GE Nuclear Energy

SH NO. 1
REV. 1

## REVISION STATUS SHEET

DOC TITLE GIRAFFE SYSTEMS INTERACTION TEST SPECIFICATION

LEGEND OR DESCRIPTION OF GROUPS

TYPE: TEST SPECIFICATION

FMF: SBWR

MPL NO: E50-00003

| REVISION | | | |
|---|---|---|---|
| 0 | | | |

PRINTS TO

| | | |
|---|---|---|
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MS-WORD

# GIRAFFE TEST SPECIFICATION

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# 1. INTRODUCTION

This document specifies the requirements for tests to be performed in the GIRAFFE test facility. The tests relate to late blowdown/early GDCS core cooling system performance in the SBWR. The tests are termed the "Systems Interactions Tests" (SIT). This facility has been designed and built by the Toshiba Nuclear Engineering Laboratory in Kawasaki City, Japan.

These tests will provide Design Basis Data for use in calculations of safety related features of the SBWR.

# 2. TEST PURPOSE/OBJECTIVES

The purpose of the SIT tests is to provide data for TRACG qualification during the late blowdown/early GDCS phase of LOCAs. This period starts about 10 minutes after scram. The SIT tests include Gravity Drain Line and Bottom Drain Line breaks. RPV water level is the primary focus of the experiment.

The objective of the GIRAFFE SIT test program is:

> Provide a database to confirm the adequacy of TRACG to predict the SBWR performance during late blowdown/early GDCS phase of a LOCA, with specific focus in potential system interaction effects.

# 3. TEST FACILITY DESCRIPTION

## 3.1 General Description

The tests specified in this document will be performed in the GIRAFFE facility, a large scale, integral system test facility which models the SBWR systems which are important to the short term ECCS performance following a LOCA.

The facility has been designed to exhibit thermal-hydraulic behavior similar to SBWR under LOCA conditions beginning approximately 10 minutes after scram. The global volume scaling of the facility is approximately 1:400 with a nominal height scaling of 1:1. The SBWR components which are modeled in the facility are: the Passive Containment Cooling System

(PCCS), the Isolation Condenser (IC) System, the Gravity Driven Cooling System (GDCS), the Reactor Pressure Vessel (RPV), the Drywell (DW), the Wetwell (WW) and the connecting piping and valves. Rigorous geometric similarity between SBWR containment and reactor vessel volumes and test facility vessels is not necessary to capture the fundamental features of the containment and RPV response and has not been attempted.

Design specifications, design drawings, analytical backup information, verifications, and design review documentation, as appropriate shall be filed in the Test and Design Record Files identified in Section 12.

The GIRAFFE vessels are connected with scaled piping components to represent the connecting lines in the SBWR. The test facility vessels and piping connections for the SIT tests are shown schematically in Figure 3-1.

The SBWR RPV is simulated by an approximately full height vessel. The actual SBWR height from the top of the core to the main steam line elevation is maintained in order to simulate RPV to PCC and RPV to GDCS pool vertical elevation differences. The RPV volume is scaled to 1:400, even though the upper and lower parts of the RPV are shortened. Electric heaters provide a variable power source to simulate the core decay heat and the stored energy in the reactor structures.

The upper drywell, including the annular portion of the drywell, is represented by one approximately full height vessel; the volume is scaled to 1:400. Cross sectional area variation with height is included to simulate the actual SBWR configuration. The vacuum breakers between the drywell and wetwell are represented by a ball valve connected to a pipe line between the drywell and the wetwell. The ball valve will be opened manually when the wetwell pressure is 3240 Pa higher than the drywell pressure. The ball valve will be closed manually when the pressure difference is less than 2060 Pa. The vacuum breaker line connects the upper drywell to the wetwell air space.

The wetwell is represented by one full height vessel. The wetwell air space volume and suppression pool volume are scaled to 1:400. The bottom of the wetwell vessel is filled with water to the same relative elevation above the top of active fuel as the SBWR suppression pool.

The GDCS pool is represented by one full height vessel. The GDCS air space and the drywell vessel are connected by a line in order to equalize their pressures. The GIRAFFE GDCS vessel was scaled down from the original GDCS pool volume with three interconnected GDCS pools. The interconnected pool design was later replaced with 3 separate GDCS pools with a total volume approximately 5% greater than the previous design.

The GIRAFFE facility includes one scaled PCC condenser. The condenser is a full length, three tube heat exchanger. This single condenser represents the three condensers found in the SBWR. Figure 3-2 shows the PCC condenser test unit and instrumentation. The PCC condenser is mounted above the drywell vessel at the same elevation above the Top of Active Fuel (TAF) as in SBWR. The PCC condenser is connected to the drywell, wetwell and GDCS pool as shown in Figures 3-1. The condenser is installed in a pool composed of a makeup pool with a chimney and cavity arrangement in which the PCC unit is set.

The GIRAFFE facility includes one scaled Isolation Condenser (IC), mounted above the drywell vessel at the same elevation above the Top of Active Fuel (TAF) as in SBWR. The IC has three 2.4m long tubes, two of which are plugged. This single condenser represents the three condensers found in the SBWR. Figure 3-3 shows the IC test unit. The IC steam supply and drain lines are connected to the RPV as shown in Figure 3-1. The IC is installed in a pool composed of a makeup pool with a chimney and cavity arrangement in which the IC unit is set.

## 3.2 Functional Capability.

The design of the facility provides the capability for establishment of initial and boundary conditions which address the test objective stated in Section 2. The tests will be conducted at temperatures and pressures representative of SBWR postulated LOCA conditions before initiation of GDCS. To assure these conditions can be tested in GIRAFFE, the RPV has been designed for 1.70 MPa (absolute) and the other facility vessels have been designed to 0.60 MPa (absolute) and 159°C . These conditions exceed SBWR LOCA conditions 10 minutes after reactor scram.

The test facility is designed to supply sufficient energy to the simulated RPV to represent the scaled decay heat and stored energy release from the fuel and internals at approximately 10 minutes after scram. Water can be supplied for pools and vessels, and steam and nitrogen

are available to establish the initial pressure and gas concentrations in the drywell and wetwell gas space. All piping is valved to provide maximum flexibility and ease of re-configuring the system. Instrumentation will be installed to measure the parameters of interest. Figures 3-2 through 3-4 shows the key instrumentation for the PCC, IC and RPV. A description of measurement requirements is given in Section 5.

