BSR/IIAR 7-201X

Developing Operating Procedures for Closed-Circuit Ammonia Refrigeration Systems

Public Review #1 Draft

Notes on the Standard Text

Metric Policy

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Normative and Informative Elements

This standard includes normative (required) provisions. The foreword and appendices are informative, or nonmandatory. Informative material shall never be regarded as a requirement.

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ANSI Status of this Document

This previously approved standard, ANSI/IIAR 7-2013, is being issued for public notice and comment under consensus procedures accredited by the American National Standards Institute. This standard, which is being issued as BSR/IIAR 7-201x for reaffirmation or revision for periodic maintenance requirements, is not a final standard and shall not be used in place of an American National Standard.

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Foreword
(Informative)

The purpose of this standard is to define the minimum requirements for developing operating procedures for closed-circuit ammonia refrigeration systems. The document reflects the consensus reached by ammonia refrigeration industry representatives on how to develop operating procedures.

This standard does not constitute a comprehensive detailed technical design manual and should not be used as such.

This standard was first issued in June of 2013 by the International Institute of Ammonia Refrigeration (IIAR). The standard was intended to replace the operations information contained in IIAR Bulletin No. 110, *Guidelines for Start-Up, Inspection, and Maintenance of Ammonia Mechanical Refrigerating Systems*. The standard was first approved as an American National Standard by the American National Standards Institute (ANSI) in August 2013 as ANSI/IIAR 7-2013. ANSI requires reaffirmation or revision for periodic maintenance requirements of existing standards every five years. Work began on periodic maintenance of this standard in February 2017 and was completed in (*place month and year here when ANSI approved)*.

Informative Appendix A was added to provide explanatory information related to provision in the standard. Sections of the standard with associated explanatory information in this appendix are marked with an asterisk "*" after the section number, and the associated appendix information is located in a corresponding section number preceded by "A."

At the time this edition of the standard was published, the IIAR Standards Committee included the following members:

Robert J. Czarnecki, Chair—Retired, Campbell Soup Company
Don Faust, Vice Chair—Johnson Controls
Eric Brown—ALTA Refrigeration, Inc.
Dennis R. Carroll—Johnson Controls
John Collins—Zero Zone, Inc.
Trevor Hegg—EVAPCO, Inc.
Glen Heron—Tyson Foods, Inc.
Eric Johnston—American Foods Group
Peter Jordan—MBD Risk Management Services, Inc.
Brian Marriott—Marriott and Associates
Rich Merrill—Retired, EVAPCO, Inc.
Joseph Pillis—Johnson Controls
Dave Schaefer—Bassett Mechanical, Inc.
Jeff Sutton—Sutton and Associates, Inc.

The subcommittee responsible for rewriting this standard had the following members at the time of publication:

Peter Jordan, Subcommittee Vice Chair—MBD Risk Management Services, Inc.
Jeanna Emmons—PSM RMP Solutions
Bill Lape—Dean Foods
Tony Lundell—IIAR Staff

CONTENTS

Part 1 General

Chapter 1. Purpose and Scope

1.1 *Purpose. The purpose of this standard is to define the minimum requirements for developing operating procedures for closed-circuit ammonia refrigeration systems.

1.2 Scope.

1.2.1 *This standard is intended for those who develop, define, or review operating procedures, or a combination thereof, for closed-circuit ammonia refrigeration systems.

1.2.2 Stationary closed-circuit refrigeration systems utilizing ammonia as the refrigerant shall comply with this standard.

1.2.3 This standard does not address the commissioning of ammonia refrigeration systems or system components. Refer to ANSI/IIAR 5-2018, *Start-up and Commissioning of Closed-Circuit Ammonia Refrigeration Systems*, for the criteria and procedures to start up and commission systems or system components.

1.2.4 This standard does not address the decommissioning of ammonia refrigeration systems or system components. Refer to ANSI/IIAR 8-2015, *Decommissioning of Closed-Circuit Ammonia Refrigeration Systems*, for the criteria and procedures to decommission systems or system components.

Chapter 2. Definitions

2.1 General. Definitions shall be in accordance with this chapter and ANSI/IIAR 1-2017, *American National Standard for Definitions and Terminology Used in IIAR Standards*.

2.2 Defined Terms. The following words and terms, which are used in this standard, shall be defined as specified in this chapter.

Trapped liquid: The complete filling of the internal volume of a container, such as a pressure vessel, pipe, or valve with liquid refrigerant subject to temperature rise. This is also referred to as hydrostatic lockup.

Sudden liquid deceleration: The rapid decrease of liquid flow in a line or pipe, for example due to the sudden closing of a valve. This is also referred to as hydraulic shock or liquid hammer.

Vapor-propelled liquid: The high-velocity movement of liquid refrigerant propelled by high-pressure vapor in hot gas or suction lines due to high or excessive differential pressure. This is also referred to as hydraulic shock, liquid hammer, or surge.

Turnaround: Scheduled events wherein an entire process unit of an industrial plant is taken offline for an extended period for revamp, renewal, or both.

Chapter 3. Reference Standards

3.1 International Institute of Ammonia Refrigeration (IIAR) standards as follows:

ANSI/IIAR 1 (2017), *American National Standard for Definitions and Terminology Used in IIAR Standards.*

ANSI/IIAR 5 (2018), *Start-up and Commissioning of Closed-Circuit Ammonia Refrigeration Systems*.

ANSI/IIAR 8 (2015), *Decommissioning of Closed-Circuit Ammonia Refrigeration Systems.*

Part 2 Developing and Maintaining Operating Procedures

Chapter 4. Operating Procedure Contents

4.1 General. Written operating procedures shall be developed and implemented to provide clear instructions for safely conducting activities involving the closed-circuit ammonia refrigeration system and shall address at least the following activities:

1. Initial start-up procedures,
2. Normal operating procedures,
3. Temporary operating procedures,
4. Normal shutdown procedures,
5. Emergency shutdown procedures,
6. Emergency operating procedures, and
7. Start-up procedures following abnormal shutdown conditions or turnarounds such as power failures or emergency shutdowns

4.2 *Customization. The operating procedures shall be customized to reflect the type and the style of equipment, components, and devices used in the refrigeration system.

4.3 *Nonroutine Tasks. When nonroutine tasks are required that are not covered by normal operating procedures, facilities shall develop procedures for these specific tasks during the planning stages.

4.4 Safety and Regulatory Considerations

4.4.1 ***Personal Protective Equipment (PPE).** Operating procedures shall describe the appropriate PPE that shall be worn when performing work on the ammonia refrigeration system.

