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Chapter 3

Oil Tanks and Piping

Introduction

The comfort, cleanliness and efficiency of today's oilheat systems rely on clean, uncontaminated fuel reaching the oilburner. To achieve this:

- Install tanks properly.
- Maintain tanks by regularly inspecting them and fixing minor defects before they lead to major problems.
- Replace aging tanks *before* they fail.

The proper installation of an oil tank is a relatively easy process, provided it is installed in accordance with the manufacturer's instructions and applicable codes and regulations are followed.

Local codes normally require you to install tanks in accordance with either their own code, the National Fire Protection Association (NFPA) or the International Code Council (ICC). It's best to check with the local authority having jurisdiction to determine which regulations you need to follow.

This chapter gives an overview of oil tanks; for more detailed information, we recommend that you read NORA's oil tank manual, "*Heating Oil Storage Tanks, Guide for Quality Installation and Maintenance.*"

Why tanks fail

The most common cause of failure is corrosion—the deterioration of the tank due to reaction with its environment. **External corrosion** is caused by electrical activity that occurs between different parts of the tank; between the tank and its piping; or between the tank and other metals in the area. For external corrosion to occur, there needs to be:

1. an *anode*— something to give up electrons (the tank);

2. a *cathode*— something to accept the electrical flow (piping, metals in the ground, etc.);

3. an *electrolyte*— something for the electricity to travel through (water).

There is not much you can do to prevent external corrosion in existing unprotected underground (buried) tanks. Later in this chapter, we'll show the types of tanks that can stand up to the corrosion factors that exist underground.

To reduce exterior corrosion for aboveground tanks, make sure that:

- The tank has clearance on all sides so that debris can't accumulate and hold moisture against the tank.
- There is sufficient clearance under the tank so that plant growth does not come in contact with it.
- Scratches and rust are repaired immediately.
- The tank is painted on a regular basis.

Internal corrosion is caused by sludge produced by bacteria. For internal corro-



Figure 3-1: Various layers of material in the tank

Figure 3-2: Internal corrosion with pin hole magnified sion to occur at the tank bottom, there needs to be bacteria and water in the tank, see Figure 3-1.

The bacteria live at the oil/water interface; they "eat" the oil and create a substance that, when mixed with water, creates an acid that corrodes the metal in the tank.

The best way to reduce internal corro-



sion, Figure 3-2, is to eliminate the water at the bottom of the tank. Removing the water is just the beginning. You must also determine how the water got into the tank and take corrective steps to prevent water from building up again. Figure 3-3.



Figure 3-3: Bacterial "Bug Tracks"

The most common causes of water in tanks are:

- Condensation
- Broken tank gauges (outside tank)
- Loose or missing fill and vent caps
- Pumping oil from an old tank into a new tank
- Failing to drain water from a tank before installation.

Condensation can be greatly reduced by installing tanks indoors or in an enclosure. If a tank is located outside, you can reduce condensation by painting it a light color and protecting it from direct sunlight.

Gauges and caps should be inspected regularly and replaced when necessary.

Following manufacturer's instructions when installing new tanks and performing the inspection procedures described at the end of this Chapter, you will greatly reduce the amount of water-related problems and extend the lives of your customers' tanks.

Properly installed and maintained tanks can last for several decades—much longer than most equipment in the home. However, like everything else, tanks eventually need to be replaced.

Installation considerations

When it is time to install a new or replacement tank—answer these three questions:

- What *size* tank will be best?
- Where is the best *place* to install it?
- What *type* of tank will be best?

Size

Although large tanks are often installed for delivery efficiency, an oversized tank can cause service problems—such as:

- Poor fuel quality—fuel oil has a shelf life and deteriorates over time.
- Corrosion—larger tanks usually build up more water from condensation.

On the other hand, tanks that are too small require frequent deliveries, leading to problems during peak delivery season.

In general, the right size tank is one that holds about one-third (1/3) of the customer's annual consumption. Therefore, a customer who uses 900 gallons of oil a year should have a 275 or 330-gallon tank. (900/3 = 300)

There may be special situations that require you to install a tank that is either

larger or smaller, but in general, it is best to apply the 1/3 rule when possible.

