

**STUDY MATERIAL FOR THE
CERTIFICATE OF FITNESS EXAMINATION FOR
SUPERVISE BULK OIL STORAGE**

3RCNY §7-08 Certificate of Fitness for Bulk Oil Storage Plants. A Certificate of Fitness issued to persons for the care and supervision of a plant for the storage, manufacture, refining or distilling of petroleum, shale oil or coal tar or any liquid product thereof, is deemed to certify that such persons are qualified to care for, maintain and supervise all fire extinguishing systems on the premises, such as standpipe systems, sprinkler systems, yard hydrant systems and foam systems.

This Certification also includes care, maintenance, and supervision of fuel oil burners and private motor fuel stations.

This study material will help you prepare for the examination for the Certificate of Fitness for Supervising Bulk Oil Storage Plants. The study material includes information taken from the Fire Prevention Code

and the Rules of the City of New York. The study material does not contain all of the information you need to know in order to perform the job of supervising a specific Bulk Oil Storage Plant. It is your responsibility to become familiar with all the applicable rules and regulations of the City of New York even if they are not covered in this material.

Each candidate must pass a multiple-choice examination to qualify for the Certificate of Fitness. Examples of the kinds of questions given on the multiple-choice examination are given on the next page. All questions on the multiple-choice examination have four alternative answers. Only one answer option is correct 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 to pass the multiple-choice examination. Read each question carefully before marking your answer. There is no penalty for guessing.

Additionally, the candidate must submit an affidavit on official letterhead from the appropriate officer at the place of employment attesting to the candidate's awareness of the requirements and responsibilities of the regulations and all contents of 3RCNY §7.

Sample Multiple Choice Questions

1. Which of the following petroleum products are stored in bulk oil storage plants?

- (A) Gasoline.
- (B) Aviation jet fuel.
- (C) #6 fuel oil.
- (D) All of the alternatives are correct.

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

2. Supervision of a bulk oil storage plant must be done by:

- (A) a college graduate.
- (B) a Certificate of Fitness holder.
- (C) any employee of the company that owns the tanks.
- (D) inspectors from the Bureau of Fire Prevention.

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

BULK OIL STORAGE

The Fire Commissioner requires that at least three Certificate of Fitness holders share responsibility of supervising operations at each bulk oil storage plant. At least one Certificate of Fitness holder must be on duty 24 hours per day, seven days per week. The Fire Commissioner may require additional Certificate

of Fitness holders at some plants. Each Certificate of Fitness holder is responsible for maintaining and supervising all fire protection systems at the plant. For example, the Certificate of Fitness holder must make sure that the standpipe, sprinkler, yard hydrant and foam fire protection systems are maintained in good working order.

Several liquid petroleum products may be stored at the bulk storage plants. These products are classified into three main groups.

Class I All liquid petroleum products that have a flashpoint below 100°F (e.g., gasoline and naphtha)

Class II All liquid petroleum products that have a flashpoint at or above 100°F and below 140°F (e.g., # 2 heating oil).

Class III All liquid petroleum products that have a flashpoint at or above 140°F to 300°F (e.g., # 4, # 6 heating oils, asphaltic cement, and waste oils).

The groups are based on the relative flashpoints of the liquid petroleum products. The flashpoint of any given product is defined as the minimum temperature at which the product releases enough vapor to form an ignitable mixture when mixed with oxygen. This classification method is used because it is the vapor released by the product that burns and not the liquid itself. When ignited, these vapors will burn with explosive violence. When oxygen is not present the vapors cannot become combustible and therefore cannot be ignited. When the vapors are not combustible they are said to be in a "super saturated state" (too rich to burn). These vapors must be considered when the product is stored in a tank at temperatures above its flashpoint. Commonly a vapor recovery system is installed to draw these vapors out of cone-roof tanks equipped with internal floating roof pans. When the tank has a floating roof the roof simply rests on top of the product and prevents the release of the vapors. It is important that the Certificate of Fitness holder understand the relationship between temperature of the product, the vapors released by the product, and the amount of oxygen in the tank.

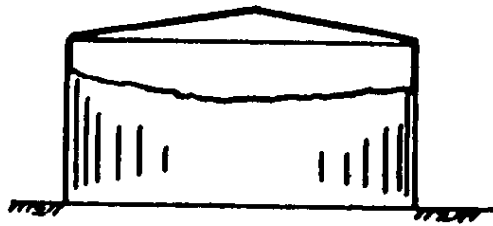
Generally, liquid petroleum products are stored in above ground storage tanks. These tanks are constructed of steel. Commonly, these tanks are painted with gray or white paint. These colors reflect the heat of the sun and help keep the product within an acceptable temperature range.

Several types of tanks may be used in bulk storage plants. However, **Cone-Roof Tanks**, **Floating-Roof Tanks** and **Mounded-Over Tanks** are most commonly installed.

CONE ROOF TANKS

Cone roof tanks may be used to store products with high flashpoints (e.g., #6 heating oil) or low flashpoints (e.g., gasoline). When #6 heating oil is stored it must be heated to keep it in a fluid state to facilitate easy transfer to and from the storage tank. However, the Certificate of Fitness holder must make sure that the heating oil is maintained at a temperature below its flashpoint. When gasoline is stored in the cone roof tank care must be taken to make sure that the vapors given off by the gasoline are not ignited by static electricity. To prevent accidental ignition due to static electricity each tank must be

electrically grounded. This is particularly important when transferring product to or from the tank. An example of a typical cone-roof tank is shown below:



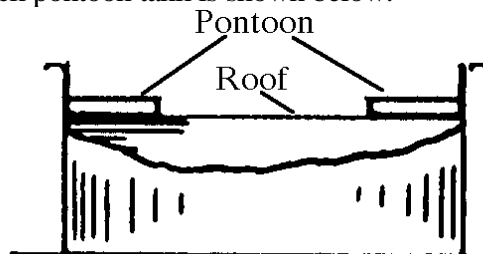
TYPICAL CONE-ROOF TANK

FLOATING-ROOF TANKS

There are two types of floating roof tanks: **Open-Top** and **Covered Tanks**.

Open-Top Floating-Roof Tanks.

These tanks have a floating-roof installed. This roof simply rests upon the product and moves up and down as the product level increases or decreases. The floating roof tanks are used to store products with lower flashpoints (e.g., gasoline and certain types of aviation jet fuel). There are two types of open-top floating-roof tanks. They are called the (a) **Single Deck Pontoon**, and (b) **Double Deck Pontoon** tanks. The roof in each of these tanks floats on top of the product. The roof on the single deck pontoon has a single floatation compartment installed. This compartment is designed to prevent the roof from sinking into the product. The double deck pontoon roof has two floatation compartments installed. An example of a typical double deck pontoon tank is shown below.



TYPICAL DOUBLE DECK PONTOON TANK

Covered Floating-Roof Tanks

These tanks are similar to the cone roof tanks. However, they have a pan-type floating-roof installed inside the tank. The pan roof consists of a single level roof, which floats on the product. There are pontoons installed on the pan roof to aid floating.

MOUNDED-OVER TANKS

Mounded-over tanks may be installed in some bulk storage plants. The mounded-over tanks are installed either partially or completely underground. These tanks must be completely covered over with earth or

reinforced concrete.

Expansion Space in Cone Roof and Mounded-Over Tanks

The Certificate of Fitness holder must make sure that the storage tanks are **never** filled to capacity. An expansion space must be maintained to allow for the possible expansion of the product. Liquid petroleum products expand when their temperature increases. For example, gasoline expands 0.07 % in volume for each 10°F increase in temperature within ordinary temperature ranges. The expansion space also permits the foam to be distributed onto the top of the product in case of an emergency. The Certificate of Fitness holder must calculate the amount of product that may be safely transferred to each storage tank.