4.4.2 **Buddy System.** Operating procedures shall indicate when the buddy system shall be practiced in performing work on the ammonia refrigeration system.

4.4.3 **Lockout/Tagout Procedures.** Operating procedures shall refer to the facility's lockout/tagout procedures where appropriate.

4.4.4 **Confined Space Entry Procedures.** Operating procedures shall refer to the facility's confined space entry procedures where appropriate.

4.4.5 ***Trapped Liquid.** Where appropriate, operating procedures shall include steps to prevent trapping liquid ammonia when closing valves to isolate system components.

4.4.6 ***Sudden Liquid Deceleration.** Where appropriate, operating procedures shall include steps to prevent damage due to sudden liquid deceleration.

4.4.7 ***Vapor-Propelled Liquid.** Where appropriate, operating procedures shall include steps to prevent damage due to vapor-propelled liquid.

4.4.8 ***Regulatory Requirements**. Operating procedures shall comply with regulatory requirements.

Chapter 5. Maintaining Operating Procedures

5.1 *Version. The version of each operating procedure shall be documented so that changes made to the operating procedure can be clearly tracked.

5.2 *Availability. Operators and technicians shall be able to obtain current operating procedures quickly and easily to prepare for and perform their assigned job tasks. The most current procedures shall be readily available to ensure that only up-to-date procedures are used to perform operations and maintenance tasks.

5.3 *Review and Updates. Operating procedures shall be reviewed when changes are made to the ammonia refrigeration system, and the operating procedures shall be updated when necessary.

Part 3 Equipment

The following items to consider in equipment operating procedures only apply to the equipment for which an operating procedure is written.

Chapter 6. Compressors

6.1 General. Ammonia refrigeration compressor operating procedures shall comply with this chapter.

6.2 Compressor Initial Start-Up Procedures. The following items shall be considered when documenting compressor initial start-up procedures:

1. Appropriate conditions, including suction and discharge pressures, suction and discharge temperatures, lubrication oil pressure and temperature, and lubrication oil level, to ensure a safe start-up;
2. Corrective actions required if the conditions are outside of operating limits;
3. Lockout/tagout procedures;
4. State of the compressor electrical disconnect;
5. Position of the compressor isolation and service valves;
6. Status of the lubrication oil cooling system;
7. Status of the compressor alarm systems; and
8. Steps to start the compressor.

6.3 *Compressor Normal Operating Procedures. The following shall be considered when documenting compressor normal operating procedures:

1. Verification that the compressor parameters are within expected operating limits and troubleshooting as necessary.

6.4 *Compressor Temporary Operating Procedures. The following items shall be considered when documenting compressor temporary operating procedures:

1. Steps to consult supervisory personnel to establish temporary operating parameters,
2. Steps to modify the compressor to operate under the temporary operating parameters, and
3. Procedures to monitor the compressor while it operates under temporary operating conditions.

6.5 Compressor Normal Shutdown Procedures. The following items shall be considered when documenting compressor normal shutdown procedures:

1. Steps to stop the compressor and
2. Steps to prepare the compressor for stand-by operations or for maintenance.

6.6 Compressor Emergency Shutdown Procedures. The following items shall be considered when documenting compressor emergency shutdown procedures:

1. Specification of the person responsible for emergency shutdown of the compressor;
2. Steps to stop the compressor;
3. Steps to close the compressor isolation valves, shut off power to the compressor, and apply lockout/tagout devices if it is safe to do so;
4. Notification of supervisory personnel, appropriate authorities, or both; and
5. Steps to log the conditions that caused the emergency shutdown.

6.7 *Compressor Emergency Operating Procedures. The following shall be considered when documenting compressor emergency operating procedures:

1. Steps to operate the compressor under emergency operations, for example when compressor conditions are outside of appropriate limits.

6.8 Compressor Start-Up Procedures Following Abnormal Shutdown Conditions or a Turnaround. The following items shall be considered when documenting compressor start-up procedures following abnormal shutdown conditions or a turnaround:

1. Appropriate practices if the compressor will be started following general maintenance, an emergency shutdown, or a system modification;
2. Appropriate conditions, including suction and discharge pressures and temperatures, lubrication oil pressure and temperature, and lubrication oil level, to ensure a safe start-up;
3. Corrective actions required if the conditions are outside of operating limits;
4. Lockout/tagout procedures;
5. State of the compressor electrical disconnect;
6. Position of the compressor isolation and service valves;
7. Status of the lubrication oil cooling system;
8. Status of the compressor alarm systems; and
9. Steps to start the compressor.

Chapter 7. Refrigerant Pumps

7.1 General. Refrigerant pump operating procedures shall comply with this chapter.

7.2 Refrigerant Pump Initial Start-Up Procedures. The following items shall be considered when documenting refrigerant pump initial start-up procedures:

1. Appropriate conditions, including suction and discharge pressure, to ensure a safe start-up:
2. Lockout/tagout procedures;
3. State of the refrigerant pump electrical disconnect;
4. Position of refrigerant pump isolation and service valves;
5. Status of the refrigerant pump alarm systems;
6. Steps to start the refrigerant pump;
7. Process status;
8. Minimum refrigerant flow;
9. Hydrostatic pressure relief; and
10. Motor cooling.

7.3 *Refrigerant Pump Normal Operating Procedures. The following shall be considered when documenting refrigerant pump normal operating procedures:

1. Verification that the refrigerant pump parameters are within expected operating limits and troubleshooting as necessary.

7.4 *Refrigerant Pump Temporary Operating Procedures. The following items shall be considered when documenting refrigerant pump temporary operating procedures:

1. Steps to consult supervisory personnel to establish temporary operating parameters,
2. Steps to modify the refrigerant pump to operate under the temporary operating parameters, and
3. Procedures to monitor the refrigerant pump while it operates under temporary operating conditions.

7.5 Refrigerant Pump Normal Shutdown Procedures. The following items shall be considered when documenting refrigerant pump normal shutdown procedures:

1. Steps to stop the refrigerant pump and
2. Steps to prepare the refrigerant pump for stand-by operations or for maintenance operations.

7.6 Refrigerant Pump Emergency Shutdown Procedures. The following items shall be considered when documenting refrigerant pump emergency shutdown procedures:

1. Specification of the person responsible for emergency shutdown of the refrigerant pump;
2. Steps to stop the refrigerant pump;
3. Steps to close the refrigerant pump isolation valves, shut off power to the refrigerant pump, and apply lockout/tagout devices if it is safe to do so;
4. Notification of supervisory personnel, appropriate authorities, or both; and

5. Steps to log the conditions that caused the emergency shutdown.

7.7 *Refrigerant Pump Emergency Operating Procedures. The following shall be considered when documenting refrigerant pump emergency operating procedures:

1. Steps to operate the refrigerant pump under emergency operations, for example when the refrigerant pump is operating outside of operating limits.

