

*\*\*original*

6-27-00  
Jda (20)  
Page 1 of 2

### ENGINEERING CHANGE NOTICE

1. ECN **661407**  
Proj. ECN

2. ECN Category (mark one)  <input type="checkbox"/> Supplemental <input checked="" type="checkbox"/> Direct Revision <input type="checkbox"/> Change ECN <input type="checkbox"/> Temporary Standby <input type="checkbox"/> Supersedure <input type="checkbox"/> Cancel/Void	3. Originator's Name, Organization, MSIN, and Telephone No. T. Nuxall, CVDF, R3-86, 372-3739	4. USQ Required? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	5. Date 6/26/00	
	6. Project Title/No./Work Order No. SNF/W-441 Spent Nuclear Fuel Cold Vacuum Drying	7. Bldg./Sys./Fac. No. CVDF 142-K	8. Approval Designator S <sup>N</sup> Q	
	9. Document Numbers Changed by this ECN (includes sheet no. and rev.) SNF-4896, Rev. 0	10. Related ECN No(s). N/A	11. Related PO No. N/A	

12a. Modification Work  <input type="checkbox"/> Yes (fill out Blk. 12b) <input checked="" type="checkbox"/> No (NA Blks. 12b, 12c, 12d)	12b. Work Package No. N/A	12c. Modification Work Complete  N/A  Design Authority/Cog. Engineer Signature & Date	12d. Restored to Original Condition (Temp. or Standby ECN only)  N/A  Design Authority/Cog. Engineer Signature & Date
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13a. Description of Change

13b. Design Baseline Document?  Yes  No

**HOOD SEIMIC TEST SPECIFICATION**

Revision to meet current design media and incorporation of CGI ECN's.

USQ Approval: (See Pg. 2, Blk. 21)  
 \*\*Unable to access original due to closure of Hanford Site, north of 300A - 6/28-29 brush

14a. Justification (mark one)

Criteria Change  Design Improvement  Environmental  Facility Deactivation   
 As-Found  Facilitate Const  Const. Error/Omission  Design Error/Omission

14b. Justification Details

Incorporation of prior ECNs.

The design verification method for SC/SS components is by independent review in accordance with EN-6-027-01. Documentation of this review is accomplished by the independent review approval signature provided on page 2 of this ECN.

15. Distribution (include name, MSIN, and no. of copies)  
 See distribution sheet.

RELEASE STAMP

JUN 29 2000

DATE: JUN 29 2000  
 STA: 15

HANFORD RELEASE

ID: 20

# ENGINEERING CHANGE NOTICE

1. ECN (use no. from pg. 1)

Page 2 of 2

661407

<b>16. Design Verification Required</b>  <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<b>17. Cost Impact</b>  <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; text-align: center;">ENGINEERING</td> <td style="width: 50%; text-align: center;">CONSTRUCTION</td> </tr> <tr> <td>Additional <input type="checkbox"/> \$</td> <td>Additional <input type="checkbox"/> \$</td> </tr> <tr> <td>Savings <input type="checkbox"/> \$</td> <td>Savings <input type="checkbox"/> \$</td> </tr> </table>	ENGINEERING	CONSTRUCTION	Additional <input type="checkbox"/> \$	Additional <input type="checkbox"/> \$	Savings <input type="checkbox"/> \$	Savings <input type="checkbox"/> \$	<b>18. Schedule Impact (days)</b>  Improvement <input type="checkbox"/> Delay <input type="checkbox"/>
ENGINEERING	CONSTRUCTION							
Additional <input type="checkbox"/> \$	Additional <input type="checkbox"/> \$							
Savings <input type="checkbox"/> \$	Savings <input type="checkbox"/> \$							



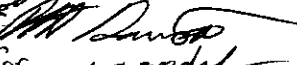
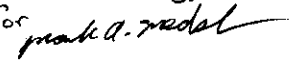

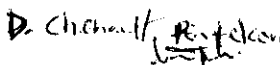
**19. Change Impact Review:** Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 13. Enter the affected document number in Block 20.

SDD/DD <input type="checkbox"/>	Seismic/Stress Analysis <input type="checkbox"/>	Tank Calibration Manual <input type="checkbox"/>
Functional Design Criteria <input type="checkbox"/>	Stress/Design Report <input type="checkbox"/>	Health Physics Procedure <input type="checkbox"/>
Operating Specification <input type="checkbox"/>	Interface Control Drawing <input type="checkbox"/>	Spares Multiple Unit Listing <input type="checkbox"/>
Criticality Specification <input type="checkbox"/>	Calibration Procedure <input type="checkbox"/>	Test Procedures/Specification <input type="checkbox"/>
Conceptual Design Report <input type="checkbox"/>	Installation Procedure <input type="checkbox"/>	Component Index <input type="checkbox"/>
Equipment Spec. <input type="checkbox"/>	Maintenance Procedure <input type="checkbox"/>	ASME Coded Item <input type="checkbox"/>
Const. Spec. <input type="checkbox"/>	Engineering Procedure <input type="checkbox"/>	Human Factor Consideration <input type="checkbox"/>
Procurement Spec. <input type="checkbox"/>	Operating Instruction <input type="checkbox"/>	Computer Software <input type="checkbox"/>
Vendor Information <input type="checkbox"/>	Operating Procedure <input type="checkbox"/>	Electric Circuit Schedule <input type="checkbox"/>
OM Manual <input type="checkbox"/>	Operational Safety Requirement <input type="checkbox"/>	ICRS Procedure <input type="checkbox"/>
FSAR/SAR <input type="checkbox"/>	IEFD Drawing <input type="checkbox"/>	Process Control Manual/Plan <input type="checkbox"/>
Safety Equipment List <input type="checkbox"/>	Cell Arrangement Drawing <input type="checkbox"/>	Process Flow Chart <input type="checkbox"/>
Radiation Work Permit <input type="checkbox"/>	Essential Material Specification <input type="checkbox"/>	Purchase Requisition <input type="checkbox"/>
Environmental Impact Statement <input type="checkbox"/>	Fac. Proc. Samp. Schedule <input type="checkbox"/>	Tickler File <input type="checkbox"/>
Environmental Report <input type="checkbox"/>	Inspection Plan <input type="checkbox"/>	
Environmental Permit <input type="checkbox"/>	Inventory Adjustment Request <input type="checkbox"/>	

**20. Other Affected Documents:** (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision	Document Number/Revision	Document Number Revision
NA		

**21. Approvals**

Signature	Date	Signature	Date
Design Authority C. Miska 	6/28/00	Design Agent	_____
Cog. Mgr. C. Haller 	6/29/00	QA	_____
QA H. Chaffin 	6/28/00	Safety	_____
Safety J. Brehm  for Mark A. Medel	6/29/00	Design	_____
Environ. N/A		Environ.	_____
Independent Reviewer C. Van Katwijk 	6/29/00	Other	_____
* _____			
• Approval authorized parallel preparation of USQ screen with Implementation of ECN per EN-4-01.			
Information D. Chenault 	6/28/00	<b>DEPARTMENT OF ENERGY</b>	
		Signature or a Control Number that tracks the Approval Signature	
<b>ADDITIONAL</b>			
_____			
_____			

## DISTRIBUTION SHEET

<b>To</b> Distribution	<b>From</b> SNF-CVD	<b>Page</b> 1 <b>of</b> 1
<b>Project Title/Work Order</b> W-441, Hood Seismic Test Specification		<b>Date</b> 6/25/00
		<b>EDT No.</b>
		<b>ECN No.</b> 661407

Name	MSIN	Text With All Attach.	Text Only	Attach./Appendix Only	EDT/ECN Only
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# Seismic Test Specification for Safety Class CVD Process Hood Components

Prepared for the U.S. Department of Energy  
Assistant Secretary for Environmental Management

Project Hanford Management Contractor for the  
U.S. Department of Energy under Contract DE-AC06-96RL13200

**Fluor Hanford**

P.O. Box 1000

Richland, Washington

# Seismic Test Specification for Safety Class CVD Process Hood Components

Project No: W-441

Document Type: SpecP

Division: SNF

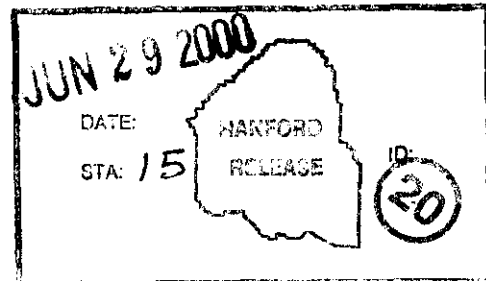
C. Van Katwijk  
Fluor Hanford, Inc.

Date Published  
June 2000

Prepared for the U.S. Department of Energy  
Assistant Secretary for Environmental Management

Project Hanford Management Contractor for the  
U.S. Department of Energy under Contract DE-AC06-96RL13200

**Fluor Hanford**  
P.O. Box 1000  
Richland, Washington



*Jamie Arndal* 6-29-00  
Release Approval Date

Release Stamp

SNF-4896  
Revision 1

**Key Words:** SNF, Project W-441

**Abstract:** The purpose of the tests is to seismically qualify the Safety Class Process Hood Components in the Cold Vacuum Drying Facility (CVDF).

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Printed in the United States of America

Total Pages: 45

**RECORD OF REVISION**

(1) Document Number  
SNF-4896

Page 1

(2) Title  
Seismic Test Specifications for Safety Class CVD Process Hood Components

**Change Control Record**

(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release		
		(5) Cog. Engr.	(6) Cog. Mgr.	Date
0	(7) EDT 629007, INITIALLY RELEASED	C. Miska	T. Choho	
1 <b>RS</b>	ECN 661407, INCORPORATION OF DESIGN REQUIREMENTS AND PRIOR ECNS	<i>C. Miska</i>	<i>T. Choho</i>	6-29-00



**SNF-4896, Rev. 1**

**SEISMIC TEST SPECIFICATIONS  
FOR  
SAFETY CLASS CVD PROCESS HOOD COMPONENTS**

*Prepared for*

**Fluor Hanford, Inc.**

June 2000

**altran**

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## SEISMIC TEST SPECIFICATIONS FOR SAFETY CLASS CVD PROCESS HOOD COMPONENTS

### 1.0 PURPOSE OF SEISMIC TESTS

The purpose of the tests is to seismically qualify the Safety Class Process Hood Components in the Cold Vacuum Drying Facility (CVDF).

### 2.0 TEST SPECIMEN

The test specimens of the Process Hood Components are to be supplied by Olympic Tool & Engineering (OTE). The safety class Process Hood components designated for shake table testing are listed in Attachment C. These specimens are divided into two testing groups (Groups A and B) with different Required Response spectrum (RRS). They are supported by rigid test fixtures supplied by the OTE. The components are supplied with their associated mounting brackets and piping stubs needed to simulate installed service conditions. The shake table mounting details are shown in Section 6.0.

### 3.0 APPLICABLE CODES AND STANDARDS

The applicable code and standard for the seismic, fragility and functional tests are as follows.

Institute of Electrical and Electronic Engineers (IEEE)

IEEE Std. 344-1987, "Recommended Practices for Seismic Qualification of Safety Class Equipment for Nuclear Power Generating Stations."

Code of Federal Regulations

10CFR50 Appendix B, "Quality Assurance Criteria for Nuclear Power Plants."

DOE Standards

DOE Standard 1020-94, "Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities."

American National Standard Institute (ANSI)

ANSI/ASME B31.3, "Chemical Plant and Petroleum Refinery Piping."

American Society of Mechanical Engineers (ASME)

ASME Boiler and Pressure Vessel Code, Section V, Article 10, "Leak Testing."

#### **4.0 SEISMIC TEST REQUIREMENTS**

The seismic tests, which include DBE and fragility tests, should be performed in accordance with the Technical Requirements as described in Attachment A.

#### **5.0 REQUIRED SEISMIC RESPONSE SPECTRA**

The CVD Process Hood components have been divided into two groups, Group A and Group B, for shake table testing. The horizontal and vertical DBE RRS for Group A components (Specimen Items 1 through 4 in Attachment C) are shown on Sht. B-2 of Attachment B. The horizontal and vertical DBE RRS for Group B components (Specimen Items 5 through 14 in Attachment C) are shown on Sht. B-3 of Attachment B. The damping ratio associated with all DBE RRS is 5%. The 5% damping TRS of each run shall envelop the corresponding 5% damping DBE RRS.