Location

There are three possible locations for a tank installation:

- 1. Inside a building—usually in the basement, utility room or garage
- 2. Outside, above-ground
- 3. Outside, underground

Before selecting a tank location, be sure to consider regulations regarding setbacks from:

- Heating equipment and other ignition sources
- Property lines
- Buildings, doors, windows, vents and air intakes
- Meters

Also remember to locate the tank where:

- The delivery vehicle can safely park during filling
- It will be accessible for inspection and servicing
- An oil release will not easily enter a drain, well or waterway
- It will not be exposed to corrosion and/or damage from dripping water, falling ice, vehicles, etc.

Inside tanks

NORA recommends above ground, indoor tank installations whenever possible. These installations offer a number of advantages over outside tanks, including:

• The oil is usually warmer, which means it burns better and won't gel or have cold weather performance problems.

- There are fewer temperature changes, which means the oil will last longer.
- If a leak develops, it will cause an odor, which quickly alerts us to the problem.
- It's easier to inspect.
- Less condensation in the tank.

It is important that you follow codes and instructions regarding:

- A. Distance from the tank to the burner (At least 5 feet.)
- B. Size and height of the vent pipe
- C. Size of the fill pipe
- D. Fusible valve at the tank
- E. Fusible valve at the burner

In addition:

1. The fill and vent lines must be pitched toward the tank

- 2. All tanks should have a vent alarm
- 3. All tanks should have a tank gauge

4. All systems should have an oil filter; it can be located at the tank, at the burner or at both the tank and burner.

5. The copper oil line from the tank to the burner (shown here running under the floor) should not touch concrete or soil. This can be done by sliding the copper oil lines into plastic conduit or plastic pipe or by using a coated copper line.

There should be no fittings in the copper lines below the floor. Figure 3-4.

Above-ground outside tanks

If there is no room for a tank inside the building, it must be installed outside, see Figure 3-5. In these cases, it is a good idea to install the tank in secondary containment



Figure 3-4: Typical indoor installation



Figure 3-5: Outside above ground tank

or in an enclosure to protect it from the elements.

The outside oil line should be connected through the top of the tank and insulated to where it enters the building. Once the line is inside, it should be connected to a thermal shut-off valve. The oil filter should NOT be installed outside. It can be installed right after the valve where the line enters the building or at the burner.

Underground tanks

Environmental regulations and insurance concerns have greatly reduced the number of inground installations,

Figure 3-6, and many homeowners with buried oil tanks have replaced them with above-ground tanks.

Unless there is no acceptable location available, NORA recommends that all new oil tanks be installed above ground.

Figure 3-6: Typical older underground installation



Figure 3-7:

Ob-round tank

Туре

Once you have determined the proper size and location to install a new tank, your customer can choose the type of tank based on price, warranty and level of spill protection. There are many choices:

Above ground tanks

Ob-round—The 275gallon "Ob-round" steel tank, Figure 3-7, has been the standard for decades and is the most common tank. Ob-round tanks are currently available in a number of sizes from slightly over 100 gallons to 330 gallons.

Newer ob-round tanks have the oil drawn from the bottom of the tank to reduce the amount of condensation and sludge build-up in the tank. Figure 3-8.

Cylindrical—These tanks are often found in mobile homes and in places where space considerations made it easier to install and service than an ob-round tank. They are typically available in sizes ranging from 160 to 320 gallons.



Externally coated ob-round—This corrosion resistant tank has a polyethylene coating on the outside of a standard ob-round tank, Figure 3-9. The coating protects the tank from external corrosion and serves as release barrier should the tank corrode internally.

Fiberglass—This corrosion proof tank is available in both single and double wall models and in 240 and 300-gallon capacities. The double wall unit is a tank within a tank— if the inner tank leaks, the outer tank prevents a release of oil, Figure 3-10.



Figure 3-10: Fiberglass tank

Figure 3-8: Bottom tap **Polyethylene/steel** – These double wall tanks combine an inner tank made of polyethylene with a steel outer tank. The outer tank protects the inner tank and provides secondary containment. See Figure 3-11.



