Bulletin No. 109 10/97

Guidelines for:

IIAR Minimum Safety Criteria for a Safe Ammonia Refrigeration System

International Institute of Ammonia Refrigeration

NOTICE

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International Institute of Ammonia Refrigeration

1. PURPOSE

The purpose of this bulletin is to present the minimum safety criteria and associated data sheets recommended for a safe ammonia refrigeration system for use by qualified individuals making safety inspections.

2. SCOPE

2.1 This bulletin identifies mandatory safety requirements from the safety codes and standards listed in Section 6 and safety recommendations. It includes inspection data sheets and serves as a convenient check list of criteria governing a safe ammonia refrigeration system.

2.2 This bulletin is not intended to replace or provide substitute for the safety codes and standards listed in Section 6.

2.3 Safety inspections shall take into account all relevant local laws, regulations, codes and standards not identified in this bulletin.

2.4 Section 6 lists the titles and sources of the codes and standards referenced in this bulletin.

3. DEFINITIONS

qualified individual

An individual qualified through adequate training and experience to service, maintain and operate a refrigerating system with which that individual has become familiar.

shall (shall not)

Used where the provision is mandatory and typically extracted from and referenced to a code or standard listed in Section 6.

should (should not)

Used where the provision is not mandatory, but is recommended good practice.

4. SAFETY CRITERIA

4.1 Compressors

4.1.1 All ammonia refrigeration compressors shall have a legible manufacturer's name plate to include the following minimum data:

a) Manufacturer's name
b) Serial number
c) Model number
d) Year of manufacture
e) Maximum design working pressure
f) Refrigerant "Ammonia"
g) Rotation speed - rpm, maximum

h) Direction of rotation
i) Flow direction
[Section 3.3.3 of ANSI/IIAR 2-1992]

4.1.2 A compressor without a nameplate (see Section 4.1.1) should not be operated unless the applicable compressor operating limitations have been verified through the identification of the manufacturer and model number of the compressor from casting numbers.

4.1.3 All refrigeration compressors should be operated within the limitations specified by the compressor manufacturer. As a minimum, the following limitations should be checked:
a) Compressor speed
b) Compressor ratio
c) Compressor design discharge pressure
d) Compressor design maximum crankcase/housing pressure
e) Compressor designed for use with ammonia refrigerant

4.1.4 The compressor drive motor should comply with all local, state and national codes and should appear to be in good order.

4.1.5 Each positive displacement ammonia compressor shall be equipped with an internal or external compressor pressure-relief device of adequate size and pressure setting to prevent rupture of the compressor.
[Section 3.3.2 (c) of ANSI/IIAR 2-1992 and Section 9.8 of ANSI/ASHRAE 15-1994]

If the discharge of the pressure relief device is vented to atmosphere, it shall be piped in accordance with Sections 3.11.4.11 and 3.11.4.12 of ANSI/IIAR 2-1992.

4.1.6 Each compressor should be fitted with suction stop valve(s), discharge stop valve(s) and a discharge check valve.

4.1.7 Each compressor shall be equipped with the following operable safety controls as a minimum:
a) Low pressure cutout switch
b) High pressure cutout switch
c) Low oil pressure cutout switch (if the compressor uses forced feed lubrication)
[Section 3.3.3 of ANSI/IIAR 2-1992]

4.1.8 Each compressor should be inspected for any signs of alteration, modification, or physical repair that might affect the integrity of the compressor casing.

4.1.9 If the compressor casing has been altered, modified or repaired, the casing should have been pressure recertified by the manufacturer or the insurance underwriter and recertification papers maintained on site.

4.1.10 The compressor should be fitted with indicating device(s) such that an observer can determine the compressor's suction and discharge pressures, oil pressure (if the compressor uses forced feed lubrication) and discharge temperature.

4.1.11 Each compressor should be observed while in operation and checked for excessive vibrations, tight anchor bolts, general cleanliness, and other conditions that affect safe operation.

4.2 Evaporative Condensers

4.2.1 All evaporative condensers should be adequately anchored and supported.

4.2.2 Access to evaporative condensers for normal service requirements should not pose a hazard to service and maintenance personnel.

4.2.3 Any excessive fan and/or drive vibrations should be corrected.

4.2.4 The entirety of each condenser should be inspected for corrosion.

4.2.5 The coil, mist eliminators and the water sump on each condenser should be checked for dirt/scale build up.

4.2.6 The efficacy of the water distribution system and mist eliminators on each condenser should be checked.

4.3 Shell and Tube Heat Exchangers and Pressure Vessels

4.3.1 Nameplates

4.3.1.1 Shell and Tube Heat Exchangers

All shell and tube heat exchangers shall have a name plate with the following minimum data:

a) Manufacturer's name (preceded by the words "certified by", if the vessel is ASME stamped)
b) Serial number
c) Model number
d) Year of manufacture
e) Design pressure
   Shell side pressure ____ at ____ temperature
   Tube side pressure ____ at ____ temperature
f) Test pressure applied
g) National Board Number (where applicable)
h) Manufacturer's ASME stamp (where applicable)

In addition, shell and tube evaporators shall include the following data in accordance with the relevant "UG" sections of the latest edition of Section VIII, Division I, ASME Boiler and Pressure Vessel Code:

i) Type of construction in accordance with the above referenced ASME Code (where applicable)
j) An additional pressure and temperature stamping may be required with reference to exchangers used below -20°F (-28.9°C)

[Sections 3.5.3; 3.7.3.1.2; and 3.7.3.2.2 of ANSI/IIAR 2-1992]

4.3.1.2 Pressure Vessels

All pressure vessels shall have a name plate with the following minimum data:

a) Manufacturer's name (preceded by the words "certified by", if the vessel is ASME stamped)
b) Serial number
c) Model number
d) Year of manufacture
e) Maximum allowable pressure ____ at ____ temperature
f) Test pressure applied
g) National Board Number (where applicable)
h) Manufacturer's ASME stamp (where applicable)

In addition, pressure vessels shall include the following data in accordance with the relevant "UG" sections of the latest edition of Section VIII, Division I, ASME Boiler and Pressure Vessel Code, including:

i) Type of construction in accordance with the above referenced ASME Code (where applicable)
j) An additional pressure and temperature stamping may be required with reference to exchangers used below -20°F (-28.9°C)

[Sections 3.6.3; and 3.7.4.2 of ANSI/IIAR 2-1992]

4.3.2 It should be determined that the heat exchanger or pressure vessel is piped and operated within the pressure and temperature limitations as specified on the name plate data.

