Drainage Interceptors For Buildings

By Michael Frankel
Associate, Plumbing
Department Head
LK Engineers
New York City

☐ A very serious problem confronting both public health department officials and consulting engineers is protecting the public sewer system, treatment facilities, and private drainage systems from harmful suspended materials. These materials have the potential to create a safety, health or mechanical hazard to the public or a piping network through blockage or pipe failure.

This article will present methods of intercepting, retaining or neutralizing such substances before they can discharge into the sanitary drainage piping. I am limiting this article to substances that plumbing engineers might generally encounter in the design of most commercial, industrial, medical or scientific projects. Exotic, highly unusual or toxic materials will require a specialist in treatment and handling of such substances.

Grease Interceptors

It is a well known fact that grease, if allowed to enter a drainage system, will soon result in a clogged pipe. Larger quantities of grease reaching sewage treatment facilities presents trouble at each phase of operation. Grease has a tendency to adhere to solids, and so, in a treatment facility (whether individual or municipal) it causes solids to remain in suspension, and reduces effectiveness of bacterial action.

Grease interceptors can be classified into two basic categories of separation (gravity or mechanical) for either intermittent or continuous operation and three grease removal types (manual, semi-automatic or enzymatic).

Interceptor Design Considerations

Generally speaking, most of the projects we work on require a predesigned unit. However, I would like to discuss interceptor design concepts, so that, in the event the plumbing engineer is presented with an unusual condition, you will have enough information to knowledgeably assist in the selection of a properly sized unit.

Since grease is lighter than an equal volume of water, grease traps operate on the principal of flotation. In order to allow adequate separation, a sufficient detention time of the liquid in the trap must be achieved.

Engineers Need Enough Information To Assist In Selecting Interceptor Size

However, since the ideal is difficult to obtain, the actual time the liquid takes to pass through the trap is called flow through time. The closer the flow through time approaches the detention time required, the more effective the trap becomes. Usually, this is accomplished by placing baffles in a smaller tank. A flow through period of 30 percent of the theoretical detention time is considered good design practice. A detention time of between one and two minutes is a generally accepted design period.

An effective separator must have a cross section large enough to limit the velocity of the liquid to a point low enough for separation to occur. Most of the problems associated with grease traps failing to do their job are a direct result of high flow rates. It is desirable to limit flow into the interceptor to that allowed by the manufacturer or designer. Therefore, a flow restrictor should be placed either on the fixture or separator to limit flow.

The separator itself also must be designed to control the internal flow by careful design of the inlet and outlet. The ideal inlet should distribute effluent evenly across the entire tank to provide the greatest effectiveness. In addition, inlet baffles should direct flow in such a way so that the entering effluent is not allowed to produce strong currents directly towards the outlet. This is a condition known as short circuiting, which is the creation of a velocity too high to permit separation. The outlet should be submerged so as not to allow surface grease to escape the interceptor. Remember to vent the grease trap and not the fixture if the grease trap is serving only one fixture. Also, do not put a trap on the fixture the interceptor is serving.

Grease removal is accomplished by one of three different methods: manually, semi-automatically and automatically.

Manual removal is the method required for most grease traps. The top is opened, interior baffles removed if required, and a perforated scoop is used to remove the grease floating on top of the water.

Semi-automatic units are cleaned by passing hot water through the unit, turning a special valve on the draw-off line to the "on" position, and allowing the grease to discharge into a separate container for removal.

Automatic units are used in large installations for commercial projects. They operate by using a skimming action to direct floating grease into a dewatering and collection hopper for continuous removal. Also included in this "automatic" type are the enzymatic units.

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Drainage Interceptors

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These units use an enzyme introduced into the grease trap to break down the grease into water soluble particles, and so become safe to release into the drainage system. Under no circumstances should caustics of any kind be used. There are several problems associated with this method that has reduced or prohibited their use. Grease and oil are classified as saponifiable or unsaponifiable. The saponifiable products are those that will react with a caustic to form soap. Mineral or petroleum oils will not do this. The use of an incorrect material may actually accelerate any stoppage that might occur inside the interceptor. Many local authorities are reluctant to allow the use of enzymes treatment because in many cases, improper or insufficient treatment has occurred and grease has been found in the sewer system.

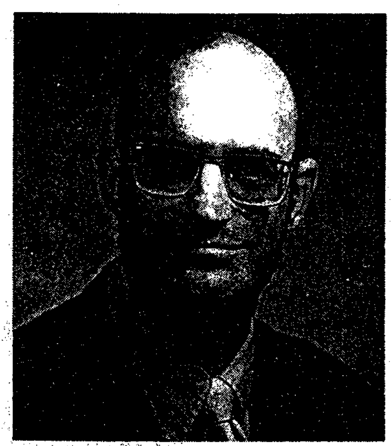
Selecting a grease trap

The smaller units used in kitchens are the most frequently used grease traps. I would like to discuss the procedure used in selecting such a trap. For larger units, due to the involved criteria required for separation, it is best to ask the advice of the manufacturer's engineering department to assist with selection of the proper unit.

