Fermilab

Section Office
ES&H Section
630.840.8069 (phone)
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Memorandum

March 19, 2009

To: Bruce Chrisman

From: Nancy Grossman

Subject: Revised FESHM Chapter 5034 – Pressure Testing

FESHM Chapter 5034, Pressure Testing, was reviewed as part of our regular periodic revision cycle. Changes are minor, the following items were added:

- Scope section
- Wording throughout the chapter was revised to also include piping systems
- Definitions for Engineering Note and Code.
- Allowance for "Standing Hydrostatic Test Permits".

This chapter was out for lab-wide review and all comments were addressed.

After final approval, please return this approval page to Elizabeth Bancroft at MS119 for posting on the web.

Encl.

Recommended for Approval:

Bruce Chrisman 3/27/09
Bruce Chrisman Date

Approved:

Piermaria Oddone 3/27/09
Piermaria Oddone Date

PRESSURE TESTING

INTRODUCTION

Pressure vessels and piping systems to be used at Fermilab must be pressure tested to assure safe operation. When such testing is done on site, precautions shall be taken to minimize the risk of injury to persons and equipment in the test area.

SCOPE

This chapter describes requirements for conducting and documenting pressure tests when required by the following Fermilab ES&H Manual (FESHM) Chapters: 5031 Pressure Vessels, 5031.1 Piping Systems, and 5031.5 Low Pressure Vessels.

DEFINITIONS

Engineering Note: A written analysis demonstrating that a given vessel or system satisfies the requirements of the appropriate FESHM Chapter.

Qualified Person: A qualified person is "a person who, by possession of a recognized degree or certificate of professional standing, or who, by extensive knowledge, training and experience, has successfully demonstrated the ability to solve or resolve problems relating to the subject matter and work." The qualified person shall serve as the test coordinator.

The Code: The following industry standard Codes are referenced in this chapter.

- ASME Boiler and Pressure Vessel Code (BPV)
- ASME B31 – Pressure Piping Code

SPECIAL RESPONSIBILITIES

The Division/Section Head who controls the area of operation of the pressure containing components is responsible for carrying out the requirements of this chapter.

The ES&H Section shall audit the Divisions and Sections on their compliance to this chapter.

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The Mechanical Safety Subcommittee is available to advise and assist Division/Section personnel with pressure testing.

STANDING HYDROSTATIC TEST PERMIT

A standing permit may be used for routine hydrostatic tests which are performed for maintenance, repair or production of components or systems if the following conditions are met: 1) a written test procedure and hazard analysis for the routine test is submitted and approved by safety, 2) the testing is performed as described in the procedure.

REQUIREMENTS

1. The qualified person responsible for the design, procurement or operation of the vessel or system shall prepare an Engineering Note when required by FESHM Chapter 5031, Chapter 5031.1, or 5031.5. The Engineering Note shall be reviewed as required in the applicable FESHM chapter by an independent qualified person, but not signed off, prior to conducting the pressure test.

2. The qualified person shall prepare a "Pressure Testing Permit" and obtain all required signatures prior to conducting the test (see "Exhibit B").

3. The division/section safety officer or designee shall review the system under test and the surrounding area to assure all appropriate safety precautions have been taken, prior to the commencement of the test.

4. Pressure testing shall be performed per the ASME BPV Code, Section VIII, Division 1, UG-99 or UG-100 for pressure vessels or per the ASME B31 Code series for piping systems. It is the responsibility of the design engineer to use hydrostatic or pneumatic pressure test values consistent with the latest revision of the applicable Code and Division.

5. All pressure tests shall be directed by a qualified person and observed by the division/section safety officer or designee.

6. A report shall be prepared for all pressure tests by the qualified person. The report shall include the time, date, location, an equipment layout drawing, test data, conditions, personnel present and pressure readings. The layout shall show all system components and their pressure ratings. See attached "Exhibit A" for suggested set up for pressure testing, and also "Exhibit B" for test report format.

7. The completed report shall be filed with the Engineering Note.

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8. A technical appendix which provides a detailed discussion of required documentation, safety precautions, equipment and materials, and test procedures is attached.