The fragility test spectra are 20% and 40% over the corresponding DBE RRS. The purpose of the fragility tests is to provide additional margin for future probabilistic type of design assessment and to cover the variance of the commercial grade items. It will also help in addressing the effect of higher ground motion at low probability.

#### **6.0 SPECIMEN MOUNTING**

There are two types of mounting details for the CVD Process Hood components. The components mounted directly to the Process Hood support frame shall be mounted directly to a rigid test fixture (provided by OTE) using the mounting hardware provided by OTE. For the components mounted in-line with piping, they will be mounted to pipe stub (provided by OTE). The pipe stub shall be welded to rigid mounting blocks (such as angle sections) provided by the OTE, then welded or rigidly bolted to a rigid test fixture (provided by the OTE). The rigid test fixture shall then be rigidly attached (welded, bolted or clamped) to the shake table. See Attachment D for mounting details.

#### **7.0 ACCELEROMETERS**

There shall be three (3) control accelerometers, one vertical and two horizontals, located on the shake table. There shall be two sets of response accelerometers, one vertical and two horizontals per set, located in the middle and at the top of the test fixture. The exact locations of the accelerometers will be directed by OTE representatives before mounting.

## 8.0 FUNCTIONAL TESTS

The functional tests shall be performed in accordance with Attachment C. The same functional test shall be performed before and after each DBE and fragility tests. No functional monitoring during the DBE and fragility tests is required.

Note that the applied pressures of all leakage tests (part of the functional tests) performed in the seismic laboratory are normal operating pressures or functional pressures specified in Attachment C. To complete the dedication requirement specified in the CGI forms of the tested specimens, the leakage test for the 110% design pressure should be performed by OTE after all seismic tests.

## 9.0 TEST REPORT AND DELIVERABLES

After successful completion of the seismic, fragility and functional tests, the final test report and other deliverables, such as TRS digitized time-histories and videotapes, shall be delivered to OTE within fourteen (14) days. The minimum requirements of the test report are provided in Section A8.0 of Attachment A. The final test report will be subject to acceptance by OTE.

**ATTACHMENT A**  
**TECHNICAL REQUIREMENTS FOR SEISMIC QUALIFICATION OF**  
**SAFETY CLASS PROCESS HOOD COMPONENTS BY TESTING**

**A1.0 GENERAL**

This procedure describes the test requirements to seismically qualify Safety Process Hood Components by testing. The seismic performance goal of the equipment is assigned to Performance Category 3 (PC-3) in accordance with HNF-SD-SNF-DRD-002, Rev. 4. In addition, the Seismic Qualification Conditions are defined as follows:

Condition A: Maintain critical function before and after seismic event.

Condition B: Maintain pressure boundary before and after seismic event.

**A2.0 WORK INCLUDED (TEST LABORATORY'S RESPONSIBILITIES)**

1. Furnishing all equipment, personnel and facilities to perform the tests covered by these requirements.
2. Preparation of detailed test procedures (to be approved by OTE prior to testing).
3. Preparation of test reports describing the performance and results of these tests.
4. Control of all test instrumentation so that calibration and accuracy of test data can be verified.

**A3.0 WORK NOT INCLUDED (OTE'S RESPONSIBILITIES)**

1. Supplying test specimens and a rigid test fixture to accommodate them.
2. Supplying required response spectra for testing.
3. Development of test acceptance criteria and device functional test requirements.
4. Review and acceptance of Test laboratory's test procedures, inspection report and test report.
5. For fragility testing, a reference or starting RRS would be provided.

**A4.0 APPLICABLE CODES AND STANDARDS**

See Section 3.0 of the test specifications.

**A5.0 TEST REQUIREMENTS**

**A5.1 Test Sequences**

Tests are to be performed in the following sequences:

1. Pre-seismic test inspection and functional tests.
2. Low level exploratory test

3. Seismic tests, including DBE and fragility tests.
4. Post-seismic test inspection and functional tests after each of the DBE and fragility tests.

#### **A5.2 Witness of Tests**

At least two weeks prior to the start of testing, Mike Laffey of OTE and Carl Van Katwijk of Fluor Hanford shall be notified so that they may have representatives on hand to witness the testing. Mr. Laffey and Mr. Van Katwijk's addresses and phone numbers are as follows:

Mike Laffey  
Olympic Tool & Engineering  
W 21 Sanderson Way  
Shelton, WA 98584  
(360) 426-7878

Carl Van Katwijk  
Fluor Hanford  
Building 2752E  
Route 4, Baltimore Ave.  
Richland, WA 99352  
(509) 376-9385

#### **A5.3 Pre-Seismic Test Inspection and Functional Tests**

Prior to testing, the test specimens are to be visually inspected for general condition and evidence of damage or defects. The condition of each test specimen is to be noted. Any functional checks called for in Attachment C are to be performed and the results shall be noted in the test report.

#### **A5.4 Device Mounting and Accelerometers**

In the vibration tests described below, the test specimens are to be mounted on a shake table as shown in Section 6.0 of the test specifications. The specimens are to be mounted to a rigid test fixture, which will be securely fastened to the shake table with the type of mounting noted for inclusion in the test report. The fasteners or welds used for the mounting are to be periodically checked during the tests to ensure that they remain secure. Accelerometers shall be installed in accordance with Section 7.0 of the test specifications.

#### **A5.5 Low Level Exploratory Tests**

The low-level exploratory test is to be performed on the CVD Process Hood components prior to the seismic tests in order to ensure the soundness of the mounting arrangements and also to ensure that the test fixture will not amplify the table motions. The test shall consist of low level random triaxial table motion. Table motion shall be approximately 1/3 of the DBE RRS (in Attachment B). Any visual observations during this test shall be noted. If any modification to the component mounting is required, a second low level exploratory test may be performed.

## A5.6 Seismic Tests

### A5.6.1 Random Input Seismic Tests using DBE RRS

In accordance with Section 2.4.1 of DOE STD-1020, OBE tests are not required. Therefore, two to three Design Basis Earthquake (DBE) random Input tests are to be performed with components at different stages (such as energized or de-energized) as shown on Sht. C-2 or Attachment C. Each DBE test shall consist of a random triaxial seismic simulation by exposure to a 20 to 25 second input motion in two horizontal and one vertical directions simultaneously. The ramp-up time of the input motion shall be longer than 1.5 seconds. The strong motion duration of the input motion shall be between 10 and 12 seconds. The decay time duration shall be approximately 7 seconds. The correlation coefficient function of any two orthogonal motions shall be less than 0.3. The TRS of each run shall envelop the corresponding DBE RRS. The responses of the test specimens shall be monitored. Any sign of malfunction or damage to the test specimens shall be noted.

The test specimens are divided into two groups (Groups A and B) and are to be tested separately. The DBE RRS curves and digitized values for each group are shown in Attachment B. The DBE RRS curves are the envelope of the response spectra at the locations of the Safety Class Process Hood components in each of Groups A and B, and the horizontal RRS are the envelope of N-S and E-W directions. They have also been peak broadened (+/-) 15% in accordance with Section 2.4.1 of DOE STD-1020. The multiplication factor of 1.4 for PC-3 equipment as specified in the same DOE standard has also been used.

Before starting the first DBE test, the control (shake table) TRS of a trial run (without the test specimens) shall be submitted to OTE witness personnel for review.

### A5.6.2 Random Input Fragility Tests

Perform two fragility tests as described in section 5.6.1 with 20% and 40% increases, respectively, in the DBE input motion level. The component stages at each fragility test are shown in Attachment C.

## A5.7 Post Seismic Test Inspection and Functional Tests

Following the completion of each of the DBE and fragility tests, the test specimens are to be visually inspected for general condition and evidence of damage. The functional tests described in Attachment C are to be performed. The results of the inspection and functional tests are to be noted for inclusion in the test report. Note that no functional test is required after the low-level exploratory test.



## **A6.0 TEST INSTRUMENTATION**

### **A6.1 General**

All instrumentation used for the tests described herein shall have a valid calibration that is traceable to the National Institute of Standards and Technology (NIST). The following specifications are the minimum acceptable. A list of all instrumentation used along with its date of calibration shall be included in the final test report.

### **A6.2 Accelerometers and Signal Conditioning Equipment**

Accelerometers shall have a frequency response of 0.2 to 500 Hz and shall be of a type suitable for the tests described. Amplitude response shall be within linearity limits up to 50 g's. Accuracy along with signal conditioning equipment shall be at least +/-5.0%.

### **A6.3 Shock Spectrum Analyzer**

The shock spectrum analyzer shall have the capability of analyzing accelerometer inputs and producing a plot of amplitude versus frequency over the range of 0.1 to 100 g's and 1 to 100 Hz. The spectrum shall represent the response of single degree of freedom filters for discrete frequencies with a maximum spacing of 1/6 octave between filters.

### **A6.4 Recorders**

Strip chart recorders shall be used to monitor the output of all accelerometers. All recorder traces shall be clearly labeled and shall show the scaling for later conversion to engineering units. The recorders shall have an accuracy of at least +/-1.0% of span. Computers or other recorders may be used with the approval of the OTE.

## **A7.0 QUALITY ASSURANCE**

### **A7.1 General**

The test laboratory shall have a nuclear quality assurance (NQA) program that conforms with the intent of 10CFR50, Appendix B. This program shall be accepted by OTE.

### **A7.2 Control of Test Instrumentation**

All test instrumentation used to perform the tests described herein shall be covered by a program to maintain calibration and for calibration to be traceable to the NIST.

### A7.3 Control of the CVD Process Hood Test Specimens

The test specimens supplied by the OTE shall be controlled by the test laboratory once they are delivered to the test laboratory. The system of control shall ensure that no unauthorized work is performed on the test specimens and that the requirements for testing outlined in this specification are carried out.

## A8.0 TEST REPORT

The test laboratory shall within fourteen (14) days of completion of testing submit a test report that clearly describes the testing performed. A registered professional engineer shall certify the report.

The report shall contain as a minimum:

- A detailed description of the devices tested including manufacturer, model number, and serial number plus any other nameplate information that describes the function or rating of the device.
- A detailed description of the testing facilities including a list of all test equipment used giving the manufacturer and model number of all such equipment along with the date of its last calibration (if applicable).
- A detailed description of the mounting arrangement used for all phases of vibration testing including bolting arrangements. Photographs and sketches (if necessary) shall be used to document all such arrangements.
- A detailed description of all monitoring circuits used to determine the proper function of tested devices.
- A detailed description of the test method(s) used.
- Seismic test data and results, including TRS plots for horizontal and vertical control accelerometers for all DBE and fragility tests. These results shall include any structural or functional abnormalities observed during seismic testing.
- TRS for one DBE test and the last fragility test shall be digitized and plotted for all accelerometers for damping values of 2%, 3% and 5%. Control accelerometer TRS shall be plotted on the same graph as the RRS.
- Functional test data and results before and after each of the seismic and fragility tests.
- The recorded time-histories for all accelerometers for one DBE test (with TRS plotted for 2%, 3% and 5% damping values), and the last fragility test shall be prepared and stored on 3-1/2 inch diskette(s) in ASCII format.
- Copies of photographs and videotape taken during the testing.

