Westinghouse Electric Corporation
Energy Systems

Box 355
Pittsburgh Pennsylvania 15230-0355

AW-94-595

February 22, 1994

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

ATTENTION: MR. R. W. BORCHARDT

APPLICATION FOR WITHHOLDING PROPRIETARY INFORMATION FROM PUBLIC DISCLOSURE

SUBJECT: AP600 TESTING PROGRAM REPORTS (WCAP-13345, WCAP-13963, WCAP-13975)

Dear Mr. Borchardt:

The application for withholding is submitted by Westinghouse Electric Corporation ("Westinghouse") pursuant to the provisions of paragraph (b)(1) of Section 2.790 of the Commission's regulations. It contains commercial strategic information proprietary to Westinghouse and customarily held in confidence.

The proprietary material for which withholding is being requested is identified in the proprietary version of the subject report. In conformance with 10CFR Section 2.790, Affidavit AW-94-595 accompanies this application for withholding setting forth the basis on which the identified proprietary information may be withheld from public disclosure.

Accordingly, it is respectfully requested that the subject information which is proprietary to Westinghouse be withheld from public disclosure in accordance with 10CFR Section 2.790 of the Commission's regulations.

Correspondence with respect to this application for withholding or the accompanying affidavit should reference AW-94-595 and should be addressed to the undersigned.

Very truly yours,

N. J. Liparulo, Manager
Nuclear Safety And Regulatory Activities

/nja

cc: Kevin Bohrer NRC 12H5

1527A

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PROPRIETARY INFORMATION NOTICE

Transmitted herewith are proprietary and/or non-proprietary versions of documents furnished to the NRC in connection with requests for generic and/or plant specific review and approval.

In order to conform to the requirements of 10 CFR 2.790 of the Commission's regulations concerning the protection of proprietary information so submitted to the NRC, the information which is proprietary in the proprietary versions is contained within brackets, and where the proprietary information has been deleted in the non-proprietary versions, only the brackets remain (the information that was contained within the brackets in the proprietary versions having been deleted). The justification for claiming the information so designated as proprietary is indicated in both versions by means of lower case letters (a) through (f) contained within parentheses located as a superscript immediately following the brackets enclosing each item of information being identified as proprietary or in the margin opposite such information. These lower case letters refer to the types of information Westinghouse customarily holds in confidence identified in Section (4)(ii)(a) through (4)(ii)(f) of the affidavit accompanying this transmittal pursuant to 10 CFR2.790(b)(1).

AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

ss

COUNTY OF ALLEGHENY:

Before me, the undersigned authority, personally appeared Brian A. McIntyre, who, being by me duly sworn according to law, deposes and says that he is authorized to execute this Affidavit on behalf of Westinghouse Electric Corporation ("Westinghouse") and that the averments of fact set forth in this Affidavit are true and correct to the best of his knowledge, information, and belief:

Brian A. McIntyre, Manager
Advanced Plant Safety & Licensing

Sworn to and subscribed
before me this 22 day
of February, 1994

Rose Marie Payne
Notary Public

Notarial Seal
Rose Marie Payne, Notary Public
Monroeville Boro, Allegheny County
My Commission Expires Nov. 4, 1996
Member, Pennsylvania Association of Notaries

(1) I am Manager, Advanced Plant Safety and Licensing, in the Advanced Technology Business Area, of the Westinghouse Electric Corporation and as such, I have been specifically delegated the function of reviewing the proprietary information sought to be withheld from public disclosure in connection with nuclear power plant licensing and rulemaking proceedings, and am authorized to apply for its withholding on behalf of the Westinghouse Energy Systems Business Unit.

(2) I am making this Affidavit in conformance with the provisions of 10CFR Section 2.790 of the Commission's regulations and in conjunction with the Westinghouse application for withholding accompanying this Affidavit.

(3) I have personal knowledge of the criteria and procedures utilized by the Westinghouse Energy Systems Business Unit in designating information as a trade secret, privileged or as confidential commercial or financial information.

(4) Pursuant to the provisions of paragraph (b)(4) of Section 2.790 of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld.

(i) The information sought to be withheld from public disclosure is owned and has been held in confidence by Westinghouse.

(ii) The information is of a type customarily held in confidence by Westinghouse and not customarily disclosed to the public. Westinghouse has a rational basis for determining the types of information customarily held in confidence by it and, in that connection, utilizes a system to determine when and whether to hold certain types of information in confidence. The application of that system and the substance of that system constitutes Westinghouse policy and provides the rational basis required.

Under that system, information is held in confidence if it falls in one or more of several types, the release of which might result in the loss of an existing or potential competitive advantage, as follows:

(a) The information reveals the distinguishing aspects of a process (or component, structure, tool, method, etc.) where prevention of its use by any of Westinghouse's competitors without license from Westinghouse constitutes a competitive economic advantage over other companies.

(b) It consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), the application of which data secures a competitive economic advantage, e.g., by optimization or improved marketability.

(c) Its use by a competitor would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing a similar product.

(d) It reveals cost or price information, production capacities, budget levels, or commercial strategies of Westinghouse, its customers or suppliers.

(e) It reveals aspects of past, present, or future Westinghouse or customer funded development plans and programs of potential commercial value to Westinghouse.

(f) It contains patentable ideas, for which patent protection may be desirable.

There are sound policy reasons behind the Westinghouse system which include the following:

(a) The use of such information by Westinghouse gives Westinghouse a competitive advantage over its competitors. It is, therefore, withheld from disclosure to protect the Westinghouse competitive position.

(b) It is information which is marketable in many ways. The extent to which such information is available to competitors diminishes the Westinghouse ability to sell products and services involving the use of the information.

(c) Use by our competitor would put Westinghouse at a competitive disadvantage by reducing his expenditure of resources at our expense.

(d) Each component of proprietary information pertinent to a particular competitive advantage is potentially as valuable as the total competitive advantage. If competitors acquire components of proprietary information, any one component may be the key to the entire puzzle, thereby depriving Westinghouse of a competitive advantage.

(e) Unrestricted disclosure would jeopardize the position of prominence of Westinghouse in the world market, and thereby give a market advantage to the competition of those countries.

(f) The Westinghouse capacity to invest corporate assets in research and development depends upon the success in obtaining and maintaining a competitive advantage.

(iii) The information is being transmitted to the Commission in confidence and, under the provisions of 10CFR Section 2.790, it is to be received in confidence by the Commission.

(iv) The information sought to be protected is not available in public sources or available information has not been previously employed in the same original manner or method to the best of our knowledge and belief.

(v) Enclosed is Letter NTD-NRC-94-4068, February 22, 1994, being transmitted by Westinghouse Electric Corporation (W) letter and Application for Withholding Proprietary Information from Public Disclosure, N. J. Liparulo (W), to Mr. R. W. Borchardt, Office of NRR. The proprietary information as submitted for use by Westinghouse Electric Corporation is in response to questions concerning the AP600 plant and the associated design certification application and is expected to be applicable in other licensee submittals in response to certain NRC requirements for justification of licensing advanced nuclear power plant designs.

This information is part of that which will enable Westinghouse to:

(a) Demonstrate the design and safety of the AP600 Passive Safety Systems.

(b) Establish applicable verification testing methods.

(c) Design Advanced Nuclear Power Plants that meet NRC requirements.

(d) Establish technical and licensing approaches for the AP600 that will ultimately result in a certified design.

(e) Assist customers in obtaining NRC approval for future plants.

Further this information has substantial commercial value as follows:

(a) Westinghouse plans to sell the use of similar information to its customers for purposes of meeting NRC requirements for advanced plant licenses.

(b) Westinghouse can sell support and defense of the technology to its customers in the licensing process.

