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TOKYO, JAPAN

December 10, 2008

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Attention: Mr. Jeffrey A. Ciocco

Docket No. 52-021
MHI Ref: UAP-HF-08280

Subject: **MHI's Response to NRC's Request for Additional Information on "Design Data for TRACE Assessment of MHI's 1/5th and 1/2 Scale Advanced Accumulator Test Facilities"**

References:
1) "Request for Additional Information RES No. 5 'Design Data for TRACE Assessment of MHI's 1/5th and 1/2 Scale Advanced Accumulator Test Facilities,'" dated November 12, 2008.
2) "REQUEST FOR ADDITIONAL INFORMATION RES TRACE," dated July 9, 2008.
3) Letter MHI Ref: UAP-HF-08143 from Y. Ogata (MHI) to U.S. NRC, "MHI's Response to NRC's Request for Additional Information on 'Design Data for TRACE Input Deck Preparation by ERI,'" dated August 8, 2008.
4) "REQUEST FOR ADDITIONAL INFORMATION RES TRACE No. 2," dated August 12, 2008.
5) Letter MHI Ref: UAP-HF-08178 from Y. Ogata (MHI) to U.S. NRC, "Additional MHI Responses to NRC's Request for Additional Information on 'Design Data for TRACE Input Deck Preparation by ERI,' Revision 1," dated September 8, 2008.
6) "Design Data for TRACE and MELCOR Input Deck Development," dated September 8, 2008.
7) Letter MHI Ref: UAP-HF-08186 from Y. Ogata (MHI) to U.S. NRC, "MHI's Responses to NRC's Request for Additional Information on 'Design Data for TRACE and MELCOR Input Deck Development,'" dated October 7, 2008.
8) "Request for Additional Information RES No. 4 Rev. 1 'Design Data for US-APWR TRACE Input Model Development,'" dated November 18, 2008.
9) Letter MHI Ref: UAP-HF-08279 from Y. Ogata (MHI) to U.S. NRC, "MHI's Responses to NRC's Request for Additional Information on 'Design Data for US-APWR TRACE Input Model Development,'" dated December 12, 2008.

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") a response entitled "MHI's Response to NRC's Request for Additional Information on 'Design Data for TRACE Assessment of MHI's 1/5th and1/2 Scale Advanced Accumulator Test Facilities'". The request for additional information ("RAI"), dated November 12, 2008 (Reference 1), represents the fifth RES Branch RAI to develop TRACE and MELCOR models of the US-APWR. (See References 2 through 9, which are associated with the previous four NRC requests and corresponding MHI responses.) The

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information in this response is only meant to address the thirteen items requested in Reference 1. The complete set of information for the TRACE and MELCOR input deck development will be obtained from the combination of this response and the responses previously provided in References 3, 5, 7, and 9.

As indicated in the enclosed materials, this document contains information that MHI considers proprietary, and therefore should be withheld from public disclosure pursuant to 10 C.F.R. § 2.390 (a)(4) as trade secrets and commercial or financial information which is privileged or confidential. A non-proprietary version of the document is also being submitted in this package (Enclosure 3). In the non-proprietary version, the proprietary information, bracketed in the proprietary version, is replaced by the designation "[ ]".

This letter includes a copy of the proprietary version (Enclosure 2), a copy of non-proprietary version (Enclosure 3), an Optical Storage Media ("OSM") containing requested electronic data files (Enclosure 4), and the Affidavit of Yoshiki Ogata (Enclosure 1) which identifies the reasons MHI respectfully requests that all materials designated as "Proprietary" in Enclosures 2 and 4 be withheld from public disclosure pursuant to 10 C.F.R. § 2.390 (a)(4).

Please contact Dr. C. Keith Paulson, Senior Technical Manager, Mitsubishi Nuclear Energy Systems, Inc. if the NRC has questions concerning any aspect of this submittal. His contact information is provided below.

Sincerely,

Y. Ogata

Yoshiki Ogata,
General Manager - APWR Promoting Department
Mitsubishi Heavy Industries, LTD.

