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Institute for Safety Technology

Experimental Data Report on LOBI-MOD2 Test BL-34

(6 % Cold Leg Break LOCA)

C. Addabbo
G. Leva
A. Annunziato

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G. Volta	JRC-Ispra (I)

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EXPERIMENTAL DATA REPORT

ON

LOBI-MOD2 TESTS BL-34

Abstract

This report contains the full set of experimental data from LOBI-MOD2 Test BL-34 with a short description of test facility configuration and test initial as well as transient assumptions. Test BL-34 simulated a 6 % cold leg break LOCA defined as counterpart to similar tests performed in the LSTF (Japan), BETHSY (France) and SPES (Italy) test facilities.

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REFERENCES

1. INTRODUCTION

This report contains the full set of experimental data from LOBI-MOD2 Test BL-34, an integral system experiment performed in the LOBI MOD2 test facility on March 22, 1990, to simulate a 6 % cold leg break Loss Of-Coolant Accident (LOCA) in Pressurized Water Reactors (PWRs). The data plots are complemented by information on test facility configuration, test conditions and measurement system.

The LOBI (LWR Off-normal Behaviour Investigations) test facility is a high pressure integral system test facility designed, constructed and operated in the Joint Research Centre of the Commission of the European Communities, Ispra Site, Italy. It incorporates the essential features of a typical 4-loops PWR primary and secondary cooling systems and is designed to preserve, within the general constraints of scaling criteria, prototypical system response during both normal and off-normal operating conditions. The test facility was commissioned in December 1979 and was operated until June 1982 in the MOD1 configuration for the investigation of large break LOCA phenomenologies; it was then extensively modified into the MOD2 configuration for the simulation of small break LOCAs and anticipated and/or abnormal transients. Major research objectives consist of:

- identification and/or verification of basic phenomenologies governing the thermal-hydraulic response of the integral system test facility for a range of postulated PWR accident conditions with emphasis on large and small break LOCAs, anticipated and abnormal transients as well as recovery procedures and accident management strategies.
- provision of an experimental data base for the development and/or improvement of analytical models and the independent assessment of large system thermal-hydraulic codes used in LWR safety analysis.

The overall research programme comprises two experimental programmes defined a and B:

- the experimental programme A is performed in the framework of a R&D contract between the Commission and the Bundesminister für Forschung und Technologie (BMFT) of the Federal Republic of Germany.
- the experimental programme B is instead performed in the framework of the Commission's Reactor Safety Research Programme with independent contribution from several industrial and institutional organizations of EC member countries.

Test BL-34 was performed in the framework of the B programme; as such is was proposed by the JRC staff and endorsed by experts of EC member countries assembled in the LOBI Working Group B (WG-B), and LOCA Programme Task Force (LPTF) [1]. It was defined as counterpart to a similar test performed in the LSTF (JAERI, J), BETHSY (CEA, F) and SPES (SIET, I).

The measured data presented in this report are contained in digital form in the Experimental Data Tape (EDT). A fist evaluation of the test and a preliminary analysis of the most significant results are outlined in the Quick Look Report of the test [2].

2. TEST DEFINITION AND OBJECTIVES

The assessment of large system codes used in the safety analysis of water cooled reactors is generally based on test data from scaled integral system and/or separate effect test facilities. Relevant test data from the reference reactors would be certainly desirable; clearly, the acquisition of experimental data in a full size plant and especially under accident conditions is prohibitive for obvious economic and practical considerations.

The typicality of experimental data acquired in test facilities is, however, often questioned due to inherent scaling distortions stemming from design or simulation compromises. Controversy thus arises when an attempt is made to extrapolate the predictive capability of a system code from a scaled installation to the full size prototype. To lend credence to the adequacy of system codes to predict a realistic system response, the code assessment process is thus diversified to a wide range of test data from test facilities having different scaling ratios and/or concepts.

Although not strictly required, it is certainly beneficial to assess the code against a set of data obtained from different test facilities under similar initial and boundary conditions. To a certain extent, this would decouple the assessment process from assumptions in the physical parameters emphasizing instead the relevance of geometrical characteristics especially on the qualitative rather than quantitative evolution of the test case.

Within this contest, a small break LOCA test has been designed and executed in 4 integral system test facilities representing the characterizing features of a commercial pressurized water reactor; i.e., LOBI operated by JRC at Ispra (I), LSTF operated by JAERI at Tokai-mura (J), BETHSY operated by CEA at Grenoble (F) and SPES operated by SIET at Piacenza (I). The collaborative bilateral and/or multilateral agreements underlining this activity has provided an unique opportunity for international cooperation in the field of water cooled reactors safety research and development.

The primary objective of Test BL-34 was to simulate major phenomenologies relevant to the response of a PWR to a small 6 % cold leg break LOCA; specific phenomena consisted in:

- first core dryout and rewet due to loop seal formation and clearout
- second core dryout and rewet due to a first inventory boil-off and accumulator safety injection
- third core dryout and rewet due to a new inventory boil-off consequent to accumulator safety injection termination and safety injection from the low pressure injection system.

As performed LOBI-MOD2 Test BL-34 together with its counterparts, represents a relevant reference test case for the assessment of the predictive capabilities and scalability of thermal-hydraulic system codes used in reactor safety analysis.

3. THE LOBI-MOD2 TEST FACILITY

The LOBI-MOD2 is a full-power high-pressure integral system test facility representing an approximately 1 : 700 scale model of a 4-loop, 1300 MWe PWR. It incorporates the essential features of a typical PWR primary and secondary cooling system. The test facility was commissioned in December 1979 and was operated until June 1982 in the MOD1 configuration for the investigation of large break LOCAs; it was then extensively modified into the present MOD2 configuration having design and instrumentation features best suited for the characterization of phenomenologies relevant to small break LOCAs and Special Transients in PWRs.

3.1 General Description

Geometrical Configuration: The test facility [3] comprises two primary loops, the intact and the broken loop which represent respectively three loops and one loop of the reference PWR, the Siemens-KWU 1300 MWe Biblis B plant. Each primary loop contains a main coolant circulation pump and a steam generator. The simulated core consists of an electrically heated 64 rod bundle arranged in an 8 x 8 square matrix inside the pressure vessel model; nominal heating power is 5.3 MW. Each heater rod of the simulated core consists of an internally pressurized hollow tube with an active heated length of 3.9 m, outer diameter of 10.75 mm and a pitch of 14.3 mm. The wall thickness is varied in 5 steps to provide a cosine shaped axial heat flux distribution. Lower plenum, upper plenum, an annular downcomer and an externally mounted upper head simulator are additional major components of the reactor model assembly.The primary cooling system which is shown schematically in Fig. 1 operates at normal PWR conditions: approximately 158 bar and 294 - 326° C pressure and temperature, respectively.

Heat is removed from the primary lops by the secondary cooling system which contains a condenser and a cooler, the main feedwater pump and the auxiliary feedwater system, Fig. 2. Normal operating conditions of the secondary cooling system are 210° C feedwater temperature and 64.5 bar pressure.

The MOD2 version of the test facility contains two shell and inverted U-tube type steam generators having geometrical configuration similar to that in the reference plant. Each steam generator consists of a single cylindrical pressure vessel with an annular downcomer separated from the riser region by a skirt tube. This tube is supported above the tube plate and carries the coarse separator; a fine separator is mounted in the uppermost part of the steam dome. The U-tubes (8 for the single loop and 24 for the triple loop steam generator) are arranged in a circle within the riser region, around an axially mounted filler tube. Feedwater is directed into the downcomer by a 'J nozzle' feed ring sparger and flows downward mixed with recirculation water returned by the coarse and fine separators. Heat is removed from the primary loops by the secondary cooling system which contains a condenser and a cooler, the main feedwater pump, and the auxiliary feedwater system.

The main coolant pumps of both loops are centrifugal type pumps having a specific speed of 29.2 (DIN). The two pumps are equal in size and are operated at two different speeds such as to yield the required steady-state mass flows of 21 kg/s and 7 kg/s for the intact and broken loop at the nominal operatingconditions. Since the resistance of the MCPs in the locked rotor conditions is less than that of the scaled reactor pump, there are provisions for the insertion of additional flow resistance at the outlet of each pump.

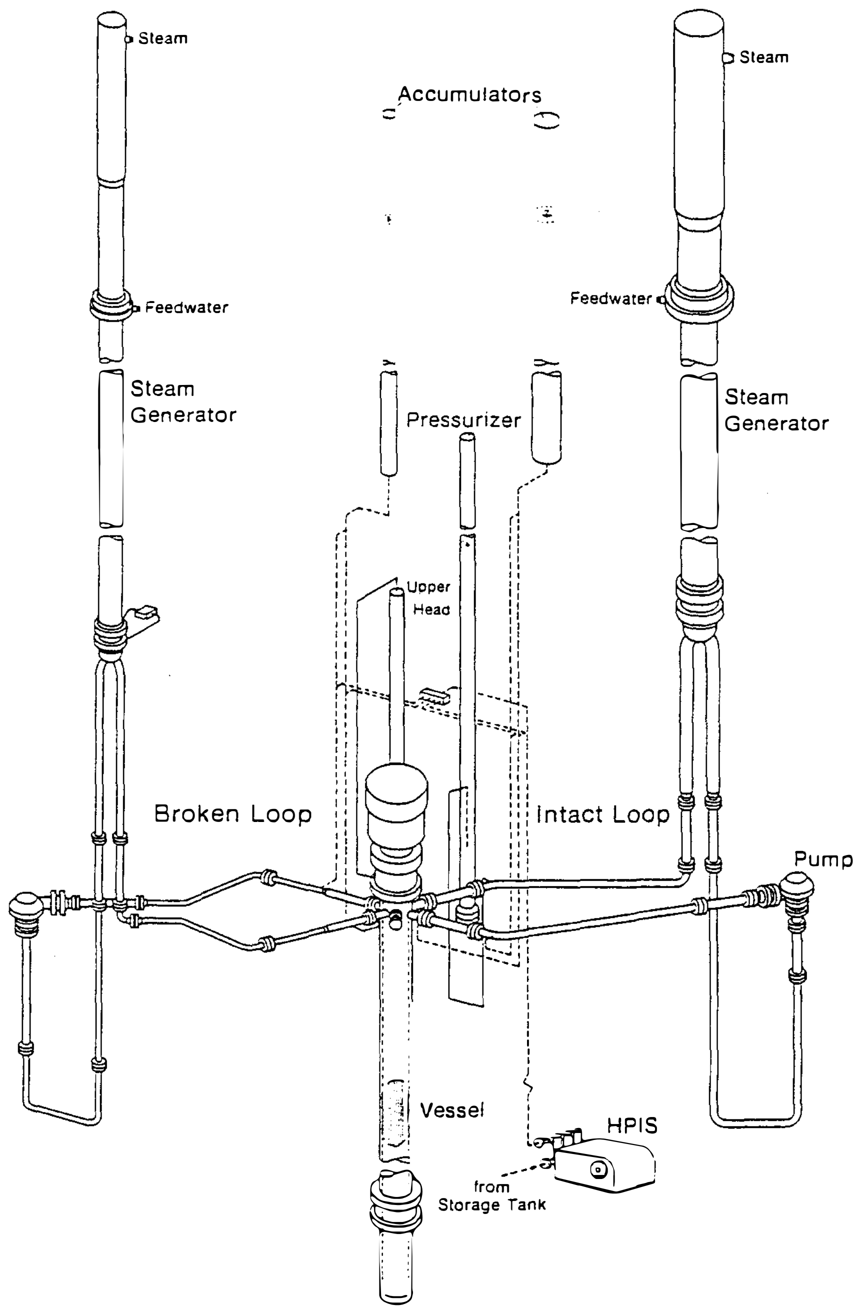


FIG.1 THE LOBI-MOD2 TEST FACILITY - PRIMARY COOLING SYSTEM

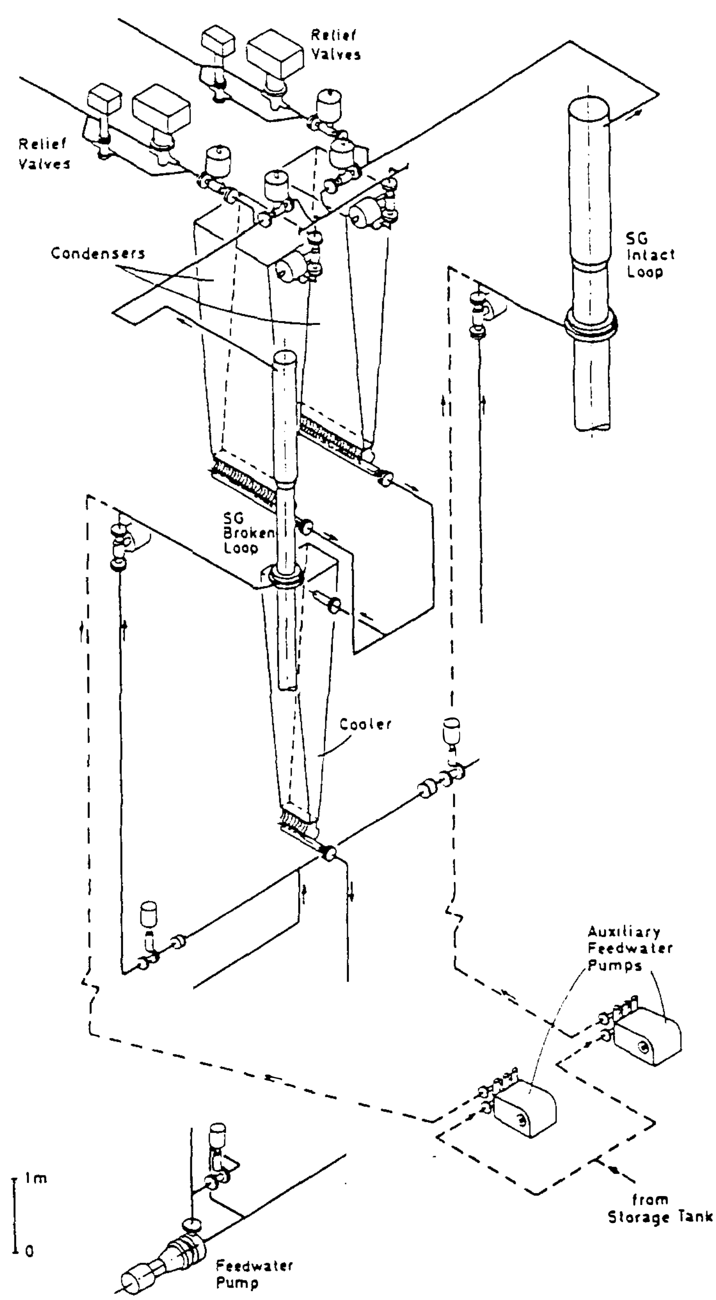


FIG.2	THE LOBI-MOD2 TEST FACILITY - SECONDARY COOLING SYSTEM

The pressurizer design is similar to that of the reference plant. It is scaled in volume but not in height. The surgeline rises within the pressurizer and leaves it radially. The pressurizer is provided with normal and additional heaters; the spray system is simulated by cooling coils placed in the steam region. There are provisions for connecting the surgeline to either the intact or broken loop hot legs. Simulation of power operated relief valves (PORVs) as well as safety relief valves (SRVs) is provided in the pressurizer relief line.

The LOBI-MOD2 Emergency Core Cooling System comprises the High Pressure Injection System (HPIS) and the Accumulator Injection System (AIS); as required the Low Pressure Injection System (LPIS) can also be represented. The volume control system and the auxiliary feedwater system (AFWS) are also configured.

A process control system allows the simulation of the main coolant pump hydraulic behaviour (speed control), of the decay and stored heat (power control to the electrically heated rod bundle), of the high pressure injection system and auxiliary feedwater system mass flow rates.

Scaling Rationales: The LOBI test facility was scaled to preserve, insofar as possible or practical, similarity of thermal-hydraulic behaviour with respect to the reference plant. A power-to-volume scaling concept was adopted in the design of the facility to ensure the preservation of the specific power input into the primary fluid.

The elevation of the major components were maintained at full height with exception of the pressurizer which, while preserving the total volume and the steam to liquid volume ratios, was somewhat shortened to allow increased radial dimensions to accomodate the internal heaters. The core and steam generators heat transfer and flow areas were matched to the scale factor. Strict adherence to the power-to-volume scale factor would have resulted in unacceptably high wall frictional pressure losses in the primary loop pipework which was appropriately shortened to increase the pipe diameter in order to match the expected pressure drop in the reference plant.

In the MOD2 configuration of the test facility special emphasis was given to the scaling of the steam generator primary and secondary sides due to their importance on the thermal-hydraulic evolution of small break LOCAs and special transients. In particular, volume ratio, heat transfer surface to volume ratio, hydraulic resistances and elevations, especially with respect to the lowest U-tube bend elevation, were preserved [4].

A major exception to the general scaling concept is the design of the reactor pressure vessel model annular downcomer. The test facility has been configured with a downcomer of two different gap widths. Initially, a downcomer gap of 50 mm was installed to reduce ECC bypass which is largely influenced by hot wall delay and counter-current flow limitation phenomena; however, this resulted in a 6.3 times too large a downcomer volume and as a consequence, in an atypical thermal-hydraulic system response during large break LOCAs. The downcomer gap width was later changed to 12 mm which again, was a technical compromise between a 7 mm volume scaled and a 25 mm pressure drop scaled downcomer.

Simulation Constraints: The LOBI test facility, therefore, as any other scaled test facility, has inherent distortions with respect to the reference plant which may impair the typicality of some results. The power-to-volume scaling concept results in a design which exhibits a basically one-dimensional thermal-hydraulic response, components high surface area to fluid volume ratio and large metal mass to fluid volume ratio. The structural stored energy and system heat losses are important contributors to distortions in those components, such as the reactor pressure vessel and steam generator downcomers, where the coupling between heat transfer and fluid flow is at time dominant.

All in all, the experimental results acquired in the LOBI test facility cannot be directly extrapolated to full-size plants; they provide, however, a reference data base for the understanding of governing thermal-hydraulic phenomenologies as well as for the development of analytical models and the assessment of system codes used in water reactor safety analysis.

3.2 System Configuration

For Test BL-34, the LOBI-MOD2 test facility was predisposed in the basic configuration for cold leg break LOCA experiments. Specific geometrical and operational data are as following:

- Break	located in the cold leg between MCP and vessel inlet and simulated by a 7.36 mm orifice, Fig. 3
- Pressurizer	connected to broken loop hot leg
- High Pressure ECC Injection	not used
- Accumulator ECC Injection	aligned with the intact loop cold leg gas pressure 40 bar injection line orifice 7.2 mm
- Low Pressure ECC Injection	aligned with the intact and broken loop cold legs activated on high heater rod temperature
- Secondary System	SRV: 72 bar cooldown not used.

Remark: The LOBI 6 % break orifice has been sized for the nominal scaled (approximately 1/700) primary coolant volume by preserving the ratio "break area to primary coolant volume".

Additional information concerning components configuration and auxiliaries operation are given in the following:

- The upper head simulator was connected in the standard configuration with an orifice of 8 mm in the downcomer connection line.
- Core bypass flow caused by two holes of 5 mm diameter in the core barrel tube at the upper plenum and by hot leg downcomer penetrations is estimated to be 2.6 % to 3.1 %, where 100 % corresponds to the nominal vessel mass flow of 28 kg/s. An additional bypass of about 1 % is caused by the upper head connection lines.
- The locked rotor resistance simulator for the broken loop was inserted already during steady-state. For the intact loop pump no additional resistance was applied.
- The pump seal water compensation system was applied throughout the test.

Test initial and boundary conditions as well as a brief description of test conduct are given in Section 4.

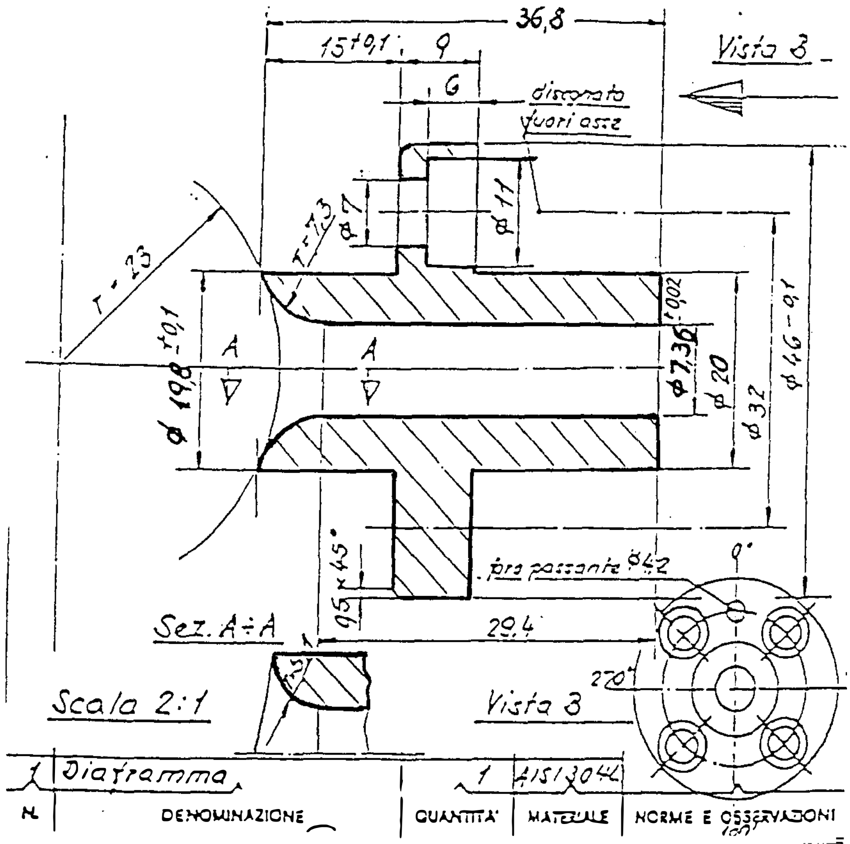


FIG.3: 6% BREAK ORIFICE FOR LOBI-MOD2 TEST BL-34

3.3 Measurement System

Generally, measurements of the main thermo-hydraulic parameters are performed at the boundaries of the principal loop components and at the important sections of the pressure vessel and of the steam generators.

Figures 4 to 7 show schematically the measurements provided for this test. The label codes identifying the measurements and the resulting data plots are explained in detail in Appendix A. This appendix also shows the disposition of the measurement locations within the facility. The measurement instrumentation of the facility is described briefly in Appendix B.

Figures 8 to 11 show the elevations of differential pressure and temperature measurement connections to the steam generators, the pressure vessel and the loops. The levels reported in Fig. 7 correspond to the elevation of differential pressure connections. The heater rod temperature measurements supplied for this test are indicated in Fig. 12.

The signals are recorded during the test by the data acquisition system in digital form on disk, as described in more detail in Appendix C. The original "raw" data is processed off-line and a final digital data tape is produced containing fully corrected data in engineering units for all the data channels which satisfy the consistency checks. The data on the Experimental Data Tape (EDT) are plotted in the present Experimental Data Report.

3.4 Special Remarks

Loop horizontality can be important for certain phenomena like stratified flow, loop seal refill and break uncovery. Since it is technically impossible to attain perfect horizontality for all pipes, relative vertical elevations at certain positions are measured and given in Fig. 13. Pipe supports are designed to maintain these elevations independent of temperature.

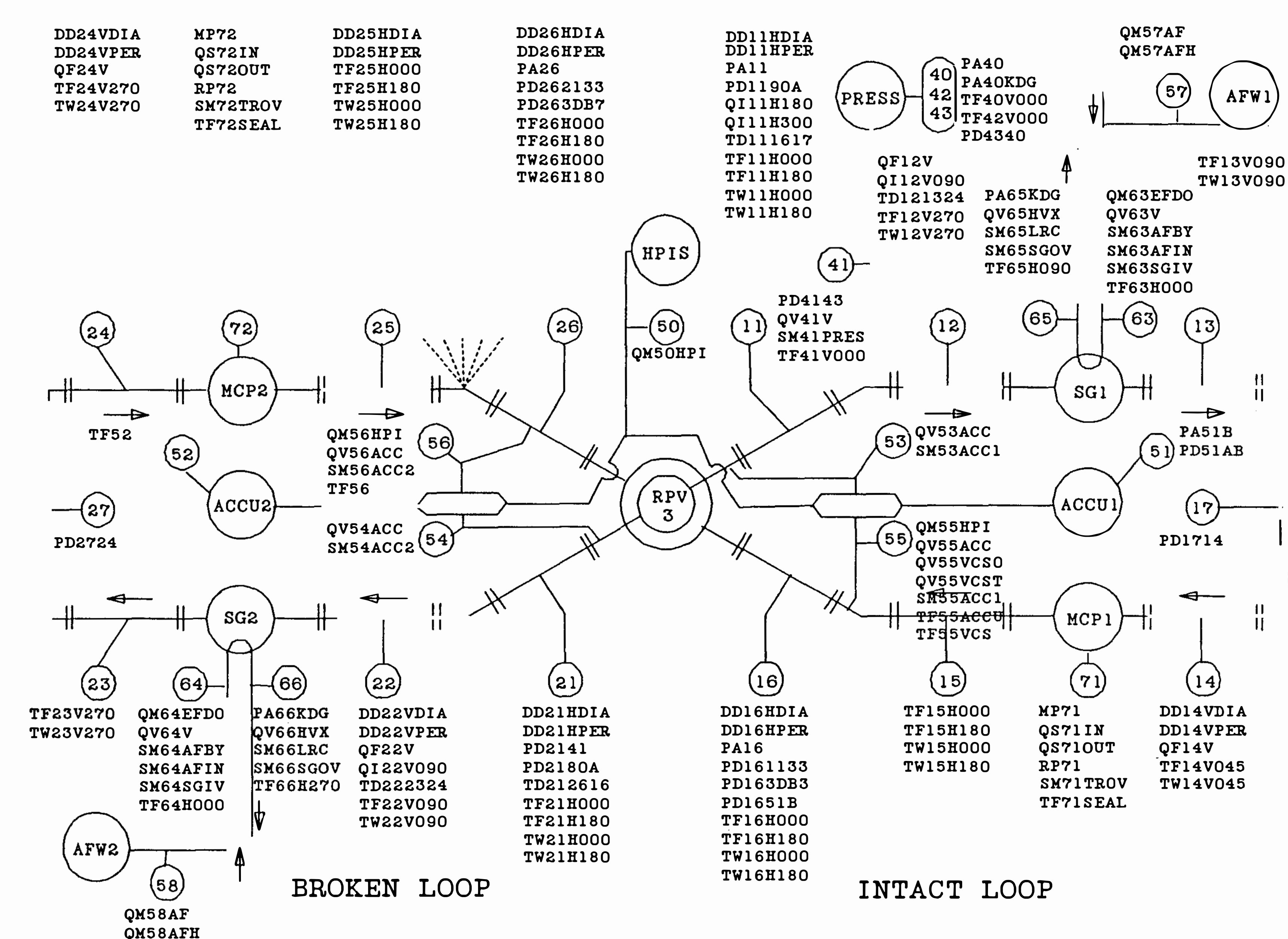
The heat losses of the LOBI-MOD2 test facility in nominal conditions are given in the following Table. The heat losses for Test BL-34 could be slightly different since the initial conditions are somewhat different from the nominal.

Table 1: **System Heat Losses for Test BL-34**

Primary System Heat Losses		
- Intact Loop	29	kW
- Broken Loop	29	kW
- Vessel and Upper Head	27.2	kW
- Pressurizer	2	kW
Secondary System Heat Losses		
- Intact Loop	6.8	kW
- Broken Loop	5	kW
- Steam Lines	3.2	kW

FIG.4

LOOP INSTRUMENTATION for TEST BL-34



LOOP INSTRUMENTATION

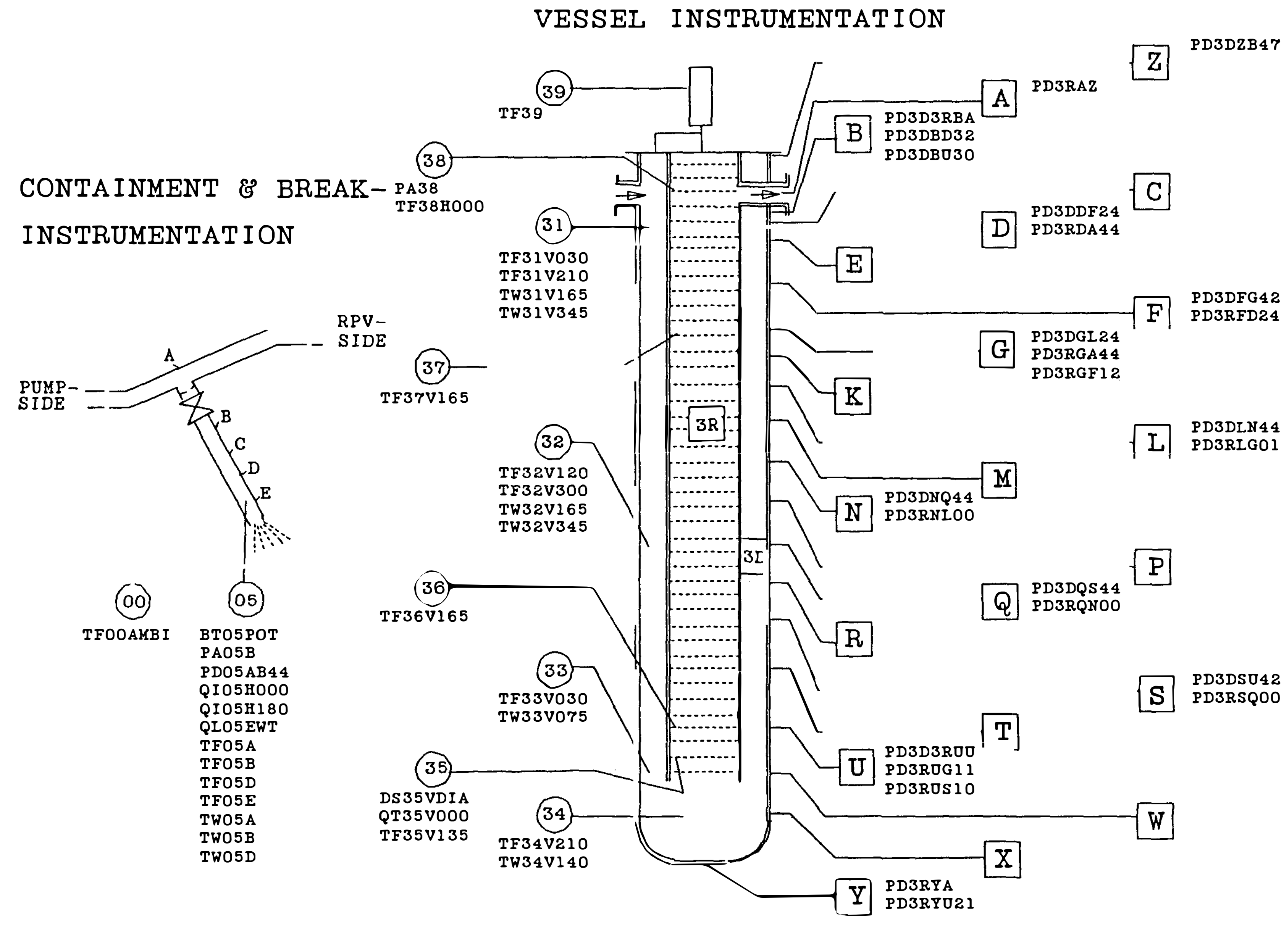


FIG.5

VESSEL INSTRUMENTATION for TEST BL-34

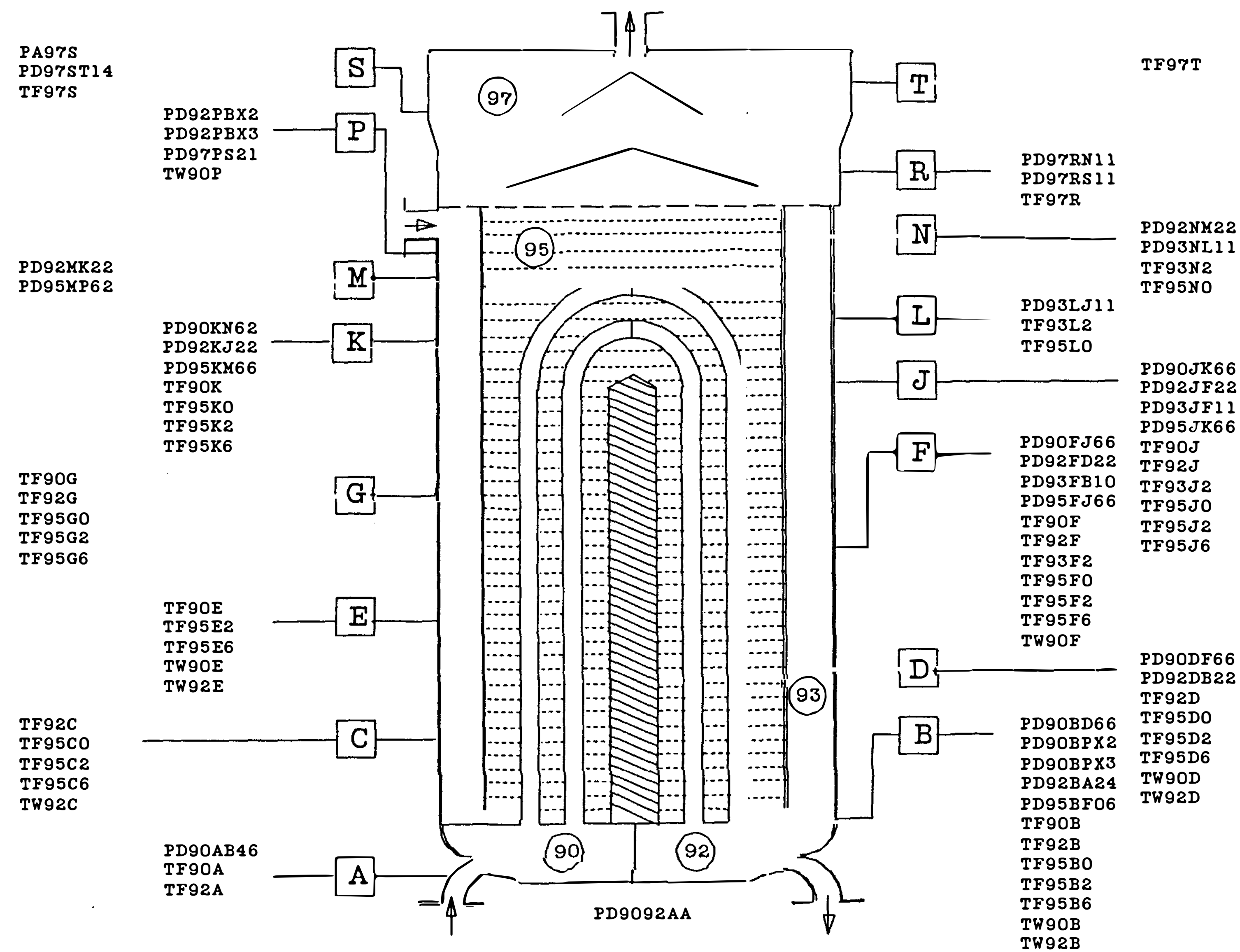


FIG.6

INSTRUMENTATION of INTACT LOOP STEAM GENERATOR for TEST BL-34

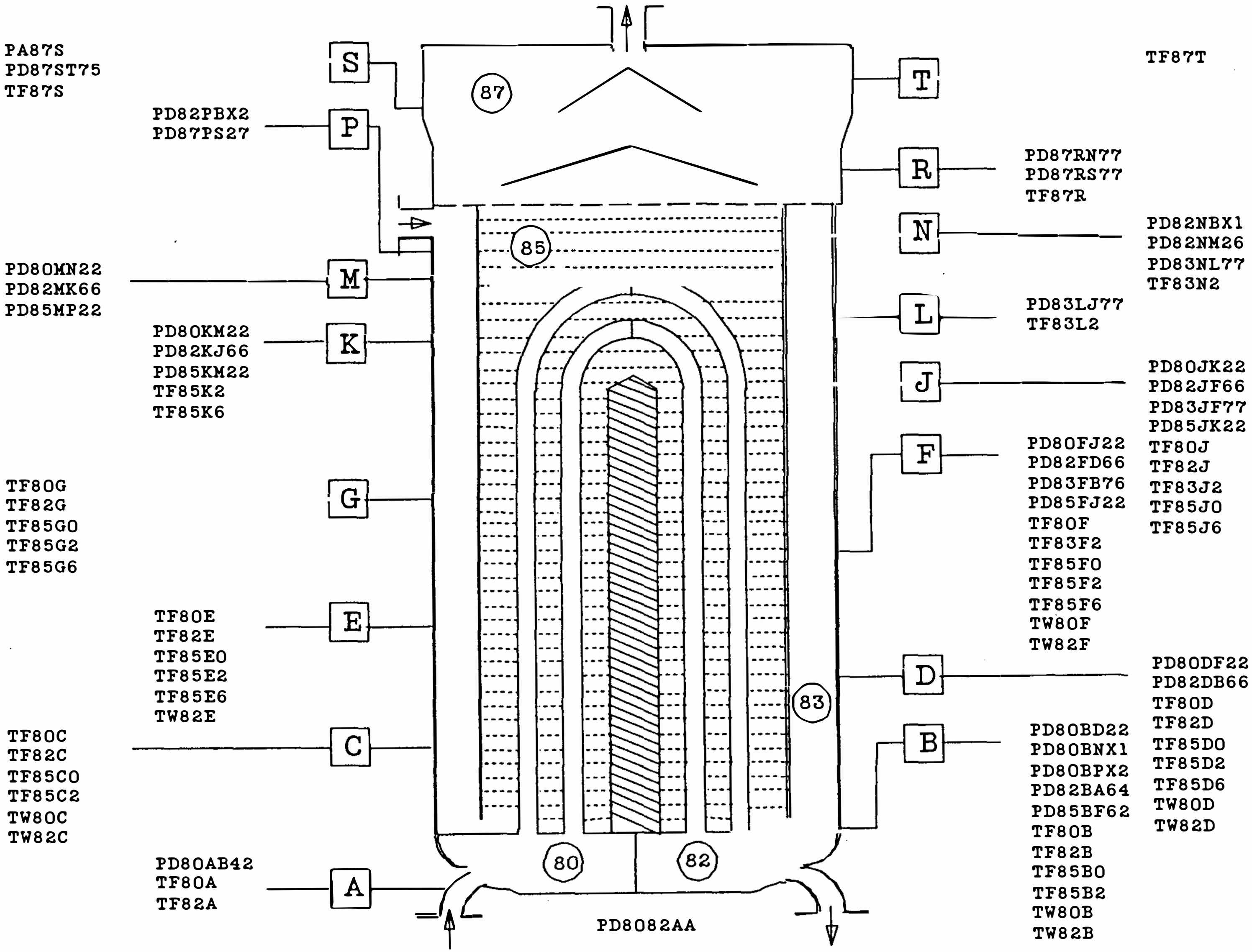


FIG.7

INSTRUMENTATION of BROKEN LOOP STEAM GENERATOR for TEST BL-34

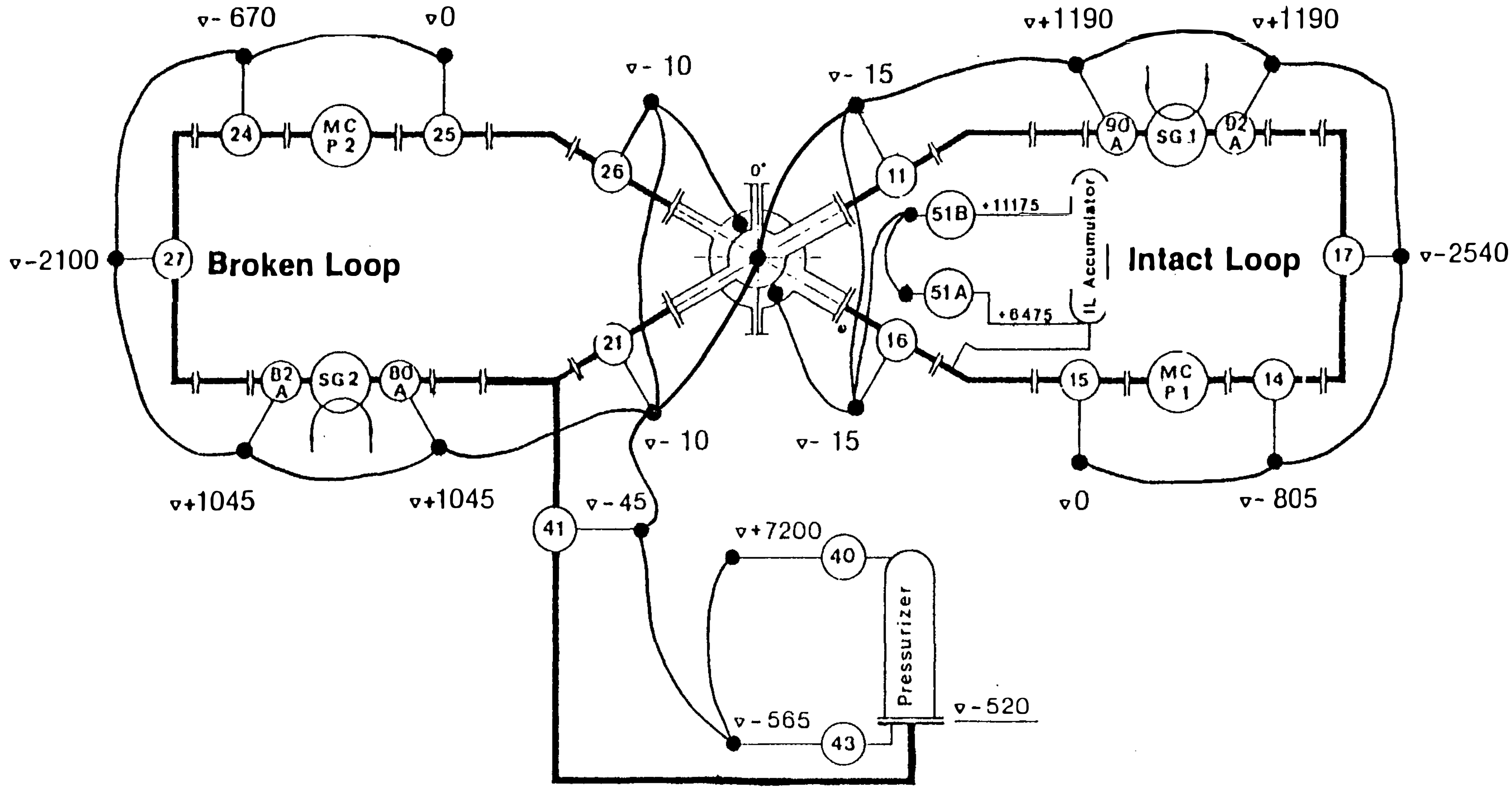


FIG.8: ELEVATION in mm OF PRIMARY LOOP DIFFERENTIAL PRESSURE CONNECTIONS FOR LOBI-MOD2 TEST BL-34

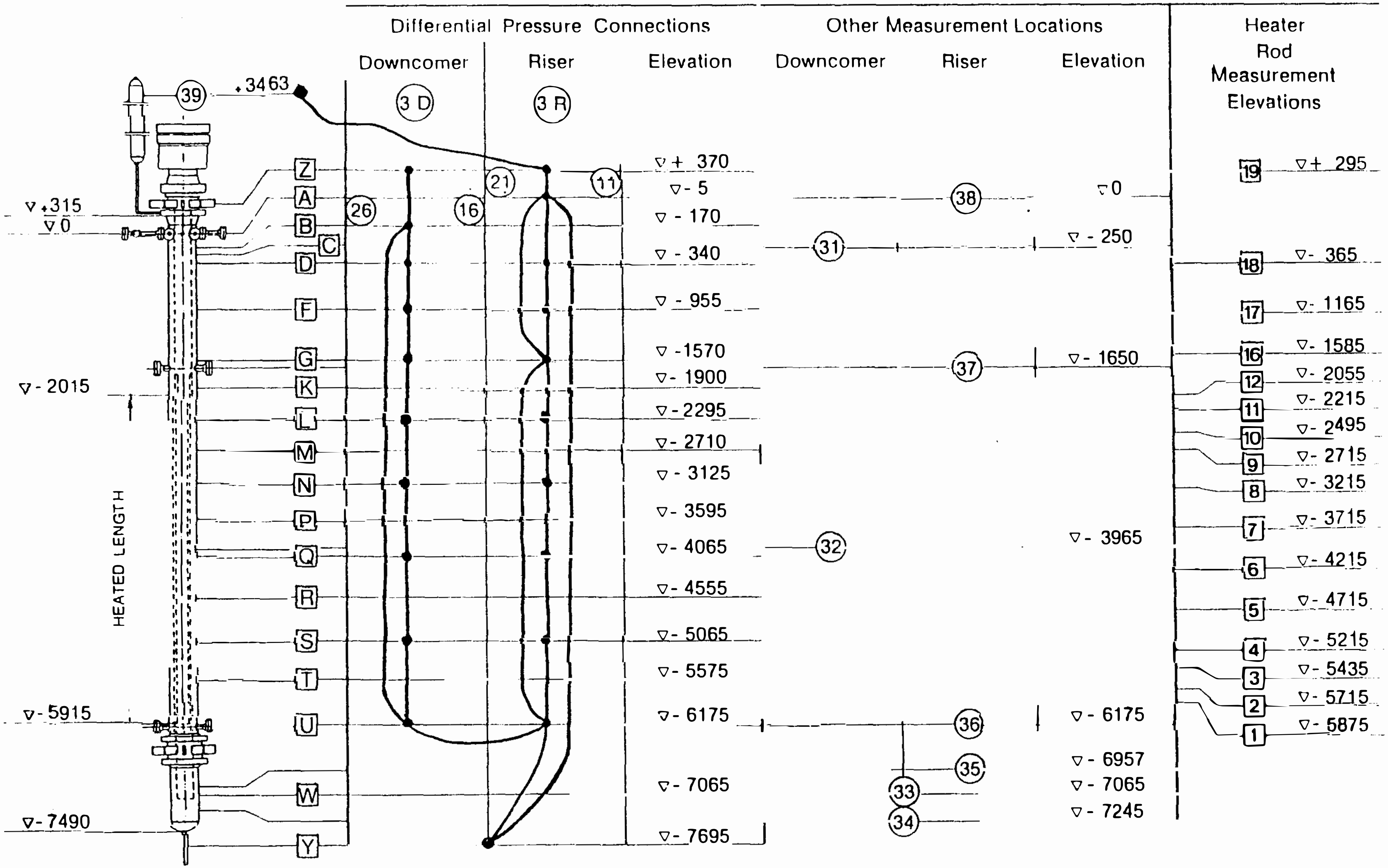


FIG.9: ELEVATION in mm OF PRESSURE VESSEL INSTRUMENTATION FOR LOBI-MOD2 TEST BL-34

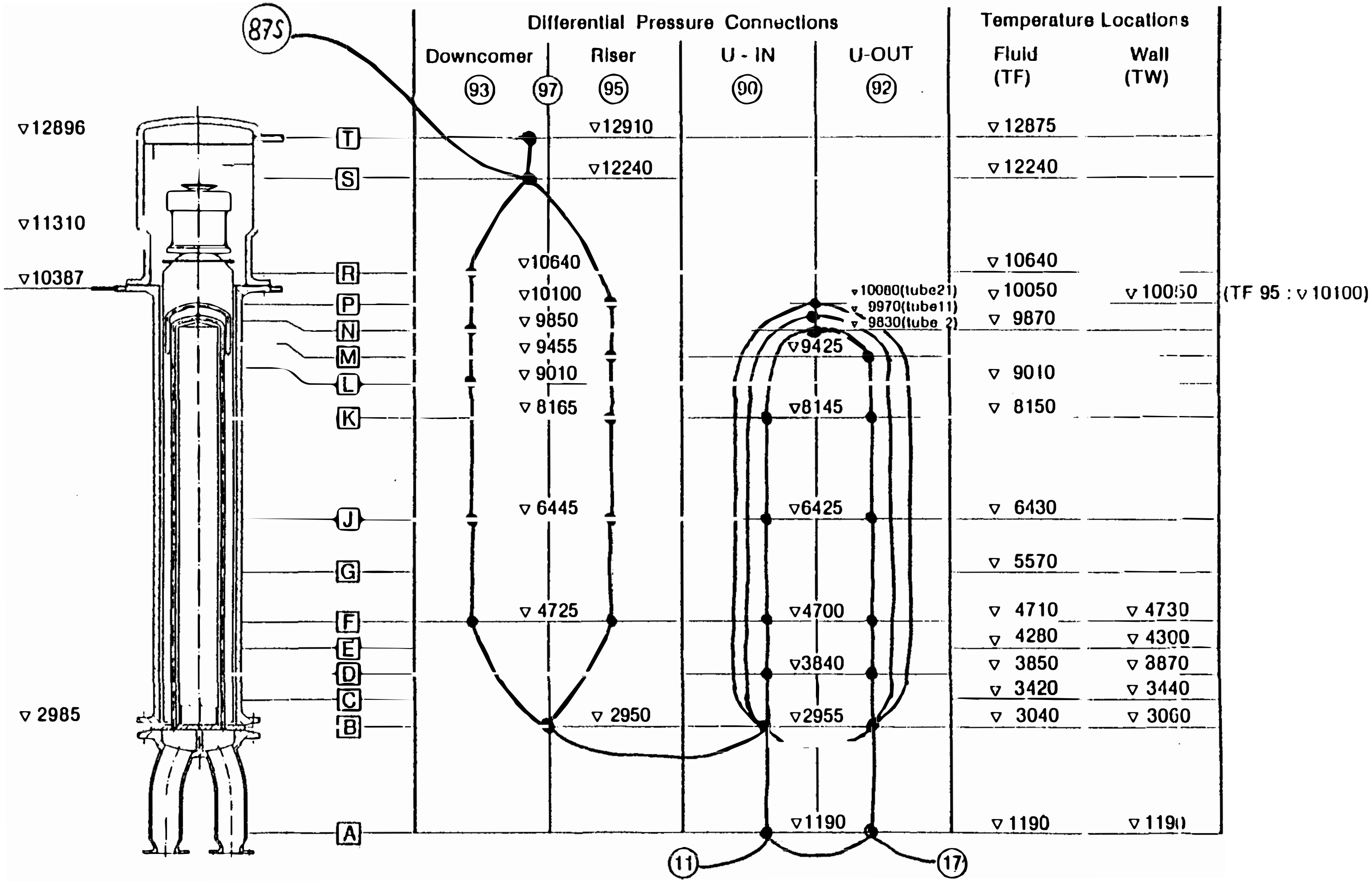


FIG.10: ELEVATION in mm OF INTACT LOOP STEAM GENERATOR INTRUMENTATION FOR LOBI-MOD2 TEST BL-34

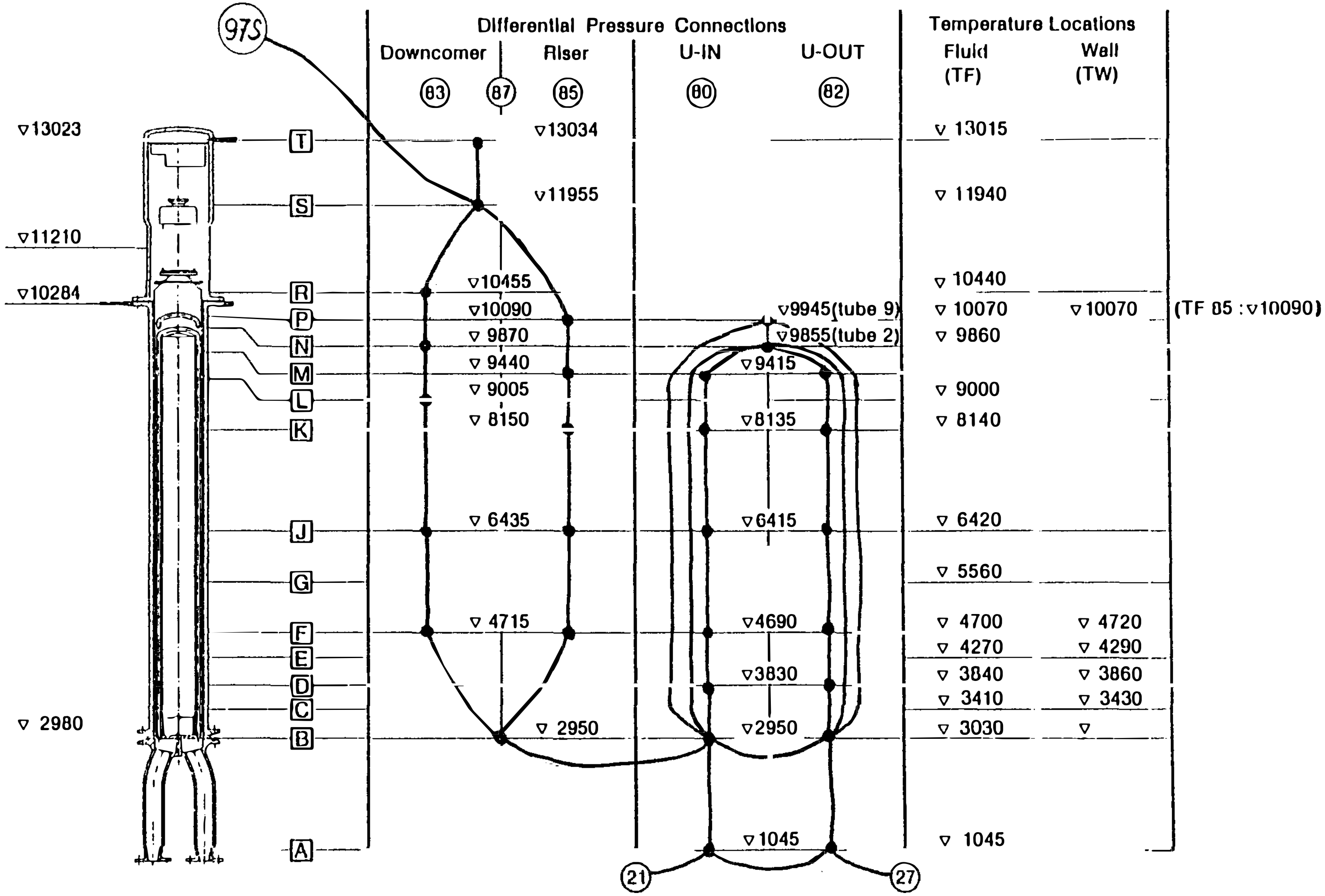


FIG.11: ELEVATION in mm OF BROKEN LOOP STEAM GENERATOR INSTRUMENTATION FOR LOBI-MOD2 TEST BL-34

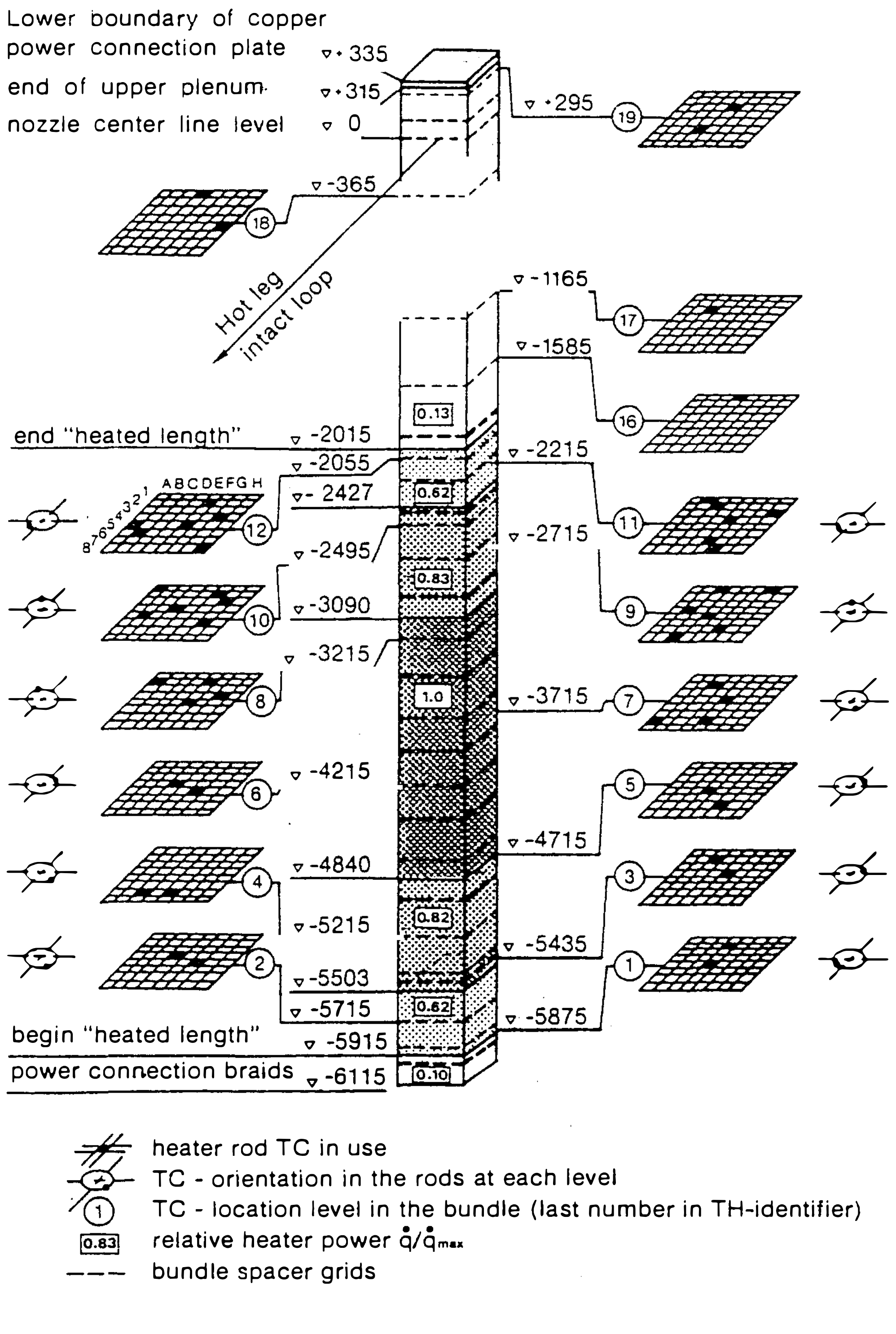


FIG.12	LOCATION OF HEATER ROD BUNDLE THERMOCOUPLES - BL-34

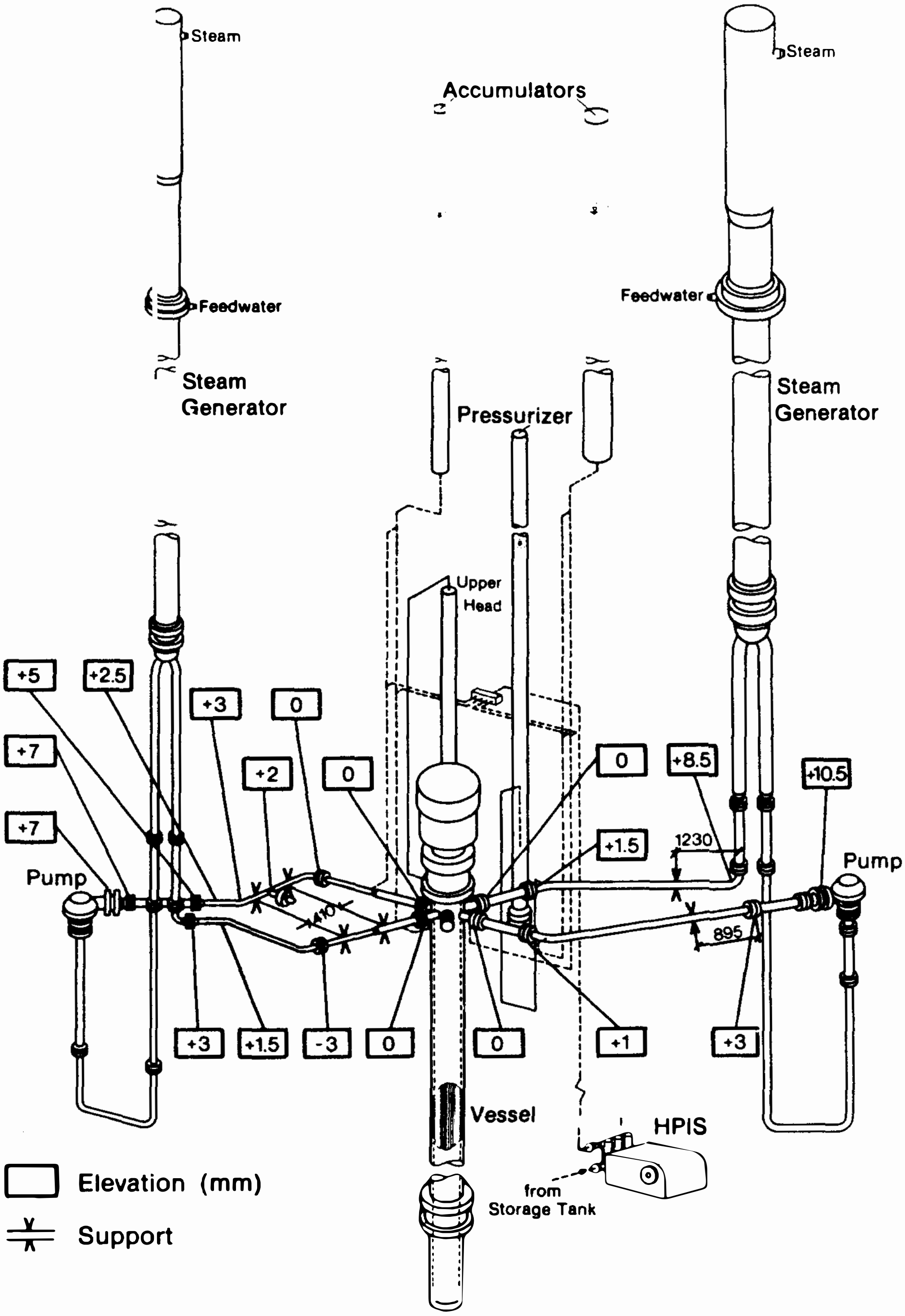


FIG.13	ALIGNMENT OF HORIZONTAL PIPEWORK - BL-34

4. TEST DESCRIPTION

This section presents test initial and boundary conditions as well as information on run-up procedure and test conduct.

4.1 Initial Conditions

The initial test conditions as well as the run-up procedure for Test BL-34 are not the typical of the LOBI installation since they have been established to represent as close as possible the scaled initial conditions of the BETHSY counter part test [1].

The specified and actual test initial conditions are listed in Table 2. Mean values of all measurement signals evaluated over about 30 s prior to test initiation are listed in Table 3.

The test facility was brought to the specified initial conditions with the secondary system in the open loop configuration and operated in the feed and steam mode. During the run-up procedure and in steady-state conditions, the main coolant pumps were operated in reverse speed in order to provide the required flow in a controllable speed range. This was required to match the reduced core power set at about decay levels as in the BETHSY installation.

4.2 Boundary Conditions

Following the establishment of the specified steady-state conditions within and acceptable tolerance, the test was initiated by opening the break valve.

- The opening of the break valve defines the initiation for the transient ('zero' time), the valve was fully open in 0.3 s.
- The actual core power for this test is shown in Fig. 14. Core power was initially set at the scaled value corresponding the BETHSY power curve. Following the 'scram' signal (13 MPa), the power was maintained for further 53 s at the initial value to compensate for the lack of full-power simulation and then started to fall merging with the expected decay curve.
- The speed of the main coolant pumps is shown in Fig. 15. The pumps were initially operated in reverse speed to provide the required flow. At 1.1 s the speed was reduced and after 2 s the pumps coasted down to zero speed.
- The secondary system was operated in the feed and steam mode during steady-state and no auxiliary feedwater injection was simulated during the transient, Fig. 16. The two steam generators remained connected without a controlled cooldown. The secondary relief valves were set at 72 bar.
- The high pressure injection system (HPIS) was not represented. The accumulator injection system (AIS) became operational at 420 s with a primary pressure at 40 bar; the accumulator injection was exhausted at 953 s after a discharge of 131 kg of water, Fig. 17. The low pressure injection system was activated at 2100 s with an injection rate of 0.4 kg/s, Fig. 18.

Test BL-34 was terminated at 2400 s after initiation. The sequence of main events is given in Table 4. Before initiation of blowdown the valve in the pipe line connecting the upper downcomer with the upper head and used to condition the fluid in the upper head at the upper downcomer fluid temperature, was closed. Sufficient time before time zero, the main coolant pump compensation system was activated. The experimental profile of primary and secondary system

Table 2: Initial Test Conditions for Test BL-34

	Specified	Actual	Units
Primary System			
Mass Flow:			
- Intact Loop	2.69	2.50	kg/s
- Broken Loop	0.89	0.90	kg/s
Pressure:			
- Upper Plenum	15.40	15.47	MPa
Fluid Temperatures:			
- Vessel outlet:			
. Intact Loop	316	316	°C
. Broken Loop	316	315	°C
- Vessel Inlet:			
. Intact Loop	285	288	°C
. Broken Loop	285	287	°C
- Pressurizer	344	344	°C
- Core Average ΔT	31	27.5	°C
- LPIS	30	c. 30	°C
- Accumulator	30	c. 30	°C
Core Power:	0.65	0.63	MW
Pump Seal Water Injection:			
- Intact Loop	0.010	0.011	kg/s
- Broken Loop	0.010	0.009	kg/s
Accumulator:			
- Pressure	4.0	3.97	MPa
- Water Volume	0.217	0.222	m^3
- Gas Volume	0.063	0.058	m^3
Pressurizer Water Level	4.7	5.0	m
Feedwater Mass Flow:			
- Intact Loop	0.182	0.19	kg/s
- Broken Loop	0.061	0.06	kg/s
Pressure:			
- Intact Loop	6.90	6.94	MPa
- Broken Loop	6.90	6.91	MPa
Temperatures:			
- Steam Generator Inlet:			
. Intact Loop	160	142	°C
. Broken Loop	160	136	°C
- Steam Generator Outlet:			
. Intact Loop	284	285	°C
. Broken Loop	284	285	°C
Downcomer Water Level (n. r.):			
- Intact Loop	8.00	8.14	m
- Broken Loop	8.40	8.48	m

Table 3: Mean Value Table at Steady-State for LOBI-MOD2 Test BL-34

TIME INTERVAL : MIN = -100.00(S) MAX = -0.50 (S)

IDENTIF.	VALUE	UNIT	IDENTIF.	VALUE	UNIT	IDENTIF.	VALUE	UNIT
CIPRES	35.9	(KG)	PA97S	6.95	(MPA)	PD80BD22	0.621E-02	(MPA)
CIPRIM	439.	(KG)	PD05AB44	4.00	(MPA)	PD80BNX1	0.499E-01	(MPA)
CISGBL	100.	(KG)	PD1190A	0.832E-02	(MPA)	PD80BPX2	0.507E-01	(MPA)
CISGIL	304.	(KG)	PD151456	-.448E-02	(MPA)	PD80DF22	0.608E-02	(MPA)
CL1190P	10.1	(M)	PD161133	0.300E-02	(MPA)	PD80FJ22	0.125E-01	(MPA)
CL1792P	9.80	(M)	PD163DB3	-.330E-03	(MPA)	PD80JK22	0.126E-01	(MPA)
CL2180P	9.95	(M)	PD1651B	0.600	(MPA)	PD80KM22	0.941E-02	(MPA)
CL2782P	9.72	(M)	PD1714	0.128E-01	(MPA)	PD80MN22	0.328E-02	(MPA)
CL3DYZ	7.99	(M)	PD2141	0.162E-04	(MPA)	PD8227A	-.225E-01	(MPA)
CL3RYZ	8.08	(M)	PD2180A	0.776E-02	(MPA)	PD82BA64	-.139E-01	(MPA)
CL4340	4.95	(M)	PD252451	-.233E-02	(MPA)	PD82DB66	-.641E-02	(MPA)
CL83BT	7.79	(M)	PD262133	0.112E-02	(MPA)	PD82FD66	-.623E-02	(MPA)
CL85BS	7.77	(M)	PD263DB7	-.721E-03	(MPA)	PD82JF66	-.124E-01	(MPA)
CL93BT	7.88	(M)	PD2724	0.106E-01	(MPA)	PD82KJ66	-.124E-01	(MPA)
CL95BS	7.85	(M)	PD3D3RBA	0.974E-03	(MPA)	PD82MK66	-.925E-02	(MPA)
CX3DYZ	8.03	(M)	PD3D3RUU	0.108E-03	(MPA)	PD82NBX1	-.500E-01	(MPA)
CX3RYZ	8.08	(M)	PD3DBD32	-.135E-02	(MPA)	PD82NM26	-.316E-02	(MPA)
CX83BT	8.48	(M)	PD3DBU30	-.441E-01	(MPA)	PD82PBX2	-.508E-01	(MPA)
CX85BS	8.57	(M)	PD3DDF24	-.454E-02	(MPA)	PD83FB76	-.123E-01	(MPA)
CX93BT	8.14	(M)	PD3DFG42	-.452E-02	(MPA)	PD83JF77	-.118E-01	(MPA)
CX95BS	8.51	(M)	PD3DGL24	-.535E-02	(MPA)	PD83LJ77	-.168E-01	(MPA)
DD11HDIA	691.	(KG/M3)	PD3DLN44	-.609E-02	(MPA)	PD83NL77	-.527E-02	(MPA)
DD11HPER	689.	(KG/M3)	PD3DNQ44	-.687E-02	(MPA)	PD85BF62	0.132E-01	(MPA)
DD14VDIA	757.	(KG/M3)	PD3DQS44	-.733E-02	(MPA)	PD85FJ22	0.113E-01	(MPA)
DD14VPER	750.	(KG/M3)	PD3DSU42	-.814E-02	(MPA)	PD85JK22	0.105E-01	(MPA)
DD16HDIA	751.	(KG/M3)	PD3DZB47	-.382E-02	(MPA)	PD85KM22	0.777E-02	(MPA)
DD16HPER	752.	(KG/M3)	PD3R11A4	0.485E-03	(MPA)	PD85MP22	0.400E-02	(MPA)
DD21HDIA	691.	(KG/M3)	PD3R21A4	-.348E-03	(MPA)	PD87PS27	0.106E-01	(MPA)
DD21HPER	691.	(KG/M3)	PD3R39Z	0.233E-01	(MPA)	PD87RN77	-.390E-02	(MPA)
DD22VDIA	690.	(KG/M3)	PD3RAZ	0.264E-02	(MPA)	PD87RS77	0.728E-02	(MPA)
DD22VPER	691.	(KG/M3)	PD3RDA44	0.224E-02	(MPA)	PD87ST75	0.464E-03	(MPA)
DD24VDIA	751.	(KG/M3)	PD3RFD24	0.421E-02	(MPA)	PD9092	-.864E-03	(MPA)
DD24VPER	748.	(KG/M3)	PD3RGA44	0.107E-01	(MPA)	PD9092AA	-.933E-03	(MPA)
DD25HDIA	754.	(KG/M3)	PD3RGF12	0.426E-02	(MPA)	PD9092BB	0.329E-04	(MPA)
DD25HPER	753.	(KG/M3)	PD3RLG01	0.530E-02	(MPA)	PD9093BB	0.504	(MPA)
DD26HDIA	756.	(KG/M3)	PD3RNL00	0.613E-02	(MPA)	PD90AB46	0.122E-01	(MPA)
DD26HPER	756.	(KG/M3)	PD3RQN00	0.698E-02	(MPA)	PD90BD66	0.612E-02	(MPA)
DS35VDIA	754.	(KG/M3)	PD3RSQ00	0.756E-02	(MPA)	PD90BPX2	0.507E-01	(MPA)
IH-1MW	20.3	(K-AMP)	PD3RUG11	0.345E-01	(MPA)	PD90BPX3	0.514E-01	(MPA)
IH-5MW	20.3	(K-AMP)	PD3RUS10	0.869E-02	(MPA)	PD90DF66	0.611E-02	(MPA)
MP71	-20.2	(NM)	PD3RYA	0.566E-01	(MPA)	PD90FJ66	0.124E-01	(MPA)
MP72	-9.30	(NM)	PD3RYU21	0.114E-01	(MPA)	PD90JK66	0.125E-01	(MPA)
PA05B	0.104	(MPA)	PD4143	-.695E-03	(MPA)	PD90KN62	0.124E-01	(MPA)
PA11	15.5	(MPA)	PD4340	0.321E-01	(MPA)	PD9217A	-.268E-01	(MPA)
PA16	15.5	(MPA)	PD51AB	0.388E-01	(MPA)	PD92BA24	-.129E-01	(MPA)
PA26	15.5	(MPA)	PD8082	-.671E-03	(MPA)	PD92DB22	-.637E-02	(MPA)
PA38	15.5	(MPA)	PD8082AA	-.884E-03	(MPA)	PD92FD22	-.626E-02	(MPA)
PA40	15.4	(MPA)	PD8082BB	0.142E-03	(MPA)	PD92JF22	-.125E-01	(MPA)
PA51B	3.96	(MPA)	PD8083BB	0.498	(MPA)	PD92KJ22	-.124E-01	(MPA)
PA87S	6.91	(MPA)	PD80AB42	0.131E-01	(MPA)	PD92MK22	-.932E-02	(MPA)

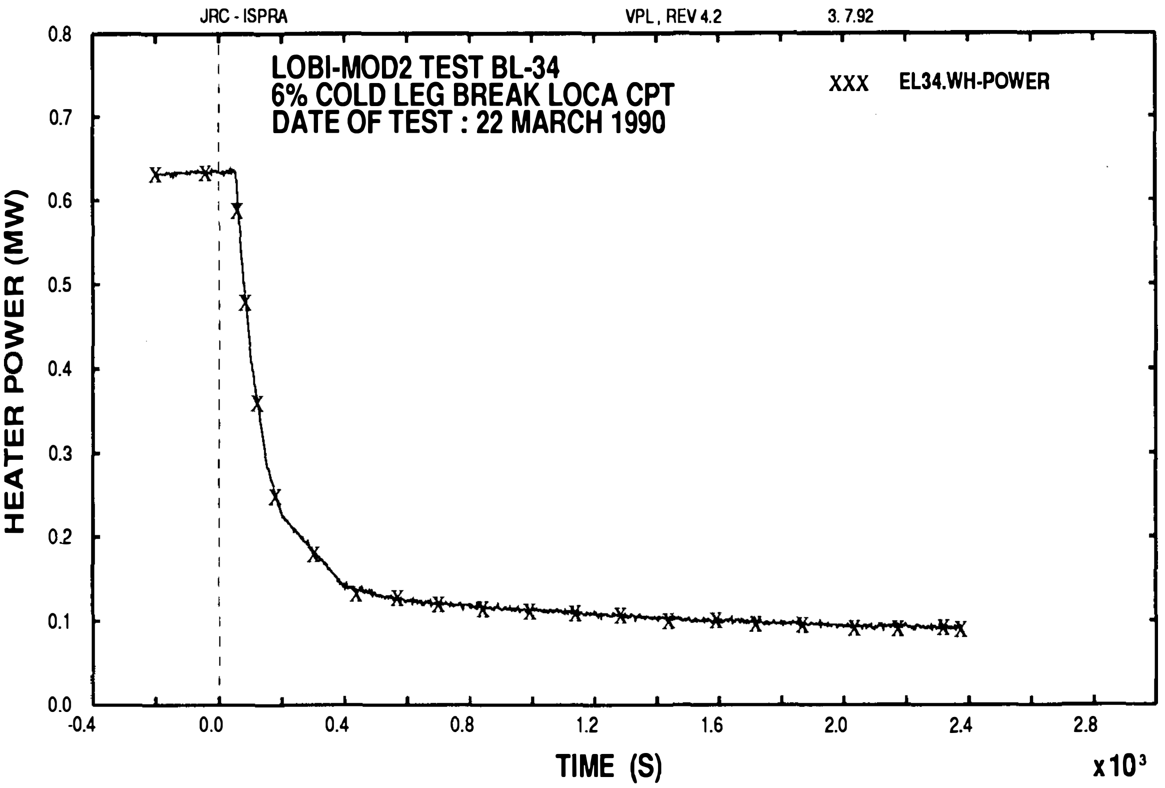
Table 3: (cont.d)

TIME INTERVAL : MIN = -100.00(S) MAX = -0.50 (S)

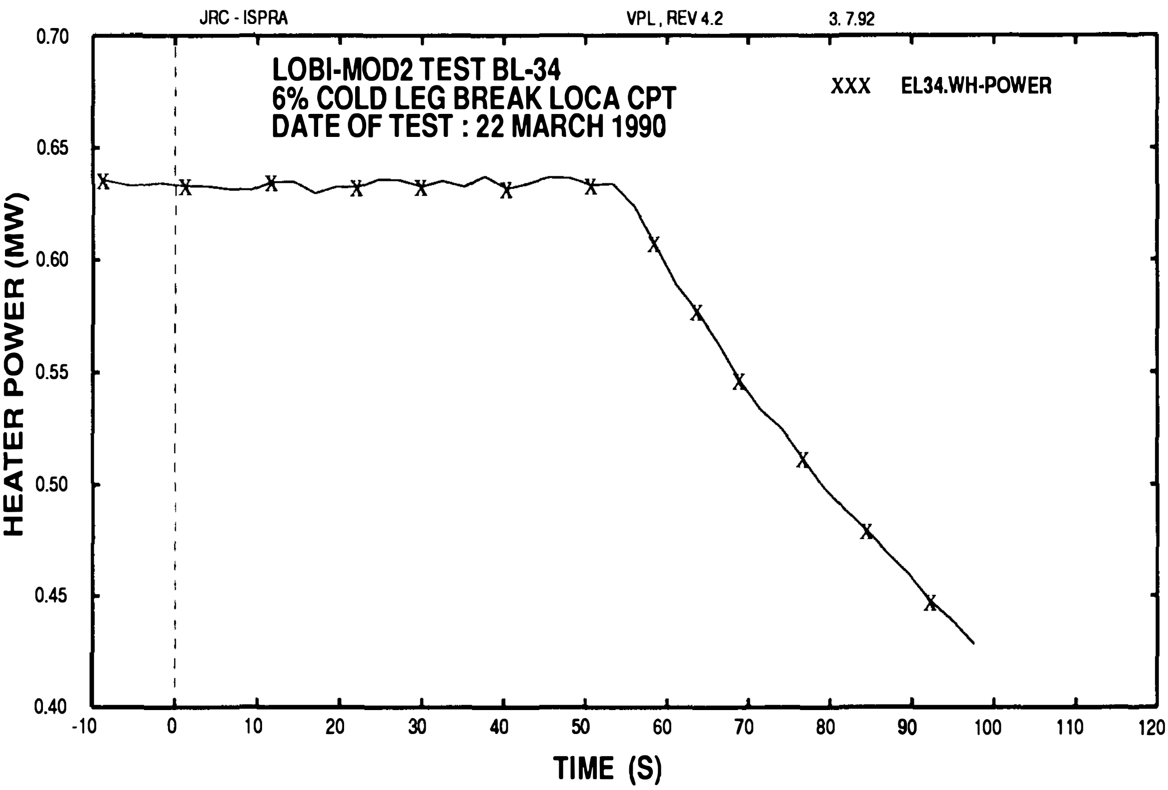
IDENTIF.	VALUE	UNIT	IDENTIF.	VALUE	UNIT	IDENTIF.	VALUE	UNIT
PD92NM22	-.290E-02	(MPA)	QV41V	0.131E-04	(M3/S)	TF71SEAL	23.7	(C)
PD92PBX2	-.505E-01	(MPA)	QV55ACC	0.000E+00	(M3/S)	TF72SEAL	23.5	(C)
PD92PBX3	-.515E-01	(MPA)	QV65HVX	0.528E-02	(M3/S)	TF80A	314.6	(C)
PD93FB10	-.127E-01	(MPA)	QV66HVX	0.163E-02	(M3/S)	TF80B	314.5	(C)
PD93JF11	-.122E-01	(MPA)	RP71	-.268E+04	(1/MIN)	TF80C	310.7	(C)
PD93LJ11	-.181E-01	(MPA)	RP72	-.180E+04	(1/MIN)	TF80D	306.5	(C)
PD93NL11	-.578E-02	(MPA)	RPHPIS	-.130	(1/MIN)	TF80E	303.4	(C)
PD95BF06	0.134E-01	(MPA)	TD111617	28.8	(C)	TF80F	302.1	(C)
PD95FJ66	0.119E-01	(MPA)	TD121324	27.3	(C)	TF80G	298.2	(C)
PD95JK66	0.109E-01	(MPA)	TD212616	31.7	(C)	TF80J	294.7	(C)
PD95KM66	0.777E-02	(MPA)	TD222324	27.5	(C)	TF82A	288.2	(C)
PD95MP62	0.393E-02	(MPA)	TF05A	282.9	(C)	TF82B	288.8	(C)
PD9787SS	-.779E-03	(MPA)	TF05B	35.3	(C)	TF82C	288.5	(C)
PD97PS21	0.101E-01	(MPA)	TF11H000	315.6	(C)	TF82D	287.0	(C)
PD97RN11	-.548E-02	(MPA)	TF11H180	316.0	(C)	TF82E	287.4	(C)
PD97RS11	0.367E-02	(MPA)	TF12V270	316.2	(C)	TF82G	287.5	(C)
PD97ST14	0.399E-03	(MPA)	TF13V090	288.7	(C)	TF82J	287.9	(C)
PDCOND	0.581E-04	(MPA)	TF14V045	288.1	(C)	TF83F2	285.2	(C)
PDCOOL	0.596E-03	(MPA)	TF15H000	287.5	(C)	TF83J2	284.5	(C)
PDSSCOND	0.746E-01	(MPA)	TF15H180	286.3	(C)	TF83L2	282.8	(C)
PDSSCOOL	0.879E-01	(MPA)	TF16H000	287.4	(C)	TF83N2	282.1	(C)
QF12V	0.847	(M/S)	TF16H180	286.8	(C)	TF85B0	287.1	(C)
QF14V	0.839	(M/S)	TF21H000	314.7	(C)	TF85B2	287.0	(C)
QF22V	0.787	(M/S)	TF21H180	315.8	(C)	TF85C0	287.8	(C)
QF24V	0.712	(M/S)	TF22V090	315.4	(C)	TF85C2	286.0	(C)
QI01H000	-.205E-03		TF23V270	288.8	(C)	TF85D0	285.9	(C)
QI01H180	-.205E-03		TF24V270	288.1	(C)	TF85D2	288.5	(C)
QI05H000	0.718E-03		TF25H000	285.4	(C)	TF85D6	287.7	(C)
QI05H180	-.135E-02		TF25H180	285.8	(C)	TF85E0	285.7	(C)
QI11H180	0.744E-03		TF26H000	284.5	(C)	TF85E2	286.7	(C)
QI11H300	-.123E-02		TF26H180	283.7	(C)	TF85E6	286.1	(C)
QI12V090	0.128E-03		TF31V030	286.4	(C)	TF85F0	286.8	(C)
QI22V090	0.769E-04		TF31V210	289.7	(C)	TF85F2	286.8	(C)
QL05EWT	0.256E-01	(KG)	TF32V120	286.6	(C)	TF85F6	286.9	(C)
QM50HPI	0.000E+00	(KG/S)	TF32V300	285.9	(C)	TF85G0	286.2	(C)
QM57AF	0.180	(KG/S)	TF33V030	286.6	(C)	TF85G2	286.5	(C)
QM57AFH	0.185	(KG/S)	TF34V210	285.2	(C)	TF85G6	287.6	(C)
QM58AF	0.606E-01	(KG/S)	TF35V135	285.6	(C)	TF85J0	286.2	(C)
QM58AFH	0.615E-01	(KG/S)	TF36V165	284.8	(C)	TF85J6	286.6	(C)
QP83V150	0.220	(KPA)	TF37V165	303.9	(C)	TF85K2	288.4	(C)
QP93V210	0.446	(KPA)	TF38H000	314.5	(C)	TF85K6	288.6	(C)
QP93V330	0.367	(KPA)	TF39	290.0	(C)	TF87R	286.8	(C)
QS70DRAI	0.236E-01	(KG/S)	TF40V000	345.9	(C)	TF87S	286.8	(C)
QS71	0.109E-01	(KG/S)	TF41V000	314.6	(C)	TF87T	286.5	(C)
QS71IN	0.586E-01	(KG/S)	TF42V000	339.3	(C)	TF90A	316.4	(C)
QS71OUT	0.478E-01	(KG/S)	TF55ACCU	84.5	(C)	TF90B	313.0	(C)
QS72	0.872E-02	(KG/S)	TF63H000	141.4	(C)	TF90E	304.1	(C)
QS72IN	0.649E-01	(KG/S)	TF64H000	135.6	(C)	TF90F	300.2	(C)
QS72OUT	0.562E-01	(KG/S)	TF65H090	285.9	(C)	TF90G	297.8	(C)
QT35V000	0.218E-02	(M/S)	TF66H270	286.3	(C)	TF90J	294.8	(C)

TIME INTERVAL : MIN = -100.00(S) MAX = -0.50 (S)

IDENTIF.	VALUE	UNIT	IDENTIF.	VALUE	UNIT	IDENTIF.	VALUE	UNIT
TF90K	290.4	(C)	TH32E208	322.2	(C)	TW21H180	313.8	(C)
TF92A	288.6	(C)	TH32E312	324.5	(C)	TW22V090	315.2	(C)
TF92B	286.4	(C)	TH32F210	323.6	(C)	TW23V270	288.5	(C)
TF92C	286.5	(C)	TH33C217	314.3	(C)	TW24V270	287.6	(C)
TF92D	286.7	(C)	TH33E119	320.9	(C)	TW25H000	283.3	(C)
TF92F	286.6	(C)	TH33G210	323.5	(C)	TW25H180	283.1	(C)
TF92G	286.0	(C)	TH33H311	323.2	(C)	TW26H000	283.6	(C)
TF92J	286.7	(C)	TH34B209	317.7	(C)	TW26H180	280.8	(C)
TF93F2	283.2	(C)	TH34D106	314.9	(C)	TW31V165	287.2	(C)
TF93J2	282.1	(C)	TH34D210	323.8	(C)	TW31V345	286.4	(C)
TF93L2	284.4	(C)	TH34D402	299.5	(C)	TW32V165	284.9	(C)
TF93N2	280.9	(C)	TH34E103	297.6	(C)	TW32V345	285.8	(C)
TF95B0	284.6	(C)	TH34E311	322.8	(C)	TW33V075	284.1	(C)
TF95B2	283.3	(C)	TH34E407	319.6	(C)	TW34V140	283.7	(C)
TF95B6	284.9	(C)	TH34G208	321.5	(C)	TW80B	289.9	(C)
TF95C0	284.5	(C)	TH34G312	325.7	(C)	TW80C	288.7	(C)
TF95C2	284.1	(C)	TH35A312	312.8	(C)	TW80D	287.5	(C)
TF95C6	285.2	(C)	TH35B210	319.7	(C)	TW80F	287.4	(C)
TF95D0	284.5	(C)	TH35D105	310.9	(C)	TW82B	286.9	(C)
TF95D2	284.7	(C)	TH35D209	321.6	(C)	TW82C	286.7	(C)
TF95D6	286.1	(C)	TH35D301	295.6	(C)	TW82D	286.1	(C)
TF95E2	285.0	(C)	TH35E208	322.2	(C)	TW82E	286.4	(C)
TF95E6	286.2	(C)	TH35E312	323.3	(C)	TW82F	286.5	(C)
TF95F0	285.8	(C)	TH35F106	316.0	(C)	TW90B	287.7	(C)
TF95F6	286.2	(C)	TH35F402	298.2	(C)	TW90D	286.2	(C)
TF95G0	286.2	(C)	TH35H518	319.1	(C)	TW90E	285.9	(C)
TF95G2	286.0	(C)	TH36B312	319.5	(C)	TW90F	286.6	(C)
TF95G6	286.3	(C)	TH36D319	320.8	(C)	TW90P	283.4	(C)
TF95J0	285.9	(C)	TH36G210	324.3	(C)	TW92B	282.9	(C)
TF95J2	287.4	(C)	TH37A407	314.5	(C)	TW92C	284.8	(C)
TF95J6	286.1	(C)	TH37C404	302.1	(C)	TW92D	284.7	(C)
TF95K0	285.6	(C)	TH37E311	319.0	(C)	TW92E	284.9	(C)
TF95K2	285.5	(C)	TH37E407	315.7	(C)	VH-1MW	32.2	(V)
TF95K6	285.3	(C)	TH37F105	308.3	(C)	VH-5MW	32.1	(V)
TF95L0	285.7	(C)	TH37F209	320.9	(C)	WH-POWER	0.634	(MW)
TF95N0	285.0	(C)	TH37G404	300.8	(C)	WH45PREZ	0.318E-02	(MW)
TF97R	286.6	(C)	TH38C209	318.1	(C)			
TF97S	287.0	(C)	TH38F311	313.8	(C)			
TF97T	286.3	(C)	TH38H312	315.1	(C)			
TH31A210	322.0	(C)	TW05B	35.5	(C)			
TH31B311	321.6	(C)	TW11H000	314.3	(C)			
TH31C209	326.1	(C)	TW11H180	315.2	(C)			
TH31D616	314.4	(C)	TW12V270	316.8	(C)			
TH31D618	317.9	(C)	TW13V090	288.8	(C)			
TH31G209	324.5	(C)	TW14V045	287.6	(C)			
TH32A208	314.6	(C)	TW15H000	287.8	(C)			
TH32C103	298.2	(C)	TW15H180	286.6	(C)			
TH32C311	321.4	(C)	TW16H000	286.2	(C)			
TH32C407	318.8	(C)	TW16H180	285.9	(C)			
TH32D301	297.6	(C)	TW21H000	313.8	(C)			

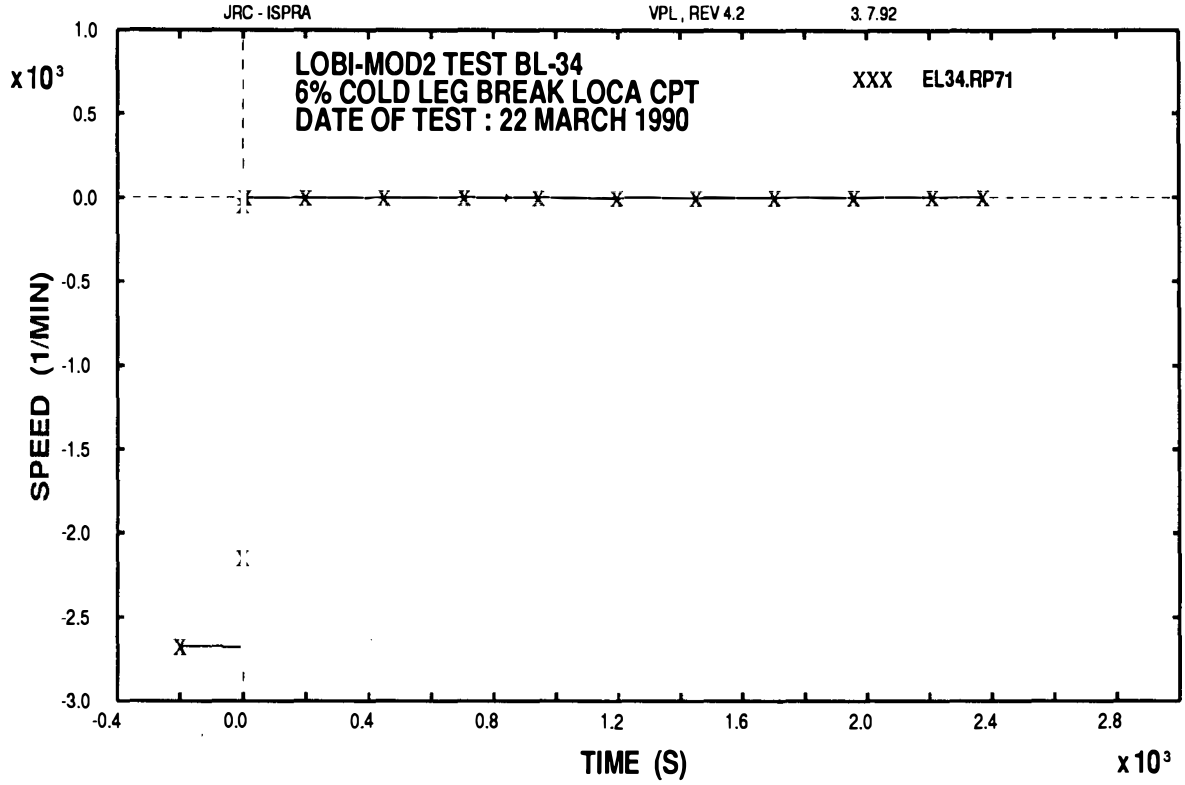


a) normal time

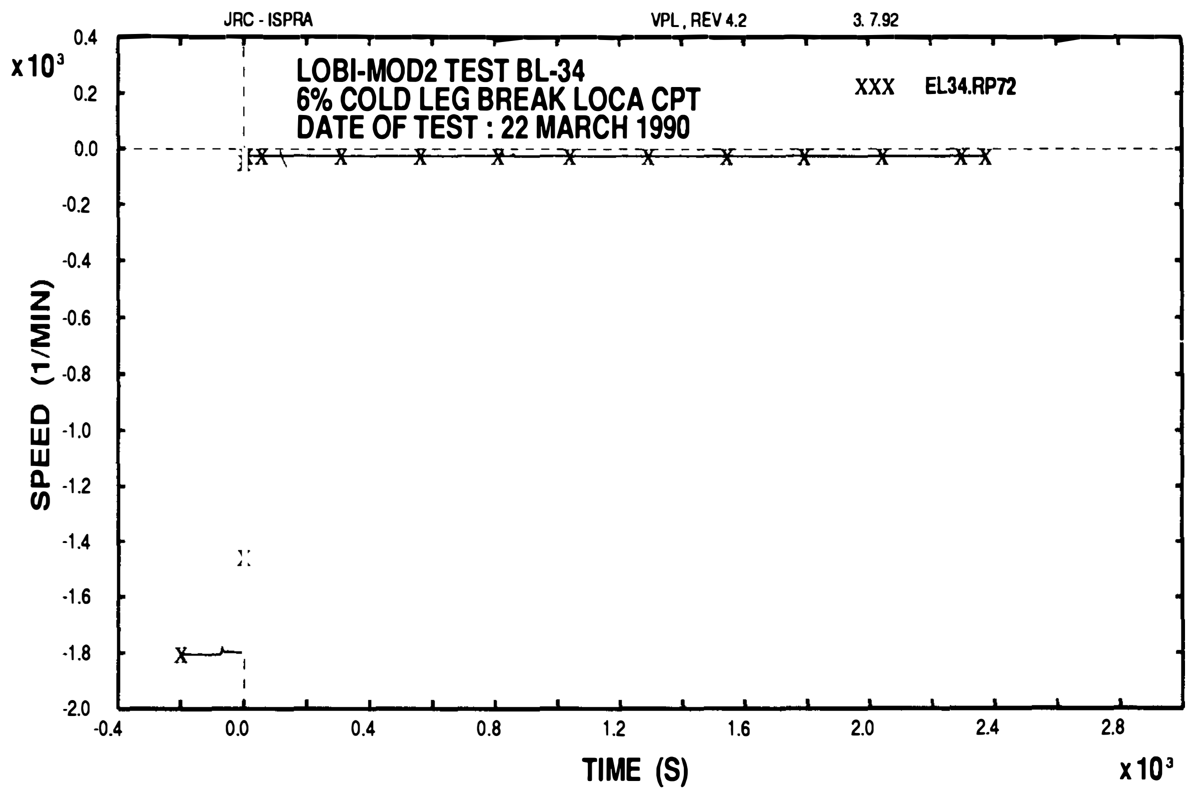


b) short time

FIG. 14: CORE POWER FOR LOBI-MOD2 TEST BL-34

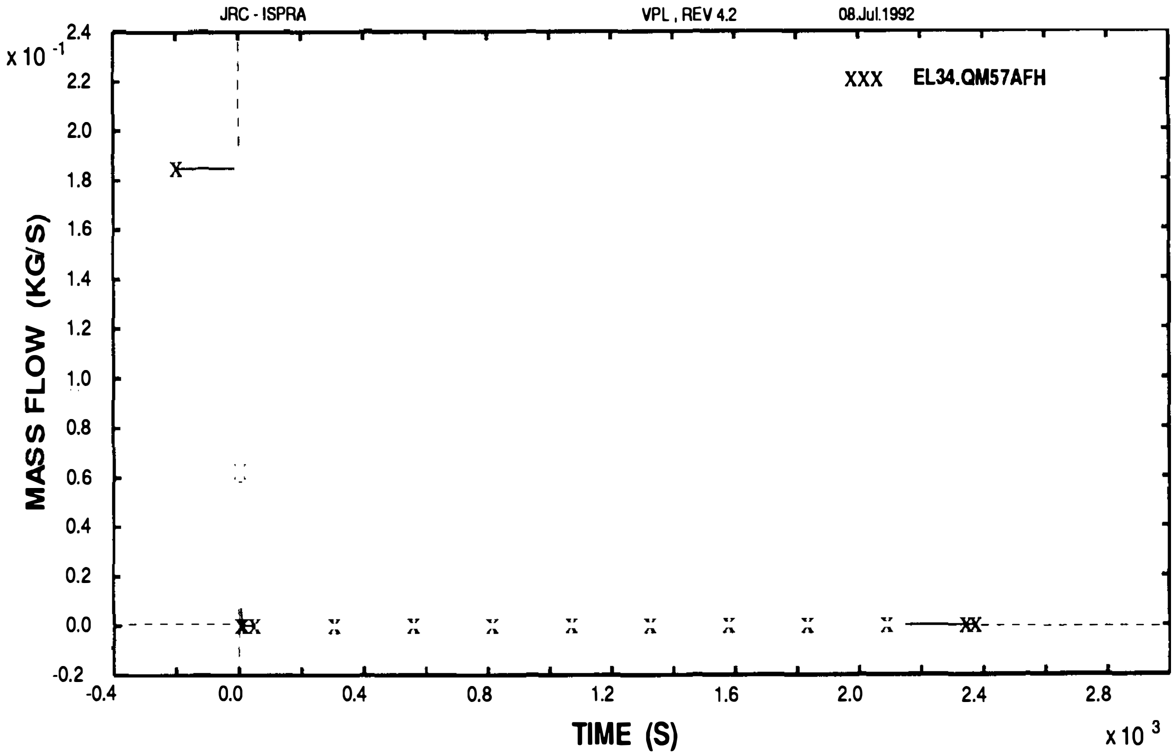


a) intact loop pump

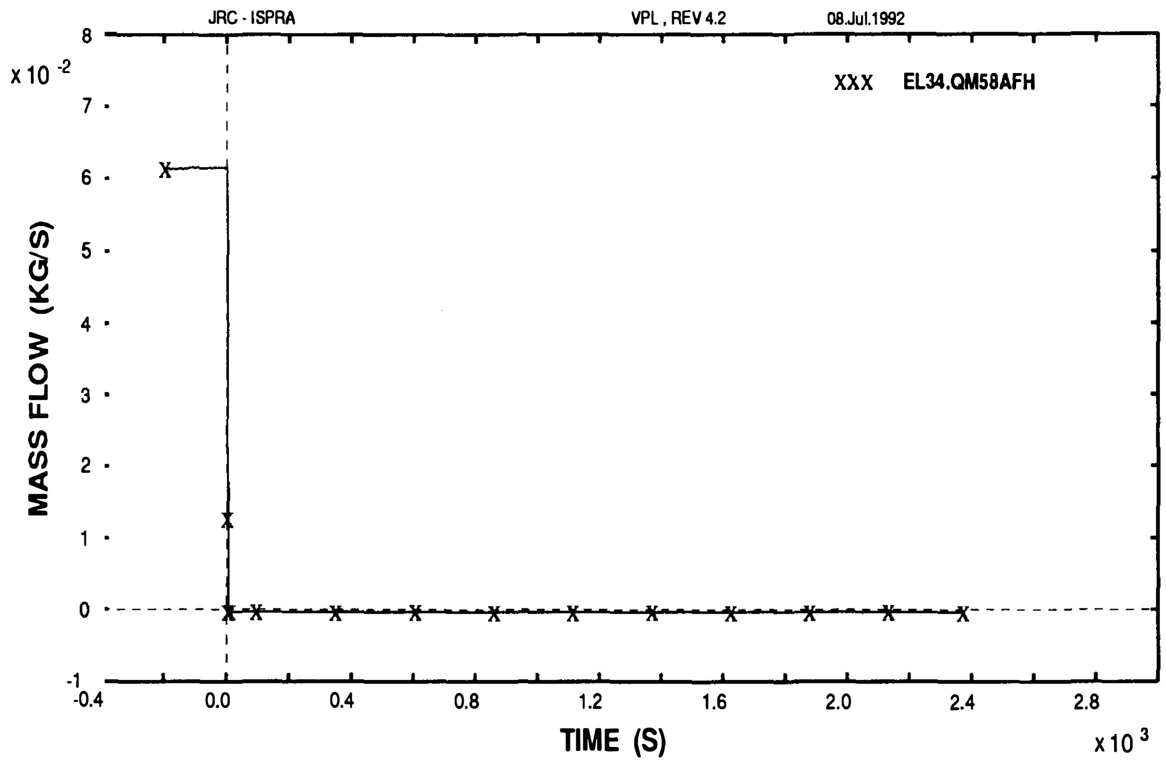


b) broken loop pump

FIG. 15: MAIN COOLANT PUMP SPEED FOR LOBI-MOD2 TEST BL-34



a) intact loop



b) broken loop

FIG.16: STEAM GENERATOR FEEDWATER INJECTION FOR LOBI-MOD2 TEST BL-34

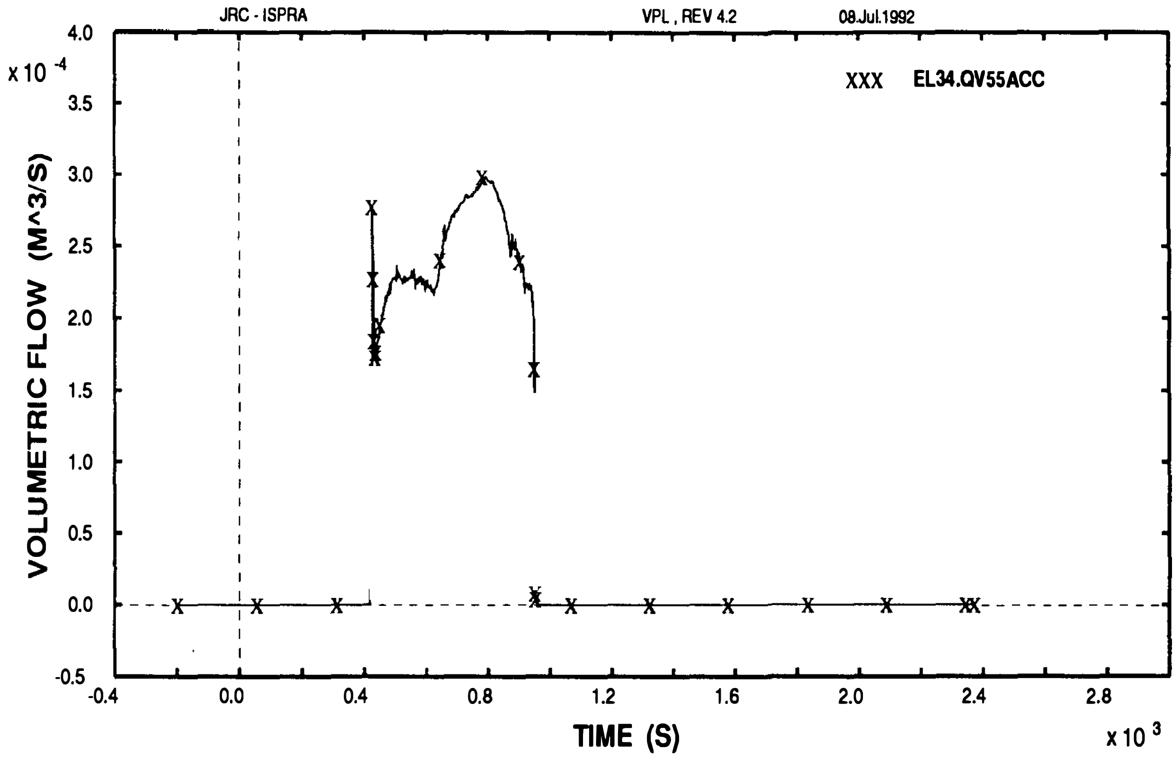


FIG.17: ACCUMULATOR INJECTION FLOW FOR LOBI-MOD2 TEST BL-34

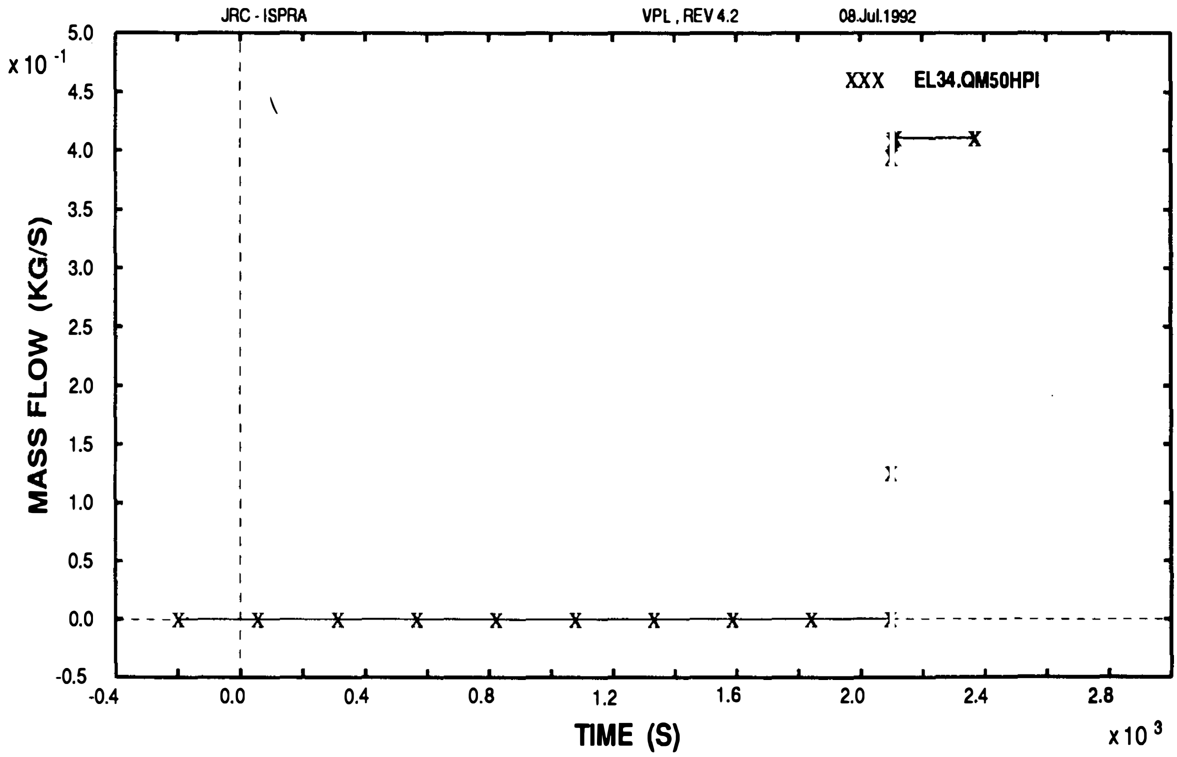


FIG.18: HPIS INJECTION FLOW FOR LOBI-MOD2 TEST BL-34

Table 4: Sequence of Main Events for Test BL-34

Time (s)	Event
- 243	Valve to top of upper head closed
- 14	MCP seal water compensation system from lower plenum on
- 4	Upper plenum seal water drain valve off
0	Break valve on, full open within 0.3 s Pressurizer heaters off
	Secondary system feed water injection stopped
	Secondary system steam off valves closed
	Secondary system relief valve set at 72 bar
1.1	MCP speed start to decrease
3.1	MCPs at zero speed, brakes on
53	Core power decay curve on
420	Accumulator injection system on
953	Accumulator injection system off
2100	Low pressure injection system on
2400	Test End

pressures and heater rod temperature is illustrated in Fig. 19 and Fig. 20, respectively.

5. DATA PRESENTATION

5.1 Plot Format

The data plots for this test cover the time range from about - 200 to 2400 s with respect to transient initiation, as selected for the corresponding experimental data tape (EDT).

Each data plot consists of 991 data points; a data point represents a mean value for the encompassing time interval. For most data points the duration of the time interval encompassing the mean values is 2.4 s. The mean values are calculated directly from the raw measurement data. Each channel is then calibrated, corrected and checked for consistency. Details of the data processing procedure, consistency checks and algorithms used for calculated parameters are outlined in Appendices C to E. All measurement channels in use for this test as well as the main characteristics of the instrumentation and related electronics are listed in the Test Log Sheet, see Appendix F.

5.2 Measurement Uncertainties

The curves for the main experimental data are provided with uncertainty bands. These bands represent the total probable range for the measurement, including the individual uncertainties of the transducers and their installation, calibration, etc., as well as those of the electronic chains and data acquisition. They are defined as the total probable uncertainty within 95 % confidence limits. The uncertainty band components for the main instrumentation types are given in Appendix D.

No attempt has been made to include the uncertainties arising from the interpretation of the measurements under two-phase flow and transient conditions. The estimated values are strictly valid only for stationary single-phase flow. This should be kept in mind when referring to uncertainty bands plotted in the graphs at different points over the course of the test.

In the fluid- and wall-temperature plots the uncertainty bands have been omitted: the actual band of circa ± 0.9 K reduces at the normal plot-scale to a single line. Note, however, that this band for the fluid temperatures does not included possible errors after dryout, due to "hot wall" effects: in the limiting case (stagnant, non-condensing steam) TFs can be expected to read virtually wall temperature.

5.3 Calculated Parameters

Calculated parameters in the Experimental Data Report for this test are mixture and collapsed liquid levels in the steam generators and the pressure vessel, as well as mass inventory data, see Section 7. The algorithm used to obtain these graphs is described in Appendix E. Calculated data should be interpreted with caution. The uncertainties of the particular model used for calculation must be kept in mind in addition to measurement uncertainties of the data used in the algorithm. Typical model errors arise for calculated liquid levels from the presence of subcooled liquid or when flow velocities are not small.

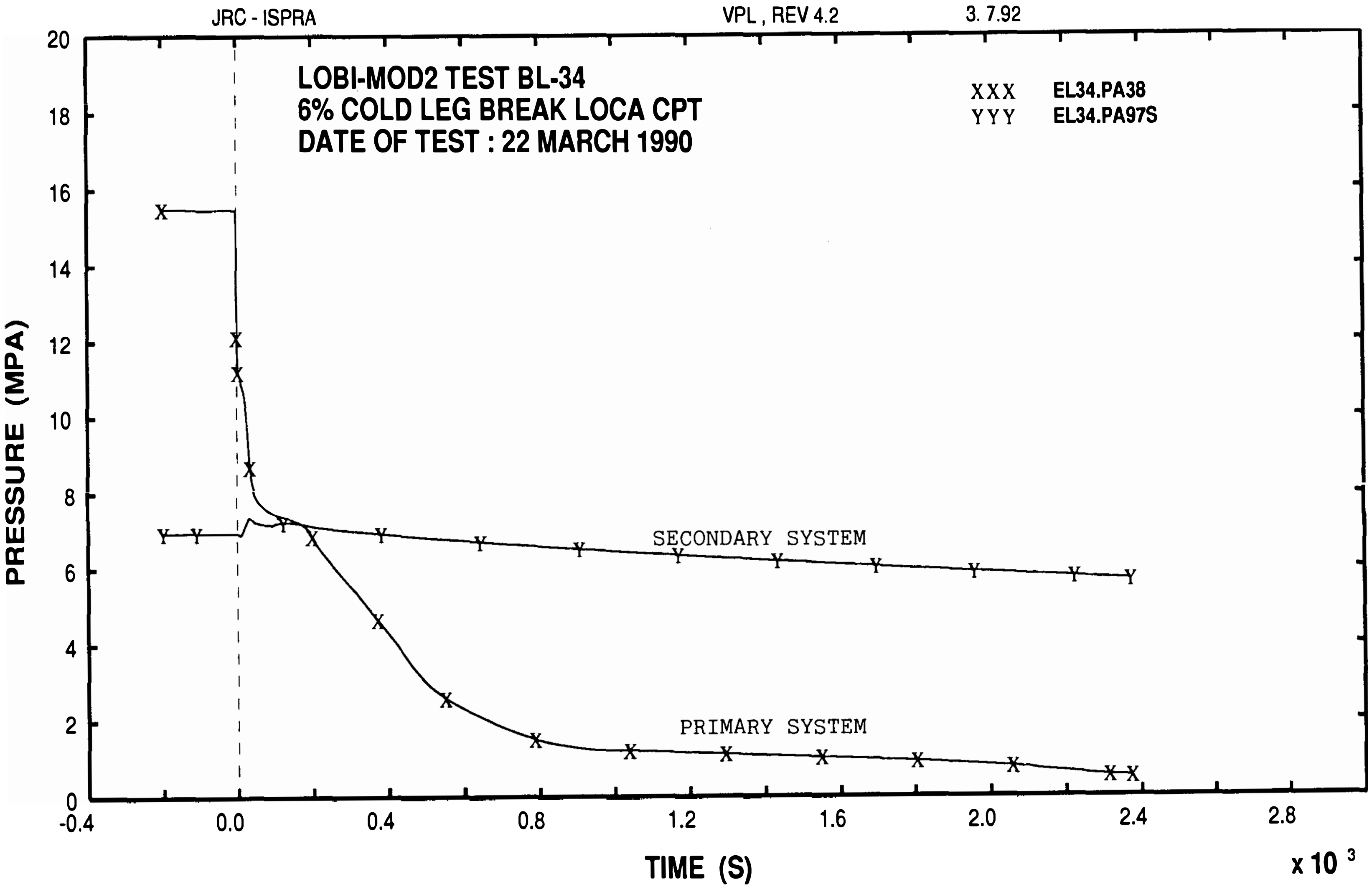


FIG. 19: PRIMARY AND SECONDARY PRESSURES FOR LOBI-MOD2 TEST BL-34

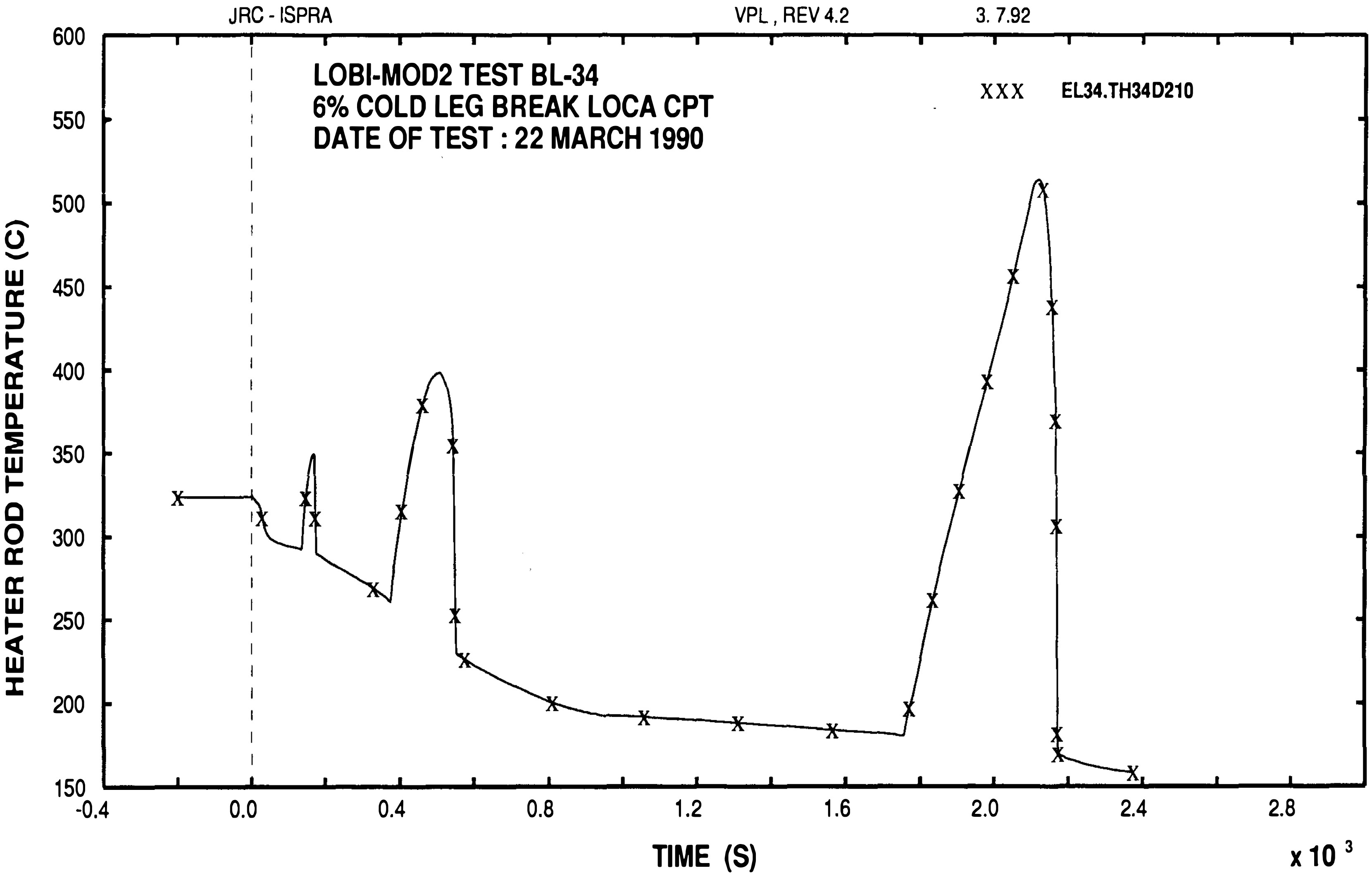


FIG. 20: HEATER ROD TEMPERATURE PROFILE AT THE UPPER ELEVATION OF THE BUNDLE FOR LOBI-MOD2 TEST BL-34

The fluid mass inventory is calculated for the primary loop, the secondary sides of the steam generators, and the pressurizer. The inventory is the sum of the fluid inventories calculated for many individual loop components from the signals for differential pressure, absolute pressure, temperature and density. The interpretation of the inventory is not valid during the initial period after transient start when the evaluations are distorted by fluid velocity. During steady-state ($t \leq 0$) the primary inventory is calculated from pressure and temperature in the loops and from the water level in the pressurizer [5].

5.4 Valve Status

The valves of the LOBI test facility are described by indicative names with an associated ID number, as illustrated in Table 5.

The status of valve end switch signals during the test is given in Table 6. The table shows first an initial status at sufficient time before transient start. Then all changes of status are listed in chronological order.

A valve status is displayed by the following four possible values:

1. "open" - valve end switch in position "open" is depressed.
2. "closed" - valve end switch in position "closed" is depressed.
3. "moving" - neither end switch is depressed. This state indicates that the valve has left a previous "open" or "closed" position.
4. "false" - error position, e.g. no valve is connected, or both end switches are depressed simultaneously.

Generally, the end switch signals may be used as the correct status of the valves. For a more accurate interpretation the following points should be considered:

1. End switch adjustment: For all valves the end switches are precisely adjusted. A minimum end play of the switches is, however, unavoidable. "closed" and "open" statuses are indicated when the switches are depressed, which is always an instant before the valve shaft is 100 % in the respective end position.
2. Data recording speed: The data in Table 6 are taken from the original data disk - not from selected data. Therefore the time resolution is better than of selected data, as used for the data plots. Containing binary information (2 bit), no mean values are calculated for these data. The status of valves is recorded at the end of each recording time interval. Delay caused by data recording are typically up to 0.01 seconds with fast recording during transient periods of the test (e.e. first minutes after test start) and up to 0.2 seconds during other periods.
3. Valve characteristics: The position "moving" leaves a wide range of angles from almost closed to almost fully open. For some valves is required some angle in shaft rotation until flow area is affected. An end switch may then be mounted even beyond a physically fully closed or open position. In this case a "moving" status would appear to be indicated early.
4. Valve leakage:; An indicated status of "closed" does not exclude the possibility of valve leakage. At some positions on/off ("enable") valves are mounted in series with regulation valves. Leakage can be virtually excluded, when such on/off valves are "closed".

The recorded data are presented in Table 4.5 without any correction or calibration. Primary and secondary loop configuration simplified flow charts and control system are given in Fig. 21 and Fig. 22.

Table 5: Valve description and ID Number

Channel	Position (Descriptive Name)	Valve Number		
6001	Upper plenum drain	2.16		
6002	Upper head bypass	4.31		
6003	Accu injection IL-CL	1.4.5.1a		
6004	Accu injection IL-HL	1.4.5.1b		
6005	Accu injection BL-CL	1.13.5.1a		
6006	Accu injection BL-HL	1.13.5.1b		
6007	Pressurizer surge line	2.23		
6008	On/off feedwater SG-IL	3.60		
6009	On/off feedwater SG-BL	3.61		
6010	Isolation SG-IL	3.62		
6011	Isolation SG-BL	3.63		
6012	Condenser inlet, sec. loop	3.64		
6013	On/off relief SG-IL	3.66		
6014	On/off relief SG-BL	3.67		
6015	Large relief control SG-IL	3.1.8a		
6016	Large relief control SG-BL	3.1.8b		
6017	Pumpbrake IL	OPEN	:	Pumpbrake engaged
6018	Pumpbrake BL	CLOSED	:	Pumpbrake not engaged
6019	Pump resistance IL (*)	4.68 OPEN	:	No additional resistance
6020	Pump resistance BL	4.69 CLOSED	:	Valve position resistance
6021	AFW-inlet SG-IL	3.76.1		
6022	AFW-inlet SG-BL	3.77.1		
6023	AFW-bypass SG-IL	3.76.2		
6024	AFW-bypass SG-BL	3.77.2		
6025	PORV	2.1.10		
6026	Pressurizer CNTR valve enable	2.14		
6027	Lower plenum chain	4.77		
6028	Small relief control SG-IL	3.1.5a		
6029	Small relief control SG-BL	3.1.5b		

(*) Not installed: i.e. no additional resistance is applied for the intact loop pump.

Table 6: Valve Status

PAGE# 1

```
*****************************************************************
*                                                               *
*           LOBI TEST  BL-34-A  DATE 22.MAR.90                  *
*    CHRONOLOGICAL SWITCHING ORDER OF THE BINARY LINES          *
*                                                               *
*****************************************************************
```

CHANNEL	POSITION	TIME[SEC]	INITIAL-STATUS
6001	UPPER PLENUM DRAIN	-300.000	OPEN
6002	UPPER HEAD BYPASS		OPEN
6003	ACCU INJECTION IL-CL		CLOSED
6004	ACCU INJECTION IL-HL		CLOSED
6005	ACCU INJECTION BL-CL		CLOSED
6006	ACCU INJECTION BL-HL		CLOSED
6007	P-RIZER SURGE LINE		OPEN
6008	ON/OFF FEEDWATER SG-IL		CLOSED
6009	ON/OFF FEEDWATER SG-BL		CLOSED
6010	ISOLATION SG-IL		OPEN
6011	ISOLATION SG-BL		OPEN
6012	CONDENSER INLET, SEC.LOOP		CLOSED
6013	ON/OFF RELIEF SG-IL		OPEN
6014	ON/OFF RELIEF SG-BL		OPEN
6015	LARGE RELIEF CONTROL SG-IL		CLOSED
6016	LARGE RELIEF CONTROL SG-BL		FALSE
6017	PUMPBRAKE IL		CLOSED
6018	PUMPBRAKE BL		CLOSED
6019	PUMPRESISTANCE IL		FALSE
6020	PUMPRESISTANCE BL		CLOSED
6021	AFW-INLET SG-IL		OPEN
6022	AFW-INLET SG-BL		OPEN
6023	AFW-BYPASS SG-IL		CLOSED
6024	AFW-BYPASS SG-BL		CLOSED
6025	PORV		CLOSED
6026	P-RIZER CNTR VALVE ENABLE		CLOSED
6027	LOWER PLENUM DRAIN		CLOSED
6028	SMALL RELIEF CONTROL SG-IL		CLOSED
6029	SMALL RELIEF CONTROL SG-BL		CLOSED

CHANNEL	POSITION	TIME[SEC]	STATUS
6002	UPPER HEAD BYPASS	-238.299	MOVING
6002	UPPER HEAD BYPASS	-234.600	CLOSED
6027	LOWER PLENUM DRAIN	-17.400	MOVING
6027	LOWER PLENUM DRAIN	-12.100	OPEN
6001	UPPER PLENUM DRAIN	-7.000	MOVING
6001	UPPER PLENUM DRAIN	-2.699	CLOSED
6021	AFW-INLET SG-IL	1.000	MOVING
6022	AFW-INLET SG-BL		MOVING
6023	AFW-BYPASS SG-IL		MOVING
6024	AFW-BYPASS SG-BL		MOVING
6021	AFW-INLET SG-IL	1.201	OPEN
6022	AFW-INLET SG-BL		OPEN
6022	AFW-INLET SG-BL	6.900	MOVING
6024	AFW-BYPASS SG-BL		OPEN
6017	PUMPBRAKE IL	7.000	OPEN
6018	PUMPBRAKE BL	7.100	OPEN
6021	AFW-INLET SG-IL		MOVING
6023	AFW-BYPASS SG-IL		OPEN
6016	LARGE RELIEF CONTROL SG-BL	9.400	CLOSED
6022	AFW-INLET SG-BL	12.900	CLOSED
6021	AFW-INLET SG-IL	13.100	CLOSED
6016	LARGE RELIEF CONTROL SG-BL	31.600	MOVING
6016	LARGE RELIEF CONTROL SG-BL	70.400	CLOSED
6003	ACCU INJECTION IL-CL	425.900	MOVING
6003	ACCU INJECTION IL-CL	426.000	OPEN
6018	PUMPBRAKE BL	802.201	CLOSED
6017	PUMPBRAKE IL	805.000	CLOSED
6017	PUMPBRAKE IL	807.400	OPEN
6017	PUMPBRAKE IL	807.600	CLOSED
6001	UPPER PLENUM DRAIN	828.600	OPEN
6002	UPPER HEAD BYPASS		MOVING

Table 6: (cont.d)

PAGE# 2

CHANNEL	POSITION	TIME[SEC]	STATUS	
6003	ACCU INJECTION IL-CL		CLOSED	
6005	ACCU INJECTION BL-CL		MOVING	
6006	ACCU INJECTION BL-HL		FALSE	
6007	P-RIZER SURGE LINE		FALSE	
6008	ON/OFF FEEDWATER SG-IL		FALSE	
6010	ISOLATION SG-IL		FALSE	
6011	ISOLATION SG-BL		CLOSED	
6012	CONDENSER INLET, SEC.LOOP		FALSE	
6013	ON/OFF RELIEF SG-IL		MOVING	
6014	ON/OFF RELIEF SG-BL		FALSE	
6015	LARGE RELIEF CONTROL SG-IL		FALSE	
6016	LARGE RELIEF CONTROL SG-BL		FALSE	
6017	PUMPBRAKE IL		OPEN	
6019	PUMPRESISTANCE IL		MOVING	
6020	PUMPRESISTANCE BL		FALSE	
6021	AFW-INLET SG-IL		MOVING	
6022	AFW-INLET SG-BL		FALSE	
6023	AFW-BYPASS SG-IL		FALSE	
6024	AFW-BYPASS SG-BL		FALSE	
6025	PORV		MOVING	
6026	P-RIZER CNTR VALVE ENABLE		MOVING	
6027	LOWER PLENUM DRAIN		CLOSED	
6029	SMALL RELIEF CONTROL SG-BL		OPEN	
6001	UPPER PLENUM DRAIN	828.701	CLOSED	
6002	UPPER HEAD BYPASS		CLOSED	
6003	ACCU INJECTION IL-CL		OPEN	
6005	ACCU INJECTION BL-CL		CLOSED	
6006	ACCU INJECTION BL-HL		CLOSED	
6007	P-RIZER SURGE LINE		OPEN	
6008	ON/OFF FEEDWATER SG-IL		CLOSED	
6010	ISOLATION SG-IL		OPEN	
6011	ISOLATION SG-BL		OPEN	
6012	CONDENSER INLET, SEC.LOOP		CLOSED	
6013	ON/OFF RELIEF SG-IL		OPEN	
6014	ON/OFF RELIEF SG-BL		OPEN	
6015	LARGE RELIEF CONTROL SG-IL		CLOSED	
6016	LARGE RELIEF CONTROL SG-BL		CLOSED	
6017	PUMPBRAKE IL		CLOSED	
6019	PUMPRESISTANCE IL		MOVING	
6020	PUMPRESISTANCE BL		CLOSED	
6021	AFW-INLET SG-IL		CLOSED	
6022	AFW-INLET SG-BL		CLOSED	
6023	AFW-BYPASS SG-IL		OPEN	
6024	AFW-BYPASS SG-BL		OPEN	
6025	PORV		CLOSED	
6026	P-RIZER CNTR VALVE ENABLE		CLOSED	
6027	LOWER PLENUM DRAIN		OPEN	
6029	SMALL RELIEF CONTROL SG-BL		CLOSED	
6018	PUMPBRAKE BL	871.701	OPEN	
6017	PUMPBRAKE IL	877.201	OPEN	
6003	ACCU INJECTION IL-CL	950.701	MOVING	
6003	ACCU INJECTION IL-CL	950.801	CLOSED	
6015	LARGE RELIEF CONTROL SG-IL	2567.090	MOVING	test end
6027	LOWER PLENUM DRAIN	2587.090	MOVING	
6002	UPPER HEAD BYPASS	2589.090	MOVING	
6001	UPPER PLENUM DRAIN	2591.090	MOVING	
6002	UPPER HEAD BYPASS	2593.090	OPEN	
6027	LOWER PLENUM DRAIN		CLOSED	
6001	UPPER PLENUM DRAIN	2595.090	OPEN	
6020	PUMPRESISTANCE BL	3180.090	MOVING	
6020	PUMPRESISTANCE BL	3181.090	OPEN	
6017	PUMPBRAKE IL	3192.090	CLOSED	
6018	PUMPBRAKE BL		CLOSED	
6018	PUMPBRAKE BL	3652.090	OPEN	
6017	PUMPBRAKE IL	3653.090	OPEN	
6017	PUMPBRAKE IL	3691.090	CLOSED	
6018	PUMPBRAKE BL		CLOSED	
6028	SMALL RELIEF CONTROL SG-IL	4085.090	MOVING	
6029	SMALL RELIEF CONTROL SG-BL	4104.090	MOVING	
6016	LARGE RELIEF CONTROL SG-BL	4106.090	MOVING	
6017	PUMPBRAKE IL	6176.090	OPEN	

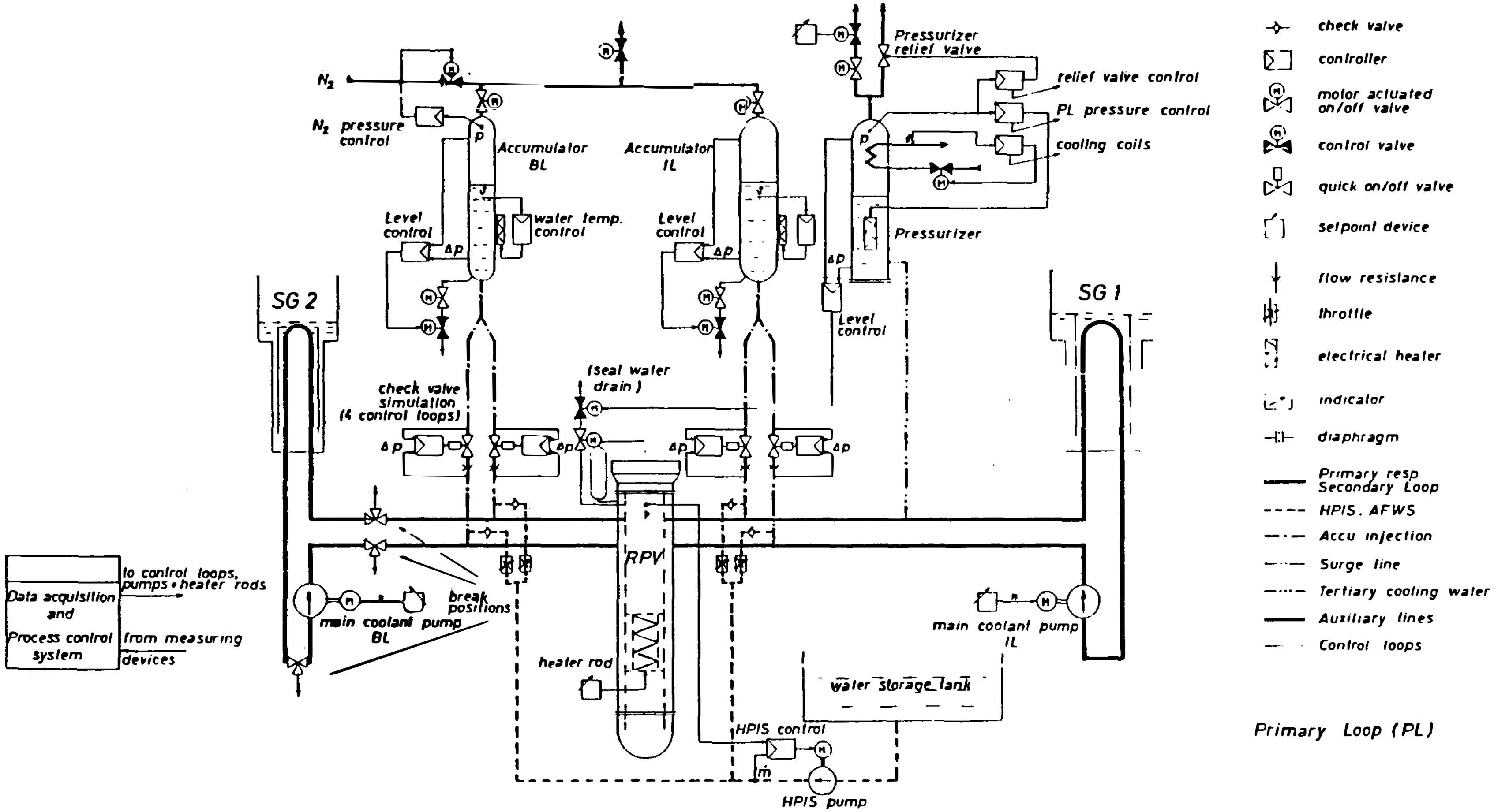


FIG. 21: SIMPLIFIED FLOW CHART OF THE LOBI-MOD2 PRIMARY COOLING SYSTEM

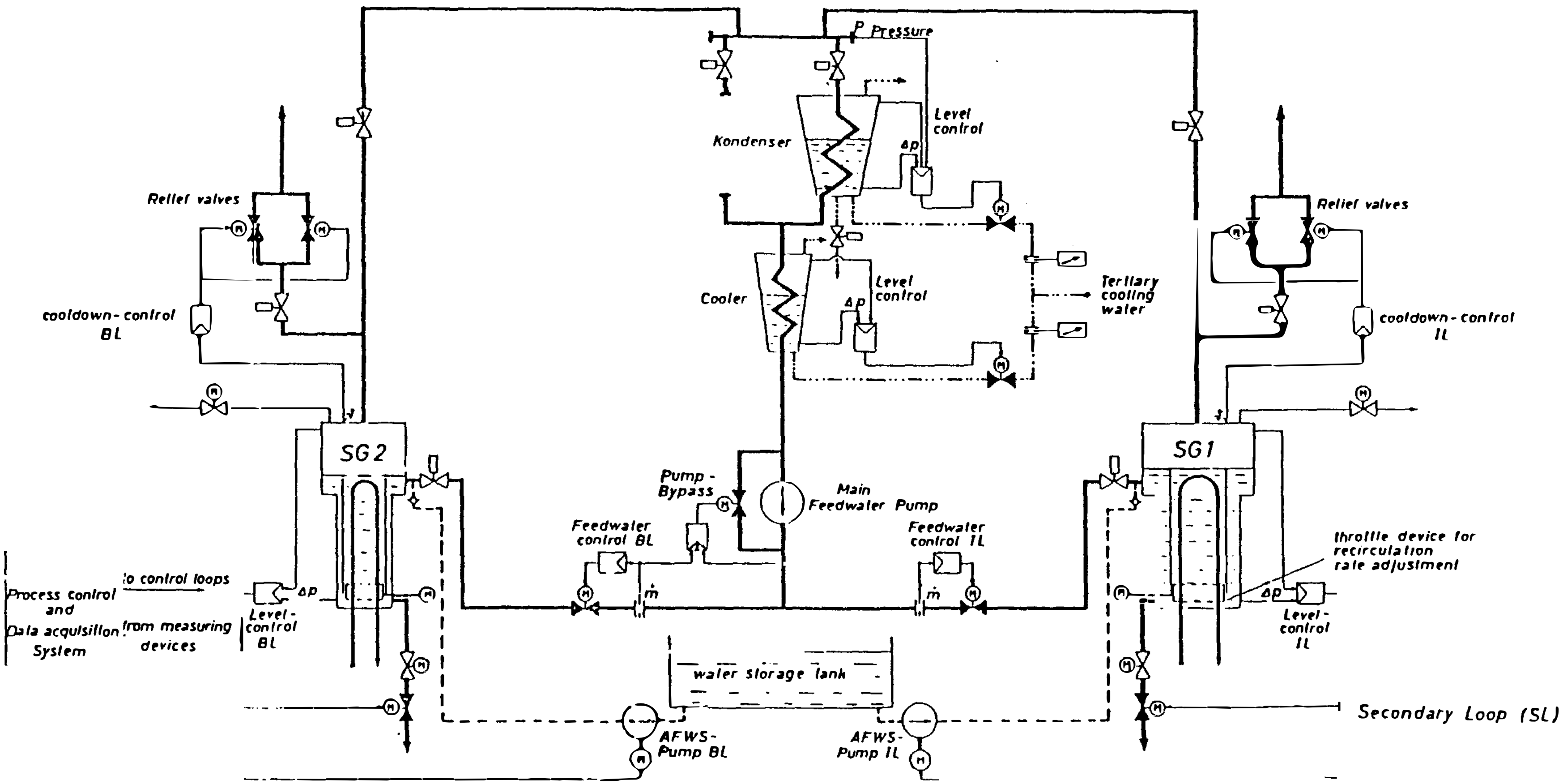


FIG. 22: SIMPLIFIED FLOW CHART OF THE LOBI-MOD2 SECONDARY COOLING SYSTEM

6. DATA PLOTS

The data and calculated parameters are plotted in sequence according to the measurement variable as in the following:

Measured Data

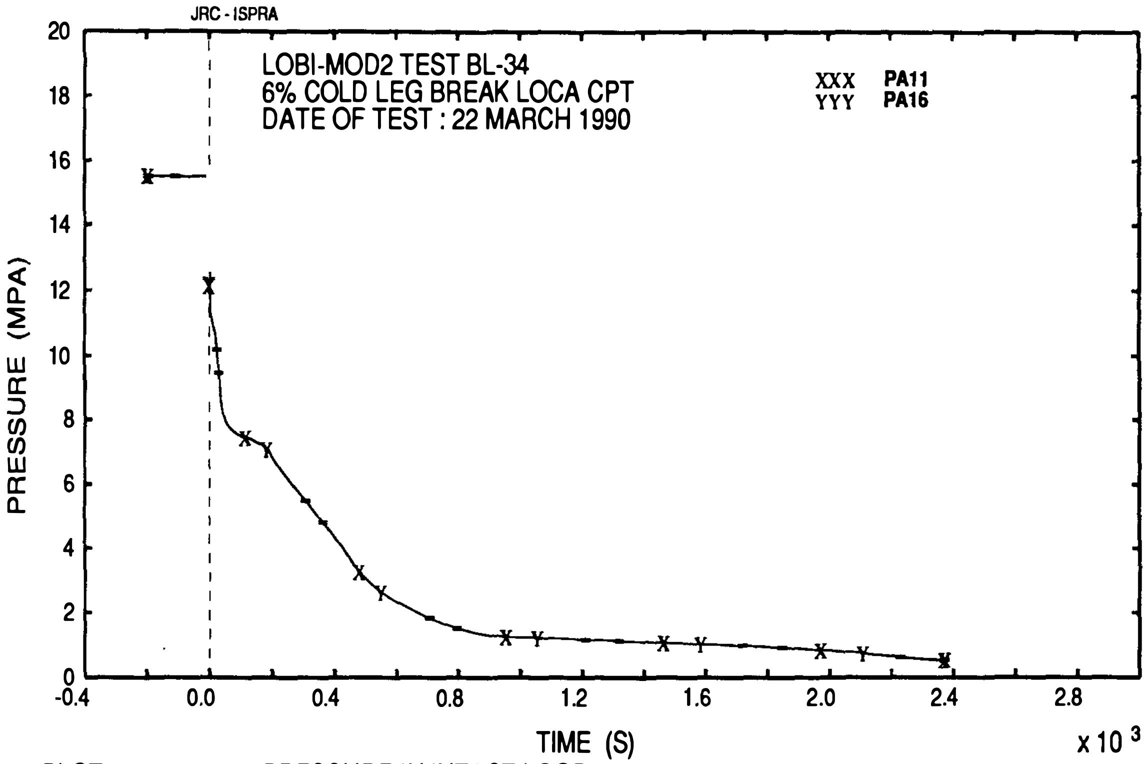
1.	PA	-	Absolute Pressure
2.	PD	-	Differential Pressure
3.	QD	-	Fluid Drag (Dragbody): not installed
4.	QF	-	Fluid Velocity (Full Flow Turbine)
	QT	-	Fluid Velocity (Local Turbine Probes)
	QL	-	Fluid Mass (Break Discharge)
	QI	-	Flow Direction Indicators
	QV	-	Volumetric Flow (Full Flow Turbine or Vortex Meter)
	QM	-	Mass Flow
	QP	-	Pitot Differential Pressure
	QS	-	Pump Sealwater Massflow
5.	DD	-	Fluid Density, double beam
	DS	-	Fluid Density, single beam
6.	TF	-	Fluid Temperature
7.	TD	-	Differential Temperature
8.	TW	-	Wall Temperature
9.	TH	-	Heater Rod Temperature
10.	HF	-	Heat Flux: not installed
11.	WH	-	Heating Power
	IH	-	Heating Current
	VH	-	Heating Voltage
12.	RP	-	Pump Speed
	MP	-	Pump Shaft Torque

Calculated Parameters

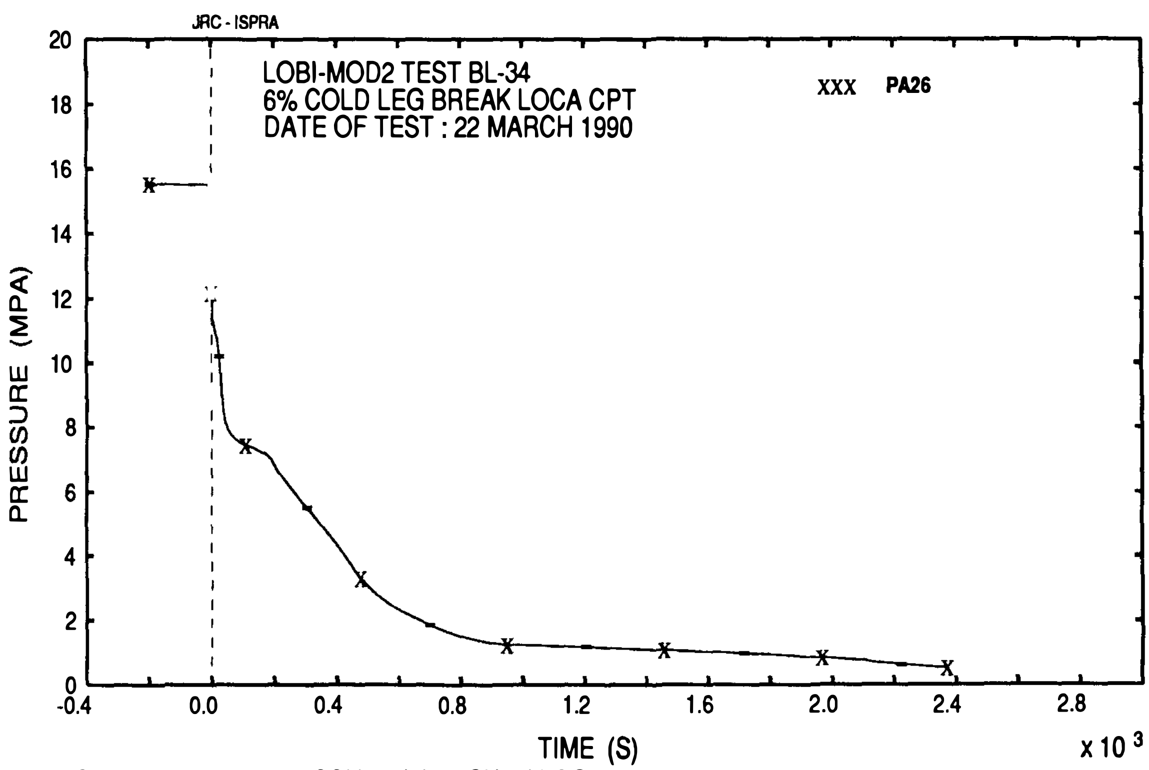
13.	CL	-	Collapsed Level
	CX	-	Mixture Level
14.	CI	-	Mass Inventory

Valve Status

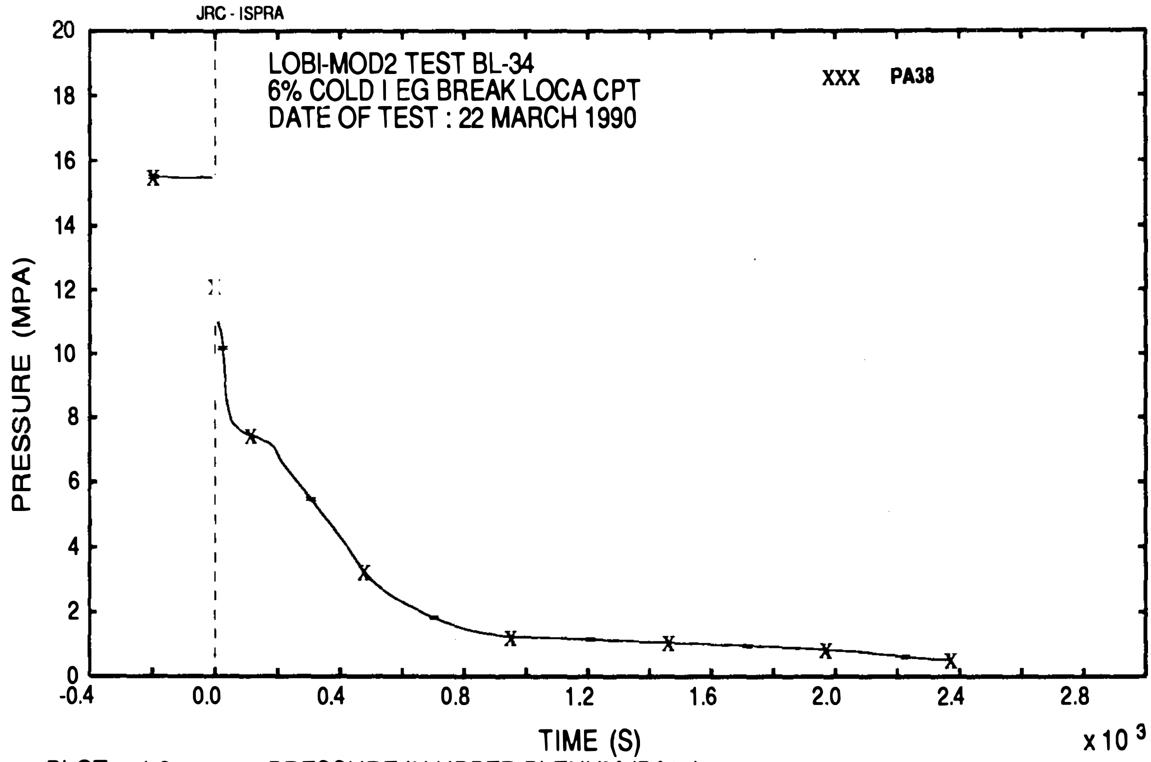
15.	SM	-	Valve on/off Signals or Stem Positions