Public disclosure of this proprietary information is likely to cause substantial harm to the competitive position of Westinghouse because it would enhance the ability of competitors to provide similar advanced nuclear power designs and licensing defense services for commercial power reactors without commensurate expenses. Also, public disclosure of the information would enable others to use the information to meet NRC requirements for licensing documentation without purchasing the right to use the information.

The development of the technology described in part by the information is the result of applying the results of many years of experience in an intensive Westinghouse effort and the expenditure of a considerable sum of money.

In order for competitors of Westinghouse to duplicate this information, similar technical programs would have to be performed and a significant manpower effort, having the requisite talent and experience, would have to be expended for developing analytical methods and receiving NRC approval for those methods.

Further the deponent sayeth not.

Westinghouse Non-Proprietary Class 3

Westinghouse Energy Systems

9205140013 38/18

WCAP-13345
Rev. 2

AP600 CORE MAKEUP TANK (CMT)

TEST SPECIFICATION

L. Conway

Westinghouse Electric Corporation
Energy Systems
P. O. Box 355
Pittsburgh, Pennsylvania 15230

AP600 DOCUMENT COVER SHEET

Form 58202F(9/93) [WP xxxx]
0058.FRM

AP600 CENTRAL FILE USE ONLY: ________ RFS #: ________ RFS ITEM #: ________

AP600 DOCUMENT NO.	REVISION NO.	PAGES ATTACHED	ASSIGNED TO
PXS T1P 005	4		

ALTERNATE DOCUMENT NUMBER: WCAP-13345 Rev. 2

DESIGN AGENT ORGANIZATION: Westinghouse Electric

PROJECT: AP600

WORK BREAKDOWN #: 2.6.10.1

TITLE: AP600 Core Makeup Tank (CMT) Test Specification

ATTACHMENTS:

CALCULATION/ANALYSIS REFERENCE:

DCP #/REV. INCORPORATED:

ELECTRONIC FILENAME:

APPLICATION: Wordperfect

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ORIGINATOR	SIGNATURE/DATE	
L. E. Conway	Lawrence E Conway 2/16/94	
AP600 RESPONSIBLE MANAGER	**SIGNATURE***	**APPROVAL DATE**
E. J. Piplica	Eugene J Piplica	2/16/94

*Approval of the responsible manager signifies that document is complete, all required reviews are complete, electronic file is attached and document is released for use.

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ACRONYMS

ADS	automatic depressurization system
CMT	core makeup tank
DAS	data acquisition system
DP	delta pressure
PCV	pressure control valve
RCS	reactor coolant system
RTD	resistance temperature detector
SWR	steam water reservoir
T/C	thermocouple

1.0 INTRODUCTION/PURPOSE

The AP600 Core Cooling System includes two core makeup tanks (CMTs) that are completely full of cold borated water and are located above the cold legs of the AP600 reactor coolant system (RCS). These tanks have a small, normally open steam supply line to the top of each CMT from the pressurizer, and a larger, normally closed water/steam supply line from the RCS cold leg. During accidents, these tanks will provide high pressure RCS makeup and safety injection to the reactor vessel via a discharge line from the bottom of each CMT to the reactor vessel. For events that result in a substantial loss of RCS inventory, the CMTs will drain and water level instrumentation, associated with the CMTs, is used to open the automatic depressurization system valves from the pressurizer. This depressurization system reduces RCS pressure to near atmospheric pressure as the CMTs continue to drain.

The purpose of this test is to simulate CMT operations over a wide range of prototypic pressures and temperatures, to demonstrate the operability of the CMT water level instrumentation, and to obtain data to support development and verification of computer models to be used in safety analyses and licensing of the AP600 design.

This test is being performed by the Westinghouse AP600 Test Engineering group (NATD/ATBA) at the Westinghouse Waltz Mill Site in Madison, PA. This test is sponsored by Westinghouse AP600 Test Engineering located at the Energy Center in Monroeville, PA.

2.0 TEST OBJECTIVES

The objectives of the CMT test are to:

- Simulate the AP600 CMT thermal-hydraulic phenomena over a full range of pressures and temperatures
- Obtain detailed experimental results for verification of computer codes used for AP600 analyses
- Verify the operability of the heated resistance temperature detector (RTD) CMT level instrumentation

3.0 REFERENCES

1) AP600 Design Report (Rev. 0), Jan. 1989, DE-AC03-865F16038.

2) Letter NS-SAT-THA-90-023, Instrumentation Requirements for the AP600 CMT Test.

3) Letter SEE-TE(93)-022, AP600 CMT Test, Cold Pre-operational Test Plan.

4) Letter SEE-TE(93)-058, AP600 CMT Hot Pre-operational Test Plan.

5) Letter SEE-TE(92)-0081, AP600 CMT Test Matrix.

6) Letter SEE-TE(92)-0036, CMT Test, Tank Length.

7) Letter SEE-TE(93)-1128, CMT Test Steam Distributor.

8) Letters NSE/TEG-0005 and NSE/TEG004, Alternate CMT Test Diffuser Design for Waltz Mill.

9) Letter SEE-TE(93)-171, CMT Test Plan.

10) CMT Test Quality Plan; GW-GAM-003, Rev. 2.

4.0 TEST FACILITY REQUIREMENTS

The test facility for the CMT Test shall have the following capabilities:

A) A saturated steam supply with a controlled pressure range from 2250 psia to 20 psia and a capacity, at 2250 psig, of approximately 60,000 lbs/hr. (Note that this high steam suppiy rate will only be required for a short time period when the "empty" CMT is initially pressurized. See Section 8.0, Test Operations.) The required steam flow rate will vary greatly during testing due to the wide range of CMT drain rates and steam pressures being tested, the changing amount of steam condensed on the CMT inner surfaces versus time, and the different facility arrangements being tested. Therefore, a steam accu... '-tor combined with a modest capacity steam boiler may be required to cover the entire range of expected steam flow rates, down to a minimum of 25 lbs/hr.

Note that the above steam supply requirements are based on the use of a CMT that is approximately 2 feet in diameter and approximately 10 feet in height (~20 ft^3); this CMT is described in Section 5.0, Test Articles and Test Components.

B) A steam/water reservoir designed for 2500 psia and 668°F. This reservoir permits simple gravity drain of the CMT under all pressure conditions. Figure 4-1 provides a schematic of the anticipated test arrangement including the reservoir and required piping connections. The tank is to be designed to withstand repeated injections of cold CMT water into the bottom of the reservoir.

C) Adequate head room to simulate the prototypic height between the CMT and the water reservoir. This requires that the top of the CMT be located approximately 28 feet above the steam/water reservoir water level.