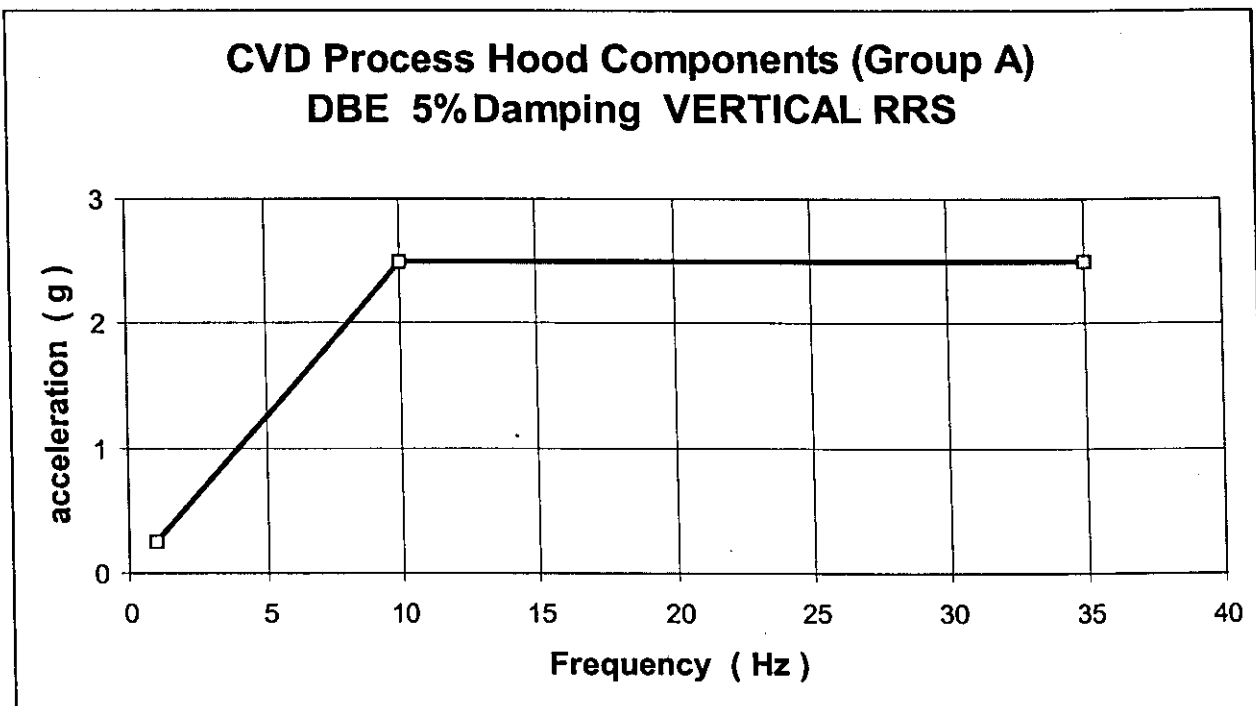
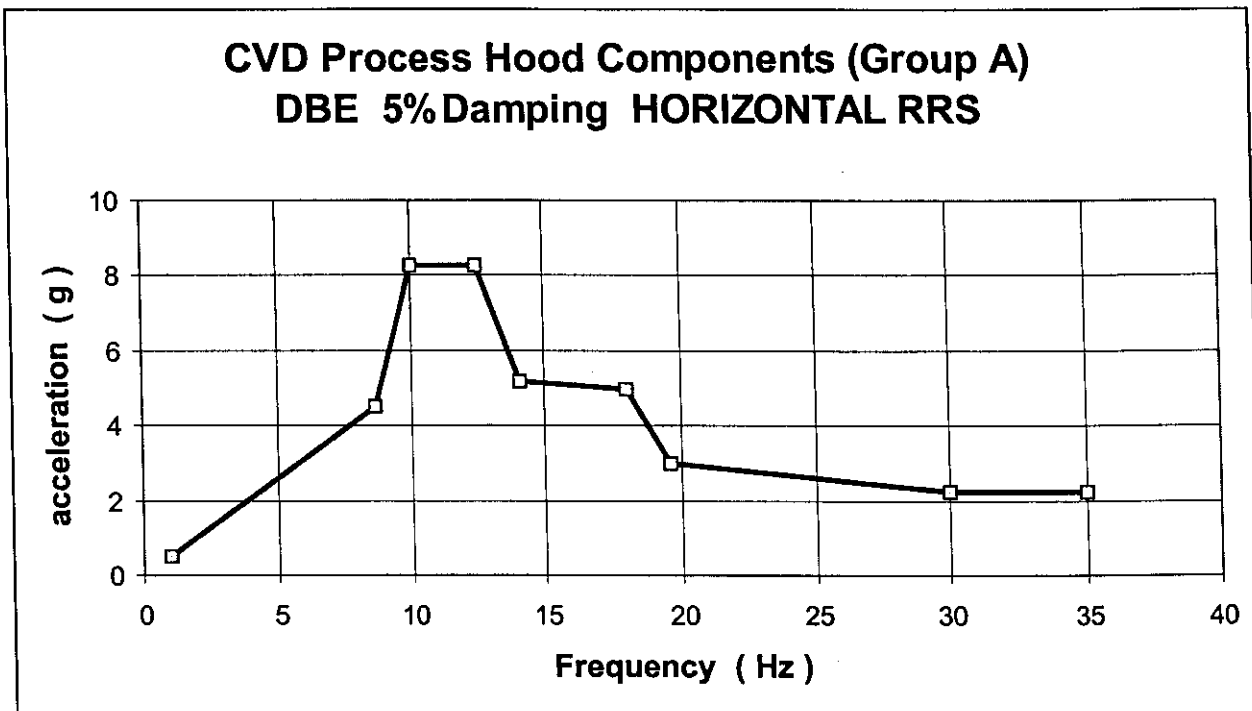
**ATTACHMENT B  
 REQUIRED 5% DAMPING DBE SPECTRA FOR SEISMIC TESTING OF  
 SAFETY CLASS CVD PROCESS HOOD COMPONENTS**

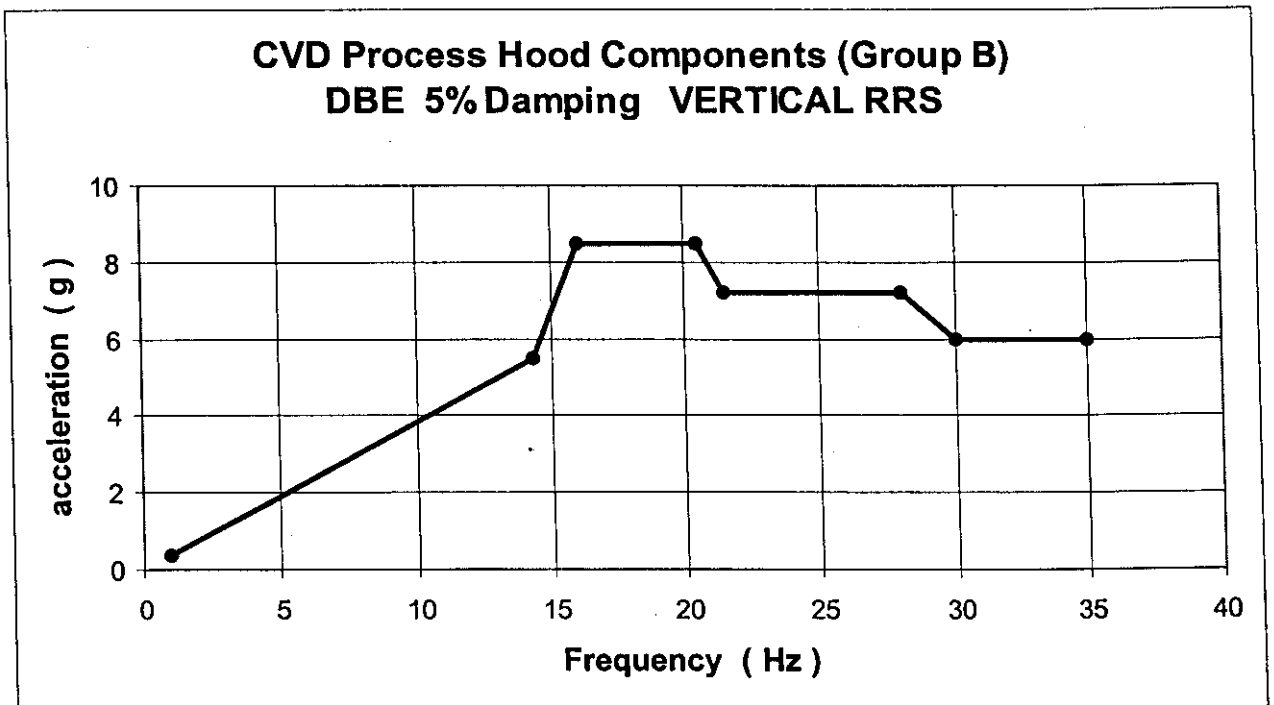
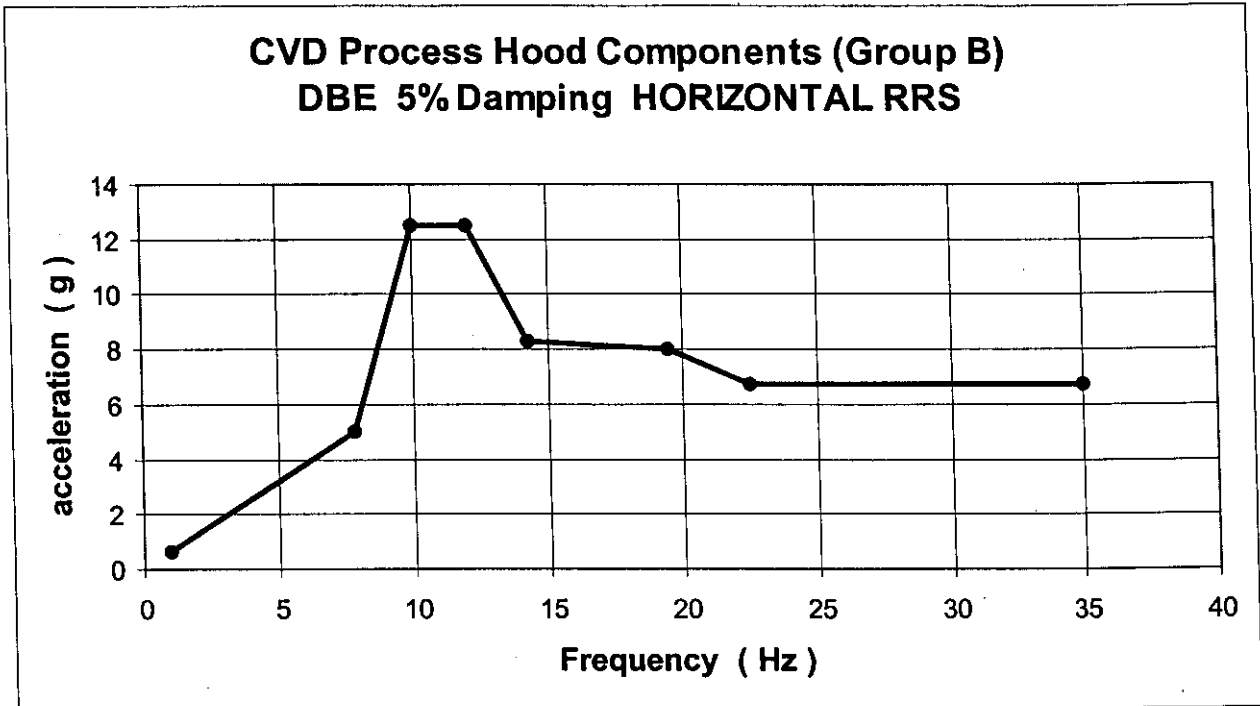
The digitized spectral accelerations of the envelope DBE RRS (for horizontal and vertical directions) at 5% damping for Groups A and B are shown below. **The Group A specimens are Items 1 through 4 in Attachment C. The Group B specimens are Items 5 through 14 in Attachment C.** The plots of the spectra used for testing are shown on the next two sheets.

GROUP A - 5% Damping RRS				GROUP B - 5% Damping RRS			
HORIZONTAL		VERTICAL		HORIZONTAL		VERTICAL	
Freq.	Accel.	Freq.	Accel.	Freq.	Accel.	Freq.	Accel.
(Hz)	(g)	(Hz)	(g)	(Hz)	(g)	(Hz)	(g)
1	0.52	1	0.25	1	0.63	1	0.38
8.6	4.5	10	2.5	7.8	5	14.3	5.5
10	8.25	35	2.5	10	12.5	16	8.5
12.5	8.25			12	12.5	20.5	8.5
14.1	5.2			14.2	8.3	21.5	7.2
18	5			19.5	8	28	7.2
19.6	3			22.5	6.75	30	6
30	2.25			35	6.75	35	6
35	2.25						

Notes:

1. The RRS (used for testing) provided above may be modified prior to start of the test by OTE representative.
2. Test specimens in Groups A and B should be tested separately.
3. Group A spectra represent enveloped M&D spectra for Group III.
4. Group B spectra represent enveloped M&D spectra for Groups Ia, Ib and II.
5. Components mounted on Cask Trailer will be tested with Group B.





Note: The RRS provided above may be modified prior to start of the test by OTE representative.

**ATTACHMENT C**  
**LIST OF COMPONENTS AND THEIR CORRESPONDING FUNCTIONAL REQUIREMENTS**  
**FOR PRE- AND POST-SEISMIC TESTS OF SAFETY CLASS CVD PROCESS HOOD**  
**COMPONENTS**

The list of the CVD Process Hood components and their corresponding functional tests are provided in the following pages. The leakage tests shall be performed in accordance with ASME B31.3. The results of each test shall be provided in the test report. The acceptance criterion for "no leakage" is defined as "no continuous bubble formation." Other functional acceptance criteria are noted with each item in the following pages.