Enclosures:

1. Affidavit of Yoshiki Ogata
2. MHI's Response to NRC's Request for Additional Information on "Design Data for TRACE Assessment of MHI's 1/5th and 1/2 Scale Advanced Test Facilities" (proprietary)
3. MHI's Response to NRC's Request for Additional Information on "Design Data for TRACE Assessment of MHI's 1/5th and 1/2 Scale Advanced Test Facilities" (non-proprietary)
4. OSM: Advanced Accumulator Test Facility Data (proprietary)

CC: J. A. Ciocco
C. K. Paulson

Contact Information
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ENCLOSURE 1

Docket No.52-021
MHI Ref: UAP-HF-08280

MITSUBISHI HEAVY INDUSTRIES, LTD.

AFFIDAVIT

I, Yoshiki Ogata, being duly sworn according to law, depose and state as follows:

1. I am General Manager, APWR Promoting Department, of Mitsubishi Heavy Industries, Ltd ("MHI"), and have been delegated the function of reviewing MHI's US-APWR documentation to determine whether it contains information that should be withheld from disclosure pursuant to 10 C.F.R. § 2.390 (a)(4) as trade secrets and commercial or financial information which is privileged or confidential.

2. In accordance with my responsibilities, I have reviewed the enclosed "MHI's Response to NRC's Request for Additional Information on 'Design Data for TRACE Assessment of MHI's 1/5th and1/2 Scale Advanced Accumulator Test Facilities'" and have determined that portions of the report contain proprietary information that should be withheld from public disclosure. Those pages containing proprietary information are identified with the label "Proprietary" on the top of the page and the proprietary information has been bracketed with an open and closed bracket as shown here "[ ]". The first page of the technical report indicates that all information identified as "Proprietary" should be withheld from public disclosure pursuant to 10 C.F.R. § 2.390 (a)(4).

3. The information in the report identified as proprietary by MHI has in the past been, and will continue to be, held in confidence by MHI and its disclosure outside the company is limited to regulatory bodies, customers and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and is always subject to suitable measures to protect it from unauthorized use or disclosure.

4. The basis for holding the referenced information confidential is that it describes the unique codes and files developed by MHI for the fuel of the US-APWR and also contains information provided to MHI under license from the Japanese Government. These codes and files were developed at significant cost to MHI, since they required the performance of detailed calculations, analyses, and testing extending over several years. The referenced information is not available in public sources and could not be gathered readily from other publicly available information. MHI knows of no way the information could be lawfully acquired by organizations or individuals outside of MHI and the Japanese Government.

5. The referenced information is being furnished to the Nuclear Regulatory Commission ("NRC") in confidence and solely for the purpose of supporting the NRC staff's review of MHI's Application for certification of its US-APWR Standard Plant Design.

6. Public disclosure of the referenced information would assist competitors of MHI in their design of new nuclear power plants without the costs or risks associated with the design of new fuel systems and components. Disclosure of the information identified as proprietary would therefore have negative impacts on the competitive position of MHI in

the U.S. nuclear plant market.

I declare under penalty of perjury that the foregoing affidavit and the matters stated therein are true and correct to the best of my knowledge, information and belief.

Executed on this 10th day of December, 2008.

Y. Ogata

Yoshiki Ogata,
General Manager- APWR Promoting Department
Mitsubishi Heavy Industries, LTD.

Enclosure 3

UAP-HF-08280

MHI's Response to NRC's Request for Additional Information on "Design Data for TRACE Assessment of MHI's 1/5th and 1/2 Scale Advanced Accumulator Test Facilities"

December 2008
(Non-Proprietary)

INTRODUCTION

This report documents MHI's response to the NRC's request for additional information (RAI) on "Design Data for TRACE Assessment of MHI's 1/5TH and 1/2 Scale Advanced Accumulator Test Facilities" dated November 12, 2008. This RAI represents the fifth request for additional information by Energy Research, Inc. (ERI) for the development of a TRACE and MELCOR model of the US-APWR. The first four requests were received from the NRC in letters dated July 9, 2008, August 12, 2008, September 8, 2008, and November 18, 2008. The responses to these requests were sent in MHI letters UAP-HF-08143-P (R0) dated August 8, 2008, UAP-HF-08143-P (R1) dated September 8, 2008, UAP-HF-08186-P (R0) dated October 7, 2008, and UAP-HF-08279-P (R0) dated December 12, 2008, respectively.