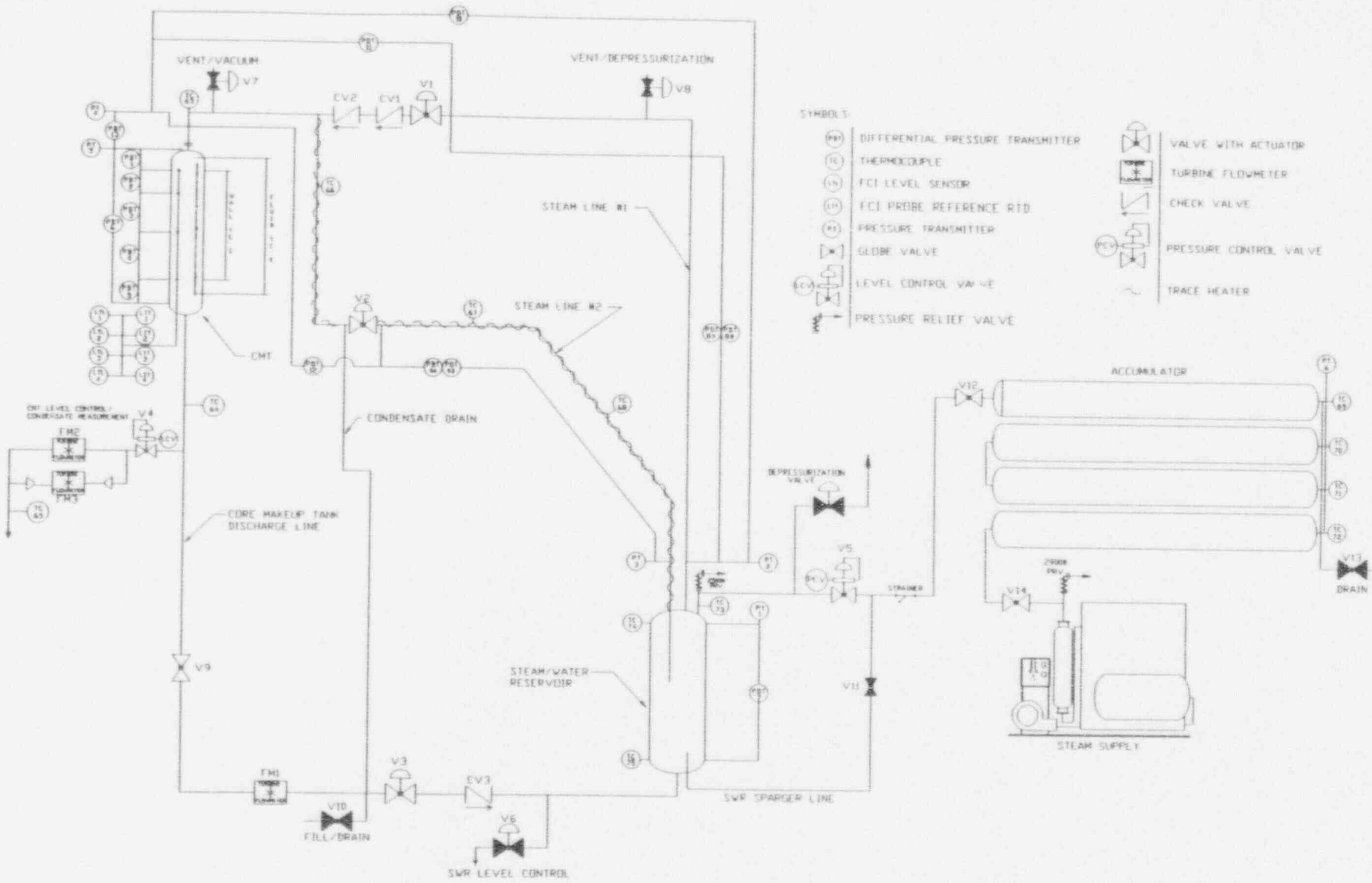

Figure 4-1. AP600 Core Makeup Tank Test Piping and Instrumentation Diagram

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D) Adequate space for the CMT, steam water reservoir, steam accumulator, boiler and their associated piping, supports, and instrumentation such that the test can be constructed and operated with efficiency and safety.

E) A data acquisition system (DAS) to record signals from the thermocouples, pressure sensors, flow meters, and other instrumentation described in Section 6.0, Instrumentation Requirements.

F) The capability to draw a vacuum to 10 inches of water pressure in the CMT and associated piping (and reservoir) to remove air prior to performing the tests.

G) Provisions to cool down the CMT so that it can be refilled with cold water to reduce the time between test runs. This can be accomplished by air cooling, water cooling, or a combination of methods.

5.0 TEST ARTICLES AND TEST COMPONENTS

The CMT tank, the prototypic type CMT level device (see Section 6.0) and any steam distributing device used in the CMT tank inlet (see Reference 9 in Section 3.0) are regarded as the test articles. The steam supply, steam/water reservoir in Section 3.0, and associated piping, valves and instrumentation with the test articles are to comprise the CMT test facility. Refer to the schematic of the CMT test shown in Figure 4-1. The required design pressure and temperature for the CMT test facility is to be $\geq$2500 psia and 668°F.

All tanks, piping, and valves are to be designed in accordance with applicable code requirements (e.g., ASME Div. 1, Section VIII for tanks, B31.1 Power Piping Code for piping) for non-nuclear components consistent with design pressure and temperature, and to withstand the repeated heat-up and cool-down transients derived from the tests described in Section 8.0. Also, as noted in Section 4.0, Item F, the CMT and portions of the attached piping are to be designed for a vacuum to 10 inches of water pressure absolute.

5.1 Core Makeup Tank

The test group conducting the CMT test will be responsible for the design, specification, and procurement of the test vessel. The vessel specification shall be submitted to the test sponsor for review and approval before vessel procurement. The CMT shall comply with the following specifications:

- Tank ID: 19.3 inches (based on 24-inch Schedule 160 pipe)
- Tank Length: ~10 feet overall
- Tank Volume: ~18 feet (with 2:1 elliptical end caps)
- Material: Carbon Steel

- Tank Penetrations

  - Top Head:
    - 1½-inch Schedule 160 steam inlet
    - Upper pressure/level tap
    - At least three penetrations for thermocouples

- Bottom Head:
  - 1½-inch Schedule 160 water outlet
  - 3-inch Schedule 160 level instrument port
  - Lower pressure/level tap

- Cylindrical Portion:
  - Level taps (test performer to determine if additional level taps and level instruments are required to obtain the accuracy specified in Section 6.0, Table 6-1)
  - 4 sets of CMT wall thermocouples
  - 30 thermocouple penetrations

Additional information on the CMT penetration locations and instrumentation is provided in Section 6.0, Instrumentation Requirements and in Figures 6-1 and 6-2.

The CMT is to be mounted vertically and elevated such that the top of the CMT is located approximately 28 feet above the steam/water reservoir water level.

At least two samples of the tank cylindrical section material are to be tested to document the thermal conductivity of the tank material.

5.2 Piping

CMT Steam Supply Line No. 1 Simulates the Pressurizer to CMT Balance Line

A 1½-inch pipe is to be routed continuously upward from the steam/water reservoir steam space to a high point above the CMT, such that no water traps form due to steam condensation.

From the high point, the steam supply piping shall slope slightly downward to the CMT inlet. This piping shall be supported so that when it is hot, the pipe will remain slightly sloped toward the CMT or be horizontal. Twenty to forty feet of sloped pipe is to be provided, as dictated by the test facility layout.

This piping (and included valves) is to be insulated so that the line will heat up and remain at the steam saturation temperature corresponding to the pressure of the test run.

CMT Steam Supply Line No. 2 Simulates the Cold Leg to CMT Balance Line

A 1½-inch pipe is to be routed from the steam/water reservoir to the CMT inlet. This line shall extend four feet into the reservoir so that its end is below a "HI" reservoir water level setpoint but is above a "LO" reservoir water level setpoint.

This pipe shall be routed from the steam/water reservoir as follows:

- 10-foot vertical run (includes section within reservoir)
- ~12-foot run sloped at ~60° from the horizontal
- ~12-foot run slightly sloped (2.5°) toward the reservoir that contains the isolation valve
- 10-foot vertical run which intersects with steam supply line no. 1
- 2-foot run slightly sloped (2.5°) toward the CMT inlet elbow

This piping (and included valve) is to be heat traced and insulated from the reservoir to the "tee" with steam supply line no. 1. Thermocouples are to be installed at 10-foot spacings. The heat tracing and thermocouples shall be used to heat and maintain the water in this line at a desired temperature, up to the saturation temperature corresponding to the pressure of the test run. The remaining portion of this line, from the isolation valve to the elbow above the CMT, shall be insulated.

This pipe shall include a small drain line located on the CMT side of the isolation valve, to the steam/water reservoir. This drain shall be used to assure that no water collects in the slightly sloped portion of the steam supply line no. 1.

A 1½-inch flanged inlet to the CMT is to be provided that shall accommodate a 1-inch Schedule 160 pipe, held in place by the flanges (See Section 6.0, Figure 6-1).