7.8 Refrigerant Pump Start-Up Procedures Following Abnormal Shutdown Conditions or a Turnaround. The following items shall be considered when documenting refrigerant pump start-up procedures following abnormal shutdown conditions or a turnaround:

1. Appropriate practices if the refrigerant pump will be started following general maintenance, an emergency shutdown, or a system modification;
2. Appropriate conditions, including suction and discharge pressures, to ensure a safe start-up;
3. Corrective actions required if conditions are outside of operating limits;
4. Lockout/tagout procedures;
5. State of the refrigerant pump electrical disconnect;
6. Position of refrigerant pump isolation and service valves;
7. Status of the refrigerant pump alarm systems;
8. Steps to start the refrigerant pump;
9. Process status;
10. Minimum refrigerant flow;
11. Hydrostatic pressure relief; and
12. Motor cooling.

Chapter 8. Condensers

8.1 General. Condenser operating procedures shall comply with this chapter.

8.2 Condenser Initial Start-Up Procedures. The following items shall be considered when documenting condenser initial start-up procedures:

1. Appropriate conditions, including pressure, temperature, and water flow, to ensure a safe startup;
2. Lockout/tagout procedures;
3. State of the condenser electrical disconnect;
4. Position of the condenser isolation and service valves;
5. Status of the condenser alarm systems; and
6. Steps to start the condenser water flow and fans.

8.3 *Condenser Normal Operating Procedures. The following shall be considered when documenting condenser normal operating procedures:

1. Verification that the condenser parameters are within expected operating limits and troubleshooting as necessary.

8.4 *Condenser Temporary Operating Procedures. The following items shall be considered when documenting condenser temporary operating procedures:

1. Steps to consult supervisory personnel to establish temporary operating parameters,
2. Steps to modify the condenser to operate under the temporary operating parameters, and
3. Procedures to monitor the condenser while it operates under temporary operating conditions.

8.5 Condenser Normal Shutdown Procedures. The following items shall be considered when documenting condenser normal shutdown procedures:

1. Steps to turn off condenser fans,
2. Steps to turn off the water pump(s),
3. Steps to turn off the water supply,
4. Steps to drain the condenser sump, and
5. Steps to prepare the condenser for stand-by operations or for maintenance.

8.6 Condenser Emergency Shutdown Procedures. The following items shall be considered when documenting condenser emergency shutdown procedures:

1. Specification of the person responsible for emergency shutdown of the condenser;
2. Steps to stop refrigerant vapor flow to the condenser by shutting down the appropriate compressor(s) and pressure vessels;
3. Steps to shut down the water pumps and fans;
4. Steps to close the condenser isolation valves and apply lockout/tagout devices if it is safe to do so;
5. Notification of supervisory personnel, appropriate authorities, or both; and

6. Steps to log the conditions that caused the emergency shutdown.

8.7 *Condenser Emergency Operating Procedures. The following shall be considered when documenting condenser emergency operating procedures:

1. Steps to operate the condenser under emergency operations, for example when condenser conditions are outside of appropriate limits.

8.8 Condenser Start-Up Procedures Following Abnormal Shutdown Conditions or a Turnaround. The following items shall be considered when documenting condenser start-up procedures following abnormal shutdown conditions or a turnaround:

1. Appropriate practices if the condenser will be started following general maintenance, an emergency shutdown, or a system modification;
2. Appropriate conditions, including pressure, temperature, and water flow, to ensure a safe startup;
3. Corrective action required if the conditions are outside of operating limits;
4. Lockout/tagout procedures;
5. State of the condenser electrical disconnect;
6. Position of the condenser isolation and service valves;
7. Status of the condenser alarm systems; and
8. Steps to start the condenser water flow and fans.

Chapter 9. Evaporators

9.1 General. Evaporator operating procedures shall comply with this chapter.

9.2 Evaporator Initial Start-Up Procedures. The following items shall be considered when documenting evaporator initial start-up procedures:

1. Appropriate conditions, including pressure, temperature, and ammonia level, to ensure a safe start-up;
2. Lockout/tagout procedures;
3. State of the evaporator electrical disconnect;
4. Position of evaporator isolation and service valves;
5. Equipment in the refrigeration system needed to accommodate this evaporator;
6. Status of the evaporator alarm systems;
7. Steps to start the evaporator; and
8. Status of the process refrigeration load.

9.3 *Evaporator Normal Operating Procedures. The following shall be considered when documenting evaporator normal operating procedures:

1. Verification that the evaporator parameters are within expected operating limits and troubleshooting as necessary.

9.4 *Evaporator Temporary Operating Procedures. The following items shall be considered when documenting evaporator temporary operating procedures:

1. Steps to consult supervisory personnel to establish temporary operating parameters,
2. Steps to modify the evaporator to operate under the temporary operating parameters,
3. Procedures to monitor the evaporator while it operates under temporary operating conditions, and
4. Steps to monitor the process while the evaporator operates under temporary operating conditions.

9.5 Evaporator Normal Shutdown Procedures. The following items shall be considered when documenting evaporator normal shutdown procedures:

1. Steps to shut down the evaporator,
2. Steps to shut down the process associated with the evaporator, and
3. Steps to prepare the evaporator for stand-by operations or for maintenance.

9.6 Evaporator Emergency Shutdown Procedures. The following items shall be considered when documenting evaporator emergency shutdown procedures:

1. Specification of the person responsible for emergency shutdown of the evaporator;
2. Steps to shut down the evaporator;
3. Steps to discontinue process operations;

4. Steps to close the evaporator isolation valves, shut off power to the evaporator, and apply lockout/tagout devices if it is safe to do so;
5. Notification of supervisory personnel, appropriate authorities, or both; and
6. Steps to log the conditions that caused the emergency shutdown.

9.7 *Evaporator Emergency Operating Procedures. The following shall be considered when documenting evaporator emergency operating procedures:

1. Steps to operate the evaporator under emergency operations, such as if the evaporator is operating near or outside of operating limits.