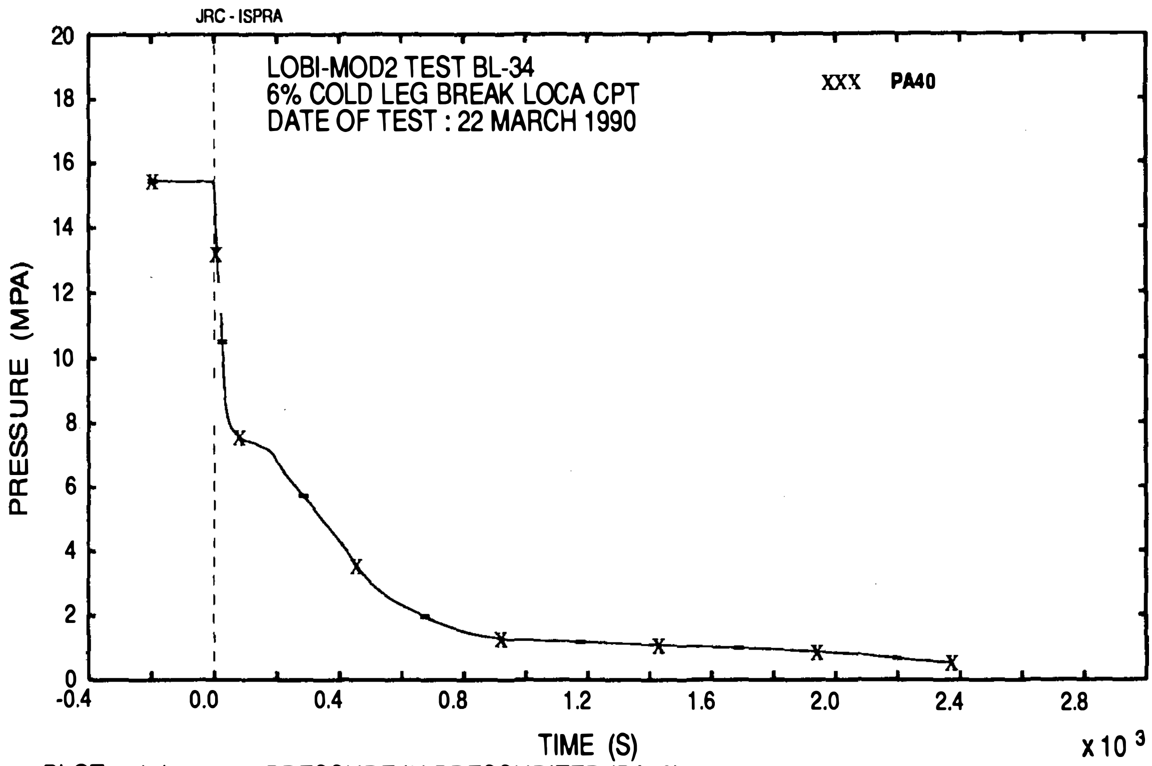
PLOT 1.1 PRESSURE IN INTACT LOOP



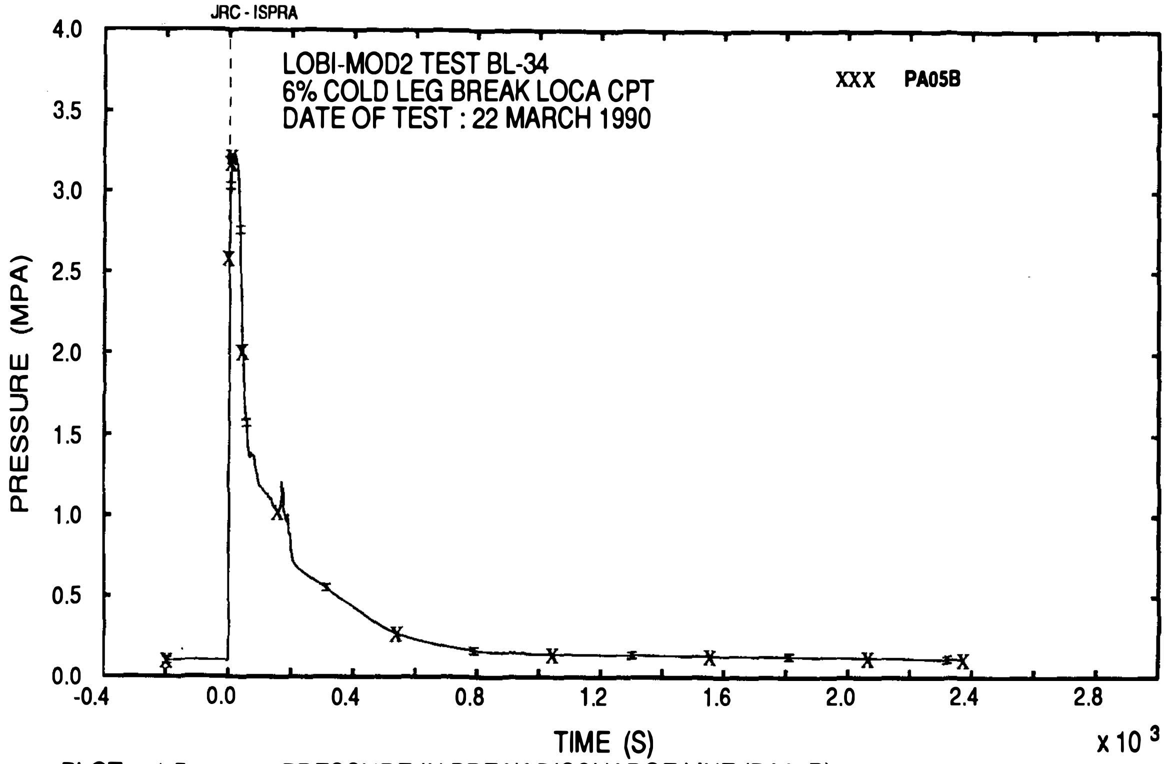
PLOT 1.2 PRESSURE IN BROKEN LOOP



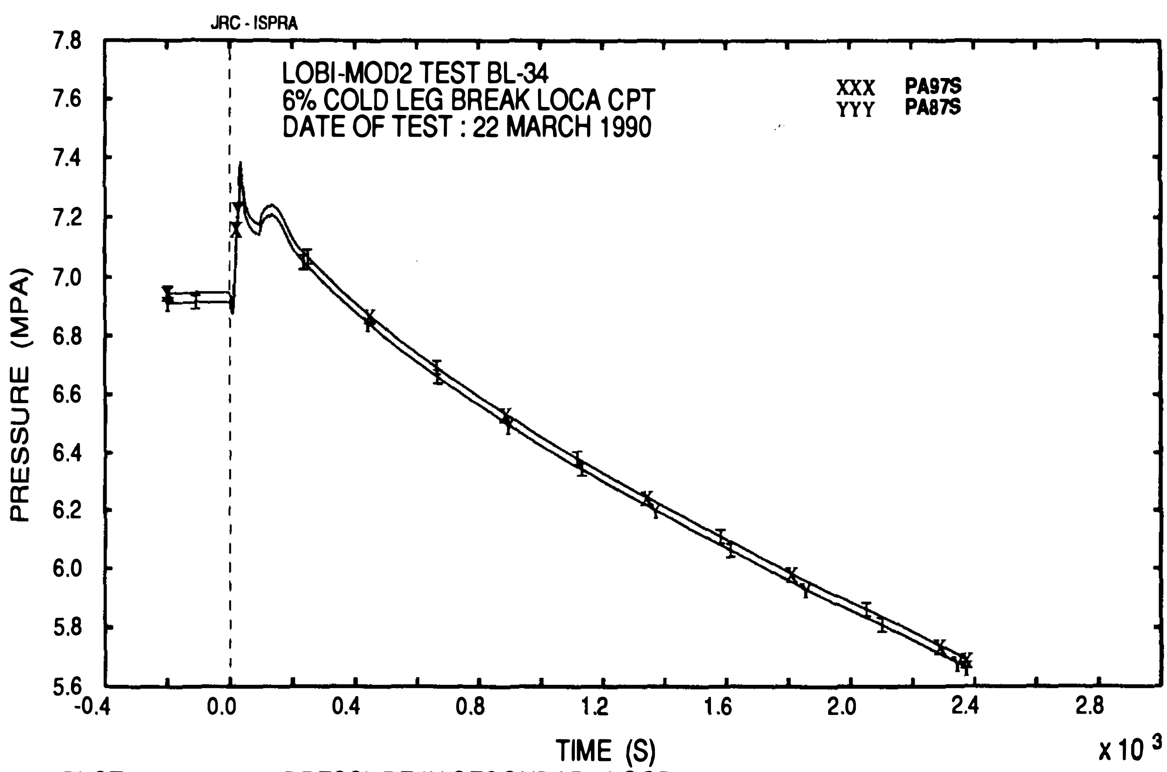
PLOT 1.3 PRESSURE IN UPPER PLENUM (PA38)



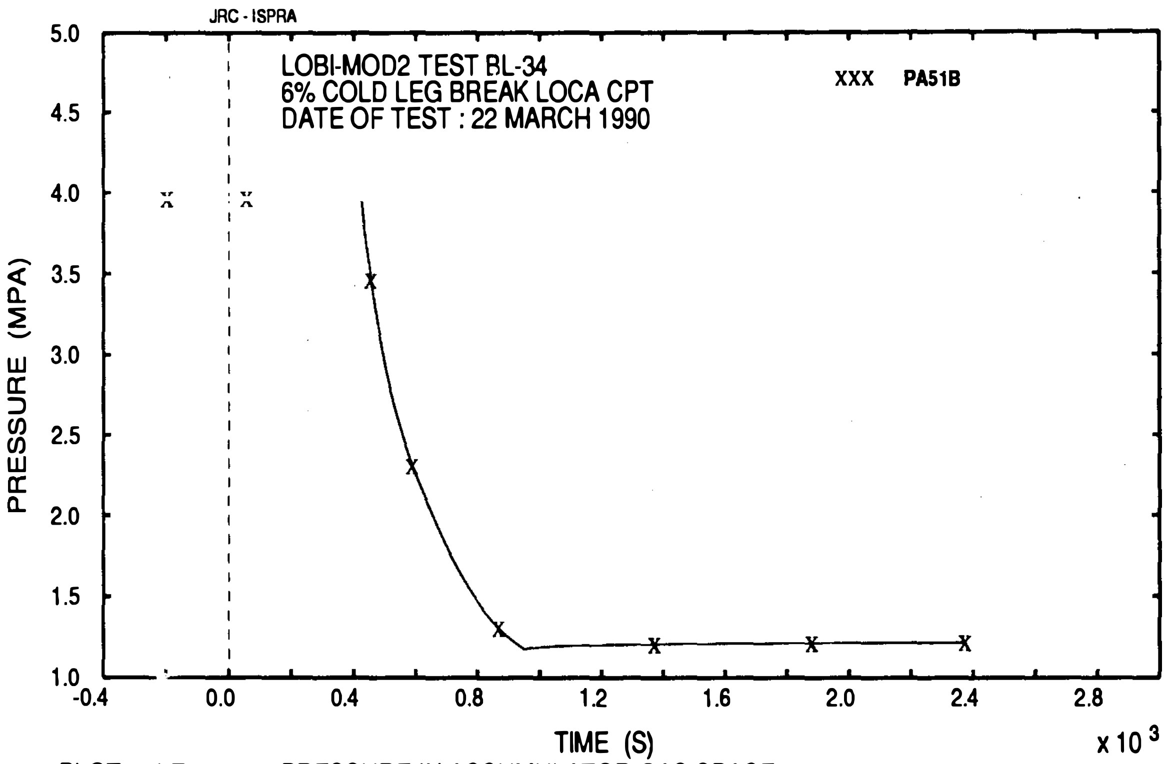
PLOT 1.4 PRESSURE IN PRESSURIZER (PA40)



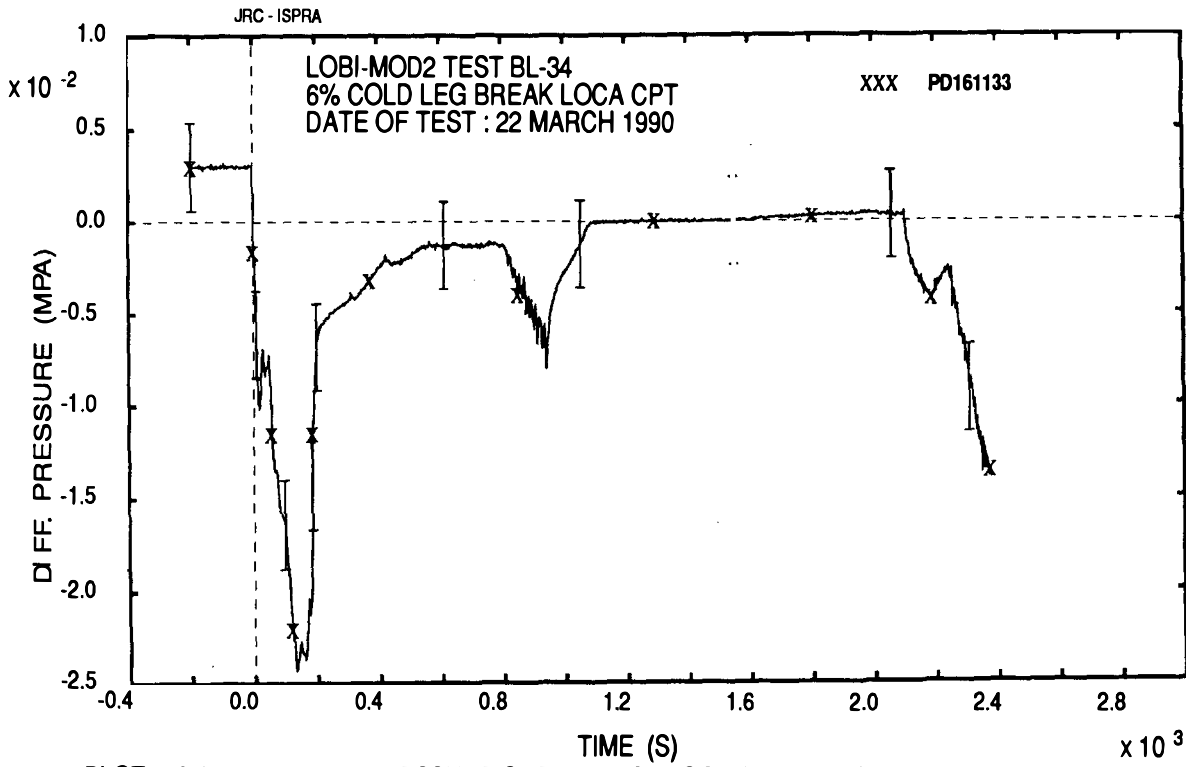
PLOT 1.5 PRESSURE IN BREAK DISCHARGE LINE (PA05B)



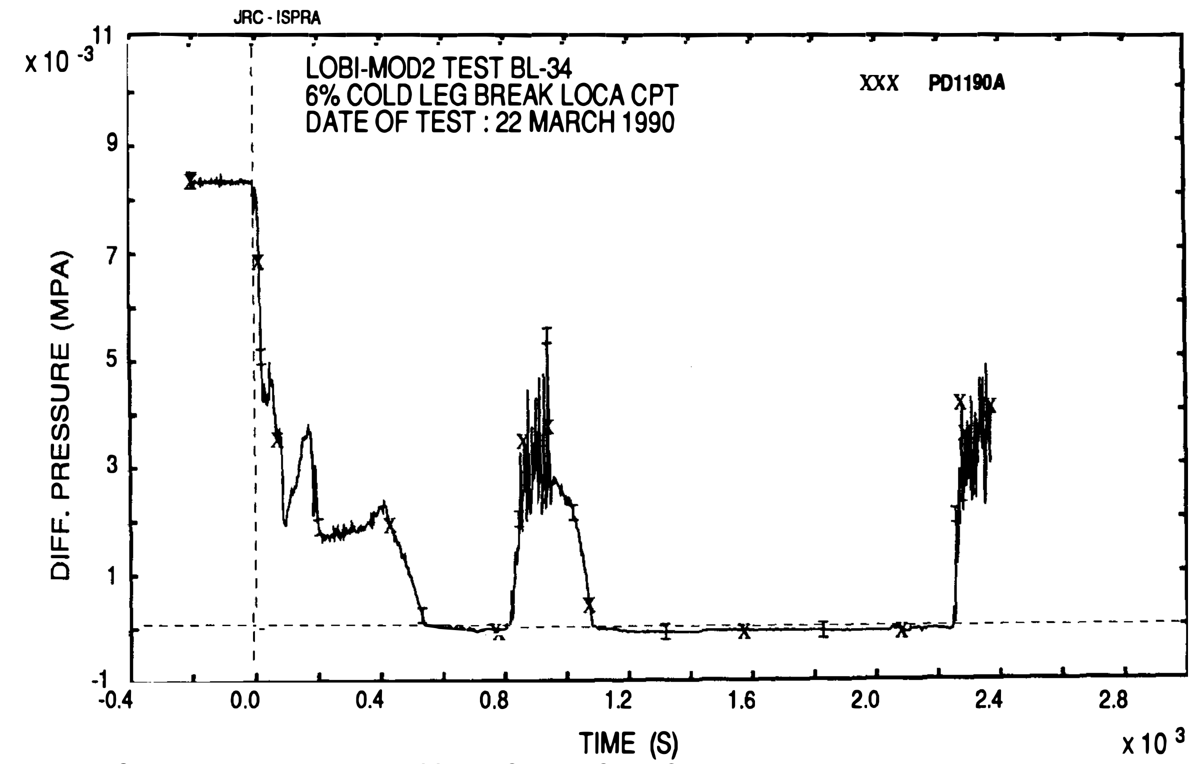
PLOT 1.6 PRESSURE IN SECONDARY LOOP
-INTACT LOOP STEAM GENERATOR, LEVEL S (PA97S)-
-BROKEN LOOP STEAM GENERATOR, LEVEL S (PA87S)-



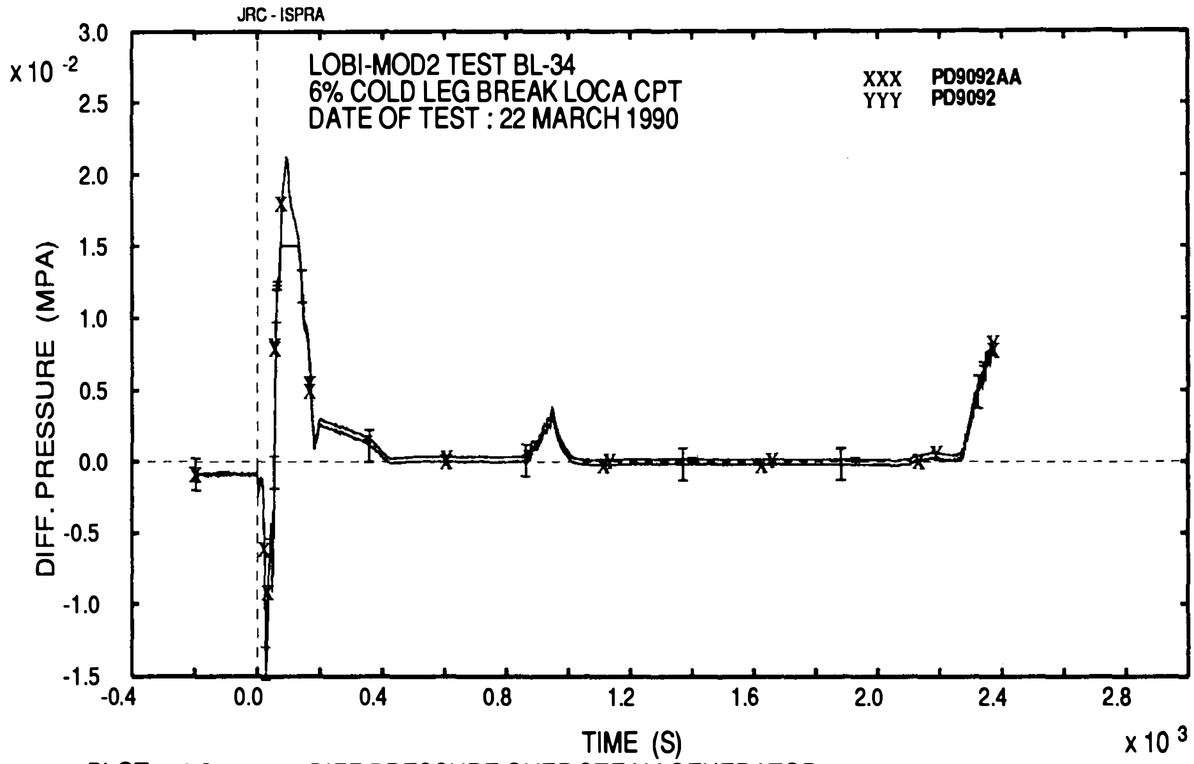
PLOT 1.7 PRESSURE IN ACCUMULATOR GAS SPACE
-INTACT LOOP (PA51B), BROKEN LOOP (PA52B)



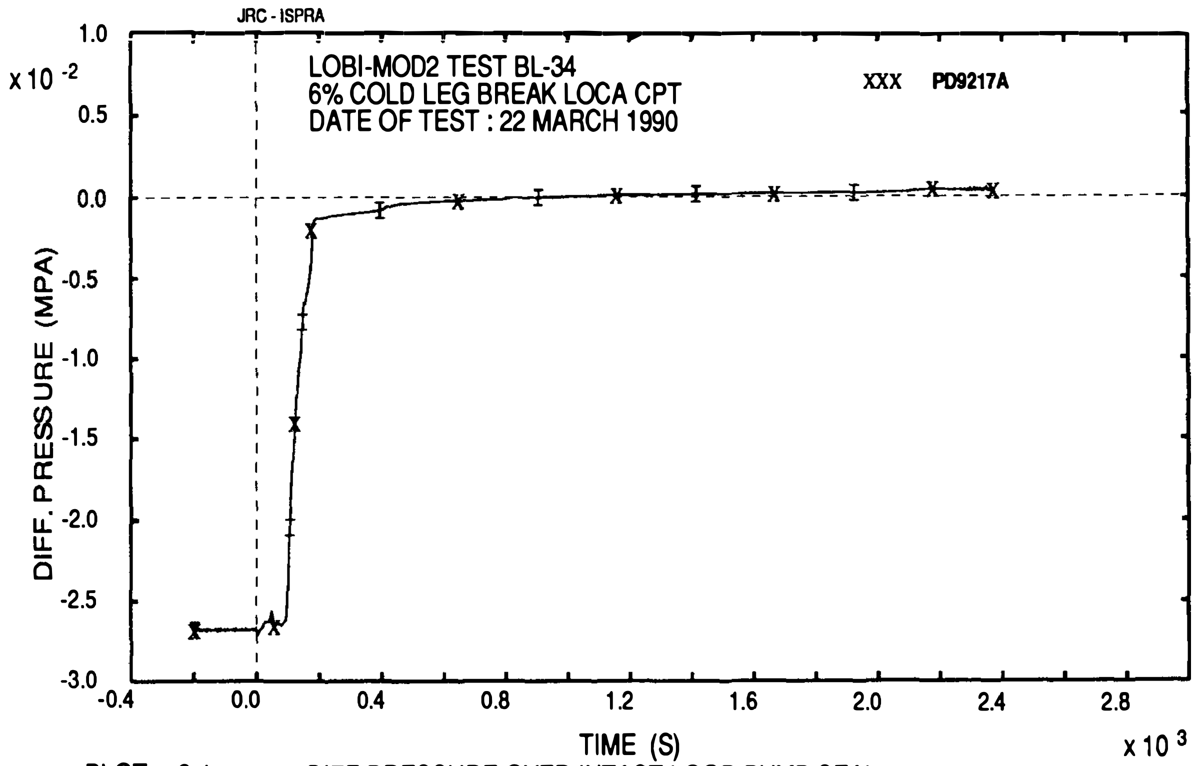
PLOT 2.1 DIFF.PRESSURE OVER INTACT LOOP (PD161133)



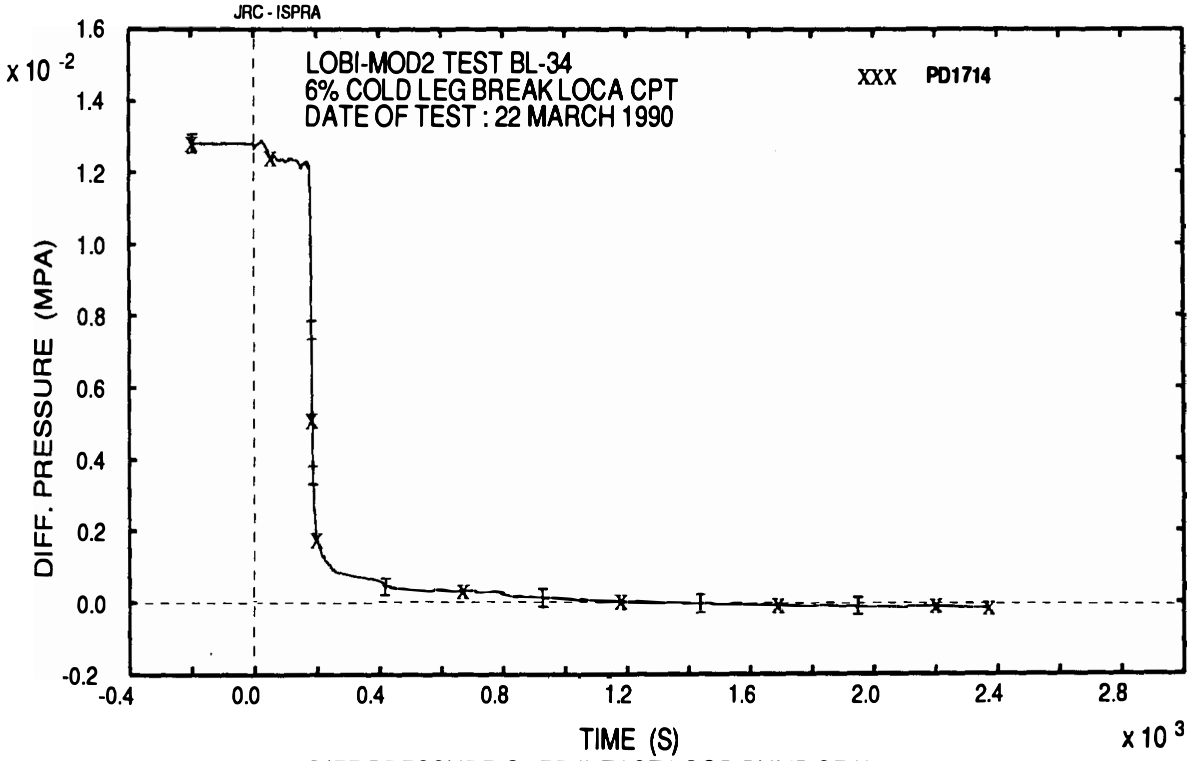
PLOT 2.2 DIFF.PRESSURE OVER HOT LEG
-INTACT LOOP SIDE (PD1190A)-



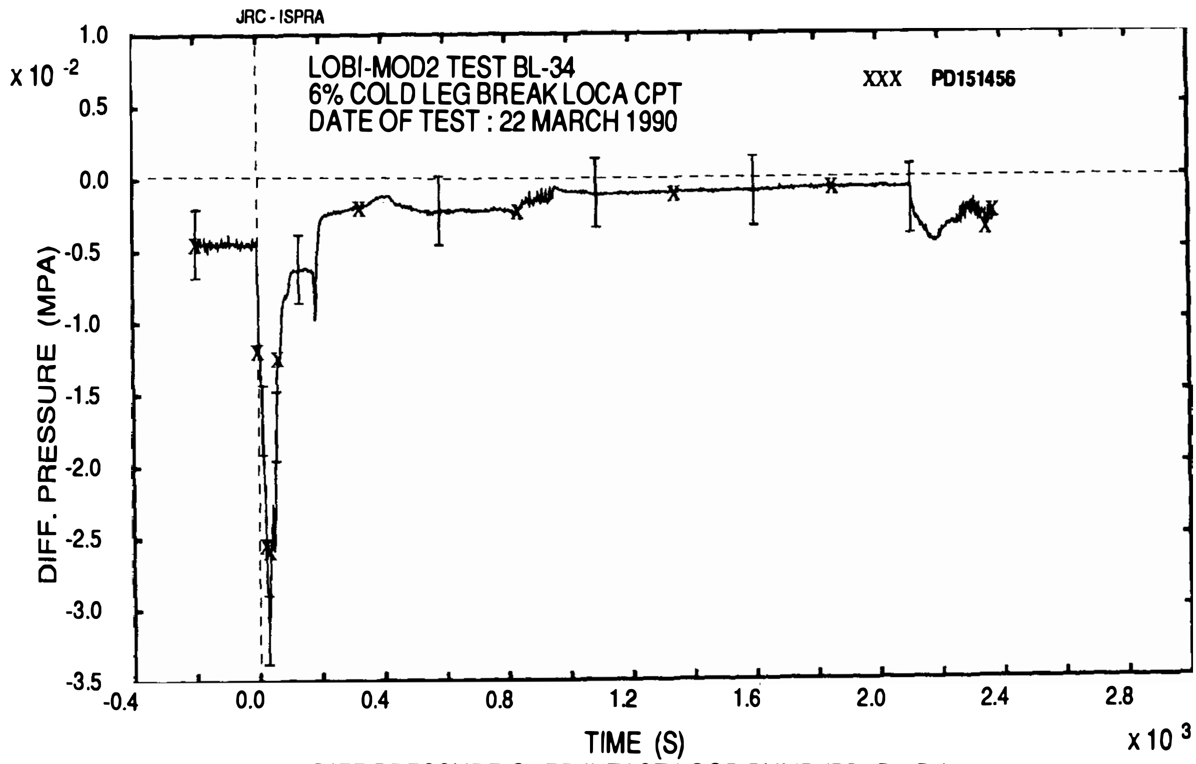
PLOT 2.3 DIFF.PRESSURE OVER STEAM GENERATOR
-INTACT LOOP SIDE (PD9092AA)-
-SMALL RANGE (PD9092)-



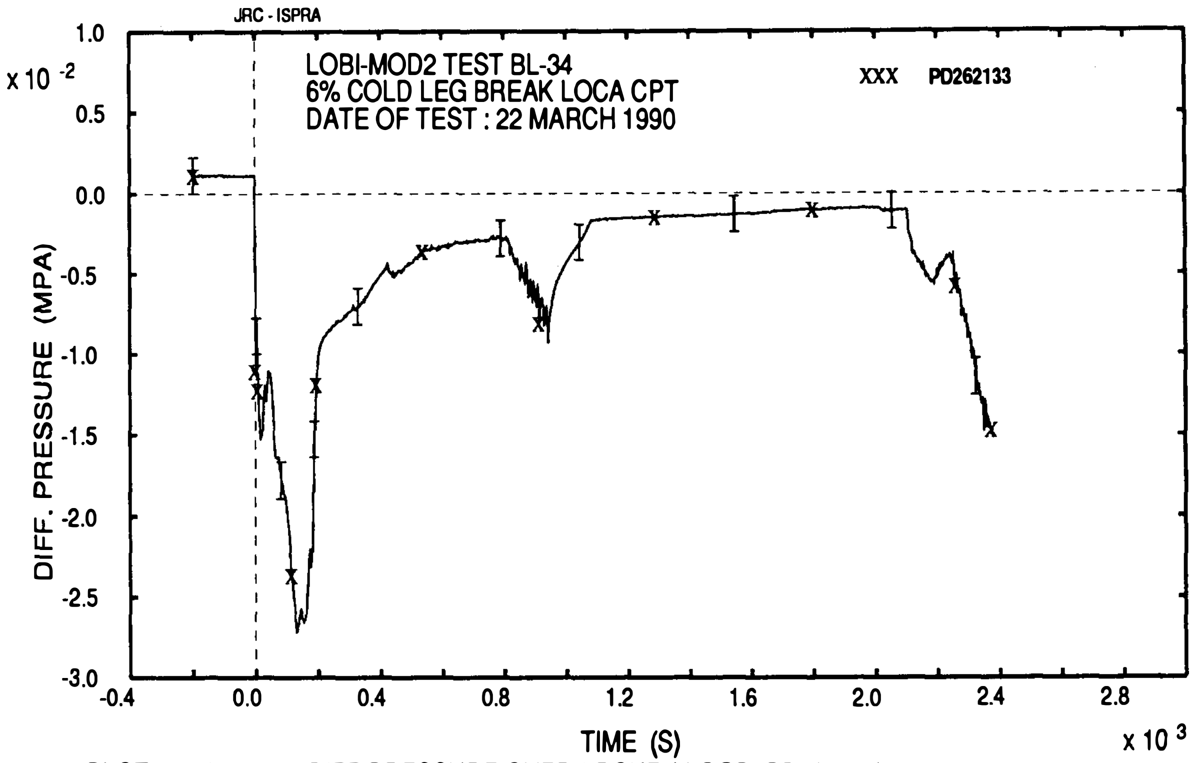
PLOT 2.4 DIFF.PRESSURE OVER INTACT LOOP PUMP SEAL
-STEAM GENERATOR TO SEAL BOTTOM (PD9217A)-



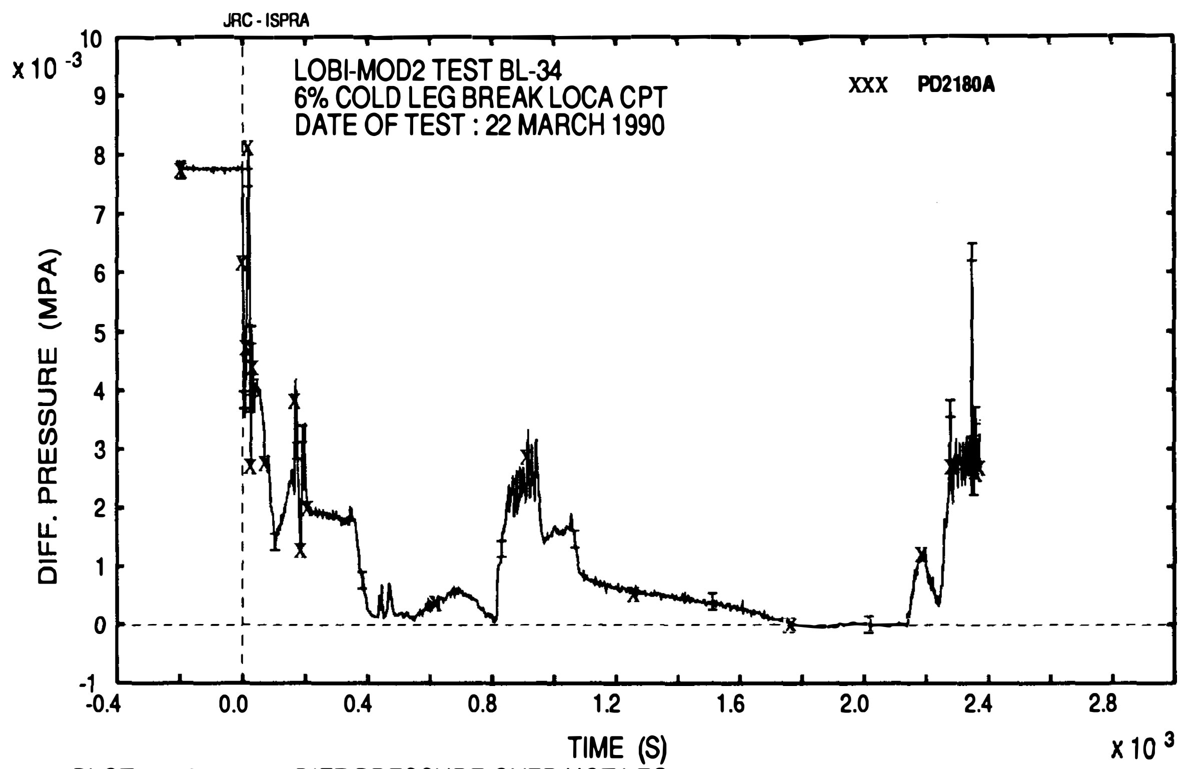
PLOT 2.5 DIFF.PRESSURE OVER INTACT LOOP PUMP SEAL
-SEAL BOTTOM TO PUMP ENTRANCE (PD1714)-



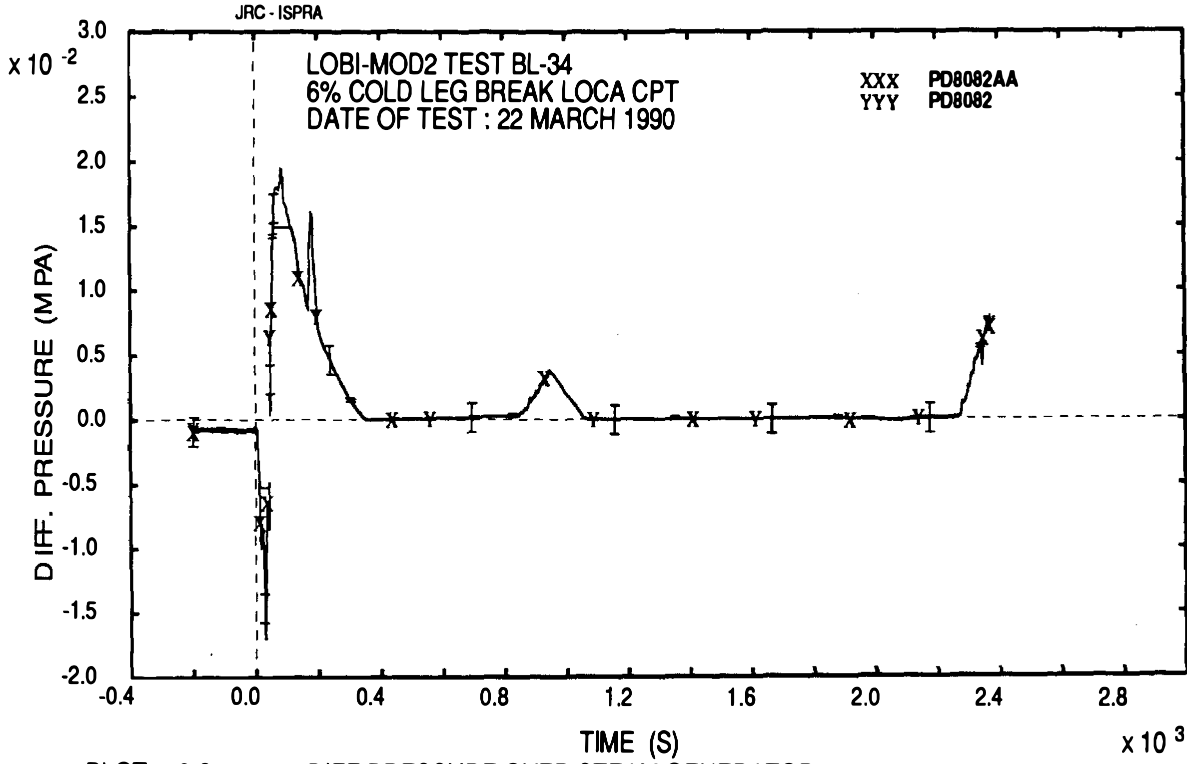
PLOT 2.6 DIFF.PRESSURE OVER INTACT LOOP PUMP (PD151456)



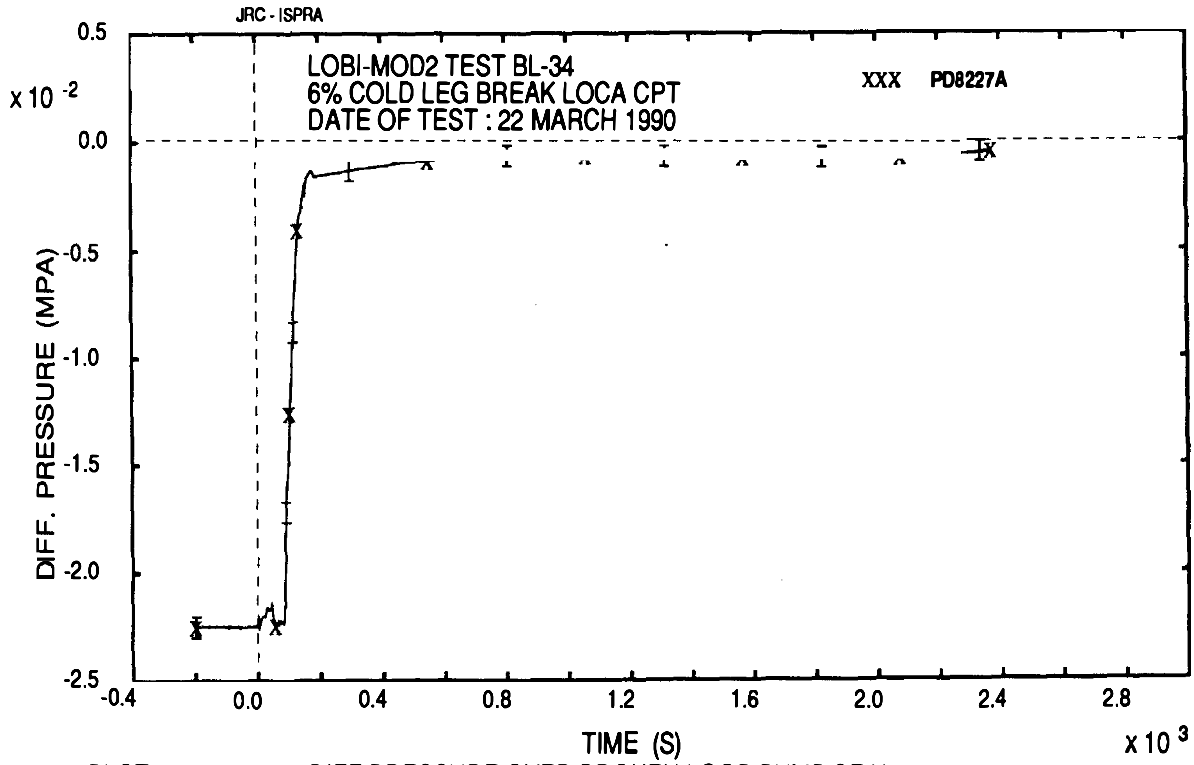
PLOT 2.7 DIFF.PRESSURE OVER BROKEN LOOP (PD262133)



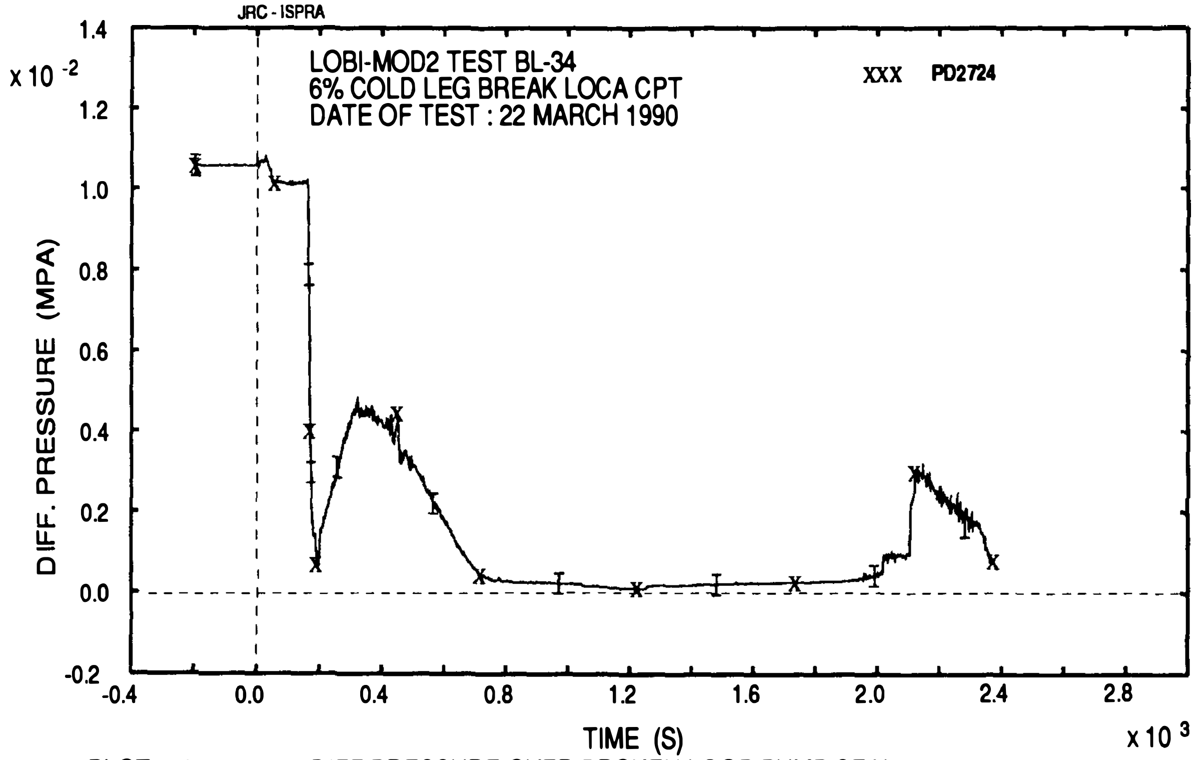
PLOT 2.8 DIFF.PRESSURE OVER HOT LEG
-BROKEN LOOP SIDE (PD2180A)-



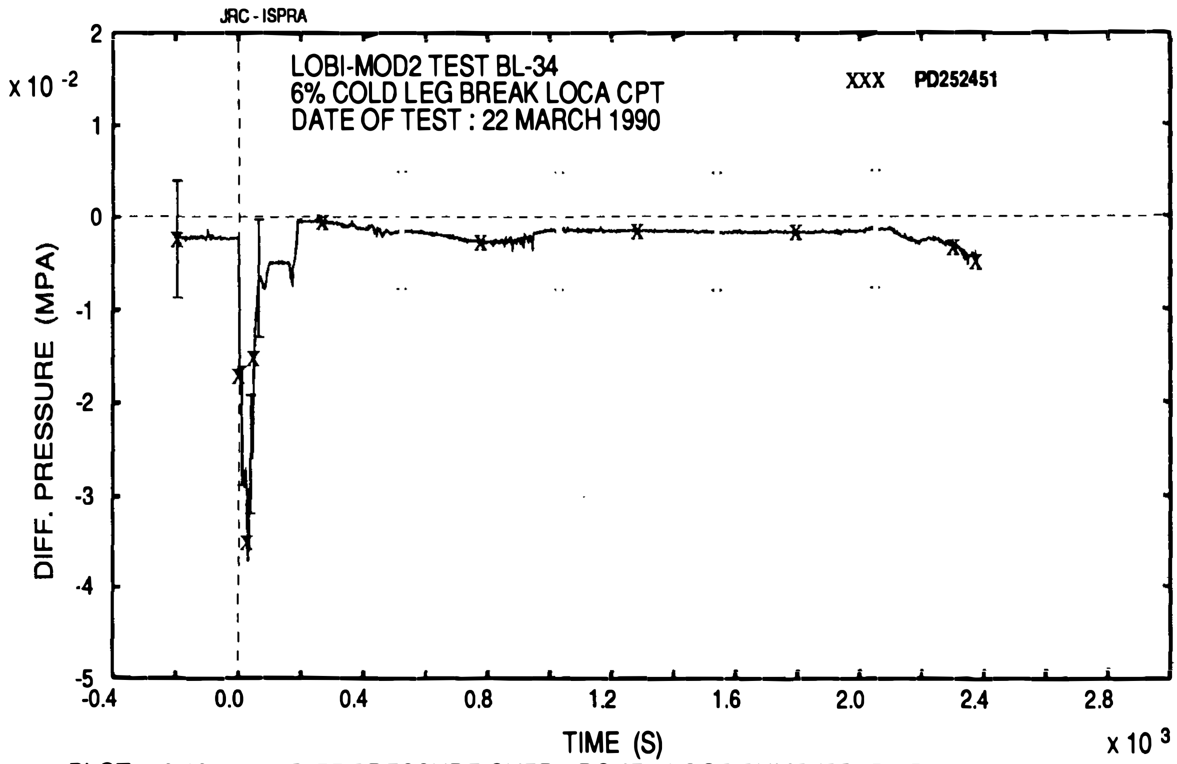
PLOT 2.9 DIFF.PRESSURE OVER STEAM GENERATOR
-BROKEN LOOP SIDE (PD8082AA)-
-SMALL RANGE (PD8082)-



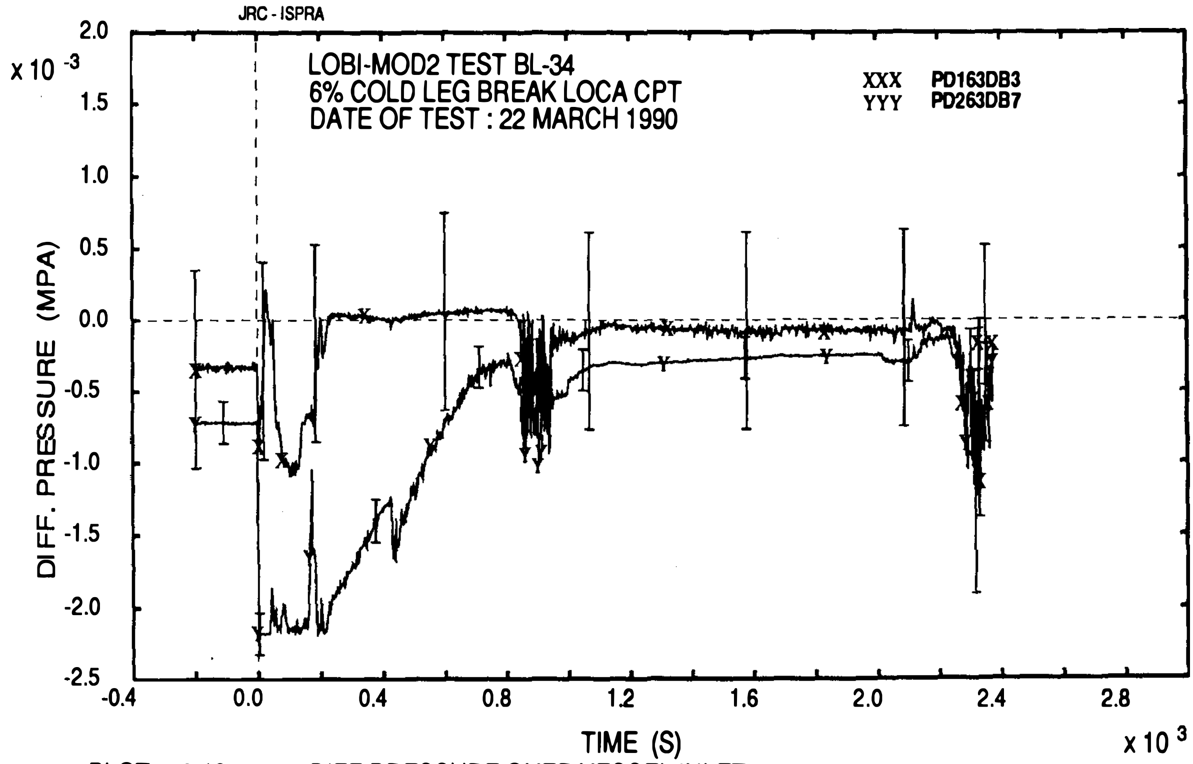
PLOT 2.10 DIFF.PRESSURE OVER BROKEN LOOP PUMP SEAL
-STEAM GENERATOR TO SEAL BOTTOM (PD8227A)-



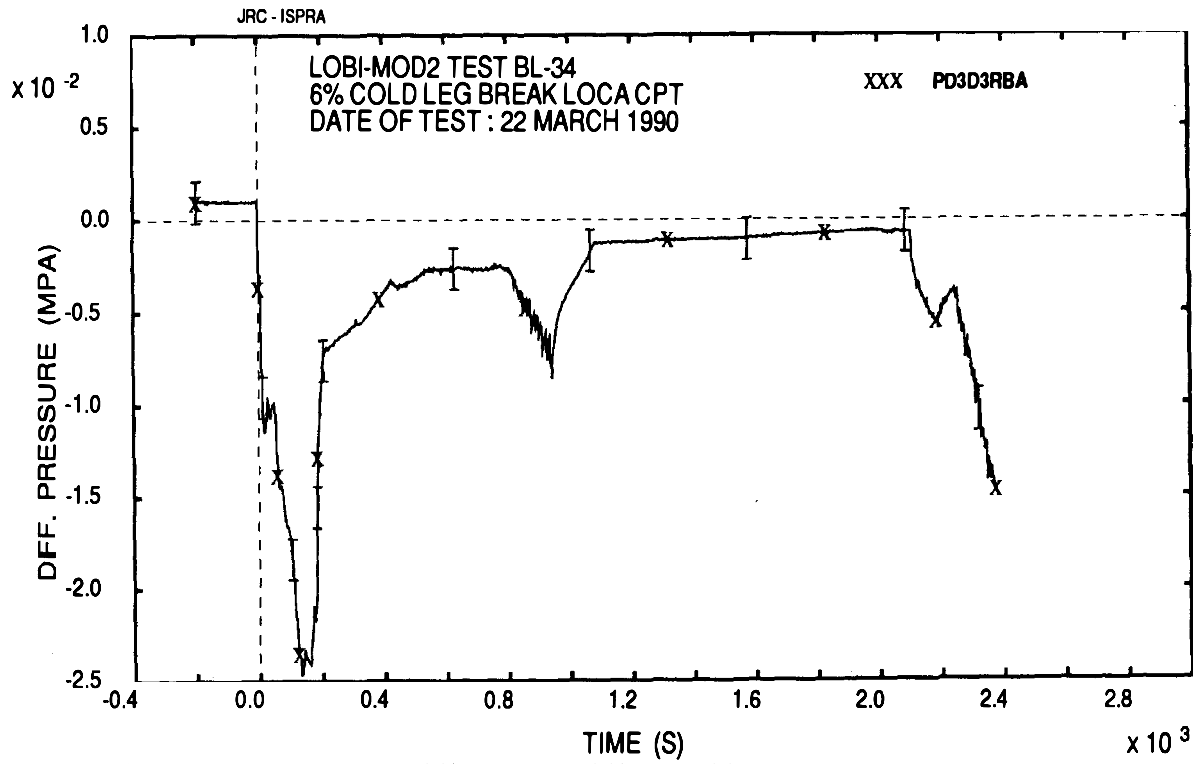
PLOT 2.11 DIFF.PRESSURE OVER BROKEN LOOP PUMP SEAL
-SEAL BOTTOM TO PUMP ENTRANCE (PD2724)-



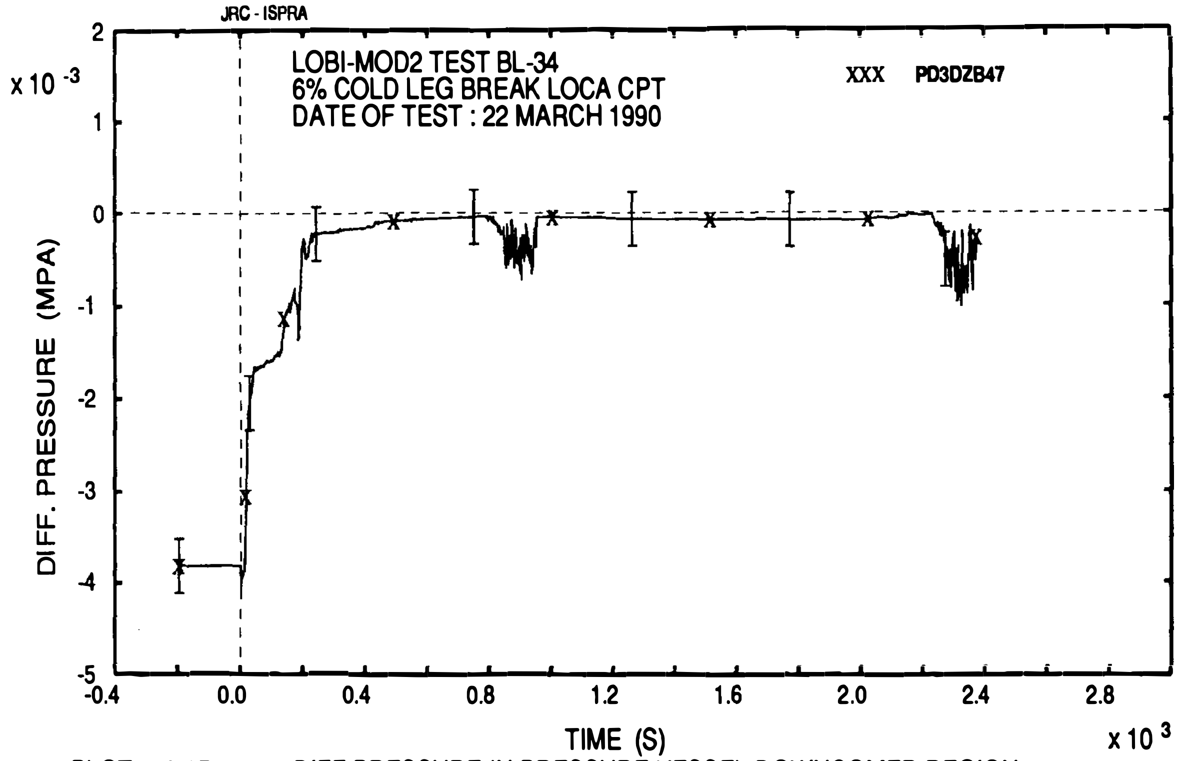
PLOT 2.12 DIFF.PRESSURE OVER BROKEN LOOP PUMP (PD252451)



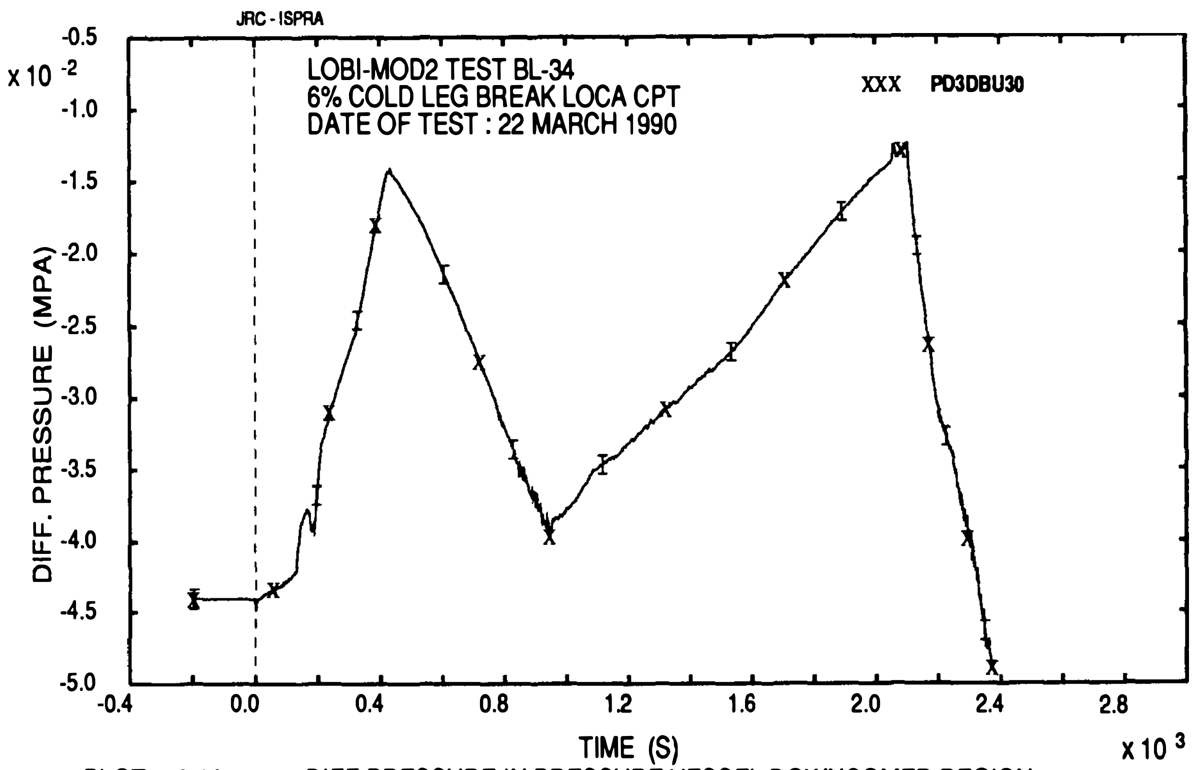
PLOT 2.13 DIFF.PRESSURE OVER VESSEL INLET
-INTACT LOOP, COLD LEG TO VESSEL DOWNCOMER (PD163DB3)-
-BROKEN LOOP, COLD LEG TO VESSEL DOWNCOMER (PD263DB7)-



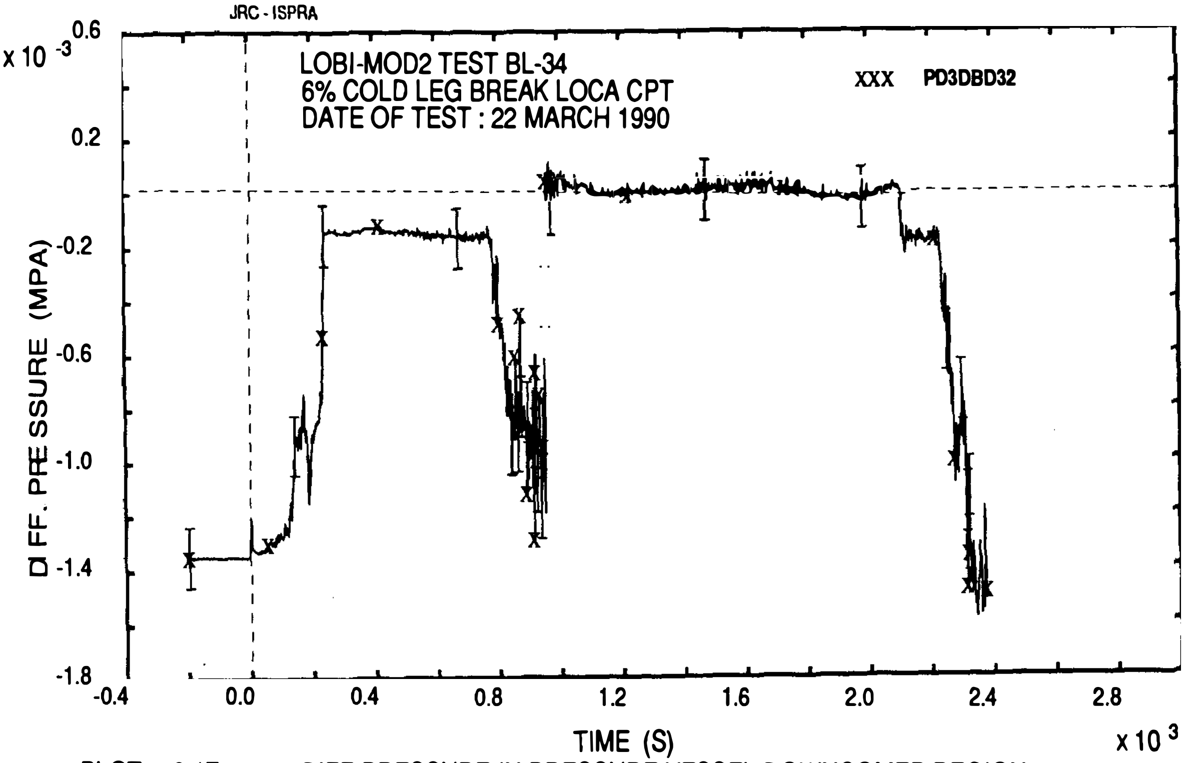
PLOT 2.14 DIFF.PRESSURE IN PRESSURE VESSEL
-DOWNCOMER LEVEL B TO RISER LEVEL A (PD3D3RBA)-
-NEAR VESSEL INLET ELEVATION-



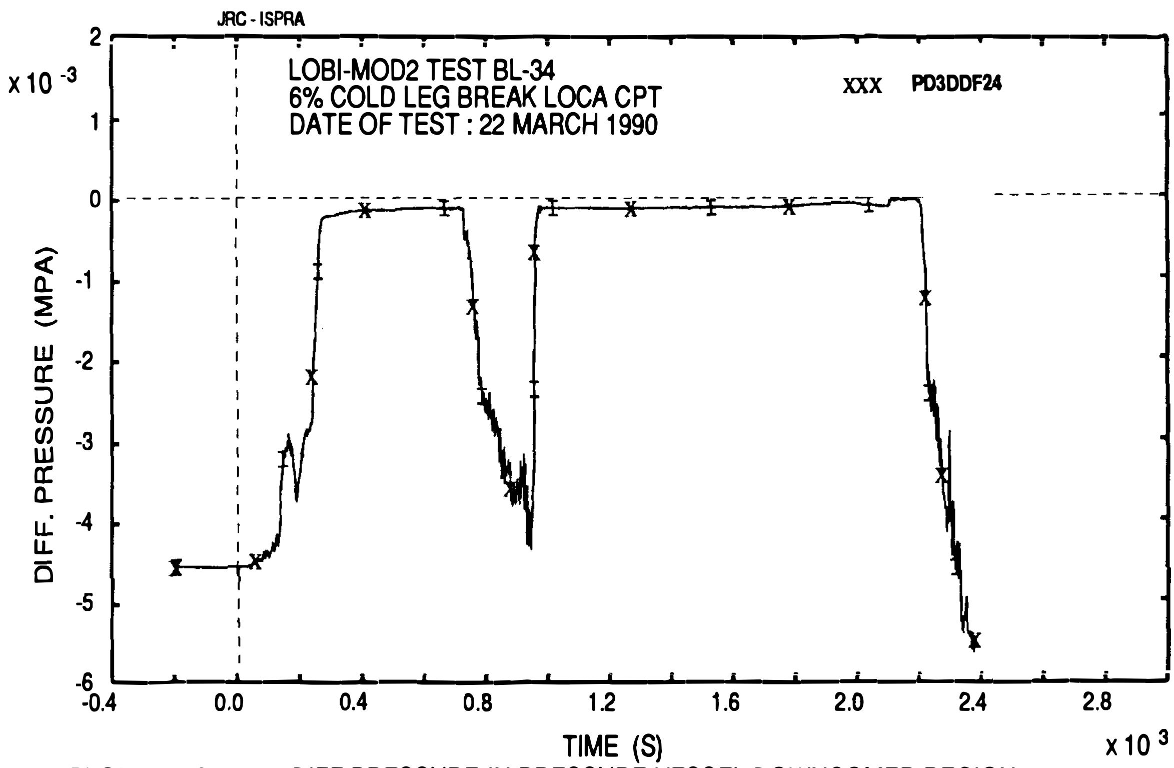
PLOT 2.15 DIFF.PRESSURE IN PRESSURE VESSEL DOWNCOMER REGION
-LEVEL Z TO B (PD3DZB47)-



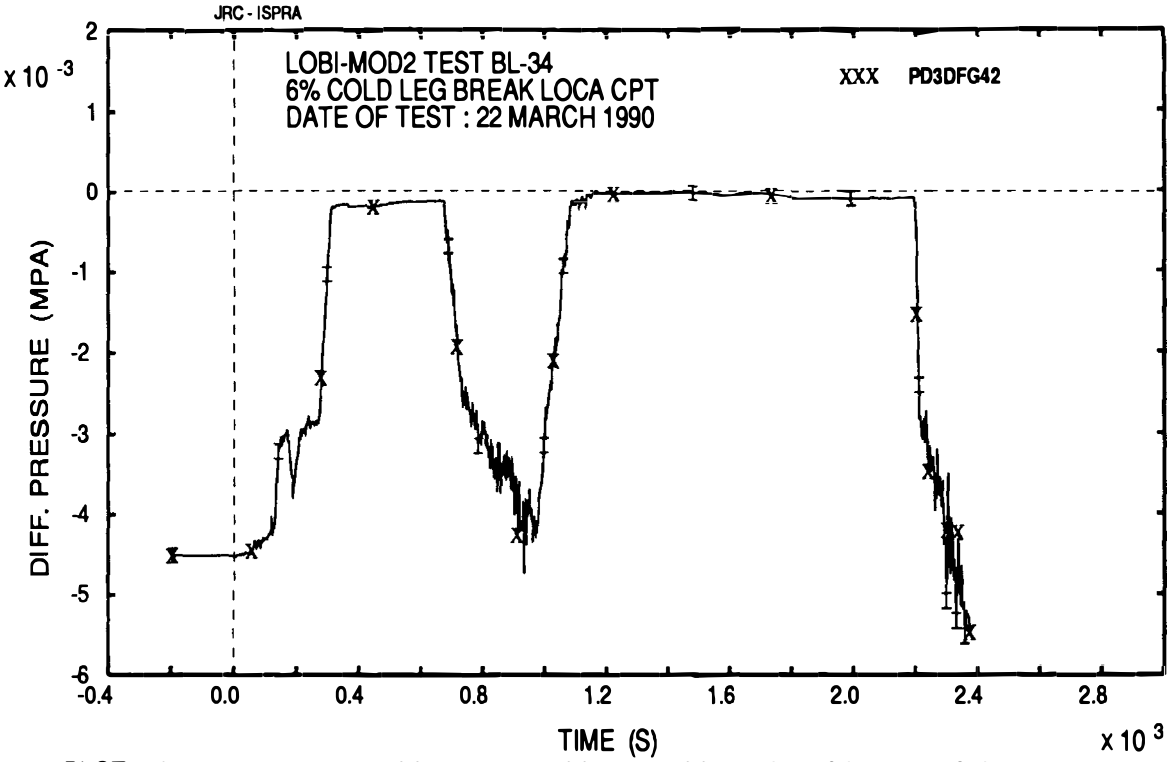
PLOT 2.16 DIFF.PRESSURE IN PRESSURE VESSEL DOWNCOMER REGION
-LEVEL B TO U (PD3DBU30)-



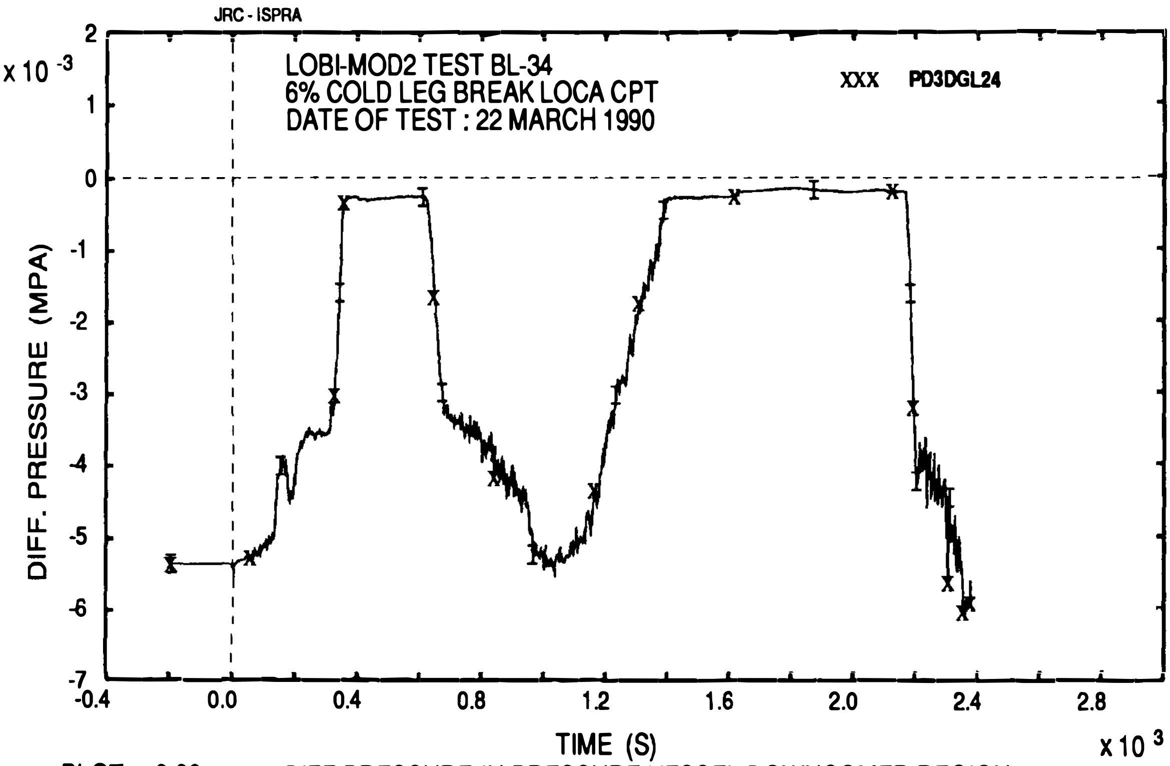
PLOT 2.17 DIFF.PRESSURE IN PRESSURE VESSEL DOWNCOMER REGION
-LEVEL B TO D (PD3DBD32)-



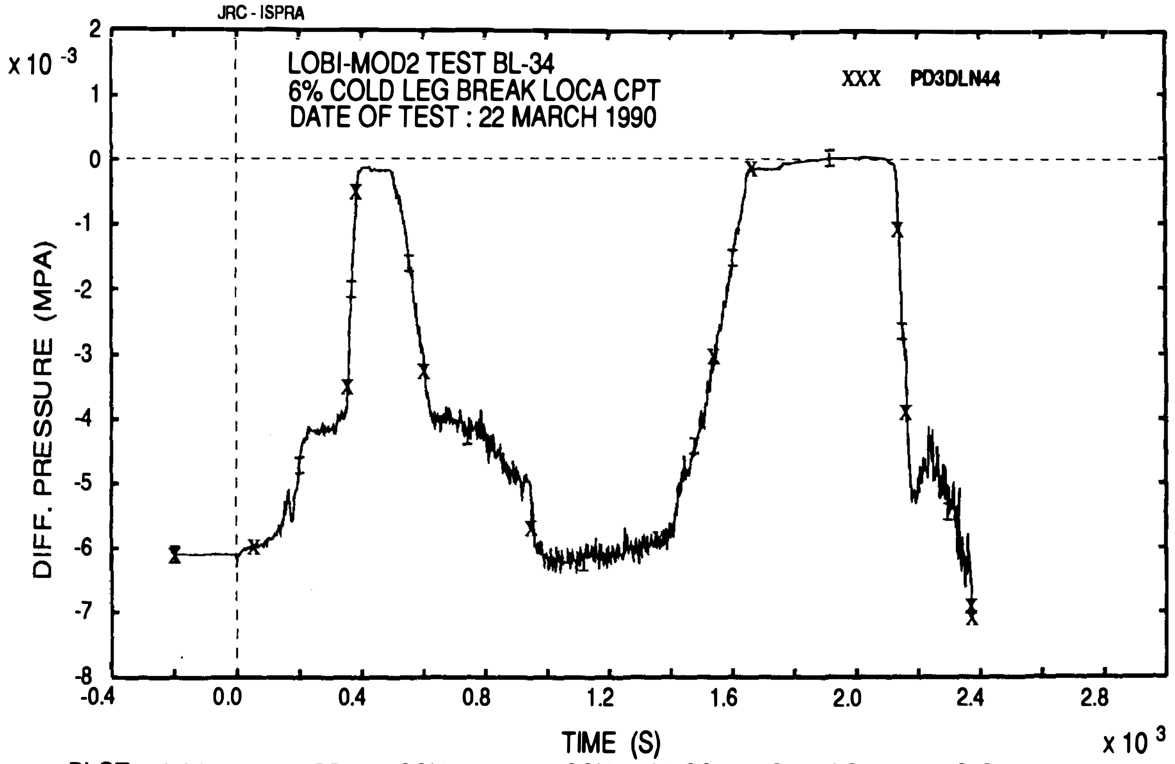
PLOT 2.18 DIFF.PRESSURE IN PRESSURE VESSEL DOWNCOMER REGION
-LEVEL D TO F (PD3DDF24)-



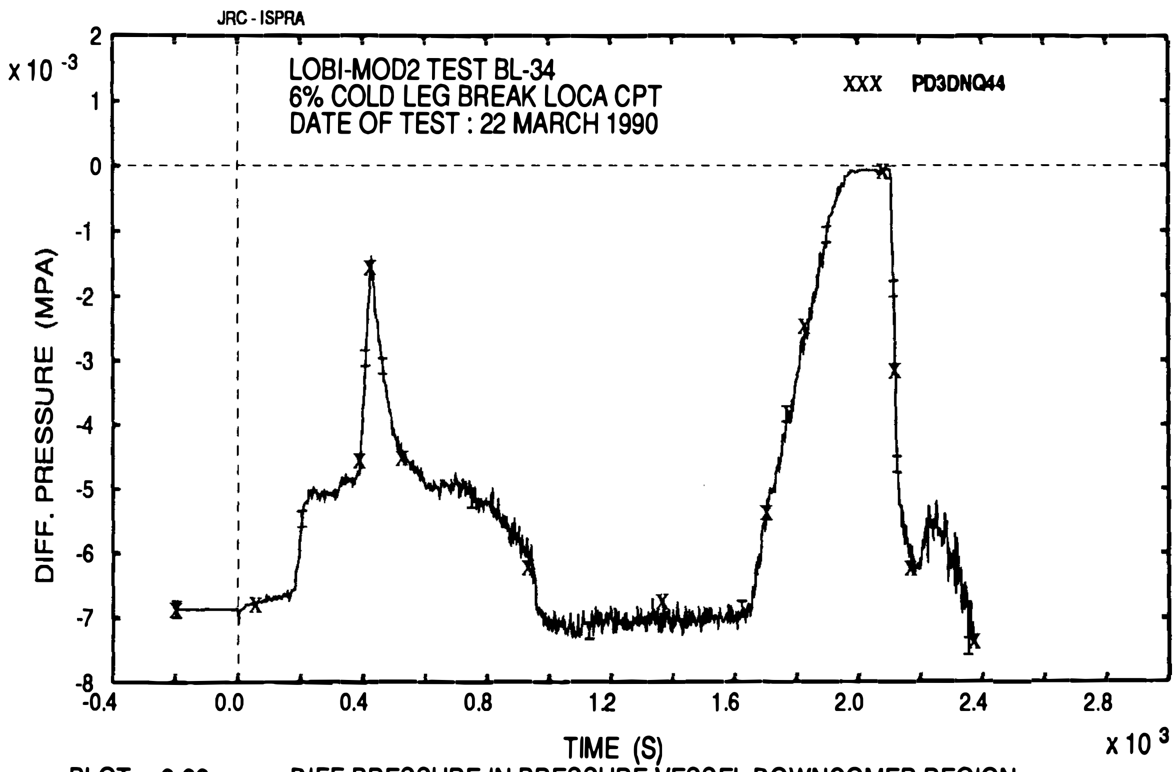
PLOT 2.19 DIFF.PRESSURE IN PRESSURE VESSEL DOWNCOMER REGION
-LEVEL F TO G (PD3DFG42)-



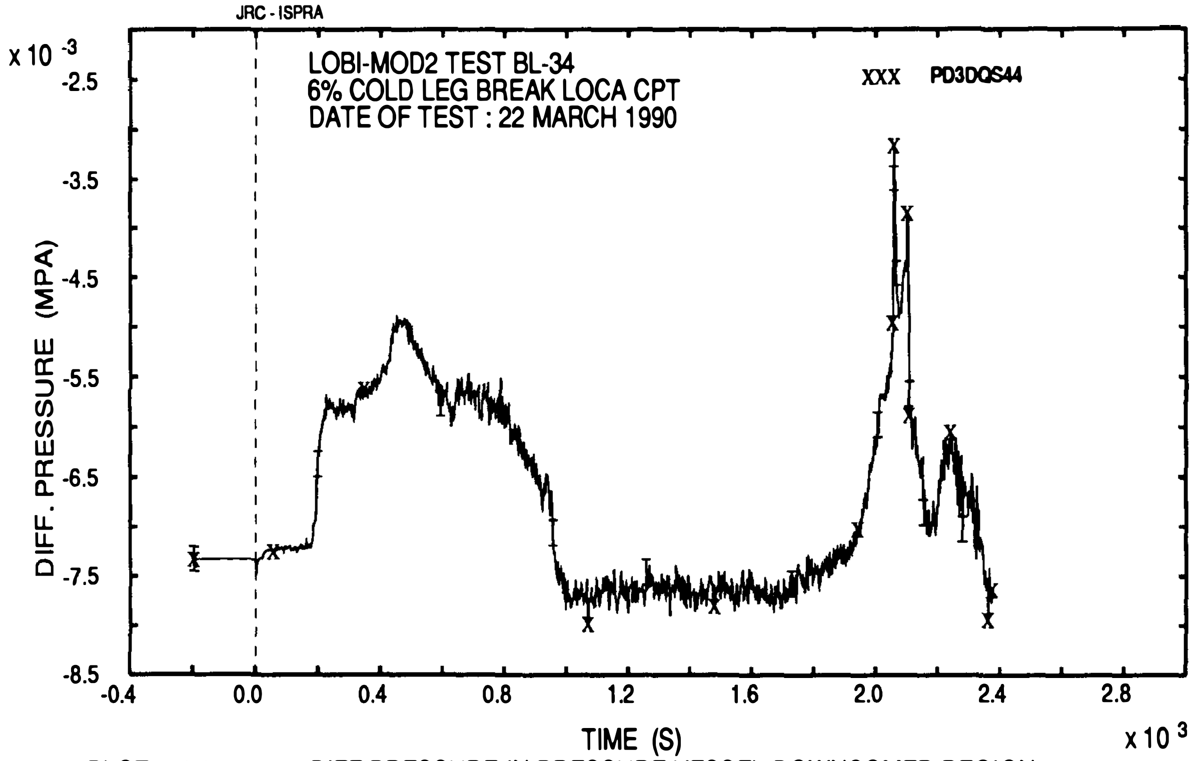
PLOT 2.20 DIFF.PRESSURE IN PRESSURE VESSEL DOWNCOMER REGION
-LEVEL G TO L (PD3DGL24)-



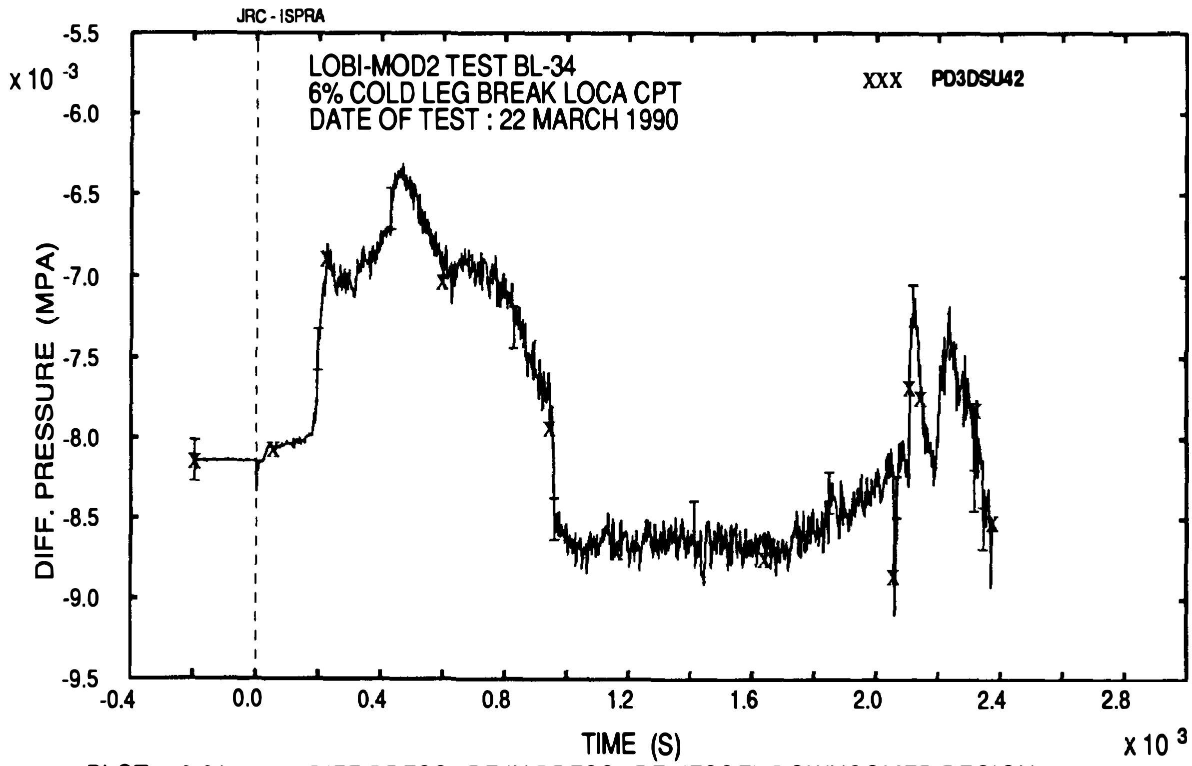
PLOT 2.21 DIFF.PRESSURE IN PRESSURE VESSEL DOWNCOMER REGION
-LEVEL L TO N (PD3DLN44)-



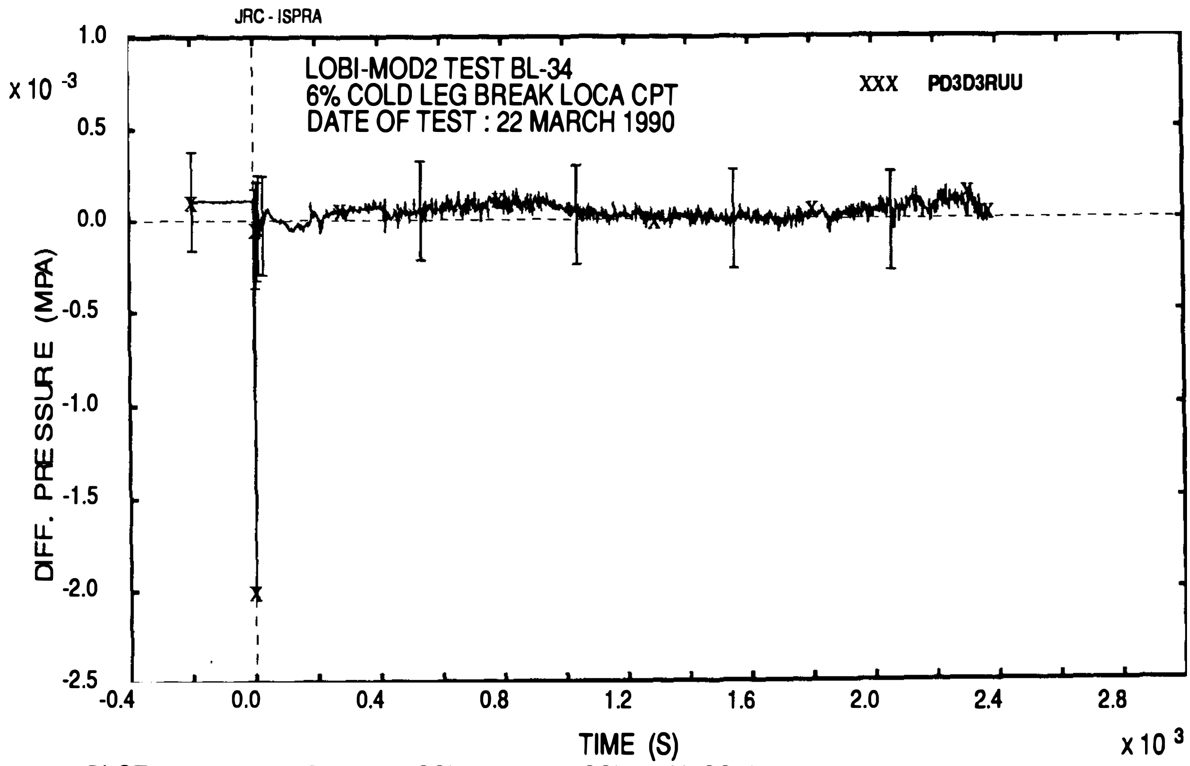
PLOT 2.22 DIFF.PRESSURE IN PRESSURE VESSEL DOWNCOMER REGION
-LEVEL N TO Q (PD3DNQ44)-



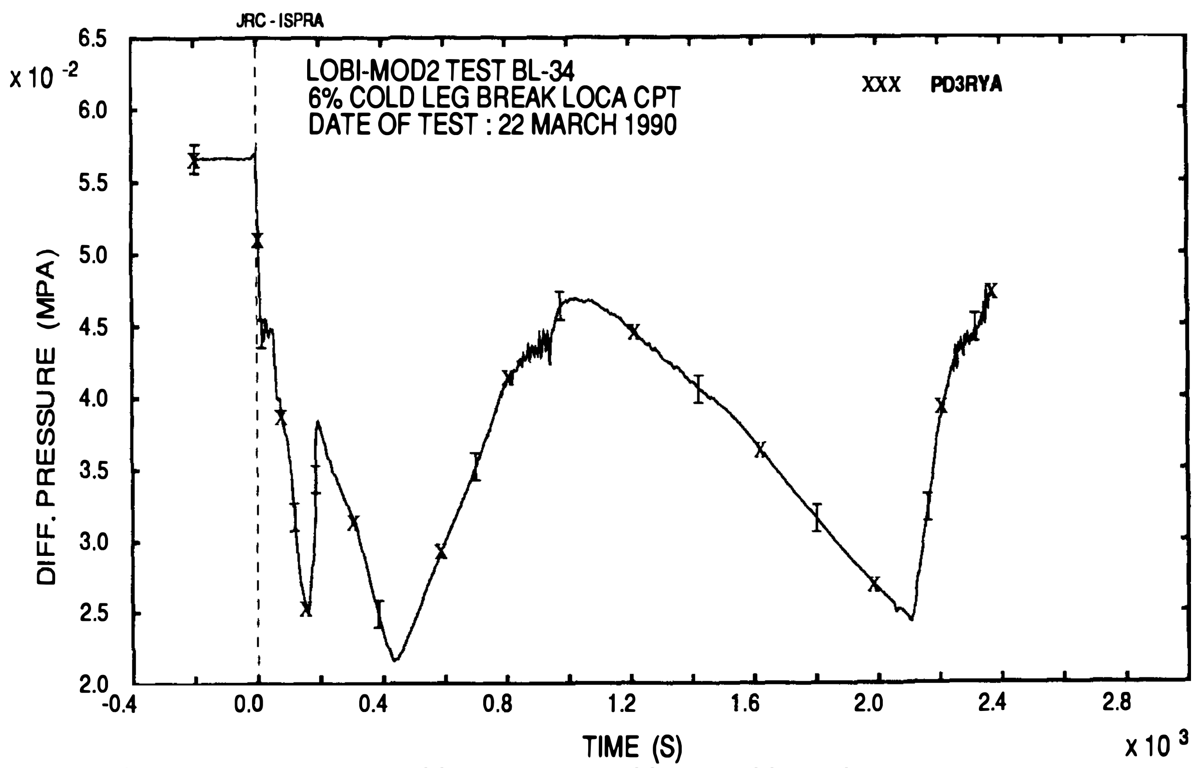
PLOT 2.23 DIFF.PRESSURE IN PRESSURE VESSEL DOWNCOMER REGION
-LEVEL Q TO S (PD3DQS44)-



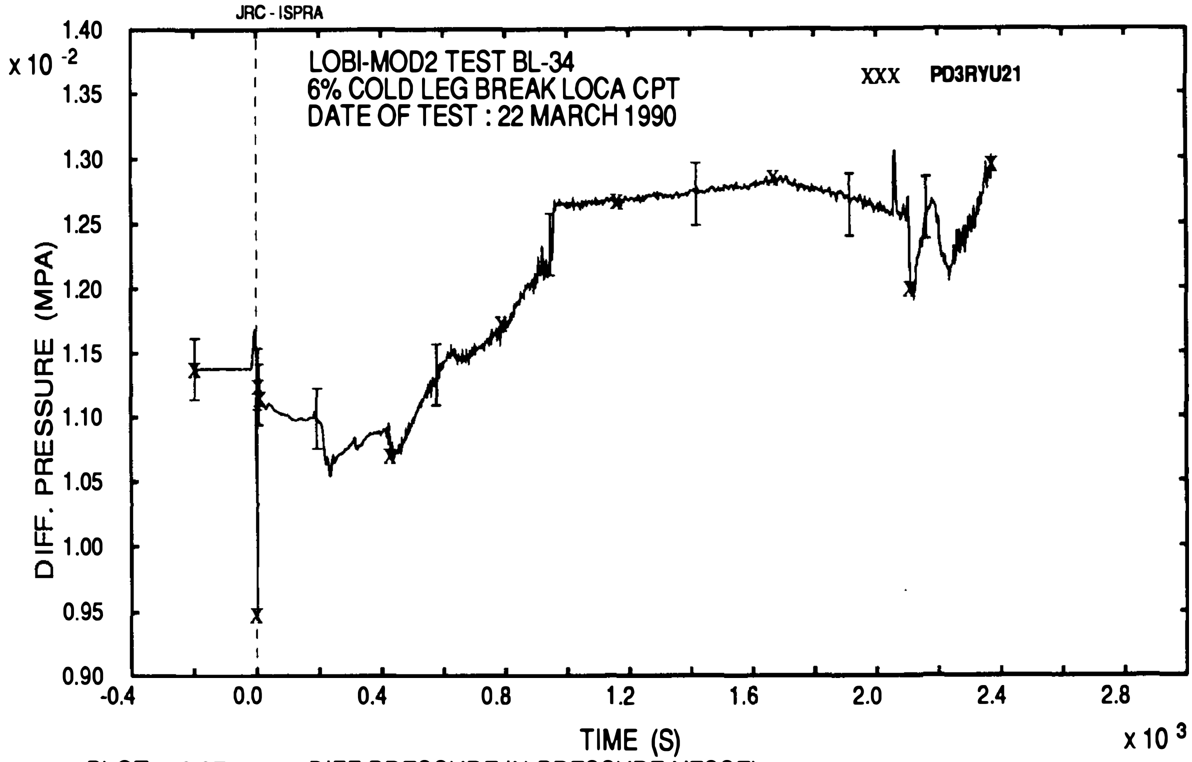
PLOT 2.24 DIFF.PRESSURE IN PRESSURE VESSEL DOWNCOMER REGION
-LEVEL S TO U (PD3DSU42)-



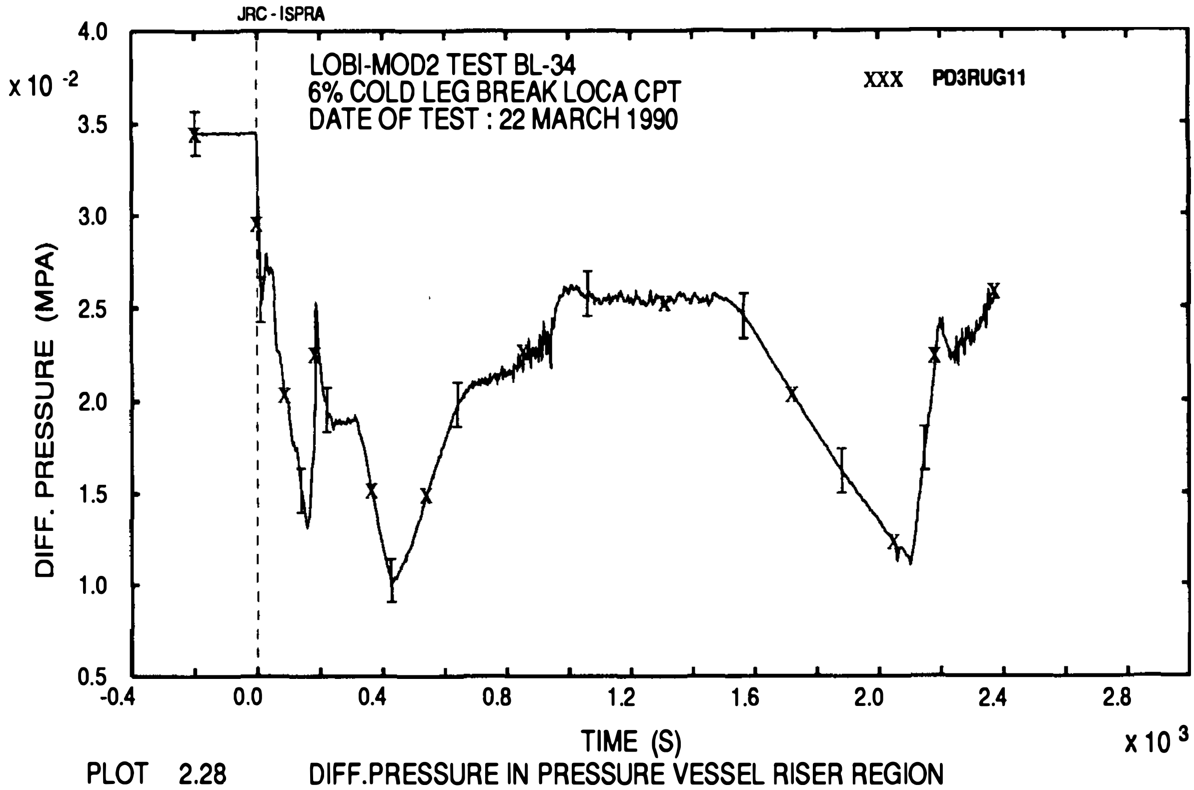
PLOT 2.25 DIFF.PRESSURE IN PRESSURE VESSEL
-DOWNCOMER LEVEL U TO RISER INLET LEVEL U (PD3D3RUU)-



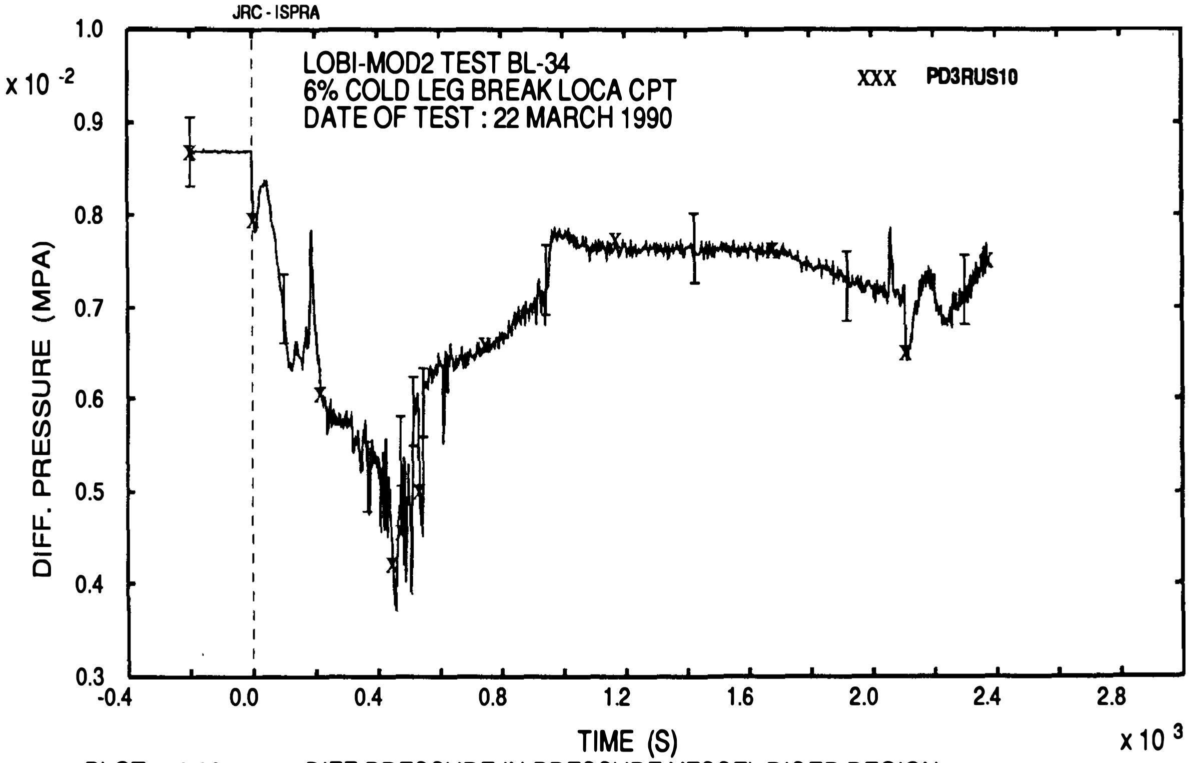
PLOT 2.26 DIFF.PRESSURE OVER PRESSURE VESSEL RISER (PD3RYA)



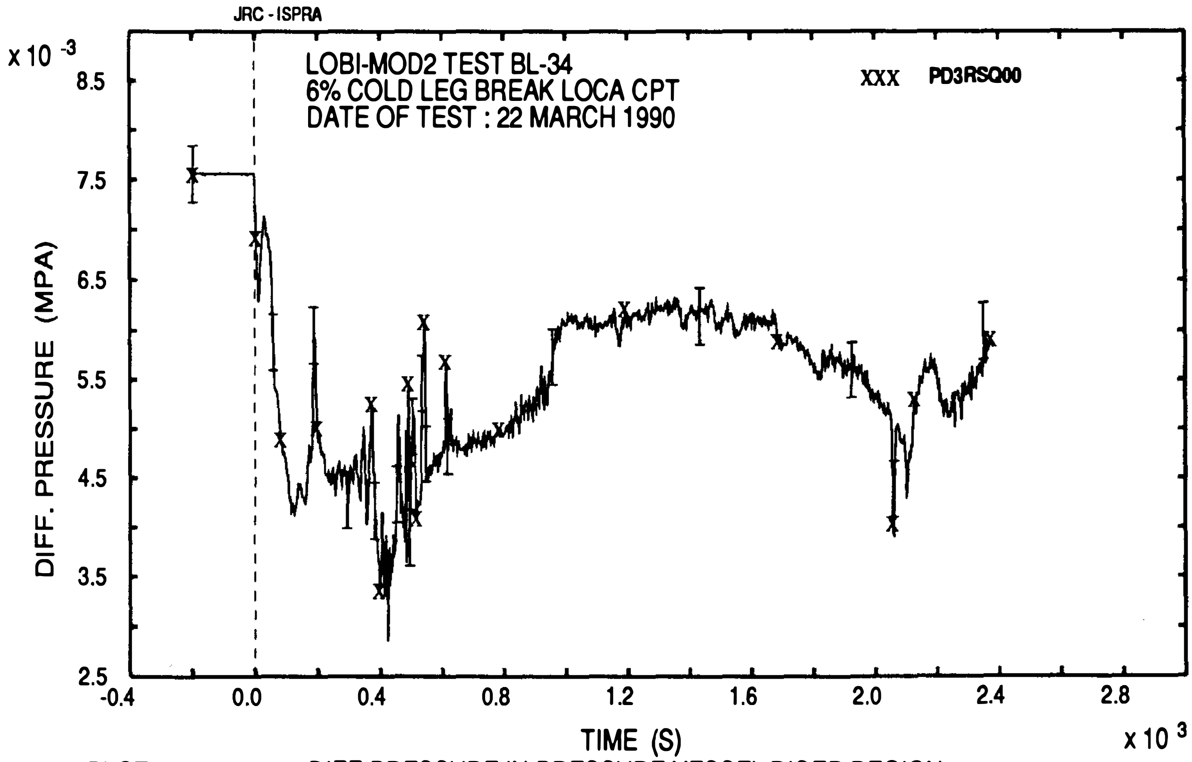
PLOT 2.27 DIFF.PRESSURE IN PRESSURE VESSEL
-LOWER PLENUM TO RISER ENTRANCE-
-LEVEL Y TO U (PD3RYAU21)-



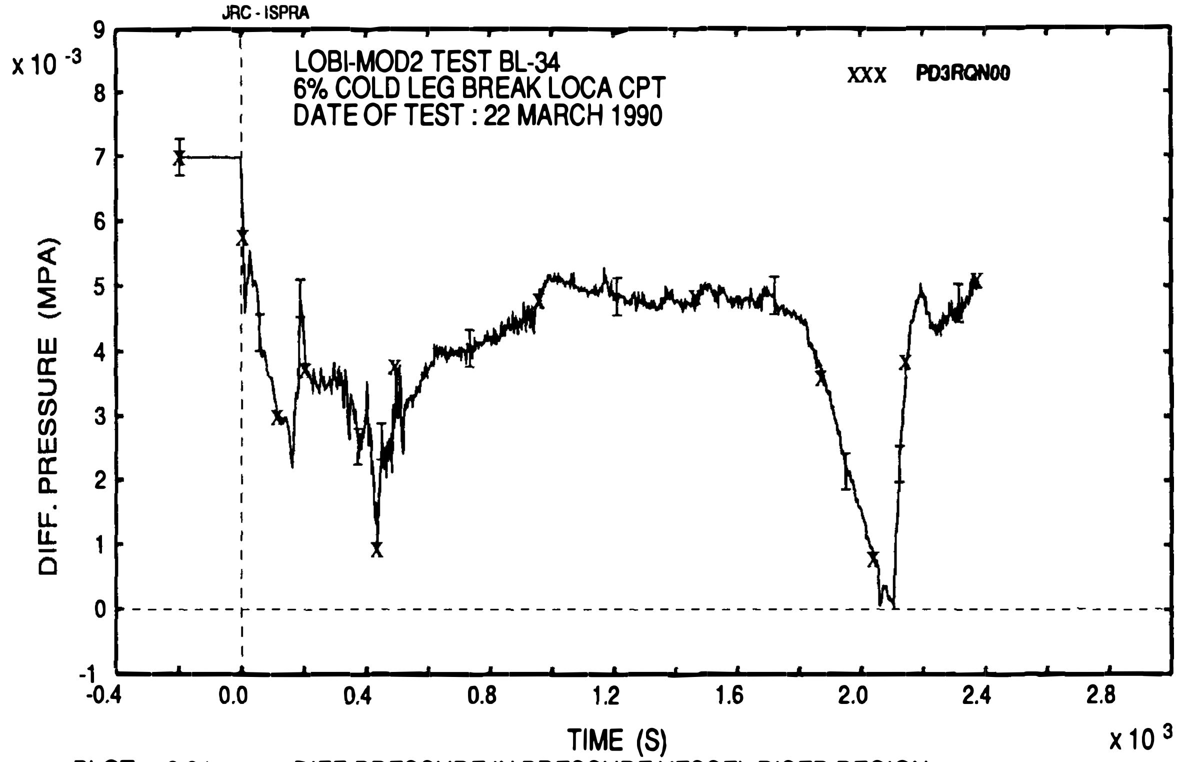
PLOT 2.28 DIFF.PRESSURE IN PRESSURE VESSEL RISER REGION
-LEVEL U TO G (PD3RUG11)-



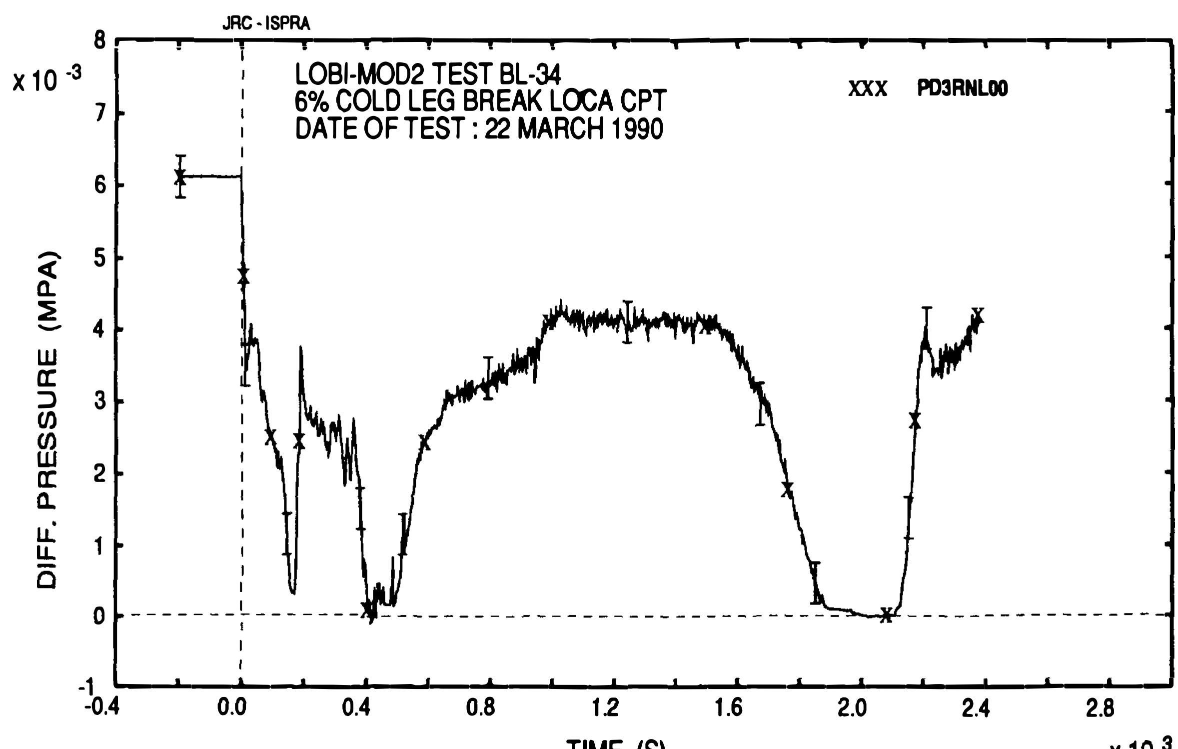
PLOT 2.29 DIFF.PRESSURE IN PRESSURE VESSEL RISER REGION
-LEVEL U TO S (PD3RUS10)-



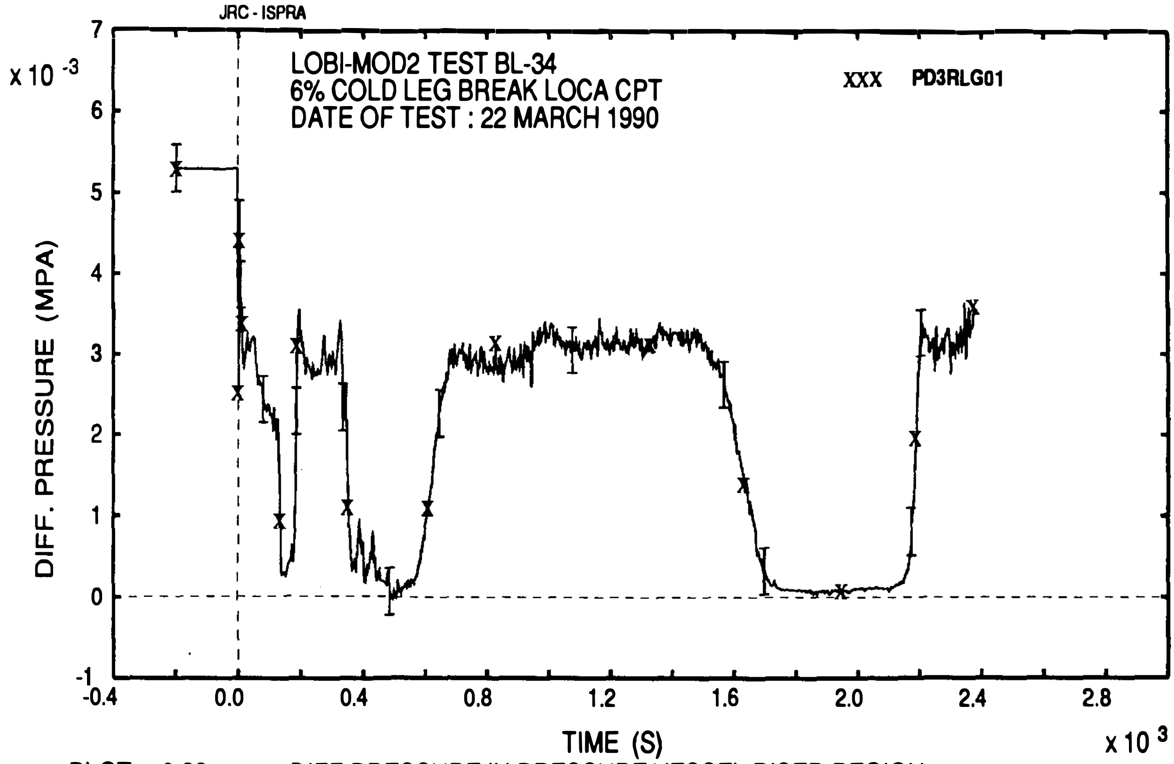
PLOT 2.30 DIFF.PRESSURE IN PRESSURE VESSEL RISER REGION
-LEVEL S TO Q (PD3RSQ00)-



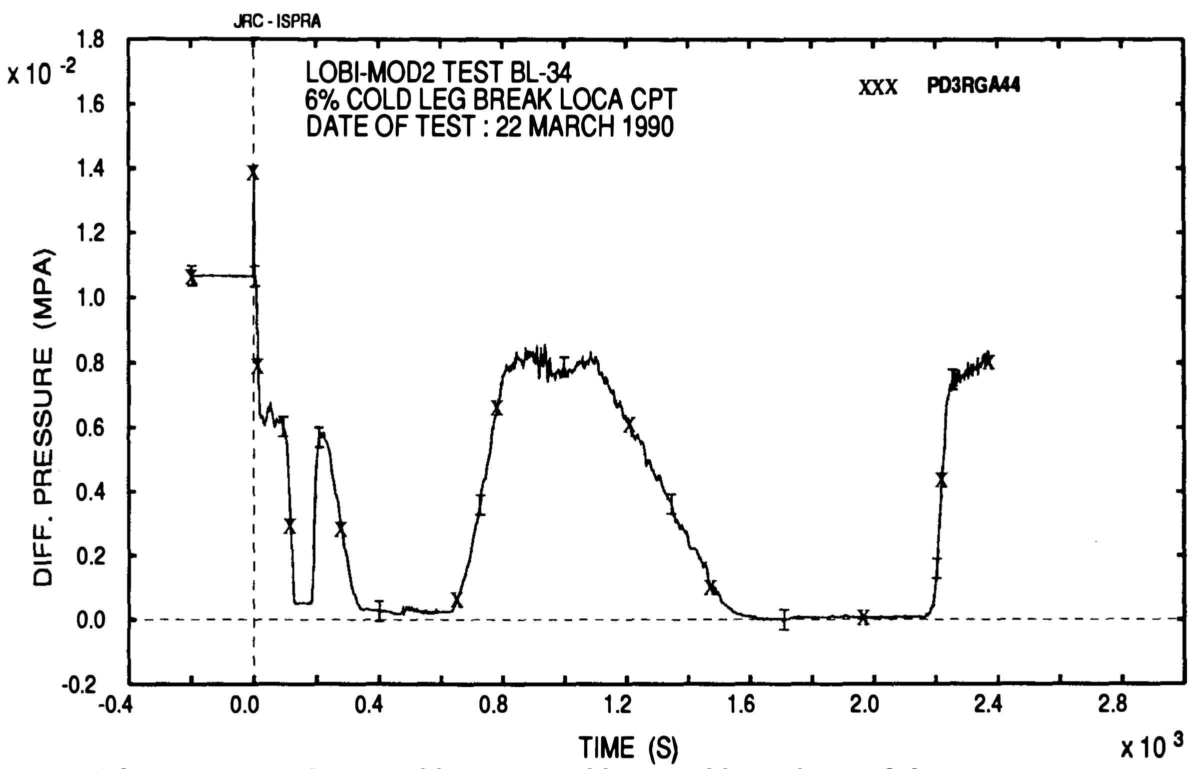
PLOT 2.31 DIFF.PRESSURE IN PRESSURE VESSEL RISER REGION
-LEVEL Q TO N (PD3RQN00)-



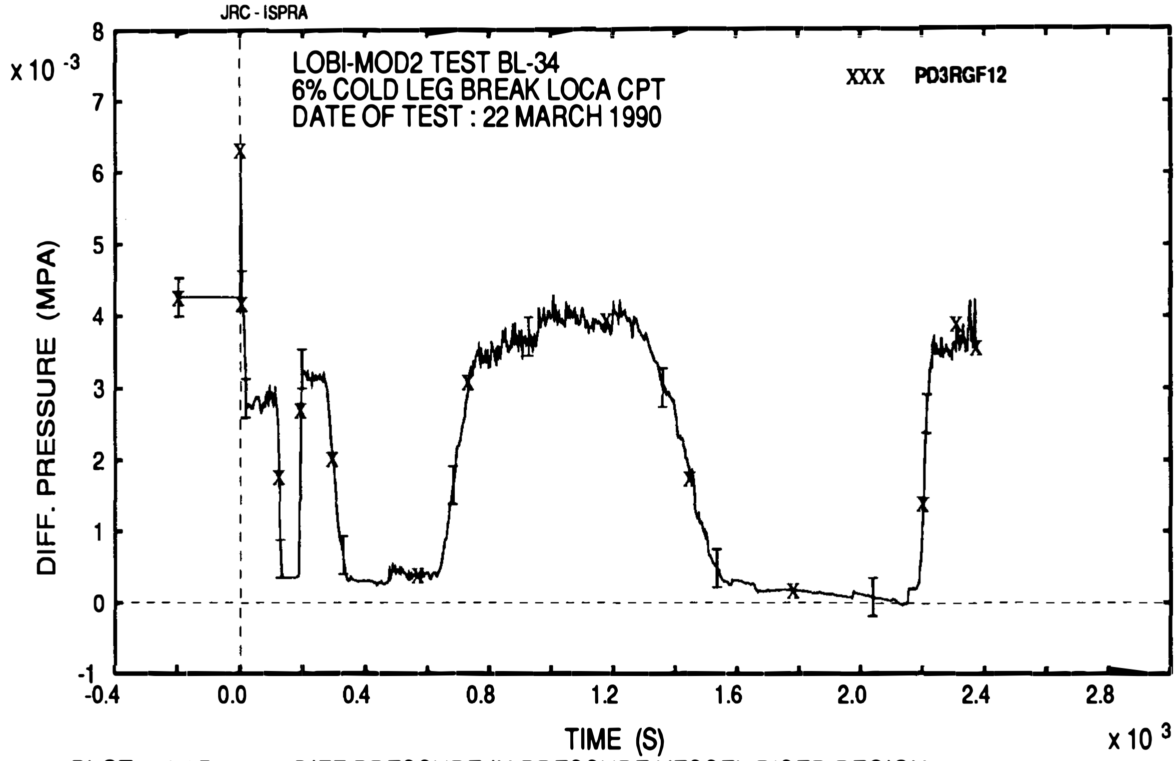
PLOT 2.32 DIFF.PRESSURE IN PRESSURE VESSEL RISER REGION
-LEVEL N TO L (PD3RNL00)-



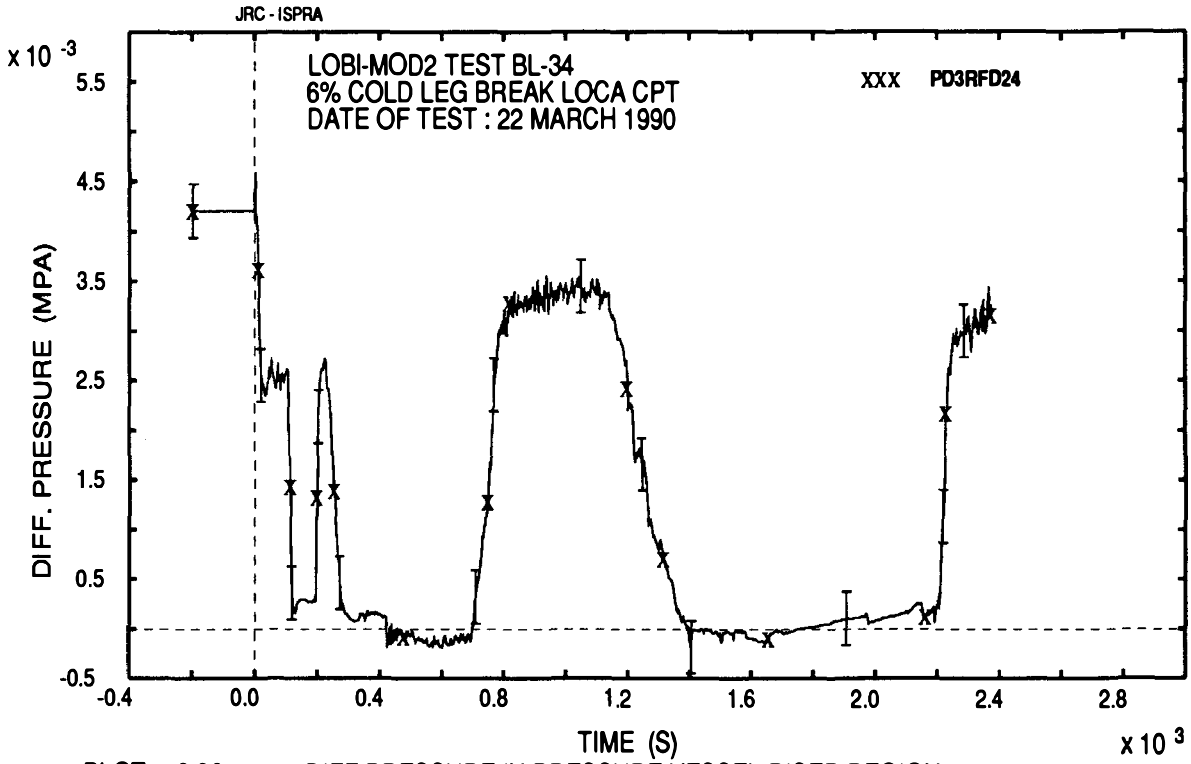
PLOT 2.33 DIFF.PRESSURE IN PRESSURE VESSEL RISER REGION
-LEVEL L TO G (PD3RLG01)-



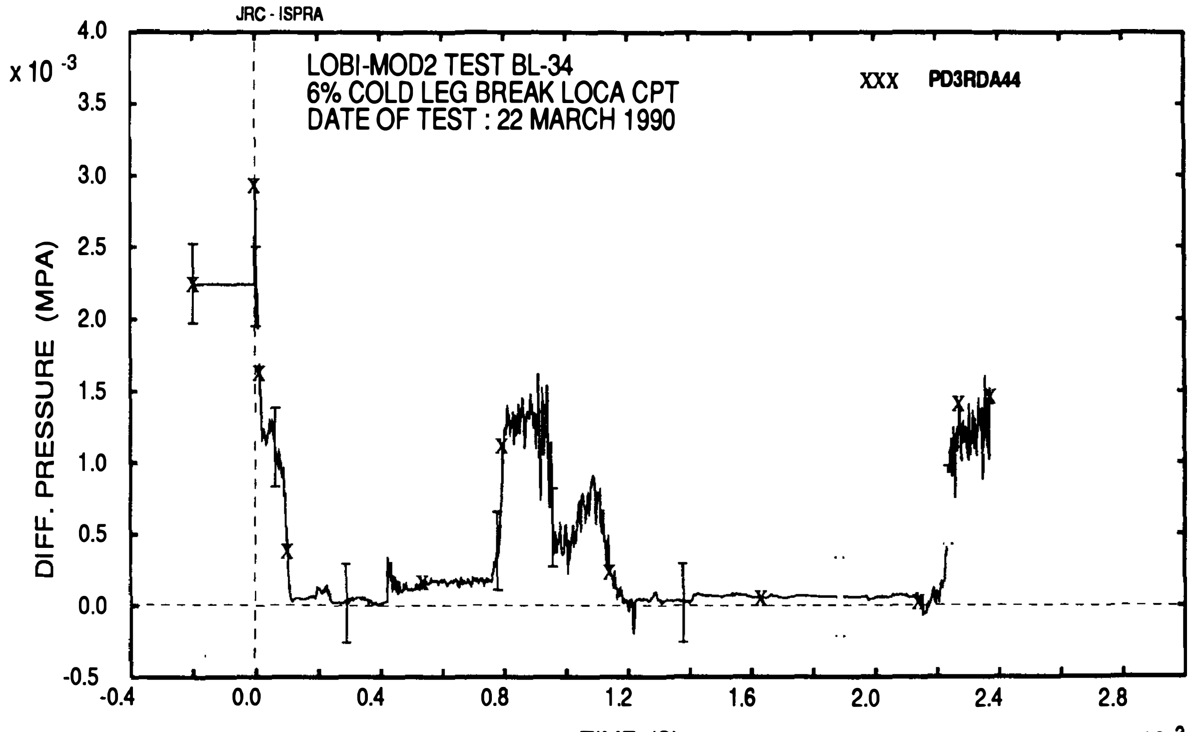
PLOT 2.34 DIFF.PRESSURE IN PRESSURE VESSEL RISER REGION
-LEVEL G TO A (PD3RGA44)-



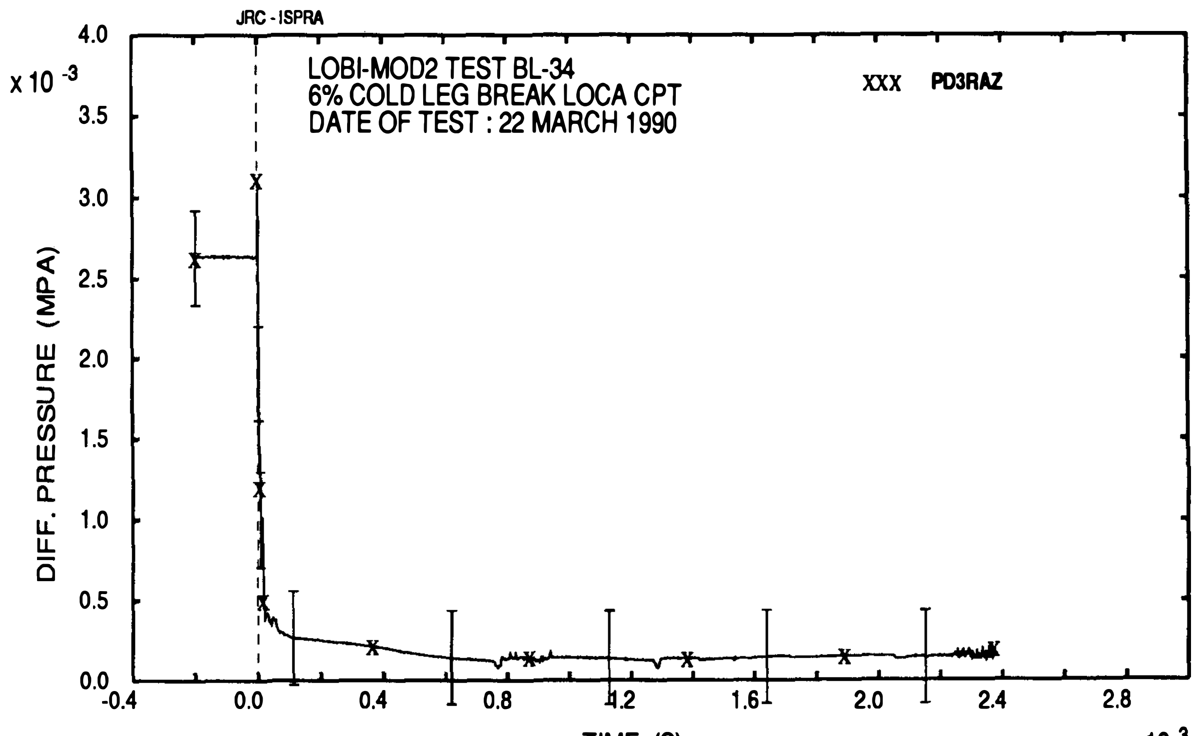
PLOT 2.35 DIFF.PRESSURE IN PRESSURE VESSEL RISER REGION
-LEVEL G TO F (PD3RGF12)-



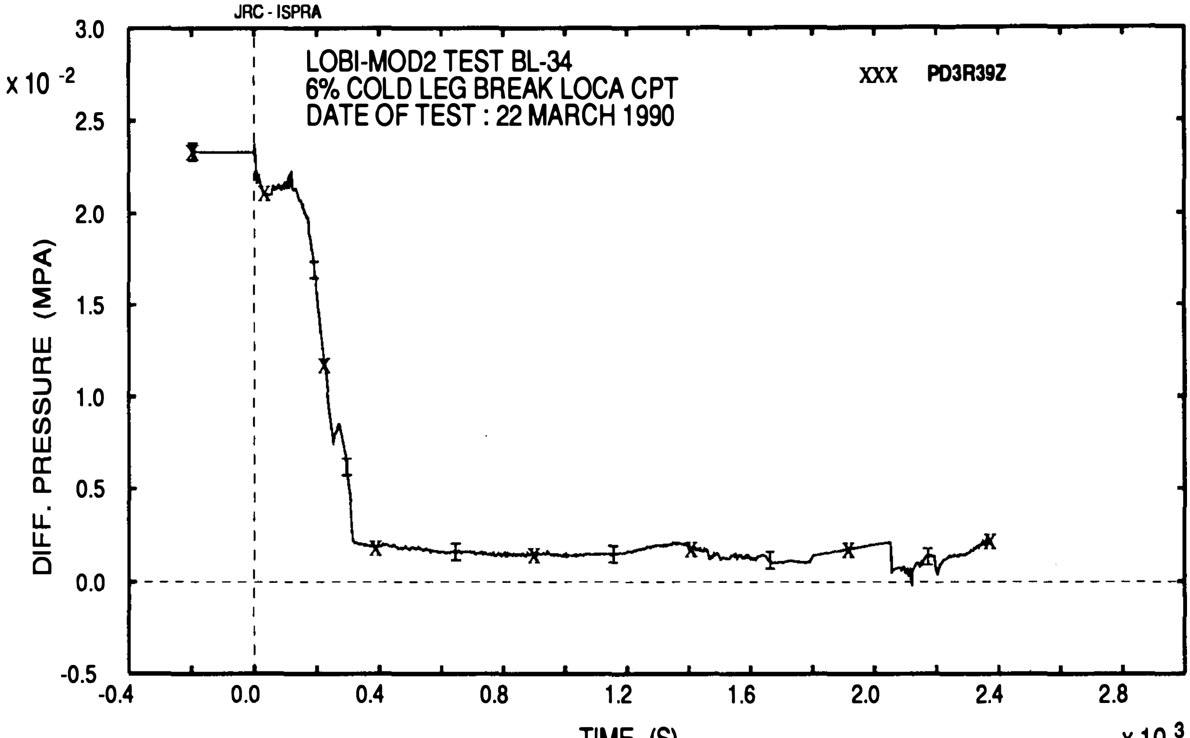
PLOT 2.36 DIFF.PRESSURE IN PRESSURE VESSEL RISER REGION
-LEVEL F TO D (PD3RFD24)-



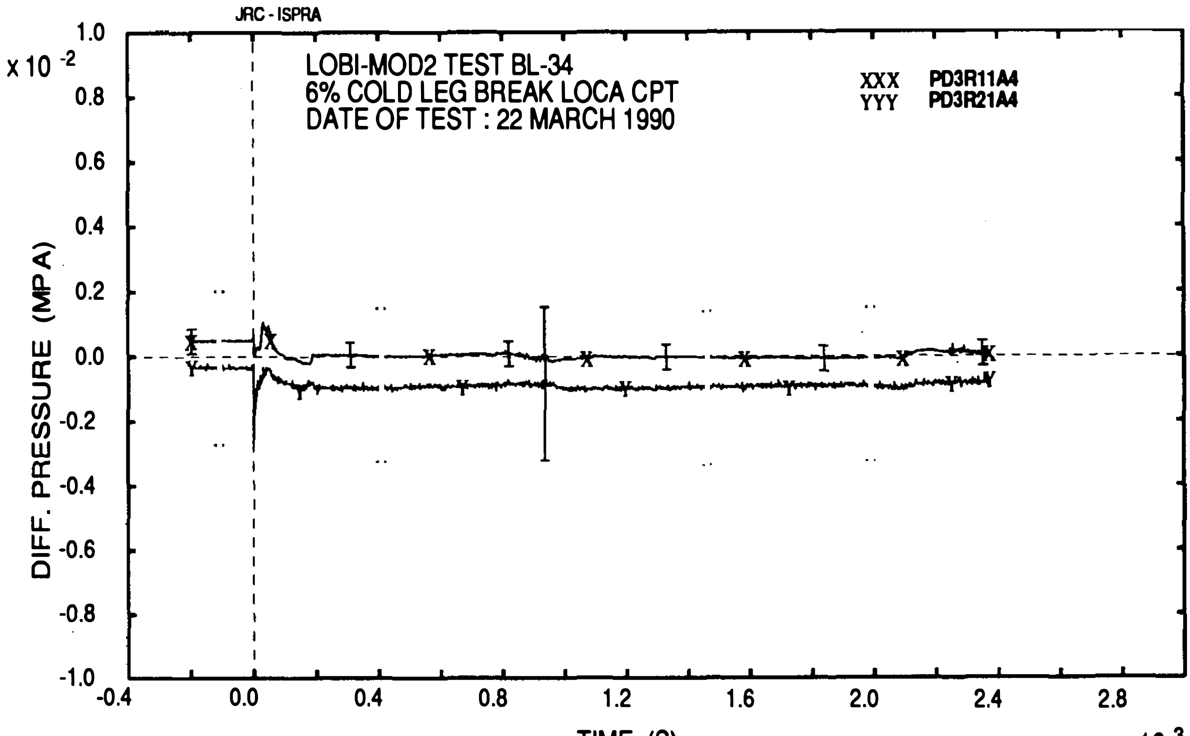
PLOT 2.37 DIFF.PRESSURE IN PRESSURE VESSEL RISER REGION
-LEVEL D TO A (PD3RDA44)-



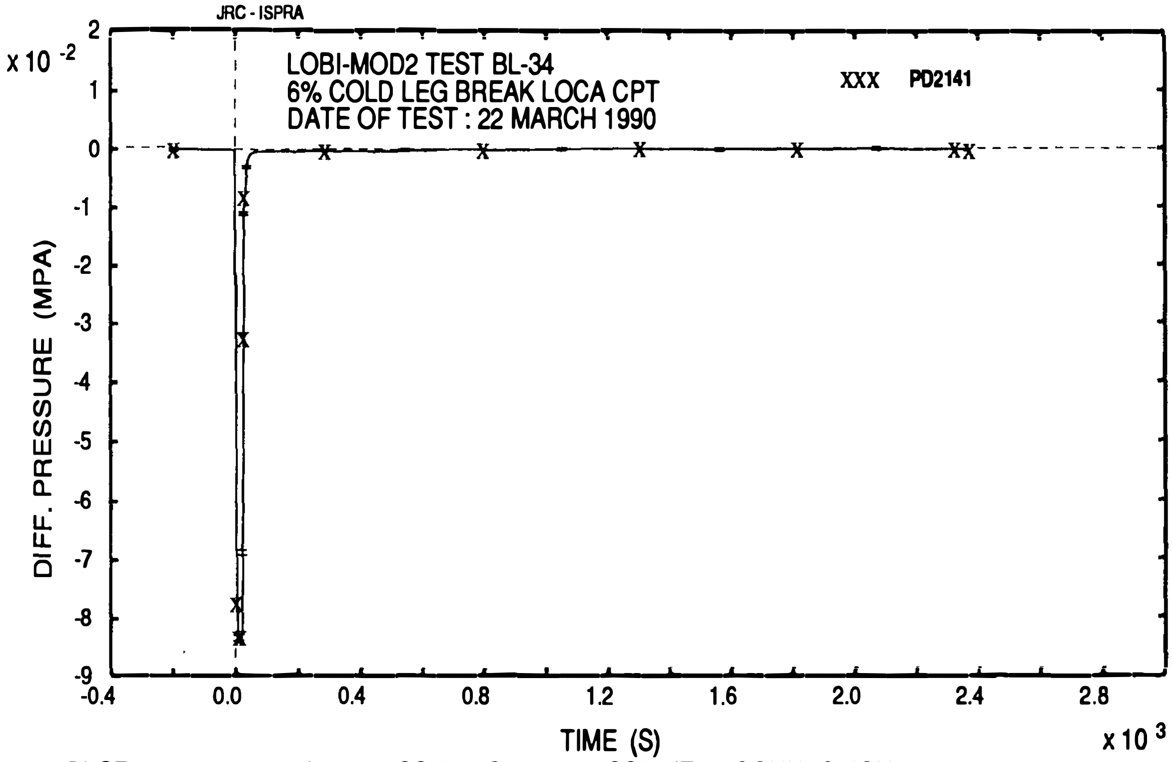
PLOT 2.38 DIFF.PRESSURE IN PRESSURE VESSEL RISER REGION
-LEVEL A TO Z (PD3RAZ)-



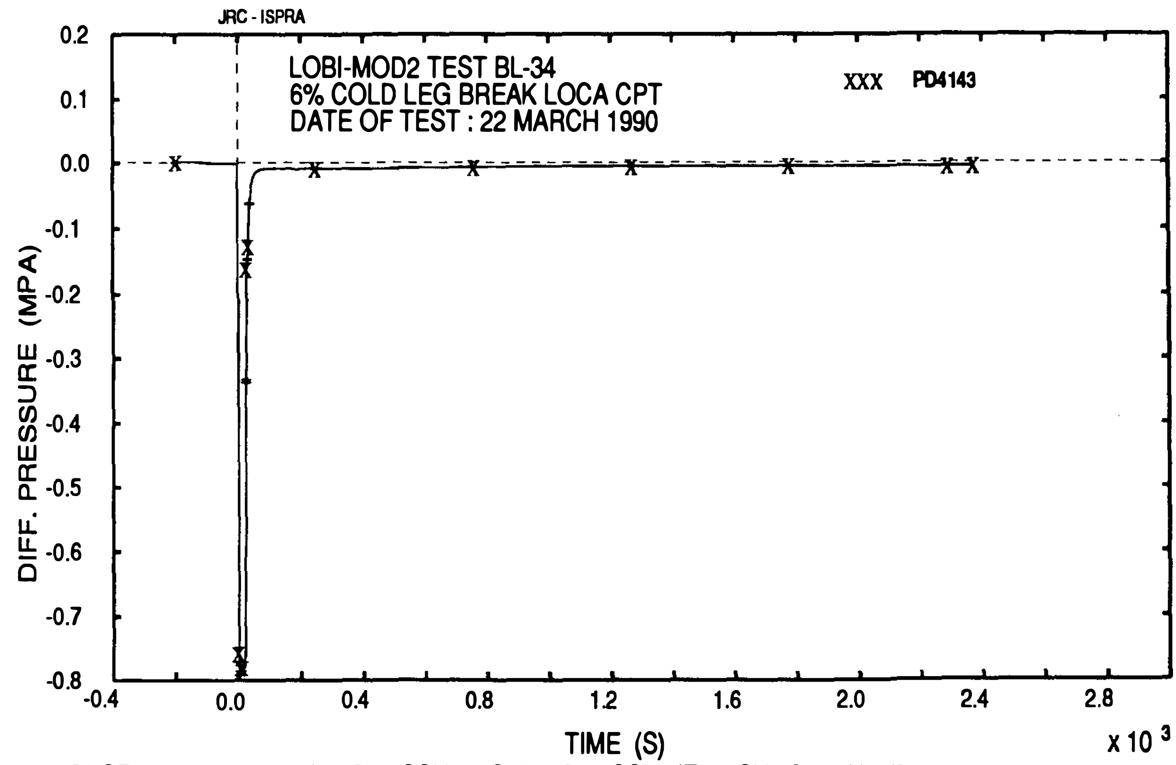
PLOT 2.39 DIFF.PRESSURE OVER UPPER HEAD SIMULATOR
-RISER LEVEL Z TO UPPER HEAD (PD3R39Z)-



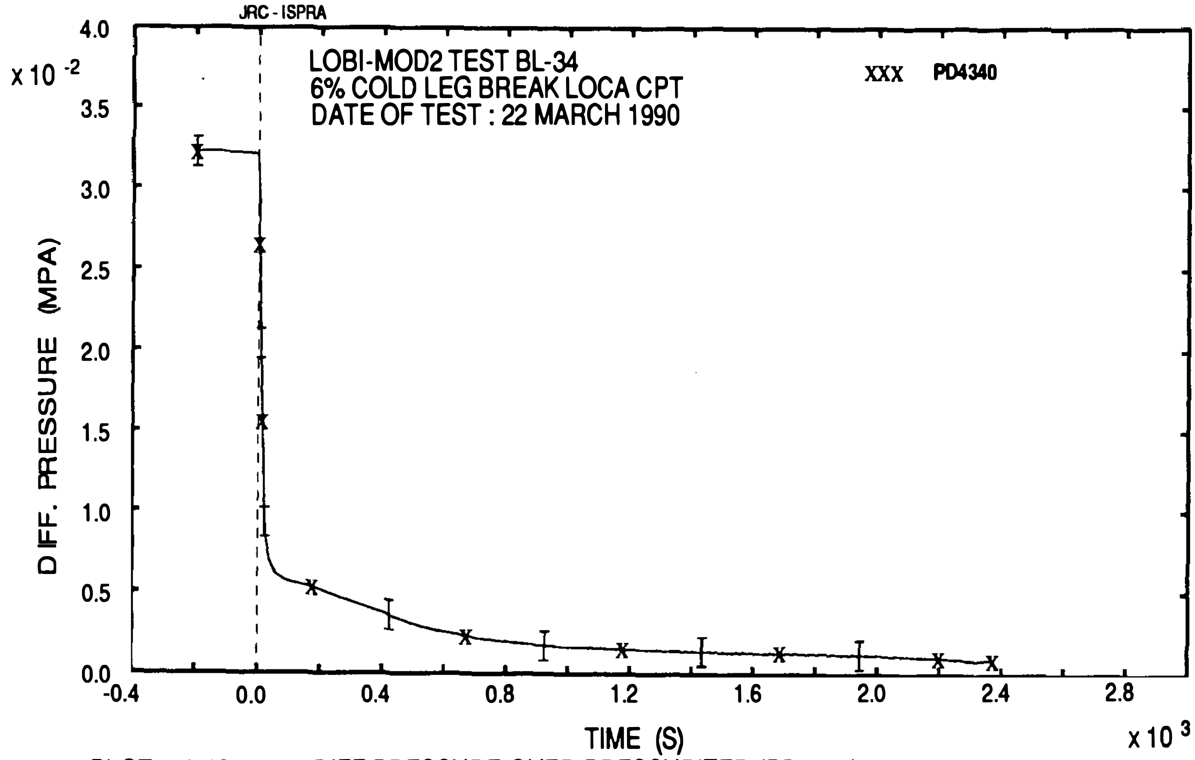
PLOT 2.40 DIFF.PRESSURE OVER VESSEL OUTLET
-RISER LEVEL A TO INTACT LOOP, HOT LEG (PD3R11A4)-
-RISER LEVEL A TO BROKEN LOOP, HOT LEG (PD3R21A4)-



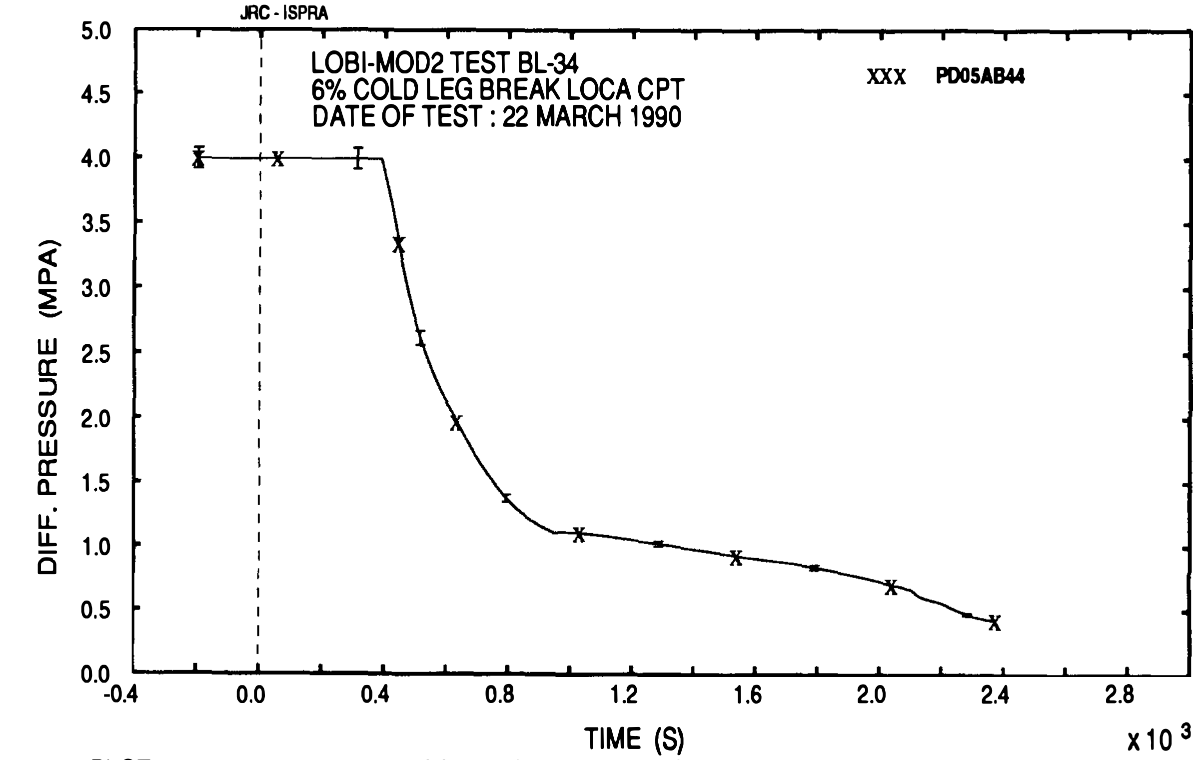
PLOT 2.41 DIFF.PRESSURE OVER PRESSURIZER CONNECTION
-SURGE LINE TO BROKEN LOOP (PD2141)-



