A Thorough Inspection for Ammonia Refrigeration Systems

Session Code TU-A4

March 25, 2024

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Alvin Lal, CUPA

27th California Unified Program
Annual Training Conference
March 24-27, 2025

Objectives

- Explain the purpose of a Minimum System Safety Evaluation and IIAR 9
- Clarify the role of supporting codes and standards
- Considerations and Resources
- Demonstrate an MSSE

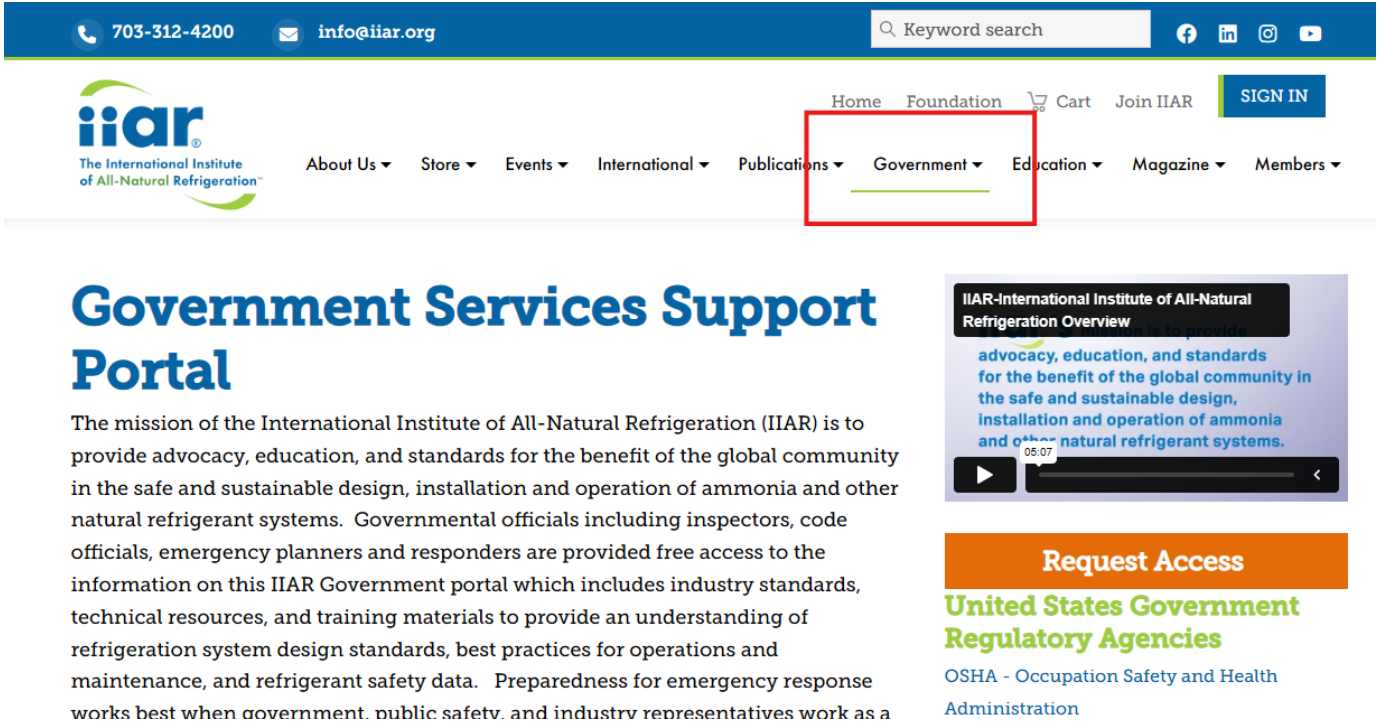
What is a Minimum System Safety Evaluation?

What is a Minimum System Safety Evaluation?

MSSE Considerations

- Initial evaluation due by January 1, 2026.
- Frequency of every 5 years.
- Follow the stricter requirement between the original design standards or IIAR 9, unless IIAR 9 allows a reduction.
- If original standards are unknown, IIAR 9 establishes the minimum requirements.
- IIAR 9 requires implementation of IIAR 6 and 7

Resources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The International Institute of All-Natural Refrigeration
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The mission of the International Institute of All-Natural Refrigeration (IIAR) is to provide advocacy, education, and standards for the benefit of the global community in the safe and sustainable design, installation and operation of ammonia and other natural refrigerant systems. Governmental officials including inspectors, code officials, emergency planners and responders are provided free access to the information on this IIAR Government portal which includes industry standards, technical resources, and training materials to provide an understanding of refrigeration system design standards, best practices for operations and maintenance, and refrigerant safety data. Preparedness for emergency response works best when government, public safety, and industry representatives work as a
IIAR-International Institute of All-Natural Refrigeration Overview
advocacy, education, and standards for the benefit of the global community in the safe and sustainable design, installation and operation of ammonia and other natural refrigerant systems.
05:07
Request Access
United States Government Regulatory Agencies
OSHA - Occupation Safety and Health Administration

DISCLAIMER

THIS IS NOT A CERTIFICATION

IIAR 9 - Minimum System Safety Evaluation Checklist Tool

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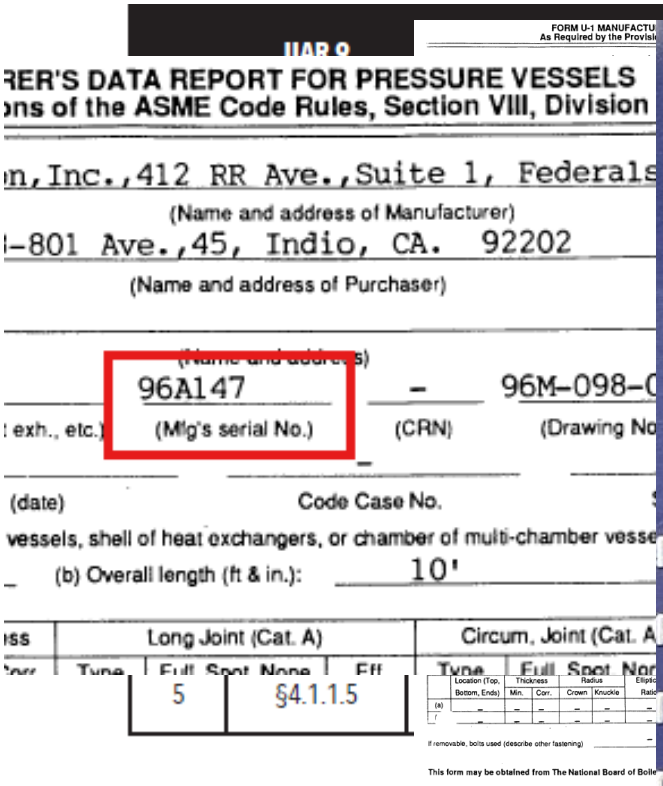
MSSE Overview

1. Documentation review
   - Equipment and system documentation
   - Inspection, Testing, and Maintenance (ITM) Records
   - Operating Procedures
2. Physical inspection of the system
3. Document corrective actions

Documentation Review

1. Data Reports** (e.g., U-1A, U-2, U-3)
2. Materials of Construction
3. Manufacturer Documentation (equipment, instrumentation, controls)
4. Inspection, Testing, and Maintenance (ITM) Records
5. Operating Procedures (per IIAR 7)

Documentation Review – Data Reports



FORM U-1 MANUFACTU
As Required by the Provisi

RER'S DATA REPORT FOR PRESSURE VESSELS
ons of the ASME Code Rules, Section VIII, Division

n, Inc., 412 RR Ave., Suite 1, Federals
(Name and address of Manufacturer)
-801 Ave., 45, Indio, CA. 92202
(Name and address of Purchaser)

(Name and address)

96A147 (Mfg's serial No.) — (CRN) 96M-098-0 (Drawing No)

exh., etc.)

(date) Code Case No.

vessels, shell of heat exchangers, or chamber of multi-chamber vesse

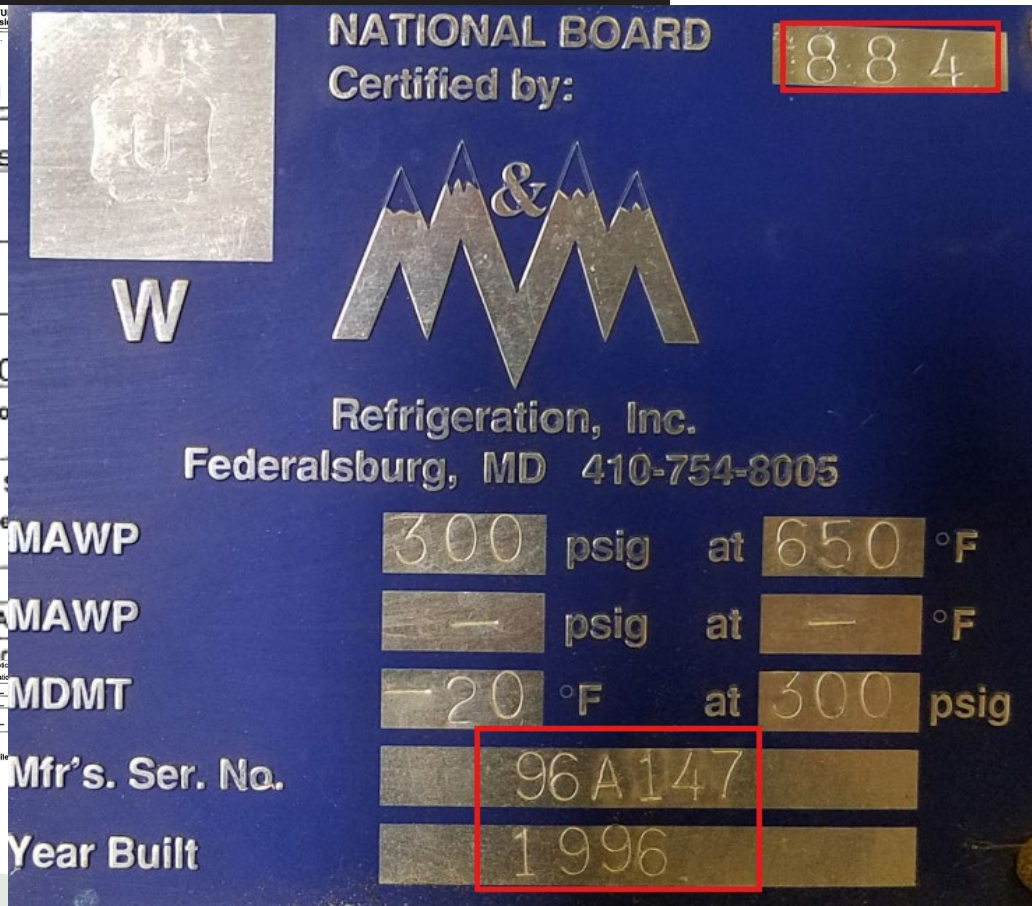
(b) Overall length (ft & in.): 10'

ss	Long Joint (Cat. A)			Circum. Joint (Cat. A
Corr.	Type	Full Spot None	Eff.	Type Full Spot Non
	5	§4.1.1.5		