4.3.3 The shell side of shell and tube heat exchangers and all pressure vessels shall be provided with adequate opening(s) for the attachment of pressure relief device(s) as required in Section 3.11.4 of ANSI/IIAR 2-1992.

[Sections 3.5.2c); 3.6.2d); 3.7.3.1.1a); and 3.7.4.1d) of ANSI/IIAR 2-1992]

When the tube side of a shell and tube heat exchanger contains refrigerant and can be isolated by valves on the inlet and outlet lines a pressure relief device(s) shall be provided to protect the unit from excess hydrostatic pressure, in accordance with Section 5.4.1.4 of ANSI/IIAR 2-1992.

[Section 3.7.3.2.1c) of ANSI/IIAR 2-1992]

4.3.4 If any heat exchanger or pressure vessel name plate is covered with insulation, the insulation should be removed to allow name plate inspection. The insulation should then be repaired and an insulation plug provided to cover the name plate area and to provide future access.

4.3.5 If the heat exchanger or pressure vessel shows signs of corrosion beyond mild surface corrosion, the heat exchanger or pressure vessel should be further inspected for soundness by a professional engineer with expertise in the field, or an ASME inspector.

4.3.6 Alterations to heat exchangers and pressure vessels shall be allowed only as directed by the governing body, for example: ASME; National Board; and shall only be performed in accordance with the requirements of the governing body. A retesting stamp shall be applied by the governing body when the modification is completed, if required.

4.3.7 All heat exchangers and pressure vessels should be identified with a component marker that identifies the particular component. The marker should also provide information regarding the operating temperature or pressure of the component as described in IIAR Bulletin 114, “Guidelines for: Identification of Ammonia Refrigeration Piping and System Components”.

4.3.8 Refer to Section 4.6, below, for visual liquid level indicator safety criteria.

4.4 Forced Air Evaporators

4.4.1 All evaporators should be properly anchored and supported.

4.4.2 Evaporators should be installed in locations where they are not exposed to possible physical damage through traffic hazards, for example: forklifts.

4.4.3 All evaporators and associated piping should be kept free from excessive buildup of ice.

4.4.4 Any excessive fan and/or drive vibrations should be corrected.

4.4.5 The entirety of each evaporator should be inspected for corrosion.

4.5 Refrigerant Pumps

4.5.1 Ammonia refrigerant pumps shall be suitable for the service in which they are being applied.

4.5.2 Ammonia pumps shall be installed with isolation valves.

4.5.3 A hydrostatic or differential pressure-relief device (or non-closeable vent pipe) shall be used for pressure protection of a liquid pump and its associated piping. *[Section 3.8.2 of ANSI/IIAR 2-1992]*

4.6 Visual Liquid Level Indicators (Bulls Eyes, Tubular Glass and Flat “Armored Glass” Linear Sight Columns/Sight Glasses)

4.6.1 All visual liquid level indicators used to observe the refrigerant level, for example: in a vessel, heat exchanger; should be installed in such a manner that they are protected from possible physical damage through traffic hazards, for example: forklifts.

4.6.2 It is recommended that linear visual liquid level indicators (sight columns/sight glasses) be of the flat “armored glass” type in preference to the tubular glass type.

4.6.3 Tubular glass linear visual liquid level indicators (sight glasses) should be fitted with internal check type shut-off valves. This type of sight glass should also have robust protection against accidental breakage 360 degrees around the glass tube, over the full length of the tube.

4.7 Piping System

4.7.1 Ammonia piping and accessories shall be installed as required in Section 5 of ANSI/IIAR 2-1992.

4.7.2 All pressure containing mechanical fasteners, for example: bonnet and flange bolts; should be periodically checked for tightness and repaired joints noted in the maintenance and repair log (see Section 4.10.15).

4.7.3 Ammonia piping should be inspected throughout a facility to determine that no refrigerant piping is exposed to possible physical damage through traffic hazards, for example: forklifts.

4.7.4 Uninsulated refrigerant piping should be examined for signs of corrosion. If corrosion exists, the pipe should be cleaned down to bare metal and painted with a rust preventive paint. Badly corroded pipe should be replaced.

4.7.5 Insulated piping showing signs of vapor barrier failure should have the insulation removed and the pipe inspected. The pipe should then be treated in accordance with Section 4.7.3, above.

4.7.6 All ammonia piping should have appropriate pipe markers attached to indicate the use of the pipe and arrows to indicate the direction of flow, such as in IIAR Bulletin 114, “Guidelines for: Identification of Ammonia Refrigeration Piping and System Components”.

4.8 Ammonia Machinery Room Ventilation System

4.8.1 Ammonia machinery room ventilation shall be in compliance with Section 4.3 of ANSI/IIAR 2-1992.

IIAR Bulletin 111, “Guidelines for: Ammonia Machinery Room Ventilation,” may be used for guidance.

4.9 Pressure-Relief Devices

4.9.1 Single or dual safety pressure relief valves or other suitable relief devices shall be provided on all vessels, heat exchangers, oil pots, oil stills and elsewhere on the ammonia refrigerating system, as specified in Section 3.11 of ANSI/IIAR 2-1992 and the general requirements of Section 9 of ANSI/ASHRAE 15-1994.

4.9.2 There shall be no stop valves located between the safety relief valve and the part(s) of the system protected except that a dual relief valve and 3-way valve manifold is an acceptable arrangement. The dual manifold should be positioned in the full open (backseated) position as a normal operating procedure.
[Section 3.11.1.4 of ANSI/IIAR 2-1992]

4.9.3 All pressure-relief devices should be connected directly to the pressure vessel or other parts of the system being protected thereby, and installed so that they are readily accessible for inspection and replacement.
[Section 3.11.1.5 of ANSI/IIAR 2-1992]

4.9.4 All pressure-relief valves shall be set to start to function at a pressure not to exceed the design pressure of the parts of the system protected.
[Section 3.11.2.1 of ANSI/IIAR 2-1992]

4.9.5 Pressure-relief valves shall be set and sealed by the manufacturer and marked with a name plate as required by Section VIII, Division I, ASME Boiler and Pressure Vessel Code.
[Section 3.11.3 of ANSI/IIAR 2-1992]

4.9.6 Pressure-relief devices shall be piped as specified in Sections 3.11.4.10 and 5.4 of ANSI/IIAR 2-1992, with particular attention to : relief vent line sizing and support; and the location of the atmospheric discharge.

No pressure-relief valves should be located in a refrigerated space unless precautions are taken to prevent moisture migration into the valve body or the relief vent line.