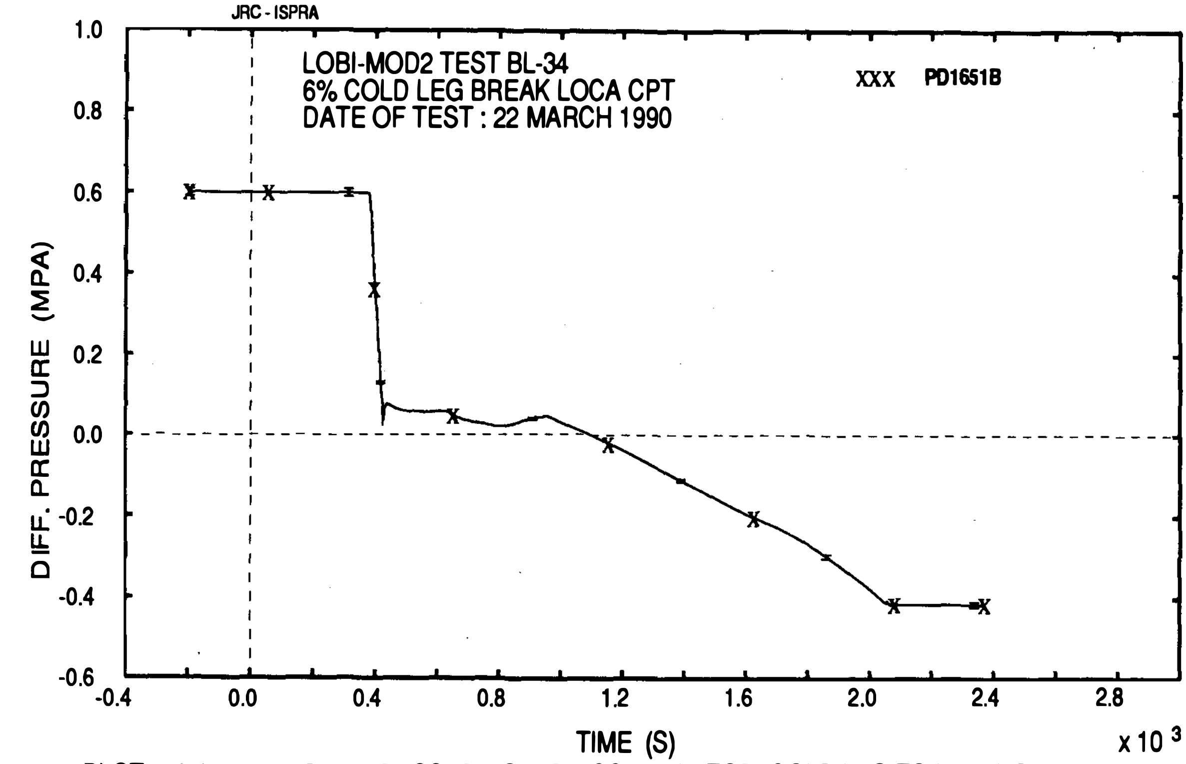
PLOT 2.42 DIFF.PRESSURE OVER PRESSURIZER SURGE LINE (PD4143)
-SURGE LINE CONNECTED TO INTACT LOOP-



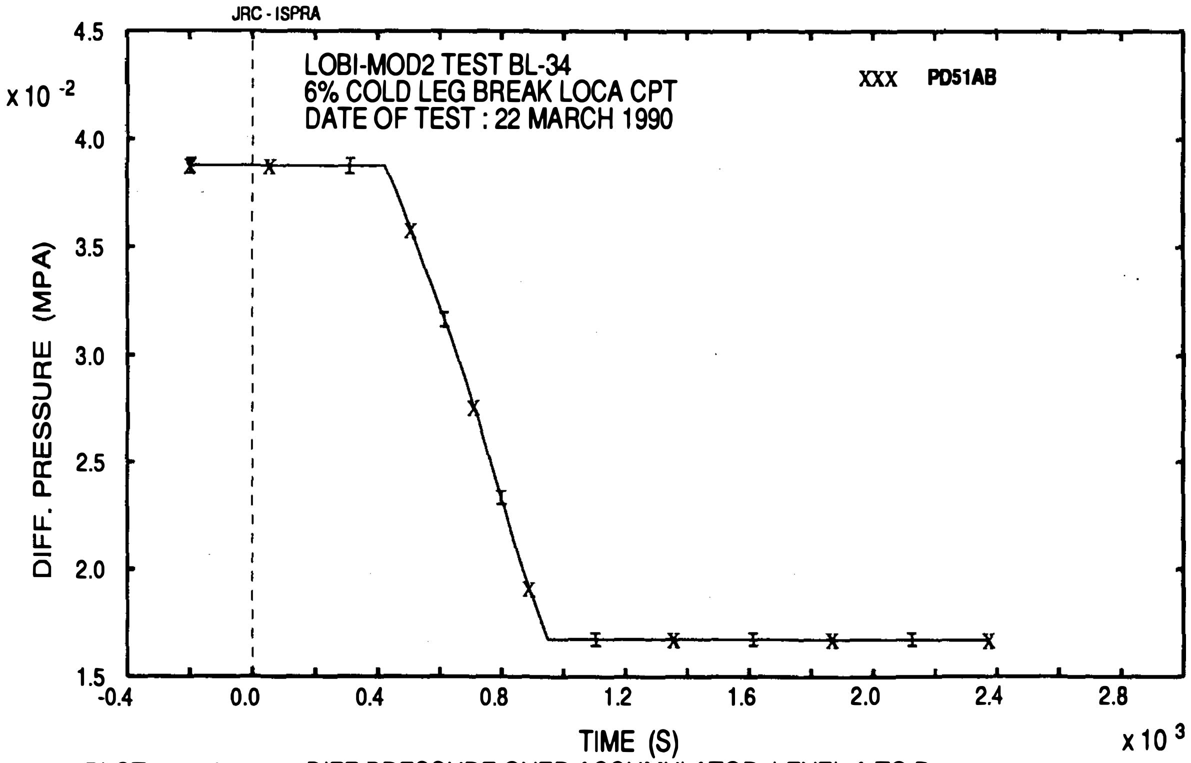
PLOT 2.43 DIFF.PRESSURE OVER PRESSURIZER (PD4340)



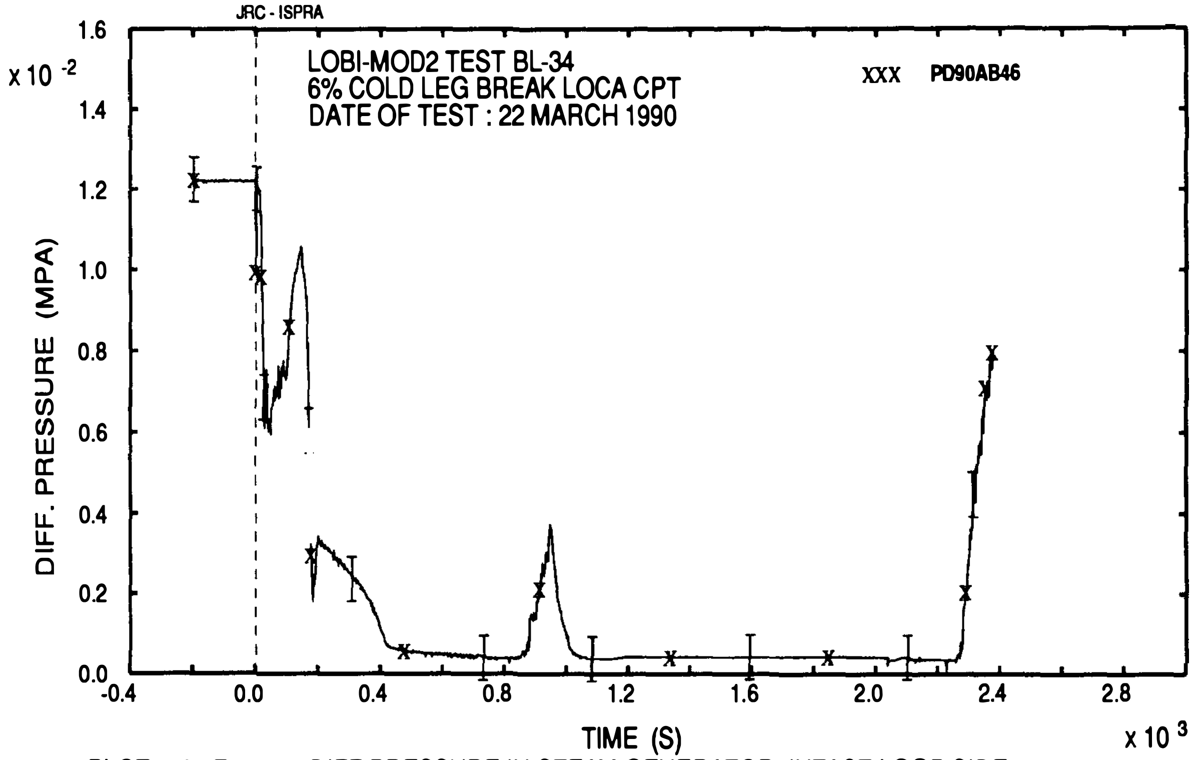
PLOT 2.44 DIFF.PRESSURE OVER BREAK ORIFICE (PD05AB44)



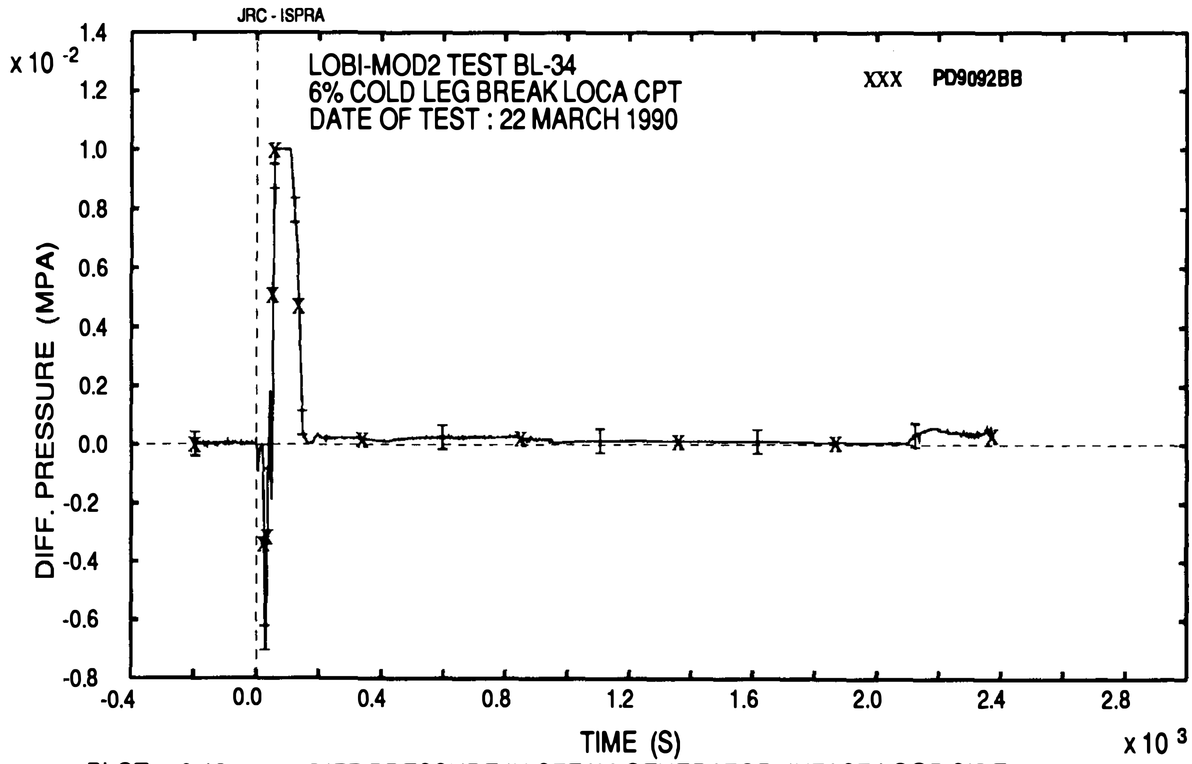
PLOT 2.45 DIFF.PRESSURE OVER ACCUMULATOR, COLD LEG TO LEVEL B
-INTACT LOOP (PD1651B)



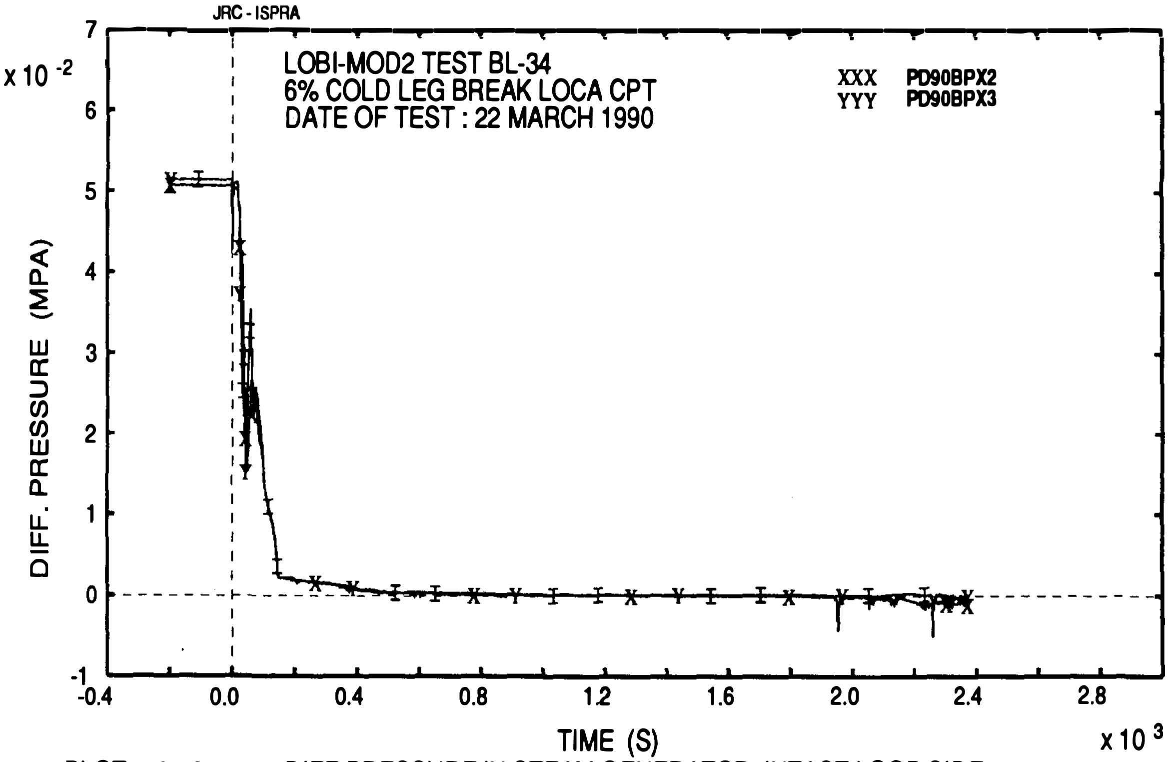
PLOT 2.46 DIFF.PRESSURE OVER ACCUMULATOR, LEVEL A TO B
-INTACT LOOP (PD51AB) AND BROKEN LOOP (PD52AB)-



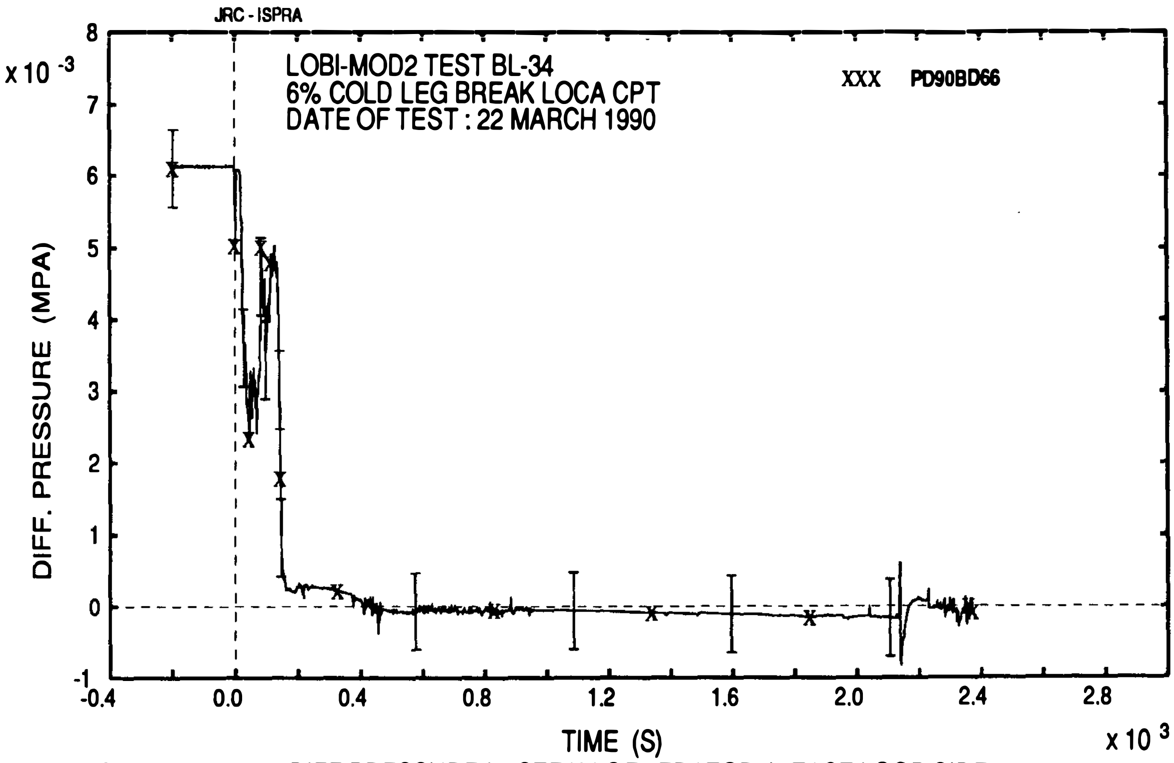
PLOT 2.47 DIFF.PRESSURE IN STEAM GENERATOR, INTACT LOOP SIDE
-ENTRANCE PRIMARY SIDE (PD90AB46)-



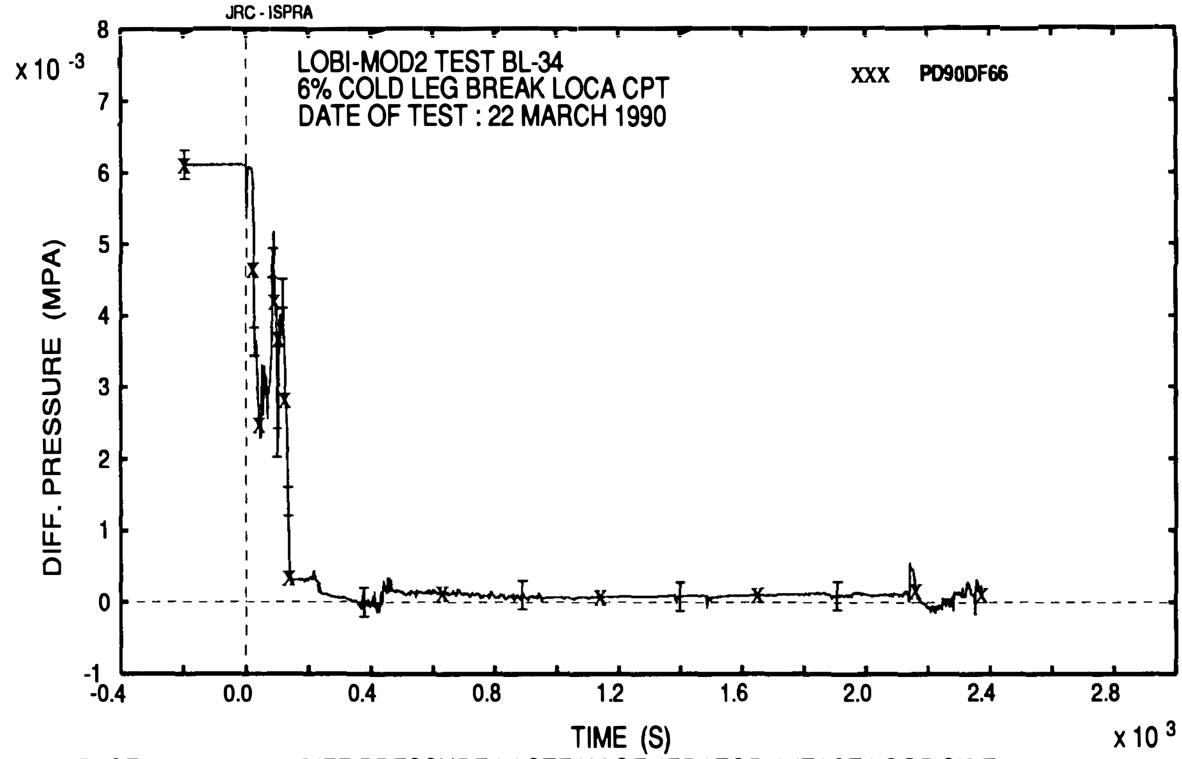
PLOT 2.48 DIFF.PRESSURE IN STEAM GENERATOR, INTACT LOOP SIDE
-U-TUBE2, ENTRANCE TO EXIT (PD9092BB)-



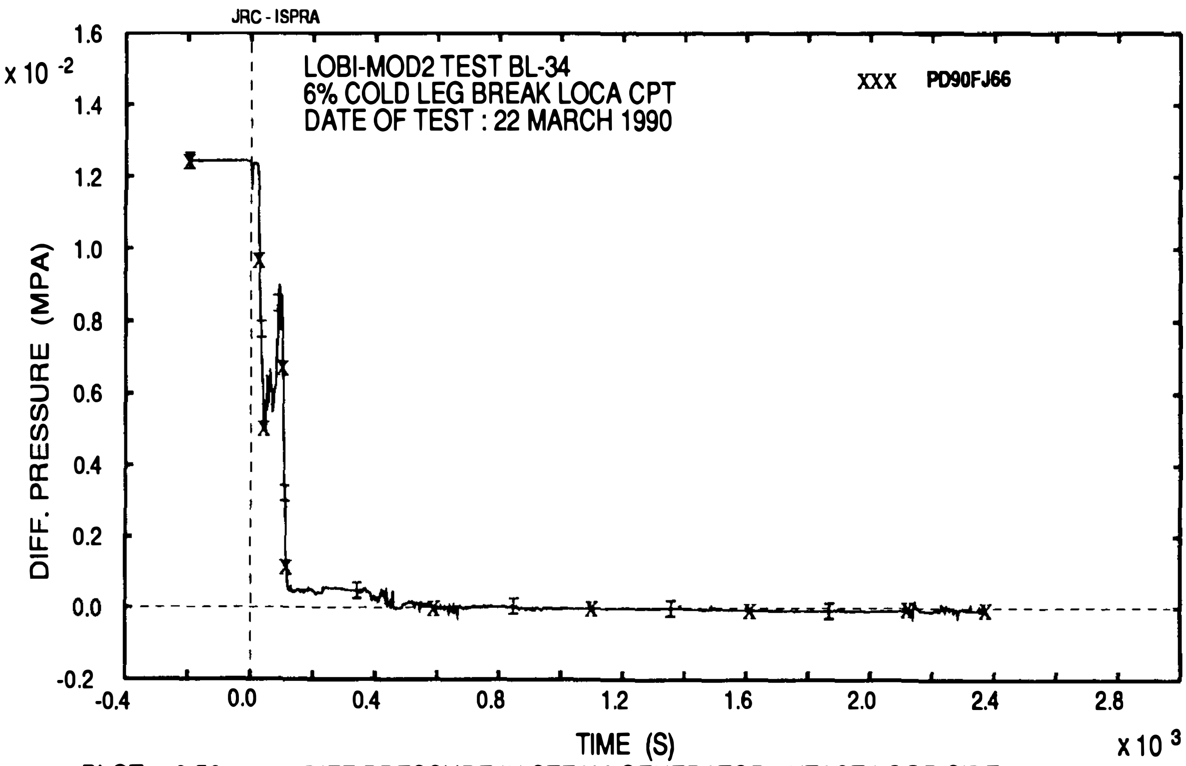
PLOT 2.49 DIFF.PRESSURE IN STEAM GENERATOR, INTACT LOOP SIDE
-U-TUBE, RISING LEG-
-TUBE11 (PD90BPX2) AND TUBE21 (PD90BPX3)-



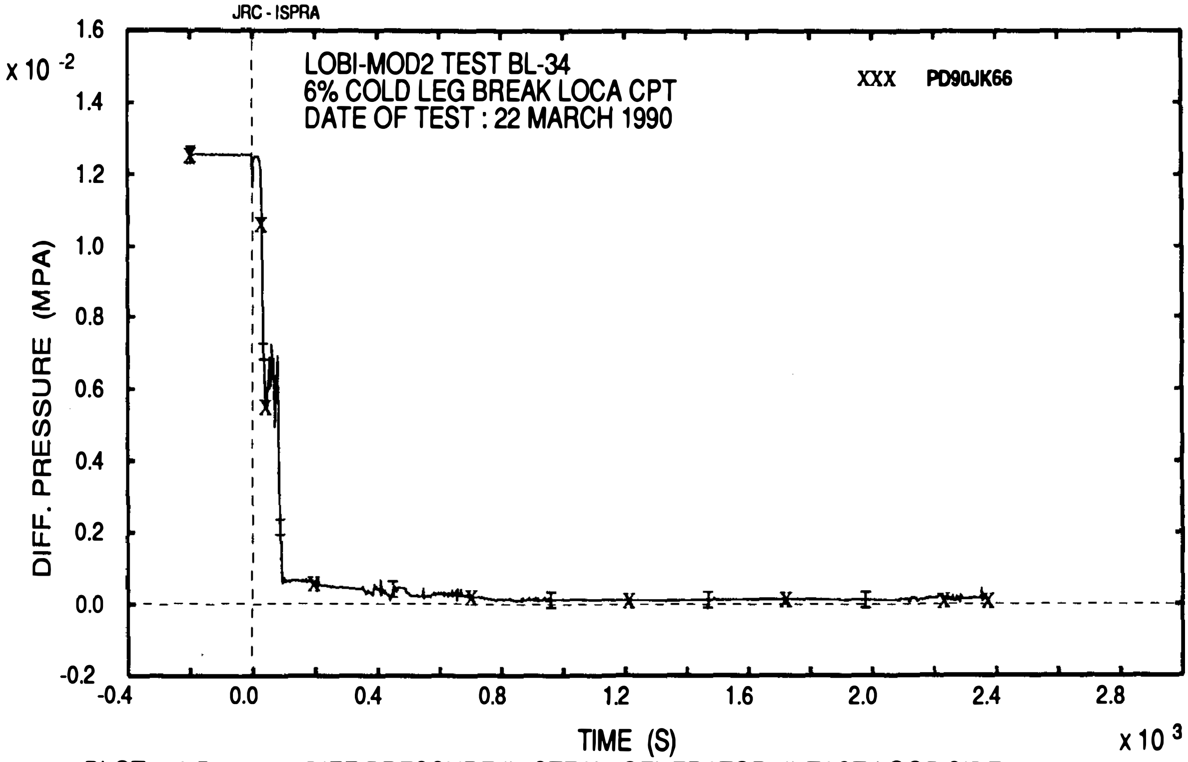
PLOT 2.50 DIFF.PRESSURE IN STEAM GENERATOR, INTACT LOOP SIDE
-U-TUBE2, RISING LEG-
-LEVEL B TO D (PD90BD66)-



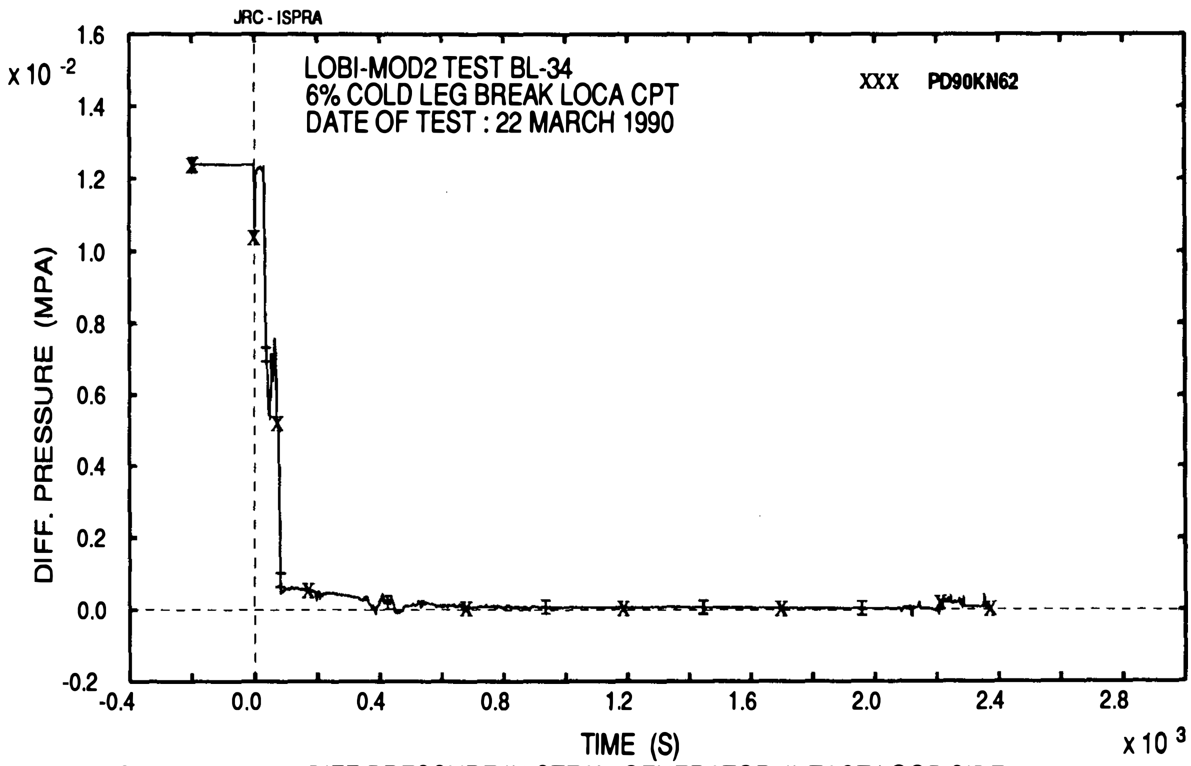
PLOT 2.51 DIFF.PRESSURE IN STEAM GENERATOR, INTACT LOOP SIDE
-U-TUBE2, RISING LEG-
-LEVEL D TO F (PD90DF66)-



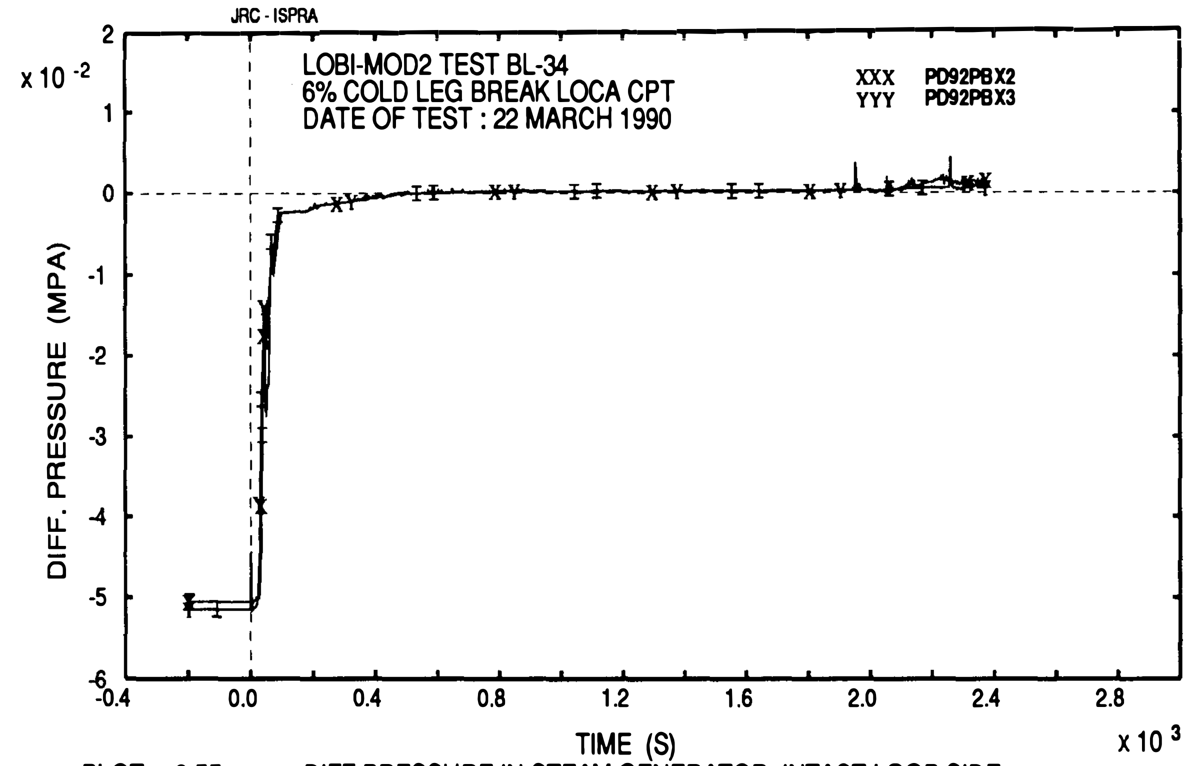
PLOT 2.52 DIFF.PRESSURE IN STEAM GENERATOR, INTACT LOOP SIDE
-U-TUBE2, RISING LEG-
-LEVEL F TO J (PD90FJ66)-



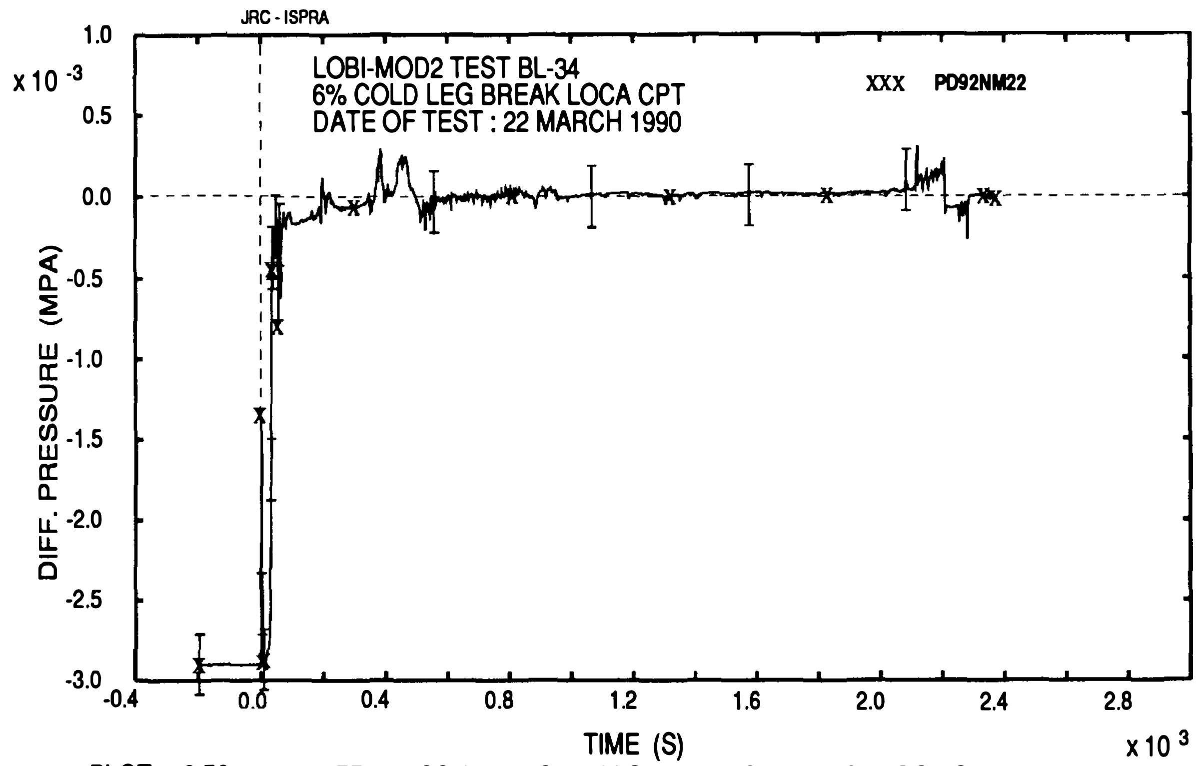
PLOT 2.53 DIFF.PRESSURE IN STEAM GENERATOR, INTACT LOOP SIDE
-U-TUBE2, RISING LEG-
-LEVEL J TO K (PD90JK66)-



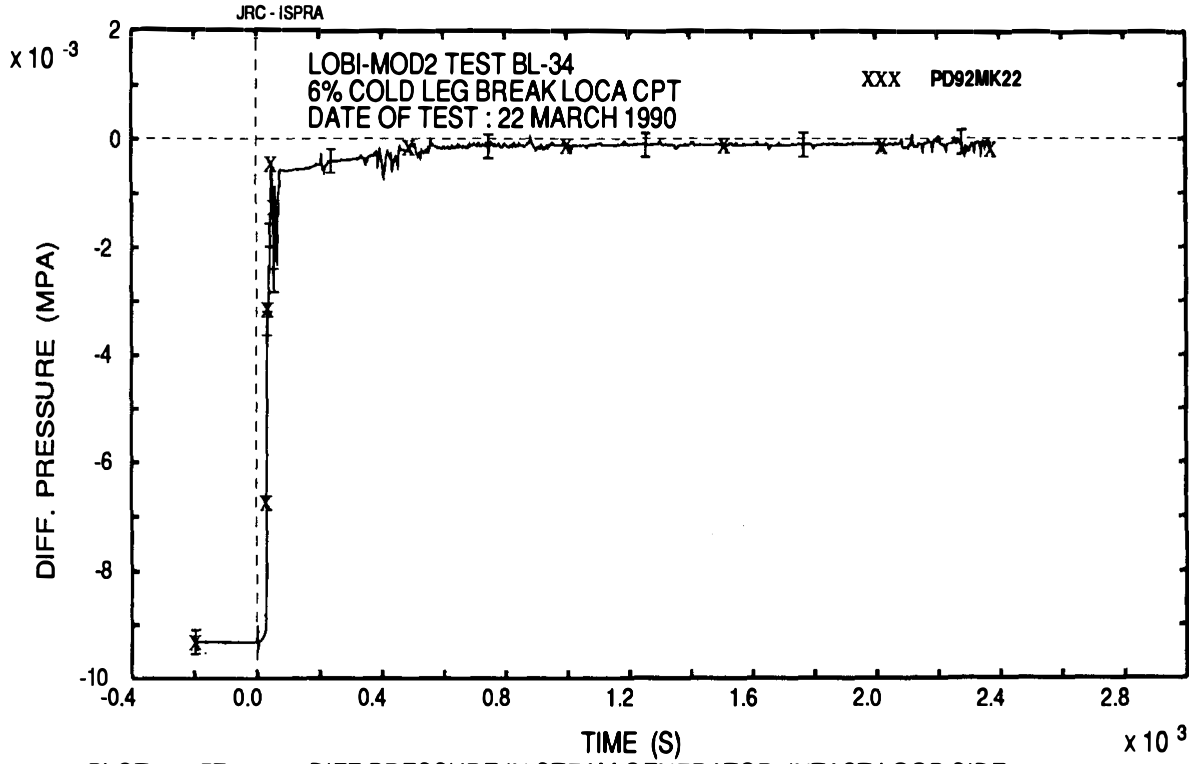
PLOT 2.54 DIFF.PRESSURE IN STEAM GENERATOR, INTACT LOOP SIDE
-U-TUBE2, RISING LEG-
-LEVEL K TO N (PD90KN62)-



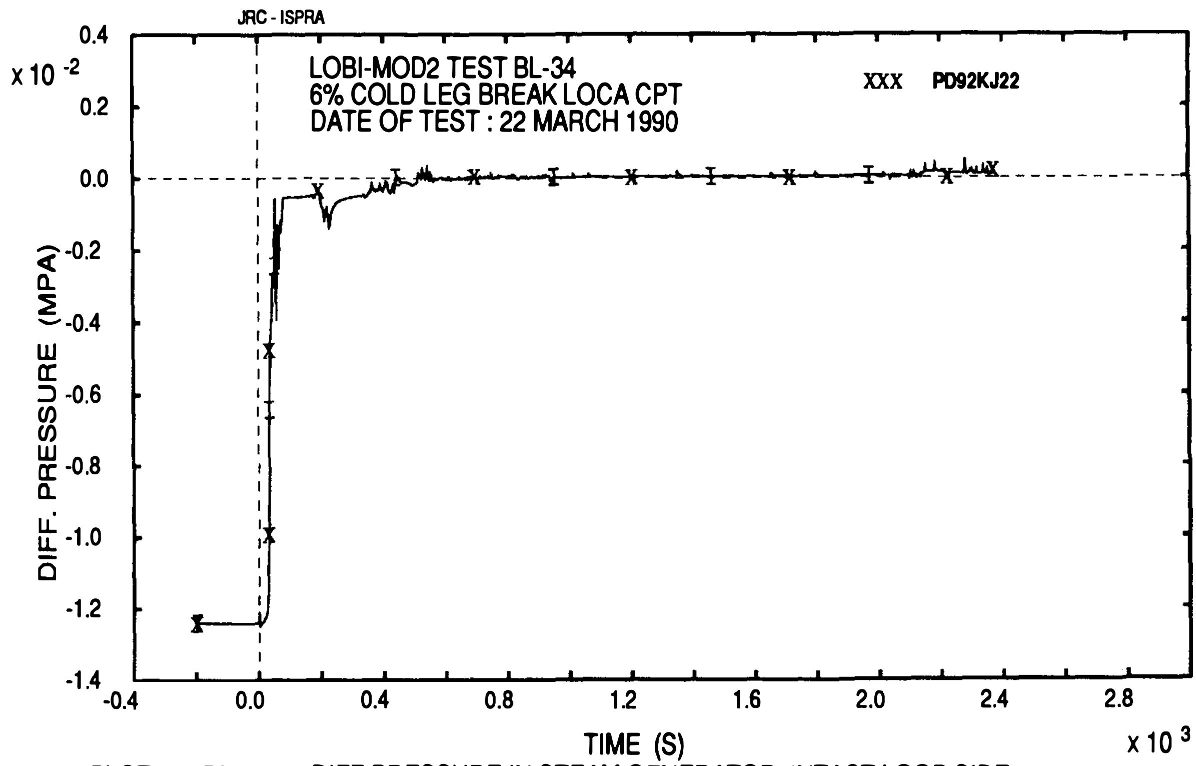
PLOT 2.55 DIFF.PRESSURE IN STEAM GENERATOR, INTACT LOOP SIDE
-U-TUBE FALLING LEG-
-TUBE11 (PD92PBX2), TUBE21 (PD92PBX3)-



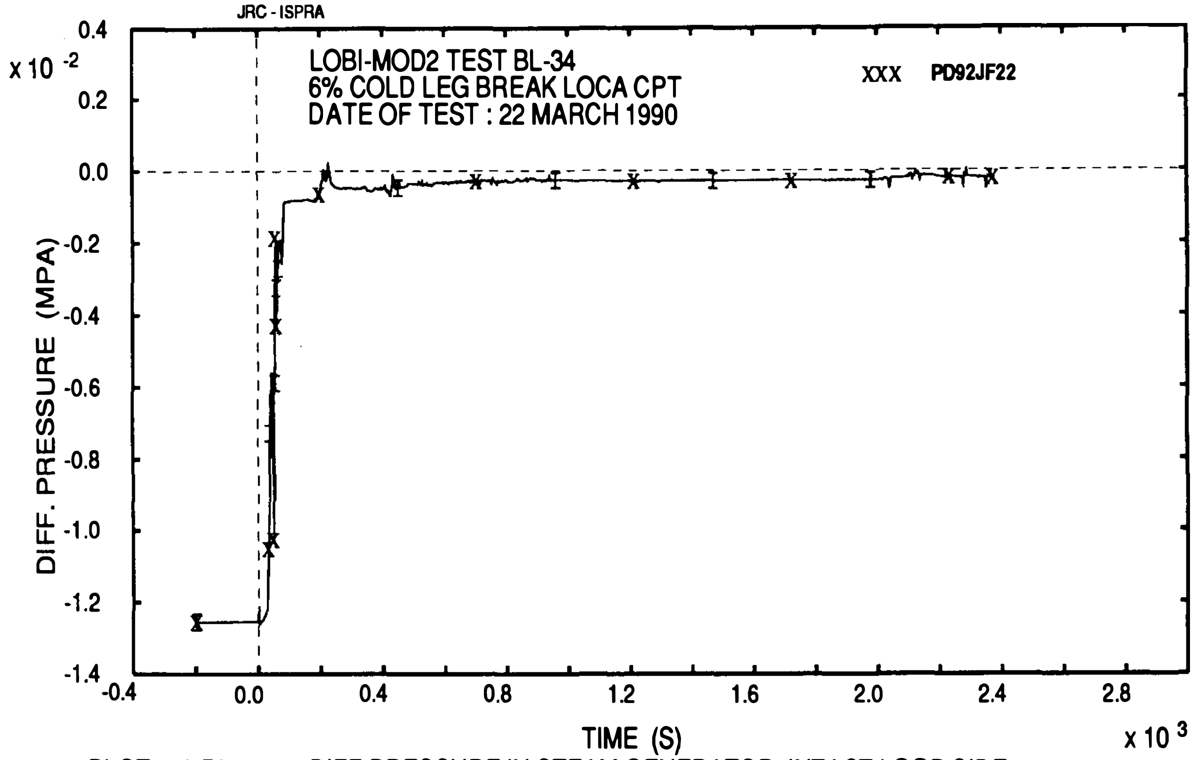
PLOT 2.56 DIFF.PRESSURE IN STEAM GENERATOR, INTACT LOOP SIDE
-U-TUBE2, FALLING LEG-
-LEVEL N TO M (PD92NM22)-



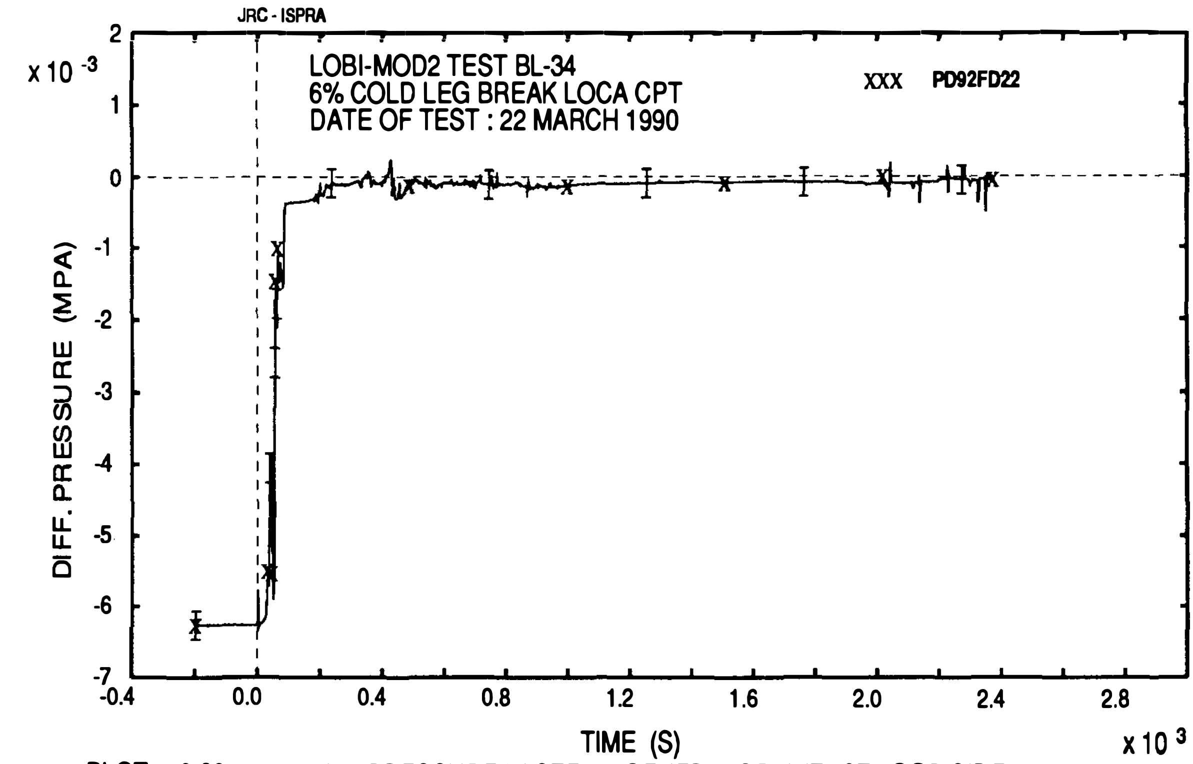
PLOT 2.57 DIFF.PRESSURE IN STEAM GENERATOR, INTACT LOOP SIDE
-U-TUBE2, FALLING LEG-
-LEVEL M TO K (PD92MK22)-



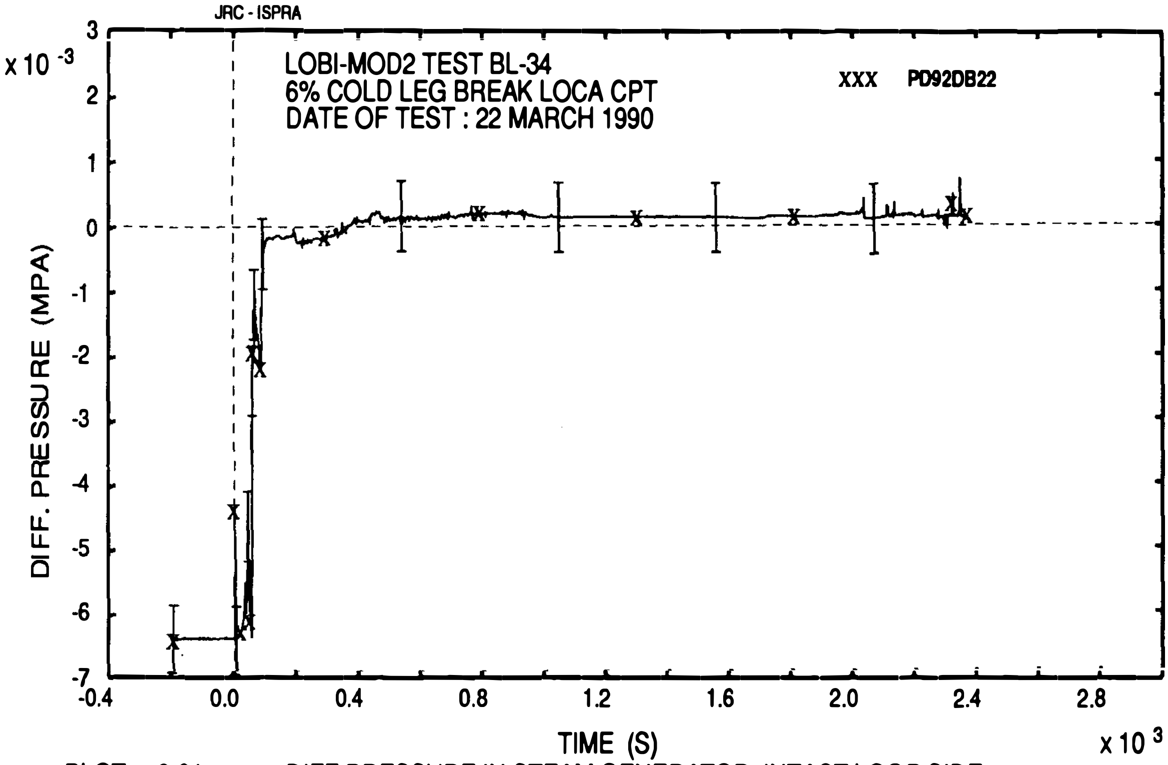
PLOT 2.58 DIFF.PRESSURE IN STEAM GENERATOR, INTACT LOOP SIDE
-U-TUBE2, FALLING LEG-
-LEVEL K TO J (PD92KJ22)-



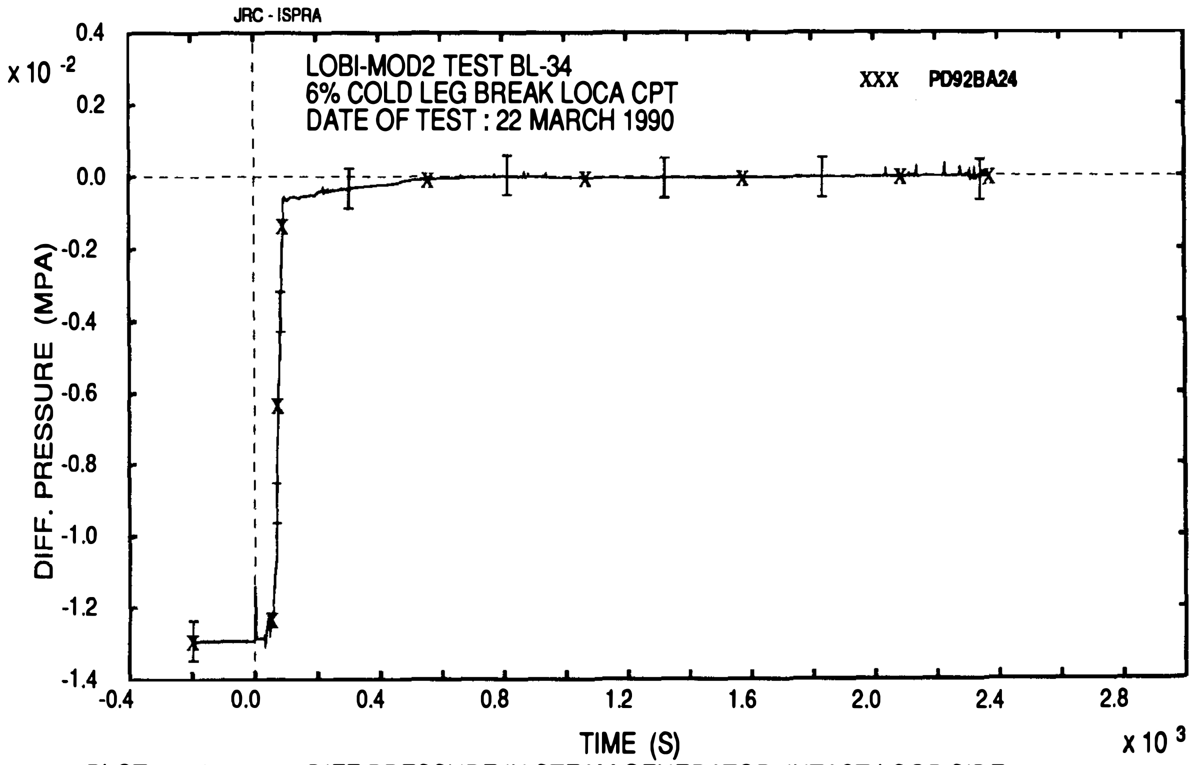
PLOT 2.59 DIFF.PRESSURE IN STEAM GENERATOR, INTACT LOOP SIDE
-U-TUBE2, FALLING LEG-
-LEVEL J TO F (PD92JF22)-



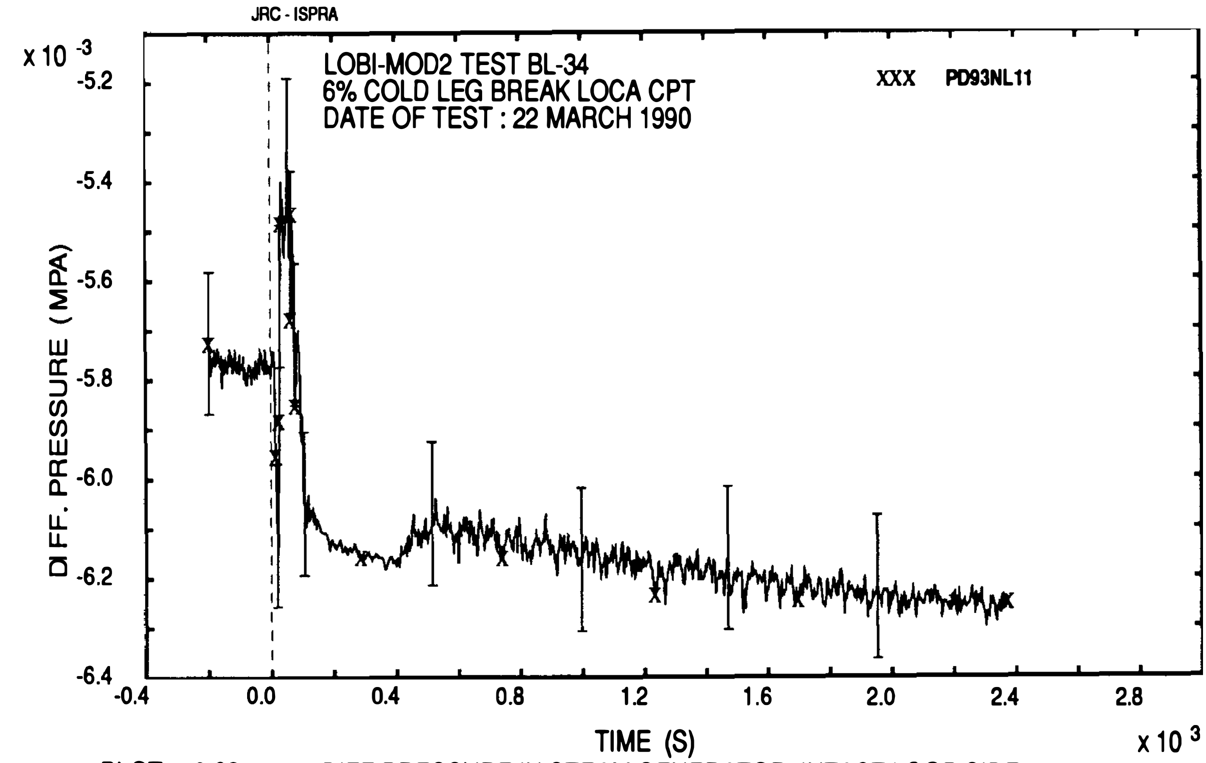
PLOT 2.60 DIFF.PRESSURE IN STEAM GENERATOR, INTACT LOOP SIDE
-U-TUBE2, FALLING LEG-
-LEVEL F TO D (PD92FD22)-



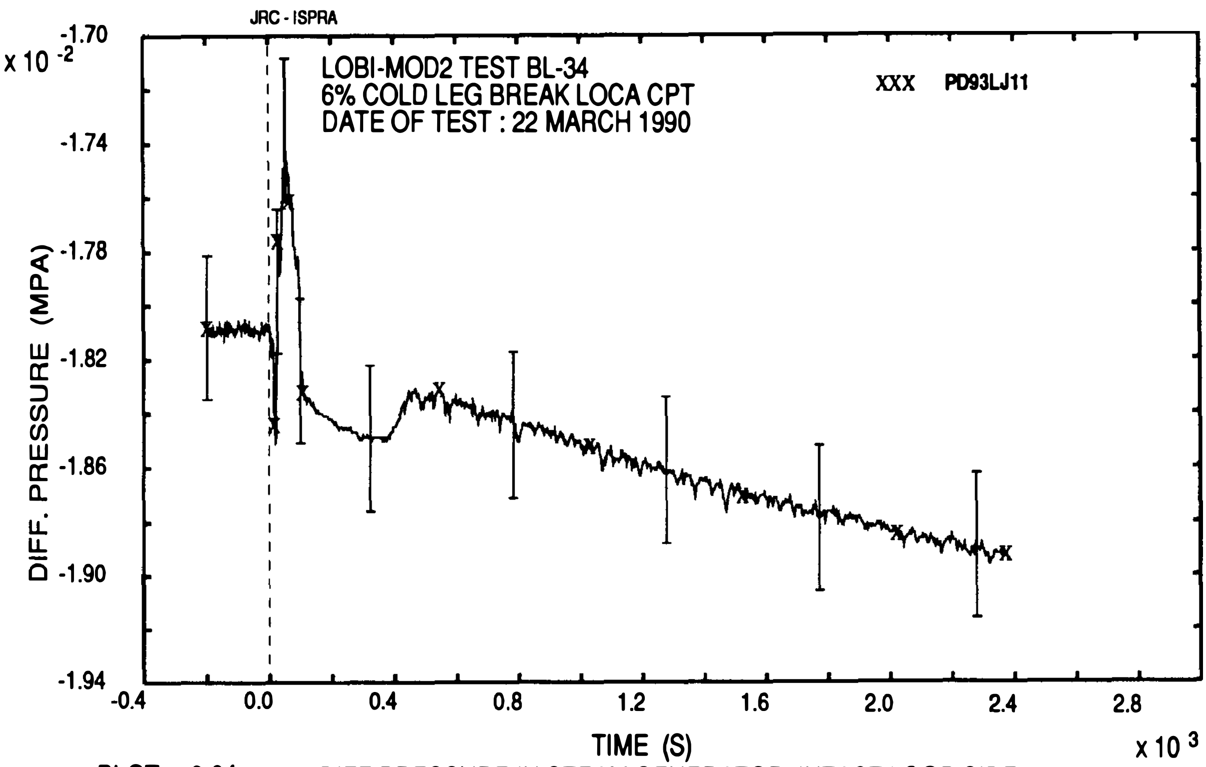
PLOT 2.61 DIFF.PRESSURE IN STEAM GENERATOR, INTACT LOOP SIDE
-U-TUBE2, FALLING LEG-
-LEVEL D TO B (PD92DB22)-



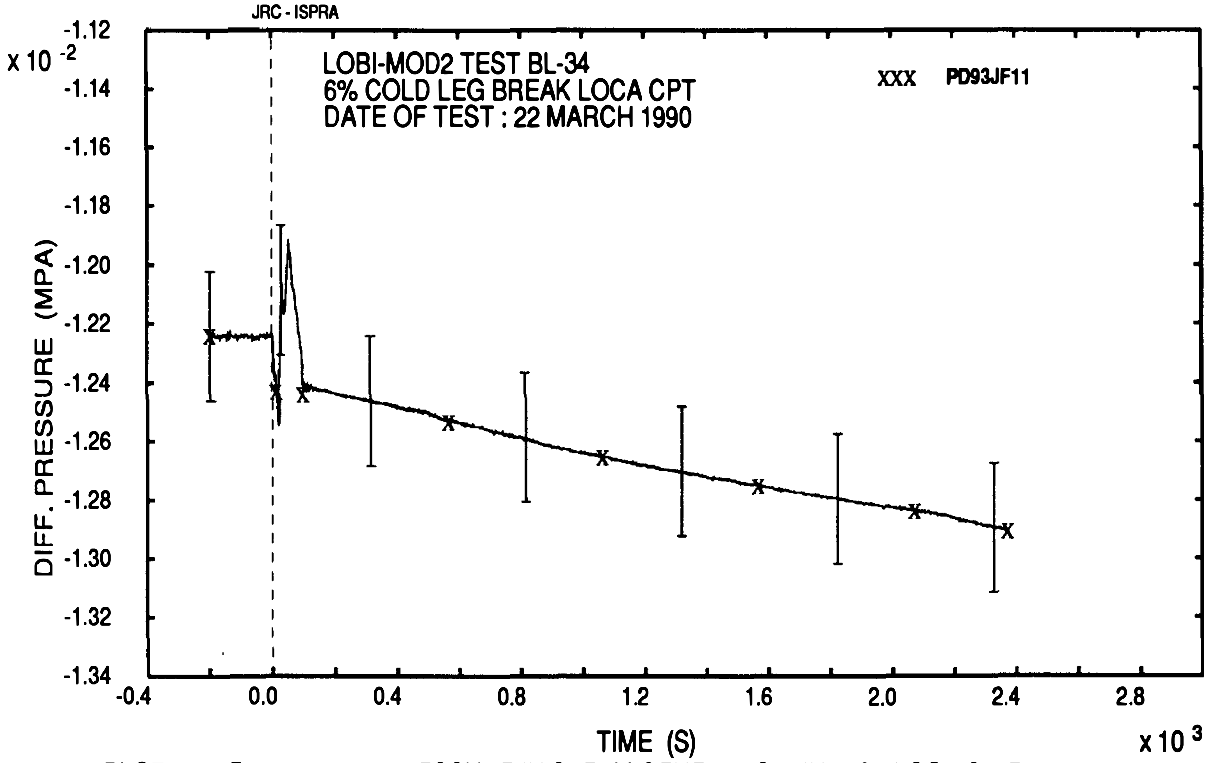
PLOT 2.62 DIFF.PRESSURE IN STEAM GENERATOR, INTACT LOOP SIDE
-EXIT PRIMARY SIDE (PD92BA24)-



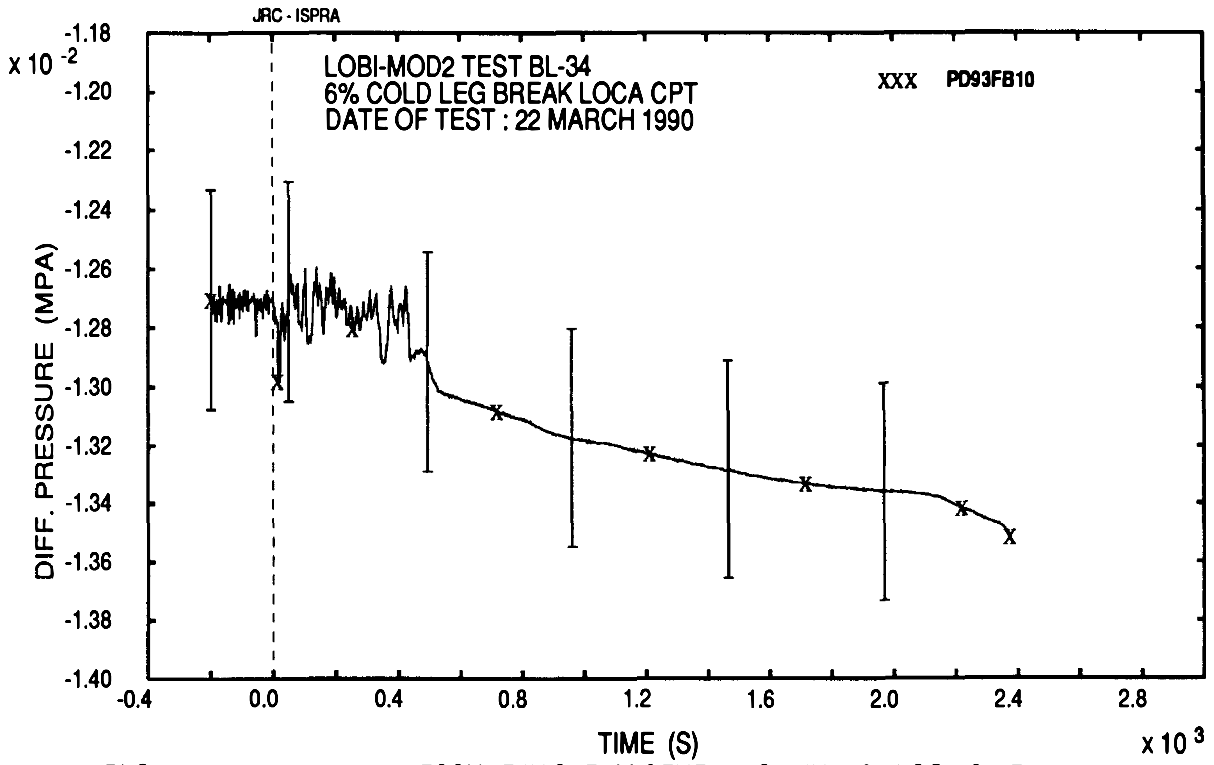
PLOT 2.63 DIFF.PRESSURE IN STEAM GENERATOR, INTACT LOOP SIDE -DOWNCOMER REGION, LEVEL N TO L (PD93NL11)-



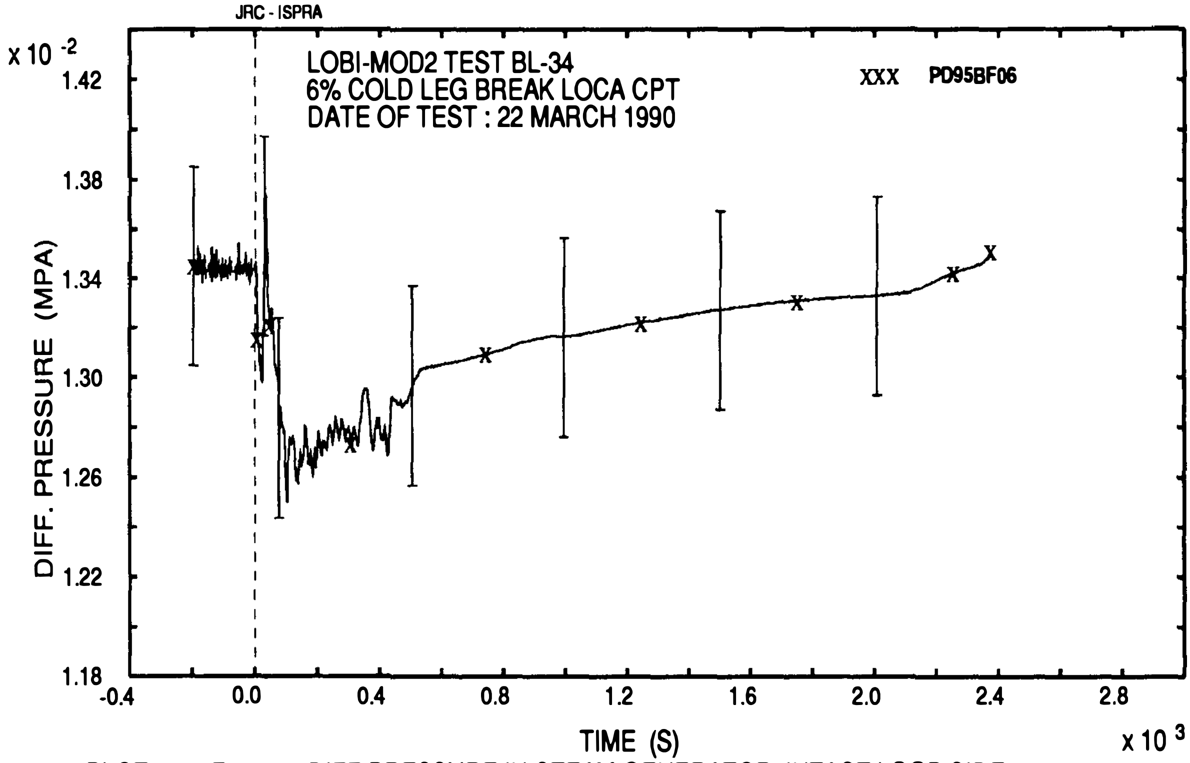
PLOT 2.64 DIFF.PRESSURE IN STEAM GENERATOR, INTACT LOOP SIDE -DOWNCOMER REGION, LEVEL L TO J (PD93LJ11)-



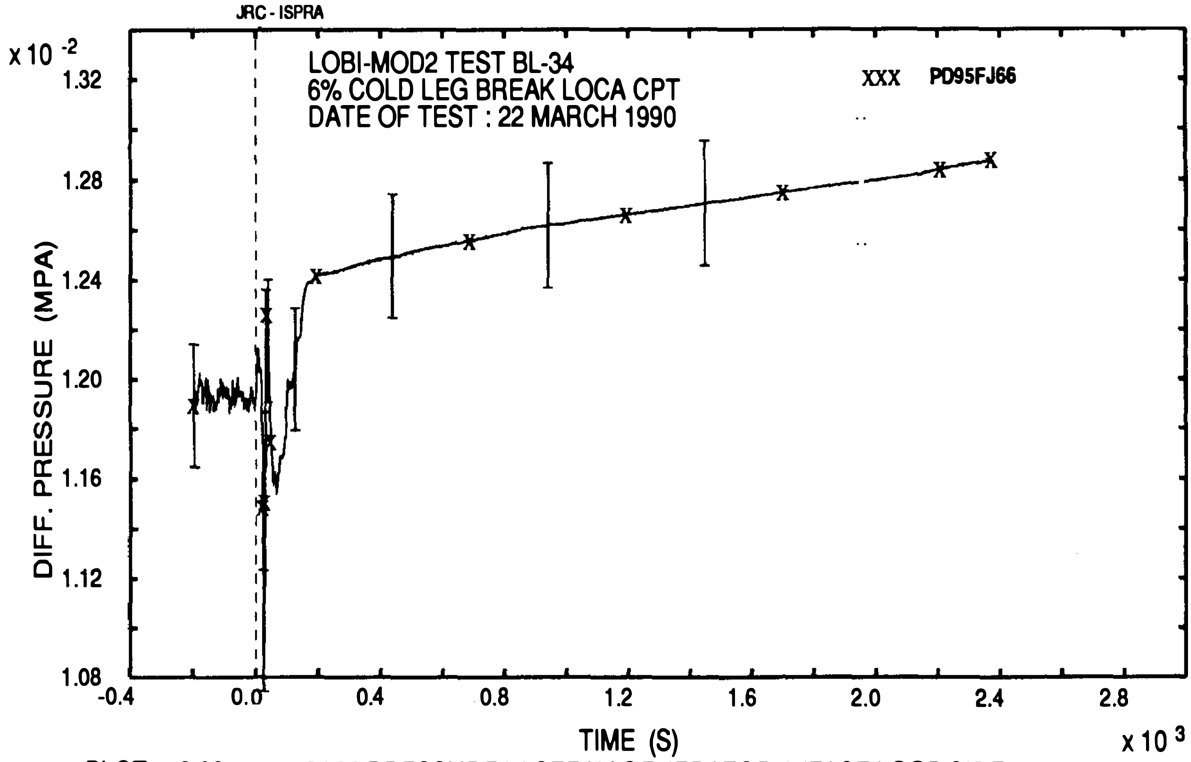
PLOT 2.65 DIFF.PRESSURE IN STEAM GENERATOR, INTACT LOOP SIDE -DOWNCOMER REGION, LEVEL J TO F (PD93JF11)-



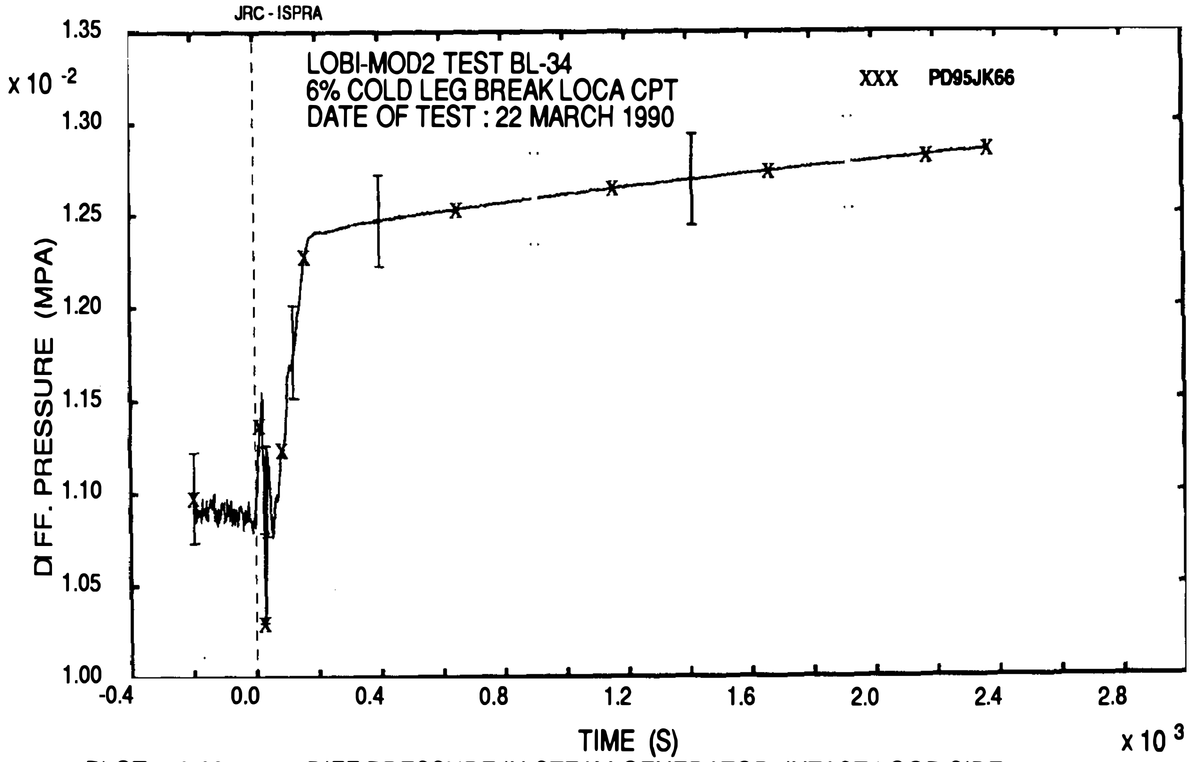
PLOT 2.66 DIFF.PRESSURE IN STEAM GENERATOR, INTACT LOOP SIDE -DOWNCOMER REGION, LEVEL F TO B (PD93FB10)-



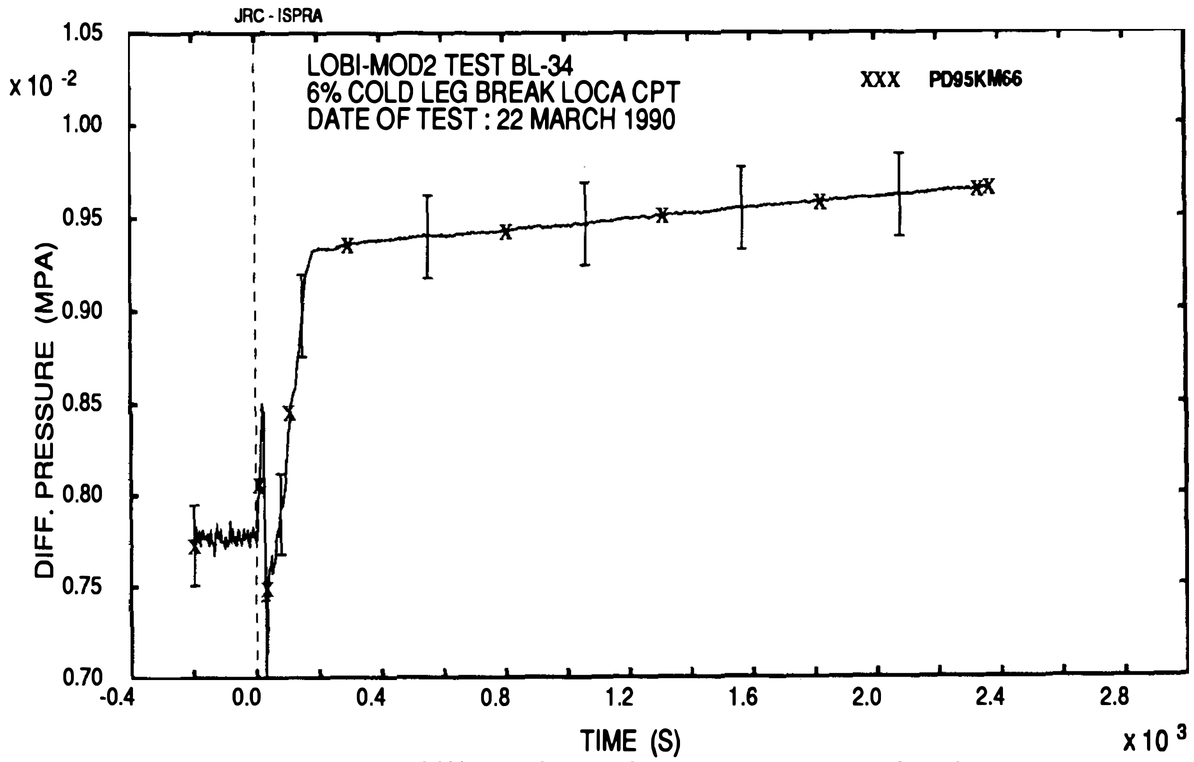
PLOT 2.67 DIFF.PRESSURE IN STEAM GENERATOR, INTACT LOOP SIDE
-RISER REGION, LEVEL B TO F (PD95BF06)-



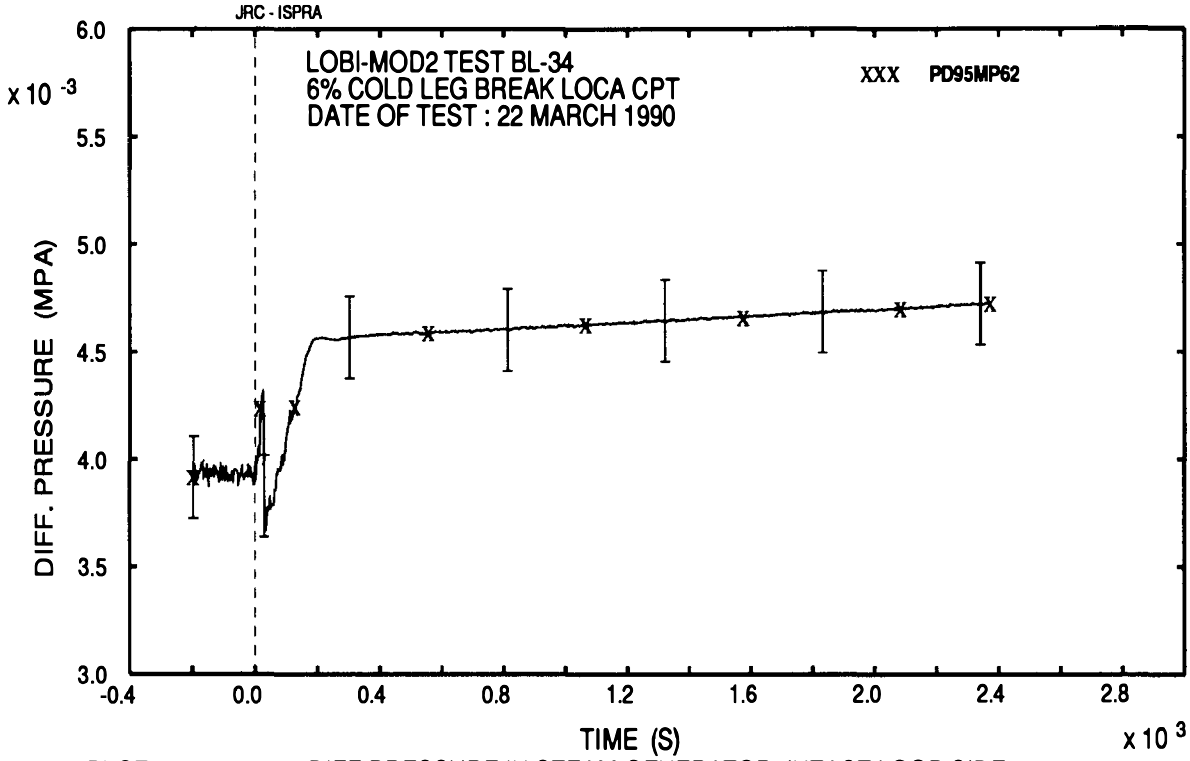
PLOT 2.68 DIFF.PRESSURE IN STEAM GENERATOR, INTACT LOOP SIDE
-RISER REGION, LEVEL F TO J (PD95FJ66)-



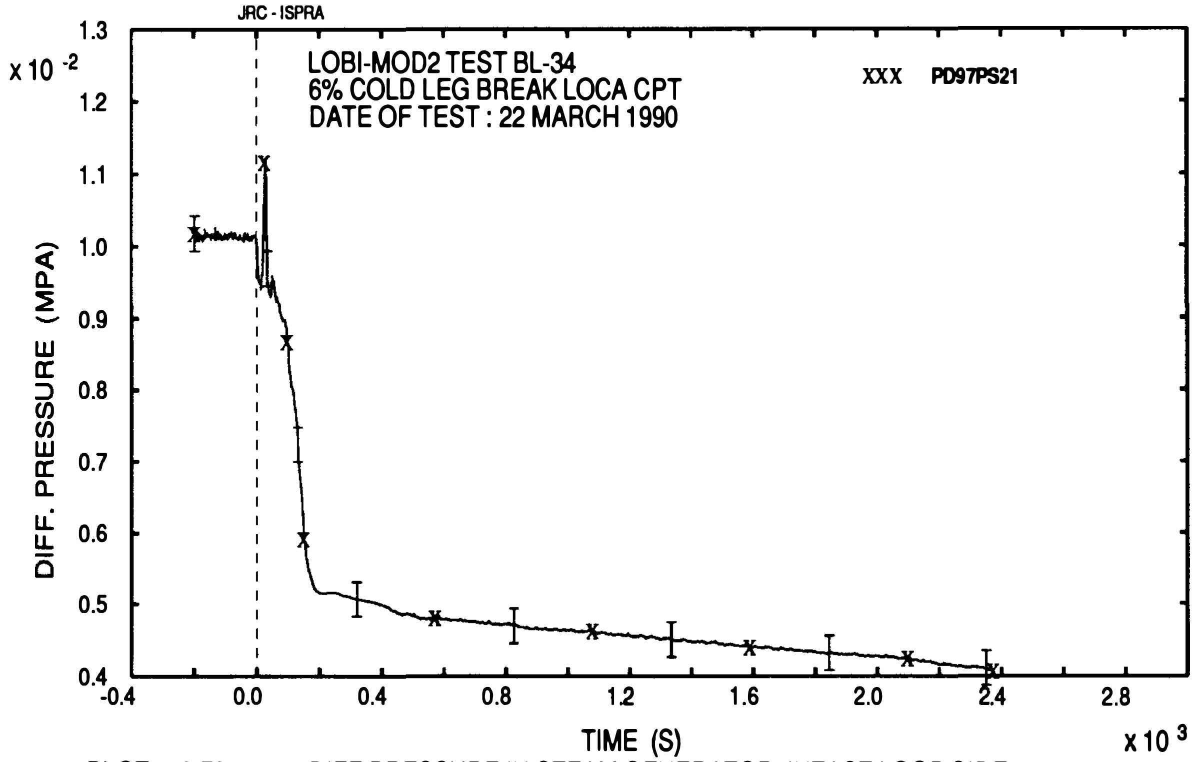
PLOT 2.69 DIFF.PRESSURE IN STEAM GENERATOR, INTACT LOOP SIDE
-RISER REGION, LEVEL J TO K (PD95JK66)-



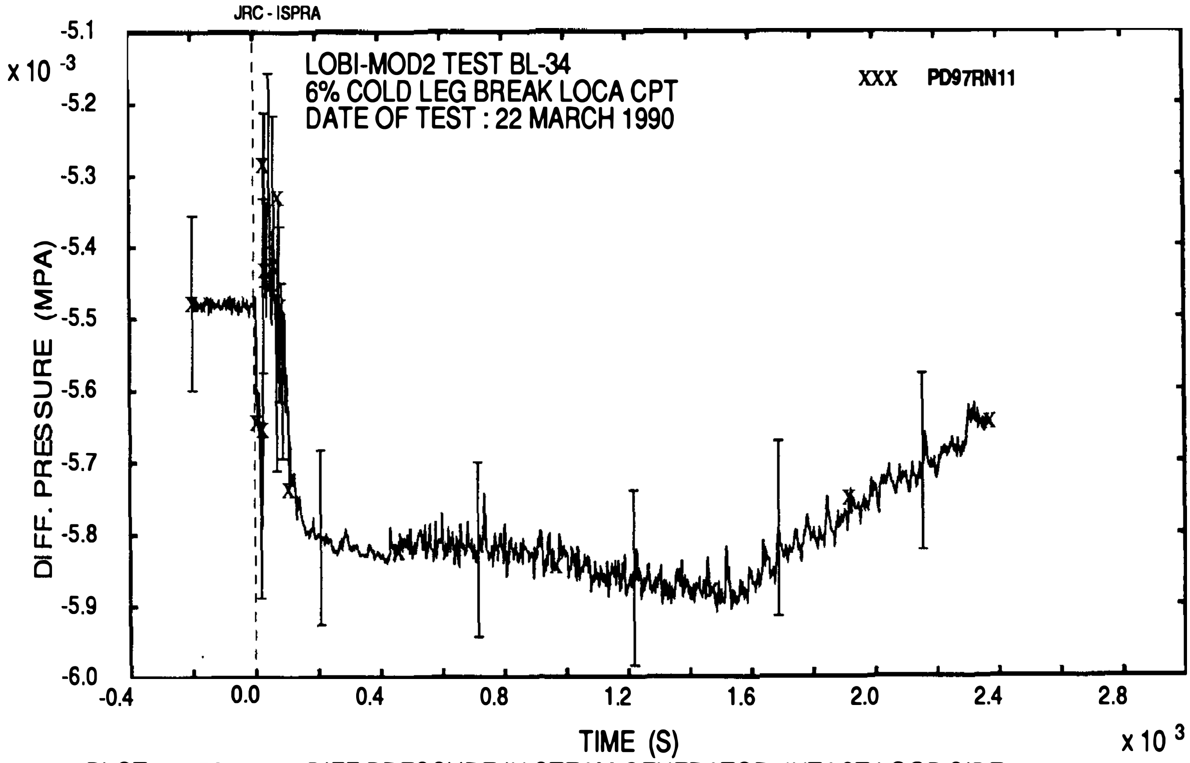
PLOT 2.70 DIFF.PRESSURE IN STEAM GENERATOR, INTACT LOOP SIDE
-RISER REGION, LEVEL K TO M (PD95KM66)-



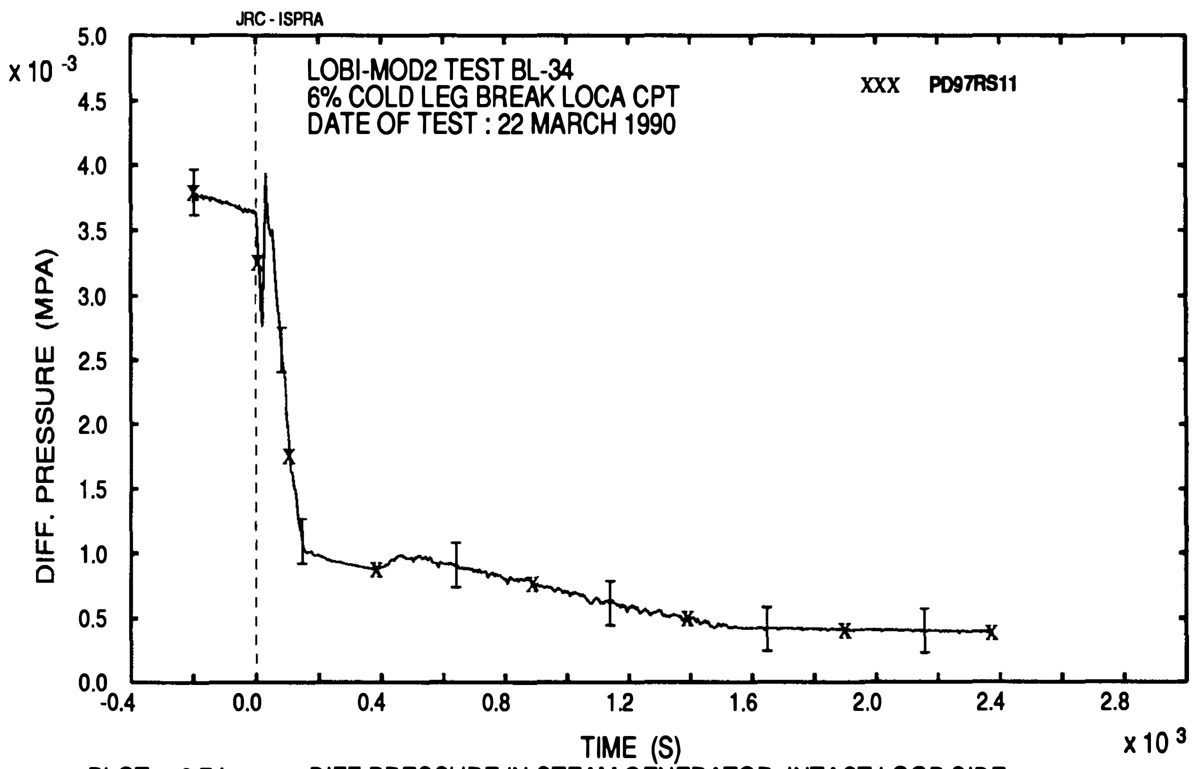
PLOT 2.71 DIFF.PRESSURE IN STEAM GENERATOR, INTACT LOOP SIDE
-RISER REGION, LEVEL M TO P (PD95MP62)-



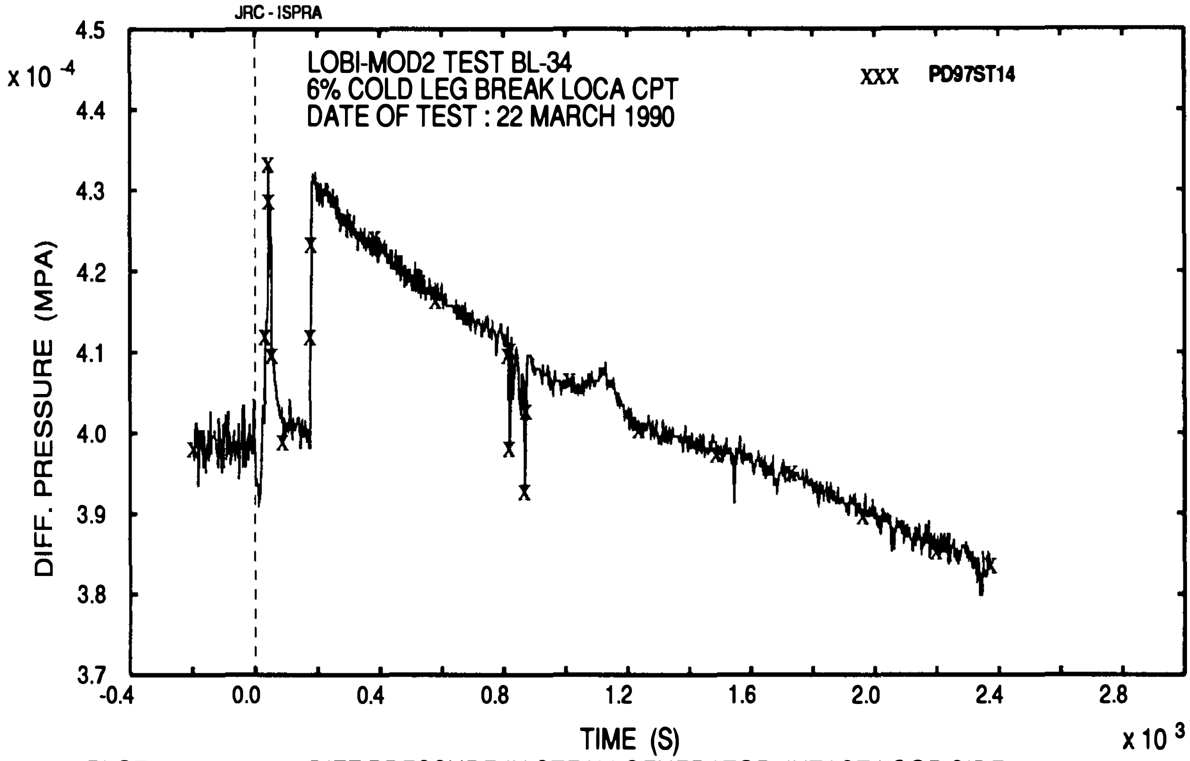
PLOT 2.72 DIFF.PRESSURE IN STEAM GENERATOR, INTACT LOOP SIDE
-STEAM DOME REGION, LEVEL P TO S (PD97PS21)-



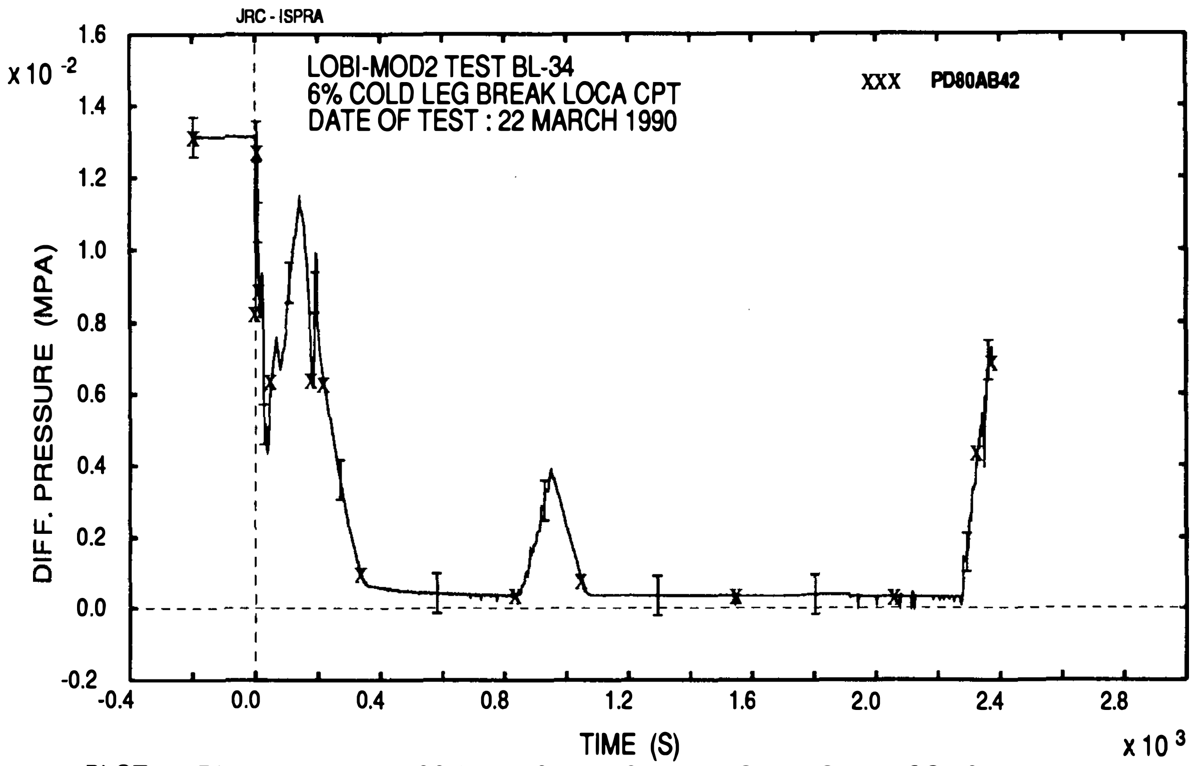
PLOT 2.73 DIFF.PRESSURE IN STEAM GENERATOR, INTACT LOOP SIDE -STEAM DOME REGION, LEVEL R TO N (PD97RN11)-



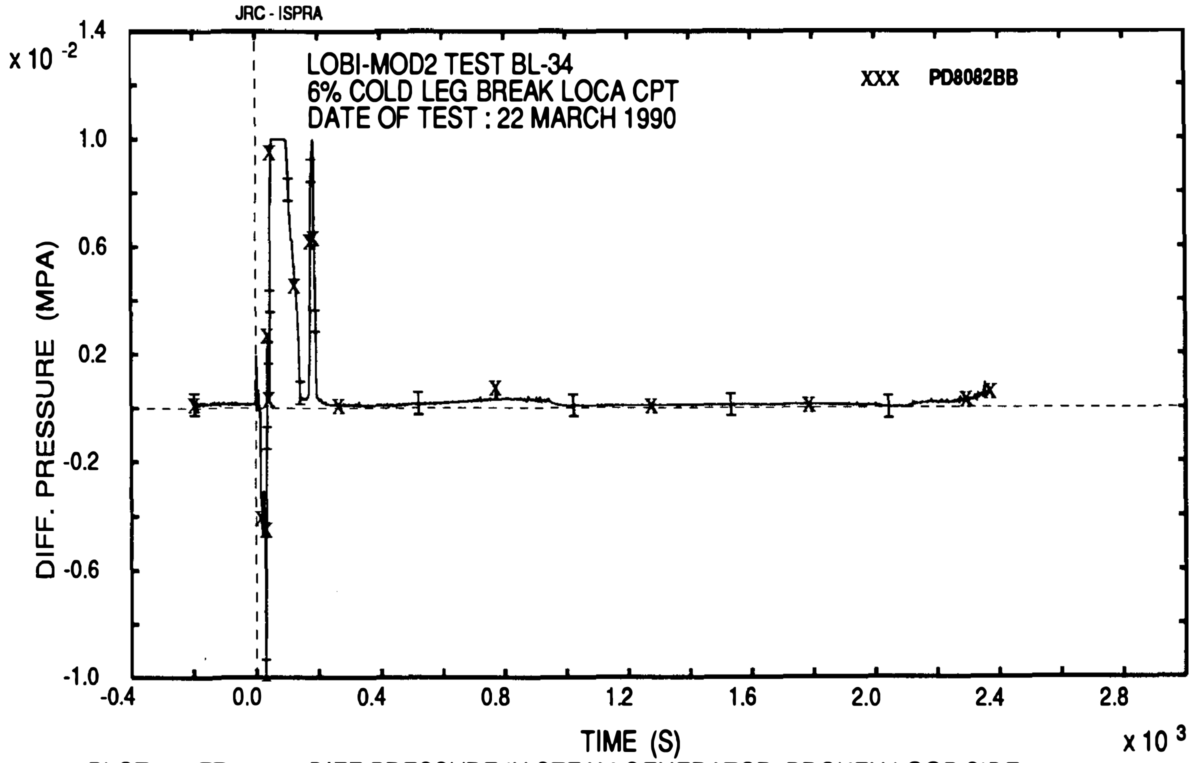
PLOT 2.74 DIFF.PRESSURE IN STEAM GENERATOR, INTACT LOOP SIDE -STEAM DOME REGION, LEVEL R TO S (PD97RS11)-



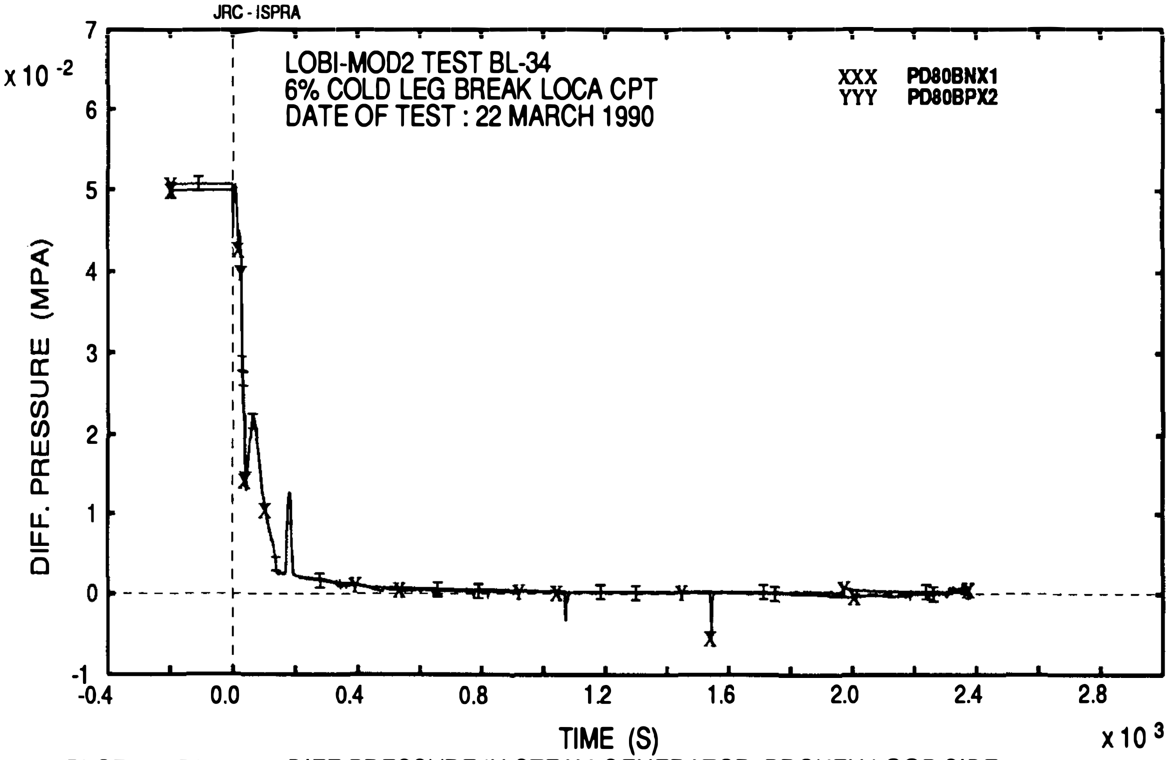
PLOT 2.75 DIFF.PRESSURE IN STEAM GENERATOR, INTACT LOOP SIDE -STEAM DOME REGION, LEVEL S TO T (PD97ST14)-



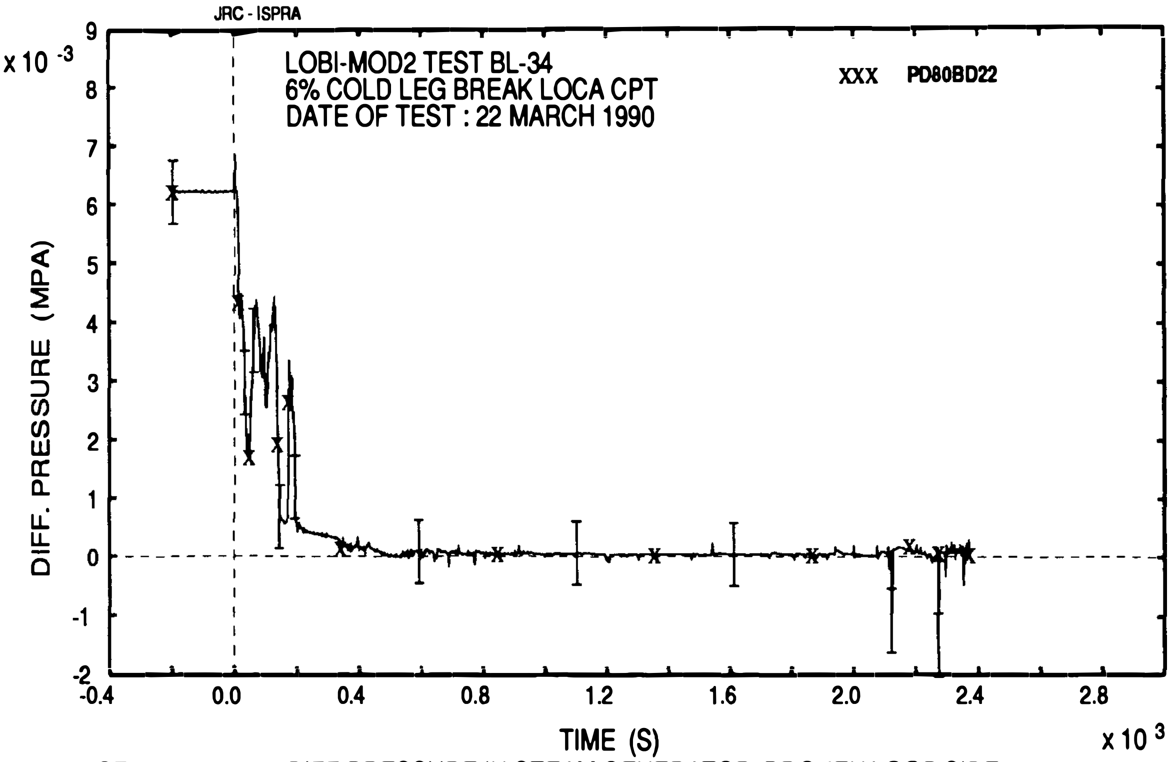
PLOT 2.76 DIFF.PRESSURE IN STEAM GENERATOR, BROKEN LOOP SIDE -ENTRANCE PRIMARY SIDE (PD80AB42)-



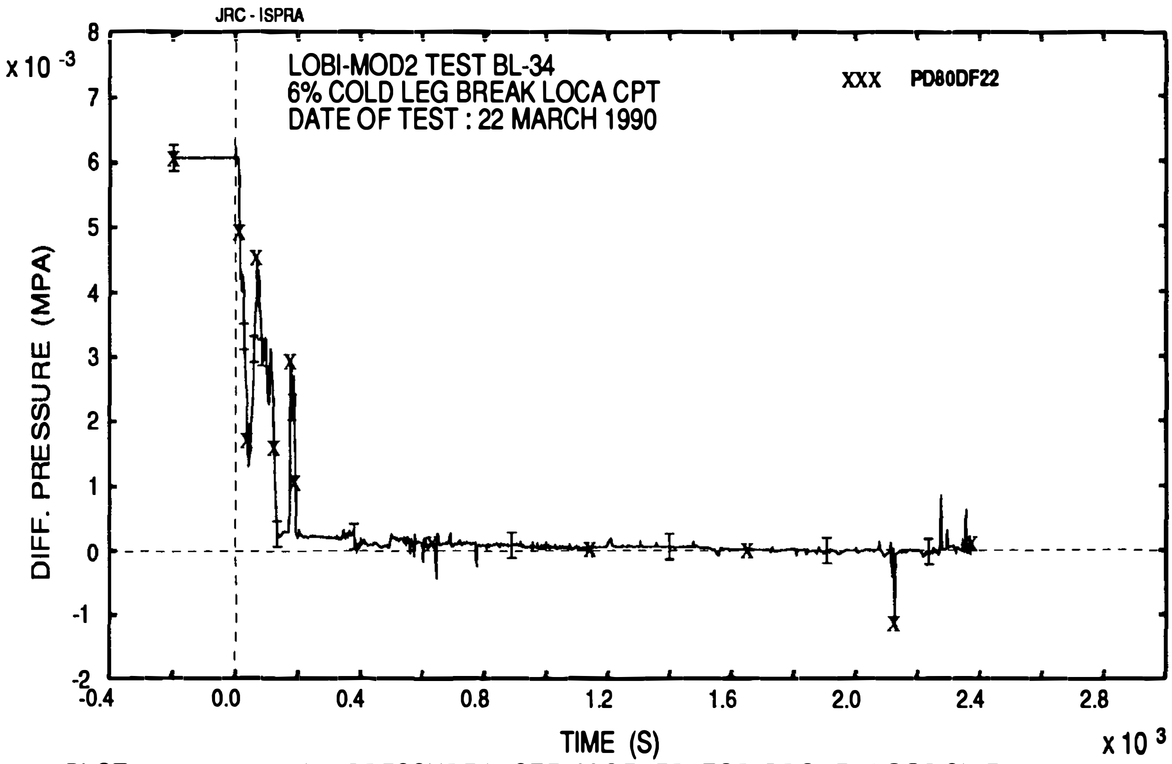
PLOT 2.77 DIFF.PRESSURE IN STEAM GENERATOR, BROKEN LOOP SIDE
-U-TUBE2, ENTRANCE TO EXIT (PD8082BB)-



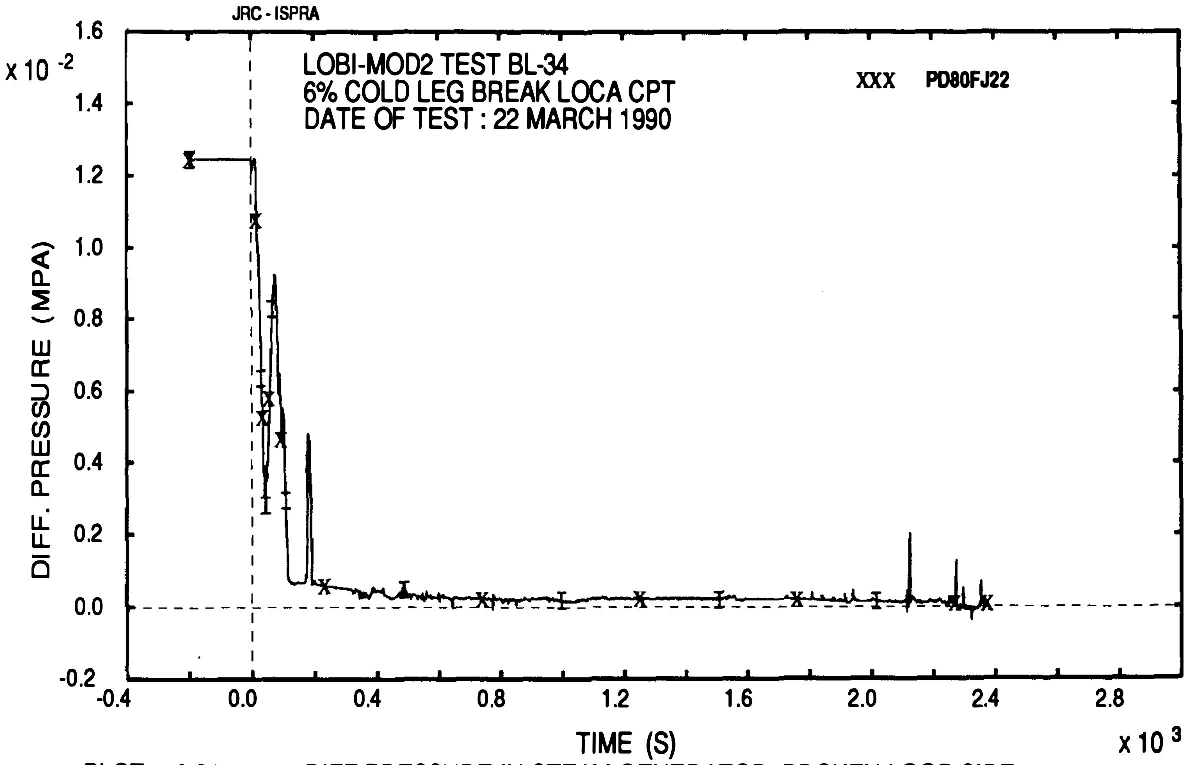
PLOT 2.78 DIFF.PRESSURE IN STEAM GENERATOR, BROKEN LOOP SIDE
-U-TUBE, RISING LEG TUBE2 (PD80BNX1)-
-U-TUBE, RISING LEG TUBE5 (PD80BPX2)-



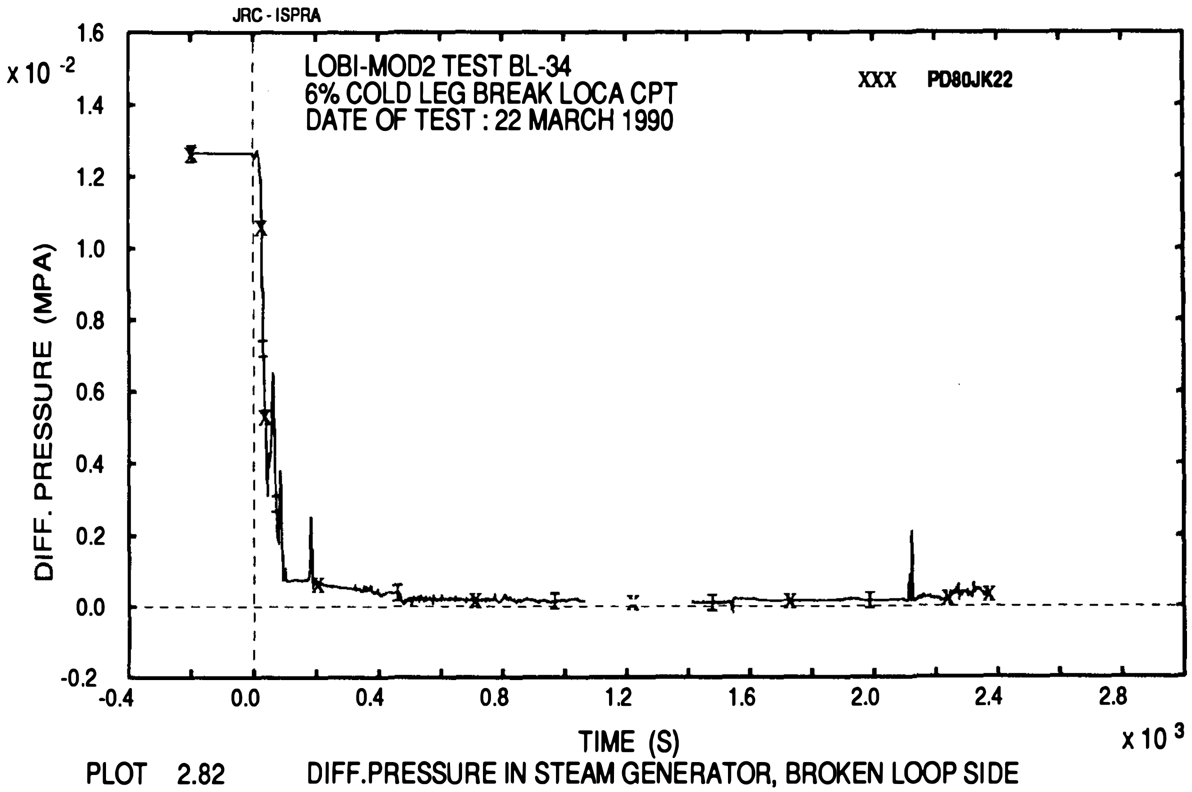
PLOT 2.79 DIFF.PRESSURE IN STEAM GENERATOR, BROKEN LOOP SIDE
-U-TUBE2, RISING LEG-
-LEVEL B TO D (PD80BD22)-



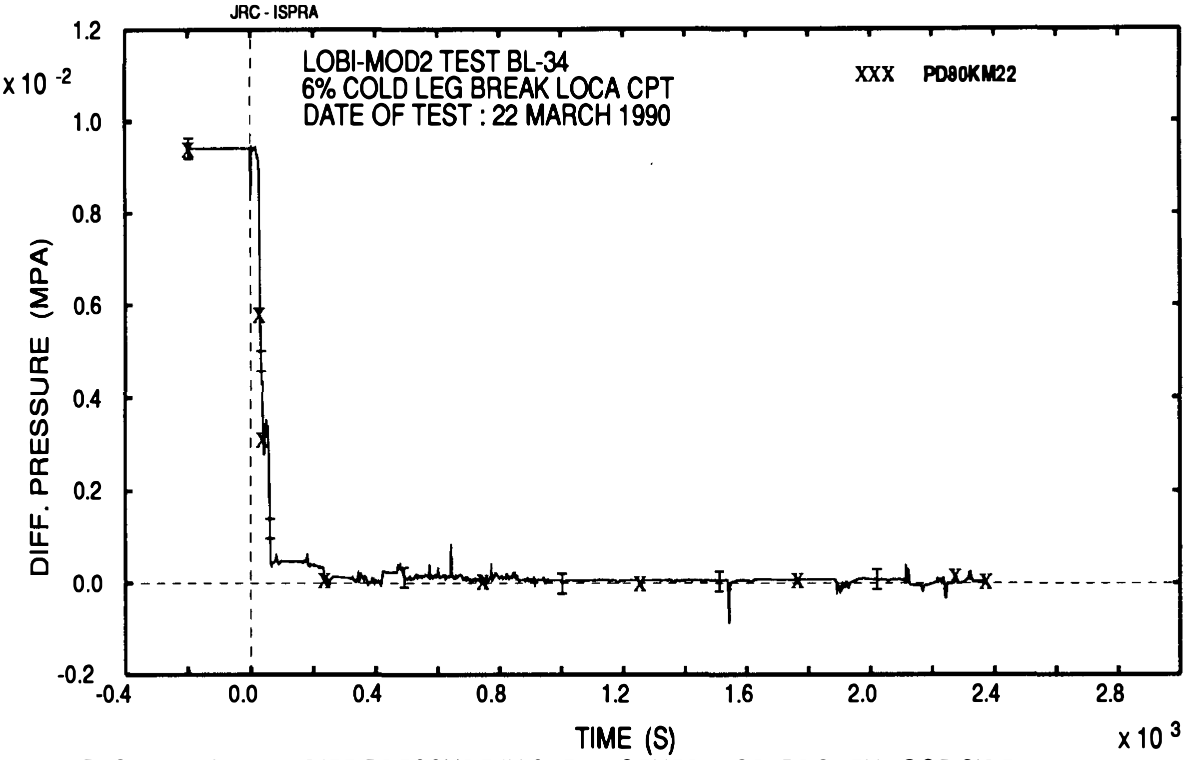
PLOT 2.80 DIFF.PRESSURE IN STEAM GENERATOR, BROKEN LOOP SIDE
-U-TUBE2, RISING LEG-
-LEVEL D TO F (PD80DF22)-



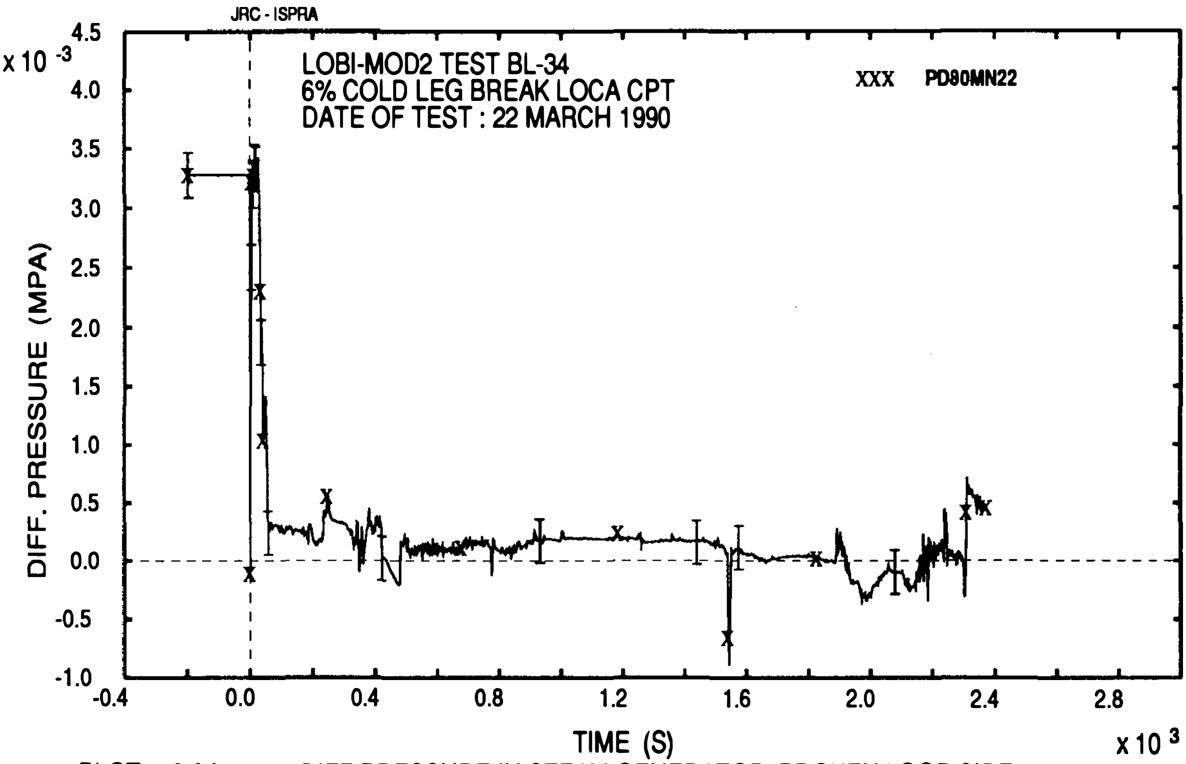
PLOT 2.81 DIFF.PRESSURE IN STEAM GENERATOR, BROKEN LOOP SIDE
-U-TUBE2, RISING LEG-
-LEVEL F TO J (PD80FJ22)-



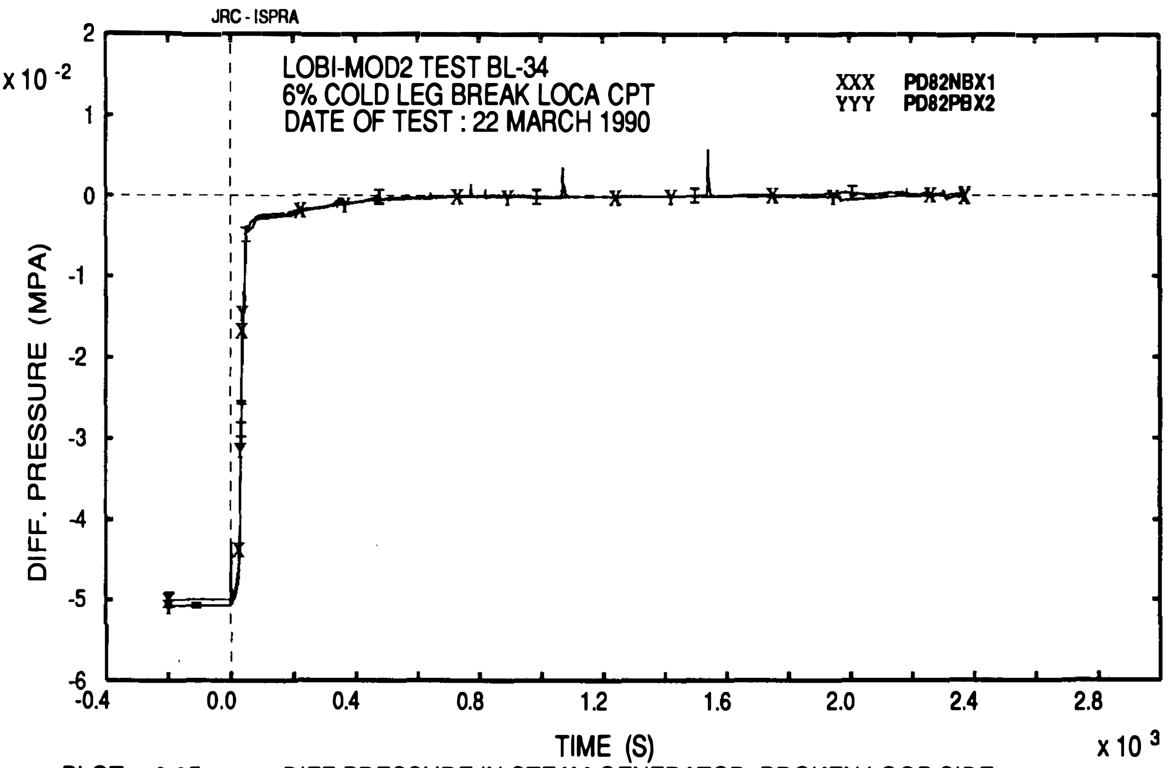
PLOT 2.82 DIFF.PRESSURE IN STEAM GENERATOR, BROKEN LOOP SIDE
-U-TUBE2, RISING LEG-
-LEVEL J TO K (PD80JK22)-



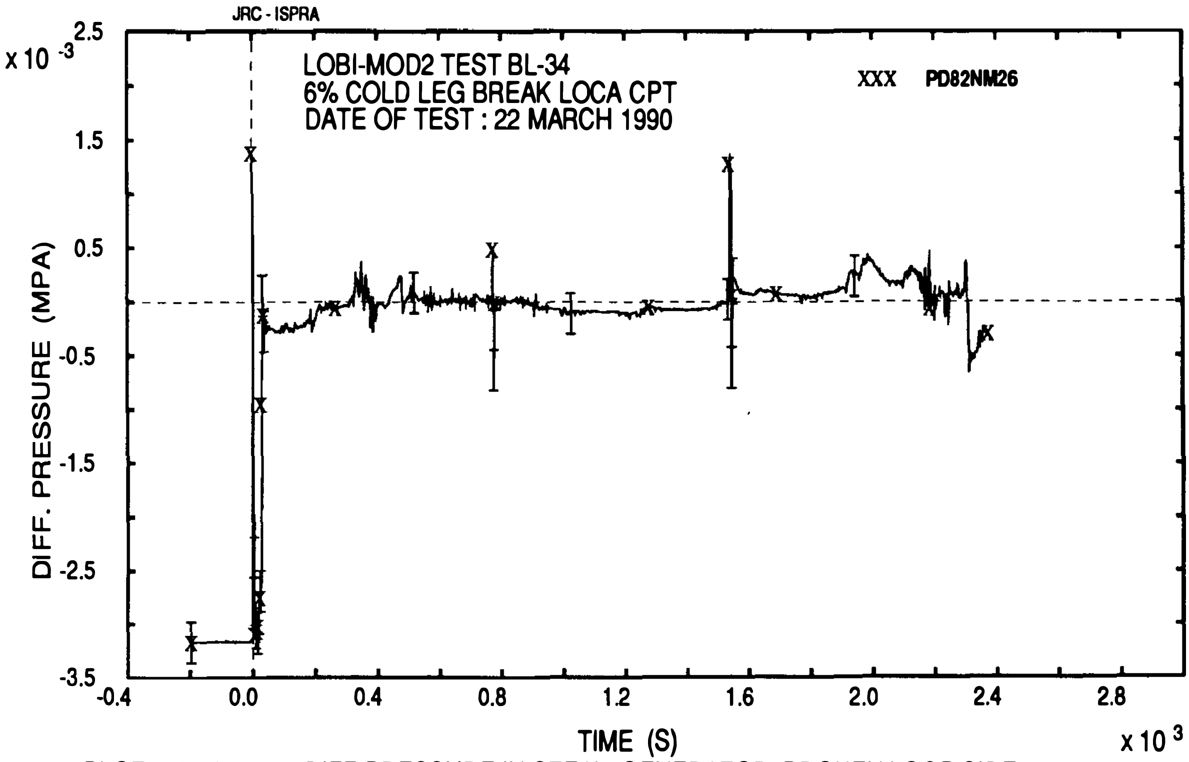
PLOT 2.83 DIFF.PRESSURE IN STEAM GENERATOR, BROKEN LOOP SIDE
-U-TUBE2, RISING LEG-
-LEVEL K TO M (PD80KM22)-



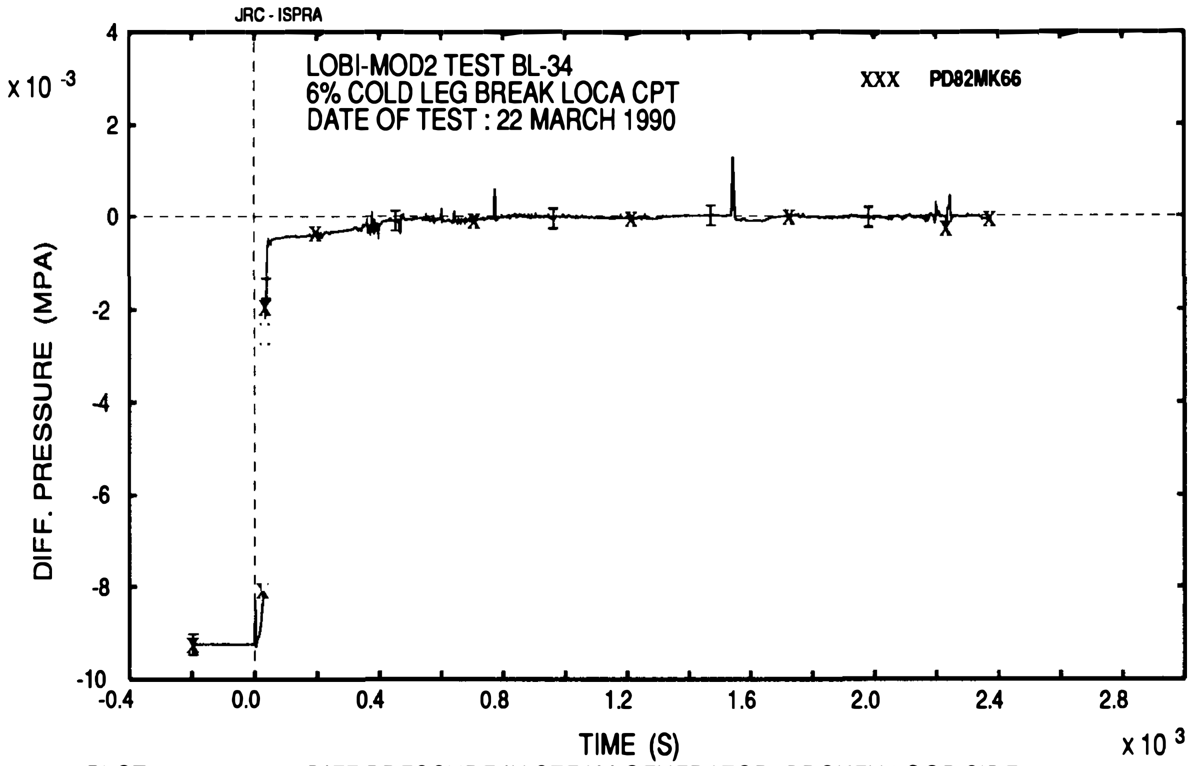
PLOT 2.84 DIFF.PRESSURE IN STEAM GENERATOR, BROKEN LOOP SIDE
-U-TUBE2, RISING LEG-
-LEVEL M TO N (PD80MN22)-



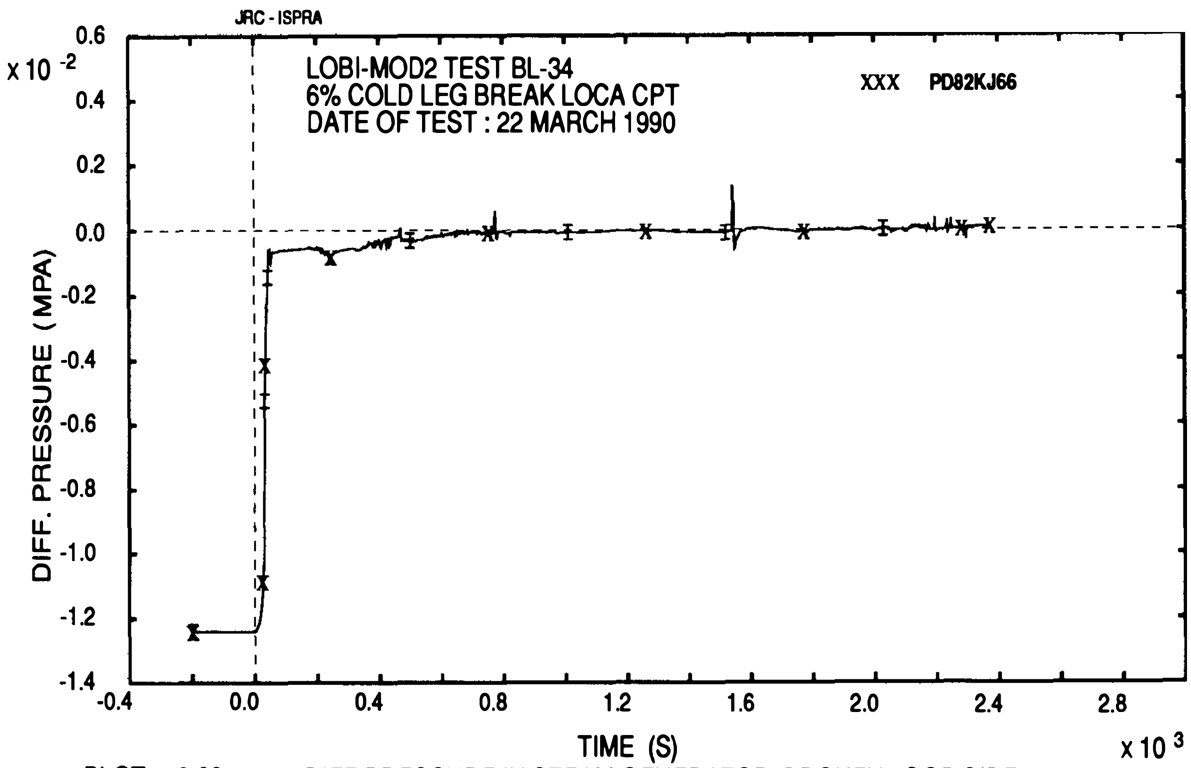
PLOT 2.85 DIFF.PRESSURE IN STEAM GENERATOR, BROKEN LOOP SIDE
-U-TUBE, FALLING LEG. TUBE2 (PD82NBX1)-
-U-TUBE, FALLING LEG. TUBE5 (PD82PBX2)-



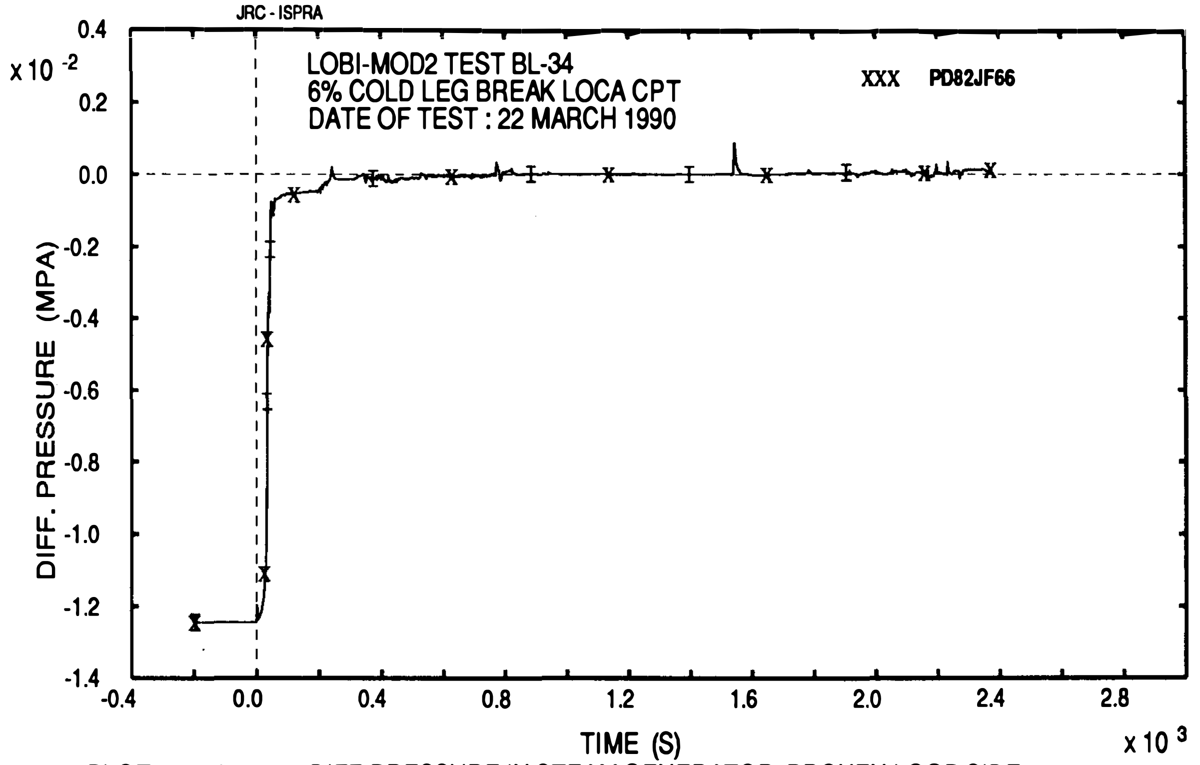
PLOT 2.86 DIFF.PRESSURE IN STEAM GENERATOR, BROKEN LOOP SIDE
-U-TUBE2, FALLING LEG-
-LEVEL N TO M (PD82NM26)-



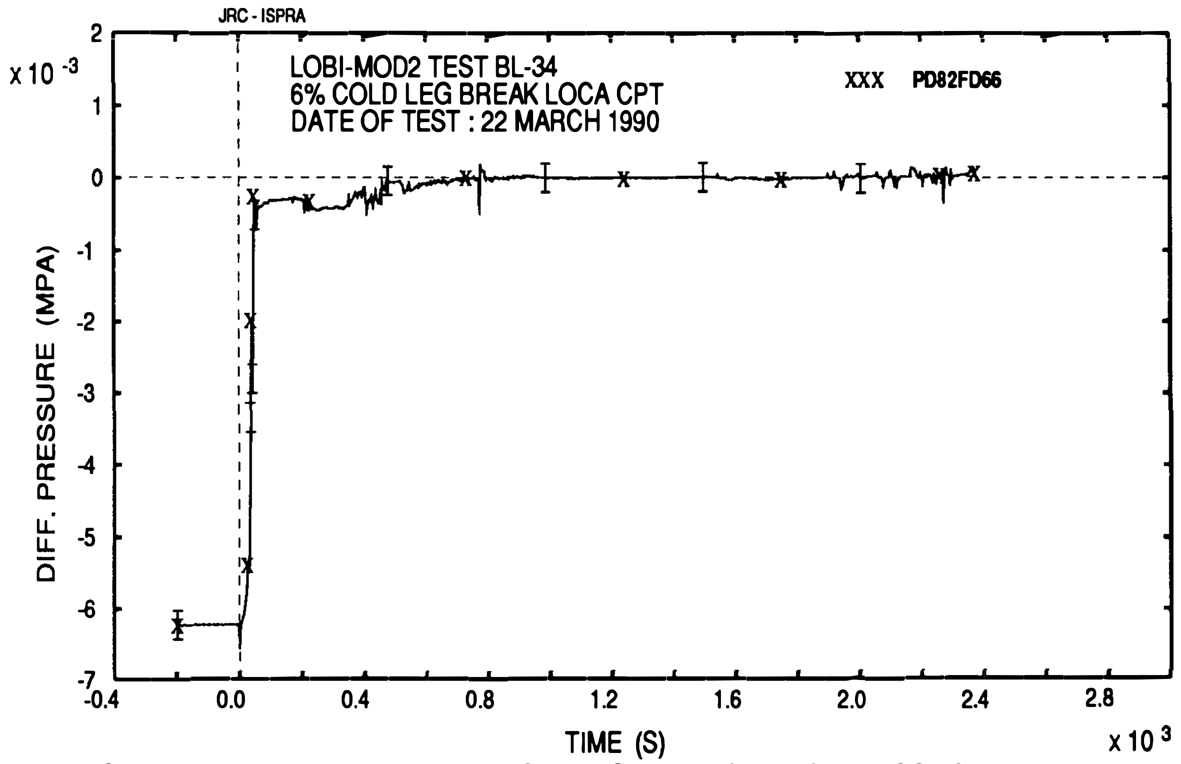
PLOT 2.87 DIFF.PRESSURE IN STEAM GENERATOR, BROKEN LOOP SIDE
-U-TUBE2, FALLING LEG-
-LEVEL M TO K (PD82MK66)-



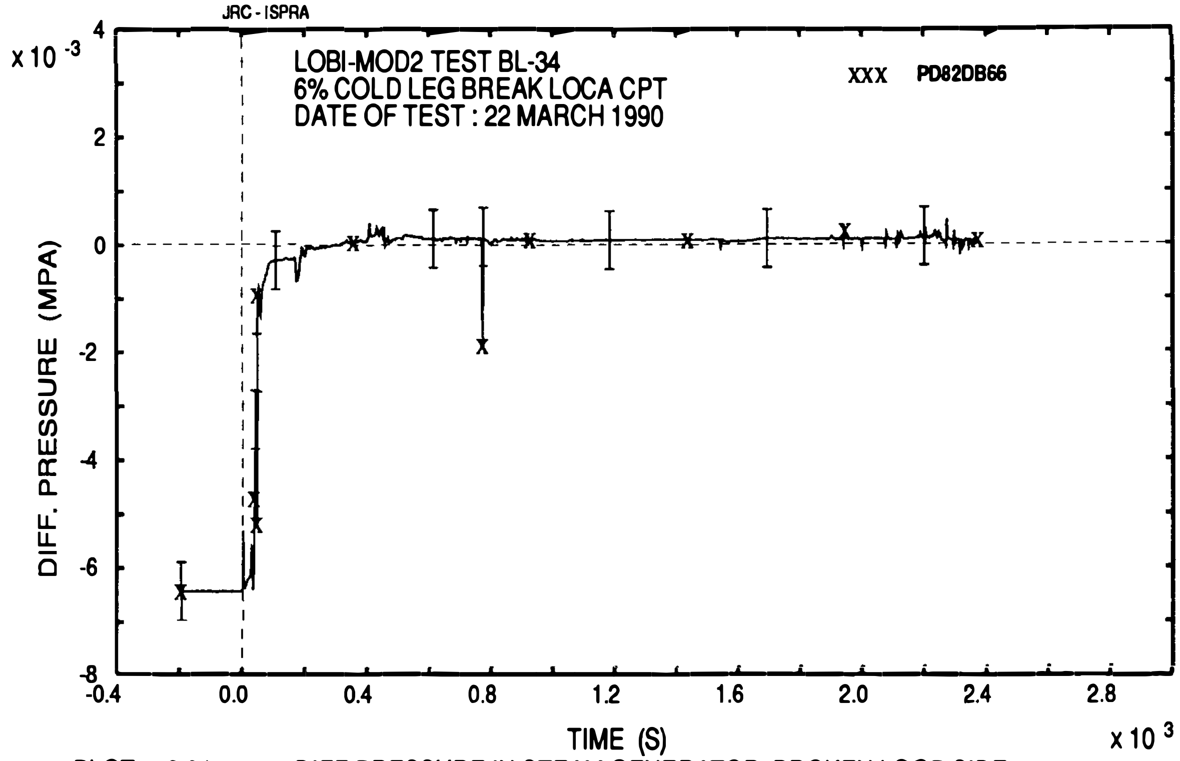
PLOT 2.88 DIFF.PRESSURE IN STEAM GENERATOR, BROKEN LOOP SIDE
-U-TUBE2, FALLING LEG-
-LEVEL K TO J (PD82KJ66)-



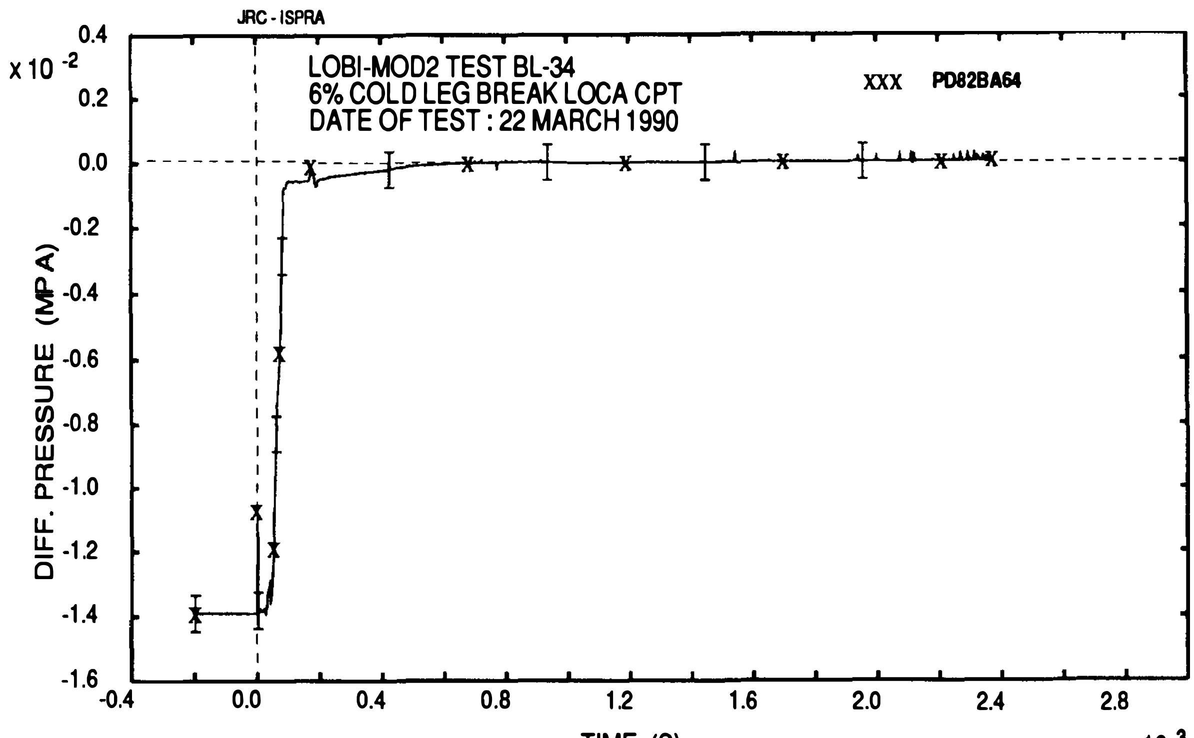
PLOT 2.89 DIFF.PRESSURE IN STEAM GENERATOR, BROKEN LOOP SIDE
-U-TUBE2, FALLING LEG-
-LEVEL J TO F (PD82JF66)-