	Location (Top, Bottom, Ends)	Thickness Min.	Thickness Corr.	Radius Crown	Radius Knuckle	Ellipti Ratio
(a)	–	–	–	–	–	–
/	–	–	–	–	–	–

If removable, bolts used (describe other fastening) –

This form may be obtained from The National Board of Boile

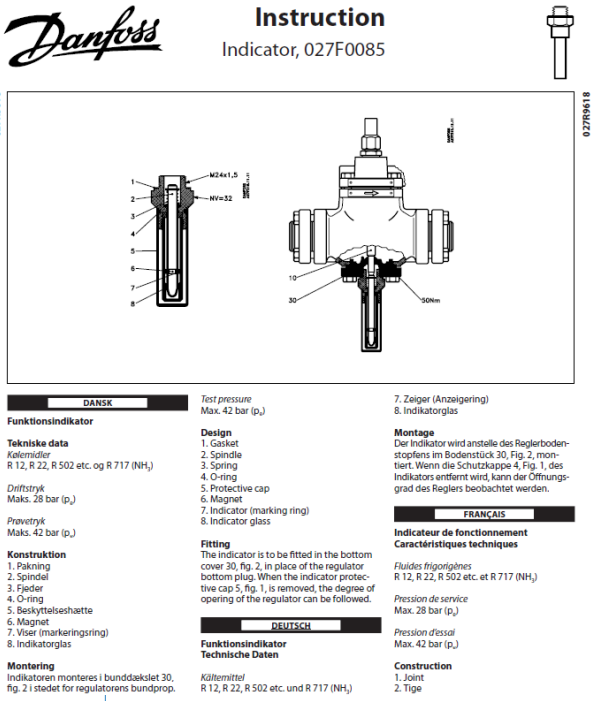


CALIFORNIA CUPA FORUM

Documentation Review – Data Reports

Item #	IIAR 9 Section	Requirement	Guideline	Existing Documentation/ Condition	Gaps Identified and recommended corrective action(s)	Date Resolved	Resolution
Documentation Review							
Equipment and System Components Documentation							
1	§4.1.1.1	Manufacturer Data Report(s) for Compressor oil separators	This documentation commonly resides in the Process Safety Information of the RMP/PSM or ARM Program. Manufacturer Data Reports (U-1A, U-2, U-3, etc.) can be either be obtained from the manufacturer or through the National Board as long as the pressure vessel or heat exchanger has a legible National Board Number, Manufacturer Name, and Date of Manufacturer on the nameplate. Manufacturer's data reports may not be available or required where these pieces of equipment are not registered with the National Board under ASME code rules (A.4.1.1).				
2	§4.1.1.2	Manufacturer Data Report(s) for Compressor oil cooler (if applicable)		Pass			
3	§4.1.1.3	Manufacturer Data Report(s) for Condensers (if applicable)					
4	§4.1.1.4	Manufacturer Data Report(s) for Pressure Vessels		Fail	Recirculator		
5	§4.1.1.5	Manufacturer Data Report(s) for Heat Exchanger (if applicable)					

Documentation Review – Manufacturer Documentation



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Documentation Review – Inspection, Testing, & Maintenance

Inspection, Testing, and Maintenance					
15	§5.1	All equipment and system components shall be inspected, tested, and maintained in accordance with ANSI/ IIAR 6 (2019)	Evaluate a random sample of inspection, test, and maintenance records for the ammonia refrigeration system components to evaluate the facility's Mechanical Integrity Program is consistent with the requiremetns IIAR 6 and manufacturer recommendations. A review of the most recent 3-yr Compliance Audit, 5-yr Mechanical Integrity Inspection, and 5-yr Process Hazard Analysis can sufficiently verify compliance with this item.		

Documentation Review – Operating Procedures

Location of Ammonia Refrigeration Equipment					
16	§6.1	Operating procedures shall be developed in accordance with the requirements of ANSI/IIAR 7 (2019)	Evaluate a random sample of operating procedures for the ammonia refrigeration system components to ensure the Operating Procedures are consistent with the requirements of IIAR 7. A review of the most recent 3-yr Compliance Audit, 5-yr Mechanical Integrity Inspection, and 5-yr Process Hazard Analysis can sufficiently verify compliance with this item.		

Documentation Review – Operating Procedures

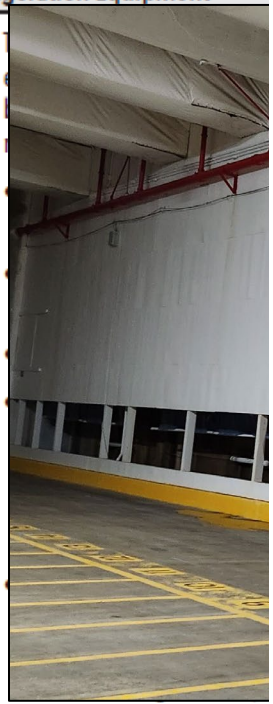
- Written
- Provide clear instructions for safe operation
- Initial startup
- Normal and temporary operation
- Normal shutdown
- Emergency shutdown
- Emergency operation
- Startup procedures following abnormal shutdown
- Specific to the type of equipment
- Safety considerations (PPE, LOTO)

Documentation Review

Ammonia Purity					
2	§7.2.1.1	Anhydrous ammonia used for the initial and subsequent charging of ammonia refrigeration systems using mechanical compression shall meet the purity requirements shown in Table 7.2.1.1 ANSI/IIAR 9-2020 Table 7.2.1.1 • Ammonia Content: 99.5% minimum • Water: 50 ppm minimum, 5000 ppm maximum • Oil (as soluble petroleum ether): 50 ppm maximum • Salt (calculated as NaCl): None • Pyridine, Hydrogen Sulfide, Naphthalene: None	An ammonia purity record provided by the ammonia supplier can validate the ammonia purity charged into the system. Performing an ammonia purity test is another was to verity the purity of ammonia in a refrigeration system.		