This document provides a complete response to all thirteen items related to the TRACE Assessment of MHI's Advanced Accumulator Test Facilities in the November 12, 2008 request.

REQUEST-1 (1/5th scale advanced accumulator test facility)

Wall thickness of the test tank

RESPONSE

The wall thickness of the test tank is 12 mm.

REQUEST-2 (1/5th scale advanced accumulator test facility)

Flow areas of the ball and gate valves

RESPONSE

The ball valve was used as an isolation valve; it was fully-closed before testing and fully-opened just after starting the test. The gate valve was used as a resistance control valve and its opening was adjusted before each test. The flow area of the ball valve and gate valve in each test case is shown below. These flow areas are estimated by a calculation with the use of the valve stroke and port diameter at the fully-opened position in each test.

	Port diameter of valve (m)	Flow area in the test (m^2)		
		T.No.1/5-2-1 Initial Pressure 128 psig	T.No.1/5-2-2 Initial Pressure 29 psig	T.No.1/5-2-3 Initial Pressure 42 psig
Ball valve	[			]
Gate valve	[			]

REQUEST-3 (1/5th scale advanced accumulator test facility)

Temperature measurements of the gas in the test tank (in electronic form)

RESPONSE

The required test data are provided in electronic form in the following files:

1/5 scale test data files

001_5th_gt_2-1.xls

002_5th-gt_2-2.xls

003_5th-gt_2-3.xls

REQUEST-4 (1/5th scale advanced accumulator test facility)

The test data is inconsistent for all three 1/5th scale tests we are investigating (Tests 2-1, 2-2 and 2-3). Specifically, the flow rate is inconsistent with the test tank water level. As an example, in Test 2-1, the volumetric flow rate (given in units of m^3/s) integrated over the first 9.8 s (just prior to the flow rate switch) is 0.237 m^3. The water level during this time drops from 1.06 m to 0.68 m. Given the test tank diameter of 1.0 m and a level drop of 0.38 m, this results in a loss of liquid of 0.298 m^3, which is about 26% higher than that based on the flow rate measurement.

a) Describe how the flow rate is measured
b) Provide the uncertainty on all of the measurements

RESPONSE

The scale of the flow damper and standpipe is 1/5 in both the longitudinal and lateral directions. However, the existing tank which had a large diameter and a scale in the lateral direction which was larger than 1/5 was used as the test tank. Therefore, the volume of the large flow area and the small flow area was not 1/125 of the actual accumulator tank. Consequently, a "hollow insert" was attached in the test tank in order to adjust the tank water volume and simulate the proper large flow volume and small flow volume.

The hollow insert used for the water volume adjustment is shown in Figure 4-1. The cross-sectional area eliminated by the hollow insert is [ ] m^2 in the large flow area and [ ] m^2 in the small flow area. Therefore, in calculating the volumetric flow rate by multiplying the difference in water level and tank cross-sectional area, these eliminated areas should be subtracted from the tank cross-sectional area ($\pi/4 \cdot 1^2$ m^2).

