

Hampton Roads Regional Technical Standards Sizing of Grease Control Devices

An element of the Special Order of Consent is the use of the MOM tool to reduce Sanitary Sewer Overflows (SSO). Within the MOM program is the Fats Oils and Grease (FOG) component. FOG has been shown to be a significant source of SSO occurrence, and the reduction of FOG in a sanitary sewer system has typically resulted in a corresponding reduction of sewer blockages and SSOs.

The reduction of FOG in a system can be accomplished by the use of Best Management Practices (BMPs) for kitchens and by interception of FOG from the facility or Food Services Establishment (FSE) properties before it reaches the public sanitary sewer system. FSEs and residences both contribute FOG. The use of BMPs in both places will certainly reduce the contribution to the public system. The use of Grease Control Devices (GCDs) is a viable method to reduce FOG in FSEs. GCDs have been required in FSEs by plumbing codes since the 1970s; however, there has not been a definitive method for determining the size of the grease control interceptor. Similarly, the cleaning frequency of the device has not been established other than by rules of thumb such as the commonly used 25% rule, i.e., when the combined depth of grease and solids within the tank, floating and settled, reaches 25% of the total liquid depth, the tank should be cleaned. Obviously the tank size becomes important, with a smaller tank becoming a candidate for more frequent cleaning than a larger tank in the same situation. Grease laden wastewater also flows through a smaller tank more quickly, leaving less time for the grease and solids to separate from the wastewater. Given the lack of guidance on tank sizing, the purpose of this document is to establish a methodology that when used produces a reasonably sized tank, consistent with other methods, and one that can produce duplicatable results throughout the region.

The variables considered in this method include the retention time of the wastewater within the tank to allow solids to settle and FOG to rise; a facility multiplier dependant upon the FSE type to account for the variables of FOG generation within the category of business; and a drainage fixture unit (DFU) value to account for the wastewater volume generated from food preparation and kitchen activities.

Retention Time

Retention times commonly used are between 20 and 30 minutes. Recent work at North Carolina State University further confirms this range as being appropriate. The variation of fats, oils and grease production within restaurant types results from the type of food being prepared, the use of kitchen BMPs, the use of garbage disposal units, the use of dishwashers, and other factors. Certainly retention times that are too short will allow FOG to pass through the GCD and into the public system. Retention times that are too long could result in anaerobic conditions, low pH or the formation of hydrogen sulfide gasses that would corrode concrete tanks. Given the industry preference, the retention time of 30 minutes has been selected.

Drainage Fixture Units (DFUs)

DFUs are commonly used in the sizing of plumbing fixtures. Although DFUs may be somewhat arbitrary, the professional practice of its use has produced acceptable conclusions. To simplify the selection, a table has been prepared for those fixtures commonly found in FSEs. This table is included as Table 1 below. These values are consistent with the International Plumbing Code.

Table 1: Assigned DFU Values

Fixture	Selected DFU Value
Floor Sink / Floor Drain	2.0
Mop Sink	5.0
Hand or Bar Sink	1.0
Dishwasher	2.0
<i>Unlisted Trap Size:</i>	
1 ¼" or less	1.0
1 ½" or less	2.0
2" or less	2.0
2 ½"	4.0
3"	5.0
4"	6.0

Two Floor Sinks / Floor Drains should to be assumed present for the purpose of calculations.

It is intended that the DFU count be determined during the plan review process. Furthermore, it is intended that this method be the basis of GCD unit sizing by the designer. It is also intended that this table be included on the plumbing sheet of the drawings submitted for design review. Any deviations should be noted and explained.

Facility Multiplier

This factor is selected from Table 2 corresponding to the appropriate NAICS description of the type of FSE. The Facility Multiplier is a value based upon the number of fixtures and type of food prepared in each FSE.

When developing the grouping, consideration was given to facilities employing disposable dinnerware, in which case automatic dishwashers may not be present.

Table 2: Facility Multipliers Related to NAICS Designations

Designation	Title	Multiplication Factor
721100	Traveler Accommodation (Hotels)	2.0
722110	Full-Service Restaurants (Except Steakhouses)	
722310	Food Service Contractors (School cafeterias, government cafeterias, hospital cafeterias, etc.)	
711110	Theater Companies and Dinner Theaters	
722100	Full-Service Restaurants (Steakhouses only)	2.5
445120	Convenience Stores	1.0
445110	Supermarkets and Other Grocery Stores	
447110	Gasoline Stations with Convenience Stores	
722211	Limited-Service Eating Places	2.5
722213	Snack and Non-Alcoholic Beverage Bars	
722320	Caterers	
722212	Cafeterias, Grill Buffets, and Buffets	3.0

* NAICS = North American Industry Classification System

Minimum and Maximum Size

Minimum size is established as 500 gallons, which is a commonly manufactured grease interceptor size. Maximum size is established at 2000 gallons because of the limitations of grease hauler truck capacity, avoiding corrosion, and preventing anaerobic conditions. Multiple tanks may be installed if required.

