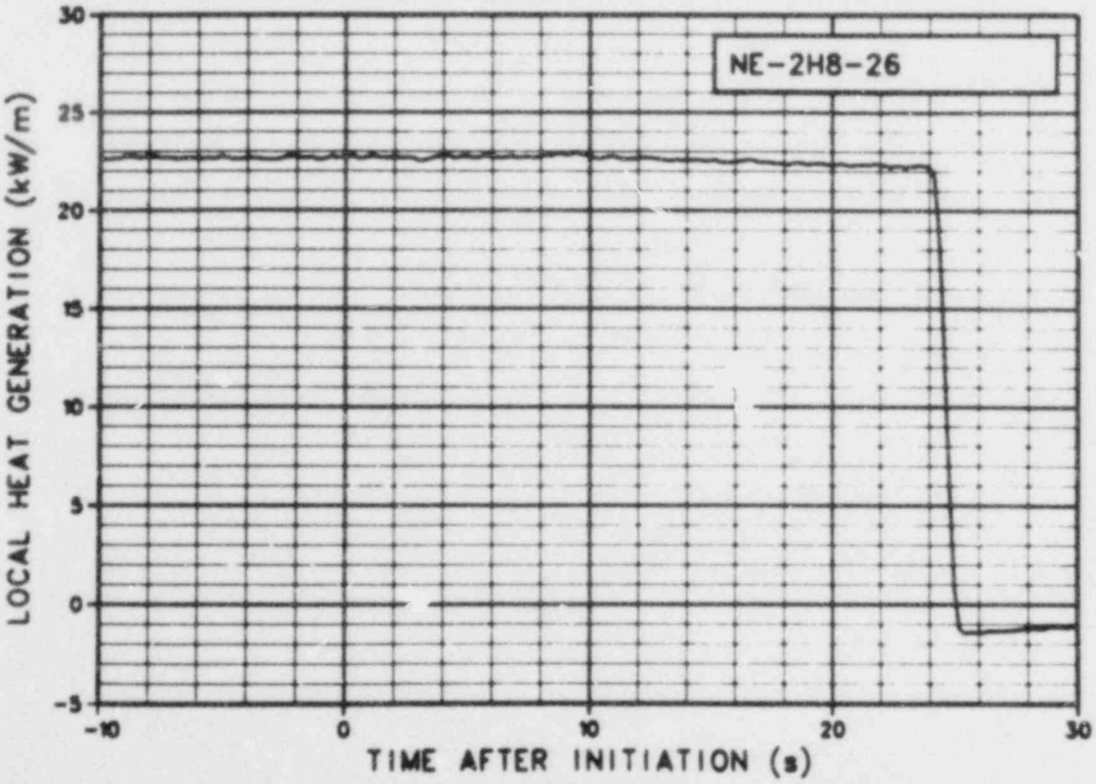


Figure 24. Local heat generation rate for Fuel Assembly 2 (NE-2H8-26) (Qualifed through reactor scram, relative changes only).

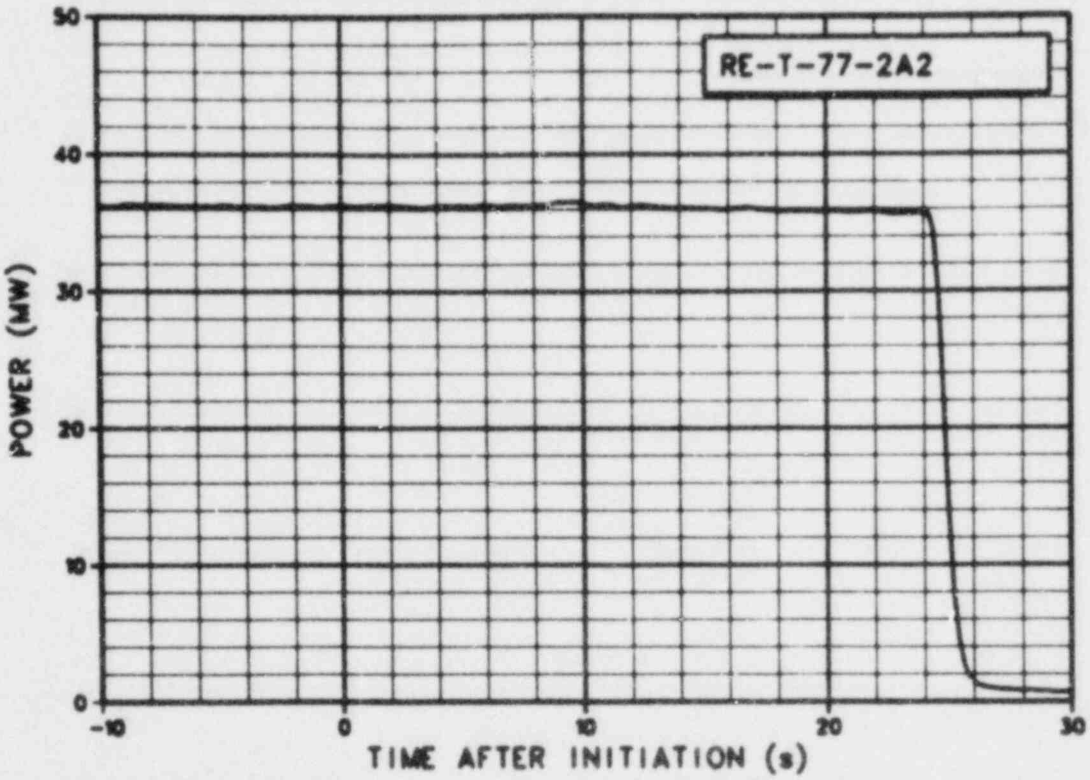


Figure 25. Local average power, Channel B (RE-T-77-2A2) (Qualified).

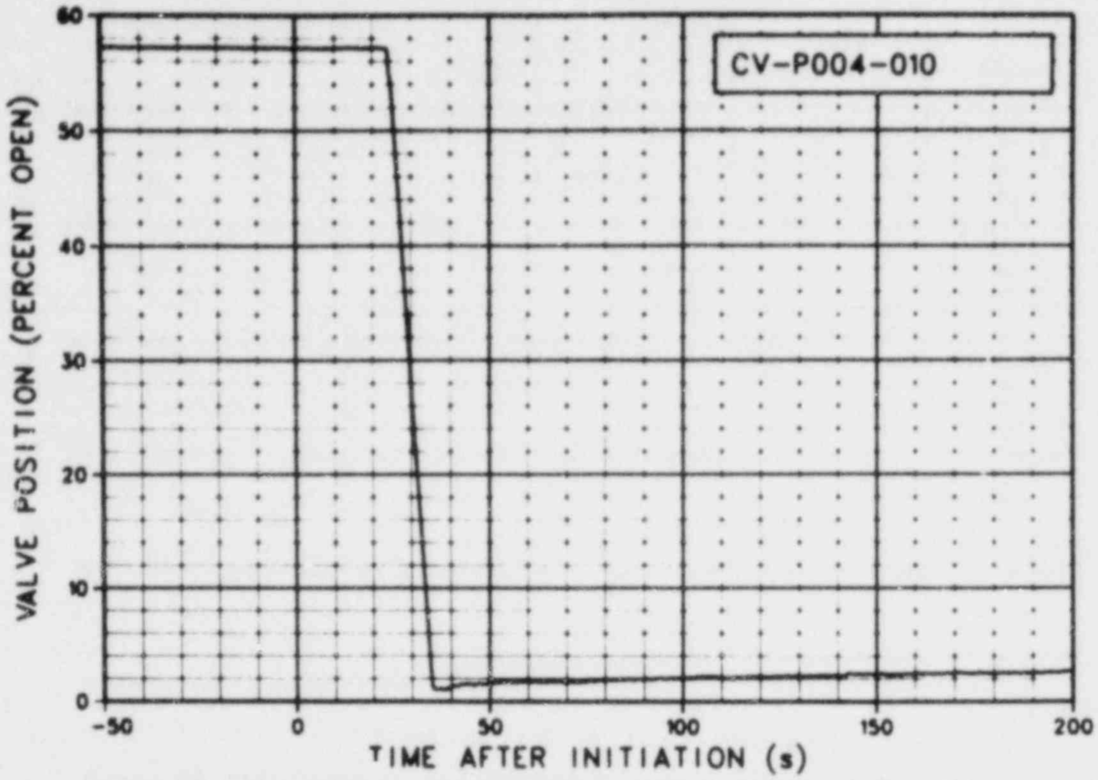


Figure 26. Valve position for secondary coolant system steam flow control valve (CV-P004-010) (Qualified).

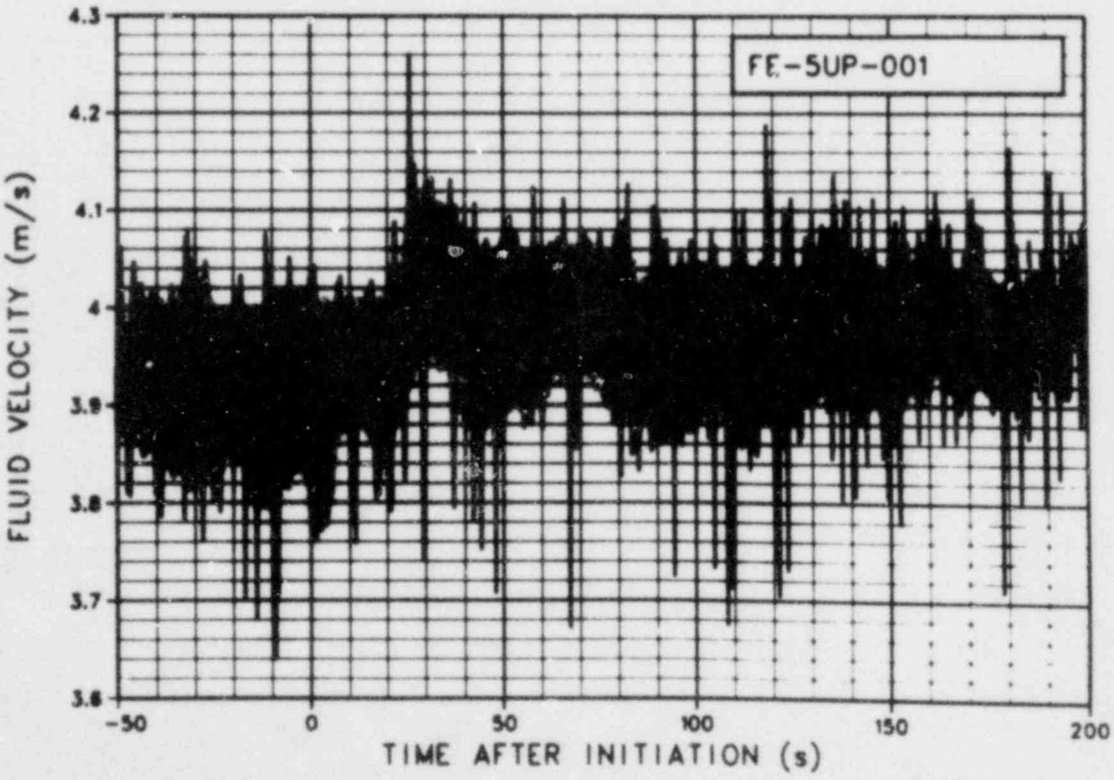


Figure 27. Fluid velocity above upper end box of Fuel Assembly 5 (FE-5UP-001) (Qualified).

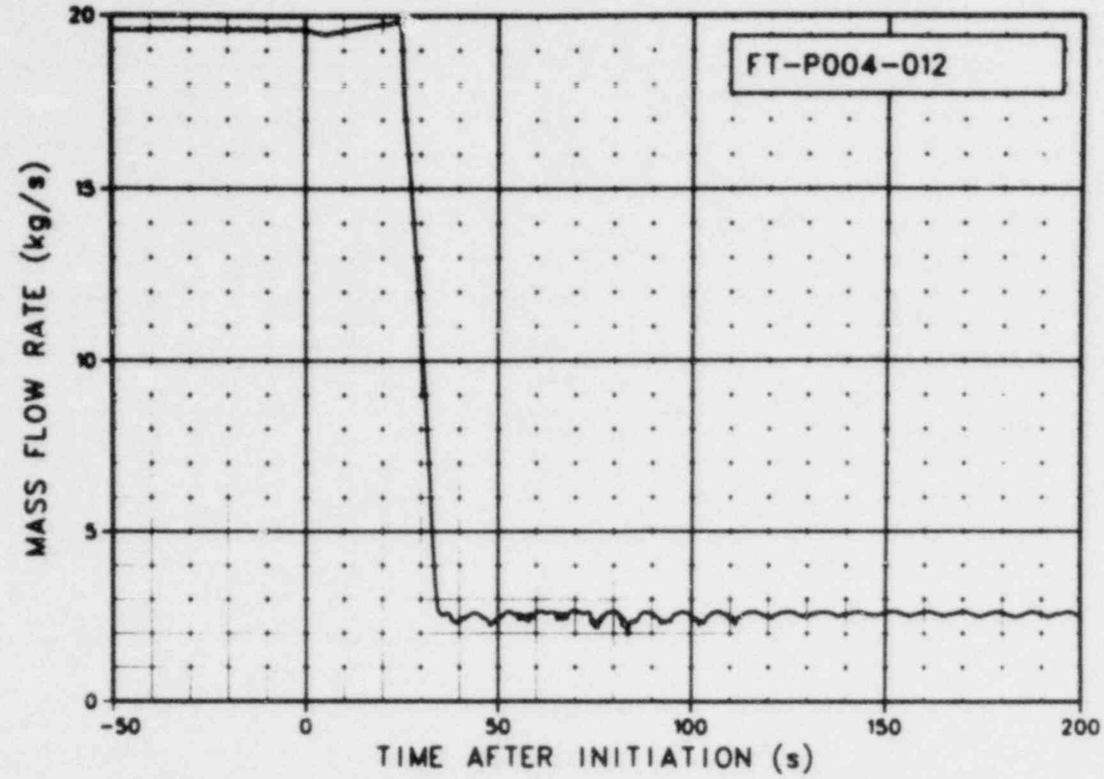


Figure 28. Steam flow rate at condenser inlet (FT-P004-012) (Qualified, magnitude uncertain after scram).

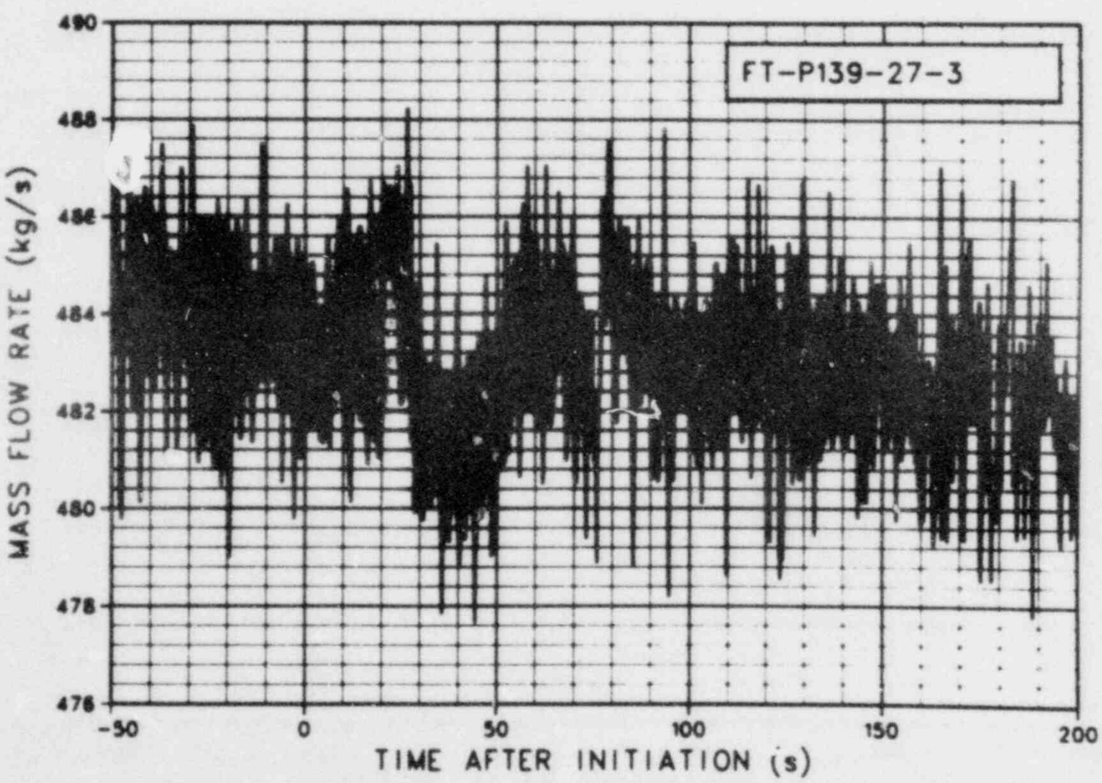


Figure 29. Flow rate in intact loop hot leg venturi (FT-P139-27-3) (Qualified).

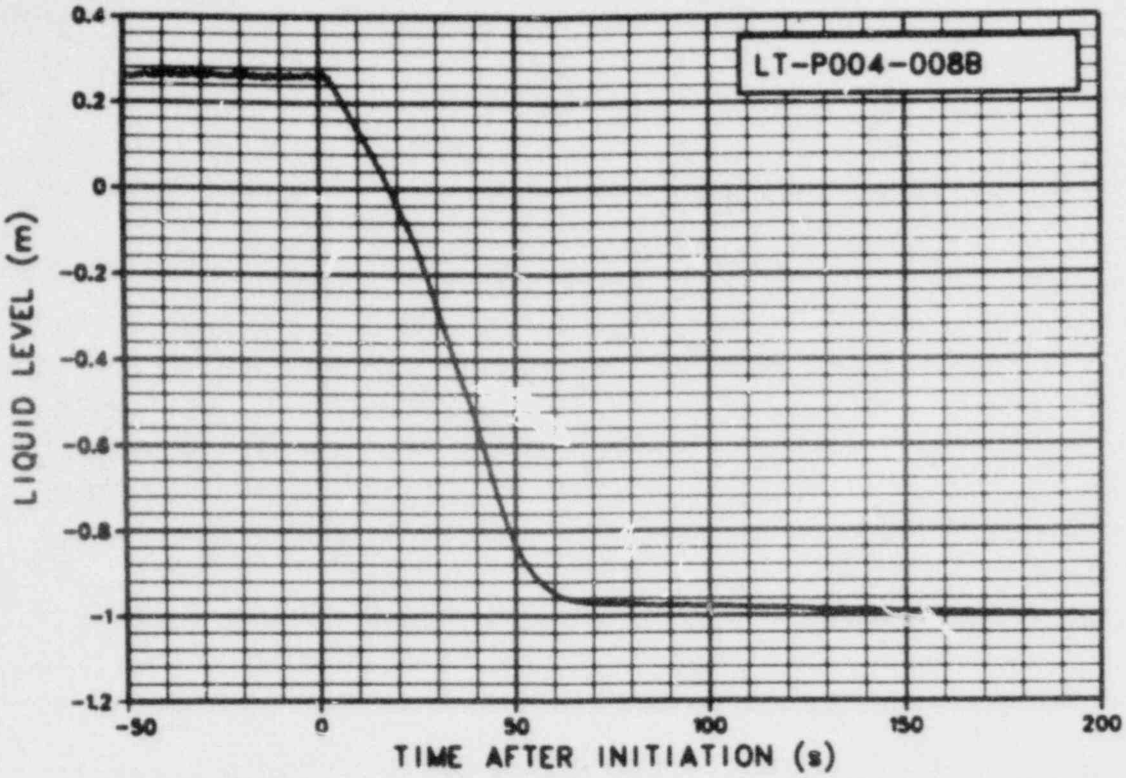


Figure 30. Liquid level in steam generator secondary side, wide range (LT-P004-008B) (Qualified, data not density compensated).

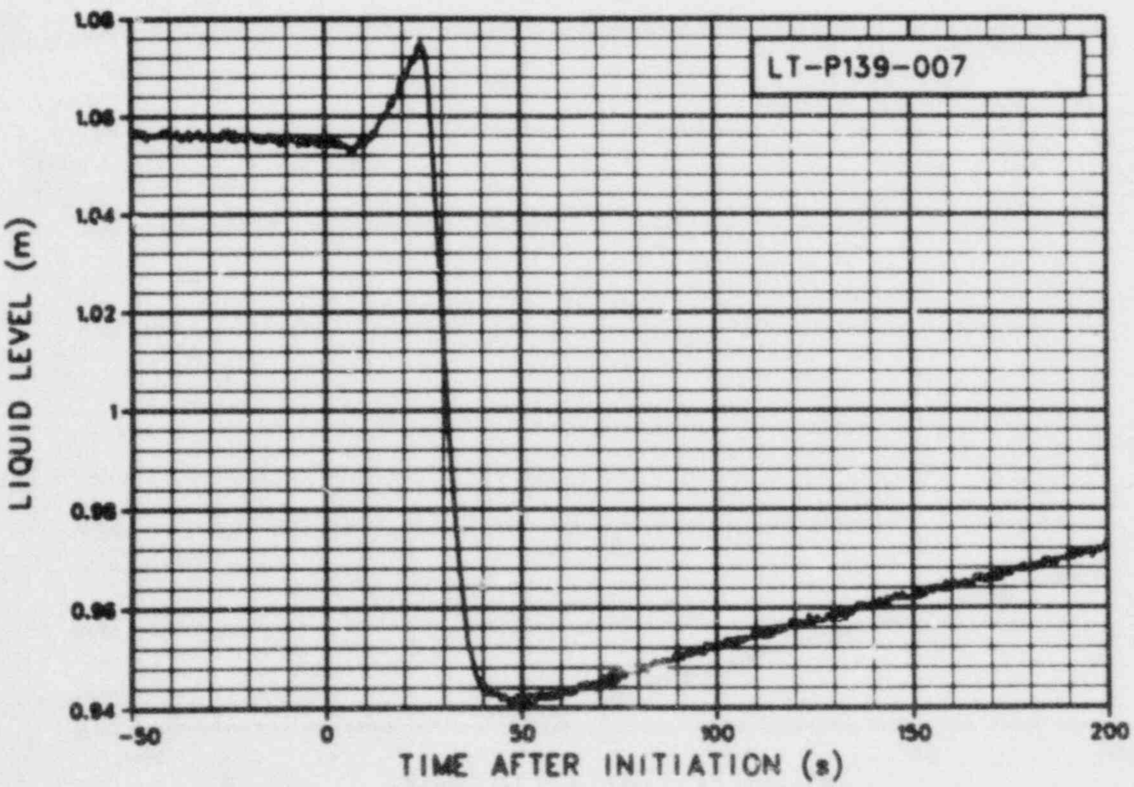


Figure 31. Liquid level in pressurizer (LT-P139-007) (Qualified for relative changes only).

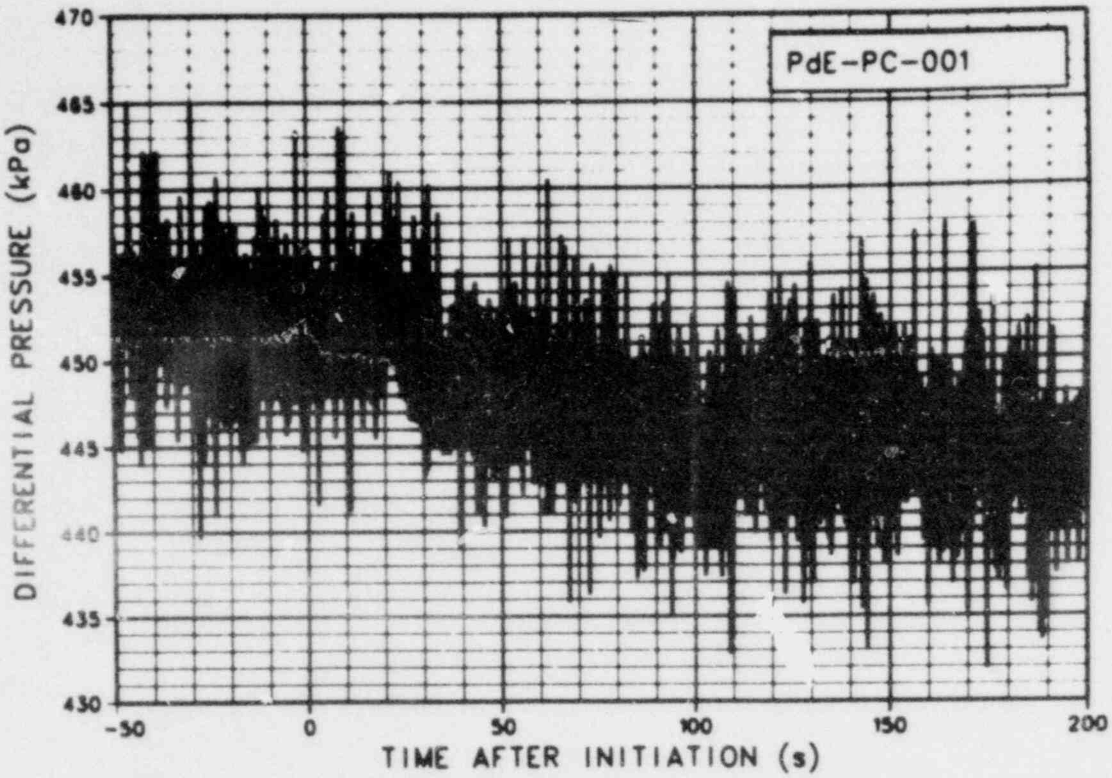


Figure 32. Differential pressure in intact loop across primary coolant Pumps 1 and 2 (PdE-PC-001) (Qualified).

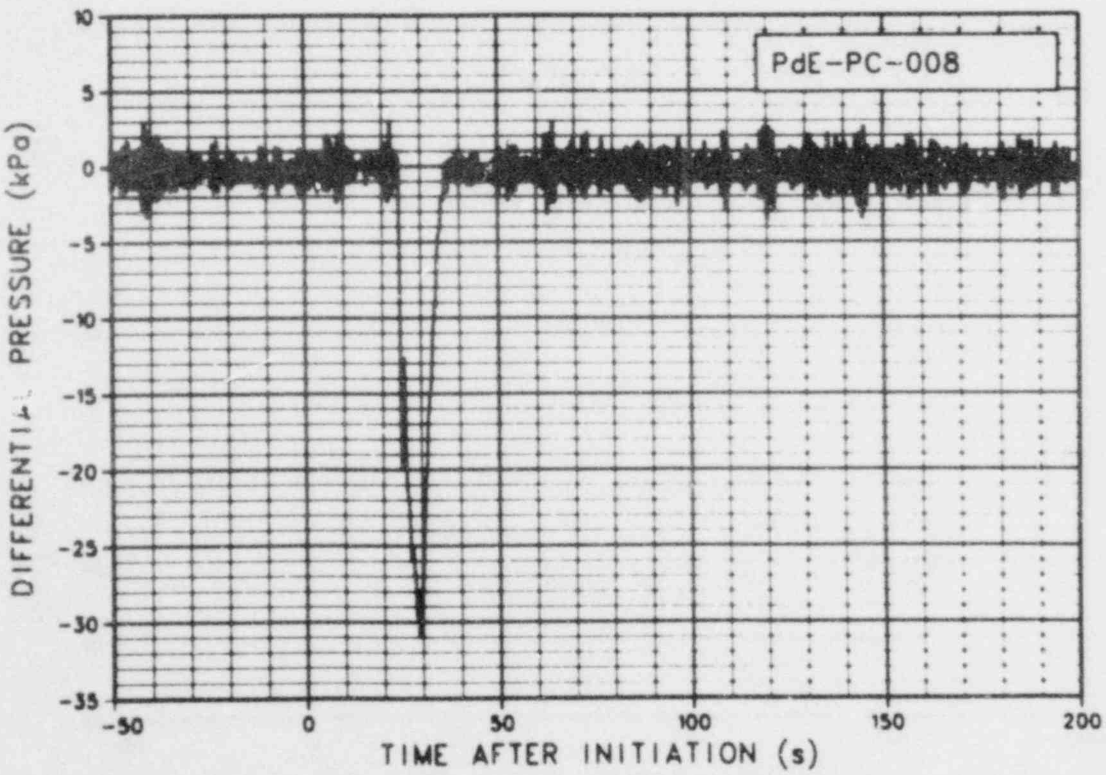


Figure 33. Differential pressure in intact loop across pressurizer surge line (PdE PC 008) (Qualified).

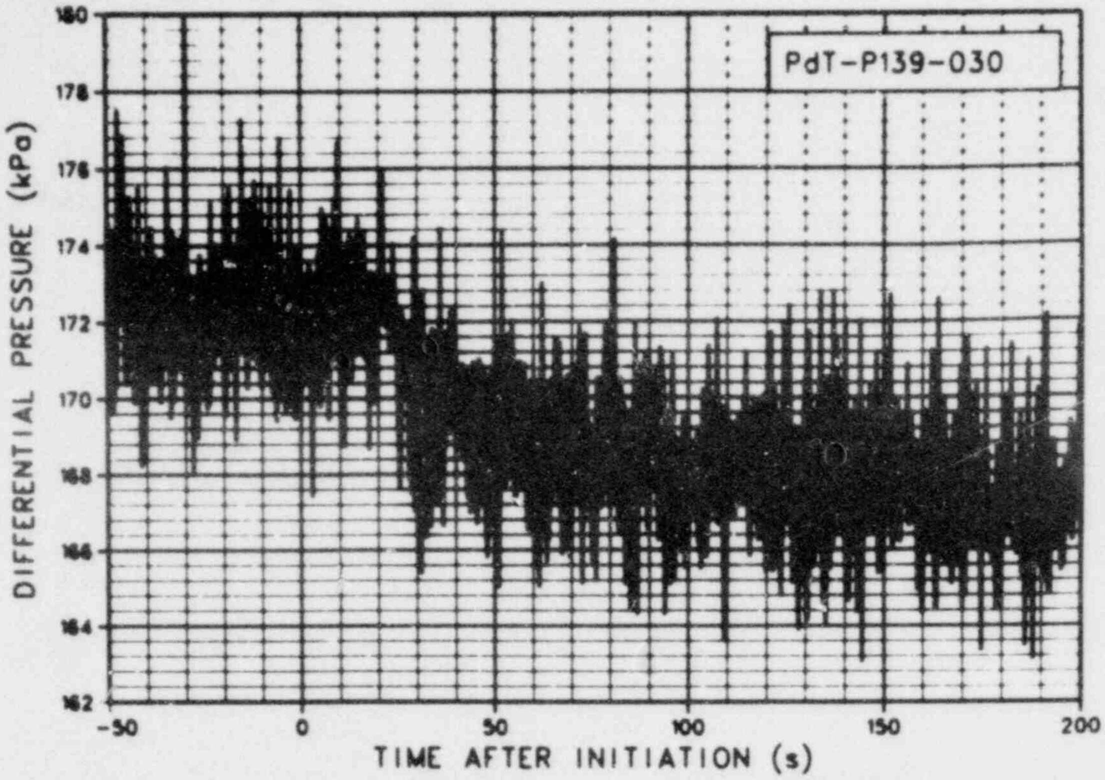


Figure 34. Differential pressure in intact loop across reactor vessel (PdT-P139-030) (Qualified).

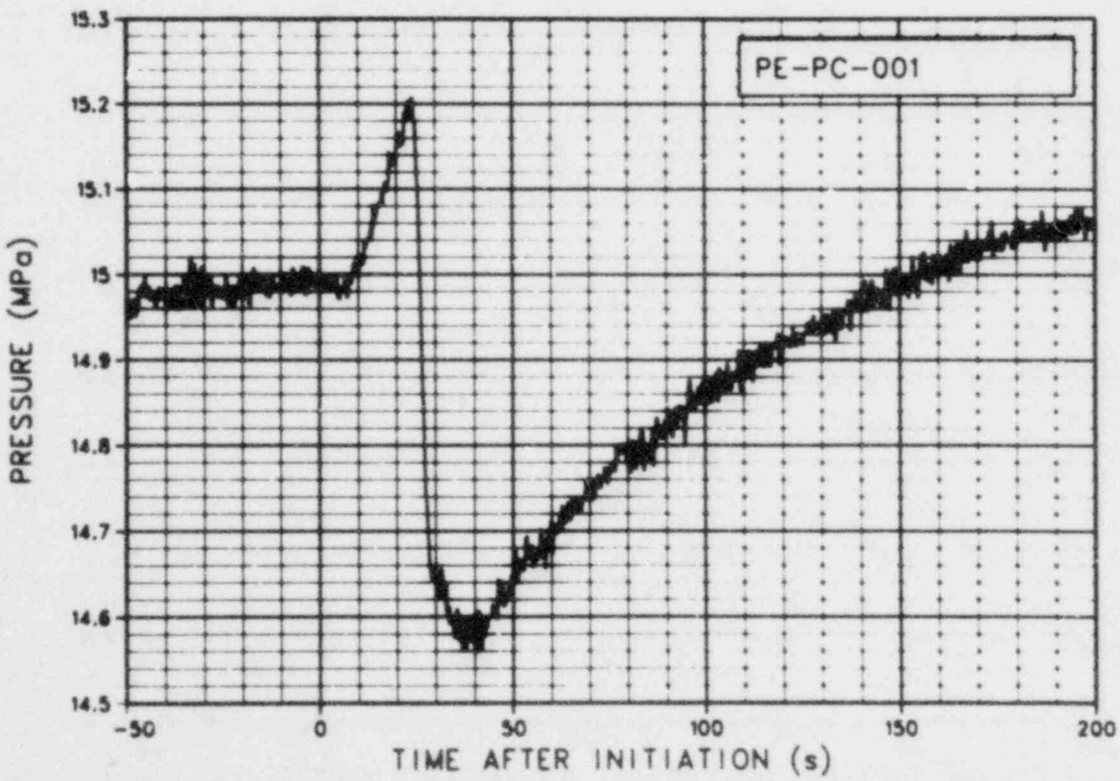


Figure 35. Pressure in intact loop cold leg (PE PC 001) (Qualified).

