

# **Wisconsin Administrative Code**

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## **DEPARTMENT OF COMMERCE**

### **Chapter Comm 45**

### **MECHANICAL REFRIGERATION**

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## INTRODUCTION

### Purpose and Structure

The Legislature, by s. 35.93 and ch. 227, Stats., directed the publication of the rules of executive agencies having rule-making authority in a loose-leaf, continual revision system known as the Wisconsin Administrative Code. The Code is kept current by means of new and replacement pages. The pages are issued monthly, together with notices of hearings, notices of proposed rules, notices of emergency rules, instructions for insertion of new material, and other information relating to administrative rules and the administrative rulemaking process. This service is called the Wisconsin Administrative Register, and comes to the subscriber near the middle and at the end of each month. Code pages are issued to subscribers only with the end of the month Register. The editing and publishing of the Register and Code is done by the Revisor of Statutes Bureau, Suite 800, 131 W. Wilson St., Madison, Wisconsin, 53703. E-mail-gary.poulson@legis.state.wi.us Telephone (608-266-7275).

### Availability

The complete code and the upkeep service are distributed to the county law libraries; to the libraries of the University of Wisconsin Law School and Marquette University Law School; to the State Historical Society; to the Legislative Reference Bureau and to the State Law Library, and to certain designated public libraries throughout the state.

The sale and distribution of the printed Register, Code and of its parts is handled by Department of Administration, Document Sales, P.O. Box 7840, Madison, Wisconsin 53707. (608-266-3358 information) (1-800-362-7253 or 608 264-9419 charge card orders).

The entire Code and Registers from January, 1996, can be found on the WisLaw<sup>®</sup> CD-ROM. End-user license and subscription order forms are available from Document Sales and Distribution.

The Code and Register can also be found on the internet at [www.legis.state.wi.us/rsb](http://www.legis.state.wi.us/rsb)

### Arrangement and Table of Contents

The Code is arranged in the complete set alphabetically by agency. Certain descriptors such as "Department" and "Wisconsin" are ignored for arrangement purposes. Several agencies further subdivide their rules either by program e.g. Department of Commerce - Plumbing or by division within the agency e.g. Department of Health & Family Services - Health, chs. HFS 110-. These Codes are arranged in numerical order within the appropriate alphabetical arrangement for the agency.

Each agency adopts a prefix to identify their rules. For example, the Department of Natural Resources uses "NR" before each chapter number.

Each Code with more than one chapter will have a table of chapters. After the title of each chapter will be the page numbers on which the chapter begins. Each chapter will have a table of sections.

### History Notes

Each page of the Code as it was originally filed and printed pursuant to the 1955 legislation, had a date line "1-2-56". A rule which is revised or created subsequent to the original printing date is followed by a history note indicating the date and number of the Register in which it was published and the date on which the revision or creation of the rule became effective. Additions to a section's history note will be shown in bold face when those affected code sections are first released. The absence of a history note at the end of a section indicates that the rule has remained unchanged since the original printing in 1956. The date line at the bottom of the page indicates the month in which the page was released, but does not necessarily mean a substantive change has occurred on that page. Some common abbreviations used in the history notes are: cr. - created, am. -amend, r. -repeal, recr. -recreate, renum. -renumber, eff. -effective and emerg. -emergency.

In some instances an *entire* chapter has been repealed and recreated or renumbered subsequent to the original printing date. When this occurs a note has been placed at the beginning of the chapter after the table of sections to contain this information. A separate history note appears after each section indicating the date when the revision or creation became effective.

Beginning July 2001, history notes will indicate the Clearinghouse Rule number associated with a rule revision. The Clearinghouse Rule number is assigned by the Legislative Council Rules Clearinghouse to a proposed rule near the start of the rulemaking process. This number is portrayed in a history note as, for example, the following: **CR 01-041**. The first 2 numbers indicate the year the rule proposal was initiated and the last 3 numbers refer to a sequential numbering of proposals as the rule proposals are received by the Legislative Council during the course of the year.

### Emergency Rules

The Legislature has granted state agencies the authority to enact rules without using the normal rule-making process by publishing those rules in the official state newspaper. To justify the use of the emergency rule process, an agency must find that the preservation of the public peace, health, safety or welfare will be jeopardized without the emergency rule. Readers should review the current Wisconsin Administrative Register to see if a particular published rule is also affected by an emergency rule. Most emergency rules are eventually adopted as permanent rules and published in the Code.

### Index

The index for the complete Wisconsin Administrative Code will be found in the last volume of the complete set. It will be recompiled, reprinted and distributed at least 3 times a year. Some Codes have a separate index prepared by the agency involved. Agency prepared indexes tend to be more comprehensive than the general index prepared by the Revisor of Statutes. See the Uniform Dwelling Code (chs. Comm 20-25) as an example.







## Chapter Comm 45

### MECHANICAL REFRIGERATION

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Note: Chapter Ind 45 as it existed on September 30, 1983 was repealed and a new chapter ILHR 45 was created effective October 1, 1983; chapter ILHR 45 as it existed on August 31, 1994 was repealed and a new chapter ILHR 45 was created effective September 1, 1994. Chapter ILHR 45 was renumbered to be chapter Comm 45 under s. 13.93 (2m) (b) 1., Stats., and corrections made under s. 13.93 (2m) (b) 6. and 7., Stats., Register, October, 1996, No. 490.

Note: Chapter Comm 45 as it existed on October 31, 2003 was repealed and a new chapter Comm 45 was created Register October 2003 No. 574, effective November 1, 2003.

#### Subchapter I — Purpose and Scope

**Comm 45.01 Purpose.** Pursuant to ss. 101.17 and 101.177, Stats., the purpose of this chapter is to establish minimum safety standards for the design, construction, installation, operation and inspection of mechanical refrigerating systems installed in public buildings and places of employment, and for preventing the release of ozone-depleting refrigerants to the atmosphere. The provisions of this chapter are not retroactive unless specifically stated in the administrative rule.

Note: Chapter Comm 5 contains requirements pertaining to the registration of persons engaged in the business of servicing refrigeration equipment or selling ozone-depleting refrigerant and persons installing and servicing refrigeration equipment which may release an ozone-depleting refrigerant.

Note: Chapters Comm 61 to 65 contain additional requirements pertaining to the installation of mechanical refrigerating systems in public buildings and places of employment.

History: CR 03-012; cr. Register October 2003 No. 574, eff. 11-1-03.

**Comm 45.02 Scope.** (1) APPLICATION. This chapter applies to all of the following:

- (a) The installation of mechanical refrigerating systems and heat pumps.
- (b) A change to a refrigerant of a different number designation.
- (c) Parts or components replaced only if they are not identical in function.
- (d) Additions or alterations to any refrigerating system that exceeds the registration criteria in s. Comm 45.07.

(2) EXEMPTIONS. This chapter does not apply to the use of water or air as the primary refrigerant.

(3) LISTED EQUIPMENT. Equipment listed by an approved nationally recognized testing laboratory is deemed to meet the design, manufacture and factory test requirements of this chapter for the refrigerants for which the equipment was designed. Listed refrigerating systems are not required to be field tested.

(4) CONFLICTS. Where rules of the department specify conflicting requirements, the most restrictive rule shall govern.

History: CR 03-012; cr. Register October 2003 No. 574, eff. 11-1-03.

**Comm 45.03 Local regulations.** This chapter does not limit the power of cities, villages and towns to make or enforce additional or more stringent regulations, provided the regulations do not conflict with this chapter, any other rule of the department, or law.

History: CR 03-012; cr. Register October 2003 No. 574, eff. 11-1-03.

#### Subchapter II — Definitions

**Comm 45.05 Definitions.** In this chapter:

- (1) "Approved" means acceptable to the department.
- (2) "Approved nationally recognized testing laboratory" means a laboratory acceptable to the department, which provides uniform testing and examination procedures and standards for meeting design, manufacturing and factory test requirements of this chapter; is organized, equipped and qualified for testing; and has a follow-up inspection service of the current production of the listed products.
- (3) "ASHRAE" means the American Society of Heating, Refrigerating and Air-Conditioning Engineers.
- (4) "Department" means the department of commerce.
- (5) "IIAR" means the International Institute of Ammonia Refrigeration.
- (6) "IMC" means the International Mechanical Code.
- (7) "Ozone-depleting refrigerant" has the meaning specified under s. 100.45 (1) (d), Stats.

Note: Under s. 100.45 (1) (d), Stats., "ozone-depleting refrigerant" means a substance used in refrigeration that is or contains a class I substance, as defined in 42 USC 7671 (3) or a Class II substance, as defined in 42 USC 7671 (4).