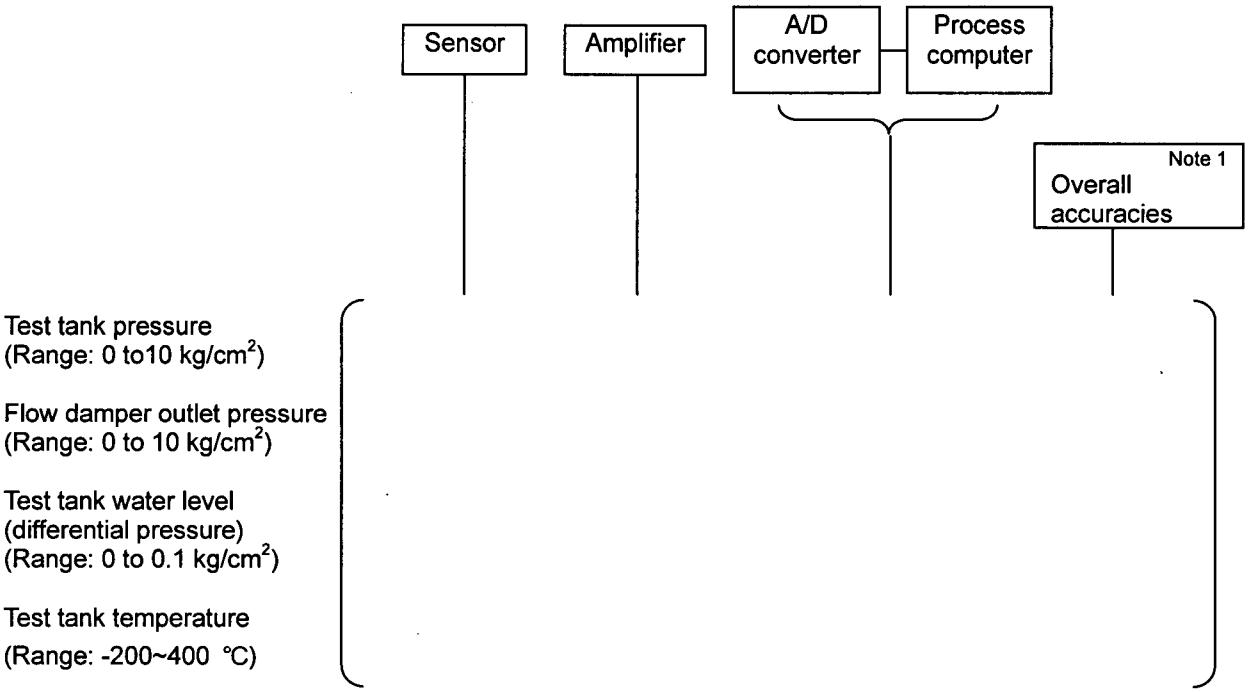
a) The volumetric flow rate was calculated as shown in the following expression using test tank water level data.

$$Qn=(L_{n-1}-L_{n+1}) \cdot (\pi \cdot Dt^2/4-A)/(T_{n+1}-T_{n-1})$$

Where,

Qn:	Flow rate at time T_n (m^3/s)
T_{n+1}	Time at n+1
T_{n-1}	Time at n-1
L_{n-1}	Test tank water level at time Tn-1 (m)
L_{n+1}	Test tank water level at time Tn+1 (m)
Dt	Test tank inner diameter (1m)
A	Area eliminated by the hollow insert (Large flow area:[ ] m^2, Small flow area:[ ] m^2)

b) The accuracies of all instruments are shown below.



Note 1: Overall accuracies were calculated by the square-root of the sum of the squares of the accuracy of each element.

Figure 4-1 Hollow Insert Assembly Drawing (1/5 scale model)

REQUEST-5 (1/5th scale advanced accumulator test facility)

Roughness of the injection pipe

RESPONSE

The roughness of the injection pipe was not measured. Commercial carbon steel pipe was used for the injection pipe. The roughness of commercial steel pipe is given as 0.05 mm on page A-23 of Crane Technical Paper 410, "Flow of Fluids" (Reference 1).

Reference 1: Flow of Fluids Through Valves Fittings and Pipe, "Crane Technical Paper" No. 410, 1999.