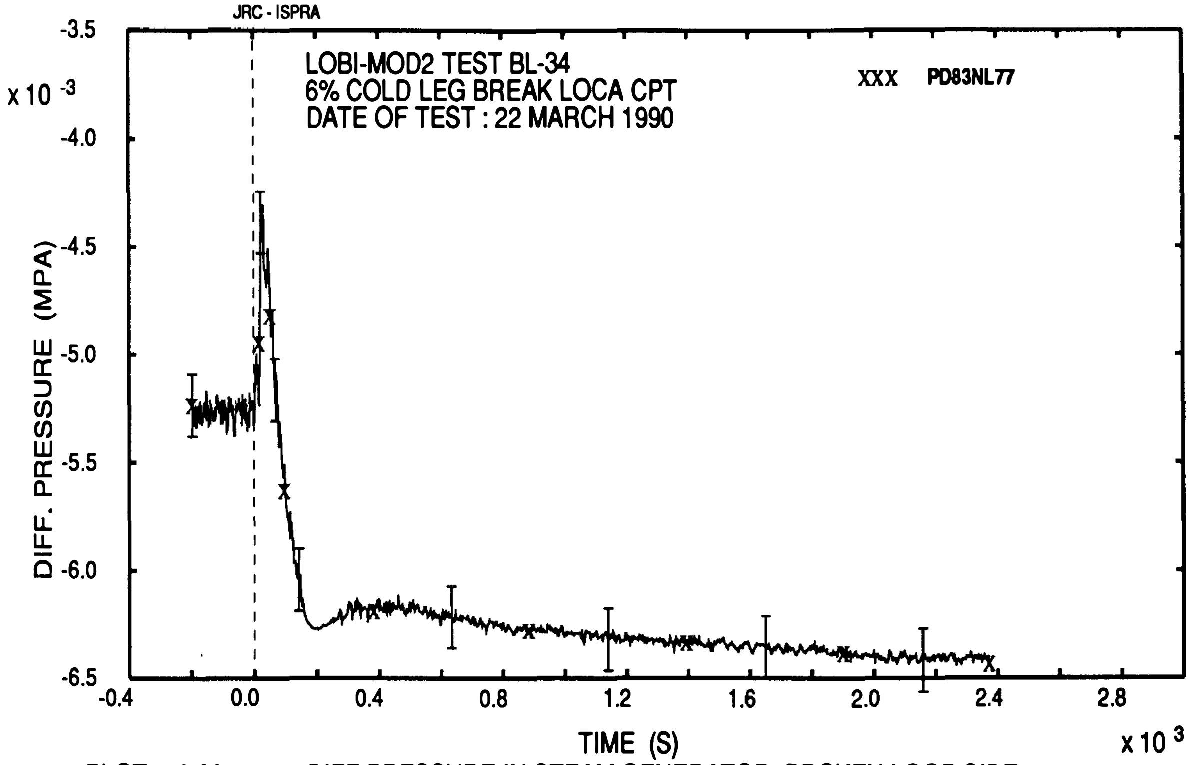
PLOT 2.90 DIFF.PRESSURE IN STEAM GENERATOR, BROKEN LOOP SIDE
-U-TUBE2, FALLING LEG-
-LEVEL F TO D (PD82FD66)-



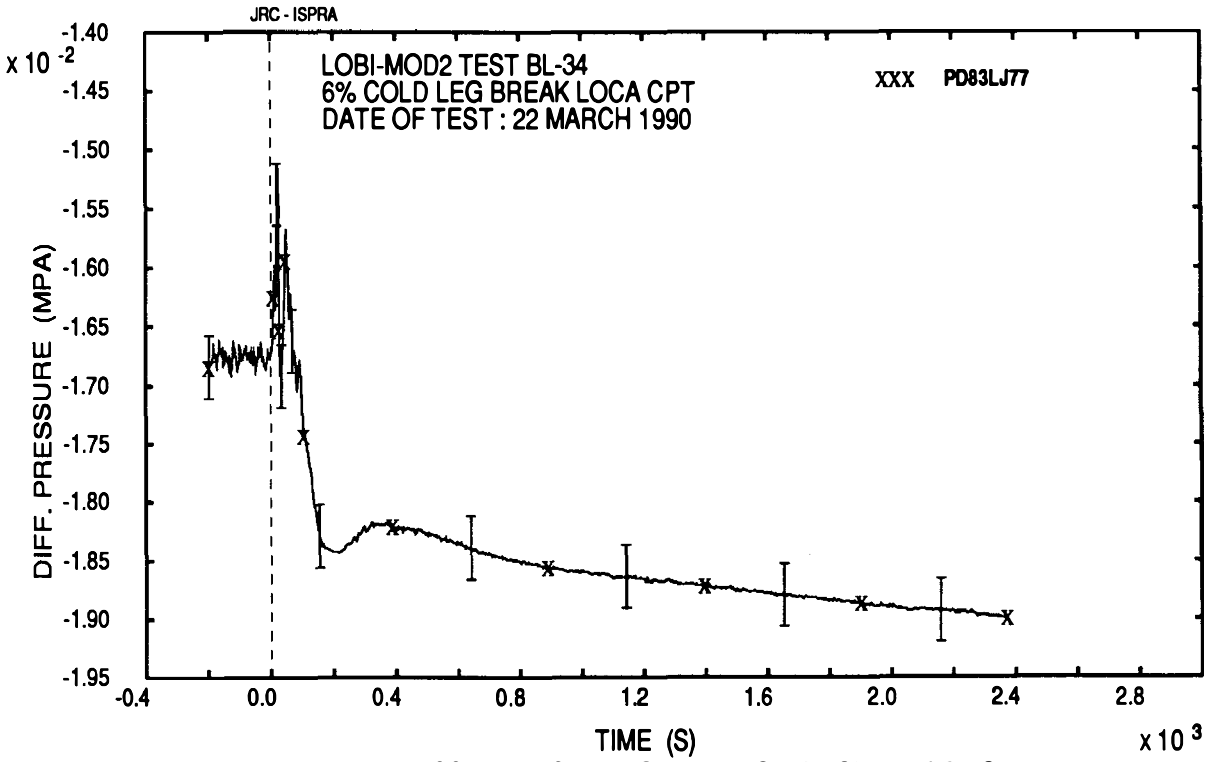
PLOT 2.91 DIFF.PRESSURE IN STEAM GENERATOR, BROKEN LOOP SIDE
-U-TUBE2, FALLING LEG-
-LEVEL D TO B (PD82DB66)-



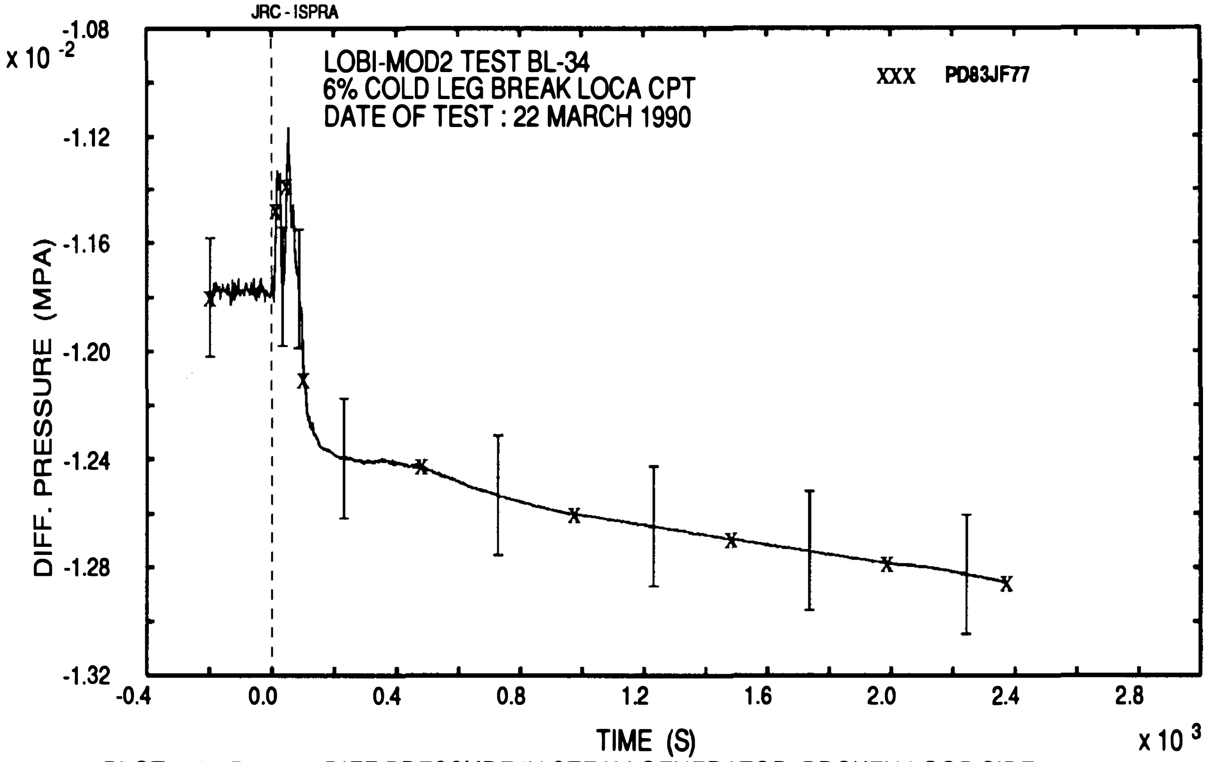
PLOT 2.92 DIFF.PRESSURE IN STEAM GENERATOR, BROKEN LOOP SIDE
-EXIT PRIMARY SIDE (PD82BA64)-



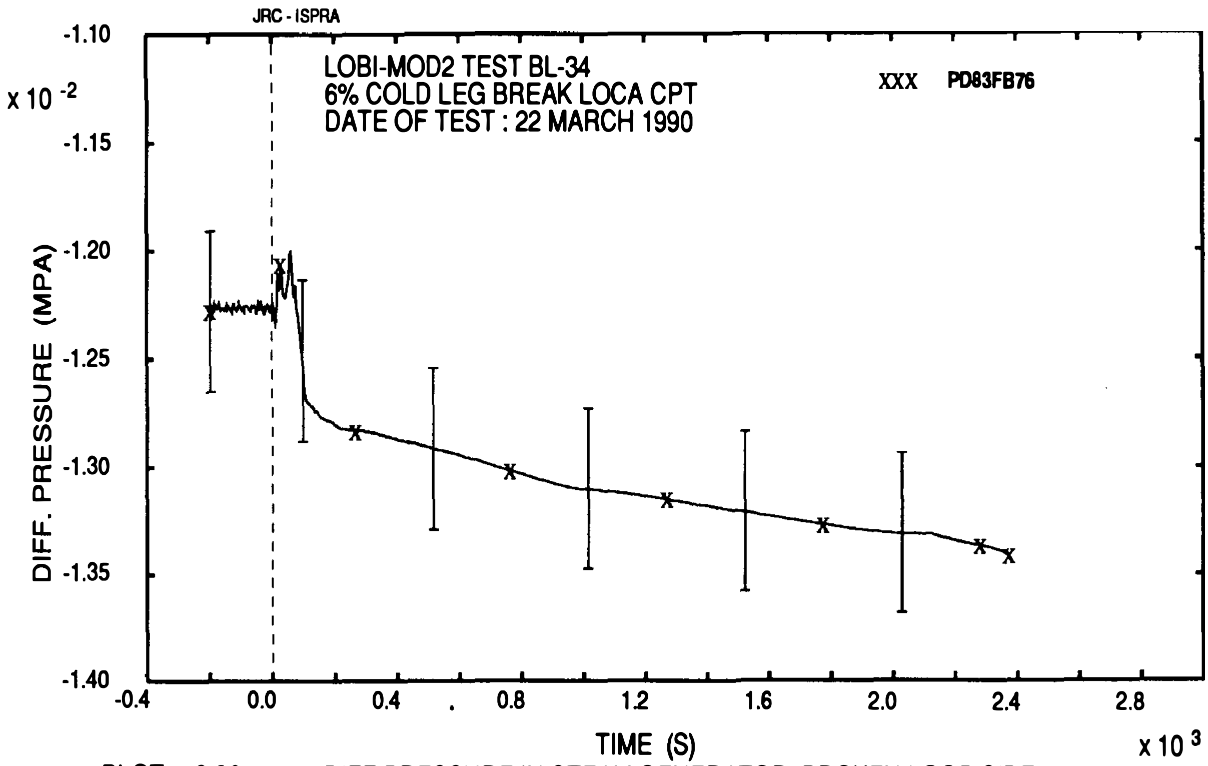
PLOT 2.93 DIFF.PRESSURE IN STEAM GENERATOR, BROKEN LOOP SIDE -DOWNCOMER REGION, LEVEL N TO L (PD83NL77)-



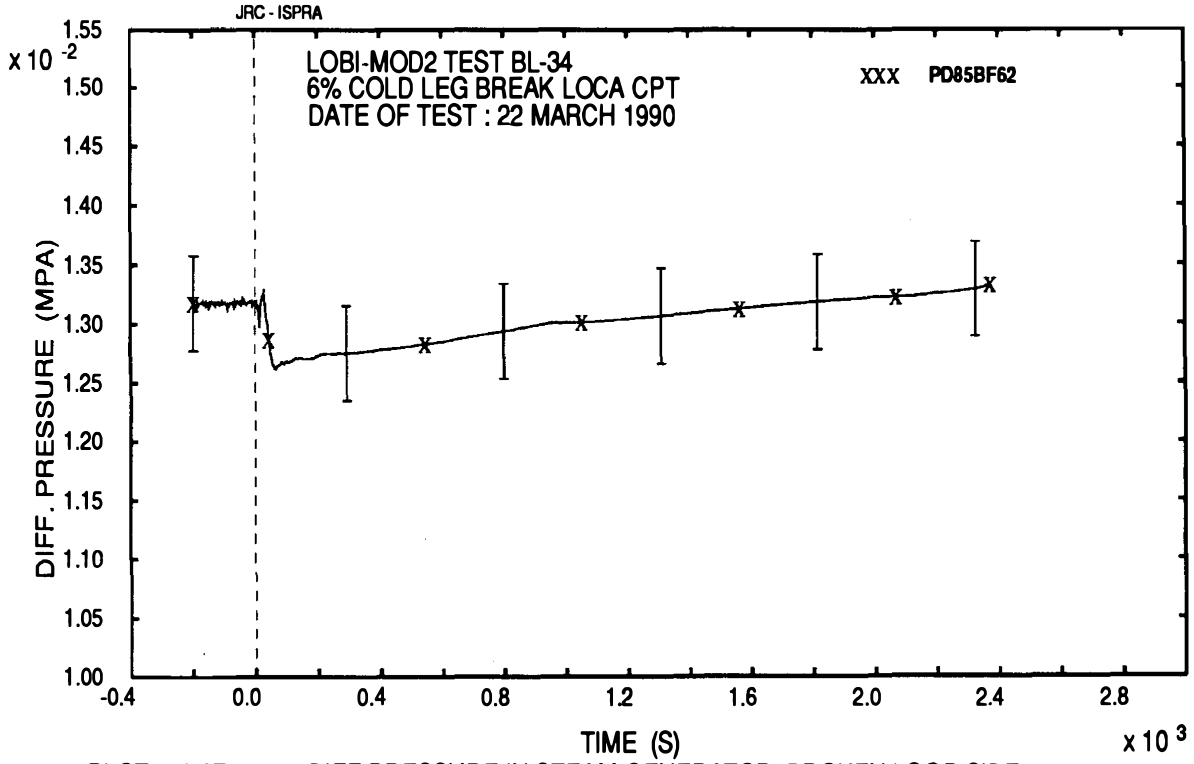
PLOT 2.94 DIFF.PRESSURE IN STEAM GENERATOR, BROKEN LOOP SIDE -DOWNCOMER REGION, LEVEL L TO J (PD83LJ77)-



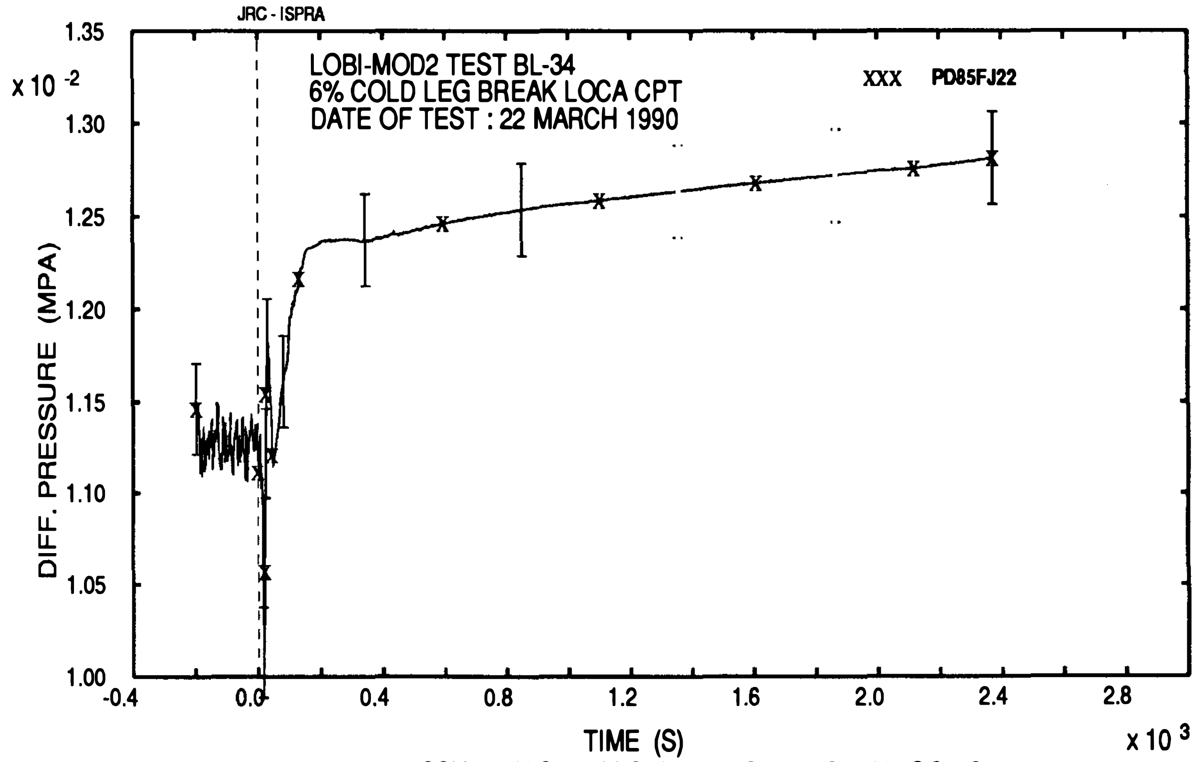
PLOT 2.95 DIFF.PRESSURE IN STEAM GENERATOR, BROKEN LOOP SIDE -DOWNCOMER REGION, LEVEL J TO F (PD83JF77)-



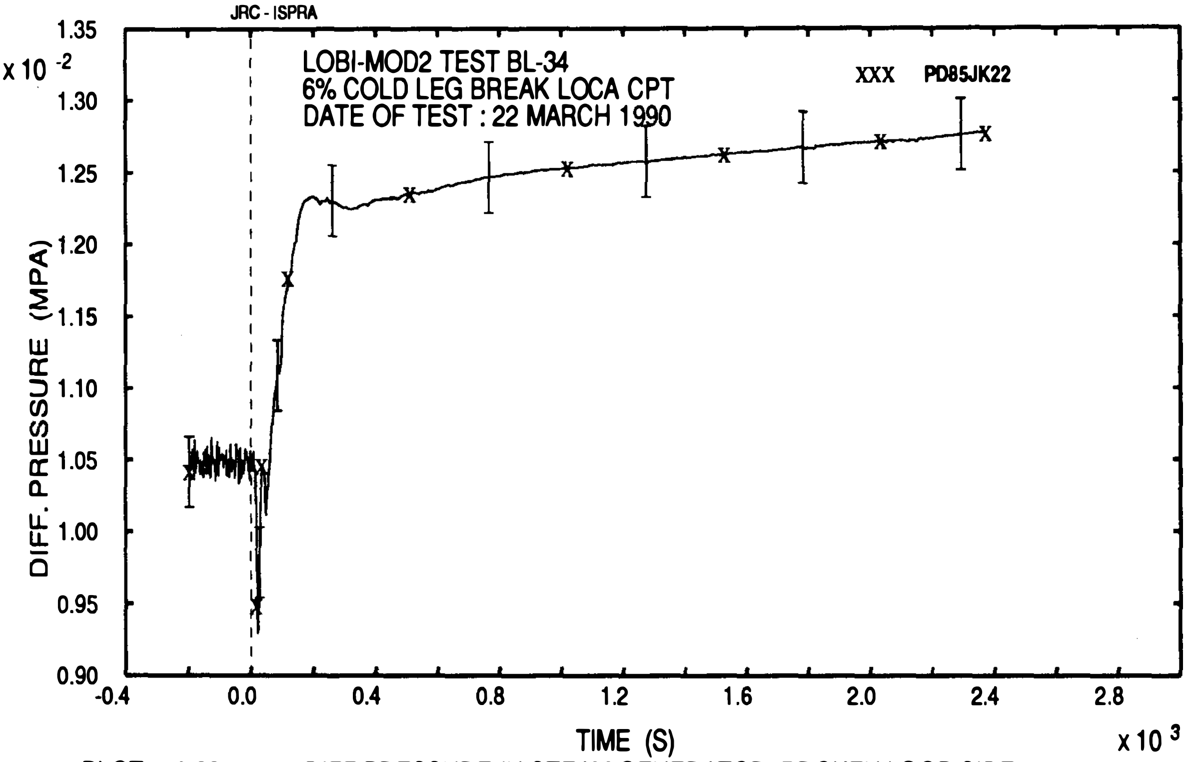
PLOT 2.96 DIFF.PRESSURE IN STEAM GENERATOR, BROKEN LOOP SIDE -DOWNCOMER REGION, LEVEL F TO B (PD83FB76)-



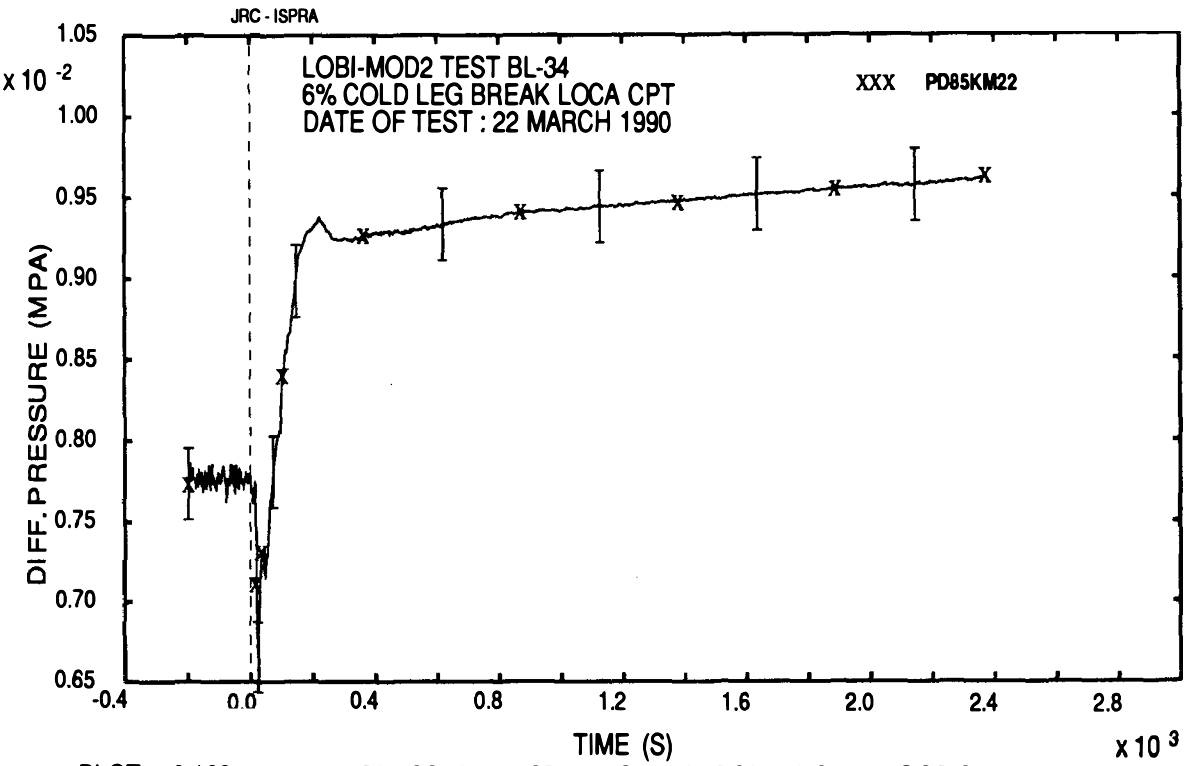
PLOT 2.97 DIFF.PRESSURE IN STEAM GENERATOR, BROKEN LOOP SIDE
-RISER REGION, LEVEL B TO F (PD85BF62)-



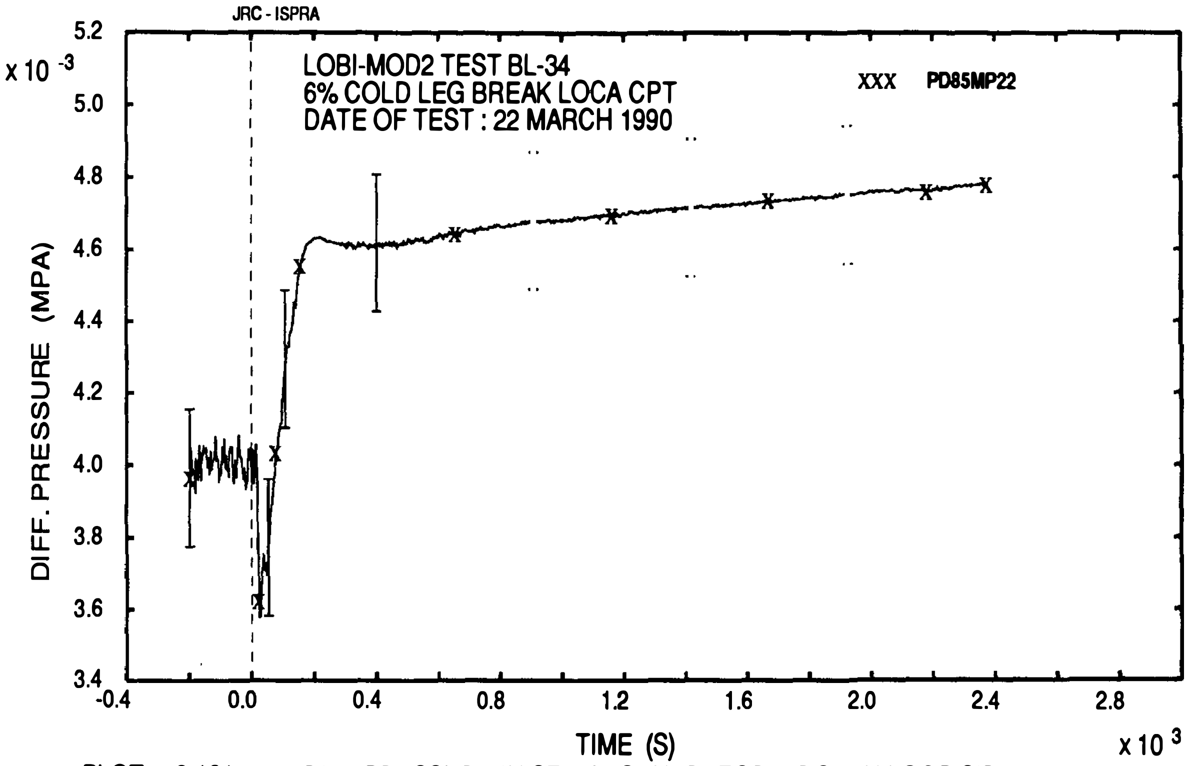
PLOT 2.98 DIFF.PRESSURE IN STEAM GENERATOR, BROKEN LOOP SIDE
-RISER REGION, LEVEL F TO J (PD85FJ22)-



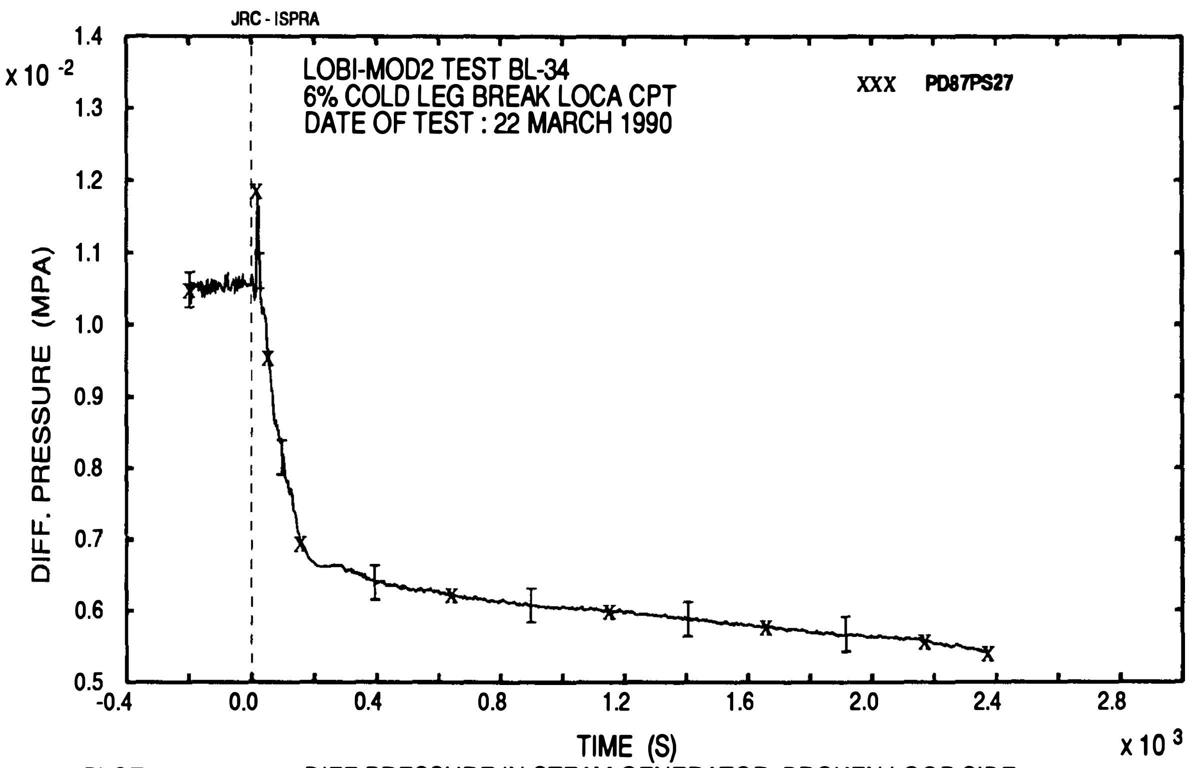
PLOT 2.99 DIFF.PRESSURE IN STEAM GENERATOR, BROKEN LOOP SIDE
-RISER REGION, LEVEL J TO K (PD85JK22)-



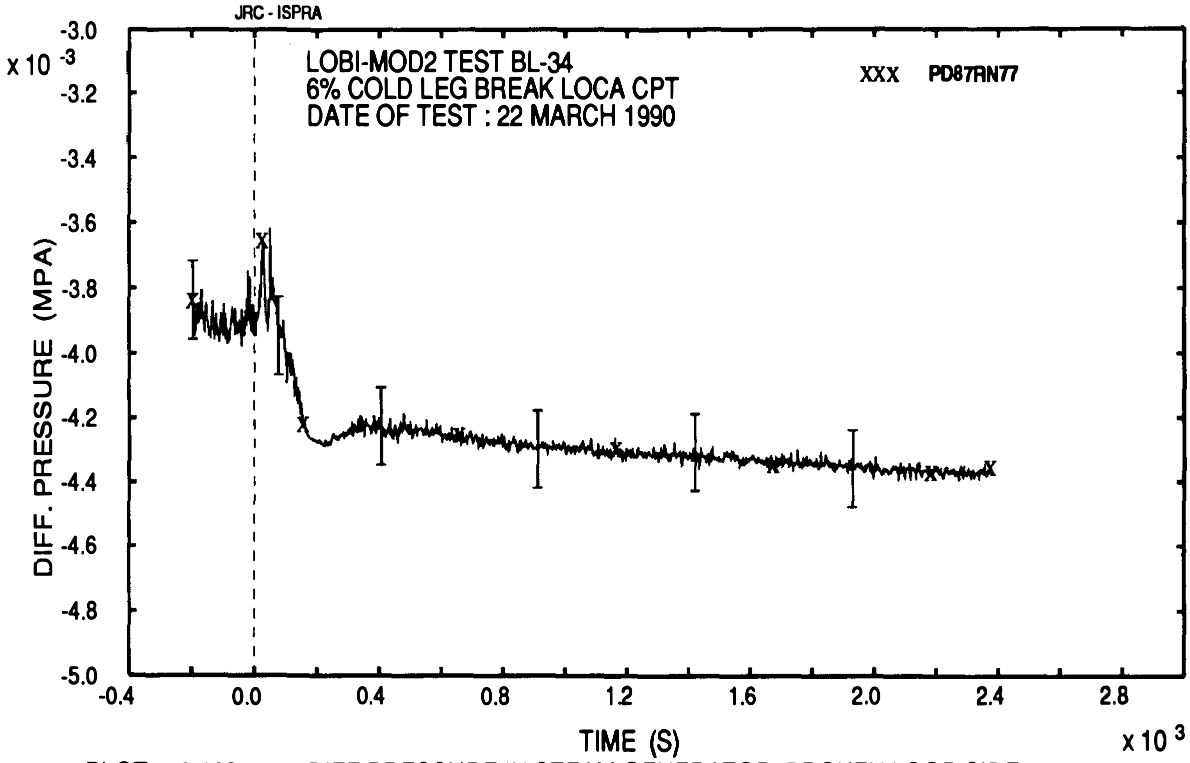
PLOT 2.100 DIFF.PRESSURE IN STEAM GENERATOR, BROKEN LOOP SIDE
-RISER REGION, LEVEL K TO M (PD85KM22)-



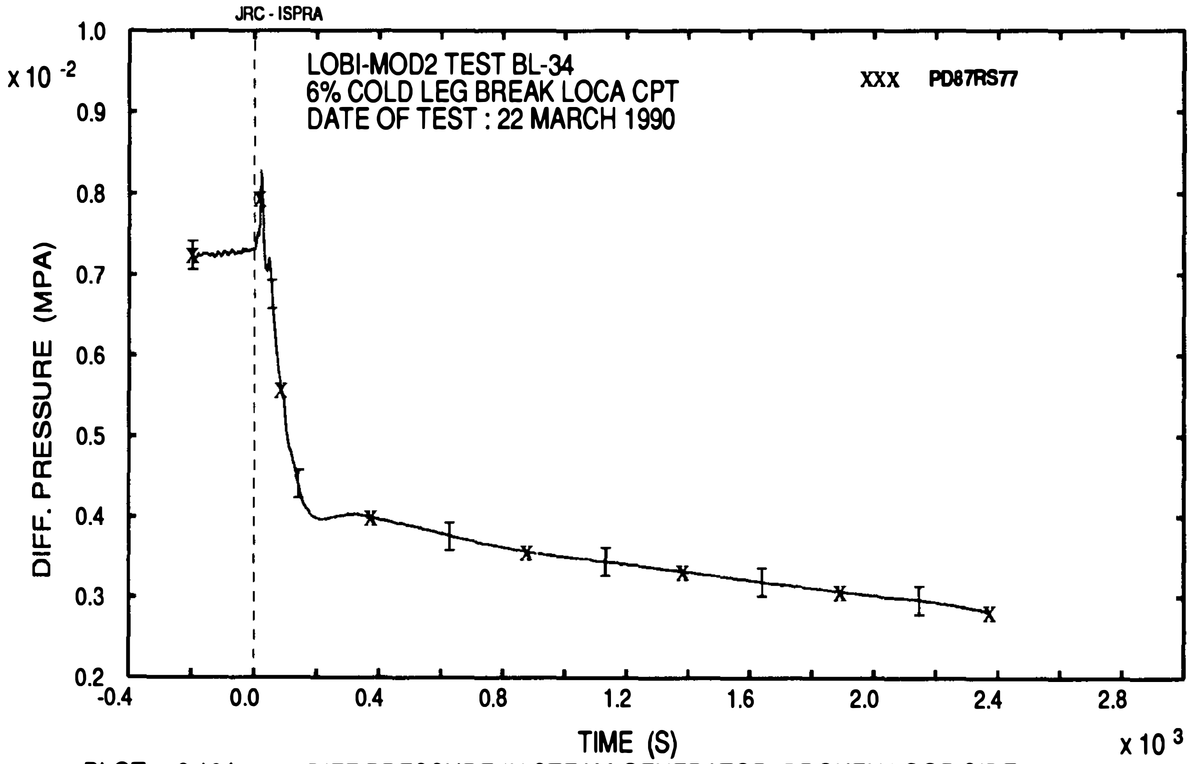
PLOT 2.101 DIFF.PRESSURE IN STEAM GENERATOR, BROKEN LOOP SIDE
-RISER REGION, LEVEL M TO P (PD85MP22)-



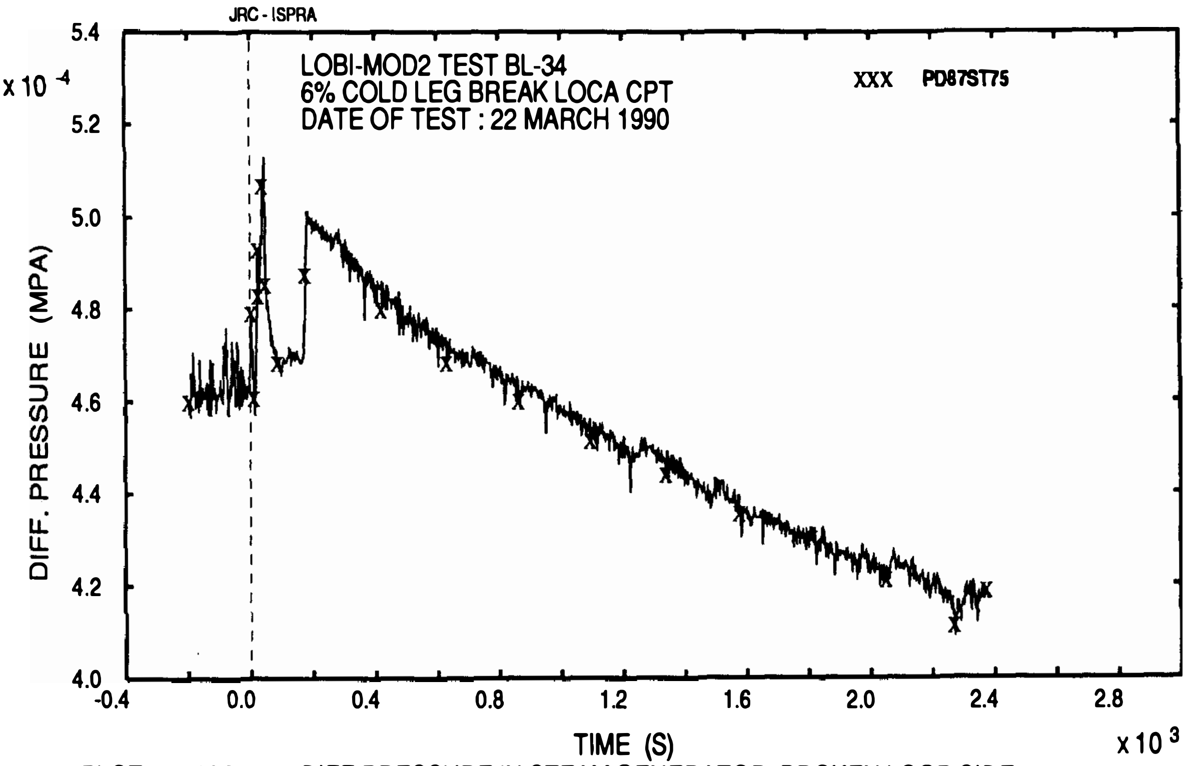
PLOT 2.102 DIFF.PRESSURE IN STEAM GENERATOR, BROKEN LOOP SIDE
-STEAM DOME REGION, LEVEL P TO S (PD87PS27)-



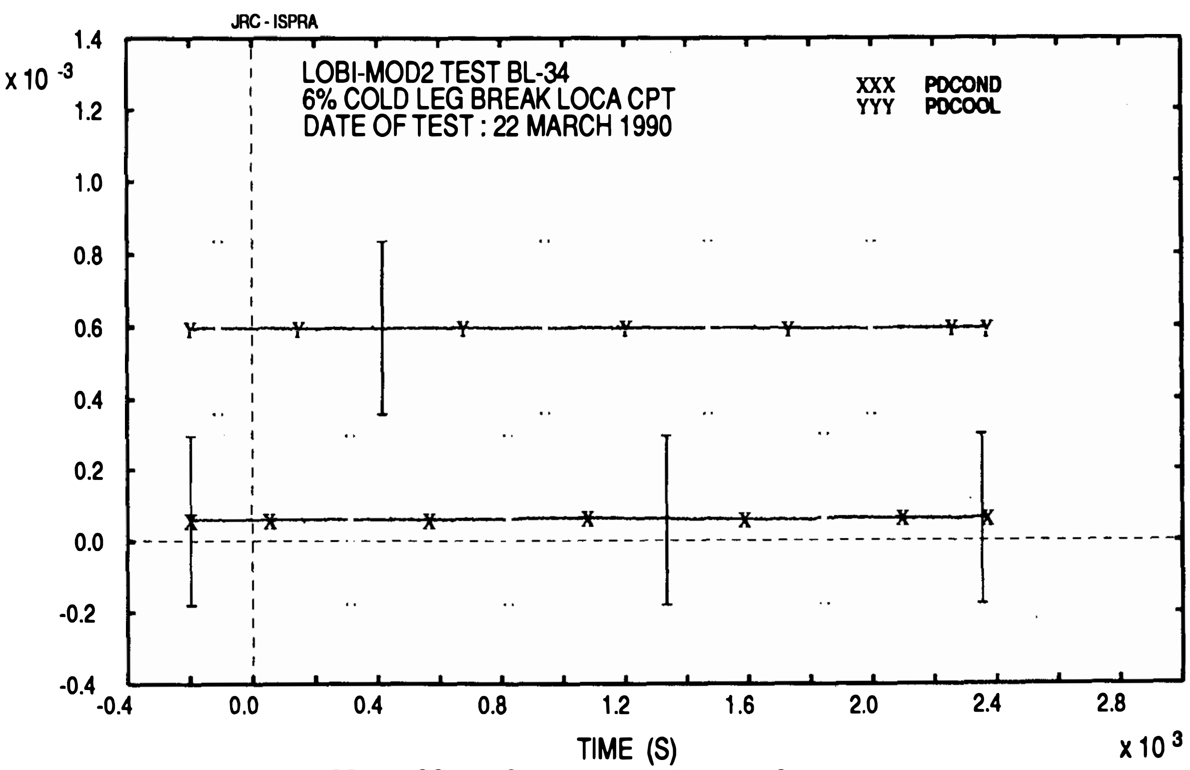
PLOT 2.103 DIFF.PRESSURE IN STEAM GENERATOR, BROKEN LOOP SIDE -STEAM DOME REGION, LEVEL R TO N (PD87RN77)-



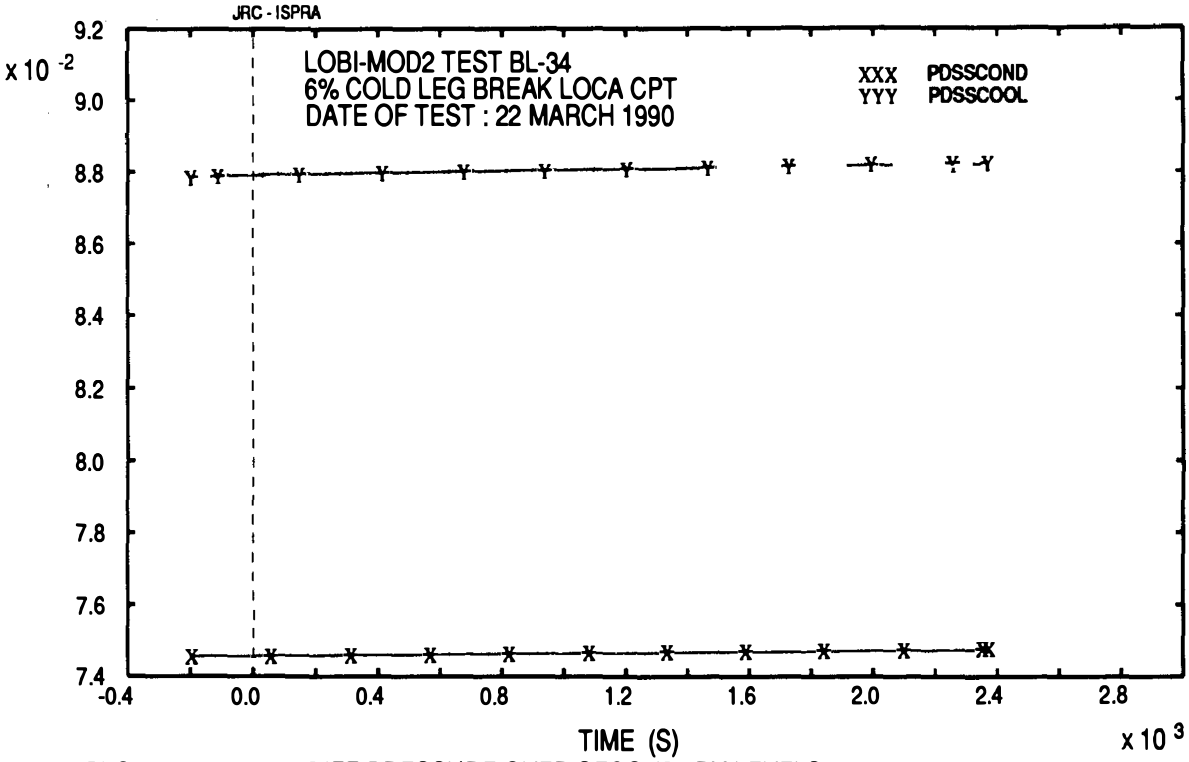
PLOT 2.104 DIFF.PRESSURE IN STEAM GENERATOR, BROKEN LOOP SIDE -STEAM DOME REGION, LEVEL R TO S (PD87RS77)-



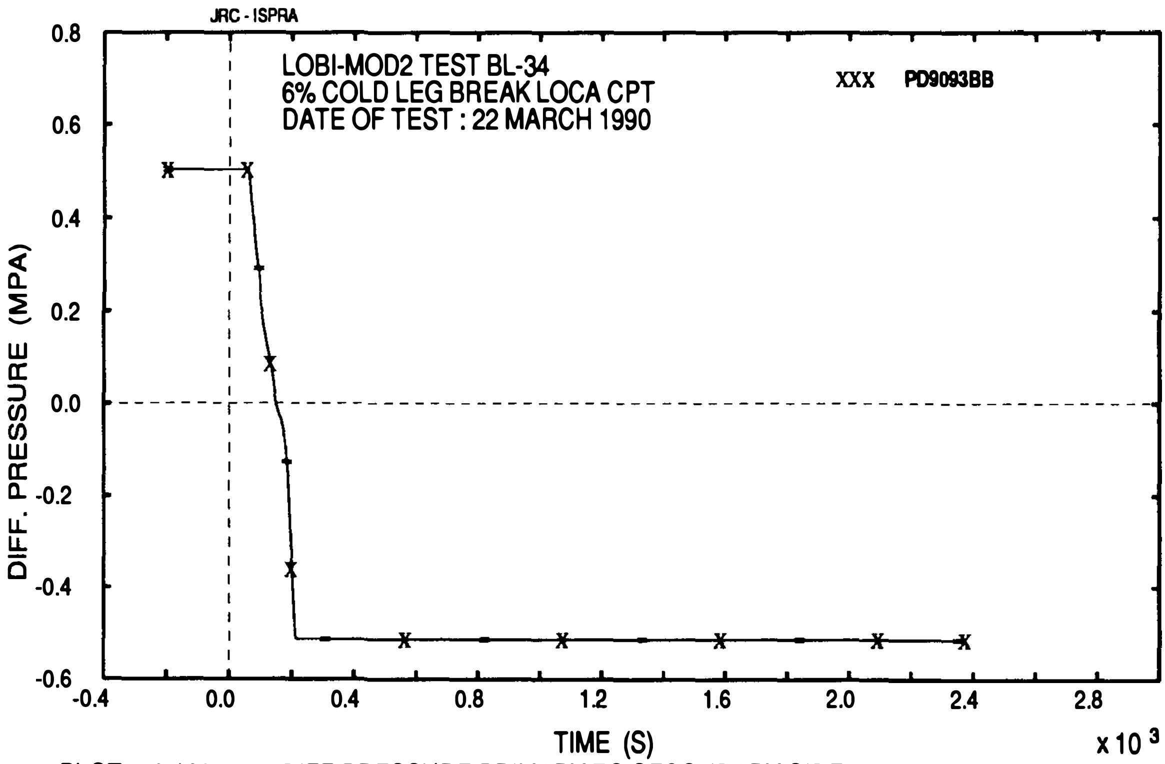
PLOT 2.105 DIFF.PRESSURE IN STEAM GENERATOR, BROKEN LOOP SIDE -STEAM DOME REGION, LEVEL S TO T (PD87ST75)-



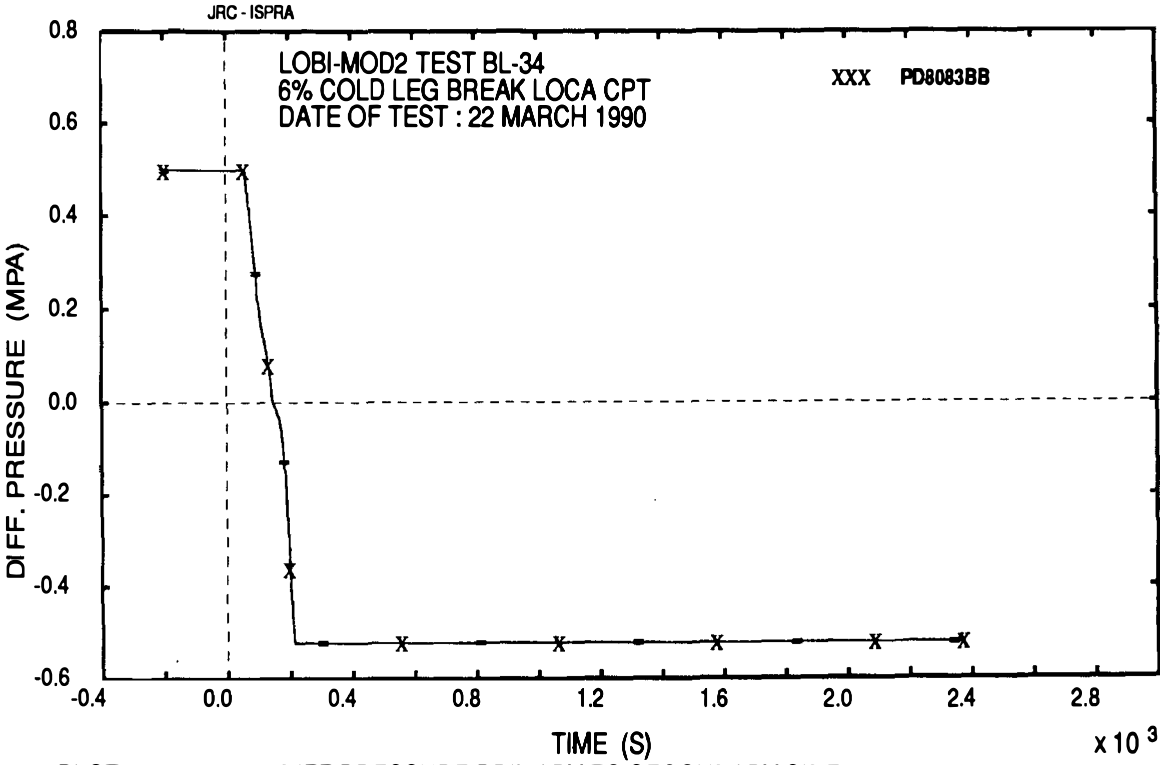
PLOT 2.106 DIFF.PRESSURE OVER TERTIARY LEVELS -CONDENSER (PDCOND) AND COOLER (PDCOOL)-



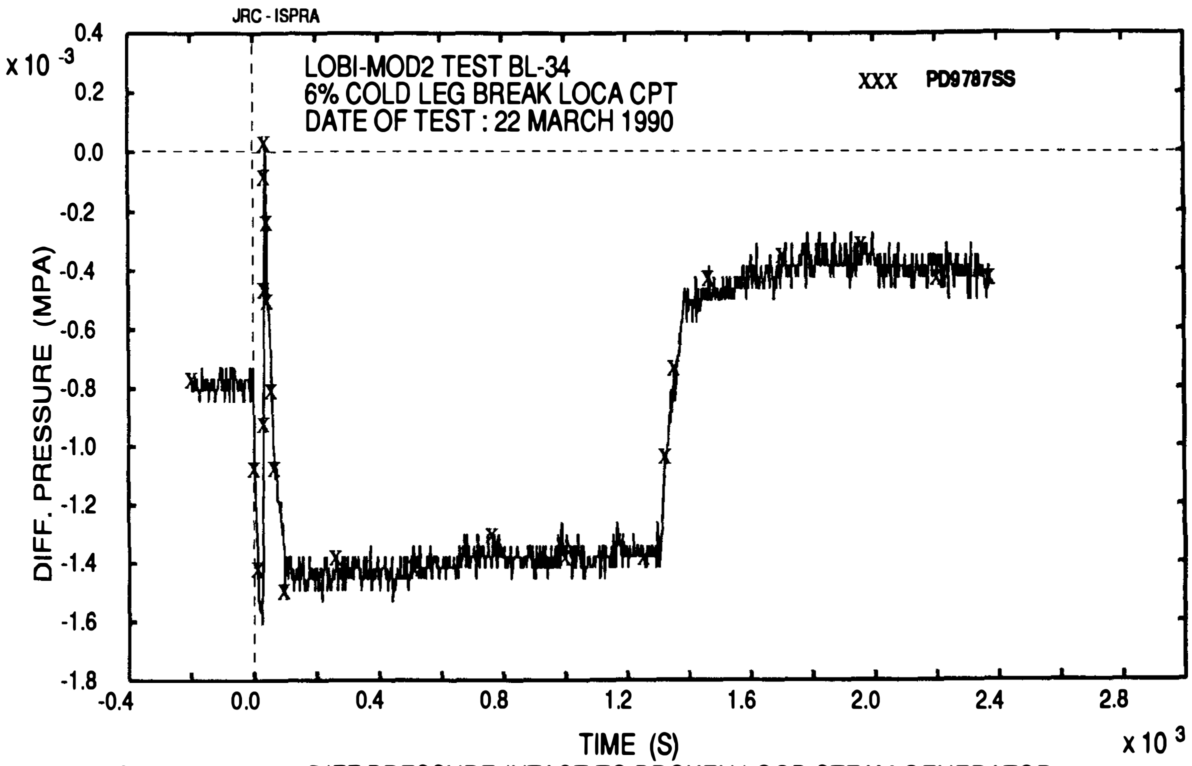
PLOT 2.107 DIFF.PRESSURE OVER SECONDARY LEVELS
-CONDENSER (PDSSCOND) AND COOLER (PDSSCOOL)-



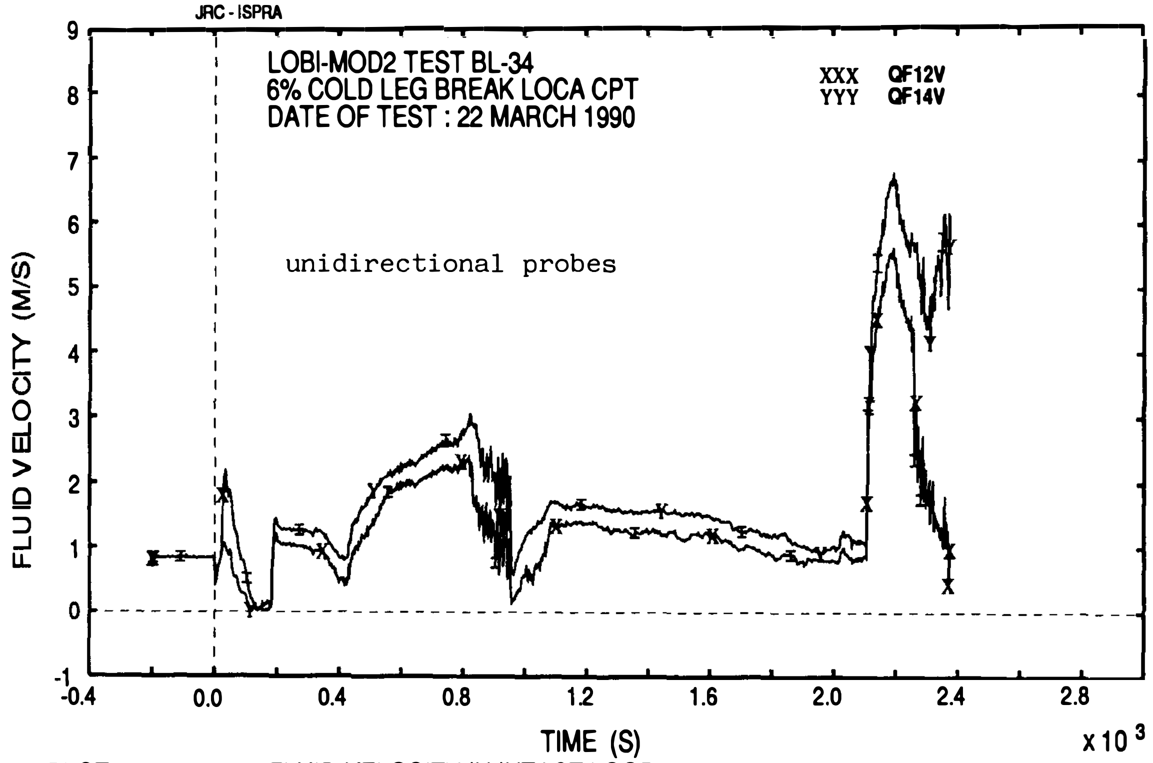
PLOT 2.108 DIFF.PRESSURE PRIMARY TO SECONDARY SIDE
-INTACT LOOP STEAM GENERATOR (PD9093BB)-



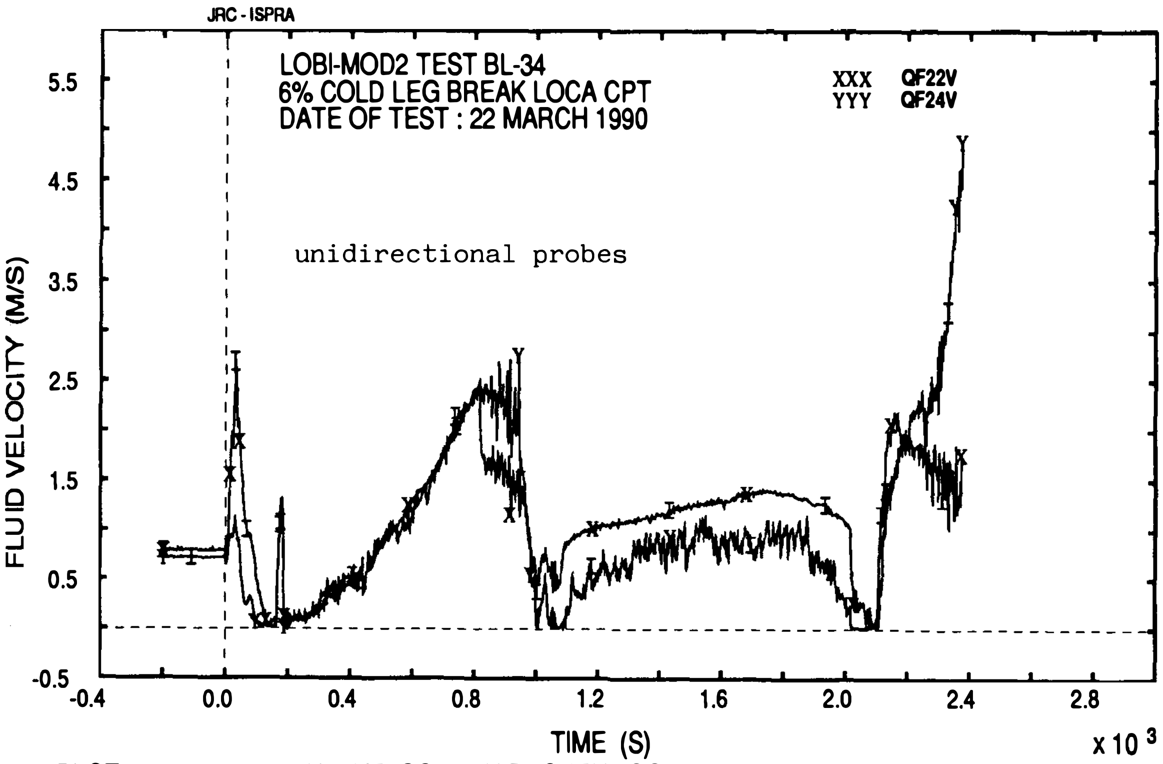
PLOT 2.109 DIFF.PRESSURE PRIMARY TO SECONDARY SIDE
-BROKEN LOOP STEAM GENERATORR (PD8083BB)-



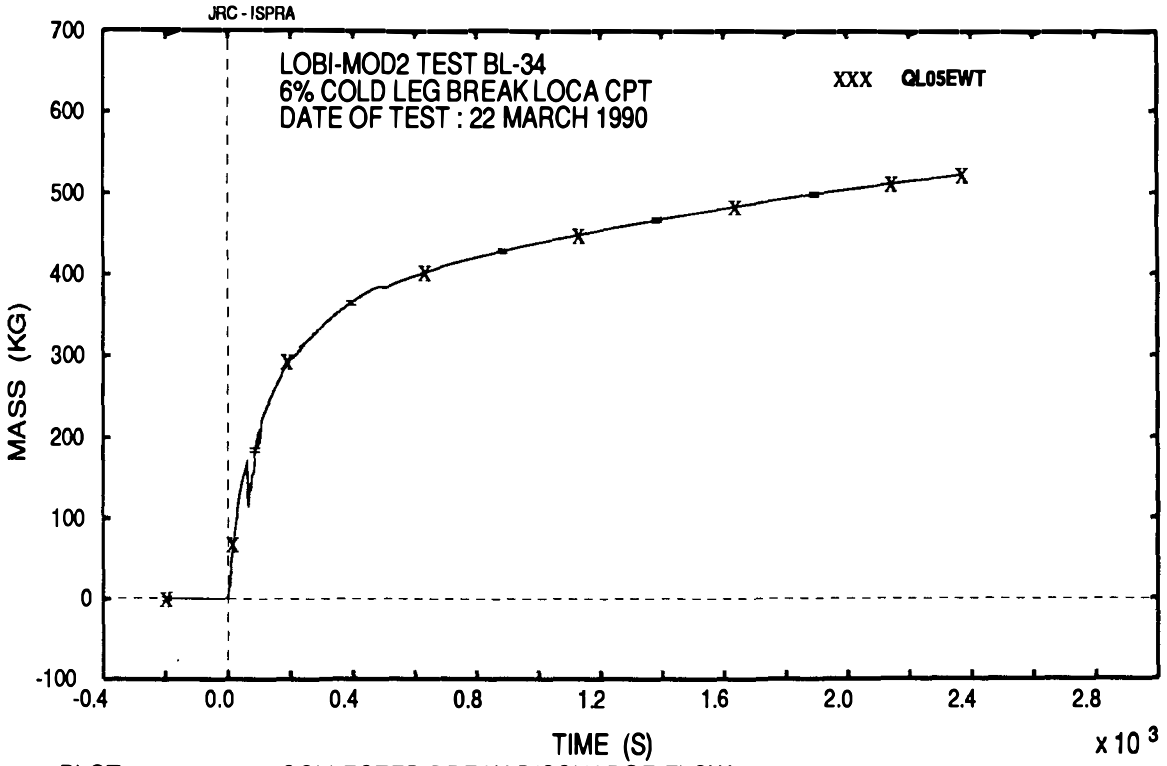
PLOT 2.110 DIFF.PRESSURE INTACT TO BROKEN LOOP STEAM GENERATOR
-SECONDARY SIDE (PD9787SS)-



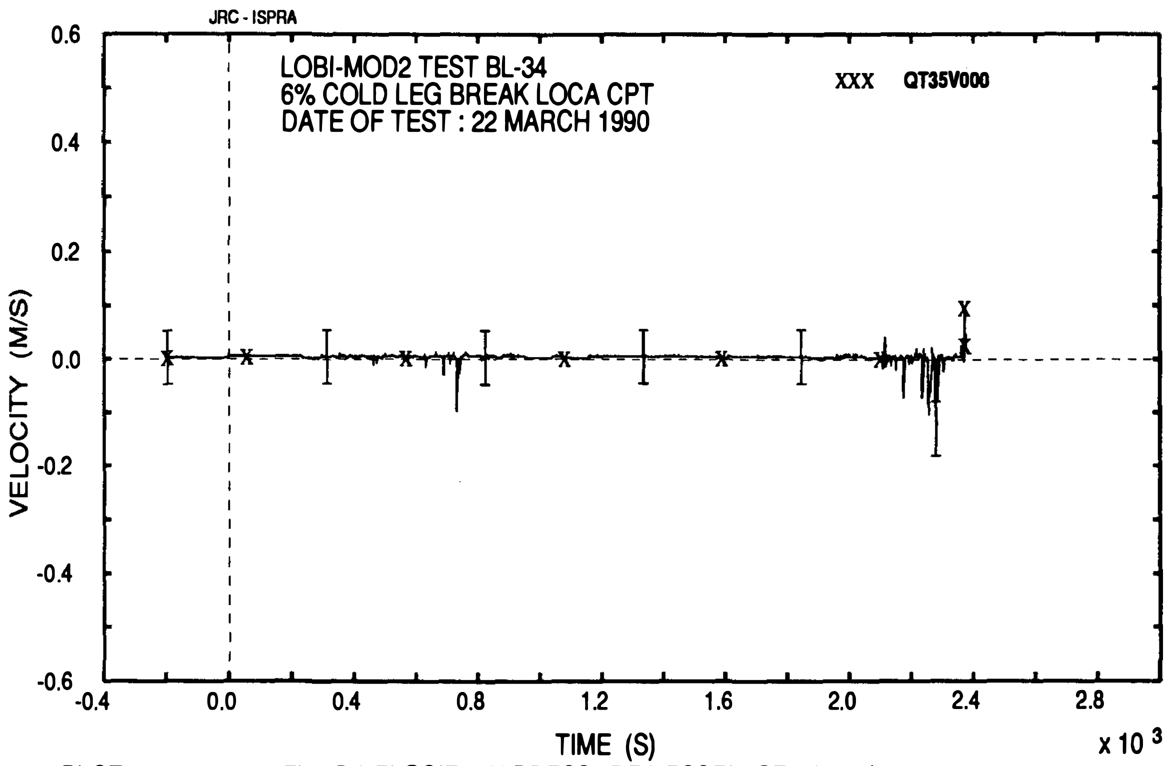
PLOT 4.1 FLUID VELOCITY IN INTACT LOOP
-STEAM GENERATOR INLET (QF12V)-
-PUMP INLET (QF14V)-



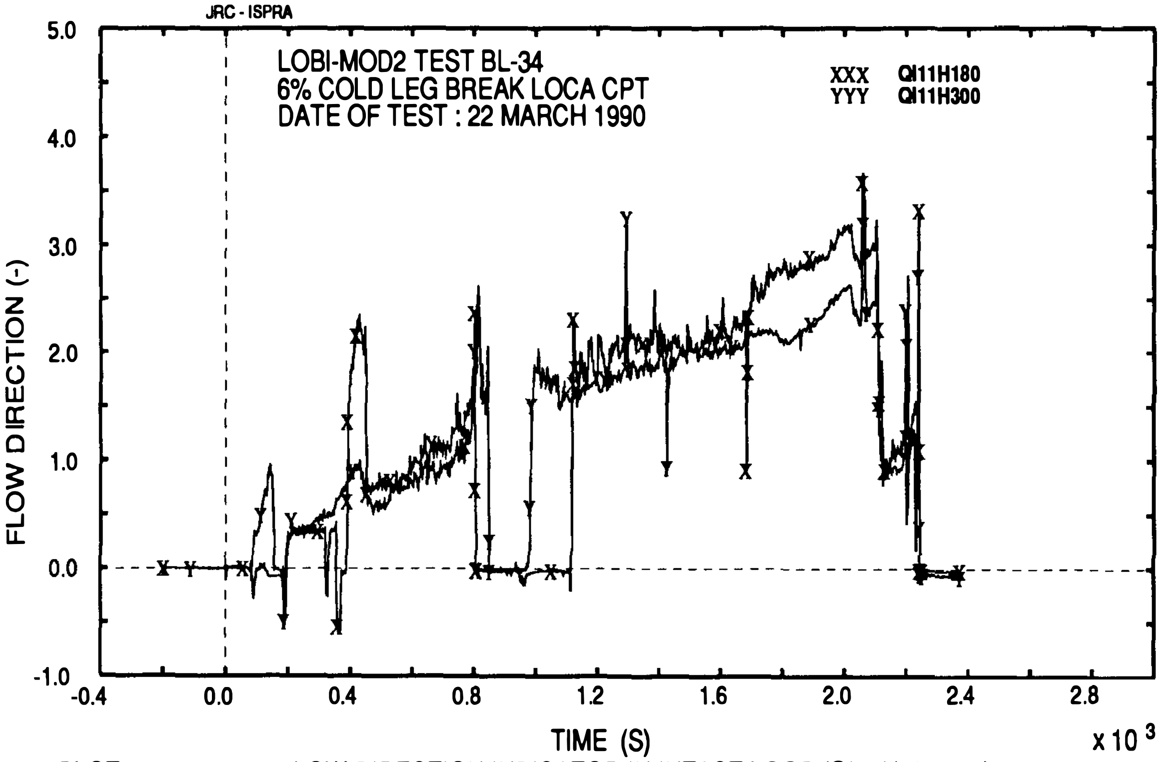
PLOT 4.2 FLUID VELOCITY IN BROKEN LOOP
-STEAM GENERATOR INLET (QF22V)-
-PUMP INLET (QF24V)-



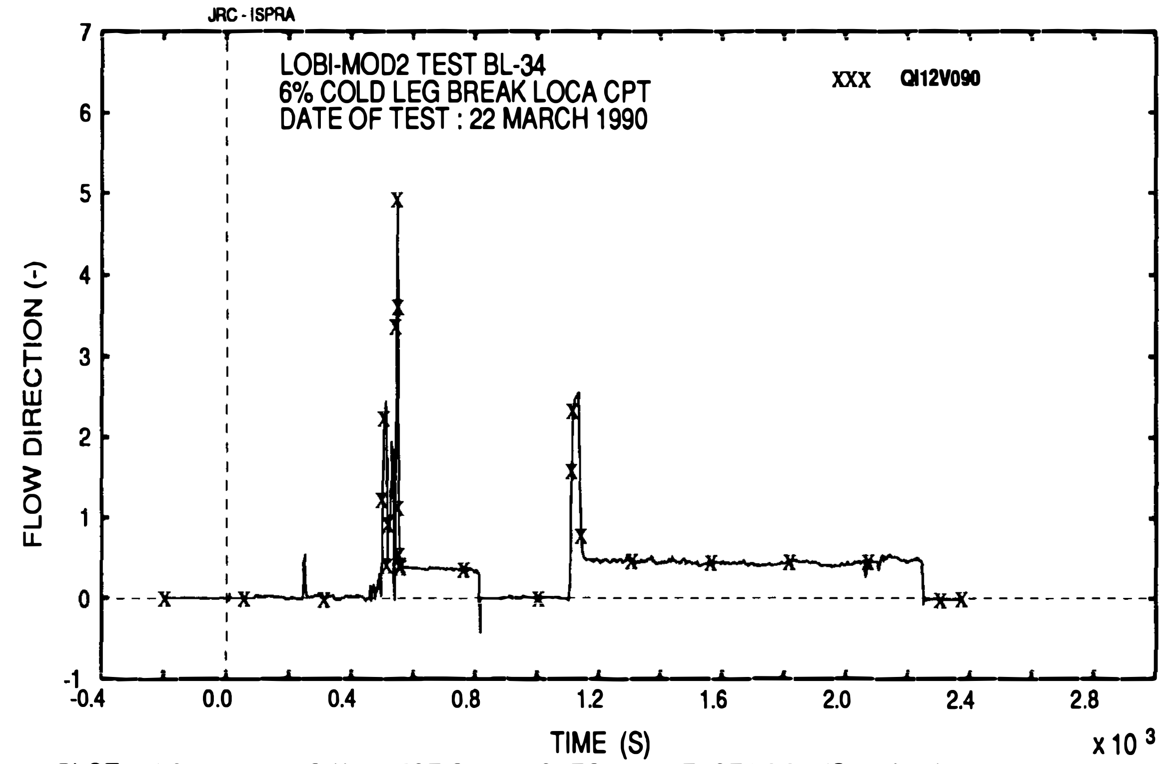
PLOT 4.3 COLLECTED BREAK DISCHARGE FLOW
-WEIGHT MEASUREMENT (QL05EWT)-



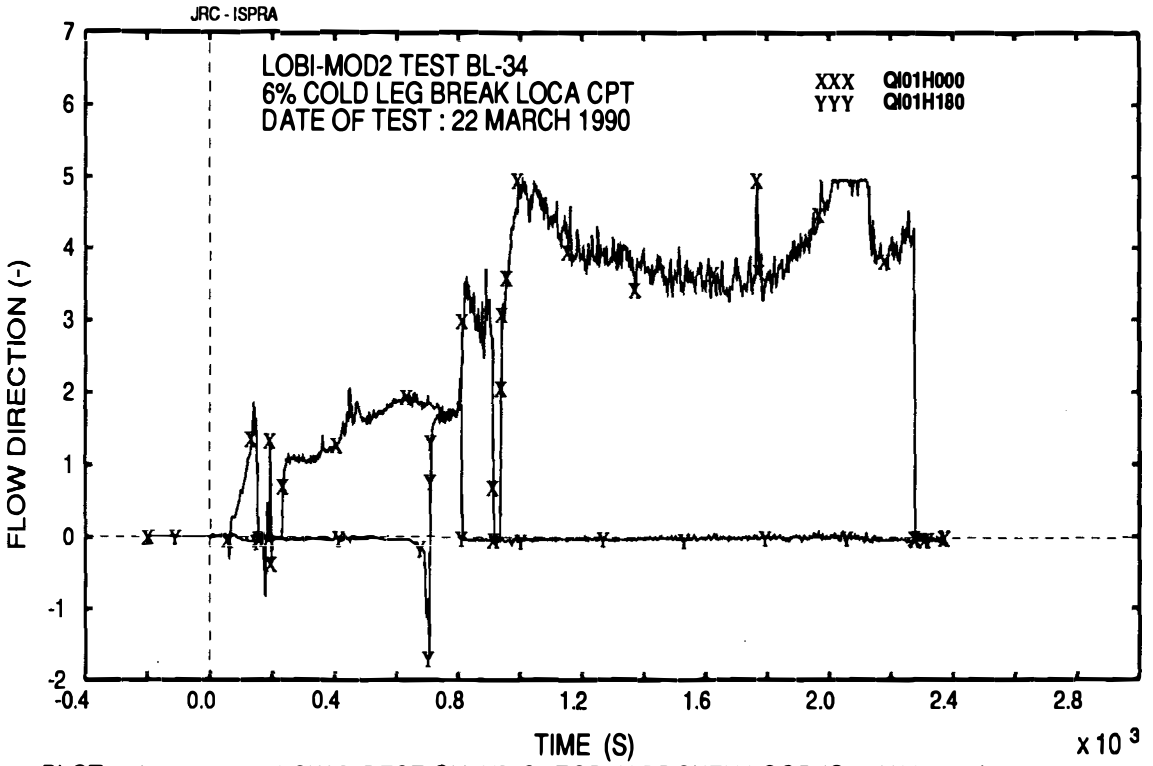
PLOT 4.4 FLUID VELOCITY IN PRESSURE VESSEL (QT35V000)
-CORE ENTRANCE SECTION-



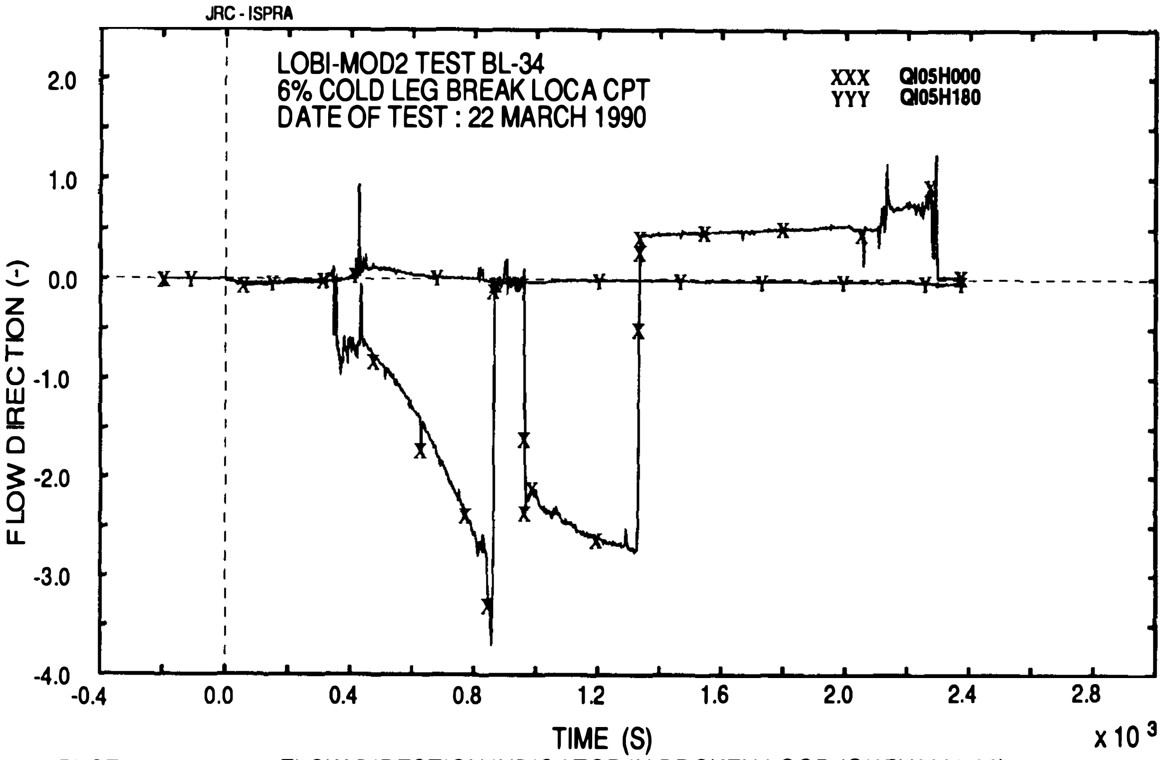
PLOT 4.5 FLOW DIRECTION INDICATOR IN INTACT LOOP (QI11H180/300)
-HOT LEG, VESSEL OUTLET SIDE-



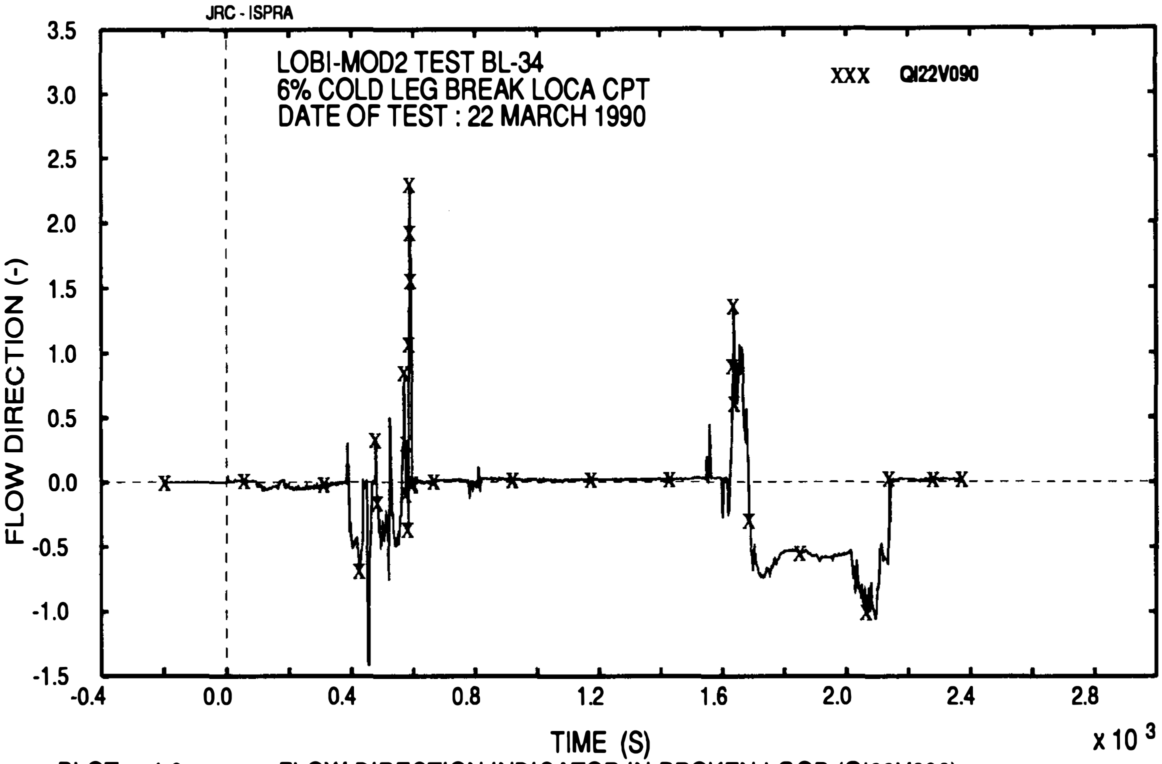
PLOT 4.6 FLOW DIRECTION INDICATOR IN INTACT LOOP (QI12V090)
-STEAM GENERATOR INLET-



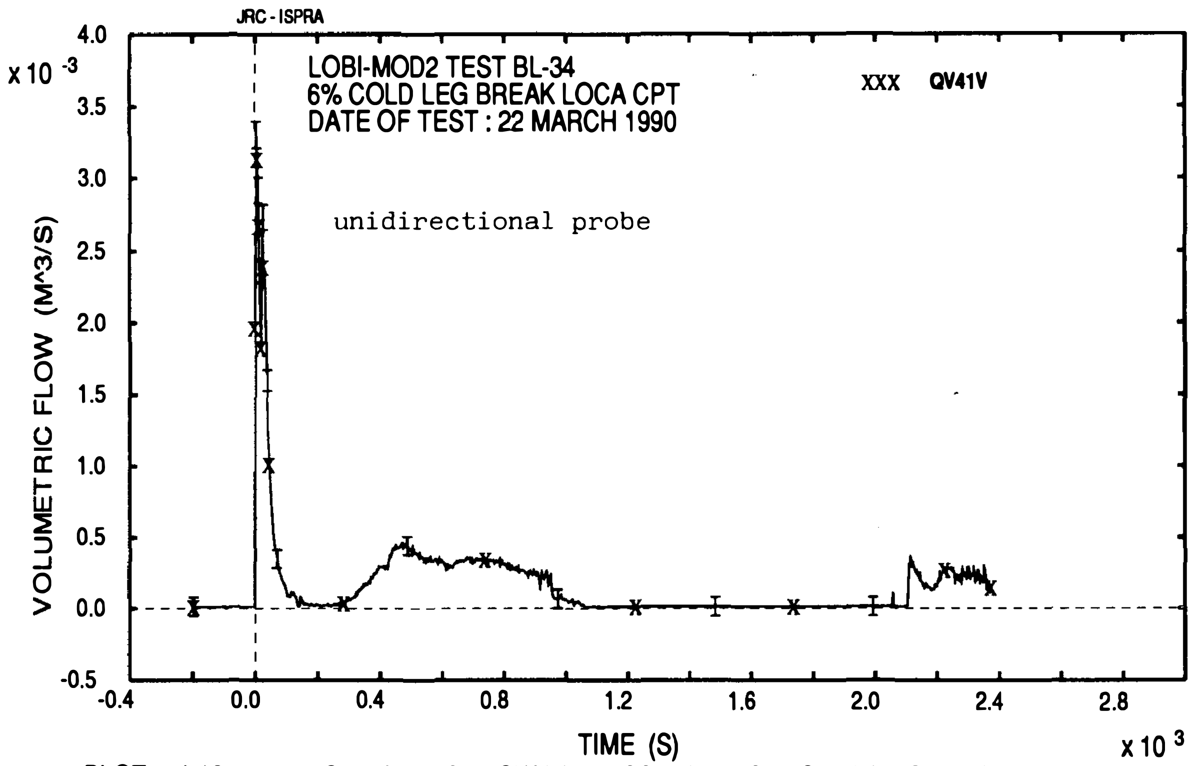
PLOT 4.7 FLOW DIRECTION INDICATOR IN BROKEN LOOP (QI01H000/180)
-HOT LEG, NEAR HOT LEG BREAK POSITION-



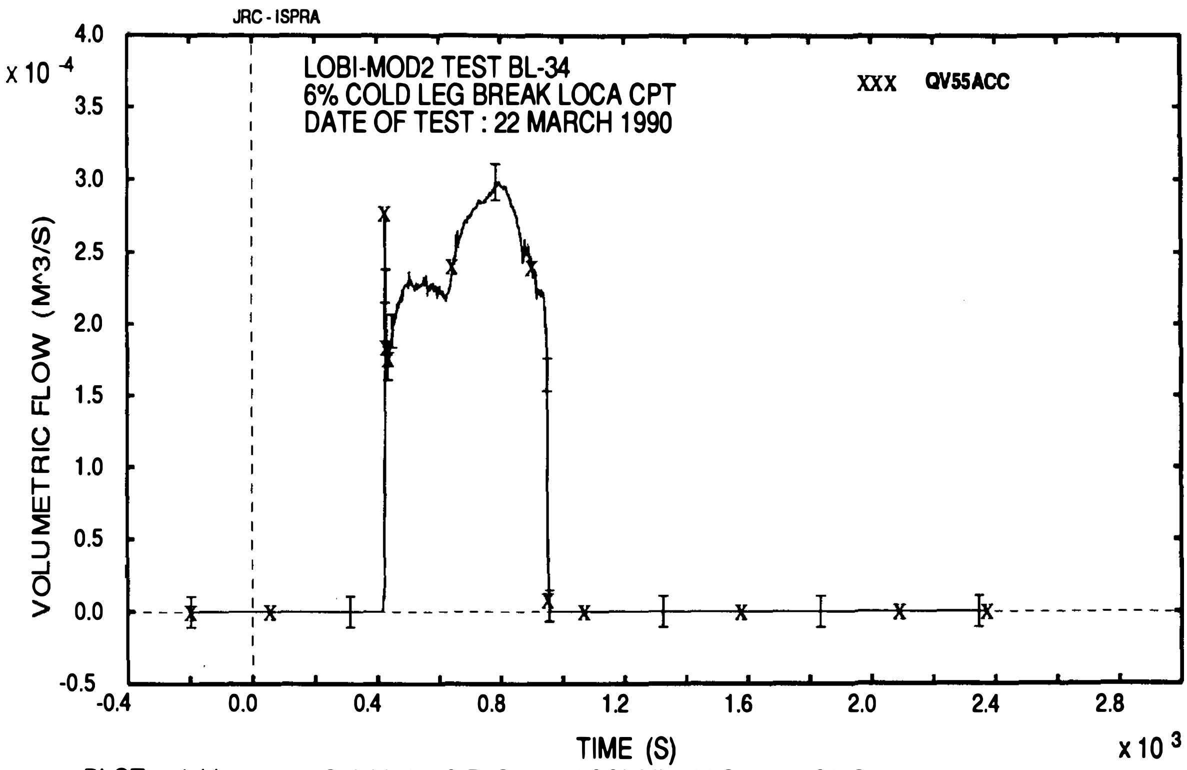
PLOT 4.8 FLOW DIRECTION INDICATOR IN BROKEN LOOP (QI05H000/180)
-COLD LEG, NEAR COLD LEG BREAK POSITION-



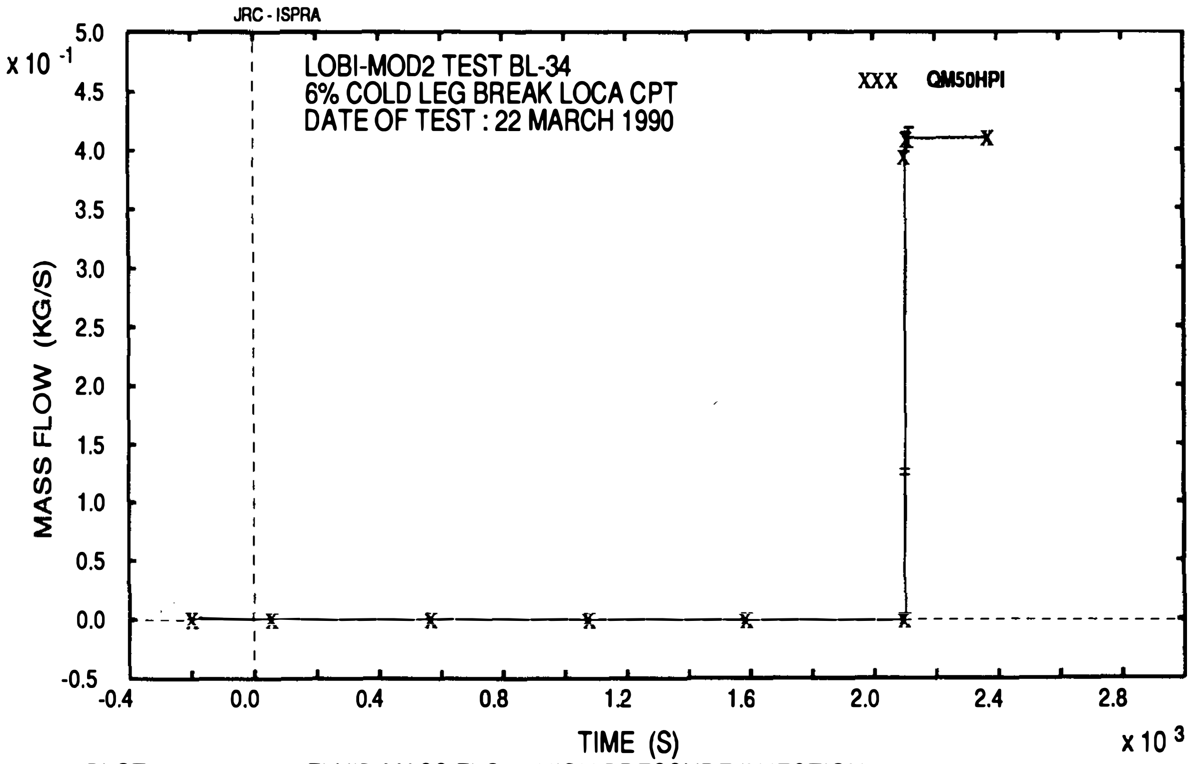
PLOT 4.9 FLOW DIRECTION INDICATOR IN BROKEN LOOP (QI22V090)
-STEAM GENERATOR INLET-



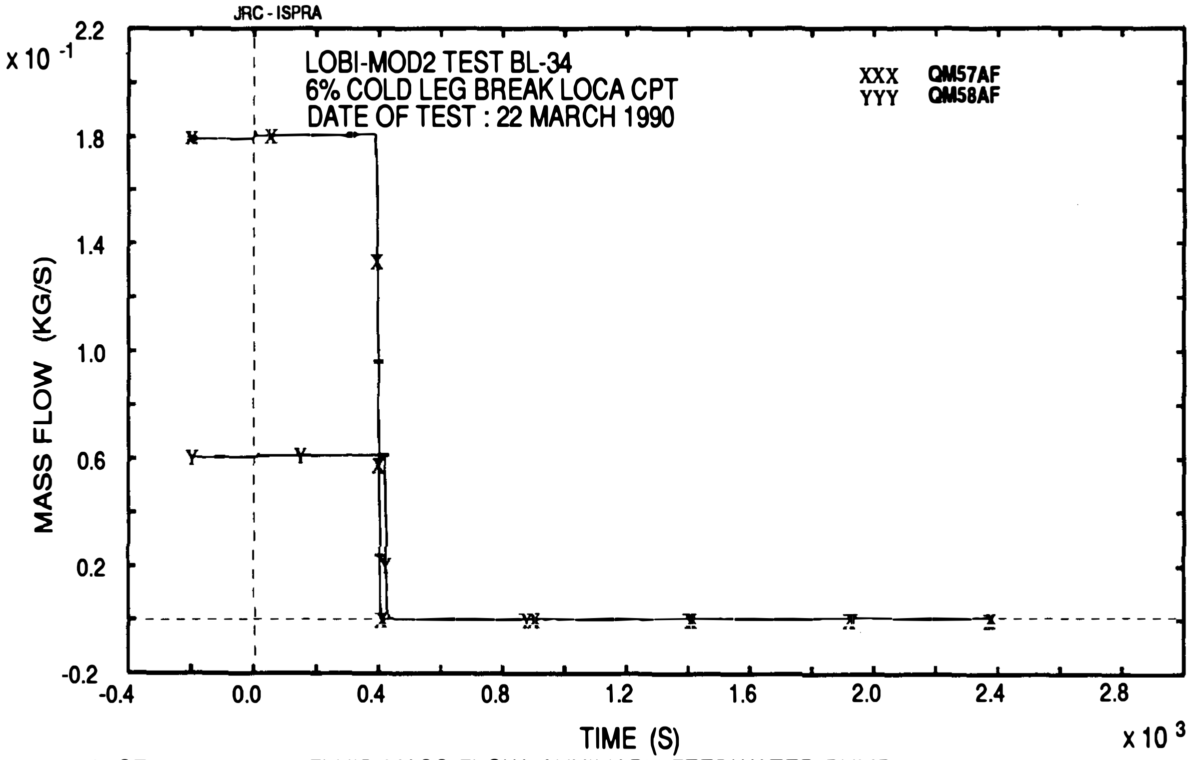
PLOT 4.10 VOLUMETRIC FLOW IN PRESSURIZER SURGE LINE (QV41V)



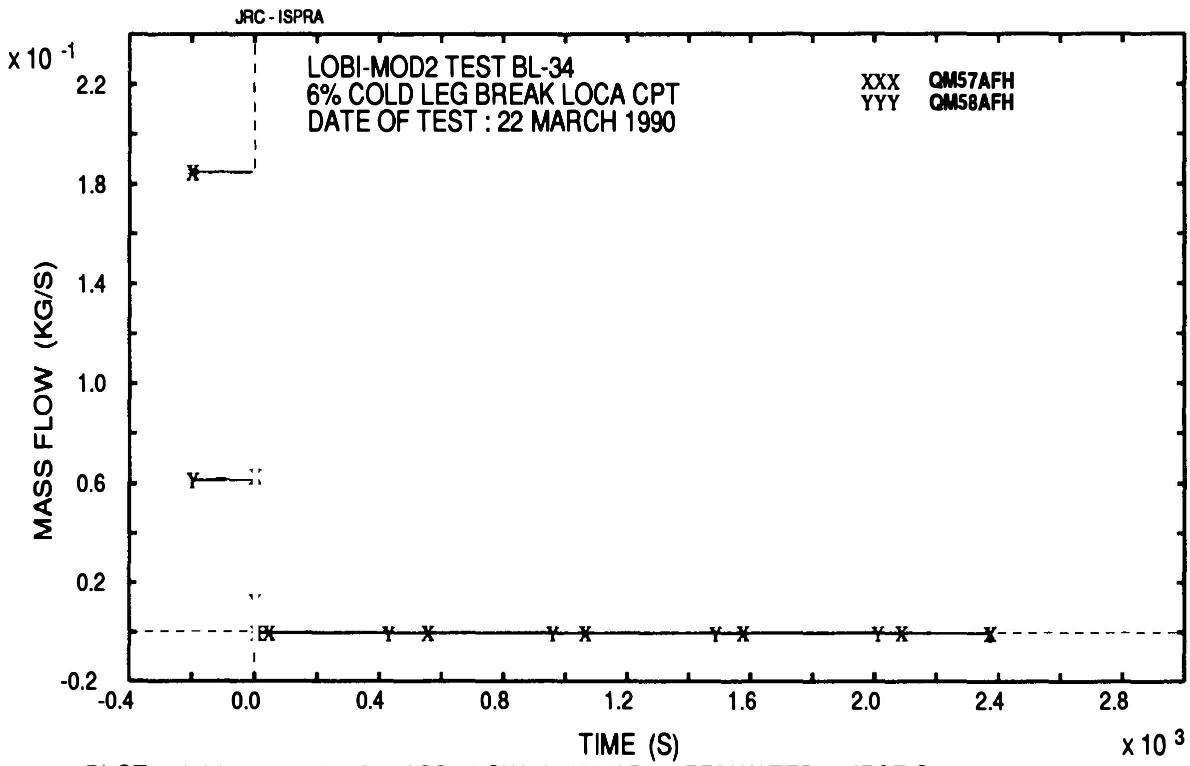
PLOT 4.11 VOLUMETRIC FLOW IN ACCUMULATOR INJECTION LINE
-INTACT LOOP HOT LEG INJECTION (QV53ACC)-
-INTACT LOOP COLD LEG INJECTION (QV55ACC)-



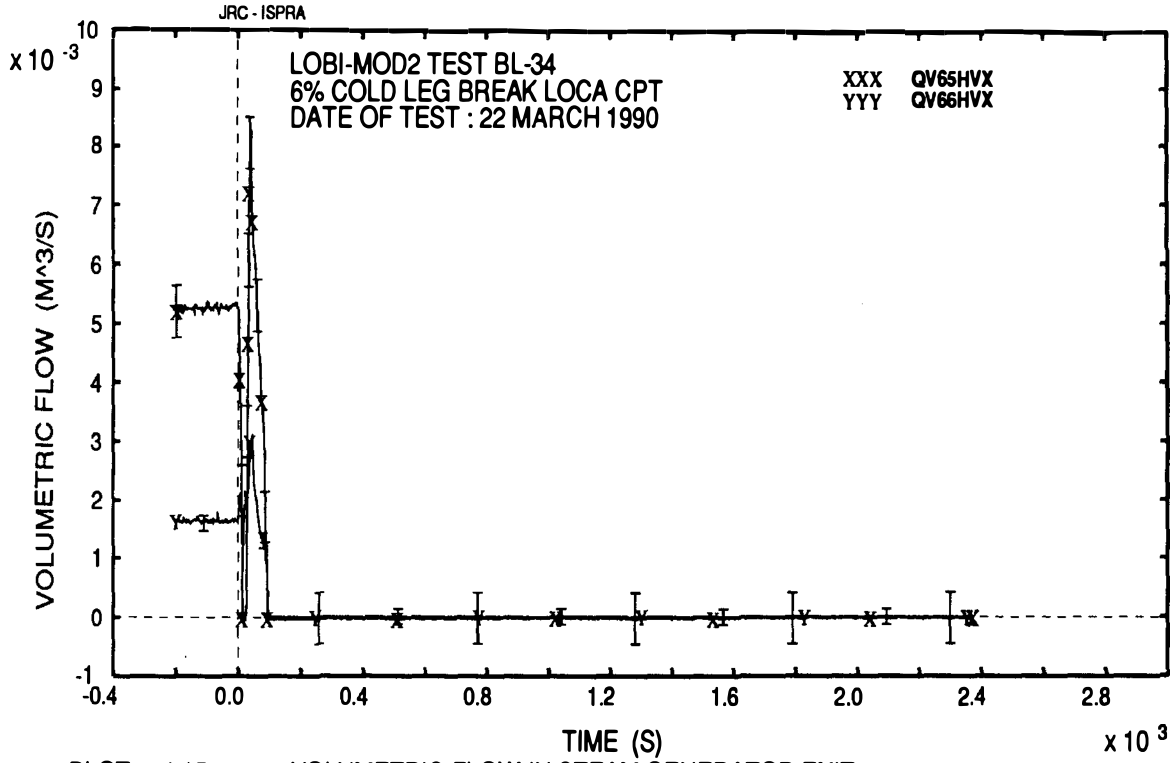
PLOT 4.12 FLUID MASS FLOW, HIGH PRESSURE INJECTION
-TOTAL INJECTION FLOW (QM50HPI)-



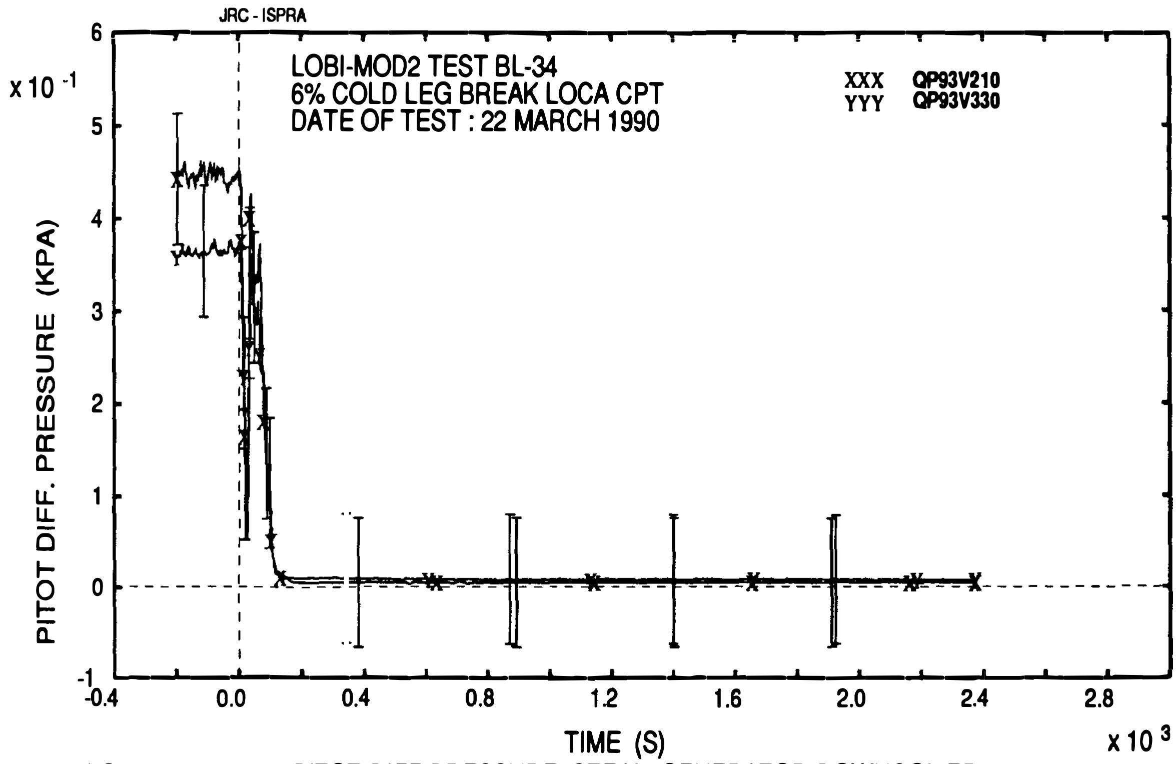
PLOT 4.13 FLUID MASS FLOW, AUXILIARY FEEDWATER PUMP
-INTACT LOOP SIDE (QM57AF)-
-BROKEN LOOP SIDE (QM58AF)-



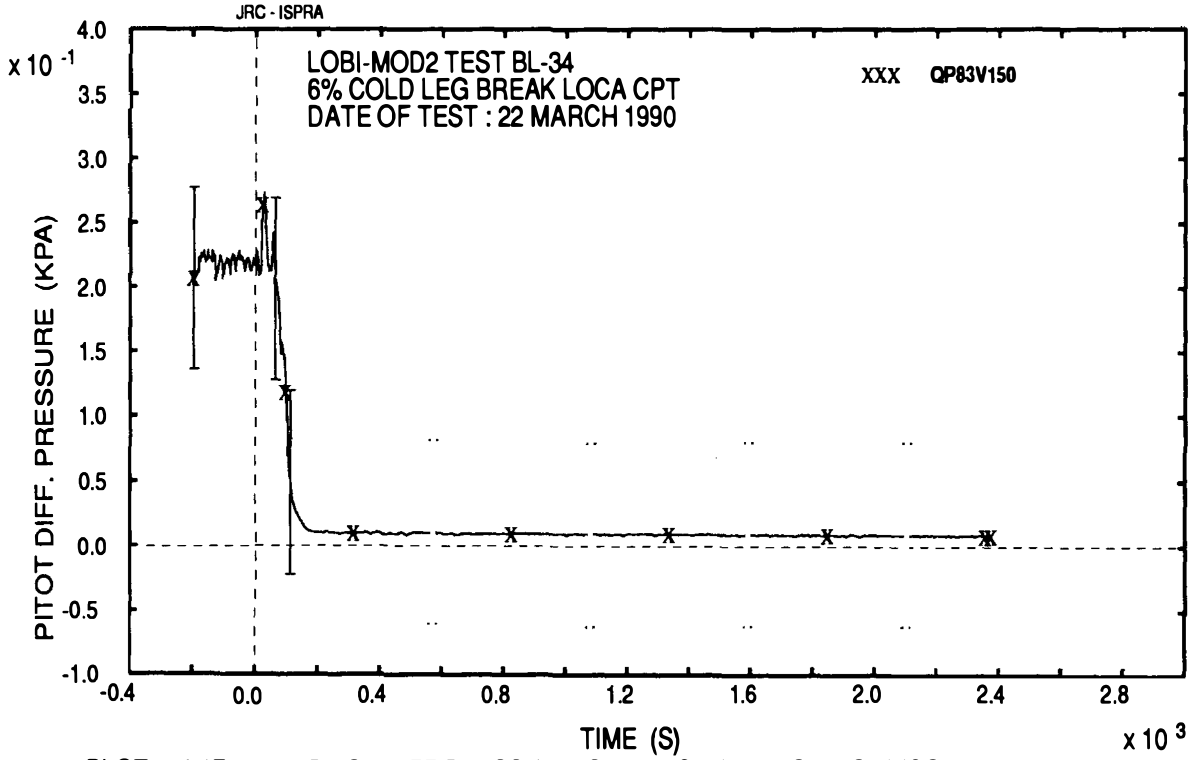
PLOT 4.14 FLUID MASS FLOW, AUXILIARY FEEDWATER INJECTION
-INTACT LOOP SIDE (QM57AFH)-
-BROKEN LOOP SIDE (QM58AFH)-



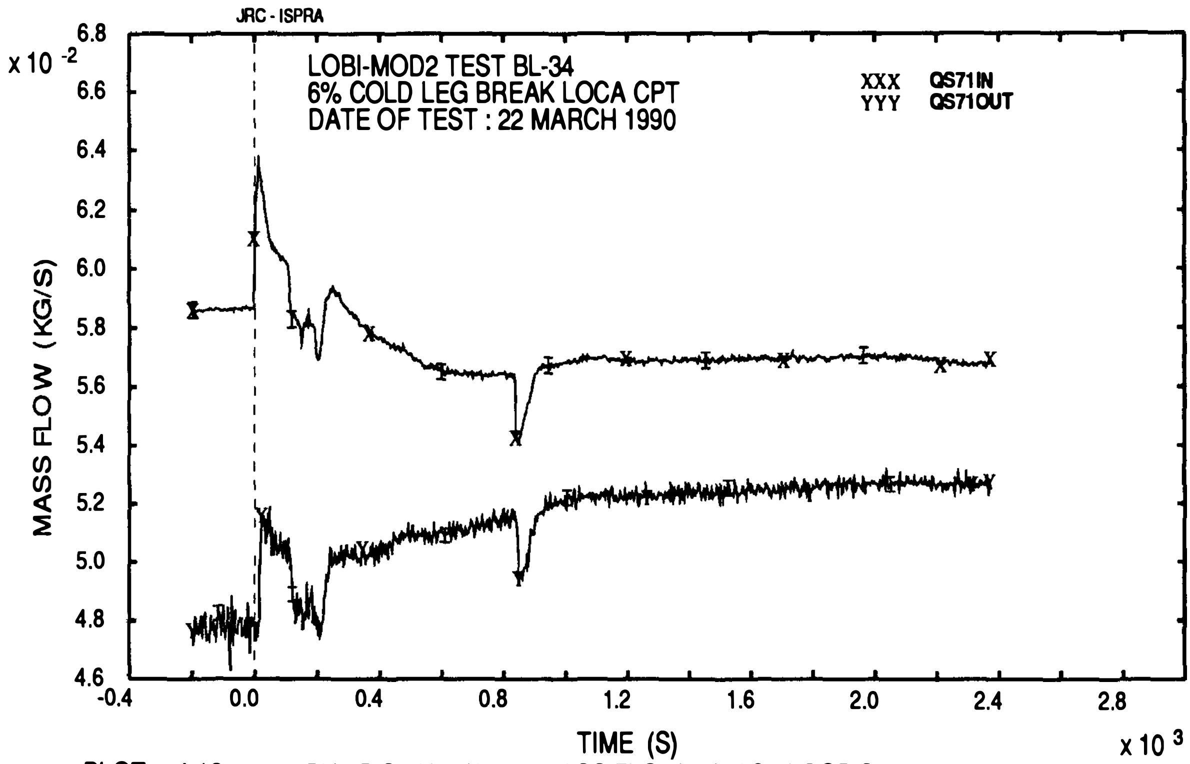
PLOT 4.15 VOLUMETRIC FLOW IN STEAM GENERATOR EXIT
-INTACT LOOP SIDE (QV65HVX)-
-BROKEN LOOP SIDE (QV66HVX)-



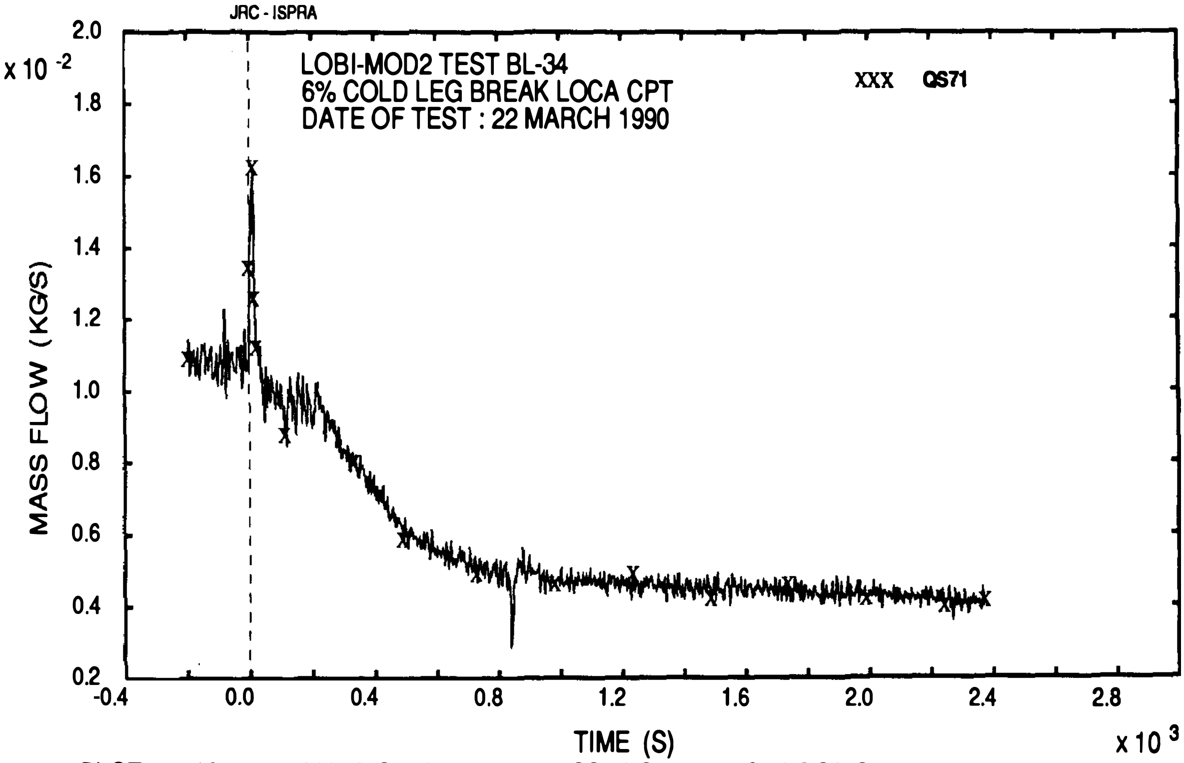
PLOT 4.16 PITOT DIFF.PRESSURE, STEAM GENERATOR DOWNCOMER
-INTACT LOOP SIDE, VERTICAL DIRECTION-



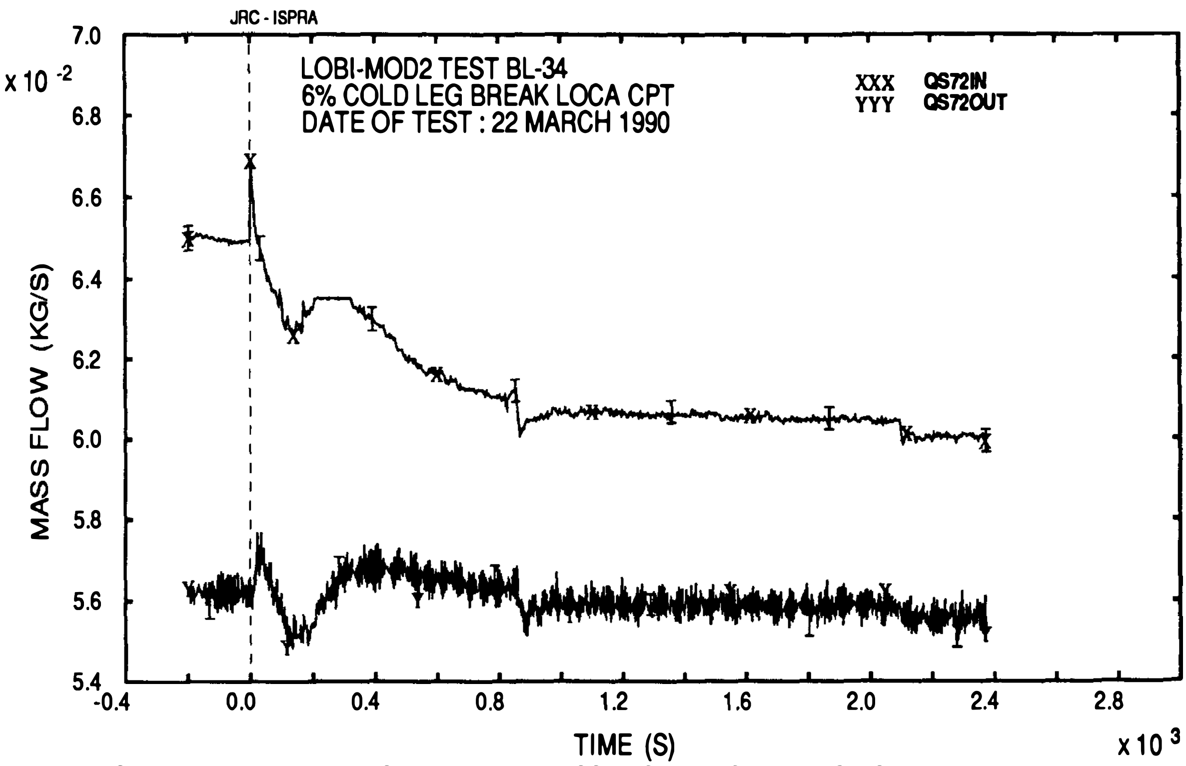
PLOT 4.17 PITOT DIFF.PRESSURE, STEAM GENERATOR DOWNCOMER
-BROKEN LOOP SIDE, VERTICAL DIRECTION-



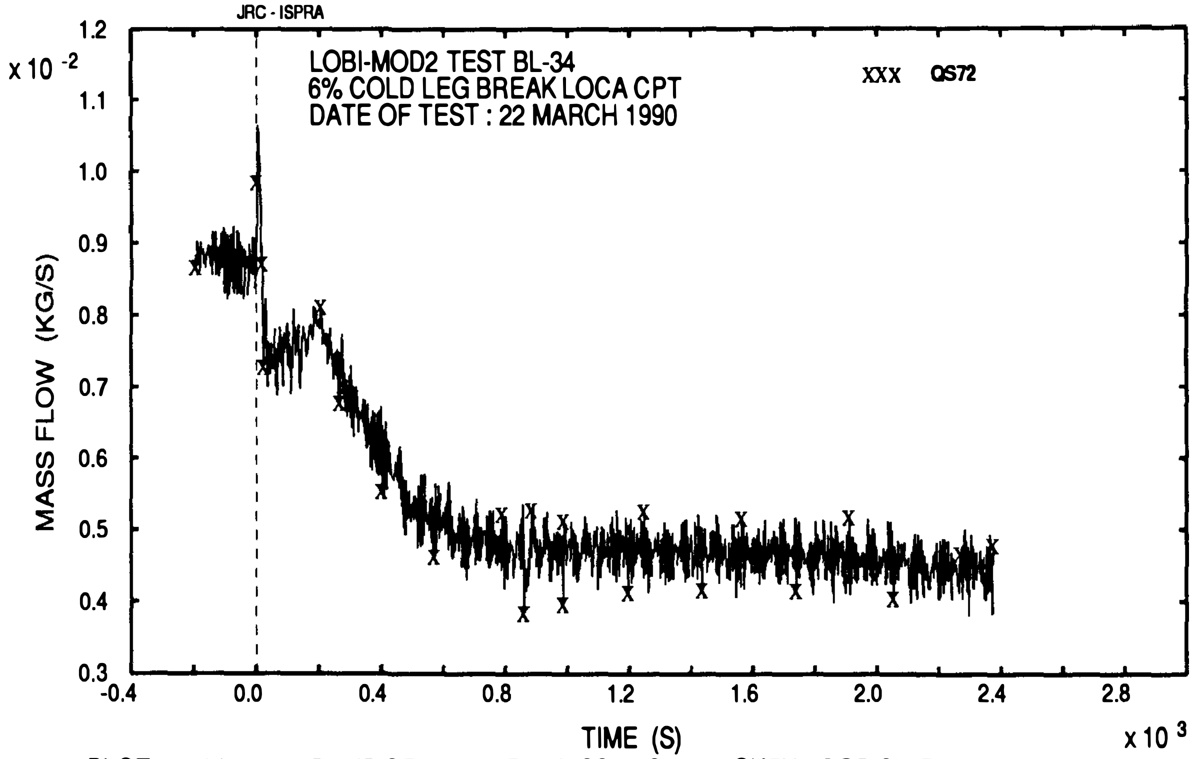
PLOT 4.18 PUMP SEAL WATER MASS FLOW, INTACT LOOP SIDE
-FLOW INTO PUMP CASING (QS71IN)-
-RETURN FLOW FROM PUMP (QS71OUT)-



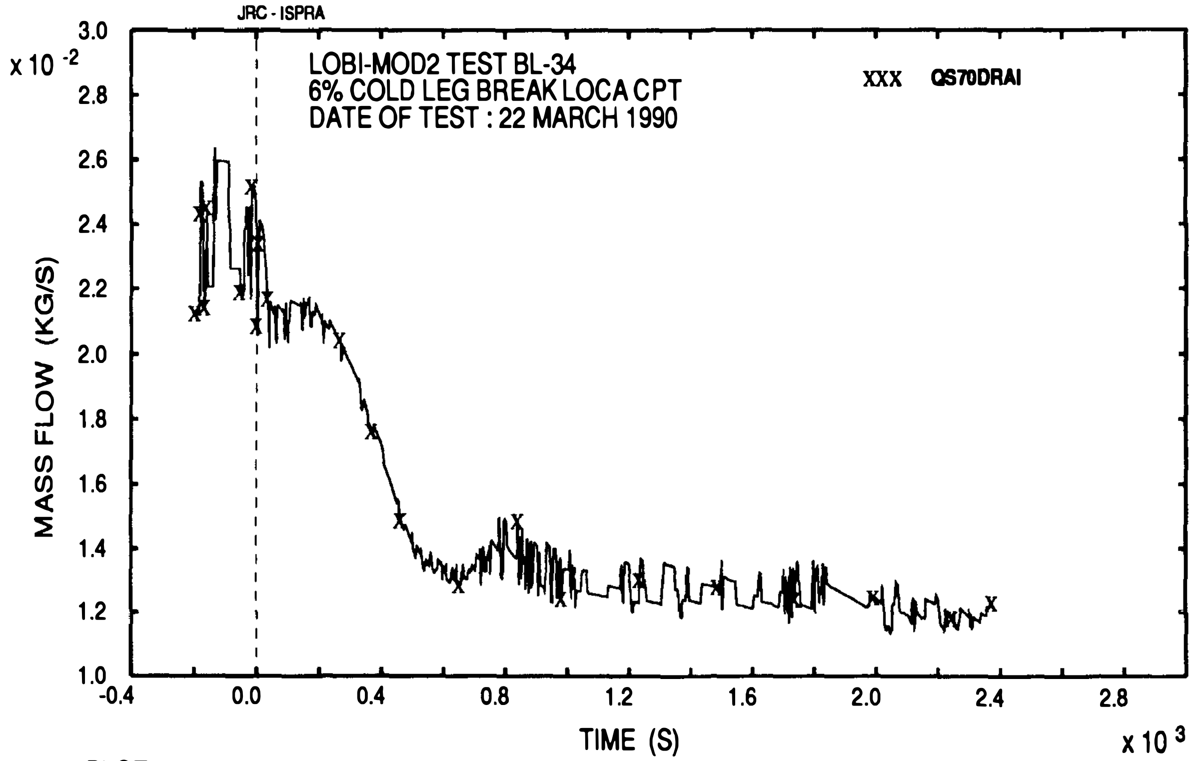
PLOT 4.19 PUMP SEAL WATER MASS FLOW, INTACT LOOP SIDE
-FLOW INJECTED INTO LOOP (QS71)-
-(CALCULATED DIFFERENCE OF QS71IN AND QS71OUT)-



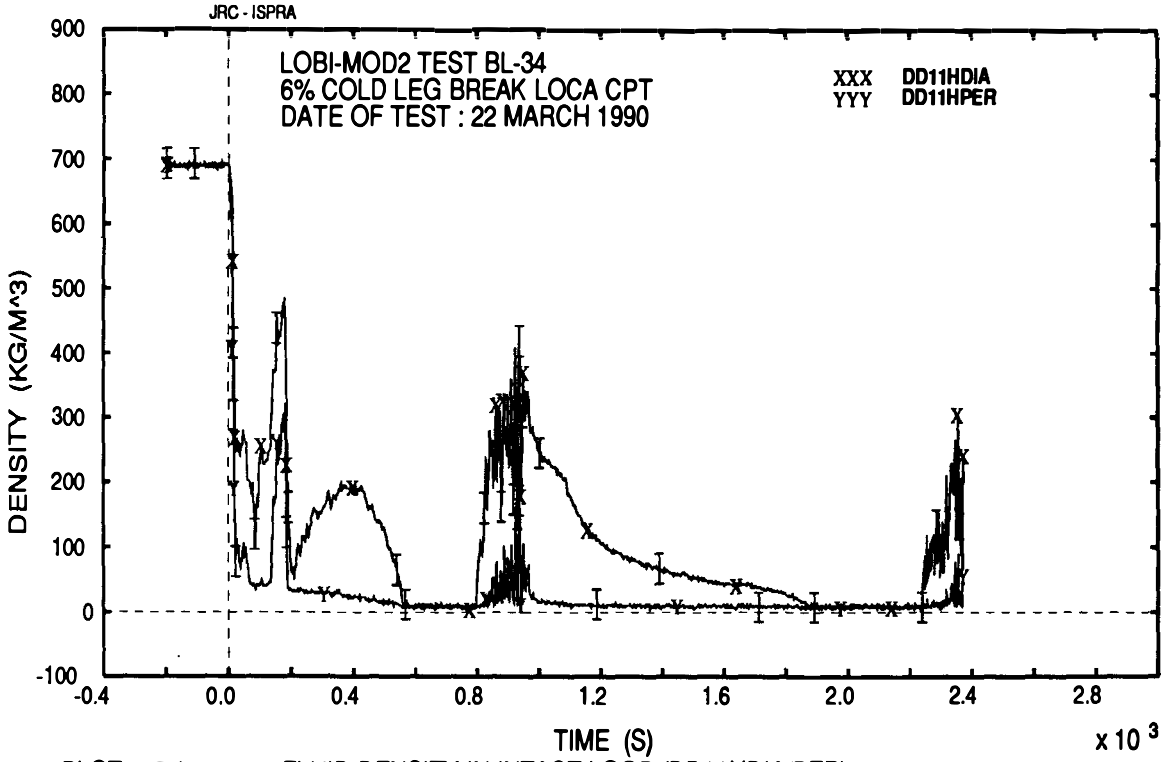
PLOT 4.20 PUMP SEAL WATER MASS FLOW, BROKEN LOOP SIDE
-FLOW INTO PUMP CASING (QS72IN)-
-RETURN FLOW FROM PUMP (QS72OUT)-



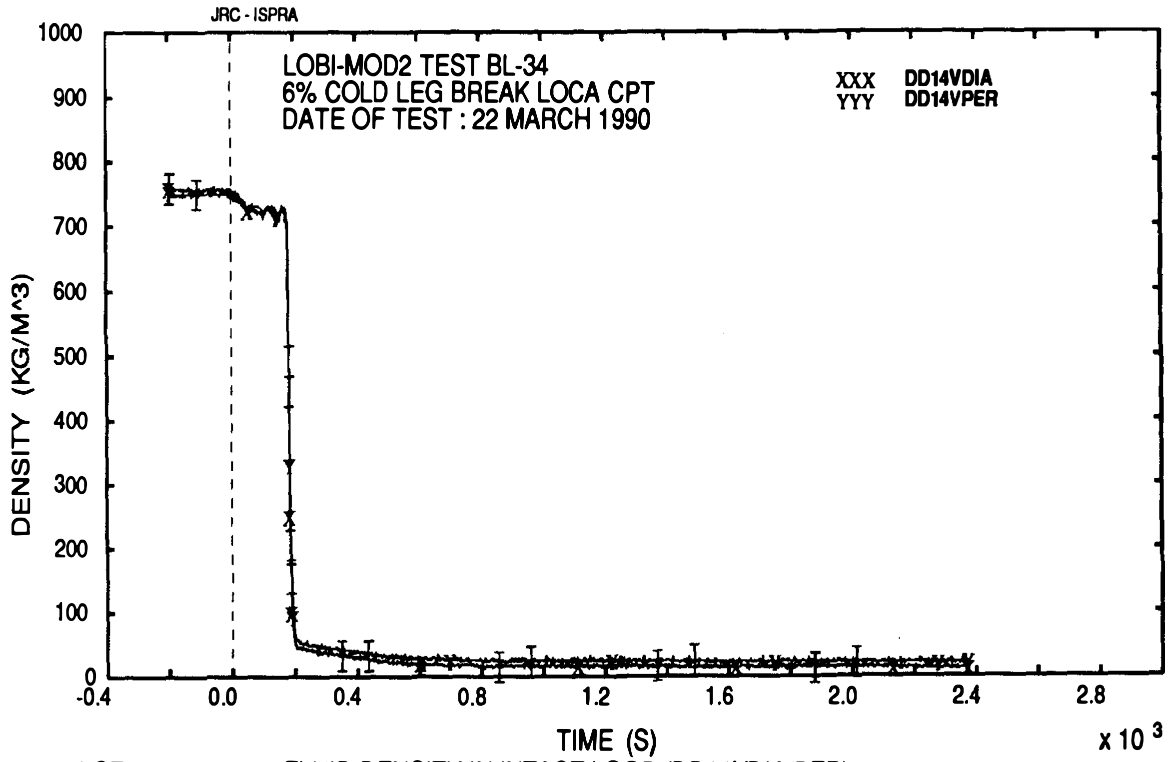
PLOT 4.21 PUMP SEAL WATER MASS FLOW, BROKEN LOOP SIDE
-FLOW INJECTED INTO LOOP (QS72)-
-(CALCULATED DIFFERENCE OF QS72IN AND QS72OUT)-



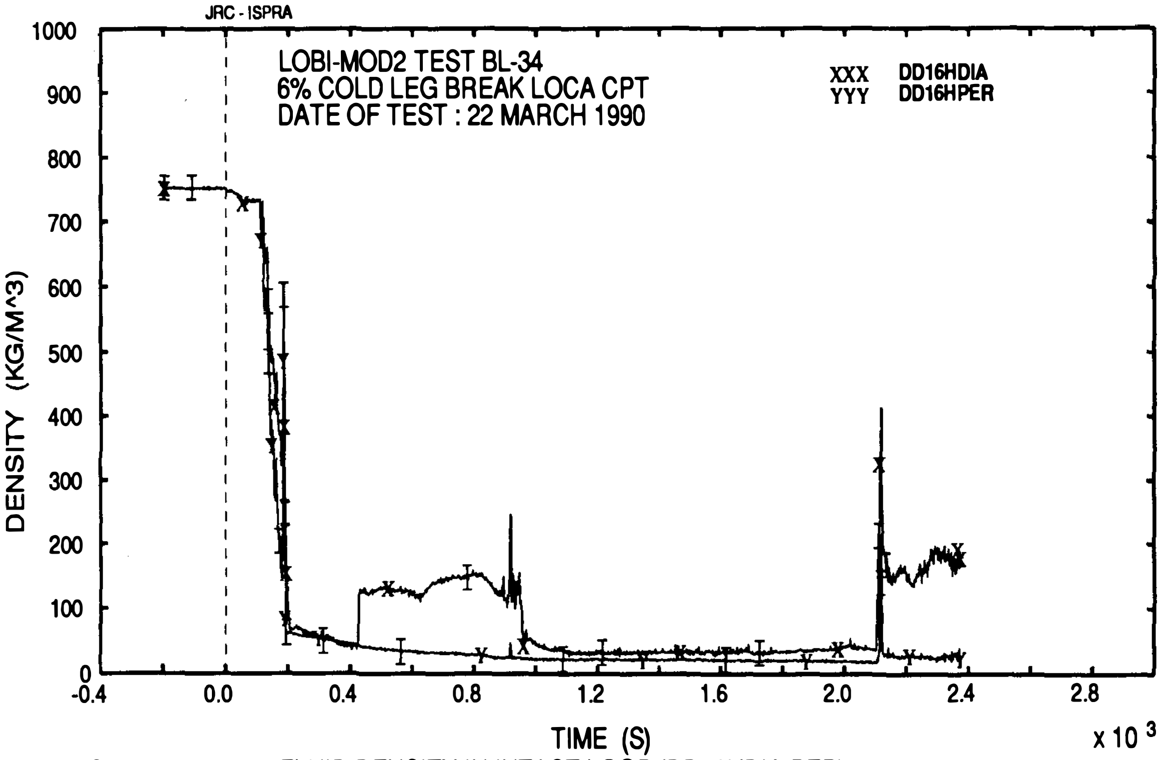
PLOT 4.22 PUMP SEAL WATER MASS FLOW
-DRAINED FROM PRIMARY CIRCUIT (QS70DRAI)-
-MAKE UP FOR COMPENSATION TANK-



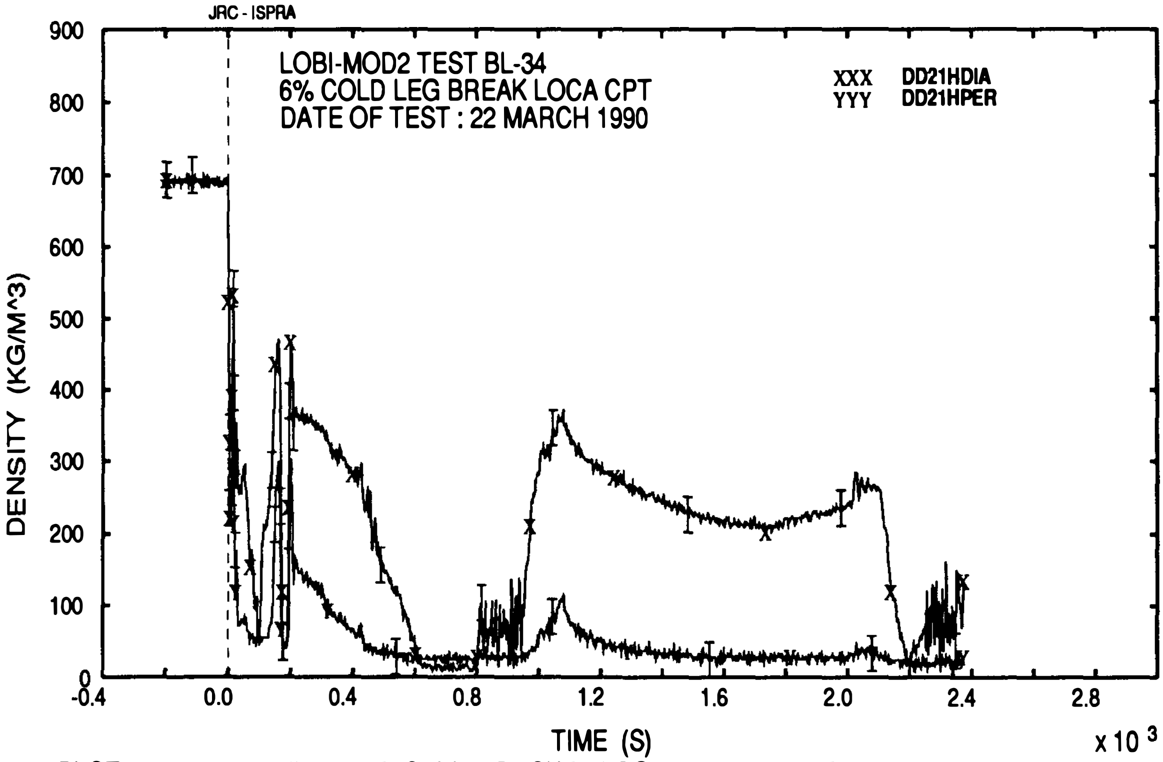
PLOT 5.1 FLUID DENSITY IN INTACT LOOP (DD11HDIA/PER)
-HOT LEG, VESSEL OUTLET-



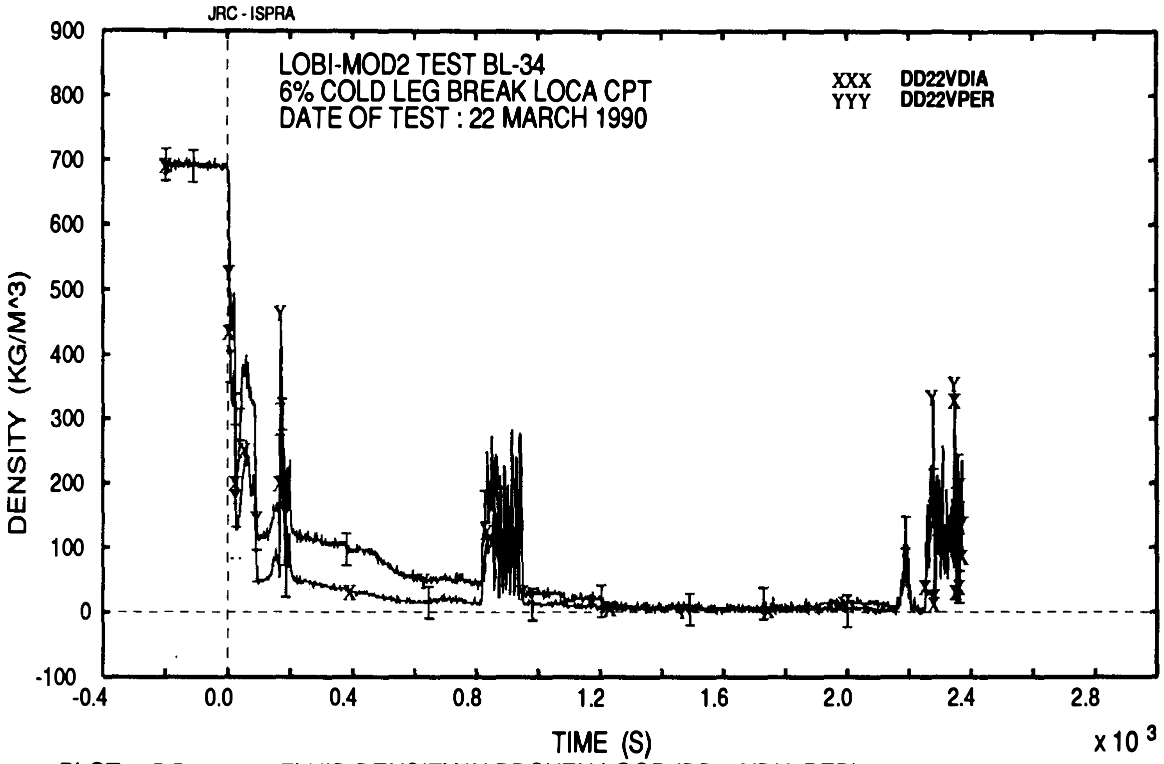
PLOT 5.2 FLUID DENSITY IN INTACT LOOP (DD14VDIA/PER)
-PUMP INLET-



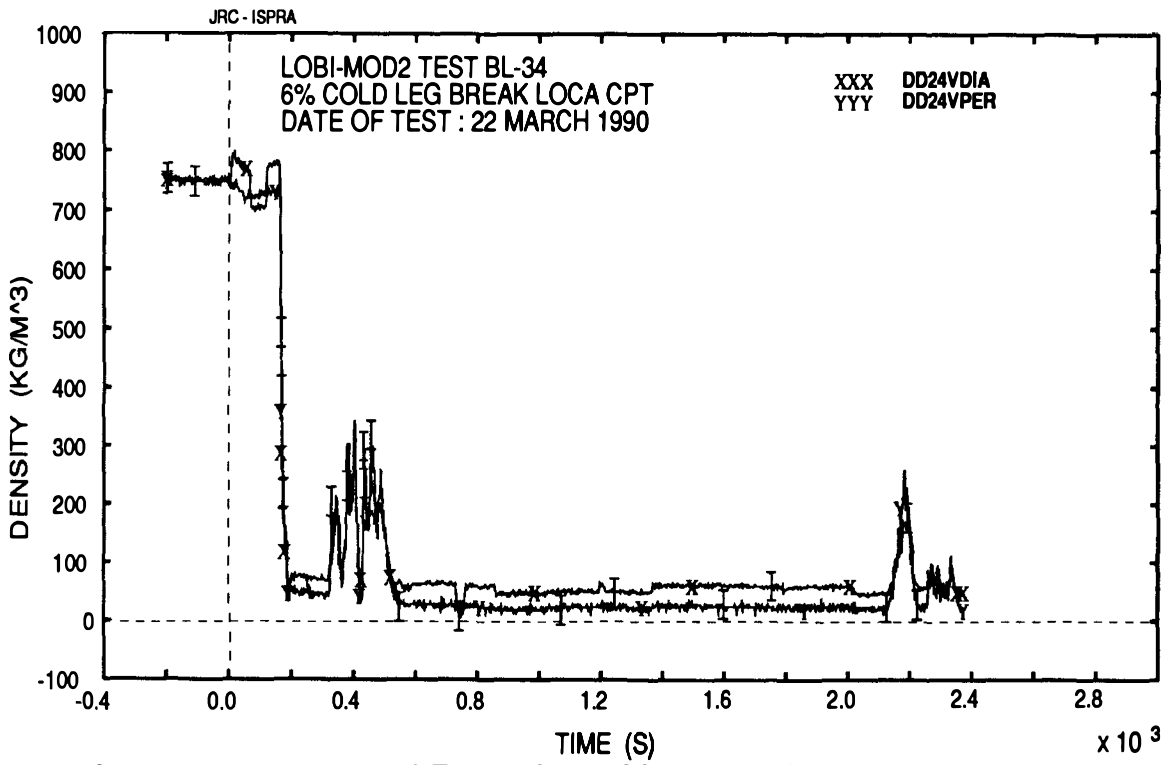
PLOT 5.3 FLUID DENSITY IN INTACT LOOP (DD16HDIA/PER)
-COLD LEG, VESSEL INLET-



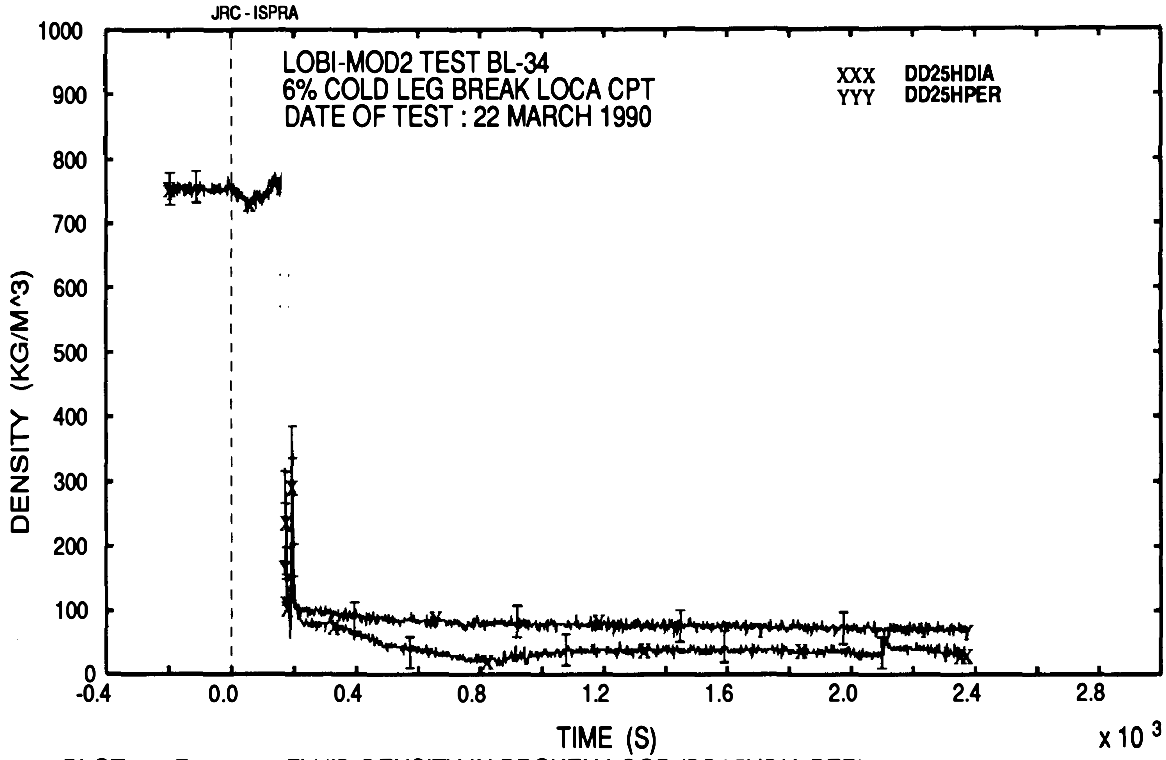
PLOT 5.4 FLUID DENSITY IN BROKEN LOOP (DD21HDIA/PER)
-HOT LEG, VESSEL OUTLET-



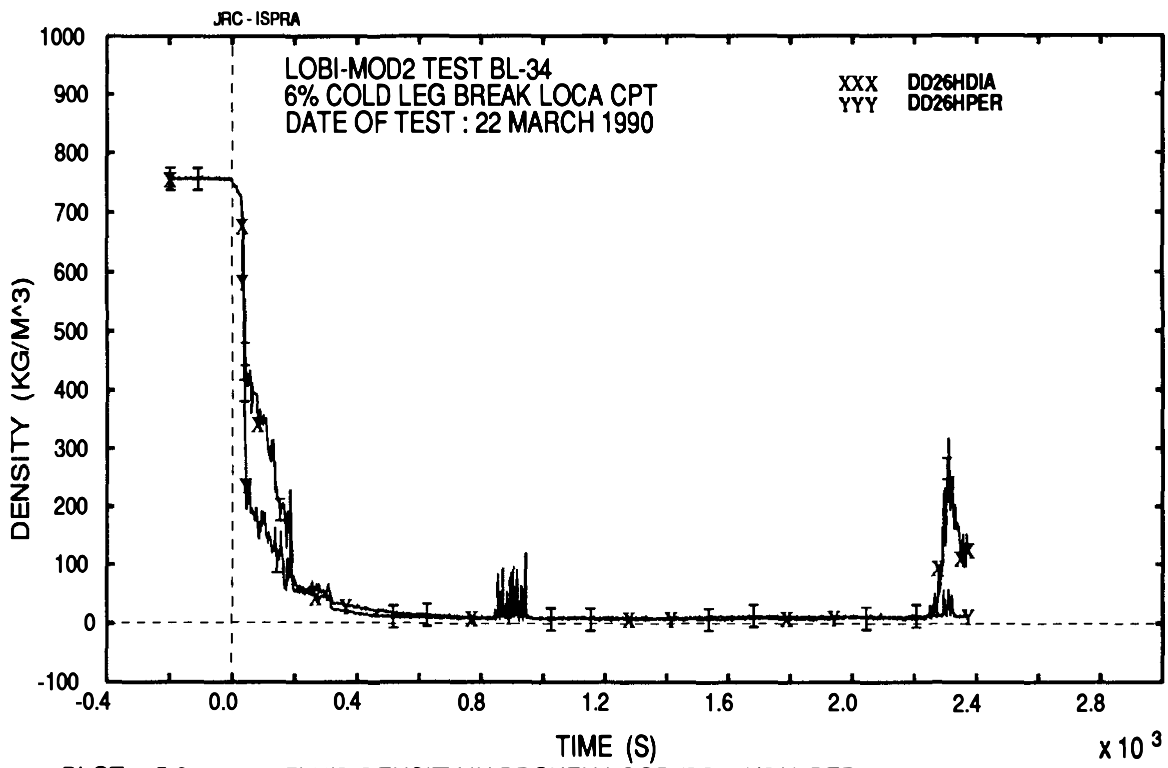
PLOT 5.5 FLUID DENSITY IN BROKEN LOOP (DD22VDIA/PER)
-HOT LEG, STEAM GENERATOR INLET-