9.8 Evaporator Start-Up Procedures Following Abnormal Shutdown Conditions or a Turnaround. The following items shall be considered when documenting evaporator start-up procedures following abnormal shutdown conditions or a turnaround:

1. Appropriate practices if the evaporator will be started following general maintenance, an emergency shutdown, or a system modification;
2. Appropriate conditions, including pressure, temperature, and ammonia level, to ensure a safe start-up;
3. Corrective actions required if conditions are outside of appropriate limits;
4. Lockout/tagout procedures;
5. State of the evaporator electrical disconnect;
6. Position of evaporator isolation and service valves;
7. Equipment in the refrigeration system needed to accommodate the evaporator;
8. Status of the evaporator alarm systems;
9. Steps to start the evaporator; and
10. Status of the process refrigeration load.

9.9 *Evaporator Defrost Procedures. The following items shall be considered when documenting evaporator defrost procedures:

1. Defrost method: air, water, hot gas, or electric;
2. The frequency of the defrost cycles;
3. The method used to initiate a defrost cycle, such as manually initiated or initiated using a timer;
4. The specific sequence of steps associated with the defrost cycle;
5. Controls and instruments associated with the defrost cycle;
6. Pressures during the defrost cycle;
7. Precautions necessary to prevent thermal shock, hydraulic shock, and liquid hammer during the defrost cycle; and
8. Process parameters and status.

Chapter 10. Pressure Vessels

10.1 General. Pressure vessel operating procedures shall comply with this chapter.

10.2 Pressure Vessel Initial Start-Up Procedures. The following items shall be considered when documenting pressure vessel initial start-up procedures:

1. Appropriate conditions, including operating pressure and ammonia liquid level, to ensure a safe start-up;
2. Lockout/tagout procedures;
3. Position of all pressure vessel isolation and service valves;
4. Status of the pressure vessel alarm systems; and
5. Steps to bring the appropriate equipment on line.

10.3 *Pressure Vessel Normal Operating Procedures. The following shall be considered when documenting pressure vessel normal operating procedures:

1. Verification that the pressure vessel parameters are within expected operating limits and troubleshooting as necessary.

10.4 *Pressure Vessel Temporary Operating Procedures. The following items shall be considered when documenting pressure vessel temporary operating procedures:

1. Steps to consult supervisory personnel to establish temporary operating parameters,
2. Steps to modify the pressure vessel to operate under the temporary operating parameters, and
3. Procedures to monitor the pressure vessel while it operates under temporary operating conditions.

10.5 Pressure Vessel Normal Shutdown Procedures. The following items shall be considered when documenting pressure vessel normal shutdown procedures:

1. Steps to stop the refrigerant flow to the pressure vessel by shutting down the appropriate equipment such as compressor(s), condenser(s), and evaporator(s):
2. Steps to shut off the liquid make-up system;
3. Steps to close isolation valves to stop liquid migration; and
4. Steps to prepare the pressure vessel for stand-by operations or for maintenance.

10.6 Pressure Vessel Emergency Shutdown Procedures. The following items shall be considered when documenting pressure vessel emergency shutdown procedures:

1. Specification of the person responsible for emergency shutdown of the pressure vessel;
2. Steps to minimize the magnitude or duration of the emergency; specific steps will depend on the emergency situation that is occurring;
3. Steps to close the pressure vessel isolation valves and apply lockout/tagout devices when it is safe and appropriate to do so;
4. Notification of supervisory personnel, appropriate authorities, or both; and

5. Steps to log conditions that caused the emergency shutdown.

10.7 *Pressure Vessel Emergency Operating Procedures. The following shall be considered when documenting pressure vessel emergency operating procedures:

1. Steps to operate the pressure vessel under emergency operations such as if the pressure vessel is operating near or outside of operating limits.

10.8 Pressure Vessel Start-Up Procedures Following Abnormal Shutdown Conditions or a Turnaround. The following items shall be considered when documenting pressure vessel start-up procedures following abnormal shutdown conditions or a turnaround:

1. Appropriate practices if the pressure vessel will be started following general maintenance, an emergency shutdown, or a system modification;
2. Appropriate conditions, including pressure and ammonia level, to ensure a safe start-up;
3. Corrective actions required if the conditions are outside of operating limits;
4. Lockout/tagout procedures;
5. Position of all pressure vessel isolation and service valves;
6. Status of the pressure vessel alarm systems; and
7. Steps to bring the appropriate equipment on line.

Chapter 11. Noncondensable Gas Purgers

11.1 General. Noncondensable gas purger operating procedures shall comply with this chapter.

11.2 Purger Initial Start-Up Procedures. The following items shall be considered when documenting purger initial start-up procedures:

1. Appropriate conditions, including foul gas pressure and purge point timing, to ensure a safe system start-up;
2. Lockout/tagout procedures;
3. State of the purger electrical disconnect;
4. Position of the purger isolation and service valves;
5. Status of the purger alarm systems;
6. Steps to start the water supply to the purger; and
7. Steps to start the purger.

11.3 *Purger Normal Operating Procedures. The following shall be considered when documenting purger normal operating procedures:

1. Verification that the purger parameters are within expected operating limits and troubleshooting as necessary.

11.4 *Purger Temporary Operating Procedures. The following items shall be considered when documenting purger temporary operating procedures:

1. Steps to consult supervisory personnel to establish temporary operating parameters,
2. Steps to modify the purger to operate under the temporary operating parameters, and
3. Procedures to monitor the purger while it operates under temporary operating conditions.

11.5 Purger Normal Shutdown Procedures. The following items shall be considered when documenting purger normal shutdown procedures:

1. Steps to stop the purger and
2. Steps to prepare the purger for stand-by operations or for maintenance.

11.6 Purger Emergency Shutdown Procedures. The following items shall be considered when documenting purger emergency shutdown procedures:

1. Specification of the person responsible for the emergency shutdown of the purger;
2. Steps to stop the purger;
3. Steps to close the purger isolation valves, turn off power to the purger, and apply lockout/tagout devices if it is safe to do so;
4. Notification of supervisory personnel, appropriate authorities, or both; and
5. Steps to log the conditions that caused the emergency shutdown.

11.7 *Purger Emergency Operating Procedures. The following shall be considered when documenting purger emergency operating procedures:

1. Steps to operate the purger under emergency operations, such as if the purger is operating near or outside of operating limits.

11.8 Purger Start-Up Procedures Following Abnormal Shutdown Conditions or a Turnaround. The following items shall be considered when documenting purger start-up procedures following abnormal shutdown conditions or a turnaround:

1. Appropriate practices if the purger will be started following general maintenance, an emergency shutdown, or a system modification;
2. Appropriate conditions, including foul gas pressure and purge point timing, to ensure a safe system start-up;
3. Corrective actions required if the conditions are outside of operating limits;
4. Lockout/tagout procedures;
5. State of the purger electrical disconnect;
6. Position of the purger isolation and service valves;
7. Status of the purger alarm systems;
8. Steps to start the water supply to the purger; and
9. Steps to start the purger.