REQUEST-6 (1/5th scale advanced accumulator test facility)

Detailed drawing of the 1/5th scale test, in particular, detailed throat dimensions of the injection pipe

RESPONSE

Detailed drawings of the 1/5th scale test equipments are shown as follows:

Figure 6-1 Test Tank Assembly Drawing (1/5 scale model)
Figure 6-2 Flow Damper Assembly Drawing (1/5 scale model)
Figure 6-3 Standpipe of 1/5 Scale Model

Figure 6-1 Test Tank Assembly Drawing (1/5 scale model)

Figure 6-2 Flow Damper Assembly Drawing (1/5 scale model)

Figure 6-3 Standpipe of 1/5 Scale Model

REQUEST-7 (1/2 scale advanced accumulator test facility)

Wall thickness of the test tank

RESPONSE

The wall thickness of the test tank is 48 mm (45 mm of carbon steel plate with 3 mm of stainless steel cladding).

REQUEST-8 (1/2 scale advanced accumulator test facility)

Roughness of the injection pipe

RESPONSE

The roughness of the injection pipe was not measured. Commercial stainless steel pipe was used for the injection pipe. The roughness of commercial steel pipe is given as 0.05 mm on page A-23 of Crane Technical Paper 410, "Flow of Fluids" (Reference 1).

Reference1: Flow of Fluids Through Valves Fittings and Pipe, "Crane Technical Paper" No. 410, 1999.

REQUEST-9 (1/2 scale advanced accumulator test facility)

Dimensions of the test tank including height of the cylindrical section and height of the top/bottom hemispherical heads

RESPONSE

Figure 9-1 shows the test tank outline drawing with detailed dimensions.

