

AMMONIA REFRIGERATION SYSTEMS

APPLICATION

Applies to buildings used for ice-making, cold storage or manufacturing or processing of food or drink and where the occupant load of the area served by such system does not exceed one person per 100 square feet of floor area.

1. PLANS

1.1 Plans, diagrams and data shall be submitted in two sets or more with each application for a permit. Plans shall be drawn to scale and be of sufficient clarity to indicate the location, nature and extent of the work proposed and show in detail that it will conform to the provisions of the code.

1.2 Minimum requirements of plan submittals:

- Compressor locations, horsepower and supports
- Ammonia vessels and heat exchangers
- Evaporative condensers and/or cooling towers
- Safety relief valves
- Required gauges
- Oil pumps, skids and evaporators
- Required stop valves
- Diffusion system
- Atmospheric release system (manual)
- High to low side release (manual)
- Ventilation system of engine room (mechanical or gravity)
- Condensate piping and disposal system
- Exiting from engine room
- Electrical plans: loads, panels, disconnects, etc.
- Piping material and schedule(s)
- Pipe supports
- Working pressure of system (high and low sides)

2. COMPRESSORS

2.1 General. Supports for compressors and condensing units shall be designed to safely carry the equipment. Supports shall be designed and constructed to sustain vertical and horizontal loads within stress limitations specified in the Building Code.

2.2 All ammonia refrigeration compressors shall have legibly displayed thereon the manufacturer's name plate.

- 2.3 All ammonia refrigeration compressors shall comply with nationally recognized standards as evidenced by the label of an approved agency.
- 2.4 All ammonia refrigeration compressors will be inspected for alteration, modification or physical repair that might affect the integrity of the compressor casing. If the compressor casing has been altered, modified or repaired, the casing shall have been pressure recertified by an approved testing agency and recertification papers submitted with the permit application.

3. VESSELS AND HEAT EXCHANGERS

- 3.1 All ammonia vessels and heat exchangers shall have a name plate with the following (if over 3.0 cubic feet):
- Manufacturer's name
 - Maximum allowable working pressure
 - Serial number
 - ASME stamp certification
- 3.2 Each vessel and heat exchanger shall have appropriate relief valves as outlined in Section 10.1.
- 3.3 Modifications to vessels will require a retesting stamp per ASME.
- 3.4 Sight glasses shall be installed in a manner so they are protected with 360 degree glass guards.
- 3.5 Sight columns shall be fitted with internal check type shut-off valves.

4. AMMONIA EVAPORATIVE CONDENSERS

- 4.1 Evaporative condensers shall be adequately supported. Fans, motors or belts that pose a hazard to personnel shall be equipped with guards.
- 4.2 Bleed-off's shall be conveyed to an approved disposal site.
- 4.3 Make-up water shall be protected by approved Reduced Pressure Principle (RPP) back-flow preventers.

5. AMMONIA OIL POTS, OIL STILLs, PUMPS AND EVAPORATORS

- 5.1 All oil pots and stills shall be fitted with safety relief valves.

5.2 Ammonia pumps shall be suitable for ammonia service. Pumps which can be isolated by valves shall be protected by safety valves vented to atmosphere or to system suction.

5.3 All evaporators shall be properly anchored and supported.

6. AMMONIA PIPE

6.1 Materials used in the construction of ammonia systems shall be suitable for the system.

6.2 Wrought steel and iron pipe shall conform to ANSI-B36.10-1959 (UMC Standard 15-1).

6.3 Pipe more than 2" IPS shall be electric-resistance welded, or seamless pipe.

6.4 Iron or steel pipe 1 ½" IPS or smaller containing liquid refrigerant shall be Schedule 80 if threaded or may be Schedule 40 if welded.

6.5 All piping subject to working pressure in excess of 300 PSIG shall be Schedule 80.

6.6 Piping shall be installed so as to prevent excessive strains on joints and be supported within 6 feet following the first bend from the compressor, within 2 feet of each bend and not more than 15 feet apart.

6.7 Iron or steel piping placed underground shall be coated so as to inhibit corrosion.

6.8 Piping crossing passageways in a building shall be not less than 7 ½ feet above the floor unless against the ceiling.

