

**STUDY MATERIAL FOR  
CONSOLIDATED EXAMINATION G-99 FOR:**

**G-09 STORAGE AND USE OF AMMONIA  
FOR HEAT TREATING  
(DISSOCIATORS)**

**G-31 USE OF ANHYDROUS AMMONIA  
WITH DUPLICATING MACHINES**

These study materials will help you prepare the written examination for the certificate of fitness for The storage and use of anhydrous ammonia. The study materials include information taken from the Fire Prevention Code, NFPA Standards, and the Fire Prevention Rules of the New York City Fire Department and OSHA. You must be familiar with 3RCNY §23-06 and 23-07 in order to take and pass this test.

All questions on the Certificate of Fitness examination are multiple choice, with four alternate answers to each question. There is only one correct answer for each question. If you do not answer a question or mark more than one alternative, your answer will be scored as incorrect. A score of 70% correct is required on the examination in order to qualify for the Certificate of Fitness. Read each question carefully before marking your answer. There is no penalty for guessing.

### Sample Questions:

- \_\_\_\_\_1. What sports team plays at Shea Stadium in New York?  
(A) Mets.  
(B) Giants.  
(C) Jets.  
(D) Cardinals.

The correct answer is "A". You would mark "A" on your answer sheet.

- \_\_\_\_\_2. Who was the first President of the United States?  
(A) George Jefferson.  
(B) George Washington.  
(C) Bill Clinton.  
(D) George Bush.

The correct answer is "B". You would mark "B" on your answer sheet.

Ammonia is the combination of two gaseous elements: Nitrogen and Hydrogen. When gaseous ammonia is in its commercial form, it is commonly referred to as "Anhydrous Ammonia." At room temperature and atmospheric pressure ammonia is a pungent, colorless gas. As a vapor, ammonia is lighter than air. As a chemical compound, ammonia is highly associated and stable. Ammonia gas burns at atmospheric pressure but only within a limited range of 16-25 percent by volume ammonia in the air. Due to this low susceptibility to fire, ammonia is classified by DOT (Department of Transportation) as nonflammable. However, ammonia is considered extremely hazardous to human health.

### **Safety Precautions when Changing Ammonia Cylinder(s):**

When approaching an anhydrous ammonia cylinder, always be alert for any smell of ammonia. If you can smell a small amount of ammonia in the area, the level of ammonia is about 5 to 10 PPM. If the ammonia odor is strong and your eyes start to tear the level of ammonia is probably above 100 PPM. Always make sure that the area around the cylinders is well ventilated.

Always use eye protection (safety goggles) or face protection equipment when changing the ammonia cylinders to prevent direct skin contact. Contact with Ammonia will cause irritation and will burn the skin. Never wear contact lenses when changing ammonia cylinders. If a problem should occur and you find it difficult to breathe, immediately evacuate the area and notify others in the area.

If ammonia is sprayed or spilled on the skin, water is the most effective remedy. Flood the infected area with water immediately for 15 minutes. If the ammonia spills on clothing, immediately remove the clothing and flood the infected area with water. If an individual is overcome by ammonia he/she should be removed to a fresh air location. Obtain medical attention immediately should anyone be unconscious or in the event of eye, nose, or throat contact with ammonia.

Persons having chronic respiratory disease or persons who have shown evidence of undue sensitivity to ammonia should not be employed where they will be exposed to ammonia. In accordance with U.S. Department of Labor Regulations, and employee's exposure to ammonia must be limited to a concentration not to exceed 50 PPM in air by volume based upon an 8-hour time weighted average.

### **CHANGING A CYLINDER:**

When the pressure gauge (flowmeter) on the cylinder supply reaches 0 PSI, it is time to replace the cylinder. The pressure drops at a quick rate from 25 PSI to 0 PSI.

### **STEPS:**

1. Insure shut-off valves on the manifold are in correct position. Close the valve at the top of the cylinder. This is done by turning the stem clockwise until it is tight. Always use the proper valve stem tool to tighten the stem.
2. Vent the pressure from the line by opening the valve for the vent line. Do not remove the yoke unless you are sure the cylinder valve is fully closed. If the valve is not fully closed ammonia gas will be released.
3. Loosen the yoke clamp by turning the T-screw counter-clockwise. Carefully lift the yoke assembly up and over the stem and set it to the side.