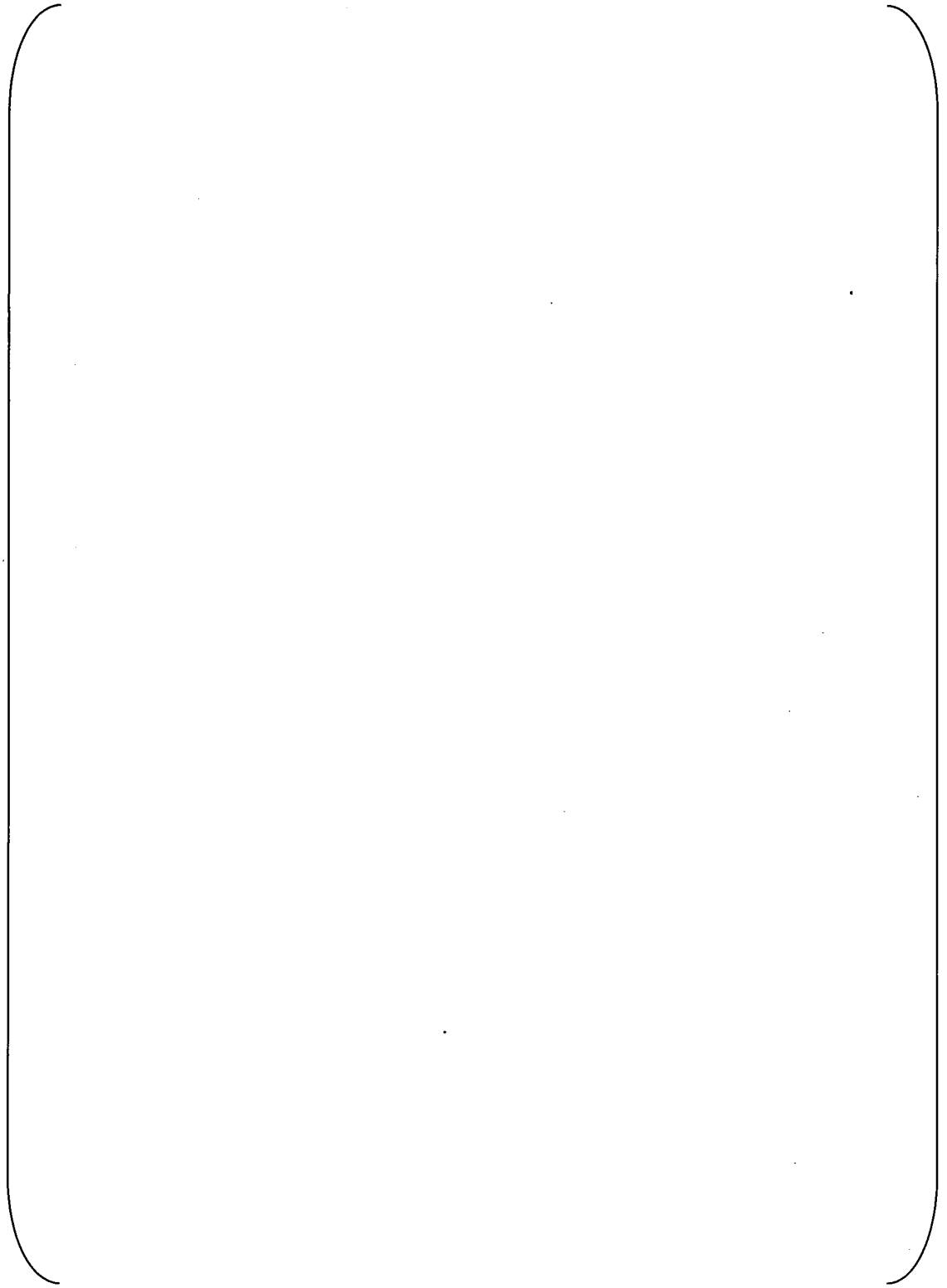


Figure 9-1 Full-Height 1/2 Scale Model Test Tank Outline Drawing

REQUEST-10 (1/2 scale advanced accumulator test facility)

Elevations of the water level measurements in the test tank and the standpipes

RESPONSE

The pipe arrangement drawing describing the detailed mounting location of the test tank differential pressure transducer for water level measurements is shown in Figure 10-1.

The standpipe outline drawing is shown in Figure 10-2. The water level in the standpipe was measured using twenty-two electrodes located along the vertical line on the wall of the standpipe, as shown in Figure 10-2 (refer to No. 11 Water Level Gauge Connection). Every electrode generates a signal output when it is submerged under water and stops when it is exposed. Therefore, the circular marks on the curves of the transient of the water level in the standpipe (Figure 4.2.4-5 to 4.2.4-11 in the topical report) indicate that the electrodes attached at the corresponding levels are submerged in water.