- (8) "Place of employment" has the meaning specified under s. 101.01 (11), Stats.

Note: Under s. 101.01 (11), Stats., "place of employment" includes every place, whether indoors or out or underground and the premises appurtenant thereto where either temporarily or permanently any industry, trade or business is carried on, or where any process or operation, directly or indirectly related to any industry, trade or business, is carried on, and where any person is, directly or indirectly, employed by another for direct or indirect gain or profit, but does not include any place where persons are employed in private domestic service which does not involve the use of mechanical power or in farming. "Farming" includes those activities specified in s. 102.04 (3), and also includes the transportation of farm products, supplies or equipment directly to the farm by the operator of said farm or employees for use thereon, if such activities are directly or indirectly for the purpose of producing commodities for market, or as an accessory to such production. When used with relation to building codes, "place of employment" does not include an adult family home, as defined in s. 50.01 (1), or, except for the purposes of s. 101.11, a previously constructed building used as a community-based residential facility, as defined in s. 50.01 (1g), which serves 20 or fewer residents who are not related to the operator or administrator.

- (9) "Public building" has the meaning specified under s. 101.01 (12), Stats.

**Note:** Under s. 101.01 (12), Stats., "public building" means any structure, including exterior parts of such building, such as a porch, exterior platform or steps providing means of ingress or egress, used in whole or in part as a place of resort, assemblage, lodging, trade, traffic, occupancy, or use by the public or by 3 or more tenants. When used in relation to building codes, "public building" does not include a previously constructed building used as a community-based residential facility as defined in s. 50.01 (1g) which serves 20 or fewer residents who are not related to the operator or administrator of an adult family home, as defined in s. 50.01 (1).

**History:** CR 03-012; cr. Register October 2003 No. 574, eff. 11-1-03.

### Subchapter III — Administration and Enforcement

**Comm 45.07 Installation registration. (1) CLASSIFICATIONS.** The installer shall register with the department the installation of new, used or additional mechanical refrigerating systems of the following classifications:

(a) Any system using a Group A1 or B1 refrigerant and having a capacity rated at or greater than 50 horsepower, 50 tons or 50,000 volt-amperes.

(b) Any system using a Group A2, B2, A3 or B3 refrigerant and having a capacity rated at or greater than 10 horsepower, 10 tons or 10,000 volt-amperes.

**(2) FORMS.** Registration information shall be submitted on form SBD-34 obtainable from the department.

**Note:** The department forms required in this chapter are available from the Division of Safety and Buildings, Material Orders, P.O. Box 2509, Madison, WI 53701-2509, telephone 608/266-3151 or 608/264-8777 (TTY), or at the Safety and Buildings web site at [www.commerce.state.wi.us](http://www.commerce.state.wi.us).

**(3) SUBMITTAL.** The registration form shall be submitted to the department before the system is placed in operation.

**Note:** The purpose of the registration is so that inspections can be made as specified in s. Comm 45.08 (2).

**(4) REACTIVATION.** The owner or user shall notify the department before reactivating a mechanical refrigerating system at any time after the expiration date on the permit to operate. The system shall be re-inspected by the department and a new permit to operate shall be obtained before the system may be reactivated.

**Note:** The department can be notified by writing to the Division of Safety and Buildings, Inspection Support Unit, P.O. Box 7302, Madison, WI 53707-7302, or by telephone at 608/266-3151 or 608/264-8777 (TTY).

**History:** CR 03-012; cr. Register October 2003 No. 574, eff. 11-1-03.

### Comm 45.08 Enforcement and inspections.

**(1) ENFORCEMENT.** This chapter shall be enforced by the department and its deputies, and by all local officials or bodies having jurisdiction to approve plans or specifications or issue permits for construction, alterations or installations within the scope of this chapter or having authority to investigate and eliminate related fire hazards.

**Note:** Examples of deputies are third party inspection agencies having a contract with the department.

**(2) INSTALLATION INSPECTIONS.** (a) The department shall inspect a mechanical refrigerating system which requires registration under s. Comm 45.07 (1) before the system is placed in operation.

(b) The department shall inspect refrigerant steel piping using welded joints to be erected on the premises after the piping material is delivered to the job site and prior to the start of construction. The installer shall give the department a minimum of 5 business days notice to arrange for the inspection.

(c) The installer shall complete form SBD-5204 and retain it at the job site prior to the refrigerant piping inspection. The certified inspector shall indicate acceptance of the refrigerant piping system design by signing form SBD-5204.

(d) The owner of the refrigerant piping system may request piping inspections in addition to the minimum inspections required under this section.

**(3) PERIODIC INSPECTIONS.** (a) 1. Except as provided in subd. 2., any mechanical refrigerating system using a Group A1 or B1 refrigerant and having a capacity rated at or greater than 50 horsepower, 50 tons or 50,000 volt-amperes shall be subject to inspection by the department at least once every 36 months.

2. Groups A1 and B1 systems located outdoors with the discharge located at least 20 feet from any building opening and used only for air-conditioning for human comfort are exempt from periodic inspections.

(b) Any mechanical refrigerating system using a Group A2, B2, A3 or B3 refrigerant and having a capacity rated at or greater than 10 horsepower, 10 tons or 10,000 volt-amperes shall be subject to inspection by the department at least once every 12 months.

**History:** CR 03-012; cr. Register October 2003 No. 574, eff. 11-1-03.

**Comm 45.09 Permit to operate. (1)** (a) The owner or user of a mechanical refrigerating system which requires periodic inspections under s. Comm 45.08 (3) shall be responsible for obtaining and maintaining a valid permit to operate.

(b) The permit to operate shall be posted in the machinery room or adjacent to the entrance to the machinery room.

**(2)** After the initial inspection or after each periodic inspection, a permit to operate shall be issued by the department upon determination that the system meets the applicable requirements of this chapter. The department shall make that determination and issue a permit to operate within 15 business days of the initial or periodic inspection.

**(3)** The permit to operate shall indicate the maximum allowable working pressure permitted under the requirements of this chapter.

**(4)** The permit to operate shall be valid until 20 days after the next periodic inspection.

**History:** CR 03-012; cr. Register October 2003 No. 574, eff. 11-1-03.

**Comm 45.10 Reporting of accidents.** Whenever mechanical refrigeration equipment or system components fail and cause injury to any person, the owner or user shall report in writing the facts involved to the department within the following 24 hours. The owner or user may not remove or disturb mechanical refrigeration equipment or any of its parts nor permit any such removal or disturbance prior to receiving authorization from the department, except for the purpose of saving human life or preventing further property damage.

**Note:** Accidents are to be reported to the department at the Safety and Buildings Division, Inspection Support Unit, P.O. Box 7302, Madison, WI 53707-7302.

**History:** CR 03-012; cr. Register October 2003 No. 574, eff. 11-1-03.

**Comm 45.11 Petition for variance.** The department shall consider and may grant a variance to a provision of this chapter in accordance with ch. Comm 3. The petition for variance shall include a position statement from the fire department having jurisdiction over the affected property.

**Note:** Chapter Comm 3 requires the submittal of a petition for variance form (SBD-9890) and a fee, and that an equivalency is established in the petition for variance that meets the intent of the rule being petitioned. Chapter Comm 3 also requires the department to process regular petitions within 30 business days and priority petitions within 10 business days.

**History:** CR 03-012; cr. Register October 2003 No. 574, eff. 11-1-03.

**Comm 45.12 Appeals. (1) APPEAL OF DEPARTMENT ORDER.** Pursuant to s. 101.02 (6) (e), Stats., any person who owns or occupies a property that is affected by an order of the department may petition the department for a hearing on the reasonableness of the order.

**(2) APPEAL OF LOCAL ORDER.** Pursuant to s. 101.02 (7) (b), Stats., any person affected by a local order that is in conflict with an order of the department may petition the department for a hearing on the local order.

**(3) PETITION FOR ADMINISTRATIVE RULE.** Pursuant to s. 227.12, Stats., any municipality, corporation or any 5 or more persons having an interest in an administrative rule may petition the department requesting the adoption, amendment or repeal of the rule.

**History:** CR 03-012; cr. Register October 2003 No. 574, eff. 11-1-03.

**Comm 45.13 Penalties.** Penalties for violations of this chapter shall be assessed in accordance with s. 101.02 (12) and (13) (a) or 101.177 (5), Stats.

Note: Section 101.02 (12), Stats., indicates that every day during which any person, persons, corporation or any officer, agent or employee thereof, fails to observe and comply with an order of the department will constitute a separate and distinct violation of such order.