Figure 3-11: Polyethylene/steel tank

Underground tanks Steel

Sti-P3—These tanks combine the strength of steel with a factory installed corrosion protection system, Figure 3-12. Sti-P3 tanks feature:

1. A protective coating over the steel that prevents external corrosion



Figure 3-12: Underground steel tank

2. Sacrificial anodes that protect the steel

3. Nylon isolation bushings that electrically isolate the tank from the fill pipe, vent pipe, oil lines and other attached piping

ACT-100 and ACT-100U

These tanks include a much thicker protective coating and offer protection similar to the Sti-P3 without sacrificial anodes, Figure 3-13.



Figure 3-13: ACT-100

Fiberglass (FRP)

Fiberglass reinforced plastic tanks never rust because they are made from corrosion resistant materials, Figure 3-14.

Once you've determined the right size, location and type of tank to install, you



Figure 3-14: Fiberglass (FRP) tank

must become thoroughly familiar with the current version of the manufacturer's installation instructions *before* you begin an installation.

Installation procedures

Be sure to follow the manufacturer's installation instructions and all applicable codes and regulations during

> the installation. This next section emphasizes some of the important steps in tank installation process.

Work neat

Protect the customer's property and the components that you are installing. It is much easier to prevent a mess than to clean it up. Cover work areas with drop cloths or builder's paper or other material, Figure 3-14.

Piping connections

It is imperative that all connections are made **tight and leak proof**. All threaded connections should be joined with a pipe compound that is non-teflon, oil resistant, and remains flexible. Be careful when applying pipe compound and make sure to wipe away excess compound so it does not get into the tank or oil lines.

Fill and vent pipes

The fill and vent pipes should be made of schedule 40 steel, be pitched toward the tank and terminate outside the building at a point at least two feet from any building opening, and five feet from any air inlet or



Figure 3-15: Above ground vent pipe/fill and vent cap

flue gas outlet. All steel fittings should be malleable, not cast.

The fill pipe should be clearly marked as a fuel oil fill. The vent cap should have a screen to prevent bugs from making a nest in the vent pipe, Figure 3-15.

Vent alarms

All above ground and indoor tanks should have a vent alarm installed, Figure 3-16. The vent alarm alerts the delivery person that the tank is filled to the proper level. Vent alarms are not always required for residential



buried tanks because a special filling device (vent-a fils, bazooka, deep fill, etc.) that includes a vent alarm may be used.

Figure 3-14: Cover work areas



Oil lines

For normal residential use, 1/2" O.D. oil lines are recommended. Copper oil lines should be connected with flare fittings. Compression fittings must **not** be used ("slip fittings", where the oil line enters the top of the tank, are the exception and are acceptable).

Oil lines should have as few fittings as possible and all fittings should be accessible.

Thermal shutoff valves

Indoor tanks should have a thermal safety shutoff (Firomatic[®]) valve in the suction line at the tank, see Figure 3-17. Outside tanks should have a shut off valve where the suction line enters the inside of the building.

Filters

An oil filter should be installed in the suction line. See Figure 3-18.

Figure 3-17: Thermal safety shutoff valve



Plug or cap

Plastic or metal plugs are used to keep water and debris out of a new tank during shipment and storage. They must be removed and discarded during



Tank inspection procedures

Oil tanks should be inspected on a regular basis so that potential problems can be discovered and corrected before they affect tank longevity and system performance.

NORA recommends three levels of inspection—an initial inspection performed before a delivery is made to a new tank or a new customer; a routine inspection performed during routine maintenance or tune-ups; and brief, pre-delivery inspection each time the tank is filled.

1.) Initial inspections and evaluations

NORA recommends that all tanks should be inspected and approved for delivery **before** the first delivery to a new customer or a new tank.

An initial inspection provides the opportunity to notice flaws in the tank, not reported by the customer, which may Figure 3-18: Oil filter installed in suction line prevent a problem in the future. It will also ensure that the fill and vent pipes are properly connected and correctly identified.

In those cases where a new tank has been installed for an existing customer, the tank inspection should include procedures to ensure that inactive fill and vent pipes have been removed.