4.9.7 Pressure-relief valves discharging to atmosphere should be replaced or inspected, cleaned and tested every five years of service. Testing should be done by an authorized testing facility.

4.10 General Ammonia Refrigeration System Safety Requirements

4.10.1 All installed instruments should be in working order. Inaccurate or broken instruments should be replaced.

4.10.2 Accumulators or interstage coolers should be equipped with high level float switches which should actuate a high level alarm, and where practical, should cause the associated compressor(s) to shut down when a high refrigerant level is detected.

4.10.3 The main shut-off valve(s) (king valve(s)); hot gas defrost line main shut-off valve; and NH_3 pump liquid main shut-off valve(s) and/or disconnects; of the ammonia system should be readily accessible and identified with a prominent sign having letters sufficiently large to be easily read.

4.10.4 There shall be a legible, permanent sign easily accessible on each refrigerating system displaying the following information:
a) Name and address of the installer
b) The refrigerant number and the amount of refrigerant in the system
c) The lubricant identity and amount
c) The field test pressure(s) applied
[Section 11.2.1 of ANSI/ASHRAE 15-1994]

4.10.5 A sign or signs should be posted in a conspicuous location providing emergency instructions and phone numbers of emergency safety and operating personnel.

4.10.6 Each plant shall have an appropriate evacuation plan on display, with persons responsible for activation clearly shown on the plan.

4.10.7 Ice formations that could endanger refrigerant piping or other components should be removed and the condition(s) that cause the ice buildup corrected.

4.10.8 If an ammonia leak is observed, the source of the leak should be investigated and the leak repaired.

4.10.9 Abnormal sounds and/or vibrations of piping, fans, pumps, pressure actuated pumping systems and hydraulic pipe pressure surges should be investigated and corrected.

4.10.10 An emergency eye wash station and deluge body shower shall be located just outside the machine room exit door. An additional emergency eye wash station and deluge body shower should be readily accessible inside the machinery room.
[Section 4.4.7 of ANSI/IIAR 2-1992]

4.10.11 Every machinery room shall have a self contained breathing apparatus located outside of, but close to, the exit door. A second, backup, self contained breathing apparatus shall also be provided.
[Section 11.6 of ANSI/ASHRAE 15-1994]

Emergency equipment should be as outlined in Chapter V of the IIAR publication "A Guide to Good Practices for the Operation of an Ammonia Refrigeration System."

4.10.12 Where only one exit to an occupied space exists, there should be no ammonia piping or equipment installed in that exit. The egress should be kept clear of all obstruction.

4.10.13 See Sections 8.13 and 8.14 of ANSI/ASHRAE 15-1994 for additional machinery room requirements.

4.10.14 There shall be no ammonia cylinders with temporary or permanent connections to the system unless actual transfer of ammonia is being conducted by suitably qualified individuals.
[Section 5.7.4 of ANSI/IIAR 2-1992]

4.10.15 There should be a current log of all maintenance and repair work performed on the refrigeration system.

4.10.16 There should be a current log of all oil added to and removed from the refrigeration system.

5. FREQUENCY OF SAFETY INSPECTIONS

5.1 Each plant should have an owner's appointed representative responsible for compliance with all refrigeration safety requirements.

5.2 Each owner should ensure an ammonia system safety check is conducted annually.

5.3 A more thorough inspection of an ammonia refrigeration system should be conducted by a competent ammonia refrigeration engineer and/or fire safety official and/or other authority every five years.

6. TITLES AND SOURCES OF REFERENCES

The following listing clearly identifies referenced documents by name of organization, reference number, year of issue and title to which reference is made in the bulletin.

6.1 American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.

ANSI/ASHRAE Standard 15-1994, Safety Code for Mechanical Refrigeration
(a, b)

6.2 American Society of Mechanical Engineers

Section VIII, Division I, Latest Edition, ASME Boiler and Pressure Vessel Code, Pressure Vessels
(c)

6.3 International Institute of Ammonia Refrigeration

ANSI/IIAR 2-1992, Equipment, Design, and Installation of Ammonia Mechanical Refrigerating Systems
(a, d)

6.4 Reference Sources

a. American National Standards Institute (ANSI)
   11 West 42nd Street
   New York, NY 10036

b. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE)
   1791 Tullie Circle, NE
   Atlanta, GA 30329

c. American Society of Mechanical Engineers (ASME)
   United Engineering Center
   345 East 47th Street
   New York, NY 10017

d. International Institute of Ammonia Refrigeration (IIAR)
   1200 19th Street NW, Suite 300
   Washington, DC 20036

7. INSPECTION CHECKLISTS

The accompanying data sheets should be used for inspection checklists when performing safety inspections. Additional copies of these forms should be used as needed for the various components of the system.