Heat losses from the facility to the surroundings have been minimized. Vessels, piping and flanges are encased by fiberglass insulation covered with metal jackets. In order to further minimize heat losses, microheaters are installed on the drywell vertical walls, wetwell vertical walls and roof, and GDCS pool vertical walls. Microheaters are also installed on the simulated RPV. These microheaters are installed beneath the fiberglass insulation. Microheater power will be established based on heat loss tests performed during facility characterization testing for the He test series.

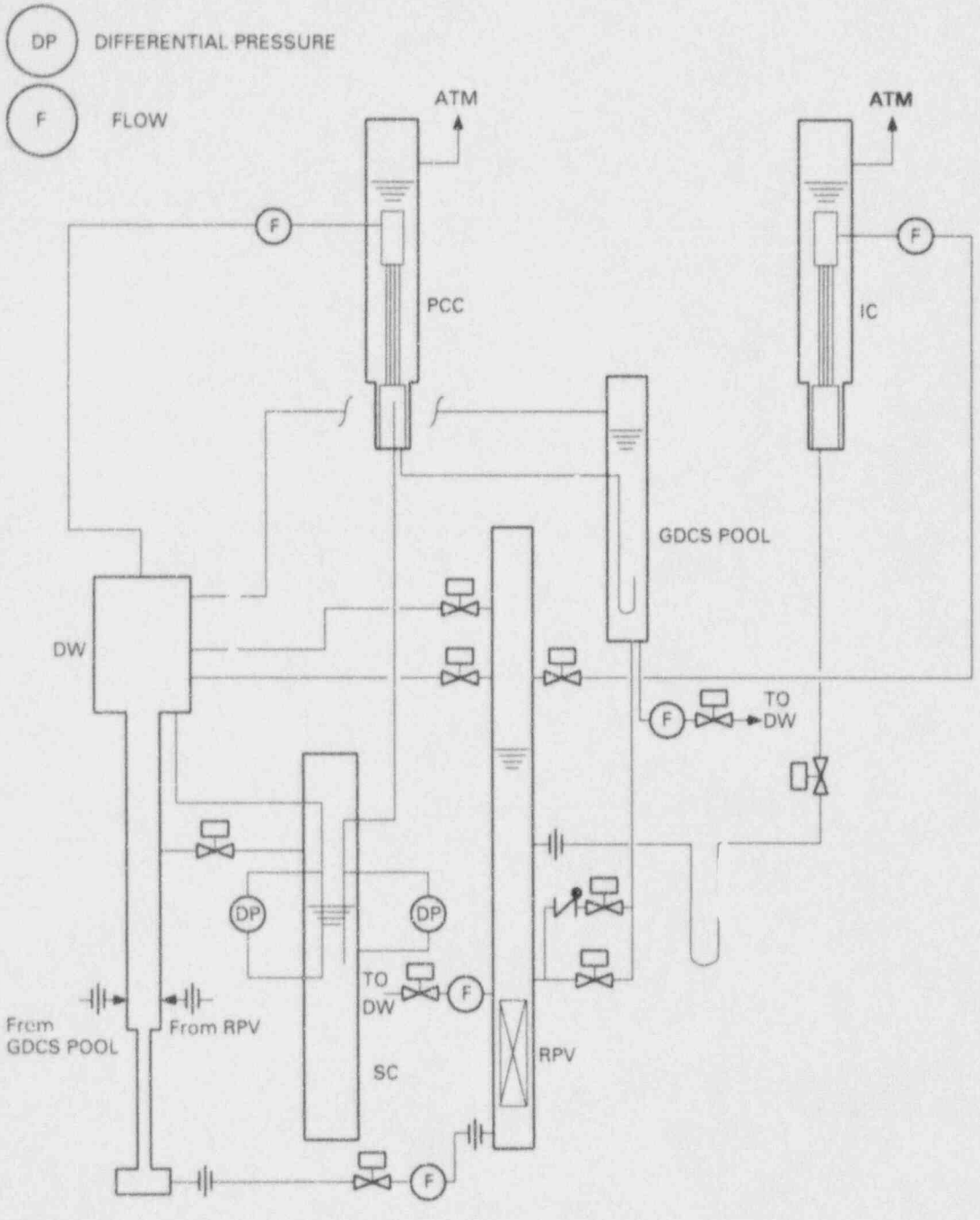


FIGURE 3-1. GIRAFFE Test Facility (System Interaction Tests)