Computed and Selected Tank Size

Assuming an average one month cleaning frequency (three month minimum), tank size is selected using the equation below:

$$\text{Volume of Tank} = \text{DFUs} \times \text{Facility Multiplier} \times 30 \text{ minutes retention time}$$

Volume of tank is the tank length times the tank width times the distance from the bottom of the tank to the invert of the outlet.

The selected tank size should be rounded up to the next commercially available tank size. Sizes commonly available are in the range of 500, 750, 1000, 1500 and 2000 gallons, depending upon the manufacturer.

Grease Interceptor Volume Range Analysis

The rationalization for the equation used to determine tank volume is shown in Table 3. Eighteen restaurants with appropriately sized grease interceptors are analyzed according to NAICS classification and total DFUs, and the resulting computed tank volumes are found to be reasonably acceptable. The multiplication factors associated with the NAICS classification are determined based on the optimum tank volume calculated.

Table 3: Range Analysis

Name	Ideal GCD Size	Calculated
	for Monthly	Grease Interceptor
	Cleaning (gal)	Size (gal)
Angie's Bakery	1000-2000	975
Arby's	1000-2000	1575
Burger King	1000-2000	1350
Chesapeake Bay Seafood	800-1500	780
Dunkin Donuts	1500-2000	825
Farm Fresh	2000	1950
Fortune Garden Chinese Restaurant	1500-2000	1500
Golden Corral - Kempsville	2000	2070
Golden Corral - Upton	2000	1440
Kempsville Grill	1000-2000	1440
Kyushu Sushi Bar	550-1000	780
McDonald's	1500-2000	1875
Popeye's	1500-2000	2025
Texas Long Horn	2000	2100
Texas Steakhouse	2000	2550
TK Tripps	1500-2000	2400
Village Inn Family Restaurant	1000-2000	1920
Wawa Store	1000-2000	720

Configuration

The configuration of a typical grease interceptor should be consistent with ASTM C1613-07, Standard Specification for Precast Concrete Grease Interceptor Tanks, as shown in Figure 1.