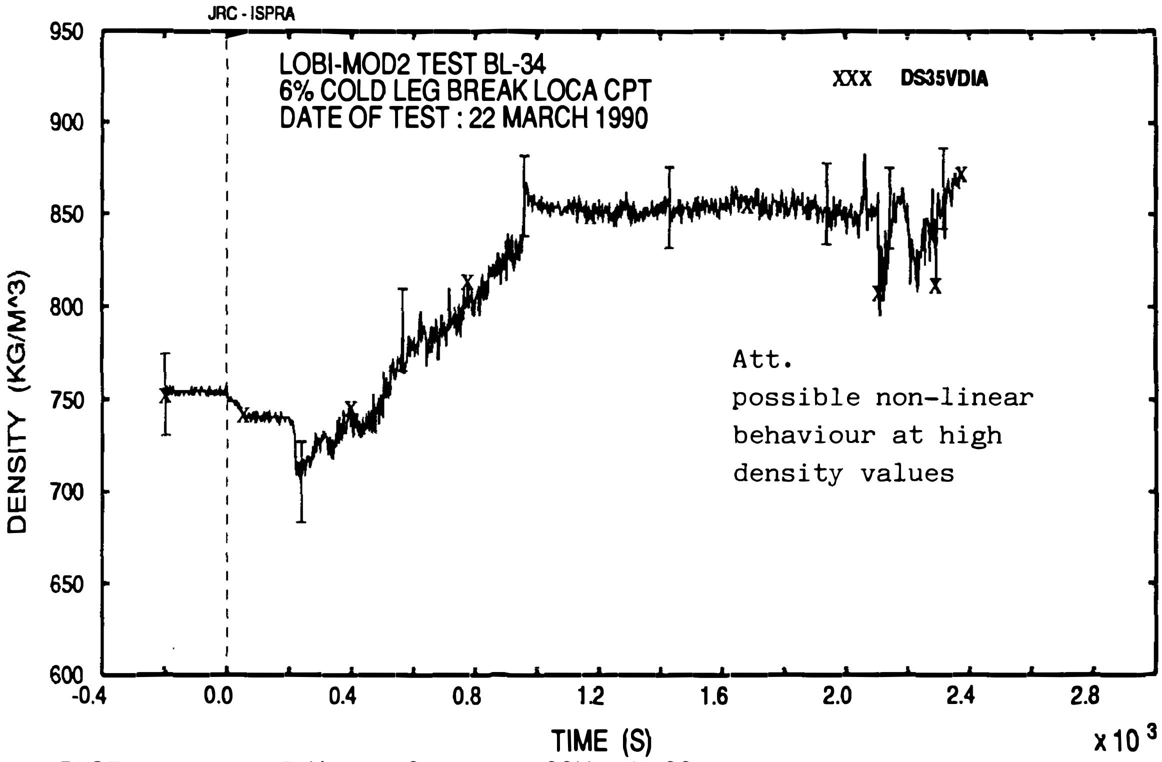
PLOT 5.6 FLUID DENSITY IN BROKEN LOOP (DD24VDIA/PER)
-PUMP INLET-



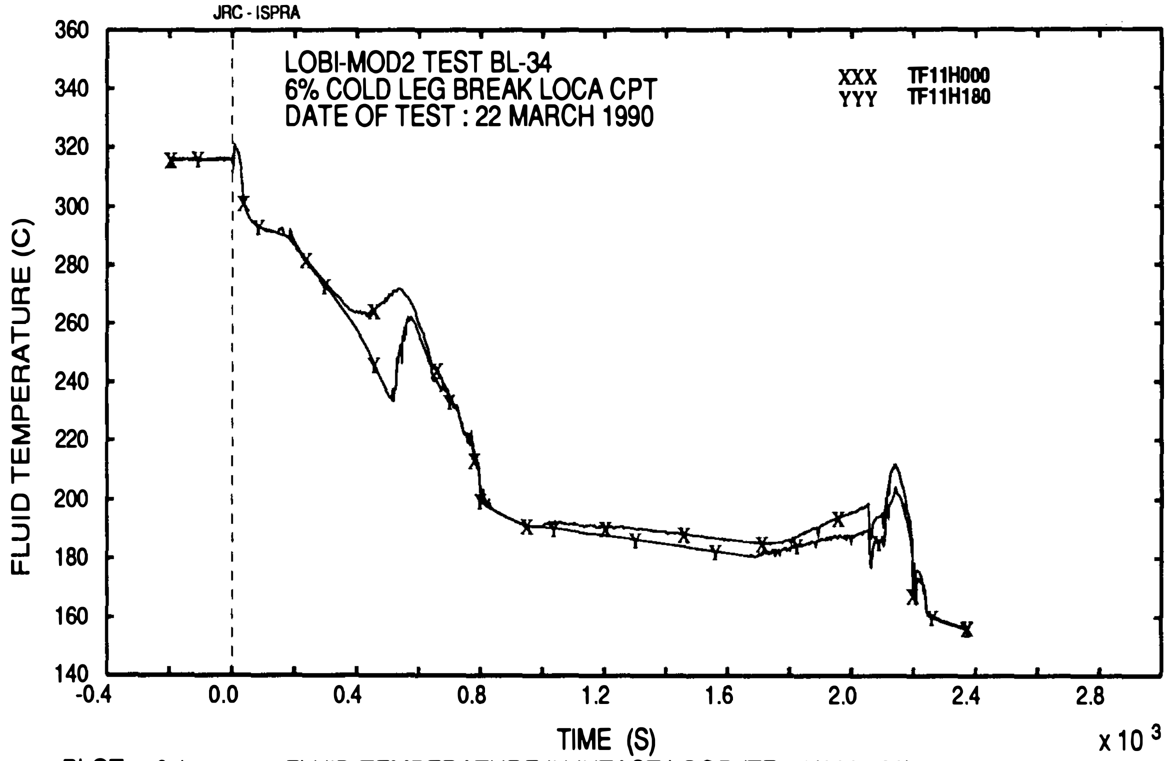
PLOT 5.7 FLUID DENSITY IN BROKEN LOOP (DD25HDIA/PER)
-PUMP OUTLET-



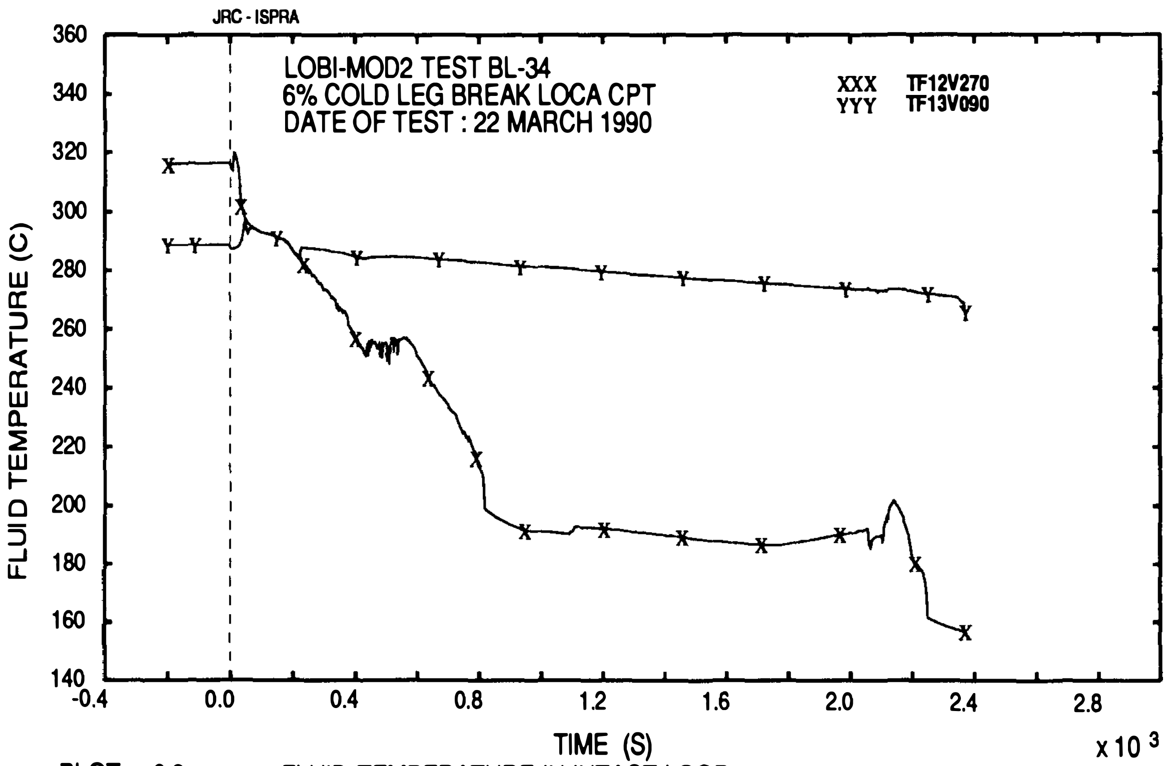
PLOT 5.8 FLUID DENSITY IN BROKEN LOOP (DD26HDIA/PER)
-COLD LEG, VESSEL INLET-



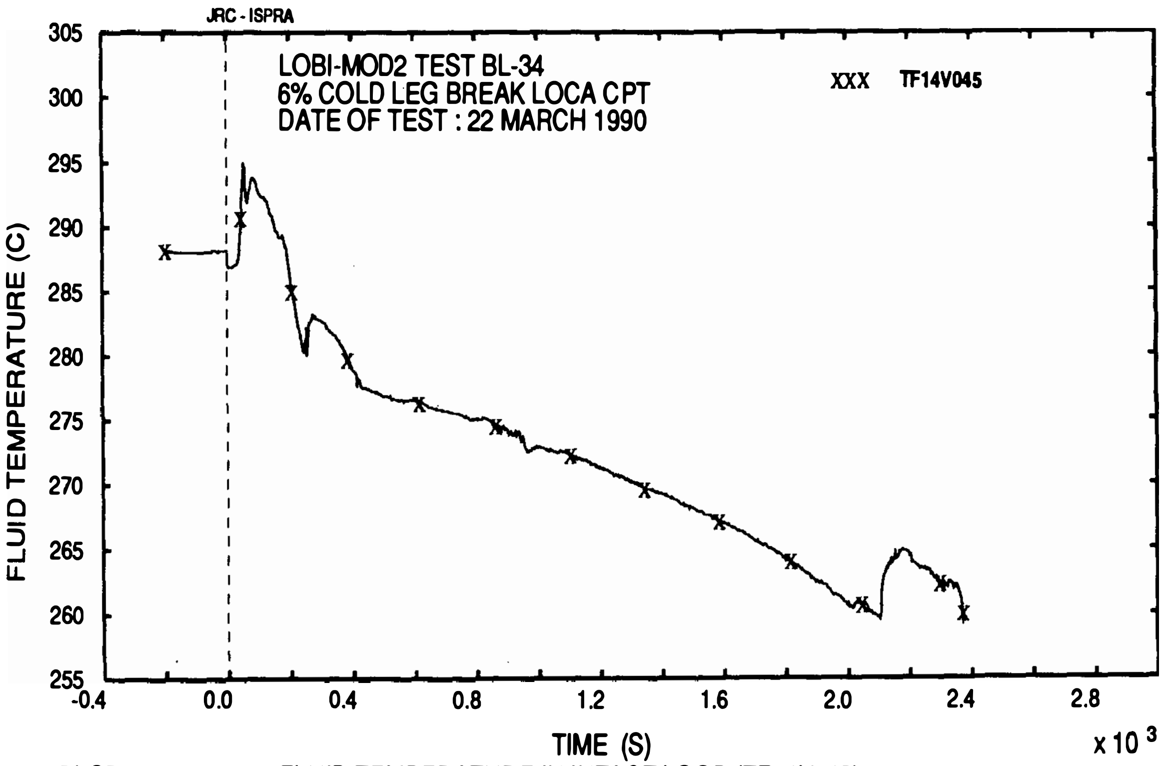
PLOT 5.9 FLUID DENSITY IN PRESSURE VESSEL -CORE ENTRANCE (DS35VDIA)-



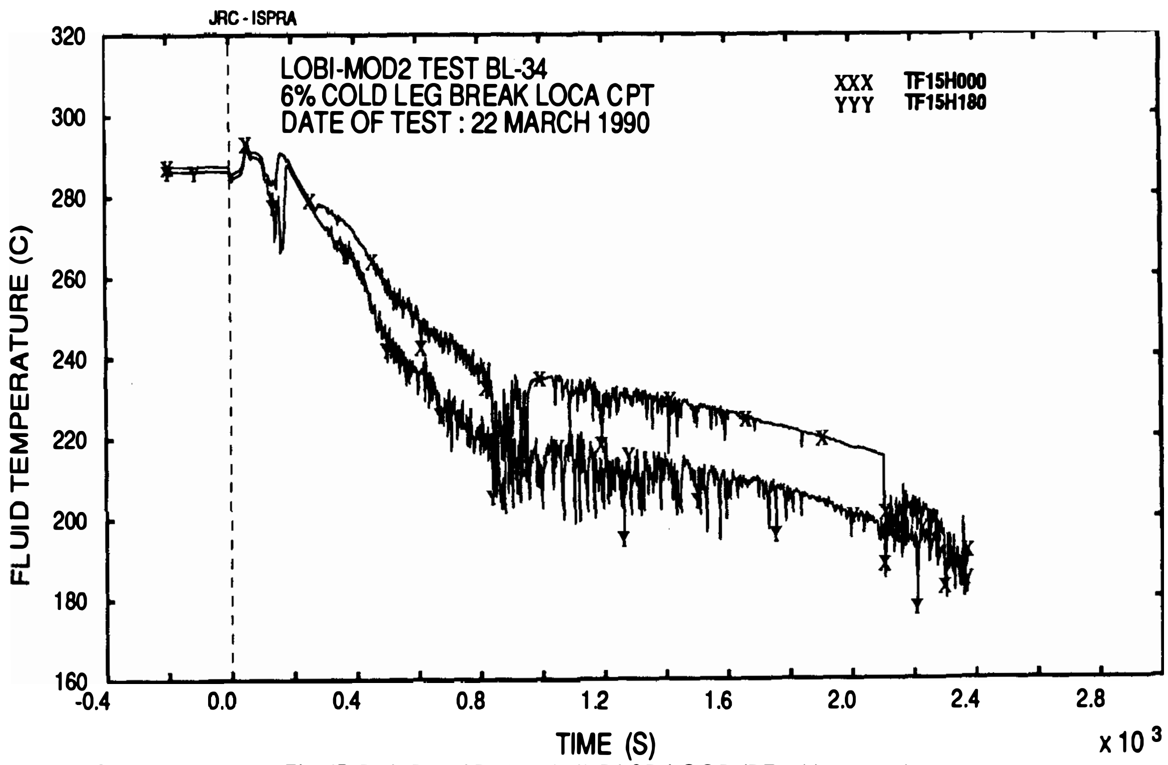
PLOT 6.1 FLUID TEMPERATURE IN INTACT LOOP (TF11H000/180)
-HOT LEG, VESSEL OUTLET SIDE-



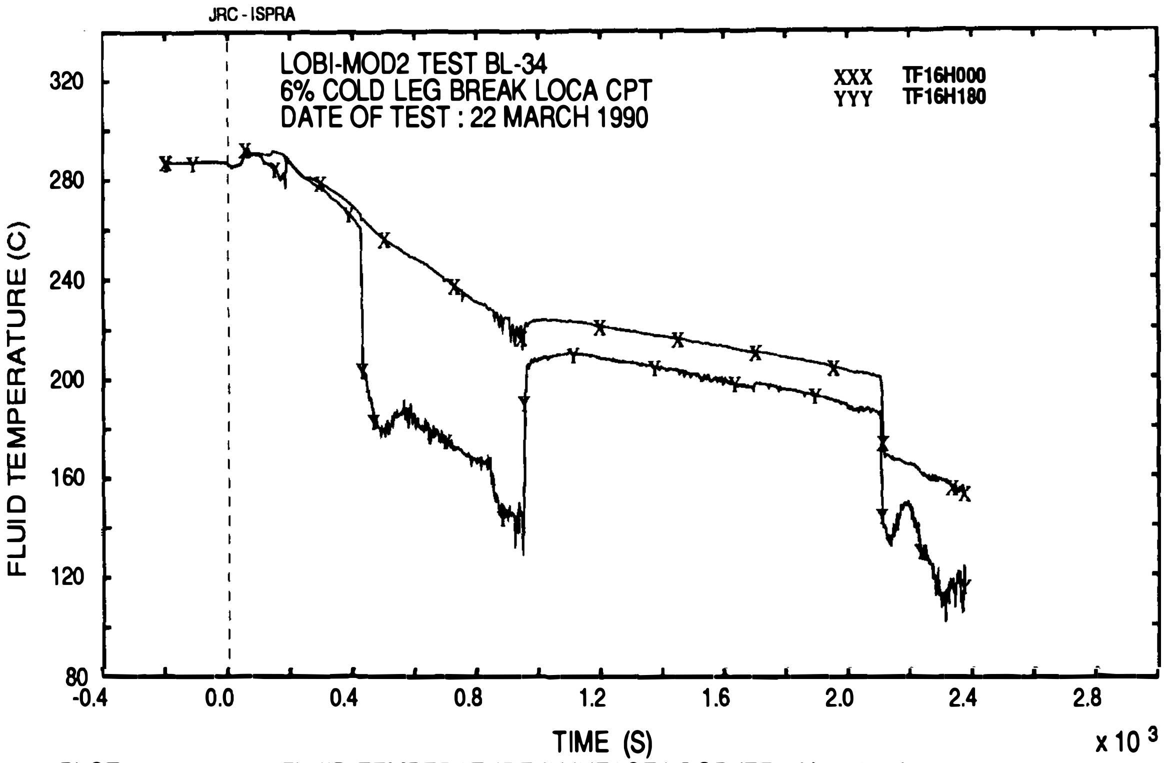
PLOT 6.2 FLUID TEMPERATURE IN INTACT LOOP
-STEAM GENERATOR INLET (TF12V270)-
-STEAM GENERATOR OUTLET (TF13V090)-



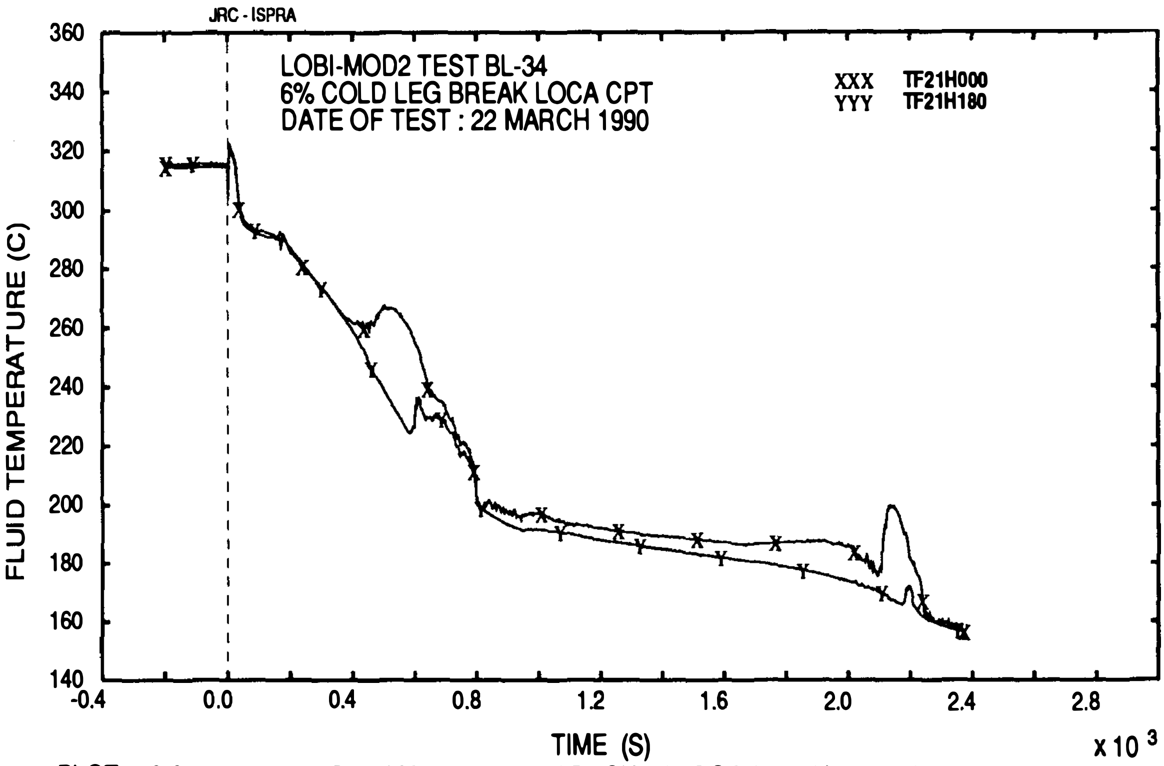
PLOT 6.3 FLUID TEMPERATURE IN INTACT LOOP (TF14V045)
-PUMP INLET-



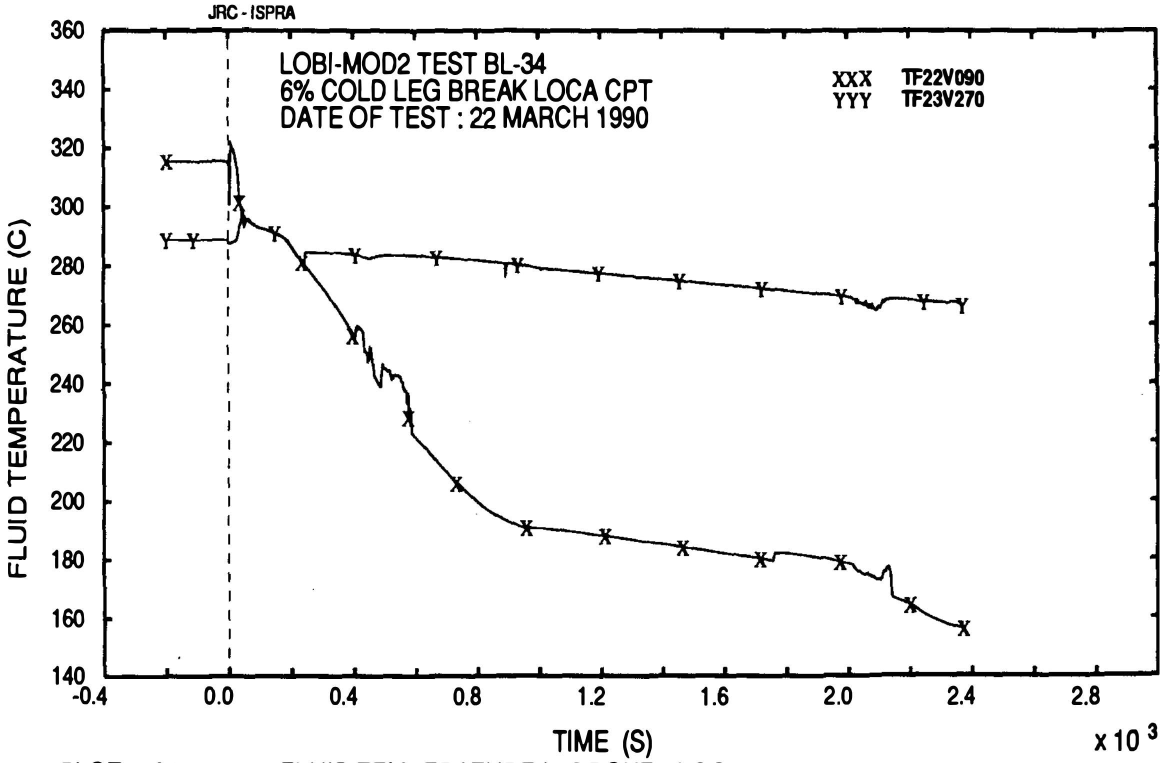
PLOT 6.4 FLUID TEMPERATURE IN INTACT LOOP (TF15H000/180)
-PUMP OUTLET-



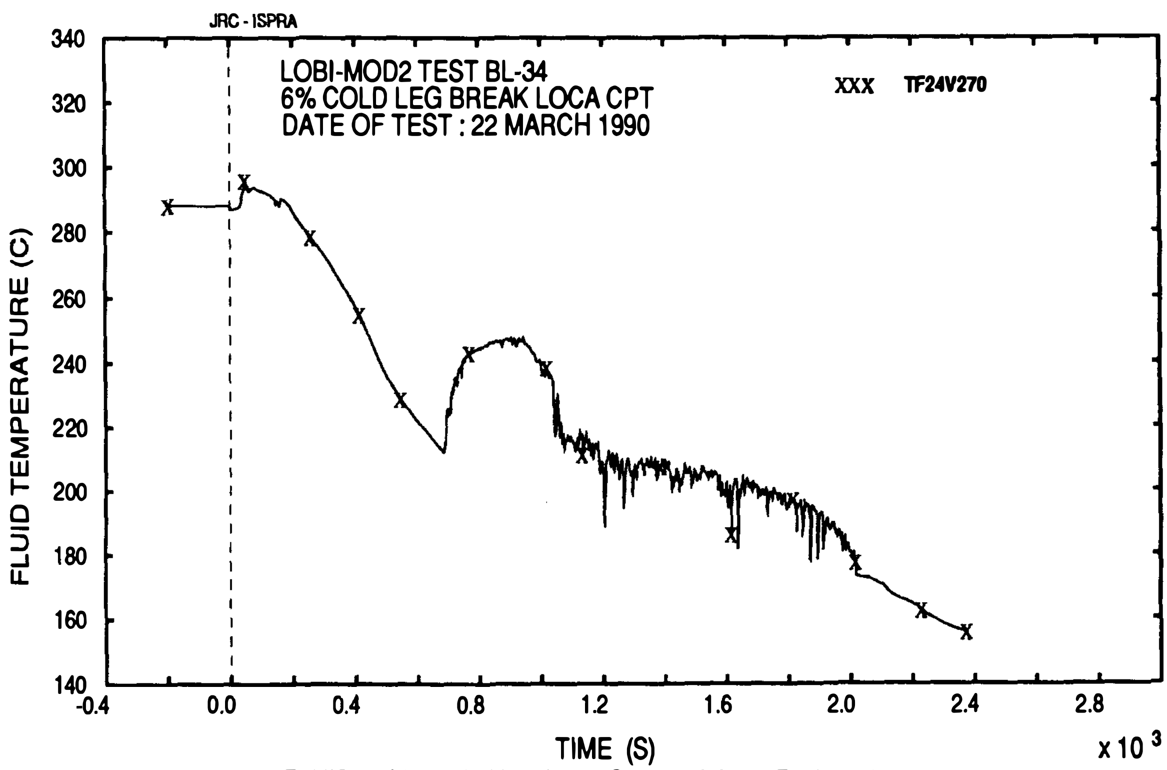
PLOT 6.5 FLUID TEMPERATURE IN INTACT LOOP (TF16H000/180)
-COLD LEG, VESSEL INLET SIDE-



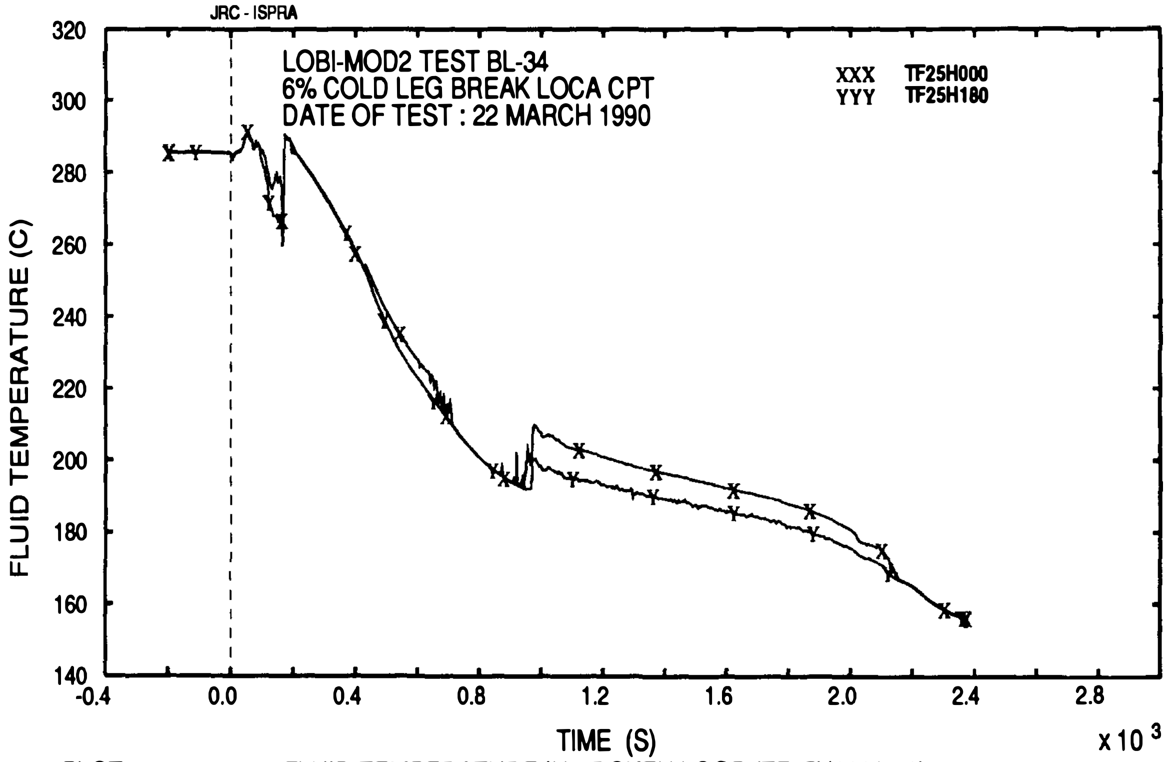
PLOT 6.6 FLUID TEMPERATURE IN BROKEN LOOP (TF21H000/180)
-HOT LEG, VESSEL OUTLET SIDE-



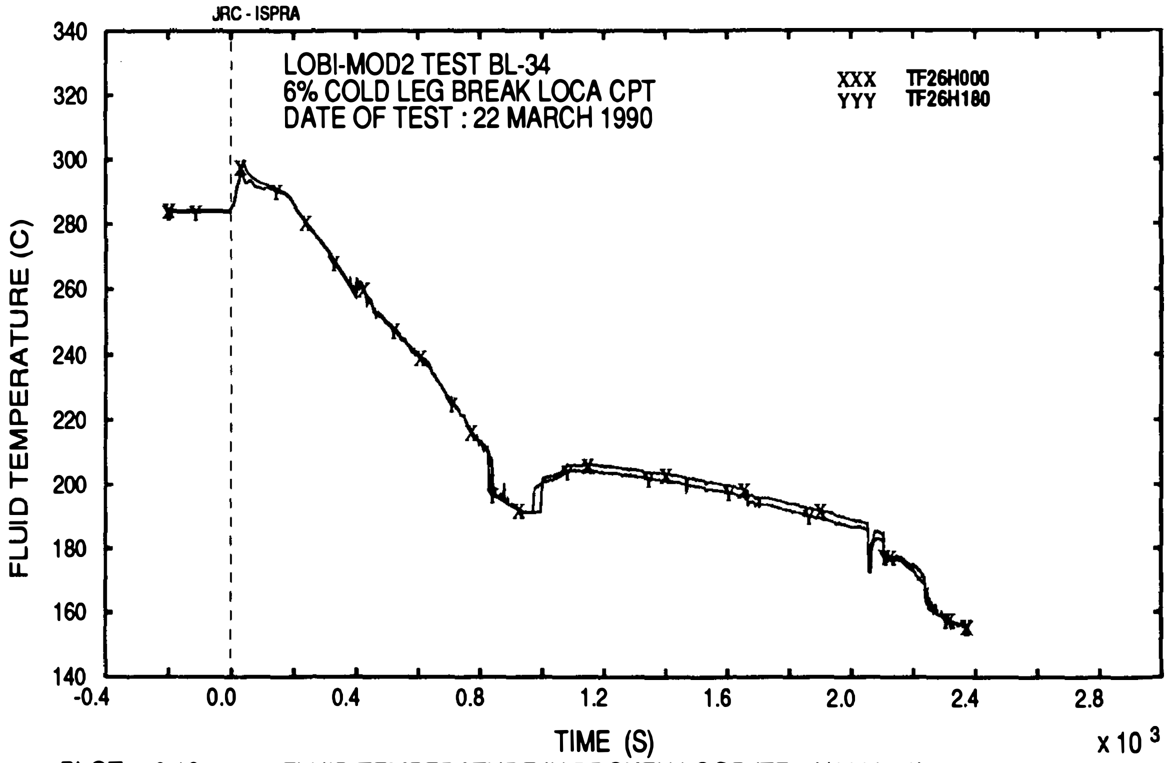
PLOT 6.7 FLUID TEMPERATURE IN BROKEN LOOP
-STEAM GENERATOR INLET (TF22V090)-
-STEAM GENERATOR OUTLET (TF23V270)-



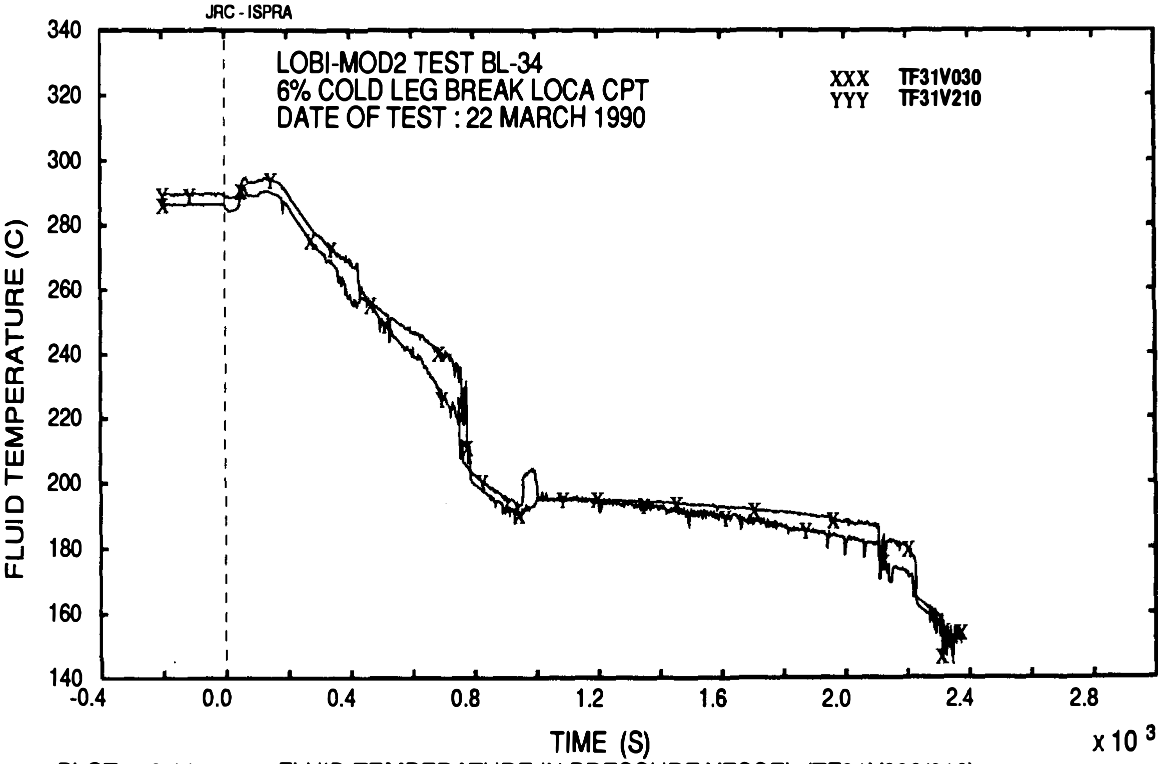
PLOT 6.8 FLUID TEMPERATURE IN BROKEN LOOP (TF24V270)
-PUMP INLET-



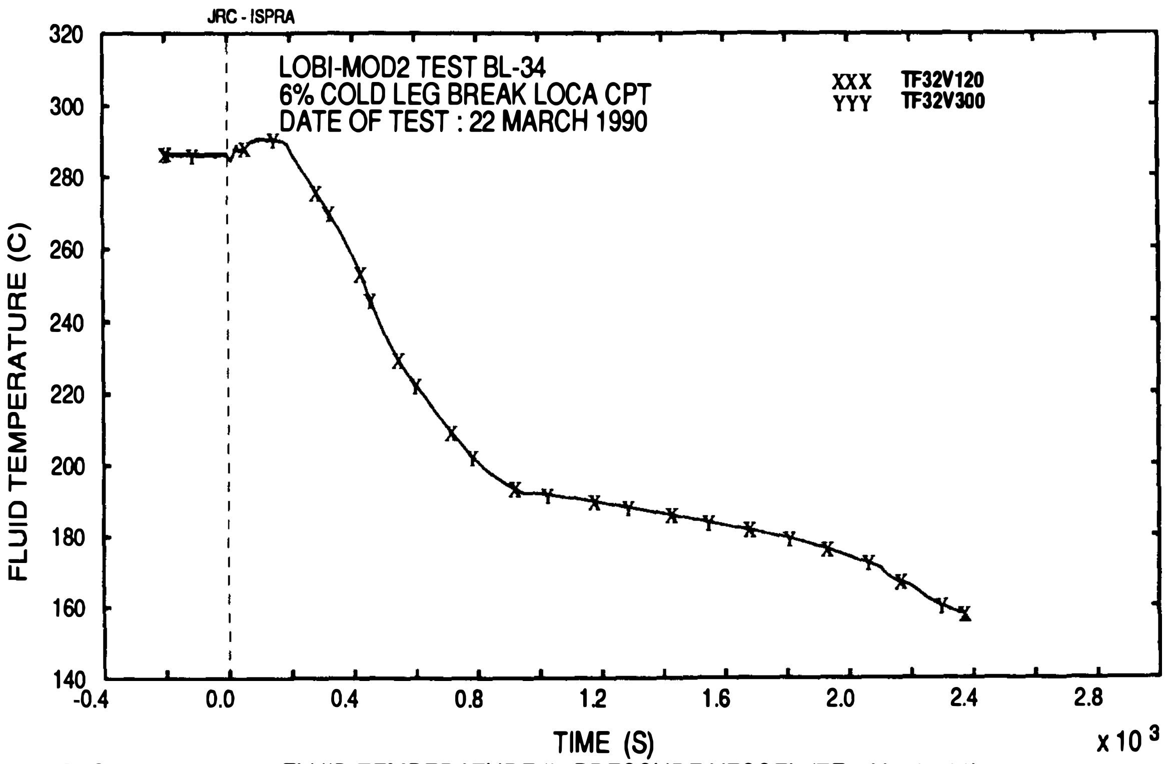
PLOT 6.9 FLUID TEMPERATURE IN BROKEN LOOP (TF25H000/180)
-PUMP OUTLET-



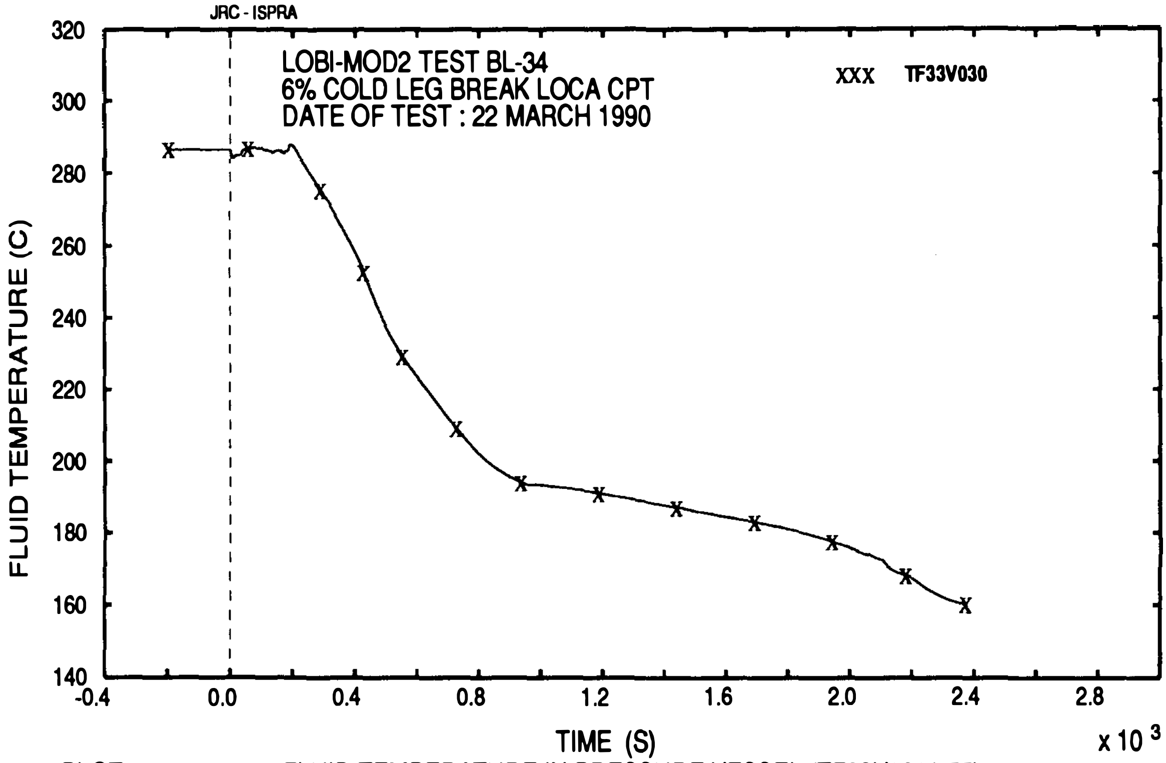
PLOT 6.10 FLUID TEMPERATURE IN BROKEN LOOP (TF26H000/180)
-COLD LEG, VESSEL INLET SIDE-



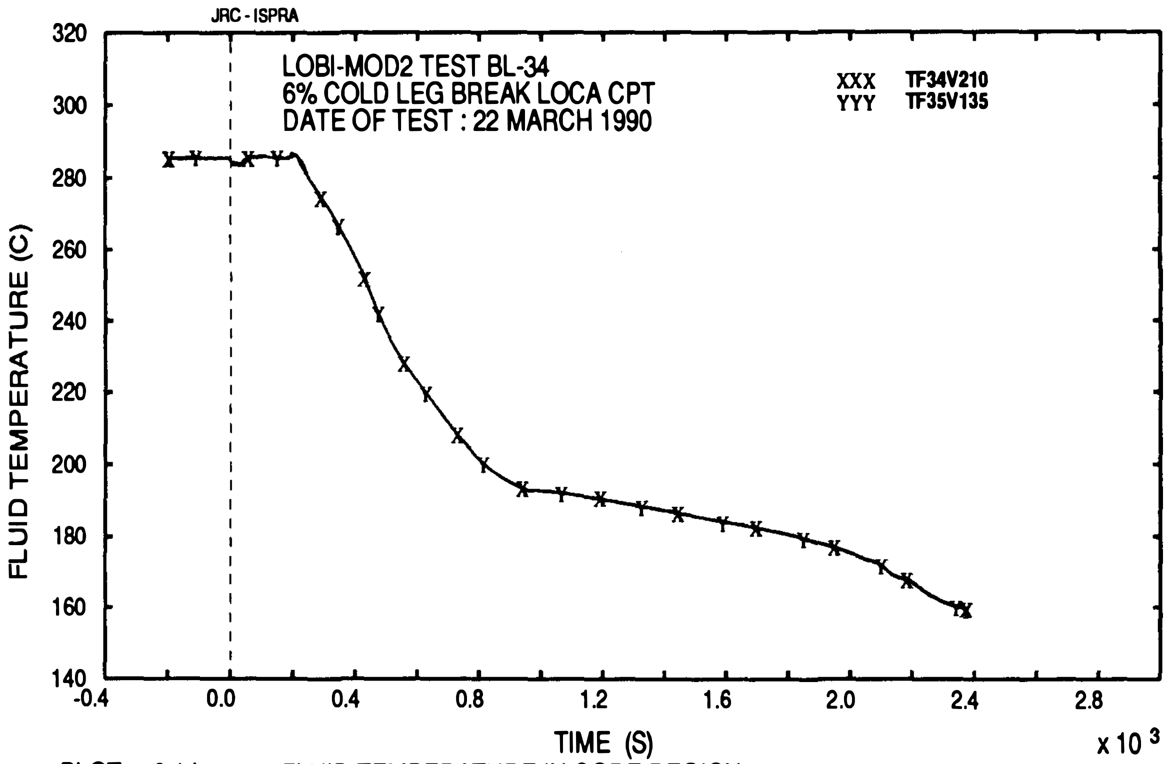
PLOT 6.11 FLUID TEMPERATURE IN PRESSURE VESSEL (TF31V030/210)
-DOWNCOMER ENTRANCE-



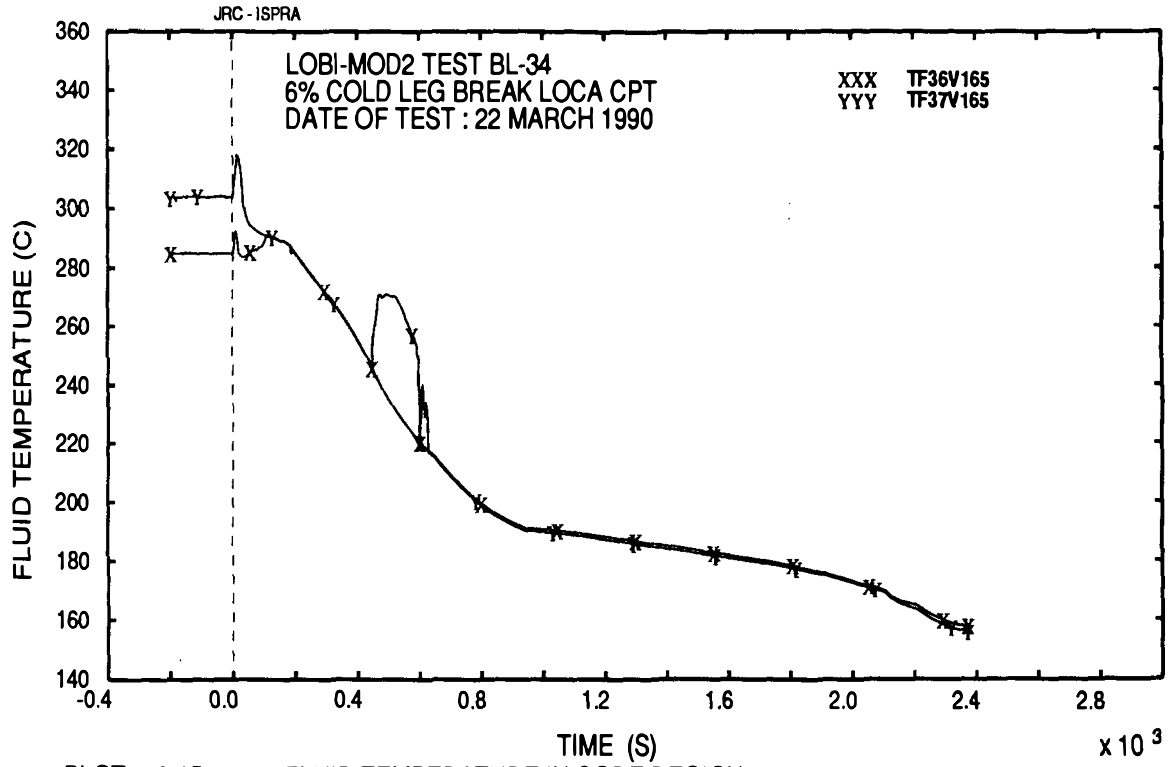
PLOT 6.12 FLUID TEMPERATURE IN PRESSURE VESSEL (TF32V120/300)
-DOWNCOMER MIDDLE SECTION-



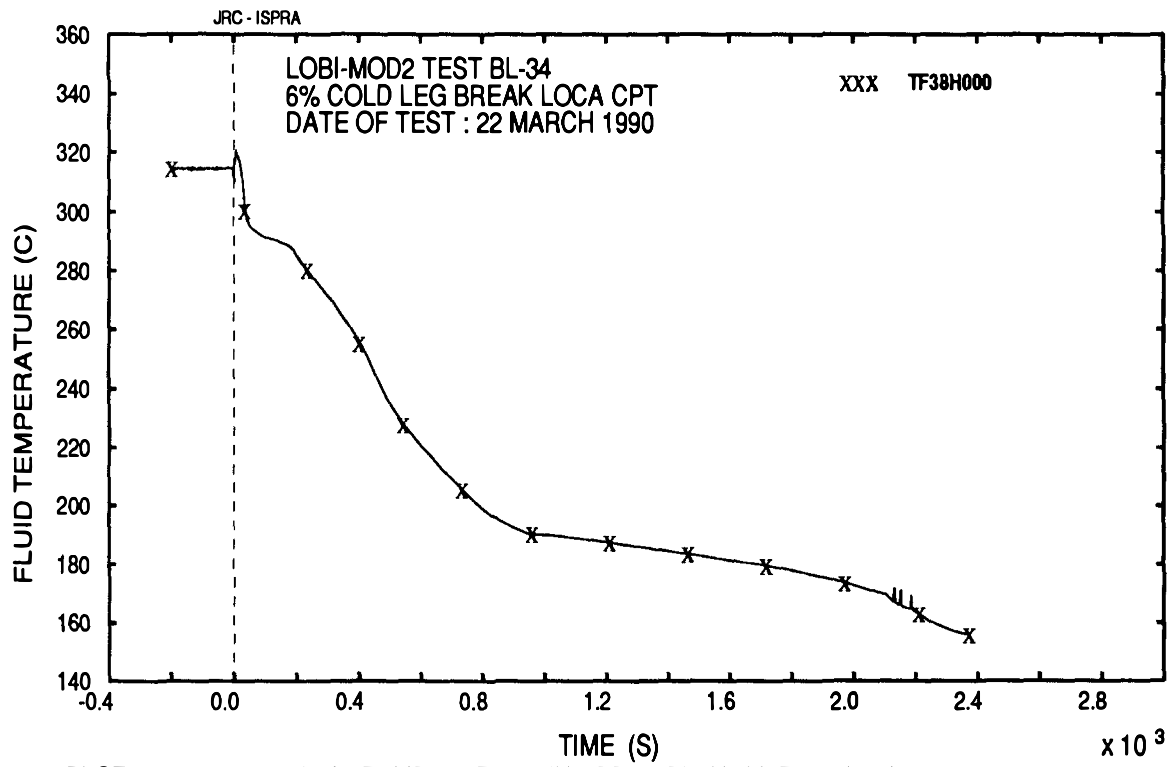
PLOT 6.13 FLUID TEMPERATURE IN PRESSURE VESSEL (TF33V030/255)
-DOWNCOMER OUTLET-



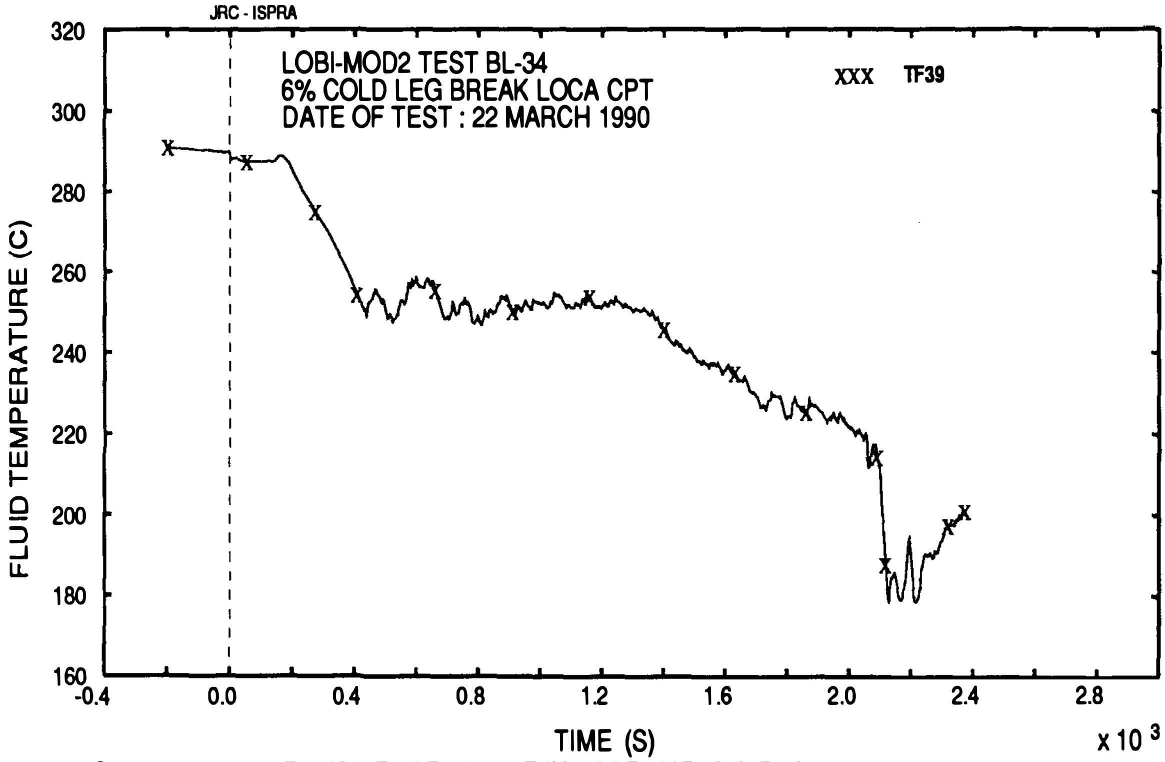
PLOT 6.14 FLUID TEMPERATURE IN CORE REGION
-LOWER PLENUM (TF34V210)-
-CORE ENTRANCE (TF35V135)-



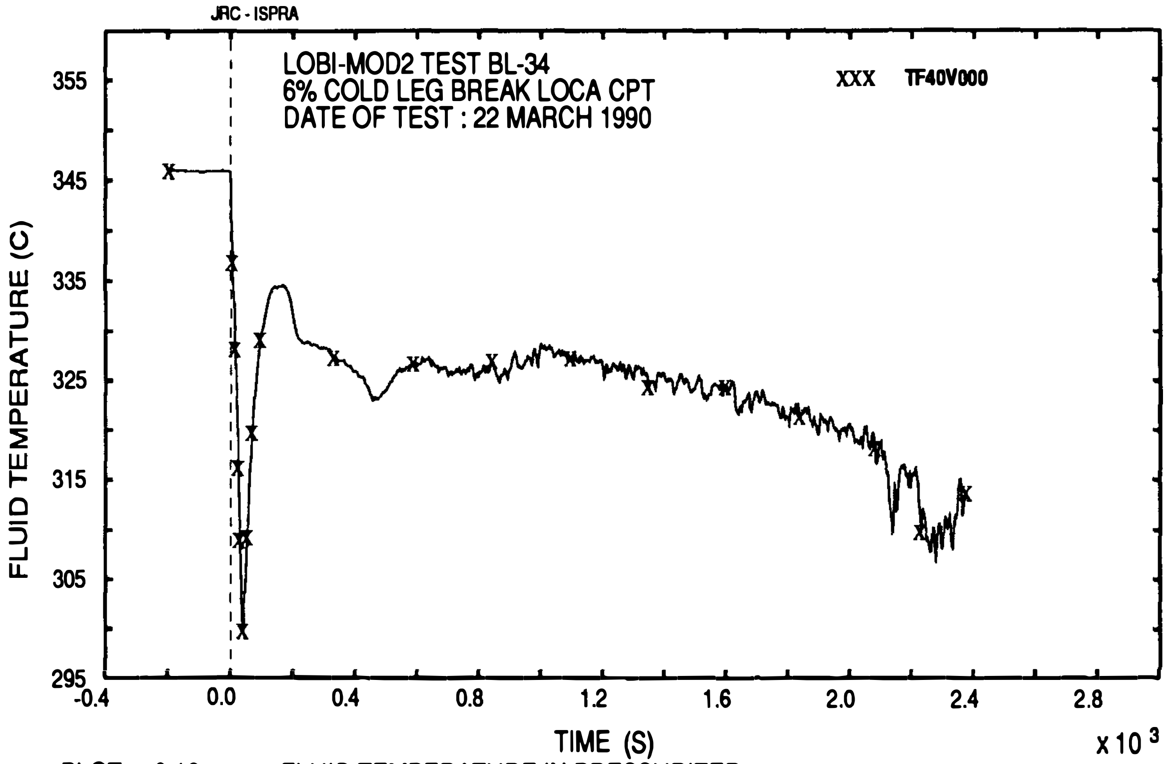
PLOT 6.15 FLUID TEMPERATURE IN CORE REGION
-HEATED LENGTH ENTRANCE (TF36V165)-
-HEATED LENGTH OUTLET (TF37V165)-



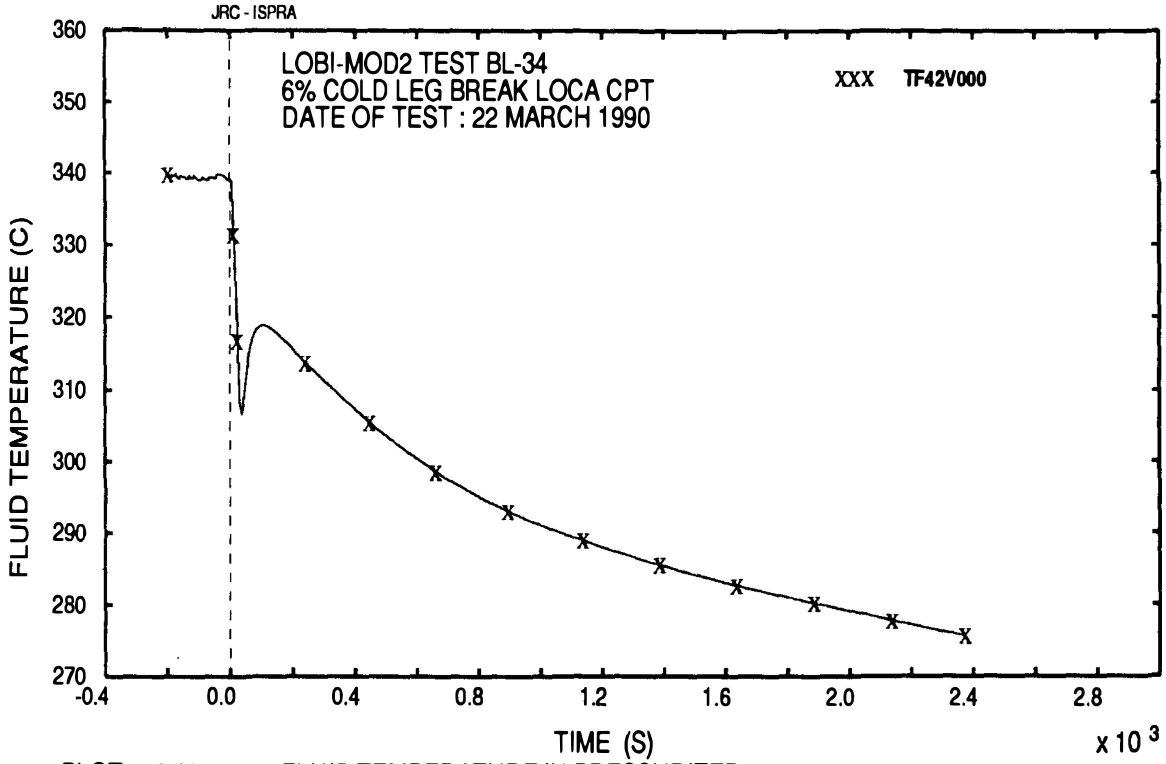
PLOT 6.16 FLUID TEMPERATURE IN UPPER PLENUM (TF38H000)



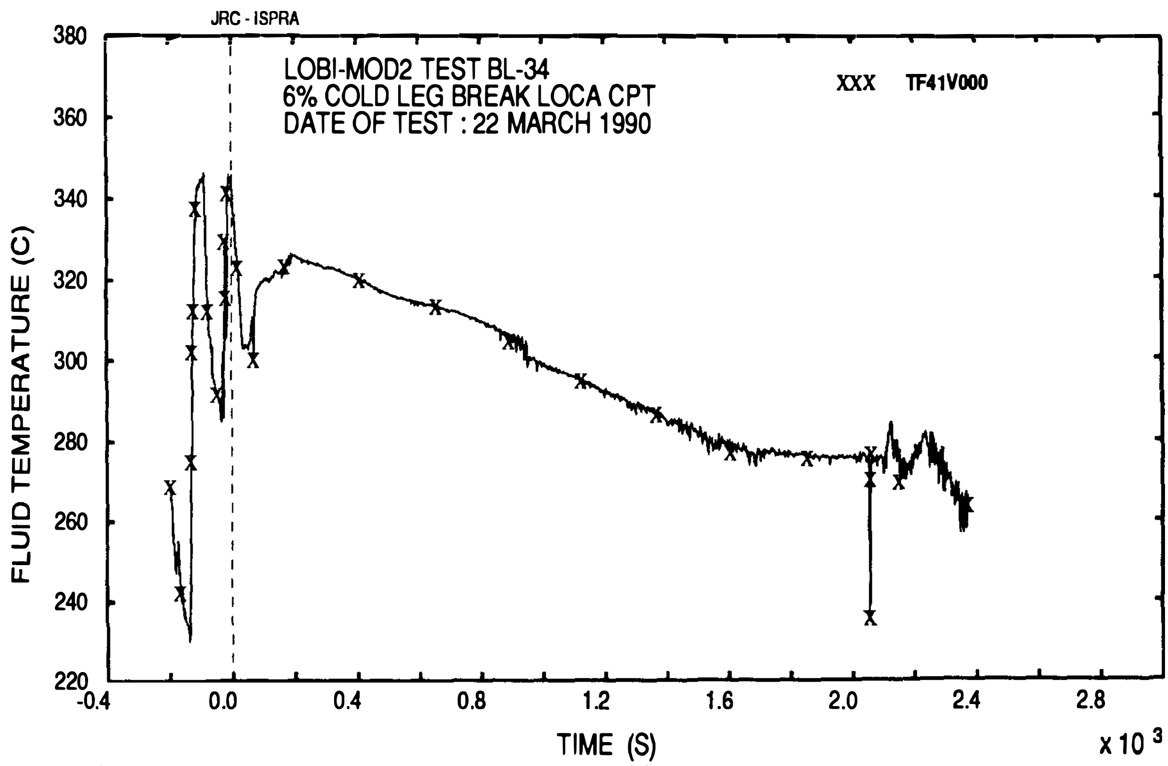
PLOT 6.17 FLUID TEMPERATURE IN UPPER HEAD (TF39)



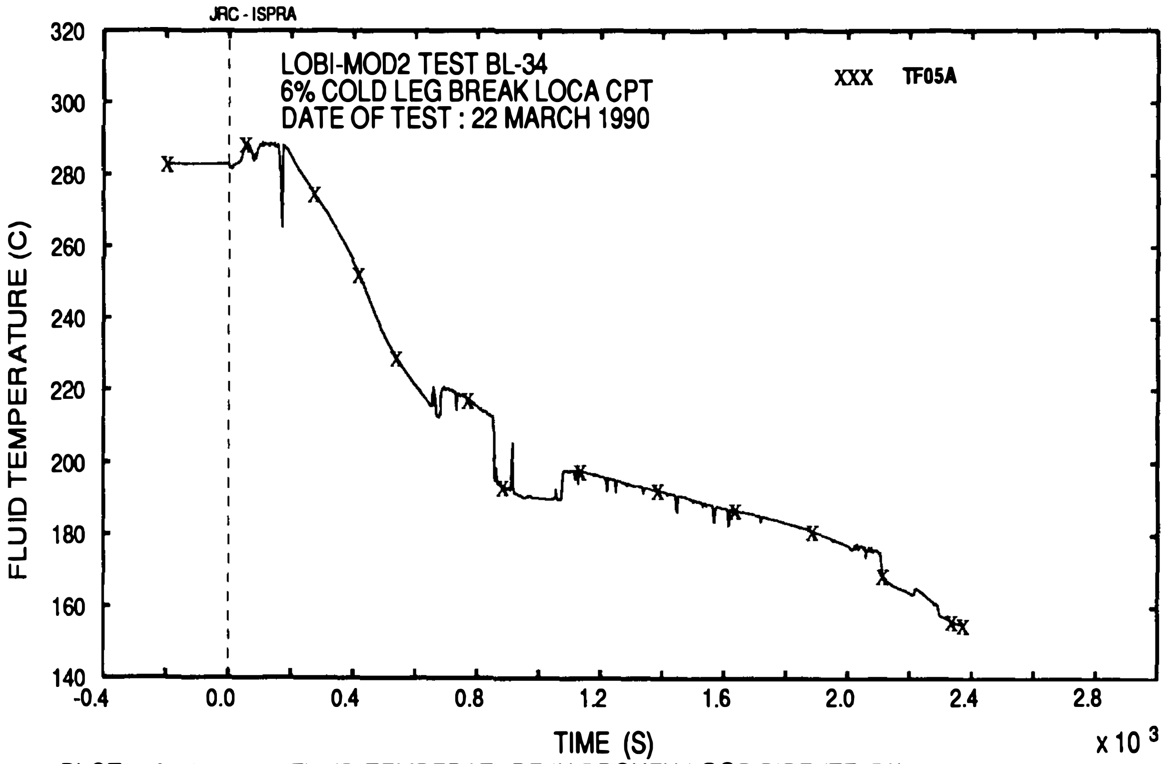
PLOT 6.18 FLUID TEMPERATURE IN PRESSURIZER
-PRESSURIZER (TF40V000)-



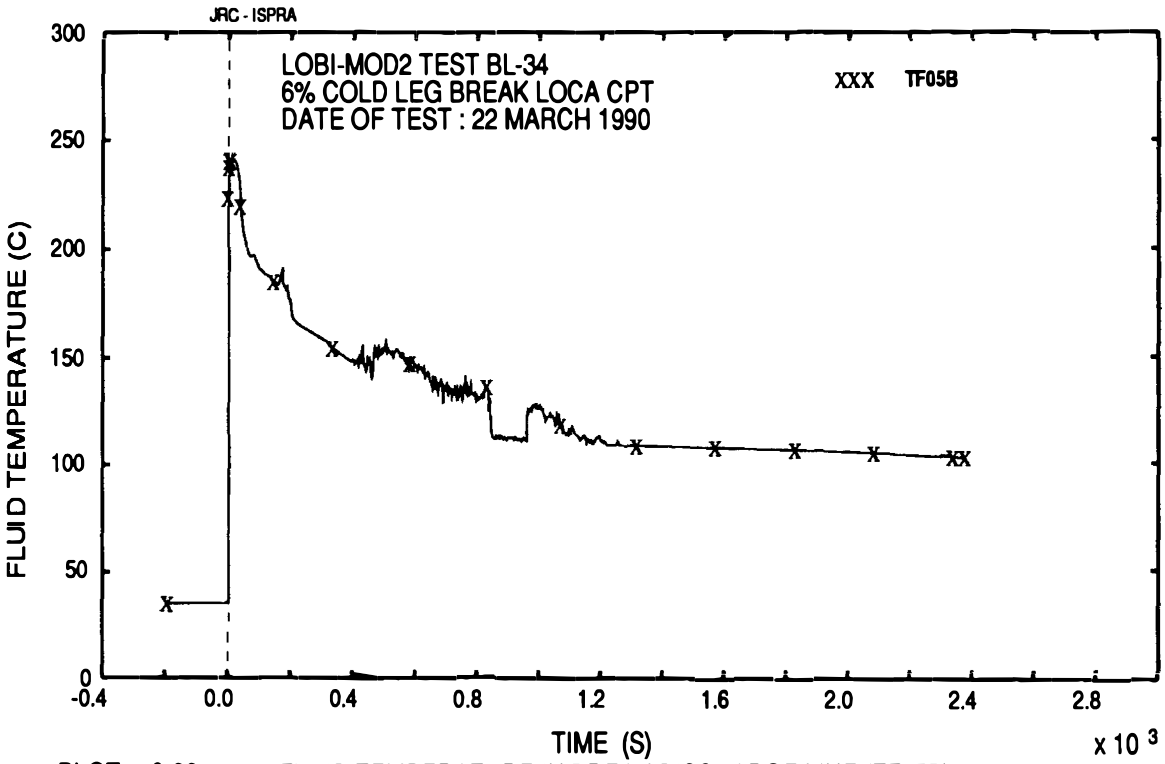
PLOT 6.19 FLUID TEMPERATURE IN PRESSURIZER
-NEAR CONNECTION LINE (TF42V000)-



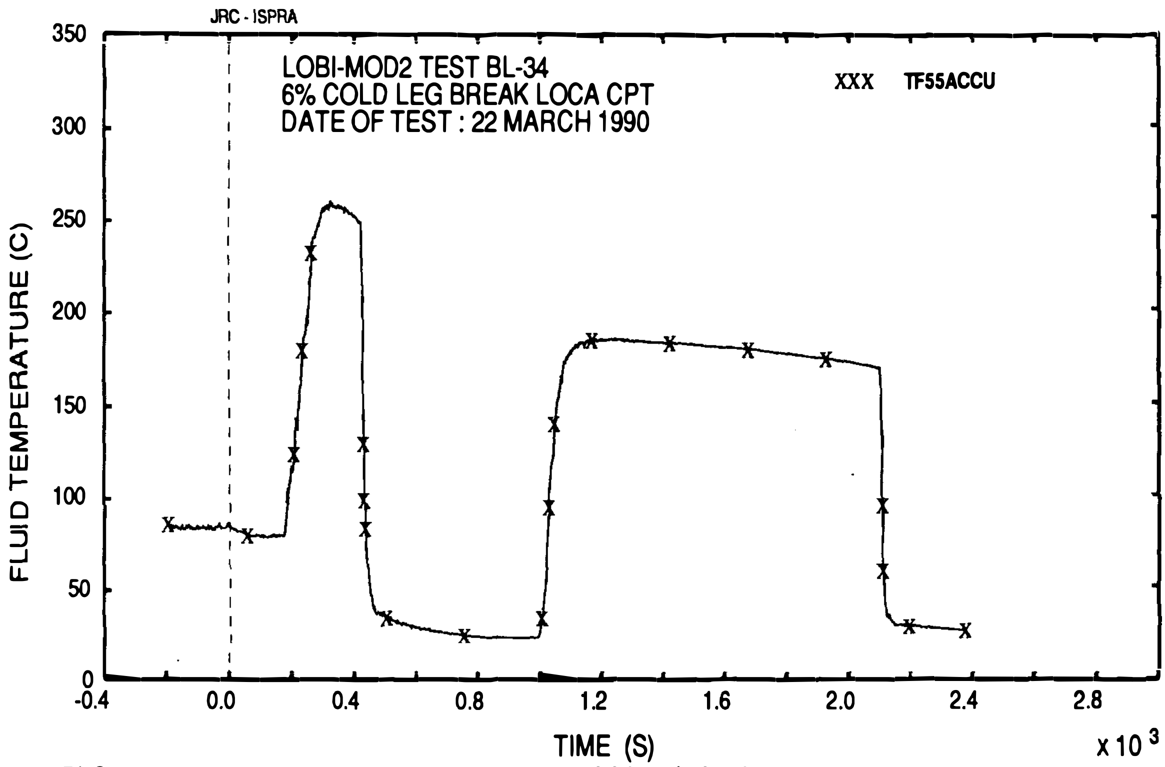
PLOT 6.20 FLUID TEMPERATURE IN PRESSURIZER
-PRESSURIZER OUTLET (TF41V000)-



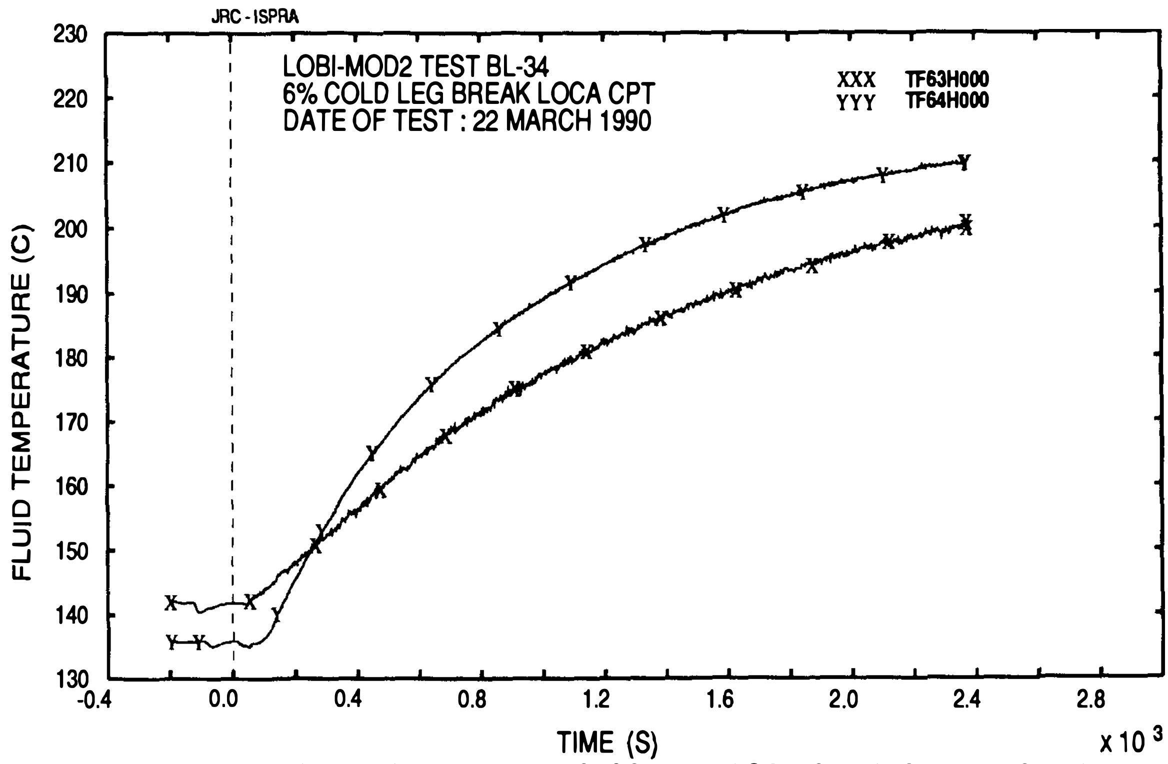
PLOT 6.21 -FLUID TEMPERATURE IN BROKEN LOOP PIPE (TF05A)
-COLD LEG AT BREAK ASSEMBLY-



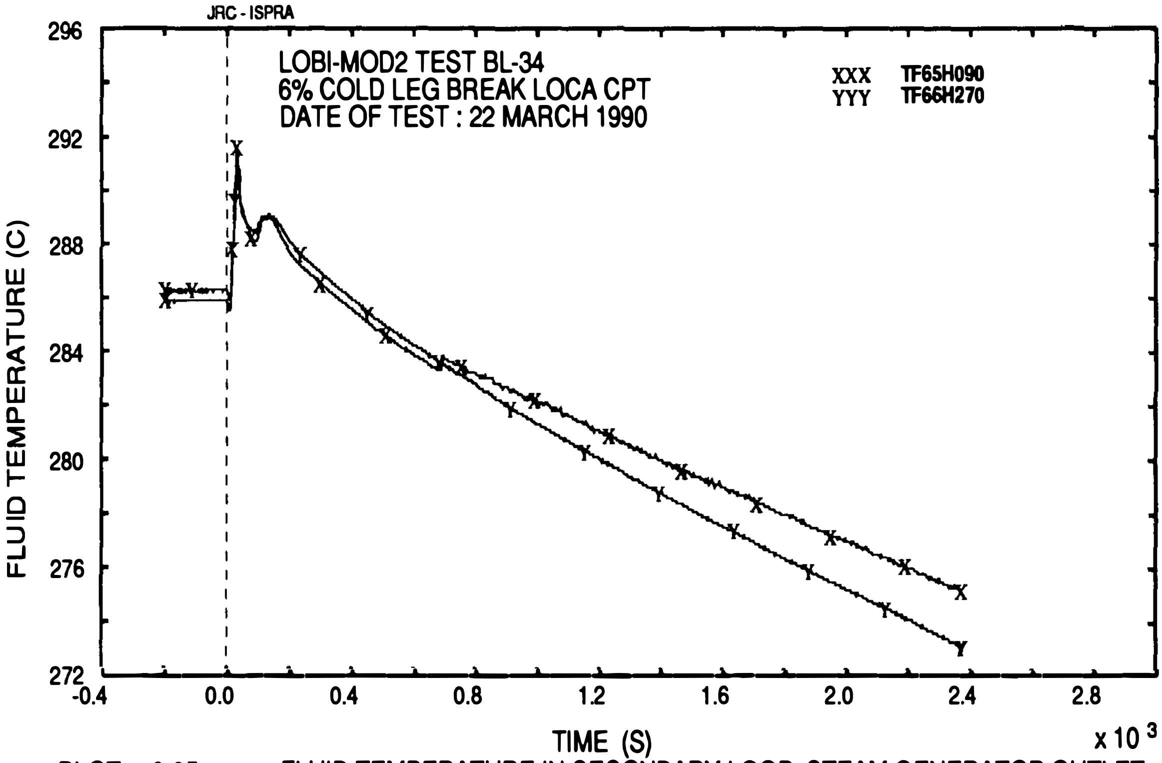
PLOT 6.22 FLUID TEMPERATURE IN BREAK DISCHARGE LINE (TF05B)



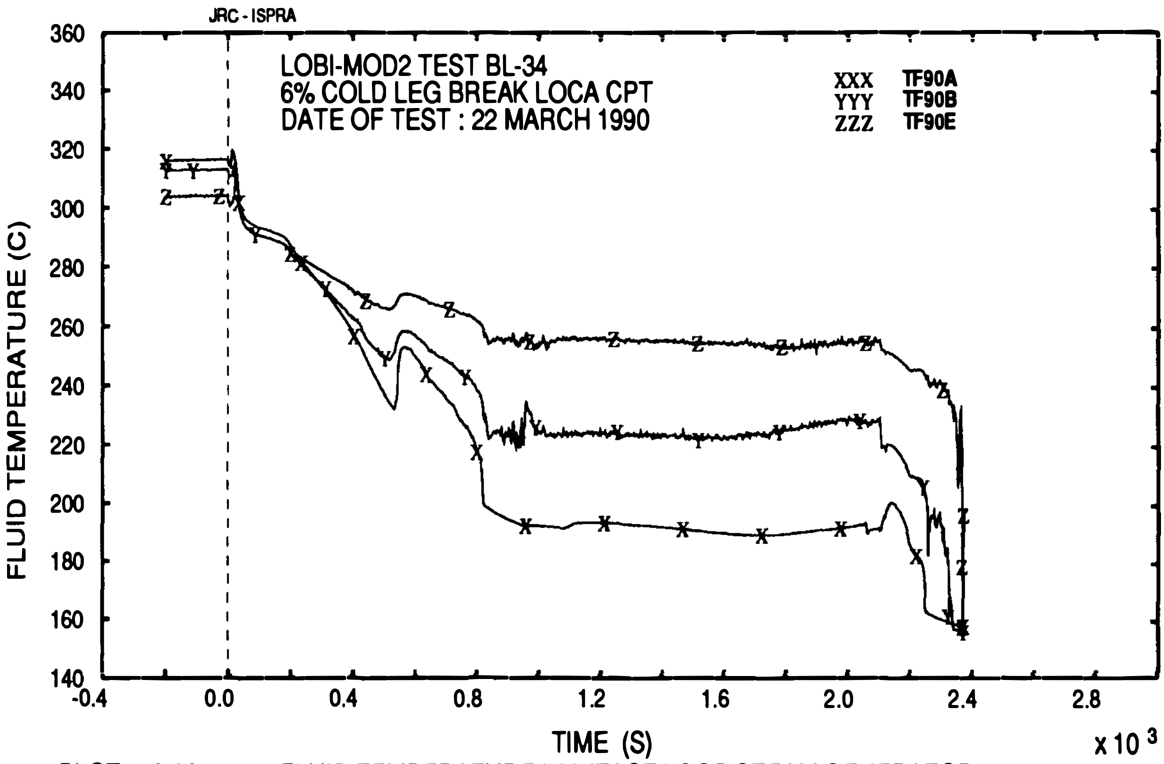
PLOT 6.23 FLUID TEMPERATURE IN ECCS INJECTION LINE
-INTACT LOOP HOT LEG (TF53)-
-INTACT LOOP COLD LEG (TF55ACCU)-



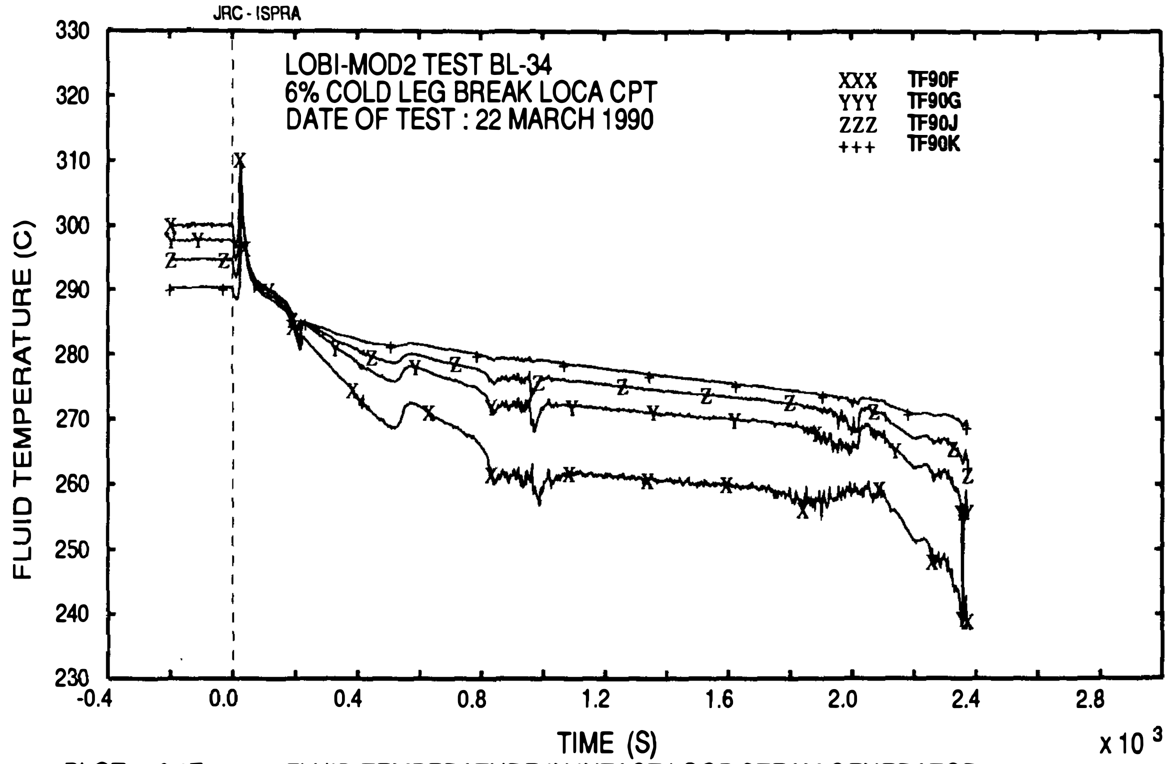
PLOT 6.24 FLUID TEMPERATURE IN SECONDARY LOOP, STEAM GENERATOR INLET
-INTACT LOOP SIDE (TF63H000)-
-BROKEN LOOP SIDE (TF64H000)-



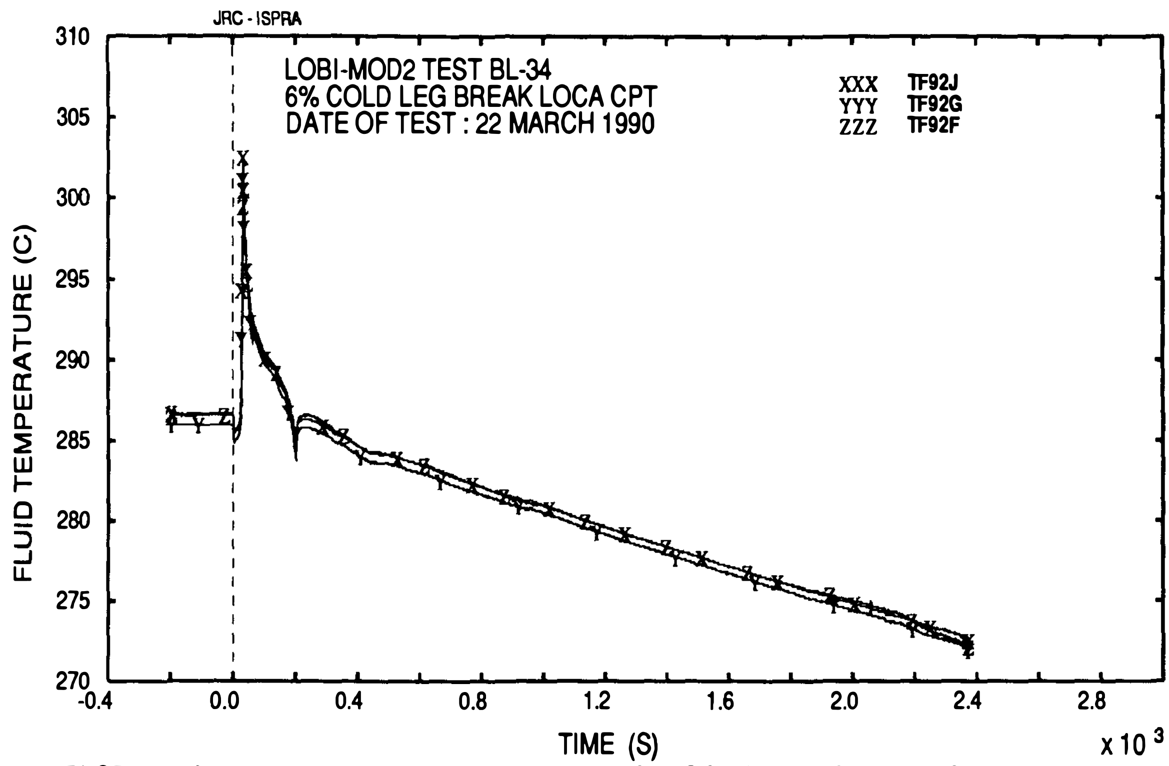
PLOT 6.25 FLUID TEMPERATURE IN SECONDARY LOOP, STEAM GENERATOR OUTLET
-INTACT LOOP SIDE (TF65H090)-
-BROKEN LOOP SIDE (TF66H270)-



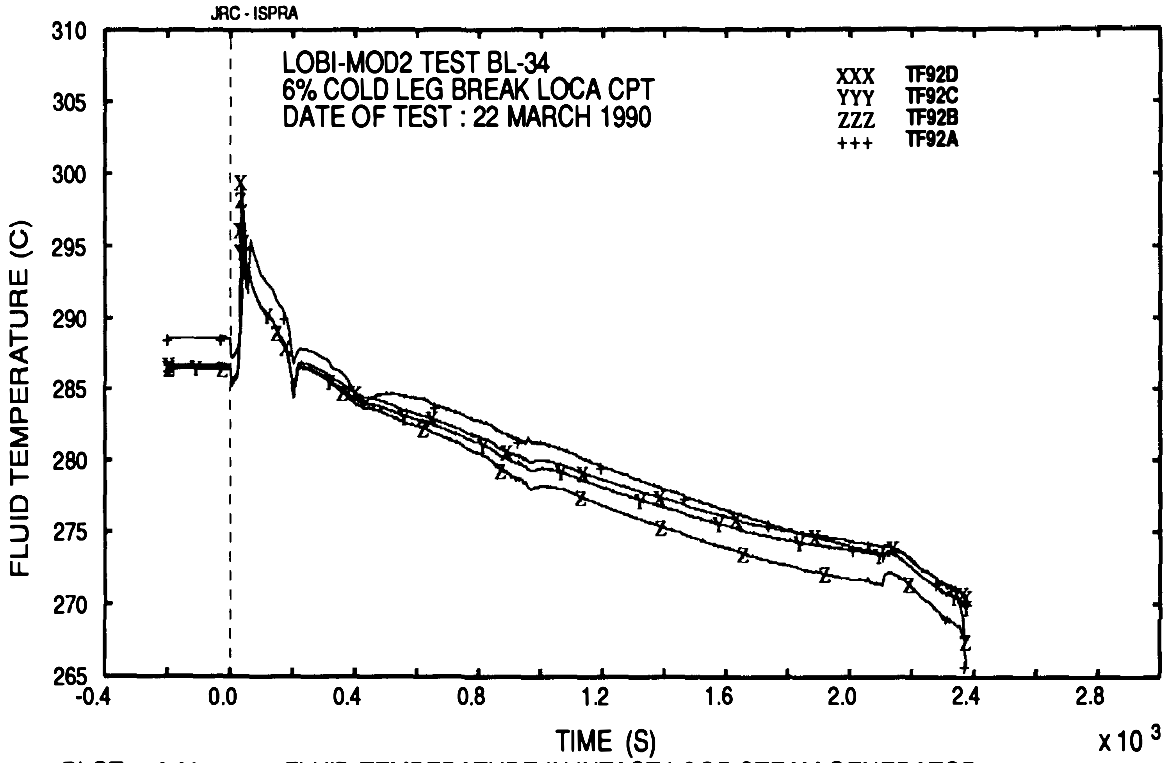
PLOT 6.26 FLUID TEMPERATURE IN INTACT LOOP STEAM GENERATOR
-INLET PRIMARY SIDE (TF90A)-
-U-TUBE, LOWER PART OF RISING LEG-



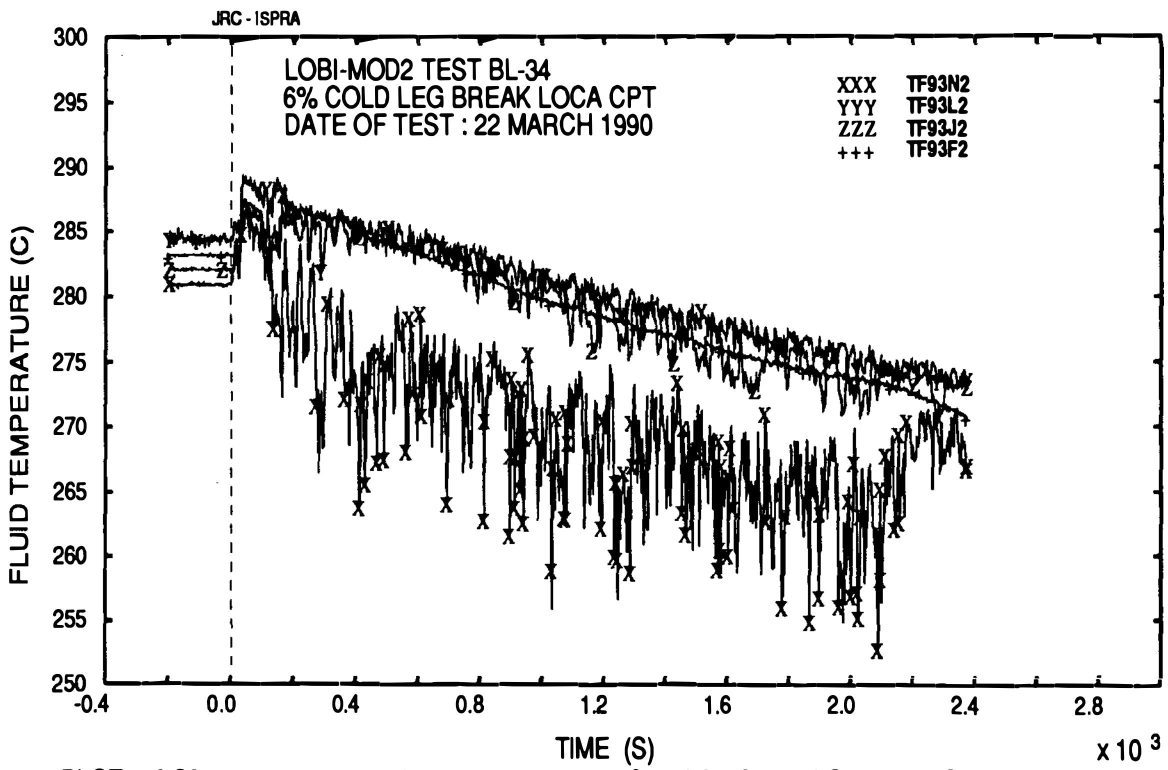
PLOT 6.27 FLUID TEMPERATURE IN INTACT LOOP STEAM GENERATOR
-U-TUBE, UPPER PART OF RISING LEG-



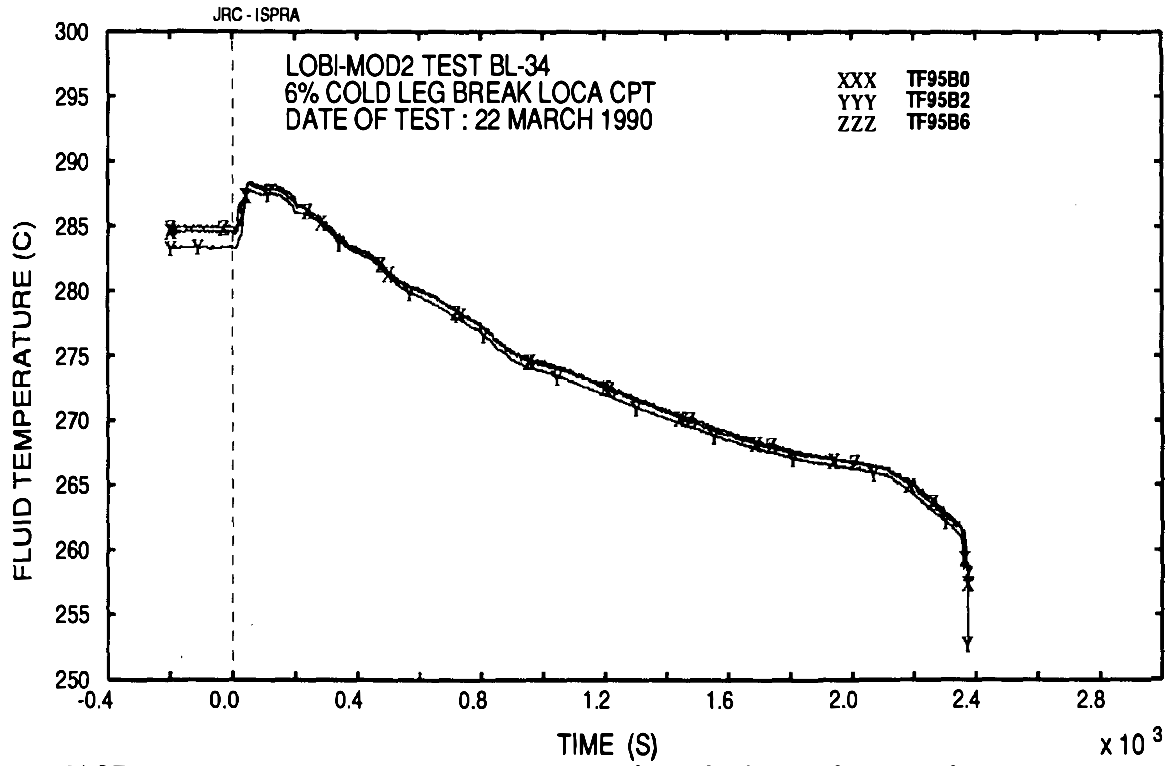
PLOT 6.28 FLUID TEMPERATURE IN INTACT LOOP STEAM GENERATOR
-U-TUBE, UPPER PART OF FALLING LEG-



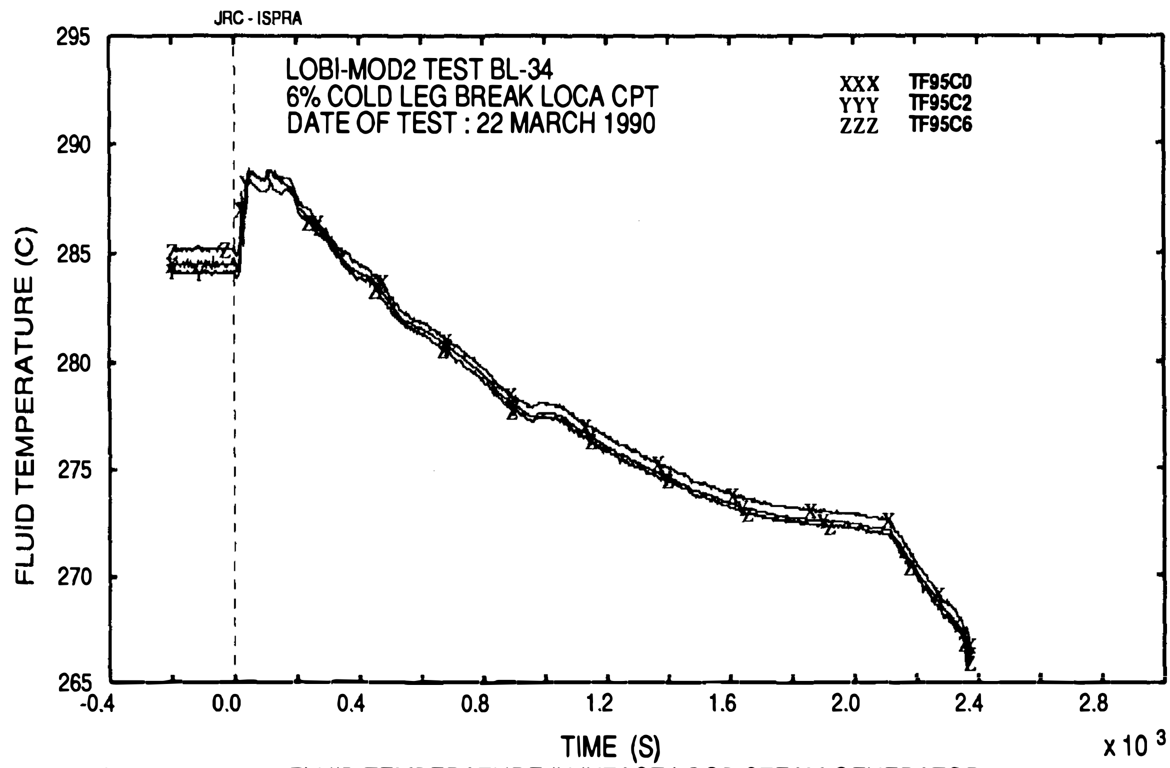
PLOT 6.29 FLUID TEMPERATURE IN INTACT LOOP STEAM GENERATOR
-OUTLET PRIMARY SIDE (TF92A)-
-U-TUBE, LOWER PART OF FALLING LEG-



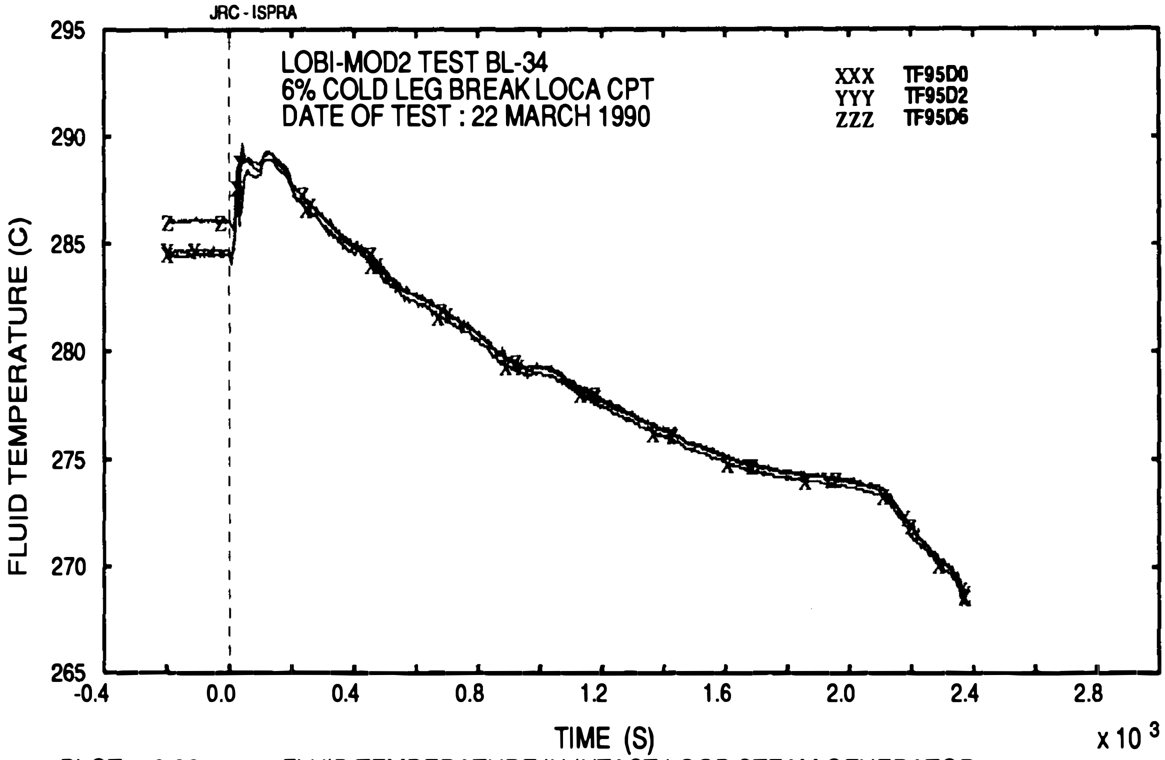
PLOT 6.30 FLUID TEMPERATURE IN INTACT LOOP STEAM GENERATOR
-DOWNCOMER REGION-



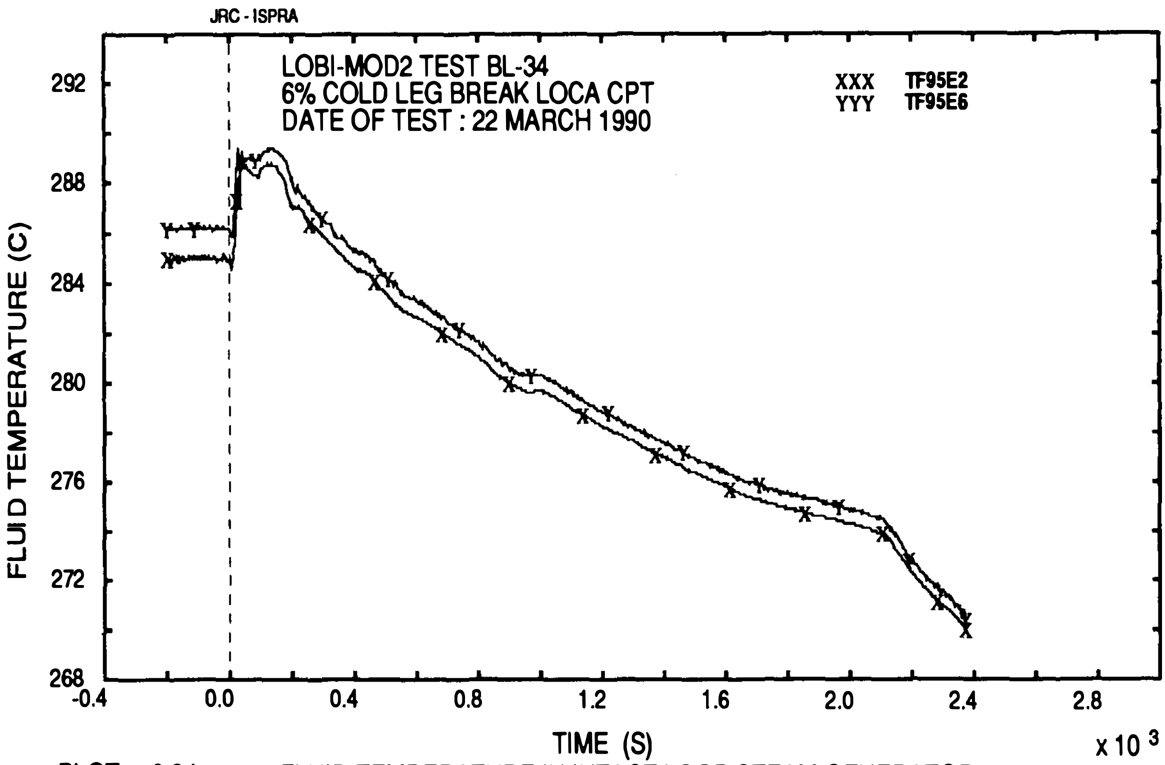
PLOT 6.31 FLUID TEMPERATURE IN INTACT LOOP STEAM GENERATOR -RISER REGION, LEVEL B-



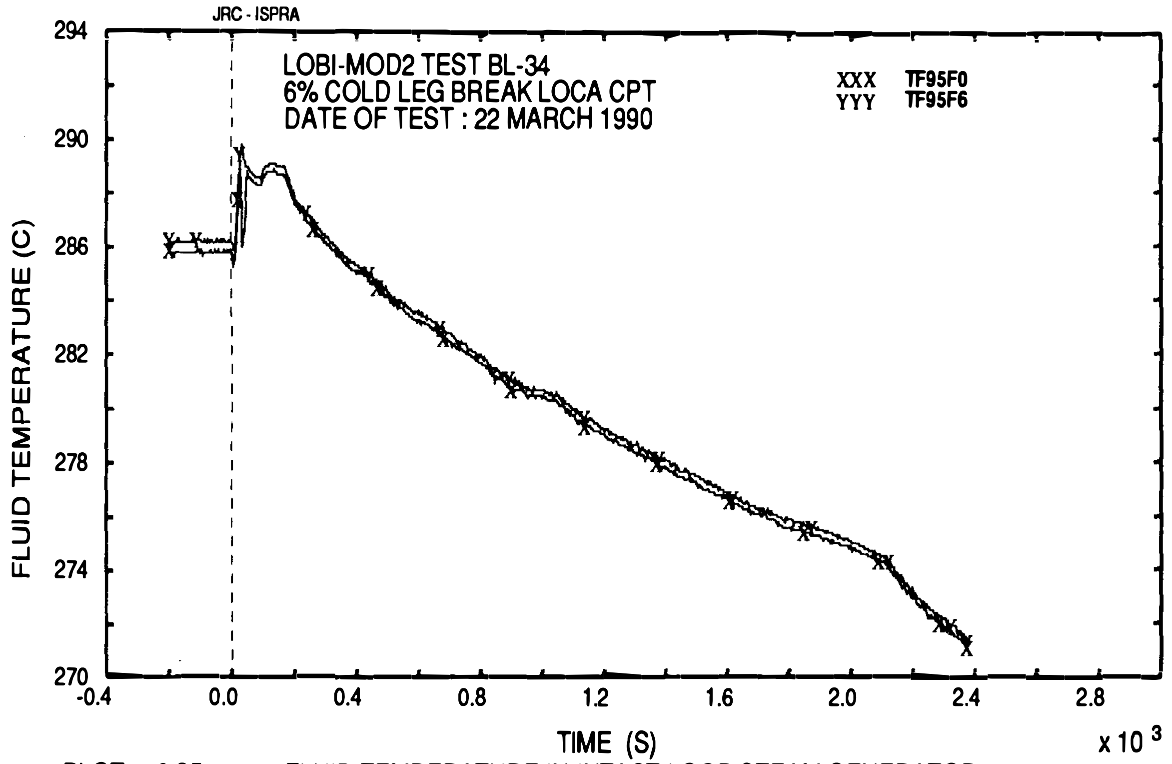
PLOT 6.32 FLUID TEMPERATURE IN INTACT LOOP STEAM GENERATOR -RISER REGION, LEVEL C-



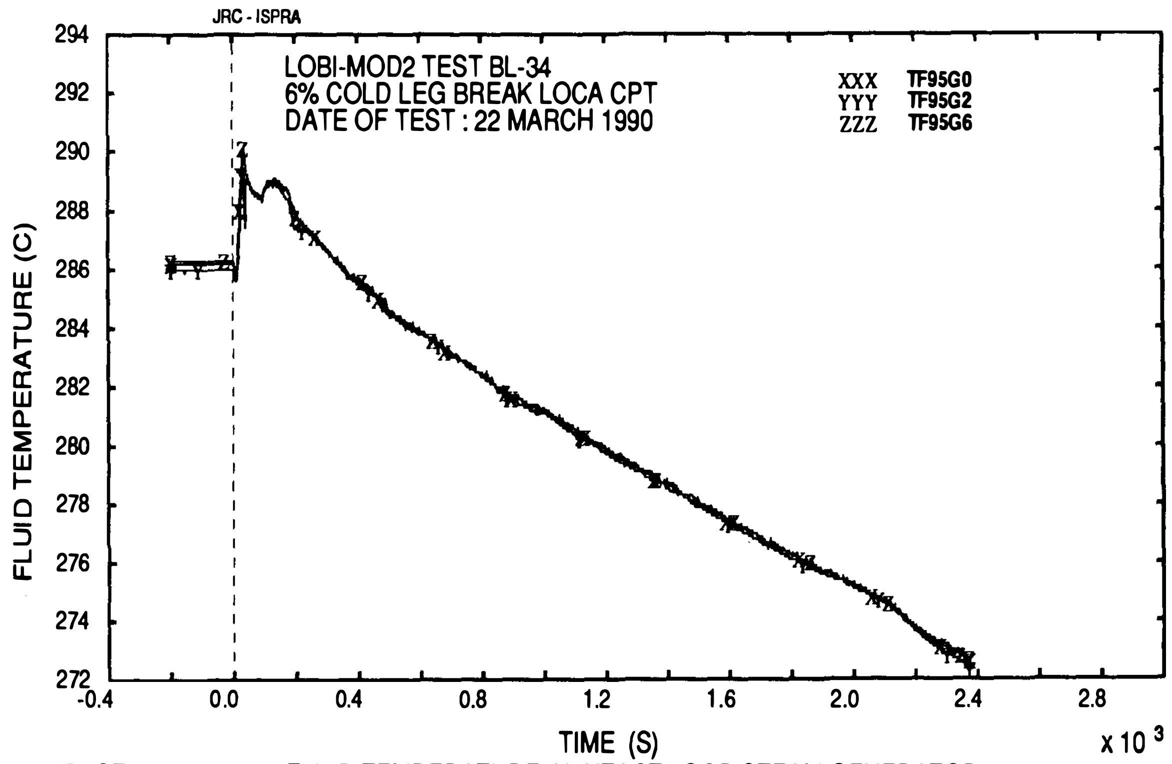
PLOT 6.33 FLUID TEMPERATURE IN INTACT LOOP STEAM GENERATOR
-RISER REGION, LEVEL D-



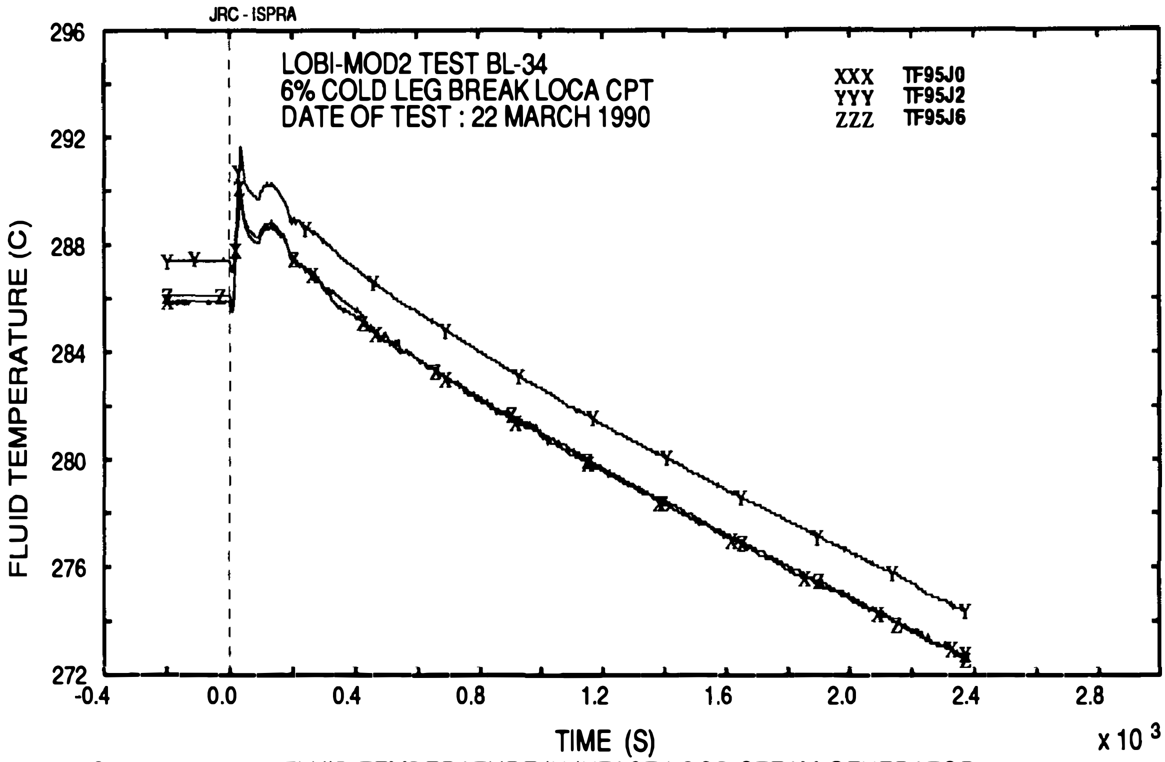
PLOT 6.34 FLUID TEMPERATURE IN INTACT LOOP STEAM GENERATOR
-RISER REGION, LEVEL E-



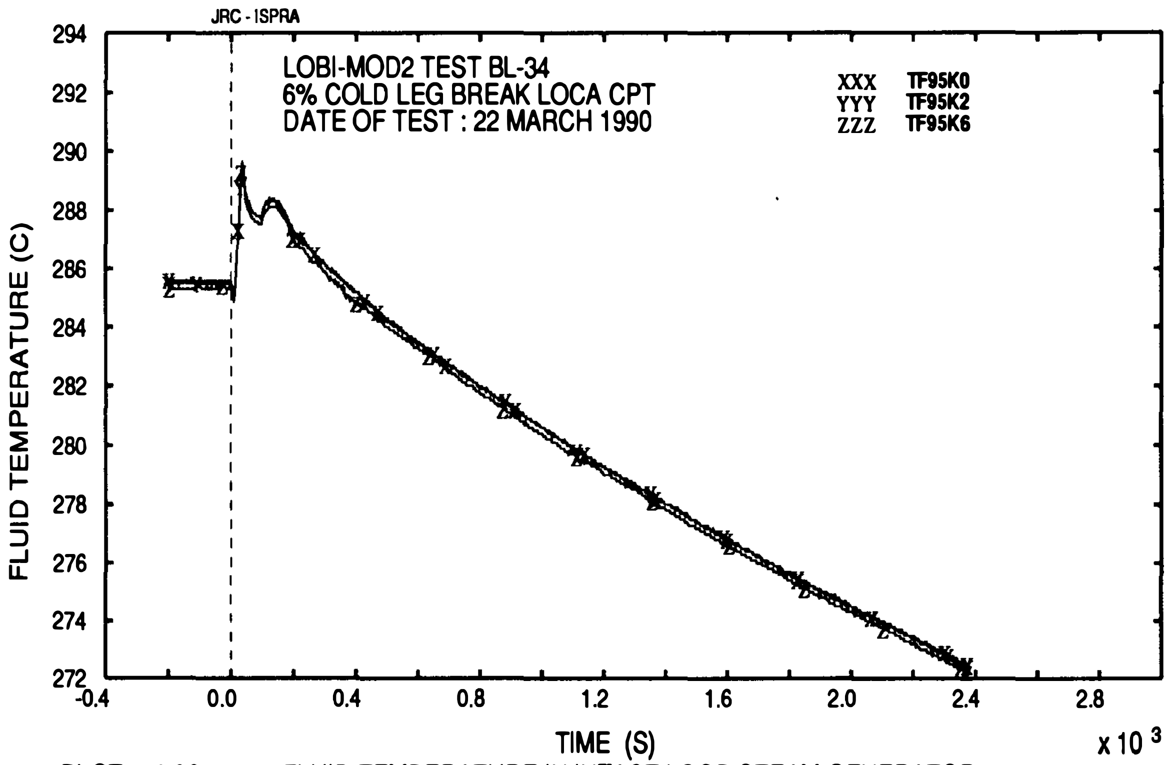
PLOT 6.35 FLUID TEMPERATURE IN INTACT LOOP STEAM GENERATOR -RISER REGION, LEVEL F-



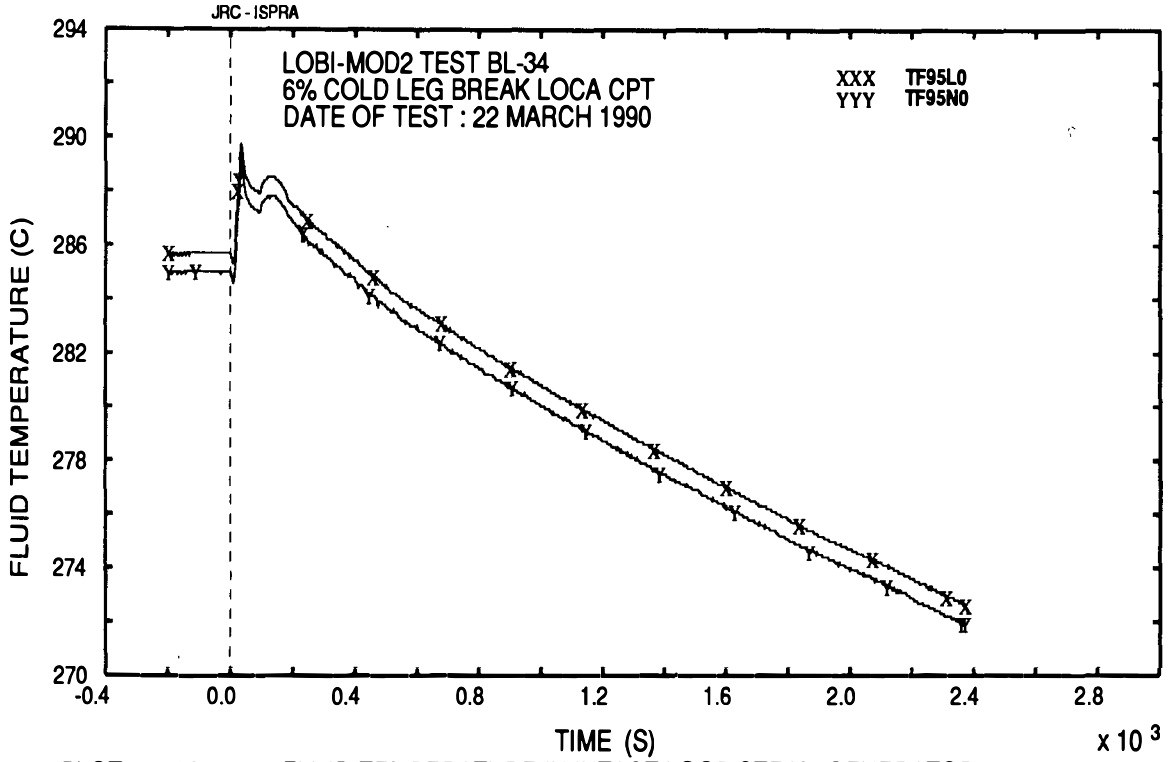
PLOT 6.36 FLUID TEMPERATURE IN INTACT LOOP STEAM GENERATOR -RISER REGION, LEVEL G-



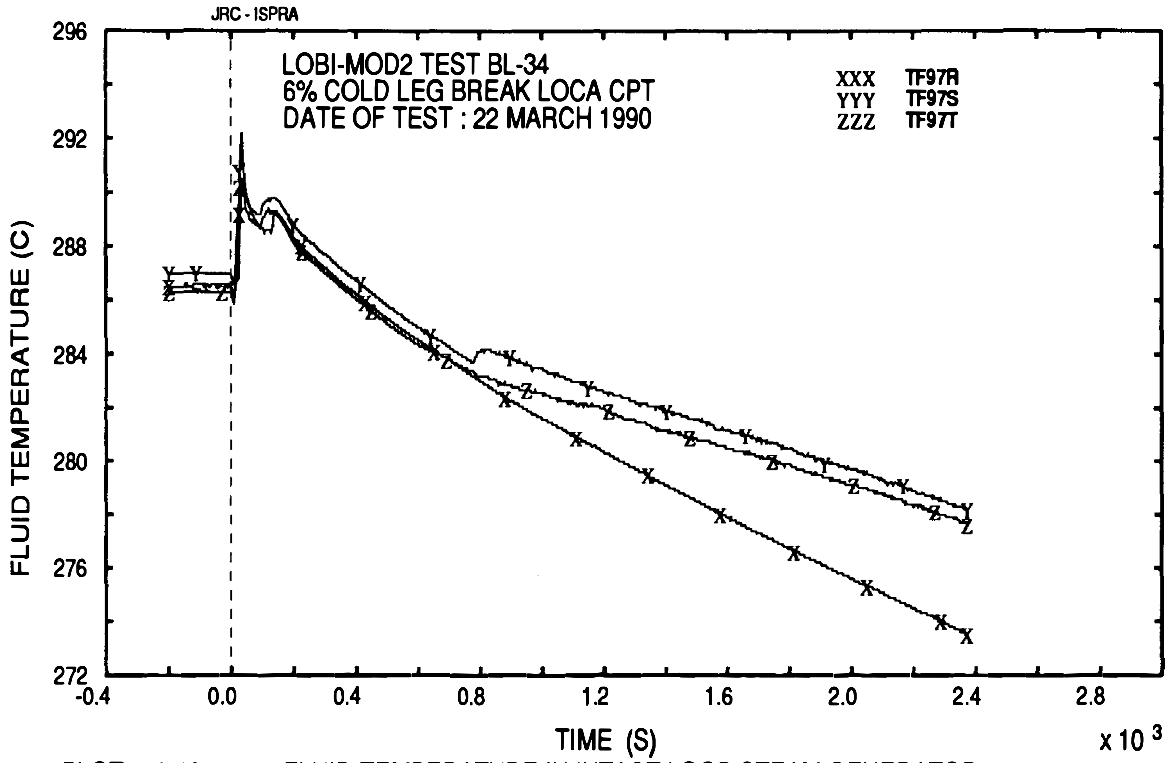
PLOT 6.37 FLUID TEMPERATURE IN INTACT LOOP STEAM GENERATOR -RISER REGION, LEVEL J-



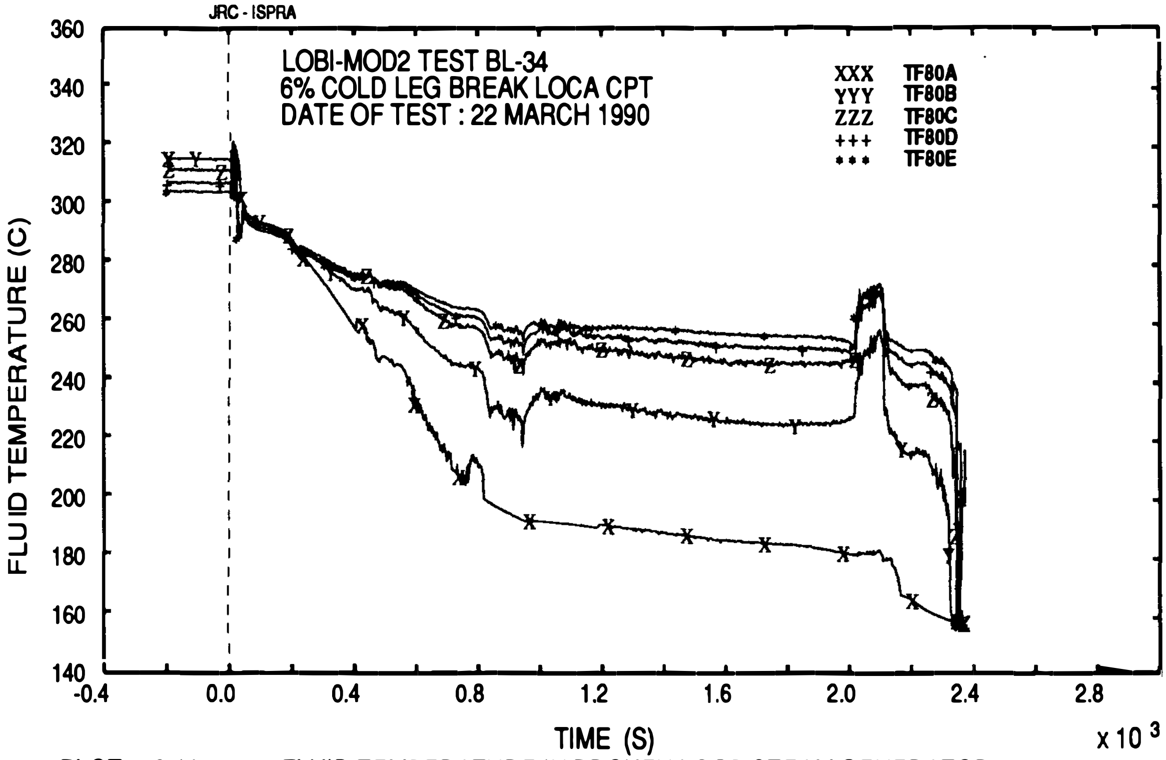
PLOT 6.38 FLUID TEMPERATURE IN INTACT LOOP STEAM GENERATOR -RISER REGION, LEVEL K-



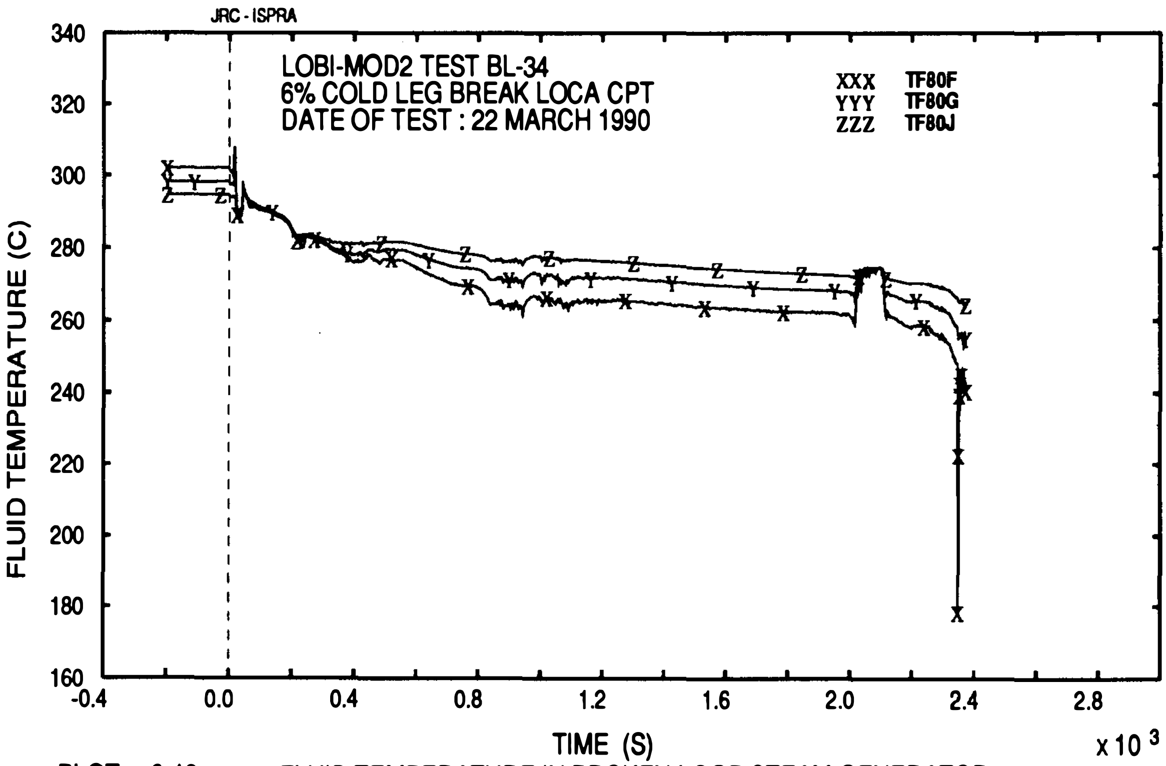
PLOT 6.39 FLUID TEMPERATURE IN INTACT LOOP STEAM GENERATOR
-RISER REGION, LEVEL L AND N-



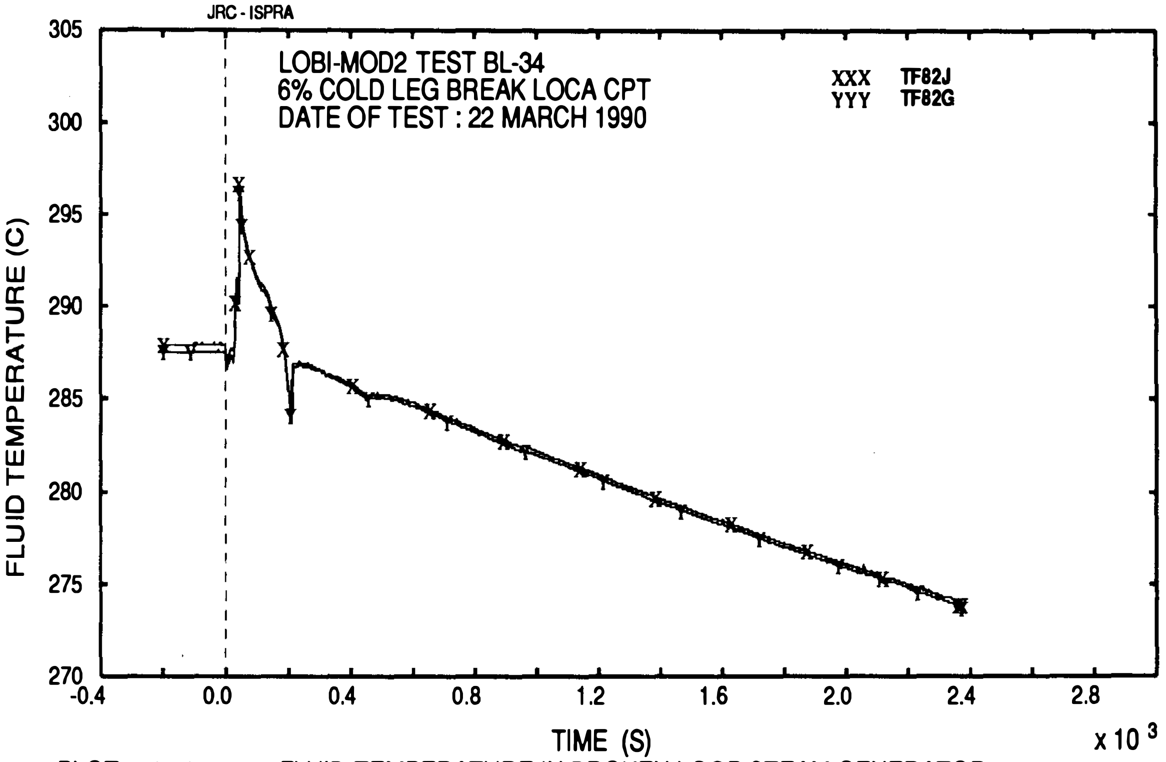
PLOT 6.40 FLUID TEMPERATURE IN INTACT LOOP STEAM GENERATOR
-STEAM DOME-



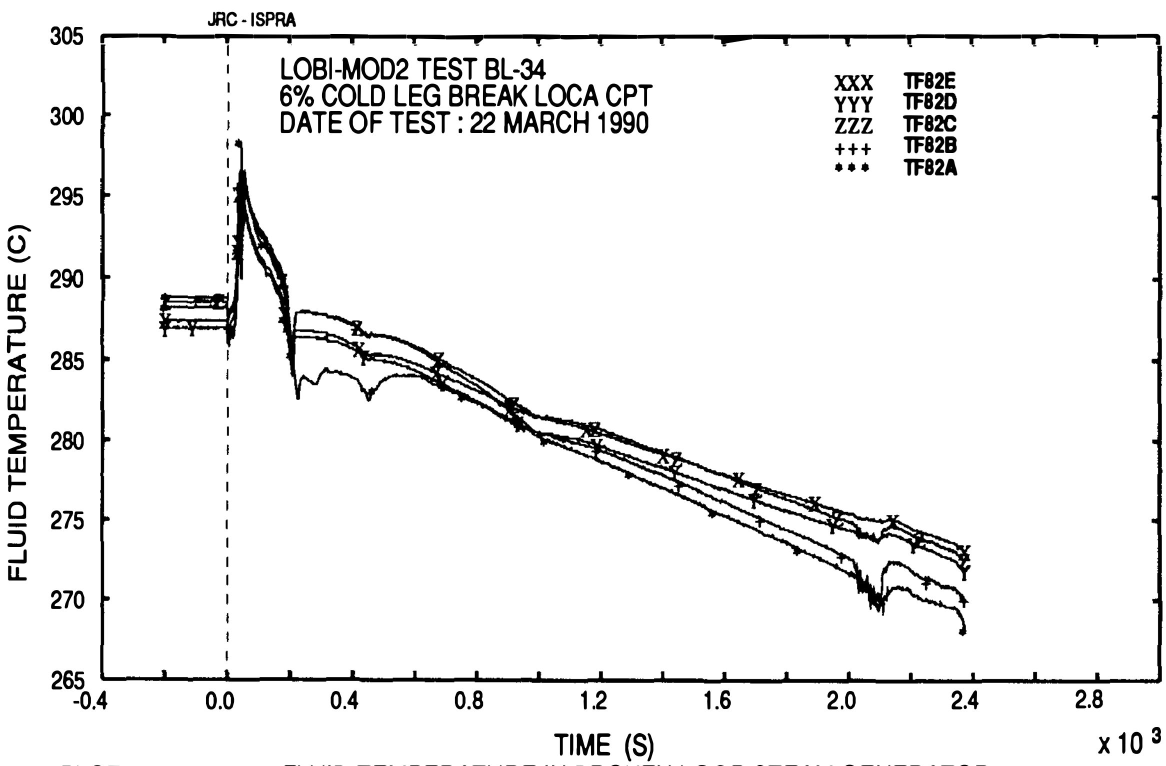
PLOT 6.41 FLUID TEMPERATURE IN BROKEN LOOP STEAM GENERATOR
-INLET PRIMARY SIDE (TF80A)-
-U-TUBE, LOWER PART OF RISING LEG-



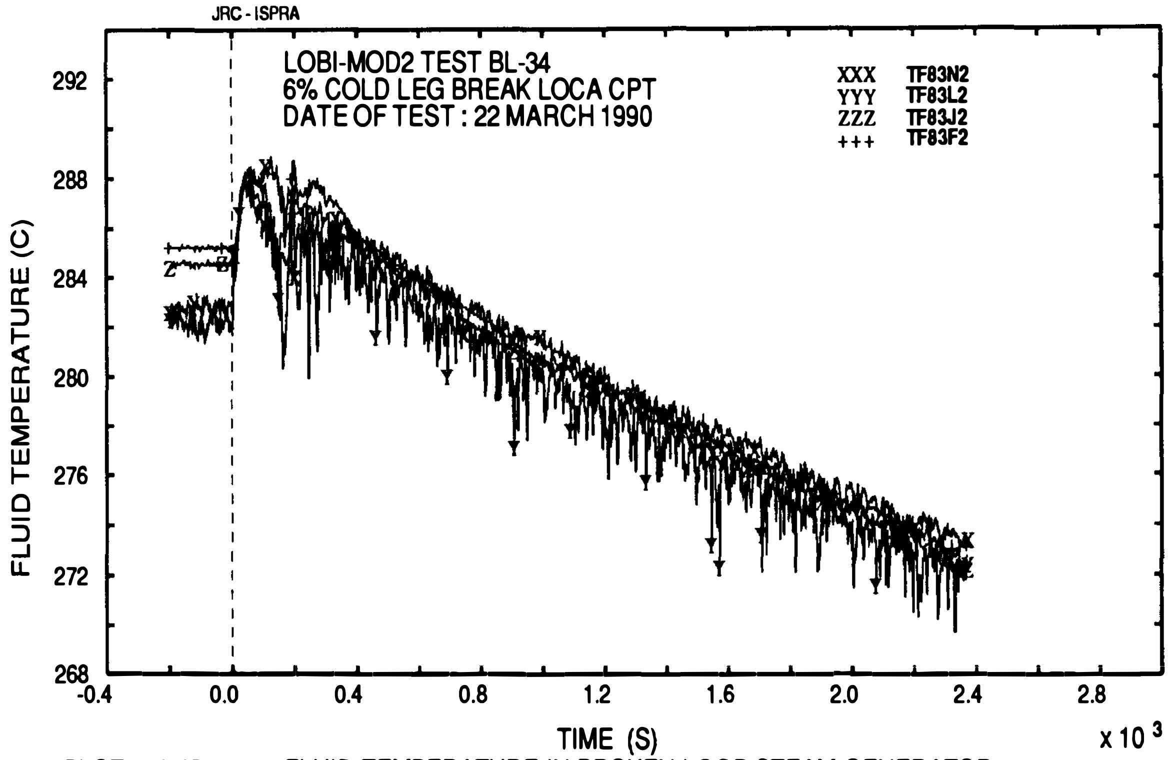
PLOT 6.42 FLUID TEMPERATURE IN BROKEN LOOP STEAM GENERATOR
-U-TUBE, UPPER PART OF RISING LEG-



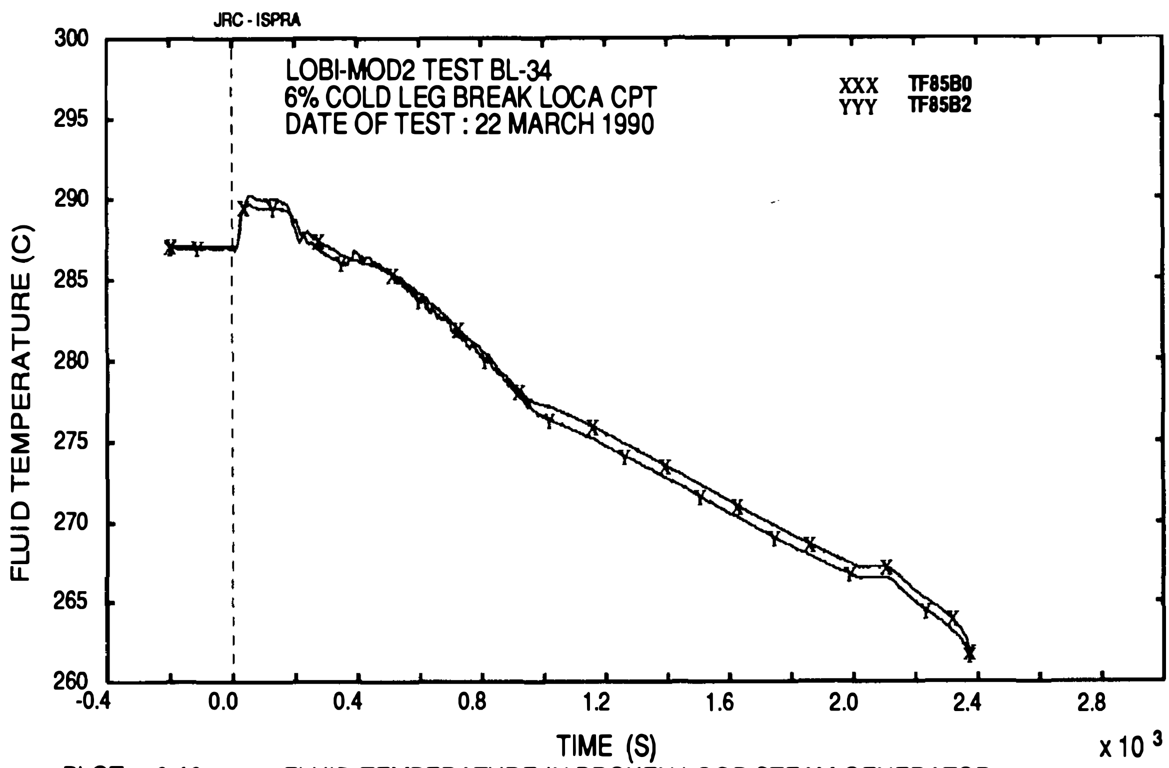
PLOT 6.43 FLUID TEMPERATURE IN BROKEN LOOP STEAM GENERATOR
-U-TUBE, UPPER PART OF FALLING LEG-



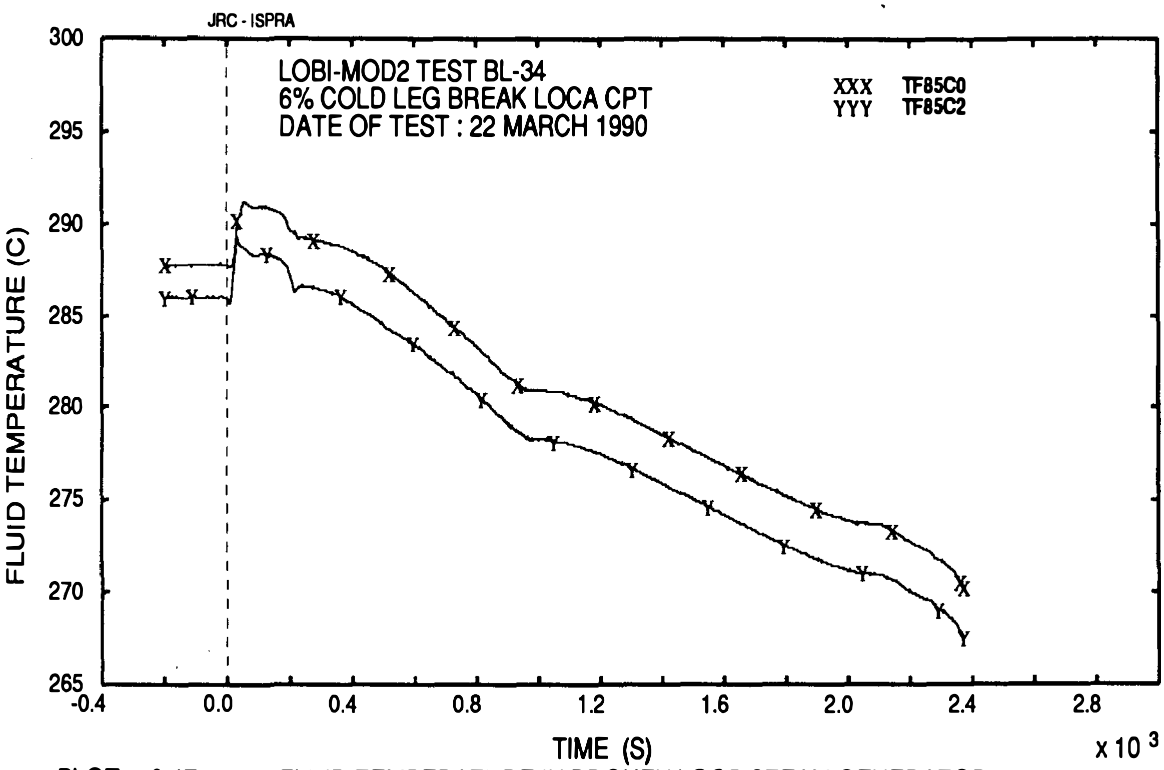
PLOT 6.44 FLUID TEMPERATURE IN BROKEN LOOP STEAM GENERATOR
-OUTLET PRIMARY SIDE (TF82A)-
-U-TUBE, LOWER PART OF FALLING LEG-



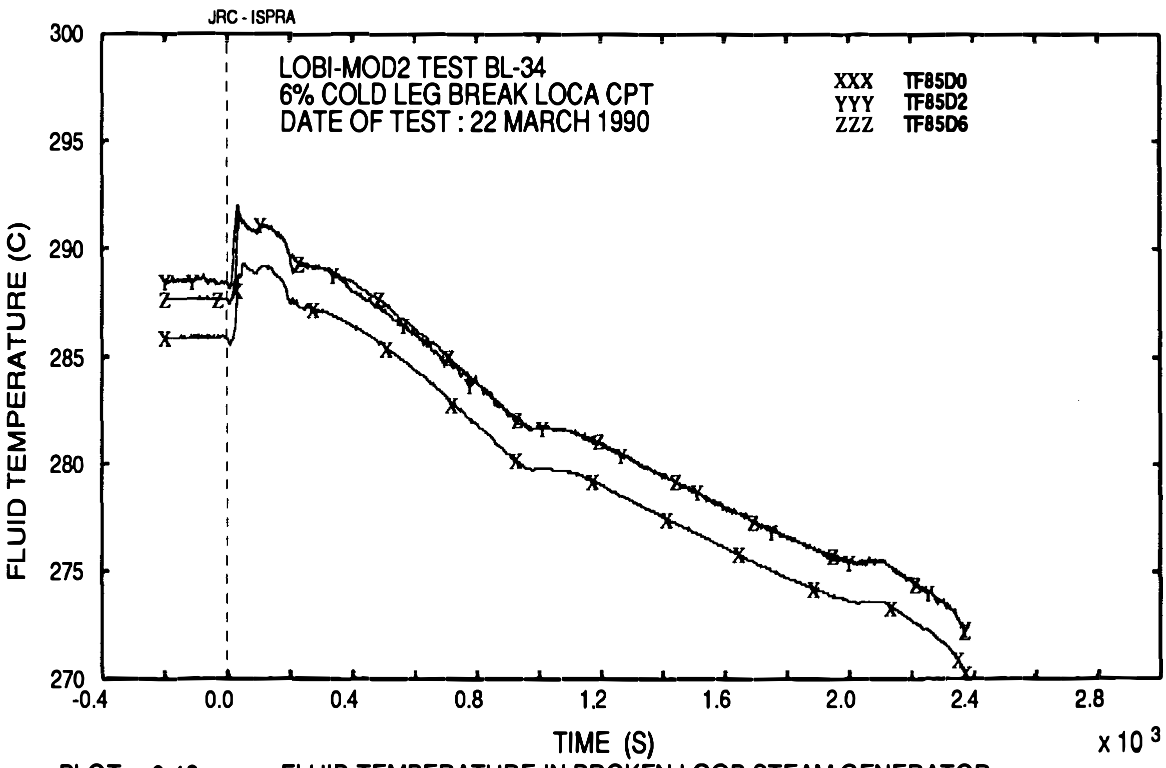
PLOT 6.45 FLUID TEMPERATURE IN BROKEN LOOP STEAM GENERATOR
-DOWNCOMER REGION-



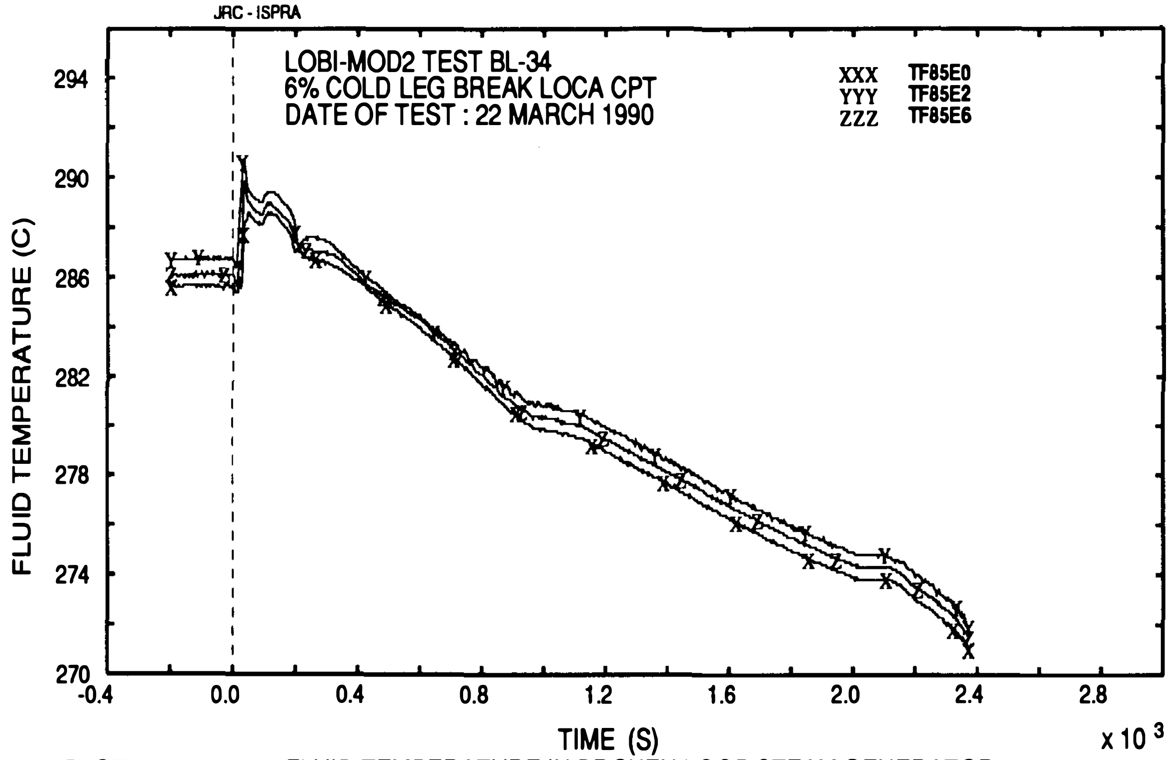
PLOT 6.46 FLUID TEMPERATURE IN BROKEN LOOP STEAM GENERATOR
-RISER REGION, LEVEL B-