Generally, the tank should not be filled above 95% of the tank's total capacity, and it must **never** be filled to above 98% total capacity.

Vapor Recovery Systems

A vapor recovery system may be installed to draw combustible vapors from storage tanks. Under normal conditions, this vapor is super saturated. However, this vapor may become combustible when the temperature of the product drops suddenly. For example, the vapor may become combustible when the tank is cooled by a rainstorm on a hot day. It may also be cooled when transferring product from the tank. These conditions allow the vapor to mix more readily with oxygen inside the tank placing the vapor within the combustible range. The vapor may remain within combustible range for several hours before it is condensed back into the product.

A vapor recovery system may be installed when a **cone roof tank** is used to store products with a low flashpoint. This system is designed to capture and remove vapors from the storage tanks through piping. This piping is connected to a manifold, which directs the vapors to a vapor recovery unit. The vapor recovery unit is used to process the vapors before they are returned to a storage tank, or are burned off.

There is less concern for the amount of vapor generated inside **mounded-over tank**. These tanks are less likely to be effected by the temperature increases necessary to generate vapor. The added insulation of additional concrete, steel and earth protect the product against the potential heat sources. Generally, these tanks are used to store fuel oils.

Tank Vents

Each tank must be fitted with vents to permit normal venting during the transfer of product to and from the tank. These vents are required to prevent distortion of the tank during product transfer. Tanks used for the storage of products with a flashpoint below 100°F may have venting devices that remain closed under normal conditions. These vents will open when the tank is under pressure. Tanks used for products with a flashpoint above 100°F have venting devices that remain open. The vents in the storage tanks may be connected to a vapor recovery system.

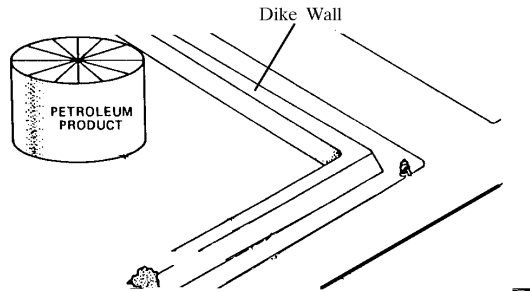
Transfer of Product Between Tanks

All tanks in the bulk storage plant must be interconnected by a series of pipelines. These pipelines permit the contents of each tank containing the same product to be transferred to any another tank in the storage

plant. This system may be used to transfer product from one tank to another when a leak is discovered.

Dikes

Dikes must be installed around all above ground storage tanks. These dikes are designed to prevent the flow of the product to other property and waterways in case of a spill. The dike walls must be constructed of earth, steel or reinforced concrete. Each dike must be liquid tight, and capable of withstanding a full hydraulic head. Some dikes are constructed so that they form a steel enclosure around each tank. Other dikes are designed to form a concrete or earth wall around several tanks. An example of a typical earth-type dike well is shown below:



TYPICAL EARTH-TYPE DYKE WALL

Emergency Shut-off Valves and Levers

All above ground and certain mounded-over tanks must be fitted with either an emergency shut-off valve. They must be installed at the point where the product line enters or leaves the tank and outside the dike wall for cone and floating roof tanks. A single emergency shut-off valve must be installed for some mounded-over tanks. It must be installed close to the tank just outside the earth or concrete enclosure.

Each emergency shut-off valve must have a fusible link installed. The fusible link permits the valve to be closed automatically when exposed to a predetermined temperature, approximately 165°. For example, when exposed to a fire the fusible link will melt and cause the valve to close automatically. When in the closed position it will prevent the product from entering or leaving the storage tank. The shut-off valves may also be manually operated.

Overfill Alarms

Overfill alarms must be installed on all storage tanks. They are designed to automatically send a signal to an annunciation panel located inside the supervised office and to the marine or pipeline receiving station when the product level inside the tank approaches a predetermined level. The first alarm is called the **HIGH-ALARM**. The Fire Department requires the high-alarm to be calibrated to signal when the tank is filled to 95% of its total capacity. The second alarm is called the **HIGH-HIGH ALARM**. The Fire Department requires the high-high alarm to be calibrated to signal when the tank is filled to 98% of its total capacity. (The HIGH and HIGH-HIGH alarms in some storage tanks may be calibrated to signal when the tank is filled to levels less than 95% and 98% total capacity. For example, the HIGH and

HIGH-HIGH alarms may be calibrated to signal when the tank is filled to 90% and 95% total capacity respectively. However, the HIGH and HIGH-HIGH alarms **must not** be calibrated to signal when the tank is filled to levels greater than 95% and 98% total capacity respectively.

When the product is delivered by a pipeline company an overflow protection device is installed. It is designed to automatically shut down the product transfer when the HIGH-HIGH alarm sounds.

FIRE PROTECTION SYSTEMS

All above ground and mounded tanks, loading racks, and other parts of the bulk storage plant must be protected by approved fire protection systems. The Certificate of Fitness holder must make sure that all fire protection systems are maintained in working order.

Portable Fire Extinguishers

Several portable fire extinguishers must be provided throughout the bulk storage plant. These extinguishers must be located in plain view and kept unobstructed at all times.

Sprinkler Systems

Sprinkler systems may be installed in the storage plant. The sprinkler systems are designed to automatically or manually discharge water through sprinkler heads in case of a fire emergency. Several water supply sources may be used for the sprinkler system. For example, gravity tanks, public water mains and water from a river or the ocean may be used. A siamese connection must be installed as part of the sprinkler system. This connection permits the Fire Department to pump water at high pressure through the sprinkler system's piping. An example of a typical Fire Department siamese connection is shown on the following page.

Yard Hydrant System

A yard hydrant fire protection system must be installed in each bulk storage plant. The yard system may be used to discharge water or foam in case of a fire emergency. This system consists of a series of interconnected pipelines that surround all tanks in the plant. Several hose cabinets are located at intervals along the system. Hoses, nozzles and other fire fighting equipment are stored inside these hose cabinets. Both fresh and salt water may be used to supply the yard hydrant system. For example, pumps may be used to draw water from rivers, gravity tanks and public water mains. These pumps then distribute the water throughout the yard hydrant system. Jockey pumps may be installed to maintain water pressure throughout the plant's yard hydrant system. Fire Department siamese connections must be installed as part of the plant's yard hydrant system.

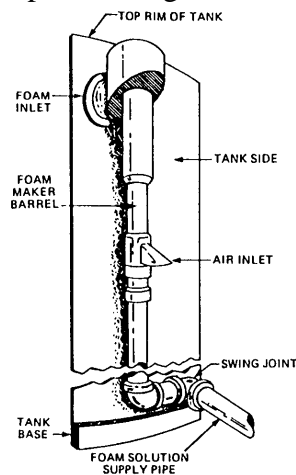
Water is effective when attempting to reduce the temperature of the product inside a storage tank. Sometimes it is necessary to cool down storage tanks to prevent a fire. For example, it may be necessary to cool down a tank when it is located next to a burning tank. The heat generated by the burning tank may cause the contents of the neighboring tank to ignite. By cooling the tank the fire fighters lower the temperature of the product inside the tank. This in turn will reduce the likelihood of the product igniting.

Water may also be discharged through spray outlets when a fire occurs in the loading rack area.