The inspections are different for aboveground tanks and buried tanks.

2.) Routine inspections

NORA recommends that additional tank inspections be conducted as an integral part of preventative maintenance tune-ups.

> While not as comprehensive as the initial inspection, routine inspections are equally important.

> > Routine inspections can detect problems that occur after the tank has passed the initial

inspection. For example, the tank gauge may have become defective, a tank leg may start to corrode, or another problem may have arisen long after the tank was initially approved for delivery.

In many situations, routine inspections detect minor problems that have recently started and that can be easily corrected before they cause a problem.

3.) Brief, pre-delivery inspection

NORA recommends a "no-whistle-no fill policy."

Oil delivery personnel should perform a brief visual inspection before and after each delivery. While this inspection normally isn't documented, it's important that fuel drivers understand the need to verify addresses and check tanks for obvious defects before and after delivery.

The step-by-step inspection procedures for above ground and underground tanks are on the following pages.

Figure 3-19: Inspection of above ground tank

Tank Evaluation Forms

Use the forms on the following pages to evaluate tank integrity and maintenance requirements.

Initial Fuel Oil Storage Tank Evaluation – Above Ground Tanks Revised May 2006

A al alve a set			
Address:	7:		
Tolenhone:	_ Zip:		
TANK			
Tank location			
If outside, is the tank protected by an enclosure?	\Box N/A	\Box Yes	□ No
Is the tank installed with full secondary containment?		\Box Yes	□ No
Tank size?			
Tank height?			
Tank type?			
Tank age?			
Tank condition satisfactory, including legs and pad or foundation	ation?	\Box Yes	□ No
Tank properly secured in flood prone areas?	\Box N/A	\Box Yes	□ No
Any evidence of historic oil spills?		\Box Yes	□ No
System checked for oil leaks?		\Box Yes	□ No
Amount of oil in tank?			
Any water in tank?		\Box Yes	□ No
If yes, how many inches?			
Tank gauge properly installed and accurate?		\Box Yes	□ No
Tank bottom at least 6" off ground?		\Box Yes	□ No
Tank at least 5 feet from burner or other sources of fire or fla	me?	\Box Yes	□ No
Evidence of excessive external corrosion?		\Box Yes	□ No
Unused openings properly plugged?		\Box Yes	□ No
Comments:			
FILL PIPE			
Pipe size			
Pitched toward tank?		\Box Yes	□ No
Proper material?		\Box Yes	□ No
In good condition?		\Box Yes	□ No
Fill cap in place and in good condition?		\Box Yes	🗆 No
Fill positioned to avoid buildup of water and snow?		\Box Yes	□ No
Properly piped, outside at least 2' from windows or openings	s?	\Box Yes	□ No
Fill properly tagged?		□ Yes	□ No
Old fill pipe removed?	\Box N/A	\Box Yes	□ No
C			

Page 1 of 2

VENT PIPE		
Pipe size		
Pitched toward tank?	□ Yes	□ No
Proper material?	□ Yes	□ No
In good condition?	□ Yes	□ No
Vent visible from fill?	□ Yes	□ No
Vent alarm installed?	□ Yes	□ No
Vent cap in place and in good condition?	\Box Yes	□ No
Vent free of obstructions?	□ Yes	□ No
Positioned to avoid buildup of water and snow?	\Box Yes	□ No
Higher than fill pipe?	\Box Yes	□ No
Properly piped, outside at least 2' from windows or openings		
and 5' from appliance air inlets or flue gas outlets?	\Box Yes	□ No
Comments:		
<u>OIL LINES</u>		
Line size		
Proper material?	\Box Yes	□ No
Oil lines encapsulated?	\Box Yes	□ No
Working shutoff at tank?	\Box Yes	□ No
OSV valve installed?	\Box Yes	□ No
All lines properly connected to tank and burner?	\Box Yes	\Box No
Outside exposed lines insulated? $\Box N/A$	\Box Yes	□ No
Any compression fittings?	\Box Yes	□ No
Oil filter properly installed?	\Box Yes	□ No
Fusible valves properly located?	\Box Yes	□ No
Comments:		
This tank is acceptable for fuel delivery.	🗆 Yes	🗆 No
This tank will be acceptable for delivery once the following defects are co	prrected:	
This tank is NOT acceptable and must be replaced prior to delivery. Comments:	□ Yes	□ No
Inspected by: Date:		
NORA ID: Date of NORA certification:		
Company:		
Town: State: Zin:		
Telephone :		
	Pe	age 2 of 2
PLEASE NOTE: The visual tank inspection performed by Certified Tank Inspector was limited to the i	tems inspect	ed on the