International Institute of Ammonia Refrigeration

Ammonia Refrigeration Safety Inspection Checklist

ID Number: _____

COMPRESSORS

Plant Owner: _____

Address: _____

Contact: _____ Telephone: _____

Inspector: _____ Date: _____

Compressor

Compressor Location: _____

Compressor Identification Mark/No.: _____

Application

☐ High Stage ☐ Single Stage

☐ Booster ☐ Swing

Type

☐ Rotary Screw ☐ Rotary Vane

☐ Reciprocating ☐ Vertical Reciprocating

Application Data

Type of Drive: ☐ Belt ☐ Direct

Operating Speed (*rpm*): _____

Design Capacity (TR): _____ Suction (*psig*): _____ Discharge (*psig*): _____

Min. Suction Pressure *(psig)*: _____ Max. Discharge Pressure *(psig)*: _____

Type of Relief Valve: ☐ Internal ☐ External

Size *(lb/min air)*: _____ Set Pressure *(psig)*: _____

Compressor Nameplate Data

Manufacturer, Name, Model, Serial No.: _____

Year Manufactured: _____

Refrigerant: ☐ Ammonia ☐ Other: _____

Max. Design Working Pressure *(psig)*: _____

Max. Rotation Speed *(rpm)*: _____

Direction of Rotation: ☐ clockwise ☐ counterclockwise

Flow Direction Shown? ☐ Yes ☐ No

Compressor Operating Limits

Speed Max. *(rpm)*: _____ Min. *(rpm)*: _____

Max. Compression Ratio: _____

Design Discharge Pressure *(psig)*: _____

Design Crankcase/Housing Pressure *(psig)*: _____

Max. Discharge Temperature *(°F)*: _____

Max. Oil Temperature *(°F)*: _____

Motor Nameplate Data

Manufacturer, Name, Model, Serial No., Year Manufactured: _____

Frame Size: _____ Type: _____ Speed *(rpm)*: _____ Power *(hp)*: _____

Voltage *(V)*: _____ FLA *(amps)*: _____ Phase: ☐ 1 ☐ 3

Frequency *(Hz)*: _____

Belt size and number: _____

Safety Cutouts

High Pressure Setting (*psig*): _____ Type: _____ Functions Properly? _____

Low Pressure Setting (*psig*): _____ Type: _____ Functions Properly? _____

Oil Pressure Setting (*psid*): _____ Type: _____ Functions Properly? _____

ID Number: _____

COMPRESSORS

Requirement/Recommendation	Conforms	Recommended Action/Comments	Safety Status	Target Date
a) Nameplate legible and complete?	☐ Yes ☐ No			
b) Designed for ammonia?	☐ Yes ☐ No			
c) Operating within limitations:				
1) Compressor RPM?	☐ Yes ☐ No			
2) Compressor ratio?	☐ Yes ☐ No			
3) Discharge pressure?	☐ Yes ☐ No			
4) Max. crankcase pressure?	☐ Yes ☐ No			
d) Drive (belts, sheaves, coupling) properly cleaned?	☐ Yes ☐ No			
e) Has compressor been modified, altered, damaged or repaired such that casing integrity is affected? If yes, has casing been recertified and documented?	☐ Yes ☐ No			
f) Free from excessive vibration?	☐ Yes ☐ No			
g) Anchored and grouted securely in place?	☐ Yes ☐ No			
h) Suction, discharge and oil pressure discharge temperature gauges present and functioning properly?	☐ Yes ☐ No			
i) High pressure, low pressure, and low diff. oil pressure switches functioning properly?	☐ Yes ☐ No			
j) Does compressor have internal or external relief valve? If external, does it meet applicable requirements?	☐ Yes ☐ No ☐ Yes ☐ No			
k) Does compressor have suction and discharge stop valves and discharge check valve?	☐ Yes ☐ No			

Are there any other conditions that might negatively affect safe compressor operation? ☐ Yes ☐ No

If yes, describe. _____

_____

_____

_____

_____

International Institute of Ammonia Refrigeration

Ammonia Refrigeration Safety Inspection Checklist

ID Number: _____

PRESSURE VESSELS

Plant Owner: _____

Address: _____

Contact: _____ Telephone: _____

Inspector: _____ Date: _____

Pressure Vessel

Vessel Location: _____

Vessel Identification Mark/No.: _____

Application

☐ High Pressure Receiver ☐ Intercooler ☐ Accumulator ☐ Oil Pot

☐ Pump Receiver, Low Temp ☐ Pump Receiver, High Temp ☐ Other (Describe) _____

Application Data

Normal Operating Pressure *(psig)*: _____ Temperature *(°F)*: _____

Vessel Size *(Diam. x L/H, ft)*: _____ Normal Liquid Level *(ft)*: _____

Normal Ammonia Inventory *(cubic ft)*: _____

Design Capacity *(Specify: Pumpdown, Surge Vol., TR, etc.)*: _____

Vessel Nameplate Data

Manufacturer, Name, Model, Serial No.: _____

Year Manufactured: _____ Max. Design Working Pressure *(psig)*: _____

Maximum Allowable Pressure *(psig)*: _____ At *(°F)*: _____

Minimum Design Metal Temperature *(°F)*: _____ At *(psig)*: _____

Test Pressure Applied *(psig)*: _____

National Board No.: _____ ASME Certification Stamp? ☐ Yes ☐ No

Safety Relief Valve Data

Type: ☐ Dual ☐ Single ☐ None

Manufacturer, Name, Model, Serial No.: _____

Year Manufactured or Recertified: _____ ASME Seal Unbroken? ☐ Yes ☐ No

Pressure Setting *(psig):* _____ Capacity *(lbs. air/min)*: _____

Valve Connections: ☐ Inlet _____ ☐ Outlet _____ Pipe Size: ☐ Inlet _____ ☐ Outlet _____

Is Valve Properly Installed and Piped to Termination? ☐ Yes ☐ No

If No, Explain: _____

Visual Liquid Level Indicator

☐ Tubular ☐ Flat Armored ☐ Armored Bullseye ☐ High Pressure Industrial ☐ None

ID Number: _____

PRESSURE VESSELS

Requirement/Recommendation	Conforms	Recommended Action/Comments	Safety Status	Target Date
a) Nameplate legible and complete?	☐ Yes ☐ No			
b) Operating within limitations:				
1) Maximum pressure?	☐ Yes ☐ No			
2) Minimum temperature?	☐ Yes ☐ No			
c) Vessel ASME stamp legible?	☐ Yes ☐ No			
d) Certification drawings on file?	☐ Yes ☐ No			
e) Manufacturer data report on file?	☐ Yes ☐ No			
f) Does vessel have known alterations/modifications?	☐ Yes ☐ No			
1) If yes, was vessel recertified?	☐ Yes ☐ No			
2) Is revised data report on file?	☐ Yes ☐ No			
g) Relief valve:				
1) Proper type?	☐ Yes ☐ No			
2) Correct setting?	☐ Yes ☐ No			
3) Capacity correct?	☐ Yes ☐ No			
4) Installation correct?	☐ Yes ☐ No			
5) Piping to termination correct?	☐ Yes ☐ No			
6) Relief valve replaced or recertified within last 5 years of service?	☐ Yes ☐ No			
7) ASME seal unbroken?	☐ Yes ☐ No			
h) Tubular linear liquid level indicator (sight glass):				
1) Protected from traffic hazards?	☐ Yes ☐ No			
2) 360° guards?	☐ Yes ☐ No			
3) Internal check shutoff valves?	☐ Yes ☐ No			
i) Vessel properly identified? (Name, pressure level per IIAR Bulletin 114)	☐ Yes ☐ No			

j) Vessel condition (check one): ☐ no visible corrosion ☐ slight visible corrosion ☐ extensive corrosion ☐ unknown (insulated)

k) Insulation condition (check one): ☐ no vapor retarder leaks ☐ slight vapor retarder leaks ☐ extensive vapor retarder leaks ☐ not insulated

l) Relief valve condition (check one): ☐ clean, no visible corrosion ☐ slight external corrosion ☐ extensive corrosion

Are there any other conditions that might negatively affect safe vessel operation? ☐ Yes ☐ No