Foam Systems

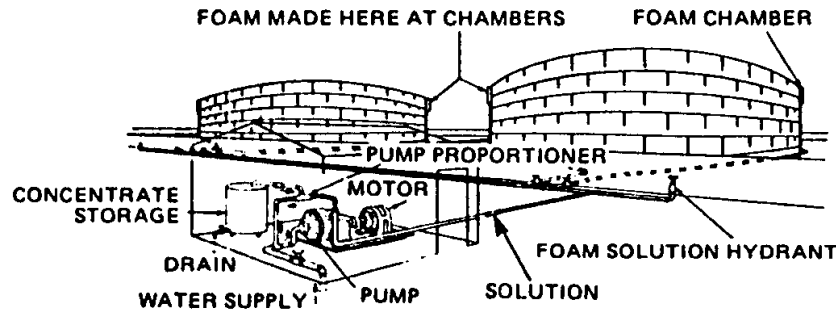
Foam fire protection systems are very effective in extinguishing fires in the bulk storage plants. The foam system may be supplied by the yard hydrant system. However, a dedicated foam fire protection system is more common. Foam is created by mixing a 3% or 6% foam concentrate with water and air. When the foam is discharged it forms a blanket that floats on top of the burning product. The foam is designed to smother the flame and prevent re-ignition. Two types of foam may be produced, mechanical or chemical. Some are light and quickly form a fire resistant blanket when discharged. Others are heavy and require more time to form a fire resistant blanket. The Certificate of Fitness holder must be familiar with the foam system installed in his/her plant.

Several fixed foam-generating systems may be used to produce foam in case of an emergency. These systems automatically control the water and foam concentrate mixture. Some systems discharge foam directly into the storage tank in case of a fire. This foam is discharged into the tank through the foam chambers. The foam then forms a blanket that covers the top of the product. The foam blanket will smother and then extinguish the fire. The figure below shows an example of a typical foam chamber attached to the top of a storage tank.



TYPICAL FOAM CHAMBER

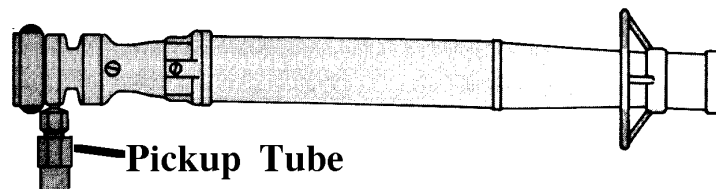
Both fixed and portable foam generating systems may be used to supply the foam chambers. Commonly these systems are supplied with foam from a central "Foam House" distribution system. In these systems the foam and the water are automatically mixed and distributed through pipelines to the burning tank. A Fire Department siamese connection must be installed as part of the fire protection system. The siamese connection may be used by the Fire Department to pump a foam solution directly to the burning tank. The figure below shows an example of a typical central "foam house" distribution system.



TYPICAL CENTRAL FOAM HOUSE DISTRIBUTION SYSTEM

Foam monitors are commonly installed throughout the tank farm area. Fixed monitor may be installed at several locations throughout the storage plant. Monitors are extremely powerful and are commonly used to discharge foam/water onto the top of a burning tank.

Portable foam-generating systems are also used in bulk storage plants. Generally, these systems are used to extinguish smaller fires and/or spills. The portable foam generating units are manually operated by one person. They consist of an aspirator nozzle with a pick-up tube attached. The nozzle is attached to a water charged hose. The pick-up tube extending from the side of the nozzle is inserted into a container filled with foam concentrate. When water is pumped through the water hose into the nozzle it draws the foam concentrate from the container. The water, the foam concentrate and air are mixed inside the nozzle before being discharged as foam. An example of a typical foam discharge nozzle with a pick-up tube is shown below.



TYPICAL FOAM DISCHARGE NOZZLE

Foam Sprinkler Systems

Foam sprinkler systems may be installed at the truck loading racks in storage plants. They may be manual or automatic in operation. The automatic systems may be actuated by smoke or fire detectors. Once actuated the foam is automatically mixed and then discharged onto the fire. These systems may be used in conjunction with water-based sprinkler systems.

The Certificate of Fitness holder must know how to control and operate all foam generating systems located at the bulk storage plant. He/she is responsible for maintaining the system in working order.

Use of the Foam Fire Protection System

Special procedures must be followed to ensure that the foam system is used most effectively and

efficiently.

1. The foam should be applied gently at a controlled rate onto the surface of the product. This will reduce the amount of time required to extinguish the fire. It will also reduce the amount of foam required to extinguish the fire and prevent a tank overflow.
2. The foam concentrate should be mixed with the water at the recommended rate. Increasing or decreasing the percentage of foam concentrate may reduce the effectiveness of the foam.
3. The foam should be discharged at the recommended rate. Increasing the discharge rate will often increase the amount of time required to extinguish the fire. The recommended discharge rate is most efficient in terms of speed and control.
4. When possible, the water used to create the foam solution should be free of contaminants. Contaminants may have an adverse impact on the quality of the foam solution.
5. Care must be taken when discharging foam onto the floating roof of a storage tank. The fire fighting personnel must be aware that the tank can only withstand the weight of a certain amount of foam. When too much foam is discharged onto the top of a floating roof tank it can cause the roof to sink into the product.

Color Coding and Labeling of the Fire Protection Systems.

The fire protection systems in the bulk storage plant must be color-coded. The color coding system makes it easier for the Fire Department to determine what fire protection systems are installed in the plant. Copies of the color coding system must be posted in all central locations used for fire extinguishing equipment. For example, they must be posted in the foam houses and in the dispatcher's office.

Standpipe and yard hydrant systems. The piping valves and hydrants on standpipe and yard hydrant systems must be painted red with white bands. The Fire Department connection to the standpipe and yard hydrant systems must be painted red with white caps.

Automatic sprinkler systems. Piping on automatic sprinkler systems must be painted red with bright green bands. The Fire Department connection to the automatic sprinkler systems must be painted red with green caps.

Foam Extinguishing Systems. The piping, valves, hydrants and hydrants houses must be painted red with bright orange bands. The Fire Department siamese connections must be painted red with orange caps. A permanent sign must be displayed beside the Fire Department water connections. The sign must read "**WATER FOR FOAM SYSTEM**". A sign must be posted next to the Fire Department foam connection. The sign must read "**CHEMICAL FOAM DIRECT TO TANKS**" or "**...% MECHANICAL FOAM SOLUTION DIRECT TO TANKS**".

Transfer of product to the storage plants

The Certificate of Fitness holder must determine the level of product in a given storage tank before any product may be transferred to that tank. The product level must be measured using a tape gauge. Then the Certificate of Fitness holder must calculate the amount of product that can be safely transferred to the tank. Product may be transferred to a tank from a marine vessel, through a pipeline company's pipeline or through an intra-plant pipeline system. Care must be taken to make sure that the storage tank is not over-filled during these transfers. The Certificate of Fitness holder is responsible for the product transfer and must supervise all transfer operations. The product level must be physically gauged periodically during the transfer and all safety regulations must be followed. When the product is transferred from a marine vessel the Certificate of Fitness holder must report to and follow the instructions issued by the Coast Guard.

Emergency Procedures

Special procedures must be followed when a leak is discovered during the transfer of product to a storage tank. The product supply line must be shut-off immediately. This is achieved by closing the shut-off valve. Then the Fire Department must be notified by telephone. The Fire Department must be told the type of product spilled and the exact location of the spill. This will allow the Fire Department to develop their strategy. The Fire Department may be contacted using the appropriate phone number from the list shown below. A local alarm may also be sounded to alert personnel that there has been a spill at the plant. Plant personnel must follow established procedures for containing the spill.