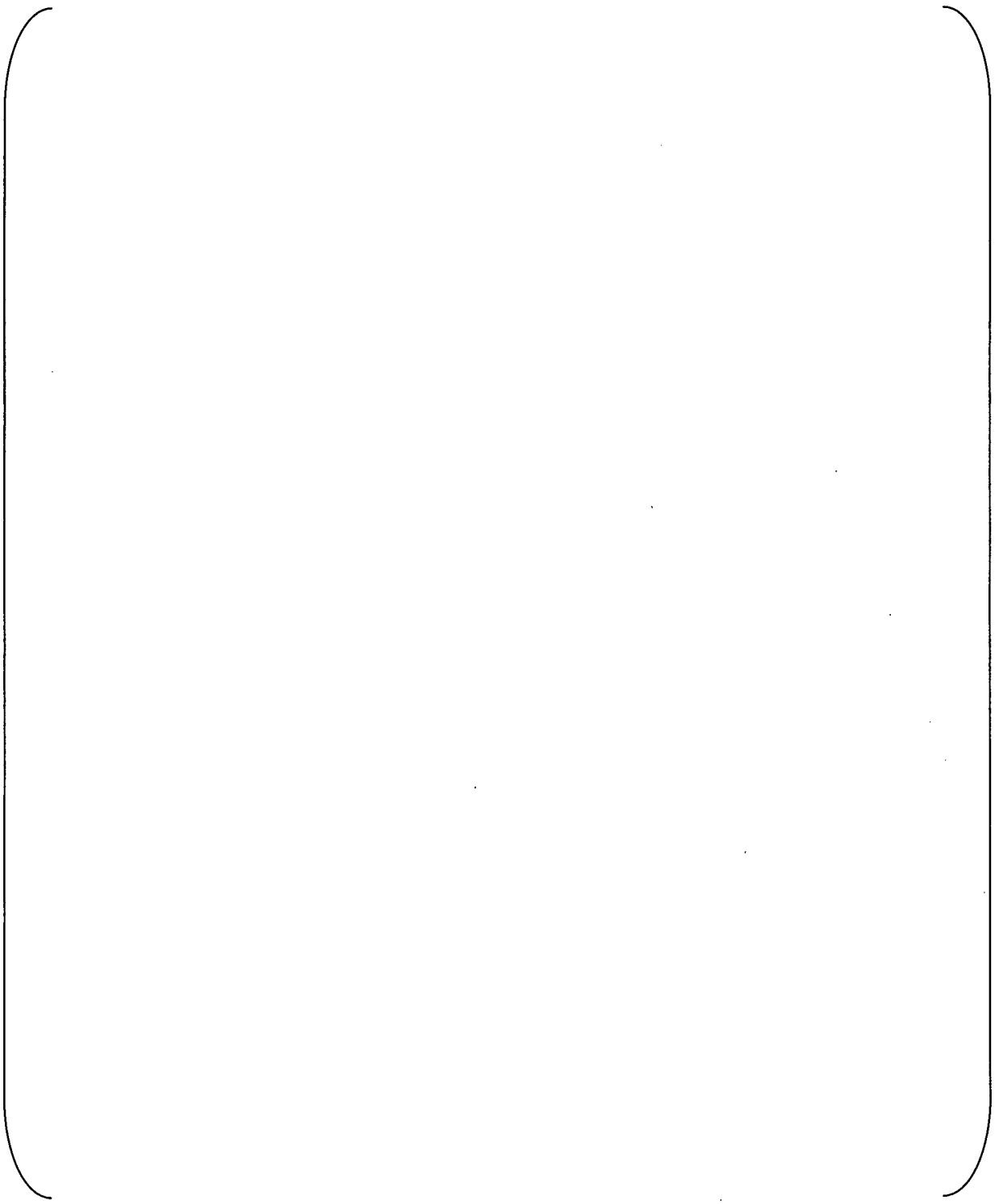


Figure 10-1 Full-Height 1/2 Scale Model Test Tank Differential Pressure Transducer and Piping Arrangement Drawing

Figure 10-2 Standpipe (Full Height 1/2 scale model)

REQUEST-11 (1/2 scale advanced accumulator test facility)

Flow areas of the ball and gate valves

RESPONSE

The ball valve was used as an isolation valve; it was fully-closed before testing and fully-opened just after starting the test. The gate valve was used as a resistance control valve and its opening was adjusted before each test. The flow area of the ball valve and gate valve in each test case is shown below. These flow areas are estimated by a calculation with the use of the valve stroke and port diameter at the fully-opened position in each test.

	Port diameter of valve (m)	Flow area in the test (m^2)
Ball valve	[	]
Gate valve		

Note) Each flow area is the same for test cases 1 to 7.

REQUEST-12 (1/2 scale advanced accumulator test facility)

Temperature measurements at the top of the test tank (as shown in Figure 4.2.4-1 on page 4.2.4-2 of "*The Advanced Accumulator*", MUAP-07001-P(R1)) in electronic form

RESPONSE

The required test data are provided in electronic form in the following files:

1/2 scale test data files

004_f-h_case1.xls
005_f-h_case2.xls
006_f-h_case3.xls
007_f-h_case4.xls
008_f-h_case5.xls
009_f-h_case6.xls
010_f-h_case7.xls

REQUEST-13 (1/2 scale advanced accumulator test facility)

Flow rate data for the 1/2 scale tests (which was not included in UAP-HF-08143, Rev.1) in electronic form

RESPONSE

The required test data are provided in electronic form in the following files (these are the same as the files shown on the preceding page):

1/2 scale test data files

004_f-h_case1.xls
005_f-h_case2.xls
006_f-h_case3.xls
007_f-h_case4.xls
008_f-h_case5.xls
009_f-h_case6.xls
010_f-h_case7.xls