If yes, describe. _____

_____

_____

_____

_____

International Institute of Ammonia Refrigeration

Ammonia Refrigeration Safety Inspection Checklist

ID Number: _____

HEAT EXCHANGERS

Plant Owner: _____

Address: _____

Contact: _____ Telephone: _____

Inspector: _____ Date: _____

Shell & Tube Heat Exchanger

S & T Heat Exchanger Location: _____

S & T Heat Exchanger Identification Mark/No.: _____

Type

☐ Condenser, Water Cooled ☐ Liquid Subcooler

☐ Evaporator: Flooded Ammonia ☐ Evaporator: Dry Type Ammonia ☐ Other *(Describe)* _____

Application Data

Normal Operating Pressure *(psig)*: _____ Temperature *(°F)*: _____

Vessel Size *(Diam. x L/H, ft.)*: _____ Normal Liquid Level *(ft)*: _____

Tube Material: ☐ carbon steel ☐ stainless steel ☐ aluminum Tube O.D (*in*): _____ Number of Tubes: _____

Normal Ammonia Inventory *(Volume/Weight)*: ☐ Cu.Ft.: _____ ☐ Lbs.: _____

Design Capacity: _____ TR with _____ GPM of _____ In @ _____°F, Out @ _____°F

Shell & Tube Heat Exchanger Nameplate Data

Manufacturer, Name, Model, Serial No.: _____

Year Manufactured: _____

Shell Side Pressure *(psig)*: _____ at °F: _____ Tube Side Pressure *(psig)*: _____ at °F: _____

Maximum Allowable Pressure *(psig)*: _____ at °F: _____ Test Pressure Applied *(psig)*: _____ at °F: _____

Minimum Design Metal Temperature *(°F)*: _____ at *(psig)*: _____

National Board No.: _____ ASME Certification Stamp? ☐ Yes ☐ No

Safety Relief Valve Data

Type: ☐ Dual ☐ Single ☐ None

Manufacturer, Name, Model, Serial No.: _____

Year Manufactured or Recertified: _____ ASME Seal Unbroken? ☐ Yes ☐ No

Pressure Setting *(psig):* _____ Capacity *(lbs. air/min)*: _____

Valve Connections: ☐ Inlet _____ ☐ Outlet _____ Pipe Size: ☐ Inlet _____ ☐ Outlet _____

Is Valve Properly Installed and Piped to Termination? ☐ Yes ☐ No

If No, Explain: _____

Visual Liquid Level Indicator

☐ Tubular ☐ Flat Armored ☐ Armored Bullseye ☐ High Pressure Industrial ☐ None

ID Number: _____

HEAT EXCHANGERS

Requirement/Recommendation	Conforms	Recommended Action/Comments	Safety Status	Target Date
a) Nameplate legible and complete?	☐ Yes ☐ No			
b) Suitable for ammonia?	☐ Yes ☐ No			
c) Operating within limits:				
1) Maximum pressure — Shell side?	☐ Yes ☐ No			
Tube side?	☐ Yes ☐ No			
2) Minimum temperature?	☐ Yes ☐ No			
d) ASME stamp legible?	☐ Yes ☐ No			
e) Certification drawings on file?	☐ Yes ☐ No			
f) Manufacturer data report on file?	☐ Yes ☐ No			
g) Does S&T heat exchanger have known alterations/modifications?	☐ Yes ☐ No			
1) If yes, was S&T heat exchanger recertified?	☐ Yes ☐ No			
2) Is revised data report on file?	☐ Yes ☐ No			
h) Safety relief and hydrostatic relief valves:				
1) Proper types?	☐ Yes ☐ No			
2) Pressure setting(s) correct?	☐ Yes ☐ No			
3) Capacity/capacities correct?	☐ Yes ☐ No			
4) Installation correct?	☐ Yes ☐ No			
5) Piping to termination correct?	☐ Yes ☐ No			
6) Relief valve(s) replaced or recertified within last 5 years of service?	☐ Yes ☐ No			
7) ASME seal unbroken (for safety relief valves)?	☐ Yes ☐ No			
i) Tubular linear liquid level indicator (sight glass):				
1) Protected from traffic hazards?	☐ Yes ☐ No			
2) 360° Guards?	☐ Yes ☐ No			
3) Internal check shutoff valves?	☐ Yes ☐ No			
j) Shell & tube heat exchanger properly identified and marked per IIAR Bulletin 114?	☐ Yes ☐ No			

k) S&T heat exch. condition (check one) ☐ no visible corrosion ☐ slight visible corrosion ☐ extensive corrosion ☐ unknown (insulated)

l) Insulation condition (check one) ☐ no vapor retarder leaks ☐ slight vapor retarder leaks ☐ extensive vapor retarder leaks ☐ not insulated

m) Relief valve condition (check one) ☐ clean, no visible corrosion ☐ slight external corrosion ☐ extensive corrosion

Are there any other conditions that might negatively affect safe heat exchanger operation? ☐ Yes ☐ No

If yes, describe. _____

_____

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International Institute of Ammonia Refrigeration

Ammonia Refrigeration Safety Inspection Checklist

ID Number: _____

AIR-COOLING EVAPORATORS

Plant Owner: _____

Address: _____

Contact: _____ Telephone: _____

Inspector: _____ Date: _____

Air Cooling Evaporators

Air Cooling Evaporator Location: _____

Air Cooling Identification Mark/No.: _____

Application

☐ Blast Freezer ☐ Storage Freezer

☐ Process Room ☐ Dock

☐ Storage Cooler

☐ Other *(Describe)*: _____

Type of Refrigerant Feed

☐ Liquid Recirculation ☐ Dry Expansion (DX)

☐ Flooded *(Surge Drum)*

☐ Other *(Describe)*: _____

Application Data

Tube and Fin Material: ☐ carbon steel ☐ stainless steel ☐ aluminum

Defrost Type: ☐ air ☐ water ☐ hot gas ☐ other _____

Design Room Air Temperature *(°F)*: _____ Normal Refrigerant Temperature *(°F)*: _____