Pre-seismic Functional Tests

1. Perform visual inspection for any irregularities and damages.
2. Perform the functional tests listed with each component in the following sheets. Air should be used for pressurization.

Post-seismic Functional Tests

1. Perform visual inspection for any irregularities and damages.
2. Perform the functional tests listed with each component in the following sheets. Air should be used for pressurization.

List of Test Specimen Items, Stages during Testing and RRS Groups

Item No.	Item Description	Specimen Stage During Testing		RRS Group
		DBE Test-1 & Fragility (20%)	DBE Test-2 & Fragility (40%)	
1	Baratron Pressure Transmitter	Pressurized to 15 psig & De-Energized	Pressurized to 15 psig & Energized	A
2	Rosemount Pressure Transmitter	Pressurized to 15 psig	Same as DBE Test - 1	A
3	Rootemp Pressure Indicator	Pressurized to 15 psig	Same as DBE Test - 1	A
4	Whitey Gauge Root Valve	Pressurized to 15 psig	Same as DBE Test - 1	A
5	Worcester Solenoid Actuated Valve	Pressurized to 15 psig De-Energized - Normally OPEN	Pressurized to 15 psig Energized - Normally CLOSED	B
6	Worcester Solenoid Actuated Valve	Pressurized to 15 psig De-Energized - Normally CLOSED	Pressurized to 15 psig Energized - Normally OPEN	B
7	Worcester Ball Valve	Pressurized to 15 psig	Same as DBE Test - 1	B
8	Griswold Flow Control (Anti-Siphon) Valve	Pressurized to 30 psig	Same as DBE Test - 1	B
9	Penberthy Liquid Level Gauge	Full of water pressurized to 30 psig	Same as DBE Test - 1	B
10	Nupro Check Valve	Pressurized to 15 psig	Same as DBE Test - 1	B
11	Swagelock Quick disconnect	Pressurized to 15 psig	Same as DBE Test - 1	B
12	Fike Pressure Safety Element	Pressurized to 15 psig	Same as DBE Test - 1	B
13	Whitey Ball Valve	Pressurized to 30 psig	Same as DBE Test - 1	B

• Items 7, 10, 11 and 12 are located on the MCO transporter/trailer and have a separate RRS. However, Group B RRS are significantly higher than the trailer RRS for frequencies higher than 5 Hz.

Item No.	Equip. No.	Manufacturer/Component Description	Model	Seismic Condition	Configuration/Mounting	Ref. CGI No.
1	PT-1*08, 1*10, 1*35	Baratron/ Pressure Transmitter	430C A00100 is tested (Model 427A A00100 is qualified by similarity since electronic output signal is non-seismic and both models have identical pressure boundaries)	Maintain pressure boundary before and after seismic event  Electronic output performance is not required post seismic (PC-3, Seismic Condition B)	Process connection: 1/4" - 18 NPT. Spec. P4, Sht. L-12.  Bolted to test fixture	CGI-SNF-D-13-P4-019, CGI-SNF-D-07-P4-010

**Mounting Details:** See item 1 in Attachment D

**Operational Pressure:** Maintain 15 psig during all seismic tests.

**Functional Tests** (to be performed before and after each seismic test):

- **Leakage:** Pressure to 15 psig, leakage test per ASME Boiler and Pressure Vessel Code section V, article 10, "Leak Testing". Leak acceptance criteria bubble tight (no continuous bubble formation) after 15 minute hold period at 15 psig.

**Pressure Boundary Integrity:** Pressure test at 165 psig (with housing lid off, zero leakage), to be performed by OTE after all seismic and functional tests.



Item No.	Equip. No.	Manufacturer/ Component Description	Model	Seismic Condition	Configuration/ Mounting	Ref. CGI No.
2	PT-1*34, 1*36, 1*37	Rosemount/ Pressure Transmitter	1153GB5PB	Nuclear Quality- No CGI dedication. Pressure boundary before and after seismic  Electronic output performance is not required post seismic (Seismic Condition B)	Spec. P4, Sht. L-14 Bolted to test fixture	CGI-SNF-D-07-P4-011

**Mounting Details:** See item 2 in Attachment D

**Operational Pressure:** Maintain 15 psig during all seismic tests.

**Functional Test** (to be performed before and after each seismic test):

- **Leakage:** Pressure to 15 psig, leakage test per ASME Boiler and Pressure Vessel Code section V, article 10, "Leak Testing". Leak acceptance criteria bubble tight (no continuous bubble formation) after 15 minute hold period at 15 psig.

**Pressure Boundary Integrity:** Pressure test at 165 psig (zero leakage), to be performed by OTE after all seismic and functional tests.

Item No.	Equip. No.	Manufacturer/ Component Description	Model	Seismic Condition	Configuration/ Mounting	Ref. CGI No.
3	PI-1*40, 1*41,	Reotemp/ Pressure Indicator (same model is also part of assembly)	PR-25-S-1-A-4-P15-D (for PI-1*40 & 1*41)	Pressure boundary before and after seismic (PC-3, Seismic Condition B)	Process connection: 1/4" NPT with 1/4"x1/2" bushing, bottom mounted. Spec. P4, Sht. L-8	CGI-SNF-D-07-P4-008

**Mounting Details:** See items 3 & 4 in Attachment D (Note: This item is mounted on top of Item No. 4.)

**Operational Pressure:** Maintain 15 psig during all seismic tests.

**Functional Test** (to be performed before and after each seismic test):

- **Leakage:** Pressure to 15 psig, leakage test per ASME Boiler and Pressure Vessel Code section V, article 10, "Leak Testing". Leak acceptance criteria bubble tight (no continuous bubble formation) after 15 minute hold period at 15 psig.

**Pressure Boundary Integrity:** Pressure test at 165 psig (zero leakage), to be performed by OTE after all seismic and functional tests.

Item No.	Equip. No.	Manufacturer/Component Description	Model	Seismic Condition	Configuration/Mounting	Ref. CGI No.
4	VPS-V- *059, *061, *014	Whitey/ Gage Root Valve	SS-6PNBGM8-F8	Maintain pressure boundary before and after seismic event <b>(PC-3, Seismic Condition B)</b>	Process Connection: 1/2" MNPT to 1/2" FNPT	CGI-SNF-D-07-P4-009

**Mounting Details:** See items 3 & 4 in Attachment D.

**Operational Pressure:** Maintain 15 psig during all seismic tests.

**Functional Tests** (to be performed before and after each seismic test):

- **Leakage:** Pressure to 15 psig, leakage test per ASME Boiler and Pressure Vessel Code section V, article 10, "Leak Testing". Leak acceptance criteria bubble tight (no continuous bubble formation) after 15 minute hold period at 15 psig.
- **Valve Seat Leakage:** < 0.1 scc/min N<sub>2</sub> at 150 psig, (may be demonstrated by ASME bubble tight leak testing at 15 psig)

**Pressure Boundary Integrity:** Pressure test at 165 psig (zero leakage), to be performed by OTE after all seismic and functional tests.

Item No.	Equip. No.	Manufacturer/Component Description	Model	Seismic Condition	Configuration/Mounting	Ref. CGI No.
5	GOV-1*02, 1*06, 5*12, 5*51, 1*11, 1*17, 5*31, 5*71	Worcester/ 1" Solenoid-actuated gas-operated MCO Isolation Valve	1" E 5966RTBW4 (valve) & 15I939SWM2120PBC (actuator)	Functional before and after seismic event (PC-3, Seismic Condition A)	Integral actuator/ valve assembly. Transverse actuator mtg. Horiz. Position per Spec P4, Sht. L-4 & L-6	CGI-SNF-D-13-P4-002, CGI-SNF-D-07-P4-042

**Mounting Details:** See item 5 in Attachment D

**Operational Pressure:** Maintain 15 psig during all seismic tests.

**Functional Tests** (to be performed before and after each seismic test):

- **External and "Through Closed Valve" Leakage:** Pressure to 15 psig, leakage test per ASME Boiler and Pressure Vessel Code section V, article 10, "Leak Testing". Leak acceptance criteria bubble tight (no continuous bubble formation) after 15 minute hold period at 15 psig.
- **GOV Fail Safe Position:** Valve fails OPEN on loss of air pressure, control signal or elec. power. Stroke time ~ 1 sec (< 2 sec)  
 Energized – valve closes      De-energized – valve opens  
 Valves 5\*12, 5\*51, 5\*31, 5\*71 fail OPEN, note that valves 1\*11, 1\*17, 1\*02, 1\*06 fail CLOSED and are enveloped by testing of item No 6

**Vacuum leakage:** Apply full vacuum (29 InHg) and establish that valve is bubble tight (<10<sup>-3</sup> ml He/sec.) under vacuum using methodology consistent ASME Boiler and Pressure Vessel Code section V, article 10, "Leak Testing", to be performed by OTE after all seismic tests.

**GOV Pressure Boundary and Seat Leakage:** Pressure test at 165 psig (zero leakage), to be performed by OTE after all seismic and functional tests.

Item No.	Equip. No.	Manufacturer/Component Description	Model	Seismic Condition	Configuration/ Mounting	Ref. CGI No.
6	GOV 1*05, 1*09, 1*03, 1*30	Worcester/ 1" Solenoid-actuated gas-operated MCO Isolation Valve	1" E 5966RTBW4 (valve) & 151939SWM2120PBC (actuator)	Functional before and after seismic event (PC-3, Seismic Condition A)	Integral actuator/ valve assembly. Transverse actuator mtg. Vert. Position per Spec P4, Sht. L-2	CGI-SNF-D-07-P4-001, CGI-SNF-D-46-1-P4-015

**Mounting Details:** See item 6 in Attachment D

**Operational Pressure:** Maintain 15 psig during all seismic tests.

**Functional Tests** (to be performed before and after each seismic test):

- **External and "Through Closed Valve" Leakage:** Pressure to 15 psig, leakage test per ASME Boiler and Pressure Vessel Code section V, article 10, "Leak Testing". Leak acceptance criteria bubble tight (no continuous bubble formation) after 15 minute hold period at 15 psig.
- **GOV Fail Safe Position:** Valve fails CLOSED on loss of air pressure, control signal or elec. power. Stroke time ~ 1 sec (<2 sec).  
 Energized – valve opens                      De-energized – valve closes

**Vacuum leakage:** Apply full vacuum (29 InHg) and establish that valve is bubble tight (<10<sup>-3</sup> ml He/sec.) under vacuum using methodology consistent ASME Boiler and Pressure Vessel Code section V, article 10, "Leak Testing", to be performed by OTE after all seismic tests.

**GOV Pressure Boundary and Seat Leakage:** Pressure test at 165 psig (zero leakage), to be performed by OTE after all seismic and functional tests.

Valves 1\*11, 1\*17, 1\*02, 1\*06 also fail CLOSED (per CGI SNF-D-13-P4-002 & D-07-P4-042) and are enveloped by testing of this item.

Item No.	Equip. No.	Manufacturer/Component Description	Model	Seismic Condition	Configuration/ Mounting	Ref. CGI No.
7	TW-V- *021, *133	Worcester/ Ball Valve	1" K5966RTBW4	Functional before and after seismic event (PC-3, Seismic Condition A)	Factory installed locking mechanism. 1" butt-weld SS, sch. 40.	CGI-SNF-D-47-P4-043

**Mounting Details:** See item 7 in Attachment D

**Operational Pressure:** Maintain 15 psig during all seismic tests.

**Functional Test** (to be performed before and after each seismic test):

- **External and "Through Closed Valve" Leakage:** Pressure to 15 psig, leakage test per ASME Boiler and Pressure Vessel Code section V, article 10, "Leak Testing". Leak acceptance criteria bubble tight (no continuous bubble formation) after 15 minute hold period at 15 psig.
- **Valve Operability:** Valve can be opened and closed manually, and flow path is established when valve is opened.