Manhattan	(212) 999-2222
Bronx	(718) 999-3333
Queens	(718) 999-5555
Brooklyn	(718) 999-4444
Staten Island	(718) 999-6666

These phone numbers must be posted at the phones most likely to be used in case of an emergency. The Certificate of Fitness holder may dial 911 if the Fire Department cannot be contacted by dialing one of the numbers above. The Class III fire alarm boxes installed throughout the plant may be used to alert the Fire Department when spills occur. The Certificate of Fitness holder must know the location of and how to operate each of the fire alarm boxes installed in the plant. The Certificate of Fitness holder must report all spills to the Fire Department. If a spill is not reported, the Certificate of Fitness holders may have their Certificate of Fitness revoked. He/she may also be subject to fines and possibly lose his/her job.

Absorbent Materials Used to Control Product Spills

Absorbent material may be used to soak up the product in case of a spill. The absorbent material must meet the minimum absorption standards established by the Fire Commissioner. Generally, each pound of the absorbent material must be capable of absorbing a half-gallon of the spilled product. The quantity of absorbent material required is determined by the Fire Commissioner.

RESPONSIBILITIES AND DUTIES

The Certificate of Fitness holder must make sure that all fire safety regulations are obeyed at the plant. He/she must also make sure that all fire protection systems are maintained in good working order. When any defective equipment is discovered the Certificate of Fitness holder must notify the Fire Department immediately. The Fire Department must also be notified when any part of the fire protection system is shut down. This will allow the Fire Department to modify its fire fighting strategies for the plant in case of an emergency. The Certificate of Fitness holder must then make arrangements to have the equipment repaired or replaced. A violation may be issued to the Certificate of Fitness holder when the Fire Department rules and regulations are not followed at the plant. In serious cases, the Certificate of Fitness may be revoked.

Testing and Maintenance

Portable fire extinguishers must be inspected at least once every six months. These inspections must be conducted by an authorized representative of the manufacturer. The extinguisher must be inspected to make sure that all extinguishers are fully charged. Defective extinguishers must be repaired or replaced. The name of the person conducting the inspections and the date must be recorded on the tag attached to the fire extinguisher. The Certificate of Fitness holder may also record these inspections in his/her log.

The Certificate of Fitness holder must visually inspect the sprinkler system at least once every month. When defects are discovered they must be reported to the Fire Department immediately. This will allow the Fire Department to modify its fire fighting strategy in case of an emergency. The Certificate of Fitness holder must then make sure that the defects are repaired. An extra supply of at least 6 sprinkler heads must be kept available at the bulk storage plant at all times. They must be used to replace damaged or defective sprinkler heads.

All fire extinguishing systems must be performance tested at least once every two years. The fire protection systems at each tank must be tested. This test is designed to make sure that there is a sufficient waterflow to supply the fire fighting equipment and that they are maintained correctly.

The foam systems must also be inspected to make sure that they are capable of producing the foam at the required rate. Tests of the water foam fire protection systems must be conducted at the tank farthest from the foam-making unit.

Fire Department Inspections

The Fire Department may conduct unscheduled inspections of the bulk storage plant. The fire safety systems and equipment may be checked during these inspections. The Fire Department views the Certificate of Fitness holder directly responsible for the condition of the fire safety systems and equipment at the plant. A violation may be issued to the Certificate of Fitness holder if any defects are discovered during these inspections. In serious cases the Certificate of Fitness may be revoked or an enforcement action taken.

The vapor recovery units must be inspected at least once every 6 months. These inspections must be conducted by an authorized representative of the manufacturer and recorded in the plant inspection log. All tests and inspections of the fire protection systems at the plant must be recorded in the plant's logbook.

Transfer of Product to Tank Trucks

The liquid petroleum products may be transferred to tank trucks when operations are supervised by the Certificate of Fitness holder. The Certificate of Fitness holder must make sure that all safety procedures are followed during the transfer. Fuel oil products may not be transferred to the tank truck unless the requirements on the sign shown below are satisfied. The following sign must be posted at each loading rack bay used to dispense fuel oil:

<p style="text-align: center;"><u>NO FUEL OIL TANK SHALL BE LOADED UNLESS IT HAS:</u></p> <ol style="list-style-type: none">1. A current Fire Department Permit and sticker for the type and amount of oil listed.2. A driver with a current commercial driver's license with Haz Mat endorsement.3. Capacity of compartments shown on tank.
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No tank may be filled to exceed USDOT requirements.

Truck Loading Racks

Truck loading racks may be installed in bulk storage plants. They are used when dispensing products from the storage tanks to the tank trucks. The loading rack must be properly grounded. The piping and loading arms of this structure must be equipped with automatic shutoff valves. These valves are designed to automatically stop the dispensing of the product in case of an emergency. The piping and loading arms must be protected against static electricity and arcing. The trucks are protected by grounding the tank truck using a metallic bond-wire. One end of the wire must be permanently connected to the loading rack. A clamping device must be installed at the other end of the wire. The clamp must be attached to a metallic part of the tank truck before the dome covers on the tank truck are opened. This prevents static electric sparks and electrical arcing from igniting the product. The clamp must not be removed until the transfer is complete and the dome covers are closed.

Each loading rack used to dispense gasoline must be equipped with a vapor recovery unit. It is designed to capture any vapors that may be emitted while dispensing the gasoline into the tank truck. A fire detection device must be installed as part of the vapor recovery unit that will shut down the vapor recovery unit in case of a fire emergency. When a fire is discovered an alarm signal will be automatically transmitted to the Fire Department via a central office connection.

Fire safety signs must be posted near the vapor recovery unit. These signs must read:

Danger - No Smoking, Matches, Open Lights

or

No Sparking Devices at the Unit

The following fire safety devices must be installed within 50 feet of the vapor recovery units:

- (a) foam hydrant
- (b) yard hydrant and monitor nozzle
- (c) a portable dry chemical fire extinguisher with a minimum of 40 BC

Many loading racks are equipped with a water spray system. This system is used to discharge water on the tank truck in case of a fire emergency. Several spray outlets are required above each tank truck loading position. These spray outlets are controlled by a manually or automatically operated control valve. The Certificate of Fitness holder must know the location of, and how to operate this control valve in case of an emergency.

Fire Safety Signs

NO-SMOKING signs must be prominently displayed throughout the bulk storage plant. The Certificate of Fitness holder must make sure that these signs are kept visible at all times.

HANDLING MOTOR FUEL (PRIVATE FILL STATION)

A permit is required in order to operate a private fill station. This permit may be included in your Bulk Oil Permit.

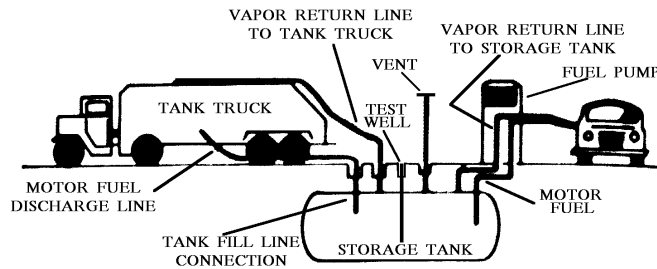
TANKS

Only approved tanks may be used to store motor fuel. Approved tanks are those tanks that meet the design and safety specifications of the Fire Commissioner's Office. An accurate log of the contents of the tanks must be recorded. This log must be completed by the Certificate of Fitness holder. This record should include the amount of fuel sold each day and the amount of fuel in the tank. The tanks must be inspected daily. They should be checked for defective equipment and leaks. If any leaks or defects are discovered, they should be repaired immediately. A record of each inspection and all repairs must also be recorded in the log. Depending on the location the tank may be installed above or below ground level. Each tank must be hydrostatically tested every 10 years. This test must be conducted by a qualified technician.