Design Capacity *(TR)*: _____ Design Air Flow *(CFM)*: _____

Total Internal Vol. *(cubic ft)*: _____

Normal Ammonia Inventory *(Volume/Weight)*: ☐ cubic ft: _____ ☐ lb: _____

Air Cooling Evaporator Nameplate Data

Manufacturer, Name, Model, Serial No.: _____

Year Manufactured: _____ Design Pressure *(psig)*: _____

Fan Motor Nameplate Data

Manufacturer, Name, Model, Serial No., Year Manufactured: _____

Frame Size: _____ Type: _____ Speed *(rpm)*: _____ Power *(hp)*: _____

Voltage *(V)*: _____ FLA *(amps)*: _____ Phase: ☐ 1 ☐ 3

Frequency *(Hz)*: _____ Belt size and number: _____

ID Number: _____

AIR-COOLING EVAPORATORS

Requirement/Recommendation	Conforms	Recommended Action/Comments	Safety Status	Target Date
a) Nameplate legible & complete?	☐ Yes ☐ No			
b) Suitable for ammonia?	☐ Yes ☐ No			
c) Operation within limits?	☐ Yes ☐ No			
d) Adequately anchored and supported?	☐ Yes ☐ No			
e) Safe access for service & maintenance?	☐ Yes ☐ No			
f) Free from excessive vibration?	☐ Yes ☐ No			
g) Adequate protection against traffic hazards?	☐ Yes ☐ No			
h) Evaporator free from excessive ice buildup and clean of dirt?	☐ Yes ☐ No			
i) Drive properly guarded & protected?	☐ Yes ☐ No			
j) Evaporator condition (check one) ☐ clean, no visible corrosion ☐ slight visible corrosion ☐ extensive corrosion				

Are there any other conditions that might negatively affect safe evaporator operation? ☐ Yes ☐ No

If yes, describe. _____

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International Institute of Ammonia Refrigeration

Ammonia Refrigeration Safety Inspection Checklist

ID Number: _____

EVAPORATIVE CONDENSERS

Plant Owner: _____

Address: _____

Contact: _____ Telephone: _____

Inspector: _____ Date: _____

Evaporative Condenser

Evaporative Condenser Location: _____

Evaporative Condenser Identification Mark/No.: _____

Application Data

Tube and Fin Material: ☐ galvanized steel ☐ stainless steel ☐ aluminum

Design Wet Bulb Temperature *(°F)*: _____ Design Water Flow *(GPM)*: _____

Design Condensing Pressure *(psig)*: _____ Temperature *(°F)*: _____

Total Internal Volume *(cubic ft)*: _____

Normal Ammonia Inventory *(Volume/Weight)*: ☐ cubic ft: _____ ☐ lb: _____

Desuperheater Coil Installed? ☐ Yes ☐ No

Evaporative Condenser Nameplate Data

Manufacturer, Name, Model, Serial No.: _____

Year Manufactured: _____ Design Pressure *(psig)*: _____

Fan Motor Nameplate Data

Manufacturer, Name, Model, Serial No., Year Manufactured: _____

Frame Size: _____ Type: _____ Speed *(rpm)*: _____ Power *(hp)*: _____

Voltage *(V)*: _____ FLA *(amps)*: _____ Phase: ☐ 1 ☐ 3

Frequency *(Hz)*: _____ Belt size and number: _____

Pump Motor Nameplate Data

Manufacturer, Name, Model, Serial No., Year Manufactured: _____

Frame Size: _____ Type: _____ Speed *(rpm)*: _____ Power *(hp)*: _____

Voltage *(V)*: _____ FLA *(amps)*: _____ Phase: ☐ 1 ☐ 3

Frequency *(Hz)*: _____ Belt size and number: _____

Non-Condensable Gas Purger

Type: ☐ Automatic, Refrigerated ☐ Manual, Refrigerated ☐ Manual, Not Refrigerated

Purge Point Locations: _____

Purger Nameplate Data

Manufacturer, Name, Model, Serial No.: _____

ID Number: _____

EVAPORATIVE CONDENSERS

Requirement/Recommendation	Conforms	Recommended Action/Comments	Safety Status	Target Date
a) Nameplate legible & complete?	☐ Yes ☐ No			
b) Suitable for ammonia?	☐ Yes ☐ No			
c) Operating within limits?	☐ Yes ☐ No			
d) Adequately anchored & supported?	☐ Yes ☐ No			
e) Safe access for normal service & maintenance (stairs, catwalks)?	☐ Yes ☐ No			
f) Free from excess, visible vibration?	☐ Yes ☐ No			
g) Adequate protection against traffic hazards?	☐ Yes ☐ No			
h) Corrosion monitoring system present?	☐ Yes ☐ No			
i) Condenser purge valves present & in good condition?	☐ Yes ☐ No			
j) Auto refrigerated air purge installed?	☐ Yes ☐ No			
k) Condenser isolation valves in good condition?	☐ Yes ☐ No			
l) Condenser Relief Valves:				
1) Type correct?	☐ Yes ☐ No			
2) Pressure setting correct?	☐ Yes ☐ No			
3) Capacity correct?	☐ Yes ☐ No			
4) Proper installation?	☐ Yes ☐ No			
5) Termination of piping correct?	☐ Yes ☐ No			
6) Relief valve replaced or recertified within last 5 years of service?	☐ Yes ☐ No			
7) ASME seal unbroken?	☐ Yes ☐ No			
m) Dust/scale buildup present:				
1) Condenser coil?	☐ Yes ☐ No			
2) Mist eliminators?	☐ Yes ☐ No			
3) Water sump?	☐ Yes ☐ No			
n) Water distributors operating effectively?	☐ Yes ☐ No			
o) Mist eliminators operating effectively?	☐ Yes ☐ No			

p) Condenser water treatment: ☐ ozone type ☐ chemical type

q) Evap. condenser condition: ☐ clean, no corrosion ☐ slight visible corrosion ☐ extensive corrosion

r) Relief valve condition: ☐ clean, no corrosion ☐ slight visible corrosion ☐ extensive corrosion

Are there any other conditions that might negatively affect safe condenser operation? ☐ Yes ☐ No

If yes, describe. _____

_____

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International Institute of Ammonia Refrigeration

Ammonia Refrigeration Safety Inspection Checklist

ID Number: _____

PUMPS

Plant Owner: _____

Address: _____

Contact: _____ Telephone: _____

Inspector: _____ Date: _____

Refrigerant Pump

Refrigerant Pump Location: _____

Refrigerant Pump Identification Mark/No.: _____

Application

☐ Low Temperature Liquid Recirculation

☐ High Temperature Liquid Recirculation

☐ Low Pressure Transfer

☐ High Pressure Transfer

☐ Other (*Describe*): _____

Type

☐ Open Centrifugal

☐ Hermetic Centrifugal

☐ Rotary Gear

☐ Rotary Vane

☐ Other (*Describe*): _____

Application Data

Type of Drive: ☐ Belt ☐ Direct

Operating Speed (*rpm*): _____

Design Capacity (*GPM@ Total Head, psig*): _____

Min. Refrigerant Temperature (°*F*): _____

Max. Refrigerant Pressure (*psig*): _____

Type of Relief Valve: ☐ External ☐ Internal

Type of Min. Flow Bypass: ☐ Manual ☐ Other: _____

Refrigerant Pump Nameplate Data:

Manufacturer, Name, Model, Serial No.: _____

Year Manufactured: _____

Refrigerant: ☐ Ammonia ☐ Other: _____

Design Pressure (*psig*): _____

Min. Temperature (°*F*): _____

Max. Speed (*rpm*): _____

Direction of Pump Rotation (Viewed from Drive End): ☐ clockwise ☐ counterclockwise

Motor Nameplate Data

Manufacturer, Name, Model, Serial No., Year Manufactured: _____

Frame Size: _____ Type: _____ Speed *(rpm)*: _____ Power *(hp)*: _____

Voltage *(V)*: _____

FLA *(amps)*: _____

Phase: ☐ 1 ☐ 3

Frequency *(Hz)*: _____

Belt size and number: _____

ID Number: _____

PUMPS

Requirement/Recommendation	Conforms	Recommended Action/Comments	Safety Status	Target Date
a) Nameplate legible?	☐ Yes ☐ No			
b) Suitable for ammonia?	☐ Yes ☐ No			
c) Operating within limits:				
1) Pump speed?	☐ Yes ☐ No			
2) Design pressure?	☐ Yes ☐ No			
3) Minimum temperature?	☐ Yes ☐ No			
d) Drive properly guarded and protected?	☐ Yes ☐ No			
e) Pump free from excessive vibration?	☐ Yes ☐ No			
f) Pump anchored securely in place?	☐ Yes ☐ No			
g) Pump suction and discharge pressure gauges functioning properly?	☐ Yes ☐ No			
h) Is proper hydrostatic relief valve or vent pipe installed?	☐ Yes ☐ No			
i) Is proper minimum flow bypass valve installed?	☐ Yes ☐ No			
j) Are safety limit switches properly installed and operable?	☐ Yes ☐ No			

Are there any other conditions that might negatively affect safe pump operation? ☐ Yes ☐ No

If yes, describe. _____

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International Institute of Ammonia Refrigeration

Ammonia Refrigeration Safety Inspection Checklist

ID Number: _____

PIPING

Plant Owner: _____

Address: _____

Contact: _____ Telephone: _____

Inspector: _____ Date: _____

Piping System

Piping System Location: _____

Piping System Identification Mark/No.: _____

Requirement/Recommendation	Conforms	Recommended Action/Comments	Safety Status	Target Date
a) Piping system adequately supported and anchored?	☐ Yes ☐ No			
b) Piping system adequately protected from traffic hazards?	☐ Yes ☐ No			
c) Is piping system free of abnormal ice formations?	☐ Yes ☐ No			
d) Is piping arranged so liquid ammonia cannot be trapped between the pump discharge check valve and shut off valve? If no, is there a properly piped hydrostatic relief valve installed?	☐ Yes ☐ No ☐ Yes ☐ No			
e) All ammonia drain valves fitted with plugs?	☐ Yes ☐ No			
f) Gauge valves and gauges installed at all control valves?	☐ Yes ☐ No			
g) All gauges in good working order?	☐ Yes ☐ No			
h) All piping has proper markers per IIAR Bulletin 114?	☐ Yes ☐ No			
i) Installation conforms with IIAR-2-1992 Section 5?	☐ Yes ☐ No			
j) Mechanical fasteners tight?	☐ Yes ☐ No			

k) Condition of piping (check one) ☐ clean, no visible corrosion ☐ slight visible corrosion ☐ extensive corrosion ☐ unknown(insulated)

l) Condition of insulation (check one) ☐ no vapor retarder leaks ☐ slight vapor retarder leaks ☐ extensive vapor retarder leaks ☐ not insulated

Are there any other conditions that might negatively affect piping operation? ☐ Yes ☐ No

If yes, describe. _____

International Institute of Ammonia Refrigeration

Ammonia Refrigeration Safety Inspection Checklist

ID Number: _____

VENTILATION

Plant Owner: _____

Address: _____

Contact: _____ Telephone: _____

Inspector: _____ Date: _____

Ammonia Machinery Room Ventilation System

Ventilation System Location: _____

Ventilation System Identification Mark/No.: _____

Machinery Room Size *(L x W x H, ft.)*: _____

Machinery Room Area *(square ft.)*: _____ Volume *(cubic ft.)*: _____

Ammonia charge in largest system with piping or vessels located in Machinery Room *(lbs. ammonia)*: _____

Nameplate Motor Horsepower in machinery room *(hp)*: _____

Other heat gain in machinery room *(BTUH)*: _____

Outside design temperature: Summer *(°F)*: _____ Winter *(°F)*: _____

Codes which have jurisdiction at this location: _____

Other requirements having jurisdiction at this location: _____

Minimum continuous mechanical exhaust required *(CFM)*: _____

Minimum emergency mechanical exhaust required *(CFM)*: _____

Actual emergency mechanical exhaust installed *(CFM)*: _____

Ammonia detector alarm level(s) *(ppm)*: _____

ID Number: _____

VENTILATION

Requirement/Recommendation	Conforms	Recommended Action/Comments	Safety Status	Target Date
a) Actual continuous mechanical exhaust is greater than or equal to the minimum required?	☐ Yes ☐ No			
b) Actual emergency mechanical exhaust is greater than or equal to the minimum required?	☐ Yes ☐ No			
c) Sail switch or other positive means installed to activate a supervised alarm if flow through continuous exhaust stops?	☐ Yes ☐ No			
d) Alarm works properly when continuous exhaust fan is stopped by using disconnect?	☐ Yes ☐ No			
e) An ammonia detector is installed in the machinery room to start emergency exhaust fan and activate a supervised alarm when ammonia is detected?	☐ Yes ☐ No			
f) Ammonia detector, control circuit, emergency exhaust fans, dampers and alarms all function properly when ammonia detector is exposed to ammonia sample?	☐ Yes ☐ No			
g) All fan belts, bearings, dampers, and filters in good operating condition?	☐ Yes ☐ No			
h) Heat is installed in machinery room to satisfy envelope heat loss and continuous ventilation load?	☐ Yes ☐ No			
i) Exhaust fan discharges are located away from doors, windows and air intake?	☐ Yes ☐ No			
j) Intake dampers are fail-open type?	☐ Yes ☐ No			
k) Intake louvers and exhaust fans are located to promote mixing and to avoid short circuiting of machinery room air?	☐ Yes ☐ No			
l) Emergency exhaust fans can be started manually from outside of machinery room?	☐ Yes ☐ No			