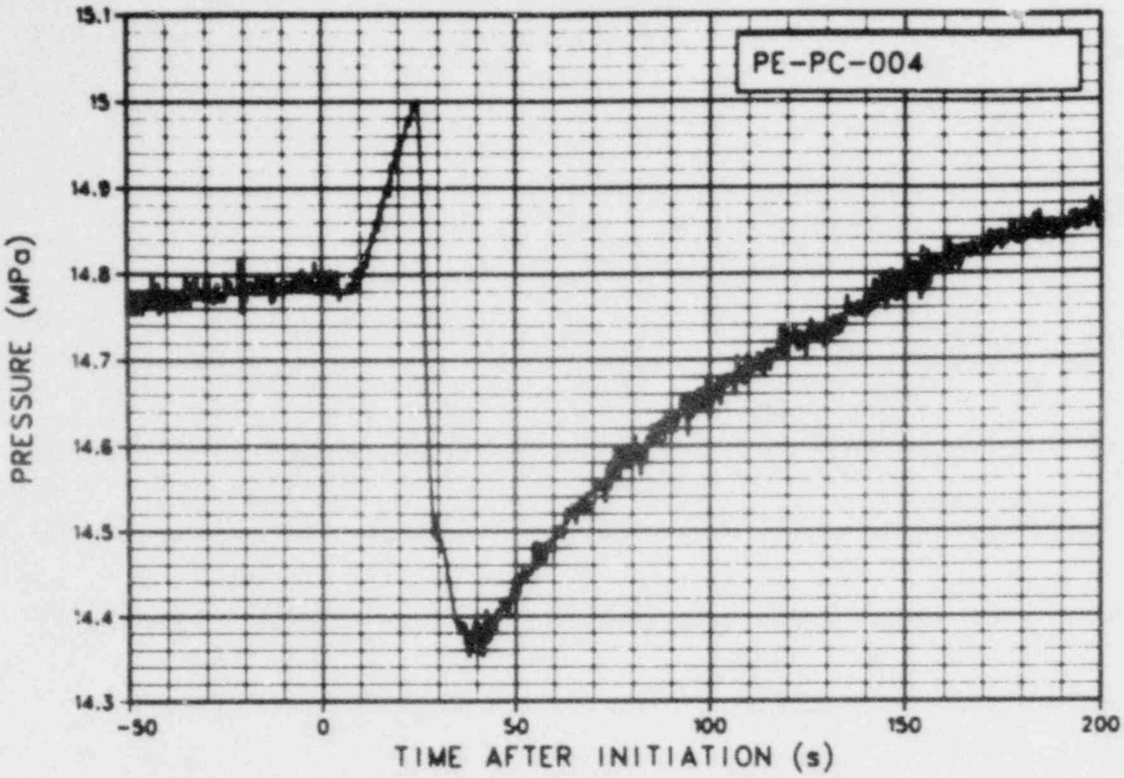


Figure 36. Pressure in pressurizer (PE-PC-004) (Qualified).

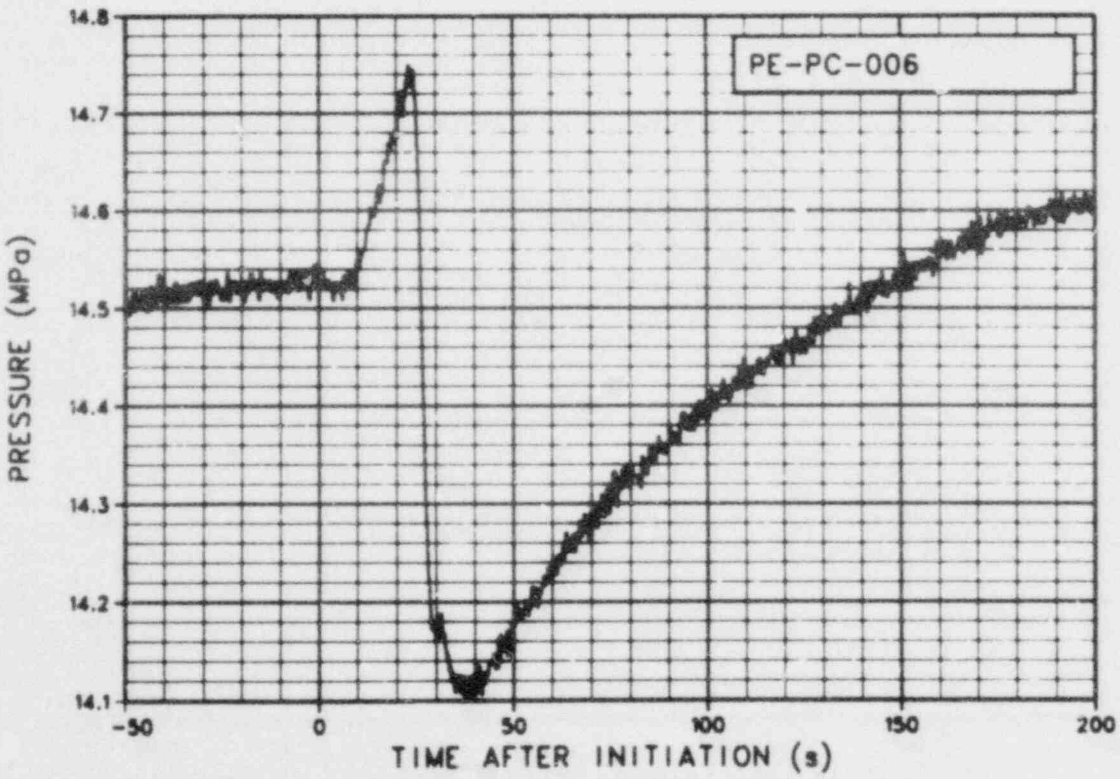


Figure 37. Reference pressure in intact loop between steam generator outlet and pump inlet (PE-PC-006) (Qualified).

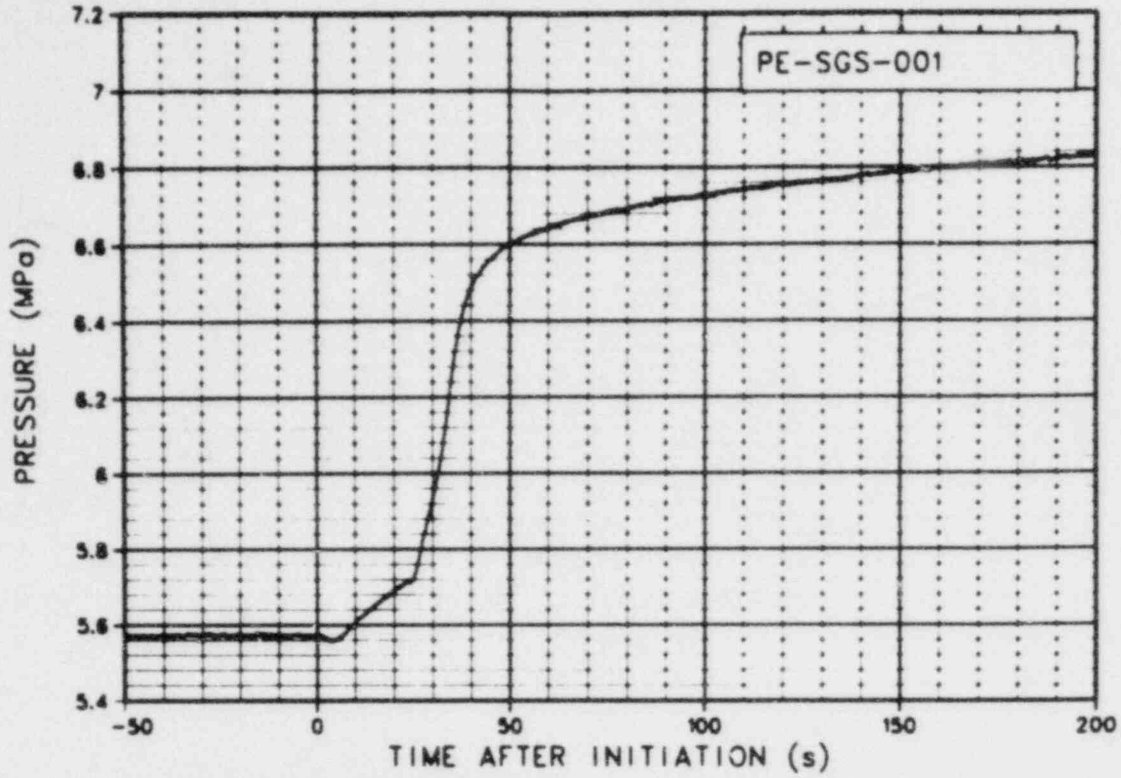


Figure 38. Pressure in steam generator dome (PE SGS 001) (Qualified).

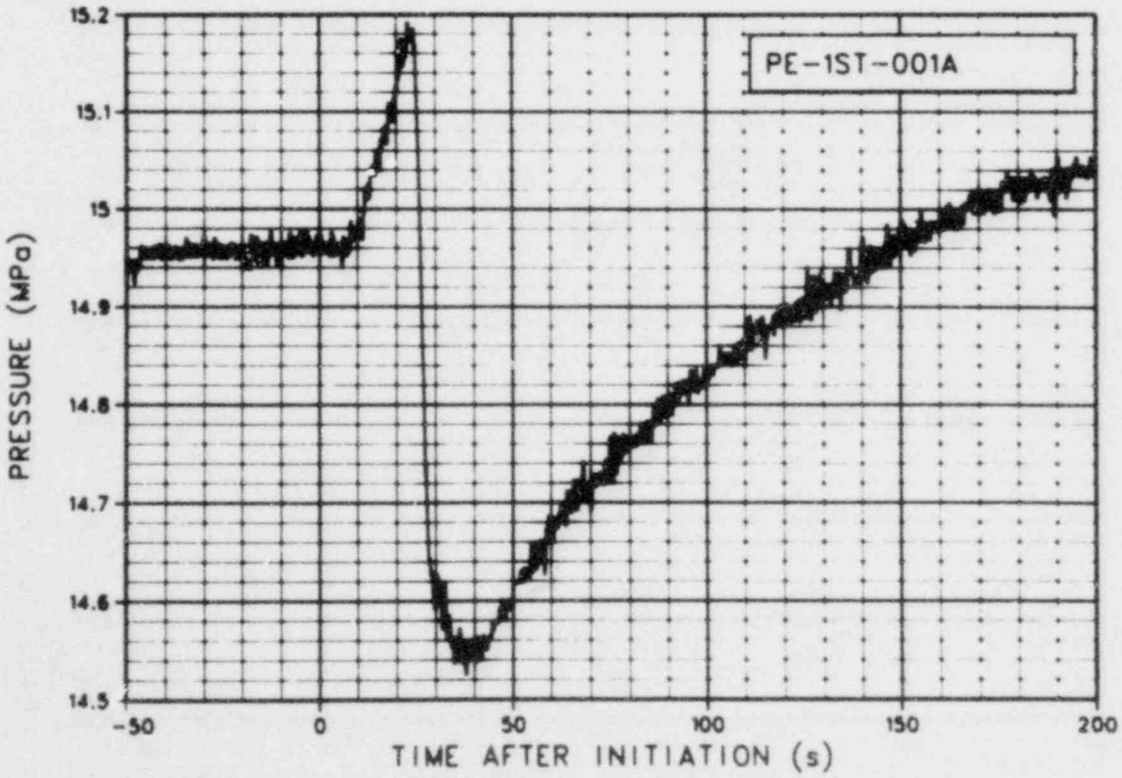


Figure 39. Pressure in reactor vessel Downcomer Stalk 1 (PE-1ST-001A) (Qualified).

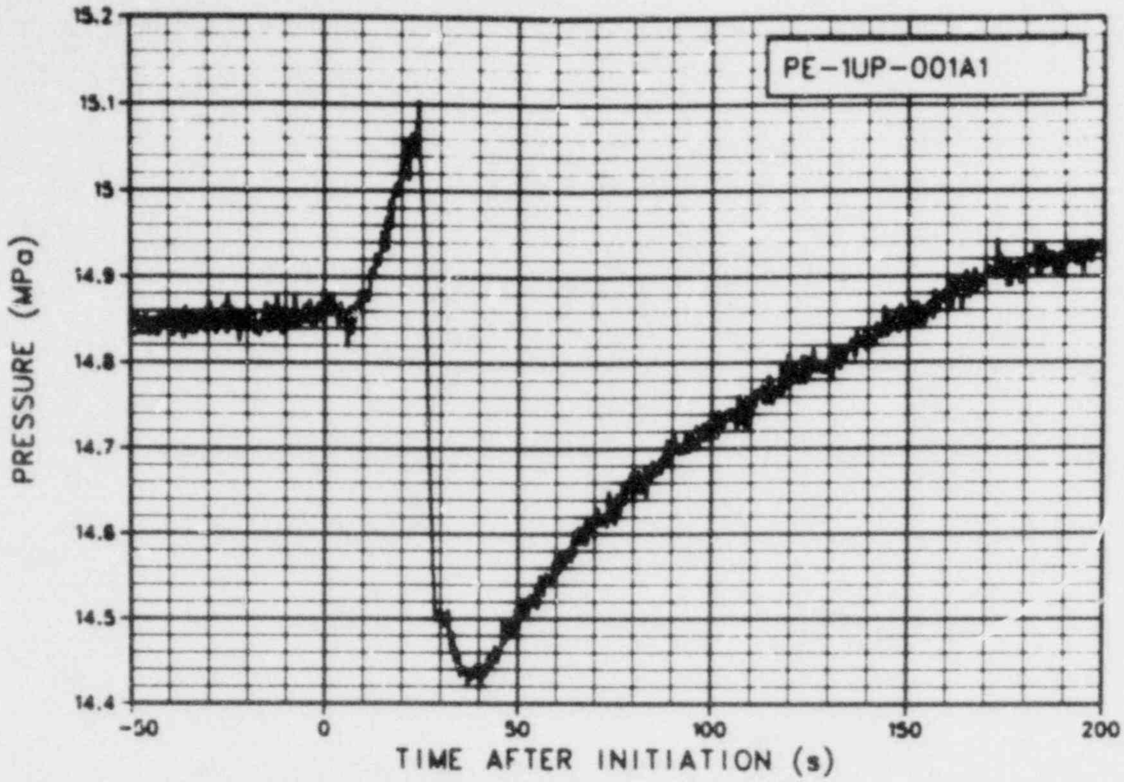


Figure 40. Pressure in reactor vessel above upper end box of Fuel Assembly 1 (PE-1UP-001A1) (Qualified).

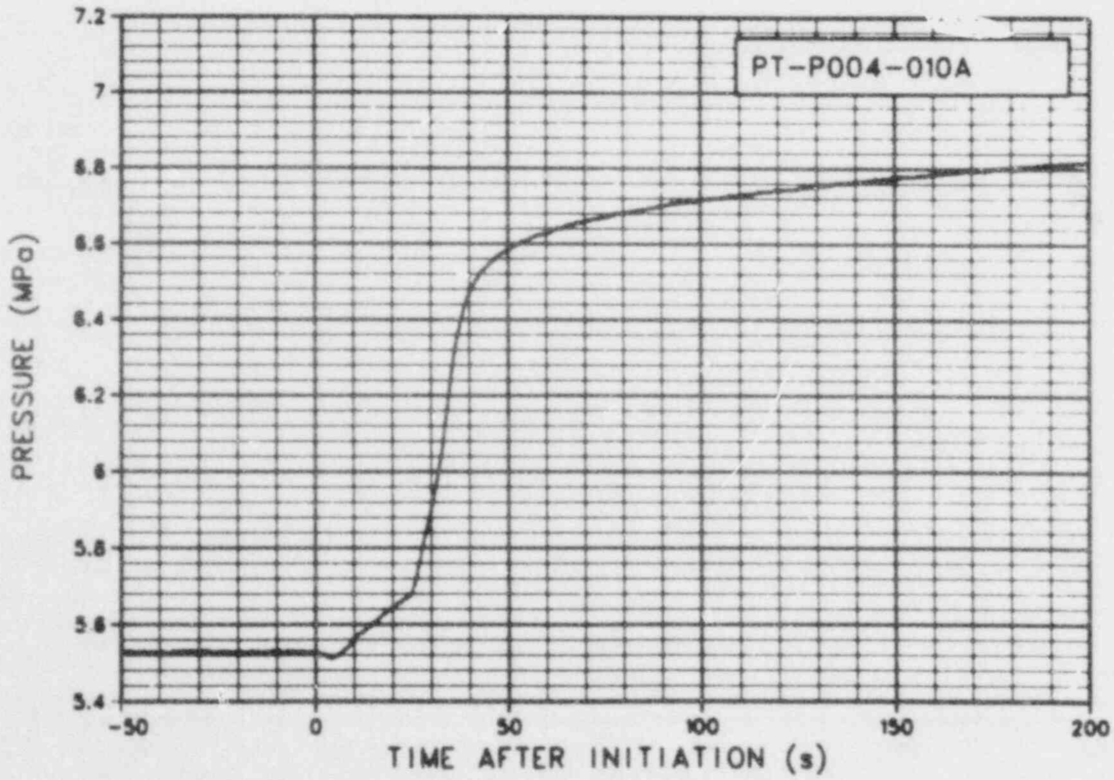


Figure 41. Pressure in steam generator secondary side 10-inch outlet (PT-P004-010A) (Qualified).

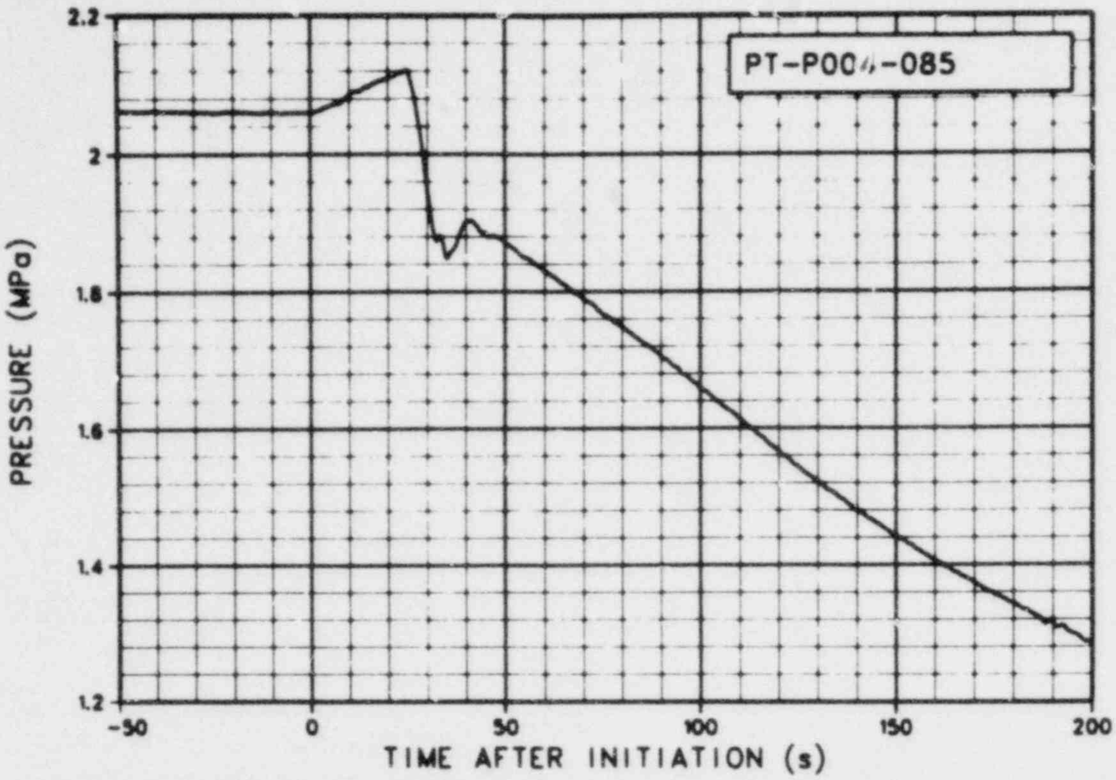


Figure 42. Pressure in secondary coolant system condenser 12-inch inlet (PT-P004-085) (Qualified).

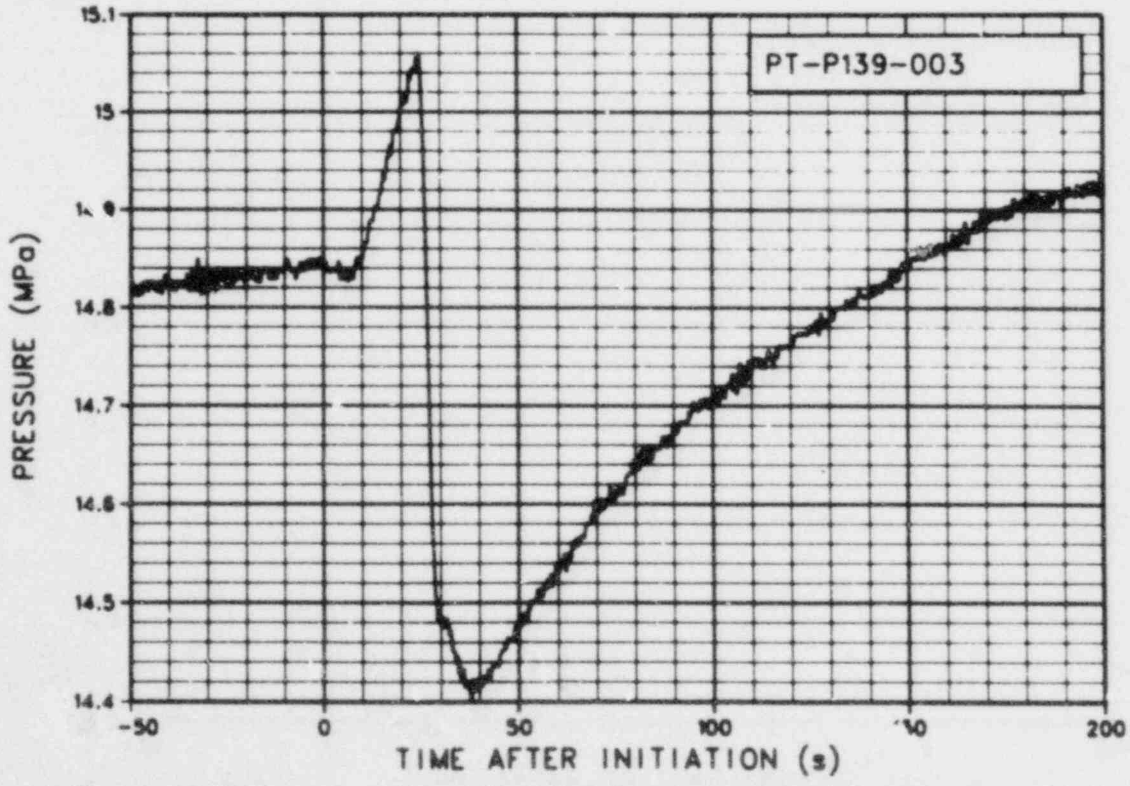


Figure 43. Pressure in intact loop hot leg venturi on left side looking toward steam generator (PT-P139-003) (Qualified).

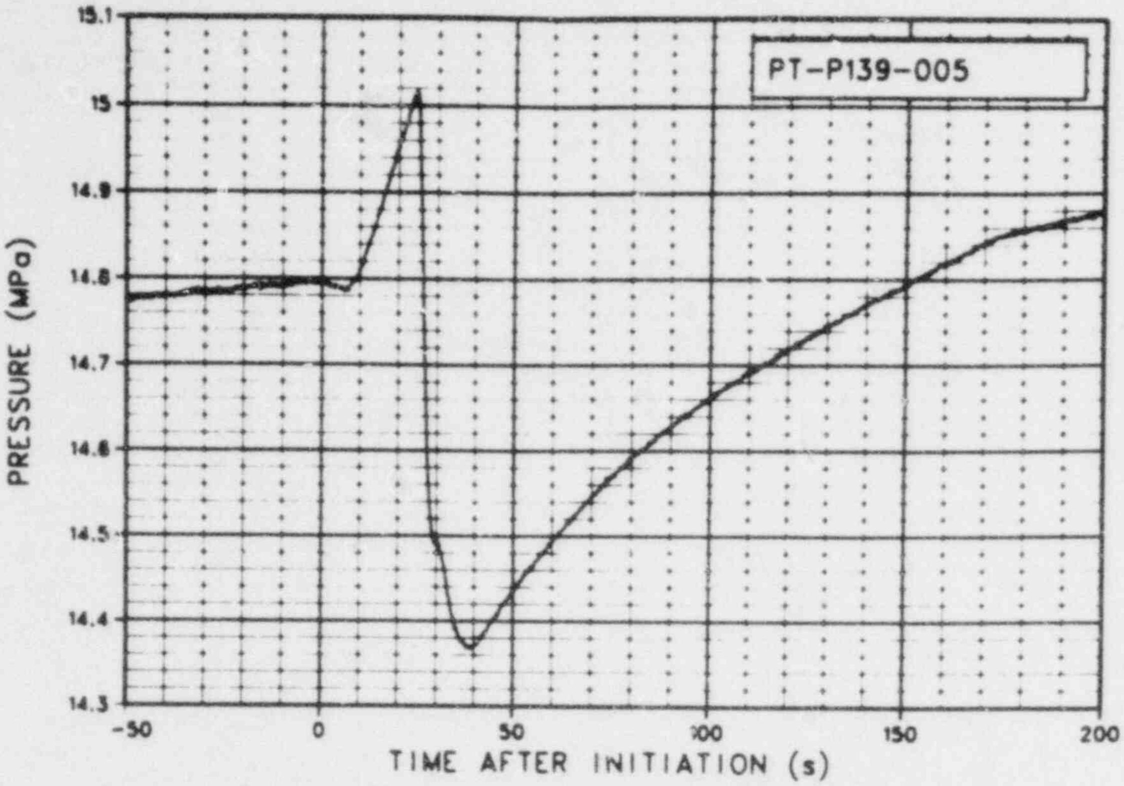


Figure 44. Pressure in pressurizer 1.88 m above pressurizer bottom (vapor space) (PT P139 005) (Qualified).

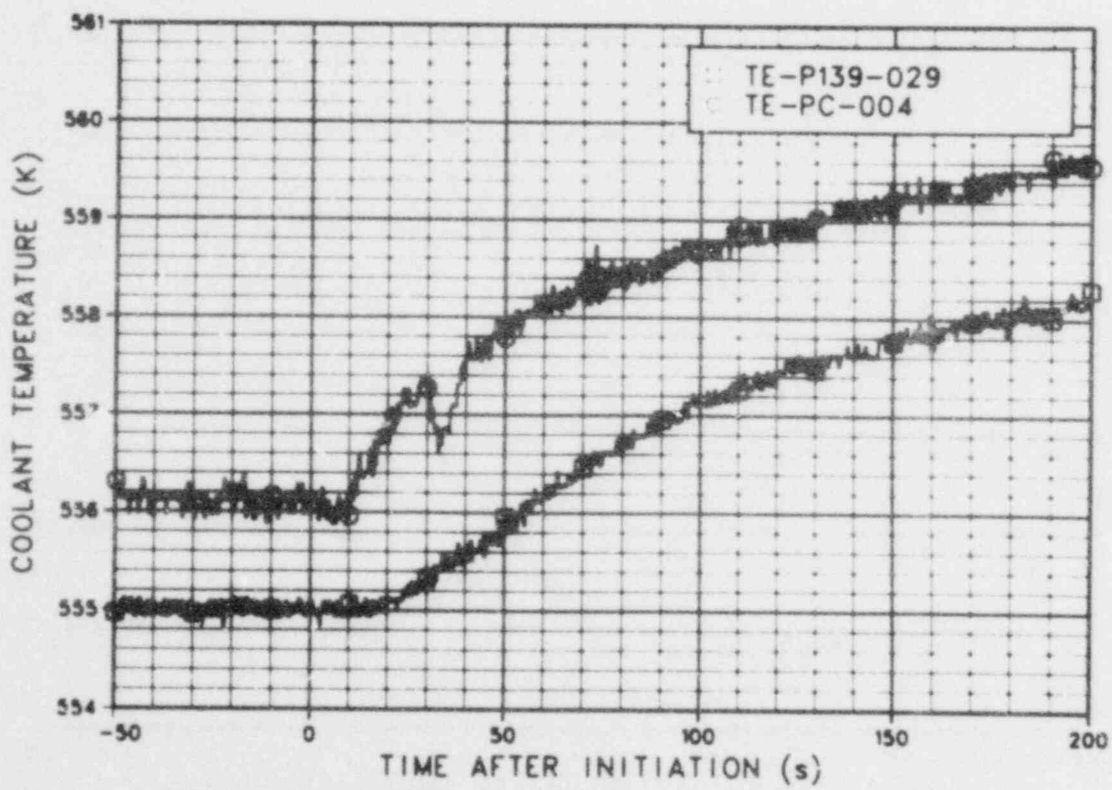


Figure 45. Coolant temperature in intact loop cold leg at bottom of ECC Rake 1 and upstream of DTT flange (TE PC 004 and (TE-P139-029) (Qualified. TE P139 029 is a process instrument with slow response time).

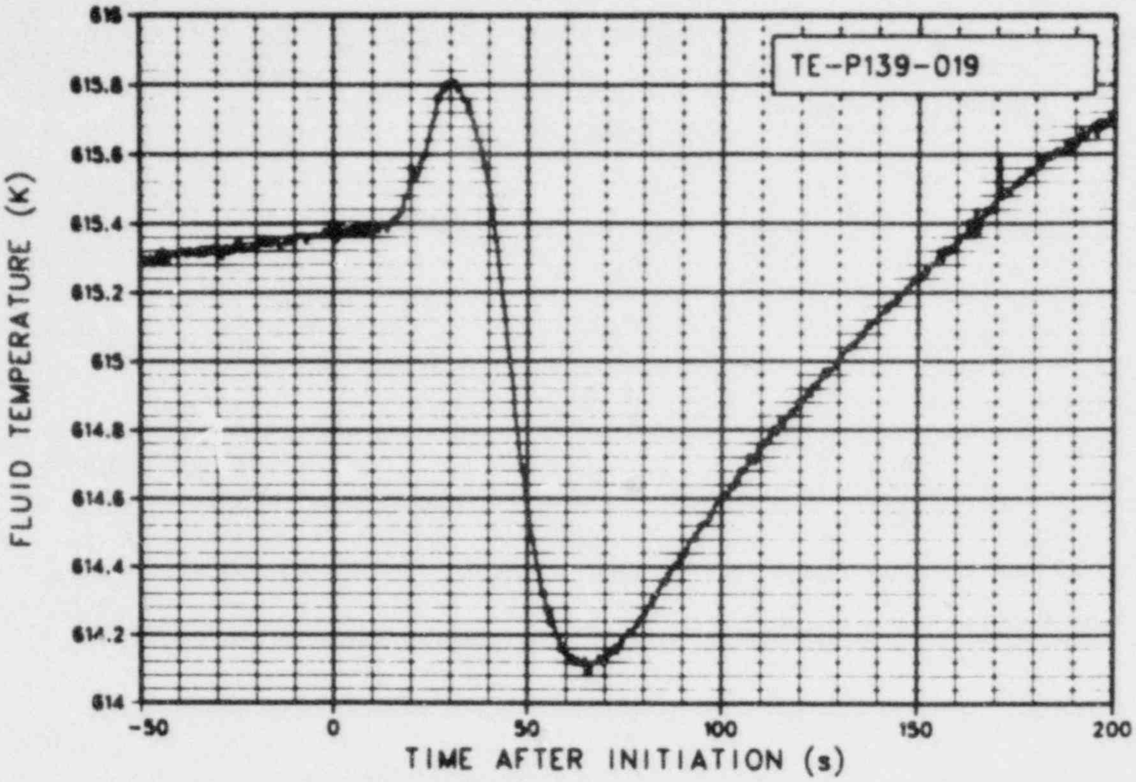


Figure 46. Fluid temperature in pressurizer vapor space (TE-P139-019) (Qualified).

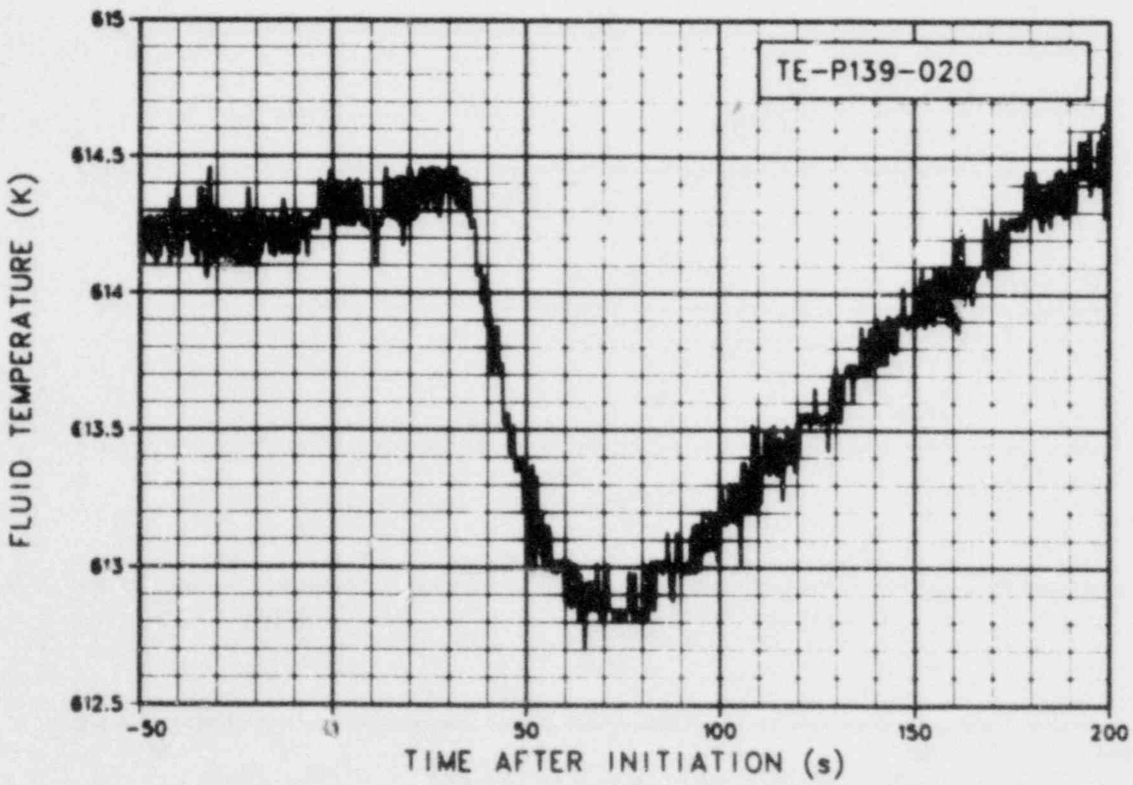


Figure 47. Fluid temperature in pressurizer liquid space (TE-P139-020) (Qualified).