**Pressure Boundary:** Pressure test at 165 psig (zero leakage), to be performed by OTE after all seismic and functional tests

Item No.	Equip. No.	Manufacturer/ Component Description	Model	Seismic Condition	Configuration/ Mounting	Ref. CGI No.
8	FCV-1*22, 1*23	Griswold/ Tempered Water Flow Regulator Valve used as Anti-Siphon Valve	4902F	Functional before and after seismic event (PC-3)	Spec, P4, Sht. L-16	CGI-SNF-D-47-P4-003

**Mounting Details:** See item 8 in Attachment D

**Operational Pressure:** Maintain 30 psig during all seismic tests.

**Functional Tests** (to be performed before and after each seismic test):

- **External Leakage:** Pressure to 15 psig with air, leakage test per ASME Boiler and Pressure Vessel Code section V, article 10, "Leak Testing". Leak acceptance criteria bubble tight (no continuous bubble formation) after 15 minute hold period at 15 psig.
- **Valve Reverse Flow:** Apply 30 psig reverse flow (ensure nominal orifice flow) to be performed by OTE after all seismic tests.
- **Flow Rate:** Maintain nominal 1 gpm output over input range of 4 to 30 psig to be performed by OTE after all seismic tests.

**Pressure Boundary:** Pressure test at 165 psig (zero leakage), to be performed by OTE after all seismic and functional tests.

Item No.	Equip. No.	Manufacturer/Component Description	Model	Seismic Condition	Configuration/Mounting	Ref. CGI No.
9	TW-LG-1*24, 1*25	Penberthy/ Liquid level gauge/level switch	Multiview LL meter with MGS-314 level switch	Functional (provide valid water level indication) before and after seismic event (PC-3, Seismic Condition A)	Process connection: 1" flange. Spec. P4, Sht. L-10	CGI-SNF-D-47-P4-007

**Mounting Details:** See item 9 in Attachment D

**Functional Tests** (to be performed before and after each seismic test):

- **External Leakage:** Pressure to 15 psig with air, leakage test per ASME Boiler and Pressure Vessel Code section V, article 10, "Leak Testing". Leak acceptance criteria bubble tight (no continuous bubble formation) after 15 minute hold period at 15 psig.
- **Operating Range/ Alarm Setpoint:** Provide water supply connection to upper/lower gage flanges, fill gage, set low level alarm trip at 6", test switch at decreasing levels, alarm at 6" (+/- 1/2").

**Reset after Seismic Event:** After a seismic event, the level gauge follower may need to be reset with a handheld magnet.



Item No.	Equip. No.	Manufacturer/Component Description	Model	Seismic Condition	Configuration/Mounting	Ref. CGI No.
10	VPS-CKV-*112	Nupro/ 1/2" Check/Relief Valve	SS-RL4M8F8	Functional before and after seismic (PC-3, Seismic Condition A)	process connection: 1/2" MNPTx1/2" FNPT	CGI-SNF-D-07-P4-040

**Mounting Details:** See items 10 & 12 in Attachment D

**Operational Pressure:** Maintain 15 psig during all seismic tests.

**Functional Tests** (to be performed before and after each seismic test):

- **Cracking Pressure Setting:** Nominal 30 psig (must not exceed 31 psig). Lockwire to be in place to maintain pressure relief setting after test.
- **Seat Leakage, Reverse Flow after Cracking: Reseal Pressure:** Reseal must occur > 20 psig. Pressurize to 15 psig (reverse direction), leakage test per ASME Boiler and Pressure Vessel Code section V, article 10, "Leak Testing". Leak acceptance criteria bubble tight (no continuous bubble formation) after 15 minute hold period at 15 psig. This reverse flow test to be performed by OTE after all seismic tests.
- **Flow Rate:** Nominal 10 std cft/min at 30 psig
- **External, and "Forward Seat" Leakage:** Pressurize to 15 psig, leakage test per ASME Boiler and Pressure Vessel Code section V, article 10, "Leak Testing". Leak acceptance criteria bubble tight (no continuous bubble formation) after 15 minute hold period at 15 psig.

**Vacuum leakage:** Apply full vacuum (29 InHg) and establish that valve is bubble tight (<10<sup>-3</sup> ml He/sec.) under vacuum using methodology consistent ASME Boiler and Pressure Vessel Code section V, article 10, "Leak Testing", to be performed by OTE after all seismic tests.

**Pressure Boundary:** Pressure test at 165 psig (zero leakage), to be performed by OTE after all seismic and functional tests.

Item No.	Equip. No.	Manufacturer/Component Description	Model	Seismic Condition	Configuration/Mounting	Ref. CGI No.
11	TW-QD- *132	Swagelok Quick Disconnect	SS-QTM8-B-16PF	PC-3 Seismic condition A	Process connection 1 inch pipe.	CGI-SNF-D-47-P4-059

**Operational Pressure:** Maintain 15 psig during all seismic tests.

**Functional Tests** (to be performed before and after each seismic test):

- **External, and Seat Leakage:** Pressurize to 15 psig, leakage test per ASME Boiler and Pressure Vessel Code section V, article 10, "Leak Testing". Leak acceptance criteria bubble tight (no continuous bubble formation) after 15 minute hold period at 15 psig.
- **Operability:** Verify quick disconnect can be opened to establish flow path.

**Pressure Boundary:** Pressure test at 165 psig (zero leakage), to be performed by OTE after all seismic and functional tests.

Item No.	Equip. No.	Manufacturer/Component Description	Model	Seismic Condition	Configuration/Mounting	Ref. CGI No.
12	VPS-PSE-1*33	Fike/ Pressure Safety Element (with rupture disc)	HOV-UT, 1", 316SS/TEF/316SS, 30 psig, 150°C, Std. MFG. Tolerance, FU-1"	Functional before and after seismic (PC-3, Seismic Condition A)	Process connection: 1" butt weld	CGI-SNF-D-07-P4-044

**Mounting Details:** See items 10 & 12 in Attachment D

**Operational Pressure:** Maintain 15 psig during all seismic tests.

**Functional Tests** (to be performed before and after each seismic test):

- **Internal Pressure:** 150 psig and full vacuum
- **External Leakage and Leakage Past Disk:** Pressurize to 15 psig, leakage test per ASME Boiler and Pressure Vessel Code section V, article 10, "Leak Testing". Leak acceptance criteria bubble tight (no continuous bubble formation) after 15 minute hold period at 15 psig

**Vacuum leakage:** Apply full vacuum (29 InHg) and establish that valve is bubble tight (<10<sup>-3</sup> ml He/sec.) under vacuum using methodology consistent ASME Boiler and Pressure Vessel Code section V, article 10, "Leak Testing", to be performed by OTE after all seismic and functional tests.

**Pressure Boundary:** Pressure test at 165 psig (Zero leakage). Supply pressure to both sides to prevent rupture of disk. This test shall be performed by OTE after all seismic and leakage past rupture disc tests.

**Rupture Disc Burst Pressure:** Nominal 32 ± 2 psig, to be performed by OTE after all seismic and functional tests. No loose pieces from ruptured disc.

Item No.	Equip. No.	Manufacturer/Component Description	Model	Seismic Condition	Configuration/Mounting	Ref. CGI No.
13		TW-V-*027 TW-V-*134	Whitey 1/4" ball valves SS-43M4-S4-LL-TR	Functional before and after seismic (PC-3, Seismic Condition A)	See item 13 in Attachment D	CGI-SNF-D-07-P4-062

**Mounting Details:** See item 13 in Attachment D

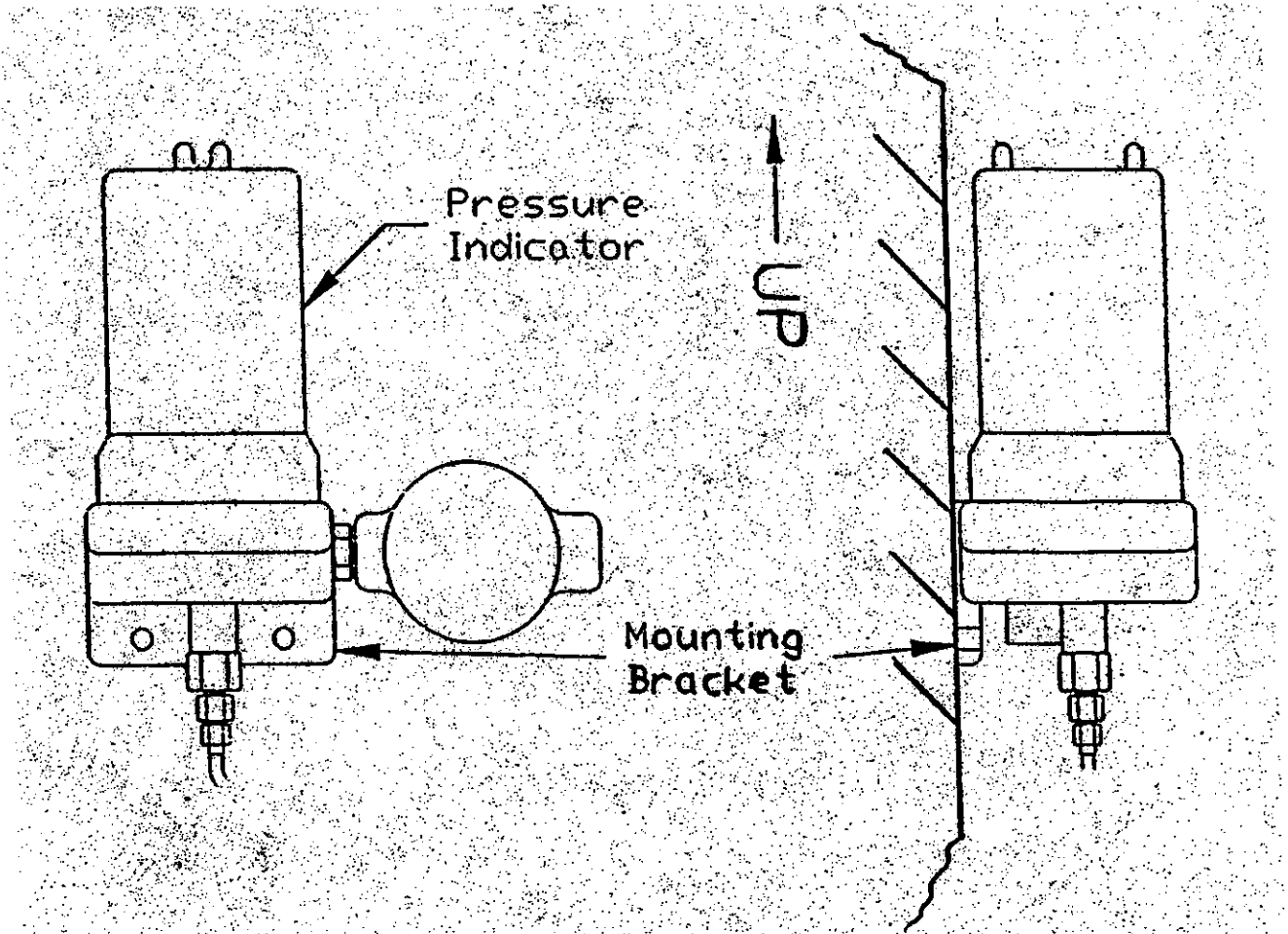
**Operational Pressure:** Maintain 30 psig during all seismic tests.