Chapter 12. Oil Removal Devices

12.1 General. Oil removal device operating procedures shall comply with this chapter.

12.2 Oil Removal Device Initial Start-Up Procedures. The following items shall be considered when documenting oil removal device initial start-up procedures:

1. Appropriate conditions, including system pressure and device pressure, to ensure a safe operation;
2. Lockout/tagout procedures;
3. Personal protective equipment (PPE) to be used;
4. Emergency action and response procedures;
5. Location of safety shower and eyewash stations;
6. Position of isolation and service drain valves;
7. Steps to operate auxiliary heating systems;
8. Status of the oil removal device alarm systems; and
9. Type of oil removal device.

12.3 Oil Removal Device Normal Operating Procedures. The following items shall be considered when documenting oil removal device normal operating procedures:

1. Position of isolation and service drain valves,
2. Steps to operate auxiliary heating systems,
3. Sequence of steps used to minimize the amount of residual ammonia in the oil,
4. Sequence of steps to drain oil from the system,
5. Amount of time needed to drain the oil,
6. Oil removal device pressure,
7. Steps to use auxiliary equipment such as a pump-out system,
8. Steps to maintain an oil log, and
9. Steps to dispose of the oil removed from the system.

12.4 *Oil Removal Device Temporary Operating Procedures. The following items shall be considered when documenting oil removal device temporary operating procedures:

1. Steps to consult supervisory personnel to establish temporary operating parameters,
2. Steps to modify the oil removal device to operate under the temporary operating parameters, and
3. Procedures to monitor the oil removal device while it operates under temporary operating conditions.

12.5 Oil Removal Device Normal Shutdown Procedures. The following items shall be considered when documenting oil removal device normal shutdown procedures:

1. Steps to return the device to standby mode,
2. Position of isolation and service drain valves,
3. Steps to turn off auxiliary equipment such as a pump-out system, and
4. Steps to verify no ammonia leaks are present.

12.6 Oil Removal Device Emergency Shutdown Procedures. The following items shall be considered when documenting oil removal device emergency shutdown procedures:

1. Specification of the person responsible for emergency shutdown of the oil removal device:
2. Steps to shut down the oil removal device;
3. Steps to close the oil removal device isolation valves, shut off power to the oil removal device, and apply lockout/tagout devices if it is safe to do so;
4. Notification of supervisory personnel, appropriate authorities, or both; and
5. Steps to log the conditions that caused the emergency shutdown.

12.7 *Oil Removal Device Emergency Operating Procedures. The following shall be considered when documenting oil removal device emergency operating procedures:

1. Steps to operate the oil removal device under emergency operations, such as when the oil removal device is operating outside of operating limits.

12.8 Oil Removal Device Start-Up Procedures Following Abnormal Shutdown Conditions or a Turnaround. The following items shall be considered when documenting oil removal device start-up procedures following abnormal shutdown conditions or a turnaround:

1. Appropriate practices if the oil removal device will be used following general maintenance, an emergency shutdown, or a system modification:
2. Appropriate conditions, including system and device pressure, to ensure safe operation:
3. Corrective actions required if the conditions are outside of operating limits:
4. Lockout/tagout procedures;
5. Personal protective equipment (PPE) to be used;
6. Emergency action and response procedures;
7. Location of safety shower and eyewash stations;
8. Position of isolation and service drain valves;
9. Steps to operate auxiliary heating systems;
10. Status of the oil removal device alarm systems; and
11. Type of oil removal device.

Chapter 13. Safety Systems

13.1 *General. Safety system operating procedures shall comply with this chapter.

13.2 Safety Systems Initial Start-Up Procedures. The following items shall be considered when documenting safety systems initial start-up procedures:

1. Appropriate conditions, including system pressure and device pressure, to ensure safe operation:
2. Lockout/tagout procedures;
3. Personal protective equipment (PPE) to be used;
4. Emergency action and response procedures;
5. Status of the safety systems; and
6. Steps to activate and operate the safety systems.

13.3 *Safety Systems Normal Operating Procedures. The following shall be considered when documenting safety systems normal operating procedures:

1. Verification that the safety system parameters are within expected operating limits and troubleshooting as necessary.

13.4 *Safety Systems Temporary Operating Procedures. The following items shall be considered when documenting safety systems temporary operating procedures:

1. Steps to consult supervisory personnel to establish temporary operating parameters,
2. Steps to modify the safety system to operate under the temporary operating parameters, and
3. Procedures to monitor the safety system while it operates under temporary operating conditions.

13.5 Safety Systems Normal Shutdown Procedures. The following items shall be considered when documenting safety systems normal shutdown procedures:

1. Steps to stop and deactivate the safety system,
2. Precautions to take while the safety system is not functional, and
3. Steps to verify no ammonia leaks are present.

13.6 Safety Systems Emergency Shutdown Procedures. The following items shall be considered when documenting safety systems emergency shutdown procedures:

1. Specification of the person responsible for emergency shutdown of the safety system;
2. Steps to stop and deactivate the safety system;
3. Precautions to take while the safety system is not functional;
4. Notification of supervisory personnel, appropriate authorities, or both; and
5. Steps to log the conditions that caused the emergency shutdown.

13.7 *Safety Systems Emergency Operating Procedures. The following shall be considered when documenting safety systems emergency operating procedures:

1. Steps to operate the safety system under emergency operations, such as when an ammonia release is occurring at the facility.

13.8 Safety Systems Start-Up Procedures Following Abnormal Shutdown Conditions or a Turnaround. The following items shall be considered when documenting safety systems start-up procedures following abnormal shutdown conditions or a turnaround:

1. Appropriate practices if the safety system will be used following general maintenance, an emergency shutdown, or a system modification;
2. Appropriate conditions, including system and device pressure, to ensure safe operation:
3. Corrective actions required if the conditions are outside of operating limits;
4. Lockout/tagout procedures;
3. Personal protective equipment (PPE) to be used;
4. Emergency action and response procedures;
5. Status of the safety systems; and
6. Steps to operate and activate the safety systems.