Note: Section 101.02 (13) (a), Stats., indicates penalties will be assessed against any employer, employee, owner or other person who fails or refuses to perform any duty lawfully enjoined, within the time prescribed by the department, for which no penalty has been specifically provided, or who fails, neglects or refuses to comply with any lawful order made by the department, or any judgment or decree made by any court in connection with ss. 101.01 to 101.25, Stats. For each such violation, failure or refusal, such employee, owner or other person must forfeit and pay into the state treasury a sum not less than \$10 nor more than \$100 for each violation.

Note: Section 101.177 (5), Stats., indicates that any person who violates the installation, servicing or sale requirements relating to ozone-depleting refrigerants will be required to forfeit not less than \$50 nor more than \$1,000. Each act of installation, servicing or sale in violation of the rule constitutes a separate violation.

History: CR 03-012; cr. Register October 2003 No. 574, eff. 11-1-03.

**Comm 45.14 Fees.** Fees for permits to operate, inspections and petitions for variance shall be submitted as specified in ch. Comm 2.

History: CR 03-012; cr. Register October 2003 No. 574, eff. 11-1-03.

### Subchapter IV — Standards

**Comm 45.20 Construction and operation. (1) GENERAL.** All mechanical refrigerating systems shall be designed, installed, maintained and operated in accordance with chapter 11 of the International Mechanical Code — 2000 incorporated by reference in s. Comm 61.05, subject to the changes, additions and omissions specified in subch. V.

(2) **ADDITIONAL STANDARD.** In addition to the requirements in IMC chapter 11, the following standard is hereby incorporated by reference into this chapter: Refrigeration Piping and Heat Transfer Components, ASME B31.5 — 2001. Refrigeration piping shall comply with ASME B31.5 — 2001.

Note: American Society of Mechanical Engineers (ASME) standards may be purchased from the ASME Order Department, 22 Law Drive, Box 2300, Fairfield, NJ 07007-2300, telephone 800 THE ASME.

Note: Copies of adopted standards are on file in the offices of the department, the secretary of state, and the revisor of statutes.

History: CR 03-012; cr. Register October 2003 No. 574, eff. 11-1-03.

**Comm 45.21 Ozone-depleting refrigerants. (1) REQUIRED CERTIFICATION.** Pursuant to s. 101.177 (2), Stats., no person may install or service a piece of refrigeration equipment that contains ozone-depleting refrigerant unless the person has been certified as a refrigerant handling technician in accordance with ch. Comm 5.

(2) **CLEANING OF EQUIPMENT.** Ozone-depleting refrigerant shall not be used for cleaning purposes, including the cleaning of interior or exterior surfaces of refrigeration equipment.

(3) **TRANSFERRING REFRIGERANT.** Whenever ozone-depleting refrigerant is removed from refrigeration equipment, the ozone-depleting refrigerant shall be transferred to storage containers using equipment that is approved by the department. The department shall approve any transfer equipment if an approved nationally recognized testing laboratory has certified the equipment.

Note: The department will accept equipment that has been tested and certified in accordance with the Air-Conditioning and Refrigeration Institute (ARI) standard ARI 740.

(4) **RELEASING REFRIGERANT.** Ozone-depleting refrigerant shall not be knowingly or negligently released to the environment, except for minimal releases that occur as a result of efforts to recover, reclaim or recycle ozone-depleting refrigerant removed from refrigeration equipment.

(5) **ADDING REFRIGERANT.** Before putting additional ozone-depleting refrigerant into refrigeration equipment, the refrigeration equipment shall be inspected and repaired if a leak is found or suspected. A yearly leak rate identified by the federal environmental protection agency shall be used to determine whether repairs are necessary.

History: CR 03-012; cr. Register October 2003 No. 574, eff. 11-1-03.

### Subchapter V — Changes, Additions or Omissions to Adopted Standards

**Comm 45.30 Changes, additions or omissions to the International Mechanical Code.** Changes or additions to or omissions from the IMC are specified in this subchapter and are rules of the department and are not requirements of the IMC.

History: CR 03-012; cr. Register October 2003 No. 574, eff. 11-1-03.

**Comm 45.31 [IMC 1101] General. (1) SCOPE.** The requirements in IMC section 1101.1 are not included as part of this chapter.

(2) **WATER CONNECTION.** Substitute the following wording for the requirements in IMC section 1101.4: Water supply and discharge connections associated with refrigeration systems shall be made in accordance with this code and chs. Comm 81 to 87.

(3) **FUEL GAS CONNECTION.** Substitute the following wording for the requirements in IMC section 1101.5: Fuel gas devices, equipment and appliances used with refrigeration systems shall be installed in accordance with ch. Comm 65.

(4) **GENERAL.** Substitute the following wording for the requirements in IMC section 1101.6:

(a) The sections of the ASHRAE 15-1994 standard, as referenced in IMC section 1101.6, that apply under this chapter are sections 8.1, 8.2, 8.6, 8.12.1, 8.12.2, 8.12.4, 8.15, 8.16, 9.1 to 9.7.4, 9.7.6 to 9.7.8.4, 9.8, 9.9, 9.10.1, 9.11, 9.12.4, 9.14, 11.1 to 11.5, 11.7.1, and 11.7.2.

(b) The sections of the IAR 2-1999 standard, as referenced in IMC section 1101.6, that apply under this chapter are sections 5.0 to 5.14, 5.15 (intro.), 5.15.3, 5.16 to 5.18, 6.1.1.2, 6.1.1.3, 6.3.1.4, 6.3.1.8, 6.3.1.9, 6.3.2.1, 6.3.2.2, 6.3.2.3, 6.3.2.4, 6.3.3.1, 6.3.3.2, 7.1.1, 7.1.2, 7.2, 7.3.1, 7.3.2, 7.3.3, 7.3.5, 7.3.6, 7.4, 7.5.2, 7.5.3, 7.5.4, 7.5.6.4, 7.5.7, 7.5.8, and 7.6.

(5) **CHANGE IN REFRIGERANT TYPE.** Substitute the following wording for the requirements in IMC section 1101.8: The type of refrigerant in refrigeration systems required to be registered under s. Comm 45.07 shall not be changed without prior notification to the department and compliance with the applicable code provisions for the new refrigerant type.

(6) **REFRIGERANT DISCHARGE.** Substitute the following wording for the requirements in IMC section 1101.9:

(a) Except as provided in par. (b), the fire department shall be notified immediately upon the automatic or manual discharge of refrigerant from systems having a refrigerant circuit containing more than 220 pounds of Group A1 or 30 pounds of any other refrigerant. Refrigerant shall not be discharged except in an emergency.

(b) Notification is not required for any of the following conditions:

1. Refrigeration systems operating at pressures below atmospheric and incorporating automatic purge systems.

2. Incidental operation of automatic pressure relief valves resulting in minor release of the refrigerant charge.

3. Incidental minor releases associated with service operations after system pump-down has been accomplished.

History: CR 03-012; cr. Register October 2003 No. 574, eff. 11-1-03.

**Comm 45.32 [IMC 1102] System requirements.** This is a department informational note to be used under IMC section 1102.2:

Note: The department will approve the use of refrigerants assigned group classifications by the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) under ASHRAE standard 34, Number Designation and Safety Classification of Refrigerants. In granting the approval, the department may require compliance with additional limitations.

History: CR 03-012; cr. Register October 2003 No. 574, eff. 11-1-03.

**Comm 45.33 [IMC 1104] System application requirements.** Substitute the following wording for the requirements and exception in IMC section 1104.4.2:

(1) Except as provided in sub. (2), when an evaporator or condenser is located in an air duct system, the volume of the smallest occupied space, or in the case of an unpartitioned multi-story building the volume of the smallest occupied story, served by the duct shall determine the permissible quantity of refrigerant in the system.

(2) When the air duct system serves several enclosed spaces, the permissible quantity of refrigerant in the system shall not exceed the amount determined by using the total volume of those spaces in which the airflow cannot be reduced to less than one quarter of its maximum when the fan is operating.

History: CR 03-012: cr. Register October 2003 No. 574, eff. 11-1-03.

**Comm 45.34 Installation restrictions.** This is a department rule in addition to the requirements in IMC chapter 11 and a substitution for the requirements in ASHRAE 15 section 8.12.3:

(1) Refrigerant piping shall not penetrate floors, ceilings or roofs, except as follows:

(a) Penetrations connecting the basement and the first floor.

(b) Penetrations connecting the top floor and a machinery penthouse or roof installation.

(c) Penetrations connecting adjacent floors served by the refrigerating system.