The pre-engineered, smaller units are selected on the basis of maximum flow through the unit. The design sequence required to select a grease trap is as follows:

1. Determine the maximum flow, in gallons per minute (GPM) that would be expected from fixtures discharging into the grease trap. For a single sink:
   A. Find the total capacity of sink (if three compartments, use all three) by multiplying the length, width & depth (in inches) to find volume.
   B. Divide the total volume by 231 (cubic inches in 1 gallon of water) This gives the total gallons the sink is capable of holding.
   C. Deduct a percent for freeboard & dish displacement. A generally accepted figure is 25% of the volume. The remaining 75% is the practical volume.
   D. Using a draindown time of between 1 & 2 minutes for the practical volume, find the maximum flow in GPM. Use the manufacturer's literature to select a unit capable of accepting a flow at or above the GPM calculated.
2. If there are multiple sinks, it is not practical to consider all sinks discharging at once. Use the figure for the largest unit.
3. If a dishwasher is also discharging into a grease trap, add the flow from the dishwasher to that of the sink to determine the size of the unit.
4. If there is any question about potential maximum fixture discharge, ask the kitchen consultant or designer about the operation of the kitchen, and determine any unusual conditions that would require special consideration.
5. Don't connect a floor drain to the branch going into a grease trap. In the event of a back-up, flooding will occur.
6. Determine if approval from local authorities is required.

About the Author



Michael Frankel, CIPE, a native of Brooklyn, N.Y., received his engineering degree from City University of New York. He has been engaged in all aspects of plumbing and fire protection design and engineering for 30 years and is a frequent contributor to Plumbing Engineer. *In addition, Mr. Frankel is a faculty member of the City University of New York where he teaches evening division courses in both Plumbing Design and Plumbing Specification Writing. He is a member of the American Society of Plumbing Engineers, Northern New Jersey Chapter.*

Locating a grease trap

1. Locate the trap as close to point of discharge as possible.
2. Place clean out cover in an accessible location.
3. Don't locate the cover where people stand. The cover becomes hot.
4. Advise structural consultant about weight of grease trap and water and dimensions of required hole in floor slab.
5. The cover should have a gasket.
6. Select a unit with Plumbing & Drainage Institute (PDI) label. This means that the unit has been tested & complies with strict standards.
7. Place a properly sized flow restrictor on the inlet of the grease trap to guarantee that flow will not exceed rating of unit.

Oil Separators

Any project where a possibility exists that fuel oil may be accidentally introduced into a drainage system must be provided with an oil interceptor.

Oil separators are designed for either intermittent or continuous operation. Continuous operation of an oil separator is required for industrial projects with a constant discharge containing oil in the process effluent. The intermittent type is used for parking areas and garages or other similar projects that do not require separations as a result of constant flow.

Oil separators function in the same way as grease traps. Oil being lighter than water will float on top. Therefore, the unit required for separation of oil from water will operate on the same principle. However, since oil is more free flowing than grease, the unit itself is designed differently.

Cleaning is either manual or automatic. The oil separator is designed with an overflow outlet. When enough oil floats on top of the designed water seal level, it is forced out of the unit by gravity to spill into a separate storage container for recovery or disposal. For small projects, the oil could remain inside the separator but the owner must be assured of timely and periodic maintenance. An adjustable draw-off tube should be provided inside the unit to allow optimum adjustment of oil draw-off level.

The size selected depends on the project and the quantity of flow expected. Smaller units for parking areas are selected by using a generally accepted figure of one gallon total capacity of a separator for each 100 square feet of floor area. Larger, continuous units should be designed using American Petroleum Institute (A.P.I.) Dallas, Texas Specification 12-J. For projects containing large amounts of fuel oil (such as power plants), the Federal Environmental Protection Agency has a Spill Prevention Containment and Control (SPCC) program that must be used for design.

The location of the oil separator is not as critical as that of a grease trap. Fuel oil is generally free flowing, and the unit can be located in any area convenient for cleaning and emptying of the oil storage container.

Where projects have a fuel oil storage tank or day tank located on the site, the proper design for prevention of discharging oil as a result of a tank rupture or overfilling is to have the area dyked. The level of the dyke should be high enough to contain the entire tank contents for disposal at a later time. Drains within the dyked area should go to a small sump inside the area, with no direct connections or discharge to the drainage system.

Where code requires that fuel oil lines run within a building to be enclosed in a second protective pipe, the lowest level of the encasement pipe should have a drain spilling into a separate container or into the dyked area sump around the fuel oil tanks. The addition of an alarm within any area or sump where an oil leak is possible, is a good idea, because these areas may not be normally supervised.

In addition to fuel oil, other light density and volatile liquids such as cutting oil, NAPTHA, lube oil, etc. must be included in the oil category.

Fuel Separators

A distinction is being made between fuel oil and fuel (such as gasoline or kerosene) because of the much greater potential of fuel as a fire hazard.