Chapter 14. Tasks

14.1 Liquid Management.

14.1.1 **Charging Ammonia to the System.** The following items shall be considered when documenting procedures for charging ammonia to the system:

1. The appropriate personal protective equipment (PPE) that shall be worn and indications of when the buddy system shall be practiced;
2. The source of the refrigerant, such as the charge from a cylinder or from a truck;
3. Charging point on the system;
4. Facility safe work practices and emergency action and response plan procedures applicable to the charging procedures;
5. Steps to inspect hoses and fittings visually to make sure they are suitable for ammonia refrigeration service;
6. Steps required to charge ammonia to the system; and
7. Steps required to purge the charging system.

14.1.2 **Transferring Ammonia within the System.** The following items shall be considered when documenting procedures for transferring ammonia within the system:

1. The appropriate PPE that shall be worn and indications of when the buddy system shall be practiced,
2. The conditions required for the transfer,
3. The source and the receiving location for the ammonia,
4. Steps to inspect hoses and fittings visually to make sure they are suitable for ammonia refrigeration service,
5. Steps required to transfer the ammonia, and
6. Steps required to terminate the transfer of ammonia.

14.2 Manually Purging Noncondensables from the System. The following items shall be considered when documenting procedures for manually purging noncondensables from the system:

1. Notification of supervisory personnel, appropriate authorities, or both;
2. The appropriate PPE that shall be worn and indications of when the buddy system shall be practiced;
3. The conditions under which manual purging is required;
4. Location where noncondensables will be purged from the system;
5. Steps required to purge noncondensables from the system;
6. Steps required to place the system back into normal operations; and
7. Steps to properly dispose of water and ammonia fluid mixture.

14.3 Line and Equipment Opening Procedures. The following items shall be considered when documenting line and equipment opening procedures:

1. The appropriate PPE that shall be worn and indications of when the buddy system shall be practiced;

2. The conditions under which pump-out for a line opening, equipment opening, or both are required;
3. Location of the line, equipment, or both that will be pumped out and/or opened;
4. Facility safe work practices and emergency action and response plan procedures applicable to the line/equipment opening procedures;
5. Steps required to pump out the line/equipment;
6. Steps required to open the line, equipment, or both; and
7. Steps required to place the system back in normal operations.

Part 4 Appendices

Appendix A. (Informative) Explanatory Material

This informative appendix is not a part of the standard. It provides explanatory information related to provisions in the standard. Sections of the standard with associated explanatory information in this appendix are marked with an asterisk "*" after the section number, and the associated appendix information is located in a corresponding section number preceded by "A."

A.1.1 Because this standard defines the minimum requirements for operating procedures, it may not be sufficient to meet other standards, regulations, or both that are applicable to each specific refrigeration system. Additional requirements may be necessary to comply with these standards, regulations, or both. The IIAR's *Process Safety Management and Risk Management Program Guidelines* addresses the additional requirements needed to meet United States regulations and contains sample overall system operating procedures designed to comply with the Occupational Safety and Health Administration's (OSHA's) Process Safety Management (PSM) Standard and the United States Environmental Protection Agency's (EPA's) Risk Management (RM) Program.

The operating procedures should be developed with the following primary goals in mind:

1. Easy to understand and follow,
2. Safe,
3. Effective,
4. Reliable, and
5. Meeting applicable regulatory requirements.

A.1.2.1 This standard presupposes that the persons who use operating procedures have a working knowledge of the functionality of their ammonia refrigeration system(s) and basic ammonia refrigeration practices and principles.

A.4.2 The following items should be considered when customizing operating procedures for the refrigeration system:

1. Type and style of equipment used in the refrigeration system,
2. Refrigeration system configuration,
3. The sequence in which the refrigeration system(s) or subsystems will be operating, and
4. If one procedure can be used for all of the equipment or whether multiple procedures must be developed for individual pieces of equipment.

Consider obtaining the direct input of system operators, technicians, or both when documenting the operating procedures for the refrigeration system.

The IIAR's *Ammonia Refrigeration Management (ARM) Program* contains sample written procedures designed to comply with OSHA's and EPA's General Duty Clause requirements.

The IIAR's *Process Safety Management and Risk Management Program Guidelines* contains sample overall system operating procedures designed to comply with OSHA's PSM Standard and EPA's RM Program.

Appendix C contains additional guidelines for developing system operating procedures.

A.4.3 Procedures for nonroutine tasks may be documented as temporary operating procedures, emergency operating procedures, or both. This can be accomplished using management of change procedures.

A.4.4.1 The IIAR's *Introduction to Ammonia Refrigeration* describes personal protective equipment (PPE) applicable to ammonia. Developers of operating procedures should review IIAR's *Introduction to Ammonia Refrigeration*, modify these requirements to reflect the work performed on their system, and incorporate the PPE requirements into their operating procedures.

A.4.4.5 Hydrostatic pressure can develop when a liquid becomes trapped with no vapor present. Whenever this is a possibility, the sequence of steps should ensure that liquid has been removed from the system line, component, equipment, or a combination thereof, to be isolated before the last isolation valve is closed.

An informative appendix in BSR/IIAR 6-201x, *Standard for Inspection, Testing, and Maintenance of Safe Closed-Circuit Ammonia Refrigeration Systems*, contains guidance for avoiding component failure in industrial refrigeration systems due to trapped liquid.

A.4.4.6 See BSR/IIAR 6-201x, *Standard for Inspection, Testing, and Maintenance of Safe Closed-Circuit Ammonia Refrigeration Systems*, for guidance on avoiding component failure in industrial refrigeration systems due to sudden liquid deceleration.

A.4.4.7 See BSR/IIAR 6-201x, *Standard for Inspection, Testing, and Maintenance of Safe Closed-Circuit Ammonia Refrigeration Systems*, for guidance on avoiding component failure in industrial refrigeration systems due to vapor-propelled liquid.

A4.4.8 In the United States, all facilities are subject to the EPA's General Duty Clause requirements [Section 112(r)(l) of the Clean Air Act] and to the General Duty Clause in section 5(a)(1) of the Occupational Safety and Health Act [29 U.S.C. § 654(a)(1)]. Additional items will need to be included in the operating procedures if the ammonia refrigeration system is covered by OSHA's PSM Standard (29 CFR 1910.119), the USEPA's RM Program Regulation (40 CFR Part 68), or state regulations that exceed minimum requirements. Some of these additional items include

1. System operating limits, including
    a) Consequences of deviations;
    b) Steps required to correct or avoid deviations;
2. Safety and health considerations, including
    a) Properties of, and hazards presented by, the chemicals used in the process (e.g., ammonia);
    b) Precautions necessary to prevent exposure, including engineering controls, administrative controls, and PPE;
    c) Control measures to be taken if physical contact or airborne exposure occurs;
    d) Quality control for raw materials and control of hazardous chemical inventory levels;
    e) Any special or unique hazards; and
3. Safety systems and their functions.