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TECHNICAL APPENDIX TO PRESSURE TESTING

Requirements for hydrostatic and pneumatic pressure testing are as follows:

1. SAFETY PRECAUTIONS FOR PRESSURE TESTING

a) Hydrostatic testing is considerably safer than pneumatic testing and should be used whenever possible.

b) Testing should be done in an area set aside for the test with unnecessary persons kept away. This is especially important in pneumatic testing. All pressurized components shall be secured to prevent them from becoming missiles or whipping assemblies. Signs, lights, fences and barriers should be employed as needed to limit unauthorized access.

c) The vessel or system support shall be evaluated to ensure that buckling will not occur during the hydrostatic test. The floor loading conditions also should be evaluated so as to safely transfer the vessel or system's weight and contents to the floor slab and the supporting grade.

d) Prior to testing, the division/section safety officer or designee shall inspect the system to assure it conforms to the system layout drawing and that all appropriate safety precautions have been taken.

2. EQUIPMENT AND MATERIALS

a) The pressure test medium shall be inert. For hydrostatic testing, a nonhazardous liquid such as water shall be used at temperatures below 90°F and over 50°F to aid in avoiding condensation on the tank during the test. For pneumatic testing, an inert gas such as nitrogen or clean air (less than 50% RH) shall be used.

b) Pressure test gauges should be of good quality and have a full scale range of 1.5 to 4.0 times the intended maximum test pressure. The gauge shall be connected directly to the vessel or system and shall be visible to the operator throughout the duration of the test. Calibration of gauges should be kept up to date and recalibrated at any time there is reason to believe that they are in error. Reference: ASME BPV Code, Section VIII, Division 1, UG-102.

c) For hydrostatic tests, vents shall be provided at high points to purge gas pockets during filling. A drain line with a valve capable of withstanding the test pressure

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shall be in place prior to filling the system. The manually operated valve shall be secured to a fitting at the lowest point of the system (flanged or threaded) and the drain line is to be connected to the outlet side of the valve. Reference: ASME BPV Code, Section VIII, Division 1, UG-99.

d) The pressure source shall have a relief valve of proper capacity and a set cracking pressure not higher than the test pressure plus the lesser of 50 psi or 10% of the test pressure. The valve shall be tested for proper operation prior to conducting the test. Reference: ASME B31.3 Code, Para. 345.5.2.

e) The gaskets, O-rings, plugs, etc. may be reused if inspected and found to be acceptable by the qualified person.

f) It is recommended that test equipment be used exclusively for pressure testing to avoid damage and contamination and should be placed in a secured storage area when not in use.

3. PRESSURE TEST GUIDELINES

a) All seams, connections of fittings, manways, plugs, couplings and welds made to the outside surface shall be visually examined in hydrostatic tests and soap-bubble checked in pneumatic tests. Helium leak testing may alternatively be used in pneumatic tests.

b) If a leak is detected at any pressure level reading during the test, the pressure shall be immediately reduced to one-half that pressure level reading while locating the leak.

c) If a leak is detected, the vessel or system shall be depressurized before attempting any repairs or adjustments.

d) If a pressure test is allowed to exceed the test pressure such that visible permanent distortion is encountered, or if visible permanent distortion in excess of the expected design amount is encountered without exceeding the maximum test pressure, an engineering review shall be required to determine the disposition of the vessel or system (e.g. repair, de-rate or scrap).

e) If a pressure test is allowed to exceed the test pressure but the vessel or system shows no measurable permanent deformation, the maximum allowable working pressure of that vessel or system need not be reduced. When this situation occurs, an engineering review shall be required before the vessel or system is accepted. This engineering review shall include a revised engineering note and a signed review of that note by a second qualified person.

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f) After inspection, the vessel or system shall be relieved of its pressure gradually through a valve at the test stand.

g) For hydrostatic tests, the vents at the top of the vessel or system shall be opened after pressurization, the liquid media drained and the system dried to preclude excessive corrosion.