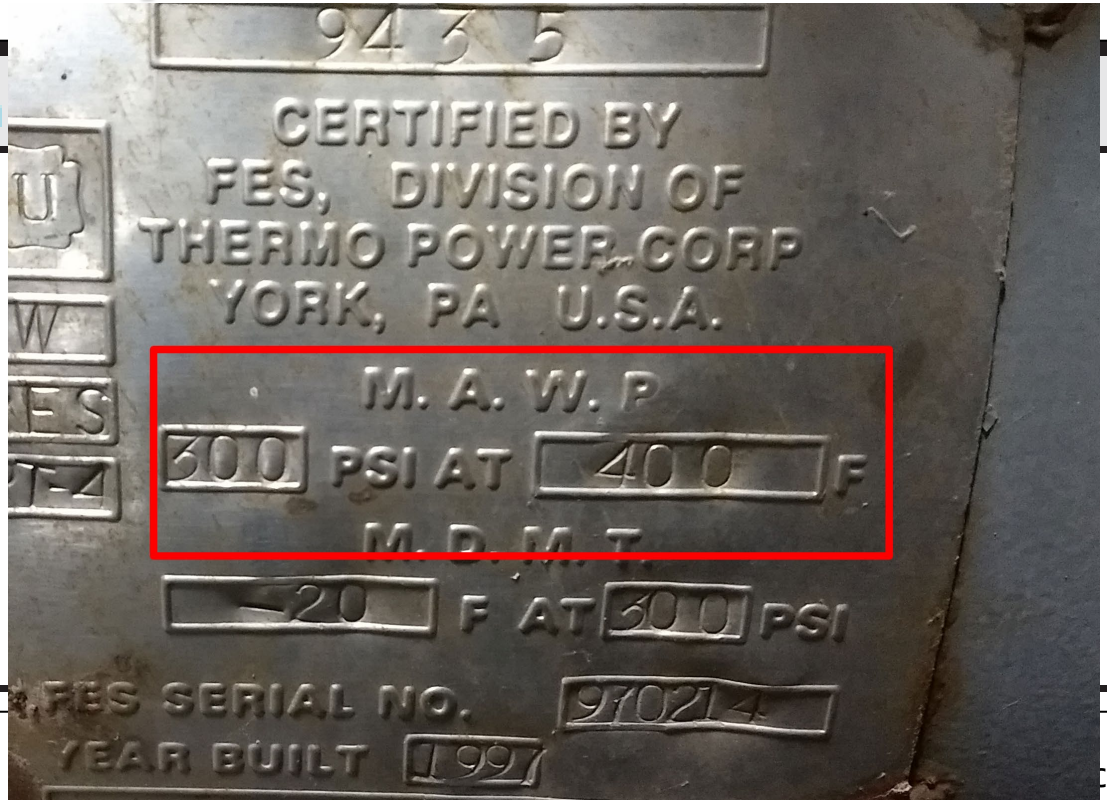
Physical Inspection

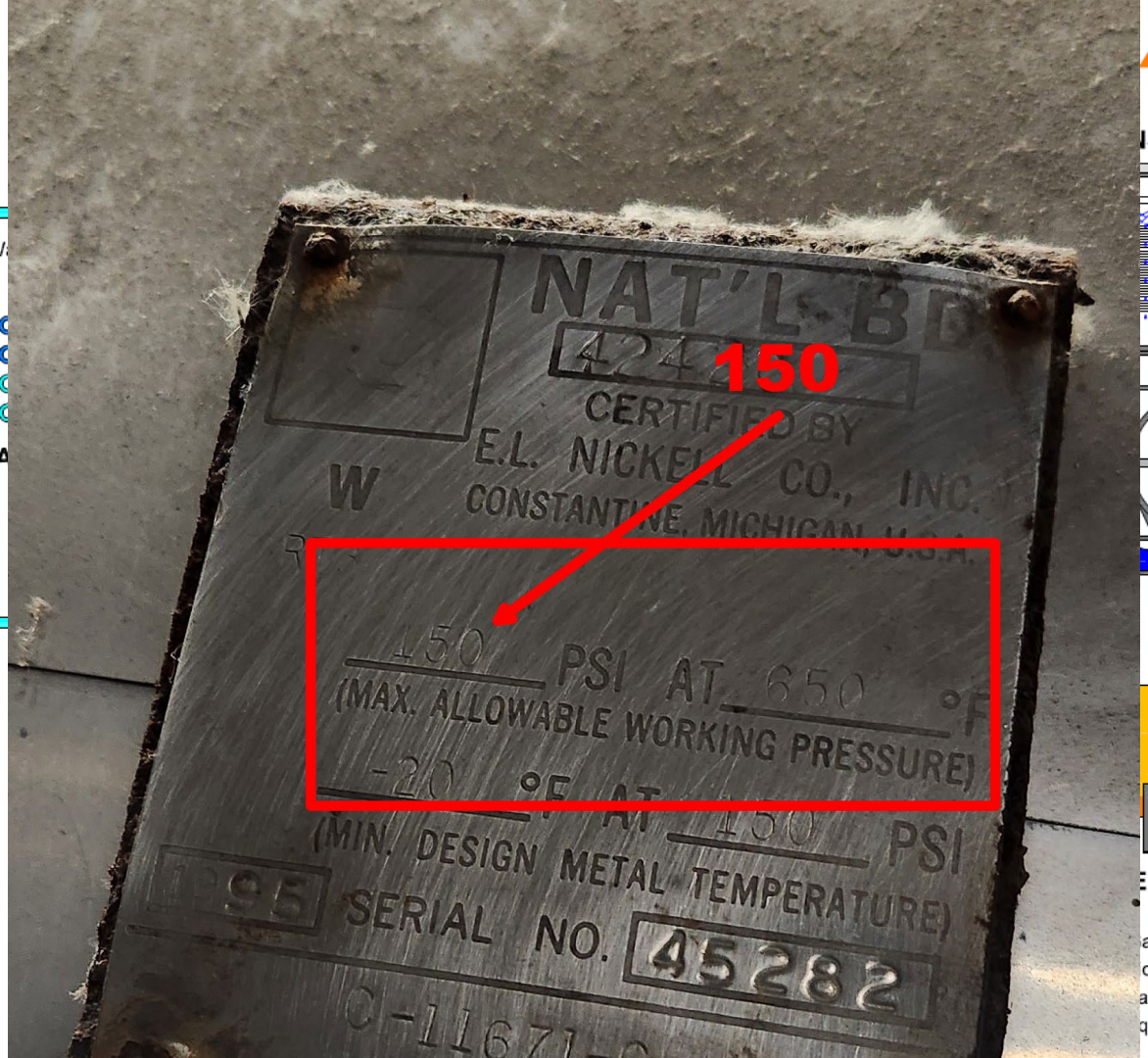
Location of Ammonia Refrigeration Equipment		
1	§7.1.2	



Physical Inspection

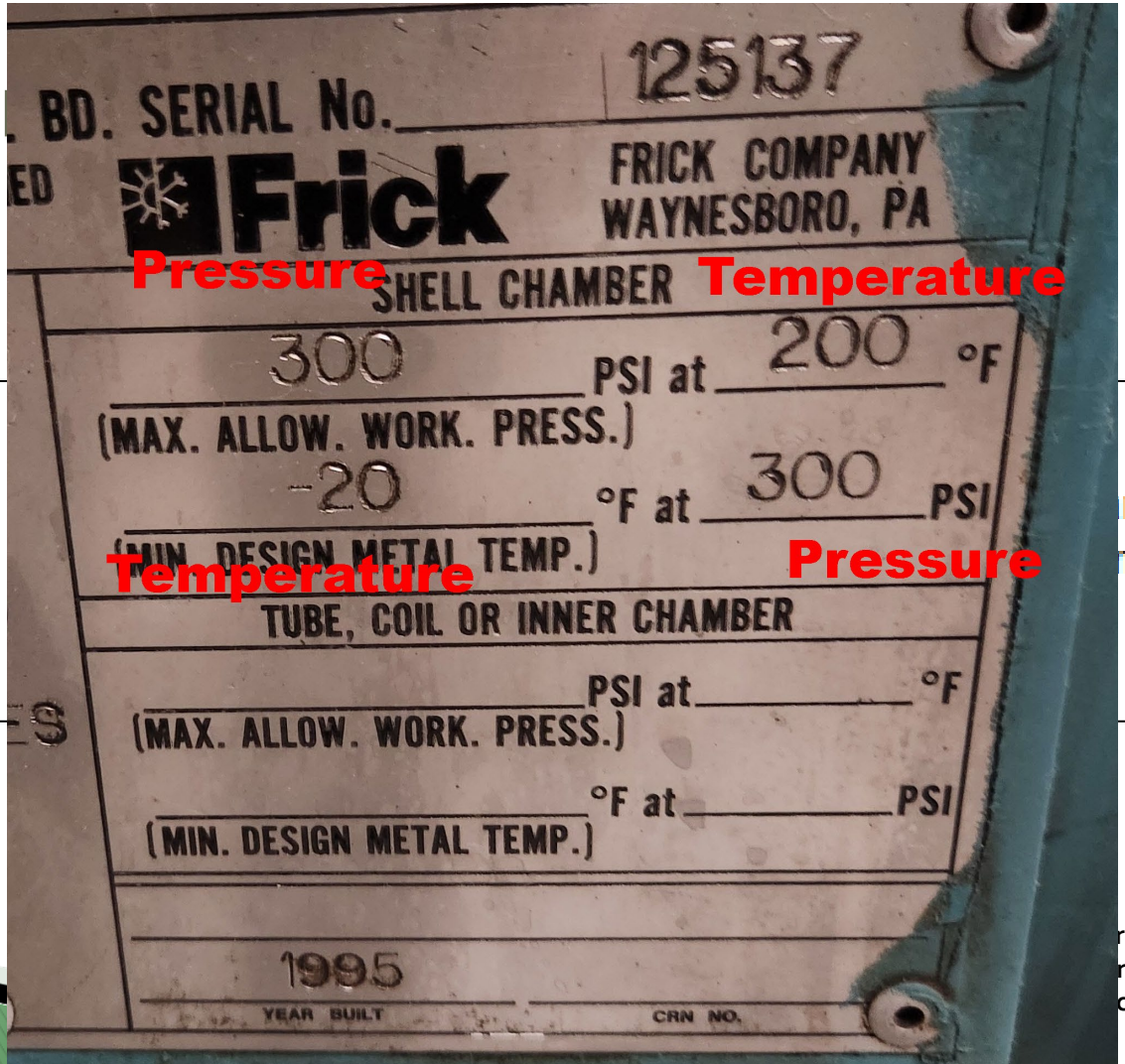
System
3




NAT'L. BD.
424
150
CERTIFIED BY
E.L. NICKELL CO., INC.
CONSTANTINE, MICHIGAN, U.S.A.
150 PSI AT 650 °F
(MAX. ALLOWABLE WORKING PRESSURE)
-20 °F AT 150 PSI
(MIN. DESIGN METAL TEMPERATURE)
SERIAL NO. 45282

Physical I

5	§7.2.3	rameters are often nt nameplate and/or



Physic

Purging and	
6	es from the accomplished or manual drain pipes.
7	sure side of re commonly ure vessels
8	alled on the

Physical I

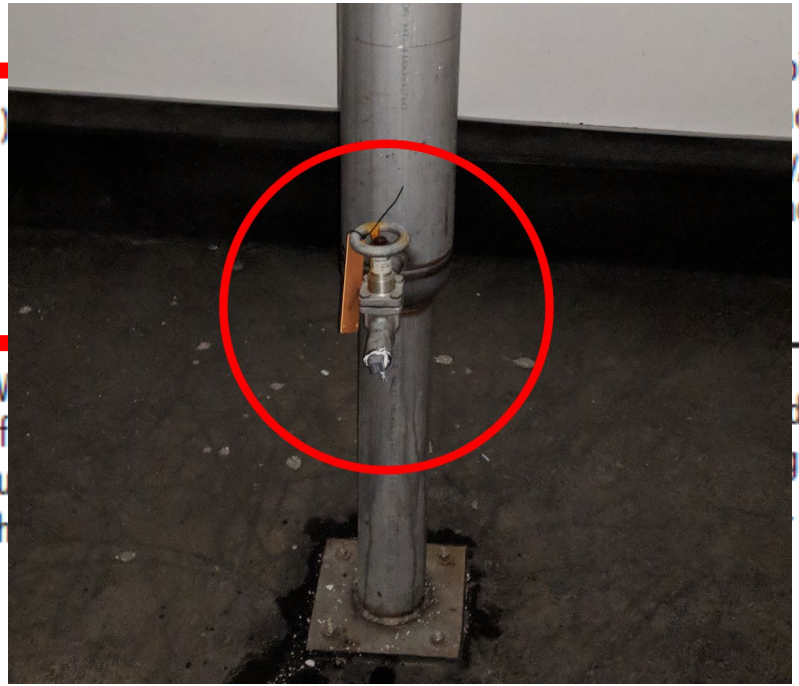
Purging and Oil Mana		
6	§7.2.4	ensable gases from the commonly accomplished auto-purger or manual condenser drain pipes.
7	§7.2.5.1	the low pressure side of locations are commonly nd low pressure vessels uration.
8	§7.2.5.2	ypically installed on the

Physical Inspection

9	§7.2.5.3	connections can be either d to the system or they ch as through the use of s (A.7.2.5.3).
10	§7.2.5.4	ning procedures can address support during the oil

Physical Inspection

		3) ...ing connections can be either ...ched to the system or they ..., such as through the use of ...oses (A.7.2.5.3).
10	§7.2.5.4	W... of... su... sh... ...draining procedures can address ... for support during the oil



Physical Inspection

10	§7.2.5.4	Where draining of oil requires the use of temporarily attached rigid piping, such piping shall be supported and shall have tight connections.	If applicable, oil draining procedures can address temporary piping for support during the oil draining process.