The following requirements must be considered when designing a fuel separation system:

1. Fire and Building Department codes must be strictly observed.
2. Fuel spilled as a result of an accident or tank rupture must be confined in the immediate area.
3. The drains located for fuel spills must be selected for immediate, concurrent removal of the fuel, fire water and/or rain water.
4. Size the drainage lines to flow ⅔ capacity at maximum projected flow.
5. The fuel must be conveyed to a separate enclosed holding tank away from the area of the spill. The holding tank must be sized for the following:
   A. Total volume of fuel expected.
   B. Required water seal volume.
   C. Volume of free space required in tank (per manufacturer).
   D. Maximum probable flow rate into holding tank.

Acid Neutralizers

When designing projects such as hospitals and laboratories, any acid waste must be prevented from entering the sanitary drainage system in quantities or strength that would prove harmful. The most common method of doing this is with an acid neutralizer using limestone chips as the neutralizing medium.

Grease Removal Is Accomplished By One of Three Different Methods

Acid neutralizers vary in size from small units, used in lieu of a trap on one fixture, to large basins (or sumps) for large acid waste systems. They are sized on either a probable discharge of 10 gallons/hour per sink or student station or standard water supply curves. The acid waste with a PH of about 1, passes through the neutralizer and around the chips inside. The chemical reaction between acid and the chips produces an effluent with a PH of between 4.5 and 5. Most authorities will permit waste with a PH of 4 to discharge into public sewers. Dilution of effluent with normal sanitary waste also brings up the PH (Neutral PH is 7).

A retention time of between 10 and 15 minutes is considered adequate for neutralization. Chips should be from 1" to 3" in size for optimum flow around them. Chips should take up about 50 percent of tank volume. One hundred pounds of limestone chips will neutralize 98 lbs of sulphuric acid or 73 lbs of hydrochloric acid. Limestone is approximately 90 percent calcium carbonate. For battery acid, dolomitic limestone has proven best.

Sand Traps

A small amount of sand or gravel that accidentally finds its way into a pipe will do no harm, and will be washed away with a heavy flow of water. But where it is probable that larger amounts of sand or sediment will be continuously suspended in an effluent (such as foundation drains or an industrial washing procedure) this sand must be prevented from entering the drainage system. This is done with a sand interceptor or trap.

Sand, being heavier than water will fall to the bottom of a container. Sand traps shall be designed so that the effluent flow will be reduced to the point that the sand will settle out, and the clear water will discharge out the upper end of the unit, using baffles or an overflow type arrangement to assure that no sand will be discharged.

Industrial or continuous sand bearing effluent will require a custom engineered interceptor to retain larger amounts of sand and gravel. Foundation drains could utilize a 2'-0" × 2'-0" size interceptor with a 2'-0" depth of sand storage at the bottom, below the invert of discharge drain line.

Maintenance is an important factor in continued efficiency of operation. These units are usually mechanically pumped out at regular intervals.

Solids Interceptor

Where a project such as dental offices or jewelry operation requires a means for the collection of precious metal chips for recovery, the installation of a solids interceptor is indicated. These are smaller units mounted either in place of a trap or on a floor. They use a wire mesh screen or basket type strainer to trap the metal at the bottom of the unit. In some cases where smaller particles are produced, a filter made of stainless steel wool may be used. If recovery of metal is not required, they can safely be discharged to the drainage system, if not in large amounts.

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Plaster & Barium Interceptors

In medical facilities, there are two substances that should not be allowed to enter the sanitary system. They are plaster and barium. Plaster is used for casts and is usually used in an area set aside for this purpose. Barium is a substance that appears opaque on x-rays, and is used for diagnosis of gastro-intestinal problems. Again, there is usually a separate room or area for this.

These interceptors remove small particles (like sediment) suspended in waste and are different in operation from a solids interceptor. They are usually placed on each fixture in the room. If there is a multiple sink installation, the interceptor can be placed on a common drain line only if the interceptor will be located close to all sinks.

Hair Interceptors

Hair will eventually cause a blockage in the trap, waste pipe or pop-up drain connectors at a sink or lavatory. Where you can expect a large amount of hair at regular intervals, such as a barber shop or beauty parlor, a hair interceptor should be used in place of a regular trap at each fixture.

These are smaller units that use a perforated basket strainer for trapping hair.

Laundry Waste

Where projects contain a battery of clothes washing machines, this type of installation usually generates significant amounts of lint, paper and other waste material. If left to harden at night or during the time these machines were not in operation, they would cause a blockage in the drainage piping.

All laundry waste should be routed to a separate sump or floor depression where the effluent can accumulate and discharge through a floor drain with a strainer capable of keeping all unwanted solids in the depressions for easy cleaning.

Radioactive Waste

Radioactive waste (radwaste) is a special category of waste that emanates from projects such as power plants, industrial facilities, hospitals and laboratories. Where radwaste treatment is not accomplished on site by others, it must be stored for removal or decay to a safe level.

Radwaste consists of radioactive material suspended in the effluent. In hospitals, patient toilet waste may also be radioactive.

The waste piping system must be an impervious material not subject to oxidation, generally stainless steel piping with welded joints, also used for storage tanks. Care must be taken to avoid fittings that may tend to accumulate crud which will produce radioactive "hots spots" in the piping network.

All piping and storage tanks must be shielded to prevent radioactive "shine" affecting any employee or other persons casually passing adjacent to the systems on a regular basis. □□

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