

Hampton Roads Regional Technical Standards

Sizing of Grease Control Devices

An element of the Special Order of Consent is the use of the Management, Operations, and Maintenance (MOM) program to reduce Sanitary Sewer Overflows (SSOs). 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 the use of Grease Control Devices (GCDs) in Food Service Establishments (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 device. 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 duplicable 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 drainage fixture unit (DFU) value to account for the wastewater volume generated from food preparation and kitchen activities; and a facility multiplier dependent upon the FSE type to account for the variables of FOG generation within the category of business.

SIZING OF GRAVITY GREASE INTERCEPTORS

Retention Time

For gravity grease interceptors, retention times commonly used are between 20 and 30 minutes. 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. 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 drain pipes. Although DFUs may be somewhat arbitrary, the professional practice of its use has produced acceptable conclusions. To simplify the selection, a table has been included as Table 1 below. These values are consistent with the 2012 Virginia Plumbing Code.

It is intended that the DFU count for all fixtures that will be connected to the GCD 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.

Table 1: Assigned DFU Values

Fixture	DFU Value
Dipper Well	1
Dishwasher	Based on fixture outlet size
Floor Drain (Food Prep Area)*	0.1
Sink (Bar, Dump, Hand, Multi-compartment, Pre-rinse, Pot)	2
Floor Sink	Based on fixtures connected***
Mop Sink	Based on fixture outlet size
Wok Range	Based on fixture outlet size
Steam or Soup Kettle	Based on fixture outlet size**
Warming Table-with Drain	Based on fixture outlet size
Fixture Outlet Size	DFU Value
1.25" Drain	1
1.5" Drain	2
2" Drain	3
3" Drain	5
4" Drain	6

**A DFU value of 0.1 has been assigned to floor drains in food prep areas. This value is assigned in place of the plumbing code recommendation which bases the DFU value on fixture outlet size, inflating GCD size.*

***If no fixture outlet is available, assume DFU value of the drain size the kettle is being poured into.*

****Fixtures connected are defined under the fixture column. (i.e. Dishwasher, Soup Kettle, etc.)*

Facility Multiplier

The Facility Multiplier is a value determined by grease production category as outlined in Table 2 below.

Table 2: Facility Multipliers by Grease Production

Category	Description/Examples	Multiplication Value
Low Grease Production	serves food prepared offsite or food that requires minimal preparation and/or warming; sandwich shop, convenience store (no kitchen), hotel breakfast bar, frozen yogurt, coffee shop, take & bake pizza, bar/club (limited food service), cafeteria (no prep), grocery meat department (no bakery, deli or other food prep), sushi (no grill), rental event halls/facilities with kitchen	1
Medium Grease Production	serves foods from a limited menu and/or with a limited amount of onsite preparation; pizza (no fryer), ice cream parlor, fast food hamburger (pre-cooked), caterer, Greek, Japanese, Vietnamese (Pho), grocery store/supercenter/warehouse club (no fryer), cafeteria (limited prep), bakery/donut shop (no fryer), convenience store with kitchen (no fryer) *low category restaurants with fryer	2
High Grease Production	serves a full menu of food prepared onsite; American traditional, hamburger (with grill), BBQ, Mexican, Italian, steak/seafood house, hibachi, buffet, fast food fried chicken, Chinese, Indian, cafeteria (full prep), *medium category restaurants with fryer	3

Minimum Size

When it is determined a Gravity Grease Interceptor is required the minimum size is established as 500 gallons. This is a commonly manufactured grease interceptor size. Multiple tanks may be installed if required.

Computed and Selected Tank Size

Tank size is selected using the equation below:

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

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.

If the calculated tank value is within 5%, the lesser tank size may be used.

(Calculated size- Interceptor Desired size) / (Interceptor Desired) *100.

Example:

$$\frac{(2100 - 2000)}{2000} * 100\% = 5\%$$

Space Constraints

When an existing property is renovated to be a FSE, there may not be enough space for installation of the gravity 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, locality approval is required.

SIZING OF HYDROMECHANICAL GREASE INTERCEPTORS (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 2012 Virginia Plumbing Code. 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 2012 Virginia Plumbing Code Commentary contains examples of this calculation in section 1003.3.4. Two examples of the Plumbing and Drainage Institute (PDI) method are shown in Appendix A.

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 and Table 1003.3.4.1 of the 2012 Virginia Plumbing Code. **Any size greater than 100 gpm will need be broken up into multiple hydromechanical grease interceptors, or use the gravity grease interceptor calculation method.**

APPENDIX A

EXAMPLE 1: A bakery has a three-compartment sink for washing utensils, pots, pans, and trays used for preparing goods for sale. All three compartments are 21-inches long by 21-inches long by 14-inches deep. The three-compartment sink is going to be directly connected to the hydromechanical grease interceptor.

Because there are no other fixtures going to be directly connected to the grease control device we can assume a hydromechanical grease interceptor will work and will verify and calculate the size needed with the steps below.

Step 1: Calculate Total Sink Volume

Use the formula:

$$\frac{(\# \text{ of compartments} * [L \text{ inches} * W \text{ inches} * H \text{ inches}])}{231 \text{ cubic inches per gallon}} = \text{gallons}$$

$$\frac{(3 * [21 \text{ inches} * 21 \text{ inches} * 14 \text{ inches}])}{231 \text{ cubic inches per gallon}} = 80.18 \text{ gallons}$$

Step 2: Calculate Actual Sink Volume

Approximately 75 percent of the sink is filled with water when items are being washed

$$0.75 * 80.18 \text{ gallons} = 60.14 \text{ gallons}$$

Step 3: Determine Acceptable Drain Time

Check with the locality to determine if 2-minute drain time is acceptable; otherwise assume 1 minute drain time.

$$\frac{60.14 \text{ gallons}}{1 \text{ minute}} = 60.14 \text{ gallons per minute (gpm)}$$

or

$$\frac{60.14 \text{ gallons}}{2 \text{ minutes}} = 30.07 \text{ gallons per minute (gpm)}$$

**if approved by locality*

Step 4: Find Approved Size

Refer to table 1003.3.4.1 of the 2012 Virginia Plumbing Code to determine hydromechanical grease interceptor size. Calculated sizes should be rounded up to the next available flow through rating.