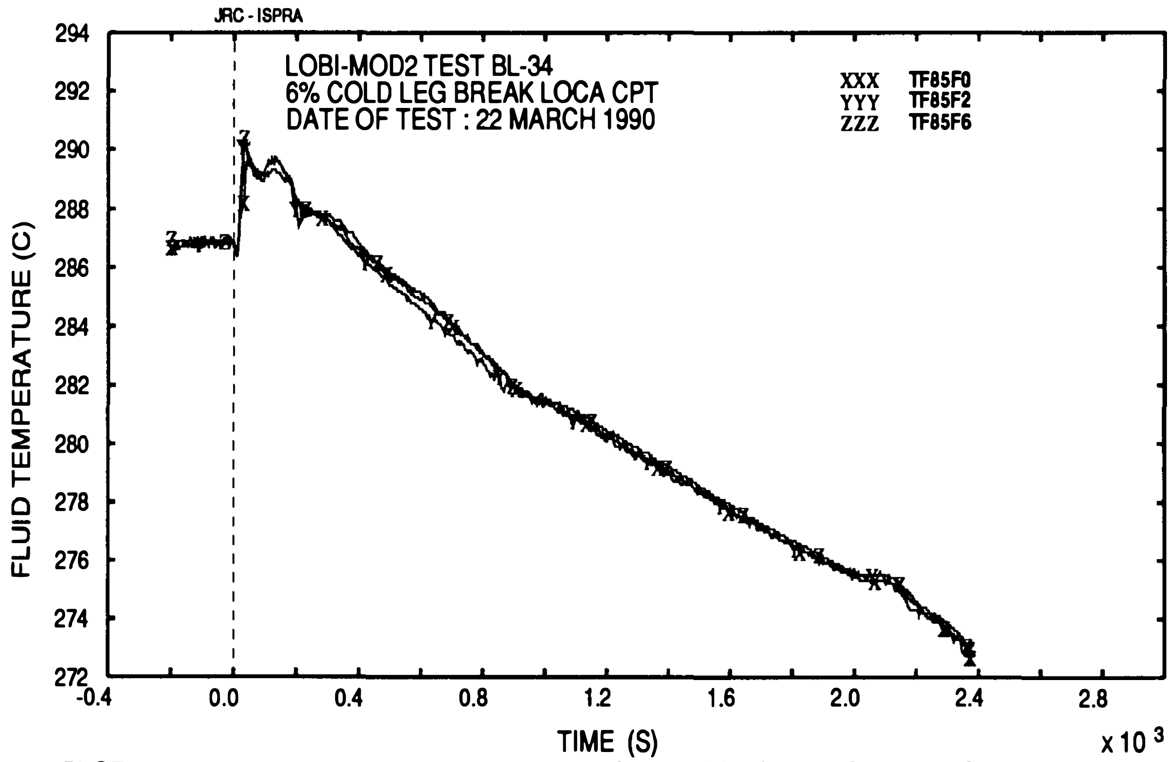
PLOT 6.47 FLUID TEMPERATURE IN BROKEN LOOP STEAM GENERATOR
-RISER REGION, LEVEL C-



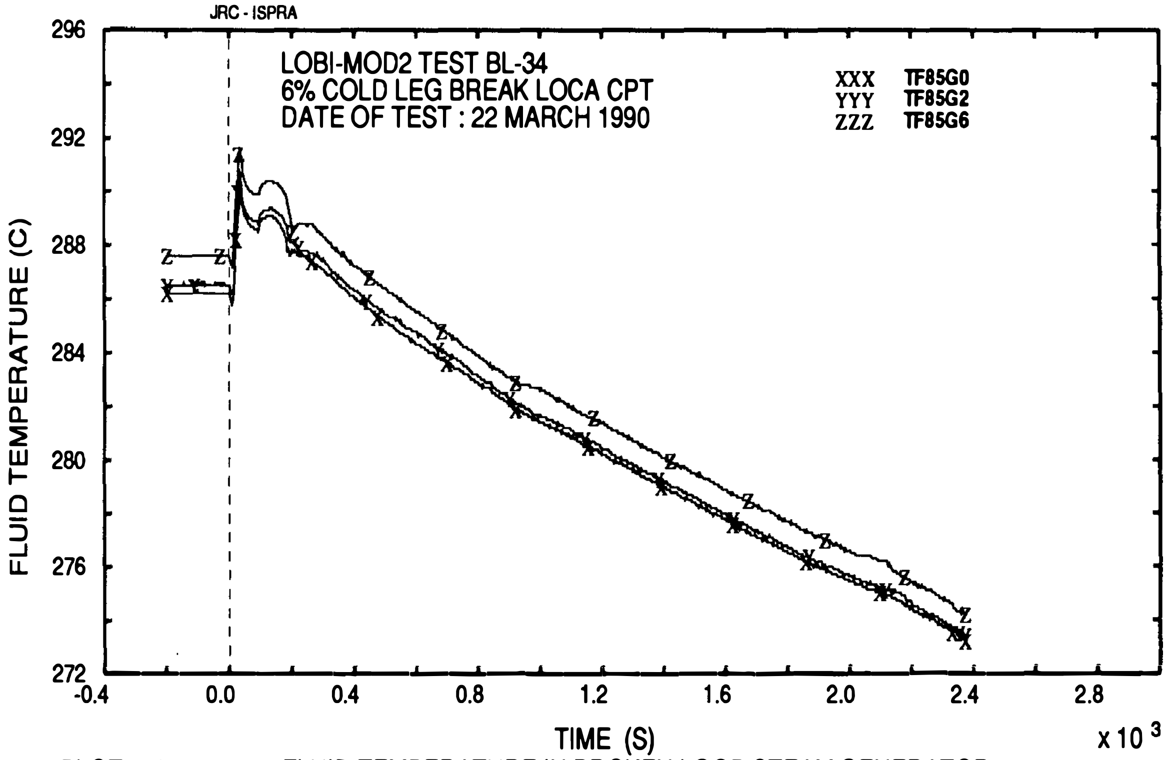
PLOT 6.48 FLUID TEMPERATURE IN BROKEN LOOP STEAM GENERATOR
-RISER REGION, LEVEL D-



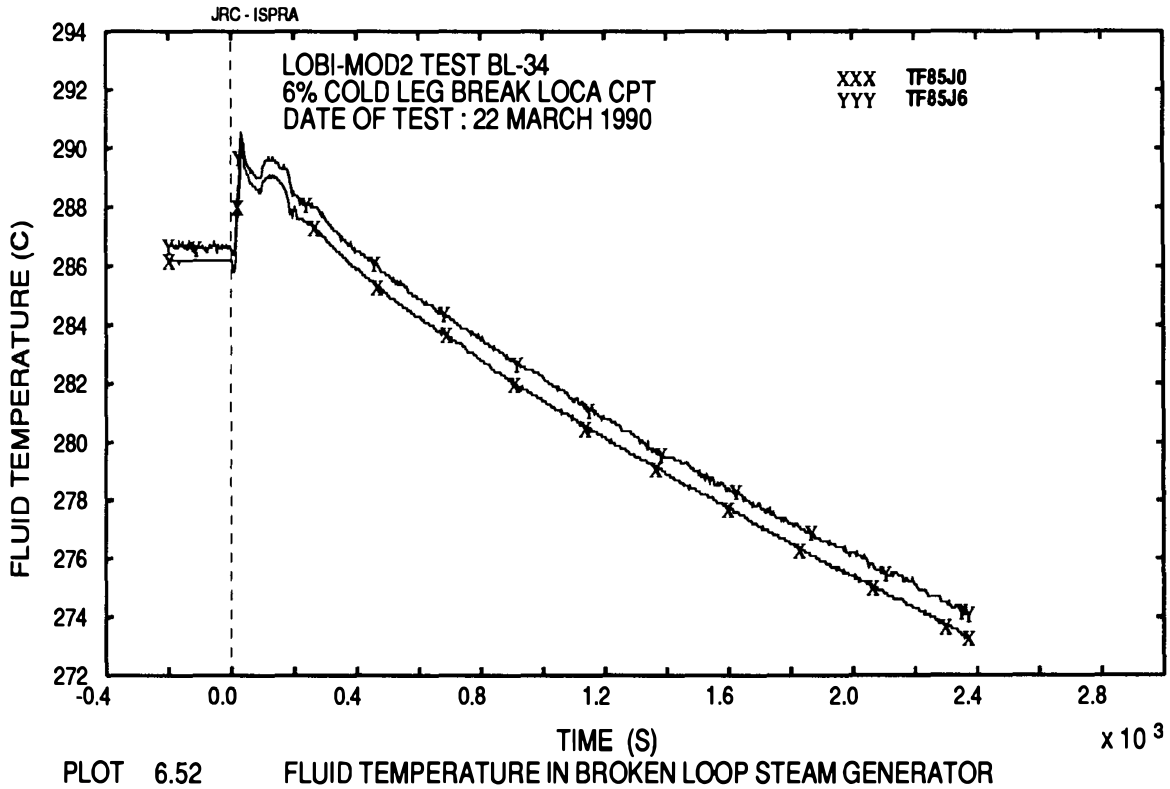
PLOT 6.49 FLUID TEMPERATURE IN BROKEN LOOP STEAM GENERATOR
-RISER REGION, LEVEL E-



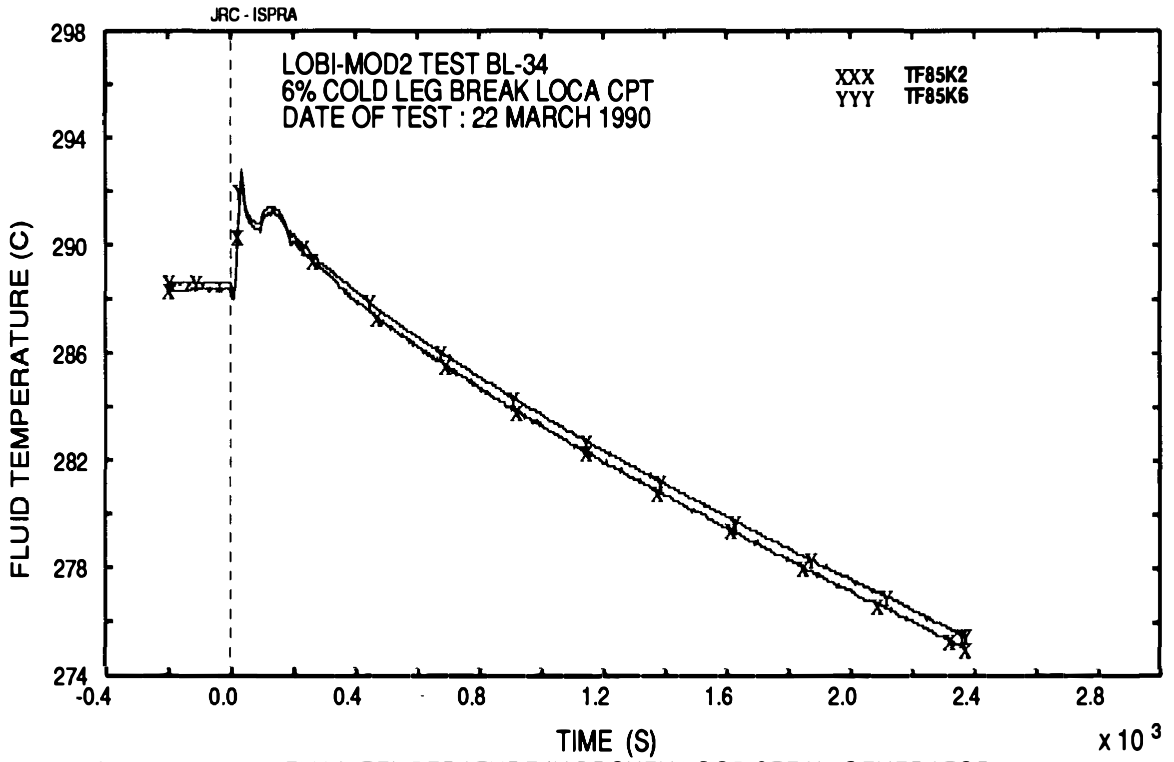
PLOT 6.50 FLUID TEMPERATURE IN BROKEN LOOP STEAM GENERATOR
-RISER REGION, LEVEL F-



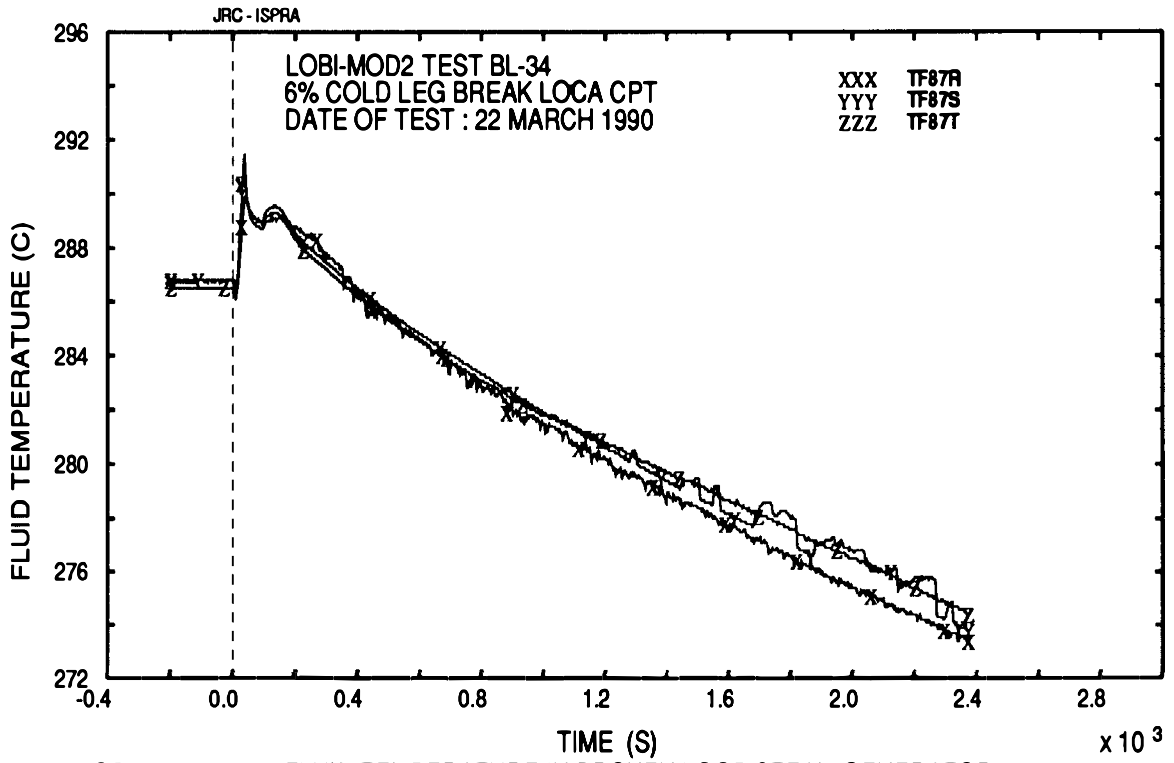
PLOT 6.51 FLUID TEMPERATURE IN BROKEN LOOP STEAM GENERATOR
-RISER REGION, LEVEL G-



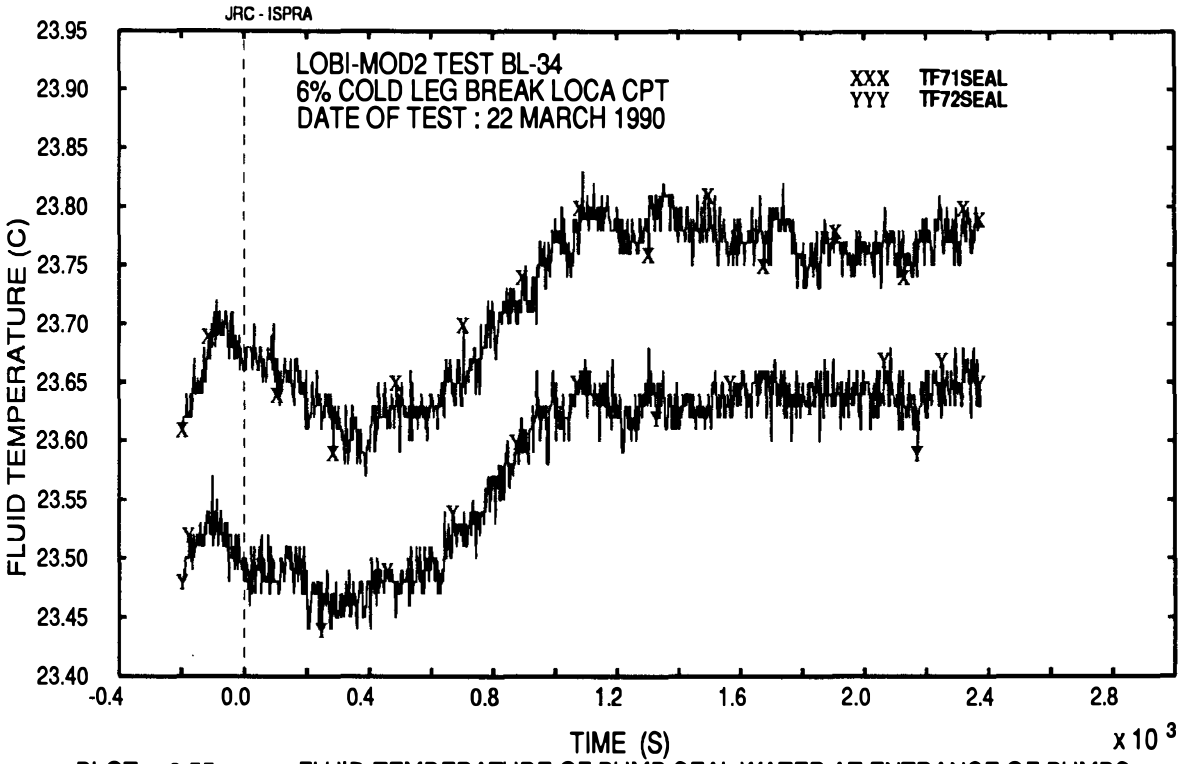
PLOT 6.52 FLUID TEMPERATURE IN BROKEN LOOP STEAM GENERATOR
-RISER REGION, LEVEL J-



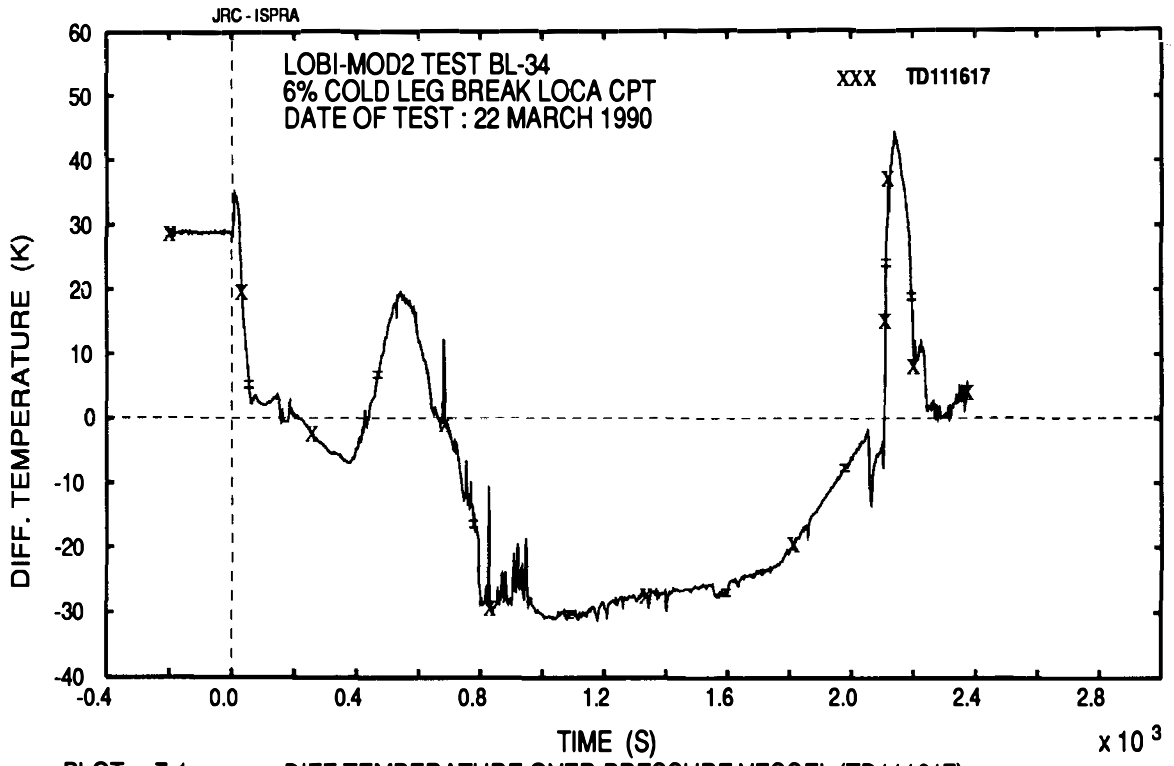
PLOT 6.53 FLUID TEMPERATURE IN BROKEN LOOP STEAM GENERATOR -RISER REGION, LEVEL K-



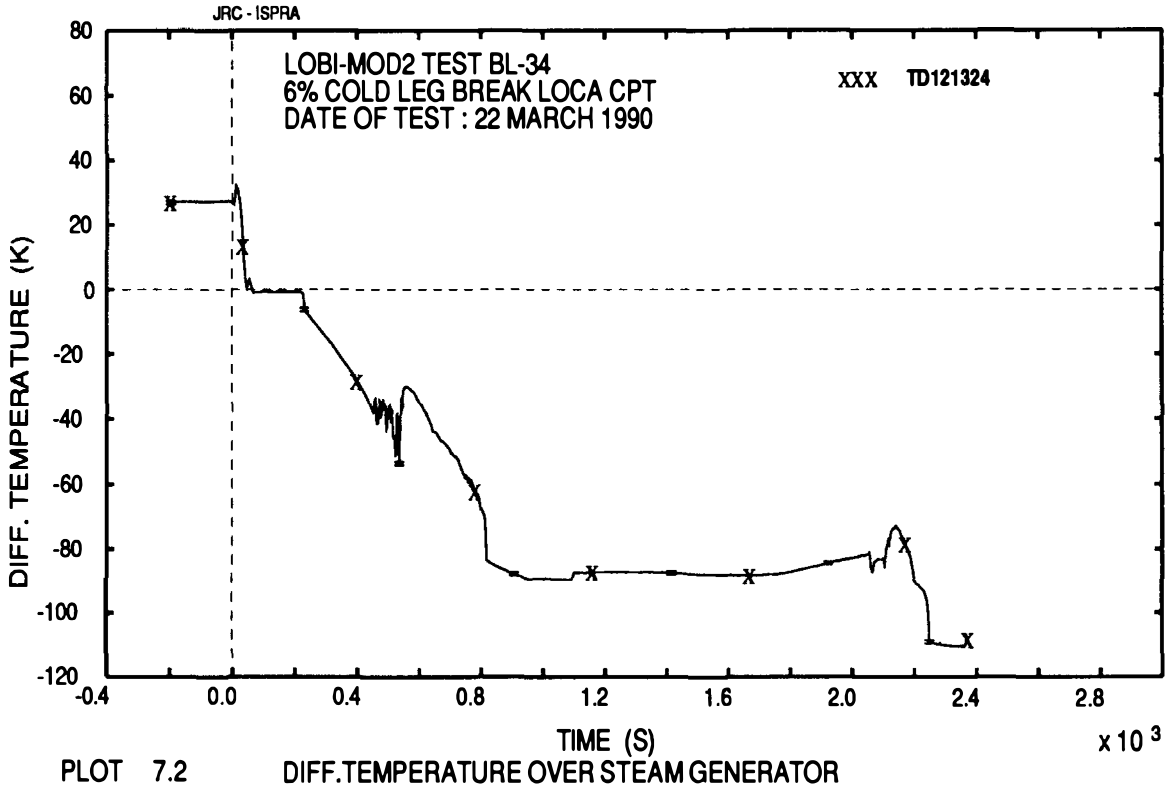
PLOT 6.54 FLUID TEMPERATURE IN BROKEN LOOP STEAM GENERATOR -STEAM DOME-



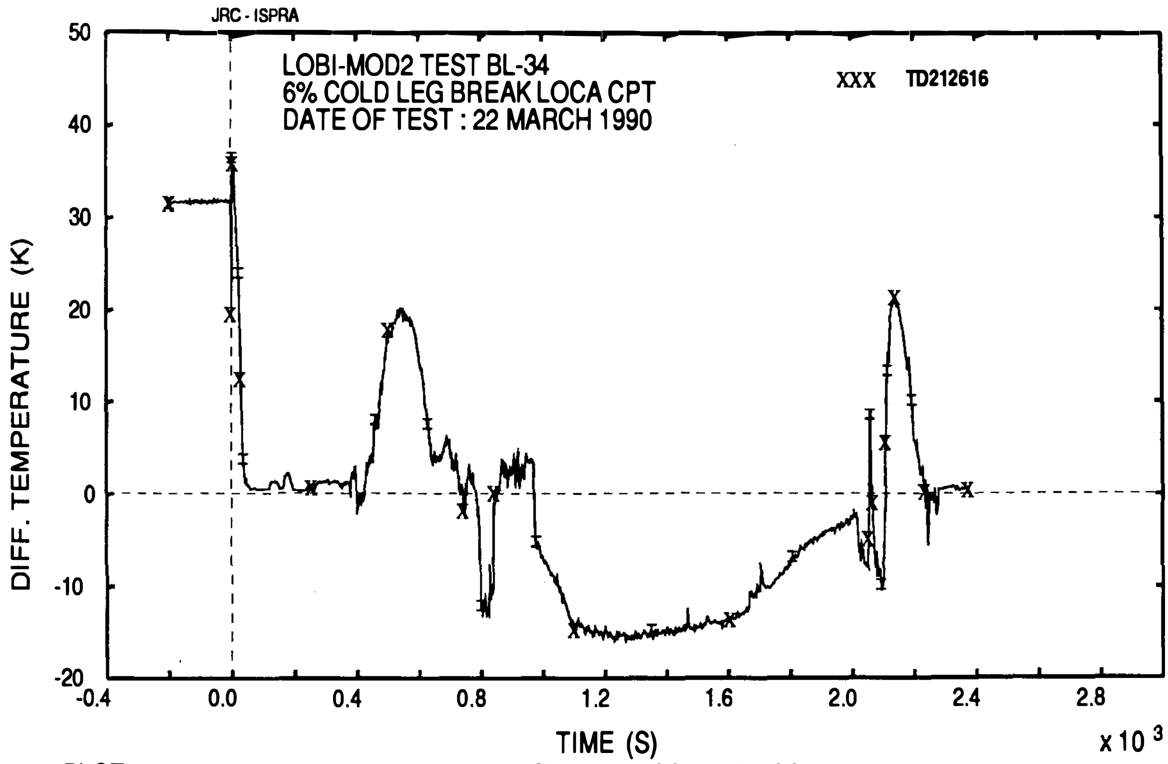
PLOT 6.55 FLUID TEMPERATURE OF PUMP SEAL WATER AT ENTRANCE OF PUMPS
-INTACT LOOP PUMP (TF71SEAL)-
-BROKEN LOOP PUMP (TF72SEAL)-



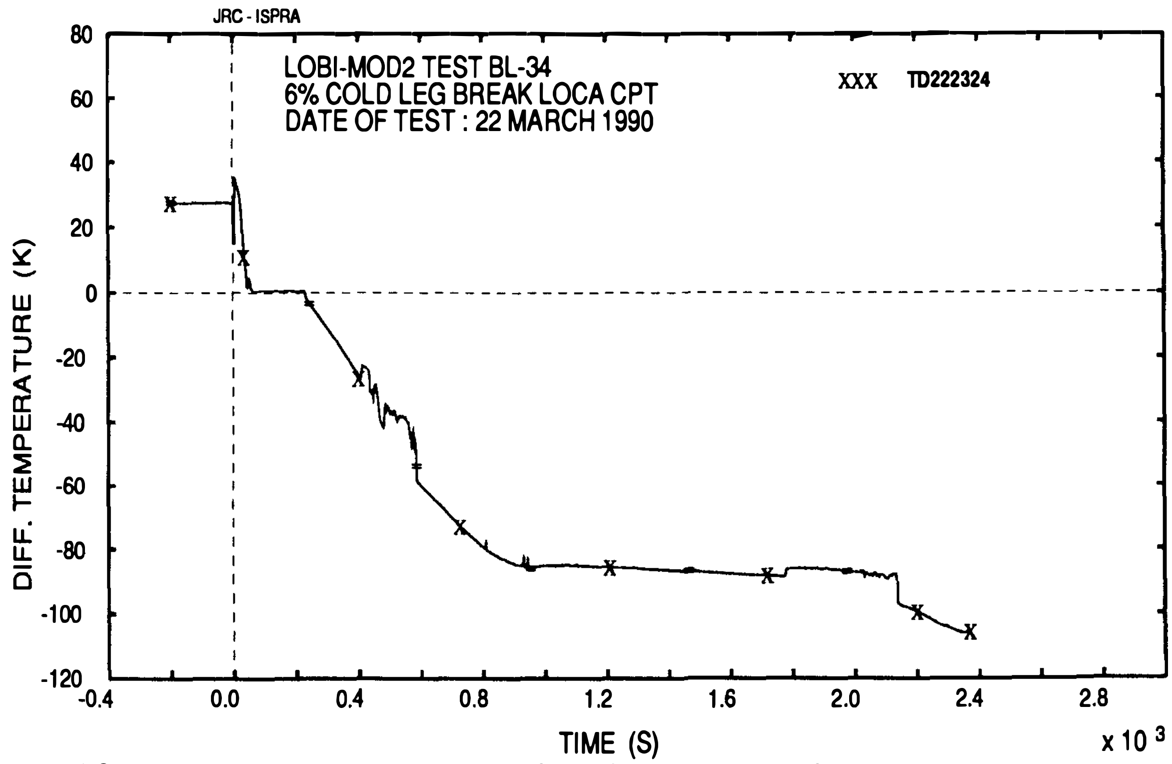
PLOT 7.1 DIFF.TEMPERATURE OVER PRESSURE VESSEL (TD111617)
-VESSEL OUTLET/INLET, INTACT LOOP SIDE-



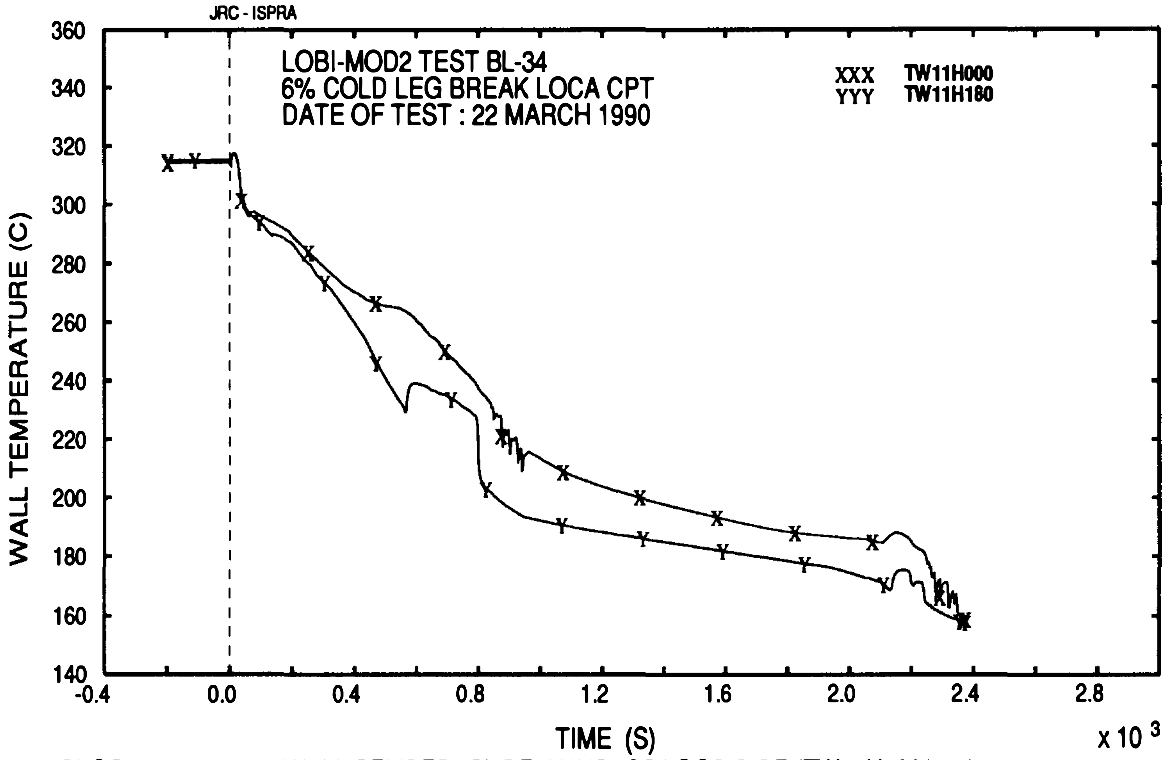
PLOT 7.2 DIFF.TEMPERATURE OVER STEAM GENERATOR
-INTACT LOOP SIDE (TD121324)-



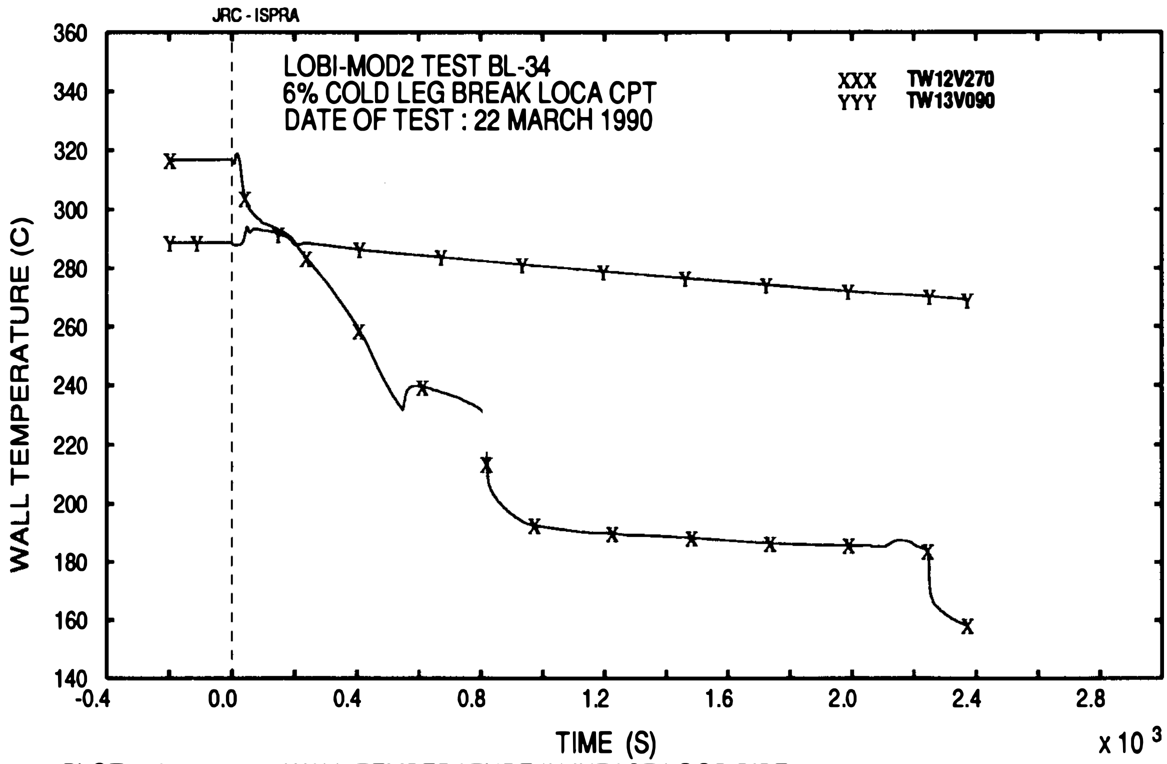
PLOT 7.3 DIFF.TEMPERATURE OVER PRESSURE VESSEL (TD212616)
-VESSEL OUTLET/INLET, BROKEN LOOP SIDE-



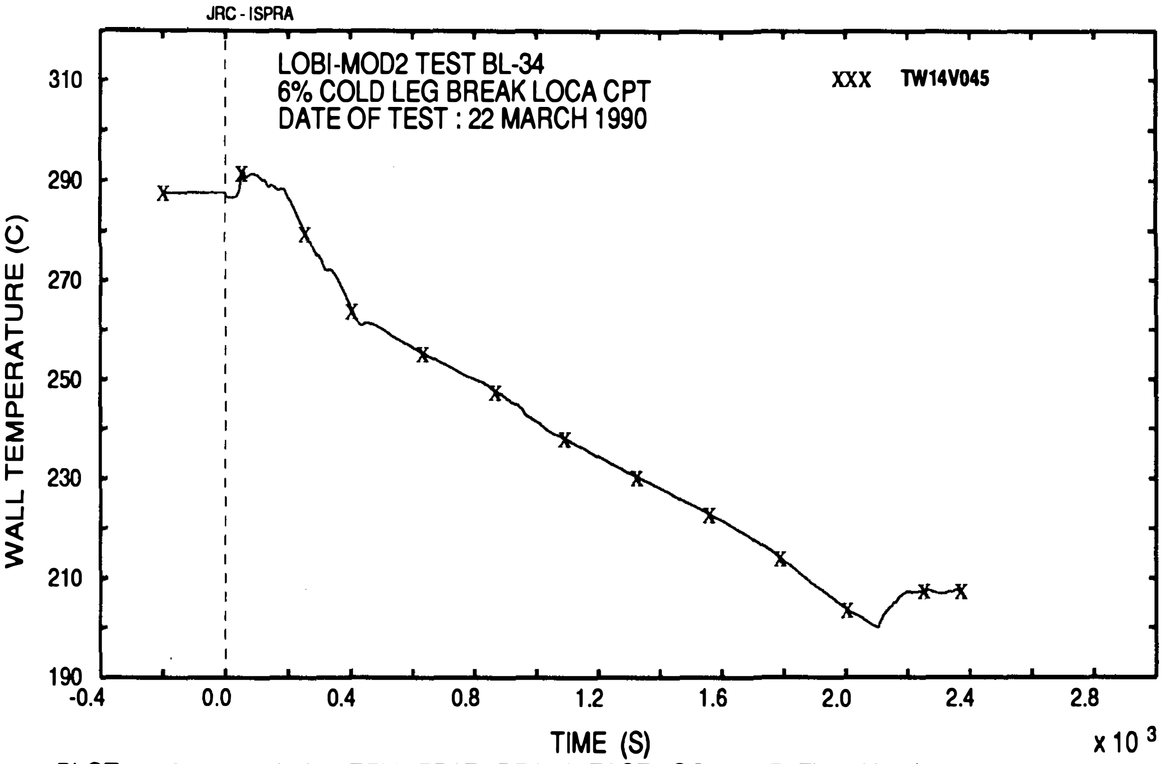
PLOT 7.4 DIFF.TEMPERATURE OVER STEAM GENERATOR
-BROKEN LOOP SIDE (TD222324)-



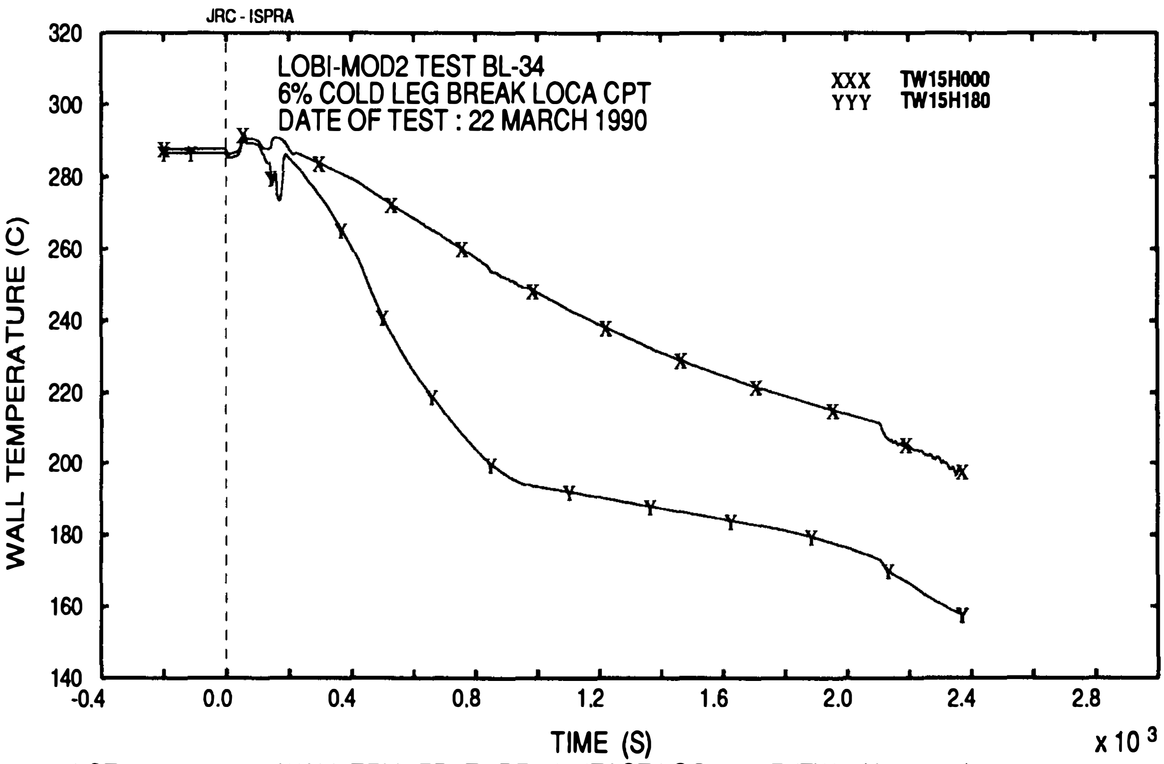
PLOT 8.1 WALL TEMPERATURE IN INTACT LOOP PIPE (TW11H000/180)
-HOT LEG, VESSEL OUTLET SIDE-



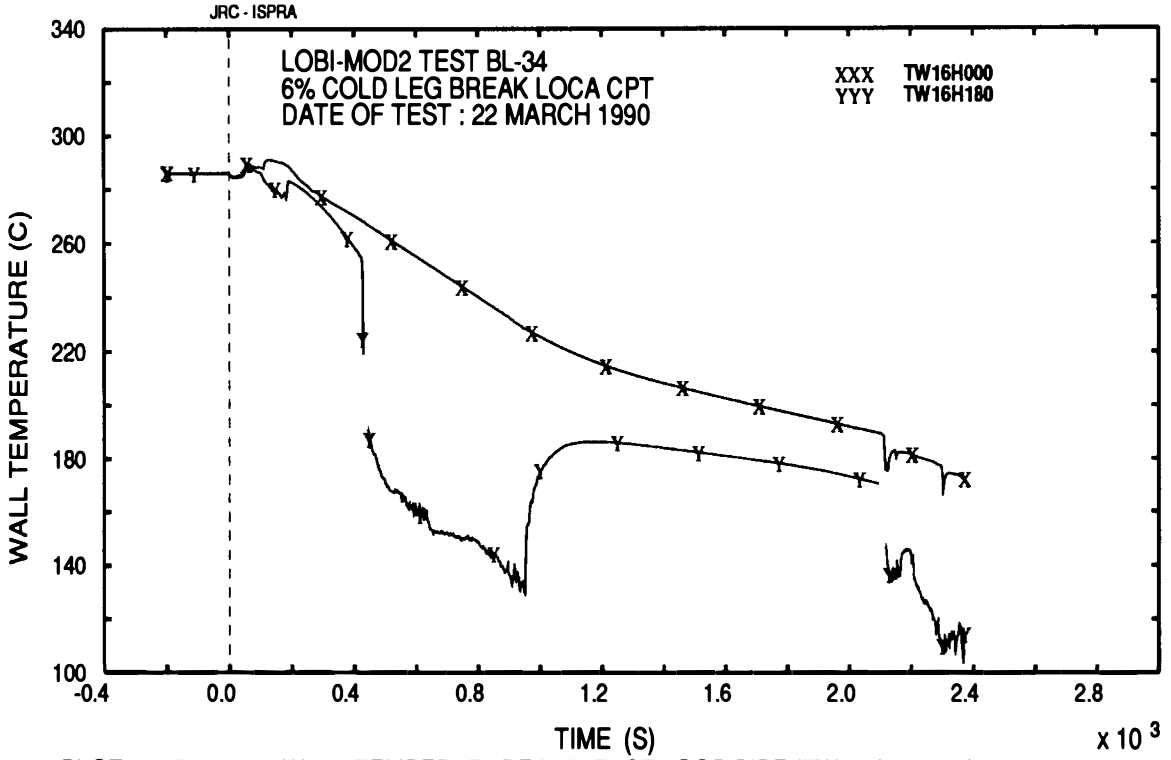
PLOT 8.2 WALL TEMPERATURE IN INTACT LOOP PIPE
-STEAM GENERATOR INLET (TW12V270)-
-STEAM GENERATOR OUTLET (TW13V090)-



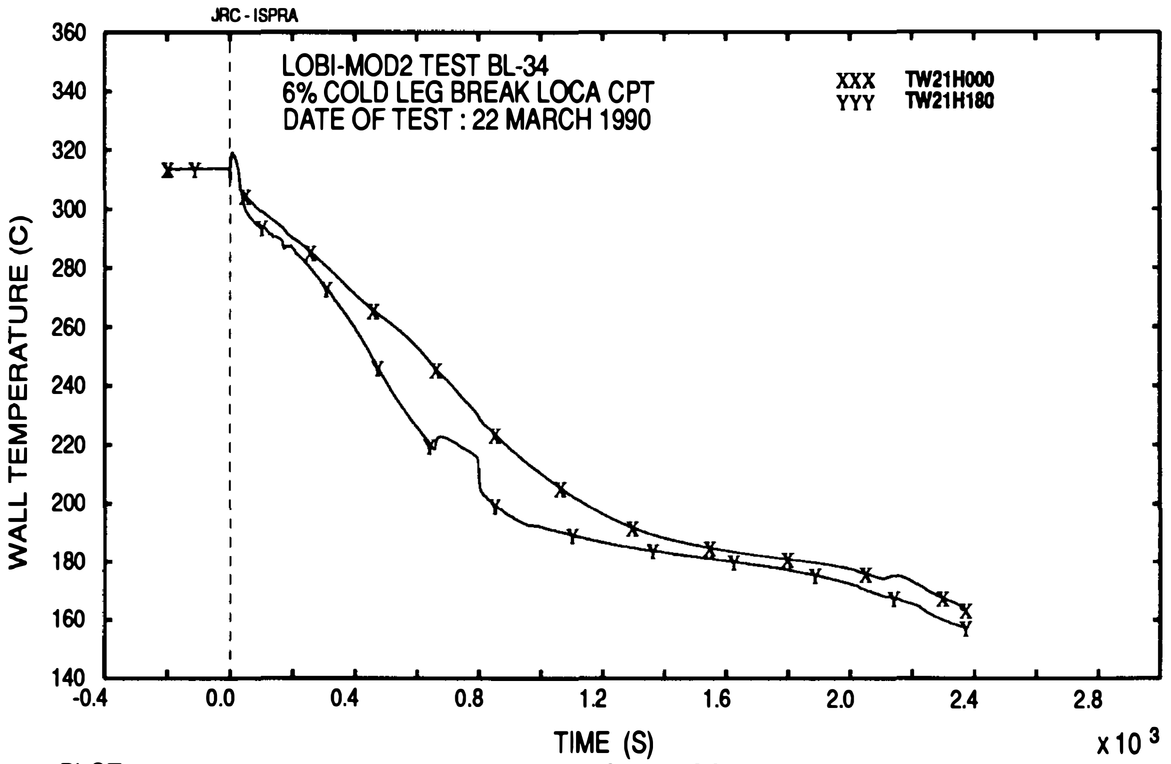
PLOT 8.3 WALL TEMPERATURE IN INTACT LOOP PIPE (TW14V045)
-PUMP INLET-



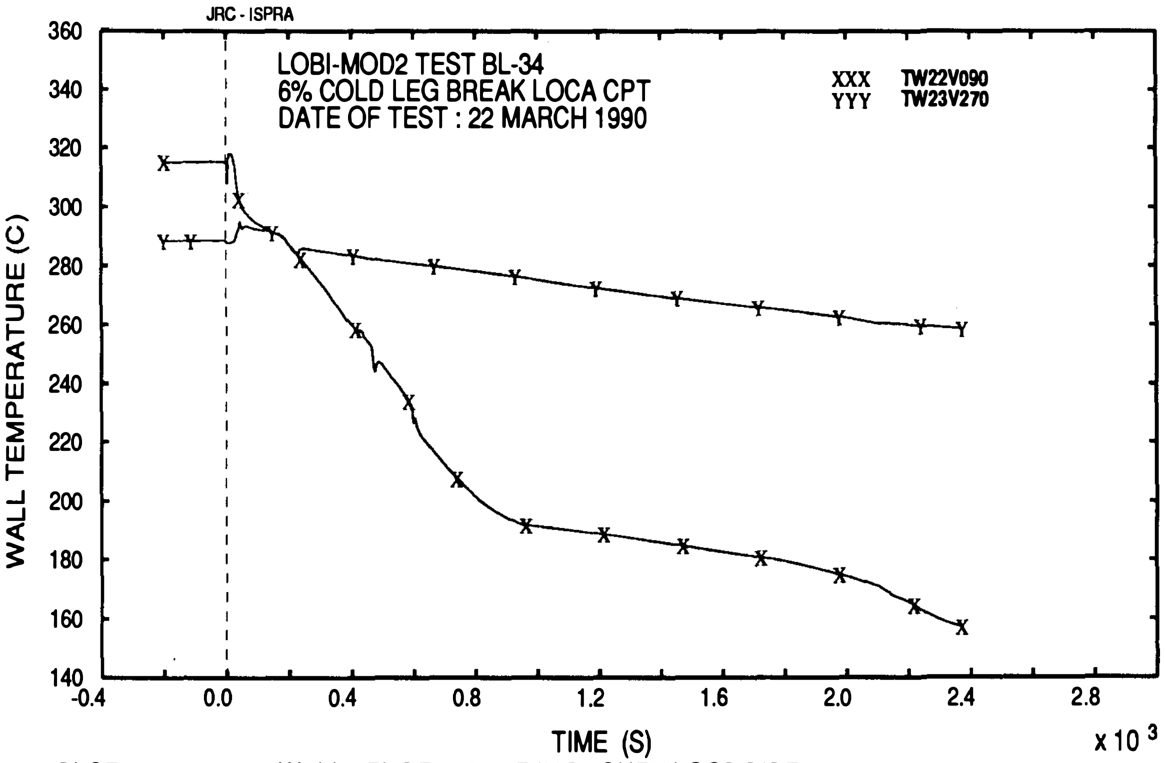
PLOT 8.4 WALL TEMPERATURE IN INTACT LOOP PIPE (TW15H000/180)
-PUMP OUTLET-



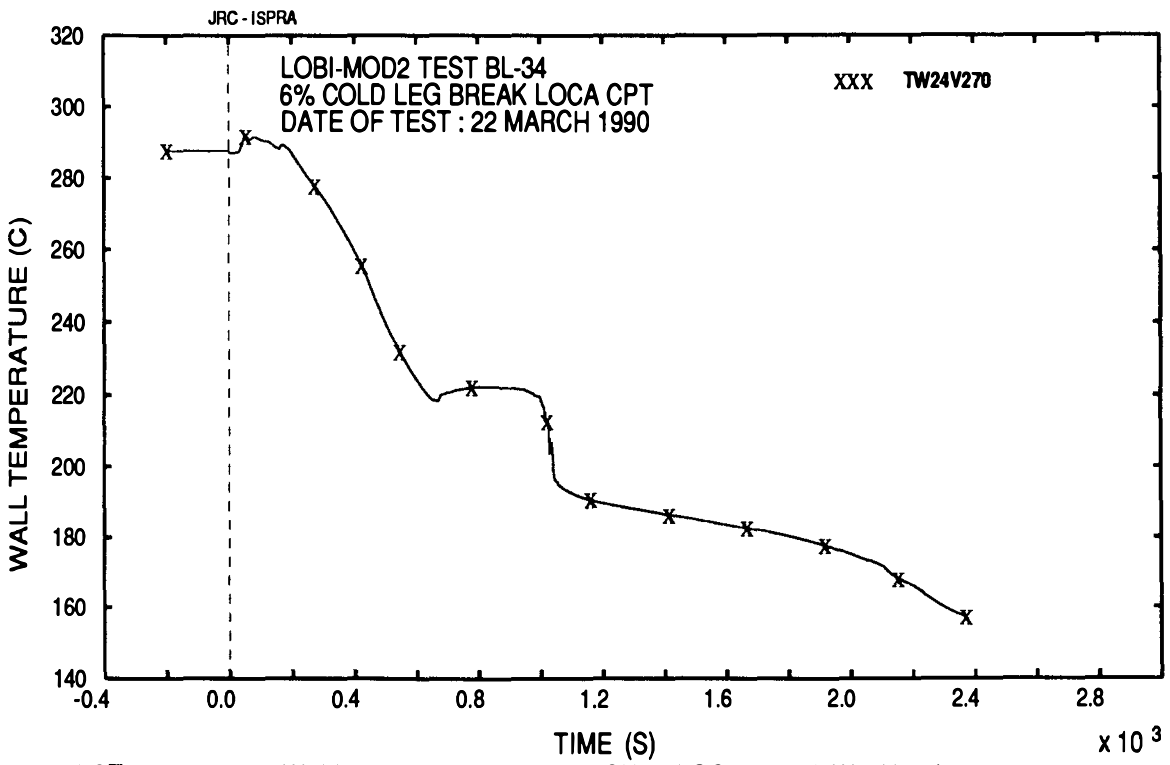
PLOT 8.5 WALL TEMPERATURE IN INTACT LOOP PIPE (TW16H000/180)
-COLD LEG, VESSEL INLET SIDE-



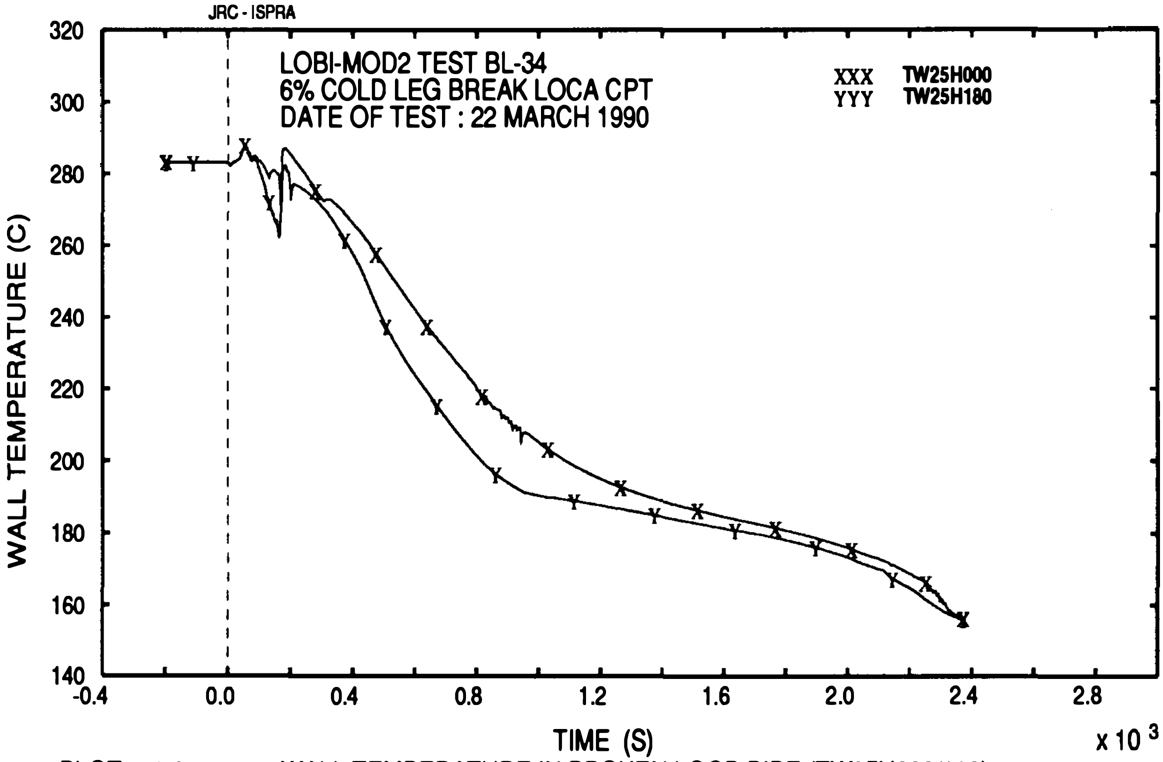
PLOT 8.6 WALL TEMPERATURE IN BROKEN LOOP PIPE (TW21H000/180)
-HOT LEG, VESSEL OUTLET SIDE-



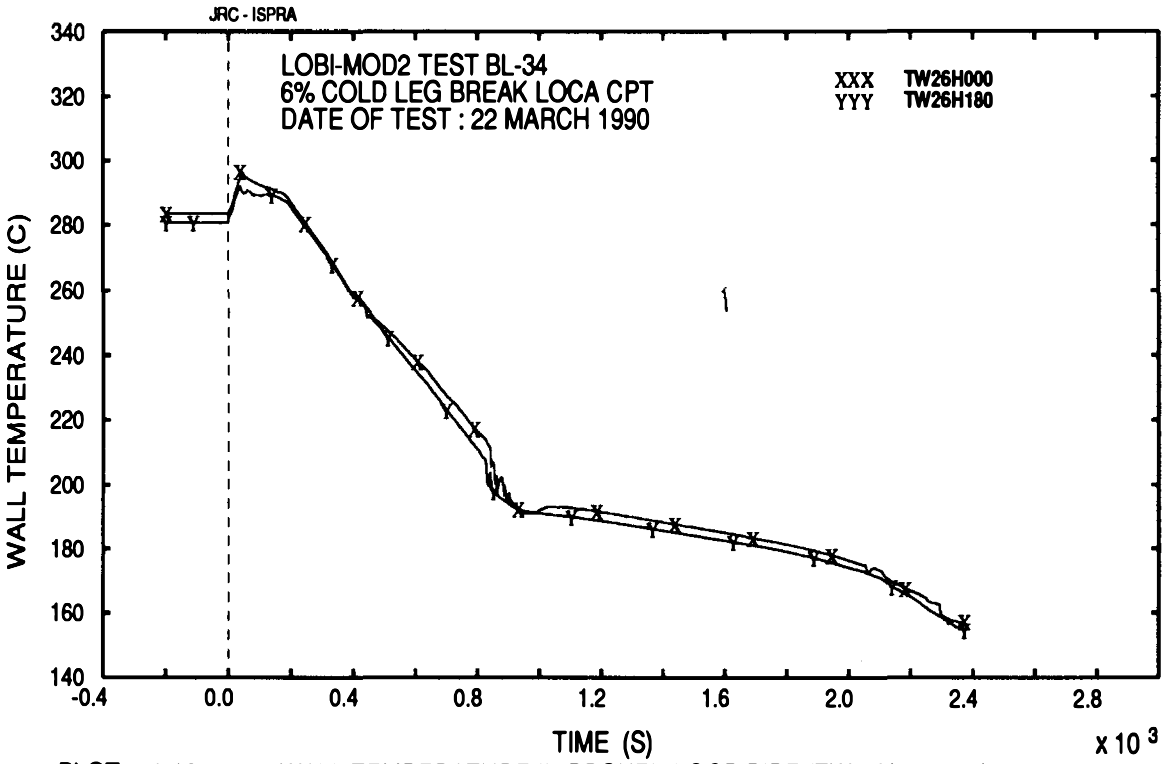
PLOT 8.7 WALL TEMPERATURE IN BROKEN LOOP PIPE
-STEAM GENERATOR INLET (TW22V090)-
-STEAM GENERATOR OUTLET (TW23V270)-



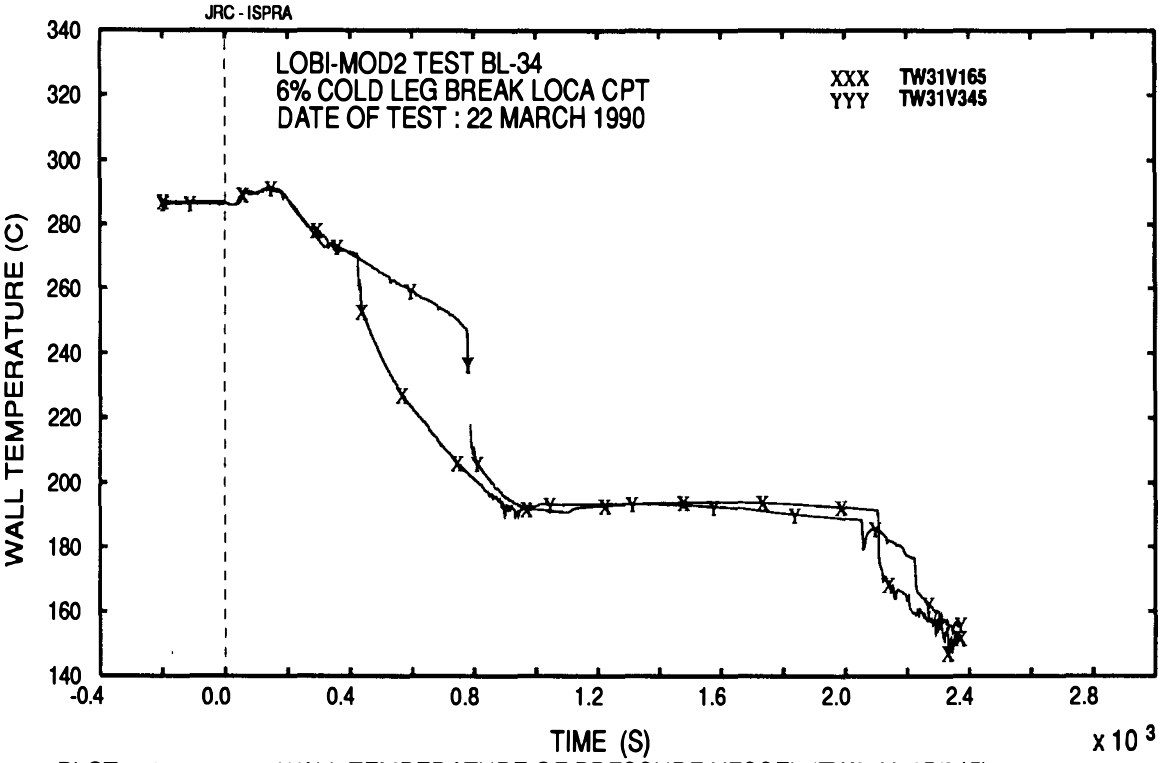
PLOT 8.8 WALL TEMPERATURE IN BROKEN LOOP PIPE (TW24V270)
-PUMP INLET-



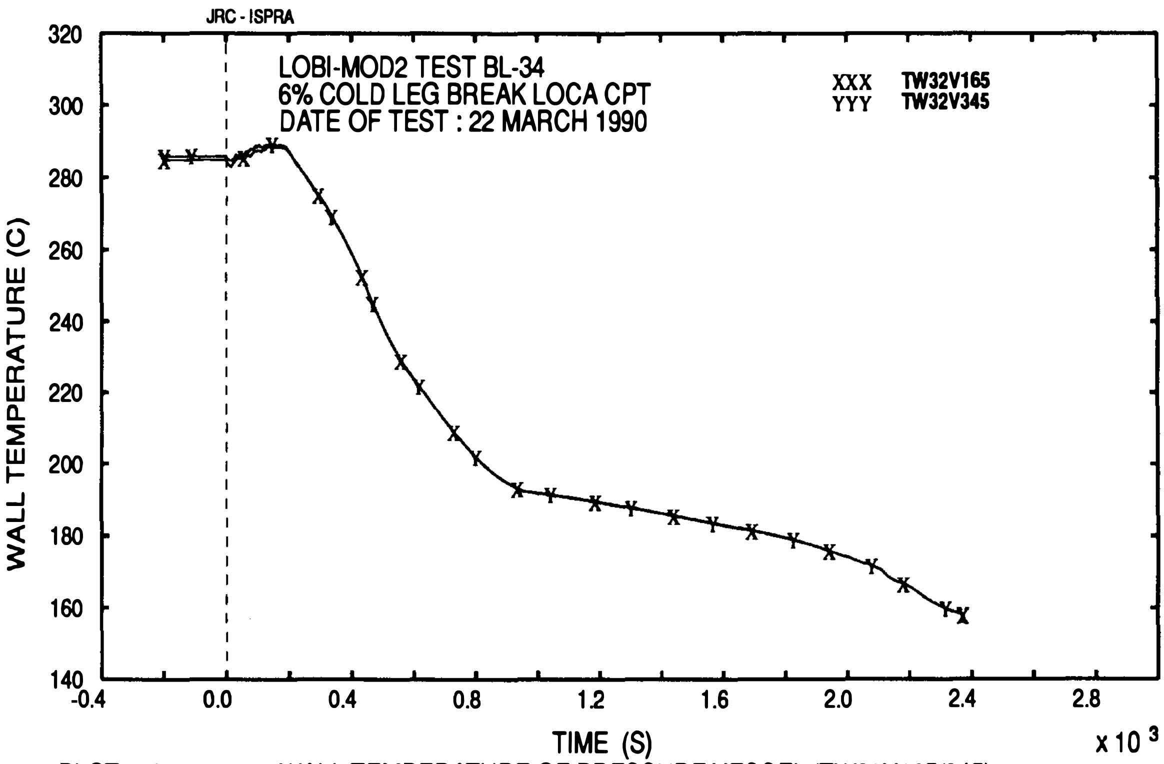
PLOT 8.9 WALL TEMPERATURE IN BROKEN LOOP PIPE (TW25H000/180)
-PUMP OUTLET-



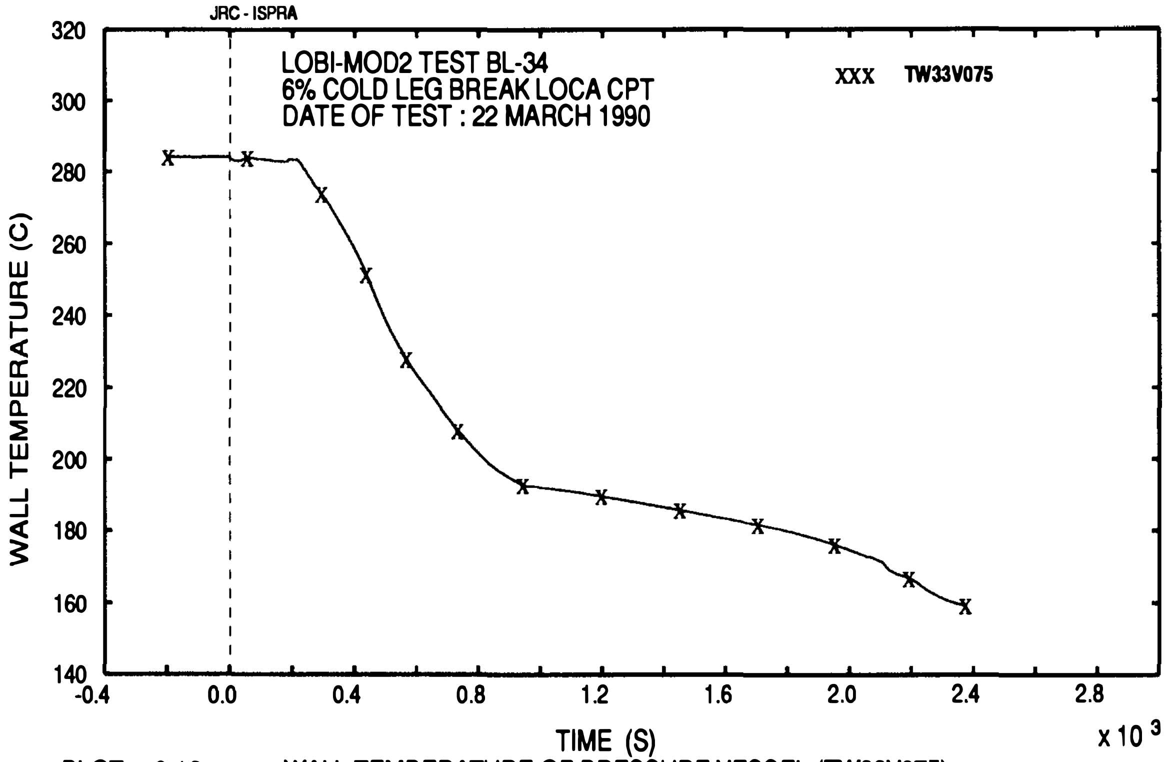
PLOT 8.10 WALL TEMPERATURE IN BROKEN LOOP PIPE (TW26H000/180)
-COLD LEG, VESSEL INLET SIDE-



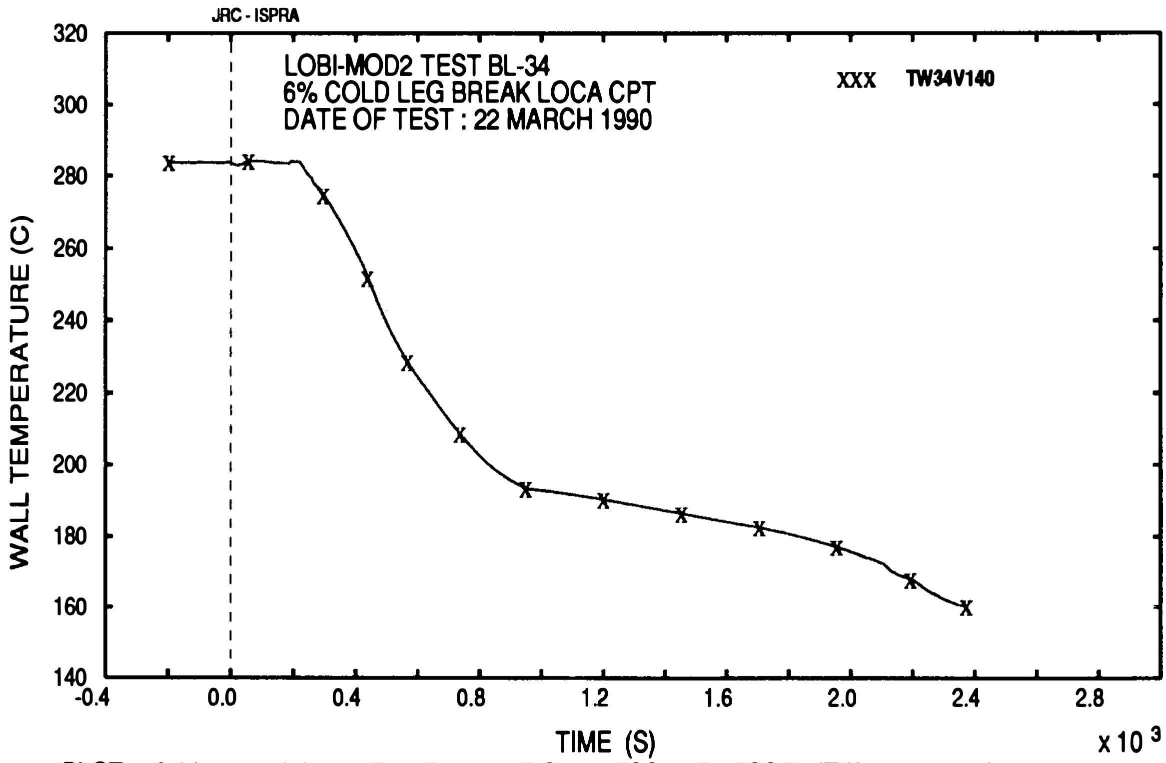
PLOT 8.11 WALL TEMPERATURE OF PRESSURE VESSEL (TW31V165/345)
-INNER SURFACE NEAR DOWNCOMER ENTRANCE-



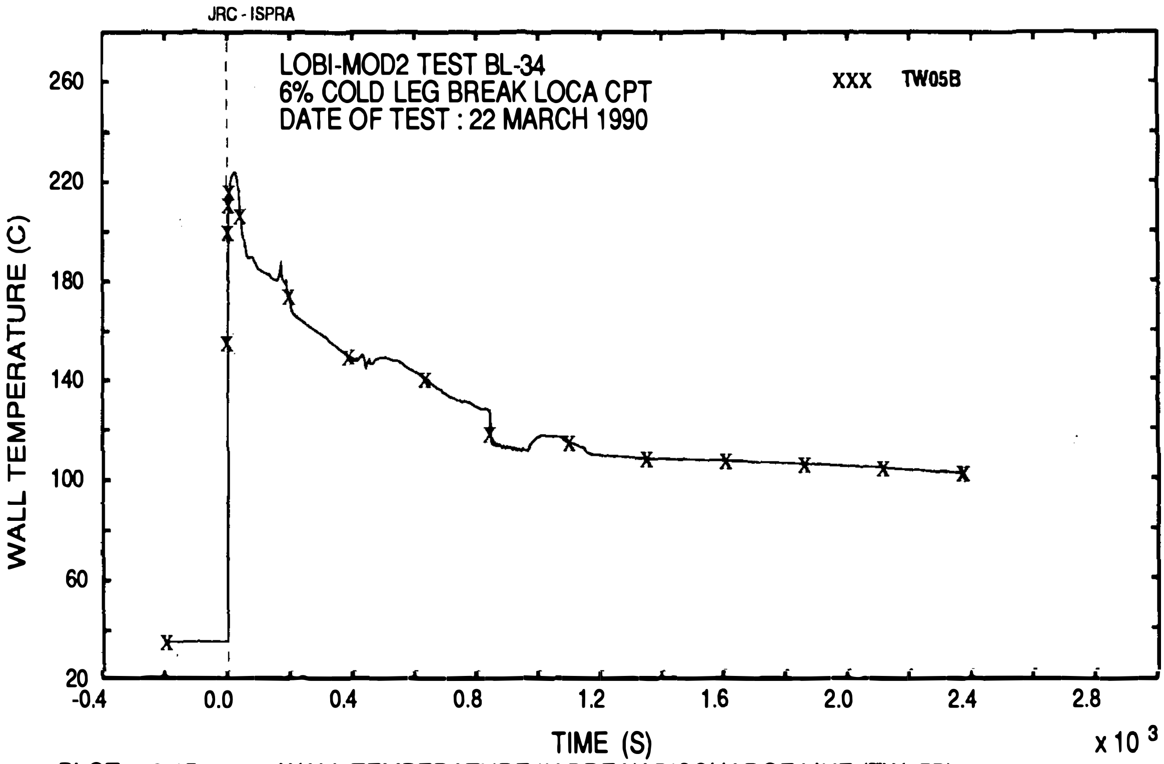
PLOT 8.12 WALL TEMPERATURE OF PRESSURE VESSEL (TW32V165/345)
-INNER SURFACE NEAR DOWNCOMER MIDDLE SECTION-



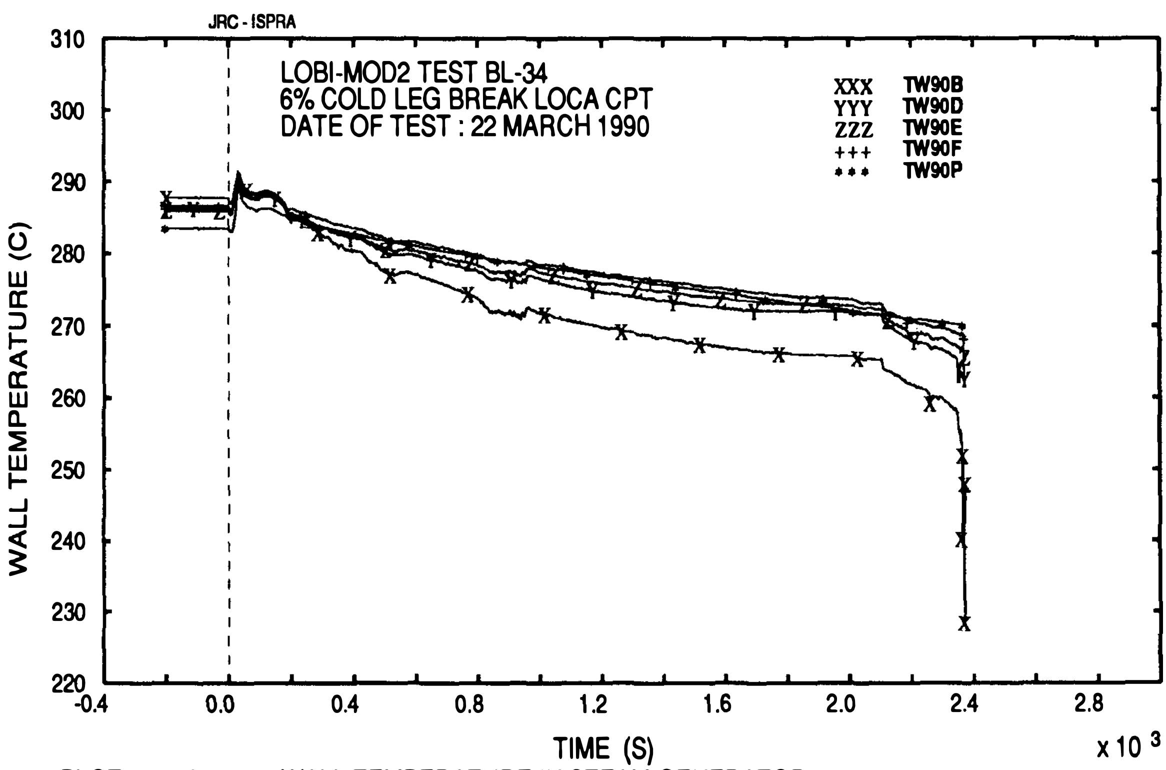
PLOT 8.13 WALL TEMPERATURE OF PRESSURE VESSEL (TW33V075)
-INNER SURFACE NEAR DOWNCOMER OUTLET-



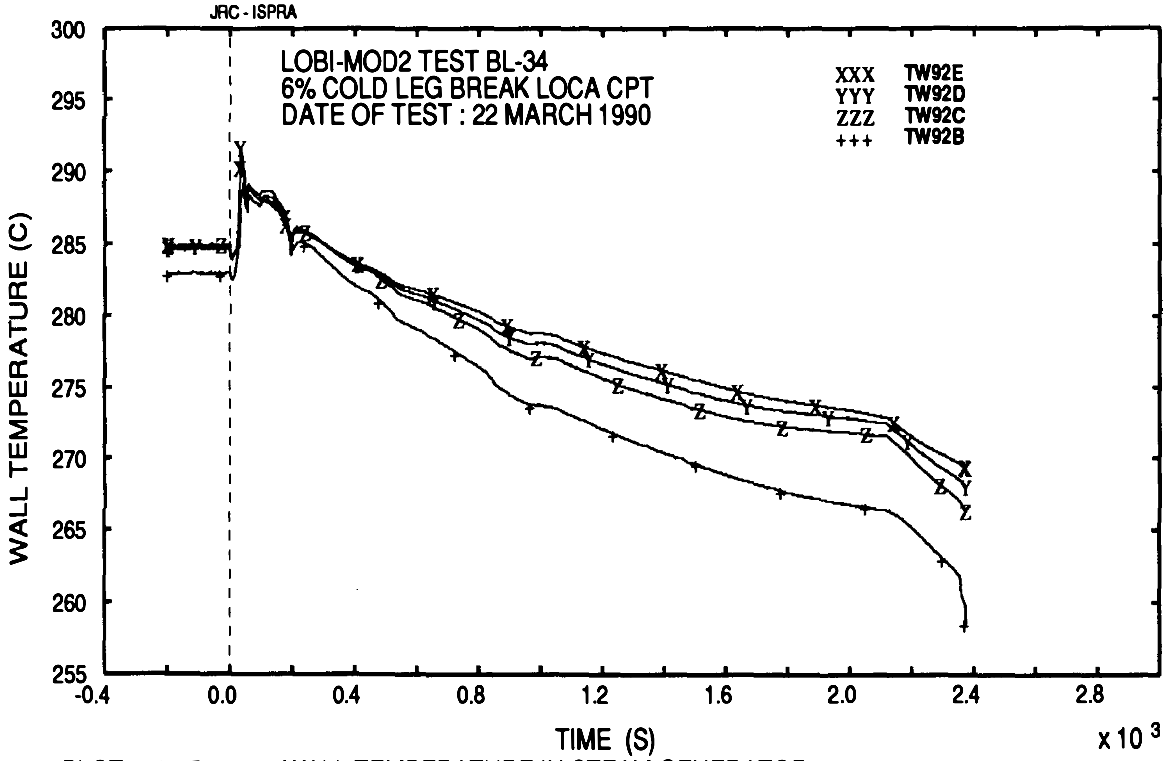
PLOT 8.14 WALL TEMPERATURE OF PRESSURE VESSEL (TW34V320/140)
-INNER SURFACE OF LOWER PLENUM-



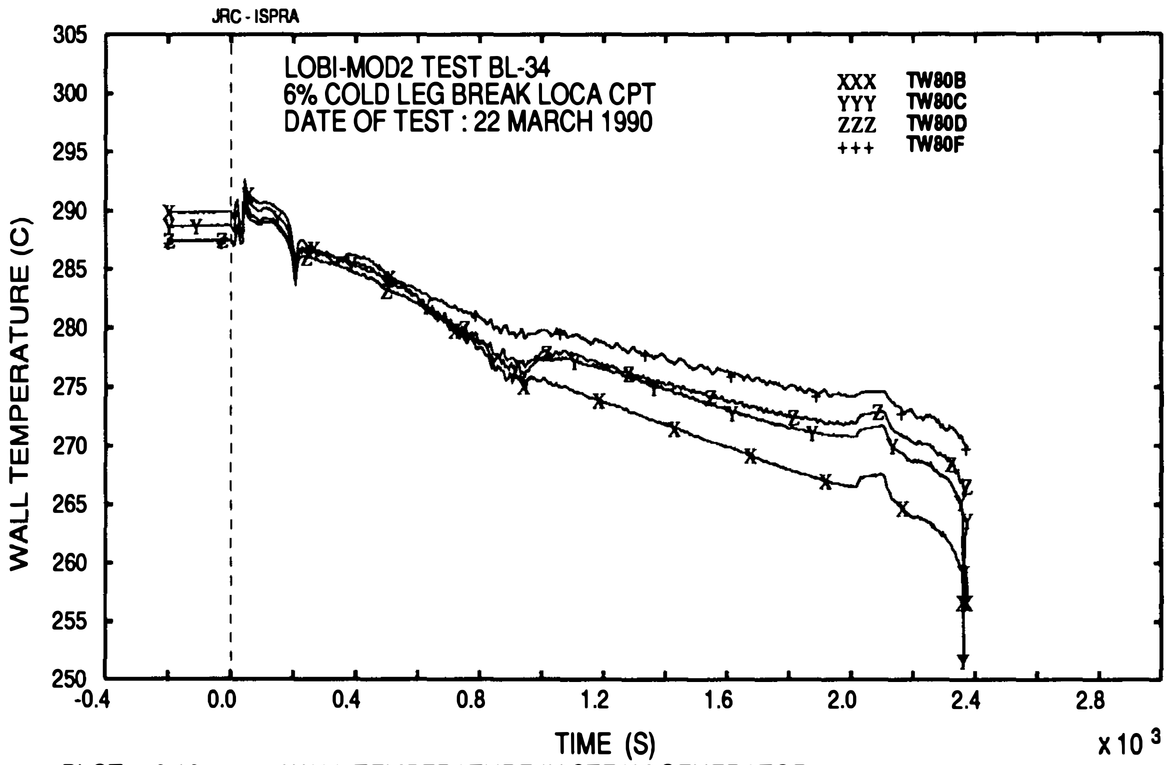
PLOT 8.15 WALL TEMPERATURE IN BREAK DISCHARGE LINE (TW05B)



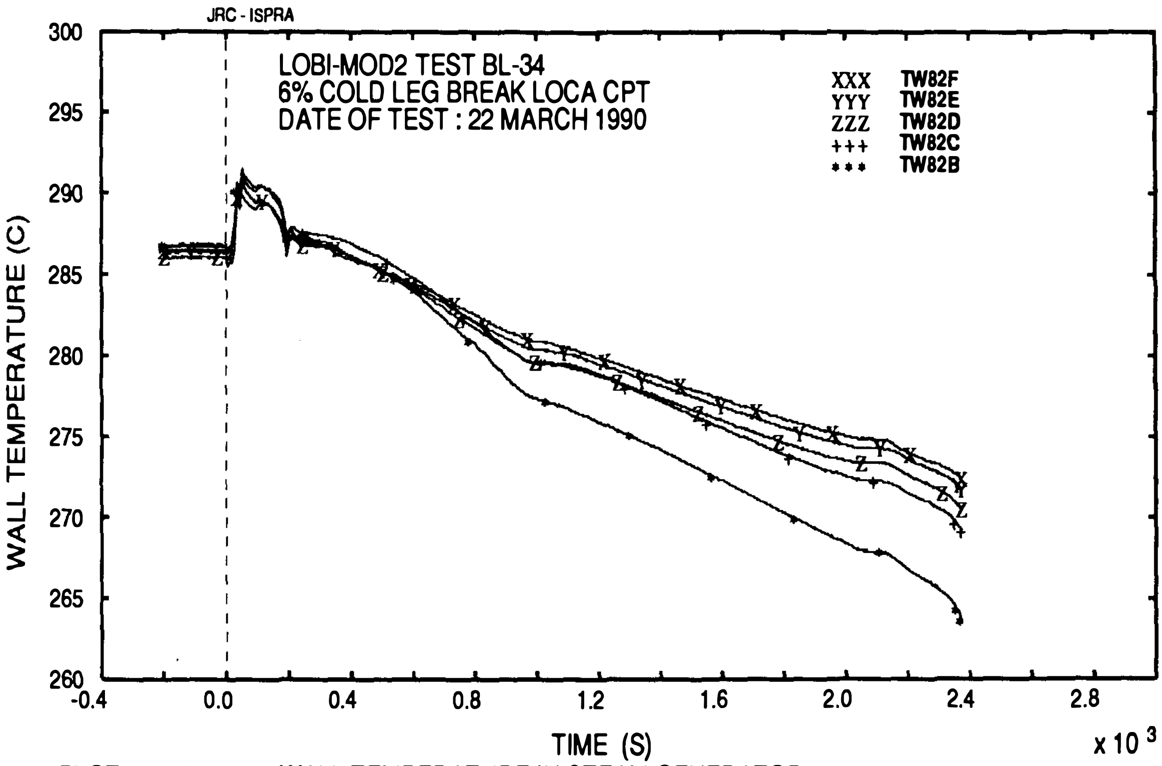
PLOT 8.16 WALL TEMPERATURE IN STEAM GENERATOR
-INTACT LOOP SIDE-
-OUTSIDE SURFACE OF U-TUBE, RISING LEG-



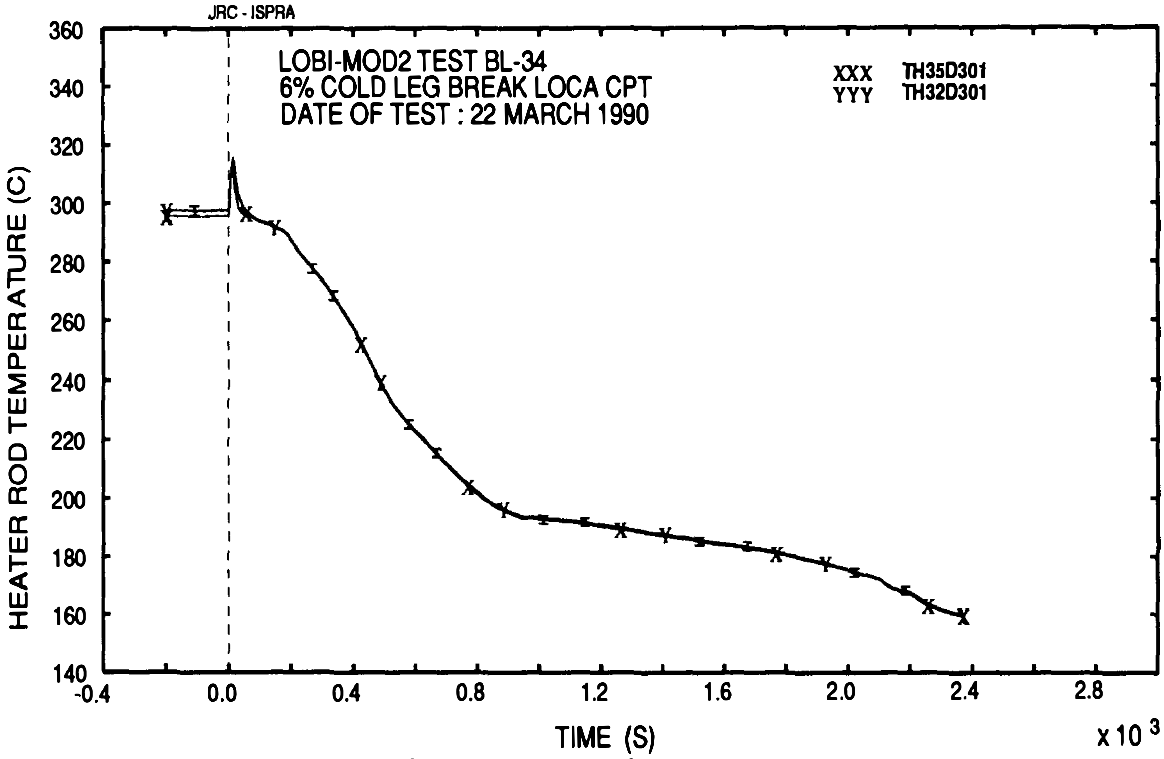
PLOT 8.17 WALL TEMPERATURE IN STEAM GENERATOR
-INTACT LOOP SIDE-
-OUTSIDE SURFACE OF U-TUBE, FALLING LEG-



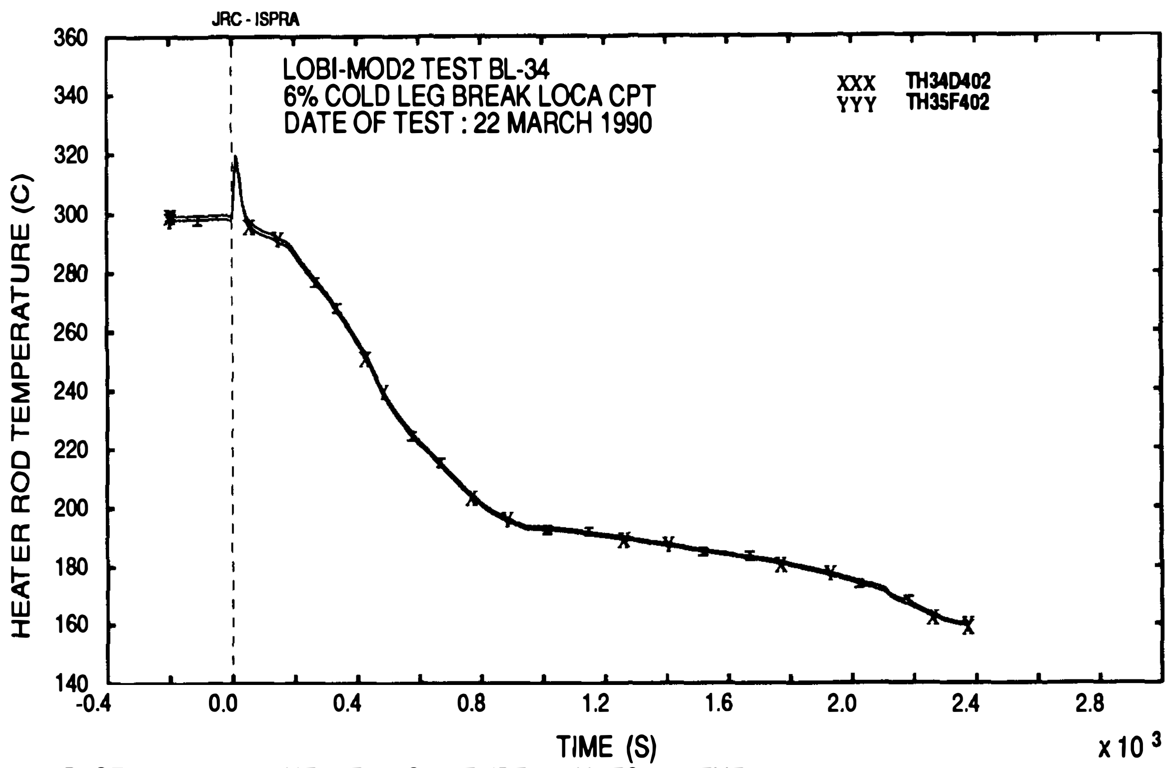
PLOT 8.18 WALL TEMPERATURE IN STEAM GENERATOR
-BROKEN LOOP SIDE-
-OUTSIDE SURFACE OF U-TUBE, RISING LEG-



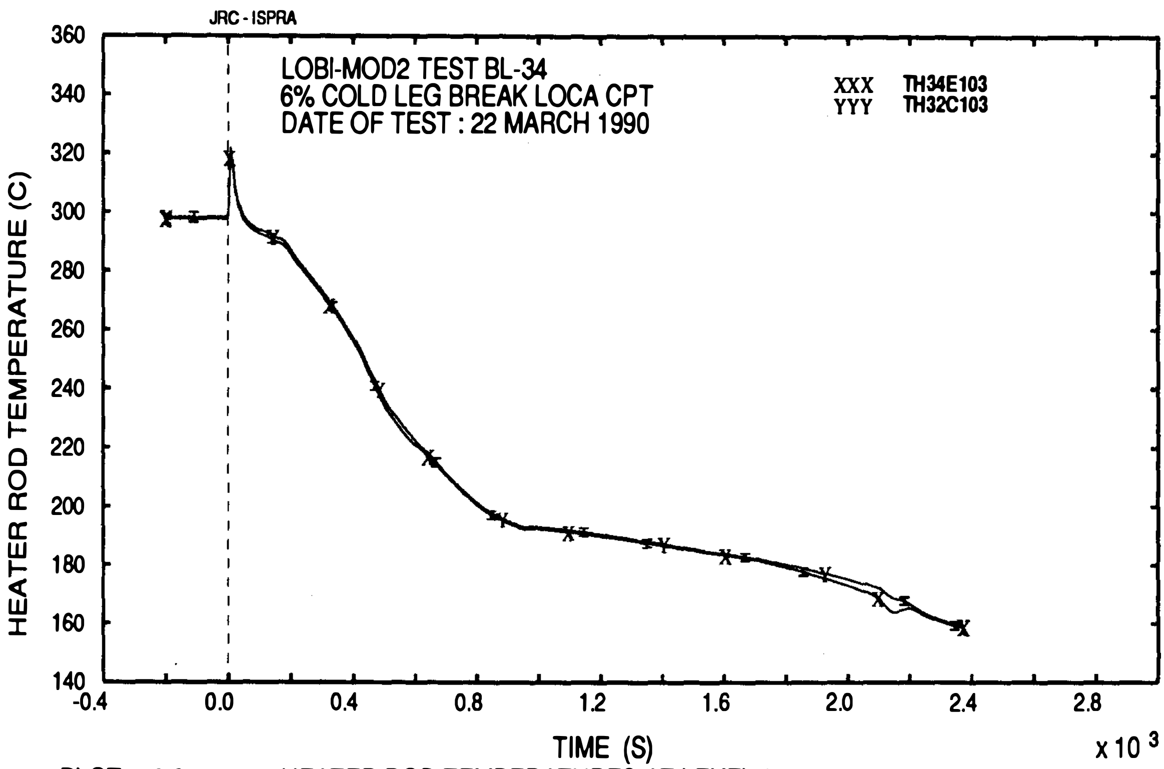
PLOT 8.19 WALL TEMPERATURE IN STEAM GENERATOR
-BROKEN LOOP SIDE-
-OUTSIDE SURFACE OF U-TUBE, FALLING LEG-



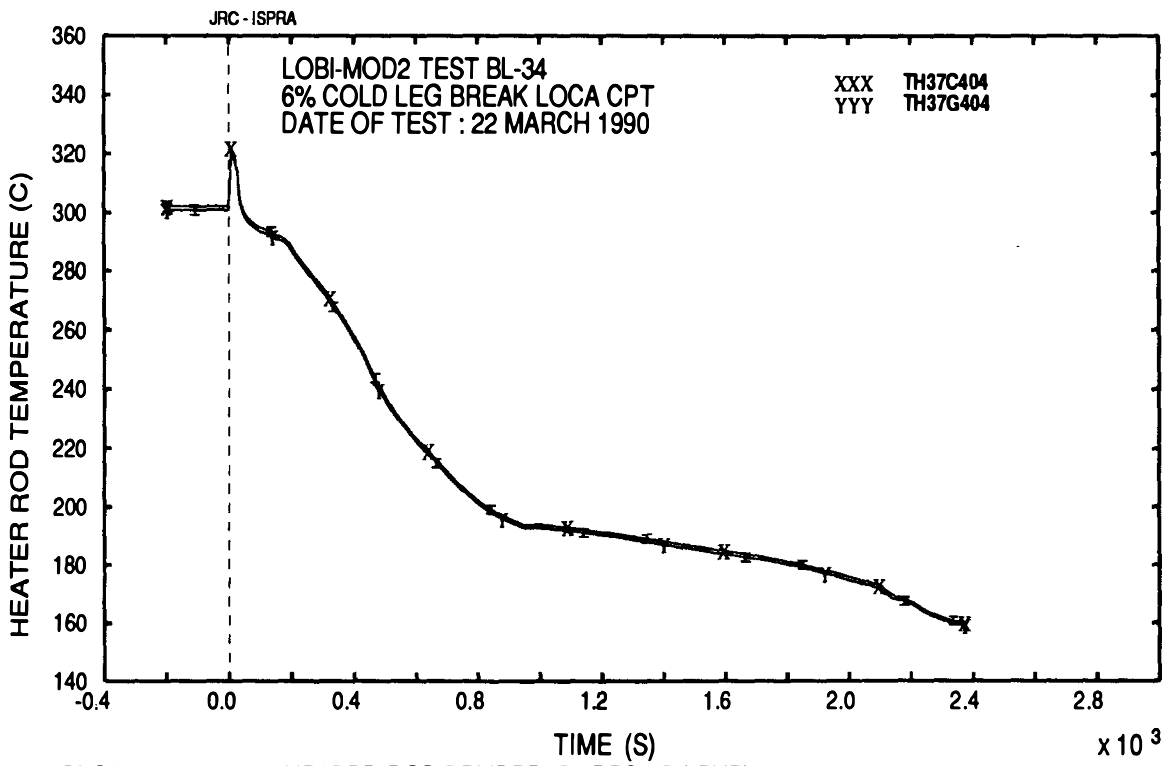
PLOT 9.1 HEATER ROD TEMPERATURES AT LEVEL 1



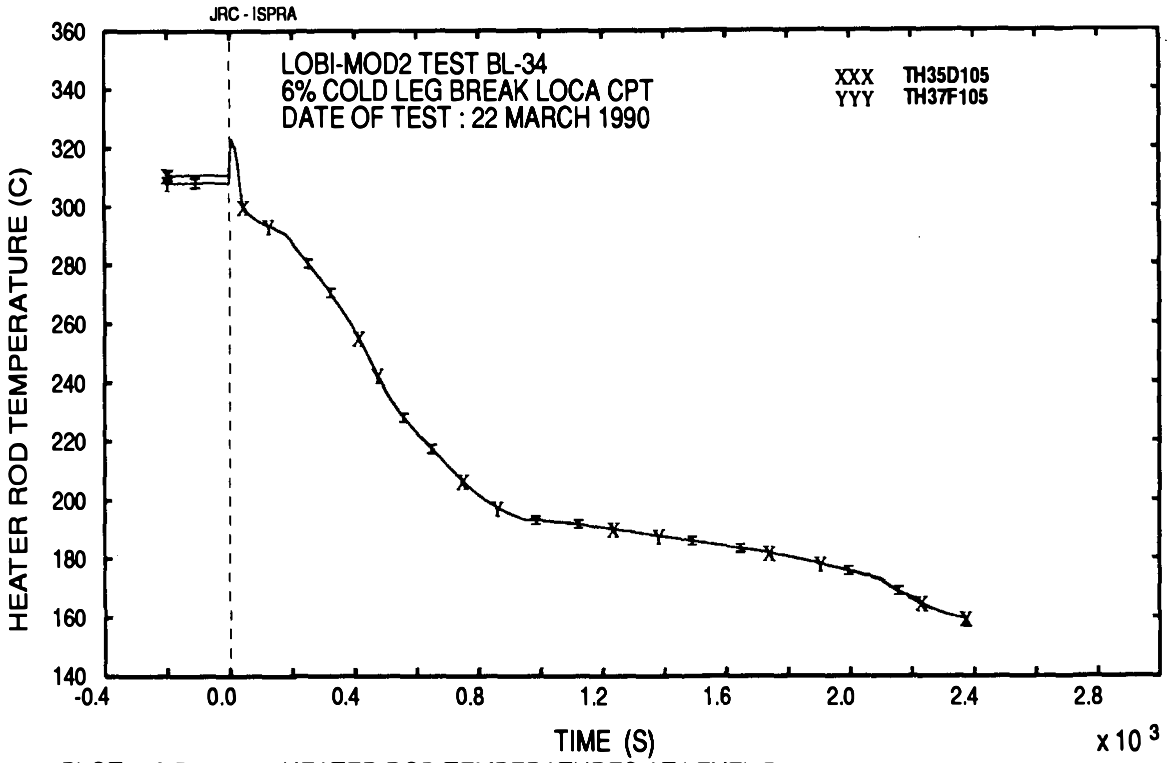
PLOT 9.2 HEATER ROD TEMPERATURES AT LEVEL 2



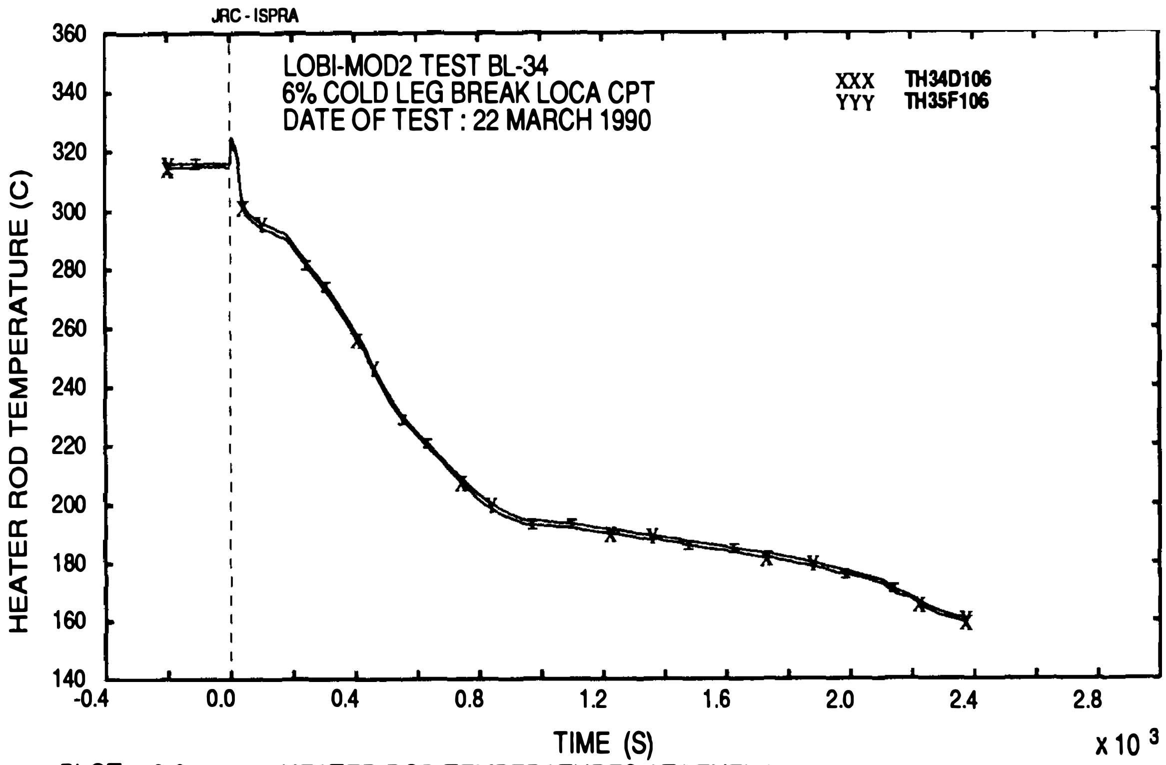
PLOT 9.3 HEATER ROD TEMPERATURES AT LEVEL 3



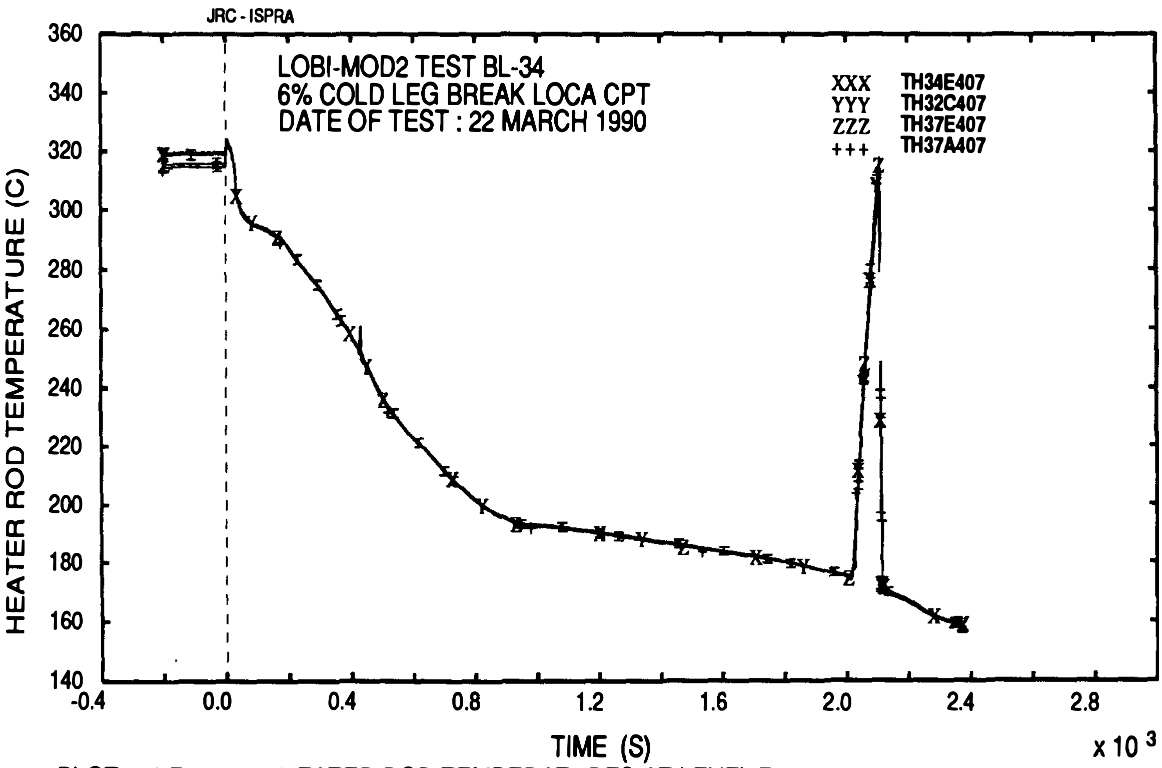
PLOT 9.4 HEATER ROD TEMPERATURES AT LEVEL 4



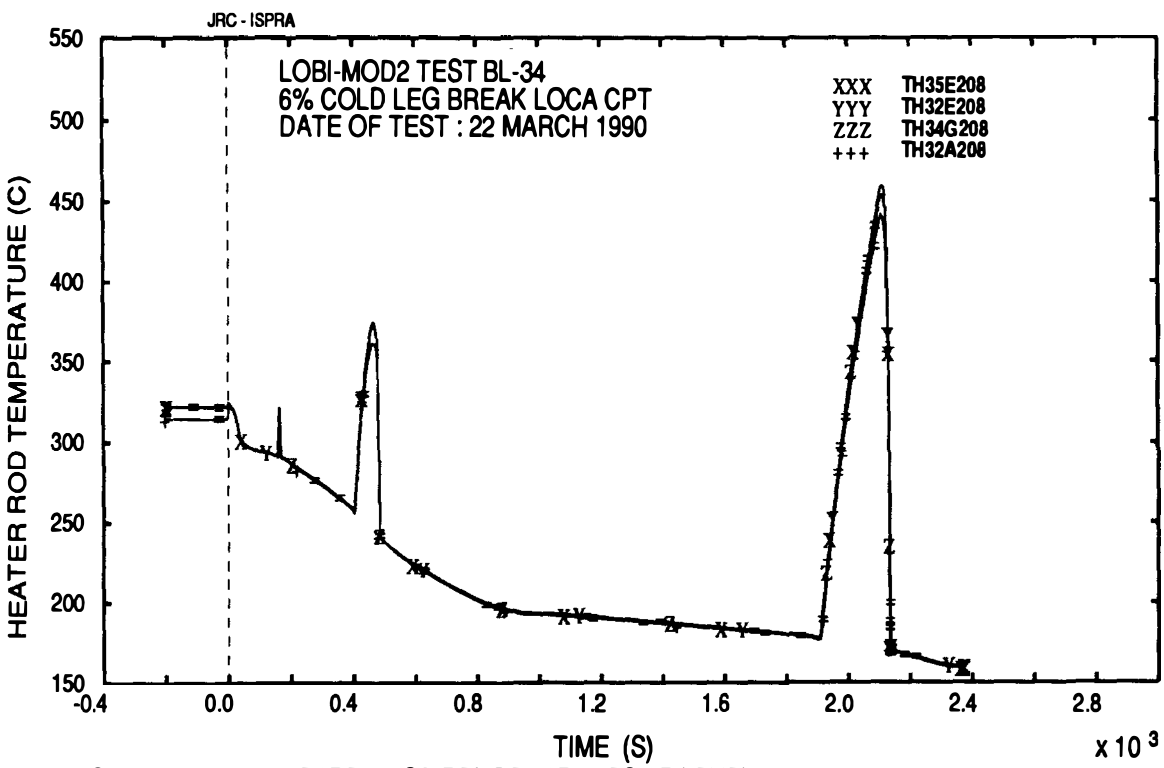
PLOT 9.5 HEATER ROD TEMPERATURES AT LEVEL 5



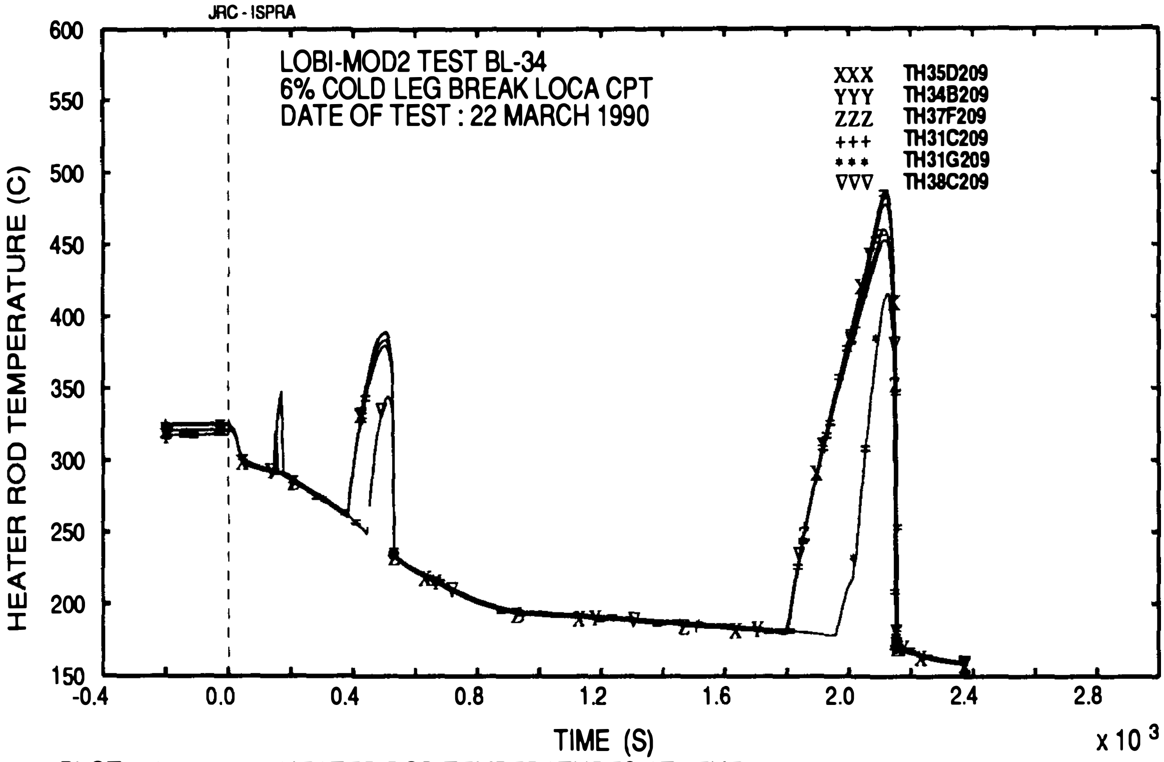
PLOT 9.6 HEATER ROD TEMPERATURES AT LEVEL 6



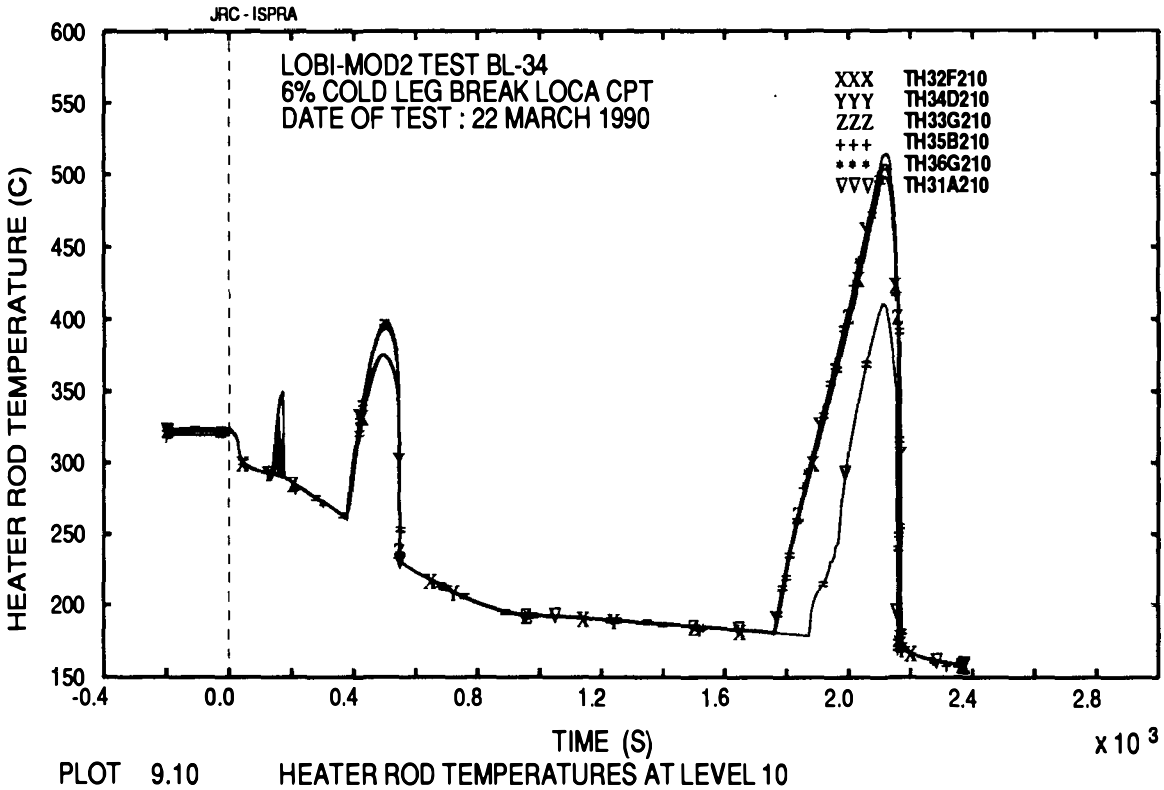
PLOT 9.7 HEATER ROD TEMPERATURES AT LEVEL 7



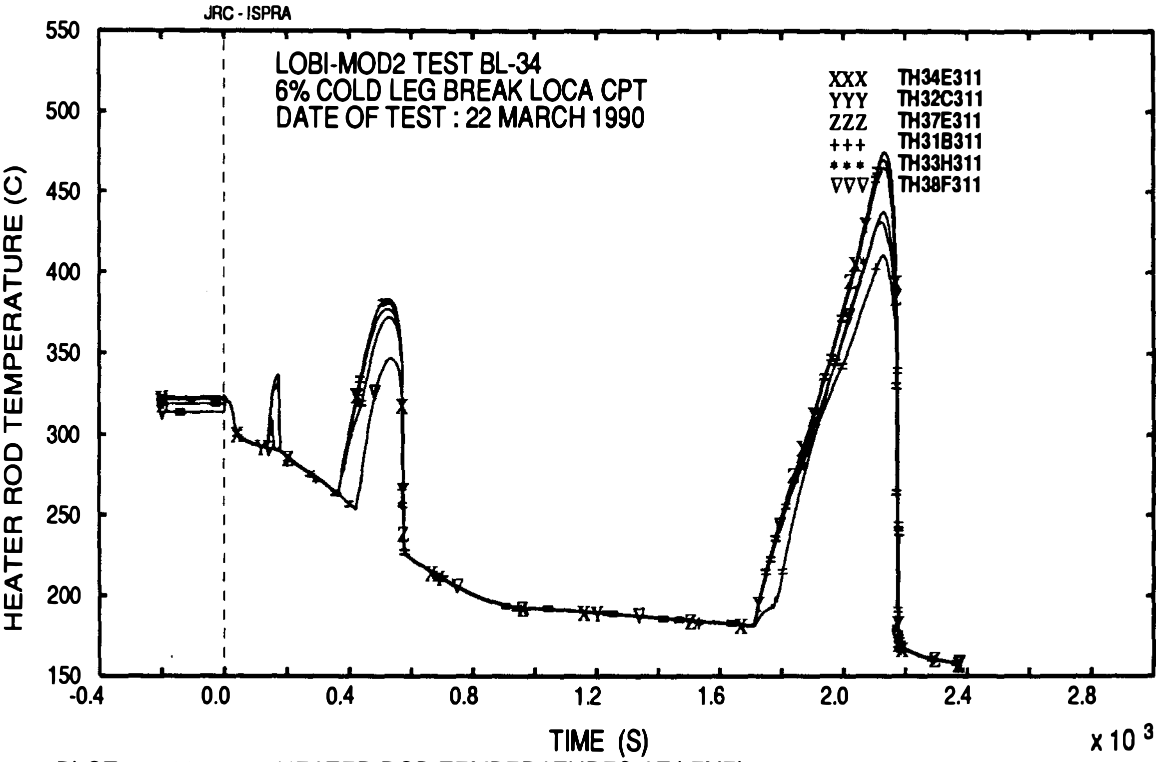
PLOT 9.8 HEATER ROD TEMPERATURES AT LEVEL 8



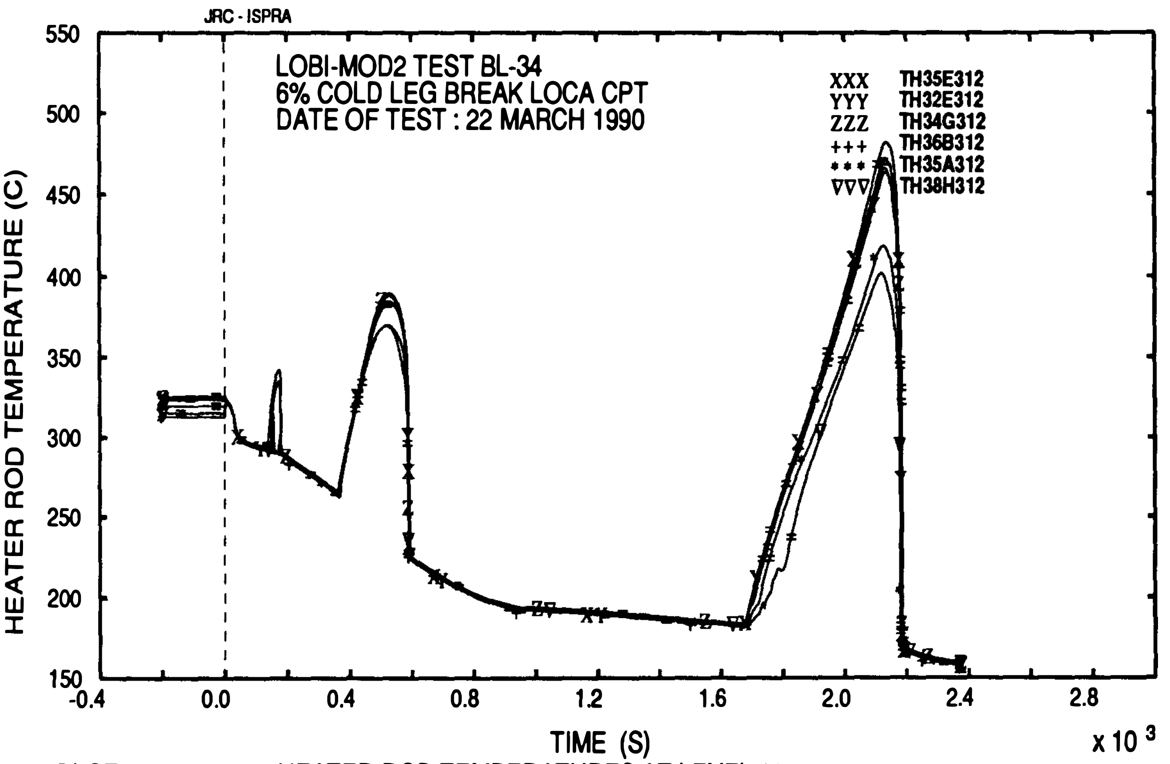
PLOT 9.9 HEATER ROD TEMPERATURES AT LEVEL 9



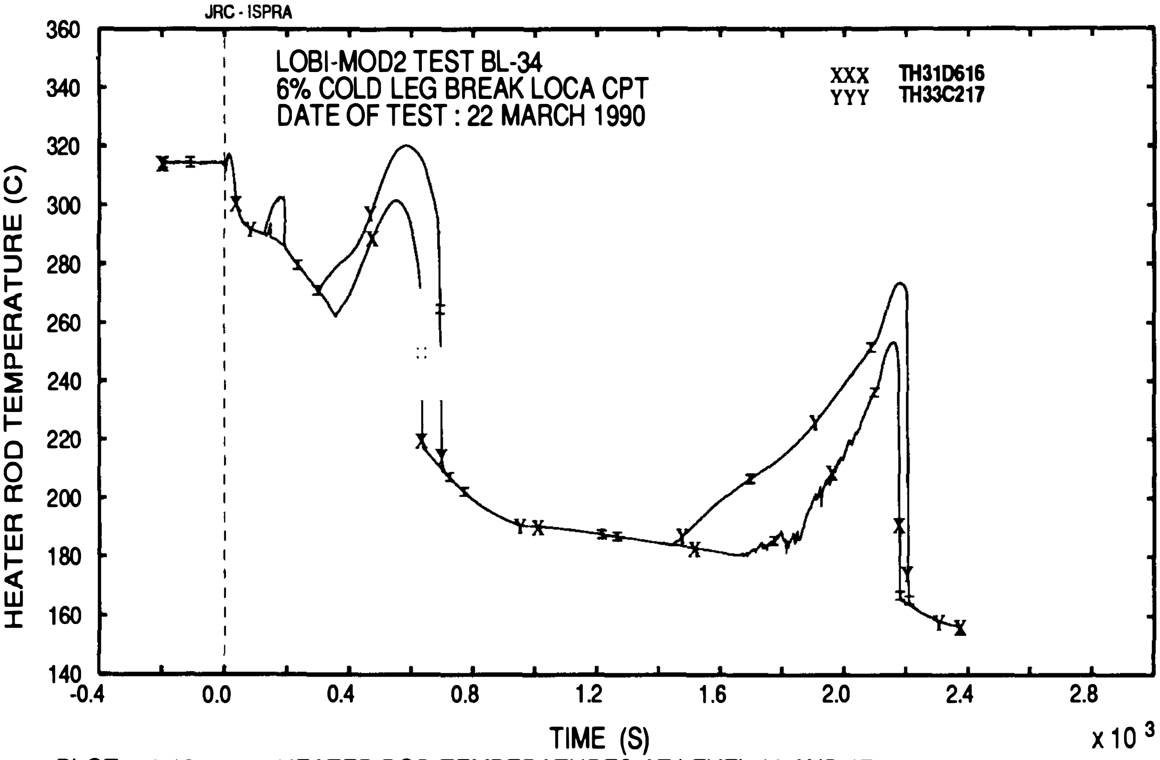
PLOT 9.10 HEATER ROD TEMPERATURES AT LEVEL 10



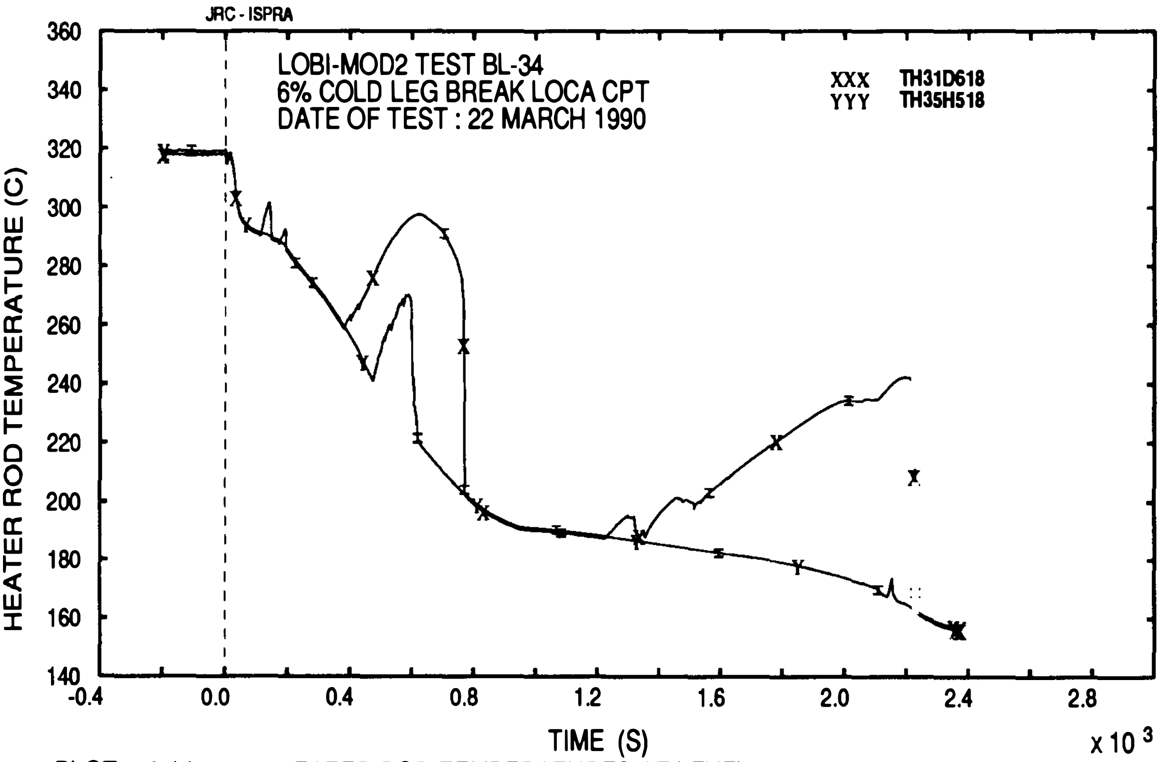
PLOT 9.11 HEATER ROD TEMPERATURES AT LEVEL 11



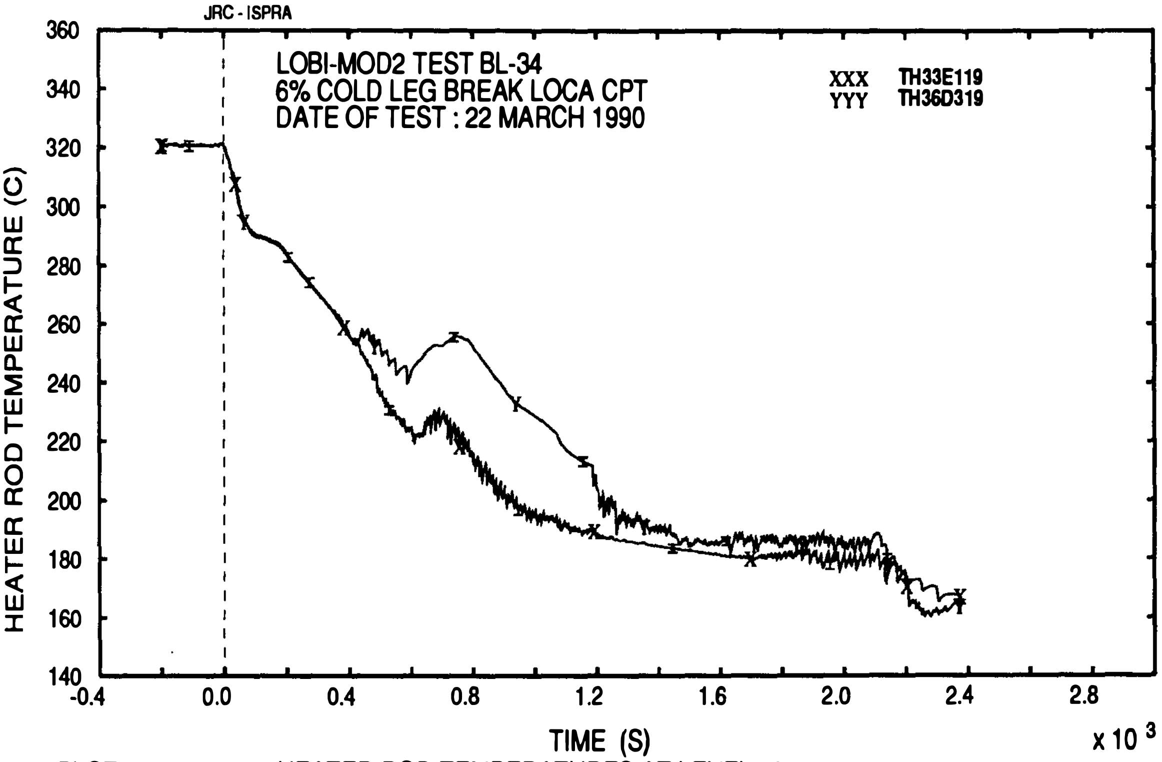
PLOT 9.12 HEATER ROD TEMPERATURES AT LEVEL 12



PLOT 9.13 HEATER ROD TEMPERATURES AT LEVEL 16 AND 17
-ABOVE HEATED LENGTH-

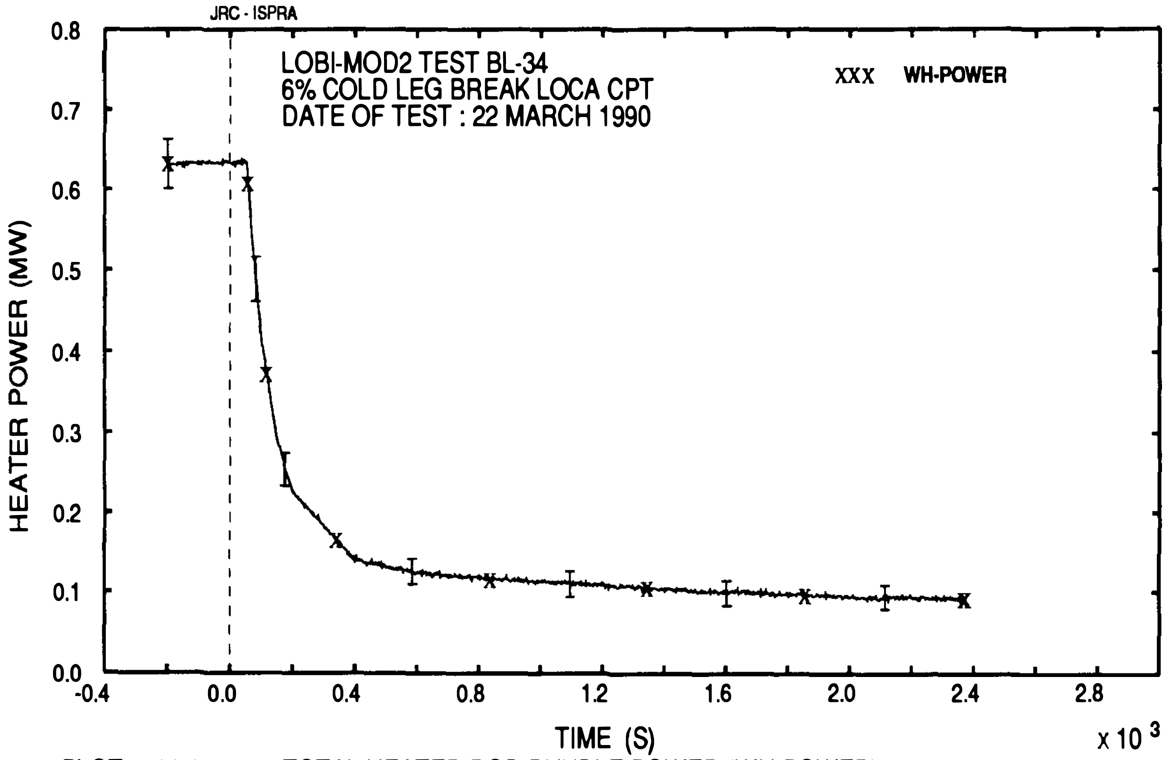


PLOT 9.14 HEATER ROD TEMPERATURES AT LEVEL 18
-ABOVE HEATED LENGTH-

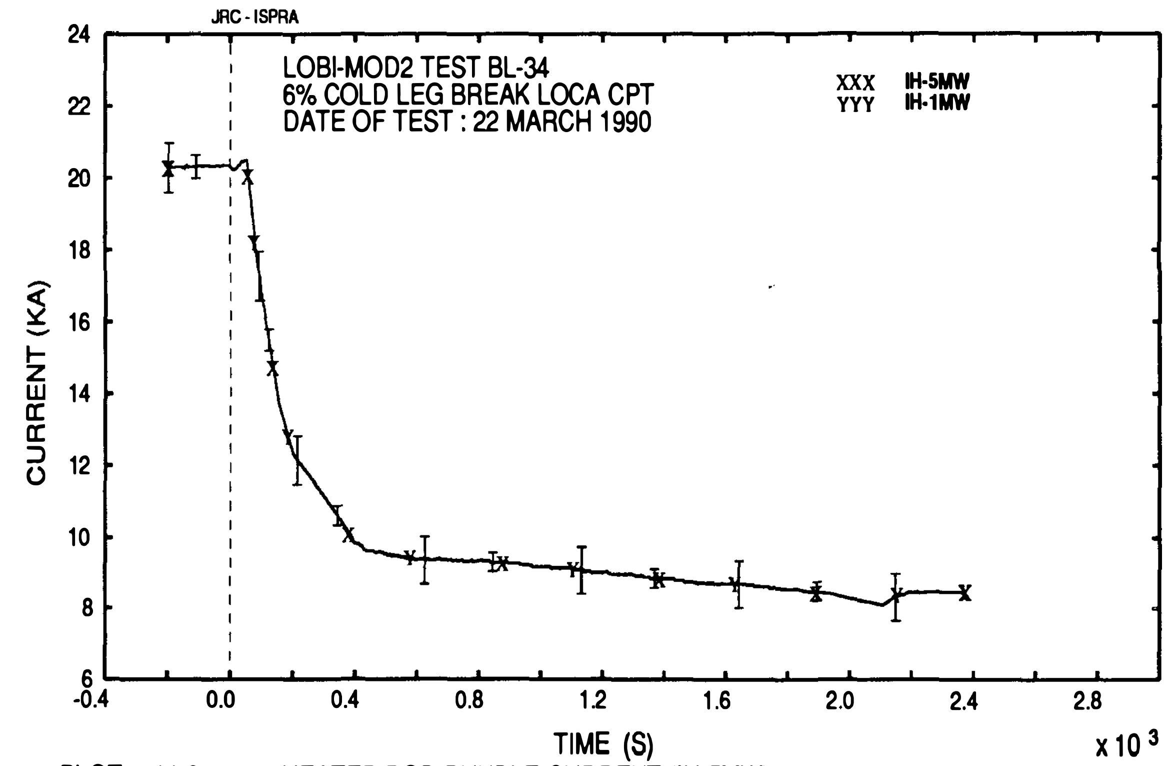


PLOT 9.15 HEATER ROD TEMPERATURES AT LEVEL 19

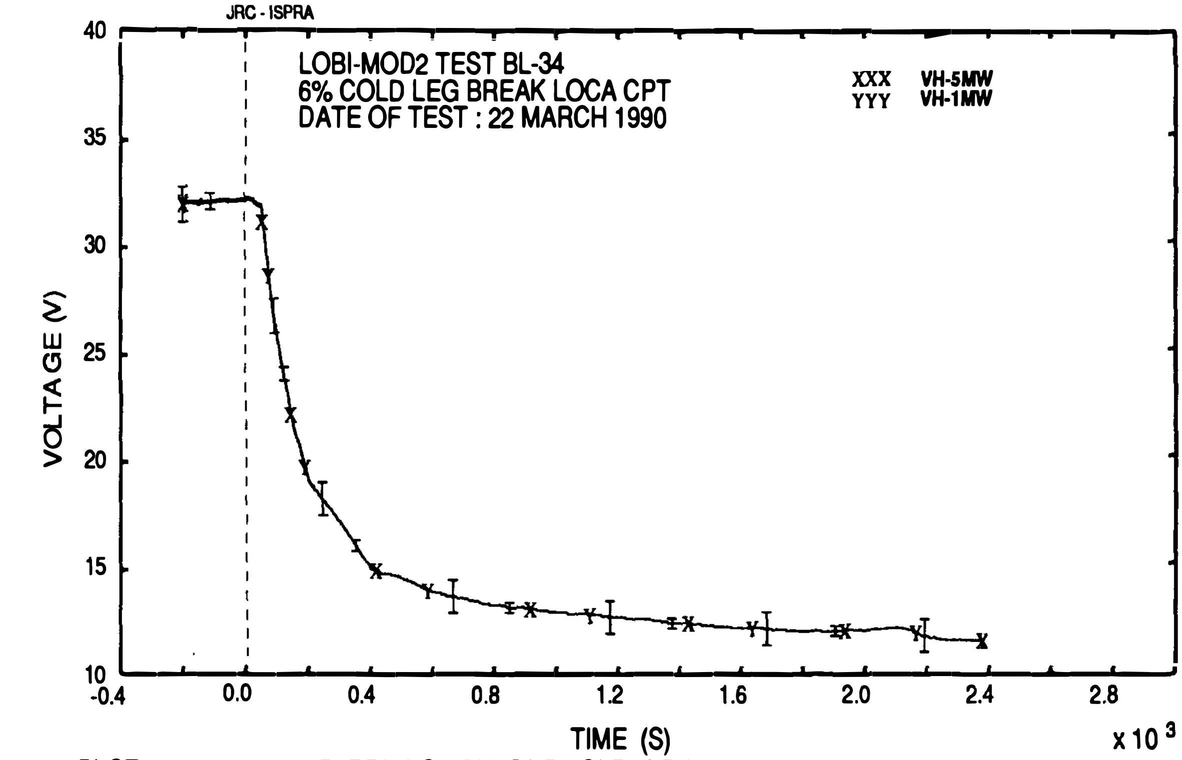
-ABOVE HEATED LENGTH-



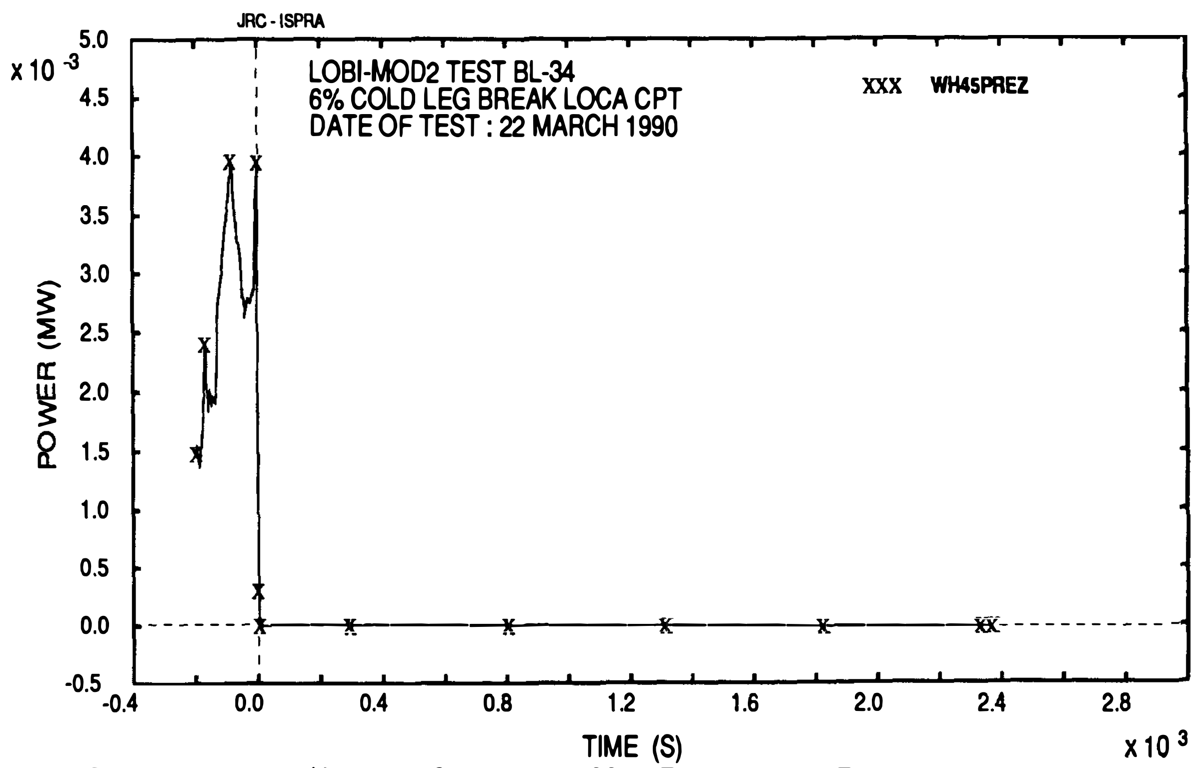
PLOT 11.1 TOTAL HEATER ROD BUNDLE POWER (WH-POWER)