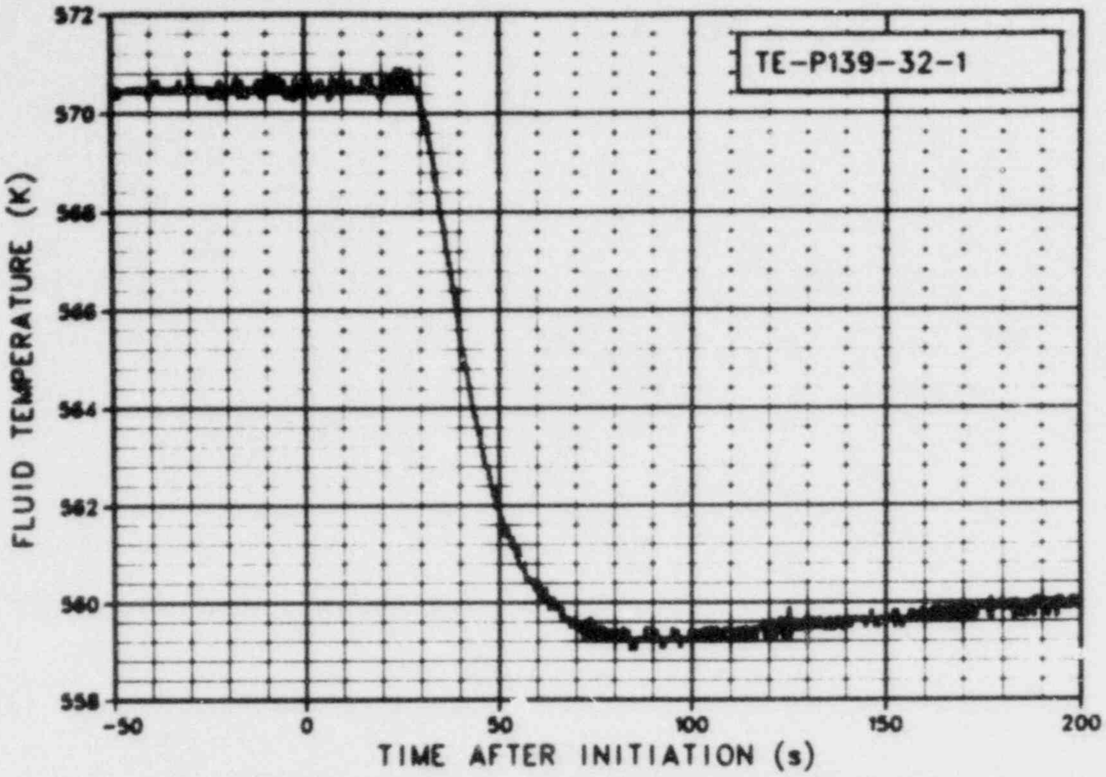


Figure 48. Fluid temperature in intact loop hot leg (TE-P139-32-1) (Qualified, process instrument, slow response time).

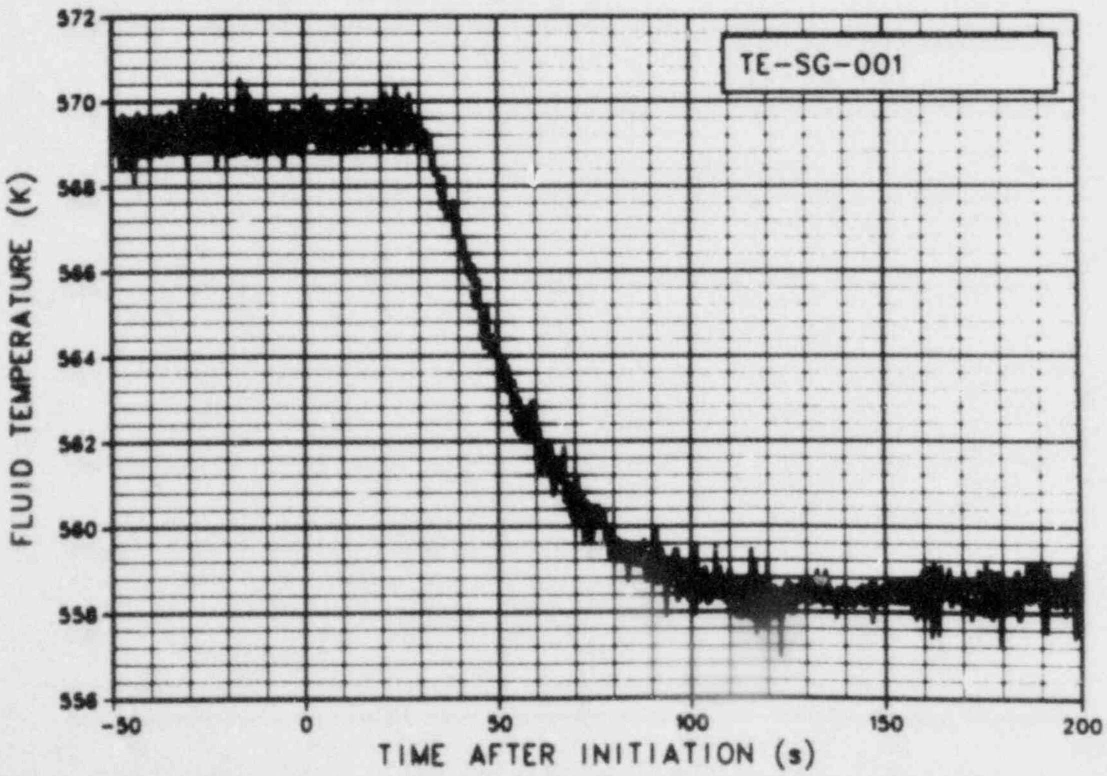


Figure 49. Fluid temperature in intact loop steam generator primary side inlet plenum (TE-SG-001) (Qualified).

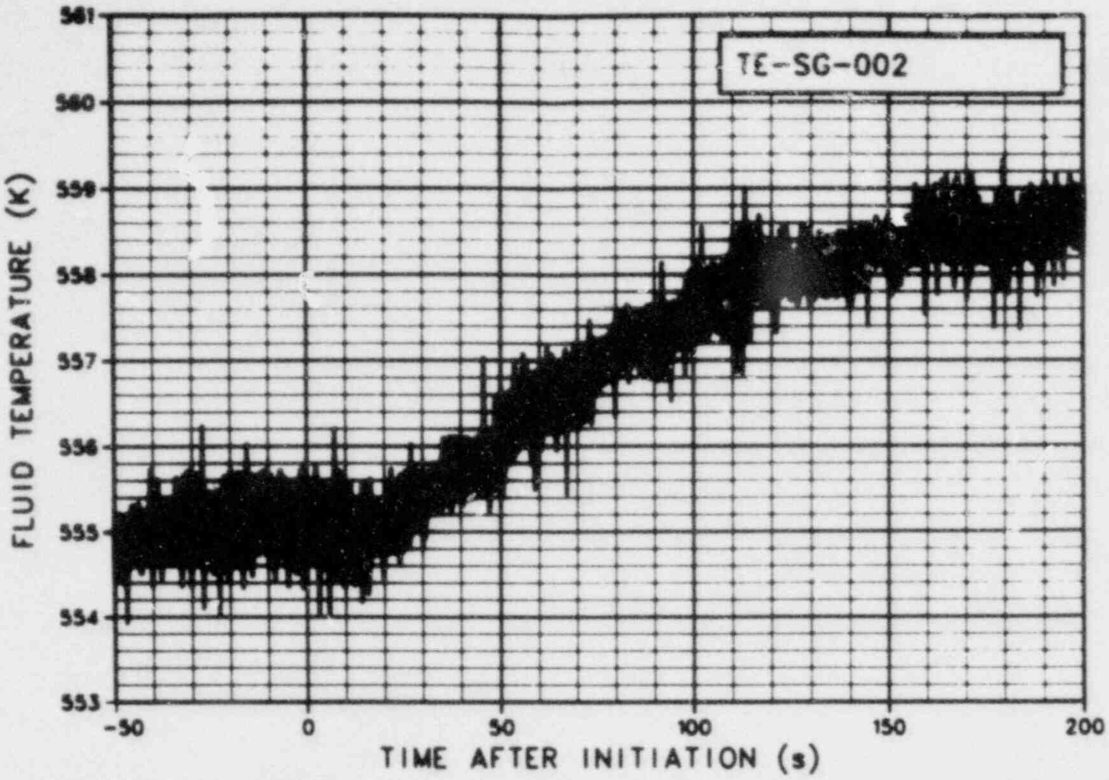


Figure 50. Fluid temperature in intact loop steam generator primary side outlet plenum (TE-SG-002) (Qualified).

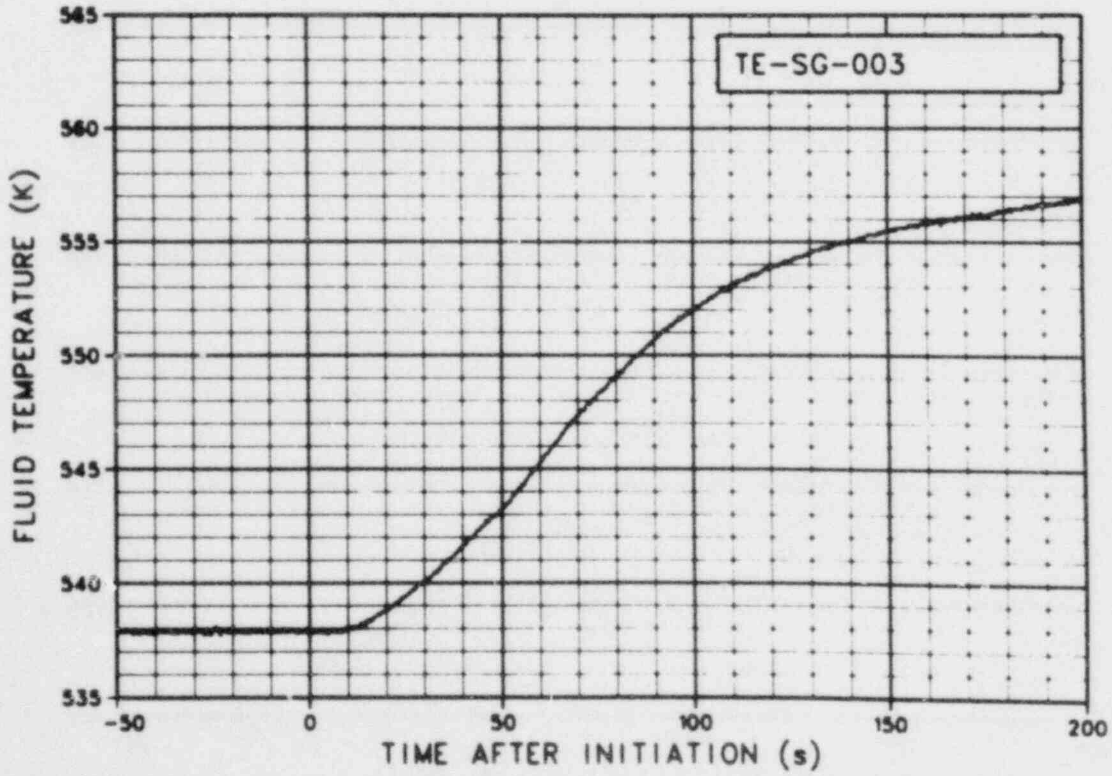


Figure 51. Fluid temperature in steam generator secondary side downcomer (TE-SG-003) (Qualified).

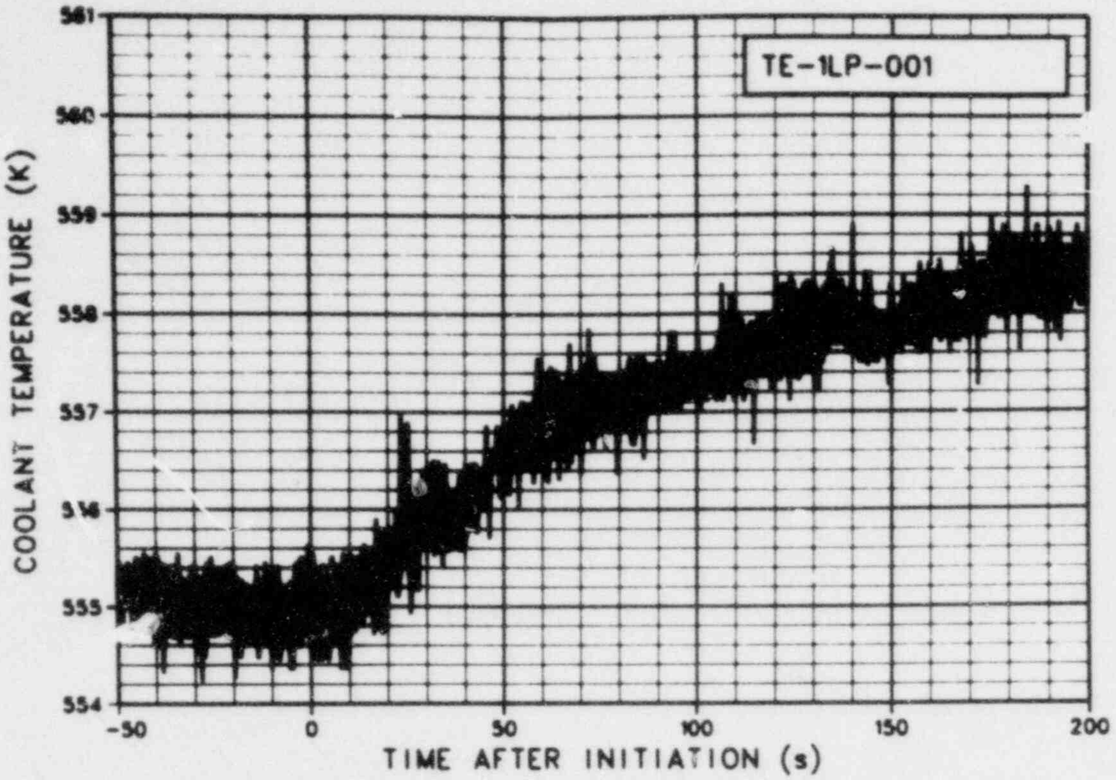


Figure 52. Coolant temperature in reactor vessel at lower end box of Fuel Assembly 1 (TE-1LP-001) (Qualified).

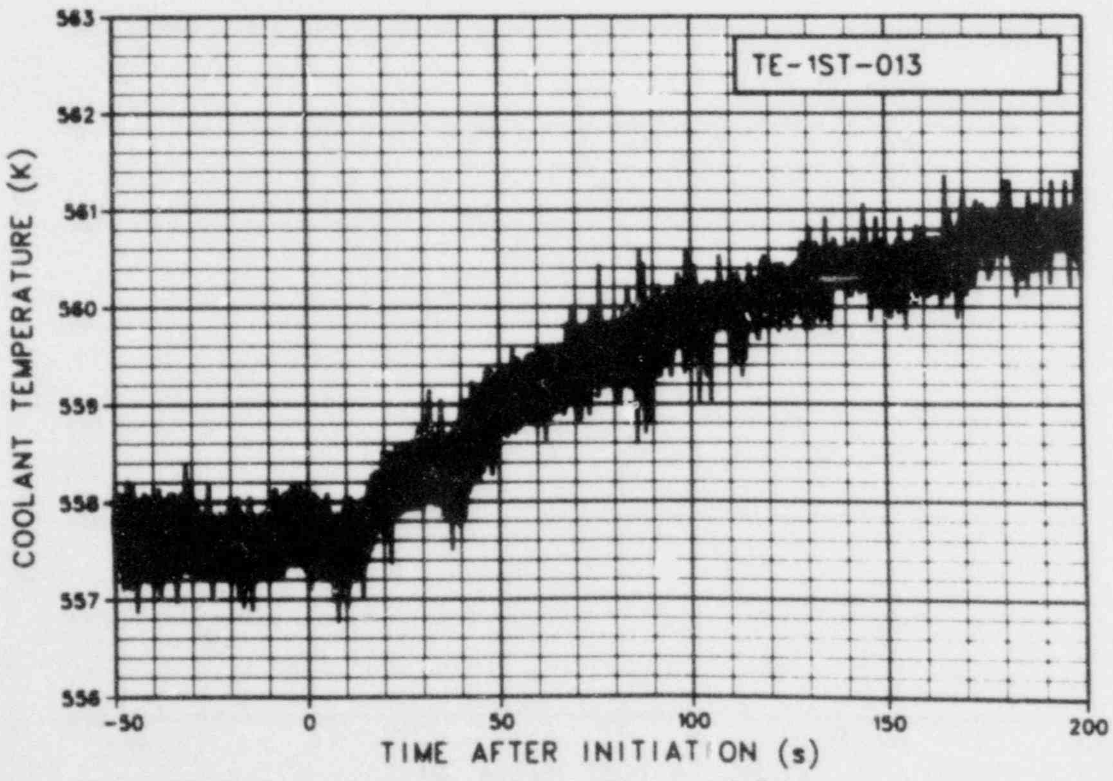


Figure 53. Coolant temperature in reactor vessel Downcomer Stalk 1 at 0.24 m from reactor vessel bottom (TE-1ST-013) (Qualified).

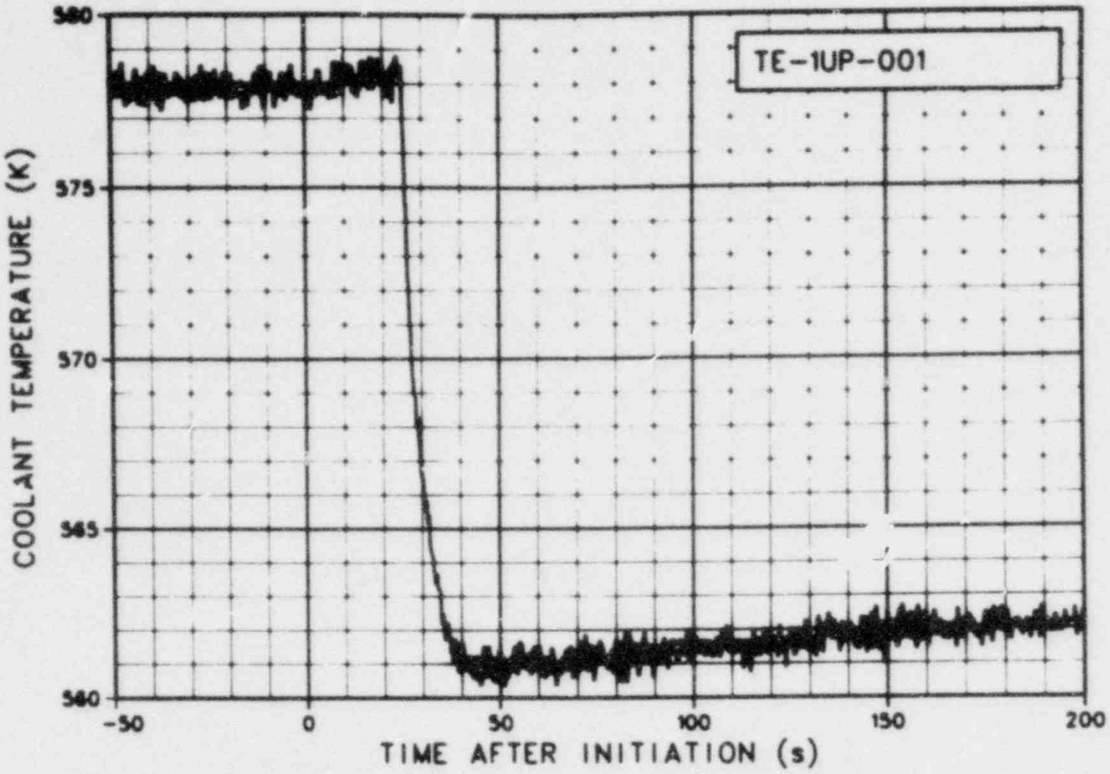


Figure 54. Coolant temperature in reactor vessel at upper end box of Fuel Assembly 1 (TE-1UP-001) (Qualified).

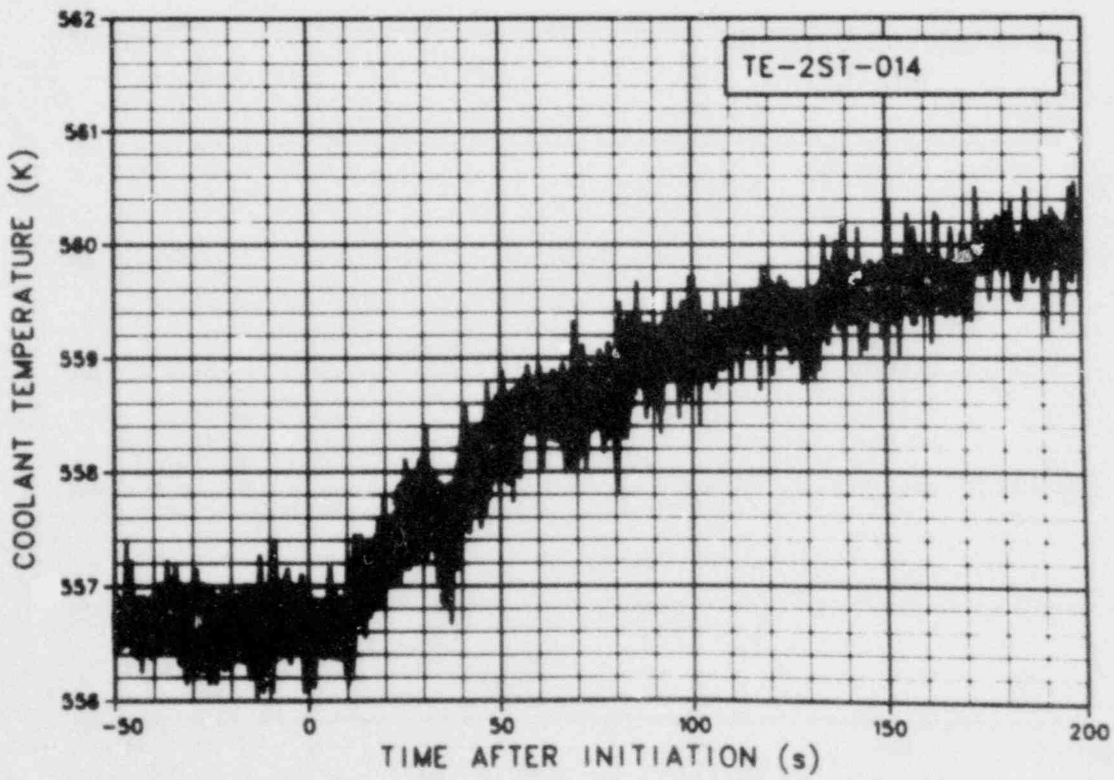


Figure 55. Coolant temperature in reactor vessel Downcomer Stalk 2 at 1.17 m from reactor vessel bottom (TE-2ST-014) (Qualified).

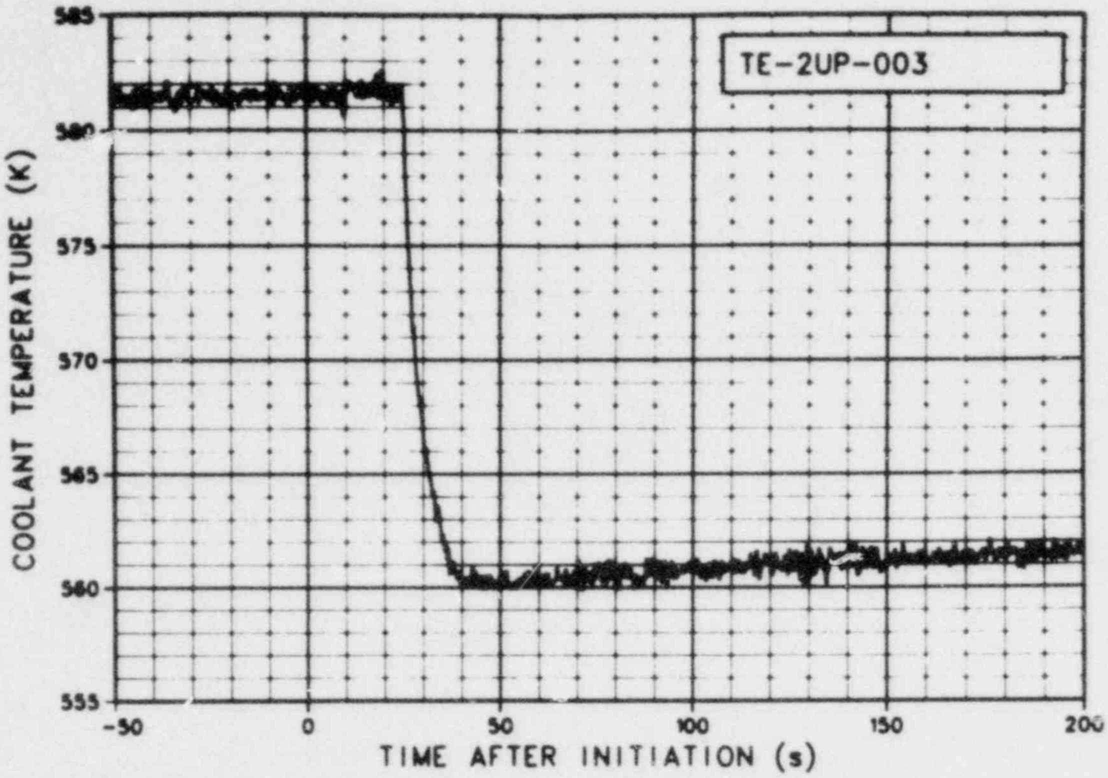


Figure 56. Coolant temperature in reactor vessel at upper end box of Fuel Assembly 2 (TE-2UP-003) (Qualified).

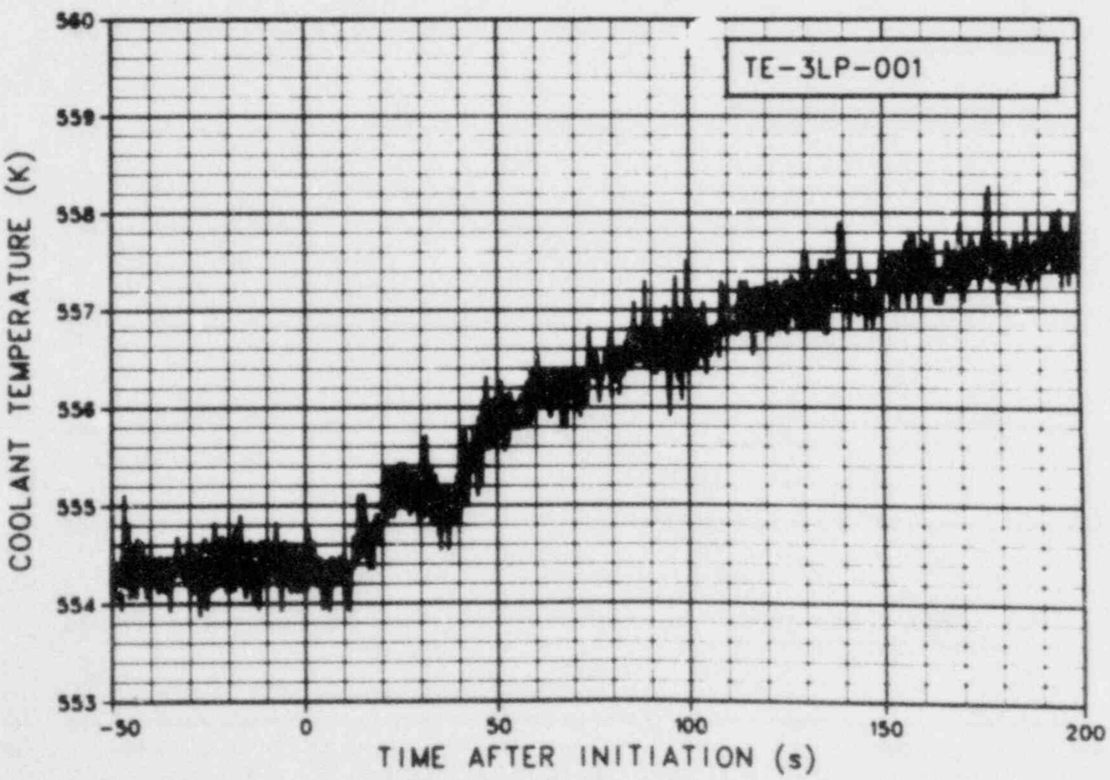


Figure 57. Coolant temperature in reactor vessel at lower end box of Fuel Assembly 3 (TE-3LP-001) (Qualified).

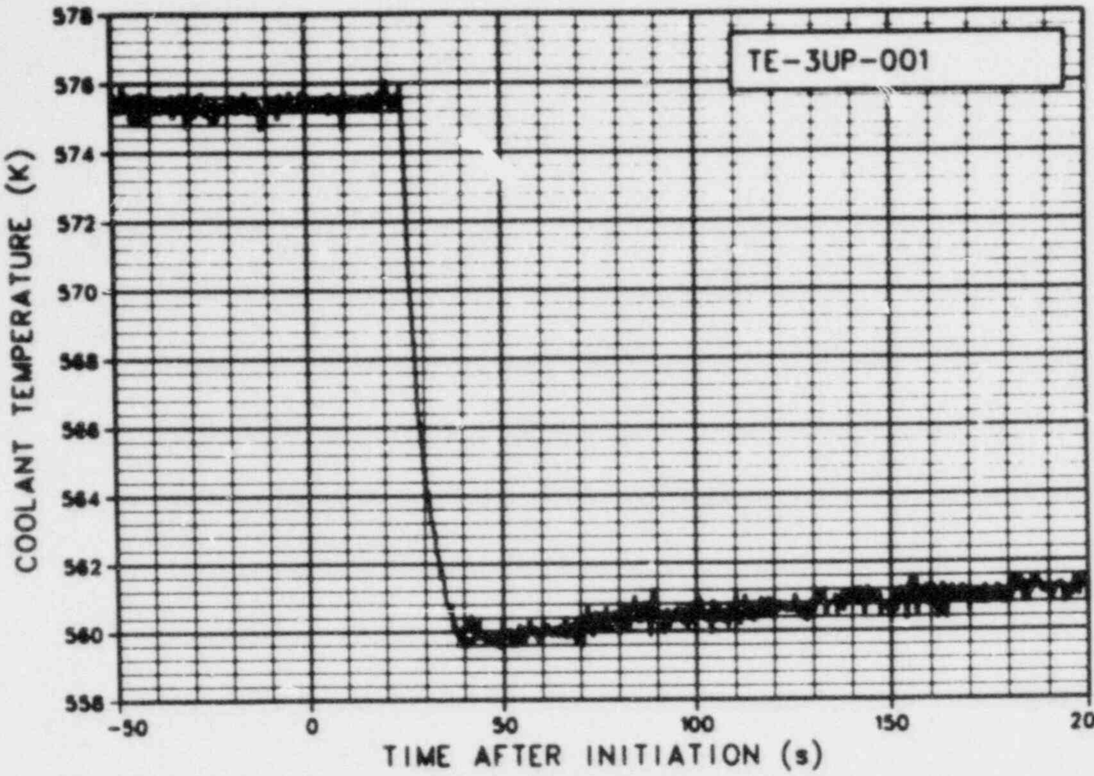


Figure 58. Coolant temperature in reactor vessel at upper end box of Fuel Assembly 3 (TE-3UP-001) (Qualified).

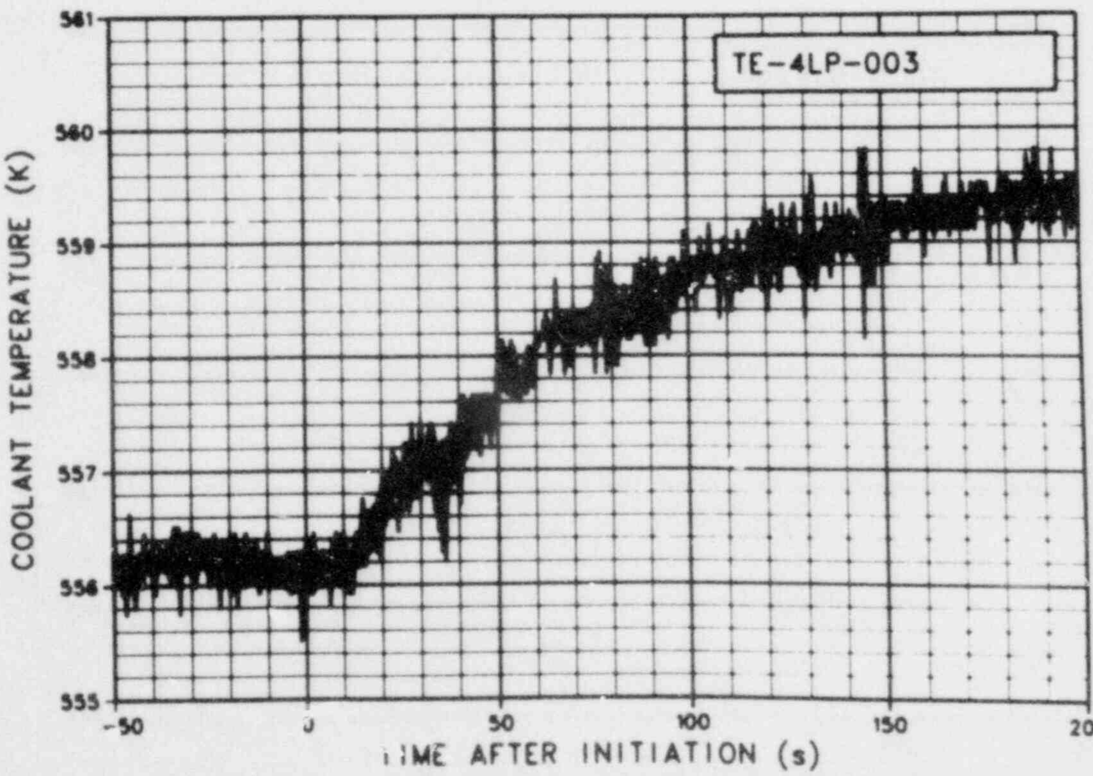


Figure 59. Coolant temperature in reactor vessel at lower end box of Fuel Assembly 4 (TE-4LP-003) (Qualified).