(d) Penetrations of a direct system where the refrigerant quantity does not exceed IMC Table 1103.1 quantity for the smallest occupied space through which the refrigerant piping passes.

(e) In other than industrial occupancies and where the refrigerant quantity exceeds IMC Table 1103.1 quantity for the smallest occupied space, penetrations that connect separate pieces of equipment that are:

1. Enclosed by an approved gas-tight, fire-resistive duct or shaft with openings to those floors served by the refrigerating system; or

2. Located on the exterior wall of a building when vented to the outside or to the space served by the system and not used as an air shaft, closed court or similar space.

History: CR 03-012: cr. Register October 2003 No. 574, eff. 11-1-03.

**Comm 45.35 [IMC 1105] Machinery room, general requirements.** (1) REFRIGERANT DETECTOR. Substitute the following wording for the requirements in IMC section 1105.3:

(a) Except as provided in par. (b), machinery rooms shall contain a refrigerant detector with an audible and visual alarm. The detector, or a sampling tube that draws air to the detector, shall be located in an area where refrigerant from a leak will concentrate. The alarm shall be actuated at a value not greater than the corresponding TLV-TWA values specified in IMC section 1103 for the refrigerant classification. The alarm shall announce visual and audible alarms inside the refrigerating machinery room and outside each entrance to the refrigerating machinery room.

(b) Detectors are not required for ammonia systems where the machinery room complies with IMC section 1106.3.

(2) TERMINATION OF RELIEF DEVICES. The requirements in IMC section 1105.7 are not included as part of this chapter.

(3) AMMONIA DISCHARGE. This is a department rule in addition to the requirements in IMC section 1105.8: Pressure relief valves for ammonia systems shall be replaced in accordance with manufacturer's recommendations but not to exceed 5 years from the date of installation. In lieu of the expiration date, a relief valve

may be used for a total of 5 years if a record is maintained of when it was installed and it was not over 2 years old at the time of installation.

History: CR 03-012: cr. Register October 2003 No. 574, eff. 11-1-03.

**Comm 45.36 [IMC 1106] Machinery room, special requirements.** (1) AMMONIA ROOM VENTILATION. Substitute the following wording for the requirements, but not the exceptions, in IMC section 1106.3: Ventilation systems in ammonia machinery rooms shall be operated continuously at the normal ventilation rate. Failure of the mechanical ventilation system shall actuate an alarm.

(2) REMOTE CONTROLS. Substitute the following wording for the requirements in IMC section 1106.5 (intro.): Remote control of the mechanical equipment and appliances located in the machinery room shall be provided at an approved location immediately outside the machinery room and adjacent to its principal entrance.

(3) EMERGENCY SIGNS AND LABELS. Substitute the following wording for the requirements in IMC section 1106.6: Refrigeration units or systems having a refrigerant circuit containing more than 220 pounds of Group A1 or 30 pounds of any other group refrigerant shall be provided with approved emergency signs, charts and labels. Hazard signs shall be in accordance with IMC section 1103 for the refrigerant classification.

Note: See NFPA 704 for information regarding emergency signs, charts and labels.

(4) SEALING OF MACHINERY ROOMS. This is a department rule in addition to the requirements in IMC section 1106: The machinery room doors shall be tight-fitting, self-closing and swing in the direction of egress travel. Walls, floors and ceilings shall be airtight, and pipes shall be tightly sealed to the walls, floor or ceiling through which they pass.

History: CR 03-012: cr. Register October 2003 No. 574, eff. 11-1-03.

**Comm 45.37 Design and construction of equipment and systems.** These are department rules in addition to the requirements in IMC chapter 11:

(1) HYDROSTATIC PRESSURE RELIEF. This is a department exception to the requirements in ASHRAE 15 section 9.4.3: For systems containing refrigerant quantities in excess of 10,000 pounds, the use of trained technicians to isolate liquid-containing parts of the system is allowed in lieu of piped hydrostatic relief devices.

(2) DISCHARGE CAPACITY. Substitute the following wording for the requirements in ASHRAE 15 section 9.7.5:

(a) The minimum required discharge capacity of the pressure-relief device or fusible plug for each pressure vessel shall be determined by the following:

$$C = fDL$$

where C = minimum required discharge capacity of the relief device in pounds of air per minute,

D = outside diameter of vessel in feet,

L = length of vessel in feet, and

f = factor dependent upon type of refrigerant from Table 45.37-1

(b) When combustible materials are used within 20 feet of a pressure vessel, the value of f shall be multiplied by 2.5. The formula is based on fire conditions; other heat sources shall be calculated separately.

**Table 45.37-1**  
Values of f

Refrigerant	Value of f
When used on the lowside of a limited-charge cascade system:	
R-23, R-170, R-744, R-1150, R-508A, R-508B	1.0
R-13, R-13B1, R-503	2.0
R-14	2.5
Other applications:	
R-718	0.2
R-717	0.5
R-11, R-32, R-113, R-123, R-142b, R-152a, R-290, R-600, R-600a, R-764	1.0
R-12, R-22, R-114, R-124, R-134a, R-401A, R-401B, R-401C, R-405A, R-406A, R-407C, R-407D, R-407E, R-409A, R-409B, R-411A, R-411B, R-411C, R-412A, R-414A, R-414B, R-500, R-1270	1.6
R-143a, R-402B, R-403A, R-407A, R-408A, R-413A	2.0
R-115, R-402A, R-403B, R-404A, R-407B, R-410A, R-410B, R-502, R-507A, R-509A	2.5

(c) When one pressure-relief device or fusible plug is used to protect more than one pressure vessel, the required capacity shall be the sum of the capacities required for each pressure vessel.

(3) DISCHARGE PIPING LENGTH. Substitute the following wording for the requirements in ASHRAE 15 section 9.7.8.5: The maximum length of the discharge piping installed on the outlet of pressure-relief devices and fusible plugs discharging to the atmosphere shall be determined by the following:

$$L = \frac{0.2146d^5(P_0^2 - P_2^2)}{fC_r^2} - \frac{d^5 \ln(P_0/P_2)}{6f}$$

where L = equivalent length of discharging piping, ft;

C<sub>r</sub> = rated capacity as stamped on the relief device in lb/min. or in SCFM multiplied by 0.0764, or as calculated in ASHRAE 15 section 9.7.7 for a rupture member or fusible plug, or as adjusted for reduced capacity due to piping as specified by the manufacturer of the device, or as adjusted for reduced capacity due to piping as estimated by an approved method;

f = Moody friction factor in fully turbulent flow from Table 45.37-2;

d = inside diameter of pipe or tube, in;

ln = natural logarithm;

P<sub>2</sub> = absolute pressure at outlet of discharge piping, psi; and

P<sub>0</sub> = absolute allowed back pressure at the outlet of pressure relief device, psi.

Note: For the allowed back pressure (P<sub>0</sub>), use the percent of set pressure specified by the manufacturer, or, when the allowed back pressure is not specified, use the following values, where P is the set pressure:

\* for conventional relief valves, 15% of set pressure, P<sub>0</sub> = (0.15P) + atmospheric pressure;

\* for balanced relief valves, 25% of set pressure, P<sub>0</sub> = (0.25P) + atmospheric pressure;

\* for rupture members, fusible plugs, and pilot operated relief valves, 50% of set pressure, P<sub>0</sub> = (0.50P) + atmospheric pressure.

Note: For fusible plugs, P is the saturated absolute pressure for the stamped temperature melting point of the fusible plug or the critical pressure of the refrigerant used, whichever is smaller, and atmospheric pressure is at the elevation of the installation above sea level. A default value is the atmospheric pressure at sea level, 14.7 psi.

Note: See appendix for a table of the flow capacity of various equivalent lengths of discharge piping for conventional relief valves using the above formula.

**Table 45.37-2**  
Moody Friction Factors

Tubing OD (in.)	ID (in.)	Value of f
3/8	0.315	0.0136
1/2	0.430	0.0128
5/8	0.545	0.0122
3/4	0.666	0.0117
7/8	0.785	0.0114
1 1/8	1.025	0.0108
1 3/8	1.265	0.0104
1 5/8	1.505	0.0101

Piping NPS	ID (in.)	Value of f
1/2	0.622	0.0259
3/4	0.824	0.0240
1	1.049	0.0225
1 1/4	1.380	0.0209
1 1/2	1.610	0.0202
2	2.067	0.0190
2 1/2	2.469	0.0182
3	3.068	0.0173
4	4.026	0.0163
5	5.047	0.0155
6	6.065	0.0149

History: CR 03-012; cr. Register October 2003 No. 574, eff. 11-1-03.