Physical I

Purging and Oil Manag		
6	§7.2.4	ble gases from the monly accomplished purger or manual denser drain pipes.
7	§7.2.5.1	ow pressure side of itions are commonly w pressure vessels on.
8	§7.2.5.2	ally installed on the

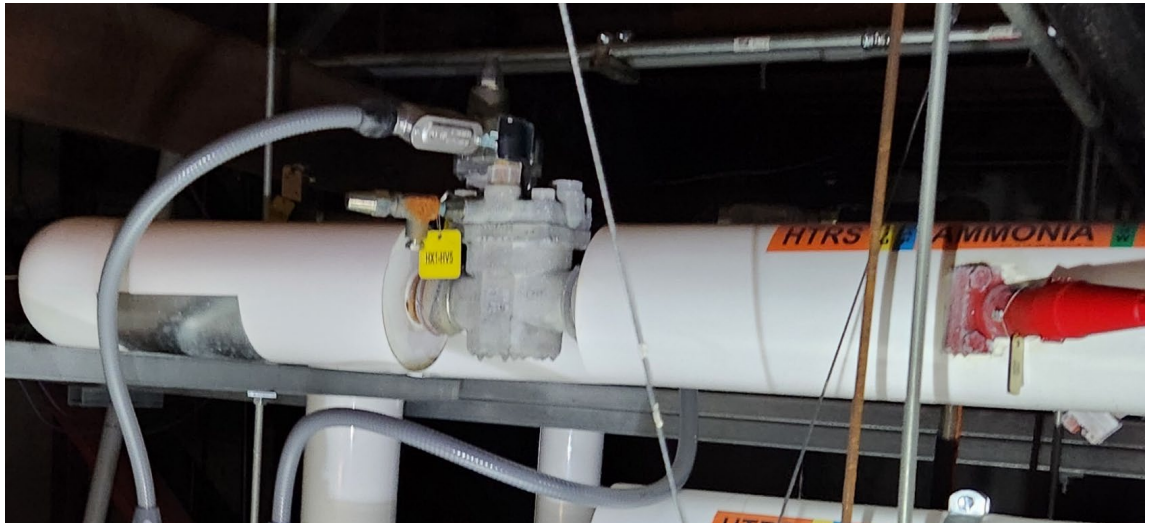
Physical Inspe

Insulation

Physical Inspection

	11	§7.2.6.1, 7.3.6.1	EXCEPTIONS: 1) Valves and other equipment shall be permitted to be uninsulated where necessary for service access provided that the vapor retarder is sealed to the piping or equipment where insulation of adjoining piping terminates. 2) Piping and fittings constructed of corrosion-resistant materials or protected with a corrosion-resistant treatment shall be permitted to be

Physical Inspection



Physical Inspection

2) Piping and fittings constructed of corrosion-resistant materials or protected with a corrosion-resistant treatment shall be permitted to be uninsulated if they are routinely defrosted or are otherwise managed to limit ice accumulation. Where defrost will be the method of ice control, a means to control and drain condensate shall be provided where condensate will present a nuisance o a hazard

Physical Inspection

Physical Inspection

Foundations, Piping, Tubing, and Equipment Supports		
12	§7.2.7.1, 7.3.2.2, 7.3.2.3, 7.3.2.4	Piping, tubing, and equipment shall be supported to prevent excessive vibration and movement.

Physical

gram
nce

Physica

Service Provisions		
13	§7.2.	y are m, or other

Physical Inspection

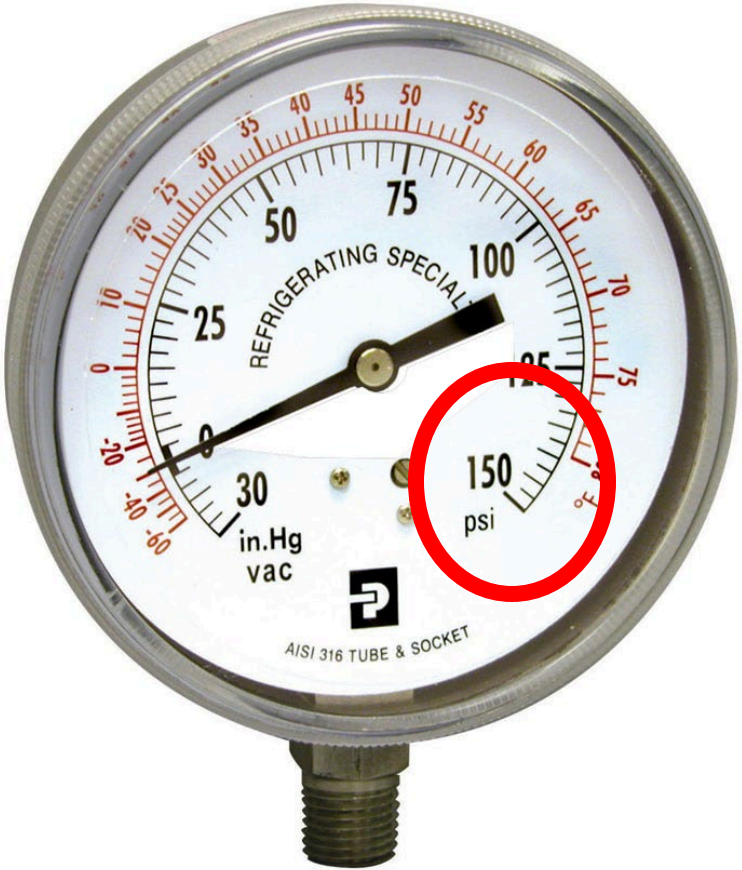
Service Provisions			
13	§7.2.8	Equipment shall be accessible for inspection, testing, maintenance, and emergency shutdown.	Observe components to ensure they are accessible from the ground, platform, or other means that provides safe access.
14	§7.2.8.1	Refrigeration system charging connections shall be plugged or capped when the charging connection is not in use. When located outdoors, they shall be locked or otherwise restricted to access by authorized personnel.	Verify all charging connections are plugged and capped. When the charging location is located outdoors, the connections be locked or have some method of restricted access.

Physical Inspection

Physical Inspection

15	§7.2.8.2	Where a pressure gauge is installed on the high side of the refrigeration system, the gauge shall be capable of measuring and displaying not less than 120% of the system rated pressure.	Verify gauges are appropriate for the system pressure. For example, system high side pressure rating of 250 PSI should be equipped with a gauge measuring and displaying at least 300 PSI. (250 PSI x 120% = 300 PSI)

Physical


REFRIGERATING SPECIAL
30
in.Hg
vac
150
psi
AISI 316 TUBE & SOCKET

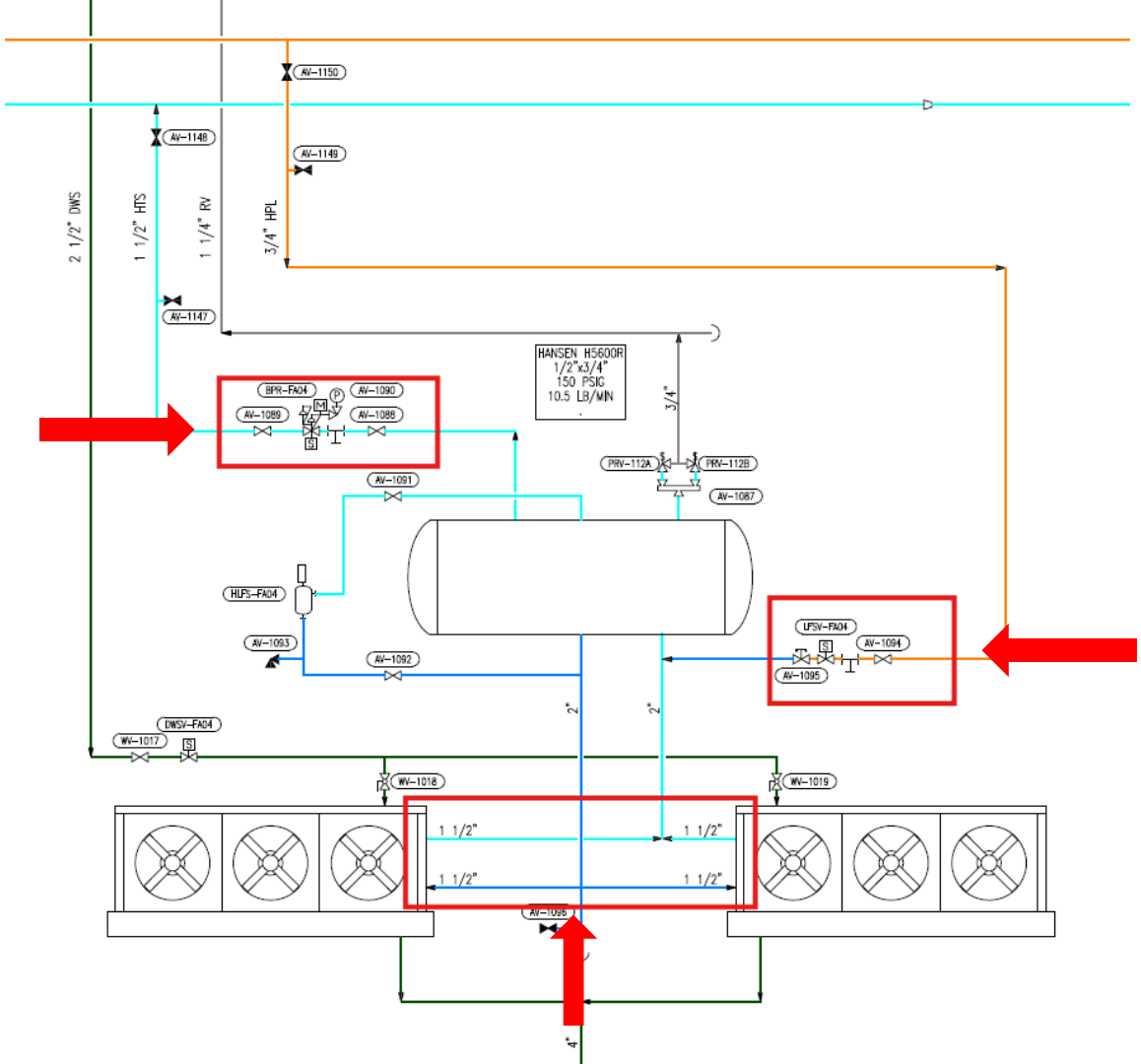
Physical Inspection

16	§7.2.8.3	Serviceable equipment shall have manual isolation valves. EXCEPTION: Packaged systems and portions of built-up systems shall be permitted to have pump-down arrangements that provide for the removal or isolation of ammonia for servicing one or more devices in lieu of isolation valves.