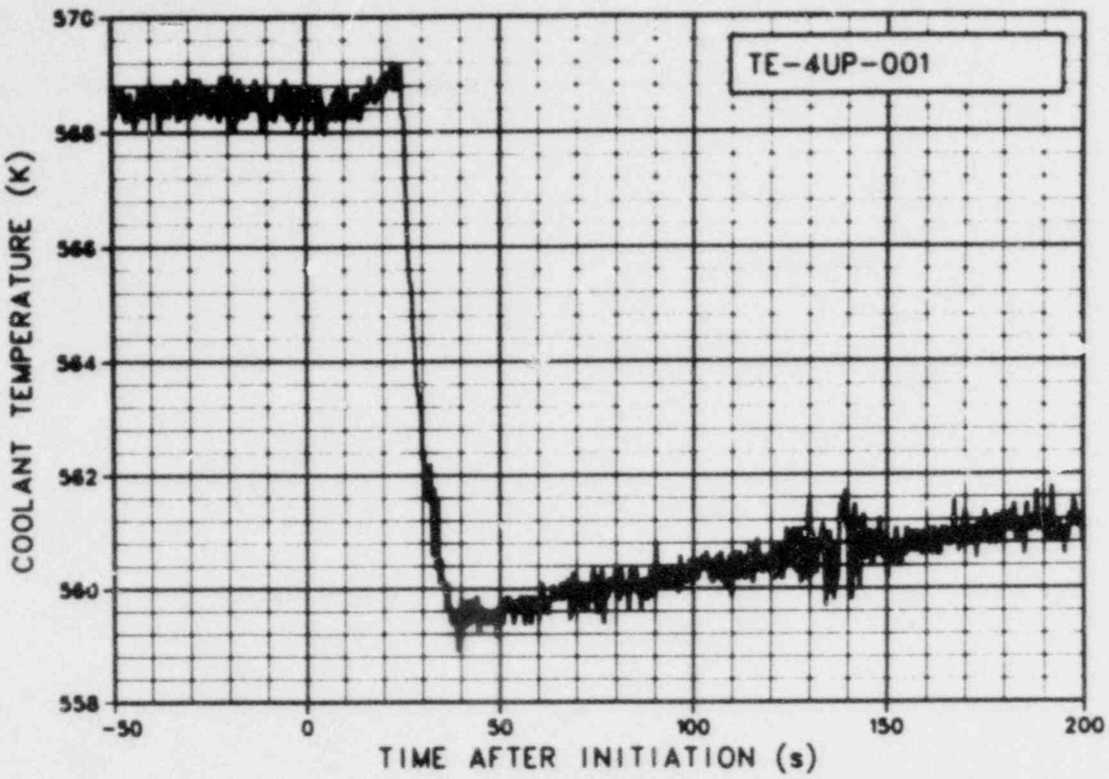


Figure 60. Coolant temperature in reactor vessel at upper end box of Fuel Assembly 4 (TE-4UP-001) (Qualified).

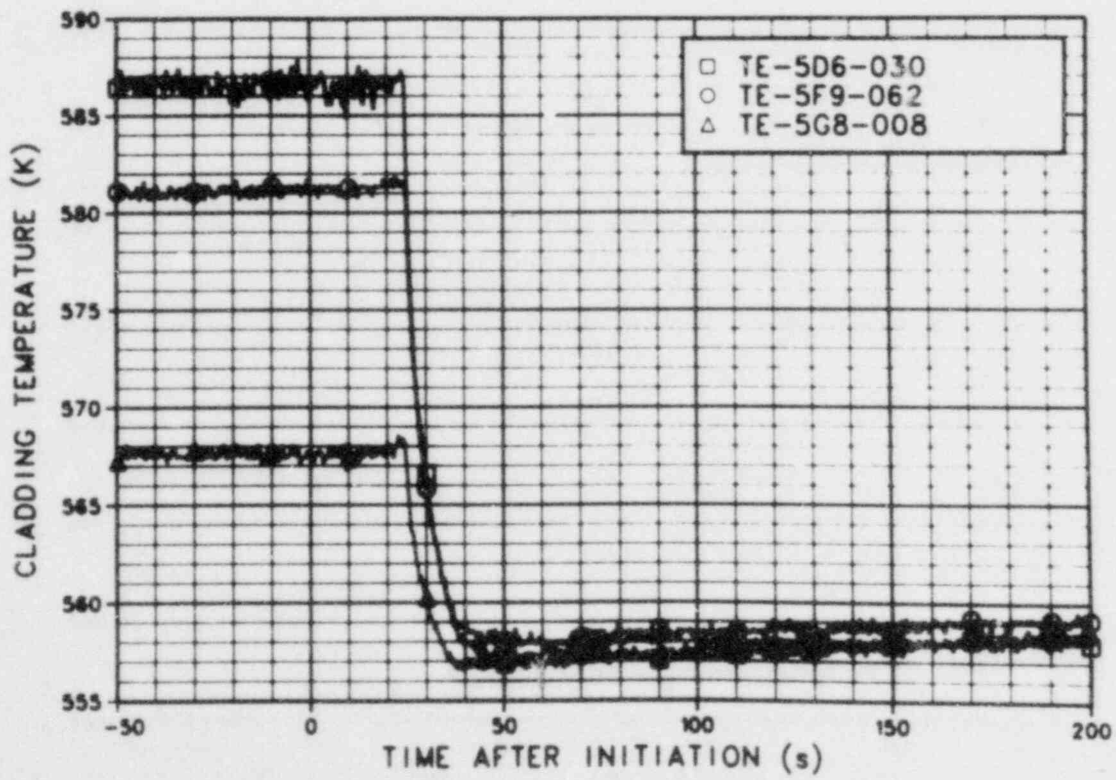


Figure 61. Cladding temperature in reactor vessel at Fuel Assembly 5, Row D, Column 6 at 0.76 m, Row F, Column 9 at 1.57 m, Row G, Column 8 at 0.20 m above bottom of fuel rod (TE-5D6-030, -5F9-062, and -5G8-008) (Qualified).

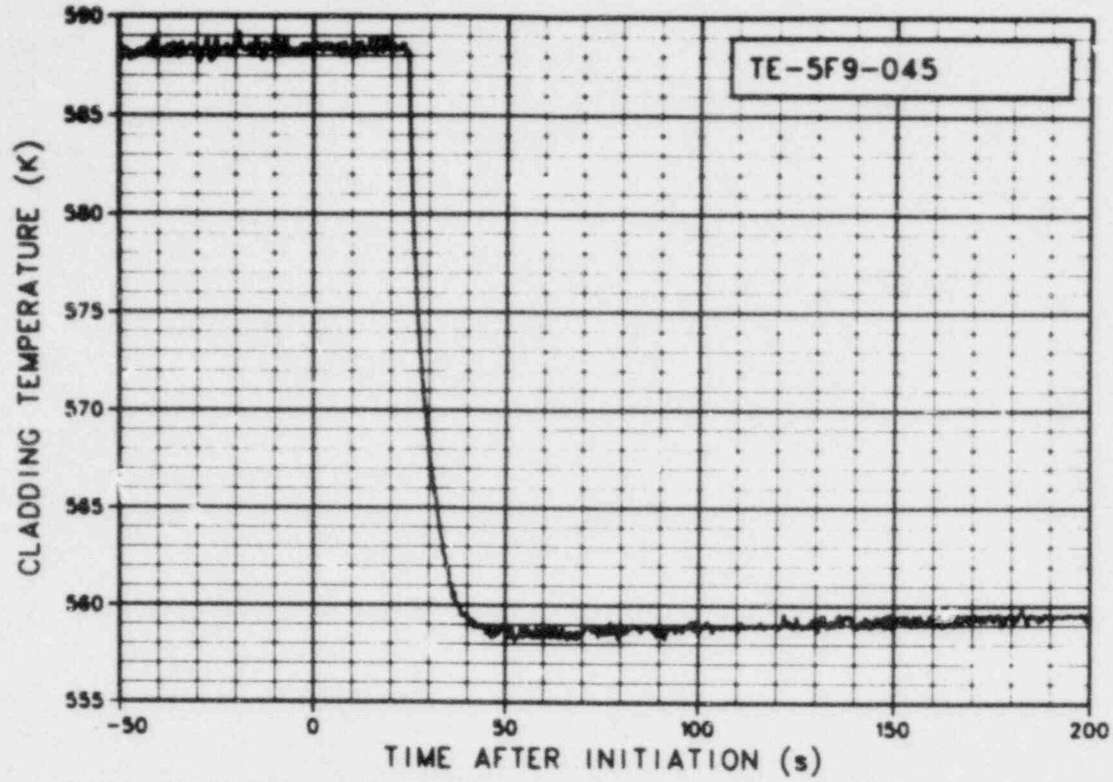


Figure 62. Cladding temperature in reactor vessel at Fuel Assembly 5, Row F, Column 9 at 1.14 m above bottom of fuel rod (TE-5F9-045) (Qualified).

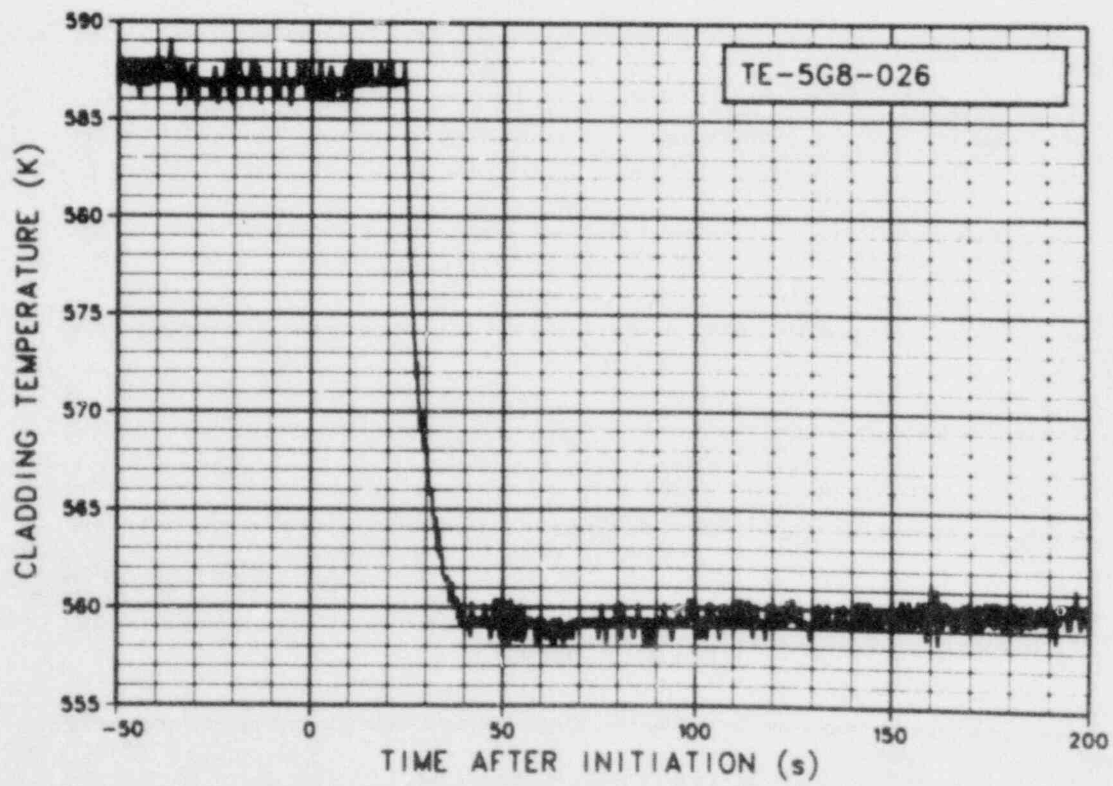


Figure 63. Cladding temperature in reactor vessel at Fuel Assembly 5, Row G, Column 8 at 0.66 m above bottom of fuel rod (TE-5G8-026) (Qualified).

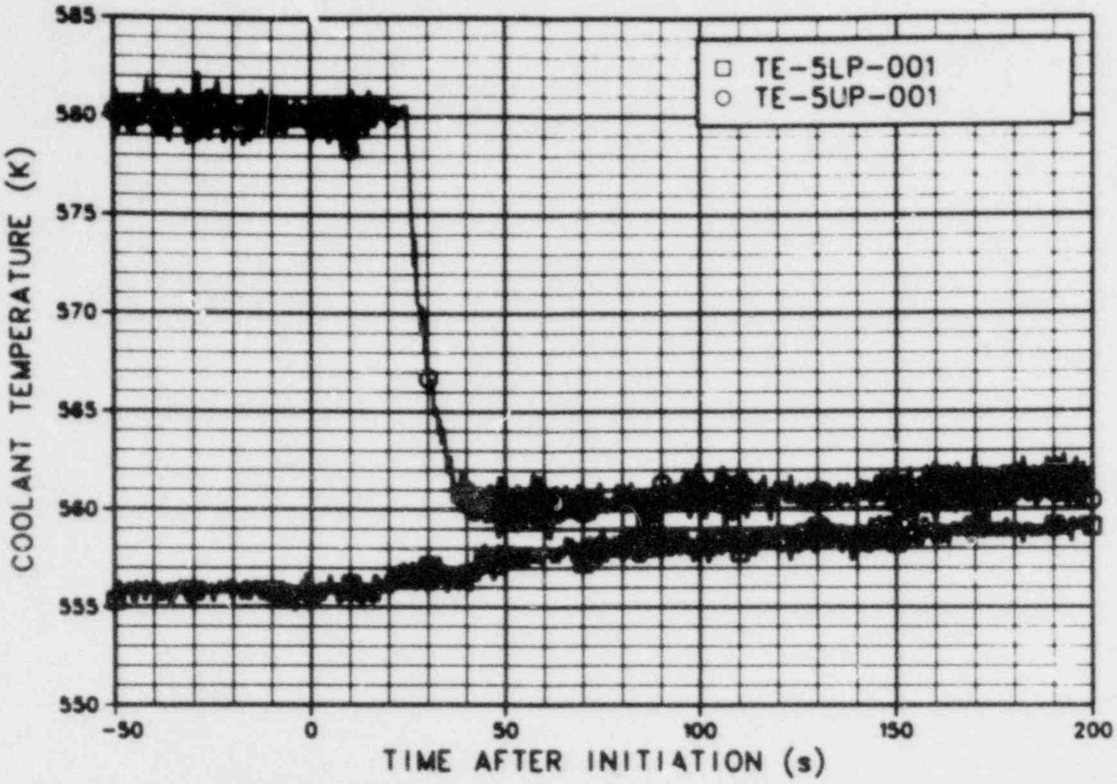


Figure 34. Coolant temperature in reactor vessel at lower and upper end boxes of Fuel Assembly 5 (TE-5LP-001 and -5UP-001) (Qualified).

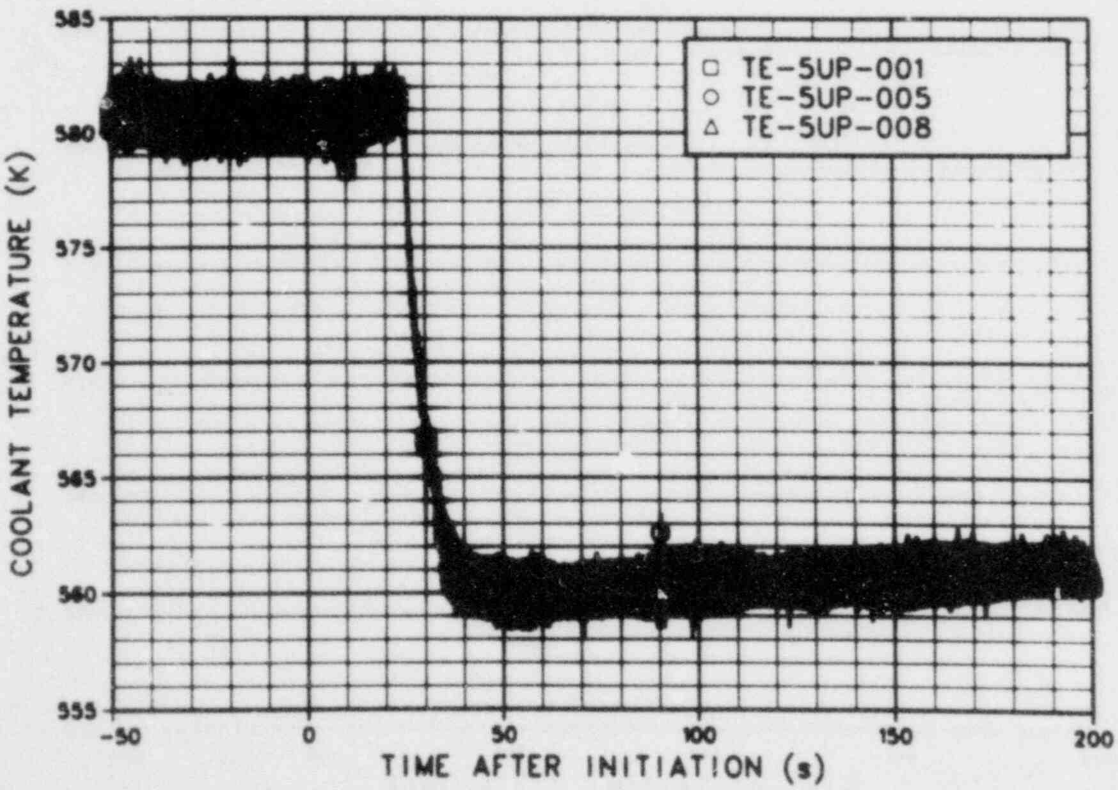


Figure 65. Coolant temperature in reactor vessel at upper end box of Fuel Assembly 5 (TE-5UP-001, -005, and -008) (Qualified).

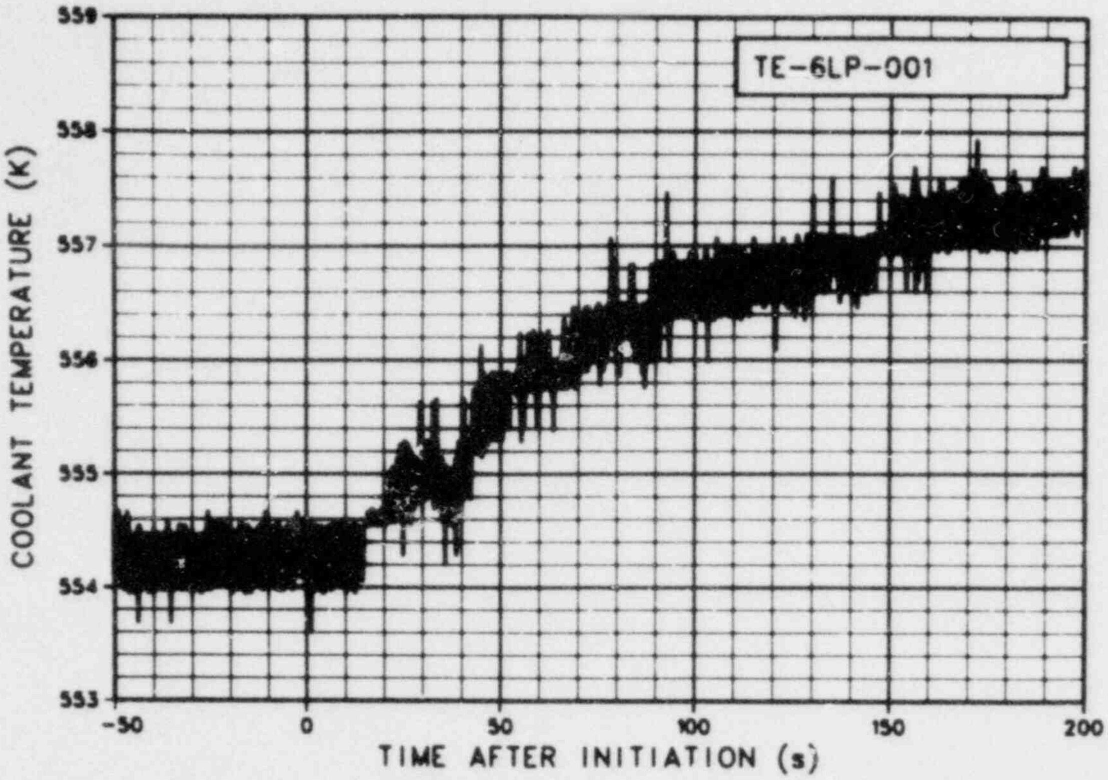


Figure 66. Coolant temperature in reactor vessel at lower end box of Fuel Assembly 6 (TE-6LP-001) (Qualified).

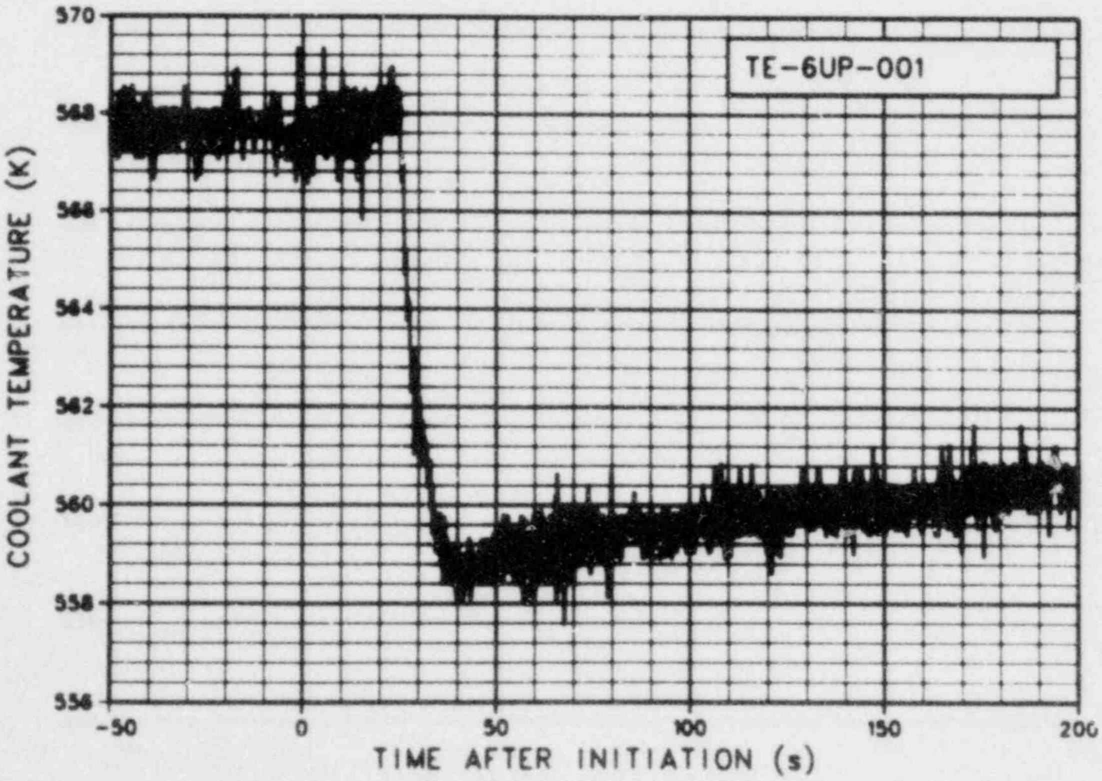


Figure 67. Coolant temperature in reactor vessel at upper end box of Fuel Assembly 6 (TE-6UP-001) (Qualified).

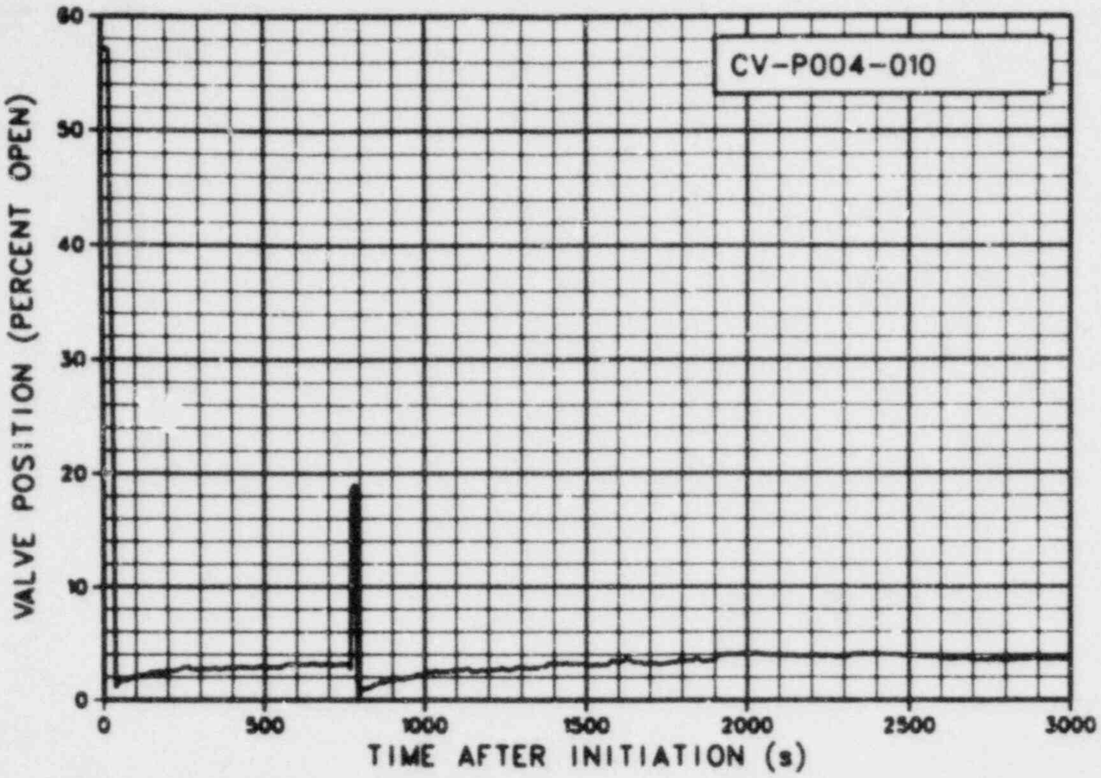


Figure 68. Valve position for secondary coolant system steam flow control valve (CV-P004-010) (Qualified).

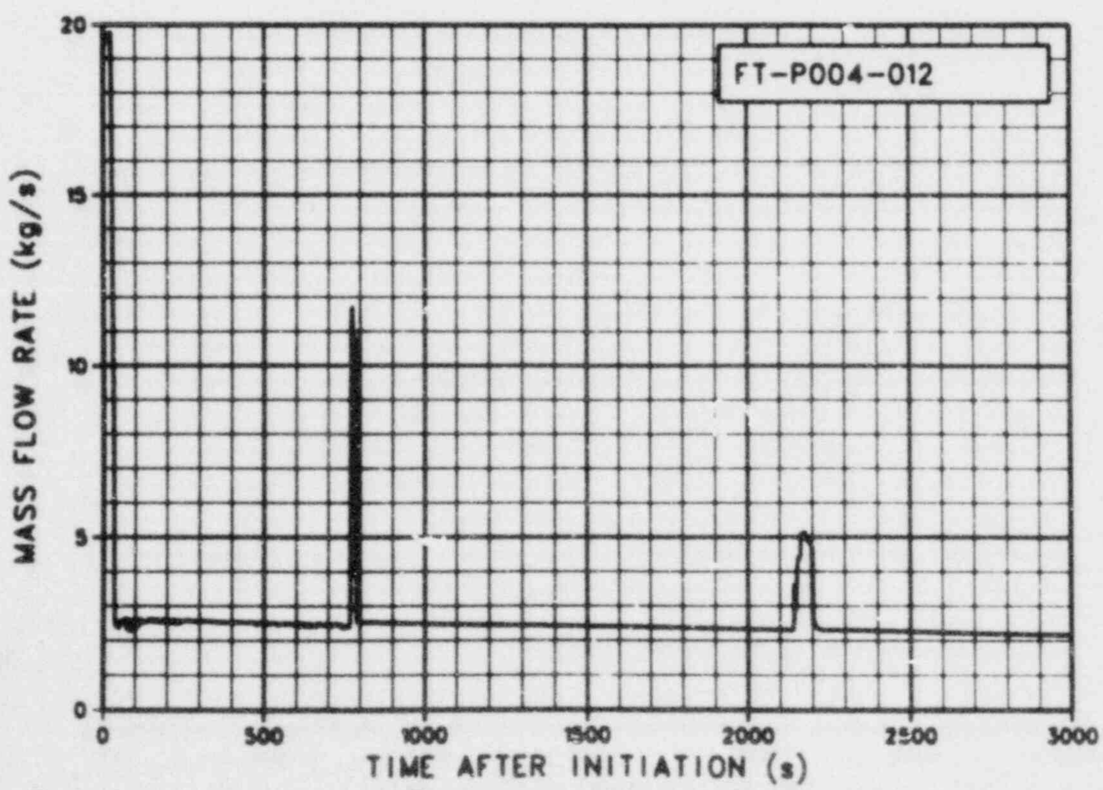


Figure 69. Steam flow rate at condenser inlet (FT-P004-012) (Qualified, magnitude uncertain after scram).

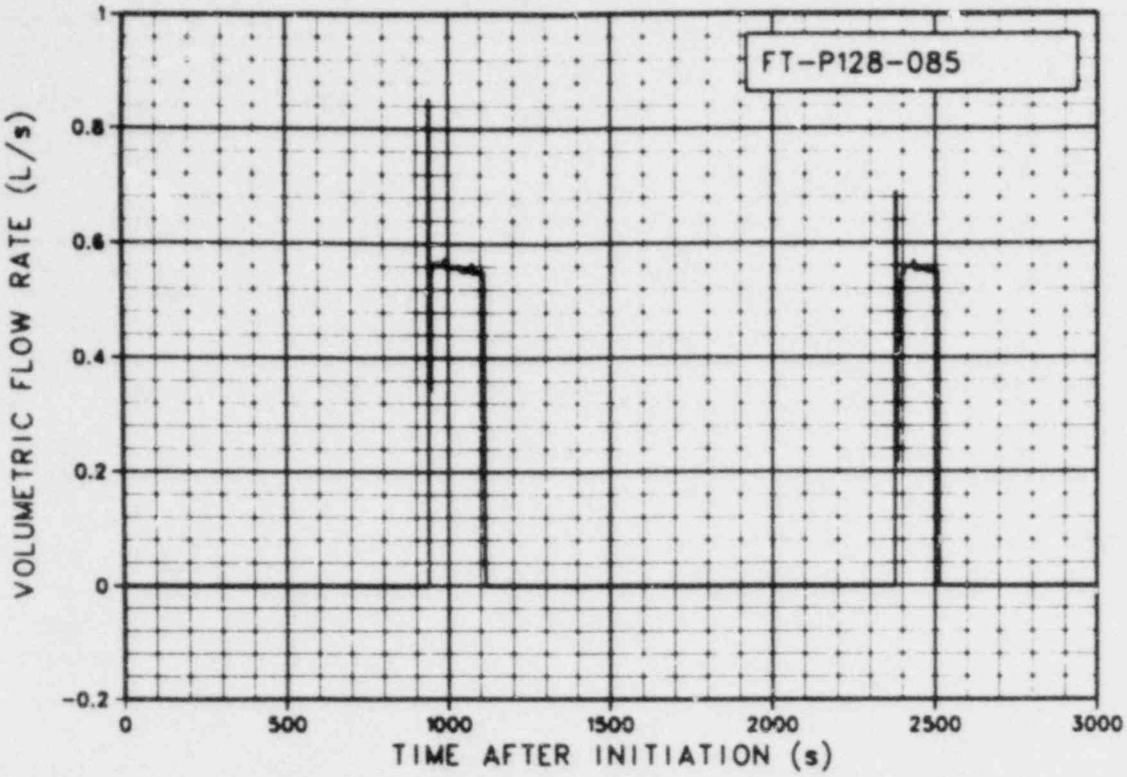


Figure 70. Flow rate in ECC charging pump AC-P-48 discharge (FT-P128-085) (Qualified).

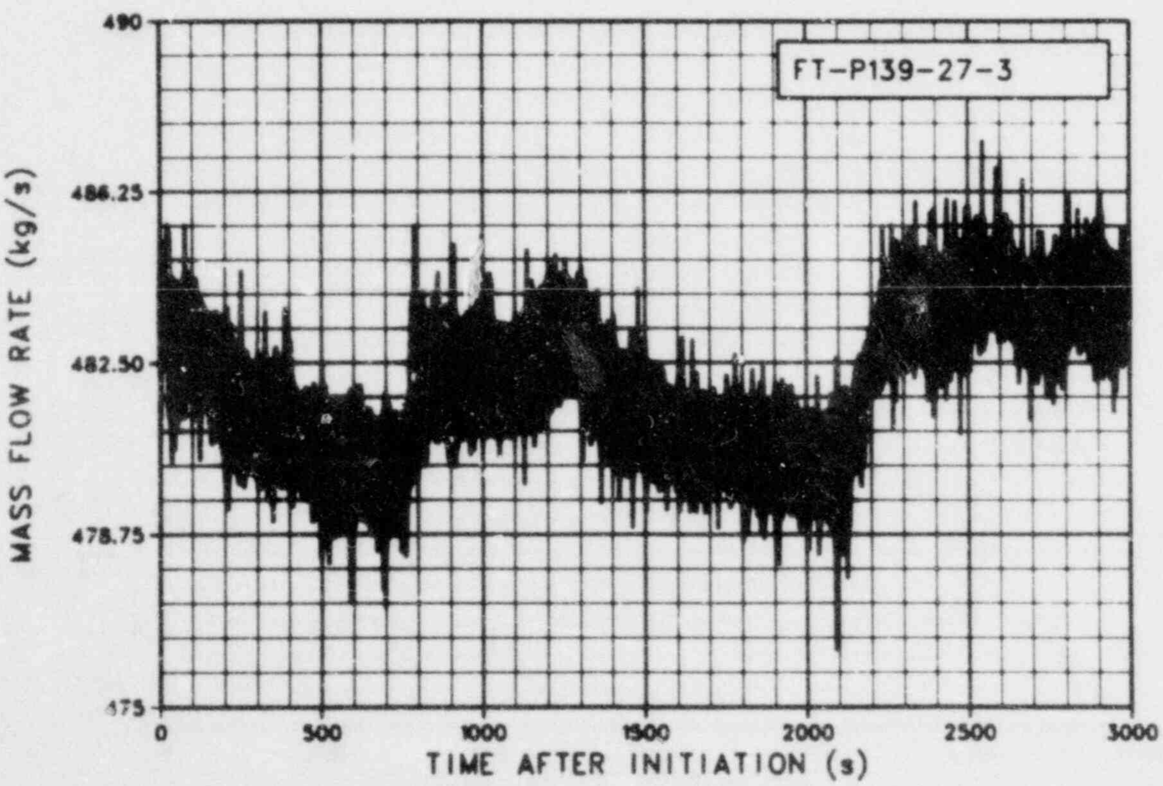


Figure 71. Flow rate in intact loop hot leg venturi (FT-P139-27-3) (Qualified).