The maximum capacity of a single storage tank is 4,000 gallons of motor fuel. There may be several storage tanks at a service station. However, there is a limit on the total amount of motor fuel permitted in a service station. The combined contents of all tanks in a service station must be less than 20,000 gallons.

Tank trucks are used to transfer motor fuel into the storage tanks. The motor fuel is transferred by gravity or pulled up from the tank truck into the storage tank. The Certificate of Fitness holder should observe the filling of the storage tanks on the premises. The motor of the tank truck should be shut off while making the transfer. Chock blocks should be placed under the wheels of the truck. The chock blocks prevent the truck from moving. The Certificate of Fitness holder make sure that the vapor return line is securely connected to the storage tank and the tank truck. The vapor-return line prevents the flammable vapors from escaping into the atmosphere. The motor fuel discharge line must also be checked to make sure that it is securely connected to the tank truck and the storage tank. If any leaks are noticed, the transfer should be stopped immediately. The defects or the leaks must be repaired before transferring

any more motor fuel into the storage tank. The transfer of motor fuel from a tank truck to a storage tank is shown below.



TRANSFER OF MOTOR FUEL FROM A TANK TRUCK TO A STORAGE TANK

A test well or gauge line on the storage tank allows the attendant to determine how much fuel is in the storage tank. The Certificate of Fitness holder and the driver making the delivery are both responsible to be sure that the test well connection is closed while filling the tanks. The test well may not be opened to speed up the filling of the storage tank. It must remain closed to make sure that no flammable vapors escape into the atmosphere. The test well may only be used to determine the amount of motor fuel in the storage tank.

DISPENSING MOTOR FUEL AT PRIVATE FILL STATIONS

Fuel is dispensed into a vehicle using a fuel pump. These pumps are usually powered by electricity. All of the pumps are connected to an electrical circuit breaker. The breaker allows the pumps to be quickly shut off in case of an emergency. The fuel is pumped through a hose when filling the vehicle. The maximum acceptable length of the dispensing hose for automotive service stations is 16 feet. Never attempt to use a longer hose. Instead, move the vehicle closer to the dispenser.

The pump has a dispensing control device installed. The control device is usually a lever installed next to a nozzle holding bracket. The control device may be turned on only when the pump nozzle is taken out of its holding bracket. It may be shut off when the pump nozzle is placed back into the holding bracket. No attempt should be made to bypass this control device. The nozzle must be placed back into holding bracket after use. Keeping the nozzle in the holding bracket reduces the risk of the hose being damaged. The vehicle's motor must always be turned off before fuel is pumped into the vehicle's tank.

The hose and nozzle must never be left laying on the ground. If the hose and nozzle are on the ground they are exposed to physical damage. This damage may result in leaks and malfunctions of the system. The hose and nozzle must always be replaced in the holding bracket when not in use.

Some installations have a vapor recovery system installed. This system is designed to capture the vapors that escape when dispensing motor fuel. These vapors are potentially dangerous. They may be ignited by sparks or open flames. A shroud is installed over the nozzle. This shroud draws the vapors into a hose. The hose is connected to the storage tank. If the vapor recovery system is installed the Certificate of Fitness holder must make sure that it is working correctly.

The Certificate of Fitness holder may pump motor fuel only into an approved portable container. The maximum capacity of the container is 1 gallon. The container must be made of metal. The container must have a cap attached. The cap must be fitted with a spout. The spout is designed to allow the motor fuel to be poured without spilling. The contents of the container must be clearly marked on the side of the container. Never fill a portable container while it is in the trunk of a vehicle. This is to make sure that no motor fuel is accidentally spilled into the trunk of the vehicle. Motor fuel must never be dispensed into glass or plastic containers.

PRIVATE FILL STATION DESIGN

The Certificate of Fitness holder must know the layout of the fuel storage system. The location of the test well, the fill line, the vent line, and the suction line to the pumps must be known. The Certificate of Fitness holder should know how to use the test well and measuring stick to determine the amount of motor fuel in a storage tank. The measuring stick is used in the same way a dipstick is used to determine the level of oil in an automobile engine. First, the measuring stick must be wiped clean. The stick is then inserted into the test well. The measuring stick is then removed and read. The stick is read by comparing the level of fuel on the stick to the measurement marks on the stick. This method allows the Certificate of Fitness holder to estimate the amount of fuel in the tank. The Certificate of Fitness holder must know this information to make sure that the tank is not overfilled accidentally.

SAFETY REGULATIONS

Motor fuels are flammable and easily ignited. For this reason no smoking is permitted anywhere on the premises. The penalty for smoking is a fine up to \$500.00, and/or imprisonment for up to 6 months. This applies to customers as well as employees. Signs must be posted indicating that no smoking is permitted on the premises.

Motor fuel should never be used to wash or clean automobile engines. This is extremely dangerous as the motor fuels are easily ignited by the heat generated by the engine.

Oily rags are also a potential fire hazard. The oily rags may be easily ignited by a spark or an open flame. Oily rags used in the service station should be stored in a metal container. This container should have a self-closing lid. The container is sometimes called a flash can. Oily rags should be replaced daily with clean rags. This container should not be stored close to any possible sources of ignition.

All oil drained from vehicles must be stored in tanks or drums. These tanks and drums should be stored outdoors. The oils are combustible and should not be exposed to sparks or open flames. They must be removed only by an approved liquid waste removal agency. Never dump any of these oils into a sewer, stream or anywhere on the property. Severe penalties will be levied against anyone who illegally dumps waste oil.

EMERGENCY PROCEDURES

The Certificate of Fitness holder must know where all control devices and fire extinguishers are located

for the private fill station. The Certificate of Fitness holder should know how to operate the control devices and extinguishers in emergency situations.

If a fire occurs, the emergency pump shut off breaker should be tripped. The Fire Department should be notified immediately. Efforts should be made to extinguish the fire with the approved fire extinguishing materials. Approved materials include sand pails, ansul powder and CO₂ fire extinguishers. If a car is on fire it should be pushed away from the pumps, if possible. These steps may prevent a major explosion.

The Certificate of Fitness holder should pour sand or other absorbing material on a motor fuel spill. "Speedy Dry" (like cat litter) is commonly used to contain and soak up motor fuel spills. The area should then be cleaned up using approved materials. If a large spill or leak occurs the local Fire Department must be notified immediately.

INSPECTION AND TESTING

Fire extinguishers must be periodically inspected to make sure that they are working properly. They should be tested according to the schedule recommended by the manufacturer. All inspections should be recorded on the tag attached to the fire extinguisher. All tanks must be hydrostatically tested once every 5 years. The test must be made by a qualified technician. The Fire Department should always be notified in case of a fire. The Fire Department should also be notified in case of an emergency such as a large spill of fuel.