**Functional Tests** (to be performed before and after each seismic test):

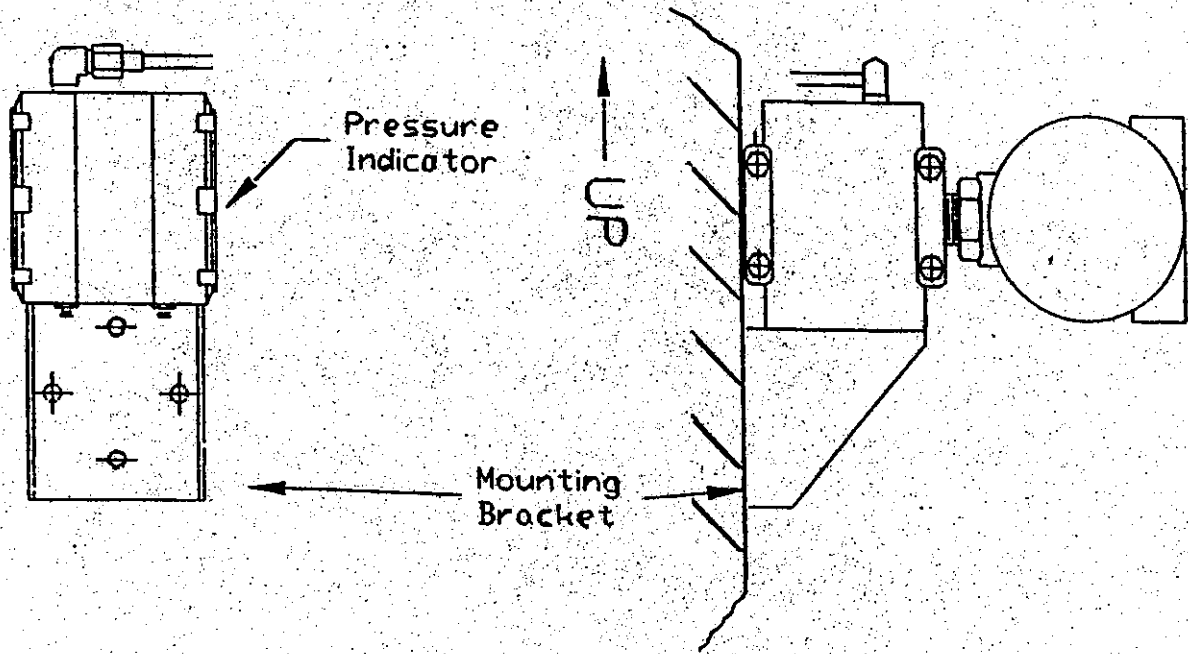
- **External Leakage of Primary and Secondary Boundary:** Pressurize to 30 psig, leakage test per ASME Boiler and Pressure Vessel Code section V, article 10, "Leak Testing". Leak acceptance criteria bubble tight (no continuous bubble formation) after 15 minute hold period at 30 psig
- **Valve Operability:** Valves can be opened and closed manually, and flow path is established when valve is opened.

**Pressure Boundary:** Pressure test at 165 psig (Zero leakage). This test shall be performed by OTE after all seismic and functional tests.

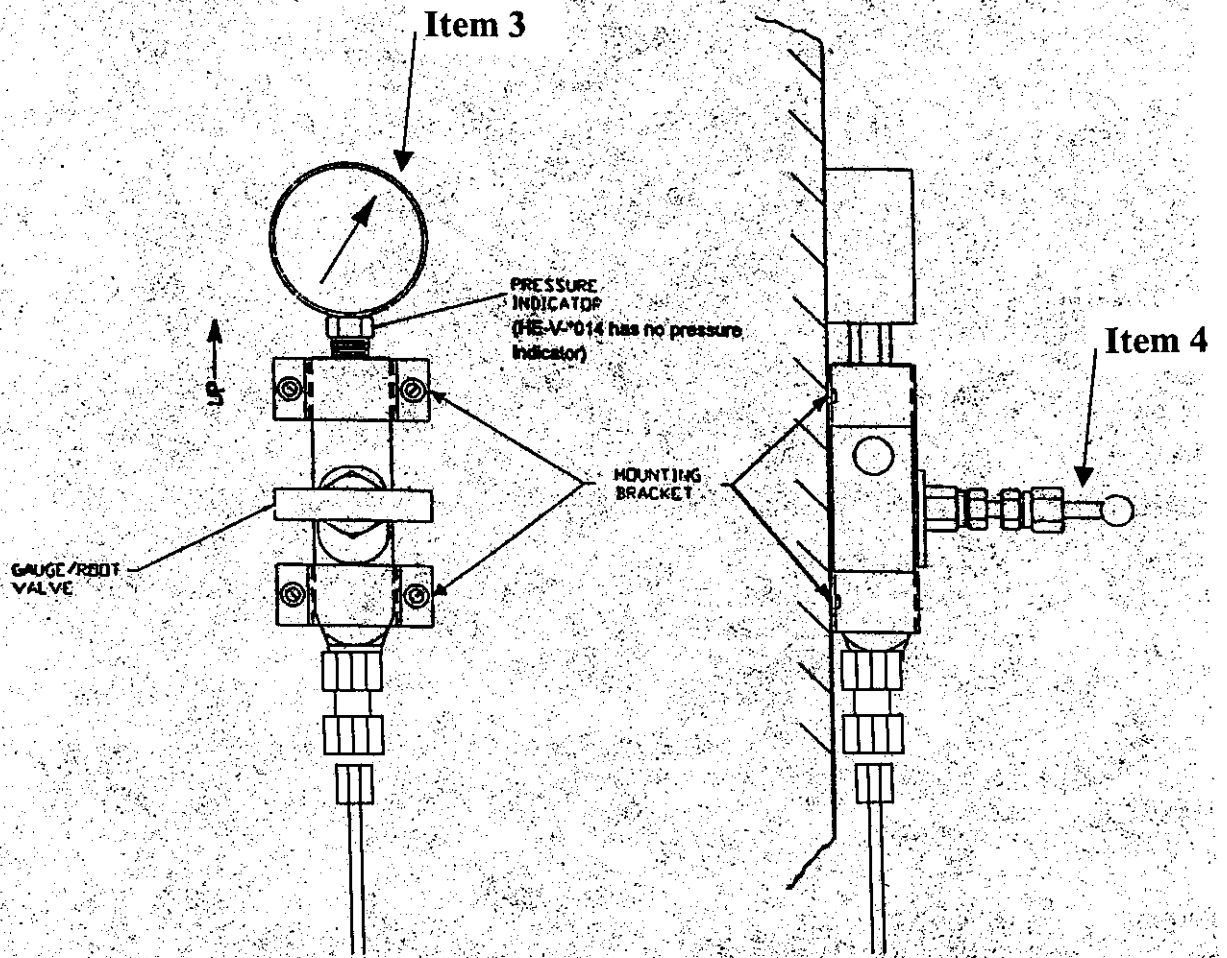
**ATTACHMENT D**  
**MOUNTING DETAILS FOR SEISMIC TESTING OF SAFETY CLASS CVD PROCESS HOOD**  
**COMPONENTS**



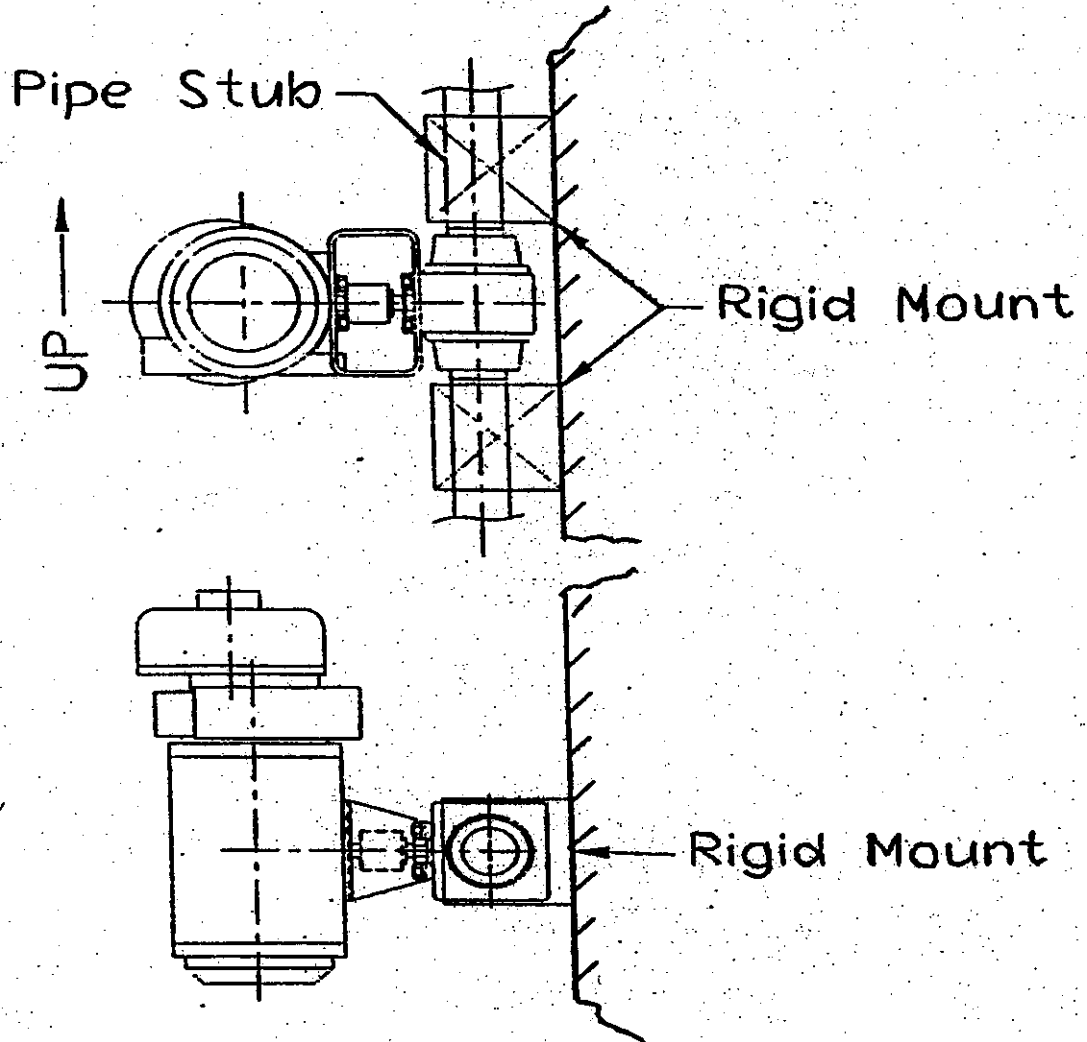
**ITEM 1: BARATRON/ PRESSURE TRANSMITTER**