**Comm 45.38 [IMC 1107] Refrigerant piping.** Substitute the following wording for the requirements in IMC section 1107.4.1: Carbon steel pipe with a wall thickness not less than Schedule 80 shall be used for Group A2, A3, B2 or B3 refrigerant liquid lines for sizes 1.5 inches and smaller. Carbon steel pipe with a wall thickness not less than Schedule 40 shall be used for Group A1 or B1 refrigerant liquid lines 6 inches and smaller, Group A2, A3, B2 or B3 refrigerant liquid lines sizes 2 inches through 6 inches, and all refrigerant suction and discharge lines 6 inches and smaller. Type F steel pipe shall not be used for refrigerant lines.

History: CR 03-012; cr. Register October 2003 No. 574, eff. 11-1-03.

**Comm 45.39 [IMC 1108] Field test. (1) TEST GASES.** Substitute the following wording for the requirements and exception in IMC section 1108.2:

(a) *Non-ammonia systems.* For non-ammonia systems, tests shall be performed with an inert dried gas such as nitrogen or carbon dioxide. Oxygen, air, combustible gases and mixtures containing such gases shall not be used.

(b) *Ammonia systems.* For ammonia systems, tests shall be performed with a dried gas such as nitrogen or air. Oxygen, carbon dioxide, halocarbon refrigerants, water or water solutions, combustible gases and mixtures containing such gases shall not be used.

(2) DECLARATION. Substitute the following wording for the requirements in IMC section 1108.4: A certificate of test shall be provided for all systems containing 55 pounds or more of refrigerant.

ant. The certificate shall give the name of the refrigerant and the field test pressure applied to the high side and the low side of the system. The certificate of test shall be signed by the installer and shall be furnished to the department upon request.

History: CR 03-012; cr. Register October 2003 No. 574, eff. 11-1-03.

**Comm 45.40 [IMC 1109] Periodic testing.** This is a department rule in addition to the requirements in IMC section 1109.1: The testing of the emergency devices and systems shall be performed at least annually and documentation of the testing shall be available onsite for the inspector.

History: CR 03-012; cr. Register October 2003 No. 574, eff. 11-1-03.

**Comm 45.41 General requirements.** These are department rules in addition to the requirements in IMC chapter 11:

(1) **SIGNS AND IDENTIFICATION.** This is a department rule in addition to the requirements in ASHRAE 15 section 11.2: Each entrance to a refrigerating machinery room shall be provided with a legible permanent sign, securely attached and easily accessible, reading "Machinery Room - Authorized Personnel Only". The sign shall further communicate that entry is forbidden except by those personnel trained in the emergency procedures required by sub. (2) when the refrigerant alarm, required by s. Comm 45.35, has been activated.

(2) **RESPONSIBILITY FOR OPERATION AND EMERGENCY SHUTDOWN.** Substitute the following wording for the requirements in ASHRAE 15 section 11.8:

(a) The person in charge of the premises on which a refrigerating system containing more than 55 pounds of refrigerant is installed shall provide a schematic drawing or panel giving directions for the operation of the system at a location that is convenient to the operators of the equipment.

(b) Emergency shutdown procedures, including precautions to be observed in case of a breakdown or leak, shall be displayed on a conspicuous card located as near as possible to the refrigerant compressor. These precautions shall address all of the following:

1. Instructions for shutting down the system in case of emergency.

2. The name, address, and day and night telephone numbers for obtaining service.

3. The names, addresses and telephone numbers of all corporate, local, state and federal agencies to be contacted as required in the event of a reportable incident.

(c) When a refrigerating machinery room is used, the emergency procedures shall be posted outside the room, immediately adjacent to each door.

(d) The emergency procedures shall forbid entry into the refrigerating machinery room when the refrigerant alarm required by s. Comm 45.35 has been activated, except by persons provided with the appropriate respiratory and other protective equipment and trained in accordance with jurisdictional requirements.

History: CR 03-012; cr. Register October 2003 No. 574, eff. 11-1-03.

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APPENDIX

The following table provides the flow capacity of various equivalent lengths of discharge piping for conventional relief valves using the formula in s. Comm 45.37 (3).  
 Pressure-Relief Valve Discharge Line Capacity (lb/min of air) of Various Discharge Line Lengths

Set Length (PSIG) (feet)	Nominal Pipe Size, NPS/DN															Set Length (PSIG) (feet)	Nominal Pipe Size, NPS/DN																
	0.5	0.75	1	1.25	1.5	2	2.5	3	4	5	6	15	20	25	32		40	50	65	80	100	125	150	0.5	0.75	1	1.25	1.5	2	2.5	3	4	5
5	2.8	3.8	10.7	21.3	31.4	37.8	38.8	148.0	278.9	469	704	7.6	14.7	24.4	46.5	65.3	111.7	162.8	256	451	718	1045	15	20	25	32	40	50	65	80	100	125	150
5	2.3	4.8	9.0	18.1	26.8	49.9	77.3	130.4	249.8	426	647	6.8	13.2	23.2	43.4	61.4	106.3	156.1	248	439	704	1027	15	20	25	32	40	50	65	80	100	125	150
5	2.0	4.2	7.9	16.0	23.7	44.5	69.9	117.8	228.2	393	601	6.1	12.2	21.6	40.8	58.1	101.6	150.2	240	429	691	1011	15	20	25	32	40	50	65	80	100	125	150
5	1.8	3.8	7.1	14.4	21.5	40.6	63.5	108.3	211.4	367	564	5.7	11.3	20.2	38.6	55.2	97.4	141.9	233	419	678	996	15	20	25	32	40	50	65	80	100	125	150
5	1.7	3.5	6.8	13.3	19.8	37.5	58.9	100.8	197.8	346	533	5.3	10.5	19.1	36.7	52.8	93.8	140.1	226	410	666	981	15	20	25	32	40	50	65	80	100	125	150
5	1.5	3.0	5.7	11.6	17.4	33.1	52.0	89.5	177.0	312	484	4.7	9.5	17.3	33.6	48.7	87.5	131.8	215	393	644	953	15	20	25	32	40	50	65	80	100	125	150
5	1.3	2.7	5.1	10.5	15.7	29.9	47.1	81.3	161.7	286	446	4.3	8.7	15.9	31.2	45.5	82.4	124.8	205	378	624	927	15	20	25	32	40	50	65	80	100	125	150
5	1.1	2.2	4.2	8.6	12.9	24.7	39.2	67.9	135.9	243	380	3.6	7.4	13.6	26.9	39.6	72.7	113.3	185	347	582	872	15	20	25	32	40	50	65	80	100	125	150
8	0.9	1.9	3.7	7.5	11.3	21.6	34.2	59.3	109.5	214	337	3.1	6.5	12.0	24.0	35.5	65.8	101.4	170	323	547	825	15	20	25	32	40	50	65	80	100	125	150
5	0.8	1.7	3.3	6.7	10.1	19.4	30.8	53.5	107.0	194	306	2.8	5.9	10.9	21.9	32.4	60.5	93.8	158	303	517	785	15	20	25	32	40	50	65	80	100	125	150
5	0.8	1.6	3.0	6.2	9.3	17.8	28.2	49.1	99.1	179	282	2.6	5.4	10.0	20.3	30.1	56.3	87.6	148	286	492	750	15	20	25	32	40	50	65	80	100	125	150
5	0.7	1.4	2.6	5.3	8.0	15.4	24.5	42.8	86.5	156	247	2.3	4.7	8.8	17.8	26.6	50.1	78.3	133	260	451	692	15	20	25	32	40	50	65	80	100	125	150
5	0.5	1.1	2.1	4.4	6.6	12.6	20.1	35.1	71.2	129	205	1.9	3.9	7.3	14.8	22.1	42.0	66.0	113	224	393	608	15	20	25	32	40	50	65	80	100	125	150
5	0.4	0.9	1.7	3.4	5.1	9.8	15.6	27.3	55.6	101	160	1.4	3.0	5.7	11.6	17.4	33.3	52.6	91	182	323	504	15	20	25	32	40	50	65	80	100	125	150
5	0.3	0.7	1.3	2.7	4.0	7.8	12.4	21.7	44.1	80	127	1.1	2.4	4.5	9.3	13.9	26.7	42.3	73	148	265	416	15	20	25	32	40	50	65	80	100	125	150
5	0.3	0.6	1.0	2.1	3.2	6.2	9.9	17.4	33.3	64	102	0.9	1.9	3.6	7.5	11.3	21.5	34.2	59	120	217	342	15	20	25	32	40	50	65	80	100	125	150
15	4.0	9.3	16.7	32.0	46.0	81.6	121.8	196.5	355.2	577	849	9.1	17.2	29.4	53.3	74.3	136.0	182.7	286	501	795	1154	15	20	25	32	40	50	65	80	100	125	150
15	3.9	8.0	15.5	28.3	41.0	74.0	111.6	182.8	334.5	550	815	8.2	15.8	27.3	50.4	70.7	131.2	176.9	279	491	783	1140	15	20	25	32	40	50	65	80	100	125	150
15	3.5	7.1	13.0	25.6	37.4	68.1	107.6	179.8	317.1	526	784	7.5	14.6	25.7	47.8	67.6	116.9	171.6	272	482	772	1127	15	20	25	32	40	50	65	80	100	125	150
15	3.1	6.5	11.9	23.6	34.6	63.5	97.1	161.2	302.2	506	757	7.0	13.7	24.3	45.7	64.8	113.1	166.8	266	474	762	1114	15	20	25	32	40	50	65	80	100	125	150
15	2.9	6.0	11.0	22.0	32.3	59.7	91.7	153.1	289.2	487	732	6.5	13.0	23.1	43.7	62.4	109.6	162.3	260	466	751	1101	15	20	25	32	40	50	65	80	100	125	150
15	2.5	5.2	9.7	19.5	28.9	53.8	83.2	140.0	267.5	455	689	5.9	11.8	21.1	40.6	58.3	103.4	154.4	249	450	752	1077	15	20	25	32	40	50	65	80	100	125	150
15	2.3	4.7	8.8	17.8	26.3	49.3	76.7	129.7	250.1	429	683	5.4	10.8	19.6	38.0	54.9	98.2	147.5	240	437	714	1054	15	20	25	32	40	50	65	80	100	125	150
15	1.9	3.9	7.3	14.8	22.1	41.3	63.3	111.6	218.0	379	583	4.5	9.2	16.9	31.2	48.1	88.0	133.7	221	407	675	1004	15	20	25	32	40	50	65	80	100	125	150