AUTOMATIC SPRINKLER SYSTEMS

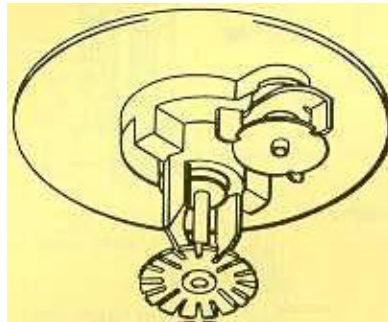
Automatic sprinkler systems are designed to automatically distribute water on a fire. The sprinkler system is designed to extinguish the fire entirely, or to prevent the spread of the fire. An automatic sprinkler system consists of a series of pipes at or near the ceiling in a building. The sprinkler system is fitted with automatic devices designed to release water on a fire. These devices are called sprinkler heads. The sprinkler heads are normally closed by a disk or cap. This cap is held in place by a heat sensitive releasing element. A rise in temperature to a predetermined heat causes the sprinkler head to open. Water is then discharged in the form of spray. When the sprinkler heads open they are said to have fused. The sprinkler heads are fitted at standard intervals on the piping. If more than one head opens, the area sprayed by each overlaps that of the sprinkler head next to it.

Most standard sprinkler systems have devices that automatically give an alarm when a sprinkler discharges water. This alarm is usually an audible signal in the building. In many cases they also give an alarm at a remote location, such as the local Fire Department or a central station. The central station monitors the entire fire protection system for water discharge and problems with the equipment. When water discharge or equipment problems are identified the local Fire Department is immediately notified. This allows the Fire Department to gain control of a fire as quickly as possible. Water is rarely discharged accidentally from sprinkler heads.

SPRINKLER HEADS

Care must be taken to make certain that no part of a sprinkler head is covered with paint when the

piping is being painted. Such a coating may interfere with the free movement of parts and delay its opening, or make it inoperative. When painting the piping or nearby areas, the heads should be protected by covering them with paper bags. These bags should be removed as soon as the painting is finished. Sprinkler heads are to be inspected and kept clean of any foreign build-up and dust. The picture below shows a typical sprinkler head.



TYPICAL SPRINKLER HEAD

Spray Pattern of Sprinklers: The best way to put out a fire is to spray the water from the sprinkler head downward and horizontally. The spray pattern will also prevent the spread of the fire. The force of the water against the deflector creates a heavy spray, which is directed outward and downward. The shape of the deflector determines the spray pattern of the water discharged from the sprinkler head. Usually, this is an umbrella shaped spray pattern. At a distance of 4 feet below the deflector, the spray covers a circular area having a diameter of approximately 16 feet when the sprinkler is discharging 15 gpm. The newest kinds of sprinkler heads allow the sprinklers to be placed farther apart need lower flow rates to give coverage to an area. These new heads offer more effective fire protection and are less likely to cause water damage than the old sprinkler heads.

Temperature Ratings of Sprinkler Heads: Automatic sprinkler heads have various temperature ratings, which state the temperatures at which they will fuse. The temperature rating of all solder type automatic sprinklers is stamped on the soldered link. For other heat sensitive units, the temperature rating is stamped on one of the releasing parts. The temperature ratings of sprinkler are also indicated by a color coding system.

Build up of Foreign Material on Sprinklers: Sometimes sprinklers need to be protected when ceilings or piping are being painted. Usually a small lightweight paper bag or a sheet of lightweight paper is placed over the heads until the painting is completed. The bag or the sheet of paper should be secured with a rubber band. The bags are likely to delay the operation of the sprinklers and should be removed immediately after the painting is completed. There is no known method to safely remove paint from under the water cap or on the fusible link. Sprinklers that have been painted other than by the manufacturer must be replaced with new units.

A supply of at least six extra sprinklers should always be kept in a sprinkler cabinet. This extra supply should be used to promptly replace any sprinklers that have opened or have been damaged. The extra supply of sprinklers should be exactly the same as the sprinklers already installed in the system. It is very

important that the replacement sprinkler heads have the same temperature rating as those installed in the system.

WATER SUPPLIES FOR SPRINKLER SYSTEMS

The methods used to supply water to sprinkler systems are the same as those for standpipe systems. Sprinklers may be supplied from one or a combination of sources. For example, they may be supplied by public mains, gravity tanks, pressure tanks, fire pumps, reservoirs, rivers, or lakes. A single water supply would appear to be all that is needed to supply a sprinkler protection system. It is recommended that a secondary water supply be available. A single water supply may be out of service (for maintenance or repair) during a fire emergency or it may be disabled during fire or before the fire is fully extinguished. Additionally, the water supply may fall below normal pressure or volume during an emergency. These are just a few reasons why it is good to have a second water supply.

When a sprinkler system is supplied from a public water main, the entire system may be closed down by closing a control valve. This valve is located between the building and the water main in a box that is recessed into the sidewalk. The location of the box is found by reading a sign on a building or post nearby. The sign will read **"Shutoff for Sprinkler System Located 6 Feet From This Sign,"** or it will have similar instructions. A special key may be required to operate this valve.

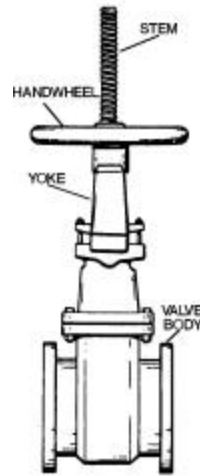
The control valve for the building may also be attached to an upright post, known as a post indicator valve (PIV). The building or section of the building controlled by the valve is usually marked on the post. The position of this valve (open or closed) is shown through a telltale opening in the post. On some posts, a padlock must first be opened or forced to release the operating wrench. On others, an iron strap must first be released by cutting a riveted leather section. A diagram of a typical PIV is shown on the following page.

The main water supply for sprinklers may also be controlled an OS&Y valve (Outside Screw and Yolk valve). The OS&Y valves are found just inside the building wall on the main riser, or outside in protected pits. It is easy to tell at a glance if the valve is open or shut. When the stem is all the way out the valve is open. When the stem is all the way in the valve is closed. Some OS&Y valves



TYPICAL POST INDICATOR VALVE (PIV)

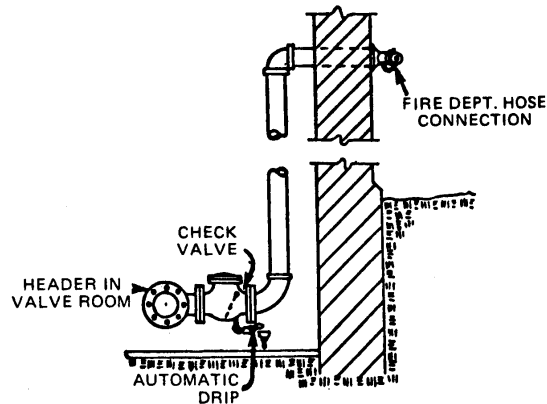
may be used to control the water supply for individual floors in a building. The OS&Y valves are also installed to shut off certain sections of an individual floor. Being able to shutoff parts of a building allows the Fire Department to have greater control over the sprinkler system.. When a fire is under control in an area the OS&Y valve can be closed to prevent any further water damage. A typical OS&Y valve is shown below.



TYPICAL OS&Y VALVE

Sometimes repairs must be made to the sprinkler system. When this happens the OS&Y valves are used to close the water supply to only those sections being repaired. This is good because the rest of the sprinkler system does not have to be shut down.

Siamese Connections for Fire Department Use: Normally a sprinkler system is connected to an automatic water supply source. Auxiliary sources of water are supplied through Fire Department siamese connections at the building. Siamese connections are a standard part of all sprinkler systems. When responding to an alarm most Fire Departments supply water to the standpipe system first. The standpipe system supplies water to the fire hoses. Water is then supplied to the sprinkler system through its own siamese connection. Care should be taken that standpipe and the sprinkler connections are properly marked because the connections look the same. The exact purpose of each siamese connection should be shown nearby or on the siamese connection itself. The New York Building Code requires siamese connections to be color-coded. The diagram below shows a typical siamese connection for Fire Department use.