**ITEM 2: ROSEMOUNT/ PRESSURE TRANSMITTER**

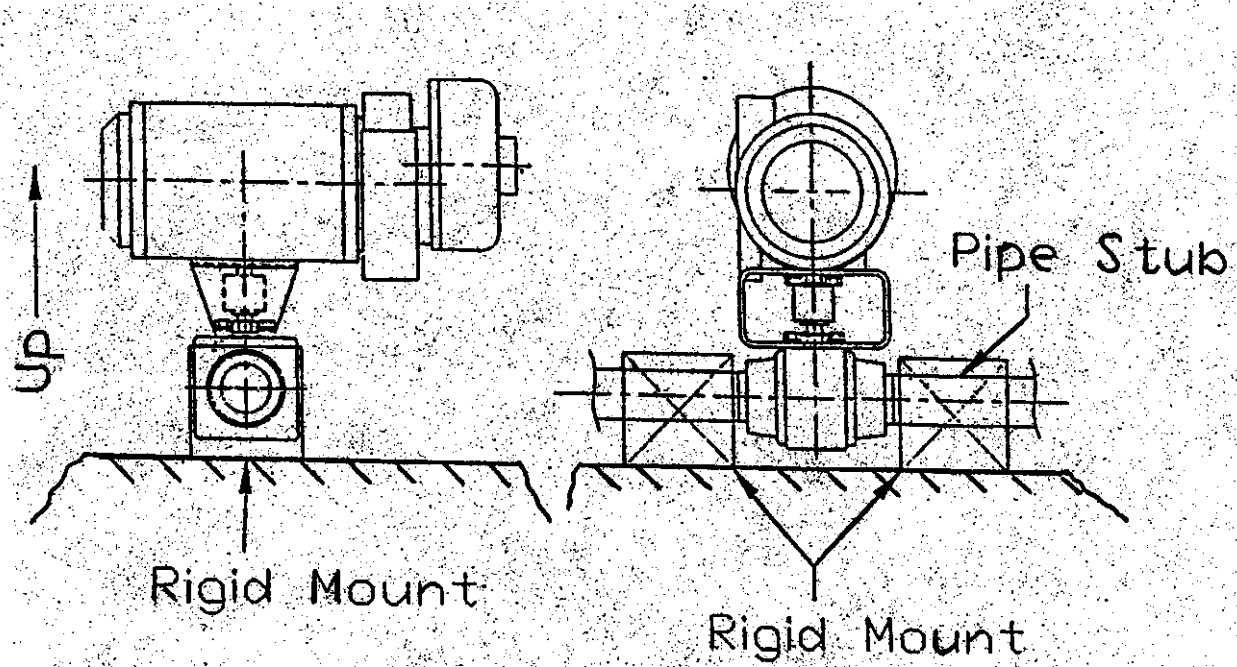


**ITEM 3: REOTEMP/ PRESSURE INDICATOR  
&  
ITEM 4: WHITEY/ GAUGE ROOT VALVE**

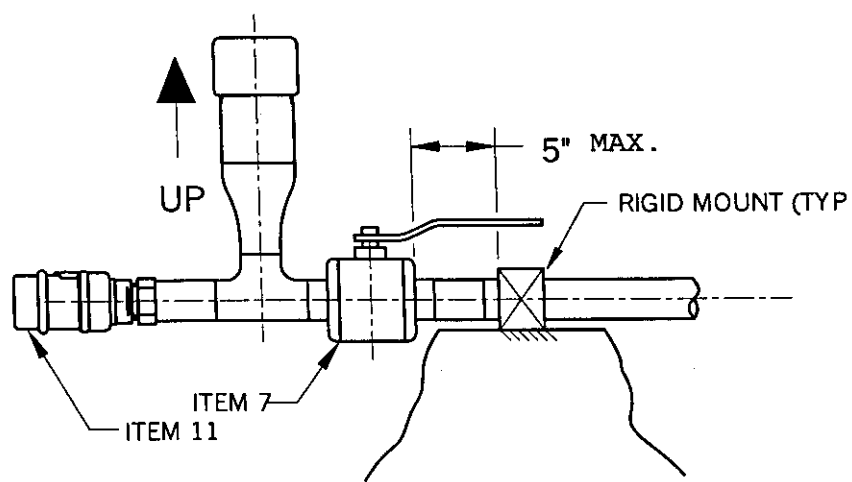


**ITEM 5: WORCESTER/ 1" SOLENOID-ACTUATED GAS-OPERATED VALVE**



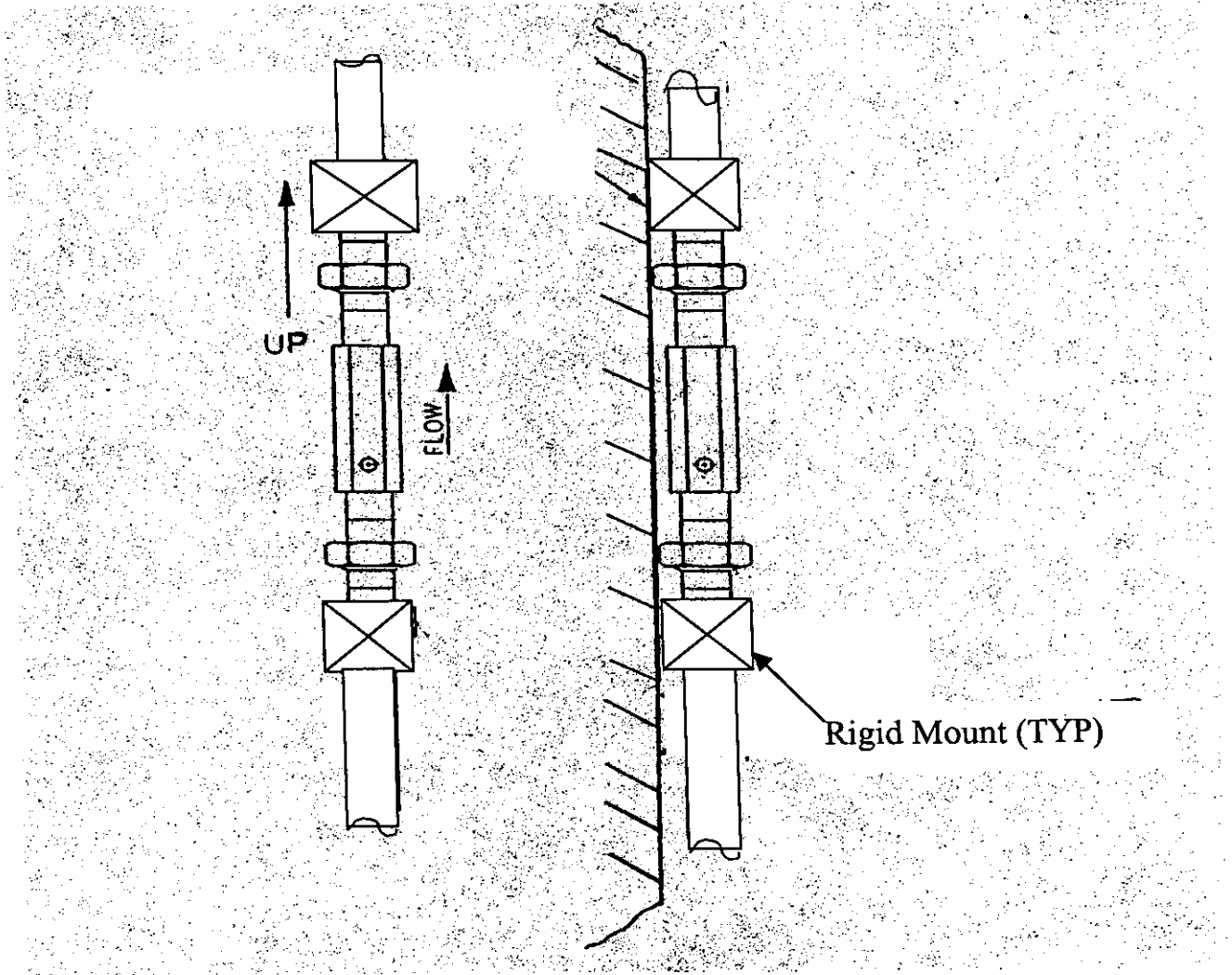


**ITEM 6: WORCESTER/ 1" SOLENOID-ACTUATED GAS-OPERATED VALVE**

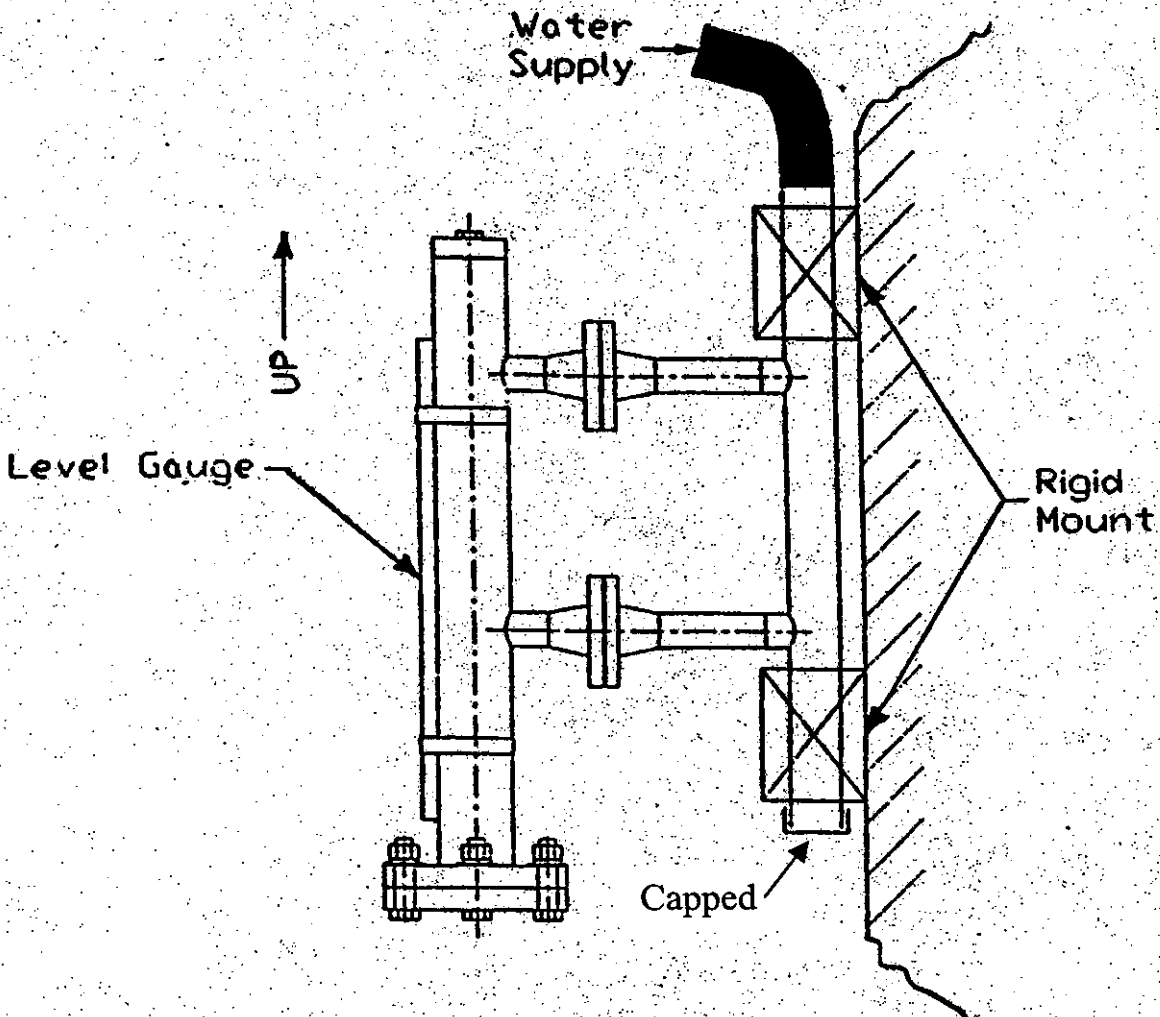


Note: Only one Worcester Valve needs to be included in the test.

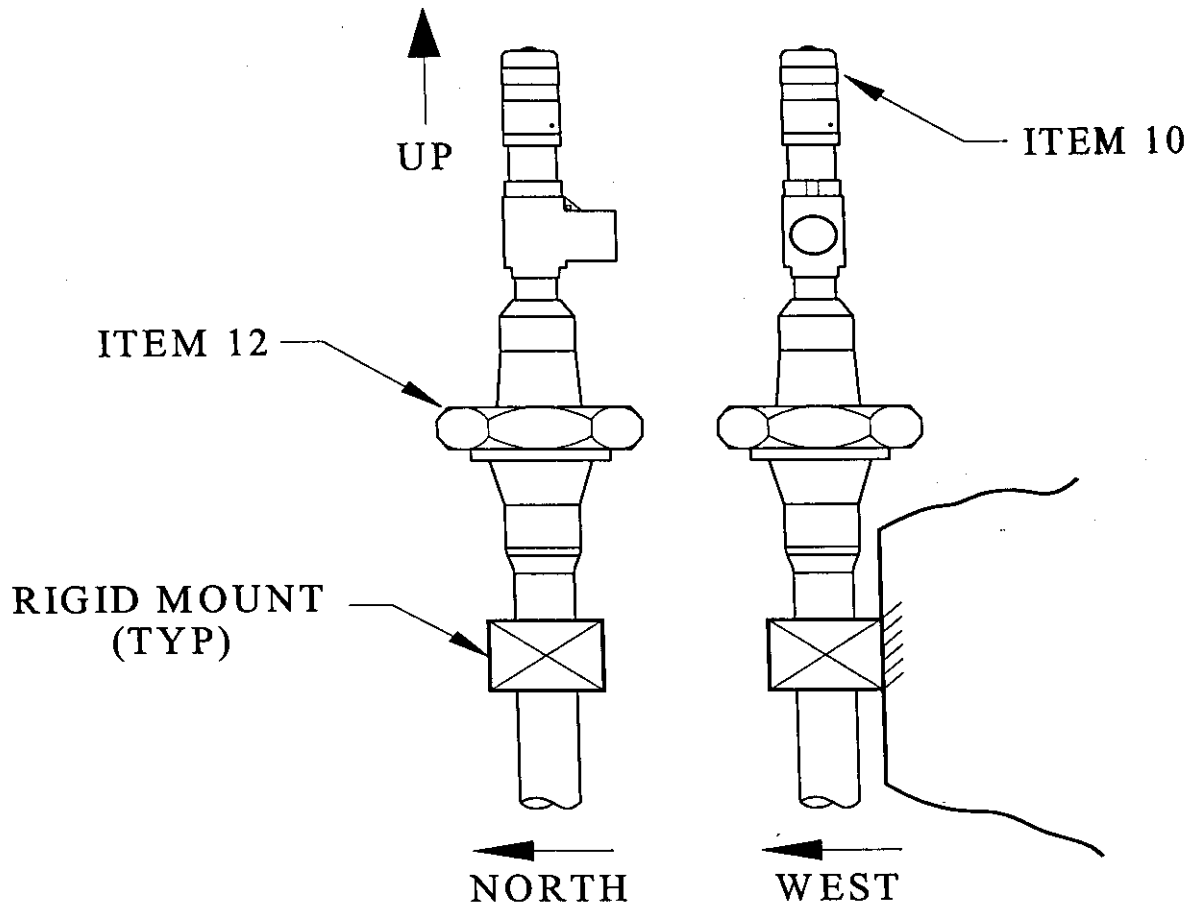
**ITEM 7: WORCESTER/ BALL VALVE  
AND  
ITEM 11: SWAGELOK QUICK DISCONNECT**



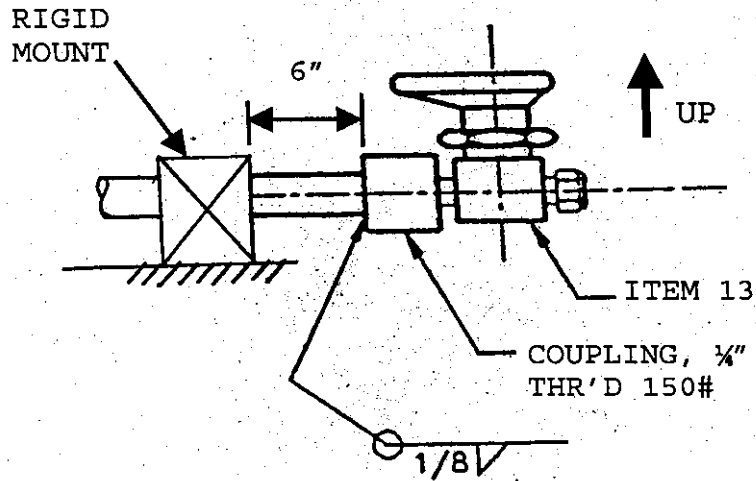
**ITEM 8: GRISWOLD/ TEMPERED WATER FLOW REGULATOR VALVE USED AS ANTI-SIPHON VALVE**



