Use only analyzer fluid for replacement. When replacing fluid, it is good practice to clean the instrument thoroughly. Use only lukewarm soapy water to clean the analyzer body.

The fluid in the analyzer may tend to increase in volume with use due to condensation from flue gas. To remove excess fluid: set analyzer upright, remove screws (4) holding top cap (3) and remove top cap assembly. Insert a tube (about size of sampling tube) through analyzer into fluid, place finger over open end of tube, and withdraw. Important: Avoid getting analyzer fluid on skin or clothing as it is harmful to both.

Replace filtering material in filter tube (12) when it becomes wet from condensed moisture or when it appears dirty. Clean out sampling tube with a stiff wire if it become clogged.

CHAPTER 10

Fuel Oil Tanks and Piping

In installing the auxiliary equipment such as the fuel oil storage tank and piping, good material together with skilled workmanship is important.

Most cities have certain rules and regulations governing the installation of such equipment and each dealer should familiarize himself with the existing local regulations.

Placement of Tanks.—There are two kinds of installations of storage tanks wherein the oil supply is stored.

1. Inside storage tanks.
2. Outside underground storage tanks.

Inside Storage Tanks.—This is the more usual method of installation because of the lower costs of installation where local regulations permit.

Ques. What is the usual arrangement?
Ans. Usually two 275 gallon storage tanks giving a total storage of 550 gallons are installed.
Ques. What fitting must be used with this arrangement?
Ans. To comply with the regulations of the Underwriter's Laboratories, a three way valve must be provided at the junction of the two oil lines.

![Diagram of fuel oil storage tank piping](image)

Fig. 1—Piping diagram for single inside fuel oil storage tank.

Ques. How is this three way valve constructed?
Ans. It is so constructed that the oil feed line, by manipulating this valve manually, can be connected to the oil supply in either tank, but not to both at the same time as shown in fig. 2.

Ques. What should be noted from the illustration?
Ans. A common fill line extending to the outside of the building connects to both tanks and both tanks are connected to the vent line, which terminates outside the building.

Ques. Describe the vent line.
Ans. It should be one inch in diameter (pipe size) and be provided with a weatherproof hood, screened to prevent any obstruction and the height above the ground should be in accordance with the existing regulations.

Ques. What should be the pitch of a vent pipe and how far should it extend?
Ans. It should be inclined so as to drain toward the tank, and should not extend more than one inch down through the top of the tank.

Ques. What is the preferred shape of tank and why?
Ans. The oblong tank is preferable to the cylindrical tank, because this construction reduces the door clearance necessary to allow passage of the tank.

All storage tanks should bear the Underwriter's label.

Ques. How are inside tanks mounted?
Ans. On some non-combustible material usually iron pipe, the fittings on the tank determine the size of pipe to be used. The tank must be anchored securely either to the wall or to the floor.

Ques. What kind of gauge should be used for indicating the amount of oil in the tank?
Ans. A suitable approved gauge screwed in the top of the tank, but in no case should a glass level gauge be used.

Ques. How should the oil feed line be connected?
Ans. It should be connected to the top of the tank as shown in fig. 1.
Fig. 2—Piping diagram for two inside fuel oil storage tanks.

Fig. 3—Pictorial view of inside tank installation.
Ques. How should the tank be installed?
Ans. It should be installed level.

Ques. What should be provided on gravity feed inside storage tanks?
Ans. Each line should be provided with a good shut off valve.

Underground Outside Storage Tanks.—This placement of tanks is necessary where required by local regulations.

Ques. What is the requirement usually specified for underground tanks?
Ans. The distance of the tank from the foundation of the building.

Ques. How deep should the tank be placed?
Ans. It should be placed deep enough so that the top is at least two feet under the surface of the ground.

Ques. What preservative should be applied to the tank?
Ans. An underground tank should have two coats of tar or asphaltum.

Where the soil contains corrosive substances, special protection may be needed.

Never allow a tank or the piping to be exposed to cinders. Clay around the tank is preferable to black soil.

Ques. What should be the minimum size of pipe used on intake or return lines?
Ans. The pipe should be at least ½ inch size—¾ inch pipe is better. Depends also on capacity. See table page 87.
How an Anti-Syphon Valve Works

Physics of the Anti-Syphon Valve.—The operation of an anti-syphon valve depends upon the opposing forces created by two elements viz.: 1, a spring which tends to close the valve and 2, a vacuum allowing the pressure of the atmosphere to act upon a diaphragm which tends to open the valve as shown in figs. 4a and 4b. The spring is strong enough to keep the valve closed against the syphon head in the fuel line, but not strong enough to keep it closed when the vacuum created by the pump, allows the pressure of the atmosphere to press the diaphragm upward which opens the valve and that’s all there is to it.
**Questions and Answers on Fuel Oil Tanks and Piping**

**Ques.** What kind of pipe and fittings should be used?

**Ans.** Full weight wrought iron steel or brass pipe with substantial fittings, or copper tubing of at least 1/16 in. wall thickness, with approved fittings.