Are there any other conditions that might negatively affect safe ventilation operation? ☐ Yes ☐ No

If yes, describe. _____

_____

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International Institute of Ammonia Refrigeration

Ammonia Refrigeration Safety Inspection Checklist

ID Number: _____

RELIEF VALVES

Plant Owner: _____

Address: _____

Contact: _____ Telephone: _____

Inspector: _____ Date: _____

Pressure Relief Valve System

Relief Valve System Location: _____

System Identification Mark/No.: _____

Requirement/Recommendation	Conforms	Recommended Action/Comments	Safety Status	Target Date
a) All pressure relief valves have legible nameplates?	☐ Yes ☐ No			
b) All pressure relief valves are suitable for ammonia?	☐ Yes ☐ No			
c) All pressure relief valves have proper relief setting?	☐ Yes ☐ No			
d) All pressure relief valves have required discharge capacity?	☐ Yes ☐ No			
e) All pressure relief valves have unbroken ASME seal?	☐ Yes ☐ No			
f) Single or dual pressure relief valves are installed on all pressure vessels, shell & tube heat exchangers, oil pots, and elsewhere as required by ANSI/IIAR-2 (latest edition)	☐ Yes ☐ No			
g) All pressure relief valves are connected above the liquid level?	☐ Yes ☐ No			
h) All inlet piping to pressure relief valves conforms to ANSI/IIAR-2 (latest edition)	☐ Yes ☐ No			
i) All discharge piping from pressure relief valves conforms to ANSI/IIAR-2 (latest edition)	☐ Yes ☐ No			
j) The extremity of all discharge piping to atmosphere is fitted with an approved ammonia diffuser and/or rain cover?	☐ Yes ☐ No			
k) All pressure relief valves are located out of refrigerated spaces? If no, what precautions are taken to prevent moisture migration into relief valve?	☐ Yes ☐ No			
l) All pressure relief valves have been replaced new, or have been inspected, repaired, tested and sealed by an ASME certified agent within the last 5 years of service?	☐ Yes ☐ No			
m) No stop valves are installed in pressure-relief inlets and outlets?	☐ Yes ☐ No			

Are there any other conditions that might negatively affect safe relief system operation? ☐ Yes ☐ No

If yes, describe. _____

_____

_____

International Institute of Ammonia Refrigeration

Ammonia Refrigeration Safety Inspection Checklist

ID Number: _____

GENERAL SAFETY

Plant Owner: _____

Address: _____

Contact: _____ Telephone: _____

Inspector: _____ Date: _____

General Ammonia System Safety Requirements/Recommendations

System Location: _____

System Identification Mark/No.: _____

System Ammonia Inventory *(lbs.)*: _____ Ammonia added since last audit *(lbs.)*: _____

Requirement/Recommendation	Conforms	Recommended Action/Comments	Safety Status	Target Date
a) Gauges and valves installed at all vessels, equipment, and controls?	☐ Yes ☐ No			
b) All gauges and other sensors in good working condition?	☐ Yes ☐ No			
c) All accumulators and intercoolers equipped with high level float switches which sound a high liquid alarm level? Do they also shut down compressors when high liquid level is detected?	☐ Yes ☐ No ☐ Yes ☐ No			
d) Main shut-off valves are prominently identified with signs?				
1) Main liquid king valves?	☐ Yes ☐ No			
2) Main hot gas valves?	☐ Yes ☐ No			
3) Main pumped liquid valves?	☐ Yes ☐ No			
e) Main shut-off valves are easily accessible?	☐ Yes ☐ No			
f) Main shut-off valves can be closed from outside the machinery room?	☐ Yes ☐ No			
g) Oil pots installed at all points where oil must be drained?	☐ Yes ☐ No			
h) Oil drain valves are self-closing?	☐ Yes ☐ No			
i) Sign in machinery room prominently displays the following:				
1) Name, address and telephone of installing/ servicing contractor?	☐ Yes ☐ No			
2) Approximate quantity of ammonia?	☐ Yes ☐ No			
3) Lubricant identity and amount?	☐ Yes ☐ No			
4) Field test pressure?	☐ Yes ☐ No			

ID Number: _____

GENERAL SAFETY

Requirement/Recommendation	Conforms	Recommended Action/Comments	Safety Status	Target Date
j) At least one sign posted in a conspicuous location provides emergency instructions and phone numbers of emergency safety and operating personnel?	☐ Yes ☐ No			
k) A written evacuation plan prominently displayed in a conspicuous location?	☐ Yes ☐ No			
l) Machinery room floor clean of oil, grease and water?	☐ Yes ☐ No			
m) Aisles in the machinery room clearly marked?	☐ Yes ☐ No			
n) Aisles in machinery room clear of obstructions?	☐ Yes ☐ No			
o) In the event of a leak can personnel exit quickly and safely?	☐ Yes ☐ No			
p) There is more than one exit from the machinery room?	☐ Yes ☐ No			
q) Is one exit from the machinery room direct to outdoors?	☐ Yes ☐ No			
r) Are exits clear of piping and other obstructions?	☐ Yes ☐ No			
s) System is free of abnormal ice formations?	☐ Yes ☐ No			
t) System is free of ammonia leaks except for traces in machinery room?	☐ Yes ☐ No			
u) System is free of abnormal sounds, vibrations and/or pulsations?	☐ Yes ☐ No			
v) Shower and eyewash basin available in machinery room and additional shower/eyewash available just outside machine main door?	☐ Yes ☐ No			
w) Ammonia gas masks, air packs and other approved emergency equipment available in conspicuous, easily accessible locations outside machinery rooms?	☐ Yes ☐ No			
x) Covers securely fastened to all electrical panels and junction boxes?	☐ Yes ☐ No			
y) Is a maintenance & repair log, including oil management, maintained?	☐ Yes ☐ No			
z) A thorough formal inspection of the entire system has been completed by a competent ammonia refrigeration engineer, fire safety official, and/or other outside authority in the last five years?	☐ Yes ☐ No			
aa) Are ammonia cylinders connected to the system?	☐ Yes ☐ No			

Are there any other conditions that might negatively affect general safety? ☐ Yes ☐ No

If yes, describe. _____

_____

_____

_____

_____

International Institute of Ammonia Refrigeration
1200 19th Street, NW
Suite 300
Washington, DC 20036-2422
(202) 857-1110