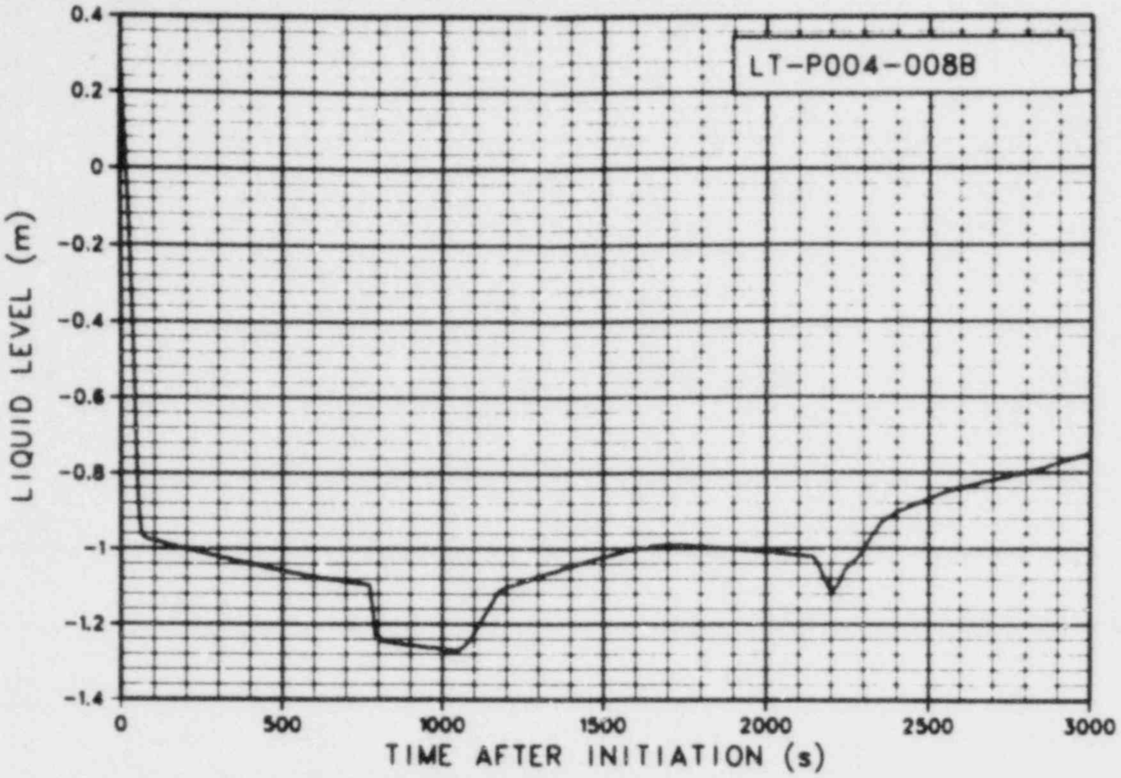


Figure 72. Liquid level in steam generator secondary side, wide range (LT-P004-008B) (Qualified, data not density compensated).

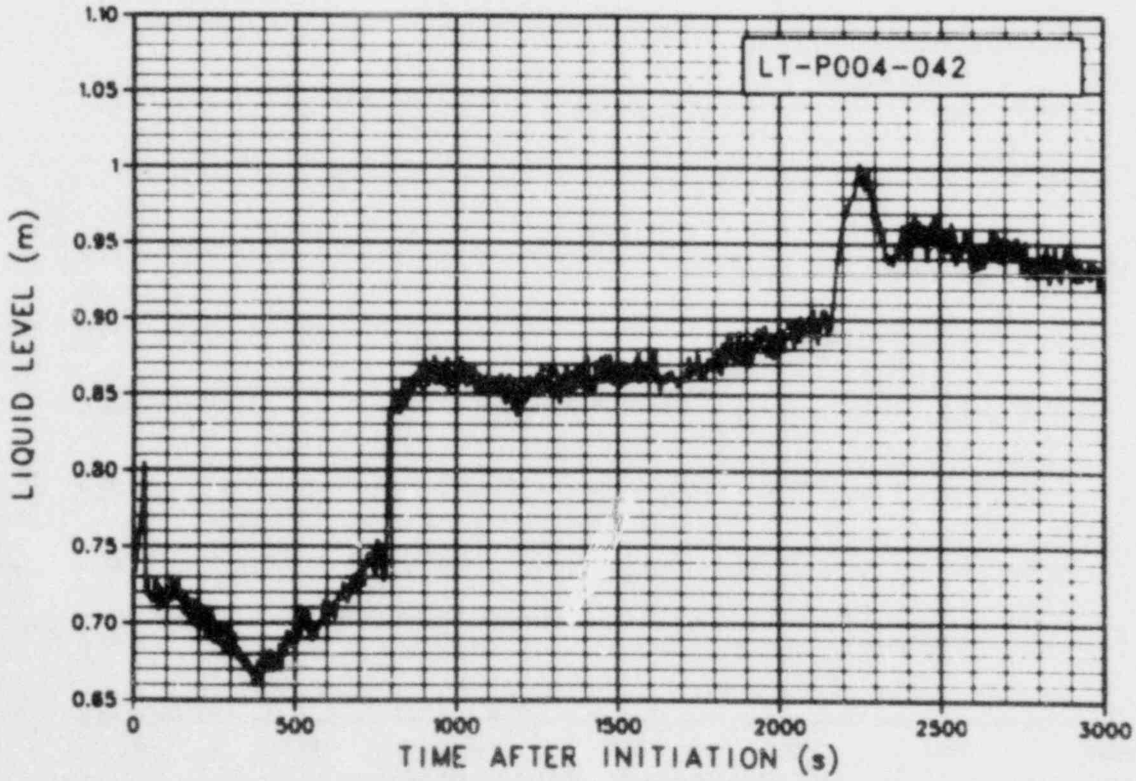


Figure 73. Liquid level in condensate receiver at centerline (LT-P004-042) (Qualified).

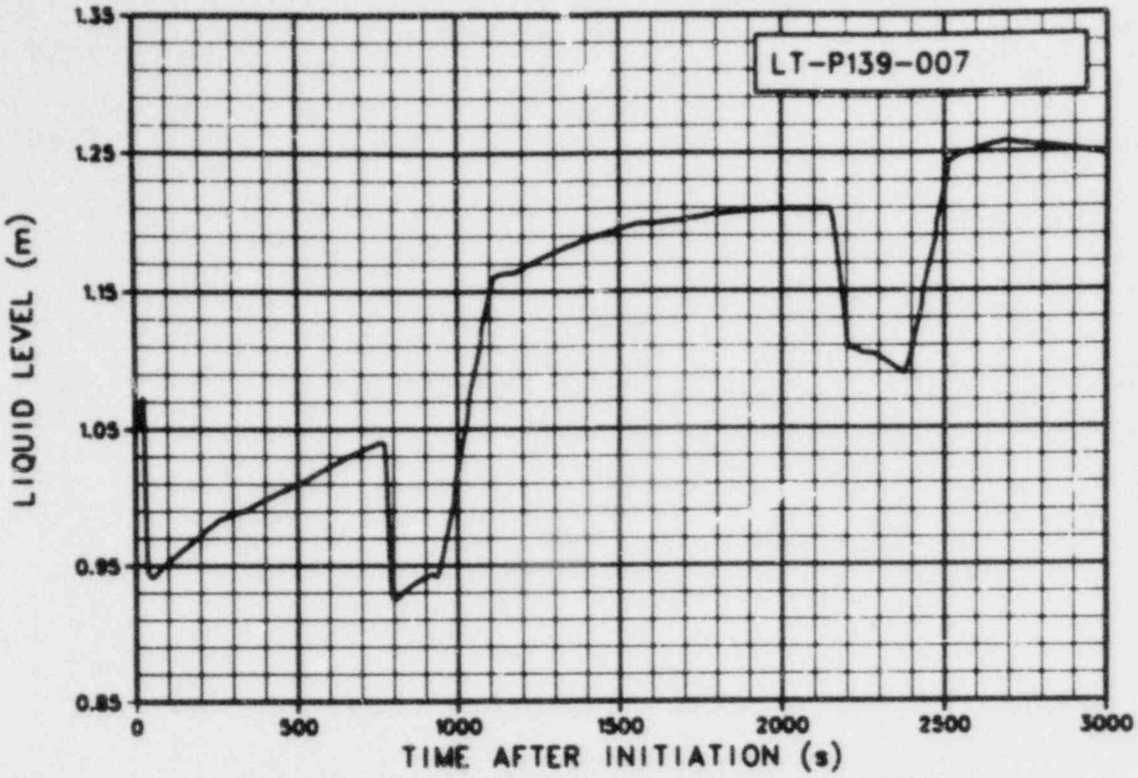


Figure 74. Liquid level in pressurizer (LT-P139-007) (Qualified for relative changes only).

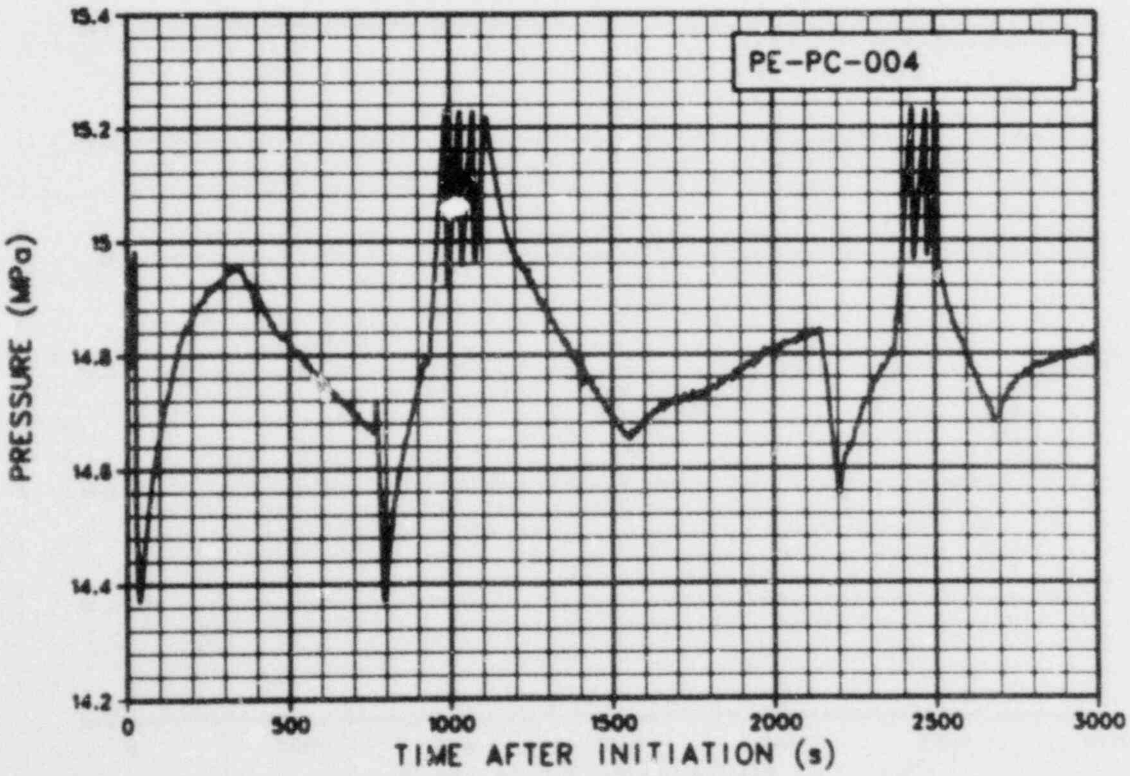


Figure 75. Pressure in pressurizer (PE-PC-004) (Qualified).

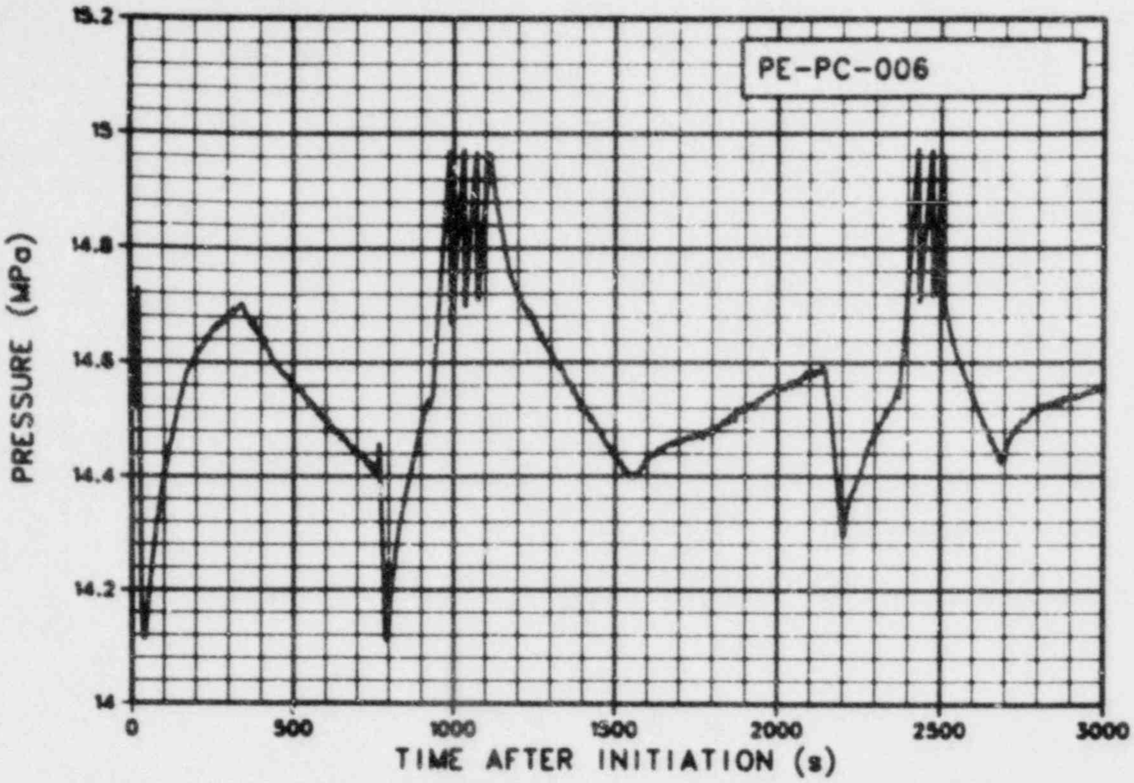


Figure 76. Reference pressure in intact loop between steam generator outlet and pump inlet (PE-PC-006) (Qualified).

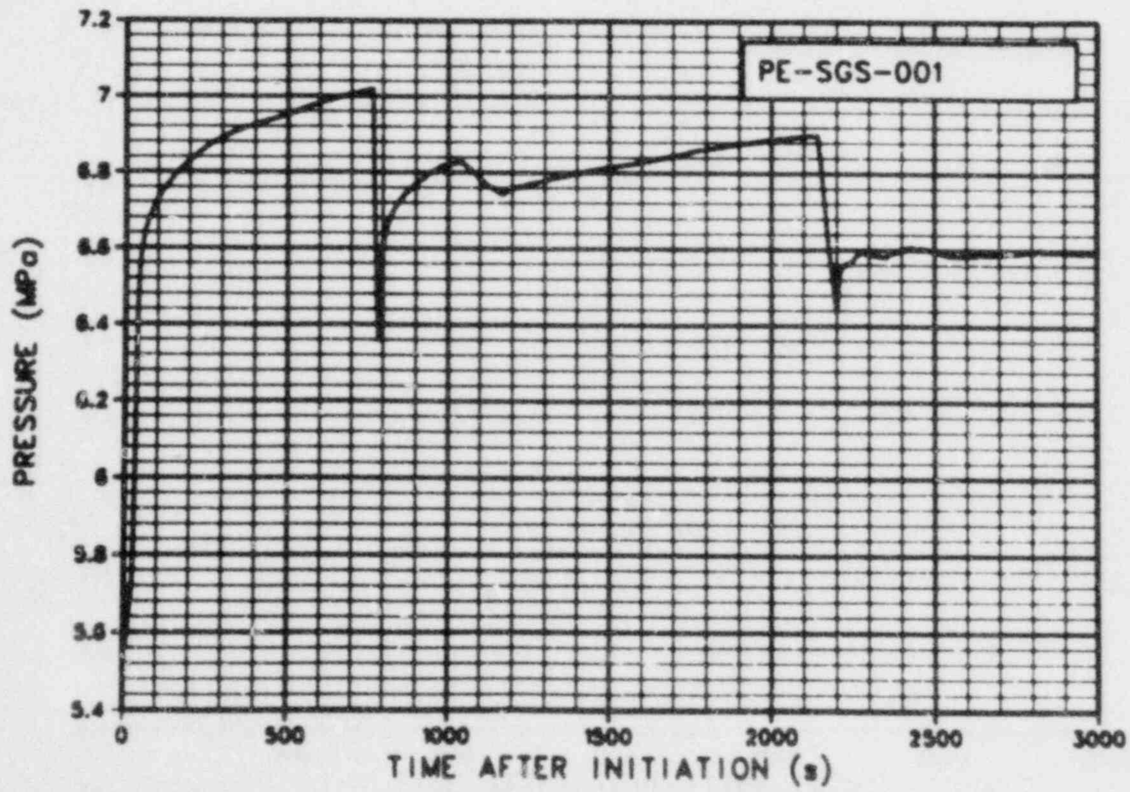


Figure 77. Pressure in steam generator dome (PE-SGS-001) (Qualified).

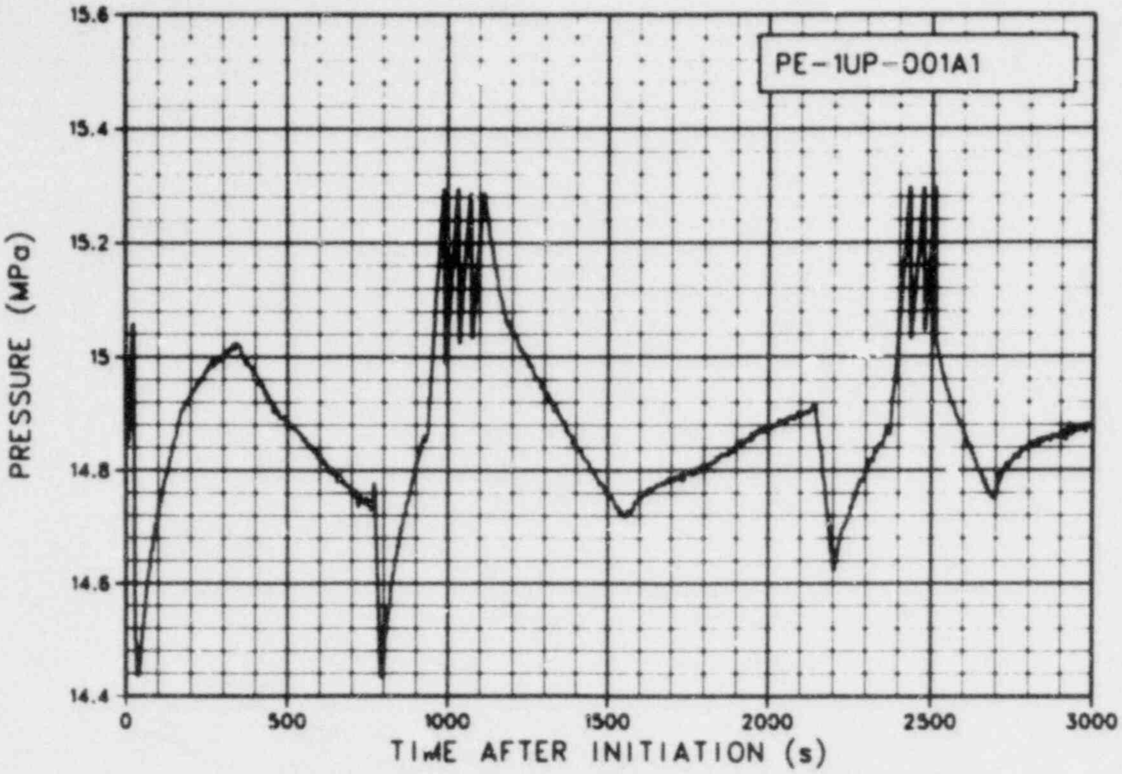


Figure 78. Pressure in reactor vessel above upper end box of Fuel Assembly 1 (PE-1UP-001A1) (Qualified).

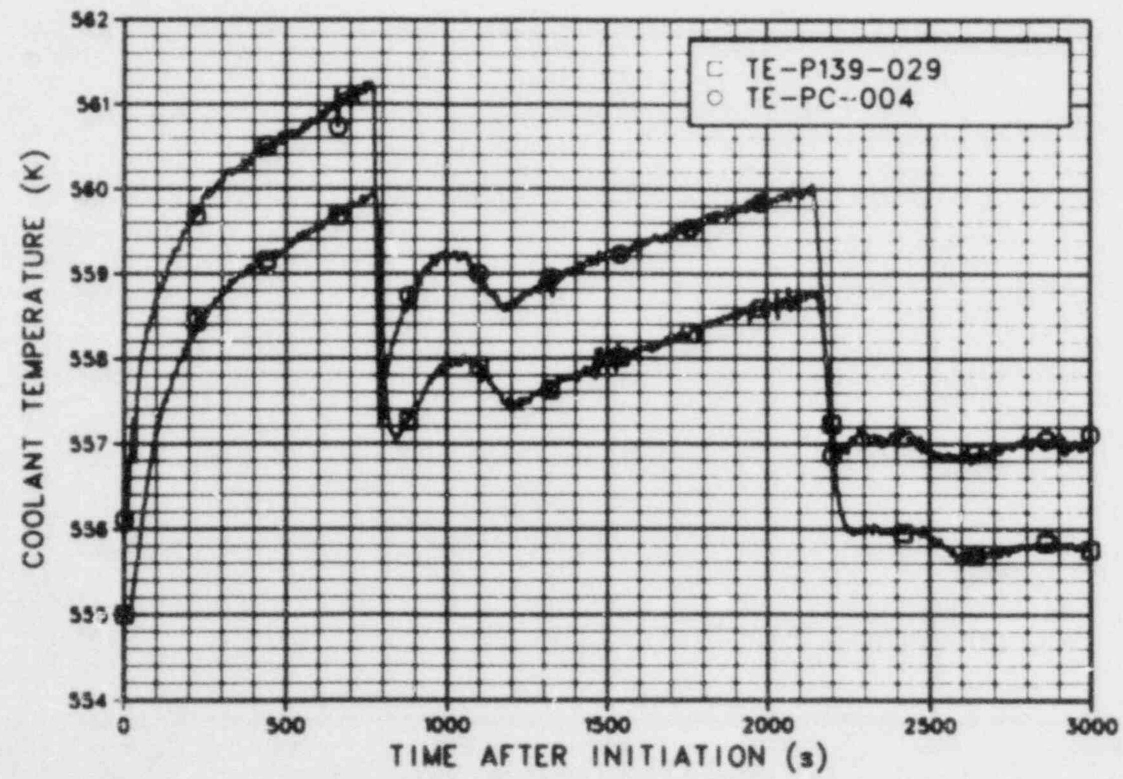


Figure 79. Coolant temperature in intact loop cold leg at bottom of ECC Rake 1 and upstream of DTT flange (TE-PC-004 and TE-P139-029) (Qualified. TE-P139-029 is a process instrument with slow response time).

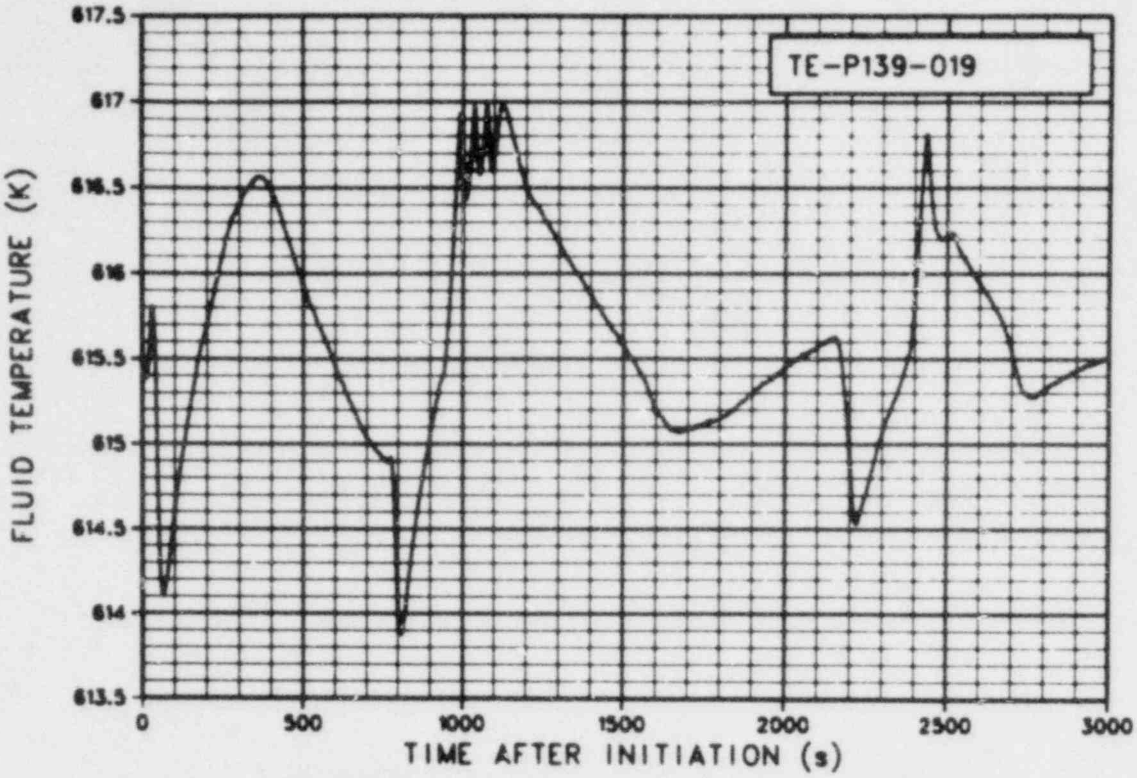


Figure 80. Fluid temperature in pressurizer vapor space (TE-P139-019) (Qualified).

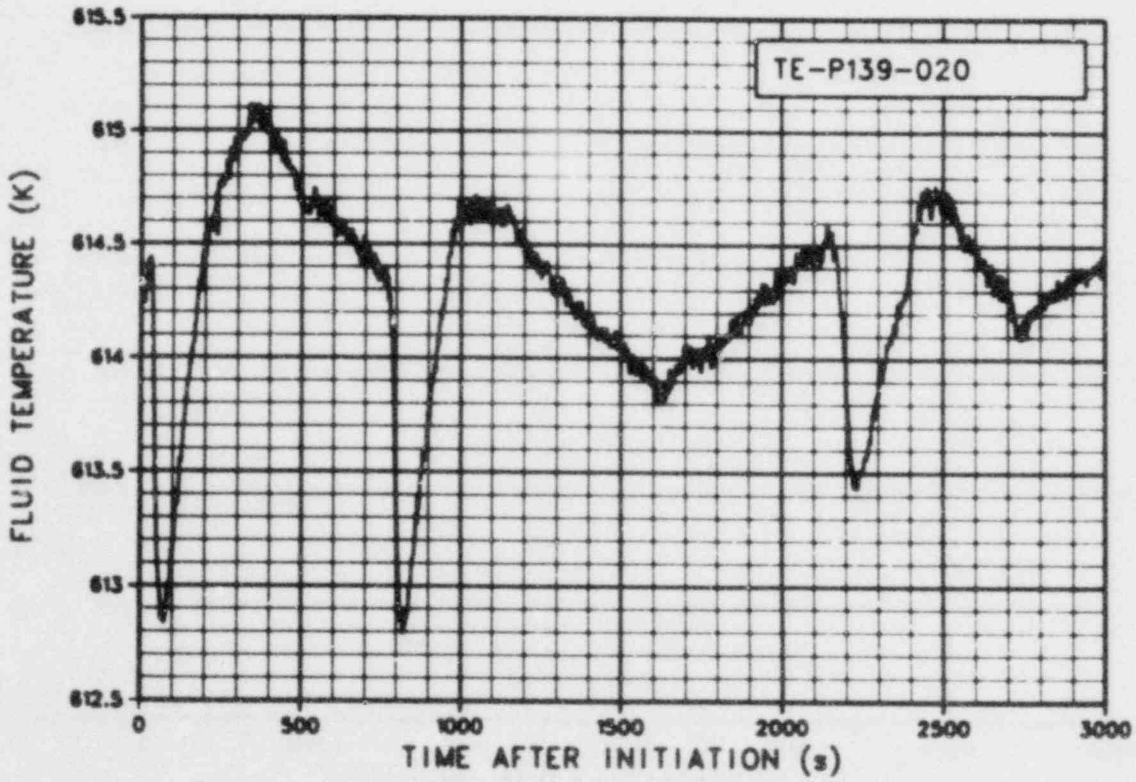


Figure 81. Fluid temperature in pressurizer liquid space (TE-P139-020) (Qualified).

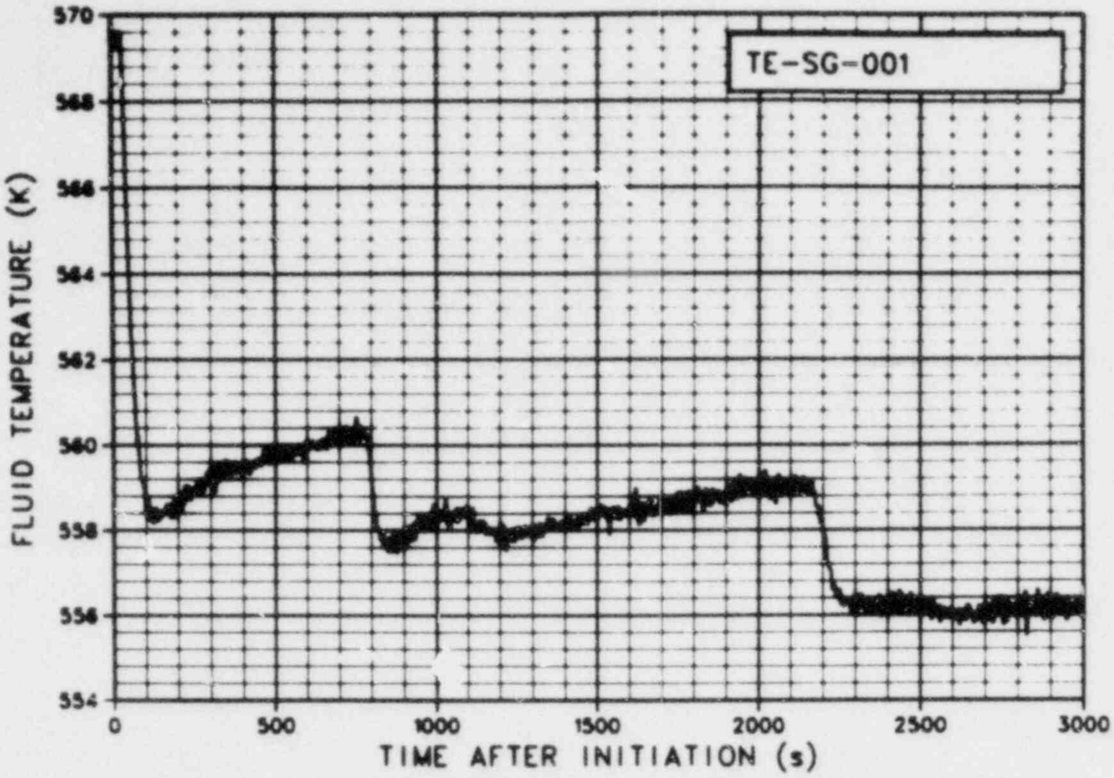


Figure 82. Fluid temperature in intact loop steam generator primary side inlet plenum (TE-SG-001) (Qualified).