Pressure-Relief Valve Discharge Line Capacity (lb/min of air) of Various Discharge Line Lengths

Set Length (PSIG) (feet)	Nominal Pipe Size, NPS/DN												Set Length (PSIG) (feet)	Nominal Pipe Size, NPS/DN											
	1.5						2							2.5						3					
	0.5	0.75	1	1.25	1.5	2	0.5	0.75	1	1.25	1.5	2		0.5	0.75	1	1.25	1.5	2	0.5	0.75	1	1.25	1.5	2
15	20	1.6	3.4	6.4	13.0	19.4	36.8	57.9	99.4	195.8	341	512	75	20	4.0	8.2	15.1	29.9	43.8	80.5	123.1	204	381	641	960
15	25	1.5	3.1	5.7	11.7	17.5	33.3	52.5	90.5	179.3	316	492	75	25	3.6	7.4	13.7	27.4	40.3	74.6	114.8	192	363	612	921
15	30	1.3	2.8	5.3	10.7	16.1	30.7	48.4	83.6	166.3	295	460	75	30	3.3	6.8	12.7	25.4	37.6	69.8	107.9	181	345	587	887
15	40	1.2	2.4	4.6	9.4	14.0	26.8	42.4	73.5	147.1	262	411	75	40	2.9	6.0	11.2	22.5	33.4	62.5	97.2	164	317	544	828
15	60	1.0	2.0	3.8	7.7	11.6	22.1	35.1	61.0	121.7	220	347	75	60	2.4	5.0	9.3	16.8	28.0	52.9	82.8	141	276	481	739
15	100	0.7	1.5	2.9	6.0	9.0	17.3	27.5	47.9	96.8	175	276	75	100	1.9	3.9	7.3	14.8	22.2	42.2	66.5	115	227	401	623
15	160	0.6	1.2	2.3	4.7	7.1	13.7	21.8	38.1	77.3	140	222	75	160	1.5	3.1	5.8	11.9	17.8	34.0	53.8	93	186	332	520
15	250	0.5	1.0	1.9	3.8	5.7	11.0	17.5	30.6	62.3	113	179	75	250	1.2	2.5	4.7	9.6	14.4	27.5	43.6	76	153	274	412
25	2	5.7	11.3	20.0	37.6	53.5	91.2	137.5	219.2	390.5	628	918	100	2	10.1	19.4	33.9	59.3	82.2	138.8	201.8	314	547	868	1288
25	3	4.9	9.9	17.8	34.0	48.8	84.5	128.8	207.5	374.4	608	893	100	3	9.4	17.9	30.9	56.4	78.9	134.4	195.4	307	539	857	1346
25	4	4.4	8.9	16.2	31.3	45.3	81.0	121.6	197.6	360.1	589	869	100	4	8.7	16.8	29.2	54.0	75.9	130.3	191.4	301	531	847	1234
25	5	4.0	8.2	14.9	29.1	42.3	76.4	115.5	188.9	347.3	572	848	100	5	8.1	15.8	27.8	51.8	73.2	126.6	185.9	295	523	837	1222
25	6	3.7	7.6	13.9	27.4	39.9	72.8	110.2	181.3	338.8	556	828	100	6	7.6	15.0	26.5	49.9	70.8	123.2	181.7	289	515	828	1219
25	8	3.3	6.7	12.4	24.6	36.1	66.4	101.5	168.3	315.9	529	791	100	8	6.9	13.7	24.5	46.6	66.6	117.2	173.0	279	501	810	1188
25	10	3.0	6.1	11.3	22.6	33.3	61.5	94.6	158.1	299.1	505	759	100	10	6.3	12.5	22.8	43.9	63.1	112.0	167.2	270	488	793	1167
25	15	2.5	5.1	9.5	19.1	28.3	52.9	82.1	138.7	266.6	457	684	100	15	5.4	10.9	19.9	38.7	56.3	101.4	153.1	250	459	756	1129
25	20	2.1	4.3	8.3	16.8	25.0	47.1	73.5	125.0	242.9	420	643	100	20	4.7	9.7	17.8	35.1	51.3	93.4	142.1	234	435	723	1077
25	25	1.9	4.0	7.5	15.2	23.7	42.9	67.1	114.7	224.5	391	602	100	25	4.3	8.8	16.3	32.3	47.4	87.0	133.2	221	415	694	1039
25	30	1.8	3.7	6.9	14.0	20.9	39.6	62.2	106.6	209.8	367	568	100	30	4.0	8.2	15.1	30.1	44.3	81.8	125.8	210	397	668	1005
25	40	1.5	3.2	6.0	12.2	18.3	34.8	54.9	94.5	187.3	331	514	100	40	3.5	7.2	13.3	26.7	39.5	73.7	114.0	192	367	625	946
25	60	1.3	2.6	4.9	10.1	15.1	28.9	45.7	79.1	158.0	281	440	100	60	2.9	5.9	11.1	22.4	33.4	62.7	97.9	166	323	558	853
25	100	1.0	2.0	3.8	7.9	11.8	22.7	36.0	62.5	125.8	226	356	100	100	2.2	4.7	8.7	17.8	26.6	50.4	74.2	136	268	471	728
25	160	0.8	1.6	3.1	6.3	9.4	18.1	28.7	50.0	101.1	183	289	100	160	1.8	3.7	7.0	14.3	21.4	40.7	64.3	111	222	393	614
25	250	0.6	1.3	2.4	5.0	7.6	14.5	22.1	40.3	81.7	148	235	100	250	1.4	3.0	5.6	11.5	17.3	33.9	52.3	91	182	326	513

Notes: SI Conversions: kPa = psig x 6.895; mm = inches x 25.4; kg/s = lb/min x 0.007559; m = feet x 0.3048.