4. The protective cap should be screwed to the top of the cylinder. The safety chain, or other cylinder holding device can be disconnected and the cylinder replaced with a full cylinder.
5. After the full cylinder is in place, connect the safety chain. Remove the protective cap and line seal from the cylinder outlet. A new washer in the cylinder outlet must always be installed.
6. Carefully place the yoke assembly to the cylinder outlet and tighten the handle by turning it clockwise.
7. Close the valve for the vent line that was opened in step two.
8. You are now ready to open the cylinder valve at the stem. You open the valve by turning the stem in a counter-clock wise direction. Be aware to always open the valve slowly but completely. The valve must be completely open to reduce possible leakage at the valve stem. When the Anhydrous Ammonia cylinder valve is opened, the gauge on the pressure side should read about 150 PSI. The PSI will vary a little if the cylinder has been stored in a hot or cold area.
9. Be alert of the smell of any vapor leaks. One of the best ways to check for leaks is to hold a sheet of fast speed diazo blue line paper at the valve and stem or the soap and water technique. If the paper changes color, go back to step one and repeat all the steps from one to nine.

#### **CHECKING FOR LEAKS:**

Checking for leaks is usually very easy because your sense of smell will let you know immediately. The use of some twelve sulfur tapers, unexposed diazo sensitized paper, moist phenolphthalein or red litmus paper should be available in the vicinity of the machine and reserve storage room to find small leaks. Another method to detect leaks in cylinders is using sulfur dioxide, which forms a white fog in contact with ammonia vapor.

Only personnel trained for and designated to handle emergencies should attempt to stop a leak. If a leak is discovered, all open flames must be shut off immediately. Respiratory equipment suitable for ammonia must be worn. If a person should be trapped in an ammonia atmosphere, they should breathe as little as possible and only open their eyes when necessary. Some protection may be gained by holding a wet cloth over the nose and mouth. Ammonia vapor rises and a trapped person should stay close to the floor.

A leak at a valve stem on an ammonia cylinder in service can usually be stopped by tightening the packing nut that has a left-hand thread. If this does not work, the valve should be closed. A cylinder that continues to leak, it should be removed from the building. Any cylinder exposed to fire must be removed.

#### **SECURING CYLINDERS INTO POSITION:**

All cylinders shall be secured by chain or other suitable means to prevent accidental toppling. Remove all safety equipment and place in the proper location.

#### **STORAGE OF AMMONIA CYLINDERS**

Systems using anhydrous ammonia cylinders which exceeds 8 lb. must be exhausted directly to a safe location in outer air through a duct of 4" minimum in diameter with an inlet near the ceiling.

Airflow is to be insured by a mechanical blower with a minimum capacity of 175 cubic feet per minute incorporated into the machine.

According to the NYC Building Code, if you have more than one ammonia gas cylinder, (not directly connected to the manifold) the maximum amount is two cylinders not exceeding 300 lb. in net weight. Such storage of ammonia cylinders shall be outdoors, protected from the sun and all mechanical injury. If outdoor storage is not permitted, inside storage is recommended by the Zoning Resolution and must be approved by the Department of Buildings or Department of Ports and Terminals. For any indoor storage, plans for reserve storage rooms must be approved by the Department of Buildings or the Department of Ports and Terminals before construction is commenced, with a copy of approved plans to be filed with the Bureau of Fire Prevention.

The door to the reserve storage room is to be self-closing and vapor tight if such doors lead to the interior of the building. All plans must be docketed (stamped, numbered, dated) by the Department of Buildings. It must be the responsibility of the applicant to furnish a certificate of occupancy or other authorization issued by the Department of Buildings.

The reserve storage room shall be equipped with open sprinkler heads, which are placed in operation by a properly labeled valve located outside the storage room.