1½-Inch CMT Water Discharge Line to the Reservoir

Because this piping drains by gravity, no portion of the piping is to be located above the CMT outlet. A water flow measurement is required to measure the full range of CMT drain rates tested. A turbine meter (or meters) or multiple flow orifices may be used, as determined by the test performer.

5.3 Level Controllers

A level control system and level control valve (See Section 4.0, Figure 4-1) are to be provided to maintain fixed CMT water levels during some of the specified tests to directly measure the amount of steam condensed on the CMT walls. These levels (described in Section 6.0) shall correspond to closely spaced groups of thermocouples extending into the CMT.

A remotely actuated drain valve is to be provided, as shown in Section 4.0, Figure 4-1, to drain water from the steam/water reservoir so that the portion of steam supply line no. 2, that extends into the steam/water reservoir can be uncovered when the CMT is being drained, or to permit adjusting the steam water reservoir level to the desired test setpoint.

5.4 Valves

As shown in Figure 4-1, several different types of valves are to be provided in the CMT steam inlet and water discharge lines. Requirements for these valves are listed in A through I below.

A) The isolation valve in steam supply line no. 1 shall:

- be remotely operated with a "fail closed" type actuator with the capability to adjust its opening time up to approximately 2 to 10 seconds
- allow water in the piping to drain completely and smoothly toward the CMT (through its orientation/location)
- have a minimum C_V to provide an overall piping resistance of ~3 ft/gpm^2.
- have the capability to be remotely positioned from a control board

B) The isolation valve in the steam supply line no. 2 shall:

- be a globe valve (to simulate the AP600)
- be remotely operated with a "fail closed" type actuator with the capability to adjust its opening time up to 10 seconds
- be installed so that flow to the CMT is from below the valve seat/plug

C) The isolation valve in the CMT water discharge line shall:

- be a globe valve (similar or identical to the steam supply line no. 2 isolation valve)
- be remotely operated with a "fail closed" type actuator with the capability to adjust its opening time up to 10 seconds
- be installed so that flow from the CMT is from below the valve seat/plug

D) The valve(s) in the CMT reservoir vent line(s) shall:

- be remotely operable
- be subjected to high delta pressure (DP), choked steam flow when the CMT is depressurized

E) The CMT level control valve shall:

- have a flow range is 0 to 25 gpm at a maximum DP of 2235 psig
- be remotely operated with a "fail closed" type actuator
- have the capability to be positioned based on a level signal from the CMT level transmitters

F) The steam/water reservoir drain valve shall:

- required flow range is 2 to 25 gpm with a DP range of up to 2235 psig
- be remotely operated with a "fail closed" type actuator

G) The check valves in the steam supply and discharge piping are to be swing check valves. These valves should be mounted in the horizontal (or slightly sloped) piping runs.

H) The manual throttle valve, provided in the CMT discharge line, is to be capable of adjusting the CMT minimum gravity drain rate down to approximately 2 gpm.

I) A depressurization valve from the steam water reservoir shall:

- be remotely operated and be positionable
- be approximately 2 inches in size
- be a globe valve

6.0 INSTRUMENTATION REQUIREMENTS

The following instrumentation is to be provided for the AP600 CMT. The sensors and their requirements are listed in Table 6-1. Note: The accuracy of each instrument channel is to nominally be within ± 3%, including sensor, signal processing and final output. An error analysis of the instruments is to be provided by the test group to document the installed instrument channel accuracy. Figures 6-1 and 6-2 schematically illustrate the location of the sensors in the test facility. All sensor output signals are to be recorded during each matrix test.

6.1 Temperature Instrumentation

The temperature of the steam and/or water throughout the CMT test apparatus is to be measured. Measurements are to include:

- The temperature of the steam supply into the steam/water reservoir
- The temperatures of both the steam space and water in the steam/water reservoir
- A temperature measurement of the water or condensed steam draining from the CMT in the CMT discharge line
- A temperature measurement of the cooled fluid or condensed steam drained from the CMT via the external drain path; this temperature is provided to assure an accurate mass flow rate measurement of condensed steam
- Four sets of CMT wall temperature measurements; each set consists of five thermocouples placed through the CMT wall. (As shown in Figure 6-2, the thermocouples in each set are to be placed such that one is at the tank wall inner surface, 0.125, 0.500, and 1.500 inches from the CMT wall inner surface, and one at the tank wall outer surface. All five thermocouples in a set are to be at the same elevation and as close together as possible.)

  Note: The thermocouples in the tank wall are placed in holes that are within ± .015 inches of the depth required to be the desired distance from the tank inner surface. The steel thickness at the hole locations was determined by ultrasonic measurement and comparison with a reference block of metal.

TABLE 6-1 AP600 CMT TEST INSTRUMENT LIST			
QTY.	INSTRUMENT TYPE	DESCRIPTION	INSTRUMENT RANGE
22	Thermocouples	CMT Wall Thermocouples	50-650°F
34	Thermocouples	CMT Fluid Thermocouples	50-650°F
1	Thermocouple	Steam In	50-650°F
1	Thermocouple	SWR Steam Temp	50-650°F
1	Thermocouple	SWR Water Temp	50-650°F
1	Thermocouple	Ambient Temperature	50-650°F
1	Thermocouple	CMT Steam In	50-650°F
1	Thermocouple	CMT Steam Out	50-650°F
1	DP Transmitter	CMT Level 1-2	0-400 in H_2O (1)
1	DP Transmitter	CMT Level 2-3	0-400 in H_2O (1)
1	DP Transmitter	CMT Level 3-4	0-400 in H_2O (1)
1	DP Transmitter	CMT Level 4-5	0-400 in H_2O (1)
1	DP Transmitter	CMT Level 5-6	0-400 in H_2O (1)
1	DP Transmitter	Overall CMT Level 1-6	0-400 in H_2O (1)
1	DP Transmitter	S/W RES Level	0-400 in H_2O (1)
1	DP Transmitter	DP Across CMT Nozzle	0-30 PSI
1	DP Transmitter	SL #1 Upstream DP	0-400 in H_2O (1)
1	DP Transmitter	SL #1 Upstream DP - Reversed	0-400 in H_2O (1)
1	DP Transmitter	Steam Line #2 Upstream DP	0-400 in H_2O (1)
1	DP Transmitter	SL #1 Downstream DP	0-600 in H_2O
1	DP Transmitter	SL #2 Downstream DP	0-10 in H_2O
1	DP Transmitter	Total SL #1 DP	0-3000 psi
1	Pressure Transmitter	Steam Line #1 Inlet	0-3000 psig (2)
1	Pressure Transmitter	Steam Line #2 Inlet	0-3000 psig (2)
1	Pressure Transmitter	SWR Press to PCV	0-3000 psig
1	Pressure Transmitter	CMT Inlet Pressure	0-3000 psig (2)
1	Pressure Transmitter	CMT Vessel Pressure	0-3000 psig (2)
1	Pressure Transmitter	Barometric Pressure	0-15.0 psia
4	Prototype Level Instruments	Temperature Sensor (Active RTD (3))	0-800°F