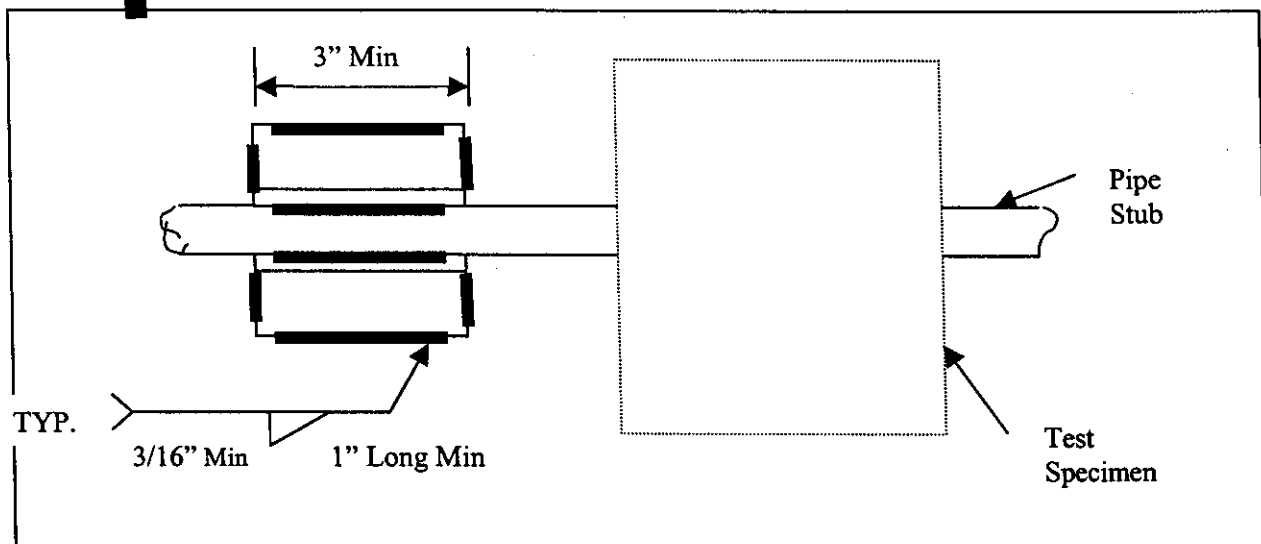
**ITEM 9: PENBERTHY/ LIQUID LEVEL GAUGE/LEVEL SWITCH**



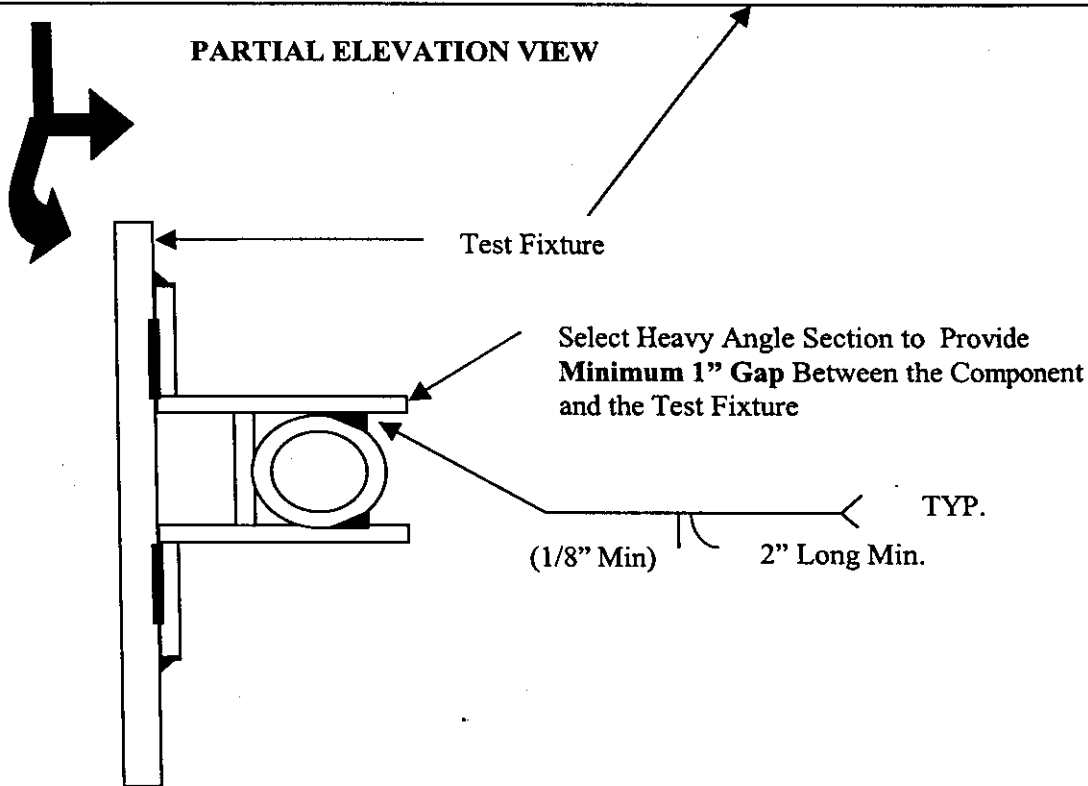
**ITEM 10: NUPRO/ RELIEF VALVE  
&  
ITEM 12: FIKE/ PRESSURE SAFETY ELEMENT**



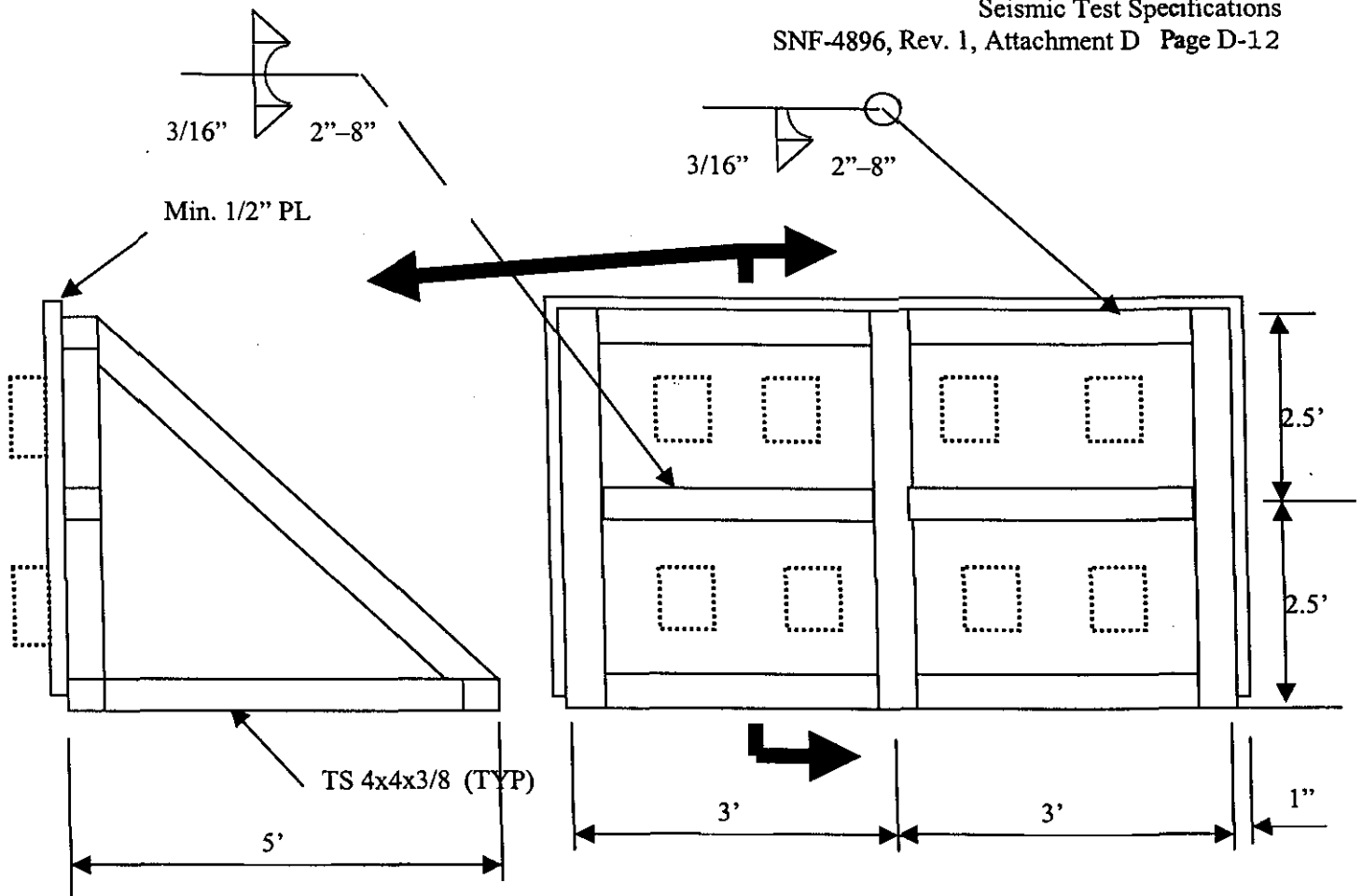
**ITEM 13: WHITEY BALL VALVE IN STAND PIPE ASSEMBLY**



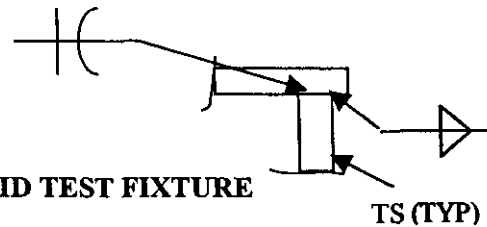
**PARTIAL ELEVATION VIEW**



**SUGGESTED DETAILS FOR PIPE RIGID MOUNT**



- Plate material shall be steel ASTM A36.
- TS material shall be ASTM A500, grade B or better.
- All TS to TS connections shall have minimum 3/16" fillet weld, 3" long, on 2 sides (UNO)
- Provide offset of 1/2" to 1" (TYP) to allow welding on 2 sides of the TS connection .
- The dimensions shown are approximate but overall length of the fixture should not exceed 7' to 8' due to limitation of the shake table dimensions.
- Fabricator may adjust dimensions to allow installation of the components on both sides of the test fixture.
- Fabricator may choose to provide more than one test fixture (smaller in size) on the table.
- Fabricator may choose to provide a different design for the rigid test fixture. However, final details of the rigid test fixture and the arrangement of the components shall be reviewed and approved by OTE.



**SUGGESTED DETAILS FOR RIGID TEST FIXTURE**