7. REFRIGERANT CONTROL VALVES

7.1 A stop valve shall be installed in the refrigerant piping of every refrigerating system:

1. At each inlet and outlet of every positive-displacement type compressor.
2. At each refrigerant outlet from a receiver.
3. At each refrigerant inlet of a pressure vessel having an internal gross volume exceeding 3 cubic feet if the vessel is a portion of a refrigerating system equipped with a positive displacement type compressor.

8. PRESSURE LIMITING DEVICE

8.1 A pressure limiting device shall be installed on a positive displacement refrigerant compressor. The pressure limiting device shall stop the action of the compressor

it serves at a pressure not exceeding 225 PSI. A stop valve shall not be placed between a pressure-limiting device and the compressor it serves.

9. PRESSURE-RELIEF VALVES-COMPRESSORS

- 9.1 Positive displacement compressors shall be equipped with a pressure-relief valve connected to the discharge side of the compressor, between such compressor and a stop valve.
- 9.2 A pressure relief valve shall be set to function at a pressure not in excess of 250 PSI.
- 9.3 Pressure relief valves shall discharge into the low pressure side of the refrigerating system or to the outside of the building. A pressure relief valve discharging into the low-pressure side must be of the type that is not affected by back pressure. If terminating outdoors shall discharge at a location 15 feet above adjoining ground level not less than 20 feet from any window, ventilating opening or exit in a building.

10. PRESSURE-RELIEF DEVICES-PRESSURE VESSELS

- 10.1 A pressure vessel over 6" in diameter which may be shutoff by valves from other parts of the system shall be equipped with a pressure-relief device.

11. PRESSURE-RELIEF DEVICE REQUIREMENTS

- 11.1 A pressure-relief device for a refrigerant vessel shall be set to function at a pressure not exceeding:
- 250 PSI High Side
 - 150 Low Side
- 11.2 Pressure-relief devices may be set to start at a pressure not to exceed the design working pressure. Such pressure shall be stamped on the vessel.
- 11.3 The minimum required rated discharge capacity for a vessel shall be : $C = F \times D \times L$
- C = Discharge capacity of the relief device in pounds of air per minute
D = Outside diameter of the vessel in feet
L = Outside length of the vessel in feet
F = 0.5
- 11.4 A pressure-relief device shall bear thereon:
1. Name of manufacturer

2. Discharge pressure in PSIG
 3. Nominal diameter of outlet
 4. Discharge capacity in pounds of air per minute
- 11.5 Pressure-relief devices shall be connected as close as practicable to the refrigerant container or evaporator it serves and above the refrigerant level in such container.
- 11.6 The discharge pipe shall be not less than the size of the relief-device outlet. – Common headers: the discharge from more than one relief device may be run in common when the sum of the areas of the pipes connected. When the length of piping exceeds 50 feet, such piping shall be increased one pipe size.
- 11.7 A strap or shut-off valve shall not be placed between a pressure-relief device and the vessel it serves.
- 11.8 Pressure-relief devices shall discharge to the atmosphere at a location not less than 15 feet above the adjoining ground level, not less than 20 feet from any window, ventilation opening or exit in a building.

12. MANUAL DISCHARGE OF AMMONIA

- 12.1 Ammonia systems located in buildings shall be equipped with means for manual discharge of the refrigerant to the atmosphere:
- A minimum 1” diameter discharge pipe shall extend above the liquid level from the high and low side into an emergency refrigerant control box.
 - A readily accessible stop valve and a high pressure gauge shall be installed on each discharge pipe ahead of each stop valve within the refrigerant control box.
 - Each valve shall have a permanent label reading “Discharge to Atmosphere.”
 - Each discharge pipe shall extend from the valve to a common pipe having a 1” minimum diameter. The common pipe shall terminate not less than 6 feet above the highest structure on the building not less than 20 feet from a window, ventilating opening or exit. The outlet shall be capped with a low pressure diaphragm.

12.1 Release From High Pressure Side

The manual means of discharge piping shall also be arranged with means of releasing the refrigerant from the high-pressure side to the low-pressure side.

- The high and low pressure side shall be interconnected with a minimum 1” pipe.