The storage and use of the anhydrous ammonia or servicing of the duplicating machines shall be under the supervision of a person holding a Certificate of Fitness from the Fire Department. It is important to have an additional person employed who has a Certificate of Fitness for supervising and/or use of anhydrous ammonia if the CoF is not present at all business hours.

**WARNING SIGNS:**

Warning signs must be posted to be visible when entering rooms where anhydrous ammonia is used or stored. Such signs shall be visible whether doors are open or closed in accordance with the following format:

**NOTICE**  
**THIS AREA CONTAINS ANHYDROUS AMMONIA**  
**IN CASE OF AN AMMONIA LEAK OR IF**  
**A VERY STRONG AMMONIA ODOR IS PRESENT**

1. CALL THE FIRE DEPT. (PHONE # \_\_\_\_\_)
2. A NON-COIN PHONE MAY BE FOUND AT: \_\_\_\_\_.
3. NOTIFY ALL PERSONNEL TO EVACUATE THE AREA.
4. SHUT OFF ALL OPEN FLAMES.
5. DO NOT SHUT OFF THE DUPLICATING MACHINE SINCE THAT WOULD SHUT OFF THE BLOWER PROVIDING HELPFUL AIR EXHAUST.
6. CLOSE ALL DOORS TO ADJOINING AREA.

A permanent chart listing safety precautions for handling anhydrous ammonia must be posted at the storage facility and where the machine is used. Detailed instructions for the operation of the

anhydrous ammonia system shall be posted in a conspicuous and permanent manner. The emergency number for the Fire Department must be posted in a conspicuous and permanent manner. Smoking is not permitted in the area where ammonia tank cylinders are used. NO SMOKING signs should be posted in the area of the ammonia tank cylinders or usage areas.

## **CYLINDERS**

The type ammonia cylinder most commonly used is the bottle-type. It is available in seamless or welded construction and in a number of convenient sizes. The most widely used has the capacity to hold 150 lb. of ammonia. Cylinders must meet the requirements of the Department of Transportation. Most common metals are not affected by dry ammonia, however when combined with water vapor, ammonia will attack copper zinc or alloys containing copper as a major alloying element. Ammonia storage cylinders, valves and fittings must be made of steel or iron. All ammonia piping should be extra heavy steel when threaded joints are used. All piping and tubing should be tested after assembly at a pressure not less than the normal operating pressure of the system and proved free from leaks.

The anhydrous ammonia cylinder shall be connected to the duplicating machines with high pressure stainless steel flexible connector rated at 4500 psi bursting pressure and/or with a synthetic rubber hose with a braid reinforcement with a bursting pressure rating of 1750 psi and/or with an equivalent rigid iron or steel pipe.

According to the Department of Transportation, a cylinder that leaks, is bulged, has defective valve or safety devices, bears evidence of physical abuse, fire or heat damage, or detrimental rusting or corrosion must not be used. All markings on the cylinders must be maintained so that they are legible.

Appliance shall be approved by New York City Board of Standards and Appeals and bear a permanently affixed label indicating such approval and its calendar number. Installation shall comply with the requirements of that Resolution. Only one cylinder of anhydrous ammonia, not exceeding 150 lb. in capacity shall be used, except that each machine may have one reserve cylinder in the use area when properly manifolded to a pressure relief valve and the supply is in the open position. Machines using a cylinder of 8 lb. net weight or less of anhydrous ammonia, in addition to the permitted manifolded reserve, may have an additional 8 lb. reserve supply, without manifold, in the use area in a metal cabinet.

Relief valves shall be provided for anhydrous ammonia machines and such valves shall be set at not over 250 psi. Relief valves shall be piped to a safe location in outer air by not less than 1/2-inch pipe. Piping to the outer air is not required for machines using a cylinder of eight pounds net weight or less if its relief valve is piped into an absorber.