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EXHIBIT A

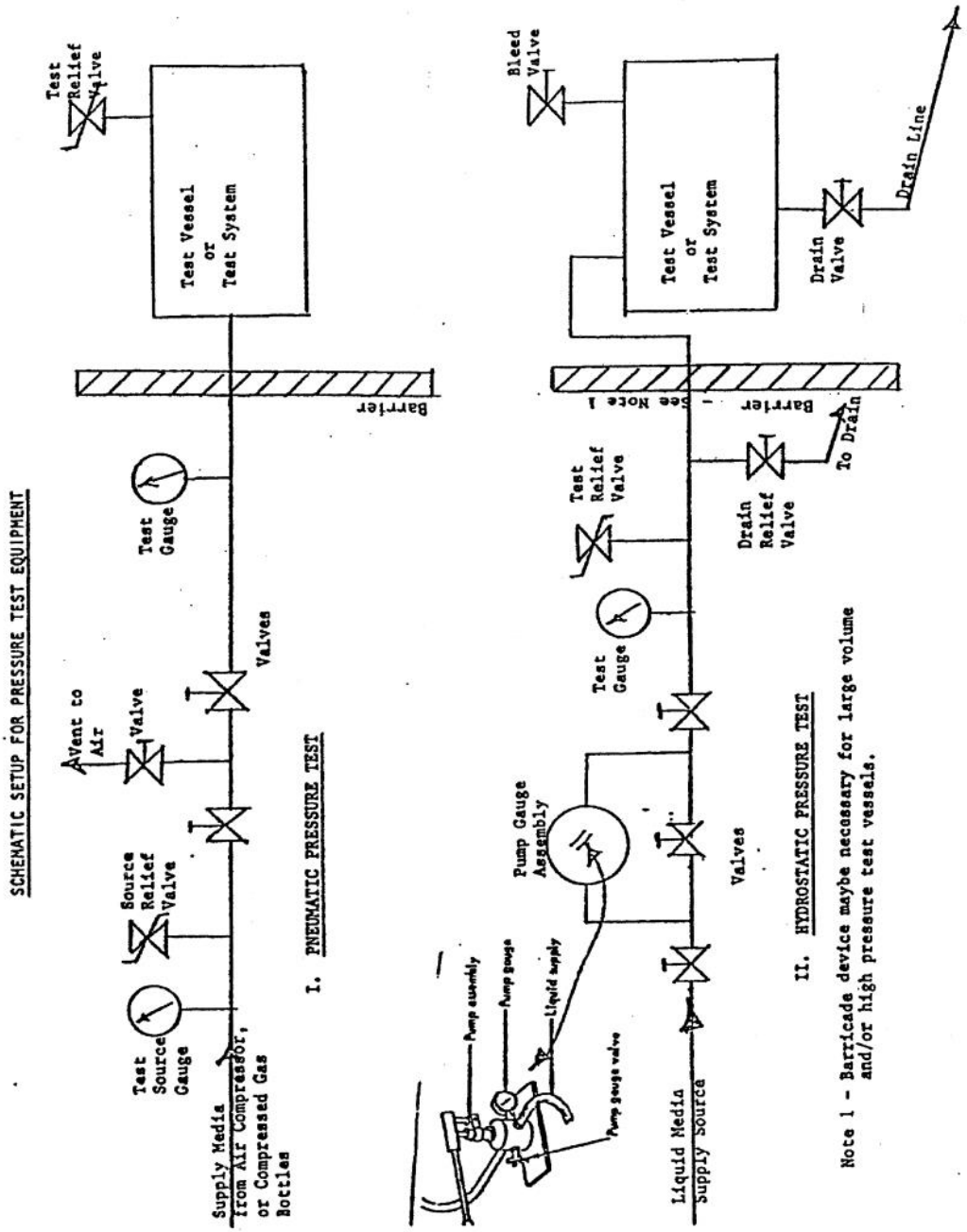

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EXHIBIT B
Pressure Testing Perm

Date: _____

Type of Test: [ ]Hydrostatic [ ] Pneumatic

Test Pressure _____ psig **Maximum Allowable Working Pressure** _____ psig

Items to be Tested

_____

_____

_____

Location of Test _____ **Date and Time** _____

Hazards Involved (use Hazard Analysis form FESHM 2060 if more space is required)

_____

_____

_____

Safety Precautions Taken

_____

_____

_____

Special Conditions or Requirements

_____

_____

_____

Qualified Person and Test Coordinator Dept/Date _____

_____

Division/Section Safety Officer Dept/Date _____

_____

Results

_____

_____

_____

_____

_____

_____

Witness _____ **Dept/Date** _____
(Safety Officer or Designee)

* Must be signed by division/section safety officer prior to conducting test. It is the responsibility of the test coordinator to obtain signatures.