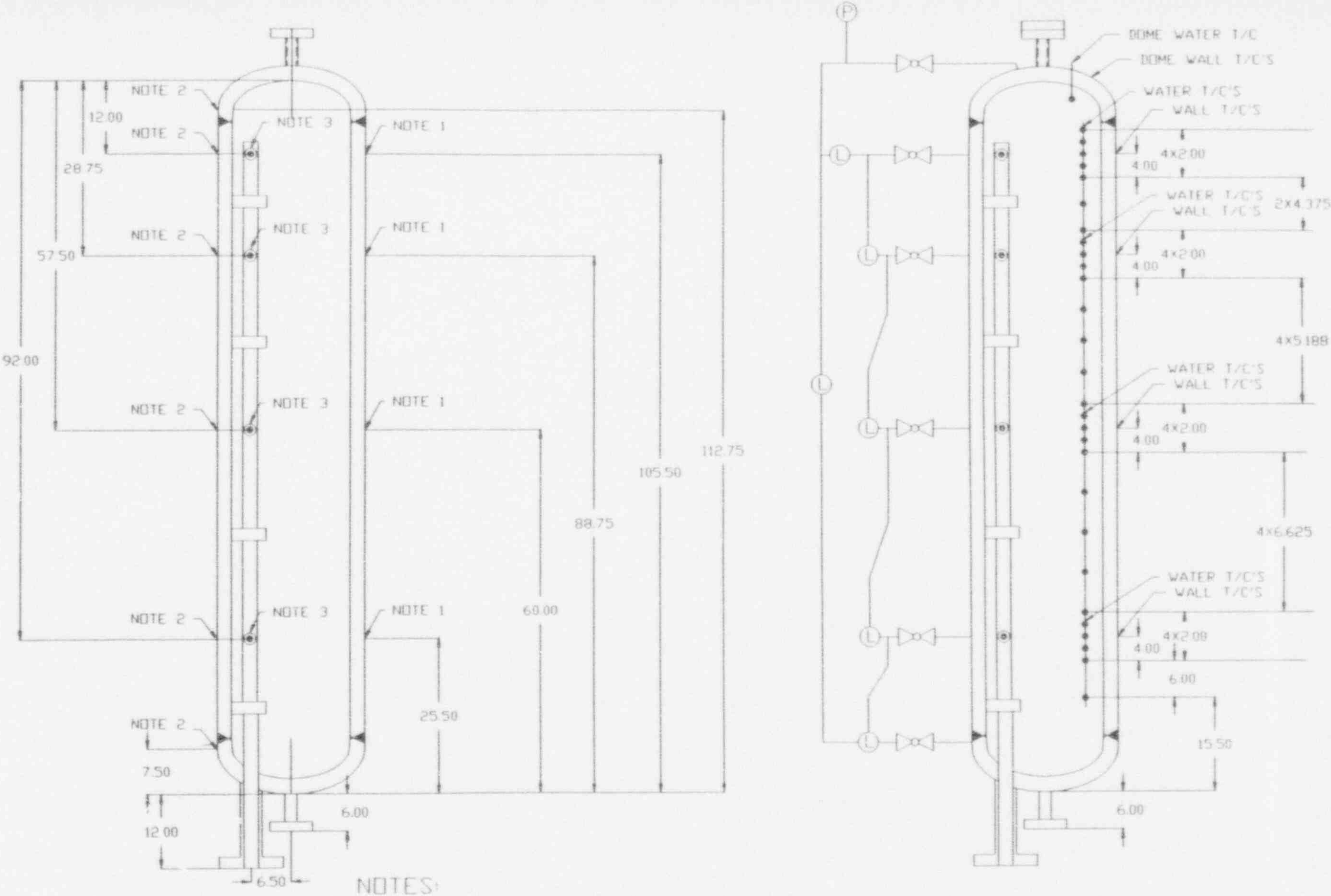
TABLE 6-1 AP600 CMT TEST INSTRUMENT LIST (cont.)			
QTY.	INSTRUMENT TYPE	DESCRIPTION	INSTRUMENT RANGE
4	Prototype Level Instruments	Temperature Sensor (Reference RTD (3))	0-800°F
1	Turbine Flow Meter	CMT Discharge Line	2.0-75.0 gpm
1	Turbine Flow Meter	CMT Condensate Drain	0.125-3.00 gpm
1	Turbine Flow Meter	CMT Condensate Drain Elapsed Time	1.5-35.0 gpm

Notes:

(1) Transmitter range can be remotely set between 1 and 400 inches of water

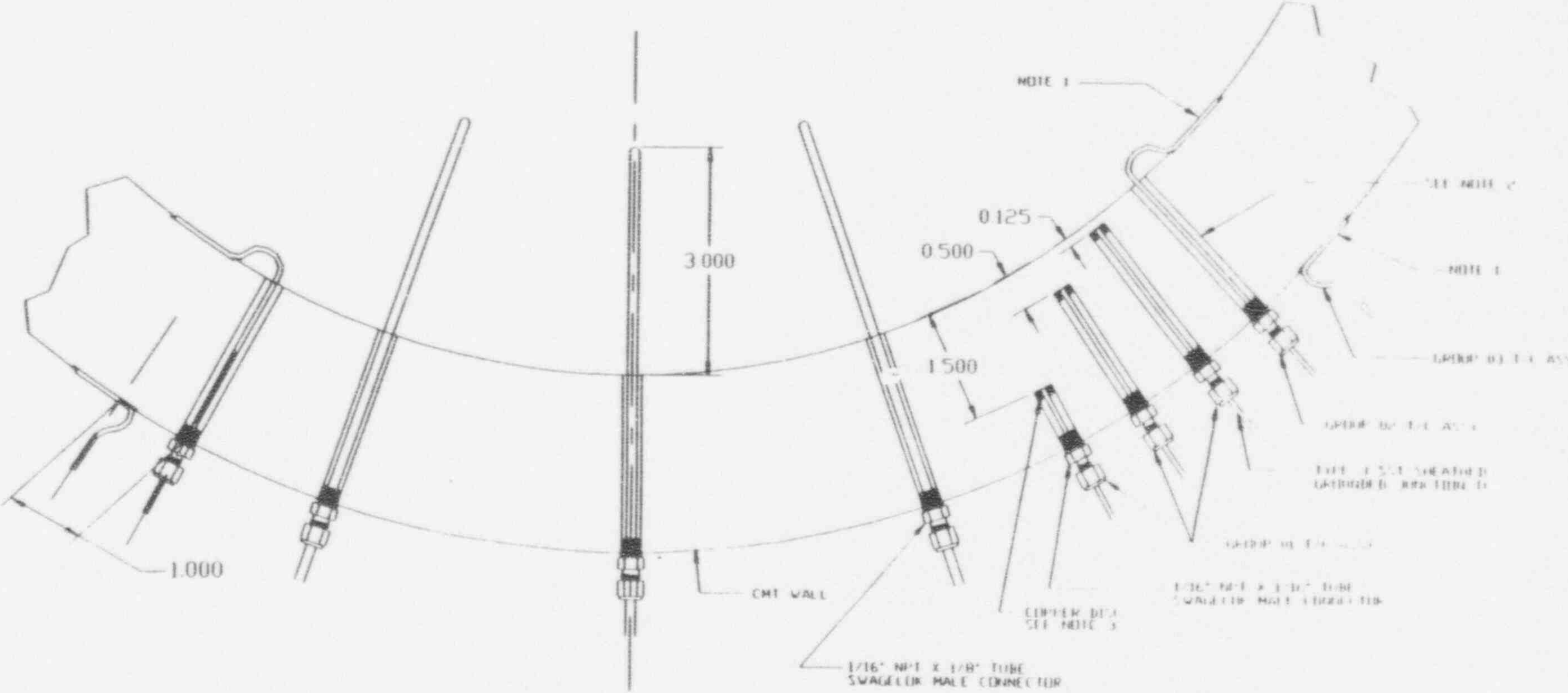
(2) Transmitter range can be remotely set between 100 and 3000 psi

(3) Prototype level instrument consisting of four sensors. Each sensor consists of a pair of RTDs arranged in a proprietary configuration. Each RTD pair consists of one heated (active) and one unheated (reference) RTD. The active and reference RTD in each pair provides a temperature measurement at the sensor location.