The IIAR's *Ammonia Refrigeration Management (ARM) Program* contains sample written procedures designed to comply with OSHA's and the EPA's General Duty Clause requirements.

The IIAR's *Process Safety Management and Risk Management Program Guidelines* contains sample overall system operating procedures designed to comply with OSHA's PSM Standard and the EPA's RM Program.

A.5.1 The version of each operating procedure can be specified using a document number, a revision number or revision date, or both.

A table of contents should be provided if many distinct operating procedures are present.

A.5.2 The operating procedures may be available as hard-copy printed documents, viewed on computer screens, printed as needed from electronic files, or a combination thereof.

A.5.3 Certain regulations, such as OSHA's PSM Standard (29 CFR 1910.119) and the EPA's RM Program Regulation (40 CFR Part 68), require operating procedures to be certified annually to ensure that they are current and accurate.
Operating procedures are not required to be updated annually, so long as they are verified and certified to be current and accurate.

A.6.3 BSR/IIAR 6-201x, *Standard for Inspection, Testing, and Maintenance of Safe Closed-Circuit Ammonia Refrigeration Systems*, lists the compressor parameters that should be inspected regularly.

A.6.4 Examples of compressor temporary operating procedures are procedures to adjust compressor setpoints temporarily using the microprocessor or procedures to modify temporarily the operation of a swing compressor.

A.6.7 An example of a compressor emergency operating procedure is the procedure to operate a compressor to pump out a system component during an ammonia release elsewhere in the system.

A.7.3 BSR/IIAR 6-201x, *Standard for Inspection, Testing, and Maintenance of Safe Closed-Circuit Ammonia Refrigeration Systems*, lists the refrigerant pump parameters that should be inspected regularly.

A.7.4 An example of a refrigerant pump temporary operating procedure is the procedure to switch temporarily to a back-up refrigerant pump.

A.7.7 An example of a refrigerant pump emergency operating procedure is the procedure to operate a refrigerant pump when refrigerant liquid levels are high in the vessel associated with the pump.

A.8.3 BSR/IIAR 6-201x, *Standard for Inspection, Testing, and Maintenance of Safe Closed-Circuit Ammonia Refrigeration Systems*, lists the condenser parameters that should be inspected regularly.

A.8.4 An example of a condenser temporary operating procedure is the procedure to temporarily operate the condenser fans and cooling water pumps manually, for example to lower system head pressure.

A.8.7 An example of a condenser emergency operating procedure is the procedure to operate (or turn off) the condenser fans and cooling water pumps if an ammonia release were to occur inside the engine room.

A.9.3 BSR/IIAR 6-201x, *Standard for Inspection, Testing, and Maintenance of Safe Closed-Circuit Ammonia Refrigeration Systems*, lists the evaporator parameters that should be inspected regularly.

A.9.4 An example of an evaporator temporary operating procedure is the procedure to change the setpoint for the evaporator temporarily.

A.9.7 An example of an evaporator emergency operating procedure is the procedure to lower the evaporator suction pressure into a vacuum during an ammonia release involving the evaporator.

A.9.9 The evaporator defrost procedures in this section typically apply if an evaporator is manually defrosted. If the evaporator defrost is computer controlled, the defrost procedures are often described in the controls and instrumentation section of the operating procedures rather than in a separate, specific procedure.

An informative appendix in BSR/IIAR 6-201x, *Standard for Inspection, Testing, and Maintenance of Safe Closed-Circuit Ammonia Refrigeration Systems*, contains guidance for avoiding component failure in industrial refrigeration systems when using hot gas for defrosting.

A.10.3 BSR/IIAR 6-201x, *Standard for Inspection, Testing, and Maintenance of Safe Closed-Circuit Ammonia Refrigeration Systems*, lists the pressure vessel parameters that should be inspected regularly.

A.10.4 An example of a pressure vessel temporary operating procedure is the procedure to operate the pressure vessel during weekend shutdown conditions when levels may temporarily increase.

A.10.7 An example of a pressure vessel emergency operating procedure is the procedure to lower the refrigerant liquid levels in the pressure vessel during system upset conditions.

A.11.3 BSR/IIAR 6-201x, *Standard for Inspection, Testing, and Maintenance of Safe Closed-Circuit Ammonia Refrigeration Systems*, lists the purger parameters that should be inspected regularly.

A.11.4 An example of a purger temporary operating procedure is the procedure to purge a specific location in the system manually.

A.11.7 Typically, no emergency operating procedures are involved with the purger.

A.12.4 Typically, no temporary operating procedures are involved with oil removal devices.

A.12.7 Typically, no emergency operating procedures are involved with oil removal devices.

A.13.1 Safety systems include machinery room ventilation systems, emergency shutoff switches, emergency pressure control systems (EPCS), and other types of safety systems that exist at the facility. Procedures to operate the safety systems may be included in the procedures developed for the individual pieces of equipment, or they may merit separate dedicated procedures as described in Chapter 13.

A.13.3 BSR/IIAR 6-201x, *Standard for Inspection, Testing, and Maintenance of Safe Closed-Circuit Ammonia Refrigeration Systems*, lists the safety system parameters that should be inspected regularly.

A.13.4 An example of a safety system temporary operating procedure is the procedure to turn off the ventilation system for the engine room manually, for example when draining oil from an oil removal device.

A.13.7 An example of a safety system emergency operating procedure is the procedure to operate a safety system manually when an ammonia release has occurred in the system.

Appendix B. (Informative) Operating Procedure Documentation

This informative appendix is not a part of the standard. It is merely informative and does not contain requirements necessary to conform to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process.

Developers of operating procedures should consider using the following documentation when writing or modifying operating procedures:

1. A list of the applicable activities involving the ammonia refrigeration system;
2. Safety data sheets;
3. Refrigeration system flow drawings, including block flow diagrams, piping and instrument diagrams (P&IDs), or both;
4. Equipment lists;
5. Installation, operation, and maintenance manuals;
6. Control system documentation;
7. Operating parameters;
8. Application data; and
9. Supplemental manufacturer-provided instructions with site-specific references such as valve numbers.

Appendix C. (Informative) Discussion—System Operating Procedures

This informative appendix is not a part of the standard. It is merely informative and does not contain requirements necessary to conform to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process.

This appendix discusses skid packages and complex refrigeration systems as follows:

C.1 Skid Packages

C.1.1 The simplest refrigeration systems are small skid packages. A typical skid package may include a compressor, a condenser, one or two pressure vessels, and one evaporator. Pieces of equipment in a skid package are typically not started up and shut down piecemeal. Instead, a single series of steps typically starts up the entire skid package rather than starting up individual components within the system.