Initial Fuel Oil Storage Tank Evaluation – In Ground Tanks

Revised May 2006				
Name:				
Address:				
Town:	State:	Zip:		
Telephone:				
TANK				
Tank location				
Tank size?				
Tank type?				
Tank age?				
Any evidence of historic oil spills?			\Box Yes	\Box No
Amount of oil in tank?				
Any water in tank?			\Box Yes	\Box No
If yes, how many inches?				,
Comments:				
FILL PIPE				
Pipe Size				
Proper material?			□ Yes	□ No
In good condition?			□ Yes	□ No
Fill cap in place and in good condition?			□ Yes	□ No
Fill positioned to avoid buildup of water and snow	N?		□ Yes	□ No
Properly piped, outside at least 2' from windows	or openings?		□ Yes	□ No
Fill properly tagged?			□ Yes	□ No
Old fill pipe removed?		\Box N/A	□ Yes	□ No
Comments:				
VENT PIPE				
Pipe Size				
Proper material?			\Box Yes	□ No
In good condition?			\Box Yes	□ No
Vent visible from fill?			\Box Yes	□ No
Vent cap in place and in good condition?			\Box Yes	□ No
Positioned to avoid buildup of water and snow?			\Box Yes	□ No
Higher than fill pipe?			\Box Yes	□ No
Properly piped, outside at least 2' from windows	or openings			
and 5' from appliance air inlets or flue gas outlets	;?		□ Yes	□ No
Comments:				

OIL LINES			
Proper material?			
Oil lines encapsulated?			
Working shutoff at wall?			
OSV valve installed?			
Lines properly connected to tank and burner?		\Box Yes	
Outside exposed lines insulated?	□ N/A	□ Yes	
Any compression fittings?		\Box Yes	
Oil filter properly installed?		\Box Yes	
Fusible valves properly located?		□ Yes	
Comments:			
This tank is acceptable for fuel delivery. This tank will be acceptable for delivery once the following o	defects are co	□ Yes orrected:	□ No
This tank is NOT acceptable and must be replaced prior to de	livery.	□ Yes	🗆 No
Comments:			
Inspected by: Date of NORA certi	Date:		
Company:			
Town: State:	Zip:		
Telephone :			
		Pa	age 2 of 2

Routine Fuel Oil Storage Tank Evaluation – Above Ground Tanks Revised May 2006

Name:	Phone:			
Address:				
Town:	State:	Zip:		
ΤΑΝΚ				
Tank properly secured in flood prone areas?		□ N/A	□ Yes	□ No
Any evidence of historic oil spills?			□ Yes	□ No
Tank checked for oil leaks?			□ Yes	□ No
Amount of oil in tank?				
Any water in tank?			□ Yes	□ No
If yes, how many inches?				
Tank gauge in good condition?			□ Yes	□ No
Tank at least 5 feet from burner or other sources	s of fire or flam	ne?	□ Yes	□ No
Evidence of excessive external corrosion?			□ Yes	□ No
Unused openings properly plugged?			□ Yes	□ No
Comments:				
FILL PIPE				
In good condition?			□ Yes	□ No
Fill cap in place and in good condition?			□ Yes	□ No
Fill positioned to avoid buildup of water and sno	swc		□ Yes	□ No
Fill properly identified?			□ Yes	□ No
Comments:				
VENT PIPE				
In good condition?			□ Yes	□ No
Vent cap in place and in good condition?			□ Yes	□ No
Vent free of obstructions?			□ Yes	□ No
Positioned to avoid buildup of water and snow?			□ Yes	□ No
Comments:				
OIL LINES				
Working shutoff at tank?			□ Yes	□ No
All lines properly connected to tank and burner	?		□ Yes	
Outside exposed lines insulated?		□ N/A	□ Yes	□ No
Comments:				
This tank is still acceptable for fuel delivery			□ Yes	
Inspected by:		Date:		
			P	age 1 of 1