NOTES:
1) CMT WALL THERMOCOUPLE LOCATIONS
2) PRESSURE TAP LOCATIONS
3) FCI LEVEL PROBE LOCATIONS

Figure 6-1. AP600 Core Makeup Tank Test - CMT Instrumentation



NOTES:

1) TC SOLDERED INTO 0.06 DP X 1.5 LG GROOVE CUT INTO CMT WALL.
2) DRILL THRU AND TAP FOR 1/16" NPT
3) DRILL 1/4" DIA. FLAT BOTTOM HOLE TO DEPTH AS SHOWN. TAP FOR 1/16" NPT. INSERT TC WITH COPPER DISC AND PEEN INTO BOTTOM OF HOLE.

Figure 6-2. Typical CMT Wall Thermocouple Installation

These temperature measurements will be used to determine the CMT wall temperatures versus time to determine the local heat flux versus time through the CMT wall.

The position of the thermocouple junctions in the tank wall shall be verified by ultrasonic measurement or other means:

- The inner and outer wall temperature of the CMT upper head shall be measured.
- Thirty-three (33) thermocouples are to be installed inside the CMT to measure fluid temperatures within the tank. These thermocouples may be individually inserted through the CMT wall and should be able to be positioned at least 3 inches into the CMT. As shown in Figure 6-1, these thermocouples include four sets of five thermocouples with a 2-inch vertical spacing centered about the thermocouples in the CMT cylindrical wall. The remaining thermocouples are placed at approximately 6-inch spacing between the 2-inch spaced sets of thermocouples.
- One (1) thermocouple to measure the ambient air temperature, is to be located near the bottom of the CMT.

Premium grade, calibrated thermocouples shall be used and connected through controlled purity extension wire to the DAS equipment. Thermocouple sensors are listed in Table 6-1. The response time of the thermocouples shall be consistent with the data sampling rate specified in Table 6-1.

6.2 Level Measurement

Water level measurements are to include:

- The water level in the steam/water reservoir is to be measured to allow the reservoir level to be adjusted.
- The water level in the CMT is to be measured and used to control the operation of the CMT condensate drain level control valve. An overall level and five narrow range levels are to be provided.
- A prototypic type CMT level sensor shall be supplied by the test sponsor and installed in the CMT. This instrument will be evaluated as a possible alternate to DP type instruments. A 3-inch raised face flange connection is to be provided on the CMT bottom head for installation. Provisions for a 4-10 milliamp output from the level device and conversion to a 1-5 volt output for recording shall be included in the DAS.

6.3 Pressure Instrumentation

Pressure measurements are to include:

- The pressure of the steam supply is to be measured (boiler discharge and/or steam accumulator tank).
- The steam pressure in the steam/water reservoir is to be measured. Also, this pressure is to be automatically maintained at a constant value throughout a given test run. Note that two or more sensors or a multiple range sensor may be required to accurately monitor and control steam pressure over the entire range of test pressures.
- The pressure in the CMT is to be measured throughout the test run. Two pressure sensors may be required to accurately monitor pressure over the entire pressure range of the test pressures. Alternatively, a multiple range sensor can be provided.
- Two DP measurements between the steam/water reservoir and the top of the CMT are to be provided on each steam supply line to measure the flow resistance through the steam supply line or water discharge line and to observe/detect any steam/water interaction during CMT draindown.

Note that the effect of system temperature changes during CMT testing on pressure transducers or transmitters is to be minimized by the use of thermal traps.

Note that if steam/water interactions occur in the CMT that cause significant pressure pulses, a high speed pressure transducer may be added to the CMT tank or piping as applicable.

6.4 Flow Instrumentation

Flow measurements are to include:

- The amount of steam supplied to the CMT during a test run shall be calculated by measuring the DP across the steam supply piping and/or valves.
- The water drain rate from the CMT is to be measured. The type of flowmeters to be used, and the number needed to provide accurate flow measurement over the entire range of flow rates tested, are to be determined by the test group.
- A steam flowmeter may be provided in each of the two CMT steam supply lines from the steam/water reservoir. The type of flowmeter to record the expected flow rate is to be determined by the test group.

7.0 DATA ACQUISITION

The test facility shall provide a DAS that includes the equipment necessary to monitor and transmit the output signals generated by the various instruments used both in the control and monitoring of the test loop.

7.1 DAS Components

The DAS components include signal amplifiers, signal conditioners, signal transmitters, signal converters (analog-to-digital and others that may be used), switch panels, interface electronics, computers, power supplies, displays (CRT, strip chart recorders, gages, etc.), and interconnected wiring, as needed to accomplish the test.

7.2 Input Channels

The DAS shall receive up to (see Table 6-1) analog signals from various temperature, pressure, level, and differential pressure sensors; flow meters; valve position indicators; and other instrumentation utilized for test operation and monitoring, and record them in a digital form. Shielded wiring shall be used for all signal input leads to minimize noise interference in the signal. High frequency filters may also be used where shown to be appropriate and approved by the test sponsor.

The test performer shall be responsible to assure that the DAS is capable of accepting and processing the range of output signals generated by the various instruments that may be used during the course of testing.

7.3 Sampling Rates

The sampling rate of the instruments by the DAS shall be set by the physical phenomena being monitored and the response time of the instrument itself. To monitor rapidly changing or oscillating phenomena, rapid scanning rates are desired, while slower scanning rates are acceptable for slower phenomena or slow response instruments. Thus, to provide for the efficient collection, storage, and handling of meaningful and useful data, the DAS may sample different instruments at different rates during the course of a test, and may vary the sampling rate for various instruments as dictated by the specific test run being performed.

The sampling rate for the instruments planned for the test is to be two samples/second. Note that this sampling rate is a minimum value; faster sampling rates are acceptable. Use of a slower sampling rate shall be reviewed and approved by the test sponsor prior to testing.

7.4 On-Line Data Storage

The DAS shall have sufficient storage capacity to capture and store all digital data collected from a given test. The maximum duration of a test is not expected to exceed sixty (60) minutes.

The data shall be stored by the DAS in engineering units (pounds per square inch or pounds per second) in order to display any selected channels during the test operation in real time and to permit easy review of test results. The scaling factors used to convert the raw data signals (volts, millivolts, milliamps, etc.) to engineering units shall be documented.

7.5 On-Line Display

The DAS shall provide for the continuous on-line display of selected instruments or calculated test parameters before (pretest), during, and following (post-test) each test performed. In general, the information displayed shall be sufficient as to allow the test loop operators to assess the following:

- Initial test loop conditions meet those specified including steam supply pressure, CMT pressure, CMT level, SWR pressure, and SWR temperature.
- Expected events including CMT discharge flow, CMT temperature, and valve positions.
- That no unexpected post-test events that might negate the test have occurred

All data displayed on line should be in the appropriate engineering units, temperature, pressure and flow, as applicable.

The on-line display shall be by CRT, with an echo to a print file for inclusion in day-of-test reports, see Section 9.1.

7.6 Test Validation

The DAS shall have the ability to perform a post-test validation check on the test performed. In general, a valid test shall satisfy the following three criteria:

1) Sufficient instrumentation channels are to be operable and their outputs recorded by the DAS to permit a CMT mass balance and energy balance.

2) Sufficient instrumentation channels are to be operable and their outputs recorded by the DAS to assure that the data needs addressed by the test are satisfied.

3) The initial test conditions should reasonably match those called for in the test matrix.

To provide guidance in determining test validity, a pre-test validation "check list" that includes key parameters associated with the test shall be performed by the tester. For parameters such as flow or temperature histories, a plot showing the predicted history, the history observed during the test, and limits of variation about the desired history, may be an appropriate presentation for use in test validation. The check list and any associated plots shall be provided post-test, along with a summary of other instrument outputs determined to be critical to a successful test, for review by the test sponsor in assessing test validity (See Section 9.0).