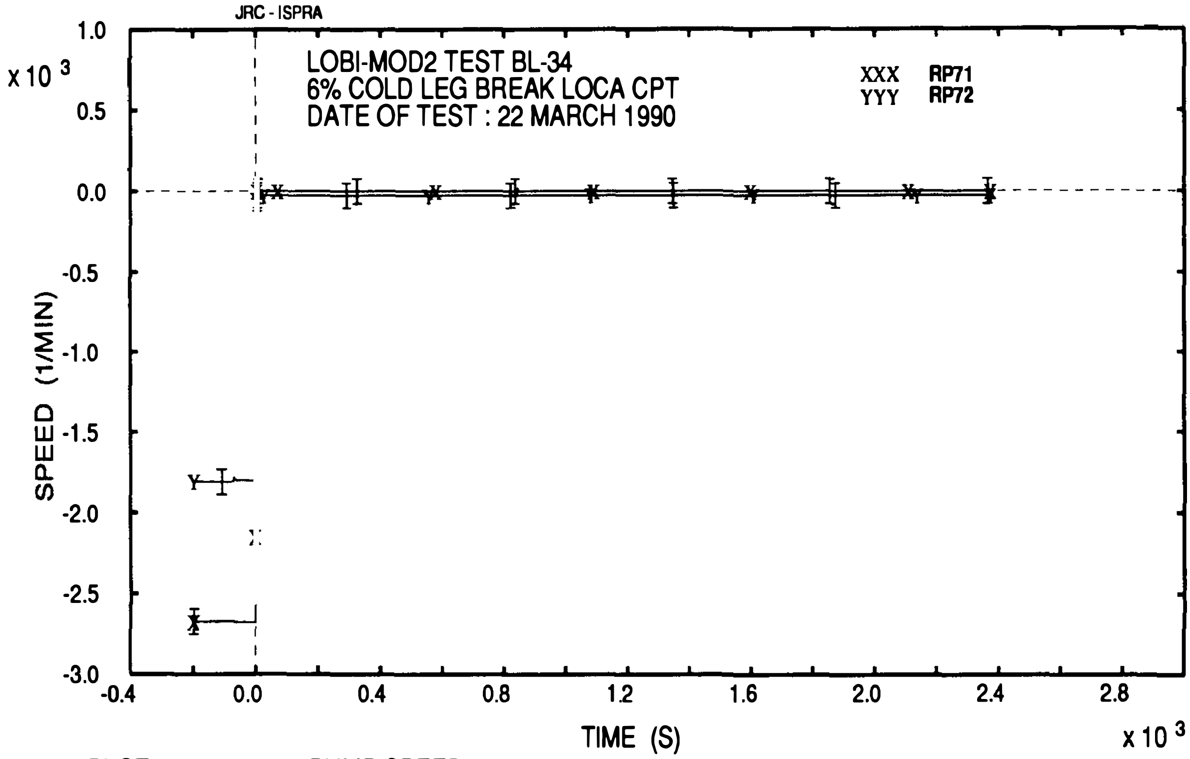
PLOT 11.2 HEATER ROD BUNDLE CURRENT (IH-5MW)
-SMALL RANGE (IH-1MW)-



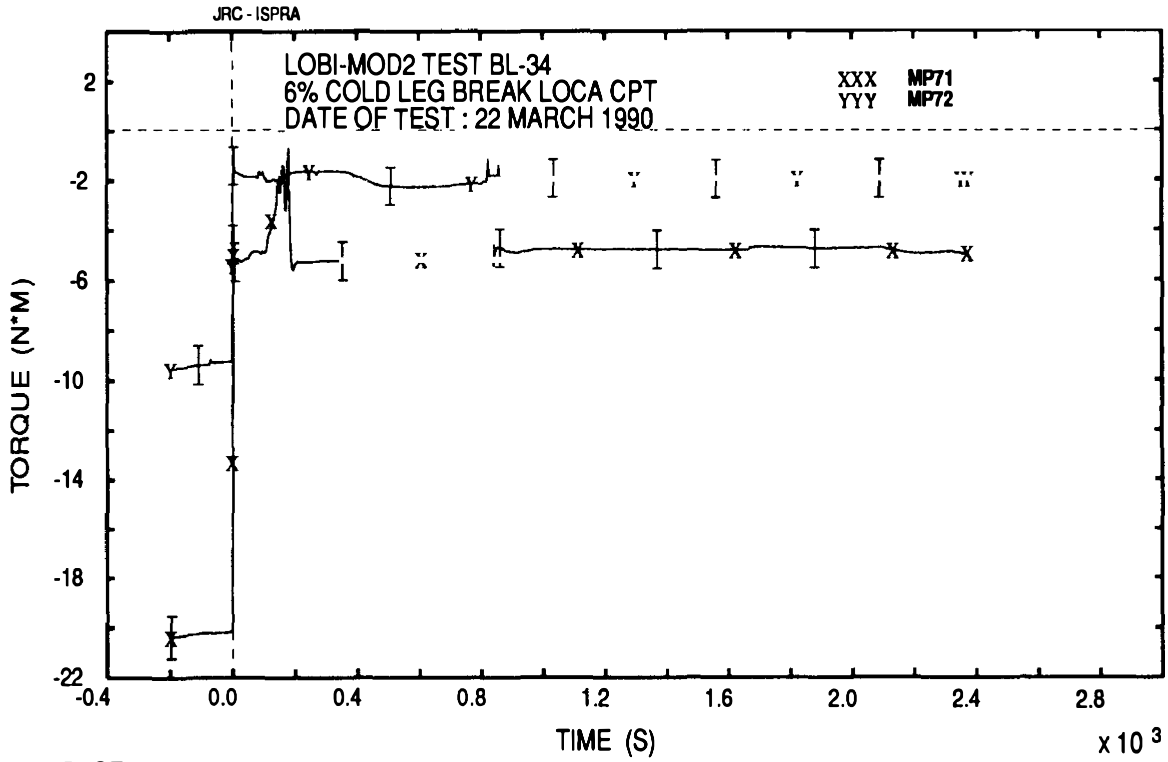
PLOT 11.3 HEATER ROD BUNDLE VOLTAGE (VH-5MW)
-SMALL RANGE (VH-1MW)-



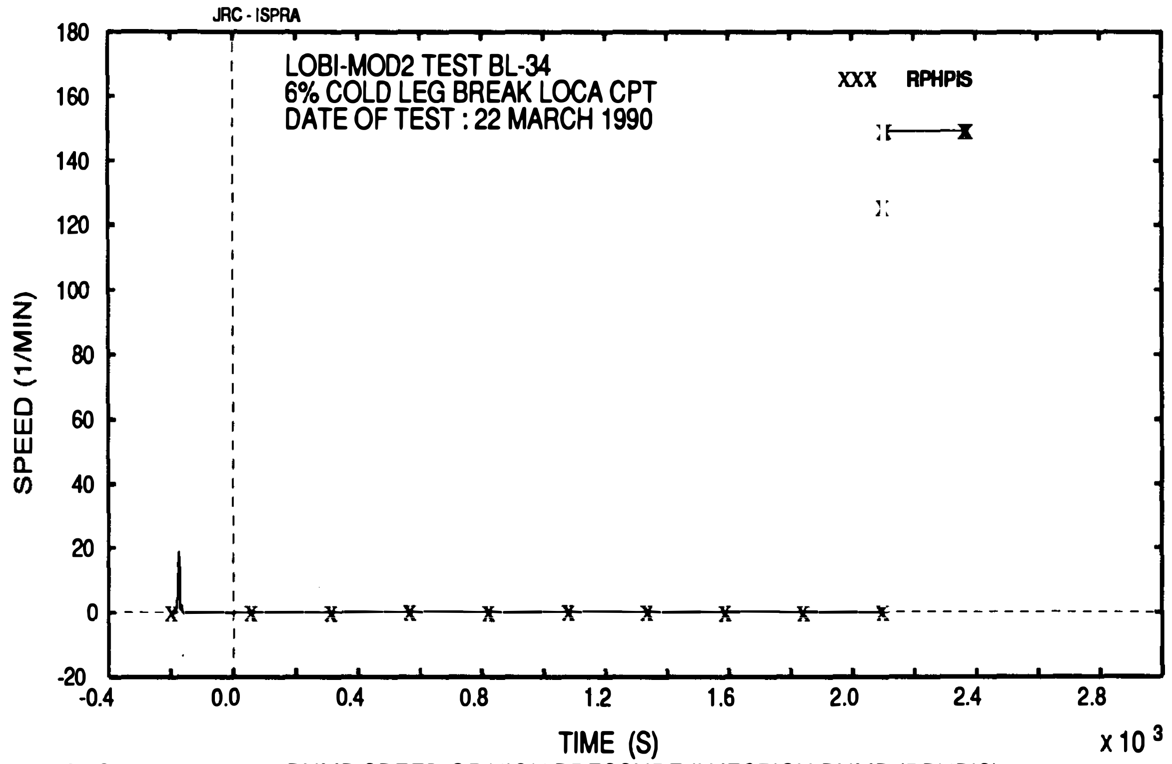
PLOT 11.4 HEATER POWER IN PRESSURIZER (WH45PREZ)



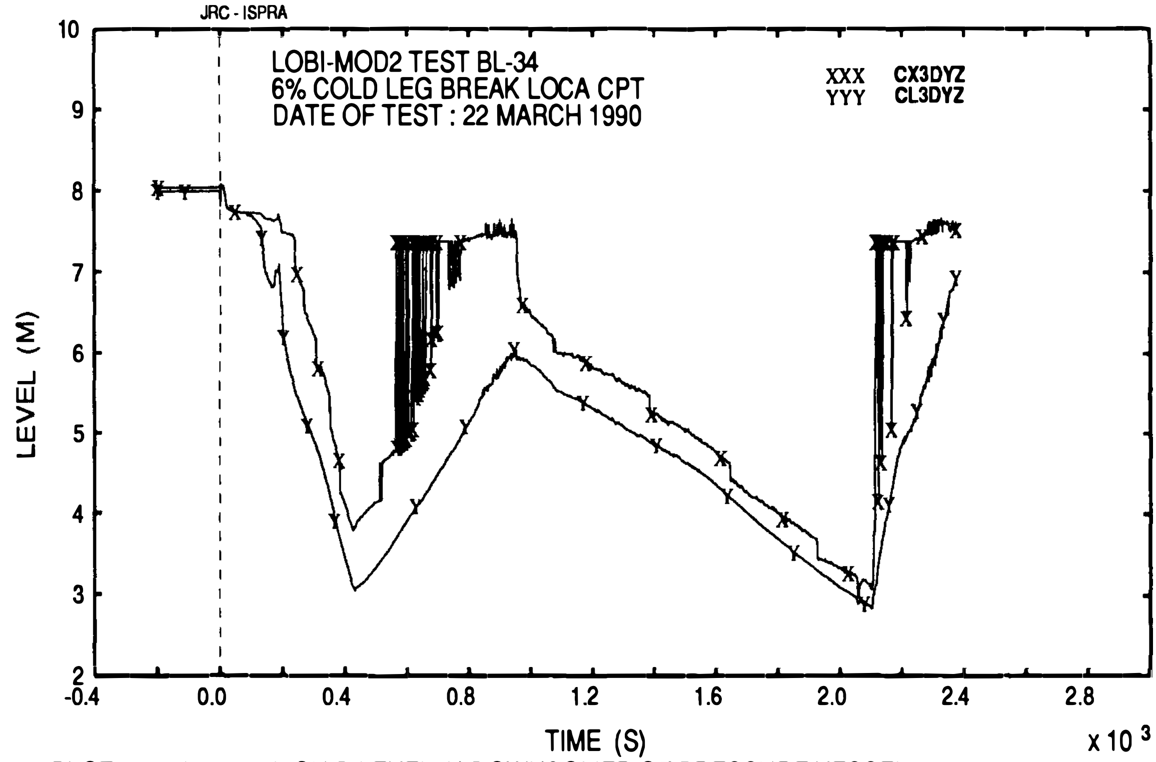
PLOT 12.1 PUMP SPEED
-INTACT LOOP PUMP (RP71)-
-BROKEN LOOP PUMP (RP72)-



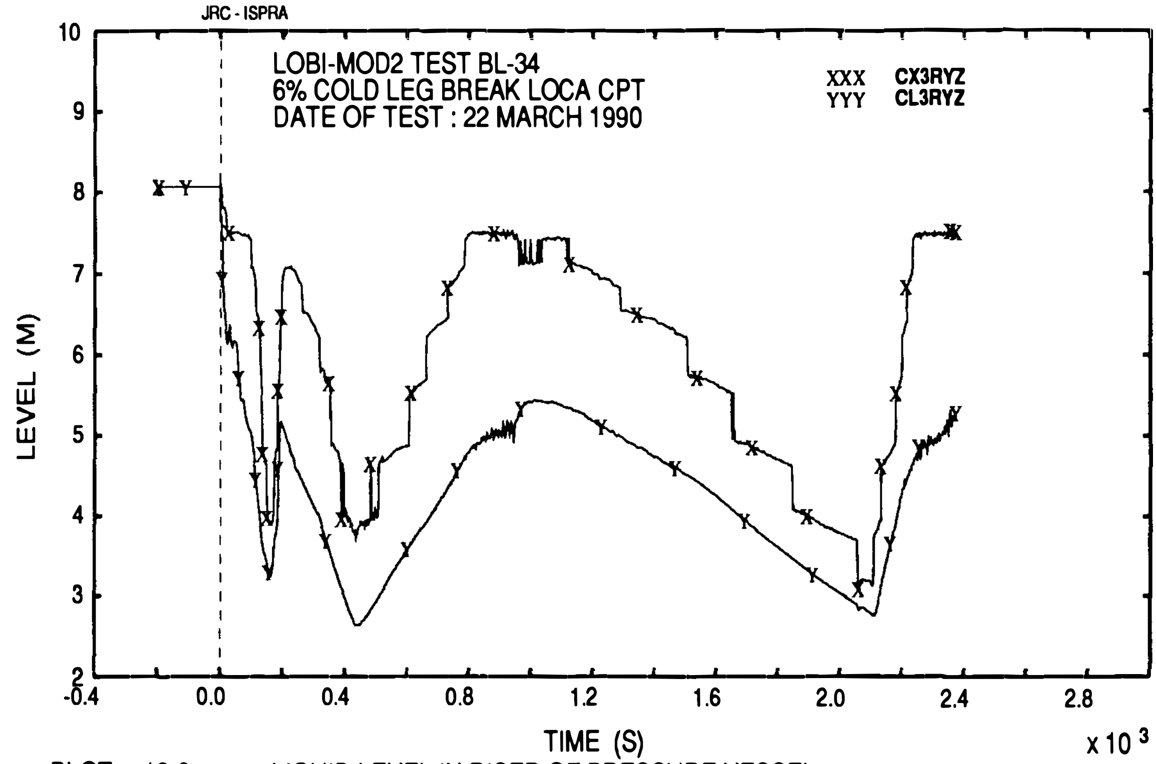
PLOT 12.2 PUMP SHAFT TORQUE
-INTACT LOOP PUMP (MP71)-
-BROKEN LOOP PUMP (MP72)-



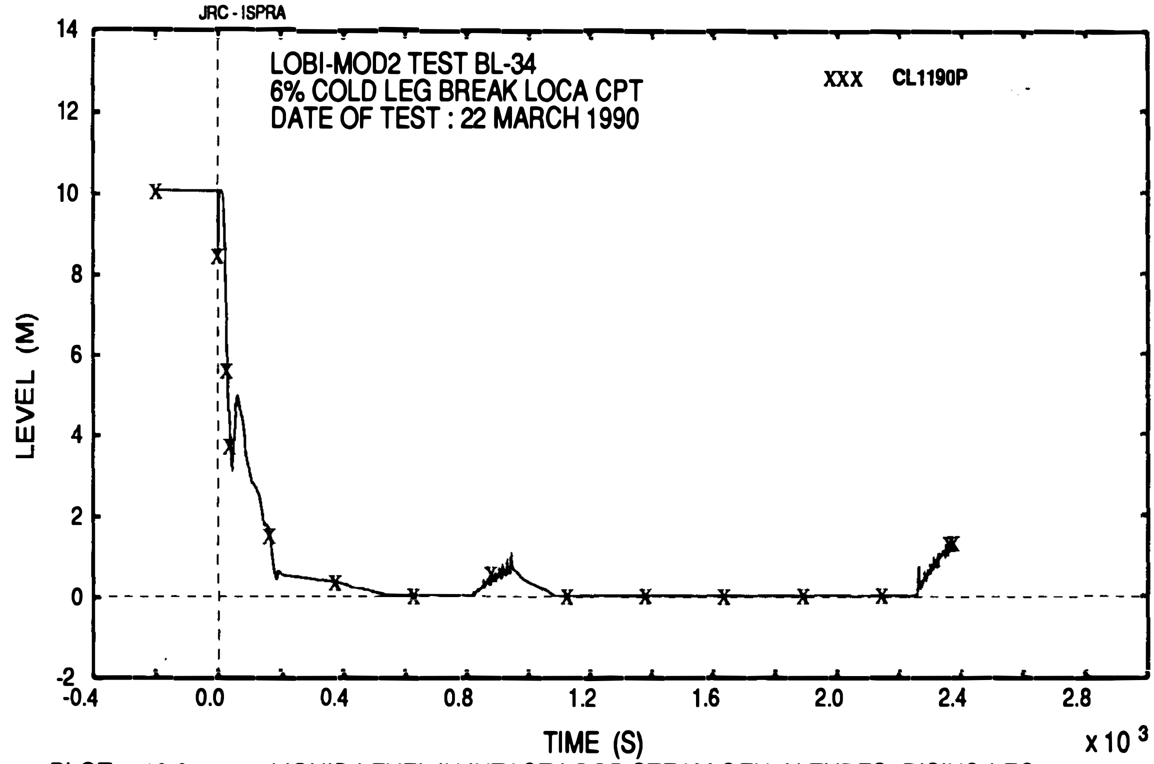
PLOT 12.3 PUMP SPEED OF HIGH PRESSURE INJECTION PUMP (RPHPIS)



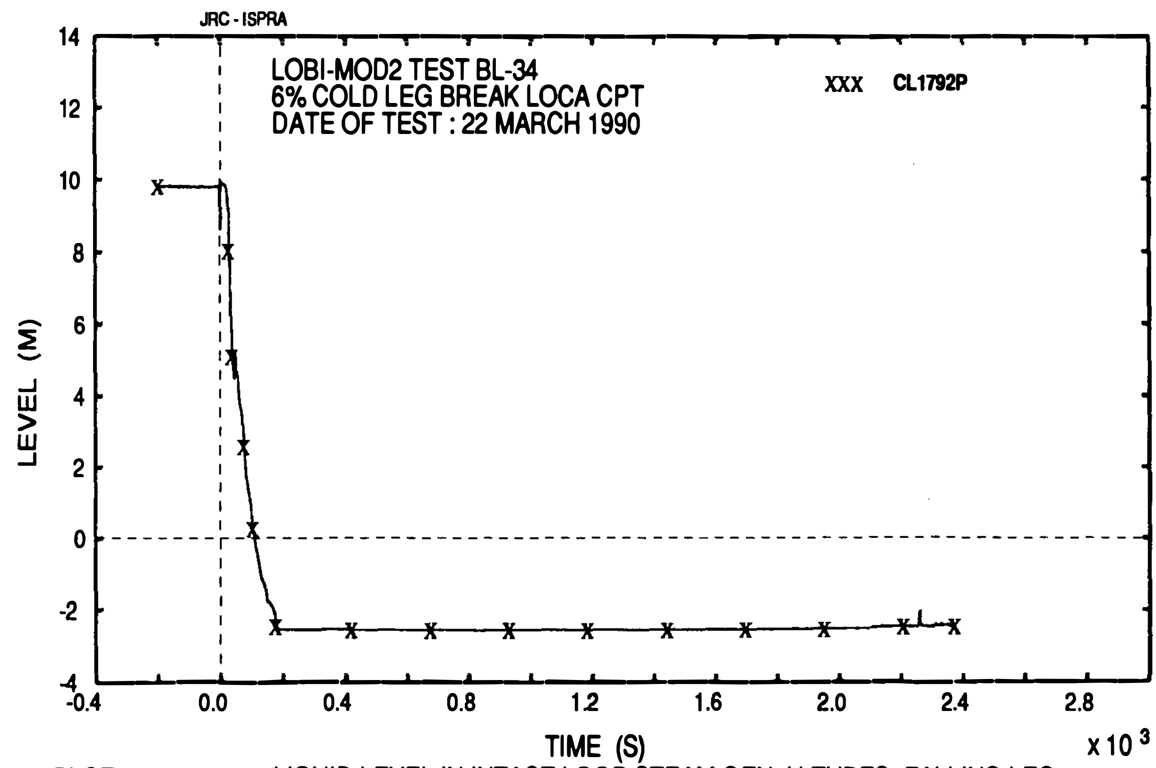
PLOT 13.1 LIQUID LEVEL IN DOWNCOMER OF PRESSURE VESSEL
-MIXTURE LEVEL (CX3DYZ) AND COLLAPSED LEVEL (CL3DYZ)-



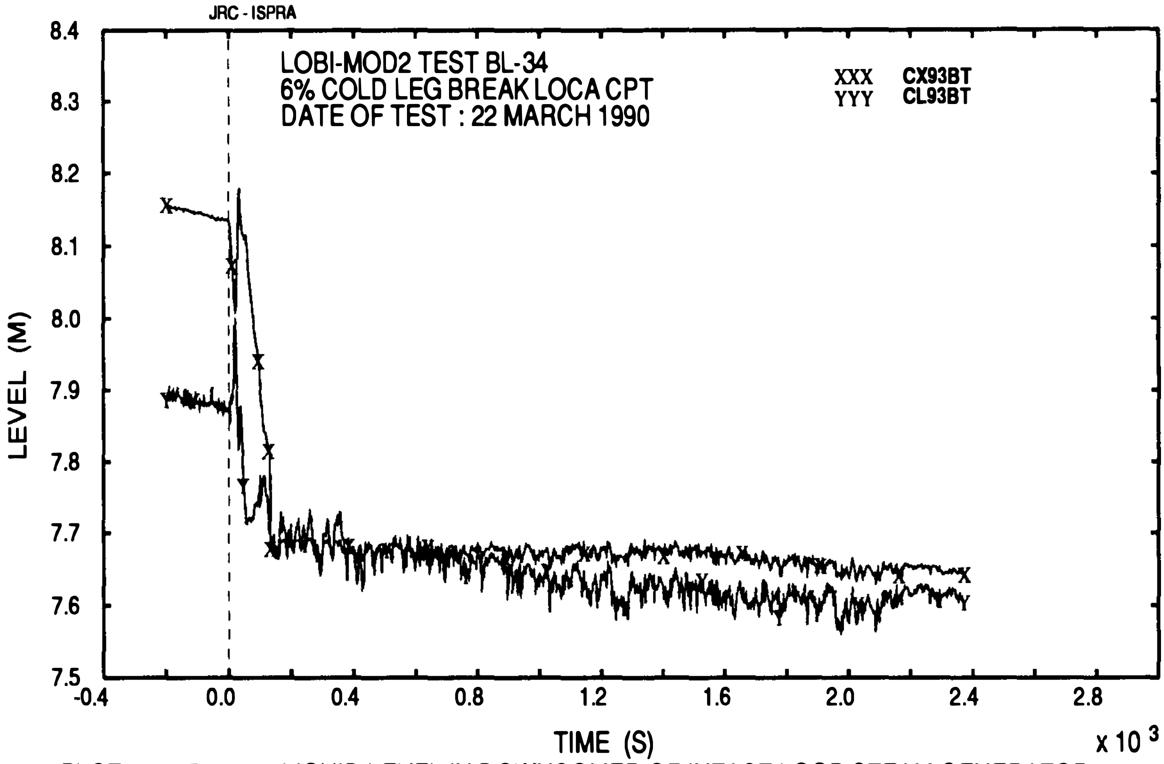
PLOT 13.2 LIQUID LEVEL IN RISER OF PRESSURE VESSEL
-MIXTURE LEVEL (CX3RYZ) AND COLLAPSED LEVEL (CL3RYZ)-



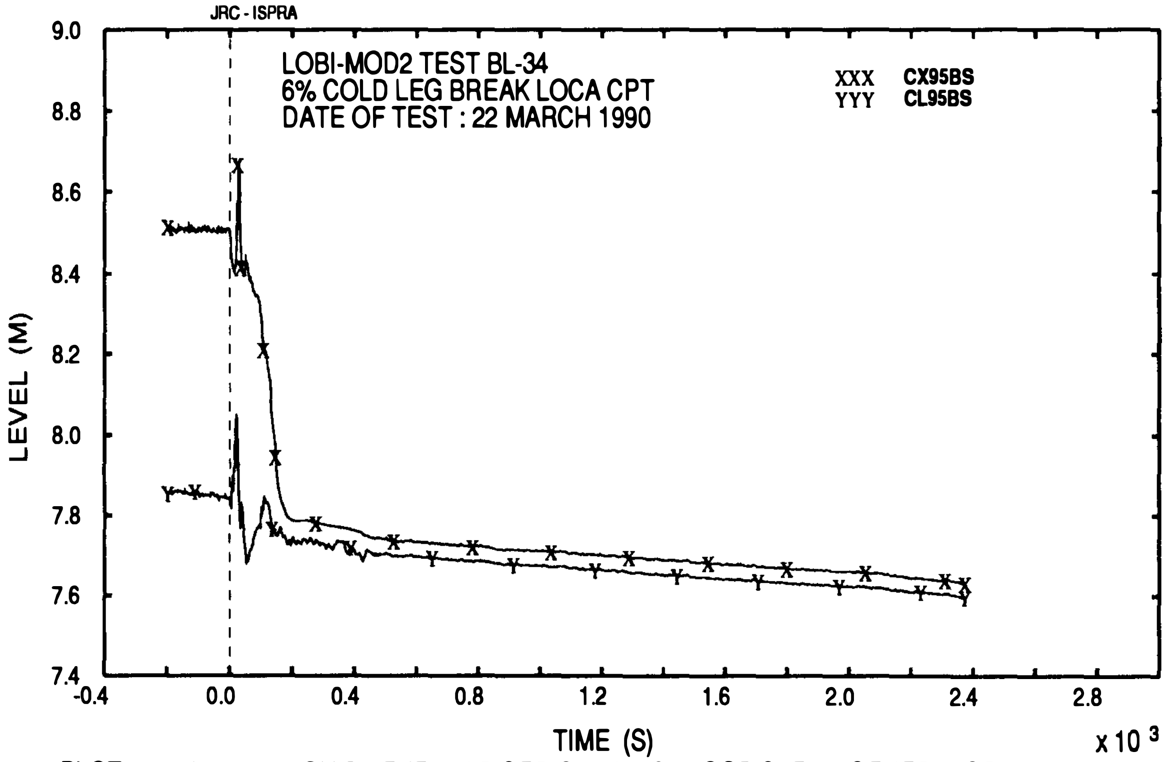
PLOT 13.3 LIQUID LEVEL IN INTACT LOOP STEAM GEN. U-TUBES, RISING LEG
-COLLAPSED LEVEL FROM LOCATION 11 TO TOP OF TUBES (CL1190P)-
-SUBTRACTED .015M FOR ZERO REFERENCE LEVEL-



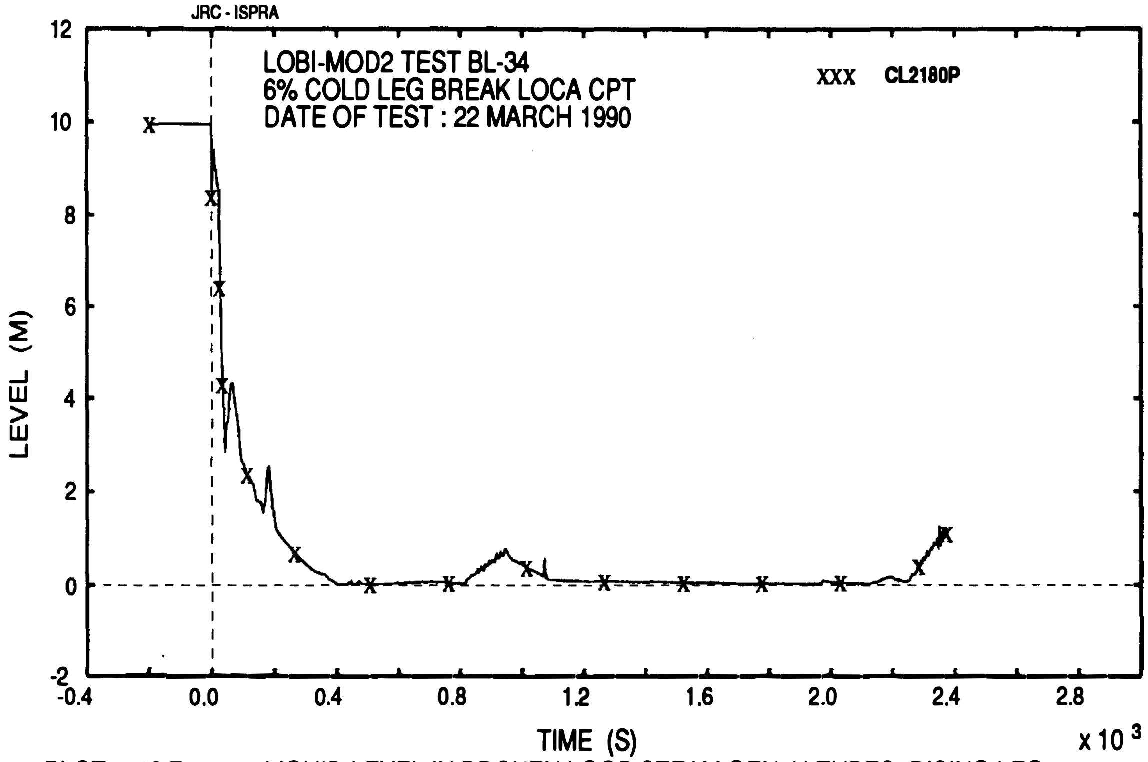
PLOT 13.4 LIQUID LEVEL IN INTACT LOOP STEAM GEN. U-TUBES, FALLING LEG
-COLLAPSED LEVEL FROM LOCATION 17 TO TOP OF TUBES (CL1792P)-
-SUBTRACTED 2.54M FOR ZERO REFERENCE LEVEL-



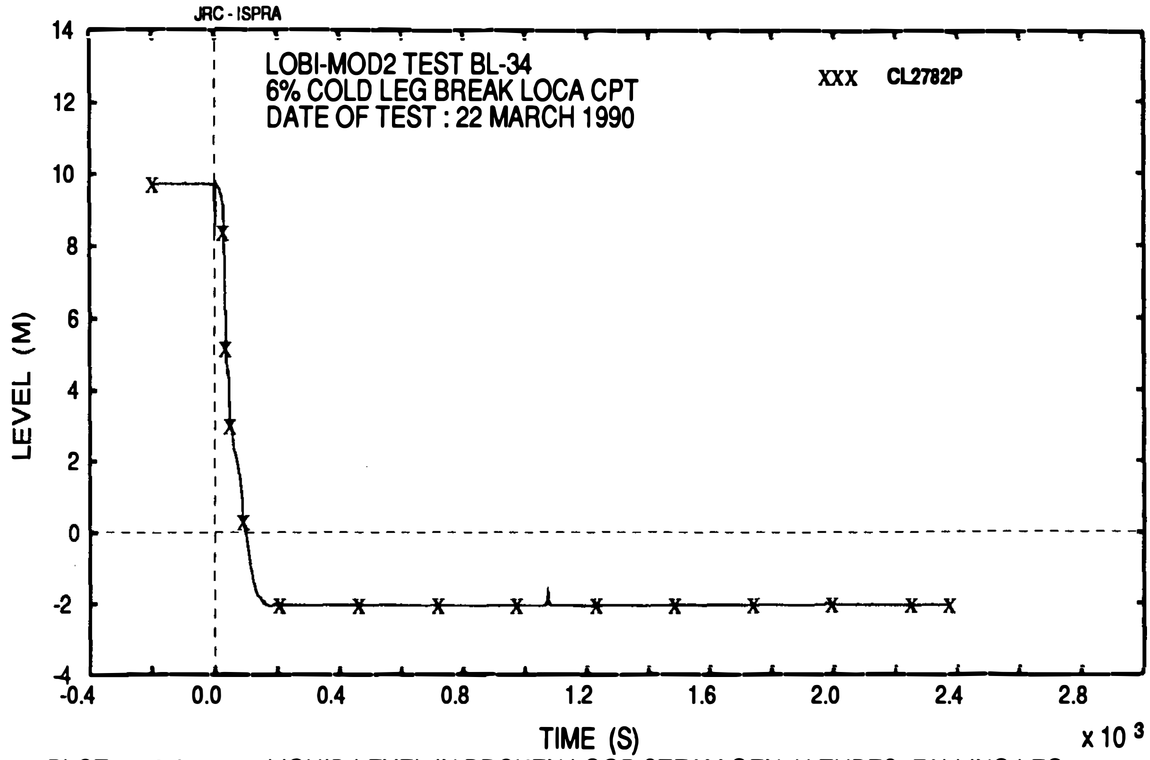
PLOT 13.5 LIQUID LEVEL IN DOWNCOMER OF INTACT LOOP STEAM GENERATOR
-MIXTURE LEVEL (CX93BT) AND COLLAPSED LEVEL (CL93BT)-



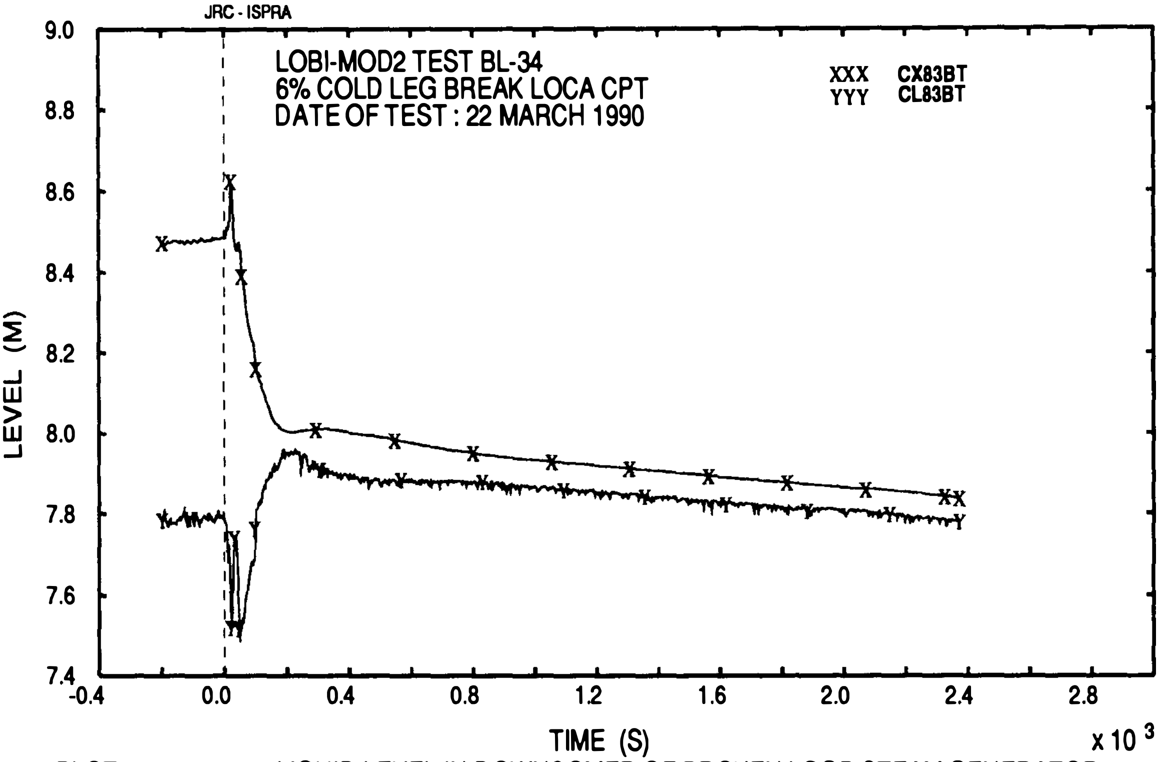
PLOT 13.6 LIQUID LEVEL IN RISER OF INTACT LOOP STEAM GENERATOR
-MIXTURE LEVEL (CX95BS) AND COLLAPSED LEVEL (CL95BS)-



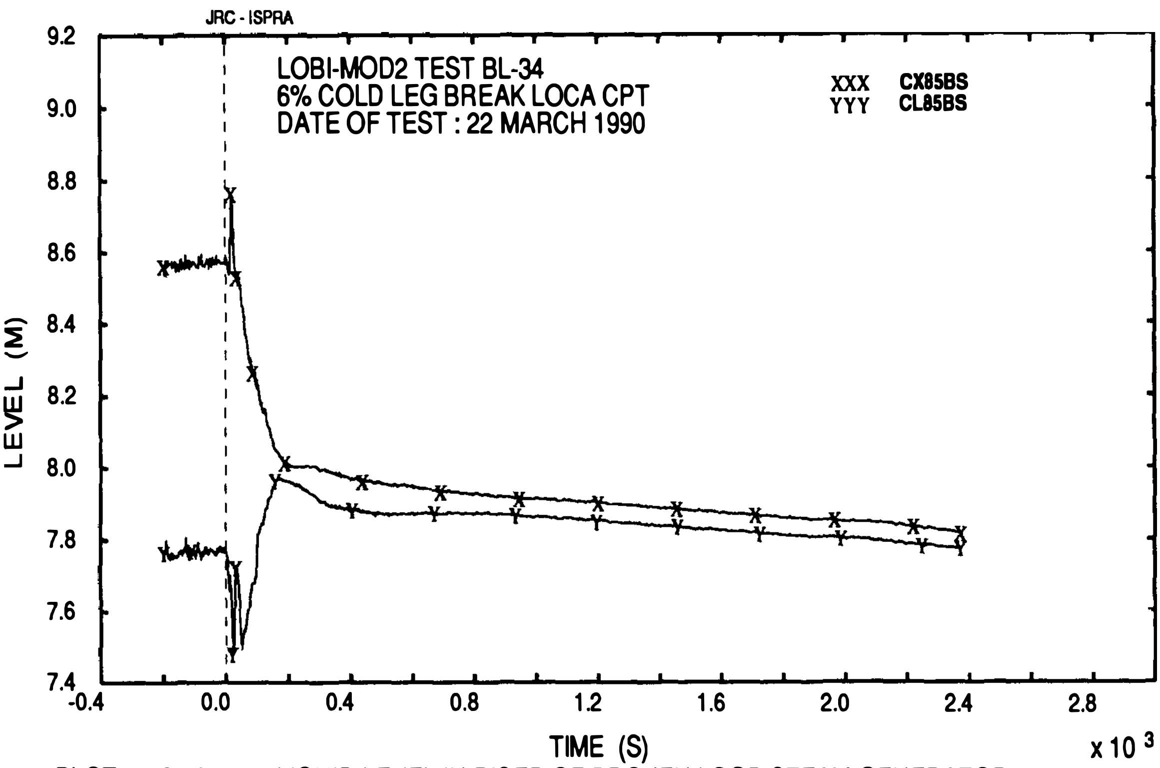
PLOT 13.7 LIQUID LEVEL IN BROKEN LOOP STEAM GEN. U-TUBES, RISING LEG
-SUBTRACTED .01M FOR ZERO REFERENCE LEVEL-



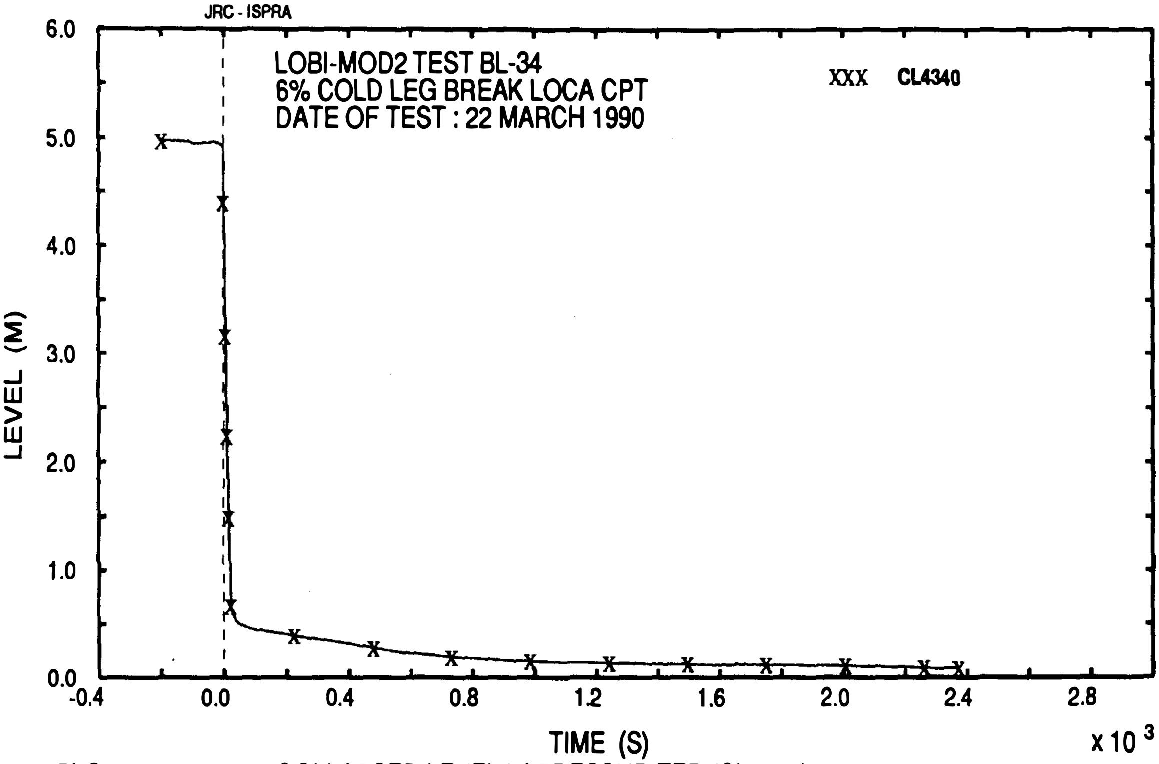
PLOT 13.8 LIQUID LEVEL IN BROKEN LOOP STEAM GEN. U-TUBES, FALLING LEG
-COLLAPSED LEVEL FROM LOCATION 27 TO TOP OF TUBES (CL2782P)-
-SUBTRACTED 2.1M FOR ZERO REFERENCE LEVEL-



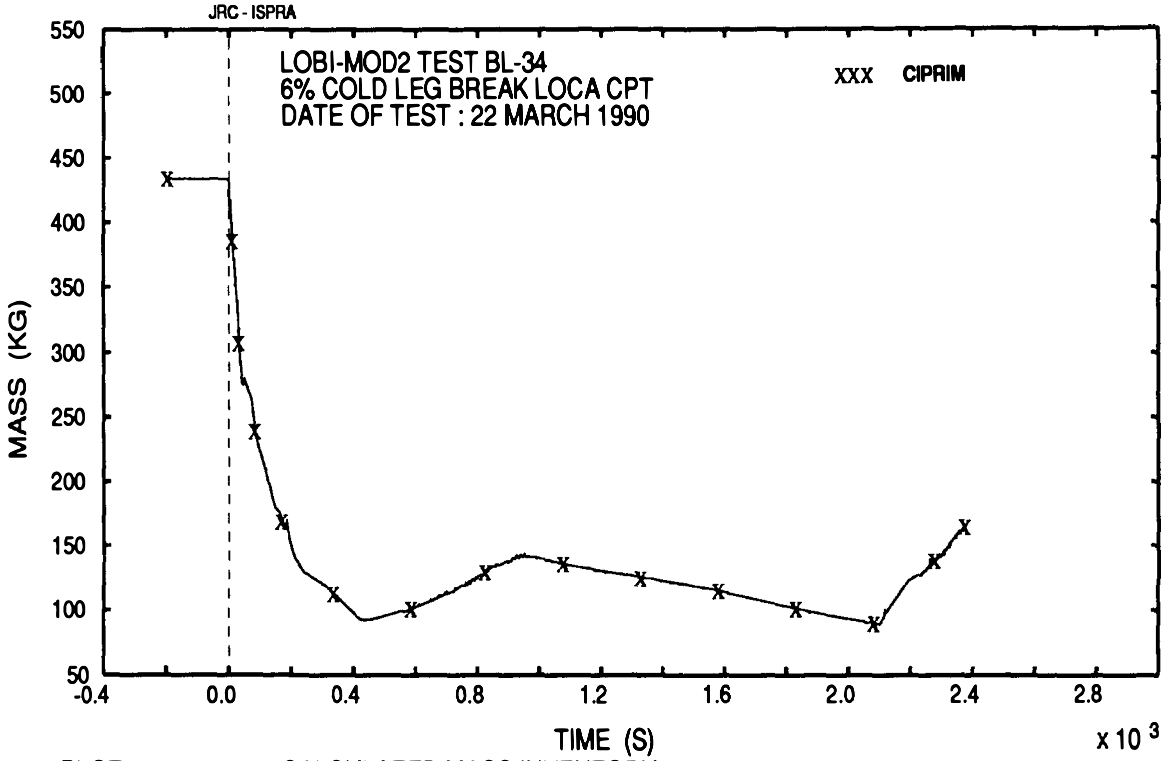
PLOT 13.9 LIQUID LEVEL IN DOWNCOMER OF BROKEN LOOP STEAM GENERATOR -MIXTURE LEVEL (CX83BT) AND COLLAPSED LEVEL (CL83BT)-



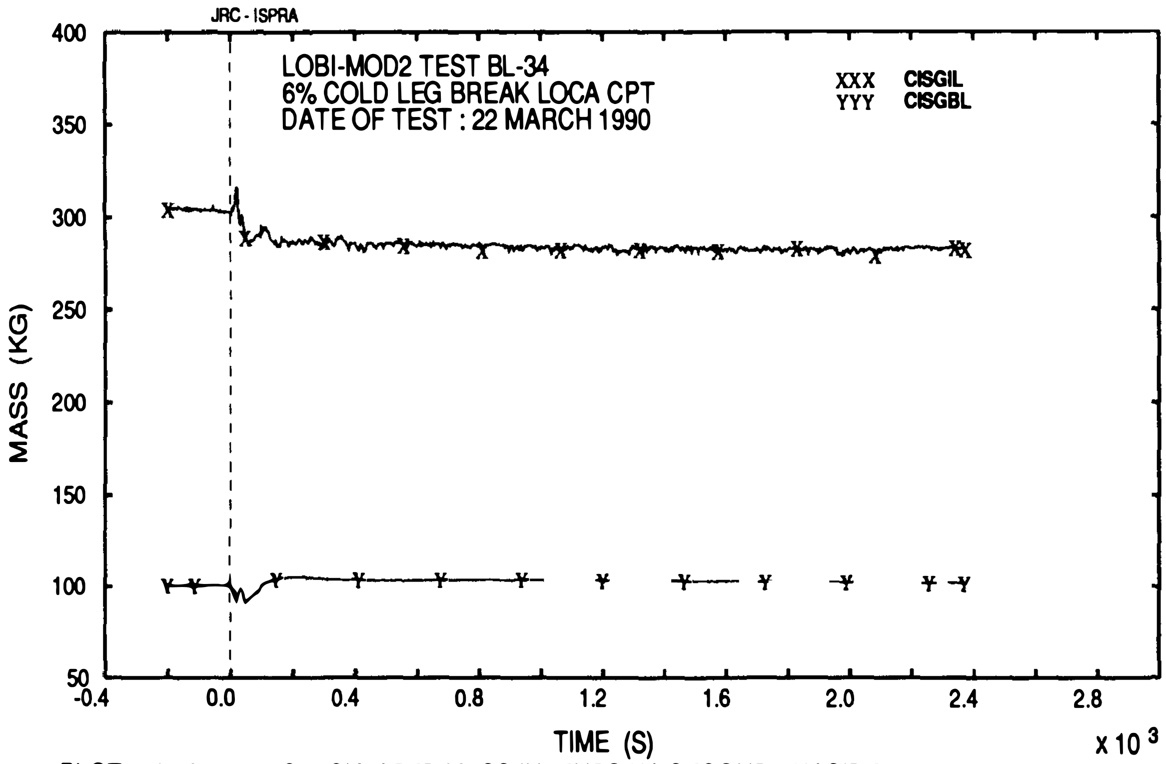
PLOT 13.10 LIQUID LEVEL IN RISER OF BROKEN LOOP STEAM GENERATOR -MIXTURE LEVEL (CX85BS) AND COLLAPSED LEVEL (CL85BS)-



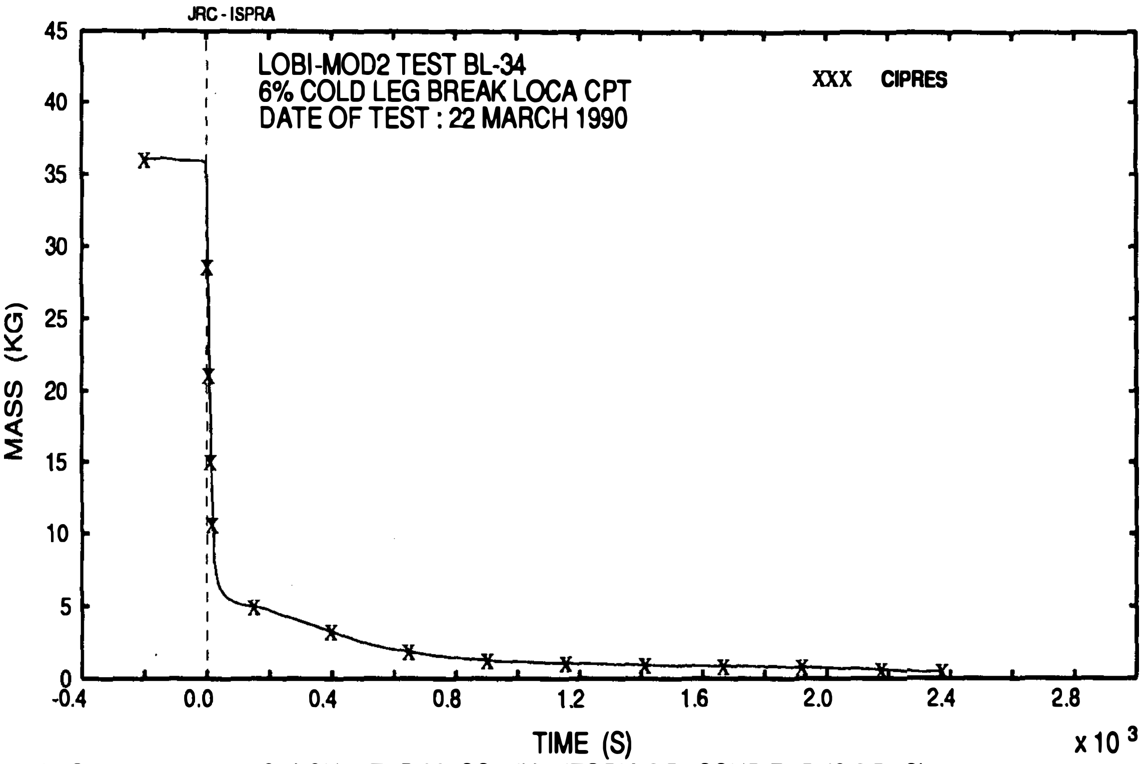
PLOT 13.11 COLLAPSED LEVEL IN PRESSURIZER (CL4340)



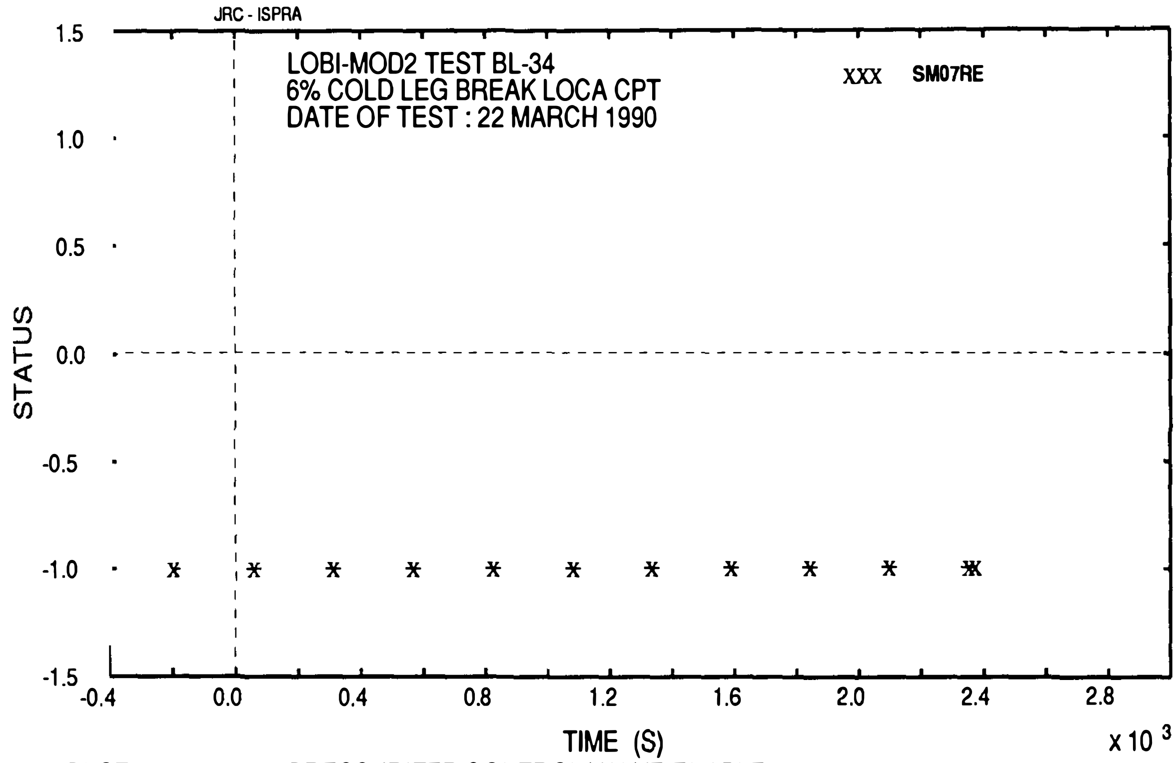
PLOT 14.1 CALCULATED MASS INVENTORY
-PRIMARY LOOP (CIPRIM)-



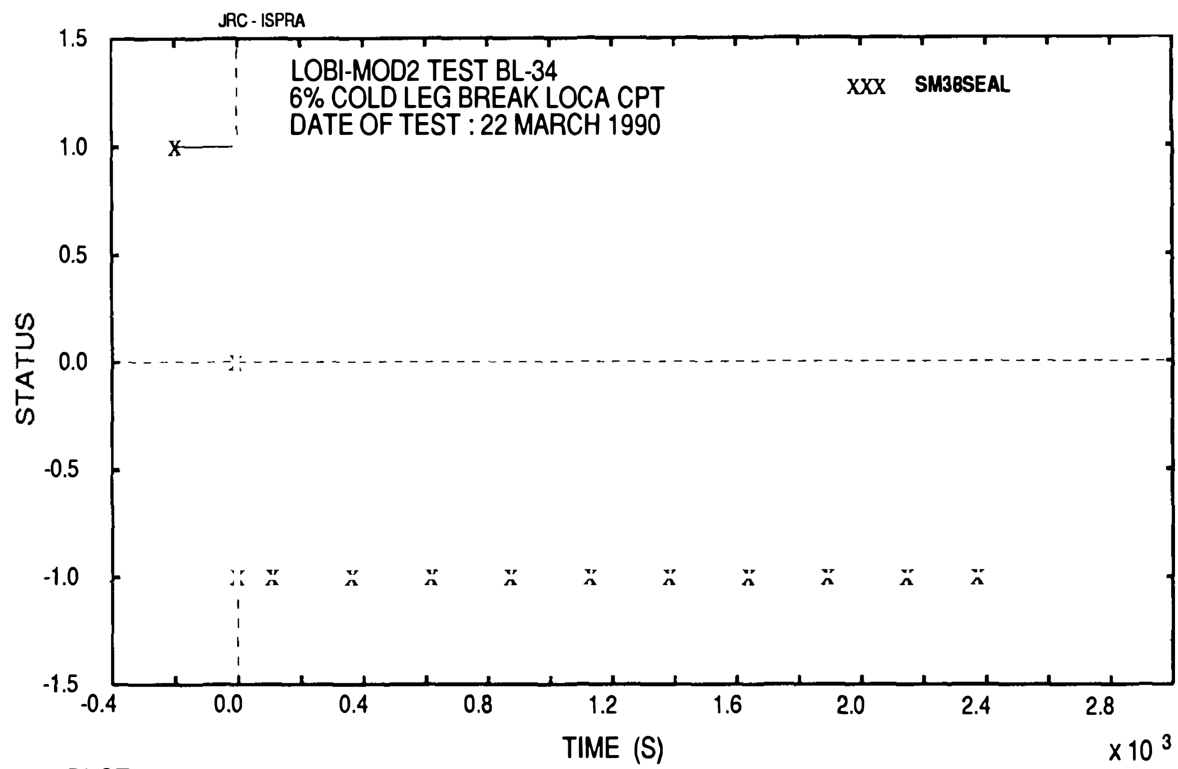
PLOT 14.2 CALCULATED MASS INVENTORY, SECONDARY SIDE
-INTACT LOOP STEAM GENERATOR (CISGIL)-
-BROKEN LOOP STEAM GENERATOR (CISGBL)-



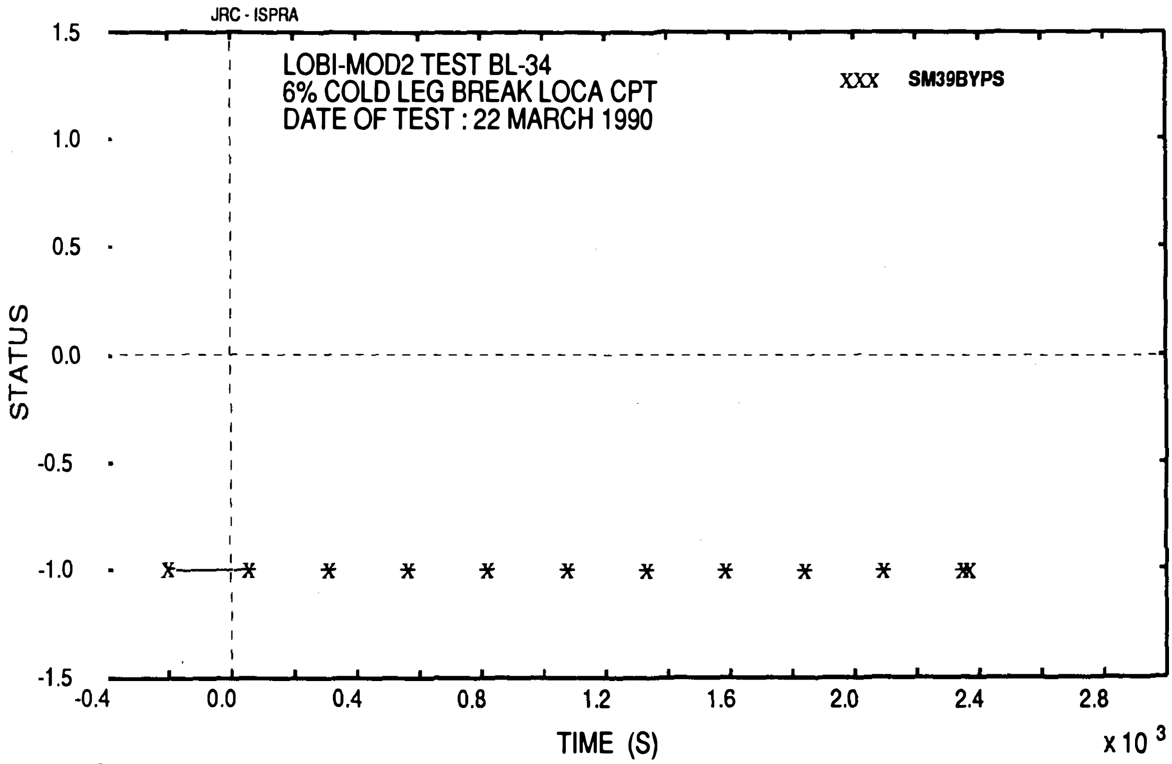
PLOT 14.3 CALCULATED MASS INVENTORY, PRESSURIZER (CIPRES)



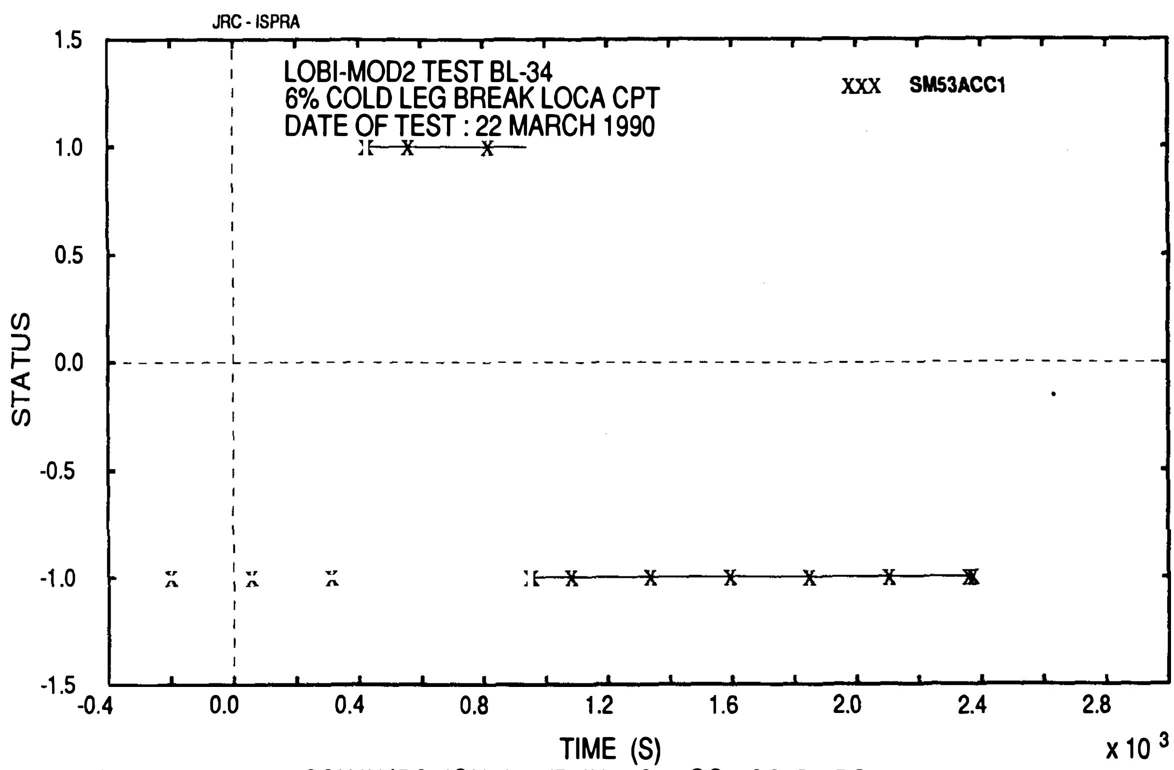
PLOT 15.1 PRESSURIZER CONTROL VALVE ENABLE
- ON (+1) - OFF (-1)



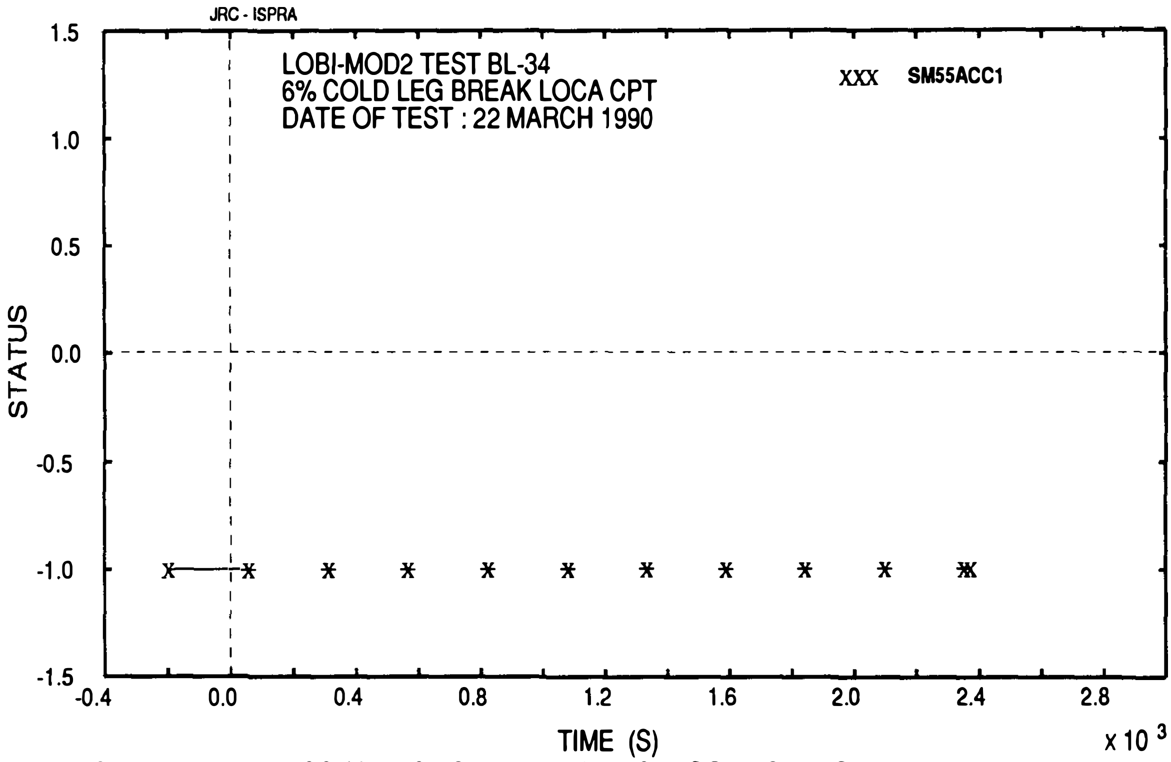
PLOT 15.2 UPPER PLENUM DRAIN VALVE
- ON (+1) - OFF (-1)



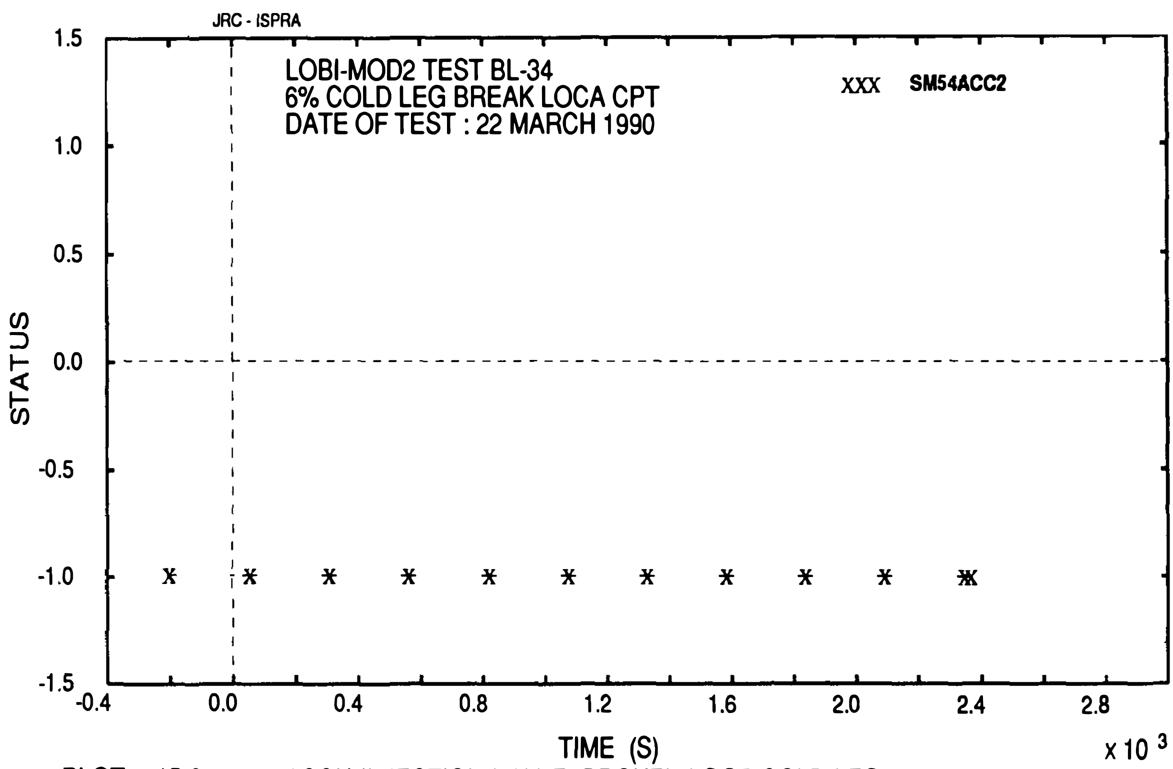
PLOT 15.3 UPPER HEAD BYPASS VALVE
- ON (+1) - OFF (-1)



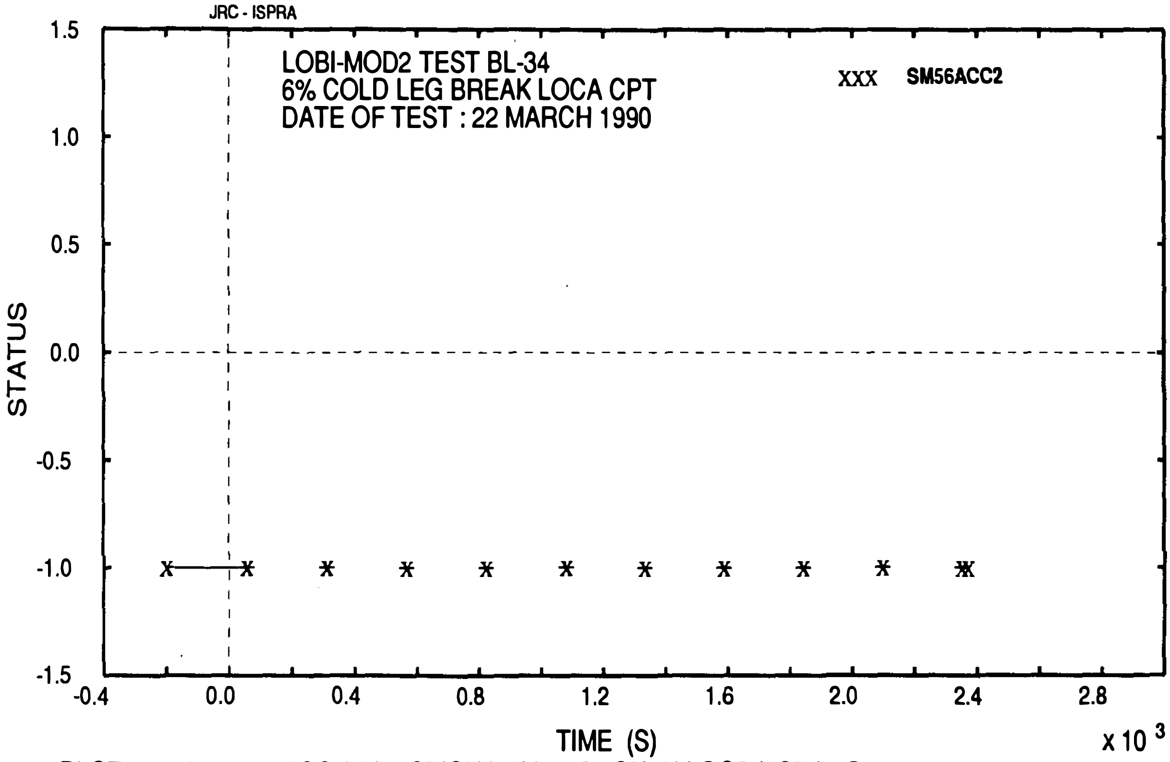
PLOT 15.4 ACCU INJECTION VALVE, INTACT LOOP COLD LEG
- ON (+1) - OFF (-1)



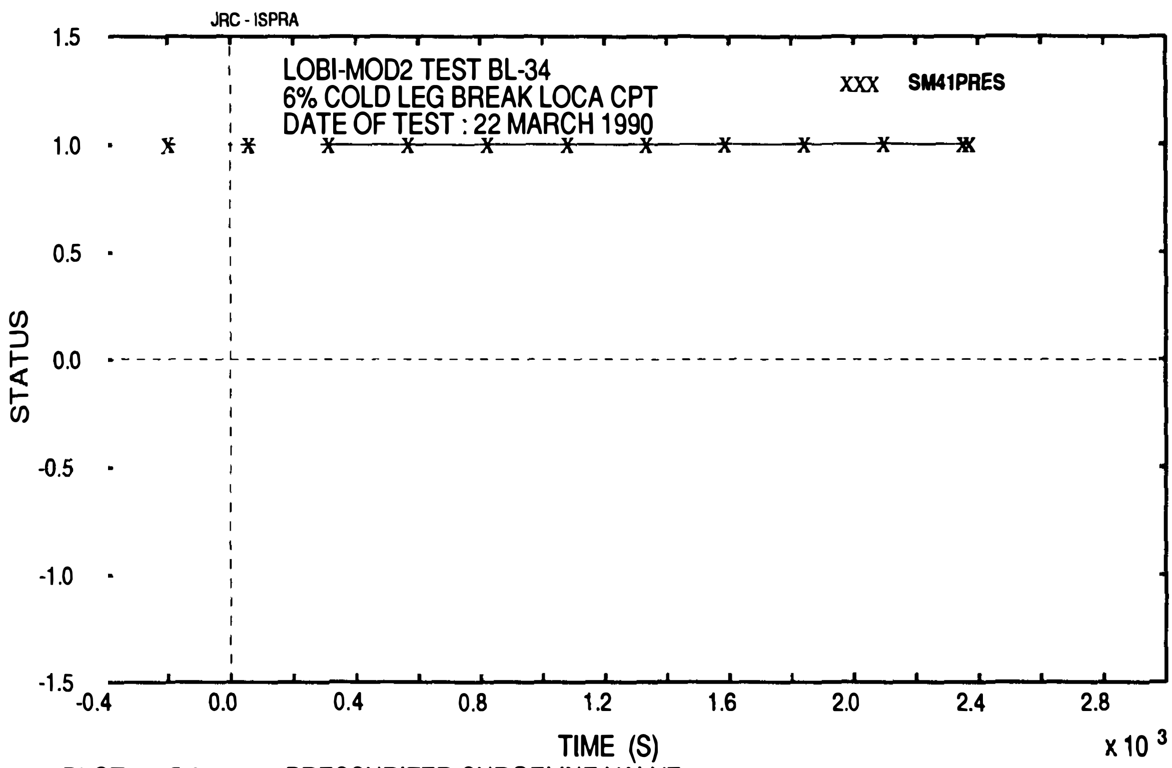
PLOT 15.5 ACCU INJECTION VALVE, INTACT LOOP HOT LEG
- ON (+1) - OFF (-1)



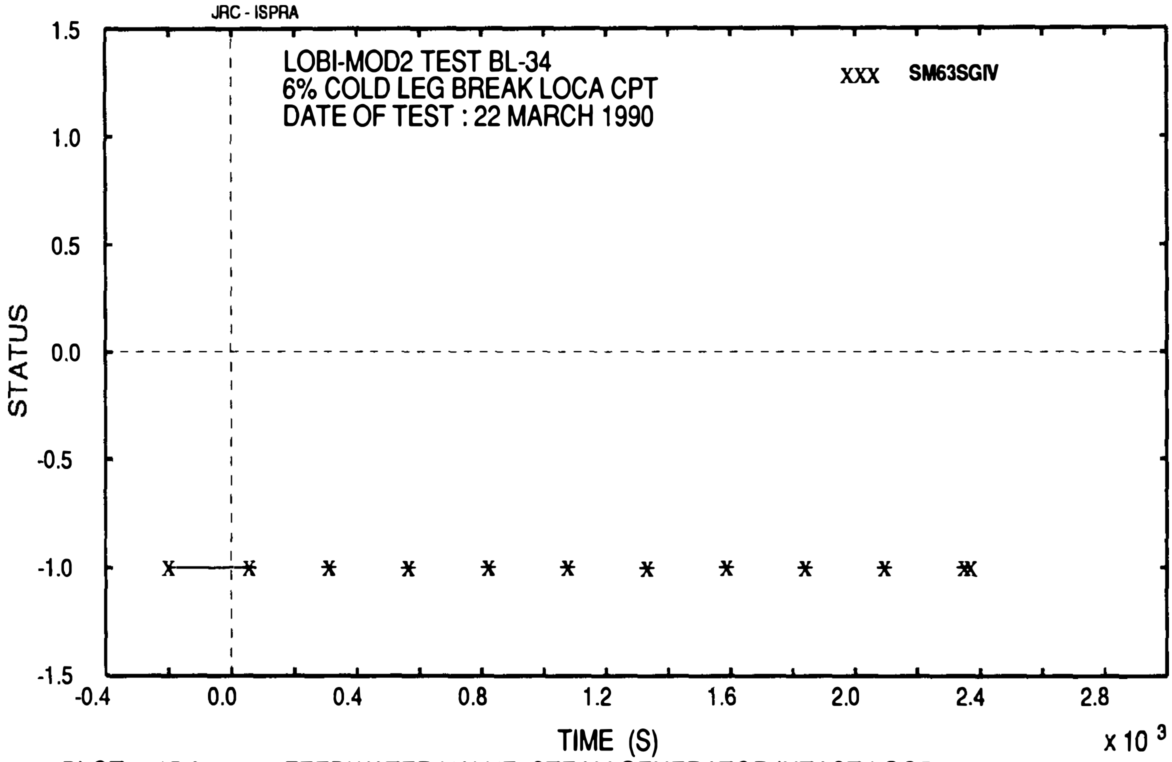
PLOT 15.6 ACCU INJECTION VALVE, BROKEN LOOP COLD LEG
- ON (+1) - OFF (-1)



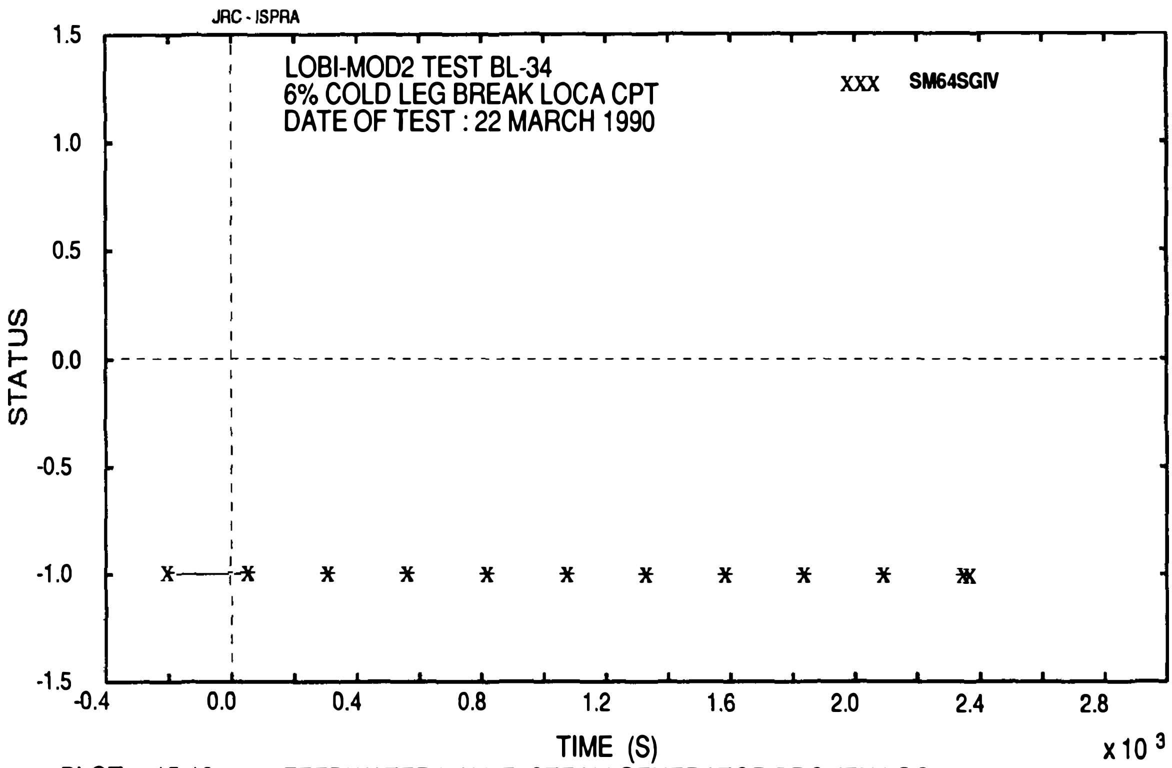
PLOT 15.7 ACCU INJECTION VALVE, BROKEN LOOP HOT LEG
- ON (+1) - OFF (-1)



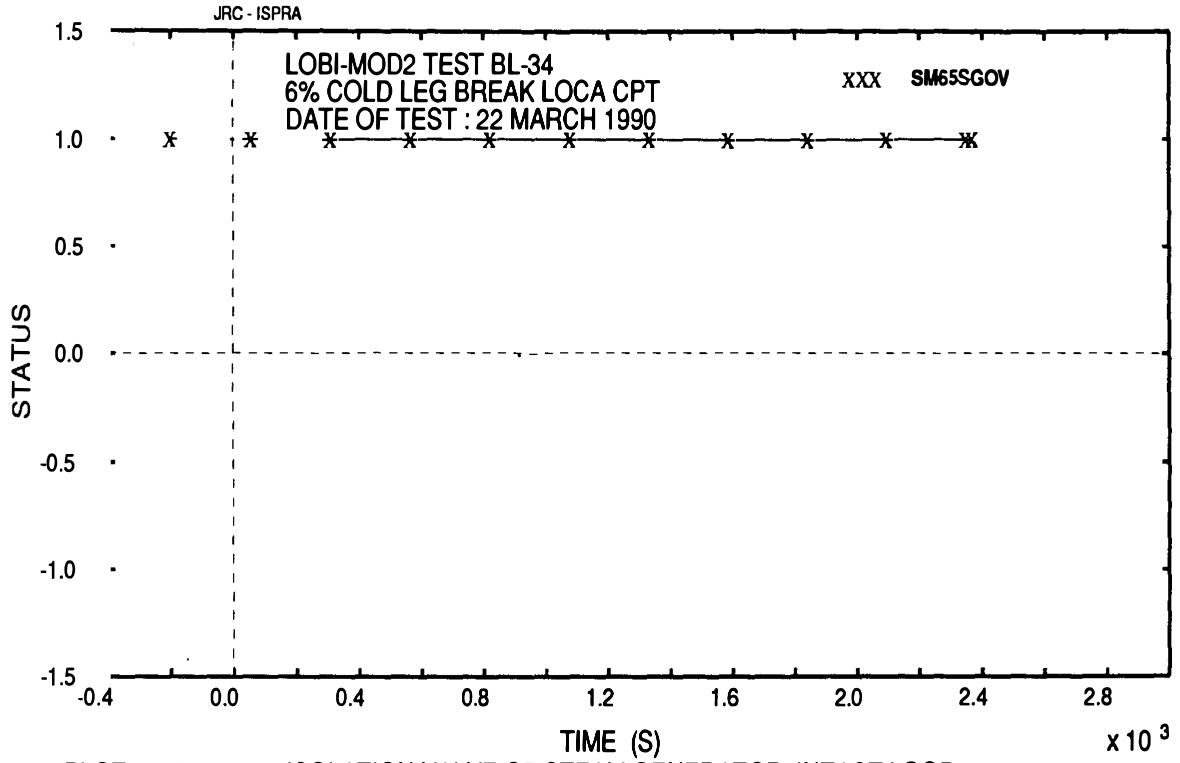
PLOT 15.8 PRESSURIZER SURGELINE VALVE
- ON (+1) - OFF (-1)



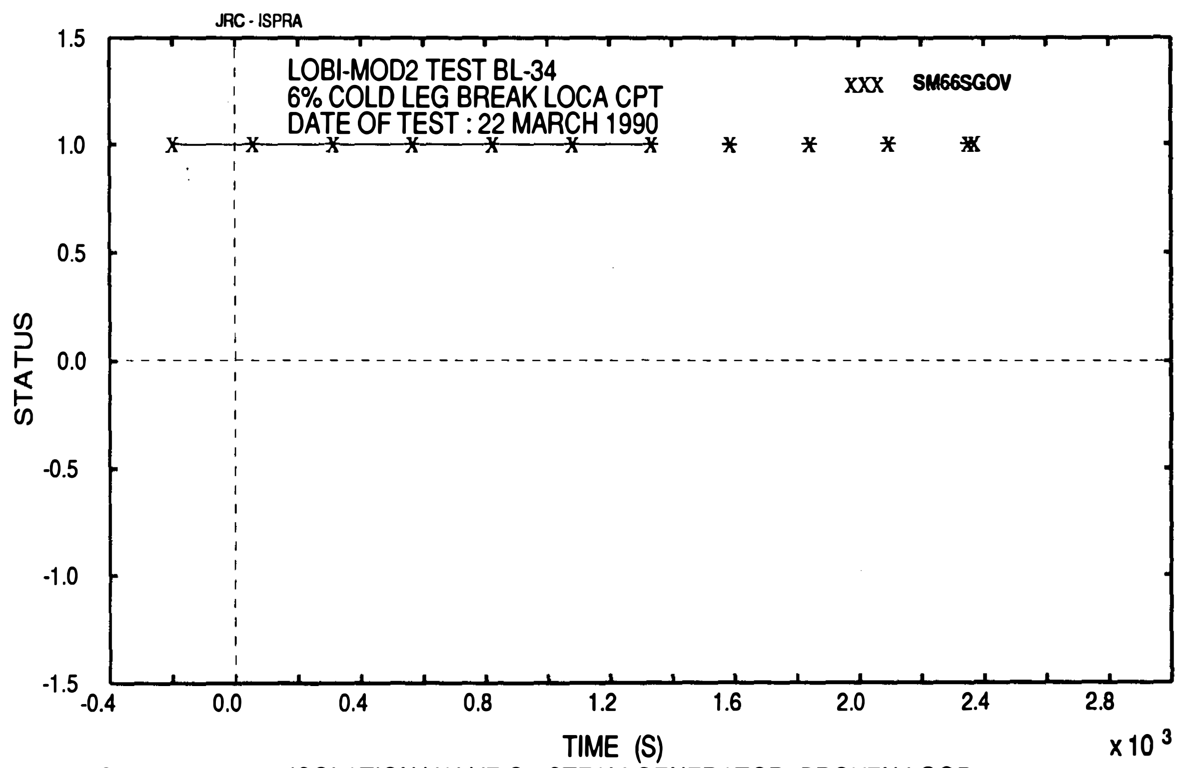
PLOT 15.9 FEEDWATER VALVE, STEAM GENERATOR INTACT LOOP
- ON (+1) - OFF (-1)



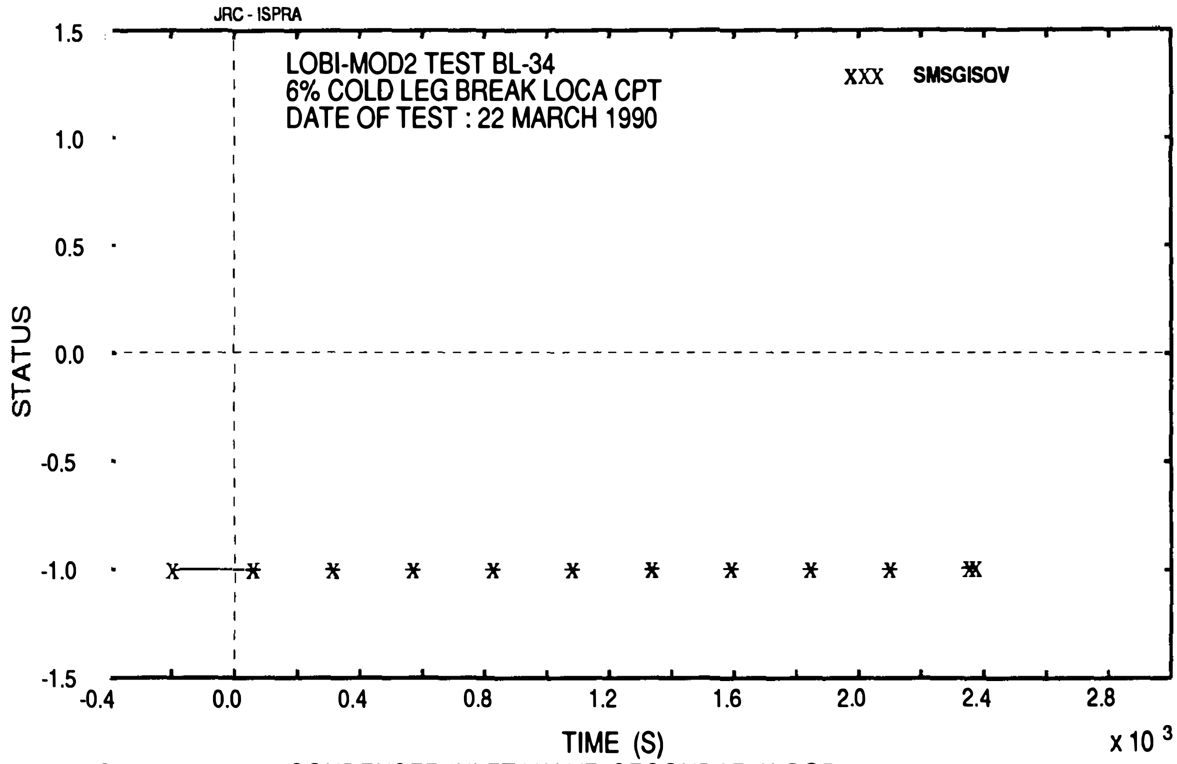
PLOT 15.10 FEEDWATER VALVE, STEAM GENERATOR BROKEN LOOP
- ON (+1) - OFF (-1)



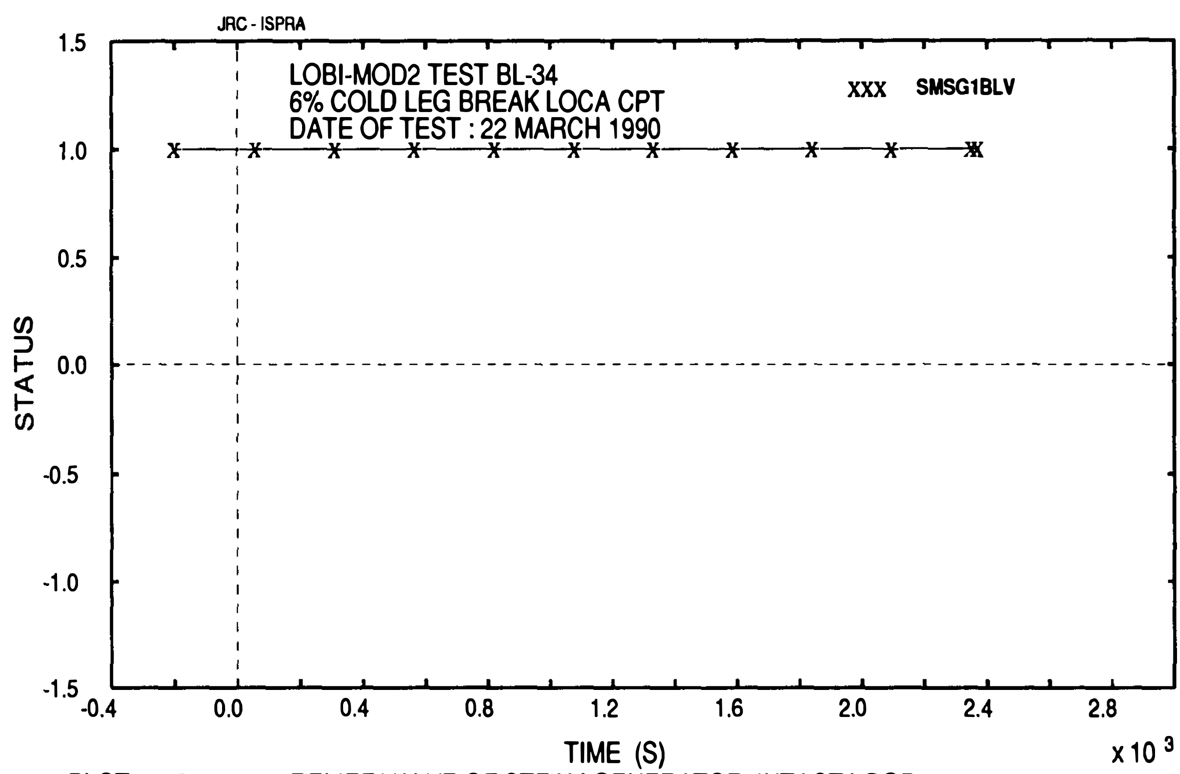
PLOT 15.11 ISOLATION VALVE OF STEAM GENERATOR, INTACT LOOP
- ON (+1) - OFF (-1)



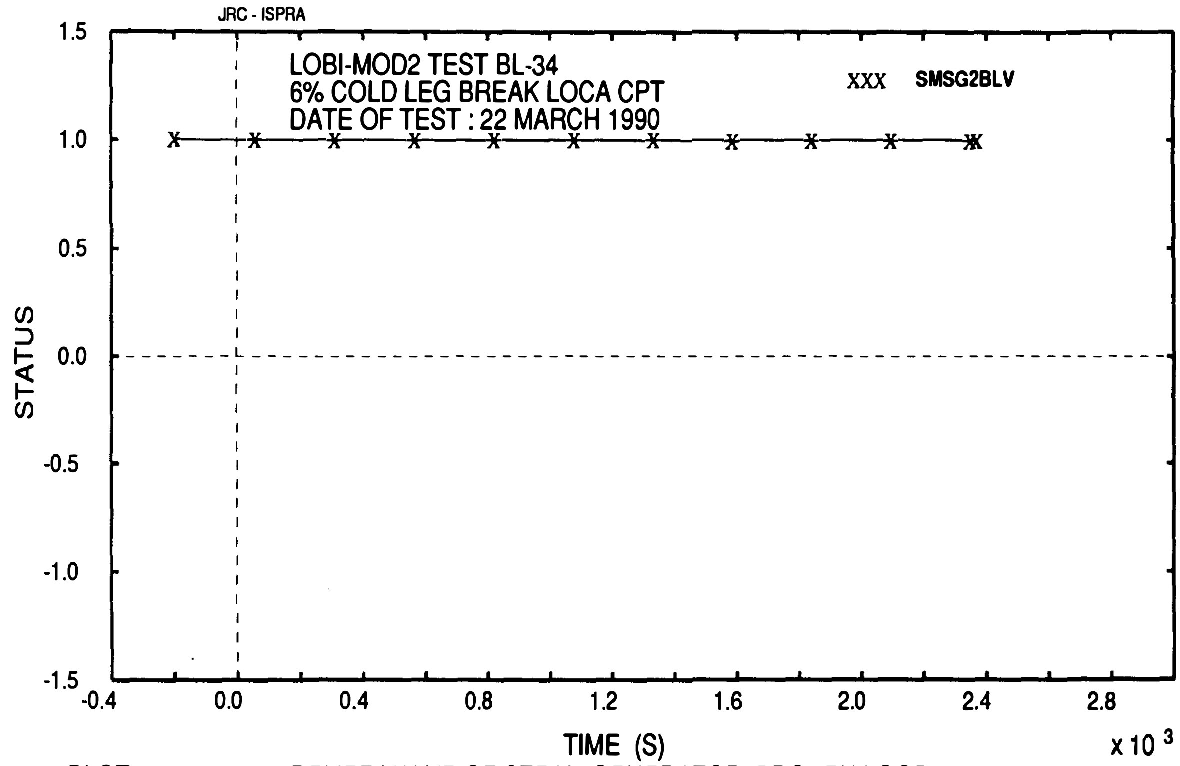
PLOT 15.12 ISOLATION VALVE OF STEAM GENERATOR, BROKEN LOOP
- ON (+1) - OFF (-1)



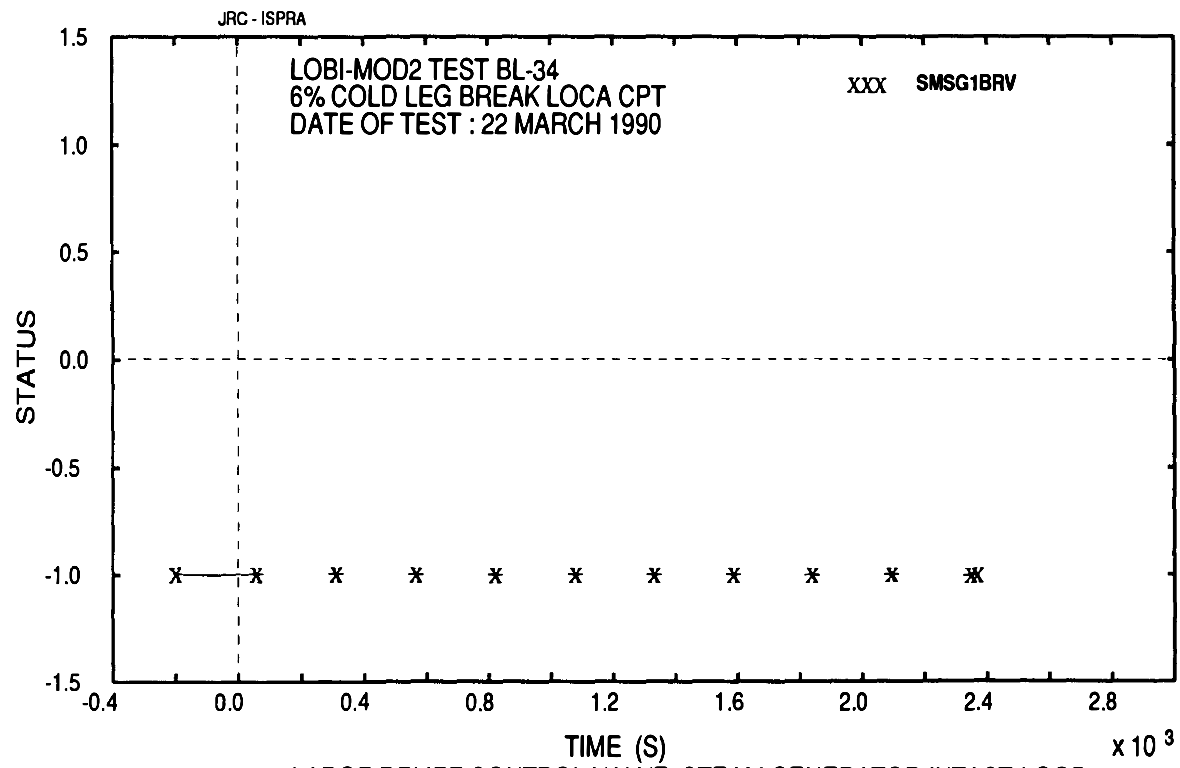
PLOT 15.13 CONDENSER INLET VALVE, SECONDARY LOOP
- ON (+1) - OFF (-1)



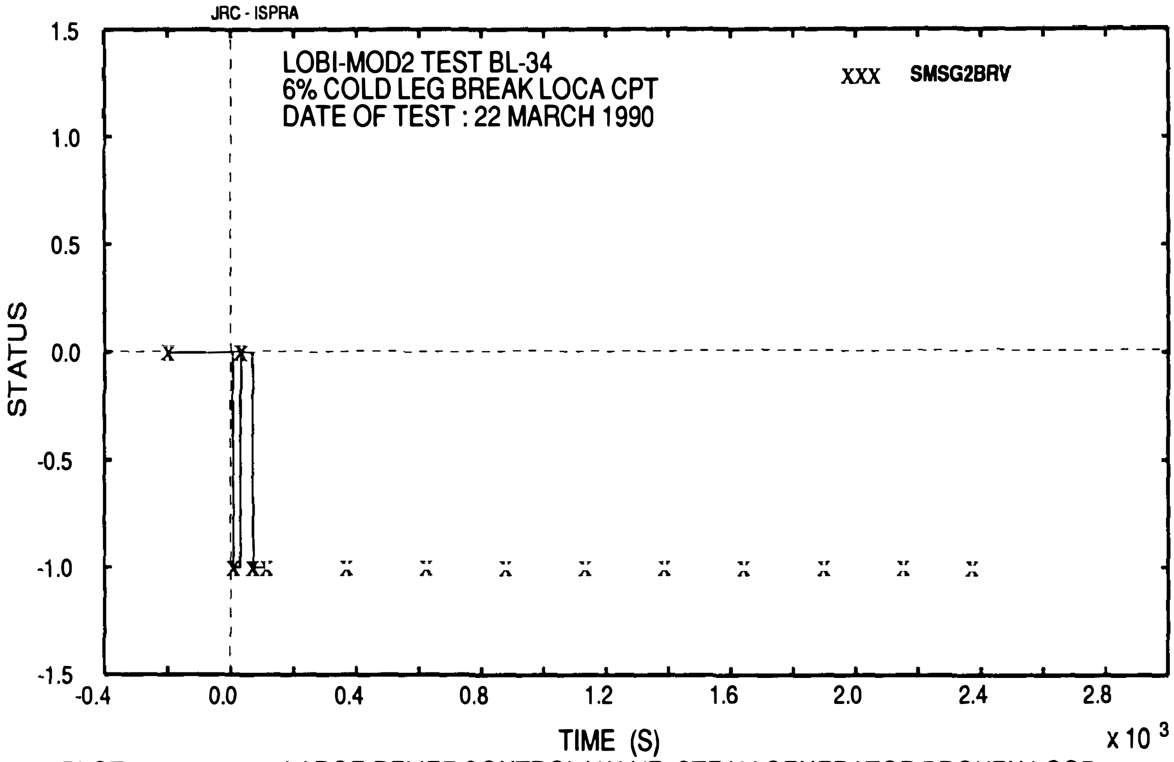
PLOT 15.14 RELIEF VALVE OF STEAM GENERATOR, INTACT LOOP
- ON (+1) - OFF (-1)



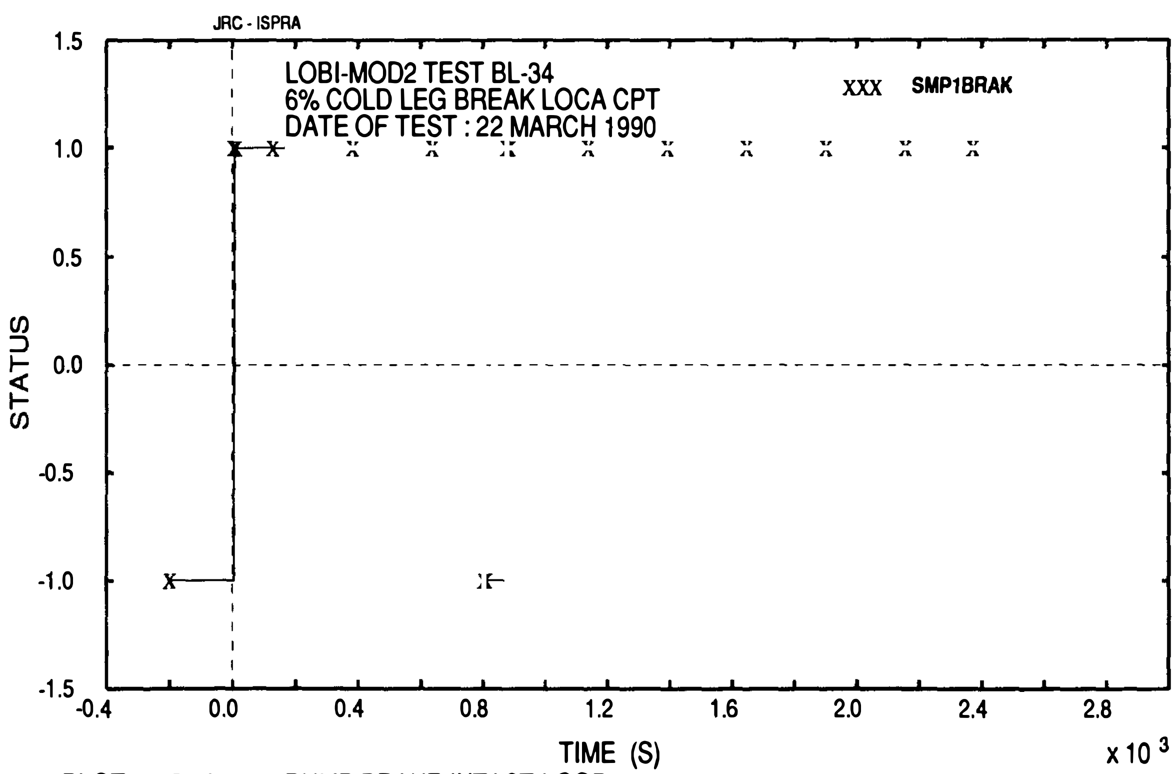
PLOT 15.15 RELIEF VALVE OF STEAM GENERATOR, BROKEN LOOP
- ON (+1) - OFF (-1)



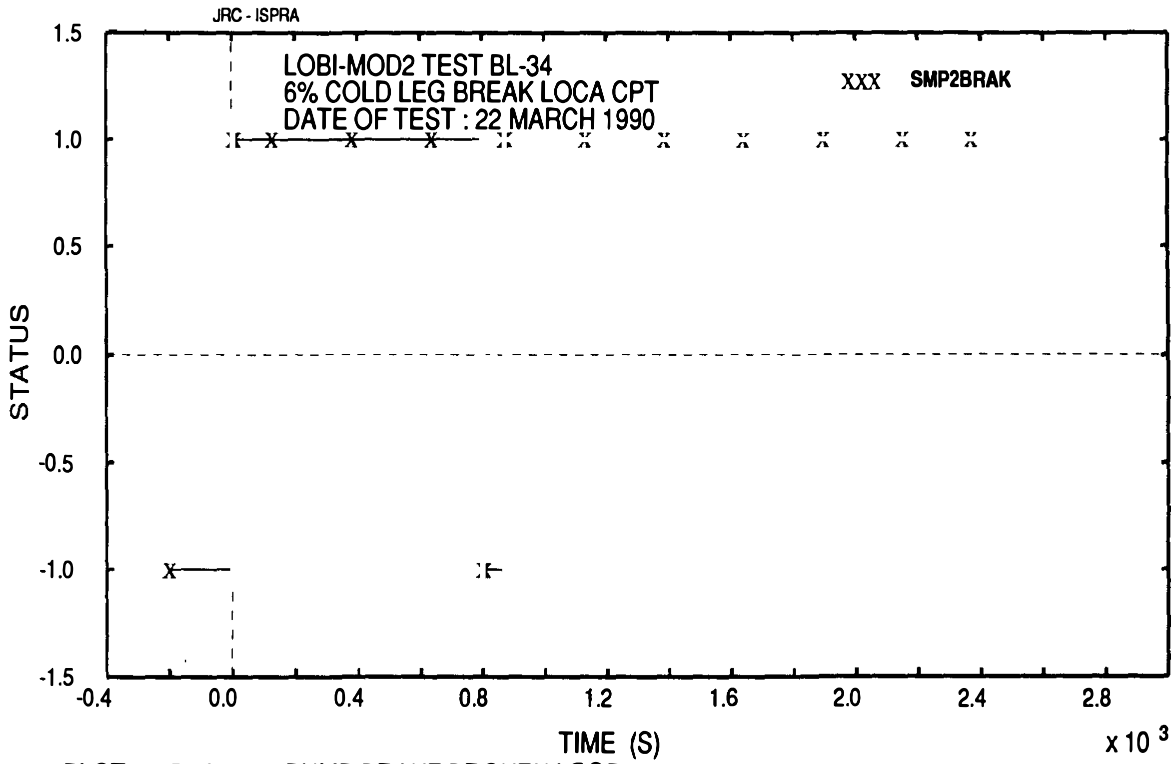
PLOT 15.16 LARGE RELIEF CONTROL VALVE, STEAM GENERATOR INTACT LOOP
- ON (+1) - OFF (-1)



PLOT 15.17 LARGE RELIEF CONTROL VALVE, STEAM GENERATOR BROKEN LOOP
- ON (+1) - OFF (-1)

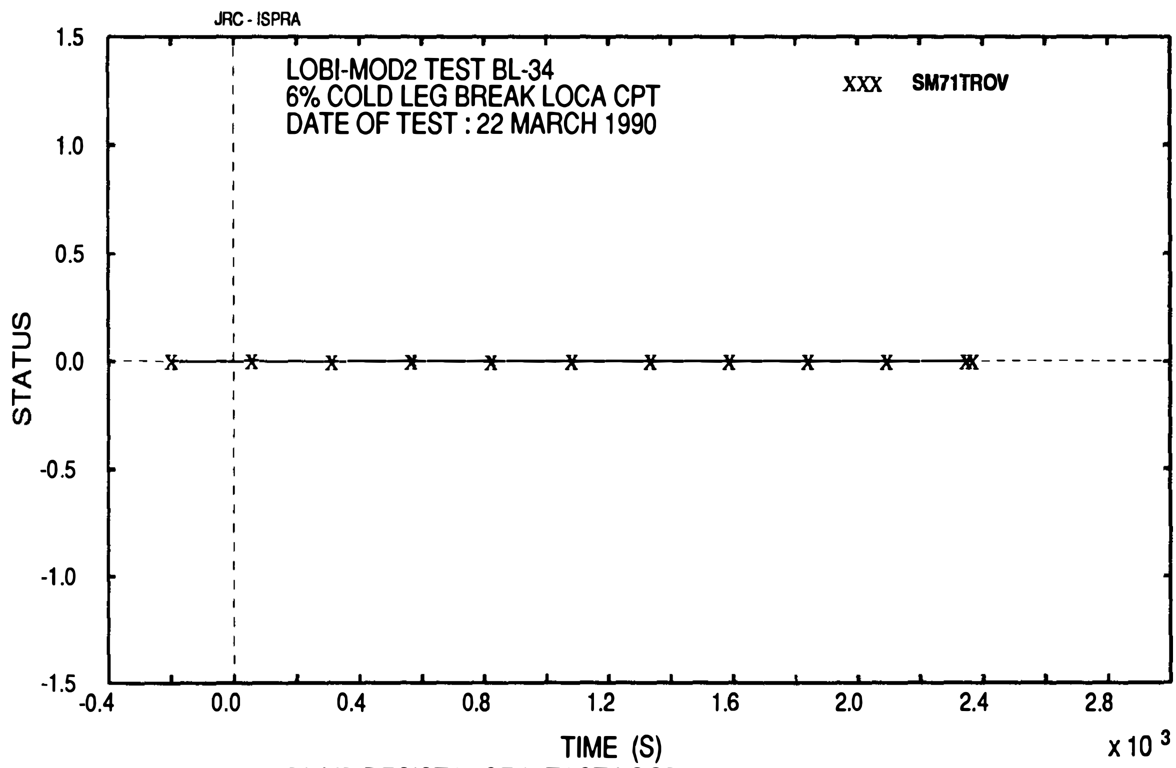


PLOT 15.18 PUMP BRAKE INTACT LOOP
- ON (+1) - OFF (-1)



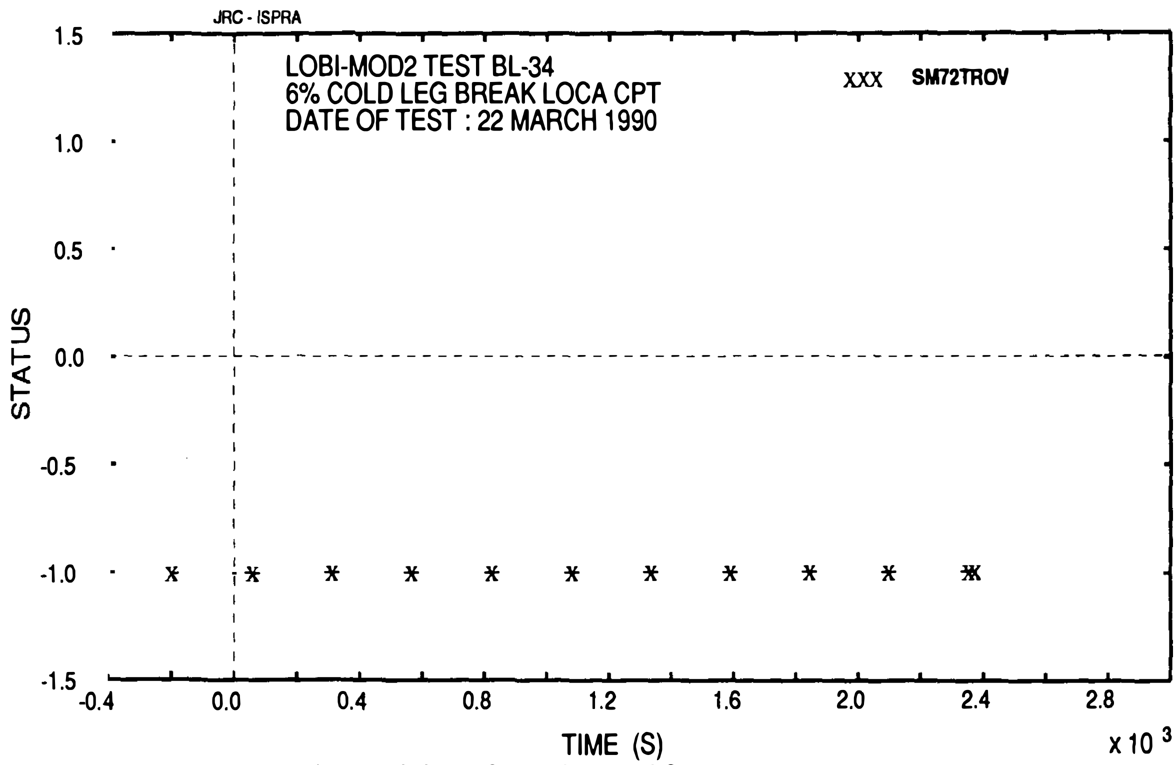
PLOT 15.19 PUMP BRAKE BROKEN LOOP

- ON (+1) - OFF (-1)

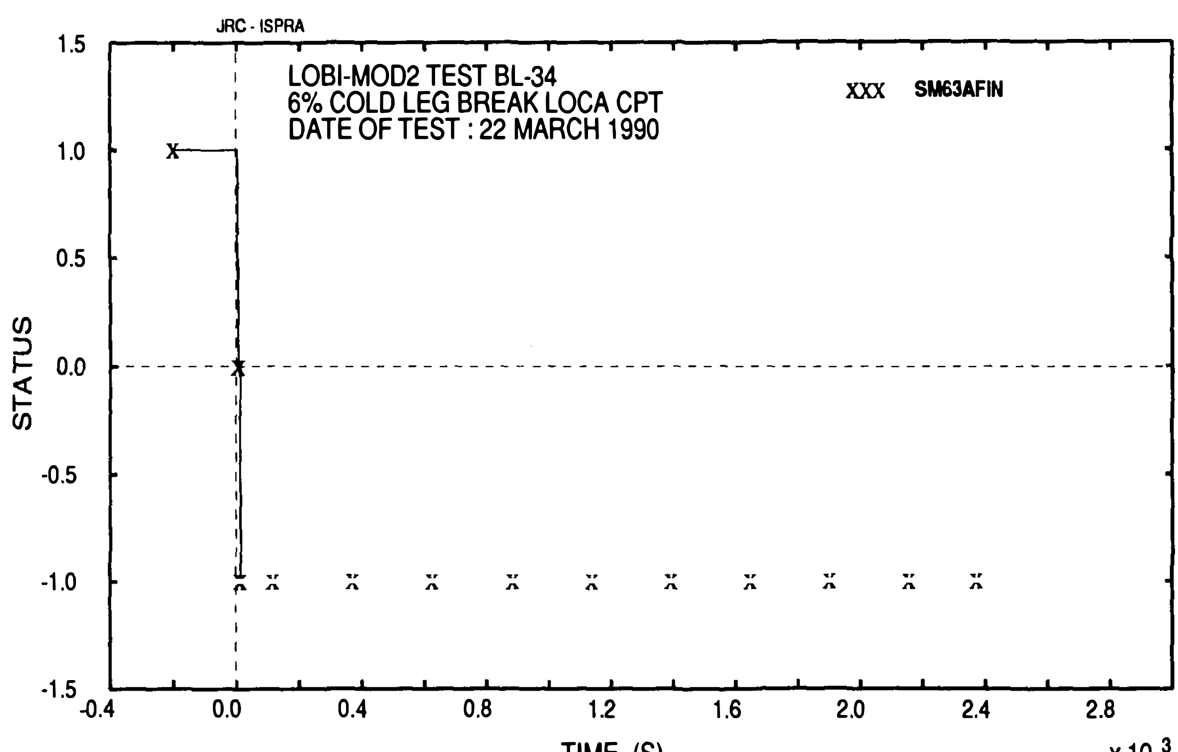


PLOT 15.20 PUMP RESISTANCE INTACT LOOP

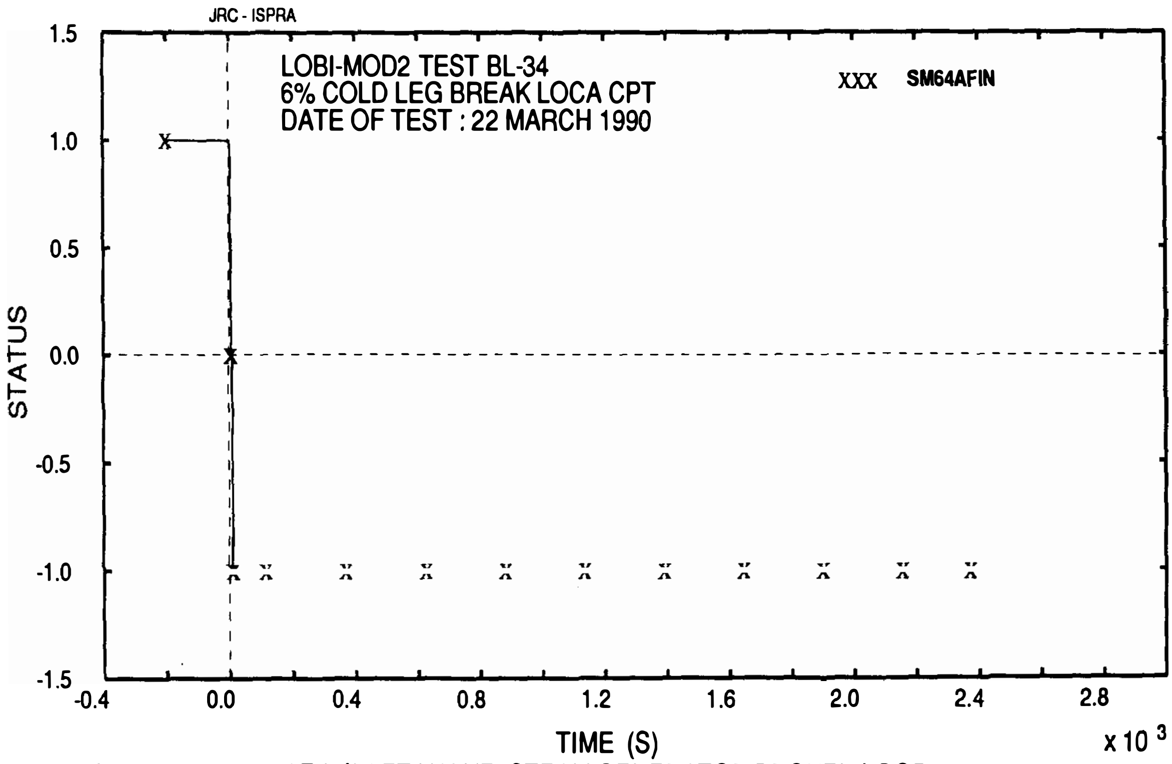
- ACTIVE (-1) - INACTIVE (+1)



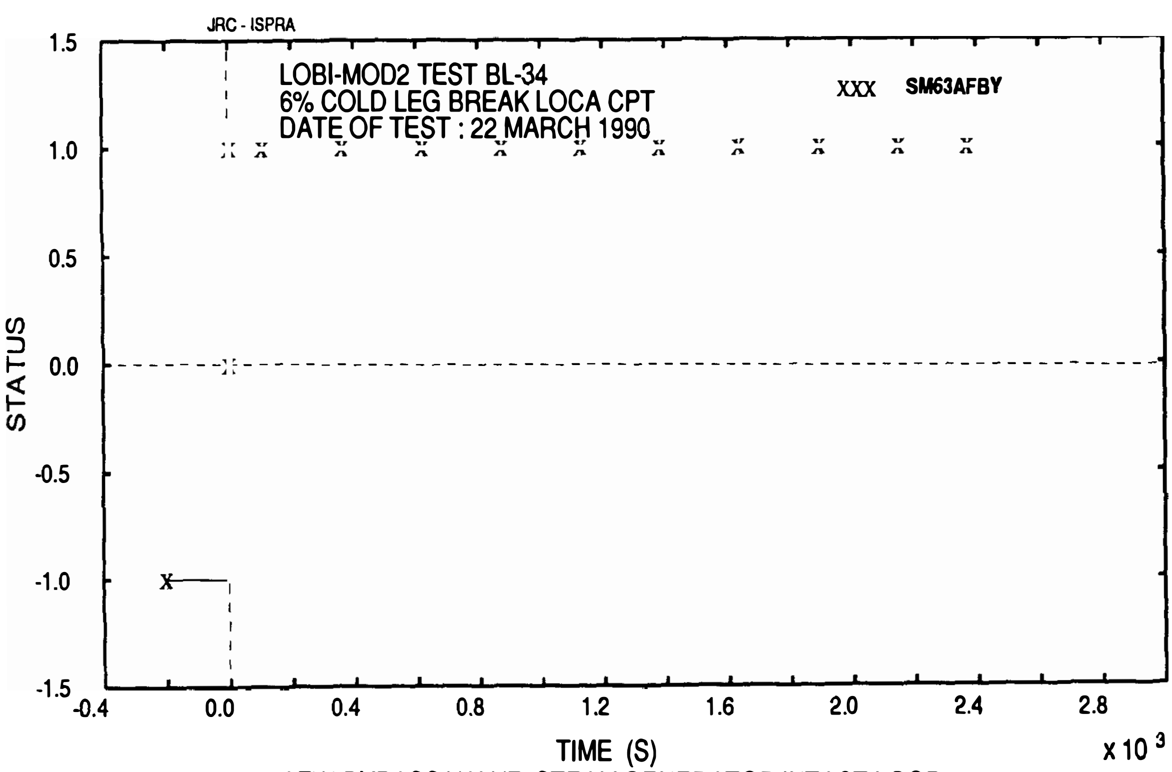
PLOT 15.21 PUMP RESISTANCE BROKEN LOOP
- ACTIVE (-1) - INACTIVE (+1)



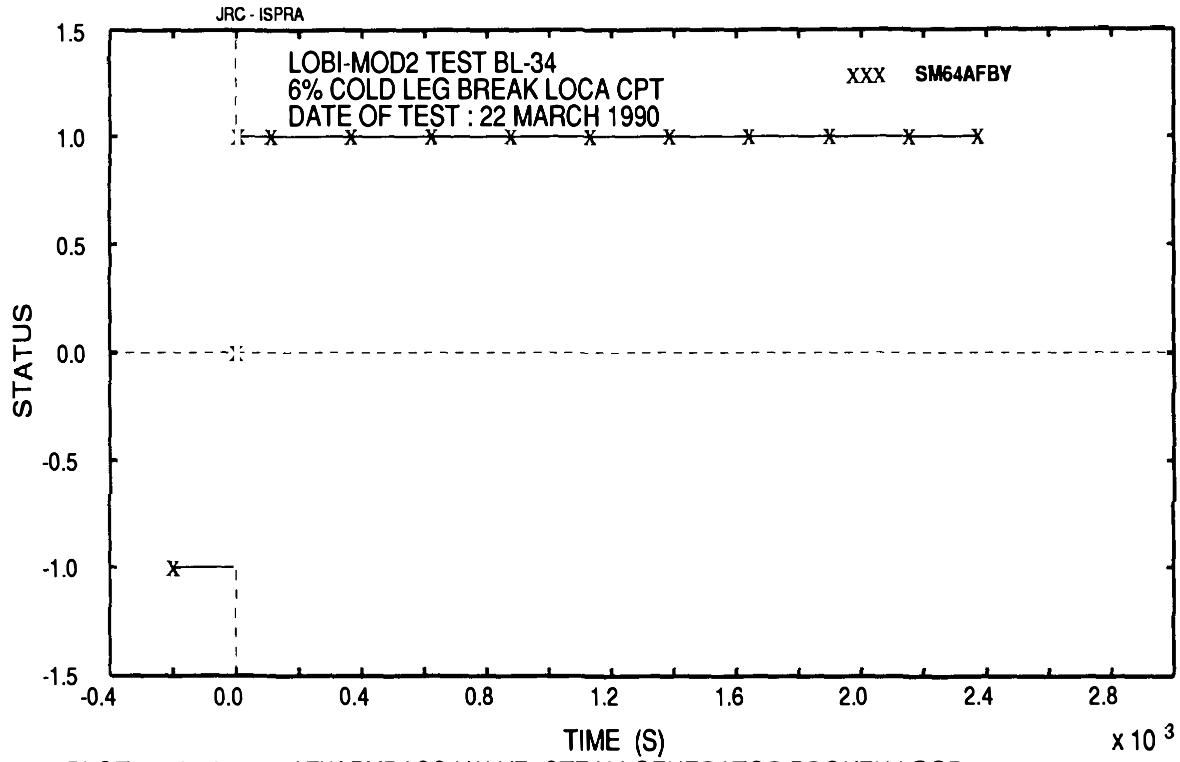
PLOT 15.22 AFW-INLET VALVE, STEAM GENERATOR INTACT LOOP
- ON (+1) - OFF (-1)



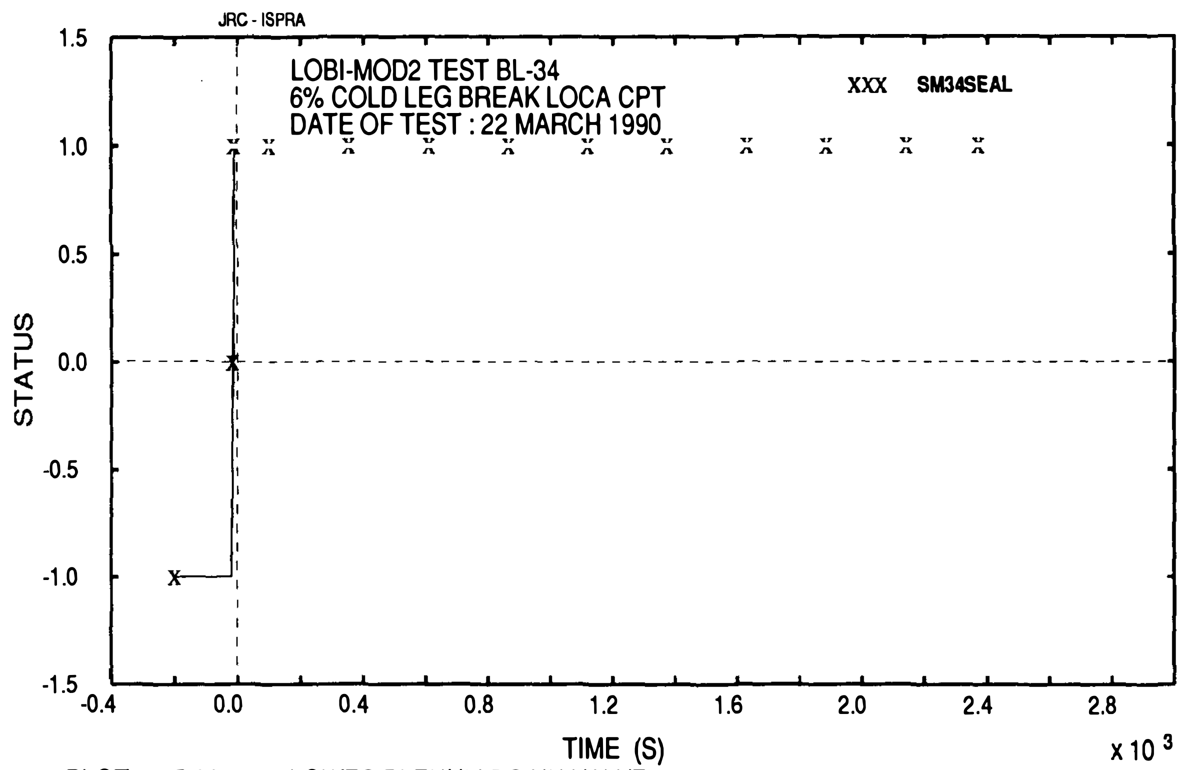
PLOT 15.23 AFW-INLET VALVE, STEAM GENERATOR BROKEN LOOP
- ON (+1) - OFF (-1)



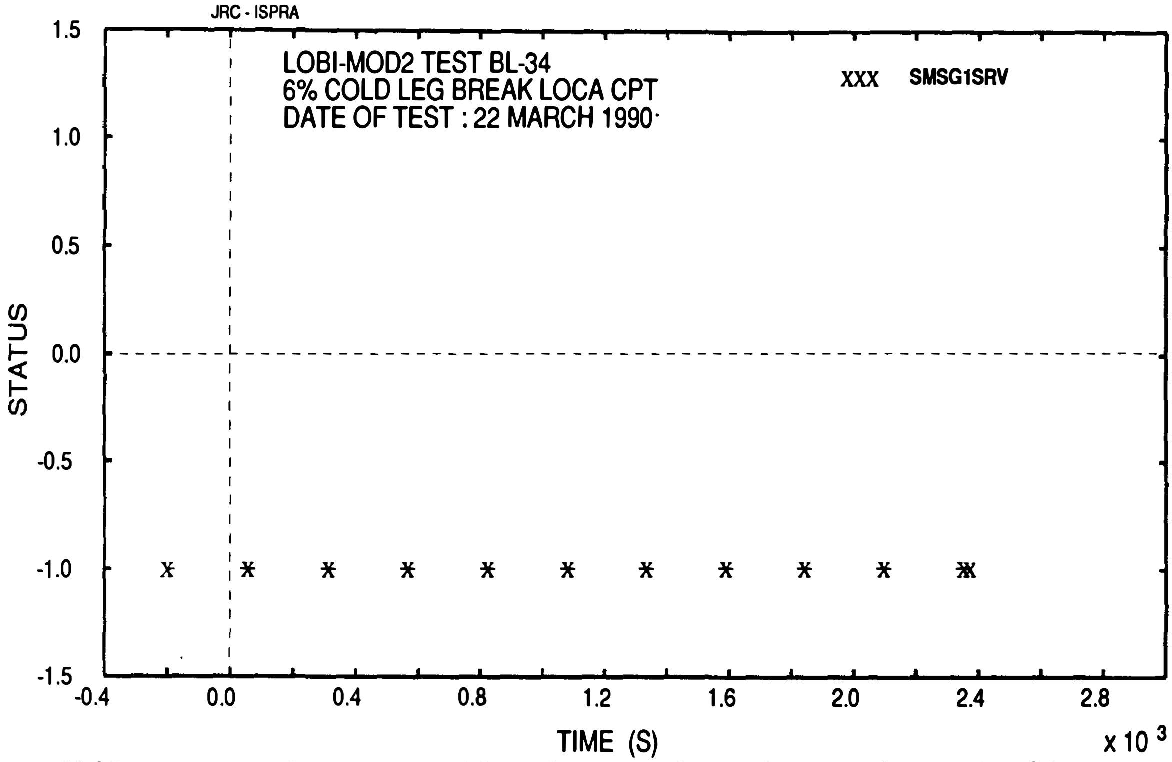
PLOT 15.24 AFW-BYPASS VALVE, STEAM GENERATOR INTACT LOOP
- ON (+1) - OFF (-1)



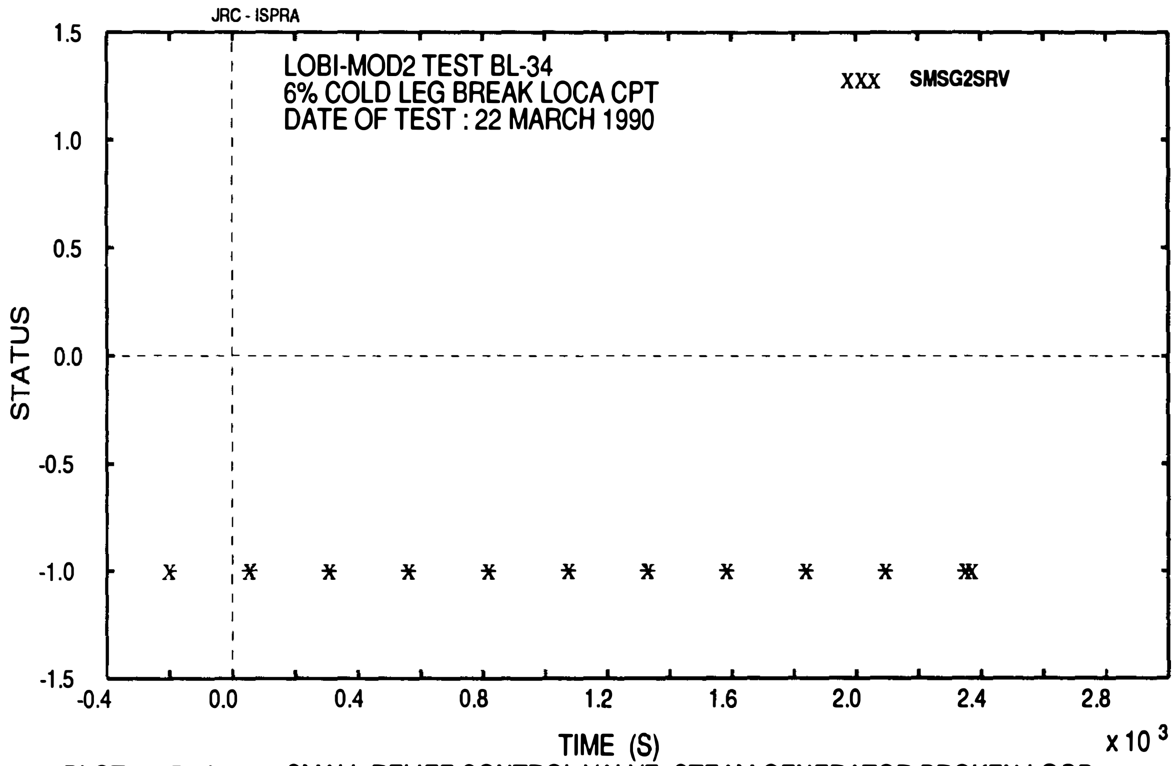
PLOT 15.25 AFW-BYPASS VALVE, STEAM GENERATOR BROKEN LOOP
- ON (+1) - OFF (-1)



PLOT 15.26 LOWER PLENUM DRAIN VALVE
- ON (+1) - OFF (-1)



PLOT 15.27 SMALL RELIEF CONTROL VALVE, STEAM GENERATOR INTACT LOOP - ON (+1) - OFF (-1)



PLOT 15.28 SMALL RELIEF CONTROL VALVE, STEAM GENERATOR BROKEN LOOP - ON (+1) - OFF (-1)

Appendix A

LOBI Measurement Identification

Each experimental measurement in the LOBI-system is identified by a code formed of eight alphanumerical symbols. The code describes the type of measurement and the measurement point location in the system. It has the following scopes :

- identification of measurements in the systems
- data identifier for data storage and processing
- identifier in plots or graphical presentation of experimental data and results.

The code, however, contains no information about the characteristics of individual measurement transducers or electronics; this information is contained in the "Log Sheet" of each test.

Table A1 gives an explanation of the identification codes with examples of the three formats in use. The first two letters in each of these formats describes the type of measurement, as detailed in **Table A2.**

Table A1 : *Measurement Identification*

FORMAT I (for normal measurement types)

Measurement type (see Tab. A2) → | Q T | 2 1 | H | 1 8 0 |

Measurement location (see Tab. 3)
Flow direction (Horizontal, Vertical) or Elevation
Installation angle in degrees or measurement point sector
(see Tab. A4)

e.g. QT21H180 : turbine probe mounted from below at the horizontal measurement position 21
TF95C2 : fluid temperature in intact loop steam generator riser, level C, point sector 2.

FORMAT II (for differential measurements)

Measurement type (PD or TD) → | P D | 1 6 | 1 1 | 3 | 3 |

Measurement location # 1 (see Tab. A3)
Measurement location # 2 (see Tab. A3) or the two elevations when both measurement locations are identical

1. measurement point sector (see Tab. A4) or elevation of first location requiring this information
2. measurement point sector (see Tab. A4) or elevation of second location requiring this information

e.g. PD161133 : diff. pressure pos. 16 to 11 (equivalent PA16-PA11)
PD3RDA44 : diff. pressure in pressure vessel riser level D to A
PD3R21A4 : diff. pressure in pressure vessel riser level A to position 21 (point sector 4)

FORMAT III (Heater rod measurements)

Measurement type (TH or VH) → | T H | 3 | 5 E | 3 | 1 2 |

Measurement location (= 3 for Pressure Vessel)
Heater rod coordinates (see Fig. A2)
Measurement point sector (see Fig. A2)
Elevation (see Fig. A2)

e.g. TH35E312 . Heater rod wall temperature, rod 5E, point sector 3, elevation 12.

Table A2 - Measurement Type Symbols

Main measurement types

BT	Break time	QT	Flow, local velocity by turbine probe
DD, DS	Density, double or single beam	QV	Flow, volumetric by full flow turbine or vortex meter (QV ... VX)
HF	Heat flux		
IH	Heater current	RP	Pump speed
MP	Torque, pump shaft	SM	Status measurement (valves, etc.)
PA	Pressure, absolute	TD	Differential temperature
PD	Differential pressure	TF	Temperature of fluid
QD	Flow, by dragbody impulse	TH	Temperature of heater rod wall
QF	Flow, velocity by full-flow turbine	TK	Temperature, correlation probe
QI	Flow direction indicator	TR	Temperature, resistance thermometer
QL	Fluid mass	TW	Temperature of wall
QM	Mass flow rate	VH	Heater voltage
QP	Flow, by Pitot differential pressure	WH	Heater power
QS	Flow, pump seal water		

Calculated parameters

CL	Collapsed level	CI	Mass inventory
CX	Mixture level	CM	Mass flow rate

Table A3 - Measurement Locations

Loop measurement locations

01-09	Break assemblies:
	01-06 Primary loop
	07 Pressurizer relief valve
	08 Secondary steam line
	09 Steam generator U-tube
11-17	Measurement inserts, intact loop
21-27	Measurement inserts, broken loop
31-39	Reactor Pressure Vessel Model
3D, 3R	Pressure Vessel Downcomer and Riser
40-44	Pressurizer
50-58	ECC and AFW injection systems

Other measurement locations

61-66	Secondary Loop
71, 72	Main Coolant Pumps
80-87	Steam Generator, broken loop
90-97	Steam Generator, intact loop
00	Containment

The normal code, see format I in Table A1, identifies with the third and fourth digits the measurement locations with the designations of the main loop components given in Table A3. Most of these locations within the test facility are shown in **Fig. A1**. The fifth symbol in the code then indicates horizontal (H) or vertical (V) flow direction. This information is important for the correct analysis of signals from certain transducer types in two-phase flow conditions. For vertical flow channels as in the pressure vessel (3R, 3D) or in the steam generators this fifth position indicates the level. The exact elevation of these levels is shown in section 3.3, Figs. 8 to 10 in the EDR. The last digits specify the installation angle or the point sector of the transducer in the flow cross-section. The definition of mounting angles and point sectors is given in **Table A4**.

Measurement types related to two measurement points such as differential pressure or differential temperature, are identified by code format II, see Table A1. This format identifies the "from" location as well as the "to" location of the measurement points. Differential signals are always defined as the absolute value at the "first location" minus the absolute value at the "second location". For example, a positive PD-value signifies that the pressure at the location labelled first in the identification code is higher than the pressure at the second location.

Measurements in the break assembly follow format I and II. The letter in the fifth position, for differential pressure measurements also in the sixth position, indicates the position within the break assembly. Further numbers indicate the angle or point sectors.

The heater rod temperature measurements require a different code format in order to specify the thermocouple positions within the rod bundle, see code format III in Table A1. The definition of axial locations and rod position in the bundle matrix as well as the thermocouple locations with respect to the bundle geometry are shown in **Fig. A2.**

For measurements where the angle and/or the flow direction information is irrelevant, the last 3 or 4 digits in the identifier may be left blank (e.g. the full-flow turbine code "QF12V"). In some cases, the last digits may then be used for other pertinent information about the measurement, e.g. in the density measurement code, the "PER" or "DIA" in the last three digits indicates that the measurement relates to the "peripheral" or the "diametral" beam through the pipe cross-section for a two-beam densitometer.

Calculated liquid levels follow format II. The first and second elevation symbol identify the lower and upper reference height. For example, "CL83BT" is the calculated collapsed level in the downcomer of the broken loop steam generator (83) from level B to T.

Table A4: Definition of Measurement Point Angles

Format I :

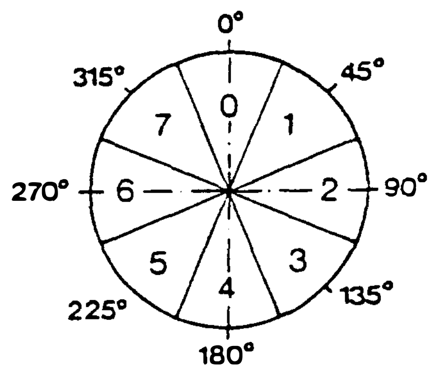
Mounting angles of measurement points with respect to the flow area plan are given, in degrees, by the 3 last digits in the identification code, see Tab. A1

Format III :

For the angular orientation of the heather rod thermocouples and for defined location sectors, see Fig. A2

Format II :

Measurement point angles are defined by 8 sectors in the measurement cross section :



Sector Nr.	Sector angle	Range from to		Range angles
0	0°	337,6	/	22,5
1	45°	22,6	/	67,5
2	90°	67,6	/	112,5
3	135°	112,6	/	157,5
4	180°	157,6	/	202,5
5	225°	202,6	/	247,5
6	270°	247,6	/	292,5
7	315°	292,6	/	337,5

LOOP COMPONENTS WITH

horizontal flow :

The 0° reference is vertically upwards; angles are defined clockwise looking in the normal flow direction

vertical flow :

The 0° reference is in the direction of the Hall north wall; angles are defined clockwise looking downwards

Fig. A1 LOBI-MOD2 facility, main measurement locations

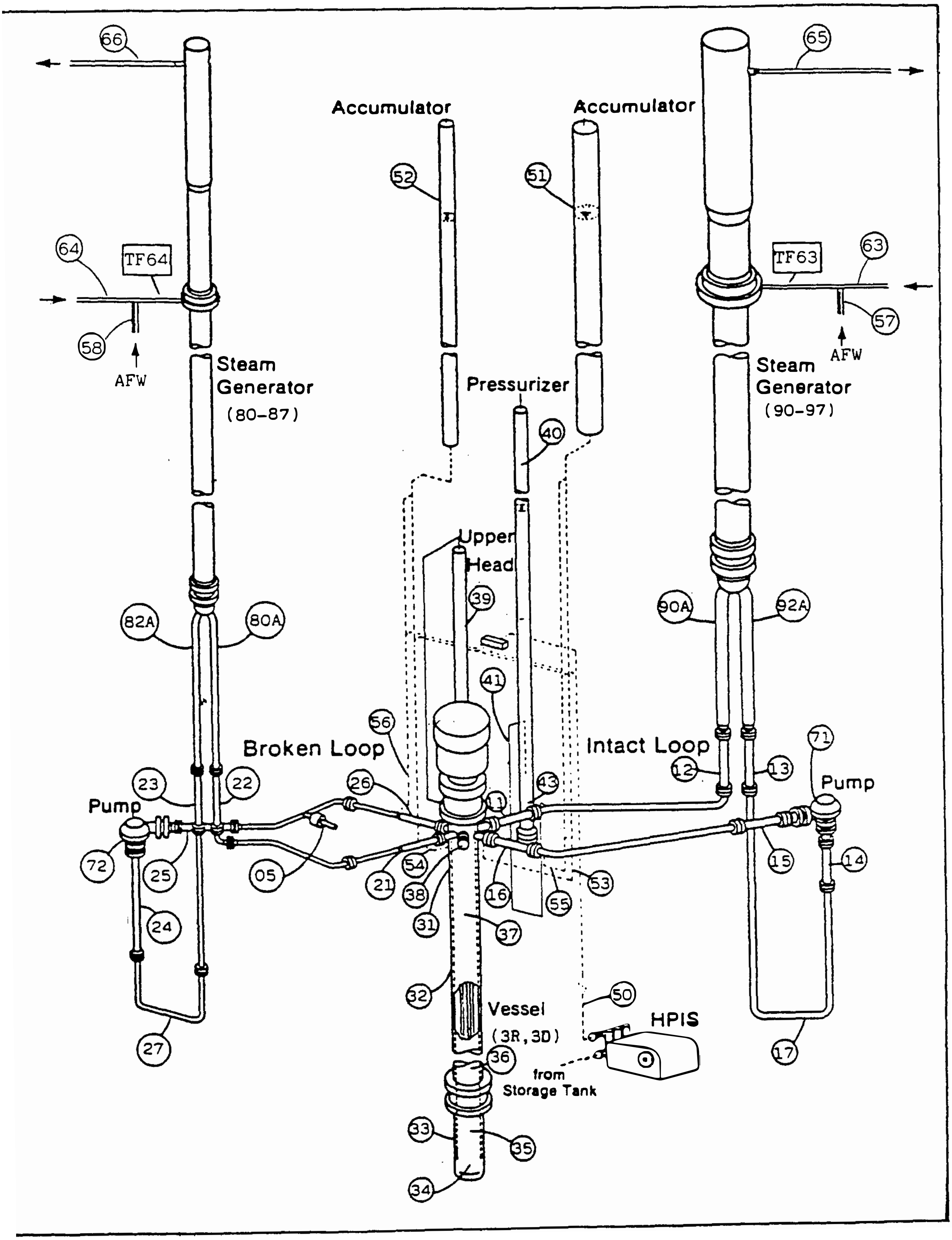
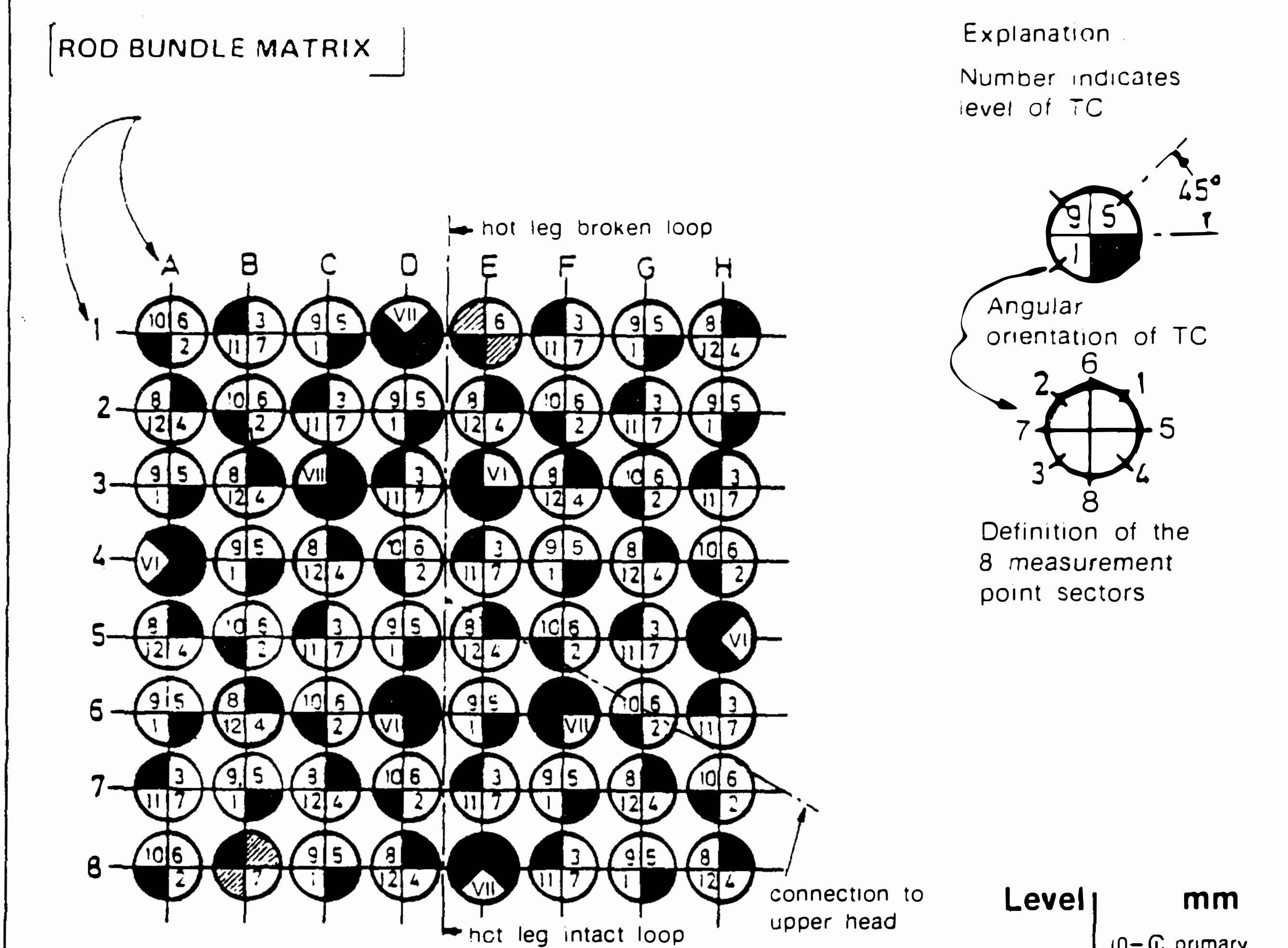
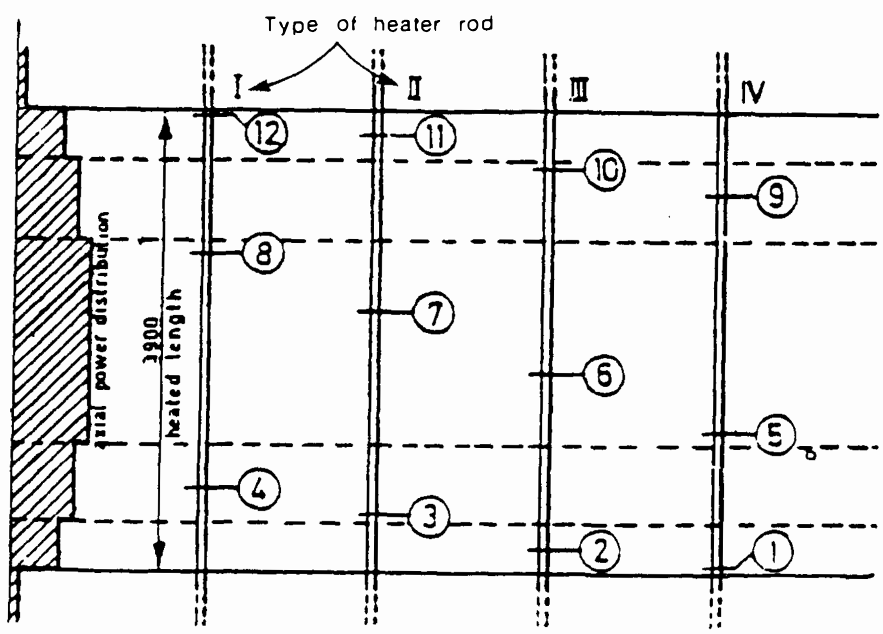


Fig. A2: Arrangement of temperature measurements in the heater rod bundle



ROD TYPES and TC-LOCATION LEVELS



Level	mm (0=℄ primary loop HL)
19	+ 295
18	- 365
17	- 1165
16	- 1585
12	- 2055
11	- 2215
10	- 2495
9	- 2715
8	- 3215
7	- 3715
6	- 4215
5	- 4715
4	- 5215
3	- 5435
2	- 5715
1	- 5875

Rod type VI: TC elevations 16, 18, 19

5 Rod type VII: TC elevations 16, 17, 18

Appendix B

LOBI Measurement Instrumentation

The instrumentation for measurement of the main thermohydraulic parameters is briefly described. The aim is to provide a comprehensive overview. Details are given only where they may explain the nature of the data supplied by the experiment.