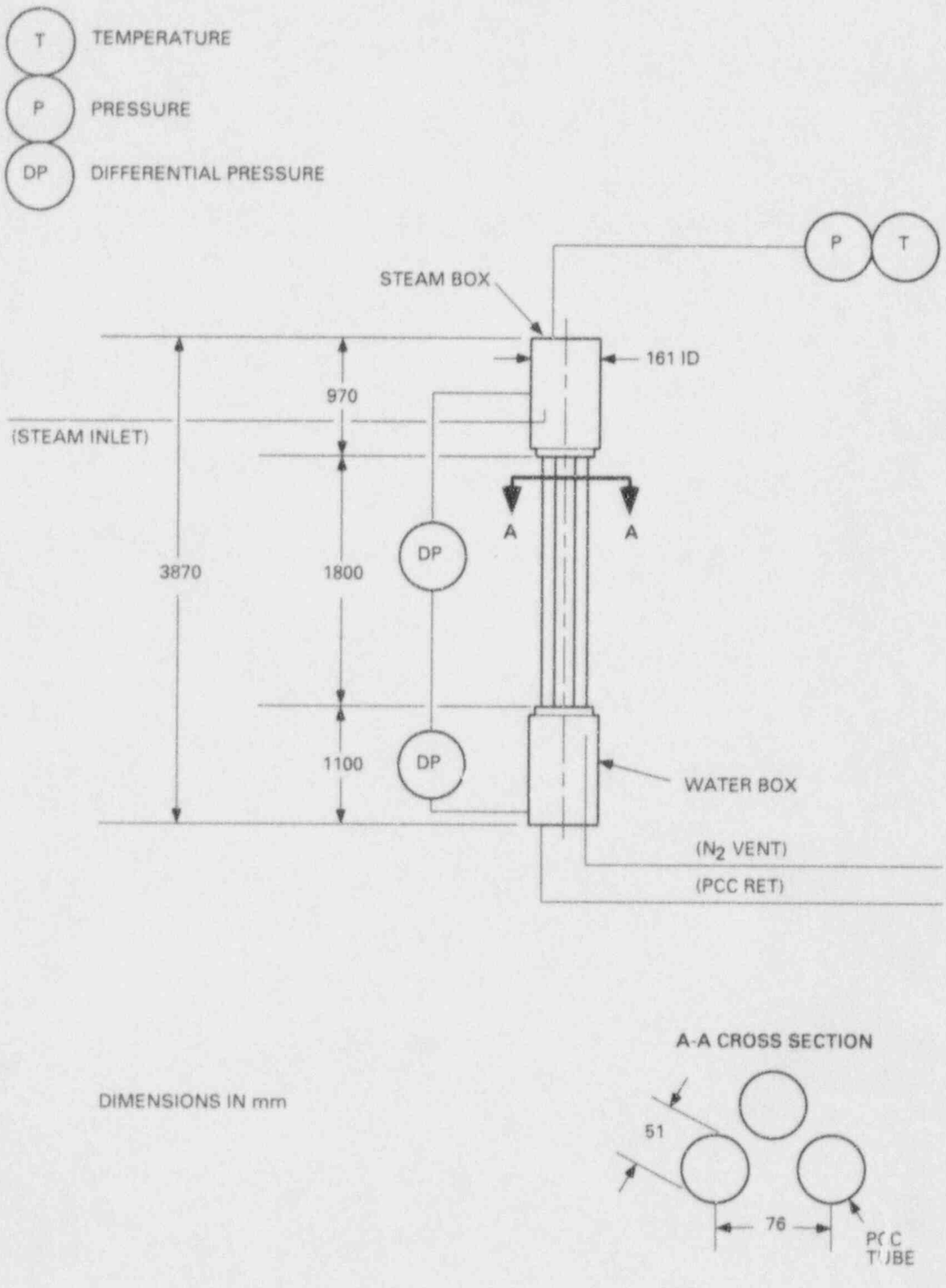


FIGURE 3-2. GIRAFFE PCC Test Unit and Instrumentation

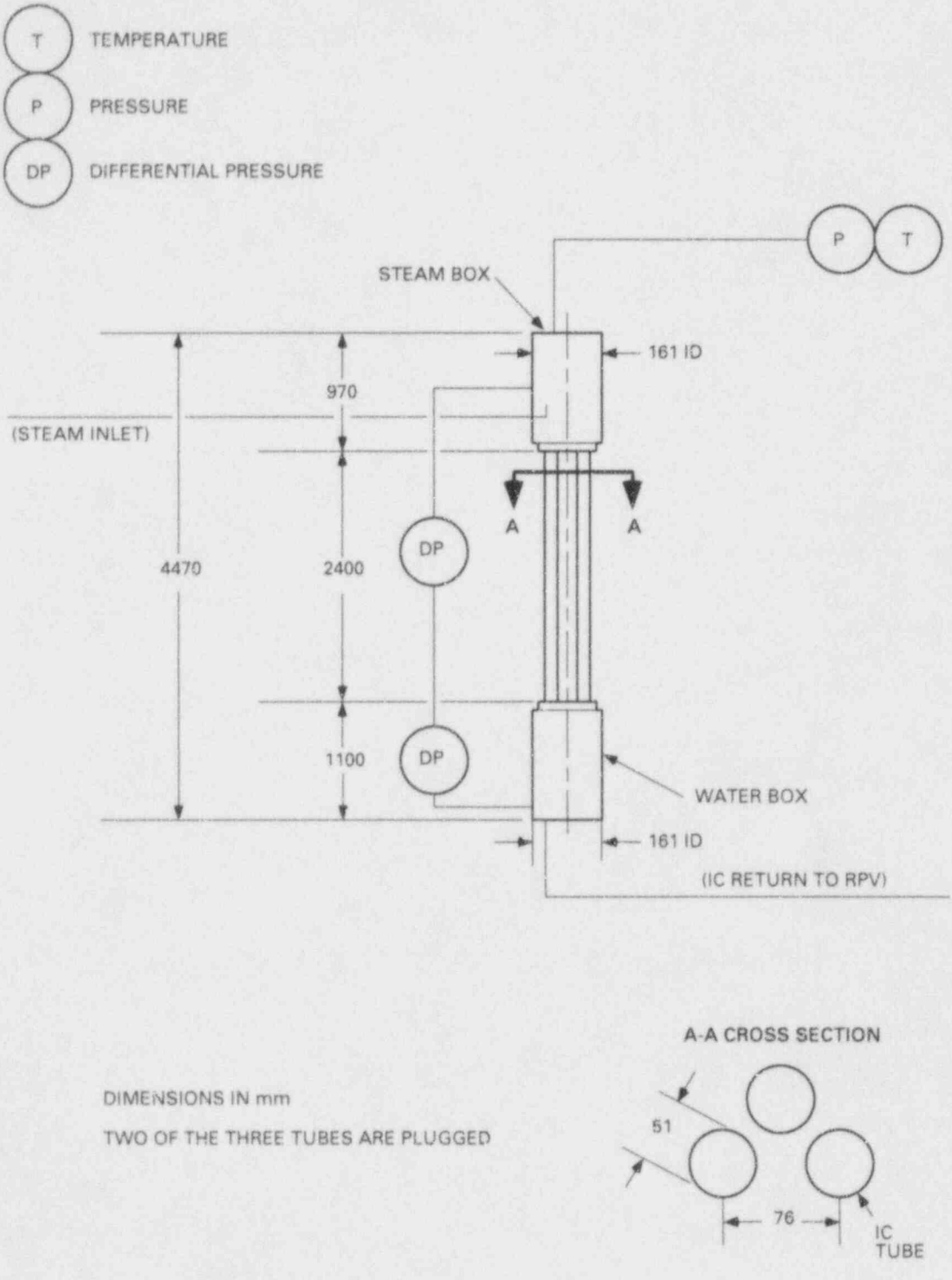


FIGURE 3-3. GIRAFFE IC Test Unit and Instrumentation

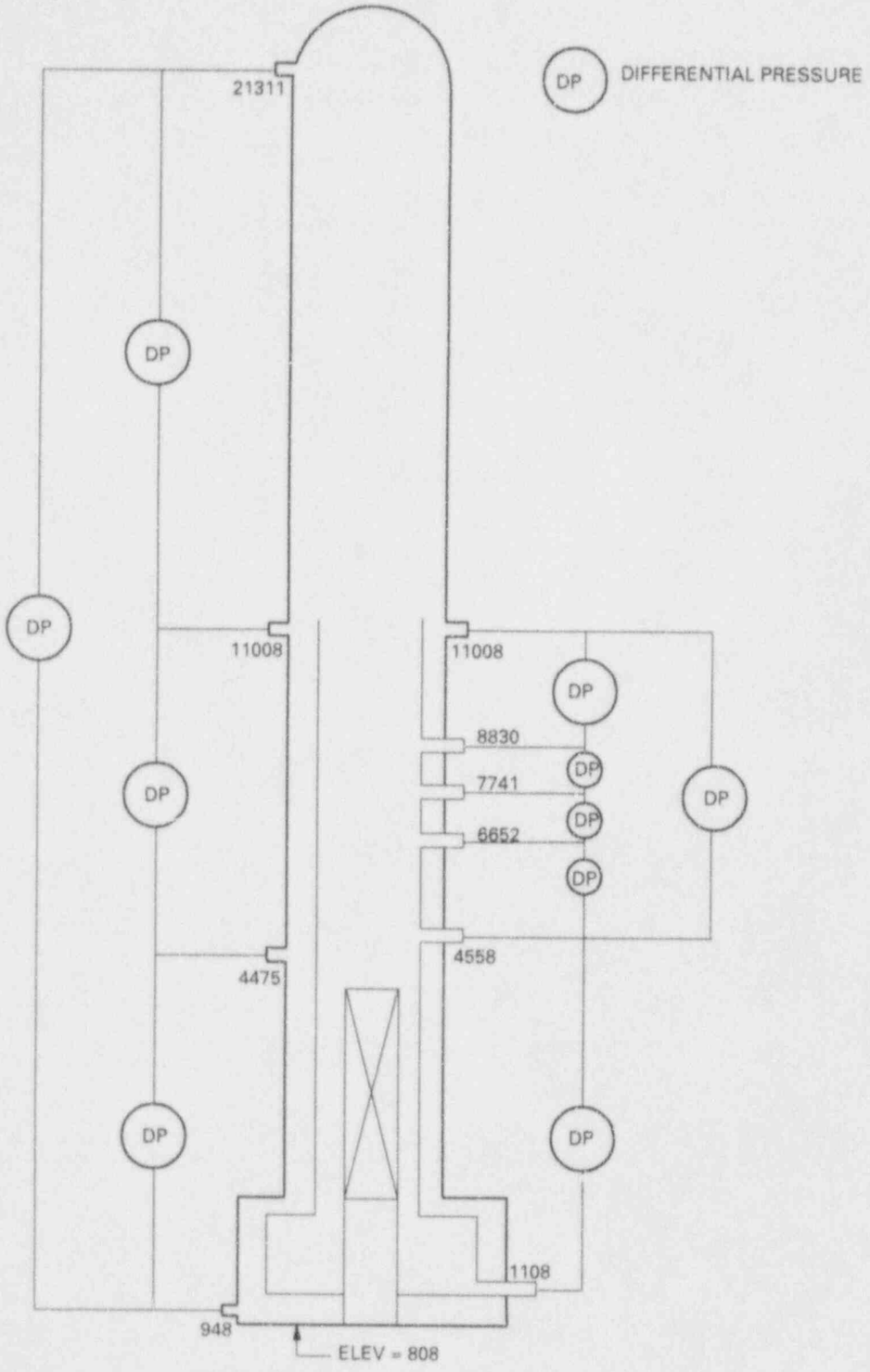


FIGURE 3-4. RPV Test Unit and Key Instrumentation

## 4. TEST PLANT CONTROL AND SAFETY CONSIDERATIONS

Capability will be included in the facility to aid the operator in controlling the initial test conditions. During the tests, control of the power to the RPV to simulate the decay heat dependence on time is required. Similar control systems are required to establish the test initial pressure, temperature and level.

Special safety conditions associated with the test shall be identified in the Test Plans and Procedures. Test facility safety requirements, will be included in the Test Plans and Procedures.

## 5. TEST INSTRUMENTATION

### 5.1 General Requirements.

The test facility shall have sufficient instrumentation to measure parameters needed to achieve the test objective defined in Section 2. Test instrumentation shall be provided by Toshiba and shall be calibrated as necessary against traceable standards, i.e. the U.S. National Institute of Standards and Technology, Japanese standards, or equivalent.

### 5.2 Instrumentation Description.

The GIRAFFE test facility shall have the capability to measure the following physical parameters: temperatures, flow rates, pressures, differential pressures, liquid levels, and electrical power. The expected ranges for the various parameters to be measured shall be defined in the Test Plans and Procedures. The basic instrumentation is similar to that used in the He tests, except that gas samples will not be taken. Considering the SIT test objectives, IC instrumentation is added and chimney water level instrumentation is enhanced. The following provides an overview of the measurement capability planned for the facility.

