Fermilab

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Memorandum

February 9, 2009

To: Bruce Chrisman

From: Nancy Grossman

Subject: Revised FESHM Chapter 5035 – Mechanical Refrigeration Systems

FESHM Chapter 5035, Mechanical Refrigeration Systems has been revised. The following revisions have been made:

1. Revised SCOPE excludes units with less than 3lbs of refrigerant.
2. Added DEFINITION section.
3. Expanded SPECIAL RESPONSIBILITIES section.
4. Revised wording from "document" to "Engineering Note".
5. Added section entitled, EXCLUSIONS FOR REQUIREMENTS FOR OTHER FESHM CHAPTERS, to more clearly express the intent of exclusions already allowed by existing revision.
6. Added PROCEDURES section.
7. Added requirement that Engineering Notes are filed with ES&H office.
8. Added requirement that approved Refrigeration Systems receive a Fermilab label, similar to silver stickers on pressure vessels, which shows that the system meets the requirements of this chapter.
9. Added Appendix that shows essential content requirements of Engineering Note.

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

Encl.

Recommended for Approval:

Bruce Chrisman — Date: 2/10/09

Approved:

Piermaria Oddone — Date: 2/12/09

MECHANICAL REFRIGERATION SYSTEMS

INTRODUCTION

Mechanical refrigeration systems such as chillers, air conditioners, and heat pumps containing pressurized refrigerants pose a potential hazard to equipment and personnel from explosion, fire, and suffocation. This chapter specifies the procedures to be followed in the design, construction, installation and operation of refrigeration systems which fall under the scope of this chapter. Consult FESHM 8081 Refrigeration Management for requirements on refrigerant inventory reporting.

SCOPE

This chapter applies to all mechanical refrigeration systems falling under the scope of ANSI/ASHRAE 15 except the following small units are excluded: reach-in refrigerators and freezers, window installed air conditioners, mobile laboratory chillers, and other units with Group A1 refrigerant (per ASHRAE 15 Table 1) inventory less than 3lbs. Also excluded are cryogenic systems of any size using a fluid whose normal boiling point is less than -150C.

DEFINITIONS

Engineering Note - A written analysis demonstrating that a refrigeration system installation satisfies the requirements of this chapter.

Exceptional Refrigeration System: A mechanical refrigeration system which cannot meet the requirements of this chapter and therefore requires a Director's exception.

Qualified Person: 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.

Definitions for refrigeration system terminology are included in ANSI/ASHRAE 15.

SPECIAL RESPONSIBILITIES

The division/section head who controls the area in which the mechanical refrigeration system is being operated is responsible for carrying out the requirements of this

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chapter. The division/section head or his/her designee shall:

1. Arrange for the review of the Engineering Note by a qualified person.
2. Certify system compliance with this chapter by signing the Engineering Note.
3. File the original Engineering Note with the ES&H section.
4. Maintain an open, current file on all refrigeration systems located in his areas of responsibility.

The ES&H Section shall audit the divisions/sections on their compliance to this chapter.

The Mechanical Safety Subcommittee (MSS) shall serve the division/section heads and ES&H Section in a consulting capacity on all refrigeration system matters.

REQUIREMENTS

1. Mechanical refrigeration system design, construction, installation, and operation must meet all requirements of the ANSI/ASHRAE 15 revision current at the initiation of the system's specification.

2. A signed engineering note by an individual deemed qualified by the appropriate division/section head must demonstrate compliance to ANSI/ASHRAE 15.

EXCLUSIONS FOR REQUIREMENTS OF OTHER FESHM CHAPTERS

Purchased mechanical refrigeration units and skids in compliance with ANSI/ASHRAE 15 comply by virtue with the intent of other ES&H Chapters.

1. ASHRAE 15 requires ASME BPV code-stamped pressure vessels. These vessels do not require engineering notes per FESHM 5031 Pressure Vessels nor Fermilab's silver conformance sticker,

2. Relief valves on the refrigeration equipment are exempt from the requirements of FESHM 5031.4 Inspection and Testing of Relief Systems.