1. Measurement Locations

Generally, measurements are performed at the boundaries of the main loop components and of each important section within the pressure vessel as well as in the steam generators. Various measurement locations within the facility are shown in Fig. A1 of Appendix A. The measurements provided at these locations are as follows.

Loop Pipes : Measurements in the loop pipes are performed within "measurement inserts" (see **Figs. B1 and B3**) which contain the complete instrumentation for each location. Normally, one of the two types of insert is used : the "simple" inserts carry instrumentation for measurement of fluid and wall temperatures and have connections for absolute and differential pressure measurements. The "complete" inserts also contain flow and density measurement devices, i.e. turbine flow meters, dragbody transducers and a gamma-densitometer. Furthermore, inserts for vertical and horizontal pipe sections differ from each other. The inserts for horizontal flow, where flow stratification may occur, are supplied with double instrumentation for temperature and flow measurements, mounted both in the lower and in the upper half of the flow cross-section. **Figures B1** to **B4** show typical examples of these measurement inserts with some details of transducer arrangements.

Reactor Pressure Vessel Model : The absolute pressure is taken in the upper plenum. Differential pressure measurements can be provided over all the main sections and sub-sections along the complete flow path of the pressure vessel (see **Fig. 8, Section 3.3 In the EDR**). A second density measurement indicates voidage of the lower plenum. Fluid temperatures are measured at all representative locations and wall temperatures in the downcomer region. The downcomer fluid temperature measurements are provided at different circumferential locations for each level, to detect possible local temperature differences. Mass flow information is provided by flow and density measurements in the core inlet box.

Liquid inventories can be obtained from the differential pressure measurements when flow velocities are small. The algorithm is shown in Appendix E.

Heater Rod Bundle : Each heater rod in the bundle is supplied with three thermocouples in the tube wall (except two rods, on which the heater voltage drop is measured). The location of this instrumentation within the bundle is shown in Fig. A2 of Appendix A. With the number of measurement channels at present available, only a proportion of the total thermocouple instrumentation of the bundle can be recorded during a test. The location of heater rod thermocouples used for this test is shown in section **3.3, Fig. 11 in the EDR.**

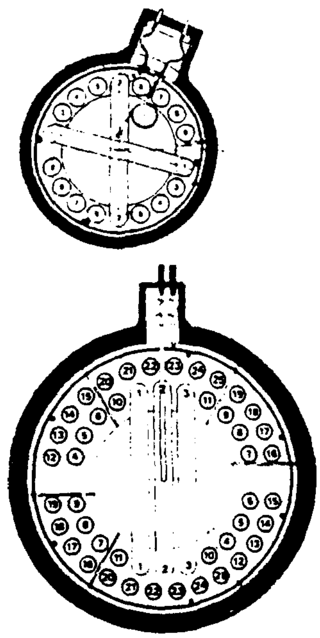
Steam Generators : Measurements include fluid temperatures, U-tube wall temperatures and differential pressure connections on the primary and secondary side. Differential pressure connections may serve to evaluate liquid levels and fluid inventory as described e.g. in Appendix E. The instrumentation of both steam generators is nearly identical. A schematic showing the instrumentation applied for this test is given in **section 3.3, Figs. 5, 6** and **Figs. 9, 10.**

A part of the instrumentation is concentrated at the lower region of the steam generators to provide good spatial resolution at the low secondary mixture levels expected during certain transients. Information about the heat exchange distribution can be derived from the combined measurements of primary and secondary fluid temperatures and from the tube wall temperatures.

Primary side instrumentation is applied to two representative U-tubes in each steam generator : the tube with the highest U-bend has the temperature instrumentation (tube 21 in the intact loop and tube 9 in the broken loop side steam generator), whereas the pressure tappings are applied mainly to the tube with the lowest U-bend (tube 2 in both steam generators).

Pitot instruments measure the flow at three peripheral positions in the downcomer gap of the secondary side. These allow to evaluate the recirculation rates.

Pressurizer : Fluid temperature and pressure are measured and the feed line flow is obtained by a full flow turbine. Differential pressure is measured over the feedline and over the height of the pressurizer to monitor the filling level.



LOBI MOD 2 STEAM GENERATOR SECTIONAL VIEW

Break Assembly : After opening of the break valve, for small break tests the fluid is released via the break orifice and the discharge pipe into a condenser/catch tank system, see Fig. B8.

Within the break assembly fluid and wall temperatures are measured before and behind the break orifice. Differential pressure is measured over the orifice. An absolute pressure measurement is taken downstream of the orifice. The break mass flow is determined by collecting and weighing the condensed fluid in the catch tank.

Secondary Loop : Measurements in the secondary loop, outside the steam generators, are limited to the feed water and steam lines :

- feed water flow is measured by a turbine in each feed line; temperature and pressure are measured at the steam generator inlet.
- measurement inserts, see Fig. B5, are installed in the steam lines at the steam generator outlet: they include volumetric flow, and fluid temperature measurements. Density in the steam line can be evaluated from pressure/temperature data, assuming dry steam flow.

Other parameters recorded during the test are :

- the core heating power, voltage and current
- the speed and shaft torque of the two main coolant pumps
- pump seal water mass flow rates
- speed of the volumetric pump for high pressure injection
- heat flux at some locations of the wall of loop pipes and the pressure vessel
- mass flow rates for each of the ECC and AFW injection lines
- cooler/condenser liquid levels at the secondary and tertiary sides.

2. Measurement Transducers

The two letter code indicated for each measurement type in the following is as used for the identifier labels.

2.1 Temperature Measurements

Fluid temperatures (TF) are measured using sheathed Chromel-Alumel thermocouples having 0.8 mm outer diameter and a response time of about 0.25 s. They are mounted with screw inserts into the loop pipes, and protrude by one third or one sixth of the pipe diameter into the flow area. Within the steam generators, most thermocouples are installed permanently. Under certain conditions, e.g. in the blowdown-end period with quasi stagnant steam and differing wall temperature, the fluid temperature indication may become falsified due to the "hot wall" effect.

Differential temperatures (TD) give a higher resolution for temperature changes of the primary fluid across the steam generators and over the pressure vessel. The thermocouples are mounted as for the fluid temperature (TF) measurement.

Wall temperatures (TW) are measured by 0.8 mm outer diameter thermocouples brazed in screw inserts. They are flush mounted in the wall and indicate the inner surface temperature of the flow channel.

Thermocouples on the outer U-tube surfaces of the steam generators are brazed into grooves of 0.6 mm depth. In nominal steady state conditions the measured offset relative to the outer U-tube surface temperature is estimated at +3.8 K at the U-tube entrance, +2.6 K at the upper region and +1.5 K near the exit.

Heater rod temperatures (TH) are measured by Chromel-Alumel thermocouples with an Inconel sheath of 0.8 mm outer diameter and Al_2O_3 isolation. The thermocouples are brazed into grooves of 0.8 mm depth and 10 mm length machined into the outer surface of the heater rod tubes, see **Fig. B6.** The connection wires of the three thermocouples installed in each rod lead through the inside of the heater rod tubes. The position of the thermocouple junction causes a temperature offset measured relative to the heater rod surface. From heat conduction calculations this offset is estimated to be +13 K for levels 3 to 10 and about +8 K for the other levels at nominal heating power input.

Heat flux probes (HF) consist of a three metal disc layer thermocouple arrangement (Ni/CrNi/Ni) of 3 mm diameter and about 2 mm thickness. They are mounted in screw inserts and indicate the heat flux at the inner surface of the flow channel. Measurement uncertainty is about 5 kW/m^2; a typical range is 100 kW/m^2. The time constant is a few milliseconds. In steady state, the probes indicate local heat losses through the structure wall. During transients, typical structural-heat to fluid interactions are shown, such as dryout or rewetting. The fluid/wall heat transfer coefficient can be determined by taking into account the measured fluid and wall temperatures.

A positive heat flux signal indicates heat flux from the tube wall to the fluid. A negative signal indicates a heat loss from the fluid to the wall.

2.2 Pressure Transducers

Fluid pressures (PA) are measured mainly by high precision, capacitive pressure transducers. With a range of 17.5 MPa they have an overall accuracy of better than 0.2%. As their operating temperature is limited to 65°C, the transducers are connected to the loop by pressure lines of maximum length 2 m. These lines are identical to those used for differential pressure lines. The useful frequency range remains below 30 Hz.

Differential pressures (PD) in the loop system are measured by transmitters of the two-capsule/differential-transformer type. The useful frequency range is limited to about 0.5 Hz. The differential-transformer transmitters have an excellent stability against overranging and line pressure influences. At ranges from 5 to 700 kPa, zero uncertainty is about 0.2%. The transducers are joined to the measurement points by water-filled pipes of 6 mm diameter and up to 5 m length. These pressure lines are connected to cooled stand-off pipes at the channel walls to minimize line flashing during blowdown.

Differential pressure is always given as the pressure difference relative to the connection level of the stand-off pipes which are as shown in section 3.3, Figs. 7 to 10. In a few cases where these stand-off pipes require intermediate connections to the loop flow channels this elevation may differ slightly from the direct connection to the loop (pressure vessel level y and z, steam generators level 8 and U-tubes level N and P).

2.3 Flow Measurements

Fluid flow data are obtained from a variety of measurement techniques, providing flow velocity, flow momentum, volumetric flow or mass flow rates. The different techniques are applied according to their suitability to measurement requirements.

Turbine Probes (QT) are of the insertion type, mounted in the loop measurement inserts. Velocity ranges are 30 and 100 m/s. The stall point lies at about 3% and 10% of full scale for liquid and gas flow, respectively. At present, no calibration data is available for two-phase flow. The turbines measure both forward and reverse flow and indicate the flow direction when provided with a bidirectional pickup. Bidirectional turbine probes will be installed in those locations where flow reversal is anticipated. The unidirectional probes give positive signals for both flow directions.

A similar insertion type turbine is installed in the core inlet box for the core flow measurement. This is a bidirectional probe with a range of 5 m/s.

Flow area reduction due to probe inserts is listed in section 5 of the EDR.

Full-flow turbine **meters** (QF) are installed in vertical loop pipe sections of the primary loop where relatively reliable interpretation of their readings as fluid velocity can be expected even under two-phase flow conditions (no stratification). The turbine meters in use have nominal ranges of 25 and 100 m/s. They are provided with bearings designed especially for blowdown test conditions and can be overranged to 150% of nominal. Their usable measuring range is better than 100:1.

Volumetric flow **rates** (QV) are measured at those locations where only single phase flow should occur, i.e. in all ECC injection lines and in the secondary loop feed lines. The instruments used are mainly of the full-flow turbine meter type, see (QF). In the main steam lines, vortex shedding flow meters have been installed.

Drag-body **probes (QD)** are bidirectional measurement devices. The sensitive element is a rectangular, sharp-edged impact plate mounted on a titanium cantelever with a strain-gage half bridge. The center of the drag plate is installed about 0.25 diameters from the pipe wall. The drag force ranges are up to 10^5 N/m^2 for the intact loop, up to 16×10^5 N/m^2 for the broken loop, and up to 15×10^3 N/m^2 for the lower plenum to cope with high fluid momentum anticipated in the initial period of a large break transient. Due to the rather poor low-range precision, most of these transducers provide little information for the stationary nominal conditions and for low flow velocities (e.g. small leak tests).

Fluid momentum data from the drag-body instrument is given as "fluid drag", i.e. the measured force on the probe plate. The flow blockage f_b by the drag plate should be considered when interpreting these signals. These blockage factors, which are not taken into account in the actual drag force data, are given in section 5, Table 4 in the EDR.

For the interpretation of the dragbody signals in two-phase massflow calculations, good results have been obtained using

$$QD = (1.2 / f_b^2)(\varrho/2)\, v^2$$

with the dynamic pressure $(\varrho/2)v^2$. At low velocities (Re < 3000) however, when the drag coefficient cannot be assumed to remain constant, this measurement interpretation becomes unreliable.

Massflowmeters (QM) measure the mass flow rate of liquids. The apparatus consists of an oscillating U-shaped pipe and a pick-up system that measures the coriolis force acting on the pipe due to the fluid passing through. The coriolis force as measured is directly proportional to the mass flow rate. The massflowmeters have an accuracy of about 0.4% for all but the lowest 5% of the adjustable range setting.

Sealwater mass flow **(QS)** is the pump seal water leakage into the primary loop. It is determined as the difference between the sealwater entering the pump (QS .. IN) and that returning from the pump (QS .. OUT) each measured by massflowmeters (QM) as described above; QS .. = (QS .. IN) — (QS .. OUT).

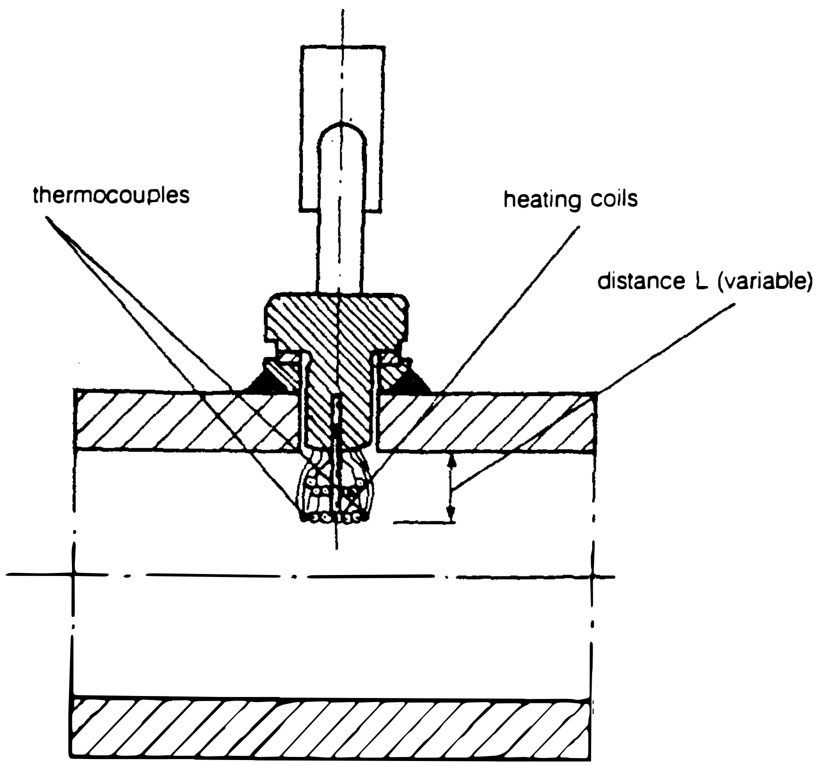
Pitot **probes (QP)** measure the vertical and horizontal components of the flow velocity in the downcomer gap of the steam generators. The probes have a specially developed four hole design. Two differential pressures are measured, each between diametricallly opposite holes. From this, both the magnitude and direction of the downcomer gap flow velocity can be evaluated. The Pitot pressure of this design is related to liquid velocity by $QP = 1.6 \times \varrho/2 \times v^2$, as results from calibration tests.

Flow direction indicators (QI) are instruments especially designed to detect the direction of flow for low fluid velocities. The instruments actually installed are prototypes, still under testing. The signals may give useful information when interpreted carefully.

The indicators consist of a heated coil placed inbetween two thermocouples such that due to fluid velocity the heat is convected to either of the thermocouples. The data plots have an arbitrary scale with the instrument range from -5 to +5. The data shown is proportional to the temperature difference between the two thermocouples. Only its sign is an indication of the flow direction : The signal should be positive for flow in the nominal flow direction; it should be negative for flow in the opposite direction.

QI-signal strength is influenced by various factors like flow velocity, heat properties for the fluid and the local flow geometry. In general, the signal is stronger for lower velocities. The signal is weak for large velocities, e.g. for water 1 m/s or more. For extremely small velocities ($V < 0.005$ m/s) the signal may be disturbed by natural convection effects at the coil dominating over forced convection caused by fluid flow.

Two flow direction indicators installed at one location in a horizontal pipe, one in the upper and one in the lower half of the pipe section, may indicate different flow directions or velocities due to stratification. The distance of the indicators to the pipe wall is 12 mm.



Flow direction indicator (QI) mounted in loop pipe
(screw insert 14x1.25 M)

Break mass flow (QL) is measured by collecting the break fluid in a tank and measuring its accumulated weight. The weight is obtained from the combined signal of three load cells (rate : 10 kN each) supporting the catch tank. The instrument accuracy is about ± 1 kg after calibration. Condensation of the steam content in the break outlet flow is ensured by a condenser (up to 250 kW) and, in addition, by the cold water pool in the tank, see **Fig. B8.**

The data of the break flow measurement is presented as the accumulated mass of the collected fluid released from the break. The overall measurement uncertainty given with the data does not include the uncertainty caused by the liquid hold-up in the condenser and the piping. The liquid hold-up should cause only a time delay in the order of seconds until the fluid arrives in the tank. The maximum liquid hold-up is limited by the volume of the break discharge line and the condenser, which is 10.2 liters for a cold leg break. The actual liquid hold-up is expected to be less due to the presence of steam and air. Normally, liquid hold-up is not expected in the exit tube behind the conderser (volume ca. 32.3 liters) due to the operation of the vent valve.

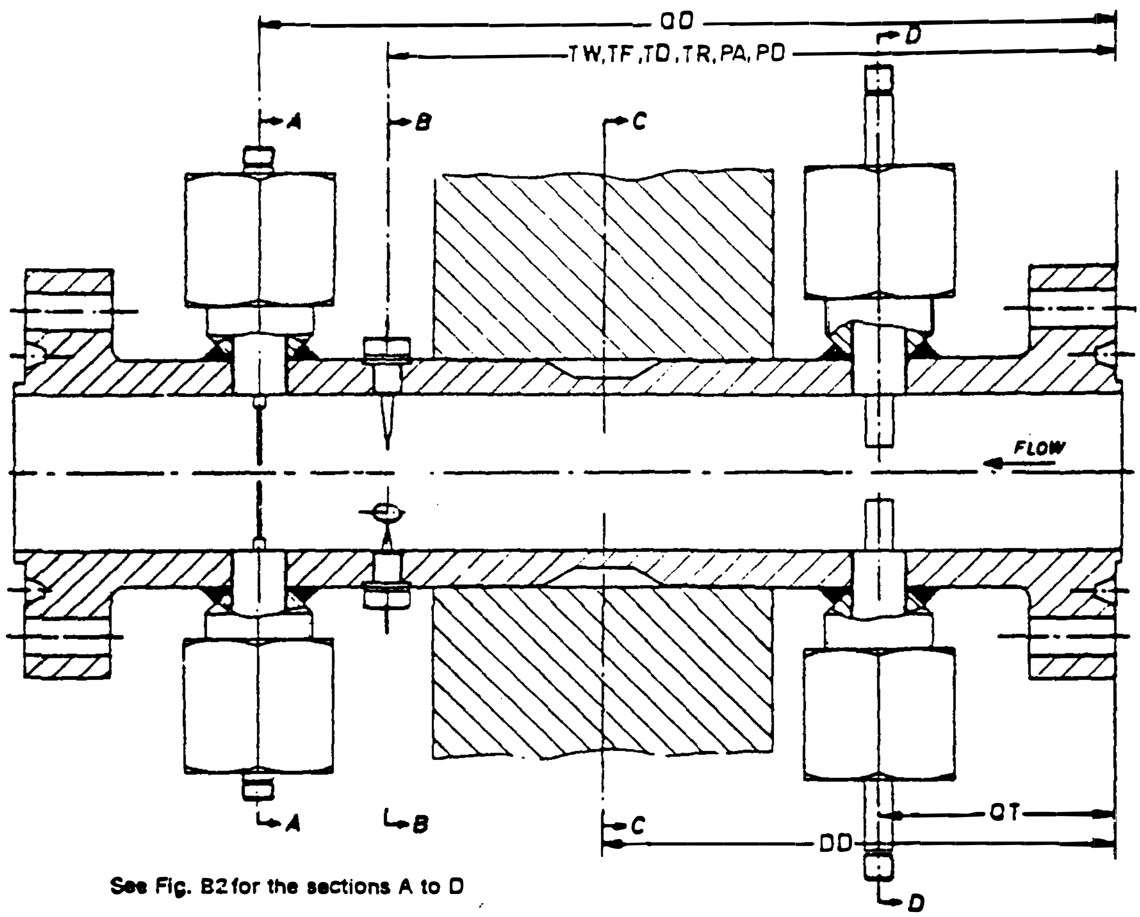
2.4 Fluid Density Measurements

Fluid density is determined by gamma-beam densitometers having a 20 Ci radioactive source (^{137}Cs) and a scintillator plus a photomultiplier detector; operating in pulse mode at rates of about 10^6 per second. The statistical error depends on the sampling period; for the minimum sampling time of 10 ms the statistical uncertainty is about 6% and decreases to 1% for 1 s averaging time.

Double-beam densitometers (DD) are used on measurement inserts. The geometries and orientation of the diametral and peripheral beams with respect to the pipe cross-section are shown in Fig. B7. The position of the beams should be observed for interpretation of two phase flow distributions.

Single-beam densitometers (DS) are used for the density measurements in the lower plenum and in the core inlet box of the pressure vessel. The single, narrow beam traverses the flow cross-section diametrically.

Fig. B1: Typical horizontal measurement insert



See Fig. B2 for the sections A to D

Distances (in mm)

Measurement Insert	QT	DD	QD	TW	TF	TD	PA	PD	L
11 H	128	279	406	184	184	–	184	184	510
15 H	–	–	–	257	197	197	197	197	520
16 H	109	238	400	340	340	–	340	340	510
21 H	112	242	432	352	352	–	352	352	1068
25 H	107	247	482	407	362	362	362	362	648
26 H	635	825	955	715	715	–	715	715	1068

Fig. B2: Measurement cross sections in horizontal insert (see Fig. B1)

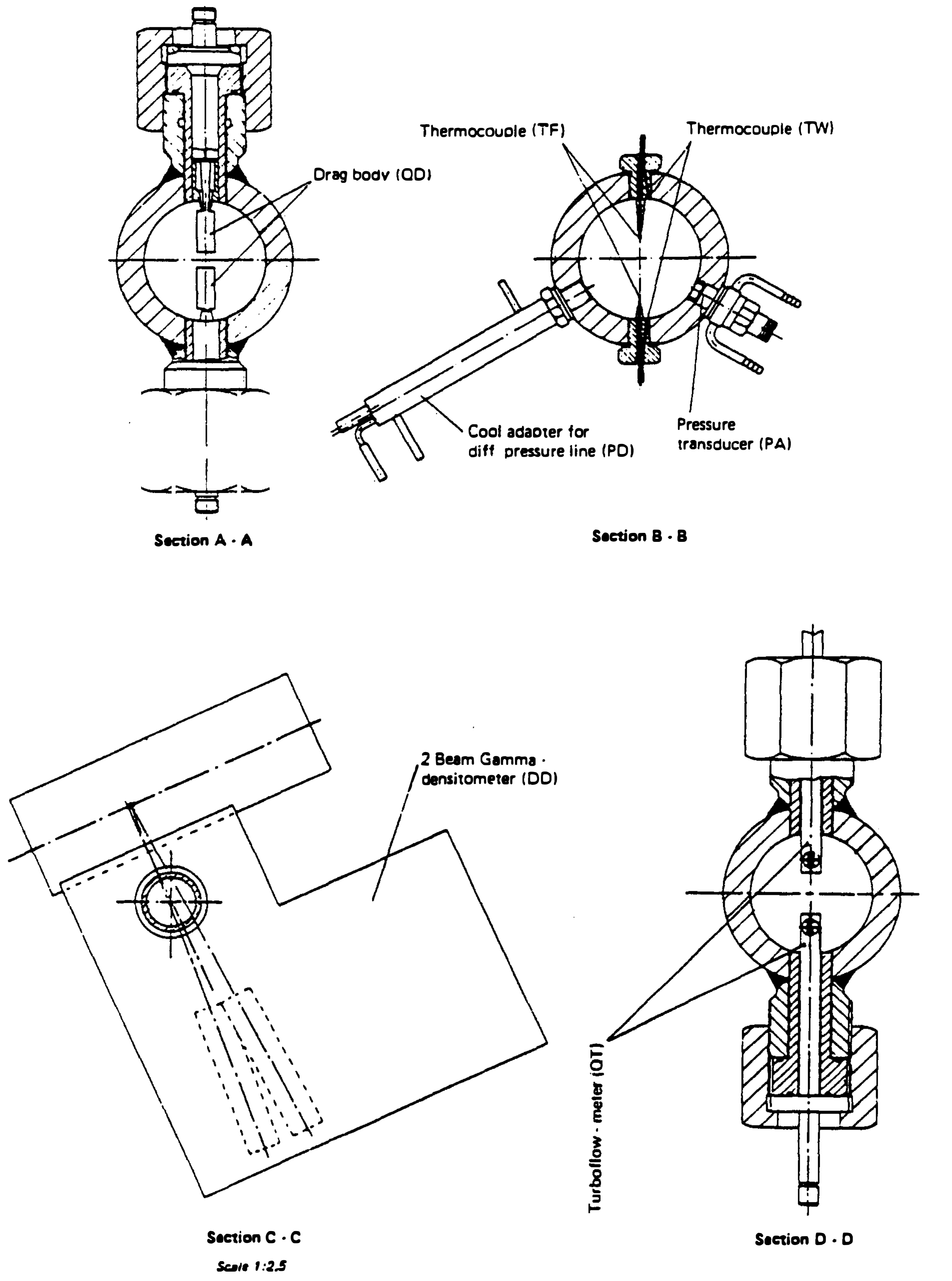
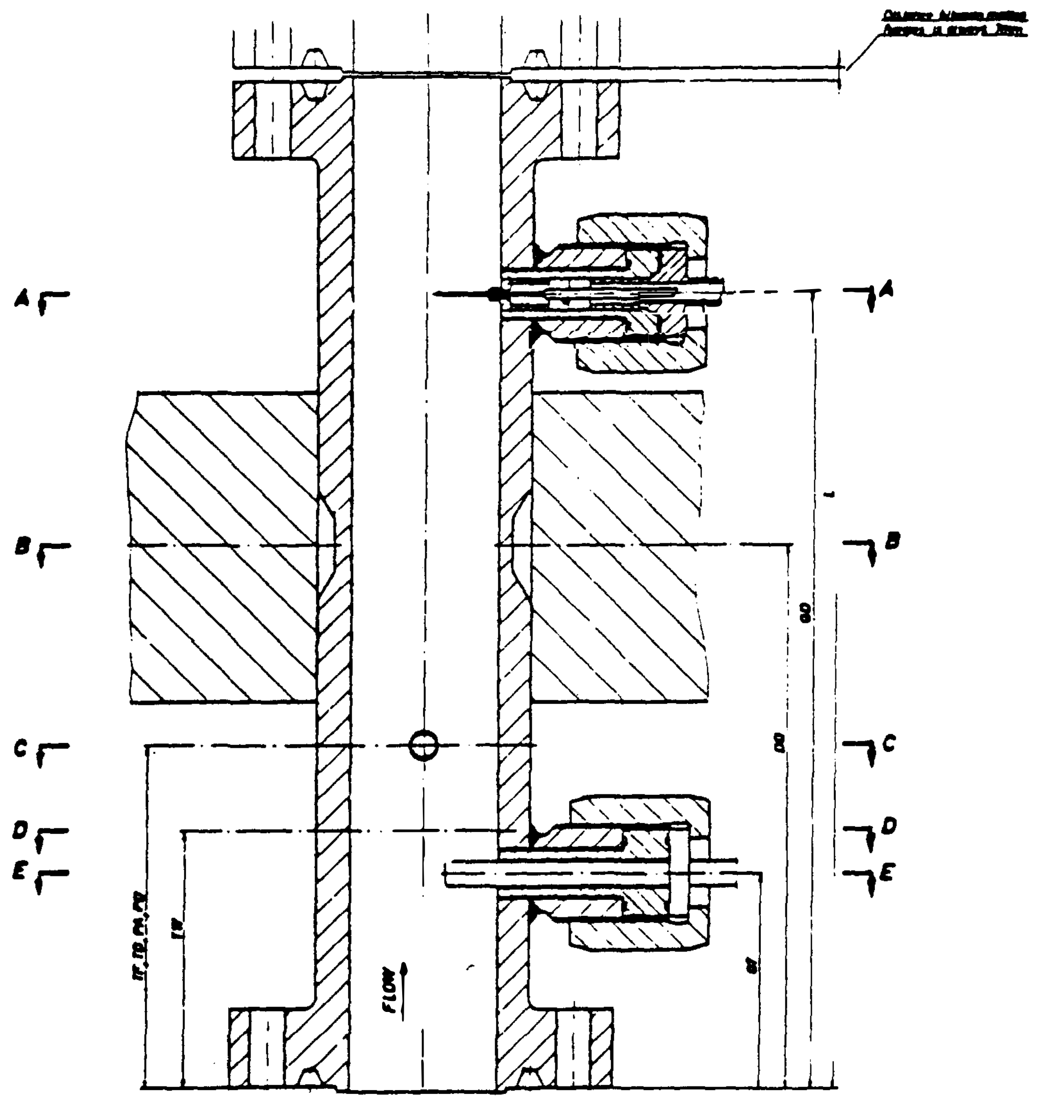
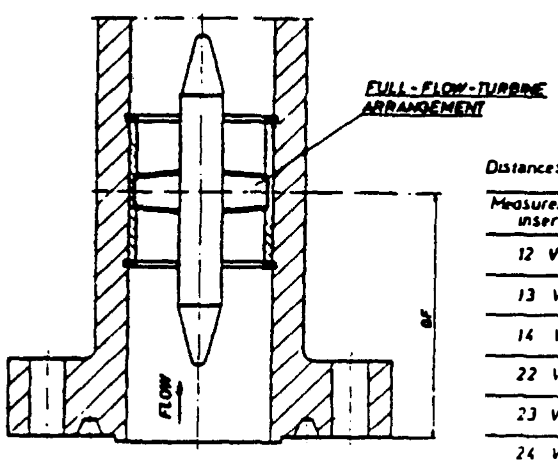


Fig. B3: Typical vertical measurement insert



See Fig. B4 for the sections A to E



Distances (in mm)

Measurement insert	QT	DD	QD	TW	TF	TD	QF	PA	PD	L
12 V	–	–	123	263	318	318	483	318	318	621
13 V	122	–	500	357	302	302	–	302	302	621
14 V	(110)	240	(410) 110	135	135	–	382	135	135	520
22 V	(112)	386	(566) 112	181	236	236	552	236	236	679
23 V	112	292	566	497	442	442	–	442	442	679
24 V	578	818	973	633	678	678	113	678	678	1144

Fig. B4: Measurement cross sections in vertical insert (see Fig. B3)

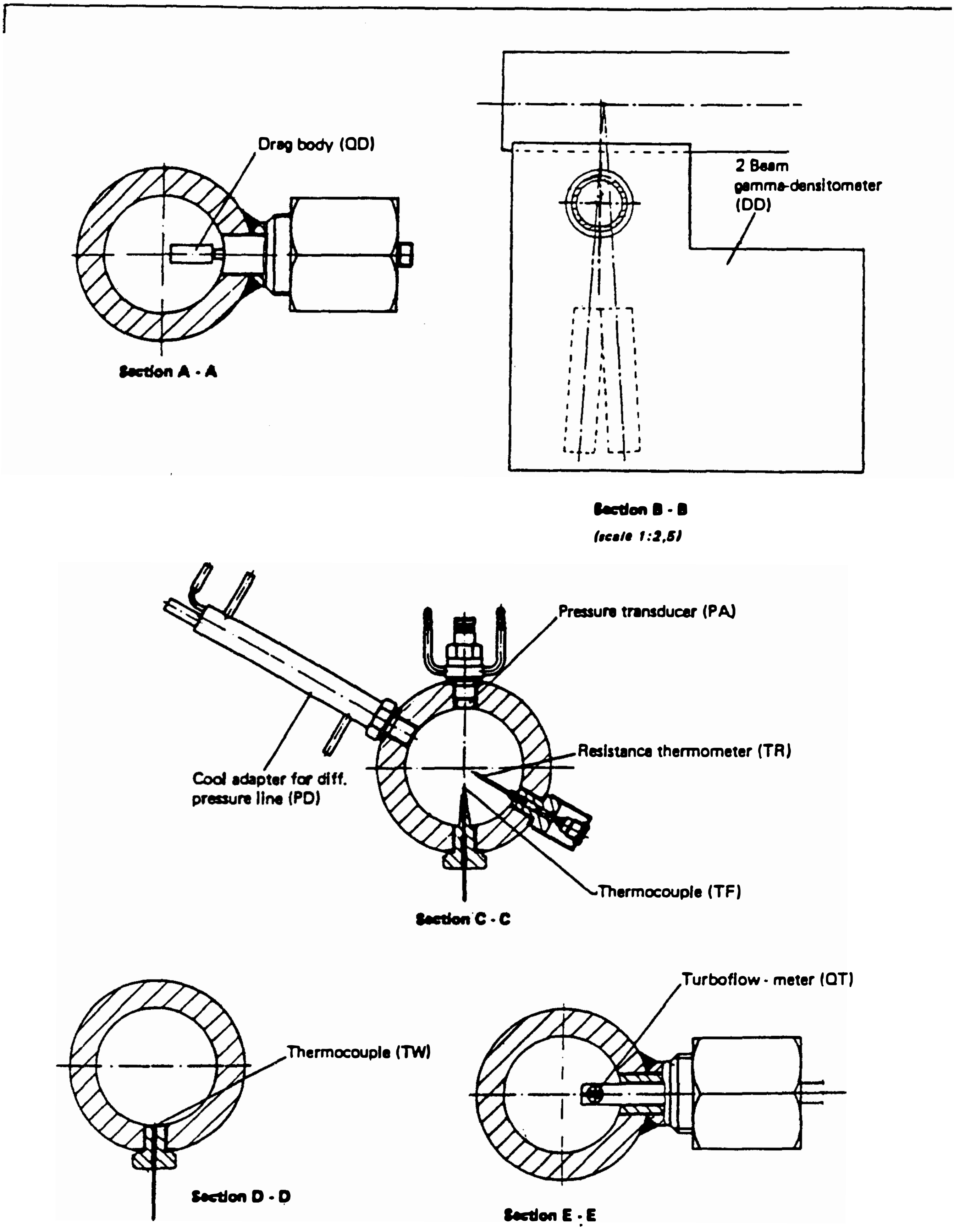
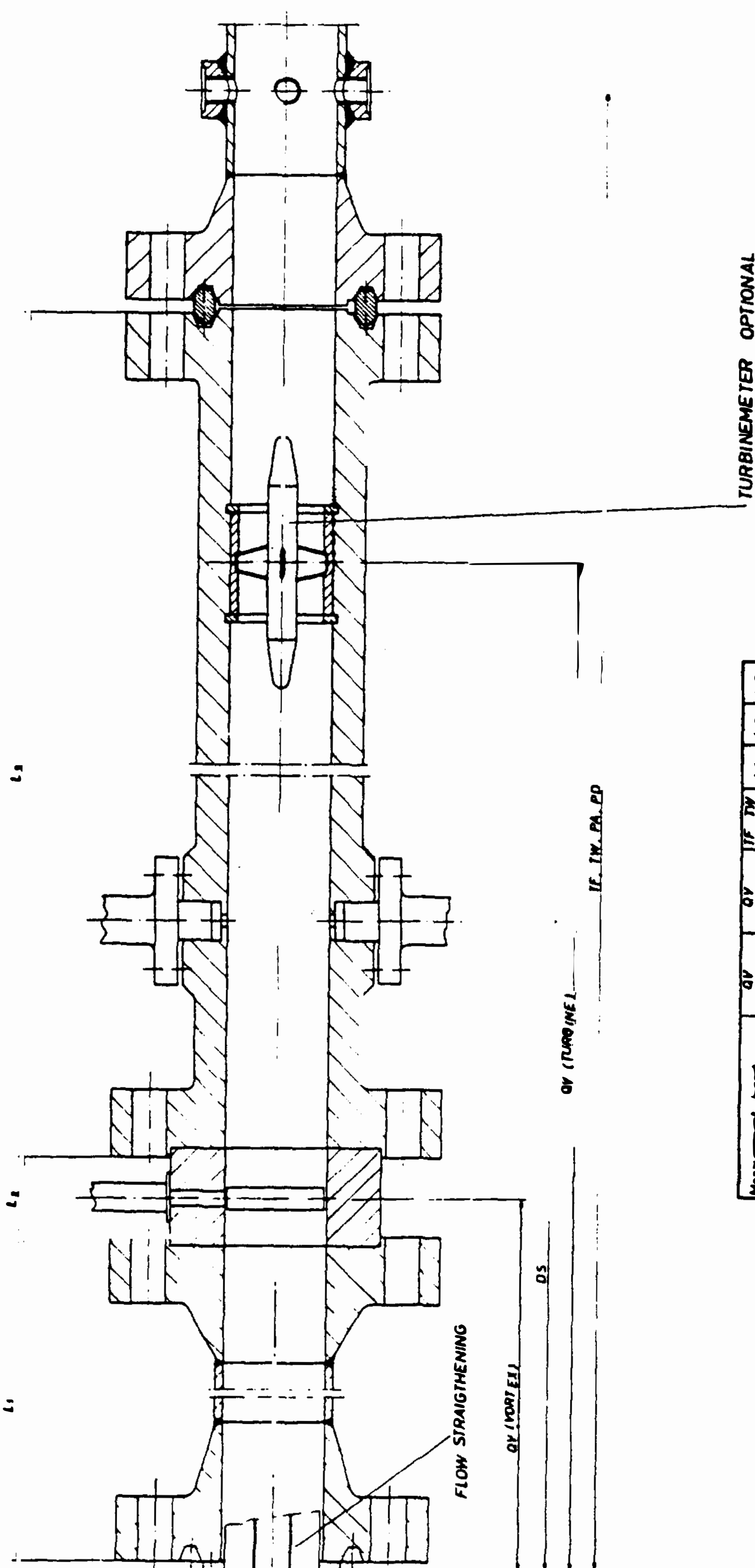


Fig. B5: Steam line measurement insert



Measurement insert	QV (VORTEX)	QV (TURBINE)	TF PA	TW PA	L1	L2	L3
Steam line 1 (intact loop)	1200	2037	2297		1168	54	940
Steam line 2 (broken loop)	814	1365	1605		789	41	650

Fig. B6: **Thermocouple mounting in the heater rod wall**

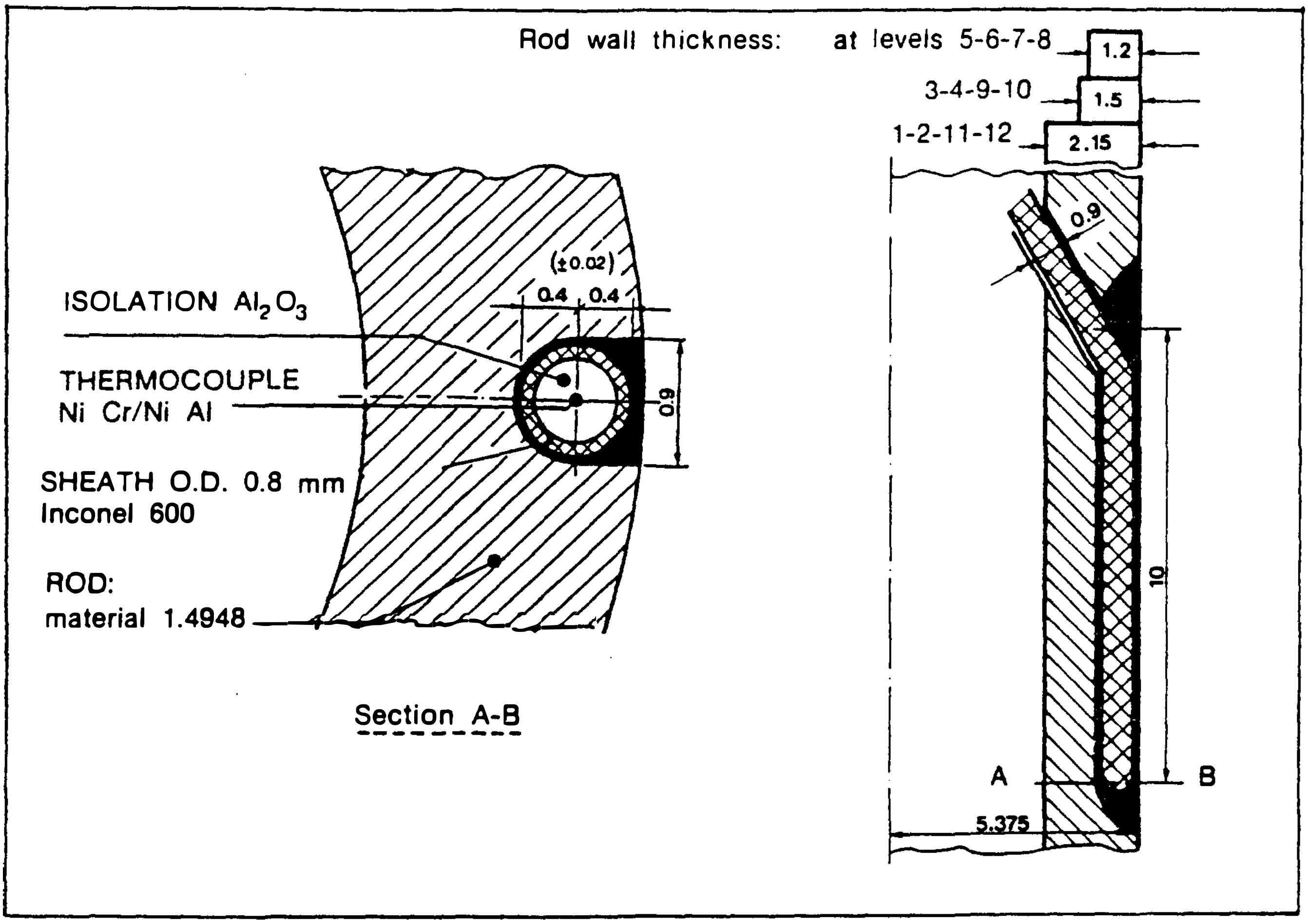
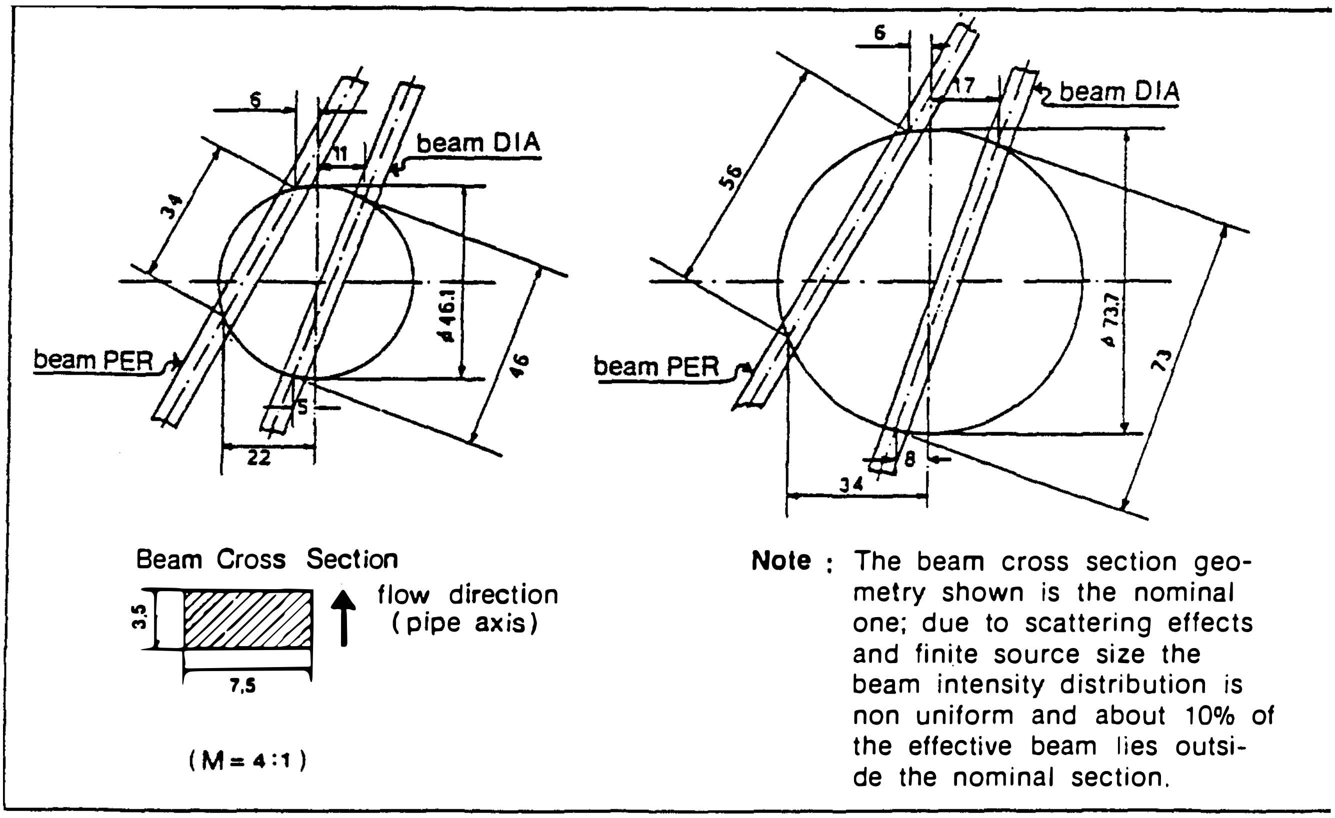
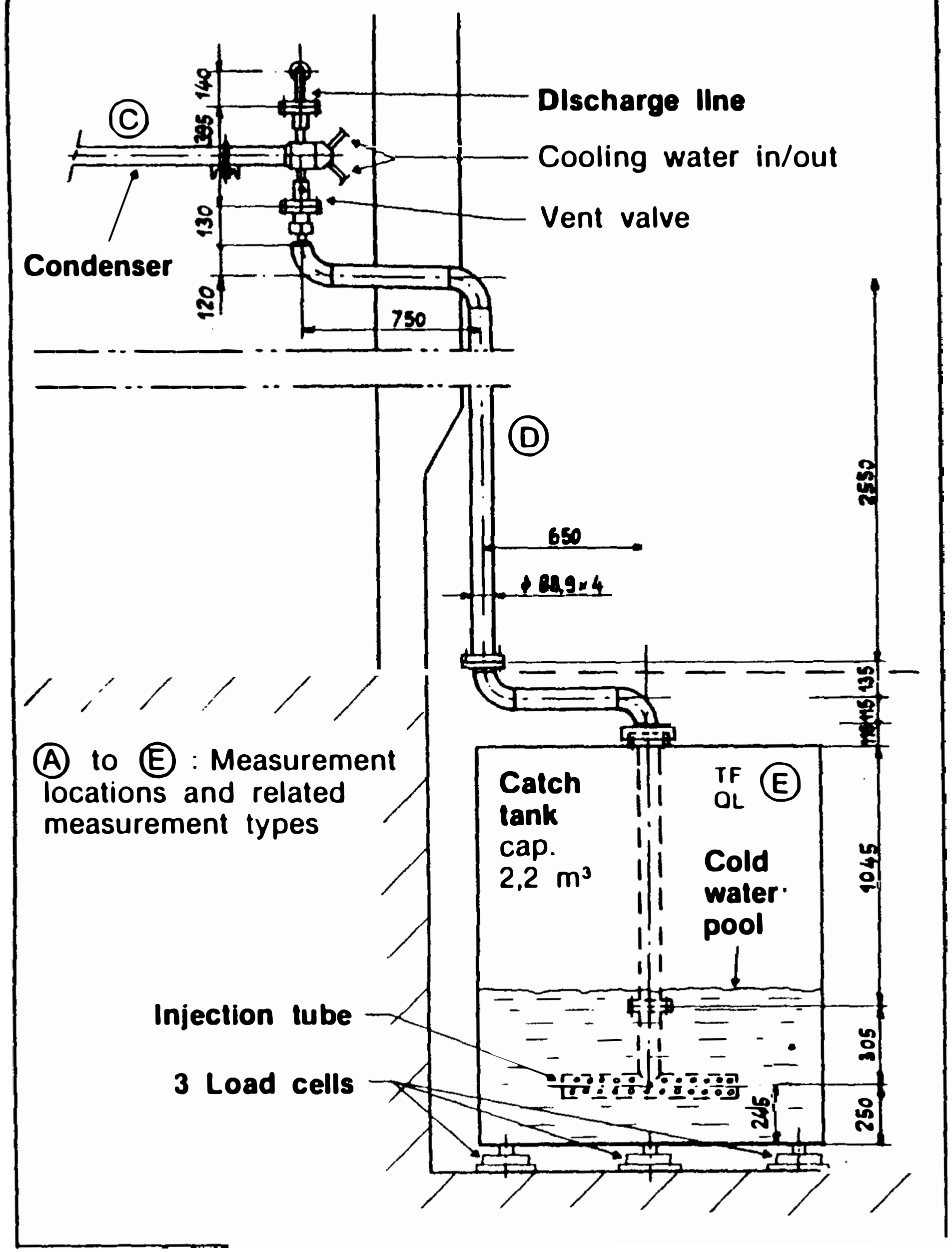


Fig. B7: **Gamma densitometer beam geometries**



Note : The beam cross section geometry shown is the nominal one; due to scattering effects and finite source size the beam intensity distribution is non uniform and about 10% of the effective beam lies outside the nominal section.

B8.1 Front view of configuration



B8.2 Elevation view of configuration

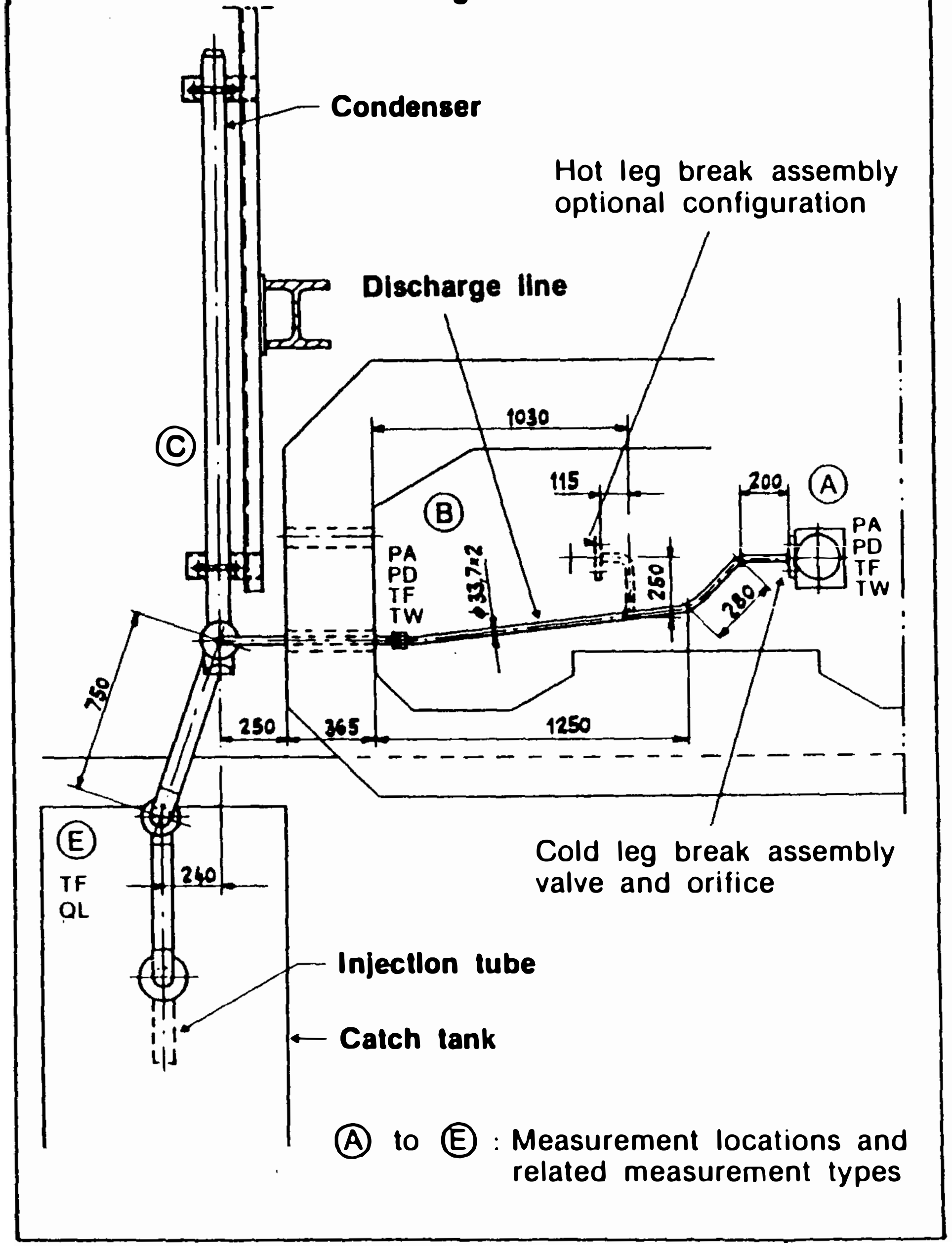


Fig. B8. LOBI break massflow measurement system

Appendix C

LOBI Data Processing and Correction

1. Data Recording

Four groups of measurement signals are recorded by the Data Acquisition System (DAS).

About 400 signal channels are recorded with a nominal sampling rate of 100 Hz, and 100 with a nominal rate of 1000 Hz. These nominal sampling rates can be adapted during the course of the experiment to the requirements of the transient information. At blowdown start, during the fast transient periods the data is recorded with the highest speed; during slower transients the sampling frequency can be reduced in order to save data storage space.

Two groups of signals are recorded directly in digital format. These are 16 densitometer signals and 64 three state status signals for valve positions and flow direction information, both of which are sampled each 10 ms.

All analog signals are low-pass filtered with signal bandwiths of 20 Hz and 200 Hz as appropriate, to avoid aliasing. At lower recording speeds an additional digital filtering is obtained by storing mean values of blocks of samples. The resolution of the analog/digital converter is 14 bit plus sign bit. Taking into account noise and drift effects, the overall uncertainty is smaller than 2.5 mV at 10 volt signal levels.

Data is stored on 300 Mbyte disk modules. The capacity of one module is sufficient for 1000 seconds of recording time at full sampling speed or up to several hours at reduced speed.

2. Data Selection

Graphs representing the measurements are produced from the raw data on the disk modules. The data, which is recorded as a 0 to 10 volt signal, is converted to engieering units using preprogrammed calibration tables.

Each graph consists of about 1000 data points. Each of these data points is the calculated average of the measurements recorded during the represented time step and it is stored at the centre of the time step. This averaging of measurement signals produces a filtering effect on the data, so that strong transients may be smoothed and in particular short data peaks may be eliminated. It should be noted that this procedure differs slightly from MOD1 in that for MOD1 data points were stored at the end of the averaging time step.

The time scale of the graphs is chosen to allow the complete test transient to be represented. The time "Zero" is determined from the opening signal of the break opening valve or it is set to indicate the initiation of the test transient.

3. Data Correction

The data correction is mainly a post-test calibration correction for systematic effects (e.g. temperature or line pressure sensitivity), for which the entire set of test data is needed. These test data are supplemented by characteristic on-line measurements taken on the day of the test; they serve to determine transducer specific correction constants. Corrections to eliminate electrical or other disturbances are applied only when a sound physical reason exists for them: in the event of any doubts, corrections are not applied.

Typical examples are :

- correction of differential pressure readings to adjust for actual zero reading and subtract pressure line head.
- correction of dragbody signal for temperature and line pressure influence on the strain-gage as well as actual zero offset.

- correction of densitometer reading to account for actual zero and readings at steady state.

The following data corrections are applied.

Absolute Pressure

- zero offset
- sensitivity

Correction formula used is : $PA = K \times (S-0)$ in MPa

S = measured signal
0 = measured zero offset
K = sensitivity scaling coefficient

Differential Pressure

- zero offset

Correction formula used is : $PD = S - 0$ in MPa

S = measured signal
0 = measured zero offset

Drag-Bodies

- zero offset
- change in zero offset with temperature
- change in zero offset with pressure
- temperature coefficient of sensitivity

Correction formula used is :

$$QD = (1-K_1 \times DT)\times(S-0-K_2 \times DT-K_3 \times DP)$$

S = measured signal
0 = zero offset at 200°C and 10 MPa
K_1 = temperature coefficient of sensitivity
K_2 = temperature coefficient of zero offset
K_3 = pressure coefficient of zero offset
DT = TW—200°C = wall temperature at measurement point minus 200°C
DP = PA—10 MPa = absolute pressure minus 10 MPa

Turbo Probe Meters

- reduction in local flow area

Correction formula used is : $QT = S \times f_b$ in m/s

S = measured signal
f_b = fractional reduction in flow area due to presence of probe body at that plane (flow area blockage).

Heat Flux Probes

- zero offset
- temperature coefficient of sensitivity

Correction formula used is :

$$HF = (S-0) \times [1+(TW-250°C) \times K] \text{ in kW/m}^2$$

S = measured signal
0 = zero offset
TW = wall temperature at measuring point
K = temperature coefficient of sensitivity

Density

- zero drift
- sensitivity drift

Correction formula used is :

$$DD = D_1 + (S-S_1) \times (D_1-D_2) / (S_1-S_2) \text{ in kg/m}^3$$

S_1 and S_2 are measured values corresponding to two calibration points, typically water immediately before blowdown, and steam immediately after blowdown. D_1 and D_2 are the true densities for these points, taken from the steam tables.

Break Flow Liquid Mass

- initial weight of tank with cold water pool

Correction formula used is : $QL = S - 0$

S = measured signal
0 = zero signal before transient start.

4. Data Correction Documentation

All corrections applied to experimental data are documented so that any time it can be determined :
- which corrections have been applied;
- what was the effect on the original data.

For the LOBI data processing a procedure has been developed producing quasi-automatically for each data correction an individual "Correction Protocol" sheet. This sheet contains the correction formula used together with the constants and factors inserted, and shows in two graphs the data before and after correction. As an example, **Fig. C1** shows a typical protocol sheet, for the case of a PD-channel correction.

5. Data Storage

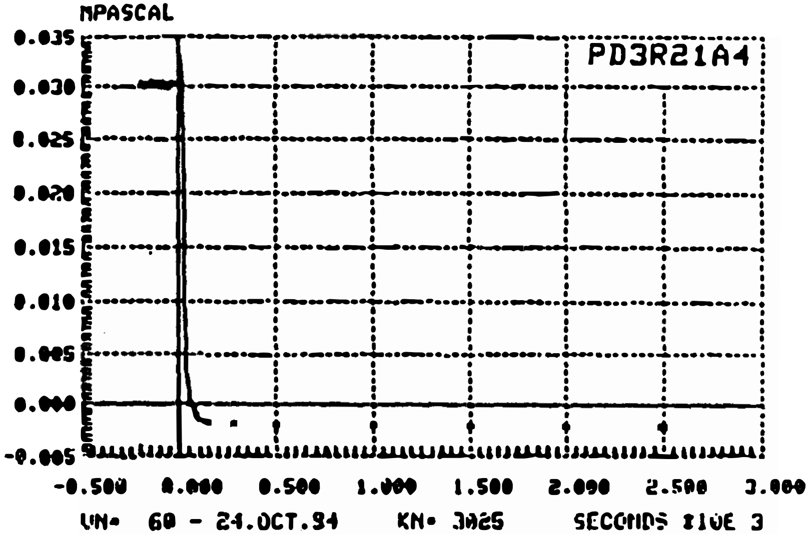
The corrected data in its final form is stored in the Experimental Data Tape (EDT). The original data is always kept available. The original data on disk and the digital tape containing both the corrected and uncorrected data files are kept in an archive, so that old data can be recovered at any time.

```
DF
  FILE NAME (FFMMMMMM)?
?SSDEMO

  LU LC I  C1 /  YX U1 XT +  U2 XT MD T1 T2 HC BR
 >>
?FN

  LU LC I  C1 /  YX U1 XT +  U2 XT MD T1 T2 HC BR

 ENTER CTRL/E TO ABORT COMMAND
  ZAHL DER KANAELE=?
?1
  LUN=?
?0
 CHANNEL-NAME OR -NUMBER(+TRACK*1000) ?
?3025
  CONSTANT = ?
?-1.85
 CONSTANT =    1000.0
  NEXT FREE CHANNEL # = 421
  INPUT CHANNEL # OR RETURN-KEY FOR # 421
?
 NEW NAME (8 CHAR.) OR RETURN-KEY
?
 NEW DIMENSION (8 CHAR.) OR RETURN-KEY
?
```



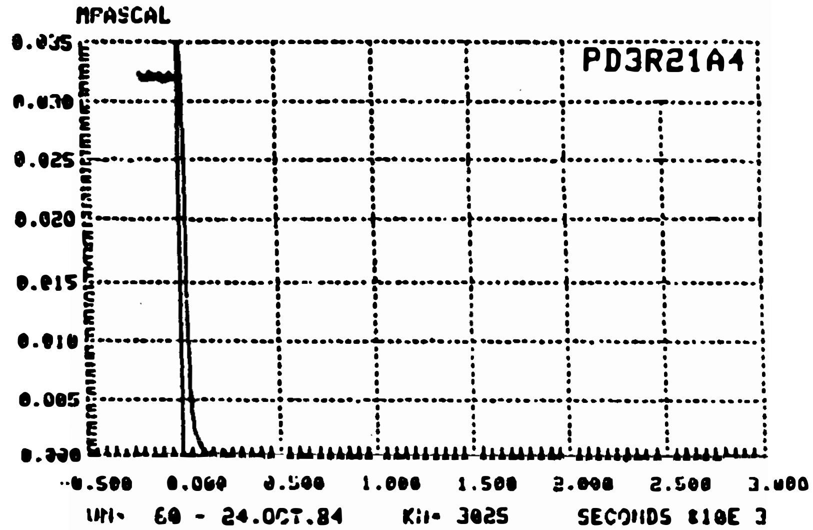


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Fig. C7: Typical correction protocol sheet

Appendix D

Data Consistency Checks and Uncertainty Bands

1. Consistency Checks

Measurement data is tested for consistency by a series of standardized tests. For this purpose, status measurements are taken to observe the instrument status during run up to nominal conditions and directly after the test as specified in the pretest procedure.

Typical status measurements are :

Vacuum	cold loop, loop empty
TC-Nullabgleich	loop filled with cold water, running pumps
P-Nullabgleich	cold water, pumps stopped, pressure as of water supply (ca. 0.7 MPa)
Druckmeßprobe	cold water, pumps stoped, 5 and 10 MPa
TC-Check	100°C water, pumps running, no heat removal
Flow-Check	200°C water at various pump speeds and pumps stopped
Instrument status	nominal test conditions
BD-Endwerte	directly after the test
Leer-Werte	empty, cold loop after the test.

These status values also serve to determine coefficients used for data correction.

The pressure data (PA) are checked during run up for zero and gain at the P-Nullabgleich, the Druckmeßprobe, the Instrument status and after the test for Leer-Werte.

Differential pressure data (PD) is checked for line pressure influence, gain and zero drift during the test. Line pressure influence is checked from the Druckmeßprobe. Comparison of zero values of the filled loop at the P-Nullabgleich with the differential pressure for the empty loop at Leer-Werte after test yields a test of gain and zero drift, taking into account the gravity head between pressure tabs.

For nominal conditions, differential pressure chains are summed within partially closed loops; they should add to zero. This test is done e.g. for the vessel, intact and broken loop and the steam generators.

Dragbody instrumentation (QD) is checked for offset immediately after the test (hot) and late after the test (cold). Gain is checked with nominal mass flow. However, at these velocities most of the readings are below 10% of full scale and this check of accuracy is therefore limited.

The density instrumentation readings (DD, DS) are checked at the TC-Check (highest reading) for linearity and at the end-of-test, when the flow channels have dried out and only steam density is measured. (The last condition, however, is not fulfilled for instance in the lower plenum of the pressure vessel, where water has accumulated at this time.)

The temperature instrumentation (TF, TW and TH) is tested during run up at ambient temperature, at 100°C with the TC-Check and at the 200°C flow check. For these tests pumps are running and heat removal from steam generators or the tertiary are suppressed.

Flow instrumentation (QF, QT, QV and QM) are checked with mass flow data where possible. These data may derive from redundant instrumentation during nominal condition in the loops, from pump characteristics or from mass balance calculations.

Heat flux probes (HF) are checked for zero readings before and after the test.

When inconsistencies occur, the measurement channel may become eliminated from the "Corrected Data" file or a warning of caution will be written into the data plot of the Experimental Data Report.

2. Uncertainty Band Contributions

The estimated uncertainty values are based on a detailed analysis of the LOBI instrumentation /7/. The results of this analysis have been updated on the basis of practical experience and calibration tests. The uncertainty bands given represent the most probable 2 sigma limits on the possible errors. They are estimated for stationary single-phase flow conditions only. Four categories of uncertainty band contributions are considered :

- Uncertainties related to full scale (A)
  Example: zero errors
- Uncertainties related to reading (B)
  Example: span errors
- Uncertainties related to absolute value of a separate variable (C or D)
  Example: error in correction of dragbody signals for temperature influence
- Uncertainties related to the difference between absolute value of signal and absolute value of separate variable (C)
  Example: wall temperature influence on fluid temperature probes.

Contributions are combined as follows :

$$\text{Probable uncertainty} = \sqrt{(A^2 + B^2 + C^2 + D^2)}$$

where

A = a
B = b x Signal
C = c x Auxiliary Signal, or
= c x (Signal-Auxiliary Signal) for TF
D = d x (Auxiliary Signal-200)

Here, a, b, c and d are constants for each measurement channel, one or more of them being, in most cases, zero. In the case that all four coefficients are put to zero, no uncertainty band is given.

"Signal" is the measured value for which the uncertainty is to be calculated.
"Auxiliary Signal" is the absolute value of some other variable which has a direct influence on "Signal".

The calculated uncertainty bands are indicated in the data plots of the Experimental Data Report. The Experimental Data Tape (EDT) contains for each measured channel the uncertainty coefficients a, b, c, d and the auxiliary channel (AUX1), as well as up to two substitute auxiliary channels. All uncertainty coefficients used are listed in **Table D1**, where the uncertainty code under the column "ERROR" corresponds to the same column in the instrumentation sheet, see Appendix F.

Table D1: Uncertainty codes used in TEST BL-34-A

a

ERROR	a	b	c	d	AUX1	AUX2	AUX3
01DD	0.231000E+02	0.000000E+00	0.000000E+00	0.000000E+00			
02DD	0.246000E+02	0.000000E+00	0.000000E+00	0.000000E+00			
04DD	0.187000E+02	0.000000E+00	0.000000E+00	0.000000E+00			
01DS	0.220000E+02	0.000000E+00	0.000000E+00	0.000000E+00			
01IH	0.660000E+00	0.100000E-01	0.000000E+00	0.000000E+00			
02IH	0.250000E+00	0.100000E-01	0.000000E+00	0.000000E+00			
01MP	0.750000E+00	0.200000E-01	0.000000E+00	0.000000E+00			
00PA	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00			
01PA	0.361000E-01	0.150000E-02	0.000000E+00	0.000000E+00			
02PA	0.211000E-01	0.150000E-02	0.000000E+00	0.000000E+00			
00PD	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00			
02PD	0.146000E-03	0.559000E-02	0.000000E+00	0.000000E+00			
03PD	0.632000E-02	0.202000E-01	0.000000E+00	0.000000E+00			
04PD	0.238000E-02	0.152000E-01	0.000000E+00	0.000000E+00			
05PD	0.209000E-03	0.559000E-02	0.000000E+00	0.000000E+00			
07PD	0.251000E-03	0.559000E-02	0.000000E+00	0.000000E+00			
09PD	0.112000E-03	0.559000E-02	0.000000E+00	0.000000E+00			
10PD	0.275000E-03	0.559000E-02	0.000000E+00	0.000000E+00			
11PD	0.266000E-03	0.559000E-02	0.000000E+00	0.000000E+00			
12PD	0.888000E-04	0.559000E-02	0.000000E+00	0.000000E+00			
13PD	0.140000E-03	0.559000E-02	0.000000E+00	0.000000E+00			
15PD	0.691000E-03	0.559000E-02	0.000000E+00	0.000000E+00			
16PD	0.380000E-03	0.559000E-02	0.000000E+00	0.000000E+00			
17PD	0.112000E-02	0.559000E-02	0.000000E+00	0.000000E+00			
20PD	0.904000E-03	0.559000E-02	0.000000E+00	0.000000E+00			
21PD	0.112000E-02	0.559000E-02	0.000000E+00	0.000000E+00			
23PD	0.274000E-03	0.559000E-02	0.000000E+00	0.000000E+00			
24PD	0.118000E-03	0.559000E-02	0.000000E+00	0.000000E+00			
25PD	0.172000E-03	0.559000E-02	0.000000E+00	0.000000E+00			
26PD	0.238000E-03	0.559000E-02	0.000000E+00	0.000000E+00			
27PD	0.140000E-03	0.559000E-02	0.000000E+00	0.000000E+00			
28PD	0.248000E-03	0.559000E-02	0.000000E+00	0.000000E+00			
29PD	0.216000E-03	0.559000E-02	0.000000E+00	0.000000E+00			
30PD	0.189000E-03	0.559000E-02	0.000000E+00	0.000000E+00			
31PD	0.295000E-02	0.152000E-01	0.000000E+00	0.000000E+00			
32PD	0.199000E-03	0.559000E-02	0.000000E+00	0.000000E+00			
34PD	0.237000E-02	0.152000E-01	0.000000E+00	0.000000E+00			
35PD	0.365000E-03	0.559000E-02	0.000000E+00	0.000000E+00			
36PD	0.540000E-03	0.559000E-02	0.000000E+00	0.000000E+00			
37PD	0.551000E-03	0.559000E-02	0.000000E+00	0.000000E+00			
38PD	0.856000E-03	0.559000E-02	0.000000E+00	0.000000E+00			
39PD	0.238000E-03	0.559000E-02	0.000000E+00	0.000000E+00			
40PD	0.395000E-03	0.559000E-02	0.000000E+00	0.000000E+00			
42PD	0.468000E-03	0.559000E-02	0.000000E+00	0.000000E+00			
44PD	0.119000E-02	0.559000E-02	0.000000E+00	0.000000E+00			
45PD	0.228000E-03	0.559000E-02	0.000000E+00	0.000000E+00			
47PD	0.935000E-03	0.559000E-02	0.000000E+00	0.000000E+00			
49PD	0.272000E-03	0.559000E-02	0.000000E+00	0.000000E+00			
50PD	0.293000E-03	0.559000E-02	0.000000E+00	0.000000E+00			
51PD	0.440000E-03	0.559000E-02	0.000000E+00	0.000000E+00			
54PD	0.632000E-02	0.202000E-01	0.000000E+00	0.000000E+00			
55PD	0.566000E-03	0.559000E-02	0.000000E+00	0.000000E+00			
56PD	0.215000E-03	0.559000E-02	0.000000E+00	0.000000E+00			
58PD	0.607000E-03	0.559000E-02	0.000000E+00	0.000000E+00			
59PD	0.304000E-03	0.559000E-02	0.000000E+00	0.000000E+00			
01PE	0.283000E-03	0.283000E-02	0.000000E+00	0.000000E+00			
02PE	0.374000E-03	0.283000E-02	0.000000E+00	0.000000E+00			
03PE	0.120000E-03	0.559000E-02	0.000000E+00	0.000000E+00			
04PE	0.287000E-03	0.559000E-02	0.000000E+00	0.000000E+00			
05PE	0.237100E-02	0.559000E-02	0.000000E+00	0.000000E+00			
06PE	0.126000E-03	0.559000E-02	0.000000E+00	0.000000E+00			
13PE	0.408000E-03	0.320000E-02	0.000000E+00	0.000000E+00			
01QF	0.722000E-01	0.203000E-01	0.000000E+00	0.000000E+00			
02QL	0.229000E+01	0.926000E-03	0.000000E+00	0.000000E+00			
00QM	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00			
01QM	0.142000E-03	0.400000E-02	0.000000E+00	0.000000E+00			
02QM	0.531000E-04	0.400000E-02	0.000000E+00	0.000000E+00			
04QM	0.177000E-03	0.400000E-02	0.000000E+00	0.000000E+00			
00QP	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00			
01QP	0.708000E-01	0.304000E-02	0.000000E+00	0.000000E+00			

Table D1: Uncertainty codes used in TEST BL-34-A
continued

ERROR	a	b	c	d	AUX1	AUX2	AUX3
00QS	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00			
03QT	0.500000E-01	0.707000E-01	0.000000E+00	0.000000E+00			
01QV	0.309000E-04	0.203000E-01	0.000000E+00	0.000000E+00			
02QV	0.108000E-04	0.203000E-01	0.000000E+00	0.000000E+00			
04QV	0.649000E-04	0.203000E-01	0.000000E+00	0.000000E+00			
05QV	0.211000E-04	0.203000E-01	0.000000E+00	0.000000E+00			
07QV	0.515000E-05	0.203000E-01	0.000000E+00	0.000000E+00			
09QV	0.438000E-03	0.141000E-01	0.000000E+00	0.000000E+00			
10QV	0.133000E-03	0.141000E-01	0.000000E+00	0.000000E+00			
00RP	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00			
01RP	0.780000E+02	0.000000E+00	0.000000E+00	0.000000E+00			
01TD	0.515000E+00	0.000000E+00	0.000000E+00	0.000000E+00			
01TF	0.909000E+00	0.000000E+00	0.500000E-01	0.000000E+00	TW11H000	TW11H180	
02TF	0.909000E+00	0.000000E+00	0.000000E+00	0.000000E+00			
03TF	0.909000E+00	0.000000E+00	0.500000E-01	0.000000E+00	TW11H180	TW11H000	
04TF	0.909000E+00	0.000000E+00	0.500000E-01	0.000000E+00	TW12V270	TW11H000	
05TF	0.909000E+00	0.000000E+00	0.500000E-01	0.000000E+00	TW13V090	TW14V090	
06TF	0.909000E+00	0.000000E+00	0.500000E-01	0.000000E+00	TW14V090	TW13V090	
07TF	0.909000E+00	0.000000E+00	0.500000E-01	0.000000E+00	TW15H000	TW15H180	
08TF	0.909000E+00	0.000000E+00	0.500000E-01	0.000000E+00	TW15H180	TW15H000	
09TF	0.909000E+00	0.000000E+00	0.500000E-01	0.000000E+00	TW16H000	TW16H180	
10TF	0.909000E+00	0.000000E+00	0.500000E-01	0.000000E+00	TW16H180	TW16H000	
11TF	0.909000E+00	0.000000E+00	0.500000E-01	0.000000E+00	TW21H000	TW21H180	
12TF	0.909000E+00	0.000000E+00	0.500000E-01	0.000000E+00	TW21H180	TW21H000	
13TF	0.909000E+00	0.000000E+00	0.500000E-01	0.000000E+00	TW22V090	TW21H000	
14TF	0.909000E+00	0.000000E+00	0.500000E-01	0.000000E+00	TW23V270	TW24V270	
15TF	0.909000E+00	0.000000E+00	0.500000E-01	0.000000E+00	TW24V270	TW23V270	
16TF	0.909000E+00	0.000000E+00	0.500000E-01	0.000000E+00	TW25H000	TW25H180	
17TF	0.909000E+00	0.000000E+00	0.500000E-01	0.000000E+00	TW25H180	TW25H000	
18TF	0.909000E+00	0.000000E+00	0.500000E-01	0.000000E+00	TW26H000	TW26H180	
19TF	0.909000E+00	0.000000E+00	0.500000E-01	0.000000E+00	TW26H180	TW26H000	
20TF	0.909000E+00	0.000000E+00	0.500000E-01	0.000000E+00	TW31V165	TW31V345	
21TF	0.909000E+00	0.000000E+00	0.500000E-01	0.000000E+00	TW31V345	TW31V165	
22TF	0.909000E+00	0.000000E+00	0.500000E-01	0.000000E+00	TW32V165	TW32V345	
23TF	0.909000E+00	0.000000E+00	0.500000E-01	0.000000E+00	TW32V345	TW32V165	
26TF	0.909000E+00	0.000000E+00	0.500000E-01	0.000000E+00	TW33V975	TW34V140	
27TF	0.909000E+00	0.000000E+00	0.500000E-01	0.000000E+00	TW34V140	TW33V075	
01TH	0.128000E+01	0.270000E-02	0.100000E+01	0.000000E+00	WH-POWER		
00TR	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00			
01TW	0.917000E+00	0.000000E+00	0.000000E+00	0.000000E+00			
02TW	0.193000E+01	0.000000E+00	0.000000E+00	0.000000E+00			
03TW	0.151000E+01	0.000000E+00	0.000000E+00	0.000000E+00			
04TW	0.115000E+01	0.000000E+00	0.000000E+00	0.000000E+00			
01VH	0.750000E+00	0.100000E-01	0.000000E+00	0.000000E+00			
02VH	0.200000E+00	0.100000E-01	0.000000E+00	0.000000E+00			
00WH	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00			
01WH	0.100000E-01	0.173000E-01	0.134000E-02	0.000000E+00	IH-5MW		

Appendix E

Algorithms Used for Calculated Parameters

Calculated parameters are derived from measurement data by use of predefined algorithms. These calculated parameters may aid in the interpretation of the data. The experimental data report will provide only a few basic calculated parameters such as mass flows and liquid levels. Further parameters and interpretations regarding a particular test are found in the Quick Look Report /1/.

Calculated data always carries the uncertainty of the algorithm in addition to uncertainties of the measurement data used for the calculations. Therefore, calculated data should always be interpreted with caution, keeping in mind the model used in its derivation. For the Experimental Data Report we try to use only relatively simple, straightforward models which should allow easy interpretation. More complicated models may yield better results in certain circumstances at the cost of generality.

1. Liquid Levels

Liquid levels may be calculated from differential pressure and temperature measurements for the following flow channels :

Pressure vessel: Downcomer and Riser

Steam generators:
- Primary side: U-tube, rising and falling leg
- Secondary side: Downcomer and Riser

For each flowchannel two differently defined levels may be calculated : the **collapsed level** and the *mixture level* (sometimes also called boiling level). The collapsed level is the measured gravity head expressed in meters. It gives an indication of liquid inventory. The mixture level is the elevation above which there is only steam. It may characterize heat transfer. Heat transfer coefficients drop sharply above the mixture level.

1.1 Algorithms - version for tests performed after June 1985

The algorithms are valid for non flow, or in the limiting case for low fluid velocities. An average mixture density $\overline{\varrho}$ can then be calculated between two differential pressure connection elevations by

$$\overline{\varrho} = PD / gh$$

where PD is differential pressure, g is gravity and h is the relative elevation of the upper to the lower connection.

The collapsed level h_c is then calculated as

$$h_c = [(\overline{\varrho} - \varrho_s) / (\varrho_w - \varrho_s)]\, h.$$

ϱ_s and ϱ_w are the densities of steam and water from absolute pressure, fluid temperature and steam tables.

If a chain of measured differential pressure data is available, the collapsed level is calculated for each individual differential pressure measurement and then added up for the whole flow channel. Doing this, fluid temperatures are considered to the extent possible to account for the density of subcooled water.

To determine the mixture level, h_x, the differential pressure transducer covering this level must be identified as that lying just below the elevation above which only steam density is measured. The mixture level is then calculated from

$$h_x = [(\overline{\varrho} - \varrho_s) / (\varrho_w - \varrho_s)]\, h + \tilde{h}$$

h is the height between the tabs of the differential pressure transducer which covers the mixture level. $\tilde{h}$ is the elevation of its lower pressure connection. By this procedure the mixture level is calculated for each measurement time point.

Both mixture and collapsed levels are given in meters relative to the two elevations indicated in the identifier. A collapsed/mixture level of zero means that between both elevations no water is contained. A mixture level indicated at the upper elevation of the identifier means that the level is at or above this elevation. Collapsed and mixture levels are truncated at the upper elevations indicated by the identifier if their value is calculated above this elevation, e.g. due to the velocity effect. During steady state flow channels in the primary loop are considered to be full and the collapsed level is set to the upper elevation indicated by the identifier.

Remark : Attention for mixture/collapsed level plots ! For certain time periods, the basic assumption $v = 0$ may not be fulfilled. For typical small leak tests the liquid levels can be regarded as valid starting some time after transient start, after decay of fluid velocity. Presence of subcooled water is considered to the extent possible with the available measurement data.

2. Fluid Mass Inventory

The fluid mass inventory is calculated for the primary loop and for the secondary sides of the steam generators.

For calculation of the fluid mass inventory the loop is divided into many sections as directed by the available instrumentation. Summing the inventories of these sections gives the total loop inventory. For vertical loop sections the inventories are determined from differential pressure, absolute pressure and temperature measurements. For horizontal loop sections the inventories are determined from density measurements and fluid conditions, considering the precise geometry of the loop. Sensible assumptions are made for loop components where no measurement is available (usually this is only necessary for the vessel downcomer above elevations "B"). Still, such gaps in measurement data could result in uncertainty of the calculated inventory data.

The interpretation of the inventory is not valid during the initial period after transient start when the evaluated data are distorted by fluid velocity. During steady state ($t < 0$) the primary inventory is calculated from pressure and temperatures in the loops and from the water level in the pressurizer. The detailed calculations are described in /8/.

Appendix F

Test Log Sheet

The Test Log Sheet, also called "Instrumentation Sheet", contains the main characteristics of the instrumentation and related electronics for each measurement channel in use for this test.

In the subsequent pages presenting the Instrumentation Sheet with the measurement channels listed in alphabetical order, the column acronyms have the following meanings :

IDENTIF	measurement identifier, see Appendix A
MIN / MAX	measurement range covered by the instrumentation and/or electronics, expressed in the following units
UNITS	engineering units, to which the measurement signals are converted using the calibration tables
TRANSD	serial number of transducer in use
CAL	calibration table to be used with the measurement signal
CODE	application code for calibration table and/or calibration-reference channel
N-GAIN	nominal gain of electronics, as used for calibration
LINE	numbering of amplifier/filter line
AMPLIF	serial number of amplifier
BANDW	low pass filter bandwidth in Hz
GAIN	gain of the measurement electronics used for the test. The data is multiplied by N-GAIN/GAIN before converting to engineering units
OFFSET	electrical zero offset (this value in mV is subtracted from the signals during data processing)
ERROR	measurement error band code (see Appendix D)
COMM	reference to comments, as indicated on the Log Sheet top page (not printed here)
CHAN	measurement channel number

INSTRUMENTATION SHEET FOR LOBI TEST NO. 98 DATE 22.MAR.90 JRC-ISPRA

TRANSDUCER * ELECTRONIC CHAIN * COMMENTS

IDENTIF	MIN	MAX	UNITS	TRANSD	CAL	CODE	N-GAIN	LINE	AMPLIF	BANDW	GAIN	OFFSET	ERROR	COMM	CHAN	
8T05POT	-180.00	180.00	DEGRANGL	POT	1208	1	1.0	222	0	1000	1.00	0	00PO	-	2012	••
DD11HDIA	-484	1986	KG/M••3	7-235	1259	1	1.0	235	0	-	1.00	0	01DD	-	4235	••
DD11HPER	-287	2991	KG/M••3	7-236	1260	1	1.0	236	0	-	1.00	0	01DD	-	4236	••
DD14VDIA	-292	2041	KG/M••3	8-231	1257	1	1.0	231	0	-	1.00	0	01DD	-	4231	••
DD14VPER	-655	2294	KG/M••3	8-232	1258	1	1.0	232	0	-	1.00	0	01DD	-	4232	••
DD16HDIA	-190	2571	KG/M••3	3-002	1156	1	1.0	2	0	1000	1.00	0	04DD	-	1002	
DD16HPER	-233	2983	KG/M••3	3-003	1146	1	1.0	3	0	1000	1.00	0	04DD	-	1003	
DD21HDIA	-354	2374	KG/M••3	1-222	1251	1	1.0	222	0	-	1.00	0	02DD	-	4222	••
DD21HPER	-1045	4921	KG/M••3	1-223	1252	1	1.0	223	0	-	1.00	0	02DD	-	4223	••
DD22VDIA	-601	2855	KG/M••3	4-224	1253	1	1.0	224	0	-	1.00	0	02DD	-	4224	••
DD22VPER	-532	4373	KG/M••3	5-225	1254	1	1.0	225	0	-	1.00	0	02DD	-	4225	••
DD24VDIA	-379	2355	KG/M••3	10-226	1255	1	1.0	226	0	-	1.00	0	02DD	-	4226	••
DD24VPER	-1209	4634	KG/M••3	10-227	1256	1	1.0	227	0	-	1.00	0	02DD	-	4227	••
DD25HDIA	-1873	3652	KG/M••3	6-222	1261	1	1.0	222	0	-	1.00	0	02DD	-	4228	••
DD25HPER	-851	2567	KG/M••3	6-223	1262	1	1.0	223	0	-	1.00	0	02DD	-	4230	••
DD26HDIA	-343	3901	KG/M••3	2-004	1145	1	1.0	4	0	1000	1.00	0	04DD	-	1004	
DD26HPER	-365	4366	KG/M••3	2-005	1144	1	1.0	5	0	1000	1.00	0	04DD	-	1005	
DS35VDIA	-46	1077	KG/M••3	4-221	1250	1	1.0	221	0	-	1.00	0	01DS	-	4221	••
IH-1MW	0.00	25.00	K-AMP	-	1168	1	1.0	191	552	20	1.00	0	02IH	-	4191	
IH-5MW	0.00	67.45	K-AMP	-	1169	1	1.0	196	557	20	1.00	0	01IH	-	4196	
MP71	-50.00	50.00	NM	-	1165	1	1.0	197	558	20	0.50	5000	01MP	-	4197	
MP72	-50.00	50.00	NM	-	1165	1	1.0	198	559	20	0.50	5000	01MP	-	4198	
PA-MCP1	-8.75	35.00	MPA-ABS	923-65	1035	1	1.0	207	199	1000	1.00	0	00PA	-	1010	
PA-MCP2	-8.32	35.18	MPA-ABS	214-30	1033	1	1.0	206	37	1000	1.00	0	00PA	-	1008	
PA058	0.04	10.40	MPA-ABS	SN494	1001	1	1.0	220	494	200	1.00	0	02PA	-	5012	••
PA11	-0.05	17.47	MPA-ABS	SN108	1010	1	1.0	221	43	200	1.00	0	01PA	-	5043	
PA16	0.04	17.51	MPA-ABS	SN-199	1012	1	1.0	222	324	20	1.00	0	01PA	-	4216	
PA26	-0.10	17.19	MPA-ABS	SN111	1016	1	1.0	225	235	80	1.00	0	01PA	3	3001	
PA38	-0.06	17.49	MPA-ABS	SN201	1007	1	1.0	226	5042	200	1.00	0	01PA	10	5042	
PA38KDG	-4.91	20.14	MPA-ABS	873-05	1031	1	1.0	201	207	1000	1.00	0	00PA	-	1006	
PA40	-0.01	17.36	MPA-ABS	SN201	1009	1	1.0	227	6583	200	1.00	0	01PA	-	5035	
PA40KDG	-4.91	20.14	MPA-ABS	873-04	1031	1	1.0	202	207	1000	1.00	0	00PA	-	1009	
PA518	-1.00	4.00	MPASCAL	18924	1332	1	1.0	169	2018	80	1.00	0	00PA	-	3026	••
PA65KDG	-2.53	10.10	MPA-ABS	873-01	1026	1	1.0	203	209	1000	1.00	0	00PA	-	1011	
PA66KDG	-2.46	10.04	MPA-ABS	873-02	1021	1	1.0	204	37	1000	1.00	0	00PA	-	1007	
PA87S	0.11	10.43	MPA-ABS	SN497	1013	1	1.0	228	5025	200	1.00	0	02PA	-	5025	
PA97S	0.10	10.44	MPA-ABS	SN445	1030	1	1.0	229	5044	200	1.00	0	02PA	3	5044	
PD05AB44	-1.00	4.00	MPASCAL	495-09	1332	1	1.0	12	6004	200	1.00	0	54PD	-	5076	••
PD1190A	-0.0375	0.0250	MPASCAL	176-78	1307	1	1.0	139	1002	80	1.00	0	13PD	3	3003	
PD151456	-0.7500	0.5000	MPASCAL	495-01	1313	1	1.0	100	1009	80	1.00	0	04PD	-	3008	
PD161133	-0.7500	0.5000	MPASCAL	495-03	1313	1	1.0	127	5010	80	1.00	0	34PD	-	3066	
PD163D83	-0.1500	0.1000	MPASCAL	674-24	1310	1	1.0	85	1011	80	1.00	0	15PD	-	3010	
PD16518	-0.7500	0.5000	MPASCAL	594-04	1313	1	1.0	87	6002	200	1.00	0	31PD	-	5074	••
PD1714	-0.0375	0.0250	MPASCAL	176-31	1307	1	1.0	99	1008	80	1.00	0	07PD	-	3007	
PD2141	-0.1200	0.0800	MPASCAL	384-02	1309	1	1.0	153	3009	80	1.00	0	56PD	-	3034	
PD2180A	-0.0600	0.1400	MPASCAL	384-05	1336	1	1.0	144	1017	80	1.00	0	13PD	3	3015	
PD252451	-1.50	1.00	MPASCAL	495-07	1314	1	1.0	104	2005	80	1.00	0	03PD	-	3020	
PD262133	-0.3750	0.2500	MPASCAL	674-29	1312	1	1.0	89	5011	80	1.00	0	17PD	-	3067	
PD263D87	-0.0100	0.0400	MPASCAL	176-21	1331	1	1.0	90	2008	80	1.00	0	02PD	-	3022	
PD2724	-0.0375	0.0250	MPASCAL	176-30	1307	1	1.0	145	2004	80	1.00	0	07PD	-	3019	
PD3D3R8A	-0.3000	0.2000	MPASCAL	674-27	1311	1	1.0	88	1012	80	1.00	0	21PD	-	3011	
PD3D3RUU	-0.0225	0.0150	MPASCAL	674-12	1305	1	1.0	110	3003	80	1.00	0	49PD	-	3031	
PD3D8D32	-0.0075	0.0050	MPASCAL	008-30	1303	1	1.0	129	2007	80	1.00	0	09PD	-	3021	
PD3DBU30	-0.1200	0.0800	MPASCAL	176-88	1309	1	1.0	150	5004	80	1.00	0	58PD	3	3059	
PD3DDF24	-0.0150	0.0100	MPASCAL	384-10	1304	1	1.0	130	4020	80	1.00	0	12PD	-	3055	
PD3DFG42	-0.0150	0.0100	MPASCAL	008-07	1304	1	1.0	74	5001	80	1.00	0	12PD	-	3056	
PD3DGL24	-0.0150	0.0100	MPASCAL	008-03	1304	1	1.0	131	7005	200	1.00	0	03PE	-	7005	
PD3DLN44	-0.0150	0.0100	MPASCAL	008-14	1304	1	1.0	132	7006	200	1.00	0	03PE	-	7006	
PD3DNQ44	-0.0150	0.0100	MPASCAL	008-25	1304	1	1.0	94	7007	200	1.00	0	03PE	-	7007	
PD3DQS44	-0.0150	0.0100	MPASCAL	008-21	1304	1	1.0	133	7008	200	1.00	0	03PE	-	7008	
PD3DSU42	-0.0100	0.0150	MPASCAL	008-06	1341	1	1.0	134	5002	80	1.00	0	03PE	-	3057	
PD3DZ847	-0.0150	0.0100	MPASCAL	674-06	1304	1	1.0	141	6001	200	1.00	0	50PD	-	5073	
PD3R11A4	-0.1200	0.0800	MPASCAL	674-18	1309	1	1.0	83	1001	80	1.00	0	16PD	-	3002	
PD3R21A4	-0.7500	0.5000	MPASCAL	495-02	1313	1	1.0	86	2017	80	1.00	0	34PD	-	3025	
PD3R39Z	-0.0533	0.0133	MPASCAL	674-19	1355	1	1.0	138	4006	200	1.00	0	51PD	-	5070	
PD3RAZ	-0.0067	0.0017	MPASCAL	008-26	1354	1	1.0	69	3002	80	1.00	0	50PD	3	3030	
PD3RDA44	-0.0075	0.0050	MPASCAL	008-28	1303	1	1.0	70	3014	80	1.00	0	10PD	3	3037	
PD3RFD24	-0.0150	0.0100	MPASCAL	008-13	1304	1	1.0	71	3012	80	1.00	0	11PD	3	3036	
PD3RGA44	-0.0375	0.0250	MPASCAL	176-39	1307	1	1.0	149	5003	80	1.00	0	59PD	-	3058	
PD3RGF12	-0.0150	0.0100	MPASCAL	008-04	1304	1	1.0	72	1010	80	1.00	0	11PD	3	3009	
PD3RLG01	-0.0375	0.0250	MPASCAL	008-27	1307	1	1.0	75	1015	80	1.00	0	04PE	-	3012	
PD3RNL00	-0.0375	0.0250	MPASCAL	008-29	1307	1	1.0	77	7001	200	1.00	0	04PE	-	7001	
PD3RQN00	-0.0300	0.0200	MPASCAL	384-07	1306	1	1.0	79	7002	200	1.00	0	01PE	-	7002	
PD3RSQ00	-0.0375	0.0250	MPASCAL	176-71	1307	1	1.0	81	7003	200	1.00	0	01PE	-	7003	
PD3RUG11	-0.3000	0.2000	MPASCAL	674-28	1311	1	1.0	136	4001	80	1.00	0	44PD	3	3041	
PD3RUS10	-0.1200	0.0800	MPASCAL	384-01	1309	1	1.0	112	7004	200	1.00	0	02PE	-	7004	
PD3RYA	-0.1500	0.1000	MPASCAL	674-22	1310	1	1.0	111	3015	80	1.00	0	47PD	-	3038	
PD3RYU21	-0.0300	0.0200	MPASCAL	176-72	1306	1	1.0	114	3008	80	1.00	0	45PD	-	3033	
PD4143	-1.0000	0.2500	MPASCAL	304-03	1353	1	1.0	152	4017	80	1.00	0	55PD	-	3052	
PD4340	-0.1500	0.1000	MPASCAL	674-23	1310	1	1.0	97	4019	80	1.00	0	20PD	-	3054	
PD51A8	-0.0500	0.0125	MPASCAL	674-15	1333	1	1.0	106	6003	200	1.00	0	23PD	-	5075	••
PD8082	-0.0100	0.0150	MPASCAL	008-23	1341	1	1.0	143	5006	80	1.00	0	06PE	-	3061	
PD8082AA	-0.3000	0.2000	MPASCAL	674-26	1311	1	1.0	142	1018	80	1.00	0	17PD	-	3016	
PD808288	-0.0150	0.0100	MPASCAL	542-12	1304	1	1.0	168	3005	80	1.00	0	13PE	-	3032	
PD8083B8	-0.7500	0.5000	MPASCAL	384-21	1313	1	1.0	163	4011	80	1.00	0	05PE	-	3046	
PD80A842	-0.0300	0.0200	MPASCAL	176-50	1306	1	1.0	1	1003	80	1.00	0	37PD	3	3004	
PD808D22	-0.0150	0.0100	MPASCAL	176-27	1304	1	1.0	3	7009	200	1.00	0	36PD	-	7009	
PD808NX1	-0.1200	0.0800	MPASCAL	176-93	1309	1	1.0	7	3019	80	1.00	0	38PD	-	3040	
PD808PX2	-0.1200	0.0800	MPASCAL	176-84	1309	1	1.0	9	2020	80	1.00	0	38PD	3	3028	
PD80DF22	-0.0150	0.0100	MPASCAL	176-33	1304	1	1.0	16	7010	200	1.00	0	32PD	-	7010	

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TRANSDUCER						•	ELECTRONIC CHAIN					•	COMMENTS		
IDENTIF	MIN	MAX	UNITS	TRANSD	CAL	CODE	N-GAIN	LINE	AMPLIF	BANDW	GAIN	OFFSET	ERROR	COMM	CHAN
PD80FJ22	-0.0300	0.0200	MPASCAL	176-59	1306	1	1.0	15	7011	200	1.00	0	29PD	-	7011
PD80JK22	-0.0300	0.0200	MPASCAL	176-75	1306	1	1.0	21	7012	200	1.00	0	29PD	-	7012
PD80KM22	-0.0300	0.0200	MPASCAL	176-70	1306	1	1.0	24	7013	200	1.00	0	29PD	-	7013
PD80MN22	-0.0075	0.0050	MPASCAL	176-17	1303	1	1.0	27	7019	200	1.00	0	30PD	-	7019
PD8227A	-0.0750	0.0500	MPASCAL	176-82	1308	1	1.0	105	2002	80	1.00	0	42PD	3	3018
PD82BA84	-0.0300	0.0200	MPASCAL	178-60	1306	1	1.0	2	5017	80	1.00	0	37PD	3	3014
PD82DB66	-0.0100	0.0150	MPASCAL	176-32	1341	1	1.0	4	7020	200	1.00	0	36PD	-	7020
PD82FD66	-0.0100	0.0150	MPASCAL	176-35	1341	1	1.0	17	1016	80	1.00	0	32PD	-	3013
PD82JF66	-0.0300	0.0200	MPASCAL	176-76	1306	1	1.0	18	7018	200	1.00	0	29PD	-	7018
PD82KJ86	-0.0300	0.0200	MPASCAL	176-66	1306	1	1.0	22	7017	200	1.00	0	29PD	-	7017
PD82MK66	-0.0300	0.0200	MPASCAL	176-83	1306	1	1.0	25	7018	200	1.00	0	29PD	-	7016
PD82NBX1	-0.1200	0.0800	MPASCAL	176-83	1309	1	1.0	8	1007	80	1.00	0	38PD	-	3008
PD82NM26	-0.0050	0.0075	MPASCAL	176-16	1340	1	1.0	28	7015	200	1.00	0	30PD	-	7015
PD82PBX2	-0.1200	0.0800	MPASCAL	176-85	1309	1	1.0	10	4018	80	1.00	0	09PD	3	3053
PD83FB76	-0.0300	0.0200	MPASCAL	176-40	1308	1	1.0	5	1013	200	1.00	0	35PD	3	5047
PD83JF77	-0.0300	0.0200	MPASCAL	176-55	1306	1	1.0	14	1006	200	1.00	0	05PD	3	5046
PD83LJ77	-0.0100	0.0400	MPASCAL	176-79	1331	1	1.0	19	1005	200	1.00	0	28PD	3	5045
PD83NL77	-0.0150	0.0100	MPASCAL	176-22	1304	1	1.0	26	2010	200	1.00	0	27PD	3	5054
PD85BF62	-0.0300	0.0200	MPASCAL	542-10	1306	1	1.0	6	1014	200	1.00	0	40PD	3	5048
PD85FJ22	-0.0300	0.0200	MPASCAL	176-53	1306	1	1.0	13	1019	200	1.00	0	26PD	3	5049
PD85JK22	-0.0300	0.0200	MPASCAL	178-38	1306	1	1.0	20	1020	200	1.00	0	26PD	3	5050
PD85KM22	-0.0300	0.0200	MPASCAL	176-51	1306	1	1.0	23	2003	200	1.00	0	29PD	3	5051
PD85MP22	-0.0150	0.0100	MPASCAL	384-12	1304	1	1.0	29	2006	200	1.00	0	30PD	3	5052
PD87PS27	-0.0300	0.0200	MPASCAL	176-54	1306	1	1.0	32	2009	200	1.00	0	26PD	3	5053
PD87RN77	-0.0150	0.0100	MPASCAL	176-26	1304	1	1.0	30	4004	200	1.00	0	24PD	3	5069
PD87RS77	-0.0250	0.0000	MPASCAL	178-57	1380	1	1.0	31	4007	200	1.00	0	25PD	10	5071
PD87ST75	-0.0250	0.0000	MPASCAL	176-41	1360	1	1.0	33	4003	200	1.00	0	27PD	-	5068
PD9092	-0.0100	0.0150	MPASCAL	008-22	1341	1	1.0	161	5019	80	1.00	0	06PE	-	3064
PD9092AA	-0.3000	0.2000	MPASCAL	674-30	1311	1	1.0	98	1004	80	1.00	0	17PD	-	3005
PD9092BB	-0.0150	0.0100	MPASCAL	542-11	1304	1	1.0	160	5008	80	1.00	0	13PE	-	3063
PD9093BB	-0.7500	0.5000	MPASCAL	384-20	1313	1	1.0	108	8021	20	1.00	0	05PE	-	4294
PD90AB46	-0.0300	0.0200	MPASCAL	176-62	1306	1	1.0	35	5007	80	1.00	0	37PD	3	3062
PD90BD66	-0.0200	0.0050	MPASCAL	176-29	1351	1	1.0	43	7021	200	1.00	0	36PD	-	7021
PD90BPX2	-0.1200	0.0800	MPASCAL	178-89	1309	1	1.0	39	4013	80	1.00	0	38PD	-	3048
PD90BPX3	-0.1200	0.0800	MPASCAL	176-94	1309	1	1.0	41	4015	80	1.00	0	38PD	3	3050
PD90DF66	-0.0150	0.0100	MPASCAL	176-28	1304	1	1.0	51	6018	20	1.00	0	32PD	-	4291
PD90FJ66	-0.0300	0.0200	MPASCAL	176-64	1306	1	1.0	48	6019	20	1.00	0	29PD	-	4292
PD90JK66	-0.0300	0.0200	MPASCAL	176-68	1306	1	1.0	54	6020	20	1.00	0	29PD	-	4293
PD90KN62	-0.0300	0.0200	MPASCAL	178-15	1308	1	1.0	65	3011	80	1.00	0	30PD	-	3035
PD9217A	-0.0750	0.0500	MPASCAL	674-17	1308	1	1.0	102	6008	200	1.00	0	42PD	3	5080
PD92BA24	-0.0300	0.0200	MPASCAL	176-81	1308	1	1.0	38	2001	80	1.00	0	37PD	3	3017
PD92DB22	-0.0150	0.0100	MPASCAL	176-36	1304	1	1.0	45	4012	80	1.00	0	36PD	-	3047
PD92FD22	-0.0150	0.0100	MPASCAL	176-34	1304	1	1.0	52	3001	80	1.00	0	32PD	-	3029
PD92JF22	-0.0300	0.0200	MPASCAL	178-73	1306	1	1.0	49	5005	80	1.00	0	29PD	-	3080
PD92KJ22	-0.0300	0.0200	MPASCAL	178-67	1308	1	1.0	55	4008	200	1.00	0	29PD	-	5072
PD92MK22	-0.0300	0.0200	MPASCAL	176-74	1308	1	1.0	62	2018	80	1.00	0	29PD	-	3024
PD92NM22	-0.0075	0.0050	MPASCAL	384-11	1303	1	1.0	59	4016	80	1.00	0	30PD	-	3051
PD92PBX2	-0.1200	0.0800	MPASCAL	176-81	1309	1	1.0	40	4014	80	1.00	0	38PD	-	3049
PD92PBX3	-0.1200	0.0800	MPASCAL	176-87	1309	1	1.0	42	2019	80	1.00	0	38PD	3	3027
PD93F810	-0.0300	0.0200	MPASCAL	176-42	1308	1	1.0	44	2014	200	1.00	0	35PD	3	5058
PD93JF11	-0.0300	0.0200	MPASCAL	178-49	1308	1	1.0	50	2013	200	1.00	0	05PD	3	5057
PD93LJ11	-0.0100	0.0400	MPASCAL	176-80	1331	1	1.0	58	2012	200	1.00	0	28PD	3	5056
PD93NL11	-0.0150	0.0100	MPASCAL	176-23	1304	1	1.0	57	2011	200	1.00	0	27PD	3	5055
PD95BF06	-0.0300	0.0200	MPASCAL	176-58	1308	1	1.0	48	3004	200	1.00	0	40PD	3	5059
PD95FJ66	-0.0300	0.0200	MPASCAL	176-56	1306	1	1.0	47	3006	200	1.00	0	26PD	3	5060
PD95JK66	-0.0300	0.0200	MPASCAL	176-37	1308	1	1.0	53	3007	200	1.00	0	28PD	3	5061
PD95KM66	-0.0300	0.0200	MPASCAL	176-47	1306	1	1.0	60	3010	200	1.00	0	29PD	3	5062
PD95MP62	-0.0150	0.0100	MPASCAL	176-20	1304	1	1.0	58	3013	200	1.00	0	30PD	3	5063
PD9787SS	-0.7500	0.5000	MPASCAL	384-22	1313	1	1.0	159	5018	80	1.00	0	05PE	-	3039
PD97PS21	-0.0300	0.0200	MPASCAL	176-52	1308	1	1.0	66	3016	200	1.00	0	26PD	3	5064
PD97RN11	-0.0150	0.0100	MPASCAL	178-25	1304	1	1.0	63	3017	200	1.00	0	24PD	3	5085
PD97RS11	-0.0250	0.0000	MPASCAL	176-44	1380	1	1.0	84	3018	200	1.00	0	25PD	10	5066
PD97ST14	-0.0250	0.0000	MPASCAL	176-45	1360	1	1.0	87	3020	200	1.00	0	27PD	-	5087
PDCOND	-0.0313	0.0000	MPASCAL	178-19	1361	1	1.0	148	4005	80	1.00	0	39PD	-	3043
PDCOOL	-0.0313	0.0000	MPASCAL	176-18	1361	1	1.0	147	4002	80	1.00	0	39PD	-	3042
PDSSCOND	0.0000	0.0385	MPASCAL	P-3.71	1386	1	1.0	0	0	80	1.00	0	00PD	-	3044
PDSSCOOL	0.0000	0.0450	MPASCAL	P-3.72	1365	1	1.0	0	0	80	1.00	0	00PD	-	3045
QF12V	0.00	15.00	M/SEC	GREN20	1549	1	1.0	28	534	200	1.00	0	01QF	-	5034
QF14V	0.00	15.00	M/SEC	GREN68	1552	1	1.0	29	533	200	1.00	0	01QF	-	5033
QF22V	0.00	15.00	M/SEC	GRE152	1558	1	1.0	24	529	200	1.00	0	01QF	-	5029
QF24V	0.00	15.00	M/SEC	GREN85	1550	1	1.0	152	532	200	1.00	0	01QF	-	5032
QI01H000	-5.00	5.00	VOLT	33-43	1166	1	1.0	21	0	1000	1.00	0	00QI	-	2009
QI01H180	-5.00	5.00	VOLT	41-42	1166	1	1.0	21	180	1000	1.00	0	00QI	-	2011
QI05H000	-5.00	5.00	VOLT	11-12	1166	1	1.0	15	0	1000	1.00	0	00QI	-	2004
QI05H180	-5.00	5.00	VOLT	53-63	1168	1	1.0	25	180	1000	1.00	0	00QI	-	2007
QI11H180	-5.00	5.00	VOLT	31-32	1186	1	1.0	11	180	1000	1.00	0	00QI	-	2010
QI11H300	-5.00	5.00	VOLT	21-22	1168	1	1.0	11	0	1000	1.00	0	00QI	-	2008
QI12V090	-5.00	5.00	VOLT	13-23	1186	1	1.0	15	180	1000	1.00	0	00QI	-	2005
QI22V090	-5.00	5.00	VOLT	51-52	1168	1	1.0	25	0	1000	1.00	0	00QI	-	2008
QL05EWT	-1000	1014	KG	353	1457	1	1.0	222	39	200	1.00	0	02QL	-	5039 **
QM-VCS	0.0000	0.5241	KG/SEC	241138	1584	1	1.0	4	516	200	1.00	0	01QM	-	5016
QM50HPI	0.0000	0.8165	KG/SEC	20501	1586	1	1.0	310	510	200	1.00	0	01QV	-	5010
QM55HPI	0.0000	0.4443	KG/SEC	20493	1585	1	1.0	31	1	200	1.00	0	01QM	-	5001
QM56HPI	0.0000	0.4444	KG/SEC	20497	1577	1	1.0	33	497	200	1.00	0	01QM	-	5003
QM57AF	0.0000	0.4444	KG/SEC	20502	1572	1	1.0	311	502	200	1.00	0	04QM	-	5011
QM57AFH	0.0000	0.4728	KG/SEC	1136E5	1580	1	1.0	537	37	200	1.00	0	01QM	-	5037
QM58AF	0.0000	0.1660	KG/SEC	20514	1573	1	1.0	39	514	200	1.00	0	02QM	-	5009
QM58AFH	0.0000	0.4624	KG/SEC	1138E2	1581	1	1.0	528	28	200	1.00	0	01QM	-	5028
QM63EFDO	0.00	3.33	KG/SEC	IL	1579	1	1.0	15	15	200	1.00	0	00QM	-	5015
QM64EFDO	0.00	1.11	KG/SEC	BL	1578	1	1.0	71	14	200	1.00	0	00QM	-	5014

INSTRUMENTATION SHEET FOR LOBI TEST NO. 98 DATE 22.MAR.90 JRC-ISPRA

TRANSDUCER * ELECTRONIC CHAIN * COMMENTS

IDENTIF	MIN	MAX	UNITS	TRANSD	CAL	CODE	N-GAIN	LINE	AMPLIF	BANDW	GAIN	OFFSET	ERROR	COMM	CHAN	
OP83V150	-1.50	2.25	KPASCAL	176-10	1338	1	1.0	117	6006	200	1.00	0	01QP	-	5078	
OP93V210	-1.50	2.25	KPASCAL	176-01	1338	1	1.0	124	6007	200	1.00	0	01QP	-	5079	
OP93V330	-1.50	2.25	KPASCAL	176-09	1338	1	1.0	122	6005	200	1.00	0	01QP	-	5077	
OPREFR	-0.0004	0.0015	MPASCAL	542-19	1367	1	1.0	76	7014	200	1.00	0	00QP	-	7014	••
QS70DRAI	0.0000	0.1667	KG/SEC	83185	1574	1	1.0	26	526	200	1.00	0	00QS	-	5026	
QS71IN	0.0000	0.4444	KG/SEC	20498	1572	1	1.0	36	498	200	1.00	0	01QM	-	5006	
QS71OUT	0.0000	0.4444	KG/SEC	20510	1572	1	1.0	35	510	200	1.00	0	01QM	-	5005	
QS72IN	0.0000	0.4444	KG/SEC	20501	1572	1	1.0	37	501	200	1.00	0	01QM	-	5007	
QS72OUT	0.0000	0.4444	KG/SEC	20511	1572	1	1.0	38	496	200	1.00	0	01QM	-	5008	
QT35V000	-5.00	5.00	M/SEC	TISP35	1521	1	1.0	25	30	200	1.00	0	03QT	-	5030	
QV41V	0.0000	0.0150	M**3/SEC	GREN30	1526	1	1.0	111	30	200	1.00	0	04QV	-	5023	
QV44	0.0000	0.0010	M**3/SEC	48185	1546	1	1.0	16	18	200	1.00	0	01QV	-	5018	
QV53ACC	0.0000	0.0060	M**3/SEC	104876	1504	1	1.0	17	104	200	1.00	0	01QV	-	5019	
QV54ACC	0.0000	0.0020	M**3/SEC	198876	1505	1	1.0	15	198	200	1.00	0	02QV	-	5017	
QV55ACC	0.0000	0.0060	M**3/SEC	105876	1509	1	1.0	110	105	200	1.00	0	02QV	-	5022	
QV55VCSO	0.0000	0.0417	LTR/SEC	00603	1559	1	1.0	0	521	200	1.00	0	01QV	-	5021	
QV55VCST	0.0000	0.0417	LTR/SEC	HM3	1557	1	1.0	12	524	200	1.00	0	01QV	-	5024	
QV56ACC	0.0000	0.0020	M**3/SEC	197876	1503	1	1.0	11	197	200	1.00	0	02QV	-	5013	
QV63V	0.0000	0.0040	M**3/SEC	214380	1507	1	1.0	210	214	200	1.00	0	05QV	10	5036	
QV64V	0.0000	0.0010	M**3/SEC	491380	1544	1	1.0	212	491	200	1.00	0	07QV	10	5038	
QV65HVX	-0.0438	0.1752	M**3/SEC	VOS2	1501	1	1.0	2	2	200	1.00	0	09QV	-	5040	
QV66HVX	-0.0133	0.0533	M**3/SEC	VOS1	1502	1	1.0	1	1	200	1.00	0	10QV	-	5041	
RP71	-8934	8934	RPM	TACH01	1170	1	1.0	193	554	20	1.00	0	01RP	-	4193	
RP72	-8724	8724	RPM	TACH02	1171	1	1.0	194	555	20	1.00	0	01RP	-	4194	
RPHPIS	0.00	150.00	RPM	-	1164	1	1.0	0	0	80	1.00	0	00RP	-	3065	
SM07PORV	0	1000	BIT	-	1200	1	1.0	25	0	-	1.00	0	-	1	6025	
SM07RE	0	1000	BIT	2.14	1200	1	1.0	26	0	-	1.00	0	-	1	6026	
SM34SEAL	0	1000	BIT	4.77	1200	1	1.0	27	0	-	1.00	0	-	1	6027	
SM38SEAL	0	1000	BIT	-	1200	1	1.0	1	0	-	1.00	0	-	1	6001	
SM39BYPS	0	1000	BIT	-	1200	1	1.0	2	0	-	1.00	0	-	1	6002	
SM41PRES	0	1000	BIT	-	1200	1	1.0	7	0	-	1.00	0	-	1	6007	
SM53ACC1	0	1000	BIT	-	1200	1	1.0	3	0	-	1.00	0	-	1	6003	
SM54ACC2	0	1000	BIT	-	1200	1	1.0	5	0	-	1.00	0	-	1	6005	
SM55ACC1	0	1000	BIT	-	1200	1	1.0	4	0	-	1.00	0	-	1	6004	
SM56ACC2	0	1000	BIT	-	1200	1	1.0	6	0	-	1.00	0	-	1	6006	
SM63AFBY	0	1000	BIT	-	1200	1	1.0	23	0	-	1.00	0	-	1	6023	
SM63AFIN	0	1000	BIT	-	1200	1	1.0	21	0	-	1.00	0	-	1	6021	
SM63SGIV	0	1000	BIT	-	1200	1	1.0	8	0	-	1.00	0	-	1	6008	
SM64AFBY	0	1000	BIT	-	1200	1	1.0	24	0	-	1.00	0	-	1	6024	
SM64AFIN	0	1000	BIT	-	1200	1	1.0	22	0	-	1.00	0	-	1	6022	
SM64SGIV	0	1000	BIT	-	1200	1	1.0	9	0	-	1.00	0	-	1	6009	
SM65LRC	0	1000	BIT	-	1600	1	1.0	2	0	-	1.00	0	-	-	2002	
SM65SGOV	0	1000	BIT	-	1200	1	1.0	10	0	-	1.00	0	-	1	6010	
SM66LRC	0	1000	BIT	-	1600	1	1.0	3	0	-	1.00	0	-	-	2003	
SM66SGOV	0	1000	BIT	-	1200	1	1.0	11	0	-	1.00	0	-	1	6011	
SM71TROV	0	1000	BIT	-	1200	1	1.0	19	0	-	1.00	0	-	1	6019	
SM72TROV	0	1000	BIT	-	1200	1	1.0	20	0	-	1.00	0	-	1	6020	
SMBDTIME	0	1000	BIT	-	1200	1	1.0	33	0	-	1.00	0	-	1	6033	
SMP1BRAK	0	1000	BIT	-	1200	1	1.0	17	0	-	1.00	0	-	1	6017	
SMP2BRAK	0	1000	BIT	-	1200	1	1.0	18	0	-	1.00	0	-	1	6018	
SMP3FEED	0	1000	BIT	-	1200	1	1.0	35	0	-	1.00	0	-	1	6035	
SMPRESRV	0.00	100.00	PERCENT	WECK	1173	1	1.0	323	688	20	1.00	0	00SM	-	4215	
SMSEALRV	0	1000	BIT	-	1200	1	1.0	34	0	-	1.00	0	-	1	6034	
SMSG1BLV	0	1000	BIT	-	1200	1	1.0	13	0	-	1.00	0	-	1	6013	
SMSG1BRV	0	1000	BIT	-	1200	1	1.0	15	0	-	1.00	0	-	1	6015	
SMSG1SRV	0	1000	BIT	-	1200	1	1.0	28	0	-	1.00	0	-	1	6028	
SMSG2BLV	0	1000	BIT	-	1200	1	1.0	14	0	-	1.00	0	-	1	6014	
SMSG2BRV	0	1000	BIT	-	1200	1	1.0	16	0	-	1.00	0	-	1	6016	
SMSG2SRV	0	1000	BIT	-	1200	1	1.0	29	0	-	1.00	0	-	1	6029	
SMSG1SOV	0	1000	BIT	-	1200	1	1.0	12	0	-	1.00	0	-	1	6012	
TD111617	-48.78	48.78	DEGRCELS	-	1207	1	1.0	320	685	20	1.00	0	01TD	-	4212	
TD121324	-48.78	48.78	DEGRCELS	-	1207	1	1.0	318	683	20	1.00	0	01TD	-	4210	
TD212616	-48.78	48.78	DEGRCELS	-	1207	1	1.0	321	686	20	1.00	0	01TD	-	4213	
TD222324	-48.78	48.78	DEGRCELS	-	1207	1	1.0	319	684	20	1.00	0	01TD	-	4211	
TF00AMBI	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	61	251	20	500.00	0	02TW	-	4061	
TF05A	0.00	486.20	DEGRCELS	LL	1201	CR199	500.0	145	518	20	500.00	0	22TF	-	4161	••
TF05B	0.00	486.20	DEGRCELS	LL	1201	CR199	500.0	155	512	20	500.00	0	22TF	-	4155	••
TF05D	0.00	486.20	DEGRCELS	LL	1201	CR199	500.0	154	511	20	500.00	0	02TF	-	4154	••
TF05E	0.00	485.00	DEGRCELS	TANK	1206	CR201	500.0	69	263	20	500.00	0	02TF	-	4069	••
TF11H000	0.00	485.00	DEGRCELS	FW13/1	1218	CR199	500.0	109	411	20	500.00	0	01TF	-	4109	
TF11H180	0.00	484.50	DEGRCELS	FW16/3	1221	CR199	500.0	110	412	20	500.00	0	03TF	-	4110	
TF12V270	0.00	483.30	DEGRCELS	FW13/8	1228	CR199	500.0	113	415	20	500.00	0	04TF	-	4113	
TF13V090	0.00	483.30	DEGRCELS	FW13/9	1228	CR199	500.0	115	417	20	500.00	0	05TF	-	4115	
TF14V045	0.00	485.00	DEGRCELS	FW1310	1218	CR199	500.0	117	419	20	500.00	0	06TF	-	4117	
TF15H000	0.00	484.60	DEGRCELS	FW13/2	1220	CR199	500.0	119	422	20	500.00	0	07TF	-	4119	
TF15H180	0.00	484.80	DEGRCELS	FW16/4	1219	CR199	500.0	120	423	20	500.00	0	08TF	-	4120	
TF16H000	0.00	484.80	DEGRCELS	FW13/7	1219	CR199	500.0	123	426	20	500.00	0	09TF	-	4123	
TF16H180	0.00	484.50	DEGRCELS	FW16/5	1221	CR199	500.0	124	427	20	500.00	0	10TF	-	4124	
TF21H000	0.00	484.80	DEGRCELS	FW23/2	1219	CR199	500.0	127	431	20	500.00	0	11TF	-	4127	
TF21H180	0.00	484.60	DEGRCELS	FW26/1	1220	CR199	500.0	128	432	20	500.00	0	12TF	-	4128	
TF22V090	0.00	484.60	DEGRCELS	FW23/3	1220	CR199	500.0	131	435	20	500.00	0	13TF	-	4131	
TF23V270	0.00	485.00	DEGRCELS	FW23/5	1218	CR199	500.0	133	437	20	500.00	0	14TF	-	4133	
TF24V270	0.00	485.00	DEGRCELS	FW23/7	1218	CR199	500.0	135	439	20	500.00	0	15TF	-	4135	
TF25H000	0.00	484.80	DEGRCELS	FW23/8	1219	CR199	500.0	137	442	20	500.00	0	16TF	-	4137	
TF25H180	0.00	484.60	DEGRCELS	FW26/2	1220	CR199	500.0	138	443	20	500.00	0	17TF	-	4138	
TF26H000	0.00	485.00	DEGRCELS	FW23/9	1218	CR199	500.0	142	446	20	500.00	0	18TF	-	4141	
TF26H180	0.00	484.80	DEGRCELS	FW26/4	1219	CR199	500.0	142	447	20	500.00	0	19TF	-	4142	
TF31V030	0.00	486.20	DEGRCELS	33F2	1201	CR199	500.0	157	514	20	500.00	0	20TF	-	4157	
TF31V210	0.00	486.20	DEGRCELS	33F5	1201	CR199	500.0	159	516	20	500.00	0	21TF	-	4159	
TF32V120	0.00	486.20	DEGRCELS	33F1	1201	CR199	500.0	162	519	20	500.00	0	22TF	-	4162	

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TRANSDUCER * ELECTRONIC CHAIN * COMMENTS

IDENTIF	MIN	MAX	UNITS	TRANSD	CAL	CODE	N-GAIN	LINE	AMPLIF	BANDW	GAIN	OFFSET	ERROR	COMM	CHAN
TF32V300	0.00	486.20	DEGRCELS	33F6	1201	CR199	500.0	165	523	20	500.00	0	23TF	-	4165
TF33V030	0.00	486.20	DEGRCELS	33F8	1201	CR199	500.0	167	525	20	500.00	0	26TF	-	4167
TF34V210	0.00	486.20	DEGRCELS	J4	1201	CR199	500.0	171	529	20	500.00	0	27TF	-	4171
TF35V135	0.00	486.20	DEGRCELS	35	1201	CR199	500.0	173	532	20	500.00	0	02TF	-	4173
TF36V165	0.00	488.20	DEGRCELS	T2	1201	CR199	500.0	180	539	20	500.00	0	02TF	-	4180
TF37V165	0.00	486.20	DEGRCELS	T1	1201	CR199	500.0	179	538	20	500.00	0	02TF	-	4179
TF38H000	0.00	486.20	DEGRCELS	3R	1201	CR199	500.0	174	533	20	500.00	0	02TF	12	4174
TF39	0.00	486.20	DEGRCELS	T3	1201	CR199	500.0	181	541	20	500.00	0	02TF	-	4181
TF40V000	0.00	486.20	DEGRCELS	PZ	1201	CR199	500.0	182	542	20	500.00	0	02TF	-	4182
TF41V000	0.00	486.20	DEGRCELS	PZ	1201	CR199	500.0	184	544	20	500.00	0	02TF	-	4184
TF42V000	0.00	486.20	DEGRCELS	PZ	1201	CR199	500.0	183	543	20	500.00	0	02TF	-	4183
TF44IN	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	66	256	20	500.00	0	02TF	-	4066
TF44OUT	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	67	261	20	500.00	0	02TF	-	4067
TF52	0.00	486.20	DEGRCELS	SEC	1201	CR199	500.0	147	453	20	500.00	0	02TF	-	4147
TF55ACCU	0.00	486.20	DEGRCELS	SEC	1201	CR199	500.0	145	451	20	500.00	0	02TF	-	4145 **
TF55VCS	0.00	486.20	DEGRCELS	SEC	1201	CR199	500.0	146	452	20	500.00	0	02TF	-	4146
TF56	0.00	486.20	DEGRCELS	SEC	1201	CR199	500.0	148	454	20	500.00	0	02TF	-	4148
TF63H000	0.00	486.20	DEGRCELS	2V2	1201	CR199	500.0	176	535	20	500.00	0	02TF	-	4176
TF64H000	0.00	486.20	DEGRCELS	1V	1201	CR199	500.0	178	537	20	500.00	0	02TF	-	4178
TF65H090	0.00	485.00	DEGRCELS	4V	1224	CR199	500.0	175	534	20	500.00	0	02TF	-	4175
TF66H270	0.00	485.00	DEGRCELS	2V1	1224	CR199	500.0	177	536	20	500.00	0	02TF	-	4177
TF71SEAL	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	89	335	20	500.00	0	02TF	-	4089
TF72SEAL	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	92	342	20	500.00	0	02TF	-	4092
TF80A	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	53	235	20	500.00	0	02TF	-	4053
TF808	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	54	236	20	500.00	0	02TF	-	4054
TF80C	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	56	242	20	500.00	0	02TF	-	4056
TF80D	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	58	244	20	500.00	0	02TF	-	4058
TF80E	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	60	246	20	500.00	0	02TF	-	4060
TF80F	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	62	252	20	500.00	0	02TF	-	4062
TF80G	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	64	254	20	500.00	0	02TF	-	4064
TF80J	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	65	255	20	500.00	0	02TF	-	4065
TF82A	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	82	324	20	500.00	0	02TF	-	4082
TF828	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	80	322	20	500.00	0	02TF	-	4080
TF82C	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	78	316	20	500.00	0	02TF	-	4078
TF82D	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	76	314	20	500.00	0	02TF	-	4076
TF82E	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	74	312	20	500.00	0	02TF	-	4074
TF82G	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	71	265	20	500.00	0	02TF	-	4071
TF82J	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	70	264	20	500.00	0	02TF	-	4070
TF83F2	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	86	332	20	500.00	0	02TF	-	4086
TF83J2	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	85	331	20	500.00	0	02TF	-	4085
TF83L2	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	84	326	20	500.00	0	02TF	-	4084
TF83N2	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	83	325	20	500.00	0	02TF	-	4083
TF8580	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	87	333	20	500.00	0	02TF	-	4087
TF8582	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	88	334	20	500.00	0	02TF	-	4088
TF85C0	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	68	262	20	500.00	0	02TF	-	4068
TF85C2	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	90	336	20	500.00	0	02TF	-	4090
TF85D0	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	72	266	20	500.00	0	02TF	-	4072
TF85D2	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	102	356	20	500.00	0	02TF	-	4102
TF85D6	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	93	343	20	500.00	0	02TF	-	4093
TF85E0	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	108	366	20	500.00	0	02TF	-	4108
TF85E2	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	94	344	20	500.00	0	02TF	-	4094
TF85E6	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	95	345	20	500.00	0	02TF	-	4095
TF85F0	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	98	346	20	500.00	0	02TF	-	4096
TF85F2	0.00	485.00	DEGRCEL9	SG	1206	CR201	500.0	97	351	20	500.00	0	02TF	-	4097
TF85F6	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	98	352	20	500.00	0	02TF	-	4098
TF85G0	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	149	455	20	500.00	0	02TF	-	4149
TF85G2	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	99	353	20	500.00	0	02TF	-	4099
TF85G6	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	100	354	20	500.00	0	02TF	-	4100
TF85J0	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	101	355	20	500.00	0	02TF	-	4101
TF85J6	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	103	361	20	500.00	0	02TF	-	4103
TF85K2	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	105	363	20	500.00	0	02TF	-	4105
TF85K6	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	106	364	20	500.00	0	02TF	-	4106
TF87R	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	150	456	20	500.00	0	02TF	-	4150
TF87S	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	151	457	20	500.00	0	02TF	-	4151
TF87T	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	152	458	20	500.00	0	02TF	-	4152
TF90A	0.00	486.20	DEGRCELS	SG	1227	CR201	500.0	153	459	20	500.00	0	02TF	-	4153
TF908	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	365	814	20	500.00	0	02TF	-	4258
TF90E	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	359	7104	20	500.00	0	02TF	-	4252
TF90F	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	357	7102	20	500.00	0	02TF	-	4250
TF90G	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	356	7101	20	500.00	0	02TF	-	4249
TF90J	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	355	796	20	500.00	0	02TF	-	4248
TF90K	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	354	795	20	500.00	0	02TF	-	4247
TF92A	0.00	486.20	DEGRCELS	SG	1227	CR201	500.0	367	816	20	500.00	0	02TF	-	4260
TF928	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	185	545	20	500.00	0	02TF	-	4185
TF92C	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	187	547	20	500.00	0	02TF	-	4187
TF92D	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	189	549	20	500.00	0	02TF	-	4189
TF92F	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	347	784	20	500.00	0	02TF	-	4240
TF92G	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	349	786	20	500.00	0	02TF	-	4242
TF92J	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	350	791	20	500.00	0	02TF	-	4243
TF93F2	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	371	824	20	500.00	0	02TF	-	4264
TF93J2	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	370	823	20	500.00	0	02TF	-	4263
TF93L2	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	369	822	20	500.00	0	02TF	-	4262
TF93N2	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	368	821	20	500.00	0	02TF	-	4261
TF9580	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	372	825	20	500.00	0	02TF	-	4265
TF9582	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	373	826	20	500.00	0	02TF	-	4266
TF9586	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	374	831	20	500.00	0	02TF	-	4267
TF95C0	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	104	362	20	500.00	0	02TF	-	4104
TF95C2	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	375	832	20	500.00	0	02TF	-	4268
TF95C6	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	376	833	20	500.00	0	02TF	-	4269
TF95D0	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	363	812	20	500.00	0	02TF	-	4256

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IDENTIF	MIN	MAX	UNITS	TRANSD	CAL	CODE	N-GAIN	LINE	AMPLIF	BANDW	GAIN	OFFSET	ERROR	COMM	CHAN	
TF95D2	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	377	834	20	500.00	0	02TF	-	4270	
TF95D6	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	378	835	20	500.00	0	02TF	-	4271	
TF95E2	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	379	836	20	500.00	0	02TF	-	4272	
TF95E6	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	380	881	20	500.00	0	02TF	-	4273	
TF95F0	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	381	882	20	500.00	0	02TF	-	4274	
TF95F2	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	382	883	20	500.00	0	02TF	-	4275	
TF95F6	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	383	884	20	500.00	0	02TF	-	4276	
TF95G0	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	387	892	20	500.00	0	02TF	-	4280	
TF95G2	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	384	885	20	500.00	0	02TF	-	4277	
TF95G6	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	385	886	20	500.00	0	02TF	-	4278	
TF95J0	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	386	891	20	500.00	0	02TF	-	4279	
TF95J2	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	107	365	20	500.00	0	02TF	-	4107	
TF95J6	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	388	893	20	500.00	0	02TF	-	4281	
TF95K0	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	389	894	20	500.00	0	02TF	-	4282	
TF95K2	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	390	895	20	500.00	0	02TF	-	4283	
TF95K6	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	391	896	20	500.00	0	02TF	-	4284	
TF95L0	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	392	8101	20	500.00	0	02TF	-	4285	
TF95N0	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	393	8102	20	500.00	0	02TF	-	4286	
TF97R	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	395	8104	20	500.00	0	02TF	-	4288	
TF97S	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	396	8105	20	500.00	0	02TF	-	4289	
TF97T	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	397	8106	20	500.00	0	02TF	-	4290	
TFREFRIN	0.00	486.20	DEGRCELS	LL	1201	CR199	500.0	147	527	20	500.00	0	02TF	-	4169	
TFREFROT	0.00	486.20	DEGRCELS	LL	1201	CR199	500.0	148	521	20	500.00	0	01TW	-	4172	
TH35D301	0.00	967.50	DEGRCELS	5D301	1203	CR200	250.0	37	211	20	250.00	0	01TH	-	4037	
TH32D301	0.00	967.50	DEGRCELS	2D301	1203	CR200	250.0	25	151	20	250.00	0	01TH	-	4025	
TH34D402	0.00	967.50	DEGRCELS	4D402	1203	CR200	250.0	38	212	20	250.00	0	01TH	-	4038	
TH35F402	0.00	967.50	DEGRCELS	5F402	1203	CR200	250.0	26	152	20	250.00	0	01TH	-	4026	
TH34E103	0.00	967.50	DEGRCELS	4E103	1203	CR200	250.0	39	213	20	250.00	0	01TH	-	4039	
TH32C103	0.00	967.50	DEGRCELS	2C103	1203	CR200	250.0	13	131	20	250.00	0	01TH	-	4013	
TH37C404	0.00	967.50	DEGRCELS	7C404	1203	CR200	250.0	14	132	20	250.00	0	01TH	-	4014	
TH37G404	0.00	967.50	DEGRCELS	7G404	1203	CR200	250.0	40	214	20	250.00	0	01TH	-	4040	
TH35D105	0.00	967.50	DEGRCELS	5D105	1203	CR200	250.0	41	215	20	250.00	0	01TH	-	4041	
TH37F105	0.00	967.50	DEGRCELS	7F105	1203	CR200	250.0	27	153	20	250.00	0	01TH	-	4027	
TH34D106	0.00	967.50	DEGRCELS	4D106	1203	CR200	250.0	42	216	20	250.00	0	01TH	-	4042	
TH35F106	0.00	967.50	DEGRCELS	5F106	1203	CR200	250.0	28	154	20	250.00	0	01TH	-	4028	
TH34E407	0.00	967.50	DEGRCELS	4E407	1203	CR200	250.0	43	221	20	250.00	0	01TH	-	4043	
TH32C407	0.00	967.50	DEGRCELS	2C407	1203	CR200	250.0	29	155	20	250.00	0	01TH	-	4029	
TH37E407	0.00	967.50	DEGRCELS	7E407	1203	CR200	250.0	15	133	20	250.00	0	01TH	-	4015	
TH37A407	0.00	967.50	DEGRCELS	7A407	1203	CR200	250.0	5	115	20	250.00	0	01TH	-	4005	
TH35E208	0.00	967.50	DEGRCELS	5E208	1203	CR200	250.0	44	222	20	250.00	0	01TH	-	4044	
TH32E208	0.00	967.50	DEGRCELS	2E208	1203	CR200	250.0	16	134	20	250.00	0	01TH	-	4016	
TH34G208	0.00	967.50	DEGRCELS	4G208	1203	CR200	250.0	30	156	20	250.00	0	01TH	-	4030	
TH32A208	0.00	967.50	DEGRCELS	2A208	1203	CR200	250.0	6	116	20	250.00	0	01TH	-	4006	
TH35D209	0.00	967.50	DEGRCELS	5D209	1203	CR200	250.0	45	223	20	250.00	0	01TH	-	4045	
TH34B209	0.00	967.50	DEGRCELS	4B209	1203	CR200	250.0	18	136	20	250.00	0	01TH	-	4018	
TH37F209	0.00	967.50	DEGRCELS	7F209	1203	CR200	250.0	31	161	20	250.00	0	01TH	-	4031	
TH31C209	0.00	967.50	DEGRCELS	1C209	1203	CR200	250.0	7	121	20	250.00	0	01TH	-	4007	
TH31G209	0.00	967.50	DEGRCELS	1G209	1203	CR200	250.0	8	122	20	250.00	0	01TH	-	4008	
TH38C209	0.00	967.50	DEGRCELS	8C209	1203	CR200	250.0	17	135	20	250.00	0	01TH	-	4017	
TH34D210	0.00	967.50	DEGRCELS	4D210	1203	CR200	250.0	46	224	20	250.00	0	01TH	-	4046	
TH32F210	0.00	967.50	DEGRCELS	2F210	1203	CR200	250.0	19	141	20	250.00	0	01TH	-	4019	
TH33G210	0.00	967.50	DEGRCELS	3G210	1203	CR200	250.0	33	163	20	250.00	0	01TH	-	4033	
TH35B210	0.00	967.50	DEGRCELS	5B210	1203	CR200	250.0	20	142	20	250.00	0	01TH	-	4020	
TH36G210	0.00	967.50	DEGRCELS	6G210	1203	CR200	250.0	32	162	20	250.00	0	01TH	-	4032	
TH31A210	0.00	967.50	DEGRCELS	1A210	1203	CR200	250.0	9	123	20	250.00	0	01TH	-	4009	
TH34E311	0.00	967.50	DEGRCELS	4E311	1203	CR200	250.0	47	225	20	250.00	0	01TH	-	4047	
TH32C311	0.00	967.50	DEGRCELS	2C311	1203	CR200	250.0	34	164	20	250.00	0	01TH	-	4034	
TH37E311	0.00	967.50	DEGRCELS	7E311	1203	CR200	250.0	21	143	20	250.00	0	01TH	-	4021	
TH31B311	0.00	967.50	DEGRCELS	1B311	1203	CR200	250.0	22	144	20	250.00	0	01TH	-	4022	
TH33H311	0.00	967.50	DEGRCELS	3H311	1203	CR200	250.0	23	145	20	250.00	0	01TH	-	4023	
TH38F311	0.00	967.50	DEGRCELS	8F311	1203	CR200	250.0	10	124	20	250.00	0	01TH	-	4010	
TH35E312	0.00	967.50	DEGRCELS	5E312	1203	CR200	250.0	48	226	20	250.00	0	01TH	-	4048	
TH32E312	0.00	967.50	DEGRCELS	2E312	1203	CR200	250.0	35	165	20	250.00	0	01TH	-	4035	
TH34G312	0.00	967.50	DEGRCELS	4G312	1203	CR200	250.0	36	166	20	250.00	0	01TH	-	4036	
TH36B312	0.00	967.50	DEGRCELS	6B312	1203	CR200	250.0	24	146	20	250.00	0	01TH	-	4024	
TH35A312	0.00	967.50	DEGRCELS	5A312	1203	CR200	250.0	11	125	20	250.00	0	01TH	-	4011	
TH38H312	0.00	967.50	DEGRCELS	8H312	1203	CR200	250.0	12	126	20	250.00	0	01TH	-	4012	
TH31D616	0.00	967.50	DEGRCELS	1D616	1203	CR200	250.0	1	111	20	250.00	0	01TH	-	4001	
TH33C217	0.00	967.50	DEGRCELS	3C217	1203	CR200	250.0	2	112	20	250.00	0	01TH	-	4002	
TH31D618	0.00	967.50	DEGRCELS	1D618	1203	CR200	250.0	3	113	20	250.00	0	01TH	-	4003	
TH35H518	0.00	967.50	DEGRCELS	5H518	1203	CR200	250.0	49	231	20	250.00	0	01TH	-	4049	
TH33E119	0.00	967.50	DEGRCELS	3E119	1203	CR200	250.0	4	114	20	250.00	0	01TH	-	4004	
TH36D319	0.00	967.50	DEGRCELS	6D319	1203	CR200	250.0	50	232	20	250.00	0	01TH	-	4050	
TIMEFAST	0.00	10.00	VOLT	-	-			0	0	-	1.00	0	-	-	8050	
TIMEMEDI	0.00	10.00	VOLT	-	-			0	0	-	1.00	0	-	-	8049	
TIMESLOW	0.00	10.00	VOLT	-	-			0	0	-	1.00	0	-	-	8048	
TRJBOX1	0	1000	MV-DC	01	1204	0	205.0	307	671	20	205.00	0	00TR	2	4199	
TRJBOX2	0	1000	MV-DC	03	1205	0	102.5	308	672	20	102.50	0	00TR	2	4200	
TRJBOX3	0	1000	MV-DC	02	1204	0	205.0	309	673	20	205.00	0	00TR	2	4201	
TW05A	0.00	486.20	DEGRCELS	LL	1201	CR199	500.0	146	522	20	500.00	0	22TF	-	4164	**
TW05B	0.00	486.20	DEGRCELS	LL	1201	CR199	500.0	156	513	20	500.00	0	22TF	-	4156	**
TW05D	0.00	485.00	DEGRCELS	DD	1206	CR201	500.0	326	782	20	500.00	0	02TF	-	4218	**
TW11H000	0.00	484.40	DEGRCELS	WF13/1	1222	CR199	500.0	111	413	20	500.00	0	01TW	-	4111	
TW11H180	0.00	484.80	DEGRCELS	WF16/3	1219	CR199	500.0	112	414	20	500.00	0	01TW	-	4112	
TW12V270	0.00	483.60	DEGRCELS	WF13/8	1229	CR199	500.0	114	416	20	500.00	0	01TW	-	4114	
TW13V090	0.00	483.60	DEGRCELS	WF13/9	1229	CR199	500.0	116	418	20	500.00	0	01TW	-	4116	
TW14V045	0.00	485.00	DEGRCELS	WF1310	1218	CR199	500.0	118	421	20	500.00	0	01TW	-	4118	
TW15H000	0.00	484.60	DEGRCELS	WF13/2	1220	CR199	500.0	121	424	20	500.00	0	01TW	-	4121	
TW15H180	0.00	485.00	DEGRCELS	WF16/4	1218	CR199	500.0	122	425	20	500.00	0	01TW	-	4122	
TW16H000	0.00	485.00	DEGRCELS	WF13/7	1218	CR199	500.0	125	428	20	500.00	0	01TW	-	4125	

INSTRUMENTATION SHEET FOR LOBI TEST NO. 98 DATE 22.MAR.90 JRC-ISPRA

		TRANSDUCER			*			ELECTRONIC CHAIN			*		COMMENTS		
IDENTIF	MIN	MAX	UNITS	TRANSD	CAL	CODE	N-GAIN	LINE	AMPLIF	BANDW	GAIN	OFFSET	ERROR	COMM	CHAN
TW16H180	0.00	485.00	DEGRCELS	WF16/5	1218	CR199	500.0	126	429	20	500.00	0	01TW	-	4126
TW21H000	0.00	484.60	DEGRCELS	WF23/2	1220	CR199	500.0	129	433	20	500.00	0	01TW	-	4129
TW21H180	0.00	484.80	DEGRCELS	WF26/1	1219	CR199	500.0	130	434	20	500.00	0	01TW	-	4130
TW22V090	0.00	485.00	DEGRCELS	WF23/3	1218	CR199	500.0	132	436	20	500.00	0	01TW	-	4132
TW23V270	0.00	484.60	DEGRCELS	WF23/5	1220	CR199	500.0	134	438	20	500.00	0	01TW	-	4134
TW24V270	0.00	484.80	DEGRCELS	WF23/7	1219	CR199	500.0	137	441	20	500.00	0	01TW	-	4136
TW25H000	0.00	484.80	DEGRCELS	WF23/8	1219	CR199	500.0	139	444	20	500.00	0	01TW	-	4139
TW25H180	0.00	484.80	DEGRCELS	WF26/2	1219	CR199	500.0	140	445	20	500.00	0	01TW	-	4140
TW26H000	0.00	484.20	DEGRCELS	WF23/9	1223	CR199	500.0	143	448	20	500.00	0	01TW	-	4143
TW26H180	0.00	484.80	DEGRCELS	WF26/4	1219	CR199	500.0	144	449	20	500.00	0	01TW	-	4144
TW31V165	0.00	486.20	DEGRCELS	1W02	1201	CR199	500.0	158	515	20	500.00	0	01TW	-	4158
TW31V345	0.00	486.20	DEGRCELS	1W04	1201	CR199	500.0	160	517	20	500.00	0	01TW	-	4160
TW32V165	0.00	486.20	DEGRCELS	1W08	1201	CR199	500.0	163	521	20	500.00	0	01TW	-	4163
TW32V345	0.00	486.20	DEGRCELS	1W09	1201	CR199	500.0	166	524	20	500.00	0	01TW	-	4166
TW33V075	0.00	486.20	DEGRCELS	3W01	1201	CR199	500.0	168	526	20	500.00	0	01TW	-	4168
TW34V140	0.00	486.20	DEGRCELS	3W02	1201	CR199	500.0	170	528	20	500.00	0	01TW	-	4170
TW80B	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	55	241	20	500.00	0	02TW	-	4055
TW80C	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	57	243	20	500.00	0	02TW	-	4057
TW80D	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	59	245	20	500.00	0	02TW	-	4059
TW80F	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	63	253	20	500.00	0	02TW	-	4063
TW82B	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	81	323	20	500.00	0	04TW	-	4081
TW82C	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	79	321	20	500.00	0	04TW	-	4079
TW82D	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	77	315	20	500.00	0	04TW	-	4077
TW82E	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	75	313	20	500.00	0	04TW	-	4075
TW82F	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	73	311	20	500.00	0	04TW	-	4073
TW90B	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	366	815	20	500.00	0	02TW	-	4259
TW90D	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	362	811	20	500.00	0	02TW	-	4255
TW90E	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	360	7105	20	500.00	0	02TW	-	4253
TW90F	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	358	7103	20	500.00	0	02TW	-	4251
TW90P	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	353	794	20	500.00	0	03TW	-	4246
TW92B	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	186	546	20	500.00	0	04TW	-	4186
TW92C	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	188	548	20	500.00	0	04TW	-	4188
TW92D	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	325	781	20	500.00	0	04TW	-	4217
TW92E	0.00	485.00	DEGRCELS	SG	1206	CR201	500.0	327	783	20	500.00	0	04TW	-	4219
VH-1MW	0.00	40.00	VOLT	-	1167	1	1.0	190	551	20	1.00	0	02VH	-	4190
VH-5MW	0.00	150.00	VOLT	-	1162	1	1.0	195	556	20	1.00	0	01VH	-	4195
WH-POWER	0.00	10.00	MVA	-	1163	1	1.0	192	553	20	1.00	0	01WH	-	4192
WH45PREZ	0.0000	0.0200	MVA	HU	1174	1	1.0	322	687	20	1.00	0	00WH	-	4214

REFERENCES

[1] A. Annunziato:
Test Specification of LOBI-MOD2 Test BL-34
CEC-JRC, TN. No. I.90.40, May 1990

[2] A. Annunziato:
Quick Look Report on LOBI-MOD2 Test BL-34
CEC-JRC, Comm. 4338, June 1991

[3] C. Addabbo, L. Piplies, W. Riebold:
Geometrical Configuration of the LOBI-MOD2 Test Facility
CEC-JRC, Comm. 4010, July 1983

[4] C. Addabbo, T. R. Fortescue, W. L. Riebold:
Adequacy of the LOBI-MOD2 Steam Generators for simulating NPP-SG transient Behaviour
UNIPEDE Specialist Meeting on Steam Generator Technology,
Stockholm, October 1984

[5] G. Leva:
Determination of Primary and Secondary System Mass Inventory in the LOBI-MOD2 Test facility
CEC-JRC, TN No. I.06.C1.86.117, November 1986