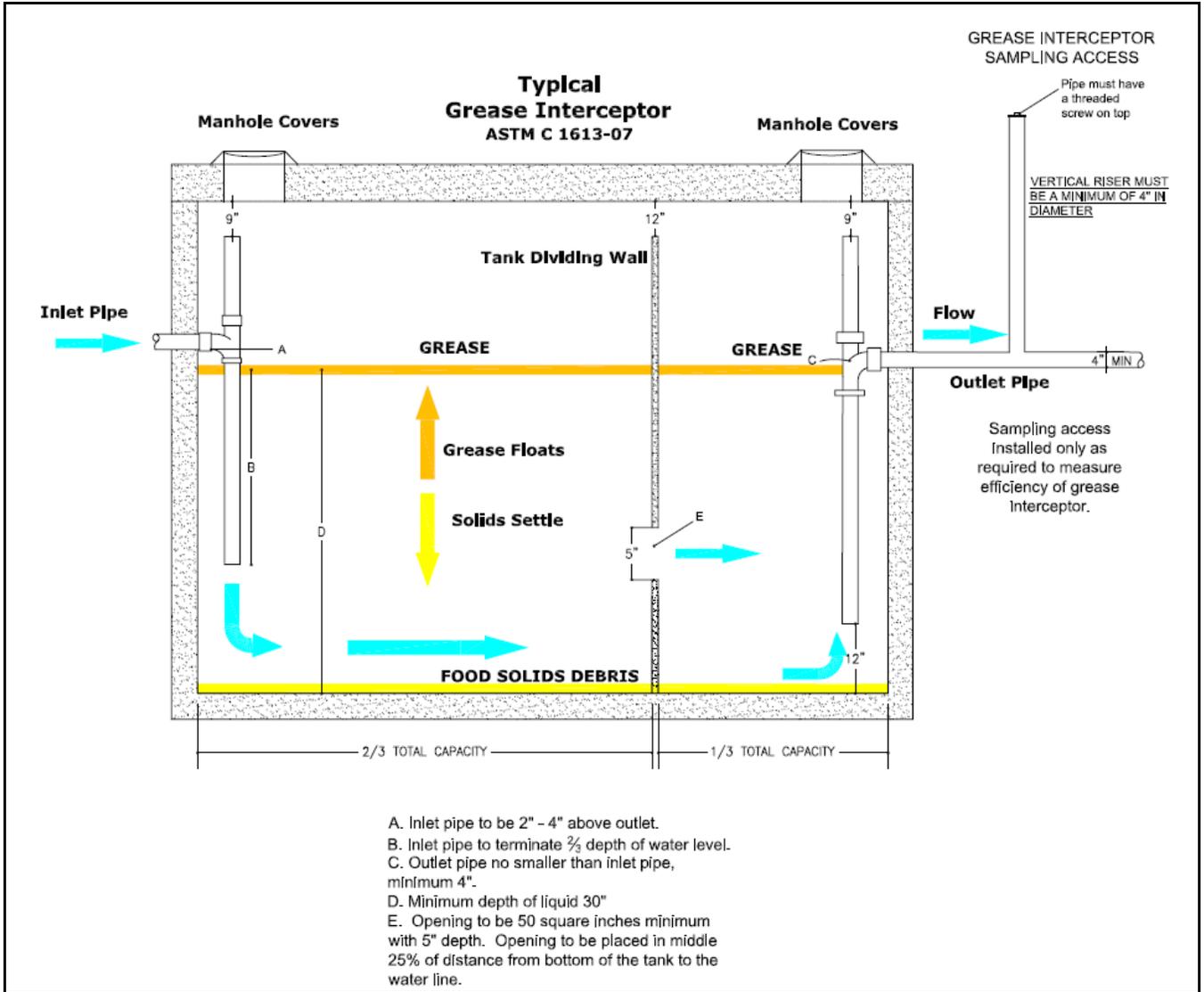


Figure 1: ASTM C 1613-07

Space Constraints

When an existing property is renovated to be a FSE, there may not be enough space for installation of the grease interceptor that is of the size calculated. In these cases, a smaller grease interceptor, a grease trap, or an automatic grease removal device may be used; however, more frequent maintenance may be necessary.

In order to install a grease control device that is smaller than the size resulting from the sizing calculation, a variance form must be submitted to the FOG program manager of the locality.

Sizing of Grease Traps and Automatic Grease Removal Devices

When grease traps or automatic grease removal devices are to be used, they must be sized and installed in accordance with the 2006 International Plumbing Code. This means that they should conform to PDI G101, ASME A112.14.3, or ASME A112.14.4. (The Plumbing and Drainage Institute has a list of certified grease traps available on their website.) The device(s) should be sized to pretreat the measured or calculated flows for all connected fixtures or equipment, according to the manufacturer's instructions.

The flow from fixtures or equipment is generally given by the manufacturer. The flow from a sink can be approximated by measuring the volume of the sink, then assuming that 75% of the capacity of the sink can be emptied in one minute. The 2006 International Plumbing Code Commentary shows an example of this calculation in section 1003.3.4.1. Example 1 is shown below:

Example 1: Single fixture installation for a three-compartment sink, each compartment 18" x 24" x 24". Grease trap (pre-manufactured unit) located under sink compartment with flow control device.

Step 1: Determine the actual liquid holding capacity of the sink. (Length x Width x Height) x Number of compartments = Cubic inches (18" x 24" x 24") x 3 = 31,104 cubic inches.

Step 2: Contents expressed in gallons =
$$\frac{\text{Cubic inches}}{231} = \frac{31,104}{231} = 134.6 \text{ gallons}$$

Step 3: Typically, a sink or fixture is seldom filled to capacity because dishes, pots, and pans displace 25 percent of the water; therefore, 75 percent of the actual fixture capacity should be used to establish the drainage load.

$$134.6 \times 75 \text{ percent} = 100.9 \text{ or } 101 \text{ gallons}$$

Step 4: Calculate the flow rate based on retention time of 1 minute:

$$\text{Flow rate in gallons per minute (gpm)} = \frac{\text{Drainage load in gallons}}{\text{retention time in minutes}} = \frac{101 \text{ gal}}{1 \text{ min}} = 101 \text{ gpm}$$

A flow control device is installed to limit the discharge from the dishwasher to 50 gpm;

Typically, grease trap retention capacity in pounds is double the flow through rating; therefore, a 50 gpm rating has a grease retention capacity of 100 pounds. It is important to note that grease trap size is in pounds according to industry specifications.

Frequency of Cleaning of Grease Traps and Automatic Grease Removal Devices

Grease traps should be cleaned according to manufacturer recommendations, or in accordance with the 25% rule. Automatic grease removal devices should be cleaned according to manufacturer recommendations as well. If the manufacturer does not have a recommended maintenance schedule, solids which have accumulated in each compartment of the device should be cleaned out once every week at minimum. During this maintenance, the sides of the tank and the heating element (if present) should be cleaned of buildup. The grease collector box should never be allowed to overflow, and should be emptied at a minimum of once daily.