3. ASHRAE 15 requires that refrigeration piping conform to ASME B31.5 Refrigeration Piping and Heat Transfer Components. Refrigeration piping that is part of the procured refrigeration equipment is exempt from demonstration of compliance to FESHM 5031.1 Piping Systems. (Piping connected to/from the refrigeration equipment is not exempted.)

4. ASHRAE 15 includes installation requirements that address oxygen deficiency, flammability, and toxicity concerns of leaking refrigerants. Installation requirements shall be addressed by the requirements of this chapter and

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therefore demonstration of compliance to FESHM 5064 Oxygen Deficiency Hazards and 6020.3 Storage and Use of Flammable Gases at Physics Experiments is exempted.

PROCEDURES

1. *Preparation of Engineering Note:* An Engineering Note shall be prepared by a qualified person for all mechanical refrigeration systems in the scope of this chapter. Essential elements of the engineering note are listed in the Appendix. Its purpose is to allow a reviewer to verify compliance to ANSI/ASHRAE 15 and other FESHM Chapters. The Engineering Note shall include documentation from vendors that certifies refrigeration equipment complies with ANSI/ASHRAE 15. The Note shall also demonstrate that ANSI/ASHRAE 15 installation-specific requirements have been met by Fermilab and subcontractors involved in the installation.

2. *Review of Engineering Note:* All Mechanical Refrigeration Engineering Notes shall be reviewed by an independent, qualified reviewer for concurrence to this chapter. The reviewer shall be from a group not reporting to the preparer of the Engineering Note or his supervisor.

3. *Exceptional refrigeration systems:* Exceptional installations require the approval of the Laboratory Director or his/her designee. The need for such exceptions is to be minimized by adherence to the provisions of this chapter. Exceptions are to be identified and submitted to the Director for review as early in the design process as possible. These exceptions shall only be allowed after the Director has assured himself that sound engineering practices will be followed and the installation is safe. The ES&H Section shall maintain copies of exceptions for the Director. The director's approval is documented by his/her signature in the engineering note.

4. *Amendment of Engineering Note:* Any subsequent changes in refrigerants, capacity, etc., which effects safety or merits documentation, requires an amendment to the original Engineering Note. This amendment shall be reviewed in the same manner as the original Note.

5. *Mechanical Refrigeration System marking:* After signed approval of the engineering note, the Fermilab engineering standard conformance label shall be attached to the refrigeration unit or posted nearby. Each system shall be permanently marked with a unique system number. This number shall also be recorded in the engineering note.

6. *Records:* Approved engineering notes shall be filed with the ES&H office.

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APPENDIX A - Engineering Note Essential Elements

1. Cover sheet identifying title, author, reviewer, and approver. Director's signature shall also be included for an Exceptional Refrigeration System.
2. Identify physical location, division responsible for the equipment, system's unique identifying number.
3. Append memo or letter from manufacturer, photo of conformance label, etc. which demonstrates that purchased refrigeration equipment complies with ANSI/ASHRAE 15.
4. Equipment Manufacturer
5. Equipment serial number(s)
6. Chilling capacity, total mass (lbs/kg) of refrigerant
7. Refrigerant type (e.g. R134):
8. Refrigerant class (circle one): 1A, 2A, 3A, 1B, 2B, 3B
9. Occupancy Class (circle one):

   Institutional / Public Assembly / Residential / Commercial / Industrial /Mixed:

   If mixed, specify:

10. Describe and demonstrate compliance with ASHRAE 15 Installation Requirements, including:
    a. Equipment location, room specifications
    b. Room ventilation
    c. Refrigeration monitor
    d. Relief valve vent lines
11. Demonstrate in this engineering note or reference a different note that piping connecting to/from equipment complies with FESHM 5031.1 Piping.

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