Physical Inspection

Verify equipment can be isolated with manual isolation valves at the inlet and outlet of the component. Reference the Standard Operating Procedure for Pump-down instructions.

Hand isolation valves should not be placed where they could hinder the function of control valves. The designer should use judgement regarding location and number of valves needed to perform service (A.7.2.8.3).


AV-1150
AV-1148
AV-1149
AV-1147
2 1/2" DWS
1 1/2" HTS
1 1/4" RV
3/4" HPL
HANSEN H5600R
1/2"x3/4"
150 PSIG
10.5 LB/MIN
3/4"
BPR-FA04
AV-1090
AV-1089
AV-1088
PRV-112A
PRV-112B
AV-1087
AV-1091
HLFS-FA04
AV-1093
AV-1092
LFSV-FA04
AV-1094
AV-1095
2"
2"
DWSV-FA04
WV-1017
WV-1018
WV-1019
1 1/2"
1 1/2"
1 1/2"
1 1/2"
AV-1096
4"

Physical Inspection

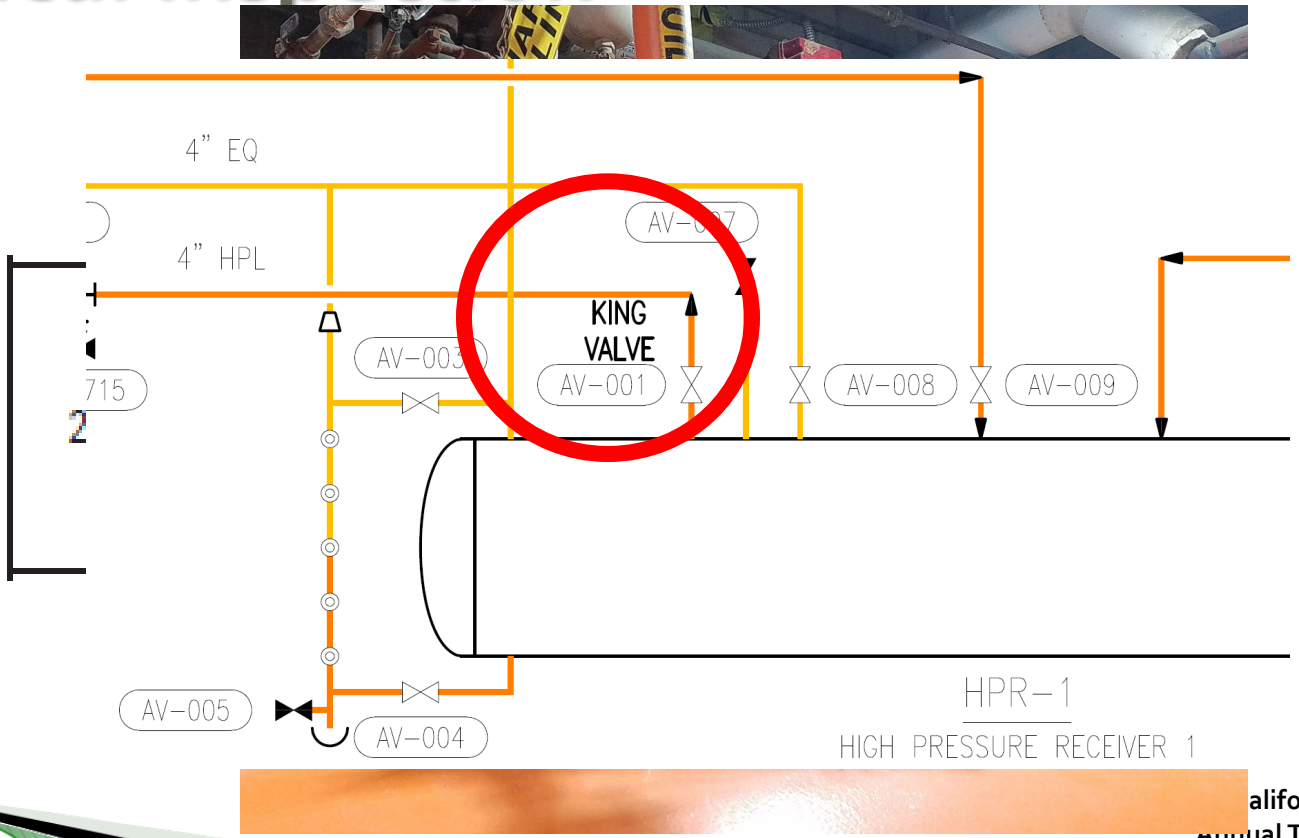
17	Verify the equipment can be pumped down. Reference Standard Operating Procedure. Provisions for pumpout of equipment and control valves may include a manual vent valve near a high point or a manual drain valve near a low point or both. Dedicated pumpout systems may also be employed. Connections for pumpout points should be capped or plugged when not in use, if they are not permanently piped to dedicated pumpout gas or liquid transfer equipment (A.7.2.8.4).	ipment vided for

Physical Inspection

Signage, Labels, Pipe Marking, and Wind Indicators		
18	§7.2.9.1	Signage shall be provided in accordance with this section. 1) NFPA 704 Placards. Buildings and facilities with refrigeration systems shall be provided with placards in accordance with NFPA 704. 2) Alarm Signage. The meaning of each alarm shall be clearly marked by signage near the visual and audible alarms. 3) Restricted Access Signage. Each machinery room entrance door shall be marked with a permanent sign to indicate that only Authorized personnel are permitted to enter the room.

Phys

Physical Inspection



Physical Inspection

21	§7.2.9.4, 7.3.6.3	Ammonia piping m branches shall be i following informati 1) "AMMONIA" 2) Physical state of 3) Relative pressur being low or hig 4) Pipe service, wh permitted to be 5) Direction of flow

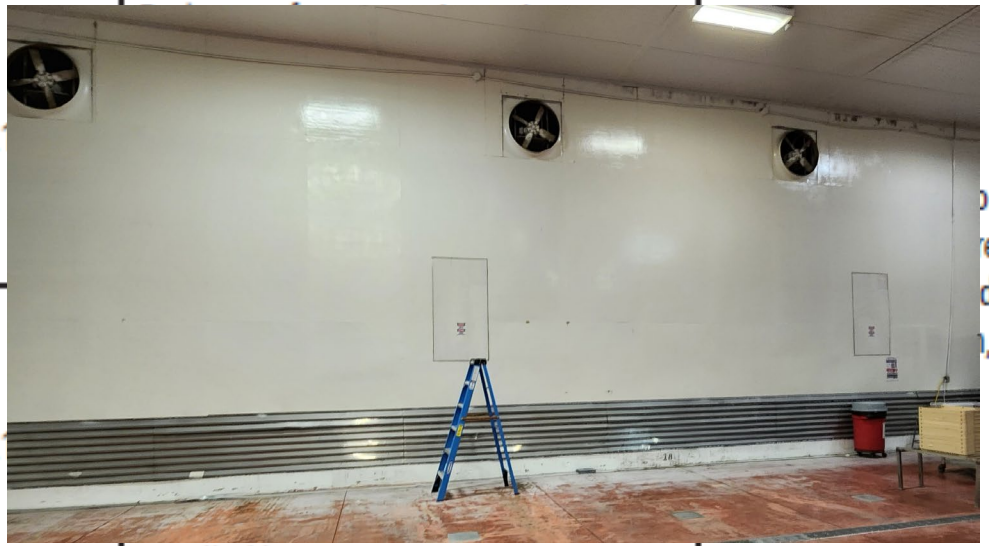
Physical Inspection

- Facility contact
- Responding contractor

22	§7.2.9.5	Emergency Contact Information. The contact information for whom to contact in an emergency.

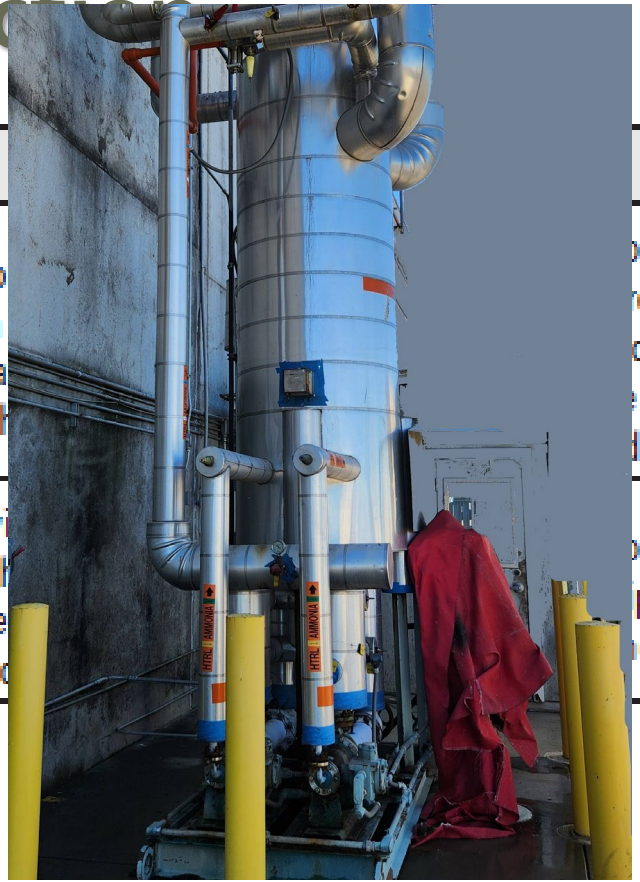
Physical Inspection

Equipment Enclosures			
23	§7.2.1		osure is an enclosure efrigeration equipment d with a closed-circuit , or both, that is not intended
24	§7.2.1	installed location.	



Physical Inspection

General Safety Requirements			
25	§7.2.11.1	Where ammo is installed in to physical da barricading sh	on that ammonia equipment is rotected from physical damage. de bollards protecting equipment ground and cages protecting ded evaporators.
26	§7.2.11.2	Exposed movi protected with in accordance 1910.212 and	on of screens and guards pment such as compressor and d evaporator and condenser fans.