Pressure-Relief Valve Discharge Line Capacity (lb/min of air) of Various Discharge Line Lengths

Set Length (PSIG) (feet)	Nominal Pipe Size, NPS/DN												Set Length (PSIG) (feet)	Nominal Pipe Size, NPS/DN																																															
	0.5						1							1.25						1.5						2						2.5						3						4						5						6					
	15	20	25	32	40	50	15	20	25	32	40	50		15	20	25	32	40	50	15	20	25	32	40	50	15	20	25	32	40	50	15	20	25	32	40	50	15	20	25	32	40	50	15	20	25	32	40	50	15	20	25	32	40	50	15	20	25	32	40	50
150	2	12.5	23.3	39.2	50.1	66.8	102.7	234.5	366	636	1006	1457	300	2	18.4	33.7	56.1	99.4	136.7	228.3	328	510	884	1395	2019																																				
150	3	11.6	21.8	37.2	67.4	93.7	138.5	229.6	360	628	995	1446	300	3	17.2	32.1	54.0	98.0	133.5	224.2	323	504	877	1386	2049																																				
150	4	10.8	20.6	35.5	64.9	90.8	134.7	225.1	354	621	987	1435	300	4	16.4	30.8	52.2	94.1	130.6	220.4	319	498	869	1378	1998																																				
150	5	10.2	19.6	34.0	62.8	88.1	131.2	220.7	348	613	979	1425	300	5	15.6	29.6	50.5	91.7	127.8	216.8	314	493	862	1369	1988																																				
150	6	9.6	18.7	32.7	60.8	85.7	127.8	216.6	343	606	970	1414	300	6	14.9	28.5	49.0	89.6	125.2	213.4	310	488	856	1361	1978																																				
150	8	8.8	17.5	30.5	57.3	81.4	121.8	209.1	333	593	954	1394	300	8	13.8	28.6	48.3	85.6	120.4	206.9	302	478	843	1345	1959																																				
150	10	8.1	16.1	28.7	54.4	77.7	116.5	202.3	324	581	938	1375	300	10	12.8	25.1	44.1	82.2	116.2	201.0	295	468	830	1330	1940																																				
150	15	6.9	14.0	25.2	48.7	70.1	125.4	187.8	304	533	902	1330	300	15	11.2	22.2	39.6	75.1	107.2	188.3	279	447	801	1293	1895																																				
150	20	6.2	12.5	22.8	44.5	64.6	116.6	176.0	288	529	870	1289	300	20	10.0	20.1	36.2	69.6	100.1	177.7	265	428	775	1260	1853																																				
150	25	5.6	11.4	21.0	41.2	60.2	109.4	166.2	274	507	841	1251	300	25	9.2	18.6	33.6	65.2	94.2	168.7	253	412	751	1229	1814																																				
150	30	5.2	10.6	19.5	38.6	56.5	103.4	157.9	261	488	815	1217	300	30	8.5	17.3	31.5	61.5	89.2	160.9	243	397	729	1200	1777																																				
150	40	4.5	9.4	17.3	34.5	50.8	93.9	144.5	241	456	769	1156	300	40	7.5	15.4	28.2	55.6	81.3	148.2	225	372	691	1148	1710																																				
150	60	3.8	7.8	14.5	29.2	43.3	80.8	125.4	212	407	686	1088	300	60	6.3	12.9	23.9	47.7	70.2	129.7	199	333	639	1061	1595																																				
150	100	2.9	6.1	11.5	23.3	34.7	65.6	102.7	175	343	597	918	300	100	4.9	10.3	19.1	38.5	57.2	107.1	167	282	544	934	1422																																				
150	160	2.3	4.9	9.2	18.7	28.0	53.3	84.0	145	286	505	785	300	160	3.9	8.2	15.4	31.3	46.6	88.1	138	236	463	807	1243																																				
150	250	1.9	3.9	7.4	15.2	22.7	43.4	68.6	119	238	423	662	300	250	3.2	6.6	12.5	25.4	38.0	72.3	114	196	389	687	1068																																				
200	2	14.6	26.9	45.0	80.2	110.6	188.2	266.6	415	721	1139	1649	350	2	20.3	37.0	61.4	108.6	149	249	388	556	967	1519	2169																																				
200	3	13.6	25.4	43.1	77.5	107.4	181.2	261.9	409	713	1130	1638	350	3	19.1	35.3	59.3	105.8	146	245	353	550	956	1510	2188																																				
200	4	12.7	24.2	41.3	75.1	104.6	177.4	257.4	404	706	1121	1628	350	4	18.1	33.9	57.4	103.3	143	241	348	544	949	1502	2178																																				
200	5	12.0	23.1	39.8	72.8	101.9	173.9	253.1	398	699	1113	1618	350	5	17.3	32.7	55.7	100.9	140	237	344	539	941	1493	2168																																				
200	6	11.5	22.1	38.4	70.8	99.4	170.6	249.1	393	692	1105	1608	350	6	16.6	31.5	54.1	98.6	137	234	340	534	935	1484	2158																																				
200	8	10.5	20.5	36.0	67.2	95.0	164.5	241.5	383	679	1089	1588	350	8	15.3	29.6	51.3	94.5	132	227	331	523	921	1468	2139																																				
200	10	9.7	19.2	34.0	64.1	91.1	159.0	234.6	374	667	1073	1570	350	10	14.4	28.0	48.9	90.9	128	221	324	514	908	1452	2120																																				
200	15	8.4	16.8	30.2	57.9	83.2	147.3	219.6	354	639	1038	1525	350	15	12.5	24.8	44.1	83.5	119	208	307	492	879	1414	2075																																				
200	20	7.5	15.2	27.5	53.2	73.0	137.9	207.2	337	614	1005	1485	350	20	11.3	22.6	40.5	77.6	111	196	293	473	852	1370	2032																																				

Pressure-Relief Valve Discharge Line Capacity (lb/min of air) of Various Discharge Line Lengths