7.7 Data Transmittal

Following the test group's post-test validation of the test, the test data shall be provided to the test sponsor on a magnetic medium (tape file, floppy disc, etc.). The final medium for the data will be decided prior to testing and will be dependent upon the amount of data that will be generated. As a minimum, the data tape is to contain the following information:

- Test run file header, containing the test run identification, date, and other pertinent information
- All of the data from one channel, presented one channel at a time

- An end-of-file mark at the conclusion of the data for a given test

A "prototype" data tape, containing signals typical of those to be recorded during matrix testing, shall be provided to the test sponsor. This "prototype" data file can be provided from the pre-operational testing to assure that it can be read by equipment available to the test sponsor.

8.0 TEST OPERATION

All tests shall be conducted in accordance with written procedures which shall be submitted to the test sponsor for approval prior to conducting the test.

8.1 Cold Pre-operational Tests

Cold pre-operational tests shall be performed to characterize the CMT test facility. These tests are to include:

- Fill and drains of the CMT, steam/water reservoir, and steam accumulator to establish tank volumes
- CMT draindowns with air to demonstrate the maximum CMT drain rate and ability to adjust (and repeat) a selected CMT drain rate
- Measurement of the resistance of each of the CMT inlet and discharge lines
- Opening time and operability of the facility isolation and control valves
- Operability of the facility instrumentation and DAS

Note: These pre-operational tests are to be documented, as needed, to utilize the derived data for test analysis and computer code verification.

8.2 Hot Pre-operational Tests

These tests shall be performed to characterize the test facility and to demonstrate the operability of the facility over the whole range of AP600 pressure and temperature operating conditions. These tests are to include:

- Characterization of all the facility thermocouples at steady state conditions
- Heat up of CMT walls by the rapid injection of steam into an empty (no water), evacuated CMT
- Characterization of the occurrence and importance of steam jetting into a completely full (with cold water) CMT
- Demonstration of the operability of the CMT external condensate drain and level control

- Measurement of the CMT steam line and water discharge line resistances at elevated temperatures (i.e., higher Reynold's numbers)

Note: These tests are to be documented, as needed, to utilize the obtained data for test analysis and nuclear safety computer code verification. However, since some of these pre-operational tests may involve some "trial and error" operations, selected tests may be re-run as required. Formal test reports for superseded test runs may be documented at a later time, based upon evaluation of pre-operational and matrix test data.

8.3 Matrix Test

Separate types of tests will be performed to characterize CMT thermo-hydraulic phenomena. These tests are outlined below and a test matrix is provided in Table 8-1.

8.3.1 Steam Condensation on CMT Walls and Water Surface

The rate at which steam condenses on the CMT walls will be measured with no water initially in the CMT in Tests 101-111. These tests will include steam addition into an evacuated (no air) CMT and tests with the CMT initially containing some air or helium. These tests will provide direct measurements of the heat flux through the CMT wall versus time and measurement of the resulting steam condensation rate versus time.

The rate at which steam condenses on the CMT walls and water surfaces and the heat up of the water surface will be measured while maintaining a fixed water level in the CMT in Tests 201-214. Four water levels, corresponding to the elevations of the groups of closely spaced fluid thermocouples inside the CMT and CMT wall thermocouples, will be tested. This will provide water heat up rates that result from the steam condensation on the four different wall areas plus condensation on the constant water surface area exposed to the steam.

The setup conditions of the facility are as follows:

- The CMT is at ambient temperature conditions and water is added to the CMT to the desired level to be used in the test run. The CMT water level controller is set to maintain this water level, and the CMT water discharge isolation valve is closed.

- Air is evacuated from the CMT, steam supply lines, and steam reservoir using the vacuum connection(s). Note: Purge the steam water reservoir and CMT steam supply piping with steam (or use a vacuum pump to remove all air).

- The steam supply lines are isolated from the CMT and the steam reservoir is pressurized with steam to the desired test pressure. The reservoir and the steam supply lines are allowed to come to thermal equilibrium.
- For Tests 106 to 111, air or helium is added to the evacuated CMT so that the CMT pressure is at the desired percentage of the steam/water reservoir steam supply absolute test pressure (psia).

The tests run are initiated by fully opening the steam supply line no. 2 isolation valve to the CMT.

The overall rate of steam condensation on the tank walls and water surface is determined by measuring the amount of condensed steam drained from the CMT versus time, and by the flow rate of steam supplied to the CMT as measured by the steam line DP. Local CMT wall condensation rate versus time will be obtained from the tank wall thermocouples. The water heat up versus time will be measured using the corresponding set of water/steam thermocouples with vertical spacing in the tank. The rate of steam condensation on the CMT wall surface with and without noncondensible gas will be performed over a full range of steam supply pressures, i.e., 10, 135, 685, 1085, and 2235 psig. The rate of steam condensation on the CMT wall and water surfaces will be performed at 10, 135, 1085, and 2235 psig.

Refer to Table 8-1 for additional information.

8.3.2 CMT Heat Transfer During Depressurization

The rate at which the CMT walls and heated water surface provide heat/mass to the CMT steam space shall be measured after the steam condensation tests and shall use the final conditions of Tests 101 to 214 as the initial conditions for the depressurization cases. For example, after the steam condensation on the CMT wall surface test at 2235 psia:

- The steam/water reservoir steam supply isolation valve (steam accumulator discharge isolation valve) and CMT level control valve are closed
- The vent line from the steam/water reservoir is opened to initially establish an approximately 300 psi/minute depressurization of the CMT

Similar depressurizations will be performed subsequent to the 1085 and 135 psig steam condensation tests at initial depressurization rates of 200 psi/minute and 50 psi/minute, respectively.

The rate at which heat transfer occurs from the tank to the steam will be obtained from the tank wall thermocouples. Similarly, the heat/mass transfer from the water surface to the CMT steam will be obtained from the water/steam thermocouples and the CMT level measurement.

8.3.3 CMT Draindown Tests

Two sets of CMT draindown tests will be performed with no recirculation heat up of the CMT water prior to draindown initiation. Tests 301 to 316 are draindowns at constant pressure. Tests 401 to 404 are draindowns performed while the steam supply pressure is decreased, similar to the expected plant depressurization with the Automatic Depressurization System (ADS) operating.

In each of these two sets of tests, draindowns are performed with high steam line resistance (steam supply line no. 1) or with the low steam line resistance (steam supply line no. 2). Initial conditions for these tests are as follows:

- The CMT is filled with water and then drained at atmospheric pressure (vents open) to set the CMT discharge line throttle and steam supply line no. 1 valve positions to get the desired CMT draindown flow rate(s). This operation also verifies proper operation of the CMT discharge flowmeter and level instrumentation.
- The steam/water reservoir is filled above the low water level tap but well below the extended end of steam supply line no. 2.
- With the CMT discharge isolation valve closed, the CMT is filled with water.
- The remaining portion of the test loop including the steam/water reservoir is evacuated or purged with steam to remove any appreciable air and the steam supply isolation valves are closed.

Prior to CMT draindown:

- Steam is supplied to the steam/water reservoir and the reservoir and the steam supply piping are allowed to come to thermal equilibrium.
- The reservoir water, steam sparger connection is used to attain saturated reservoir water temperature during the heat up.
- The desired steam supply line is opened and the CMT draindown is initiated by simply opening the CMT discharge isolation valve.

8.3.4 Natural Circulation Followed by Draindown

Tests 501 to 506 will simulate the heat up of the CMT water, with subsequent draindown and depressurization. In these tests, the reservoir hot water level is initially maintained such that the extended end of steam supply line no. 2 is initially covered with water. The heated water in the reservoir will rise and replace the heavier, cold CMT water. The natural circulation flow rate versus time will be monitored as the CMT is filled with hotter water and the reservoir water temperature decreases. After the CMT has been heated to the depth desired (~1/5, ~1/2, or fully heated), the steam/water reservoir is drained. When the extended end of the steam supply line no. 2 is uncovered, CMT draindown will begin. When the CMT water level has dropped ~18 inches (level is ~97 inches), the steam/water reservoir will be depressurized during draindown to observe the behavior of the heated CMT water and level instrument measurement during ADS depressurization.