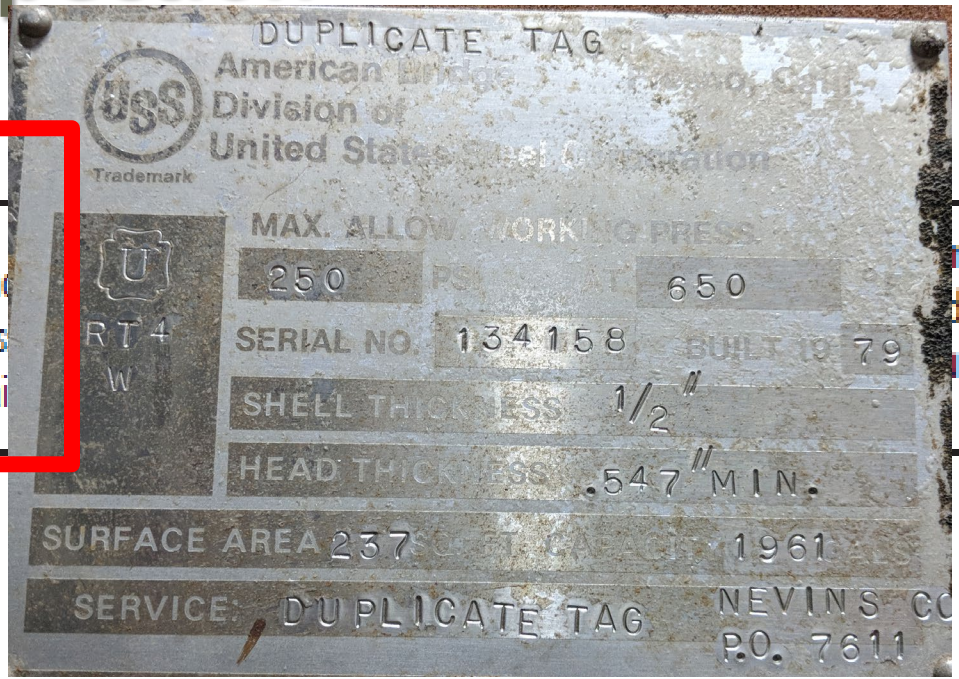


Physical Inspection

General Safety Requirements			
25	§7.2.11.1	Wh is in to p bar	mmonia equipment is rom physical damage. ds protecting equipment and cages protecting rators.
26	§7.2.11.2	Exp pro in a 191	ens and guards ich as compressor and ator and condenser fans.

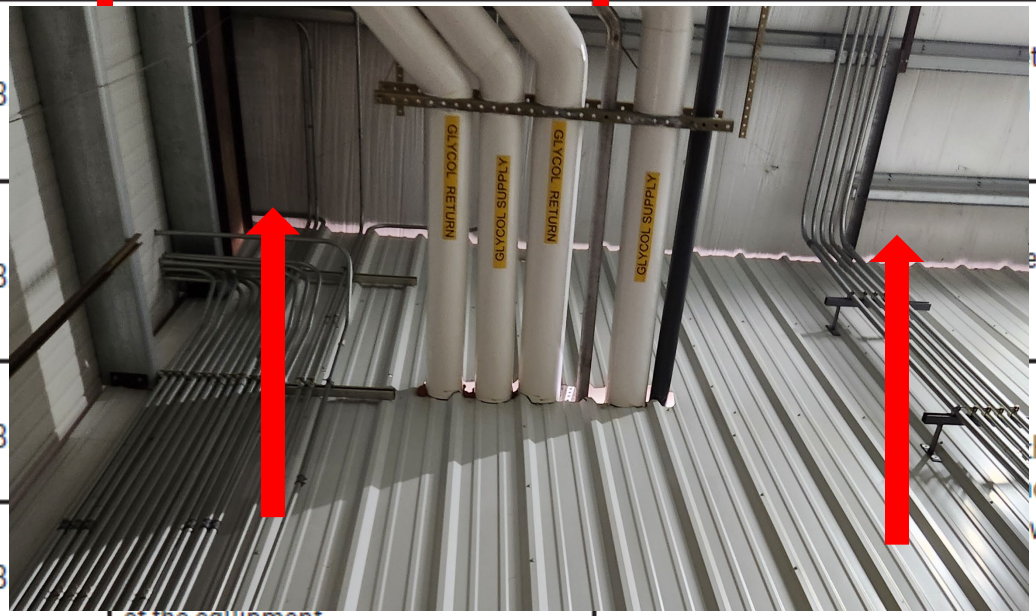
Physical Inspection

27	§7.2.11.3		Amm or ves contai	neplates or lers or vessels used itable for anhydrous



Physical Inspection

Physical Inspection

Machinery Room Construction			
29	§7.3		tations are air flow to
30	§7.3		excessive
31	§7.3		hored to ould be free ve vibration
32	§7.3	of the equipment.	

Physical Inspection

Machinery Room Construction			
29	§7.3.2.1	The machi from the re tight-fittin comply wi	machinery room penetations are struction not allowing air flow to om.
30	§7.3.2.2	Piping sup of the pipi and insula sway braci	for areas of sagging, excessive ying.
31	§7.3.2.3	Supports a adequate t equipmen	uld be adequately anchored to and the foundation should be free on that allows excessive vibration
32	§7.3.2.4	Supports a adequate t of the equ	of equipment.

Physical Inspection

Machinery Room Constructi		
29	§7.3.2.1	T f t c
30	§7.3.2.2	P C a s
31	§7.3.2.3	S a e
32	§7.3.2.4	S a c

netations are
ng air flow to

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should be free
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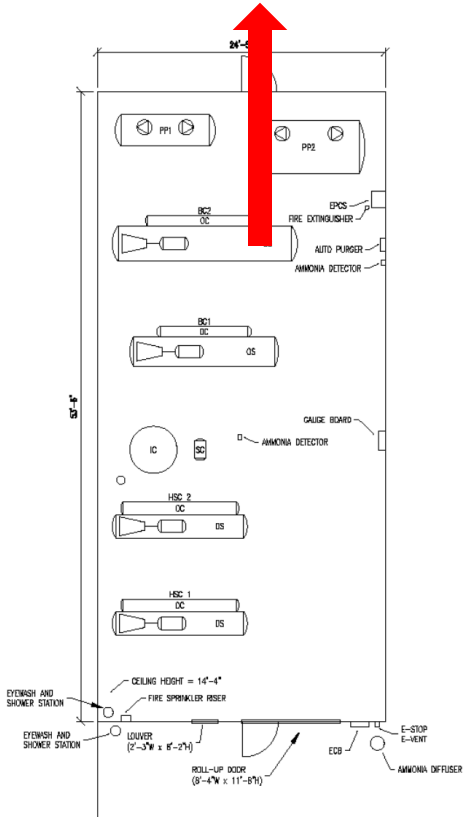
Physical Inspection

Physical Inspection

Physical Inspection

Machinery Room Acce		
35	§7.3.3.1	nery ı a m any of an arances tion, ording to



Physical Inspection

36

Physical Inspection

37	§7.3.3.4	nery room shall be rized personnel. inery room doors shall on 7.2.9.

Physical Inspection

Section 5: Fire-Fighting Measures

NFPA 704 Hazard Class

Health: 0 **Flammability:** 1 **Instability:** 0

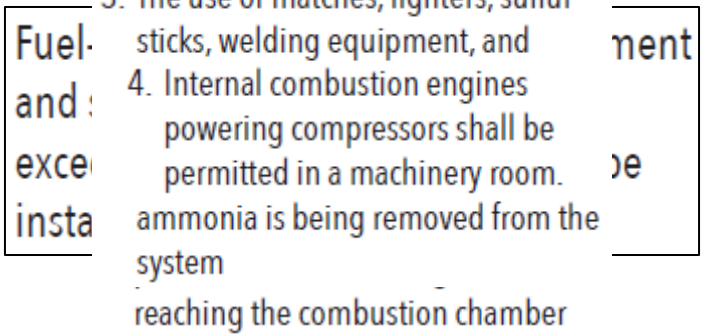
0 (Minimal)
1 (Slight)
2 (Moderate)
3 (Serious)
4 (Severe)

Extinguishing Media: Dry chemical, carbon dioxide, foam, or water spray is recommended. Water or foam may cause frothing materials heated above 212°F / 100°C. Carbon dioxide can displace oxygen. Use caution when applying carbon dioxide in confined spaces. Simultaneous use of foam and water on the same surface is to be avoided as water destroys the foam.

Specific hazards arising from the chemical

Unusual Fire & Explosion Hazards: This material may burn, but will not ignite readily. If container is not properly cooled, it can rupture in the heat of a fire.

Physical Inspection



EXCEPTIONS:

3. The use of matches, lighters, sulfur sticks, welding equipment, and
4. Internal combustion engines powering compressors shall be permitted in a machinery room.

ammonia is being removed from the system

reaching the combustion chamber

Physical Inspection

40	§7.3.6.4	Ammonia cylinders shall not be connected to a refrigeration system unless ammonia is in the process of being transferred by authorized personnel.

Physical Inspection

6.6.7.1.3.3 A temporary or portable means for the provision of quick drenching or ıg flushing of the eyes and body is provided within the machinery room for e ated or ıply ot with the temperature, flow, and duration specifications of ANSI/ISEA Z358.1.

43	§7.3.7.3	Emergency eyewash/safety shower unit installations shall comply with ANSI/ ISEA Z358.1.

Physical Inspection

44	§7.3.8.1	Floor drains or other means shall be provided to dispose of liquids.
45	§7.3.8.2	Where a drainage system is not designed for handling oil, secondary coolants, or other liquids that might be spilled, a means shall be provided to limit such substances from entering the drainage system.
46	§7.3.8.3	A means shall be provided to limit the spread of a liquid ammonia spill into the machinery room drainage system.

Physical Inspection

	Machinery rooms exceeding 1,000 ft² (93 m²) in area shall not have fewer than two exit doors or exit-access doors

If it is impractical to install a second emergency exit in an existing machinery room which exceeds 1,000 ft (93 m), the owner or operator should provide an alternative escape method from the machinery room such as the use of escape equipment (A.7.3.9.1).