5.2.1 Temperature

There will be capability to measure the following fluid temperatures :

- in the gas and liquid regions of vessels, i.e.
  - RPV
  - drywell
  - wetwell
  - IC/PCC pool
  - GDCS pool
- in the steam and water box of the IC unit and of the PCC unit
- inside one of the PCC unit tubes

5.2.2 Flow rate

There will be capability to measure flow rates in GIRAFFE at the following locations:

- the IC steam supply line
- the PCC supply lines
- the PCC drain line to GDCS pool
- the GDCS line to RPV
- all break flow lines

5.2.3 Pressure

There will be capability to measure pressure at the following locations:

- in the RPV
- in the drywell vessel
- in the wetwell vessel (gas space)
- in the PCC steam box
- in the IC steam box
- in the GDCS vessel (gas space)

5.2.4 Water Level

There will be capability to measure the actual water levels using differential pressure transducers (i.e., "collapsed" level if steam voids are present) at the following locations:

- wetwell vessel
- drywell vessel
- RPV (downcomer and chimney)
- IC pool tank
- IC unit tube
- IC unit water box
- PCC pool tank
- PCC unit tube
- PCC unit water box
- GDCS pool
- PCC vent line to wetwell
- LOCA vent line to wetwell

5.2.5 Miscellaneous.

Wattmeters will be used to measure the electrical power to the RPV heaters, simulating the core, and microheaters installed on the drywell, wetwell and GDCS pool walls to minimize heat losses, and on the RPV to simulate RPV metal stored energy transfer to water.

5.3 Specific Requirements

The instrumentation required for performance of particular tests, i.e. number of instruments and accuracy requirements for the measurements, shall be specified in the Test Plans and Procedures documents for each test series. Accuracy requirements are specified in Table 5.3-1.

**Table 5.3-1 GIRAFFE Instrumentation Accuracy Requirements**

| Measurement Type | Accuracy Requirement |
|---|---|
| Temperature | ± 1.0K |
| Pressure | ± 0.2% of full range |
| Differential Pressure | ± 0.2% of full range |
| Flow Rate | ± 2% |
| Heater Power | ± 2% |

## 6. DATA ACQUISITION SYSTEM AND RECORDING

A digital data acquisition system, of sufficient capacity to monitor and record specified measurements shall be used for the GIRAFFE tests. The measurements shall be recorded in digital format, on magnetic tape or disk, for subsequent reference and analysis. The required measurement frequency is one hertz.

## 7. DATA ANALYSIS

The processing and analysis of the recorded test data will be done in two phases in support of preparation of test reports. Equipment and software necessary for the specified data processing will be provided by Toshiba. Toshiba will prepare a plan for verification of the accuracy of the data acquisition and data reduction software. This plan and verification will be completed prior to the start of testing.

The following general data reduction software capabilities will be available:

Conversion of all recorded signals to digital values in engineering units (metric).

Print tables of digital values of recorded signals in engineering units for selected time periods.

Capability of performing simple arithmetic operations between test variables.

Calculate and prepare tables of mean, standard deviation, minimum and maximum value for any measurement (in engineering units) during a specified time period.

Plot graphs of any selected test variable as a function of time (time history) for any selected test time window. Be able to plot groups of test variables on a single graph.

The first data processing and analysis phase has the purposes of providing representative results from the most significant measurements to be used in the Apparent Test Results report (specified in Section 11) and to aid in defining the details of the remainder of the analysis. Time history plots of key parameters shall be prepared and examined to determine time periods of significant interest for more detailed analysis. For the SIT tests these parameters are: all RPV water levels, RPV pressure, ADS and break flow rates, DW and WW pressure and temperature, IC and PCC flow rates. Summary plots of typical results will be

prepared. This first phase is expected to be completed approximately two weeks after each test.

The plots and tables for the other Test Reports, (described in Section 11), will be generated during the second data processing and analysis phase to be completed three months after the test. The purpose of this phase is to organize the data in a form that provides an integrated interpretation of the test results to show the performance of the system and demonstrate that the test objectives have been achieved. Data will also be provided in digital format.

## 8. SHAKEDOWN AND PLANT CHARACTERIZATION

Facility shakedown and plant characterization tests will be performed. The plant characterization tests will consist of tests to quantify specific characteristics of the facility which have not been determined from previous tests such as IC line delta pressure checks and other lines added to simulate liquid breaks. These will be done by Toshiba using Toshiba procedures and the records will be included in the GIRAFFE SIT Toshiba test file in accordance with Table 12-1.

Shakedown or debugging of the facility and its test measurement and recording system will be achieved by running tests prior to running the "matrix" tests. These shakedown tests will be run in a manner which will expose the facility components and auxiliary systems to conditions similar to those expected during the "matrix" tests. These shakedown tests will be run with test procedures prepared for the "matrix" tests in order to identify any corrections required in the test procedures.

## 9. TEST MATRIX

Tables 9-1 through 9-4 define the cases to be simulated and the initial conditions for SIT Tests GS1, GS2, GS3, GS4.

The detailed facility configurations and conditions to be tested will be agreed upon by Toshiba and GE and will be documented in the test reports, and the basis will be included in the Toshiba and GE Design Record Files.

**TABLE 9-1**

**GS1 CONDITIONS - GDL BREAK, DPV FAILURE, IC/PCCS OFF**

| Parameter | Value | Tolerance |
|---|---|---|
| RPV Pressure (kPa) | 1034 | ±6 kPa |
| RPV Initial Water Mass (kg) | 303 | ±1% |
| Initial Heater Power (W) (excludes stored energy) | 1.40E5 | ±1 kW |
| Drywell Pressure (kPa) | 295 | ±4 kPa |
| Drywell Air Pressure (kPa) | 45 | ±4 kPa |
| Drywell Steam Pressure (kPa) | 250 | ±4 kPa |
| Drywell Initial Water Mass (kg) | 133 | ±5% |
| Wetwell Pressure (kPa) | 255 | ±4 kPa |
| Wetwell Air Pressure (kPa) | 241 | ±4 kPa |
| GDCS Gas Space Pressure (kPa) | 295 | ±4 kPa |
| GDCS Gas Space Air Pressure (kPa) | 107 | ±4 kPa |
| Suppression Pool Temperature (K) | 334 | ±2 K |
| PCCS Pool Temperature (K) | 373 | ±2 K |
| GDCS Pool Temperature (K) | 322 | ±2 K |
| GDCS Pool Level* (m) | 16.3 | ±0.075 m |
| Suppression Pool Level* (m) | 3.15 | ±0.075 m |
| PCC Pool Level* (m) | 23.2 | ±0.075 m |
| PCC Vent Line Submergence (m) | 0.85 | ±0.075 m |
| Drywell to Wetwell Main Vent Submergence (m) | 1.60 | ±0.075 m |