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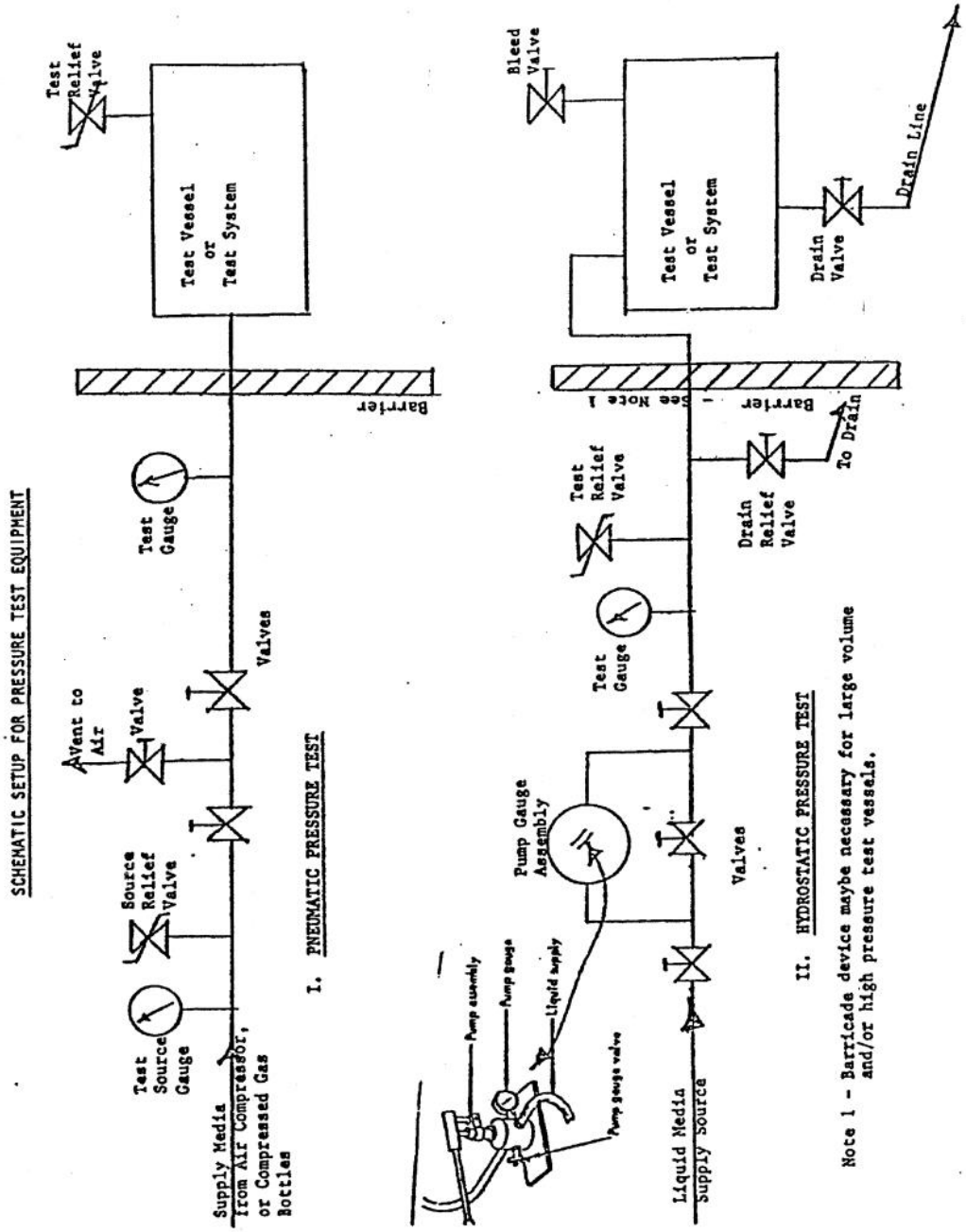

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