

## FESHM 5035: MECHANICAL REFRIGERATION SYSTEMS

### Revision History

<b>Author</b>	<b>Description of Change</b>	<b>Revision Date</b>
Dave Pushka	Five-year review of chapter 5035. Release Chapter 5035 using new FESHM template. Significant changes to the scope intended to streamline the documentation requirement for commercially produced packaged refrigeration systems where the manufactures do not explicitly indicate compliance with ASHRAE 15	Revision 1 07-March-2019

## TABLE OF CONTENTS

<b>1.0</b>	INTRODUCTION.....	3
<b>2.0</b>	SCOPE.....	3
<b>3.0</b>	DEFINITIONS.....	3
<b>4.0</b>	SPECIAL RESPONSIBILITIES.....	3
<b>5.0</b>	REQUIREMENTS.....	4
<b>6.0</b>	EXCLUSIONS FOR REQUIREMENTS OF OTHER FESHM CHAPTERS.....	4
<b>7.0</b>	PROCEDURE FOR PACKAGED REFRIGERATION UNITS WHICH DO NOT EXPLICITLY INDICATE ASHRAE 15 COMPLIANCE.....	5
<b>8.0</b>	PROCEDURES.....	5
<b>9.0</b>	TECHNICAL APPENDIX A - Engineering Note Essential Elements.....	7

## 1.0 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.

## 2.0 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 three (3) lbs. Also excluded are cryogenic systems of any size using a fluid whose normal boiling point is less than -150C (These are covered by another FESHM chapter).

## 3.0 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 using a refrigerant other than a refrigerant in Group A1 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 Safety Standard for Refrigeration Systems

## 4.0 SPECIAL RESPONSIBILITIES

### The Division/Section Head

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 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 via Teamcenter standard workflow process.
3. File the original Engineering Note ~~with the ES&H Section~~ in Teamcenter and apply standard

workflow review process.

4. Maintain an open, current file on all refrigeration systems located in his areas of responsibility.

### **The ES&H Section**

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

### **The Mechanical Safety Subcommittee**

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

## **5.0 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. Where industry does not provide an ANSI/ASHRAE 15 compliant mechanical refrigeration system, the mechanical safety committee shall act as the authority having jurisdiction (AHJ) and will specify the engineering note content needed to show conformance with the ASHRAE 15. Notes shall include, as a minimum the topics shown in section 7.0 of this chapter.
3. A signed engineering note by an individual deemed qualified by the appropriate division/section head must demonstrate compliance to ANSI/ASHRAE 15 or as deemed required by the AHJ.

## **6.0 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 therefore demonstration of compliance to FESHM 4240 Oxygen Deficiency Hazards and 6020.3 Storage and Use of Flammable Gases at Physics Experiments is exempted.

## 7.0 PROCEDURE FOR PACKAGED REFRIGERATION UNITS WHICH DO NOT EXPLICITLY INDICATE ASHRAE 15 COMPLIANCE

Purchased mechanical refrigeration units and skids which do not indicate compliance with ANSI/ASHRAE 15 must have an engineering note prepared which includes:

1. Documentation that any vessel which fall under the scope of the ASME BPV are code-stamped pressure vessels. These vessels do not require engineering notes per FESHM 5031 Pressure Vessels nor the silver conformance sticker.
2. Documentation that any relief valves are sufficiently sized. Relief valves on the refrigeration equipment are exempt from the requirements of FESHM 5031.4 Inspection and Testing of Relief Systems.
3. Documentation that refrigeration piping meets ASME B31.5 requirements (See ASHRAE 15 paragraph 9.10).
4. Documentation that the flammability, ODH and toxicity concerns of leaking refrigerants from the system meet ASHRAE 15 requirements. Installation requirements shall be addressed by the requirements of this chapter and therefore demonstration of compliance to FESHM 4240 Oxygen Deficiency Hazards and 6020.3 Storage and Use of Flammable Gases at Physics Experiments is exempted.

## 8.0 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 ESH&H office.

## 9.0 TECHNICAL 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,
7. Total mass (pounds or kg) of refrigerant
8. Refrigerant type (e.g. R134):
9. Refrigerant class or Group per ASHRAE 15 (circle one): 1A, 2A, 3A, 1B, 2B, 3B
10. Occupancy Class (circle one):  
Institutional / Public Assembly / Residential / Commercial / Industrial / Mixed:  
If mixed, specify:
11. 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
12. Demonstrate in this engineering note or reference a different note that piping connecting to/from equipment complies with FESHM 5031.1 Piping.