**Ques.** Why should cast iron fittings not be used?

**Ans.** Because they may break when subjected to strain.

**Ques.** How many oil lines should be used with an outside underground storage tank and why?

**Ans.** Two lines must always be run into the building—one for the intake and the other for the return.

**Ques.** How should the connections in these lines and in the vent be constructed and why?

**Ans.** They should consist of swing joints, as shown in fig. 4 to permit flexibility to avoid strain that might otherwise be brought about due to settling of the tank or piping.

**Ques.** What additional use may be made of the fill line if run directly above the tank?

**Ans.** It can be used as a test well to ascertain how much oil is in the tank.
Points on Piping. — There are some points covering the installation of a burner which may seriously affect the proper performance of the pump and of course influence the performance of the burner. The selection of the size of pipe for the inlet line is important. Selection involves four points:

1. Maximum volume to be handled.
2. Viscosity of oil.
3. Length of inlet line.
4. Number of elbows used.

In pumping highly viscous oils through a small pipe of considerable length, a great deal of pipe line friction is set up which will cause high operation vacuums at the pump.

An inlet line should never be less than \( \frac{1}{8} \) in. in diameter, even though the line be only a few feet long. The reason is that sediment gradually collects and restricts the oil flow.

An inlet line too small can be detected by placing a vacuum gauge in the line close to the entrance into the strainer. More than a 10 inch vacuum is liable to cause trouble.

Pipe and Tube Specifications. — The following table indicates the recommended tube or pipe sizes to be used with the various burners:

<table>
<thead>
<tr>
<th>Length of inlet line flow up to 30 g.p.h.</th>
<th>Inlet lifts from 3–15 ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 25 ft.</td>
<td>3/8 or 1/2 in.</td>
</tr>
<tr>
<td>25 to 100 ft.</td>
<td>1/2 in.</td>
</tr>
<tr>
<td>100 to 200 ft.</td>
<td>3/4 in.</td>
</tr>
</tbody>
</table>

Flow from 30 to 90 g.p.h.

| Up to 25 ft. | 3/8 in. | 1 in. 1 3/4 in. |
| 25 to 100 ft. | 3/4 in. | 1 in. 1 3/4 in. |
| 100 to 200 ft. | 1 in. | 1 1/2 in. |

If more than one burner be installed in conjunction with one tank, each burner must have a separate inlet line.
The term Oil Burner.—It should be noted that the term "oil burner" is a glaring misnomer, but at this stage nothing can be done about it.

Fig. 15.—Feeding heater from large storage drum. Whenever local regulations permit heater may be fed from large storage drum where the bottom of the drum can be placed at least a few inches higher than the float valve on heater to give gravity flow. Brackets can be supplied for attaching floats to most models in place of the usual tank equipment. Where heater is already equipped with six gallon tank and float, it is only necessary to break connections between six gallon tank and float and reconnect as shown to large storage tank. Underwriters also require that on such installations heater must be anchored to floor.
Ques. In an underground installation, if the top of the tank be higher than the oil inlet to the burner, how should the oil intake line be run?
Ans. It should incline slightly to the point where it enters the basement, at which point an anti-siphoning valve should be provided and from this point the intake line can then continue its course to the burner.

Ques. How should the pipe not be run and why?
Ans. The pipe should not be run along the joists of a ceiling due to the vibration of the pipe being transmitted to the building.

Ques. What should be provided on any outside storage tank with lift feed?
Ans. A shut off valve and a foot valve, the latter being placed in the tank at the end of the intake line.

Ques. What is the purpose of the foot valve?
Ans. To maintain a column of oil in the intake line during the “off” period of the burner.

Ques. How should the bottom of the valve be placed and why?
Ans. It should be set four inches from the bottom of the tank to allow space for accumulation of water or sediment.

CHAPTER 11
Classification of Burners

There is a great multiplicity of types of so-called oil burners. Of the numerous makes of house heating burners, there are basic features common to all, differing in minor details. It may be said that they are now pretty well standardized.

A classification to be comprehensive should be made from various points of view, as:

1. With respect to control, as:
   b. Semi-automatic.
   c. Fully automatic.

2. With respect to service, as:
   a. Domestic.
   b. Commercial.
   c. Industrial.

3. With respect to fuel, as:
   a. Gasoline.
   b. Kerosene.
   c. Oil
      - light domestic.
      - medium domestic.
      - heavy domestic.
      - light industrial.
      - medium industrial.
      - heavy industrial.