*Referenced to TAF

**TABLE 9-2**

**GS2 CONDITIONS - GDL BREAK, DPV FAILURE, IC/PCCS ON**

| Parameter | Value | Tolerance |
|---|---|---|
| RPV Pressure (kPa) | 1034 | ±6 kPa |
| RPV Initial Water Mass (kg) | 340 | ±1% |
| Initial Heater Power (W) (excludes stored energy) | 1.39E5 | ±1 kW |
| Drywell Pressure (kPa) | 295 | ±4 kPa |
| Drywell Air Pressure (kPa) | 37 | ±4 kPa |
| Drywell Steam Pressure (kPa) | 258 | ±4 kPa |
| Drywell Initial Water Mass (kg) | 147 | ±5% |
| Wetwell Pressure (kPa) | 263 | ±4 kPa |
| Wetwell Air Pressure (kPa) | 250 | ±4 kPa |
| GDCS Gas Space Pressure (kPa) | 295 | ±4 kPa |
| GDCS Gas Space Air Pressure (kPa) | 110 | ±4 kPa |
| Suppression Pool Temperature (K) | 331 | ±2 K |
| PCCS Pool Temperature (K) | 373 | ±2 K |
| GDCS Pool Temperature (K) | 322 | ±2 K |
| GDCS Pool Level* (m) | 16.3 | ±0.075 m |
| Suppression Pool Level* (m) | 3.15 | ±0.075 m |
| PCC Pool Level* (m) | 23.2 | ±0.075 m |
| PCC Vent Line Submergence (m) | 0.85 | ±0.075 m |
| Drywell to Wetwell Main Vent Submergence (m) | 1.60 | ±0.075 m |

*Referenced to TAF

**TABLE 9-3**

**GS3 CONDITIONS - BDL BREAK, DPV FAILURE, IC/PCCS ON**

| Parameter | Value | Tolerance |
|---|---|---|
| RPV Pressure (kPa) | 1034 | ±6 kPa |
| RPV Initial Water Mass (kg) | 487 | ±1% |
| Initial Heater Power (W) (excludes stored energy) | 1.15E5 | ±1 kW |
| Drywell Pressure (kPa) | 338 | ±4 kPa |
| Drywell Air Pressure (kPa) | 8 | ±4 kPa |
| Drywell Steam Pressure (kPa) | 330 | ±4 kPa |
| Drywell Initial Water Mass (kg) | 104 | ±5% |
| Wetwell Pressure (kPa) | 294 | ±4 kPa |
| Wetwell Air Pressure (kPa) | 284 | ±4 kPa |
| GDCS Gas Space Pressure (kPa) | 338 | ±4 kPa |
| GDCS Gas Space Air Pressure (kPa) | 131 | ±4 kPa |
| Suppression Pool Temperature (K) | 328 | ±2 K |
| PCCS Pool Temperature (K) | 373 | ±2 K |
| GDCS Pool Temperature (K) | 323 | ±2 K |
| GDCS Pool Level* (m) | 16.3 | ±0.075 m |
| Suppression Pool Level* (m) | 3.15 | ±0.075 m |
| PCC Pool Level* (m) | 23.2 | ±0.075 m |
| PCC Vent Line Submergence (m) | 0.85 | ±0.075 m |
| Drywell to Wetwell Main Vent Submergence (m) | 1.60 | ±0.075 m |

*Referenced to TAF

TABLE 9-4

GS4 CONDITIONS - GDL BREAK, GDCS VALVE FAILURE, IC/PCCS ON

| Parameter | Value | Tolerance |
|---|---|---|
| RPV Pressure (kPa) | 1034 | ±6 kPa |
| RPV Initial Water Mass (kg) | 343 | ±1% |
| Initial Heater Power (W) (excludes stored energy) | 1.40E5 | ±1 kW |
| Drywell Pressure (kPa) | 298 | ±4 kPa |
| Drywell Air Pressure (kPa) | 40 | ±4 kPa |
| Drywell Steam Pressure (kPa) | 258 | ±4 kPa |
| Drywell Initial Water Mass (kg) | 142 | ±5% |
| Wetwell Pressure (kPa) | 258 | ±4 kPa |
| Wetwell Air Pressure (kPa) | 245 | ±4 kPa |
| GDCS Gas Space Pressure (kPa) | 298 | ±4 kPa |
| GDCS Gas Space Air Pressure (kPa) | 117 | ±4 kPa |
| Suppression Pool Temperature (K) | 331 | ±2 K |
| PCCS Pool Temperature (K) | 373 | ±2 K |
| GDCS Pool Temperature (K) | 326 | ±2 K |
| GDCS Pool Level* (m) | 16.3 | ±0.075 m |
| Suppression Pool Level* (m) | 3.15 | ±0.075 m |
| PCC Pool Level* (m) | 23.2 | ±0.075 m |
| PCC Vent Line Submergence (m) | 0.85 | ±0.075 m |
| Drywell to Wetwell Main Vent Submergence (m) | 1.60 | ±0.075 m |

*Referenced to TAF

## 10. PRETEST PREDICTIONS/ACCEPTANCE CRITERIA

Pretest calculations need not be performed. Other analyses may be performed by Toshiba or GE to assist in determining initial conditions for the SIT tests.

The acceptance criteria will be specified in the Test Plans and Procedures. This acceptance criteria will define the tolerance on the initial conditions and any other input test conditions (such as simulated decay heat) which can influence the test results. The acceptance criteria will also define the instrumentation performance required in order to consider the test as acceptable.

## 11. REPORTING

### 11.1 Data Transmittal.

Toshiba will provide a copy to GE of all test data on 3-1/2 inch floppy disks in a DOS readable format. This data will be provided in engineering units.