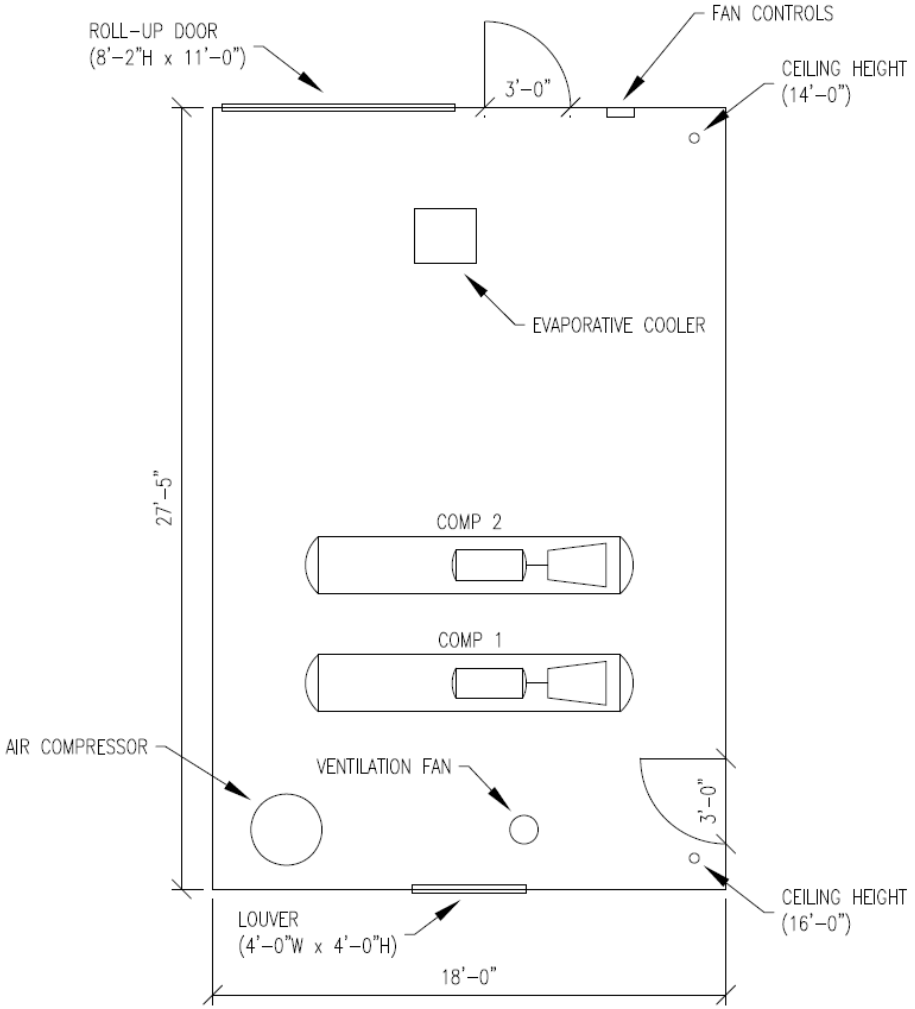
	or exit-access door, unless the Building Code permits an increased travel distance.

Physical Inspection

48	§7.3.9.2	Machinery room doors shall be self-closing and tight fitting. Doors that are part of the means of egress shall be equipped with panic hardware and shall be side hinged to swing in the direction of egress for occupants leaving the machinery room. Where the machinery room is not provided with fire sprinklers, doors communicating with the building interior shall be one-hour fire rated. Doors to the outdoors shall be fire rated based on the fire rating required for exterior wall openings.

Physical Inspection

Total Area = 495 ft²

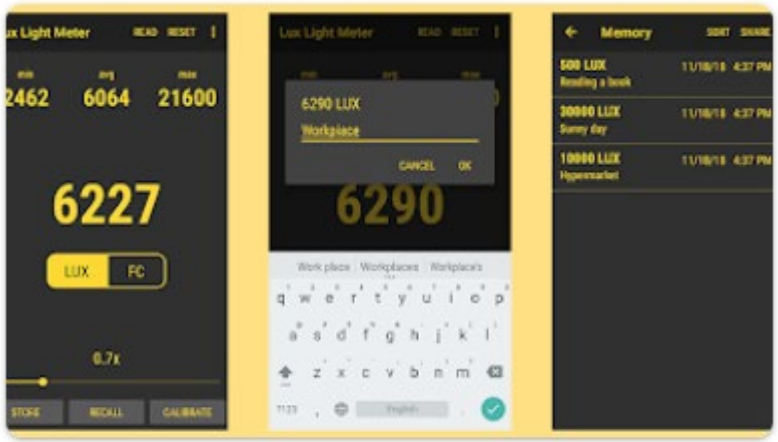


Physical Inspection

Physical Inspection

49	§7.3.10.1	Machinery rooms shall be equipped with light fixtures delivering a minimum of 30 foot-candles (320 lumens/m^2) at the working level, 36 in (0.91 m) above a floor or platform.

Physical Inspection



Lux Light Meter Pro
Doggo Apps
4.8 ★

Light Meter - Lux Meter
Coolexp
4.8 ★

Physical Inspection

50	§7.3.11.1	A clearly identified emergency shut-off switch with a tamper-resistant cover shall be located outside and adjacent to the designated principal machinery room door. The switch shall provide off-only control of refrigerant compressors, refrigerant pumps, and normally closed automatic refrigerant valves located in the machinery room. The function of the switch shall be clearly marked by signage near the controls.

Physical Inspection

Physical Inspection

51	§7.3.11.2	A clearly identified control switch for emergency ventilation with a tamper-resistant cover shall be located outside the machinery room and adjacent to the designated principal machinery room door unless the continuous ventilation operates at a rate at or above that required for emergency ventilation. The switch shall provide "ON/AUTO" override capability for emergency ventilation. The function of the switch shall be clearly marked by signage near the controls.

Physical Inspection

Physical Inspection

Physical Inspection

Machinery rooms shall be provided with ammonia detection and alarms with the following features:

1) At least one ammonia detector shall be provided in the room or area.

Physical Inspection

2) The detector shall activate an alarm that reports to a monitored location so that corrective action can be taken.

Physical Inspection

3) Audible and visual alarms shall be provided inside the room. Additional audible and visual alarms shall be located outside of each entrance to the machinery room.

Physical Inspection

Physical Inspection

Physical Inspection

At a minimum, the machinery room alarm response shall be at an appropriate arrangement for the following to occur:

1) Activates an alarm to a monitored location so an immediate response can be set in place at a detected concentration of no higher than 50 ppm.

Physical Inspection

Physical Inspection

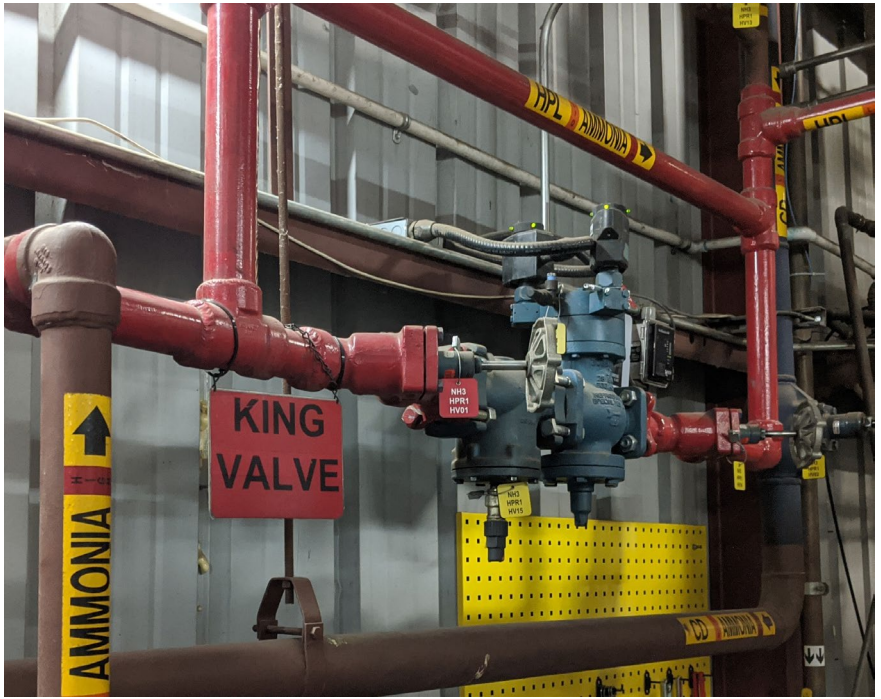
2) Activate emergency ventilation at a detected concentration of no higher than 1000 ppm.

Physical Inspection

Physical Inspection

3) Automatically de-energize determined equipment at a detected concentration no higher than 40,000 ppm (25% LFL). At a minimum, the determined equipment shall include the following: the refrigerant compressors; refrigerant pumps; and normally closed automatic refrigerant valves that are not part of an emergency control system.

Physical Inspection



Physical Inspection

54	§7.3.12.3	The power supply for the ammonia detectors and alarms shall be a dedicated branch circuit. In the event of a loss of power on other circuits or an emergency shutdown of refrigeration equipment, the ammonia detection and alarm system shall remain on. In the event of a loss of power to the ammonia detection and alarm system, a power failure trouble signal shall be sent to a monitored location.

Physical Inspection

Physical Inspection

55	§7.3.12.4	Are all leak detection sensors, or the inlet of sampling tubes that draw air to a leak detection sensor mounted in a position where ammonia from a leak is expected to accumulate and positioned where they can be accessed for maintenance and testing? In rooms equipped with continuous exhaust ventilation, the leak detection sensors and sampling tubes shall take into account the air movement toward the inlet of the ventilation system.

Physical Inspection

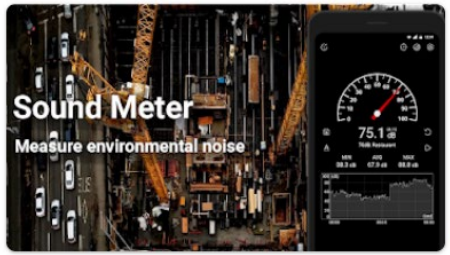
Physical Inspection

56	§7.3.12.5	The audible alarms providing notification shall provide a sound pressure level of 15 decibels (dBA) above the average ambient sound level and 5 dBA above the maximum sound level of the area in which it is installed.