## **FIRE EXTINGUISHER:**

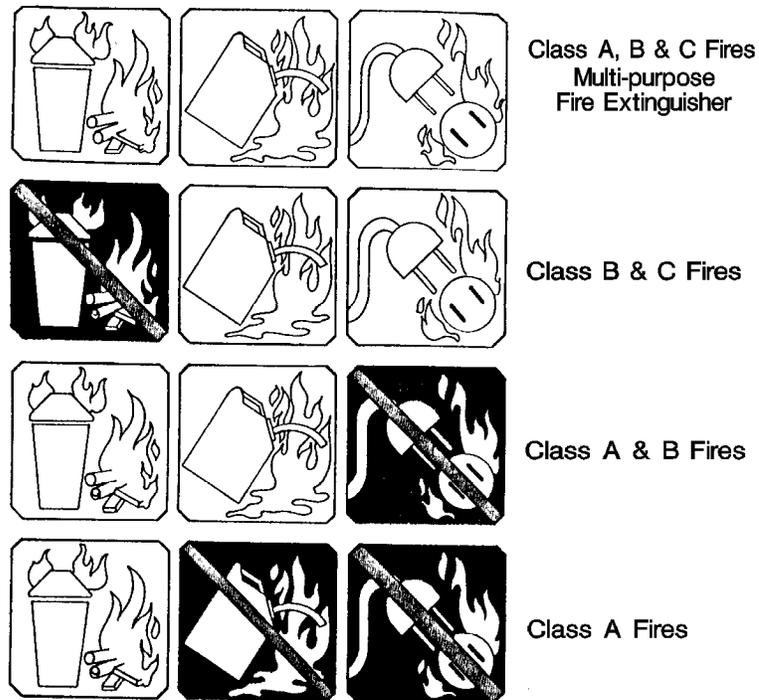
All persons handling anhydrous ammonia should have knowledge of the different types of fire extinguisher. These persons must know how to operate the extinguisher in a safe and efficient manner. He/she must know the difference between the various types of extinguisher and when they should be used. A description of the three classes of fires and the appropriate extinguisher are described on the following page.

**Class A** fires occur when ordinary combustible materials are ignited. For example, wood and paper fires are classified as class A fires. Water type extinguisher should be used to extinguish these fires. The water type extinguisher cool the fire while quenching the flame.

**Class B** fires occur when flammable liquids or greases are ignited. These fires must be extinguished by smothering the flame. The flame may be smothered using CO2, dry chemical or foam extinguisher. Water type extinguishers are not effective for class B fires.

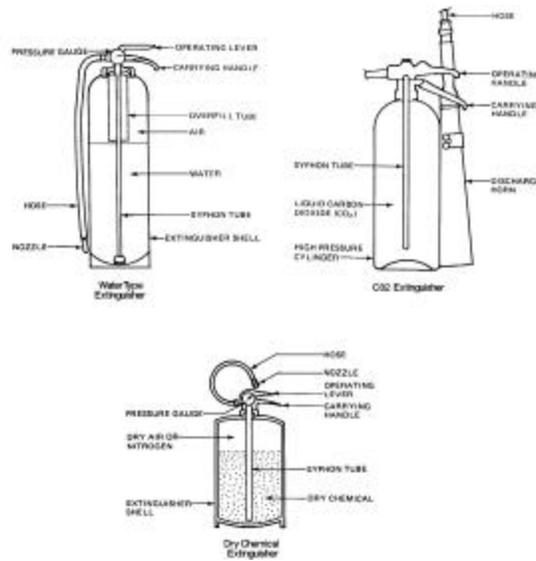
**Class C** fires occur when electrical equipment catches fire. These fires must be fought with fire extinguisher that do not conduct electricity. CO2 and dry chemical extinguisher must be used to extinguish electrical fires. Foam and water type extinguisher must not be used to extinguish electrical fires.

Examples of Water type, CO2 and Dry Chemical extinguishers are shown on the next page.



### TYPICAL SYMBOLS PAINTED ON FIRE EXTINGUISHERS

The symbol with the shaded background and the slash indicated that when the extinguisher must not be used. All persons must understand these symbols. All persons must make sure that the fire extinguishers are kept in good working order at all times.



**Examples of Water type, CO2 and Dry Chemical extinguishers**

Generally, operation instructions are clearly painted on the side of the fire extinguisher. They clearly describe how to use the extinguisher in case of an emergency. An example of these instructions is shown below.