### 11.2 Reports.

A brief Apparent Test Results (ATR) report will be prepared by Toshiba for each test. The ATR will contain test data to be integrated into the Final Test Report. The ATR will not include any evaluation of the test data. The ATR will include a description of test anomalies and will include a list of any failed instruments and the review and disposition of these anomalies. The ATR shall be reviewed by the Toshiba responsible manager and the GE GIRAFFE responsible engineer.

A Data Transmittal Report and a Data Analysis Report prepared by Toshiba and GE will contain the data, analysis and results of all tests. The reports will include a complete description of the test facility and components tested.

Table 11-1 notes the table of contents for these 3 reports.

**TABLE 11-1**
**TABLE OF CONTENTS FOR APPARENT TEST RESULTS, DATA TRANSMITTAL REPORT, DATA ANALYSIS REPORT**

**Apparent Test Results**

- Brief report on each test
- Tables and plots of key measurements
- Identification of any non-conformances related to test results

**Data Transmittal Report**

1.0 Introduction
- General description and purpose of tests
- Purpose of report

2.0 Objectives
- General Objectives
- Specific Objectives

(Note: General Objectives are given in TAPD, Appendix A, reference 14.2c, for each of the tests)

3.0 Test Facility Description
- Detailed description of facility layout
- Scaling study

(Note: Facility descriptions will be from the Test Specification and/or Test Plan and Procedures. Scaling study will be a reference to the final version of the scaling report.)

4.0 Instrumentation
- Instrument type and characteristics
- Calibration

5.0 Data Acquisition System
- Hardware configuration
- Data Reduction
- Software

6.0 Test Matrix
- Grouped by type of test

**TABLE 11-1. CONTINUED**

7.0 Test Results
- Grouped by type of test

8.0 Conclusions
- Adequacy of test data
- Applicability to test objectives

9.0 References

**Appendices**

A. Instrument List (Type of instrument, number of instrument, measurement, and range)

B. Modified and Failed Instruments
- Listed by test

C. Facility Characterization Tests
- Pressure drop tests
- Heat loss tests

D. Error Analysis
- Maximum error of measurement

E. Data Records
- Format of Data Tapes

**Data Analysis Report**

1.0 Introduction
- General description and purpose of tests
- Purpose of report

2.0 Objectives
- General Objectives
- Specific Objectives

(Note: General Objectives are given in TAPD, Appendix A, reference 14.2c, for each of the tests)

**TABLE 11-1. CONTINUED**

3.0 Test Analysis

- Grouped by type of test
- Description of test conditions
- Analysis of test results

(Note: Framework of test results analysis is given in the "Test Matrix and Data Analysis sections of the TAPD," reference 14.2c, Appendix A)

- Discussion of observed phenomena

4.0 Conclusion

- Adequacy of test data
- Applicability to test objectives

5.0 References

## 12. RECORD RETENTION

All test records, analyses and verification records will be filed by Toshiba into a test file for a storage period of at least 60 years. The SIT files shall be maintained separately from the other GIRAFFE files. The GE Nuclear Energy Design Record File (DRF) will be maintained for at least 60 years. The DRF number is E50-00003, and the DRF custodian is J. D. Duncan. The data stored electronically will be in a form suitable for long term storage, i.e. 60 years. Table 12-1 gives the table of contents for the Toshiba test file and the GE DRF.

**TABLE 12-1**
**GIRAFFE SIT TEST FILE AND DESIGN RECORD FILE**
**TABLE OF CONTENTS**

| | | Toshiba Test File | GE DRF |
|---|---|---|---|
| 1. | TEST REQUIREMENTS DOCUMENTS | X | X |
| 1.1 | Test Specification | X | X |
| 1.2 | Quality Assurance Program | X | X |
| 1.3 | Test Plans and Procedures | X | X |
| 1.4 | Test and Analysis Program Document | X | X |
| 1.5 | Meeting Minutes | X | X |
| 2. | TEST FACILITY DESIGN | X | |
| 2.1 | Facility Design Drawings | X | |
| 2.2 | Design Review | X | |
| 2.3 | Procurement | X | |
| 3. | TEST FACILITY CHECKOUT | X | X |
| 3.1 | As-Built Drawings | X | X* |
| 3.2 | Shakedown Test Procedure | X | X |
| 3.2.1 | Hydrotests | X | X |
| 3.2.2 | Heat Loss Tests | X | X |
| 3.2.3 | Line Pressure Drop Tests | X | X* |
| 4. | INSTRUMENTATION | | |
| 4.1 | Instrumentation List (include serial number) | X | ** |
| 4.2 | Range and Accuracy Requirements | X | ** |
| 4.3 | Manufacturers' Specifications | X | |
| 4.4 | Uncertainty Analysis | X | ** |
| 4.5 | Calibration | X | |
| 4.5.1 | Plan/Procedures | X | ** |
| 4.5.2 | Records | X | |
| 4.6 | Exact Location on Test Facility (drawings or sketches and tables) | X | ** |

* The as-built drawings in the GE-DRF will include the detail data needed for creating a TRACG model of GIRAFFE to be used to perform the TRACG post-test analysis. Test facility documents used to define orifice loss coefficients will be included in GE-DRF.

** To be included in Test Plan and Procedure document.

**TABLE 12-1. CONTINUED**

| | | Toshiba Test File | GE DRF |
|---|---|---|---|
| 5. | DATA ACQUISITION SYSTEM | | |
| | 5.1 DAS Hardware Requirements | X | ** |
| | 5.2 DAS Hardware Description | X | ** |
| | 5.3 Wire/Cable Lists–DAS Hookup | X | |
| | 5.4 Wire/Cable Lists Verification | X | ** |
| | 5.5 DAS Software | X | ** |
| | 5.6 DAS Software Verification | X | |
| 6. | TEST MATRIX | X | X |
| | 6.1 Facility Configuration | X | X |
| | 6.2 Initial Conditions/Acceptance Criteria | X | X |
| | 6.3 Test Schedule Plan | X | X |
| 7. | SHAKEDOWN TEST RESULTS | X | X |
| | 7.1 Facility Configuration | X | ** |
| | 7.2 Initial Conditions/Acceptance Criteria | X | ** |
| | 7.3 Non-conformance Items | X | X |
| 8. | TEST OPERATION | X | ** |
| | 8.1 Pre-test Checklists/Procedures | X | ** |
| | 8.1.1 Preconditioning/Final Valve Alignment | X | |
| | 8.1.2 Initial Condition Acceptance | X | |
| | 8.1.3 DAS/Instrumentation Acceptance | X | |
| | 8.2 Post-test Checklists/Procedures | X | ** |
| | 8.2.1 Test Logs | X | |
| | 8.2.2 Non-conformance Items | X | |
| | 8.3 Data Printouts | X | |
| | 8.4 Raw Data Storage Information | X | X |
| 9. | POST TEST DATA REDUCTION | X | X |
| | 9.1 Data Reduction Plan | X | X |
| | 9.2 Data Reduction Software and Verification | X | X |
| | 9.3 Reduced Data Records | X | X |