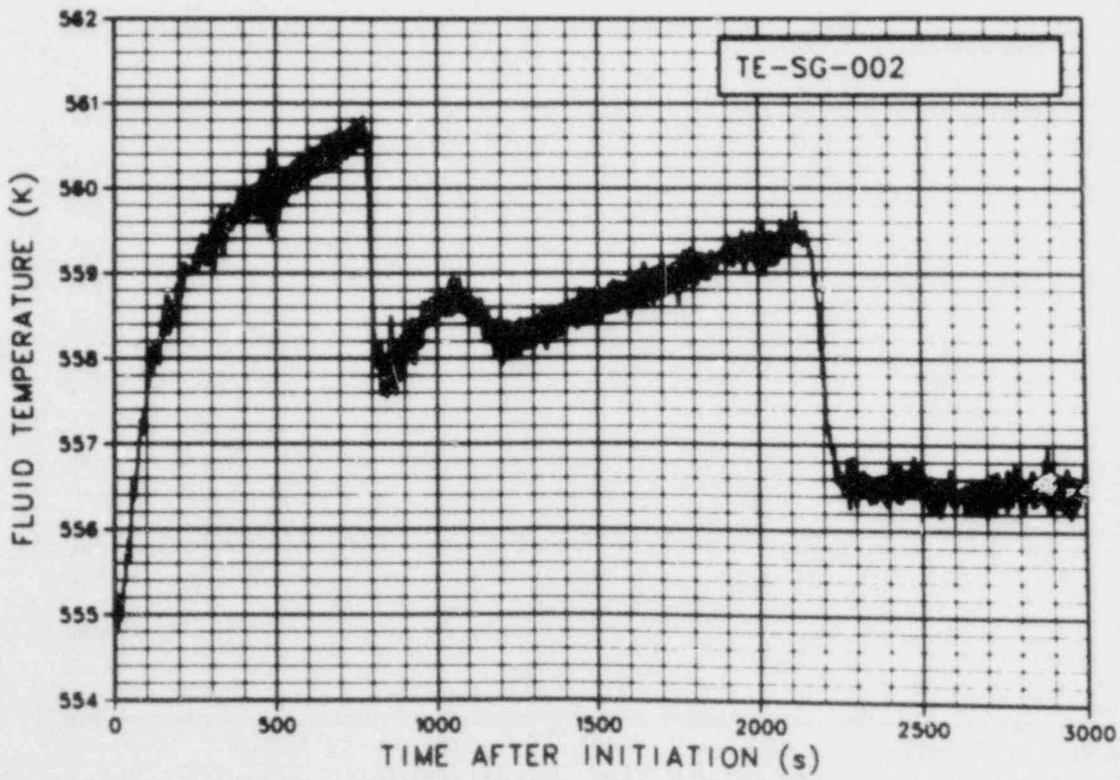


Figure 83. Fluid temperature in intact loop steam generator primary side outlet plenum (TE-SG-002) (Qualified).

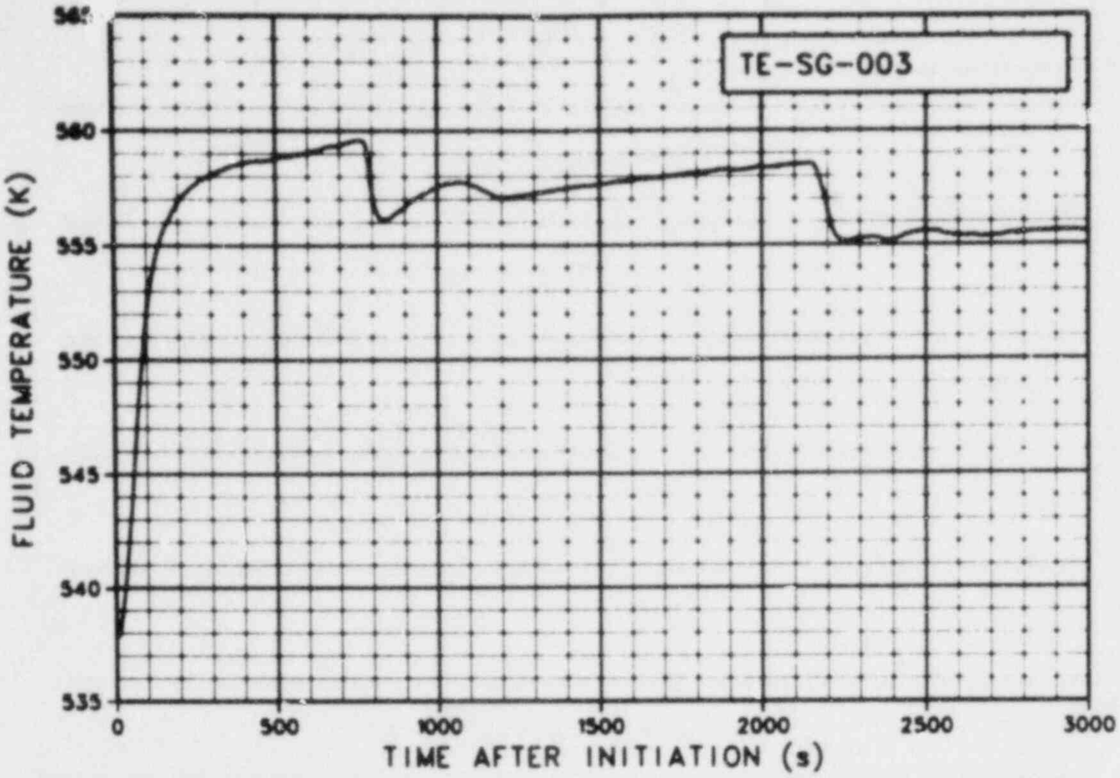


Figure 84. Fluid temperature in steam generator secondary side downcomer (TE-SG-003) (Qualified).

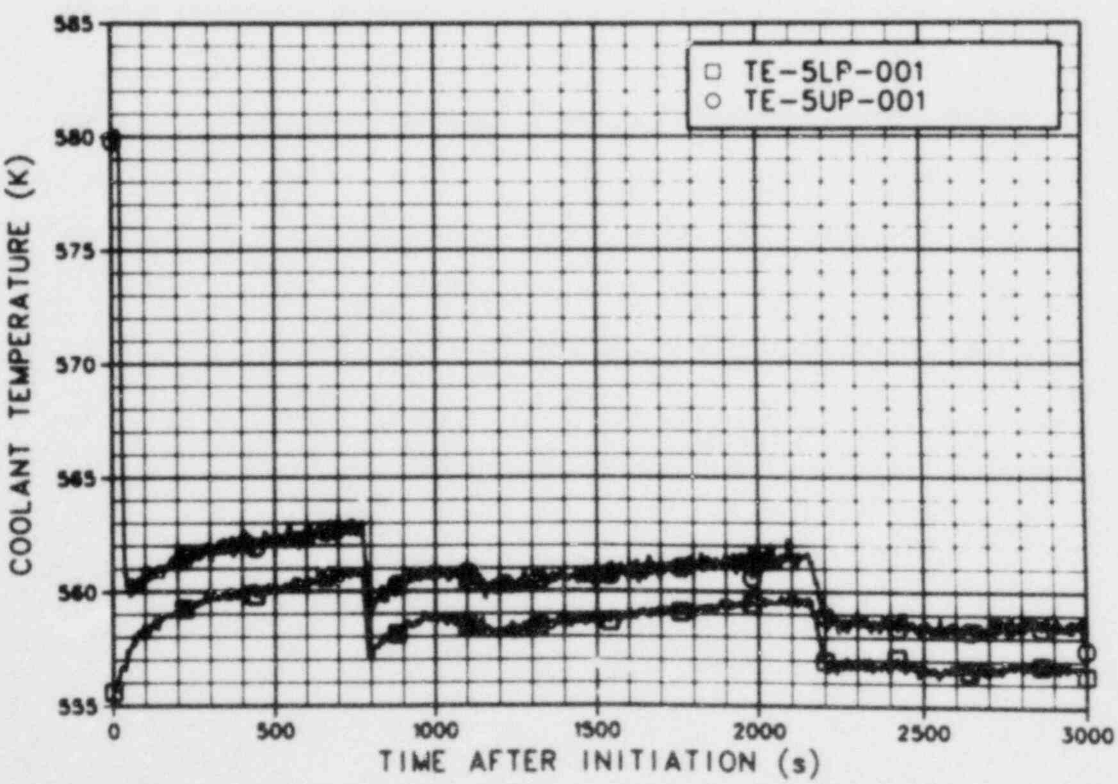


Figure 85. Coolant temperature in reactor vessel at lower and upper end boxes of Fuel Assembly 5 (TE-5LP-001 and -5UP-001) (Qualified).

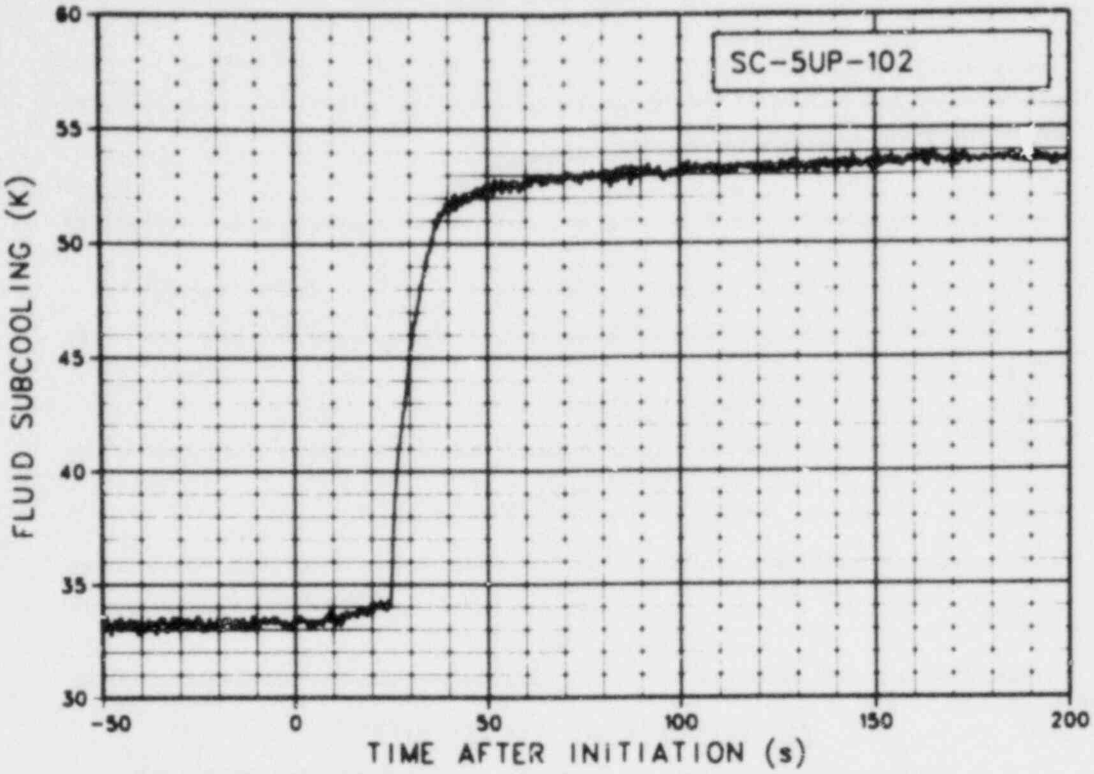


Figure 86. Fluid subcooling in reactor vessel upper plenum (SC-5UP-102) (Qualified).

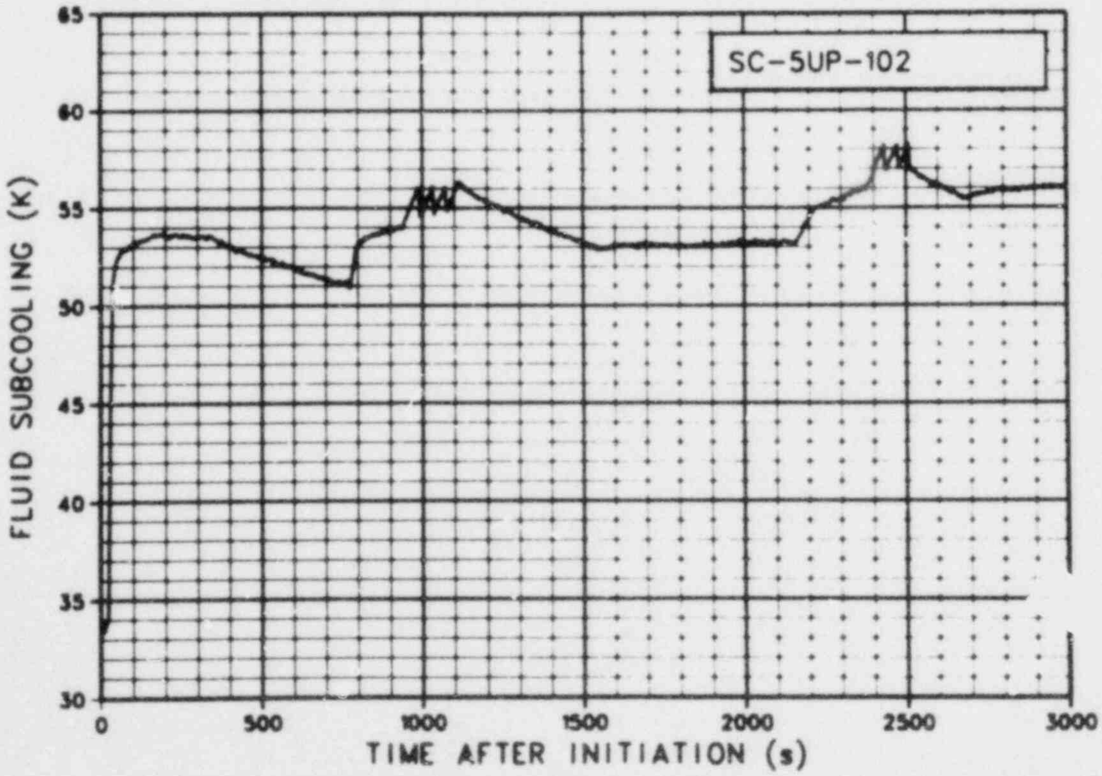


Figure 87. Fluid subcooling in reactor vessel upper plenum (SC-5UP-102) (Qualified).

6. REFERENCES

1. D. L. Reeder, *LOFT System and Test Description (5.5-ft. Nuclear Core 1 LOCEs)*, NUREG/CR-0247, TREE-1208, July 1978.

2. M. L. Russell, *LOFT Fuel Modules Design, Characterization, and Fabrication Program*, TREE-NUREG-1131, June 1977.

3. F. S. Miyasaki, *Digital Data Acquisition Program*, ANCR-1250, August 1975.

4. N. L. Norman, *LOFT Data Reduction*, ANCR-1251, August 1975.

5. *Proposed ANS Standard 5.1 Decay Heat Power in Light Water Reactors*, September 1978.

6. S. Silverman, *LOFT Experimental Measurements Uncertainty Analyses, VolumeXIV, LOFT Drag Disc-Turbine Transducer Uncertainty Analysis*, NUREG/CR-0169, TREE-1089, November 1978.

7. G. D. Lassahn, *LOFT Experimental Measurements Uncertainty Analyses, VolumeVII, LOFT Self-Powered Neutron Detector Uncertainty Analysis*, NUREG/CR-0169, TREE-1089, August 1978.

APPENDIX A

DATA CONSISTENCY CHECKS

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DATA CONSISTENCY CHECKS

The following discussion describes several techniques used to perform consistency checks on the data presented in this report. The purpose of these checks is to establish data integrity and to evaluate the performance of a given transducer. Tests were performed on data before, during, and after the experiment. The tests conducted during and after the experiment were similar to those conducted on preexperiment data, so only the procedure for the preexperiment tests is given.

A series of tests was conducted at various temperatures, pressures, and flow rates prior to the experiment initiation. These tests included static pressure, steady state flow, zero flow, pump coastdown, and isothermal tests. Using the data from these tests, the following checks were performed.

1. ABSOLUTE PRESSURE DATA

During the approach to initial conditions, a series of static pressure tests was performed. After each test, the absolute pressure measurements were compared with two reference pressures (PE-PC-005 and -006). The pressure tests were used to evaluate the slope coefficient of the calibration equations, and to evaluate the pressure sensitivity of the transducers.

The steam generator pressure transducer was checked against the pressure obtained from the steam tables using the steam generator temperature.

2. FLOW DATA

Measurements of fluid flow included pump speed, differential pressure, venturi, turbines, and drag discs. The measurements were analyzed primarily to check the zero offset. Turbine and drag-disc measurements were also analyzed to check slope coefficient (gain) changes.

2.1 Pump Speed Data

The reference measurement for all intact loop flow measurements was primary coolant pump speed, because it is the most accurate and stable of the flow measurements. The pump speed measurement was adjusted using a square wave generator to calibrate the digital to analog conversion.

During heatup, the zero reading was checked at every zero flow point, and during flow tests, the pump speed was checked against pump frequency. Pump speed measurements were checked for consistency by comparison with pump speed as calculated from the primary system motor generator frequencies. Prior to the experiment, the pump speed was further checked by reviewing the agreement with previous LOFT experiments.

Pump run voltages and currents were evaluated prior to the experiment by calculating the pump electrical horsepower input, the pump water power, and finally the combined pump efficiency. These calculated efficiencies were then compared with previously recorded efficiencies determined during pump requalification tests.

2.2 Differential Pressure Data

Zero offsets were determined from flow data, static pressure tests, and temperature sensitivity data derived during the heatup. Steady state flow conditions for the primary coolant system (PCS) were then established, and selected PCS pressure drops were compared with predicted values. At various flow conditions, intact loop flow resistance coefficients were calculated and verified to remain essentially constant and to agree with previously tabulated data. Further consistency checks were performed on the intact loop differential pressure measurements by plotting the square root of the differential pressure against pump speed using data from the pump frequency tests. The results of the curve fits performed on those plots were then used to confirm zero offsets. Both prior to and during the experiment, differential pressure measurements were compared with the differential pressure computed by subtracting appropriate absolute pressure measurements. Finally, pressure closure was calculated for the PCS intact loop.

2.3 Venturi Data

Consistency checks were performed by comparing the venturi mass flow rate with venturi mass flow rates from previous LOFT experiments (with the same loop resistance) and to each other. A comparison of the venturi with the pump speed consisted of performing a least squares fit of the venturi data versus the pump data (derived from the pump speed frequency test). The results were used to correct any zero offset in the venturi. The corrected venturi data were then used to calculate the average fluid velocity and momentum flux of the intact loop. The computed velocity was compared to the differential pressure measured across the pumps, the steam generator, and the reactor vessel.

In addition, the computed fluid velocity and the momentum flux were compared to the output of the turbines and drag discs in the reactor vessel.

2.4 Drag-Disc Turbine (DTT) Data

Data from the reactor vessel drag discs were compared with values calculated from venturi mass flow, assuming the full flow area. Slope coefficients were calculated and the effect of temperature on the calibration coefficients was determined.

After the slope coefficients had been verified, the data for a given transducer were plotted against pump speed and a least squares fit performed. The zero offset from this curve fit was used to modify the zero offset of the transducers.

As an independent check, the turbine flowmeter and drag-disc data were used to calculate fluid density. These values were then compared to the known density prior to the experiment. This analysis was performed on all the turbine flowmeter and drag disc measurements in the reactor vessel with the exception of those that failed.

3. GAMMA DENSITOMETER DATA

To evaluate the PCS average fluid densities, calculations were performed using the gamma densitometers. The densitometers were checked for normal operation by recording and observing spectra, count rate data, and live-time data on the densitometer system display console during and immediately before the experiment.

4. LEVEL MEASUREMENT DATA

Liquid level measurements for the pressurizer and the steam generator secondary side were evaluated. Both liquid levels were reviewed by redundant level measurements.

5. THERMOCOUPLE DATA

Temperature measurements were analyzed by comparing them with other temperature data obtained during the isothermal tests. Resistance temperature measurements were used for reference where they existed. Temperature measurements outside the PCS were compared with a known temperature in the same area.

APPENDIX B

EXPERIMENT L6-5 INSTRUMENTATION LIST

APPENDIX B

EXPERIMENT L6-5 INSTRUMENTATION LIST

Table B-1 contains a list of all the instruments in the Loss-of-Fluid Test (LOFT) system that were available to be used for Experiment L6-5. Included in Table B-1 are the instrument location, range, initial condition uncertainty, uncertainty at specific readings, and recording frequency. The "Comments" column contains information relative to the usability of the data. No entry under the "Comments" column means that the instrument was recorded, but the data were not reviewed or presented. No entry under the "Initial Condition Uncertainty" column means that the instrument was recorded only on the plant log and surveillance system.

TABLE B-1. EXPERIMENT L6-5 INSTRUMENTATION LIST

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation: Reading	After Experiment Initiation: Uncertainty (±)	Comments
VALVE OPENING							
Intact Loop							
CV-P004-008	Main feedwater control valve.	0 to 100%	1 Hz	3.2%	0%	3.0%	Qualified to 200 s.
					25%	3.13%	
					50%	3.47%	
					100%	4.61%	
CV-P004-010	Main steam control valve.	0 to 100%	1 Hz	3.9%	0%	3.0%	Qualified.
					25%	3.13%	
					50%	3.47%	
					100%	4.61%	
CV-P004-090	Main steam bypass valve.	0 to 100%	1 Hz	--	0%	3.0%	
					25%	3.13%	
					50%	3.47%	
					100%	4.61%	
CV-P004-091	Main feedwater bypass valve.	0 to 100%	1 Hz	3.0%	0%	3.0%	
					25%	3.13%	
					50%	3.47%	
					100%	4.61%	
Broken Loop							
CV-P138-001	Broken loop cold leg between break plane and suppression tank.	0 to 100%	1 Hz	3.0%	0%	3.0%	
					25%	3.13%	
					50%	3.47%	
					100%	4.61%	
CV-P138-015	Quick-opening blowdown valve (QOBV) in hot leg.	0 to 100%	1 Hz	3.0%	0%	3.0%	
					25%	3.13%	
					50%	3.47%	
					100%	4.61%	

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation Reading	After Experiment Initiation Uncertainty (±)	Comments
VALVE OPENING (continued)							
Broken Loop (continued)							
CV-P138-070A	Blowdown system bypass valve.	0 to 100%	1 Hz	4.61%	0% 25% 50% 100%	3.0% 3.13% 3.47% 4.61%	
CV-P138-071A	Blowdown system bypass valve.	0 to 100%	1 Hz	4.61%	0% 25% 50% 100%	3.0% 3.13% 3.47% 4.61%	
CV-P138-123	1.3-L/s spray header control valve.	0 to 100%	1 Hz	3.0%	0% 25% 50% 100%	3.0% 3.13% 3.47% 4.61%	
CV-P138-124	3.8-L/s spray header control valve.	0 to 100%	1 Hz	3.0%	0% 25% 50% 100%	3.0% 3.13% 3.47% 4.61%	
CV-P138-125	13.9-L/s spray header control valve.	0 to 100%	1 Hz	3.05%	0% 25% 50% 100%	3.0% 3.13% 3.47% 4.61%	
CHORDAL DENSITY							
Broken Loop							
DE-BL-001A	Broken loop cold leg at drag disc turbine transducer (DTT) flange. Beam A is 14° 21 min from Beam B [CW looking toward reactor vessel (RV)].	0 to 1.0 Mg/m^3	10 Hz	--	--	0.072 Mg/m^3[b]	
DE-BL-001B	Broken loop cold leg at DTT flange. Beam B through centerline of pipe 45° from vertical (CCW looking toward RV).	0 to 1.0 Mg/m^3	10 Hz	--	--	0.072 Mg/m^3	

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation: Reading	After Experiment Initiation: Uncertainty (±)	Comments
CHORDAL DENSITY (continued)							
Broken Loop (continued)							
DE-BL-001C	Broken loop cold leg at DTT flange. Beam C is 22° 7 min from Beam B (CCW looking toward RV).	0 to 1.0 Mg/m^3	10 Hz	--	--	0.116 Mg/m^3	
DE-BL-002A	Broken loop hot leg at DTT flange. Beam A is 14° 21 min from Beam (CCW looking toward RV).	0 to 1.0 Mg/m^3	10 Hz	--	--	0.068 Mg/m^3	
DE-BL-002B	Broken loop hot leg at DTT flange. Beam B through centerline of pipe 45° from vertical (CW looking toward RV).	0 to 1.0 Mg/m^3	10 Hz	--	--	Not available.	
DE-BL-002C	Broken loop hot leg at DTT flange. Beam C is 22° 7 min from Beam B (CW looking toward RV).	0 to 1.0 Mg/m^3	10 Hz	--	--	Not available.	Not installed.
Intact Loop							
DE-PC-001A	Intact loop cold leg at DTT flange. Beam A is 14° 21 min from Beam B (CW looking away from RV).	0 to 1.0 Mg/m^3	10 Hz	--	--	Not available.	
DE-PC-001B	Intact loop cold leg at DTT flange. Beam B through centerline of pipe 45° from vertical (CCW looking away from RV).	0 to 1.0 Mg/m^3	10 Hz	--	--	0.072 Mg/m^3	

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation Reading	After Experiment Initiation Uncertainty (±)	Comments
CHORDAL DENSITY (continued)							
Intact Loop (continued)							
DE-PC-001C	Intact loop cold leg at DTT flange. Beam C is 22° 7 min from Beam B (CCW looking away from RV).	0 to 1.0 Mg/m^3	10 Hz	--	--	Not available.	
DE-PC-002A	Intact loop hot leg at DTT flange. Beam A is 14° 21 min from Beam B (CW looking away from RV).	0 to 1.0 Mg/m^3	10 Hz	--	--	Not available.	
DE-PC-002B	Intact loop hot leg at DTT flange. Beam B through centerline of pipe 45° from vertical (CCW looking away from RV).	0 to 1.0 Mg/m^3	10 Hz	--	--	Not available.	
DE-PC-002C	Intact loop hot leg at DTT flange. Beam C is 22° 7 min from Beam B (CCW looking away from RV).	0 to 1.0 Mg/m^3	10 Hz	--	--	Not available.	
DE-PC-003A	Intact loop below steam generator (SG) at DTT flange. Beam C is 14° 21 min from Beam B (CCW looking away from RV).	0 to 1.0 Mg/m^3	1 Hz	--	--	Not available.	
DE-PC-003B	Intact loop below SG at DTT flange. Beam B through centerline of pipe 45° from vertical (CW looking away from RV).	0 to 1.0 Mg/m^3	1 Hz	--	--	Not available.	

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation: Reading	After Experiment Initiation: Uncertainty (±)	Comments
CHORDAL DENSITY (continued)							
Intact Loop (continued)							
DE-PC-003C	Intact loop below SG at DTT flange. Beam C is 22° 7 min from Beam B (CW looking away from RV).	0 to 1.0 Mg/m^3	1 Hz	--	--	Not available.	
FUEL ASSEMBLY DISPLACEMENT							
Assembly 5							
DIE-5UP-001	At top center of Fuel Assembly 5.	±12.7 mm	100 Hz	0.3 mm	0 mm 6.35 mm 12.7 mm	0.3 mm[c] 0.33 mm 0.39 mm	
DIE-5UP-002	At top center of Fuel Assembly 5.	±12.7 mm	100 Hz	0.3 mm	0 mm 6.35 mm 12.7 mm	0.3 mm 0.33 mm 0.39 mm	
FLUID VELOCITY							
Intact Loop							
FE-PC-002A	Hot leg DTT flange at bottom of pipe.	0.6 to 15.0 m/s	1 Hz	0.18 m/s	1 m/s 8 m/s 15 m/s	0.16 m/s[d] 0.48 m/s 0.86 m/s	Not installed.
FE-PC-002B	Hot leg DTT flange at middle of pipe.	0.6 to 15.0 m/s	1 Hz	0.16 m/s	1 m/s 8 m/s 15 m/s	0.16 m/s 0.48 m/s 0.86 m/s	Not installed.
FE-PC-002C	Hot leg DTT flange at top of pipe.	0.6 to 15.0 m/s	1 Hz	0.20 m/s	1 m/s 8 m/s 15 m/s	0.16 m/s 0.48 m/s 0.86 m/s	Not installed.
Reactor Vessel							
FE-5UP-001	Above upper end box of Fuel Assembly 5.	0.5 to 10.0 m/s	1 Hz	0.23 m/s	1 m/s 5 m/s 10 m/s	0.06 m/s 0.28 m/s 0.56 m/s	Qualified to 200 s.

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation Reading	After Experiment Initiation Uncertainty (±)	Comments
FLOW RATE							
Blowdown Suppression Tank Spray System							
FE-P138-138	Blowdown suppression tank (BST) spray flow rate in the 3.79-L/s header.	0 to 6.3 L/s	1 Hz	0.07 L/s	0 L/s 4 L/s 6 L/s	0.06 L/s 0.23 L/s 0.35 L/s	
FE-P138-139	BST spray flow rate from pump discharge.	0 to 25.2 L/s	1 Hz	0.26 L/s	0 L/s 12 L/s 25 L/s	0.25 L/s 0.72 L/s 1.43 L/s	
FE-P138-140	BST spray flow rate in 13.9-L/s header.	0 to 18.9 L/s	1 Hz	0.26 L/s	0 L/s 10 L/s 18.9 L/s	0.19 L/s 0.60 L/s 1.08 L/s	
FE-P138-153	BST spray flow rate in the spray pump recirculation line.	0 to 9.5 L/s	1 Hz	0.10 L/s	0 L/s 5 L/s 9.5 L/s	0.10 L/s 0.30 L/s 0.54 L/s	
Intact Loop							
FT-P004-012	Inlet to air-cooled condenser inlet header.	0 to 40 kg/s	1 Hz	0.8 kg/s	--	0.8 kg/s	Qualified, magnitude uncertain after scram.
FT-P004-072A	Main feedwater pump discharge flow.	0 to 25 kPa	10 Hz	0.17 kPa	--	0.17 kPa	Qualified.
FT-P004-72-2	Flow out of main feedwater pump.	0 to 40 kg/s	1 Hz	0.8 kg/s	--	0.8 kg/s	
Emergency Core Cooling System							
FT-P120-36-1	Accumulator A in 6-in. line downstream of orifice.	0 to 126.2 L/s	1 Hz	3.5 L/s	--	3.5 L/s	
FT-P120-36-5	Accumulator A in 6-in. line downstream of orifice.	0 to 37.9 L/s	1 Hz	3.5 L/s	--	3.5 L/s	
FT-P120-085	Low-pressure injection system (LPIS) Pump A in 4-in. line between heat exchanger and orifice.	0 to 25.2 L/s	1 Hz	--	--	2.5 L/s	

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation Reading	After Experiment Initiation Uncertainty (±)	Comments
FLOW RATE (continued)							
Emergency Core Cooling System (continued)							
FT-P128-085	Charging pump AC-[illegible]-48 discharge.	0 to 1.89 L/s	1 Hz	0.02 L/s	--	0.02 L/s	Qualified.
FT-P128-104	High-pressure injection system (HPIS) Pump A discharge.	0 to 1.89 L/s	1 Hz	0.02 L/s	--	0.02 L/s	
Intact Loop							
FT-P139-27-1	Intact loop hot leg venturi flowmeter (right side facing SG).	0 to 630.0 kg/s	1 Hz	17 kg/s	--	17 kg/s	Qualified to 200 s.
FT-P139-27-2	Intact loop hot leg venturi flowmeter (bottom of pipe).	0 to 630.0 kg/s	1 Hz	17 kg/s	--	17 kg/s	Qualified to 200 s.
FT-P139-27-3	Intact loop hot leg venturi flowmeter (left side facing SG).	0 to 630.0 kg/s	1 Hz	17 kg/s	--	17 kg/s	Qualified.
Primary Component Cooling System							
FT-P141-022	Primary component cooling system.	0 to 22 L/s	10 Hz	0.11 L/s	--	0.11 L/s	
LIQUID LEVEL							
Emergency Core Cooling System System							
LIT-P120-044	Accumulator A.	0 to 3.0 m	1 Hz	0.02 m	--	0.02 m	
Secondary Coolant System							
LT-P004-008A	SG feedwater level (narrow range).	-1.1 to 1.5 m	1 Hz	--	--	0.03 m	Qualified, not density compensated.

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation: Reading	After Experiment Initiation: Uncertainty (±)	Comments
LIQUID LEVEL (continued)							
Secondary Coolant System (continued)							
LT-P004-008B	SG feedwater level (wide range).	-3.6 to 1.4 m[e]	1 Hz	0.05 m	--	0.05 m	Qualitied, data not density compensated.
Intact Loop							
LT-P004-042	Condensate receiver level, 183 m south of condensate receiver centerline.	0 to 1.2 m	1 Hz	0.02 m	--	0.02 m	Qualified to 200 s.
Blowdown Suppression Tank							
LT-P138-033	BST level on north end of tank.	0 to 3.4 m	1 Hz	0.03 m	--	0.03 m	
LT-P138-058	BST level on south end of tank.	0 to 3.4 m	1 Hz	0.03 m	--	0.03 m	
Intact Loop							
LT-P139-006	Pressurizer level on southeast side.	0 to 1.9 m	1 Hz	0.04 m	--	0.04 m	Qualified to 200 s.
LT-P139-007	Pressurizer level on southwest side.	0 to 1.9 m	1 Hz	0.04 m	--	0.04 m	Qualified for relative changes only.
LT-P139-008	Pressurizer level on north side.	0 to 1.9 m	1 Hz	0.04 m	--	0.04 m	
MOMENTUM FLUX							
Intact Loop							
ME-PC-002A	Hot leg DTT flange at bottom of pipe.	1.0 to 21.0 $Mg/m \cdot s^2$	1 Hz	0.20 $Mg/m \cdot s^2$	1.0 $Mg/m \cdot s^2$ 11.0 $Mg/m \cdot s^2$ 21.0 $Mg/m \cdot s^2$	0.20 $Mg/m \cdot s^2$ 0.27 $Mg/m \cdot s^2$ 0.38 $Mg/m \cdot s^2$	Not installed.
ME-PC-002B	Hot leg DTT flange at middle of pipe.	1.0 to 21.0 $Mg/m \cdot s^2$	1 Hz	0.20 $Mg/m \cdot s^2$	1.0 $Mg/m \cdot s^2$ 11.0 $Mg/m \cdot s^2$ 21.0 $Mg/m \cdot s^2$	0.20 $Mg/m \cdot s^2$ 0.27 $Mg/m \cdot s^2$ 0.38 $Mg/m \cdot s^2$	Not installed.