TYPICAL FIRE DEPARTMENT SIAMESE CONNECTION

Fire Department connections must always be accessible. Each connection must be fitted with a check valve, but not with a gate valve. The check valve prevents the draining of the system.

The automatic drip device between the check valve and the outside hose coupling prevents water from building up in the dry portion of the piping. This drip device makes sure that the Fire Department connection is not blocked by water that has frozen in the piping. If water freezes in the piping, the Fire Department will not be able to pump water into the system.

FIRE PUMPS

A fire pump having both a reliable source of power and a reliable suction water supply is a desirable piece of equipment. A suction water supply is simply a body of water that the pump can draw water from. Fire pumps are commonly used because they can pump water into the sprinkler system under high pressure. With a good water supply a fire pump can pump water into a sprinkler system for a long time.

A fire pump can be started automatically or manually. The pump can be started automatically by an electric controller or an engine controller. These controllers activate the pump when there is a drop of water pressure or water flow in the fire protection system. The controllers are adjusted so that a minor drop in water pressure or minor increase in water flow due to a small leak will not activate the pumps. The controllers for the fire pumps are expensive, require extensive maintenance and periodic testing. Where electric motor drive is used, a standby power generator is sometimes required. If an engine controller is used the appropriate fuel storage tanks should be filled and checked regularly.

Manually started pumps may be used as a secondary supply source if the primary water supply will last long enough to allow the pump to be started. This kind of system must give an automatic waterflow signal to the Certificate of Fitness holder when the pump must be started.

Fire pumps can be used as a main water supply source for sprinkler systems. There may also be used in combination with gravity tanks and pressure tanks to supply sprinkler system. Fire pumps are designed to take the water from a supply source and then discharge the water into the fire protection system under pressure. The amount of pressure with which the water is discharged from the pump is called the total head. The total head is usually measured in pounds per square inch (psi). The higher the psi rating of the

pump the greater the pressure with which the water can be discharged. Acceptable fire pumps must deliver a minimum of at least 25 psi at the highest line of sprinkler heads in the fire protection system.

The Centrifugal Pump. The centrifugal fire pump is the standard pump currently used in fire protection systems. This is the preferred pump because it is reliable, compact, requires low maintenance, and it can be powered by a variety of drivers including: electric motors, internal combustion engines, and steam turbines.

The water available to the centrifugal pump must always be under pressure because the pump cannot draw water for the supply source. A water tank can be used if the tank supplies the pump due to gravity. In other words the weight of the water forces the water to flow into the pump. This type of water tank is called a suction tank. The water flows from tank through the supply inlet into the pump. As the water passes to the center of the pump it reaches a rotating impeller. This impeller is designed to grab the water on the inlet side of the pump and then discharge the water under increased pressure into the fire protection system.

Depending on the model, centrifugal pumps are capable of discharging water from 25 gpm (gallons per minute) up to 5,000 gpm. Most centrifugal pumps have a single impeller and are therefore commonly called single stage fire pumps.

The Vertical Turbine Pump. A vertical turbine pump is really a modified centrifugal pump that has the capability to draw water from streams, ponds, wells etc. Unlike the standard centrifugal pump the vertical turbine pump does not need the suction supply to be under pressure for it to operate. Instead it draws the water into the pump by suction. The water is drawn into the pump. When it reaches the rotating impellers the water pressure is increased and then forcefully discharged into the fire protection system.

When using a pump to draw water from a suction supply source it is important to ensure the water intake hose, foot valve, and screens are inspected regularly. Mud, gravel, leaves, may cause damage to the pump or obstruct the sprinkler system piping.

Pressure Maintenance Pumps (Jockey Pumps)

Pressure maintenance pumps, sometimes referred to as **jockey**, or **makeup pumps**, are often found on sprinkler systems. These pumps are designed to automatically operate when there is a slight drop in pressure due to the leakage in the system or a pressure surge. The jockey pump restores the pressure in the fire protection system to the desired level. When the drop of pressure in the system greater than the capacity of the jockey pump the fire pump is activated.

Fire Pump Location

The fire pump should be housed in a room that is fire resistant or constructed of noncombustible material. The pump room should be located as close as possible to the fire protection system. The pump room should be kept clean and accessible at all times. The fire pump, driver, and controller should be protected against possible interruption of service. The temperature inside the pump room should be maintained above 40° Fahrenheit at all times to prevent freezing of the water. The pump room should

only be used for fire protection functions and not for general plant operations.

Pump Inspection and Maintenance

In order to ensure the reliable operation of the pump in the case of an emergency regular inspections and maintenance should be conducted by the Certificate of Fitness holder. The pump should be activated each week according to the manufacturer's specifications to ensure that it is functioning properly. When the pump is in operation a small water leak is desirable and should not be considered a malfunction.

The centrifugal pump relies on the water supply for cooling and lubrication and should never be operated without the pump being supplied with water.

A visual inspection of all parts of the pump and the controlling equipment should also be conducted each week. This inspection should include the condition and reliability of the power supply. If any problems are discovered with the equipment immediate action should be taken to correct the problem.

Fire pumps should be fully tested annually to make sure that the pump, driver, power supply and all other parts are functioning properly.

YARD HYDRANT SYSTEMS

A yard hydrant system is most often used in large private manufacturing and bulk oil plants or storage buildings. The yard system is often needed because the public water supply does not meet the needs of the fire protection system. The yard hydrant system usually has several private water sources supplying the total fire protection system. The total system may have a sprinkler system, hydrants, and a standpipe and hose system installed.

The water supply sources are all connected together in the yard system. This allows the water to be directly supplied to any part of the system when needed. Water can be supplied even when one of the supply sources is not working. The combined sources of water keep the water pressure in the system at a high level.

The water supply sources are all connected to a main water supply grid. This supply grid surrounds the entire plant. Control valves are installed at various locations on the system. These valves are called post indicator valves (PIV – see diagram on page 21) . As the name suggests they indicate the position of the valve. The valves are manually operated. Each valve has two positions, opened and closed. Under normal conditions the PIV valves are sealed open.

The PIV valves allow the Fire Department to shut down only part of the system. The PIV valves are also used to shut down parts of the system when conducting repairs and maintenance.

The water in the yard system is not allowed to flow into the public water system. It is prevented from doing so by a check valve and/or back flow preventers.

Fire Pump: The fire pump may draw water from a suction tank and pump it into the system when

needed.

Public Waterworks Connection: The street main supplies water using the water pressure in the public water works system.

Hose Cabinets: Hose cabinets may be installed on the system. The hose cabinet must be painted red and provided with a white strip and number. The cabinet must be accessible at all times. Hoses, nozzles and other fire protection tools are kept in the hose cabinet. Hose connections are located in the hose cabinet. These connections allow the fire fighters to connect directly into the yard system.

Fire Department Siamese Connection: A siamese connection is always installed on the system. The siamese connection is used by the Fire Department to pump water into the system.

INSPECTION AND MAINTENANCE OF YARD SYSTEM

The Certificate of Fitness holder should conduct regular inspections of the entire yard system. A record of all inspections should be made. The Certificate of Fitness of holder should sign and date all records. These records should be kept for at least one year. They should be made available to any representative of the Fire Department.

The Certificate of Fitness holder should make sure that the hose cabinets are in good working order. All equipment inside should be inspected. The hose cabinets must be accessible at all times. The hose house should be painted red at regular intervals. Care should be taken to make sure that the area inside the cabinets is kept clean and dry.