** To be included in Test Plan and Procedure document.

**TABLE 12-1. CONTINUED**

| | | Toshiba Test File | GE DRF |
|---|---|---|---|
| 10. | TEST REPORTS | X | X |
| | 10.1 Apparent Test Results Reports | X | X |
| | 10.2 Final Test Reports | X | X |
| | 10.2.1 Analytical Basis/Supporting Data | X | X |
| | 10.2.2 Draft Report Comment Resolution | X | X |
| | 10.2.3 Report Verification | X | X |
| 11. | AUDIT REPORTS | X | X |
| 12. | PERSONNEL TRAINING, PROCEDURES AND DOCUMENTATION | X | X |
| 13. | REFERENCES | X | X |

# 13. QUALITY ASSURANCE REQUIREMENTS

## 13.1 References.

The GIRAFFE tests will be performed in conformance with the Toshiba SBWR QA program, AS-50092, Rev. 0 (Reference 14.1a) and the GIRAFFE Quality Assurance Plan, AS-50128-E, Rev. 0 (Reference 14.1b), which are based on the requirements of Japanese National Standard JEAG-4101 (Reference 14.2a) and ANSI/ASME NQA-1/1a-1983 (Reference 14.2b). The procedures to implement the QA requirements will be included in the Test Plans and Procedures document.

## 13.2 Review and Audit Requirements

GE Nuclear Energy may perform reviews to verify that Toshiba's quality assurance program is in place and being followed. A facility Quality Assurance Readiness Assessment will be performed prior to the start of matrix testing. Toshiba QA personnel will perform an internal audit to verify compliance with the quality assurance requirements specified in the TP&P document.

## 13.3 Notification.

Toshiba has the responsibility to notify GE Nuclear Energy with documentation of:

(a) any changes in the test procedure,

(b) any failure of the test device(s) or system(s) to meet performance requirements,

(c) any revisions or modifications of the test device(s) or system(s),

(d) the dates when tests are expected to be performed, and

(e) any changes to the QA requirements specified in the Toshiba SBWR QA program (Reference 14.1a), GIRAFFE Quality Assurance Plan (Reference 14.1b) and Test Plans and Procedures document.

## 13.4 Test Plan and Procedures.

The tests will be performed in accordance with the Test Plan and Procedures (TP&P) document to be prepared by and issued by Toshiba. The GE GIRAFFE responsible engineer shall review and approve the TP&P. The Toshiba GIRAFFE responsible test engineer will

changes the TP&P to reflect changes in how test data is obtained. The GE GIRAFFE responsible engineer shall review and agree with any changes to the TP&P. The TP&Ps shall be a traceable and retrievable document of test requirements consisting of the following parts:

a. Test Plan.
Document how test is to be set up and performed to meet the Test Specification and any special safety conditions associated with the test.

b. QA Plan.
Specify quality assurance requirements per the test specification and describe how they are met, including instrumentation (calibration and adequacy), confirmation of test facility configuration and the test equipment status, test record information (date, performer, results, anomalies, corrective actions, etc.), certification of test personnel, and establishment of test equipment conditions, data logging, data acquisition systems, and others needed to satisfy test requirements.

c. Test Procedures.
Document the specific procedures required to perform the test.

d. Test Records.
Include requirements for filing facility checkout and shakedown records, instrument calibration records, verified as-built drawings for test facility, Data Acquisition System wire list verifications, pre- and post-test checklists, test logs, disposition of test or instrumentation anomalies, engineering units printout of data records, and electronic media data storage information in the Toshiba Test File and GE DRF as specified in Table 12-1.

e. Instrumentation.
Document the measurements required on the test facility. Include an instrument list and its basis, measurement accuracy requirements and analyses, calibration requirements and methods and pre-test acceptability criteria (zero shift acceptability, identification of critical instruments, etc.).

f Personnel Certification.
Document the qualification requirements for test personnel and evidence that test personnel meet these requirements.

g. Data Acquisition System Documentation.
Include the total number of measurements and scan rates, hardware and software descriptions, cabling, filtering, multiplexing, etc. Include requirement that software listings, wiring diagrams or hook-up lists, and software or systems validation requirements and procedures shall be filed in the Toshiba Test File as specified in Table 12-1.

h. Data Reduction.
Document data reduction software, if used. Include the analytical basis for equations used in data manipulations, software coding listings, and software validation procedures and documentation, if used. Include requirement that data reduction inputs, reduced data printouts, and electronic storage media information shall be filed in the Toshiba Test File and the GE DRF as specified in Table 12-1.

i. Data Analysis and Reports.
Include the requirement that backup information, such as data analysis, to support conclusions drawn, comments and comment resolutions, and verifications as appropriate shall be filed in the Toshiba Test File and the GE DRF as specified in Table 12-1.

## 14. REFERENCES

### 14.1 Toshiba Documents:

a. Quality Assurance Program for Simplified Boiling Water Reactor Document No. AS-50092, Rev. 1, issued 01 Feb 95.

b. GIRAFFE Quality Assurance Plan (TOGE-110 Test Programs), Document No. TOGE-110-TO1 AS-50128-E, Rev. 1, issued April 1995.

14.2 Other Documents:

a. Japanese National Standard JEAG-4101-1990, "Guide for Quality Assurance of Nuclear Power Plants".

b. ANSI/ASME NQA-1-1983 and Addenda NQA-1a-1983.

c. GE Document NEDC-32391P.