Set Length (PSIG) (feet)	Nominal Pipe Size, NPS/DN																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
	0.5							1							2							3							4							5							6																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
	15	20	25	32	40	50	65	80	100	125	150	175	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2200	2400	2600	2800	3000	3200	3400	3600	3800	4000	4200	4400	4600	4800	5000																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
200	6.8	13.9	21.3	29.5	38.5	48.5	59.5	71.0	83.0	95.5	108.5	122.0	136.0	150.5	165.5	181.0	197.0	213.5	230.5	248.0	266.0	284.5	303.5	323.0	343.0	363.5	384.5	406.0	428.0	450.5	473.5	497.0	521.0	545.5	570.5	596.0	622.0	648.5	675.5	703.0	731.0	759.5	788.5	818.0	848.0	878.5	909.5	941.0	973.0	1005.5	1038.5	1072.0	1106.0	1140.5	1175.5	1211.0	1247.0	1283.5	1320.5	1358.0	1396.0	1434.5	1473.5	1513.0	1553.0	1593.5	1634.5	1676.0	1718.0	1760.5	1803.5	1847.0	1891.0	1935.5	1980.5	2026.0	2072.0	2118.5	2165.5	2213.0	2261.0	2309.5	2358.5	2408.0	2458.0	2508.5	2559.5	2611.0	2663.0	2715.5	2768.5	2822.0	2876.0	2930.5	2985.5	3041.0	3097.0	3153.5	3210.5	3268.0	3326.0	3384.5	3443.5	3503.0	3563.0	3623.5	3684.5	3746.0	3808.0	3870.5	3933.5	3997.0	4061.0	4125.5	4190.5	4256.0	4322.0	4388.5	4455.5	4523.0	4591.0	4659.5	4728.5	4798.0	4868.0	4938.5	5009.5	5081.0	5153.0	5225.5	5298.5	5372.0	5446.0	5520.5	5595.5	5671.0	5747.0	5823.5	5900.5	5978.0	6056.0	6134.5	6213.5	6293.0	6373.0	6453.5	6534.5	6616.0	6698.0	6780.5	6863.5	6947.0	7031.0	7115.5	7200.5	7286.0	7372.0	7458.5	7545.5	7633.0	7721.0	7809.5	7898.5	7988.0	8078.0	8168.5	8259.5	8351.0	8443.0	8535.5	8628.5	8722.0	8816.0	8910.5	9005.5	9101.0	9197.0	9293.5	9390.5	9488.0	9586.0	9684.5	9783.5	9883.0	9983.0	10083.5	10184.5	10286.0	10388.0	10490.5	10593.5	10697.0	10801.0	10905.5	11010.5	11116.0	11222.0	11328.5	11435.5	11543.0	11651.0	11759.5	11868.5	11978.0	12088.0	12198.5	12309.5	12421.0	12533.0	12645.5	12758.5	12872.0	12986.0	13100.5	13215.5	13331.0	13447.0	13563.5	13680.5	13798.0	13916.0	14034.5	14153.5	14273.0	14393.0	14513.5	14634.5	14756.0	14878.0	15000.5	15123.5	15247.0	15371.0	15495.5	15620.5	15746.0	15872.0	15998.5	16125.5	16253.0	16381.0	16509.5	16638.5	16768.0	16898.0	17028.5	17159.5	17291.0	17423.0	17555.5	17688.5	17822.0	17956.0	18090.5	18225.5	18361.0	18496.5	18633.0	18769.5	18906.5	19044.0	19182.0	19320.5	19459.5	19599.0	19739.0	19879.5	20020.5	20162.0	20304.0	20446.5	20589.5	20733.0	20877.0	21021.5	21166.5	21312.0	21458.0	21604.5	21751.5	21899.0	22047.0	22195.5	22344.5	22494.0	22644.0	22794.5	22945.5	23097.0	23249.0	23401.5	23554.5	23708.0	23862.0	24016.5	24171.5	24327.0	24483.0	24639.5	24796.5	24954.0	25112.0	25270.5	25429.5	25589.0	25749.0	25909.5	26070.5	26232.0	26394.0	26556.5	26719.5	26883.0	27047.0	27211.5	27376.5	27542.0	27708.0	27874.5	28041.5	28209.0	28377.0	28545.5	28714.5	28884.0	29054.0	29224.5	29395.5	29567.0	29739.0	29911.5	30084.5	30258.0	30432.0	30606.5	30781.5	30957.0	31133.0	31309.5	31487.0	31665.0	31843.5	32022.5	32202.5	32383.0	32564.0	32745.5	32927.5	33110.0	33293.0	33476.5	33660.5	33845.0	34030.0	34215.5	34401.5	34588.0	34774.5	34961.5	35149.0	35337.0	35525.5	35714.5	35904.0	36094.0	36284.5	36475.5	36667.0	36859.0	37051.5	37244.5	37438.0	37632.0	37826.5	38021.5	38217.0	38413.0	38609.5	38806.5	39004.0	39202.0	39400.5	39599.5	39799.0	39999.0	40199.5	40399.5	40599.5	40799.5	40999.5	41199.5	41399.5	41599.5	41799.5	41999.5	42199.5	42399.5	42599.5	42799.5	42999.5	43199.5	43399.5	43599.5	43799.5	43999.5	44199.5	44399.5	44599.5	44799.5	44999.5	45199.5	45399.5	45599.5	45799.5	45999.5	46199.5	46399.5	46599.5	46799.5	46999.5	47199.5	47399.5	47599.5	47799.5	47999.5	48199.5	48399.5	48599.5	48799.5	48999.5	49199.5	49399.5	49599.5	49799.5	49999.5	50199.5	50399.5	50599.5	50799.5	50999.5	51199.5	51399.5	51599.5	51799.5	51999.5	52199.5	52399.5	52599.5	52799.5	52999.5	53199.5	53399.5	53599.5	53799.5	53999.5	54199.5	54399.5	54599.5	54799.5	54999.5	55199.5	55399.5	55599.5	55799.5	55999.5	56199.5	56399.5	56599.5	56799.5	56999.5	57199.5	57399.5	57599.5	57799.5	57999.5	58199.5	58399.5	58599.5	58799.5	58999.5	59199.5	59399.5	59599.5	59799.5	59999.5	60199.5	60399.5	60599.5	60799.5	60999.5	61199.5	61399.5	61599.5	61799.5	61999.5	62199.5	62399.5	62599.5	62799.5	62999.5	63199.5	63399.5	63599.5	63799.5	63999.5	64199.5	64399.5	64599.5	64799.5	64999.5	65199.5	65399.5	65599.5	65799.5	65999.5	66199.5	66399.5	66599.5	66799.5	66999.5	67199.5	67399.5	67599.5	67799.5	67999.5	68199.5	68399.5	68599.5	68799.5	68999.5	69199.5	69399.5	69599.5	69799.5	69999.5	70199.5	70399.5	70599.5	70799.5	70999.5	71199.5	71399.5	71599.5	71799.5	71999.5	72199.5	72399.5	72599.5	72799.5	72999.5	73199.5	73399.5	73599.5	73799.5	73999.5	74199.5	74399.5	74599.5	74799.5	74999.5	75199.5	75399.5	75599.5	75799.5	75999.5	76199.5	76399.5	76599.5	76799.5	76999.5	77199.5	77399.5	77599.5	77799.5	77999.5	78199.5	78399.5	78599.5	78799.5	78999.5	79199.5	79399.5	79599.5	79799.5	79999.5	80199.5	80399.5	80599.5	80799.5	80999.5	81199.5	81399.5	81599.5	81799.5	81999.5	82199.5	82399.5	82599.5	82799.5	82999.5	83199.5	83399.5	83599.5	83799.5	83999.5	84199.5	84399.5	84599.5	84799.5	84999.5	85199.5	85399.5	85599.5	85799.5	85999.5	86199.5	86399.5	86599.5	86799.5	86999.5	87199.5	87399.5	87599.5	87799.5	87999.5	88199.5	88399.5	88599.5	88799.5	88999.5	89199.5	89399.5	89599.5	89799.5	89999.5	90199.5	90399.5	90599.5	90799.5	90999.5	91199.5	91399.5	91599.5	91799.5	91999.5	92199.5	92399.5	92599.5	92799.5	92999.5	93199.5	93399.5	93599.5	93799.5	93999.5	94199.5	94399.5	94599.5	94799.5	94999.5	95199.5	95399.5	95599.5	95799.5	95999.5	96199.5	96399.5	96599.5	96799.5	96999.5	97199.5	97399.5	97599.5	97799.5	97999.5	98199.5	98399.5	98599.5	98799.5	98999.5	99199.5	99399.5	99599.5	99799.5	99999.5	100199.5	100399.5	100599.5	100799.5	100999.5	101199.5	101399.5	101599.5	101799.5	101999.5	102199.5	102399.5	102599.5	102799.5	102999.5	103199.5	103399.5	103599.5	103799.5	103999.5	104199.5	104399.5	104599.5	104799.5	104999.5	105199.5	105399.5	105599.5	105799.5	105999.5	106199.5	106399.5	106599.5	106799.5	106999.5	107199.5	107399.5	107599.5	107799.5	107999.5	108199.5	108399.5	108599.5	108799.5	108999.5	109199.5	109399.5	109599.5	109799.5	109999.5	110199.5	110399.5	110599.5	110799.5	110999.5	111199.5	111399.5	111599.5	111799.5	111999.5	112199.5	112399.5	112599.5	112799.5	112999.5	113199.5	113399.5	113599.5	113799.5	113999.5	114199.5	114399.5	114599.5	114799.5	114999.5	115199.5	115399.5	115599.5	115799.5	115999.5	116199.5	116399.5	116599.5	116799.5	116999.5	117199.5	117399.5	117599.5	117799.5	117999.5	118199.5	118399.5	118599.5	118799.5	118999.5	119199.5	119399.5	119599.5	119799.5	119999.5	120199.5	120399.5	120599.5	120799.5	120999.5	121199.5	121399.5	121599.5	121799.5	121999.5	122199.5	122399.5	122599.5	122799.5	122999.5	123199.5	123399.5	123599.5	123799.5	123999.5	124199.5	124399.5	124599.5	124799.5	124999.5	125199.5	125399.5	125599.5	125799.5	125999.5	126199.5	126399.5	126599.5	126799.5	126999.5	127199.5	127399.5	127599.5	127799.5	127999.5	128199.5	128399.5	128599.5	128799.5	128999.5	129199.5	129399.5	129599.5	129799.5	129999.5	130199.5	130399.5	130599.5	130799.5	130999.5	131199.5	131399.5	131599.5	131799.5	131999.5	132199.5	132399.5	132599.5	132799.5	132999.5	133199.5	133399.5	133599.5	133799.5	133999.5	134199.5	134399.5	134599.5	134799.5	134999.5	135199.5	135399.5	135599.5	135799.5	135999.5	136199.5	136399.5	136599.5	136799.5	136999.5	137199.5	137399.5	137599.5	137799.5	137999.5	138199.5	138399.5	138599.5	138799.5	138999.5	139199.5	139399.5	139599.5	139799.5	139999.5	140199.5	140399.5	140599.5	140799.5	140999.5	141199.5	141399.5	141599.5	141799.5	141999.5	142199.5	142399.5	142599.5	142799.5	142999.5	143199.5	143399.5	143599.5	143799.5	143999.5	144199.5	144399.5	144599.5	144799.5	144999.5	145199.5	145399.5	145599.5	145799.5	145999.5	146199.5	146399.5	146599.5	146799.5	146999.5	147199.5	147399.5	147599.5	147799.5	147999.5	148199.5	148399.5	148599.5	148799.5	148999.5	149199.5	149399.5	149599.5	149799.5	149999.5	150199.5	150399.5	150599.5	150799.5	150999.5	151199.5	151399.5	151599.5	151799.5	151999.5	152199.5	152399.5	152599.5	152799.5	152999.5	153199.5	153399.5	153599.5	153799.5	153999.5	154199.5	154399.5	154599.5	154799.5	154999.5	155199