C.1.2 The written procedures for skid packages often reflect this mode of operation. Typically, separate procedures are not written for each piece of equipment in the system. Developing one "system" procedure that simultaneously incorporates all pieces of equipment is acceptable practice. This system procedure often includes the series of steps required to start up and shut down the entire package. For example, the system start-up procedures may include steps to start up the condenser, steps to start up the compressor, steps to start up the pressure vessels, and steps to start up the evaporator in a single "start-up" procedure. System operating, shutdown, emergency shutdown, and temporary procedures are typically also developed.

C.2 Complex Refrigeration Systems

C.2.1 Most refrigeration systems are larger and more complex than simple skid packages. In complex systems, individual pieces of equipment need to be started and stopped separately in varying degrees of urgency as loads shift in the system. For example, individual compressors may need to be started and stopped as loads increase and decrease in the system. Operators should also identify applicable activities that may require the operation of several different system components. For example, starting the refrigeration system may require operators to conduct tasks related to compressors, evaporators, vessels, refrigerant pumps, and other equipment simultaneously.

C.2.2 The written procedures for complex systems typically reflect this mode of operation. For complex systems, separate procedures are often developed for each piece of equipment in the system. For example, one set of operating procedures may be written for the compressors. Separate sets of procedures may be developed for the condensers, the pressure vessels, etc. Each of these sets of

operating procedures typically contains the items described in Part 3 of this standard. Other activities require considering the effects on the entire system. In these cases, meaningfully categorizing procedures by equipment alone may be difficult, and therefore procedures should be written for system activities in conjunction with procedures for each piece of equipment. Each of these sets of operating procedures typically contains the items described in Chapters 4–14, which describe systems and tasks.

C.2.3 When documenting procedures for complex systems, decisions need to be made on how to handle similar pieces of equipment. The key question is whether to develop individual procedures for each piece of equipment or whether to combine multiple pieces of similar equipment into a single procedure. The following criteria may be used to aid in these decisions:

1. A single procedure may be developed if the similar equipment is identical, i.e., compressors of the same manufacturer and model number with identical operating procedures.
2. A single procedure may be developed even if the similar equipment is not identical, provided that the operating procedures account for the differences between the similar equipment. For example, a single procedure may be written for all compressors of the same manufacturer even if the system contains multiple compressor models provided that the compressors are in similar service (e.g., all high-stage compressors). Methods that can be used to account for the differences include
    a. Using tables to list the specific valve numbers for each piece of equipment;
    b. Providing "notes" in the procedures that describe steps needed to operate a specific piece of equipment; and
    c. Adding additional sections to the procedures with steps for a specific piece of equipment, for example, procedures to operate a swing compressor.
3. Separate procedures are often developed if the equipment is not similar (for example, reciprocating compressors vs. screw compressors), or if the equipment is not in similar service (for example, high-stage compressors vs. booster compressors).
4. Separate procedures are typically developed if the equipment is located in separate refrigeration systems that are not interconnected.

C.2.4 The following practices are often followed when documenting procedures for complex systems:

1. Procedures for refrigerant pumps are often combined with the procedures for the vessel associated with the refrigerant pumps.
2. Separate procedures are typically not written for instrumentation. Instrumentation is typically included in the procedure for the specific piece of equipment associated with that instrumentation. For example, a pressure vessel procedure would include instrumentation associated with the pressure vessel level control system.

3. Oil draining procedures are typically included with the equipment from which the oil is drained.
4. Pressure vessels associated with evaporators in flooded systems are often combined with the evaporators into a single procedure.
5. Procedures for systems with secondary refrigerants (such as glycol chillers) are typically included with the procedures for the evaporators associated with the secondary refrigerant.
6. Separate procedures are typically developed for the carbon dioxide equipment in an ammonia/carbon dioxide cascade refrigeration system.

C.2.5 System-wide operating procedures are typically developed for complex systems in addition to the procedures developed for the individual pieces of equipment. Examples of such system-wide operating procedures include

1. Start-up procedures following a system-wide outage, for example following a planned system shutdown or turnaround;
2. Start-up procedures following a system-wide emergency shutdown;
3. Operating procedures during and after a system-wide power outage;
4. Shutdown procedures for a system-wide shutdown, for example a planned turnaround; and
5. Emergency shutdown and operating procedures for the entire system, for example, following a large ammonia release or a natural disaster.

C.2.6 System-wide controls may be included in the procedures developed for the individual pieces of equipment or may merit separate dedicated procedures. Examples of system wide-controls include

1. Master hot gas outlet pressure control regulators,
2. Emergency pressure control systems,
3. Ammonia detection systems,
4. Ammonia ventilation systems, and
5. Ammonia pressure relief systems.

Appendix D. (Informative) References and Sources of References

D.1 Informative References

D.1.1 Environmental Protection Agency (2004):

40 CFR Part 68, *Accidental Release Prevention Requirements: Risk Management Programs Under Clean Air Act*

Section 112(r)(l) of the Clean Air Act, *General Duty Clause*

D.1.2 International Institute of Ammonia Refrigeration (IIAR):

Introduction to Ammonia Refrigeration (2008)

Process Safety Management & Risk Management Program Guidelines (2012)

The Ammonia Refrigeration Management (ARM) Program (2005)

BSR/IIAR 6-201x, *Standard for Inspection, Testing, and Maintenance of Safe Closed-Circuit Ammonia Refrigeration Systems*

IIAR Bulletin No. 110 *Guidelines for Start-Up, Inspection, and Maintenance of Ammonia Mechanical Refrigerating Systems* (1993)

D.1.3 Occupational Safety and Health Administration (OSHA), U.S. Department of Labor (2012):

29 CFR 1910.119, *Process Safety Management of Highly Hazardous Chemicals*

29 CFR 1910.147, *Control of Hazardous Energy ("Lockout/Tagout")*

29 U.S.C. § 654, 5(a)(1), *General Duty Clause*.

D.2 Sources of References (Informative)

D.2.1 Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Washington, DC 20460
www.epa.gov

D.2.2 International Institute of Ammonia Refrigeration (IIAR)
1001 North Fairfax Street, Suite 503
Alexandria, VA 22314
www.iiar.org

D.2.3 U.S. Department of Labor/Occupational Safety and Health Administration (USDoL/OSHA)
Publications Department
200 Constitution Avenue, NW, Room N3101
Washington, DC 20210
www.osha.gov