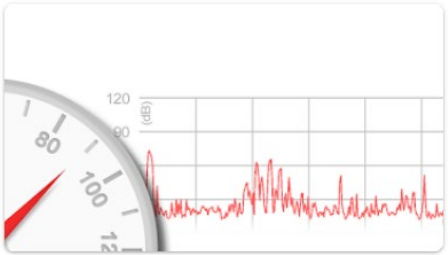
Physical Inspection

Sound Decibel Meter
Splend Apps
4.7 ★

Sound Meter & Noise Detector
Tools Dev
4.7 ★ $2.99



Sound meter : SPL & dB meter
KTW Apps
4.6 ★



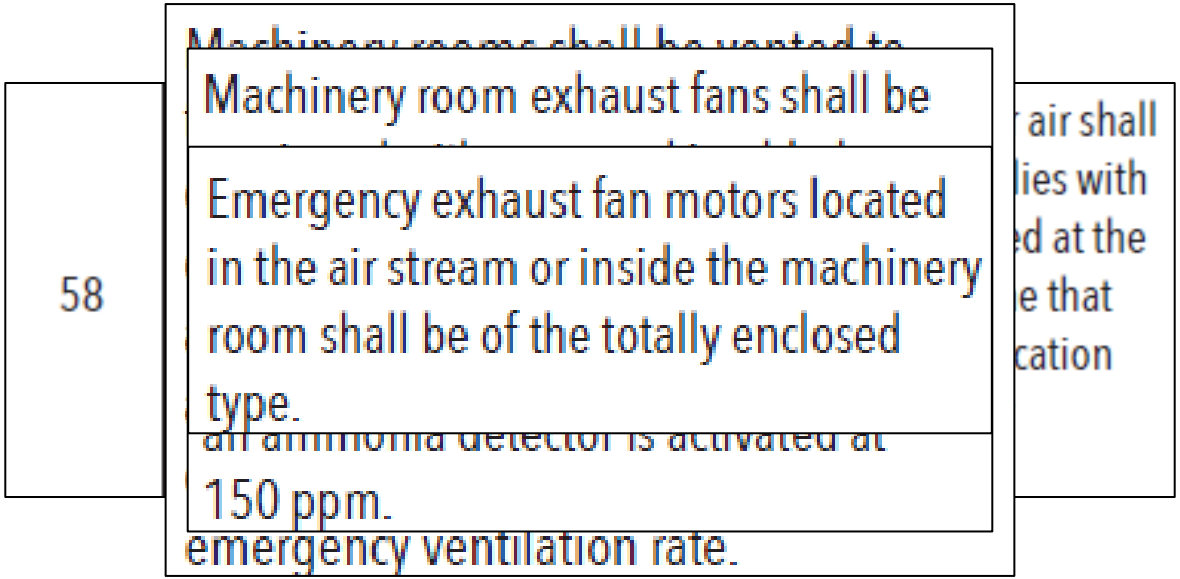
Sound Meter
rootApps
4.5 ★

Physical Inspection

57	§7.3.12.6	Ammonia leak detection alarms shall be identified by signage adjacent to visual and audible alarm devices.

Physical Inspection

Physical Inspection



Physical Inspection

Physical Ins

60	§7.3.13.3	1) Make-up air shall be provided to replace air being exhausted. 2) Make-up air supply locations in the machinery room shall prevent short-circuiting of the make-up air directly to the exhaust. 3) Intakes for make-up air shall draw uncontaminated outdoor air. 4) Intakes for make-up air to the machinery room shall serve only the machinery room. 5) Motorized louvers or dampers, where utilized, shall fail to the open position upon loss of power. 6) Where direct openings or openings with ducts are not provided to supply makeup air, make-up air shall be provided by fans or fans with ducts.

Physical Ins

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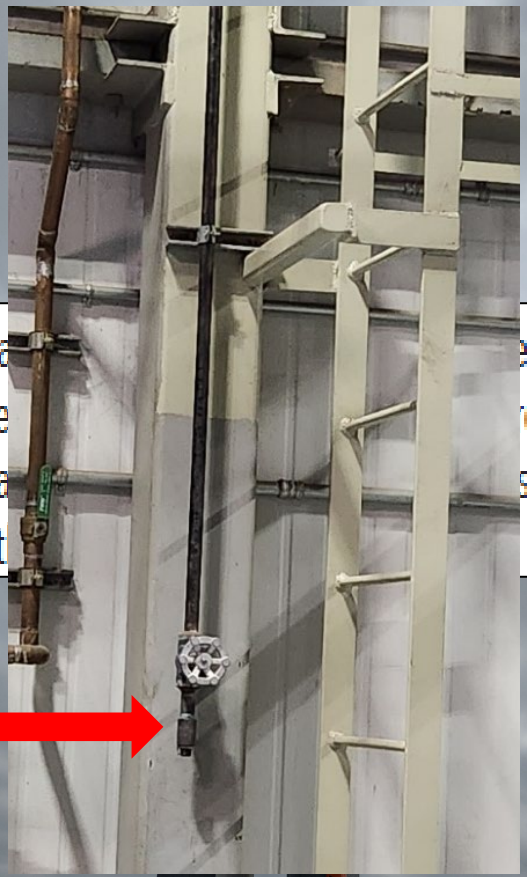
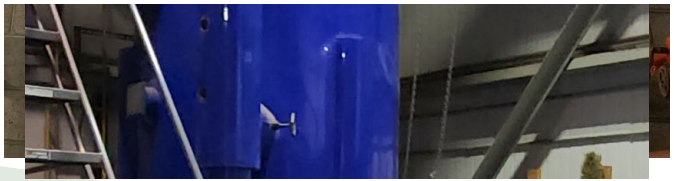


Physical Ins

Protection against thermal hydrostatic expansion

63	§7.4.3	Protection against overpressure due to thermal hydrostatic expansion of trapped liquid ammonia shall be provided for equipment and piping sections that can be isolated and can trap liquid ammonia in an isolated section in any of the following situations: • Automatically during normal operation. • Automatically during shutdown by any means, including alarm or power failure. • During planned isolation for standby or seasonal conditions. • During planned isolation for standby or seasonal conditions. • Refrigerant pumps and connected piping shall be provided with a means of protection from hydrostatic overpressure. EXCEPTION: If trapping of liquid with subsequent thermal hydrostatic expansion is only possible during maintenance or service operations, engineering or administrative controls, or both, shall be permitted as a means of relieving or preventing overpressure.

Physical Inspection



Physical Inspection

65	§7.4.5	Compressors shall be provided with high-discharge-pressure limiting device to shut down the compressors when the safe ranges are exceeded.

Physical Inspection

Physical Inspection

Physical Inspection

Location of Piping		
66	§7.4.6	• Refrigerant piping shall not obstruct a means of egress. • Refrigerant piping shall not be placed in an elevator shaft, dumbwaiter shaft, or other shaft containing a moving object. • Refrigerant piping shall not be installed in a stair, landing, or means of egress that is enclosed and is accessible to the public. • Refrigerant piping shall be permitted to be installed underground provided that the piping is protected from corrosion. • Refrigerant piping installed in concrete floors shall be encased in pipe duct.

Physical Inspection

Physical Inspection

67	§7.4.7.1	Instrumentation and controls shall be provided to indicate operating parameters of the refrigeration system and equipment and provide the ability to manually or automatically control the starting, stopping, and operating of the system or the equipment.

Physical Inspection

27th California Unified Program
Annual Training Conference
March 24-27, 2025

CALIFORNIA CUPA FORUM

Physical Inspection

68	§7.4.7.2	A means shall be provided for monitoring the concentration of an ammonia release in the event of a power failure.

Physical Inspection

Physical Inspection

69	§7.4.7.3	Changing of safety settings shall be limited to authorized personnel only. Changing of system operational settings shall not permit or affect changes to safety settings.

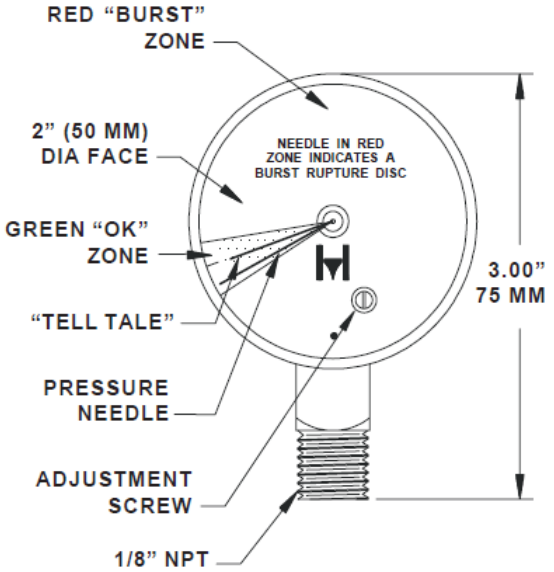
Physical Inspection

Physical Inspection

70	§7.4.7.4	The pressure-containing envelope maximum allowable working pressure of instruments and visual level indicators shall be equal to or greater than the maximum allowable working pressure of the system or subsystem in which they are installed.

Physical Inspection

Physical Inspection



PRESSURE GAUGES

These special gauges are designed specifically for use with Hansen rupture disc assemblies.

The 2" (50 mm) diameter face has an easy-to-read "OK/burst" display. The green "OK" range is from 0 to 15 psig (0 to 1 bar). When normal pressure is less than 15 psig, the "Tell Tale" indicates the occurrence of pressure, especially useful on vacuum side of refrigeration systems.

The ambient temperature range for these gauges is +32°F to +125°F (0°C to +52°C) and they have a safe working pressure of 400 psig (27 bar). Contact Hansen for applications below +32°F (0°C) ambient temperature.

Physical Inspection

Liquid Level Indicators		
71	§7.4.7.5	Visual liquid level indicators, including but not limited to glass bull's eyes, flat ""armored glass"" linear sight glasses, or sight columns and pressure gauges, shall comply with this section. 1) Sight glasses and linear liquid level indicators shall not be installed where a risk of hydraulic shock exists 2) Visual liquid level indicators used to observe ammonia level, such as in a vessel or heat exchanger, shall be specified for installation in a manner that provides protection from physical damage.

Physical Inspection

Physical Inspection

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Physical Inspection

Physical Inspection

71	§7.4.7.5	manner that provides protection from physical damage 3) Linear liquid level indicators shall be fitted with internal check-type shutoff valves. Protection against accidental breakage of the glass tube from any direction shall be provided for the entire length of the tube. EXCEPTION: Liquid level indicators using bull's eye type sight glasses. 4) Bull's eye sight glass types shall be compatible for use with ammonia, and the thickness and diameter shall be sized for the intended application.

Physical Inspection

Physical Inspection

Physical Inspection

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Any Questions?

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559-707-3203