8.3.5 CMT Heat up, and Draindown Initiation with Noncondensible Gases

Tests 601 to 612 will be performed with the steam/water reservoir heated to simulate the AP600 cold leg temperature, and the extended end of steam supply line no. 2 below the reservoir water level. In these tests the CMT steam supply lines from the isolation valves to the CMT will initially contain either steam or helium. The steam supply lines will be opened simultaneously with the CMT discharge line. The reservoir can provide steam via steam supply line no. 1 or water via steam supply line no. 2.

TABLE 8-1
AP600 CMT TEST MATRIX (Sheet 1 of 2)

Test No.	Test Type	CMT Drain Rate	Steam Supply Pressure(s) psig	Comments
101-105	CMT wall condensation with and without noncondensible gases	N/A CMT drain rate based on steam condensation rate and drain capability.	10/135/685/1085/2235, with subsequent depressurization	CMT initially contains no water, and is evacuated (no air).
106-108			10	CMT initially evacuated and then pressurized with air (or N_2) to .236, 1.13 and 2.13 psia, respectively.
109-111			1085	CMT initially evacuated and then pressurized with helium to 42, 146, and 296 psia, respectively.
201-208	CMT Wall and Water Surface Condensation	N/A - CMT level fixed. Water drained from CMT via external path to match steam condensation	10/135/1085/2235, with subsequent depressurization	CMT initially 90% and 75% full, CMT level control used to maintain fixed CMT level.
209-214			10/135/1085, with subsequent depressurization	CMT initially 50% and 25% full, CMT level control used to maintain fixed CMT level.
301-312	CMT draindown at constant pressure	6/11/16/MAX	10/135/1085	Low resistance steam supply line no. 2 utilized; drain rate controlled by discharge line resistance.
313-316		Flow rate controlled by steam supply line no. 1 resistance, (3 ft/gpm^2).	1085/2235	Discharge line resistance set to provide 6/16 gpm.
401-402	CMT draindown during depressurization	Discharge line resistance for 6/16 gpm	1085 followed by depressurization to 20	Low resistance steam supply line no. 2 utilized; drain rate controlled by discharge line resistance.
403-404		Drain rate controlled by steam supply line no. 1 resistance	2235 followed by depressurization to 20	Discharge line resistance set to provide 6/16 gpm gravity drain rate at atmospheric pressure.

TABLE 8-1 AP600 CMT TEST MATRIX (Sheet 2 of 2)				
Test No.	**Test Type**	**CMT Drain Rate**	**Steam Supply Pressure(s) psig**	**Comments**
501-502	Natural circulation followed by draindown and depressurization	Discharge line resistance set for 6/16 gpm drain rate	1085 followed by depressurization to 20	Steam supply line no. 1 is closed. Reservoir water level at "HI" level. reservoir water temperature initially 545°F. Steam supply line no. 2 is opened to initiate natural circulation until one-fifth of CMT heated. Reservoir water level is reduced to initiate draindown. The steam supply is isolated and the water/steam reservoir is vented when the CMT is drained to 97 inches.
503-504				Repeat with natural circulation until one-half of CMT heated.
505-506				Repeat with natural circulation until CMT is completely heated.
601-606	CMT actuation with both steam lines, with and without noncondensible gas.	Discharge line resistance set for 6/16 gpm. Steam supply line no. 1 resistance set to be 3 ft/gpm^2.	1835 - constant	Reservoir water level "HI". Reservoir water temperature initially 545°F. Steam supply line no. 1 is open. Both steam supply line no. 2 and CMT discharge lines opened simultaneously. Performed with steam, and with 146 and 296 psig of He initially in CMT side of steam supply line no. 2.
607-612			1085 - constant	

9.0 TEST REPORTS AND DATA REQUIREMENTS

All test data shall be the property of Westinghouse Electric Corporation, and shall not be released, used, published, or otherwise disseminated without the express approval of the Company.

The test data is to be documented by means of two types of reports: a day-of-test report and a final test report.

9.1 Test Criteria

For each of the Matrix Tests identified in Section 8.3, specific test criteria will be provided by the test sponsor to the test group for each group of matrix tests prior to the actual performance of each test. The test criteria will include:

1. Initial conditions plus tolerance
2. Setpoints plus tolerance
3. All instruments operational (exceptions approved by the test sponsor)
4. List of critical instruments that must function during the test.
5. ΔP and P reference lines zeroed at end of test.

The actual test parameters (Items 1 and 2 above), exceptions (Items 3 and 4 above), and any change in ΔP/P following refill of the reference lines after the test; shall be attached to the Day of Test Report.

9.2 Day-of-Test Report

All data from collected from each test is to be provided to the test sponsor. Engineering as soon as practical following completion of a test run as a day-of-test report. This report shall include the following:

- Specific test criteria (as defined in Section 9.1) including:
    - Copy of the signed-off pre-test check list used in establishing the test initial conditions
    - Copy of the post-test validation check list

- Copy of any key instrument outputs used to establish test validity
- Copies of any notes pertinent to the performance of the test

- Copy of all the test data on the magnetic medium agreed to by the test sponsor and the test performer
- Channel Assignment Table, associating instruments with specific DAS channels and identifying other information pertinent to instrument identification, as required
- Reference to the calibration file, containing all information necessary to account for shifts in zero settings and convert raw instrument outputs from volts to engineering units

One such day-of-test report is to be provided for each test performed.

9.3 Final Test Report

Upon completion of testing, the test performer shall prepare and submit a final test report to the test sponsor. The final test report shall contain the following:

- Description of the test facility design, including engineering drawings, piping schematics, wiring schematics, and flow schematics
- Details of the instrumentation, including location and placement of instrumentation, data channel assignments, and instrumentation identification
- Description of the data acquisition system and data acquisition software capabilities
- Test matrices that were performed over the course of the experimental program
- A description of the facility operation, including the test procedure
- Data collected from the test program
- Experimental error and uncertainty analysis for the data that accounts for errors associated with instruments, the DAS, manufacturing tolerances, and other factors, as appropriate
- Description of any data reduction tasks performed
- Description and summary of the test verification tasks

The final test report will serve to summarize and formally transmit the experimental data collected as a result of the program.

10.0 QUALITY ASSURANCE REQUIREMENTS

Testing quality assurance shall conform to ANSI/ASME NQA-1-1986. As this is a safety related test, the Code of Federal Regulations, Title 10 Part 21, (10CFR21) is also applicable. To incorporate the requirements of NQA-1, the following measures shall be taken in the detailed test procedure:

A) Provisions for ensuring that those performing the tests are qualified and trained in the quality assurance requirements of this specification

B) Provisions for ensuring that changes to the test procedure are reviewed and approved to the same extent as the originals

C) Provisions for ensuring that the latest approved revisions of the test procedure are used

D) Provision for calibration of test equipment, traceable to recognized national standards; if no such standard exists, a description of the calibration method shall be included

E) Provisions for verification and configuration control of computer software (if any) used to collect or reduce test data

F) Provision for reporting and reconciling deviations from the approved test procedure

G) Provisions (such as a signed checklist) for ensuring that test prerequisites are met

H) Provisions for ensuring that necessary monitoring is performed and that test conditions are maintained (a test log containing periodic signed entries that include any pertinent observations or information not captured elsewhere is recommended)

I) Documented evaluation of test results by the test sponsor to ensure that test requirements were met

J) Identification in test records of items tested, date of test, instrumentation and data recorders, type of observation, results and acceptability, action taken in connection with noted deviations, and person who evaluates the test results