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation: Reading	After Experiment Initiation: Uncertainty (±)	Comments
MOMENTUM FLUX (continued)							
Intact Loop (continued)							
ME-PC-002C	Hot leg DTT flange at top of pipe.	1.0 to 21.0 $Mg/m \cdot s^2$	1 Hz	0.20 $Mg/m \cdot s^2$	1.0 $Mg/m \cdot s^2$ 11.0 $Mg/m \cdot s^2$ 21.0 $Mg/m \cdot s^2$	0.20 $Mg/m \cdot s^2$ 0.27 $Mg/m \cdot s^2$ 0.[illegible]3 $Mg/m \cdot s^2$	Not installed.
Reactor Vessel							
ME-1ST-001	Downcomer Stalk 1, 1.16 m above RV bottom.	0.3 to 5.2 $Mg/m \cdot s^2$	1 Hz	0.78 $Mg/m \cdot s^2$	--	0.78 $Mg/m \cdot s^2$	
ME-2ST-001	Downcomer Stalk 2, 1.16 m above RV bottom.	0.3 to 5.2 $Mg/m \cdot s^2$	1 Hz	0.78 $Mg/m \cdot s^2$	--	0.78 $Mg/m \cdot s^2$	
ME-1UP-001	Fuel Assembly 1 above upper end box.	0.3 to 5.2 $Mg/m \cdot s^2$	1 Hz	0.78 $Mg/m \cdot s^2$	--	0.78 $Mg/m \cdot s^2$	
ME-3UP-001	Fuel Assembly 3 above upper end box.	0.3 to 5.2 $Mg/m \cdot s^2$	1 Hz	0.78 $Mg/m \cdot s^2$	--	0.78 $Mg/m \cdot s^2$	
ME-5UP-001	Fuel Assembly 5 above upper end box.	0.3 to 5.2 $Mg/m \cdot s^2$	1 Hz	0.78 $Mg/m \cdot s^2$	--	0.78 $Mg/m \cdot s^2$	
NEUTRON DETECTION							
Reactor Vessel							
NE-2H8-26	Neutron detector in Fuel Assembly 2.	0 to 52.5 kW/m (local)	1 Hz	2.03 kW/m	--	2.03 kW/m[f]	Qualified through reactor scram, relative changes only.
NE-4H8-26	Neutron detector in Fuel Assembly 4.	0 to 52.5 kW/m (local)	1 Hz	2.03 kW/m	--	2.03 kW/m	Qualified through reactor scram, relative changes only.
NE-5D8-26	Neutron detector in Fuel Assembly 5.	0 to 52.5 kW/m (local)	1 Hz	2.03 kW/m	--	2.03 kW/m	Qualified through reactor scram, relative changes only.

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation Reading	After Experiment Initiation Uncertainty (±)	Comments
NEUTRON DETECTION (continued)							
Reactor Vessel (continued)							
NE-6H8-26	Neutron detector in Fuel Assembly 6.	0 to 52.5 kW/m (local)	1 Hz	2.03 kW/m	--	2.03 kW/m	Qualified through reactor scram, relative changes only.
ELECTRICAL FREQUENCY							
Intact Loop							
PCP-1-F	Intact loop Pump 1.	0 to 75 Hz	10 Hz	0.75 Hz	--	0.75 Hz[g]	
PCP-2-F	Intact loop Pump 2.	0 to 75 Hz	10 Hz	0.75 Hz	--	0.75 Hz	
ELECTRICAL POWER							
Intact Loop							
PCP-1-P	Intact loop Pump 1.	0 to 1 MW	10 Hz	0.05 MW	--	0.05 MW	
PCP-2-P	Intact loop Pump 2.	0 to 1 MW	10 Hz	0.05 MW	--	0.05 MW	
DIFFERENTIAL PRESSURE							
Broken Loop							
PdE-BL-002	Broken loop cold leg across small break orifice.	±17.5 MPa (differential)	1 Hz	0.025 MPa	0 MPa 5 MPa 10 MPa 15 MPa	0.025 MPa 0.026 MPa 0.028 MPa 0.032 MPa	
PdE-BL-003	Broken loop cold leg across 5- to 8-inch expansion.	±3.5 MPa (differential)	1 Hz	0.009 MPa	0 MPa 2 MPa 3.5 MPa	0.009 MPa 0.010 MPa 0.010 MPa	
PdE-BL-009	Broken loop from end to middle of 5-inch pipe.	±700 kPa (differential)	1 Hz	1.7 kPa	0 kPa 350 kPa 700 kPa	1.7 kPa 1.7 kPa 1.9 kPa	

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation: Reading	After Experiment Initiation: Uncertainty (±)	Comments
DIFFERENTIAL PRESSURE (continued)							
Broken Loop (continued)							
PdE-BL-010	Broken loop from middle to end of 5-inch pipe.	±700 kPa (differential)	1 Hz	--	0 kPa 350 kPa 700 kPa	1.7 kPa 1.7 kPa 1.9 kPa	
PdE-BL-013	SG simulator, inlet to top.	±40 kPa	1 Hz	0.28 kPa	0 kPa 20 kPa 40 kPa	0.28 kPa 0.285 kPa 0.291 kPa	
PdE-BL-014	SG simulator, outlet to top.	±40 kPa	1 Hz	0.291 kPa	0 kPa 20 kPa 40 kPa	0.28 kPa 0.285 kPa 0.291 kPa	Not installed.
Intact Loop							
PdE-PC-001	Intact loop cold leg across primary coolant pumps (PCPs).	±700 kPa (differential)	1 Hz	1.8 kPa	0 kPa 350 kPa 700 kPa	1.7 kPa 1.7 kPa 1.9 kPa	Qualified to 200 s.
PdE-PC-002	Intact loop across SG.	±350 kPa (differential)	1 Hz	0.94 kPa	0 kPa 150 kPa 300 kPa	0.89 kPa 0.90 kPa 0.98 kPa	Qualified to 200 s.
PdE-PC-003	Intact loop hot leg piping, RV to SG inlet.	±100 kPa (differential)	1 Hz	0.50 kPa	0 kPa 50 kPa 100 kPa	0.49 kPa 0.50 kPa 0.52 kPa	Failed.
PdE-PC-004	Intact loop hot leg piping, surge line junction to SG inlet.	±100 kPa (differential)	1 Hz	0.50 kPa	0 kPa 50 kPa 100 kPa	0.49 kPa 0.50 kPa 0.52 kPa	
PdE-PC-005	Intact loop cold leg PCPs to RV nozzle.	±100 kPa (differential)	1 Hz	0.50 kPa	0 kPa 50 kPa 100 kPa	0.49 kPa 0.50 kPa 0.52 kPa	Qualified to 200 s.
PdE-PC-006	Intact loop RV outlet to inlet.	±100 kPa (differential)	1 Hz	0.51 kPa	0 kPa 50 kPa 100 kPa	0.49 kPa 0.50 kPa 0.52 kPa	
PdE-PC-008	Intact loop across pressurizer surge line.	±10.34 kPa (differential)	1 Hz	0.025 kPa	0 kPa 5 kPa 10 kPa	0.025 kPa 0.026 kPa 0.028 kPa	Qualified to 200 s.

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation: Reading	After Experiment Initiation: Uncertainty (±)	Comments
DIFFERENTIAL PRESSURE (continued)							
Intact Loop (continued)							
PdE-PC-009	Intact loop across Pump 1.	±700 kPa (differential)	1 Hz	1.8 kPa	0 kPa 350 kPa 700 kPa	1.7 kPa 1.7 kPa 1.9 kPa	
PdE-PC-010	Intact loop across Pump 2.	±700 kPa (differential)	1 Hz	1.8 kPa	0 kPa 350 kPa 700 kPa	1.7 kPa 1.7 kPa 1.9 kPa	
PdE-PC-011	Pitot tube at top of emergency core coolant (ECC) Rake 1 (facing RV).	±40 kPa (differential)	1 Hz	0.29 kPa	0 kPa 20 kPa 40 kPa	0.28 kPa 0.285 kPa 0.291 kPa	
PdE-PC-012	Pitot tube next to top of ECC Rake 1 (facing RV).	±40 kPa (differential)	1 Hz	0.29 kPa	0 kPa 20 kPa 40 kPa	0.28 kPa 0.285 kPa 0.291 kPa	
PdE-PC-015	Pitot tube at top of ECC Rake 1 (facing pump).	±40 kPa (differential)	1 Hz	0.29 kPa	0 kPa 20 kPa 40 kPa	0.28 kPa 0.285 kPa 0.291 kPa	
PdE-PC-016	Pitot tube next to top of ECC Rake 1 (facing pump).	±40 kPa (differential)	1 Hz	0.29 kPa	0 kPa 20 kPa 40 kPa	0.28 kPa 0.285 kPa 0.291 kPa	
PdE-PC-017	Pitot tube next to bottom of ECC Rake 1 (facing pump).	±40 kPa (differential)	1 Hz	0.29 kPa	0 kPa 20 kPa 40 kPa	0.28 kPa 0.285 kPa 0.291 kPa	
PdE-PC-17B	Pitot tube next to bottom of ECC Rake 1 (facing pump).	±5 kPa (differential)	1 Hz	0.037 kPa	--	0.037 kPa	
PdE-PC-018	Pitot tube at bottom of ECC Rake 1 (facing pump).	±40 kPa (differential)	1 Hz	--	0 kPa 20 kPa 40 kPa	0.28 kPa 0.285 kPa 0.291 kPa	Not installed.

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation: Reading	After Experiment Initiation: Uncertainty (±)	Comments
DIFFERENTIAL PRESSURE (continued)							
Intact Loop (continued)							
PdE-PC-18B	Pitot tube at bottom of ECC Rake 1 (facing pump).	±5 kPa (differential)	1 Hz	0.037 kPa	--	0.037 kPa	
PdE-PC-019	Pitot tube at top of ECC Rake 2 (facing RV).	±40 kPa (differential)	1 Hz	0.29 kPa	0 kPa 20 kPa 40 kPa	0.28 kPa 0.285 kPa 0.291 kPa	
PdE-PC-020	Pitot tube next to top of ECC Rake 2 (facing RV).	±40 kPa (differential)	1 Hz	0.29 kPa	0 kPa 20 kPa 40 kPa	0.28 kPa 0.285 kPa 0.291 kPa	
PdE-PC-023	Pitot tube at top of ECC Rake 2 (facing pump).	±40 kPa (differential)	1 Hz	0.284 kPa	0 kPa 20 kPa 40 kPa	0.28 kPa 0.285 kPa 0.291 kPa	
PdE-PC-024	Pitot tube next to top of ECC Rake 2 (facing pump).	±40 kPa (differential)	1 Hz	0.286 kPa	0 kPa 20 kPa 40 kPa	0.28 kPa 0.285 kPa 0.291 kPa	
PdE-PC-025	Pitot tube next to bottom of ECC Rake 2 (facing pump).	±40 kPa (differential)	1 Hz	0.287 kPa	0 kPa 20 kPa 40 kPa	0.28 kPa 0.285 kPa 0.291 kPa	
PdE-PC-25B	Pitot tube next to bottom of ECC Rake 2 (facing pump).	±5 kPa (differential)	1 Hz	0.037 kPa	--	0.037 kPa	
PdE-PC-026	Pitot tube at bottom of ECC Rake 2 (facing pump).	±40 kPa (differential)	1 Hz	--	0 kPa 20 kPa 40 kPa	0.28 kPa 0.285 kPa 0.291 kPa	
PdE-PC-26B	Pitot tube at bottom of ECC Rake 2 (facing pump).	±5 kPa (differential)	1 Hz	0.037 kPa	--	0.037 kPa	

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation: Reading	After Experiment Initiation: Uncertainty (±)	Comments
DIFFERENTIAL PRESSURE (continued)							
Intact Loop (continued)							
PdE-PC-027	SG outlet to pump suction (lowest point).	±40 kPa	1 Hz	0.29 kPa	0 kPa 20 kPa 40 kPa	0.28 kPa 0.285 kPa 0.291 kPa	
PdE-PC-028	Pump suction (lowest point) to Pump 2 inlet.	±40 kPa	1 Hz	0.284 kPa	0 kPa 20 kPa 40 kPa	0.28 kPa 0.285 kPa 0.291 kPa	
PdE-PC-029	Pitot tube next to bottom of ECC Rake 1 (facing RV).	±40 kPa (differential)	1 Hz	0.29 kPa	0 kPa 20 kF 40 kPa	0.28 kPa 0.285 kPa 0.291 kPa	
PdE-PC-030	Pitot tube at bottom of ECC Rake 1 (facing RV).	±40 kPa (differential)	1 Hz	0.29 kPa	0 kPa 20 kPa 40 kPa	0.28 kPa 0.285 kPa 0.291 kPa	
PdE-PC-031	Pitot tube next to bottom of ECC Rake 2 (facing RV).	±40 kPa (differential)	1 Hz	0.29 kPa	0 kPa 20 kPa 40 kPa	0.28 kPa 0.285 kPa 0.291 kPa	
PdE-PC-032	Pitot tube at bottom of ECC Rake 2 (facing RV).	±40 kPa (differential)	1 Hz	0.29 kPa	0 kPa 20 kPa 40 kPa	0.28 kPa 0.285 kPa 0.291 kPa	
Reactor Vessel							
PdE-RV-002	Fuel Assembly 1 from lower end box to upper end box.	±175 kPa (differential)	1 Hz	1.3 kPa	0 kPa 100 kPa 175 kPa	1.3 kPa 1.3 kPa 1.4 kPa	
PdE-RV-003	Intact loop cold leg inlet to bottom of downcomer.	±100 kPa (differential)	1 Hz	0.50 kPa	0 kPa 50 kPa 100 kPa	0.49 kPa 0.50 kPa 0.52 kPa	
PdE-RV-004	Fuel Assembly 1 lower end box to the RV outlet nozzle in the intact loop hot leg.	±175 MPa (differential)	1 Hz	--	0 kPa 100 kPa 175 kPa	1.3 kPa 1.3 kPa 1.4 kPa	

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation Reading	After Experiment Initiation Uncertainty (±)	Comments
DIFFERENTIAL PRESSURE (continued)							
Reactor Vessel (continued)							
PdE-RV-005	Top of RV to intact loop hot leg.	±40 kPa (differential)	1 Hz	0.29 kPa	0 kPa 20 kPa 40 kPa	0.28 kPa 0.285 kPa 0.291 kPa	
Blowdown Suppression Tank							
PdE-SV-001	BST.	0 to 1.27 m	1 Hz	--	0 m 0.7 m 1.4 m	0.005 m 0.006 m 0.008 m	
PdE-SV-009	BST across the vacuum breaker line.	±70 kPa (differential)	10 Hz	0.55 kPa	0 kPa 30 kPa 70 kPa	0.55 kPa 0.56 kPa 0.56 kPa	
Reactor Vessel							
PdE-2ST-001	Bottom of Downcomer Stalk 2 to Fuel Assembly 3 upper end box.	±70 kPa (differential)	1 Hz	--	0 kPa 30 kPa 70 kPa	0.55 kPa 0.56 kPa 0.56 kPa	
PdE-2ST-003	Top of Downcomer Stalk 2 to Fuel Assembly 3 upper plenum.	±175 kPa (differential)	2.3 Hz	--	0 kPa 100 kPa 175 kPa	1.3 kPa 1.3 kPa 1.4 kPa	
PdE-2ST-004	Bottom of Downcomer Stalk 2 to Fuel Assembly 3 lower end box.	±70 kPa (differential)	1 Hz	--	0 kPa 30 kPa 70 kPa	0.55 kPa 0.56 kPa 0.56 kPa	
Intact Loop							
PdT-P139-27-1	Intact loop venturi, Channel A.	0 to 200 kPa (differential)	1 Hz	2 kPa	--	2 kPa	Qualified to 200 s.
PdT-P139-27-2	Intact loop venturi, Channel B.	0 to 200 kPa (differential)	1 Hz	2 kPa	--	2 kPa	
PdT-P139-27-3	Intact loop venturi, Channel C.	0 to 200 kPa (differential)	1 Hz	2 kPa	--	2 kPa	

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation Reading	After Experiment Initiation Uncertainty (±)	Comments
DIFFERENTIAL PRESSURE (continued)							
Intact Loop (continued)							
PdT-P139-030	Across RV just beyond intact loop inlet and and outlet nozzles.	0 to 300 kPa (differential)	1 Hz	3 kPa	--	3 kPa	Qualified to 200 s.
PRESSURE[h]							
Broken Loop							
PE-BL-001	Broken loop cold leg at DTT flange.	0.1 to 20.8 MPa[h]	1 Hz	0.251 MPa	0 MPa 10 MPa 20 MPa	0.199 MPa 0.223 MPa 0.282 MPa	Qualified to 200 s.
PE-BL-002	Broken loop hot leg at DTT flange.	0.1 to 20.8 MPa	1 Hz	0.2[illegible]7 MPa	0 MPa 10 MPa 20 MPa	0.199 MPa 0.223 MPa 0.282 MPa	Failed.
PE-BL-003	Broken loop hot leg downstream of pump simulator.	0.1 to 20.8 MPa	1 Hz	0.25[illegible] MPa	0 MPa 10 MPa 20 MPa	0.199 MPa 0.223 MPa 0.282 MPa	
PE-BL-004	Broken loop cold leg at inlet of spool piece.	0.1 to 20.8 MPa	1 Hz	--	0 MPa 10 MPa 20 MPa	0.199 MPa 0.223 MPa 0.282 MPa	
PE-BL-006	Broken loop hot leg at outlet of SG simulator.	0.1 to 20.8 MPa	1 Hz	--	0 MPa 10 MPa 20 MPa	0.199 MPa 0.223 MPa 0.282 MPa	
PE-BL-008	Broken loop cold leg in 8-in. pipe downstream of break.	0.1 to 20.8 MPa	1 Hz	0.251 MPa	0 MPa 10 MPa 20 MPa	0.199 MPa 0.223 MPa 0.282 MPa	
Intact Loop							
PE-PC-001	Intact loop cold leg at DTT flange.	0.1 to 20.8 MPa	1 Hz	0.251 MPa	0 MPa 10 MPa 20 MPa	0.199 MPa 0.223 MPa 0.282 MPa	Qualified to 200 s.
PE-PC-002	Intact loop hot leg at DTT flange.	0.1 to 20.8 MPa	1 Hz	0.282 MPa	0 MPa [illegible]0 MPa [illegible] MPa	0.199 MPa 0.223 MPa 0.282 MPa	Not installed.

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation Reading	After Experiment Initiation Uncertainty (±)	Comments
PRESSURE (continued)							
Intact Loop (continued)							
PE-PC-004	Intact loop pressurizer vapor space.	0.1 to 20.8 MPa	1 Hz	0.251 MPa	0.1 MPa 10 MPa 20 MPa	0.199 MPa 0.223 MPa 0.282 MPa	Qualified.
PE-PC-005	Intact loop reference pressure between SG outlet and pump inlet.	0.1 to 17.0 MPa	1 Hz	0.028 MPa	--	0.028 MPa	Qualified to 200 s.
PE-PC-006	Intact loop reference pressure between SG outlet and pump inlet.	0.1 to 17.0 MPa	1 Hz	0.028 MPa	--	0.028 MPa	Qualified.
PE-SGS-001	SG dome pressure.	0.1 to 7.0 MPa	1 Hz	0.012 MPa	--	0.012 MPa	Qualified.
Blowdown Suppression System							
PE-SV-003	BST across from Downcomer 1 (south end), 157.5° from top vertical (CW looking north).	0.1 to 0.7 MPa	1 Hz	0.008 MPa	--	0.008 MPa	
PE-SV-014	BST header above Downcomer 4, 327° from top vertical (CW looking north).	0.1 to 0.7 MPa	1 Hz	0.008 MPa	--	0.008 MPa	
PE-SV-015	BST across from Downcomer 4, 230° from top vertical (CW looking north).	0.1 to 0.7 MPa	1 Hz	0.008 MPa	--	0.008 MPa	
PE-SV-016	BST across from Downcomer 1, 230° from top vertical (CW looking north).	0.1 to 0.7 MPa	1 Hz	0.008 MPa	--	0.008 MPa	
PE-SV-017	BST, 1.38 m north of Downcomer 3 centerline, 0° from top vertical (CW looking north).	0.1 to 0.7 MPa	1 Hz	0.008 MPa	--	0.008 MPa	

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation Reading	After Experiment Initiation Uncertainty (±)	Comments
PRESSURE (continued)							
Blowdown Suppression System (continued)							
PE-SV-018	BST header above Downcomer 1.	0.1 to 0.7 MPa	1 Hz	0.008 MPa	--	0.008 MPa	
PE-SV-043	BST tank bottom under Downcomer 2.	0.1 to 0.7 MPa	1 Hz	0.008 MPa	--	0.008 MPa	
PE-SV-044	BST bottom under Downcomer 3.	0.1 to 0.7 MPa	1 Hz	0.008 MPa	--	0.008 MPa	
PE-SV-055	BST top, 0.15 m north of Downcomer 4 centerline.	0.1 to 0.7 MPa	1 Hz	0.008 MPa	--	0.008 MPa	
PE-SV-060	BST top above Downcomer 1.	0.1 to 0.7 MPa	1 Hz	0.008 MPa	--	0.008 MPa	
Reactor Vessel							
PE-1ST-001A	Downcomer Stalk 1, 0.62 m above RV bottom, wide range (0 to 20.8 MPa).	0.1 to 20.8 MPa	1 Hz	0.200 MPa	0.1 MPa 10.0 MPa 20.5 MPa	0.199 MPa 0.199 MPa 0.200 MPa	Qualified to 200 s.
PE-1ST-003A	Downcomer Stalk 1, 5.32 m above RV bottom, wide range (0 to 20.8 MPa).	0.1 to 20.8 MPa	1 Hz	0.25 MPa	0.1 MPa 10 MPa 20 MPa	0.2 MPa 0.22 MPa 0.28 MPa	Qualified to 200 s.
PE-1UP-001A	Above Fuel Assembly 1 upper end box, high range.	0.1 to 20.8 MPa	1 Hz	0.25 MPa	0.1 MPa 10 MPa 20 MPa	0.2 MPa 0.22 MPa 0.28 MPa	Qualified.
PE-1UP-001A1	Above Fuel Assembly 1 upper end box, high range.	0.1 to 20.8 MPa	1 Hz	0.25 MPa	0.1 MPa 10 MPa 20 MPa	0.2 MPa 0.22 MPa 0.28 MPa	Qualified.
PE-2ST-001A	Downcomer Stalk 2, 0.62 m above RV bottom, wide range (0 to 20.8 MPa).	0.1 to 20.8 MPa	1 Hz	0.25 MPa	0.1 MPa 10 MPa 20 MPa	0.2 MPa 0.22 MPa 0.28 MPa	Qualified to 200 s.

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation: Reading	After Experiment Initiation: Uncertainty (±)	Comments
PRESSURE (continued)							
Secondary Coolant System							
PT-P004-010A	In 10-in. line from SG.	0.1 to 8.4 MPa	1 Hz	0.110 MPa	--	0.110 MPa	Qualified to 200 s.
PT-P004-022	Condensate receiver pressure.	0 to 2.8 MPa	1 Hz	--	--	0.075 MPa	
PT-P004-034	Downstream of main feedwater pump.	0 to 10.3 MPa	10 Hz	0.07 MPa	--	0.07 MPa	
PT-P004-085	Upstream of inlet to air-cooled condenser header.	0 to 2.8 MPa	1 Hz	0.075 MPa	--	0.075 MPa	Qualified to 200 s.
Emergency Core Cooling System							
PT-P120-029	Accumulator B, 0.69 m above water outlet.	0.1 to 7.0 MPa	1 Hz	0.055 MPa	--	0.055 MPa	
PT-P120-043	Accumulator A, 0.69 m above water outlet.	0.1 to 7.0 MPa	1 Hz	0.055 MPa	--	0.055 MPa	
PT-P120-061	ECC injection.	0.1 to 20.8 MPa	1 Hz	0.158 MPa	--	0.158 MPa	
PT-P120-074	LPIS Pump B discharge.	0.1 to 7.0 MPa	1 Hz	0.055 MPa	--	0.055 MPa	
PT-P120-083	LPIS Pump A discharge.	0.1 to 7.0 MPa	1 Hz	0.04 MPa	--	0.04 MPa	
Broken Loop							
PT-P138-023	Blowdown header.	0.1 to 1.4 MPa	10 Hz	--	--	0.007 MPa	
PT-P138-111	Broken loop cold leg QOBV inlet between isolation valve and QOBV.	0.1 to 13.9 MPa	100 Hz	--	--	0.20 MPa	
PT-P138-112	Broken loop hot leg QOBV inlet between isolation valve and QOBV.	0.1 to 13.9 MPa	100 Hz	--	--	0.20 MPa	

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation: Reading	After Experiment Initiation: Uncertainty (±)	Comments
PRESSURE (continued)							
Intact Loop							
PT-P139-002	Intact loop hot leg at venturi on bottom.	0.1 to 20.8 MPa	1 Hz	0.25 MPa	--	0.25 MPa	Qualified to 200 s.
PT-P139-003	Intact loop hot leg at venturi on left side when looking toward SG.	0.1 to 20.8 MPa	1 Hz	0.25 MPa	--	0.25 MPa	Qualified to 200 s.
PT-P139-004	Intact loop hot leg at venturi on right side when looking toward SG.	0.1 to 20.8 MPa	1 Hz	0.25 MPa	--	0.25 MPa	Qualified to 200 s.
PT-P139-005	1.88 m above pressurizer bottom (vapor space).	10.3 to 17.2 MPa	1 Hz	0.12 MPa	--	0.12 MPa	Qualified to 200 s.
PUMP SPEED							
Intact Loop							
RPE-PC-001	Intact loop Pump 1.	0 to 10 000 rpm	1 Hz	10.26 rpm	1000 rpm 2000 rpm 3000 rpm 4000 rpm	7.65 rpm 8.825 rpm 10.10 rpm 11.66 rpm	
RPE-PC-002	Intact loop Pump 2.	0 to 10 000 rpm	1 Hz	10.27 rpm	1000 rpm 2000 rpm 3000 rpm 4000 rpm	7.65 rpm 8.825 rpm 10.10 rpm 11.66 rpm	
REACTIVITY							
Reactor Vessel							
RE-TRM-86-5	Transient reactivity meter in shield tank.	±0.145 Rho	10 Hz	0.01 Rho	--	0.01 Rho	
RE-TRM-86-6	Transient reactivity meter in shield tank.	±0.145 Rho	10 Hz	0.01 Rho	--	0.01 Rho	
RE-T-77-1A2	Power range, Channel A level.	0 to 100% power	1 Hz	3%	--	3%	

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation Reading	 Uncertainty (±)	Comments
REACTIVITY (continued)							
Reactor Vessel (continued)							
RE-T-77-2A2	Power range, Channel B level.	0 to 100% power	1 Hz	3%	--	3%	Qualified to 200 s.
RE-T-77-3A2	Power range, Channel C level.	0 to 100% power	1 Hz	3%	--	3%	
RE-T-87-4A2	Power range, Channel D level.	0 to 100% power	10 Hz	3%	--	3%	
TEMPERATURE							
Broken Loop							
TE-BL-001B	Broken loop cold leg at DTT rake center.	255.2 to 588.6 K	1 Hz	2.5 K	350 K 450 K 550 K 650 K	2.4 K 2.5 K 2.5 K 3.2 K	
TE-BL-002B	Broken loop hot leg at middle of DTT flange.	255.2 to 588.6 K	1 Hz	2.5 K	350 K 450 K 550 K 650 K	2.4 K 2.5 K 2.5 K 3.2 K	
Intact Loop							
TE-PC-002A	Intact loop hot leg DTT flange at bottom of pipe.	422 to 1533 K	1 Hz	--	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	Not installed.
TE-PC-002B	Intact loop hot leg DTT flange at middle of pipe.	422 to 1533 K	1 Hz	--	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	Not installed.
TE-PC-002C	Intact loop hot leg DTT flange at top of pipe.	422 to 1533 K	1 Hz	--	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	Not installed.
TE-PC-004	Bottom of ECC Rake 1 (between PdE-PC-014 and PdE-PC-018).	270 to 1530 K	1 Hz	3.1 K	350 K 450 K 550 K 650 K	2.8 K 2.9 K 3.0 K 3.6 K	Qualified.

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation: Reading	After Experiment Initiation: Uncertainty (±)	Comments
TEMPERATURE (continued)							
<u>Intact Loop (continued)</u>							
TE-PC-005	Next to bottom of ECC Rake 1 (between PdE-PC-013 and PdE-PC-017).	270 to 1530 K	1 Hz	3.1 K	350 K 450 K 550 K 650 K	2.8 K 2.9 K 3.0 K 3.6 K	
TE-PC-006	Next to top of ECC Rake 1 (between PdE-PC-012 and PdE-PC-016).	270 to 1530 K	1 Hz	3.1 K	3[illegible] K 4[illegible] K 550 K 650 K	2.8 K 2.9 K 3.0 K 3.6 K	
TE-PC-007	Top of ECC Rake 1 (between PdE-PC-011 and PdE-PC-015).	270 to 1530 K	1 Hz	3.1 K	350 K 450 K 550 K 650 K	2.8 K 2.9 K 3.0 K 3.6 K	Qualified to 200 s.
TE-PC-008	Bottom of ECC Rake 2 (between PdE-PC-022 and PdE-PC-026).	270 to 1530 K	1 Hz	3.1 K	350 K 450 K 550 K 650 K	2.8 K 2.9 K 3.0 K 3.6 K	
TE-PC-009	Next to bottom of ECC Rake 2 (between PdE-PC-021 and PdE-PC-025).	270 to 1530 K	1 Hz	3.[illegible]	350 K 450 K 550 K 650 K	2.8 K 2.9 K 3.0 K 3.6 K	
TE-PC-010	Next to top of ECC Rake 2 (between PdE-PC-020 and PdE-PC-024).	270 to 1530 K	1 Hz	3.1 K	350 K 450 K 550 K 650 K	2.8 K 2[illegible] [illegible] 3.6 K	
TE-PC-011	Top of ECC Rake 2 (between PdE-PC-019 and PdE-PC-023).	270 to 1530 K	1 Hz	3.1 K	350 K 450 K 550 K 650 K	2.8 K 2.9 K 3.0 K 3.6 K	
<u>Emergency Core Cooling System</u>							
TE-P120-027	Accumulator B temperature.	255.2 to 366.3 K	1 Hz	0.7 K	--	0.7 K	
TE-P120-041	Accumulator A temperature.	255.2 to 366.3 K	1 Hz	0.7 K	--	0.7 K	

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation Reading	After Experiment Initiation Uncertainty (±)	Comments
TEMPERATURE (continued)							
Blowdown Suppression Tank Spray System							
TE-P138-137	Outlet of BST spray system heat exchanger.	250 to 420 K	1 Hz	0.7 K	--	0.7 K	
TE-P138-141	Temperature of spray in 3.79-L/s header.	255.2 to 420 K	1 Hz	1.3 K	--	1.3 K	
TE-P138-142	Temperature of spray pump discharge.	255.2 to 420 K	1 Hz	1.3 K	--	1.[illegible] K	Not installed.
TE-P138-143	Temperature of spray in 13.88-L/s header.	255.2 to 420 K	1 Hz	1.3 K	--	1.3 K	Not installed.
Broken Loop							
TE-P138-170	Hot leg warm-up line.	73 to 622 K	1 Hz	--	--	Not available.	
TE-P138-171	Cold leg warm-up line.	172 to 672 K	1 Hz	--	--	Not available.	Failed.
Intact Loop							
TE-P139-019	Pressurizer vapor space, 0.86 m above the heater rods.	588.6 to 644.1 K	1 Hz	0.5 K	--	0.5 K	Qualified.
TE-P139-020	Pressurizer liquid volume, 0.36 m above heater rods.	283 to 644.1 K	1 Hz	3.0 K	--	3.0 K	Qualified.
TE-P139-028-2	Intact loop cold leg.	530 to 620 K	1 Hz	0.6 K	--	0.6 K	Qualified to 200 s, process instrument, slow response time.
TE-P139-029	Intact loop cold leg.	280 to 620 K	1 Hz	2.1 K	--	2.1 K	Qualified, process instrument, slow response time.
TE-P139-32-1	Intact loop hot leg.	280 to 620 K	1 Hz	1.43 K	--	1.43 K	Qualified to 200 s, process instrument, slow response time.