- A stop valve shall be installed in the interconnection and be located in the emergency refrigerant control box. A permanent label shall be attached to the valve reading “High-to-Low Pressure Control Valve.” (See Drawing A)

DRAWING “A”

Figure 1518-1

12.2 Emergency Refrigerant Control Box

Shall be located outside the building not more than 6 feet above adjoining ground level. This box shall be No. 16 gauge iron or steel with a hinged cover and lock. Such box shall be provided with a permanent label reading “Emergency Refrigerant Control Box.”

13. LABELS

- #### 13.1
- Permanent labels are required on all ammonia condensers, receivers, absorbers and accumulate setting forth the type of refrigerant in the vessel.

Manifolds shall have a permanent label setting forth the equipment controlled by each valve.

Exposed piping shall be labeled at intervals not more than 30 feet plus a label.

Compressors over 10 horsepower shall have a label within 10 feet giving the following:

1. Name of contractor
2. Kind of refrigerant
3. Amount of refrigerant

Pressure-relief devices shall be labeled giving the discharge capacity and pressure it will begin functioning. (See Drawing B)

DRAWING "B"

14. TESTING

14.1 All field assembled portions of the ammonia system shall be tested at:

- 300 PSIG – High side
- 150 PSIG – Low side

14.2 Factory tested compressors, pressure gauges, control mechanisms and safety devices need not be subject to above test pressure vessels that are labeled as constructed to approval standards. (See Drawing C)

DRAWING “C”

CONTRACTOR INSTALLING EQUIPMENT	
DELL SMITH CO., INC. 3320 WHITTIER BLVD., LOS ANGELES PHONE 261-3168	
KIND OF REFRIGERANT	FREON 22
AMOUNT	NORMAL PRESSURE
30 lbs.	200 lbs.

1 STAMP REQUIRED ON EACH 30 FEET OF PIPING

MAIN-DISCONNECT

TO BE ½" IN HEIGHT

EMERGENCY-REFRIGERATION SWITCH

Figure 1519-1

15. GENERAL SYSTEM SAFETY

- 19.1 Engine rooms shall have mechanical or gravity ventilation extending to the outside. Minimum gravity openings shall be not less than 2 square feet or Table 15-B. (See Drawing D)

DRAWING "D"

Table No. 15-B
Minimum air duct net areas and openings

TOTAL HORSEPOWER	MECHANICAL DISCHARGE OF AIR, cfm	MECHANICAL EXHAUST DUCT AREA (SQUARE FEET)	AREA OF GRAVITY OPENINGS TO THE OUTSIDE OF THE BUILDING (SQUARE FEET)
6	150	$\frac{1}{4}$	4
16	250	$\frac{1}{3}$	6
33	400	$\frac{1}{2}$	10
50	550	$\frac{2}{3}$	$12 \frac{1}{2}$
66	680	$\frac{2}{3}$	14
83	800	1	15
100	900	1	17
133	1,100	$1 \frac{1}{4}$	20
166	1,275	$1 \frac{1}{4}$	22
200	1,450	$1 \frac{1}{2}$	24
233	1,630	$1 \frac{1}{2}$	26
266	1,800	2	28
300	1,950	2	30
333	2,050	2	31
416	2,250	$2 \frac{1}{4}$	33
500	2,500	$2 \frac{1}{4}$	37
583	2,700	$2 \frac{1}{4}$	38
667	2,900	$2 \frac{1}{4}$	40
833	3,300	$2 \frac{1}{2}$	43
1,000	3,700	3	48
1,333	4,600	$3 \frac{3}{4}$	55
1,667	5,500	$4 \frac{1}{2}$	62
2,000	6,300	5	68
2,333	7,200	$5 \frac{1}{2}$	74
2,667	8,000	$5 \frac{3}{4}$	80
3,000	8,700	$6 \frac{1}{4}$	85
3,333	9,500	$6 \frac{1}{2}$	90
4,000	10,900	7	100
4,667	12,200	$7 \frac{1}{2}$	109
5,333	13,300	$7 \frac{3}{4}$	118
6,000	14,300	8	125
6,667	15,200	$8 \frac{1}{4}$	130
8,333	17,000	$8 \frac{3}{4}$	140
10,000	18,200	9	145
11,667	19,400	$9 \frac{1}{4}$	150
13,333	20,500	$9 \frac{1}{2}$	155
15,000	21,500	$9 \frac{3}{4}$	160
or greater			

- 15.2 Accumulators or interstage coolers shall be equipped with high level float switches which shall sound a high level alarm.