Routine Fuel Oil Storage Tank Evaluation – In Ground Tanks Revised May 2006

Name:	Phone:		
Address:			
Town: S	tate: Zip:		
TANK			
Any evidence of historic oil spills?		□ Yes	□ No
Amount of oil in tank?			
Any water in tank?		□ Yes	□ No
If yes, how many inches?			
Comments:			
In good condition?			
Fill can in place and in good condition?			
Fill positioned to avoid buildup of water and snow?		\Box Ves	
Fill properly identified?		□ Yes	
Comments:			
VENT PIPE			
In good condition?		\Box Yes	
Vent cap in place and in good condition?		\Box Yes	
Vent free of obstructions?		\Box Yes	
Comments:			
comments.			i
<u>OIL LINES</u>			
Working shutoff at wall?		□ Yes	□ No
All lines properly connected to burner?		□ Yes	□ No
Outside exposed lines insulated?	□ N//	A □ Yes	□ No
Comments:			
This tank is still accentable for fuel delivery			
Comments:			
Inspected by:	Date: _		
		Р	age 1 of 1

Pre-Delivery Procedure/Discrepancy Report – Above Ground Tanks Revised May 2006

Name:				
Address:				
Town: St	ate:	Zip:		
Telephone:				
LOCATION				
Address verified?			□ Yes	□ No
Delivery instructions verified?			□ Yes	□ No
Tank location verified?			□ Yes	□ No
TANK: If the tank is readily accessible check the foll	owing:			
Amount of oil in tank?			_	
Any water in tank?			\Box Yes	□ No
If yes, how many inches?			-	
Tank gauge in good condition?			\Box Yes	□ No
Any evidence of historic spills?			\Box Yes	□ No
Tank condition satisfactory including legs and found	lation?		\Box Yes	□ No
Unused openings properly plugged?			\Box Yes	□ No
FILL PIPE				
In good condition?			\Box Yes	□ No
Fill cap in place and in good condition?			\Box Yes	□ No
VENT PIPE				
In good condition?			□ Yes	□ No
Vent cap in place and in good condition?			□ Yes	□ No
Vent free of obstructions?			□ Yes	□ No
Positioned to avoid buildup of water and snow?			\Box Yes	□ No
Vent alarm working properly?			\Box Yes	□ No
OIL LINES				
Outside exposed lines insulated?		□ N/A	□ Yes	□ No
FINAL SCAN				
Checked for oil leaks after delivery?			□ Yes	□ No
Comments:				
Inspected by:		Date:		
			Pa	age 1 of 1

Pre-Delivery Procedure/Discrepancy Report Form – In Ground Tanks Revised May 2006

Name: Address:				
Town: Telephone:	State:	Zip:		
LOCATION				
Address verified?			\Box Yes	□ No
Delivery instructions verified?			\Box Yes	□ No
Tank location verified?			\Box Yes	□ No
TANK				
Any evidence of historic oil spills?			□ Yes	□ No
Amount of oil in tank?				
Any water in tank?			\Box Yes	□ No
If yes, how many inches?				
FILL PIPE				
In good condition?			□ Yes	□ No
Positioned to avoid buildup of water and snow?			\Box Yes	\Box No
Fill cap in place and in good condition?			\Box Yes	□ No
Fill properly identified?			\Box Yes	\Box No
VENT PIPE				
In good condition?			□ Yes	□ No
Vent cap in place and in good condition?			□ Yes	□ No
Positioned to avoid buildup of water and snow?			□ Yes	□ No
Vent free of obstructions?			\Box Yes	□ No
Vent alarm working properly?			\Box Yes	□ No
FINAL SCAN				
Verified that no oil spilled during delivery?			□ Yes	□ No
Comments:				
Inspected by:		Date:		
			P	age 1 of 1