All valves should be checked to make sure that they are in the correct position.

Any problems with the equipment in the yard system should be noted. Major defects should be reported to the Fire Department immediately. In all cases the defects in the system should be repaired immediately.

LOW PRESSURE BOILERS WITH PREHEATERS

The oil storage tank provides the supply of oil for combustion in the oil burner. In its normal condition, #6 fuel oil is very thick, heavy and is not easily pumped through the circulation system. For this reason preheaters are used.

A suction pump circulates the oil throughout the system. Dirt and sediment is present in the fuel oil coming from the oil storage tank. The oil strainer removes most of these contaminants from the oil before the oil reaches the burner. The vacuum gauge is a device that measures pressure below atmospheric pressure. Excessive vacuum readings indicate to the burner operator or supervisor that there is an obstruction in the suction line (such as a dirty oil strainer). When this occurs the flow of oil can be stopped by closing the shut off valve. This permits the operator to clean the strainer or to perform other maintenance.

Preheaters are used to heat the oil further before the oil enters the burner for combustion. The oil is heated to between 160 and 180 degrees Fahrenheit. Preheating makes it easier to pump the oil and also makes it easier to atomize the oil. The oil is pumped to the burner where it is atomized by the spinner or atomizer cup. The atomized oil and air are mixed in the combustion chamber and burned.

The main fuel valve is electrically operated and will open or close the line leading to the atomizer of the oil burner. It will shut down the burner system if there is a failure of ignition or combustion.

Oil circulates through the system back to the storage tank through the oil return line. The normal oil pressure for #6 oil burners is between 30 to 50 psi. A back pressure relief valve is provided for safety if the pressure becomes too great. Additional heaters may be present in the return line to ensure oil is maintained at the proper temperature for easy circulation in the system.

The following are several conditions that can lead to improper operation of the oil burner system and to possibly dangerous conditions:

1. A defective oil cutoff valve can lead to afterdrip. This is a very common fault. The oil drips into the combustion chamber when the burner is off, and the excessive oil is absorbed by the combustion chamber floor and walls. This will cause the burner to be unusually noisy when it starts up or shuts down. It will eventually lead to a carbon deposit buildup and to the less efficient operation of the burner. Afterdrip is also dangerous in that it may lead to a fire on the floor in front of the heating unit.

2. A leaking seal on the oil pump shaft bearing may also cause oil to leak on the floor in front of the heating unit. This also could become ignited.

3. Dirty or damaged nozzles or rotary cups cause improper atomization. This will eventually lead to a carbon deposit buildup in the combustion chamber. Nozzles in a #6 oil burner should be cleaned when necessary.

4. Blockage in the chimney or flue passage will cause the cellar or boiler room to become filled with smoke.

5. Water in the fuel oil or the wrong grade of fuel oil will cause improper atomization.

6. The protective relay is supposed to shut down the oil burner if a flame is not established quickly. A delay in ignition is the most common cause for burner puffback. Puffback can cause the boiler door to blow open and the smoke pipe to all down.

One of the most dangerous conditions that occurs is when the oil burner goes into operation when the chamber is not hot and the source of ignition fails. If the chamber has not been preheated, the combustion chamber, the flue and the chimney can become filled with vaporized oil fumes. These fumes may become ignited and caused a puffback. If proper ignition has not occurred the only indication of flame failure may be a strong odor of fuel oil in the area. Vaporized oil looks like condensed steam; it is pure white but smells and tastes like fuel oil. When this condition is present it should be handled by immediately shutting

off the burner. The area should be handled by immediately shutting off the burner. The area should be completely vented. Any possible source of ignition should be eliminated. An attempt should not be made to light the burner until the system has been completely cleaned of combustible mixtures. Preventive maintenance should be done regularly to maintain reliability of the equipment and control devices. regular preventive maintenance also reduces the need for corrective maintenance. Cleanliness and good housekeeping practices will also contribute to the prevention of fire and explosion.

Oil Burner Control

The following information describes in more detail the various controls and devices on the oil burner and boiler.

1. As described earlier, the fuel oil is stored in the oil tank.
2. The tank shut off valve permits the operator to stop the flow of oil to clean the strainer and to perform other maintenance.
3. The oil strainer separates dirt and sediment from the fuel oil coming from the oil storage tank.
4. The vacuum gauge readings indicate to the operator whether there is an obstruction in the suction line (e.g., the oil strainer is dirty and requires cleaning).
5. The oil preheater raises the temperature of the oil for easier pumping and atomization.
6. The main fuel valve is an electrically operated valve which will open or close the line leading to the atomizer of the oil burner. Under certain conditions it is activated by the primary control. The burner shut off valve is located as close as possible to the burner to reduce the amount of oil remaining in the burner line after an emergency shutdown.
7. The atomizing cup (spinner) is a device that breaks up (atomizes) the fuel oil for proper combustion.
8. The vaporstat is a low pressure, pressure control mounted on the fan housing and will shut down an oil burner if no air for combustion exists. A dangerous condition occurs when the oil is being pumped to the combustion chamber and is not being atomized properly. An explosion could result.
9. The mixture of fuel oil and air is ignited at first by a gas pilot or by electric ignition. After ignition combustion is maintained by retained heat in the combustion chamber.
10. The Photoelectric cell is a flame detection control. It is a device that will shut down an oil burner if a flame is not visible to the scanner or photoelectric cell. A dangerous condition will arise if oil is being pumped into the combustion chamber, but is not burning. The atomized, unburned fuel could cause an explosion if a spark or other source of

ignition occurred.

11. The Aquastat operates the oil burner in the summer for domestic hot water needs.

12. The low water cut off is an automatic electric control that will shut down the burner when the water level is below a safe operating point. A shortage of water in the steam boiler could lead to a dangerous condition.

13. The gauge glass is a device used to indicate the water level of a steam boiler. It is the most important control on the steam boiler. The gauge glass should have water visible when the boiler is in operation.

14. The stack switch (or primary control) is the main combustion controller. It will stop the oil burner and lock the oil burner out on safety in case of ignition failure or loss of flame in the combustion chamber. The stack switch operates when there is no heat in the smoke stack. A dangerous condition arises if the oil is being atomized and vaporized in the combustion chamber but no flame exists. A spark could cause an explosion in the combustion chamber.

15. The smoke alarm is a device mounted on the smoke stack or chimney. The smoke alarm will shut down an oil burner and put on an alarm if there is excessive smoke or if the fire is improper. A dangerous condition would exist if all the oil was not being burned or (properly atomized), or too much oil was admitted to the combustion chamber. If the condition was not corrected, an explosion might occur. The smoke alarm is also a required combustion and air pollution control.

16. The boiler steam pressure gauge shows the steam pressure inside the steam boiler. The pressure gauge reads in P.S.I. (pound pressure per square inch). It is located on or near the top of the steam boiler. Normal steam pressure for low pressure boilers is less than 15 pounds per square inch.

17. The safety or pop off valve is a device used to relieve excessive steam pressure. It is located on or near the top of a steam boiler.

18. The pressuretrol (Pressure Control) is an automatic electric control. It is an operating limit control and is a device that will shut down the oil burner when the steam pressure reaches a desired point. A dangerous condition could occur when the steam pressure is rising. If the pressure continued to rise unchecked, the boiler could blow up.

19. The manual reset pressuretrol (Pressure Control) is a control that will shut down a steam boiler if the pressure continues to rise above the operating pressure control setting. It will lock out the oil burner on safety in case the operating limit pressuretrol (#18) fails to stop the oil burner. This switch will not close again automatically. It must be reset manually.