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation		Comments
					Reading	Uncertainty (±)	
TEMPERATURE (continued)							
Primary Component Cooling System							
TE-P141-94	Downstream from primary component cooling system heat exchanger.	275 to 350 K	10 Hz	0.32 K	--	0.32 K	
TE-P141-95	Upstream from primary component cooling system heat exchanger.	275 to 350 K	10 Hz	0.32 K	--	0.32 K	
Intact Loop							
TE-SG-001	Intact loop cold leg SG outlet.	253.2 to 977.4 K	1 Hz	2.8 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.7 K 3.3 K	Qualified.
TE-SG-002	Intact loop hot leg SG inlet.	253.2 to 977.4 K	1 Hz	2.8 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.7 K 3.3 K	Qualified.
Secondary Coolant System							
TE-SG-003	SG secondary side.	253.2 to 588.6 K	1 Hz	2.5 K	350 K 450 K 550 K 650 K	2.4 K 2.5 K 2.5 K 3.2 K	Qualified.
Blowdown Suppression System							
TE-SV-001	BST, 0.3 m north of Downcomer 1, 0.53 m east of tank centerline, 2.72 m from tank bottom.	253.2 to 477.4 K	1 Hz	0.9 K	300 K 350 K 400 K	0.9 K 1.0 K 1.3 K	
TE-SV-002	BST, 0.3 m north of Downcomer 1, 0.53 m east of tank centerline, 2.36 m from tank bottom.	253.2 to 477.4 K	1 Hz	0.9 K	300 K 350 K 400 K	0.9 K 1.0 K 1.3 K	

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation: Reading	After Experiment Initiation: Uncertainty (±)	Comments
TEMPERATURE (continued)							
Blowdown Suppression System (continued)							
TE-SV-003	BST, 0.3 m north of Downcomer 1, 0.53 m east of tank centerline, 1.90 m from tank bottom.	253.2 to 477.4 K	1 Hz	0.9 K	300 K 350 K 400 K	0.9 K 1.0 K 1.3 K	
TE-SV-004	BST, 0.3 m north of Downcomer 1, 0.53 m east of tank centerline, 1.45 m from tank bottom.	253.2 to 477.4 K	1 Hz	0.9 K	300 K 350 K 400 K	0.9 K 1.0 K 1.3 K	
TE-SV-005	BST, 0.3 m north of Downcomer 1, 0.53 m east of tank centerline, 0.99 m from tank bottom.	253.2 to 477.4 K	1 Hz	--	300 K 350 K 400 K	0.9 K 1.0 K 1.3 K	
TE-SV-006	BST, 0.3 m north of Downcomer 1, 0.53 m east of tank centerline, 0.37 m from tank bottom.	253.2 to 477.4 K	1 Hz	0.9 K	300 K 350 K 400 K	0.9 K 1.0 K 1.3 K	
TE-SV-007	BST, 0.3 m north of Downcomer 3, 0.53 m east of tank centerline, 2.72 m from tank bottom.	253.2 to 477.4 K	1 Hz	0.9 K	300 K 350 K 400 K	0.9 K 1.0 K 1.3 K	
TE-SV-008	BST, 0.3 m north of Downcomer 3, 0.53 m east of tank centerline, 2.36 m from tank bottom.	253.2 to 477.4 K	1 Hz	0.9 K	300 K 350 K 400 K	0.9 K 1.0 K 1.3 K	

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation: Reading	After Experiment Initiation: Uncertainty (±)	Comments
TEMPERATURE (continued)							
Blowdown Suppression System (continued)							
TE-SV-009	BST, 0.3 m north of Downcomer 3, 0.53 m east of tank centerline, 1.90 m from tank bottom.	253.2 to 477.4 K	1 Hz	0.9 K	300 K 350 K 400 K	0.9 K 1.0 K 1.3 K	
TE-SV-010	BST, 0.3 m north of Downcomer 3, 0.53 m east of tank centerline, 1.45 m from tank bottom.	253.2 to 477.4 K	1 Hz	0.9 K	300 K 350 K 400 K	0.9 K 1.0 K 1.3 K	
TE-SV-011	BST, 0.3 m north of Downcomer 3, 0.53 m east of tank centerline, 0.99 m from tank bottom.	253.2 to 477.4 K	1 Hz	0.9 K	300 K 350 K 400 K	0.9 K 1.0 K 1.3 K	
TE-SV-012	BST, 0.3 m north of Downcomer 3, 0.53 m east of tank centerline, 0.37 m from tank bottom.	253.2 to 477.4 K	1 Hz	0.9 K	300 K 350 K 400 K	0.9 K 1.0 K 1.3 K	
Reactor Vessel							
TE-1A11-030	Fuel Assembly 1, Row A, Column 11, 0.762 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-1B10-037	Fuel Assembly 1, Row B, Column 10, 0.940 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-1B12-026	Fuel Assembly 1, Row B, Column 12, 0.660 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation Reading	After Experiment Initiation Uncertainty (±)	Comments
TEMPERATURE (continued)							
Reactor Vessel (continued)							
TE-1C11-021	Fuel Assembly 1, Row C, Column 11, 0.533 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K	2.8 K	
					600 K	3.2 K	
					800 K	4.7 K	
					1000 K	6.2 K	
TE-1C11-039	Fuel Assembly 1, Row C, Column 11, 0.991 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K	2.8 K	
					600 K	3.2 K	
					800 K	4.7 K	
					1000 K	6.2 K	
TE-1F7-015	Fuel Assembly 1, Row F, Column 7, 0.381 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K	2.8 K	
					600 K	3.2 K	
					800 K	4.7 K	
					1000 K	6.2 K	
TE-1F7-021	Fuel Assembly 1, Row F, Column 7, 0.533 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K	2.8 K	
					600 K	3.2 K	
					800 K	4.7 K	
					1000 K	6.2 K	
TE-1F7-026	Fuel Assembly 1, Row F, Column 7, 0.660 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K	2.8 K	
					600 K	3.2 K	
					800 K	4.7 K	
					1000 K	6.2 K	
TE-1F7-030	Fuel Assembly 1, Row F, Column 7, 0.762 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K	2.8 K	
					600 K	3.2 K	
					800 K	4.7 K	
					1000 K	6.2 K	
TE-1LP-001	Fuel Assembly 1 lower end box.	311 to 977.4 K	1 Hz	2.7 K	350 K	2.5 K	Qualified to 200 s.
					450 K	2.6 K	
					550 K	2.6 K	
					650 K	3.3 K	
TE-1ST-001	Downcomer Stalk 1, 4.8 m from RV bottom.	253.2 to 977.4 K	1 Hz	2.7 K	350 K	2.5 K	
					450 K	2.6 K	
					550 K	2.7 K	
					650 K	3.3 K	

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation: Reading	After Experiment Initiation: Uncertainty (±)	Comments
TEMPERATURE (continued)							
Reactor Vessel (continued)							
TE-1ST-002	Downcomer Stalk 1, 4.2 m from RV bottom.	253.2 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.7 K 3.3 K	
TE-1ST-005	Downcomer Stalk 1, 2.37 m from RV bottom.	253.2 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.7 K 3.3 K	Qualified to 200 s.
TE-1ST-009	Downcomer Stalk 1, 0.64 m from RV bottom.	253.2 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.7 K 3.3 K	
TE-1ST-013	Downcomer Stalk 1, 0.24 m from RV bottom.	253.2 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.7 K 3.3 K	Qualified to 200 s.
TE-1ST-014	Downcomer Stalk 1, 1.17 m from RV bottom (inside of DTT).	253.2 to 977.4 K	1 Hz	--	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	
TE-1UP-001	Fuel Assembly 1 upper end box.	311 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.7 K 3.3 K	Qualified to 200 s.
TE-1UP-002	Fuel Assembly 1 upper end box.	311 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	
TE-1UP-003	Fuel Assembly 1 support column above RV nozzle.	311 to 977.4 K	1 Hz	--	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation Reading	After Experiment Initiation Uncertainty (±)	Comments
TEMPERATURE (continued)							
Reactor Vessel (continued)							
TE-1UP-004	Fuel Assembly 1 support column above RV nozzle.	311 to 977.4 K	10 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	
TE-1UP-005	DTT FE-1UP-1 above Fuel Assembly 1.	311 to 977.4 K	10 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	
TE-1UP-006	Fuel Assembly 1 support column.	311 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	
TE-2E8-045	Cladding on Fuel Assembly 2, Row E, Column 8 at 1.14 m above bottom of fuel rod.	422 to 1533 K	10 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-2F7-037	Cladding on Fuel Assembly 2, Row F, Column 7 at 0.94 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-2G14-011	Cladding on Fuel Assembly 2, Row G, Column 14 at 0.28 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	Qualified to 200 s.
TE-2G14-030	Cladding on Fuel Assembly 2, Row G, Column 14 at 0.76 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.7 K 3.2 K 4.7 K 6.2 K	Qualified to 200 s.

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation: Reading	After Experiment Initiation: Uncertainty (±)	Comments
TEMPERATURE (continued)							
Reactor Vessel (continued)							
TE-2G14-045	Cladding on Fuel Assembly 2, Row G, Column 14 at 1.14 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	400 K 600 K 800 K 1000 K	2.7 K 3.2 K 4.7 K 6.2 K	Qualified.
TE-2H01-037	Cladding on Fuel Assembly 2, Row H, Column 1 at 0.94 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	400 K 600 K 800 K 1000 K	2.7 K 3.2 K 4.7 K 6.2 K	
TE-2H02-028	Cladding on Fuel Assembly 2, Row H, Column 2 at 0.71 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	400 K 600 K 800 K 1000 K	2.7 K 3.2 K 4.7 K 6.2 K	
TE-2H02-032	Cladding on Fuel Assembly 2, Row H, Column 2 at 0.81 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	400 K 600 K 800 K 1000 K	2.7 K 3.2 K 4.7 K 6.2 K	
TE-2H08-039	Guide tube for Fuel Assembly 2, Row H, Column 8 at 0.99 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	400 K 600 K 800 K 1000 K	2.7 K 3.2 K 4.7 K 6.2 K	
TE-2LP-001	Fuel Assembly 2 lower end box.	311 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	Qualified to 200 s.
TE-2LP-003	Fuel Assembly 2 lower end box.	311 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation Reading	After Experiment Initiation Uncertainty (±)	Comments
TEMPERATURE (continued)							
Reactor Vessel (continued)							
TE-2ST-001	Downcomer Stalk 2, 4.8 m from RV bottom.	253.2 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.7 K 3.3 K	
TE-2ST-005	Downcomer Stalk 2, 2.37 m from RV bottom.	253.2 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.7 K 3.3 K	
TE-2ST-009	Downcomer Stalk 2, 0.64 m from RV bottom.	253.2 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.7 K 3.3 K	
TE-2ST-013	Downcomer Stalk 2, 0.24 m from RV bottom.	253.2 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.7 K 3.3 K	
TE-2ST-014	Downcomer Stalk 2, 1.17 m from RV bottom.	253.2 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.7 K 3.3 K	Qualified.
TE-2UP-001	Fuel Assembly 2 upper end box.	311 to 977.4 K	1 Hz	--	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	
TE-2UP-002	Fuel Assembly 2 upper end box.	311 to 977.4 K	10 Hz	--	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	
TE-2UP-003	Fuel Assembly 2 upper end box.	311 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	Qualified to 200 s.

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation: Reading	After Experiment Initiation: Uncertainty (±)	Comments
TEMPERATURE (continued)							
Reactor Vessel (continued)							
TE-3B12-026	Cladding on Fuel Assembly 3, Row B, Column 12 at 0.66 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-3C11-021	Cladding on Fuel Assembly 3, Row C, Column 11 at 0.53 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-3C11-039	Cladding on Fuel Assembly 3, Row C, Column 11 at 0.99 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-3F7-015	Cladding on Fuel Assembly 3, Row F, Column 7 at 0.38 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-3F7-021	Cladding on Fuel Assembly 3, Row F, Column 7 at 0.53 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-3F7-026	Cladding on Fuel Assembly 3, Row F, Column 7 at 0.66 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-3F7-030	Cladding on Fuel Assembly 3, Row F, Column 7 at 0.76 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation Reading	After Experiment Initiation Uncertainty (±)	Comments
TEMPERATURE (continued)							
Reactor Vessel (continued)							
TE-3LP-001	Fuel Assembly 3 lower end box.	311 to 977.4 K	1 Hz	2.6 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	Qualified to 200 s.
TE-3UP-001	Fuel Assembly 3 upper end box.	311 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	Qualified to 200 s.
TE-3UP-002	Fuel Assembly 3 upper end box.	311 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	Qualified to 200 s.
TE-3UP-003	Fuel Assembly 3 support column above RV nozzle.	311 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	
TE-3UP-004	Fuel Assembly 3 support column above RV nozzle.	311 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	
TE-3UP-005	DTT FE-3UP-1 above Fuel Assembly 3.	311 to 977.4 K	1 Hz	--	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	
TE-3UP-006	Support column.	311 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	
TE-3UP-007	Support column.	311 to 977.4 K	1 Hz	--	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation: Reading	After Experiment Initiation: Uncertainty (±)	Comments
TEMPERATURE (continued)							
Reactor Vessel (continued)							
TE-3UP-008	Liquid level transducer above Fuel Assembly 3.	311 to 977.4 K	1 Hz	2.7 K	350 K	2.5 K	
					450 K	2.6 K	
					550 K	2.6 K	
					650 K	3.3 K	
TE-3UP-009	Liquid level transducer above Fuel Assembly 3.	311 to 977.4 K	1 Hz	--	350 K	2.5 K	
					450 K	2.6 K	
					550 K	2.6 K	
					650 K	3.3 K	
TE-3UP-010	Liquid level transducer above Fuel Assembly 3.	311 to 977.4 K	1 Hz	2.7 K	350 K	2.5 K	
					450 K	2.6 K	
					550 K	2.6 K	
					650 K	3.3 K	
TE-3UP-011	Liquid level transducer above Fuel Assembly 3.	311 to 977.4 K	1 Hz	2.7 K	350 K	2.5 K	Qualified to 200 s.
					450 K	2.6 K	
					550 K	2.6 K	
					650 K	3.3 K	
TE-3UP-012	Liquid level transducer above Fuel Assembly 3.	311 to 977.4 K	1 Hz	2.7 K	350 K	2.5 K	
					450 K	2.6 K	
					550 K	2.6 K	
					650 K	3.3 K	
TE-3UP-013	Liquid level transducer above Fuel Assembly 3.	311 to 977.4 K	1 Hz	2.7 K	350 K	2.5 K	
					450 K	2.6 K	
					550 K	2.6 K	
					650 K	3.3 K	
TE-3UP-014	Liquid level transducer above Fuel Assembly 3.	311 to 977.4 K	1 Hz	2.7 K	350 K	2.5 K	
					450 K	2.6 K	
					550 K	2.6 K	
					650 K	3.3 K	
TE-3UP-015	Liquid level transducer above Fuel Assembly 3.	311 to 977.4 K	1 Hz	2.7 K	350 K	2.5 K	
					450 K	2.6 K	
					550 K	2.6 K	
					650 K	3.3 K	

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation: Reading	After Experiment Initiation: Uncertainty (±)	Comments
TEMPERATURE (continued)							
Reactor Vessel (continued)							
TE-3UP-016	Liquid level transducer above Fuel Assembly 3.	311 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	
TE-4G14-011	Cladding on Fuel Assembly 4, Row G, Column 14 at 0.28 m above bottom of fuel rod.	422 to 1533 K	1 Hz	--	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-4G14-030	Cladding on Fuel Assembly 4, Row G, Column 14 at 0.76 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-4G14-045	Cladding on Fuel Assembly 4, Row G, Column 14 at 1.14 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-4H01-037	Cladding on Fuel Assembly 4, Row H, Column 1 at 0.94 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-4H02-028	Cladding on Fuel Assembly 4, Row H, Column 2 at 0.71 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-4H02-032	Cladding on Fuel Assembly 4, Row H, Column 2 at 0.81 m above bottom of fuel rod.	422 to 1533 K	1 Hz	--	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation: Reading	After Experiment Initiation: Uncertainty (±)	Comments
TEMPERATURE (continued)							
Reactor Vessel (continued)							
TE-4H08-039	Cladding on Fuel Assembly 4, Row H, Column 8 at 0.99 m above bottom of fuel rod.	422 to 1533 K	10 Hz	3.1 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-4LP-001	Fuel Assembly 4 lower end box.	311 to 977.4 K	1 Hz	2.6 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	
TE-4LP-003	Fuel Assembly 4 lower end box.	311 to 977.4 K	1 Hz	2.6 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	Qualified to 200 s.
TE-4UP-001	Fuel Assembly 4 upper end box.	311 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	Qualified to 200 s.
TE-4UP-002	Fuel Assembly 4 upper end box.	311 to 977.4 K	1 Hz	--	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	
TE-4UP-003	Fuel Assembly 4 upper end box.	311 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	Qualified to 200 s.
TE-5C6-024	Guide tube for Fuel Assembly 5, Row C, Column 6 at 0.61 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation: Reading	After Experiment Initiation: Uncertainty (±)	Comments
TEMPERATURE (continued)							
Reactor Vessel (continued)							
TE-5D6-030	Cladding on Fuel Assembly 5, Row D, Column 6 at 0.76 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	Qualified to 200 s.
TE-5D6-032	Cladding on Fuel Assembly 5, Row D, Column 6 at 0.81 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-5D6-037	Cladding on Fuel Assembly 5, Row D, Column 6 at 0.94 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	Qualified to 200 s.
TE-5D6-039	Cladding on Fuel Assembly 5. Row D, Column 6 at 0.99 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	Qualified to 200 s.
TE-5E8-002	Cladding on Fuel Assembly 5, Row E, Column 8 at 0.05 m above bottom of fuel rod.	422 to 1533 K	1 Hz	--	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-5E8-015	Cladding on Fuel Assembly 5, Row E, Column 8 at 0.38 m above bottom of fuel rod.	420 to 1810 K	1 Hz	4.1 K	450 K 600 K 800 K 1000 K	3.8 K 4.2 K 5.2 K 6.7 K	
TE-5E8-034.5	Cladding on Fuel Assembly 5, Row E, Column 8 at 0.88 m above bottom of fuel rod.	420 to 1810 K	1 Hz	4.1 K	450 K 600 K 800 K 1000 K	3.8 K 4.2 K 5.2 K 6.7 K	

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation		Comments
					Reading	Uncertainty (±)	
TEMPERATURE (continued)							
Reactor Vessel (continued)							
TE-5E8-049	Cladding on Fuel Assembly 5, Row E, Column 8 at 1.24 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-5F3-024	Cladding on Fuel Assembly 5, Row F, Column 3 at 0.61 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K 600 K 300 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-5F4-015	Cladding on Fuel Assembly 5, Row F, Column 4 at 0.38 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	Qualified to 200 s.
TE-5F4-021	Cladding on Fuel Assembly 5, Row F, Column 4 at 0.53 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	Qualified to 200 s.
TE-5F4-026	Cladding on Fuel Assembly 5, Row F, Column 4 at 0.66 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	Qualified to 200 s.
TE-5F4-030	Cladding on Fuel Assembly 5, Row F, Column 4 at 0.76 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	Qualified to 200 s.
TE-5F7-005	Cladding on Fuel Assembly 5, Row F, Column 7 at 0.13 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6 2 K	

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation: Reading	After Experiment Initiation: Uncertainty (±)	Comments
TEMPERATURE (continued)							
Reactor Vessel (continued)							
TE-5F7-021	Cladding on Fuel Assembly 5, Row F, Column 7 at 0.53 m above bottom of fuel rod.	420 to 1810 K	1 Hz	--	450 K 600 K 800 K 1000 K	3.8 K 4.2 K 4.7 K 6.2 K	
TE-5F7-039	Cladding on Fuel Assembly 5, Row F, Column 7 at 0.99 m above bottom of fuel rod.	420 to 1810 K	1 Hz	--	450 K 60C K 800 K 1000 K	3.8 K 4.2 K 5.2 K 6.7 K	Failed.
TE-5F7-054	Cladding on Fuel Assembly 5, Row F, Column 7 at 1.37 m above bottom of fuel rod.	422 to 1533 K	1 Hz	--	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-5F8-024	Cladding on Fuel Assembly 5, Row F, Column 8 at 0.61 m above bottom of fuel rod.	420 to 1810 K	1 Hz	4.1 K	450 K 600 K 800 K 1000 K	3.8 K 4.2 K 5.2 K 6.7 K	Failed.
TE-5F8-028	Cladding on Fuel Assembly 5, Row F, Column 8 at 0.71 m above bottom of fuel rod.	420 to 1810 K	1 Hz	4.1 K	450 K 600 K 800 K 1000 K	3.8 K 4.2 K 5.2 K 6.7 K	
TE-5F8-032	Cladding on Fuel Assembly 5, Row F, Column 8 at 0.81 m above bottom of fuel rod.	420 to 1810 K	1 Hz	4.1 K	450 K 600 K 800 K 1000 K	3.8 K 4.2 K 5.2 K 6.7 K	
TE-5F8-037	Cladding on Fuel Assembly 5, Row F, Column 8 at 0.94 m above bottom of fuel rod.	420 to 1810 K	1 Hz	--	450 K 600 K 800 K 1000 K	3.8 K 4.2 K 5.2 K 6.7 K	Failed.

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation: Reading	After Experiment Initiation: Uncertainty (±)	Comments
TEMPERATURE (continued)							
Reactor Vessel (continued)							
TE-5F9-011	Cladding on Fuel Assembly 5, Row F, Column 9 at 0.28 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	Qualified to 200 s.
TE-5F9-030	Cladding on Fuel Assembly 5, Row F, Column 9 at 0.76 m above bottom of fuel rod.	420 to 1810 K	1 Hz	4.2 K	450 K 600 K 800 K 1000 K	3.8 K 4.2 K 5.2 K 6.7 K	
TE-5F9-045	Cladding on Fuel Assembly 5, Row F, Column 9 at 1.14 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	Qualified to 200 s.
TE-5F9-062	Cladding on Fuel Assembly 5, Row F, Column 9 at 1.57 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	Qualified to 200 s.
TE-5G6-011	Cladding on Fuel Assembly 5, Row G, Column 6 at 0.28 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-5G6-030	Cladding on Fuel Assembly 5, Rod G, Column 6 at 0.76 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-5G6-045	Cladding on Fuel Assembly 5, Row G, Column 6 at 1.14 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation Reading	 Uncertainty (±)	Comments
TEMPERATURE (continued)							
Reactor Vessel (continued)							
TE-5G6-062	Cladding on Fuel Assembly 5, Row G, Column 6 at 1.57 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-5G8-008	Cladding on Fuel Assembly 5, Row G, Column 8 at 0.20 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	Qualified to 200 s.
TE-5G8-026	Cladding on Fuel Assembly 5, Row G, Column 8 at 0.66 m above bottom of fuel rod.	410 to 1820 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	3.3 K 4.2 K 5.2 K 6.7 K	Qualified to 200 s.
TE-5G8-041	Cladding on Fuel Assembly 5, Row G, Column 8 at 1.04 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-5G8-058	Cladding on Fuel Assembly 5, Row G, Column 8 at 1.47 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-5H5-002	Cladding on Fuel Assembly 5, Row H, Column 5 at 0.05 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	Qualified to 200 s.
TE-5H5-015	Cladding on Fuel Assembly 5, Row H, Column 5 at 0.38 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation: Reading	After Experiment Initiation: Uncertainty (±)	Comments
TEMPERATURE (continued)							
Reactor Vessel (continued)							
TE-5H5-034.5	Cladding on Fuel Assembly 5, Row H, Column 5 at 0.88 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-5H5-049	Cladding on Fuel Assembly 5, Row H, Column 5 at 1.24 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-5H6-024	Cladding on Fuel Assembly 5, Row H, Column 6 at 0.61 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	Qualified to 200 s.
TE-5H6-028	Cladding on Fuel Assembly 5, Row H, Column 6 at 0.71 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	Qualified to 200 s.
TE-5H6-032	Cladding on Fuel Assembly 5, Row H, Column 6 at 0.81 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	Qualified to 200 s.
TE-5H6-037	Cladding on Fuel Assembly 5, Row H, Column 6 at 0.94 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	Failed.
TE-5H7-008	Cladding on Fuel Assembly 5, Row H, Column 7 at 0.20 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation: Reading	After Experiment Initiation: Uncertainty (±)	Comments
TEMPERATURE (continued)							
Reactor Vessel (continued)							
TE-5H7-026	Cladding on Fuel Assembly 5, Row H, Column 7 at 0.66 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-5H7-041	Cladding on Fuel Assembly 5, Row H, Column 7 at 1.04 m above bottom of fuel rod.	422 to 1533 K	1 Hz	--	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-5H7-058	Cladding on Fuel Assembly 5, Row H, Column 7 at 1.47 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-5I6-005	Cladding on Fuel Assembly 5, Row I, Column 6 at 0.13 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-5I6-021	Cladding on Fuel Assembly 5, Row I, Column 6 at 0.53 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-5I6-039	Cladding on Fuel Assembly 5, Row I, Column 6 at 0.99 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-5I6-054	Cladding on Fuel Assembly 5, Row I, Column 6 at 1.37 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation: Reading	After Experiment Initiation: Uncertainty (±)	Comments
TEMPERATURE (continued)							
Reactor Vessel (continued)							
TE-5I8-008	Cladding on Fuel Assembly 5, Row I, Column 8 at 0.20 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-5I8-026	Cladding on Fuel Assembly 5, Row I, Column 8 at 0.66 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-5I8-041	Cladding on Fuel Assembly 5, Row I, Column 8 at 1.04 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-5I8-058	Cladding on Fuel Assembly 5, Row I, Column 8 at 1.47 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-5J3-024	Cladding on Fuel Assembly 5, Row J, Column 3 at 0.61 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-5J4-015	Cladding on Fuel Assembly 5, Row J, Column 4 at 0.38 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-5J4-021	Cladding on Fuel Assembly 5, Row J, Column 4 at 0.53 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation: Reading	After Experiment Initiation: Uncertainty (±)	Comments
TEMPERATURE (continued)							
Reactor Vessel (continued)							
TE-5J4-026	Cladding on Fuel Assembly 5, Row J, Column 4 at 0.66 m above bottom of fuel rod.	422 to 1533 K	1 Hz	---	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-5J4-030	Cladding on Fuel Assembly 5, Row J, Column 4 at 0.76 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-5J7-011	Cladding on Fuel Assembly 5, Row J, Column 7 at 0.28 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-5J7-030	Cladding on Fuel Assembly 5, Row J, Column 7 at 0.76 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-5J7-045	Cladding on Fuel Assembly 5, Row J, Column 7 at 1.14 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-5J7-062	Cladding on Fuel Assembly 5, Row J, Column 7 at 1.57 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-5J8-024	Cladding on Fuel Assembly 5, Row J, Column 8 at 0.61 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation Reading	After Experiment Initiation Uncertainty (±)	Comments
TEMPERATURE (continued)							
Reactor Vessel (continued)							
TE-5J8-028	Cladding on Fuel Assembly 5, Row J, Column 8 at 0.71 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-5J8-032	Cladding on Fuel Assembly 5, Row J, Column 8 at 0.81 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-5J8-037	Cladding on Fuel Assembly 5, Row J, Column 8 at 0.94 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-5J9-005	Cladding on Fuel Assembly 5, Row J, Column 9 at 0.13 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-5J9-021	Cladding on Fuel Assembly 5, Row J, Column 9 at 0.53 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-5J9-039	Cladding on Fuel Assembly 5, Row J, Column 9 at 0.99 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-5J9-054	Cladding on Fuel Assembly 5, Row J, Column 9 at 1.37 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation: Reading	After Experiment Initiation: Uncertainty (±)	Comments
TEMPERATURE (continued)							
Reactor Vessel (continued)							
TE-5K8-002	Cladding on Fuel Assembly 5, Row K, Column 8 at 0.05 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-5K8-013	Cladding on Fuel Assembly 5, Row K, Column 8 at 0.38 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-5K8-034.5	Cladding on Fuel Assembly 5, Row K, Column 8 at 0.88 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-5K8-049	Cladding on Fuel Assembly 5, Row K, Column 8 at 1.24 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-5LP-001	Fuel Assembly 5 lower end box.	311 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	Qualified.
TE-5LP-002	Fuel Assembly 5 lower end box.	311 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	
TE-5LP-003	Fuel Assembly 5 lower end box.	311 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation Reading	After Experiment Initiation Uncertainty (±)	Comments
TEMPERATURE (continued)							
Reactor Vessel (continued)							
TE-5LP-004	Fuel Assembly 5 lower end box.	311 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	
TE-5L6-030	Cladding on Fuel Assembly 5, Row L, Column 6 at 0.76 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-5L6-032	Cladding on Fuel Assembly 5, Row L, Column 6 at 0.81 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-5L6-037	Cladding on Fuel Assembly 5, Row L, Column 6 at 0.94 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-5L6-039	Cladding on Fuel Assembly 5, Row L, Column 6 at 0.99 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-5L8-011	Guide tube for Fuel Assembly 5, Row L, Column 8 at 0.28 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	Qualified to 200 s.
TE-5L8-024	Guide tube for Fuel Assembly 5, Row L, Column 8 at 0.61 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	Qualified to 200 s.

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation: Reading	After Experiment Initiation: Uncertainty (±)	Comments
TEMPERATURE (continued)							
Reactor Vessel (continued)							
TE-5L8-039	Guide tube for Fuel Assembly 5, Row L, Column 8 at 0.99 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	Qualified to 200 s.
TE-5L8-045	Guide tube for Fuel Assembly 5, Row L, Column 8 at 1.14 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	Qualified to 200 s.
TE-5M6-024	Guide tube for Fuel Assembly 5, Row M, Column 6 at 0.61 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-5UP-001	Fuel Assembly 5 upper end box.	311 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	Qualified.
TE-5UP-002	Fuel Assembly 5 upper end box.	311 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	Qualified.
TE-5UP-003	Fuel Assembly 5 upper end box.	311 to 977.4 K	1 H	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	Qualified.
TE-5UP-004	Fuel Assembly 5 upper end box.	311 to 977.4 K	Hz	2.7 K	350 K 450 K 500 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	Qualified.

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation		Comments
					Reading	Uncertainty (±)	
TEMPERATURE (continued)							
Reactor Vessel (continued)							
TE-5UP-005	Fuel Assembly 5 upper end box.	311 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	Qualified.
TE-5UP-006	Fuel Assembly 5 upper end box.	311 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	Qualified.
TE-5UP-007	Fuel Assembly 5 upper end box.	311 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	Qualified.
TE-5UP-008	Fuel Assembly 5 upper end box.	311 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	Qualified.
TE-5UP-009	Fuel Assembly 5 upper end box.	311 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	Qualified to 200 s.
TE-6E8-045	Cladding on Fuel Assembly 6, Row E, Column 8 at 1.14 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-6G14-011	Cladding on Fuel Assembly 6, Row G, Column 14 at 0.28 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation: Reading	After Experiment Initiation: Uncertainty (±)	Comments
TEMPERATURE (continued)							
Reactor Vessel (continued)							
TE-6G14-030	Cladding on Fuel Assembly 6, Row G, Column 14 at 0.76 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-6G14-045	Cladding on Fuel Assembly 6, Row G, Column 14 at 1.14 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.2 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-6H01-037	Cladding on Fuel Assembly 6, Row H, Column 1 at 0.94 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-6H02-028	Cladding on Fuel Assembly 6, Row H, Column 2 at 0.71 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-6H02-032	Cladding on Fuel Assembly 6, Row H, Column 2 at 0.81 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-6H08-039	Cladding on Fuel Assembly 6, Row H, Column 8 at 0.99 m above bottom of fuel rod.	422 to 1533 K	1 Hz	3.1 K	450 K 600 K 800 K 1000 K	2.8 K 3.2 K 4.7 K 6.2 K	
TE-6LP-001	Fuel Assembly 6 lower end box.	311 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	Qualified to 200 s.

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation Reading	After Experiment Initiation Uncertainty (±)	Comments
TEMPERATURE (continued)							
Reactor Vessel (continued)							
TE-6LP-003	Fuel Assembly 6 lower end box.	311 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	
TE-6UP-001	Fuel Assembly 6 upper end box.	311 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	Qualified to 20(›.
TE-6UP-003	Fuel Assembly 6 upper end box.	311 to 977.4 K	1 Hz	2.7 K	350 K 450 K 550 K 650 K	2.5 K 2.6 K 2.6 K 3.3 K	Qualified to 200 s.
Secondary Coolant System							
TT-P004-004	Secondary coolant system feedwater.	366 to 505 K	1 Hz	0.9 K	--	0.9 K	
Emergency Core Cooling System							
TT-P120-062	Cold leg injection in 4-in. line upstream of cold leg injection point.	280 to 620 K	1 Hz	2.1 K	--	2.1 K	
Intact Loop							
TT-P139-032	Intact loop hot leg primary coolant, Channel A.	533 to 616 K	1 Hz	0.5 K	--	0.5 K	Qualified to 200 s, process instrument, response limited.
TT-P139-033	Intact loop hot leg primary coolant, Channel B.	533 to 616 K	1 Hz	0.5 K	--	0.5 K	Qualified to 200 s, process instrument, response limited.
TT-P139-034	Intact loop hot leg primary coolant, Channel C.	533 to 516 K	1 Hz	0.5 K	--	0.5 K	Qualified to 200 s, process instrument, response limited.

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation Reading	After Experiment Initiation Uncertainty (±)	Comments
TRANSIT TIME							
Broken Loop							
TTE-BL-01A-1	Cold leg, bottom, front.	±76 m/s	1 Hz	--	0 m/s 40 m/s 76 m/s	0.75 m/s 2.36 m/s 4.33 m/s	Not recorded.
TTE-BL-01A-2	Cold leg, bottom, center.	±76 m/s	1 Hz	--	0 m/s 40 m/s 76 m/s	0.75 m/s 2.36 m/s 4.33 m/s	Not recorded.
TTE-BL-01A-3	Cold leg, bottom, rear.	±76 m/s	1 Hz	--	0 m/s 40 m/s 76 m/s	0.75 m/s 2.36 m/s 4.33 m/s	Not recorded.
TTE-BL-01B-1	Cold leg, center, front.	±76 m/s	1 Hz	--	0 m/s 40 m/s 76 m/s	0.75 m/s 2.36 m/s 4.33 m/s	Not recorded.
TTE-BL-01B-3	Cold leg, center, rear.	±76 m/s	1 Hz	--	0 m/s 40 m/s 76 m/s	0.75 m/s 2.36 m/s 4.33 m/s	Not recorded.
TTE-BL-01C-1	Cold leg, top, front.	±76 m/s	1 Hz	--	0 m/s 40 m/s 76 m/s	0.75 m/s 2.36 m/s 4.33 m/s	Not recorded.
TTE-BL-01C-2	Cold leg, top, center.	±76 m/s	1 Hz	--	0 m/s 40 m/s 76 m/s	0.75 m/s 2.36 m/s 4.33 m/s	Not recorded.
TTE-BL-01C-3	Cold leg, top, rear.	±76 m/s	1 Hz	--	0 m/s 40 m/s 76 m/s	0.75 m/s 2.36 m/s 4.33 m/s	Not recorded.

TABLE B-1. (continued)

Variable, System, and Detector	Location	Measurement Range	Recording Frequency[a]	Initial Condition Uncertainty (±)	After Experiment Initiation: Reading	After Experiment Initiation: Uncertainty (±)	Comments

a. Recording frequency is the measurement channel bandwidth at the ±3 dB level.

b. Reference B-1.

c. Reference B-2.

d. Reference B-3.

e. The steam generator level is defined as 0 at 2.95 m above the top of the tube sheet.

f. Reference B-4.

g. Reference B-5.

h. Pressure measurements are presented as absolute values.

REFERENCES

B-1. G. D. Lassahn, *LOFT Experimental Measurements Uncertainties Analyses, Volume XVI, LOFT Three-Beam Gamma Densitometer System*, TREE-NUREG-1089, February 1979.

B-2. G. L. Biladeau, *LOFT Experimental Measurements Uncertainty Analyses, Volume VI, LOFT Linear Variable Differential Transformer Displacement Transducer Uncertainty Analysis*, TREE-NUREG-1089, February 1978.

B-3. S. Silverman, *LOFT Experimental Measurements Uncertainty Analyses, Volume XIV, LOFT Drag Disc-Turbine Transducer Uncertainty Analysis*, NUREG/CR-0169, TREE-1089, November 1978.

B-4. G. D. Lassahn, *LOFT Experimental Measurements Uncertainty Analyses, Volume VII, LOFT Self-Powered Neutron Detector Uncertainty Analysis*, NUREG/CR-0169, TREE-1089, August 1978.

B-5. L. D. Goodrich, Jr., *LOFT Experimental Measurements Uncertainty Analyses, Volume XV, LOFT Primary Coolant Pump Speed Measurement Uncertainty Analysis*, TREE-NUREG-1089, April 1978.