According to Table 1003.3.4.1, a 75-gpm hydromechanical grease interceptor would be needed for the 1-minute drain time. If locality approved 2 minute drain time, a 35 gpm hydromechanical grease interceptor would need to be installed.

EXAMPLE 2: A restaurant kitchen that prepares a full menu of food onsite has the fixtures listed below:

Two three-compartment sinks for washing utensils, pots and pans. Each compartment is 17-inches long by 21-inches wide by 12-inches deep.

One one-compartment sink for food preparation. The sink is 24-inches long by 24-inches wide by 12-inches deep.

One pre-wash sink used to rinse glassware, plates, bowls and silverware before going into the dishwasher. The sink is 18-inches long by 18-inches wide by 14-inches deep.

One steam kettle with 50-gallon capacity with no drain and tipping into a 4-inch floor sink.

One dishwasher with a 35-gpm rating for washing plates, bowls and silverware.

One dishwasher with 20-gpm rating for washing glasses and cups.

Two hand sinks only used for washing hands. Both sinks are 17-inches long by 15-inches wide by 6-inches deep.

One 4-inch trap mop sink used for emptying mop buckets. The sink is 20-inches long by 16-inches wide by 12-inches deep.

Three 2-inch trap floor drains.

Step 1: Determine What Fixtures Do Not Need to be Attached to the Grease Interceptor

Since there is a pre-wash sink for glassware, plates, bowls and silverware, the two dishwashers do not need to be connected to the grease interceptor (1003.3.1 2012 *Virginia Plumbing Code*).

While hand sinks are not generally considered high FOG producing sinks, employees washing their hands of food waste does contribute to FOG. If the hand sinks were strictly used for sanitation purposes only then they would not need to be attached to the grease interceptor. In our example, we are going to assume that the hand sinks are not strictly used for sanitation.

Step 2: Calculate Total Sink Volume and Actual Sink Volume

Check with the locality to determine if 2-minute drain time is acceptable; otherwise assume 1-minute drain time

Three-compartment Sink

$$\left(\frac{(3 * [17 \text{ inches} * 21 \text{ inches} * 12 \text{ inches}])}{231 \text{ cubic inches per gallon}} \right) * 0.75 = 41.72 \text{ gallons each}$$

One-compartment Sink

$$\left(\frac{(24 \text{ inches} * 24 \text{ inches} * 12 \text{ inches})}{231 \text{ cubic inches per gallon}} \right) * 0.75 = 22.44 \text{ gallons}$$

Pre-wash Sink

$$\left(\frac{(18 \text{ inches} * 18 \text{ inches} * 14 \text{ inches})}{231 \text{ cubic inches per gallon}} \right) * 0.75 = 14.73 \text{ gallons}$$

Mop-Sink

$$\left(\frac{(20 \text{ inches} * 16 \text{ inches} * 12 \text{ inches})}{231 \text{ cubic inches per gallon}} \right) * 0.75 = 12.47 \text{ gallons}$$

Hand Sink

$$\left(\frac{(17 \text{ inches} * 15 \text{ inches} * 6 \text{ inches})}{231 \text{ cubic inches per gallon}} \right) * 0.75 = 4.97 \text{ gallons each}$$

Step 3: Determine Other Equipment Discharge Rates

Steam Kettle: 50 gpm

Check with the locality to determine if 2-minute drain time is acceptable; otherwise assume 1-minute drain time

Floor Drains: 1 gpm each

Assume floor drains typically only have a flow during floor cleanings or accidental spills

Step 4: Calculate total flow rate from all equipment

$$\begin{aligned} &= 41.72 + 41.72 + 22.44 + 14.73 + 12.47 + 4.97 + 4.97 + 50 + 1 + 1 + 1 \\ &= 196.02 \text{ gpm} \end{aligned}$$

Because the total flow rate is greater than 100 gpm (the maximum allowable flow rate for a certified hydromechanical grease interceptor), several hydromechanical grease interceptors will be required or the use of a gravity grease interceptor may be required. Consider cleaning requirements of your locality when making the decision and check with your locality to determine the best option. . Below are two possible configurations:

Hydromechanical Grease Interceptor Configuration

Hydromechanical Grease Interceptor No. 1: 100 gpm rating with 100 gpm flow control to accommodate both three-compartment sinks

Hydromechanical Grease Interceptor No. 2: 50 gpm rating with 50 gpm flow control to accommodate soup kettle

Hydromechanical Grease Interceptor No. 3: 25 gpm rating with 25 gpm flow control to accommodate both hand sinks, the mop sink and the floor drains

Hydromechanical Grease Interceptor No. 4: 15 gpm rating with 15 gpm flow control to accommodate the pre-wash sink

Hydromechanical Grease Interceptor No. 5: 25 gpm rating with 25 gpm flow control to accommodate the one-compartment sink

Gravity Grease Interceptor Configuration

Step 1: Calculate DFUs

Three-compartment sink: $2 * 2 = 4$

One-compartment: 2

Pre-wash: 2

Steam kettle: 6

Hand sinks: $2 * 2 = 4$

Mop Sink: 6

Dishwashers: 0

2-inch trap floor drains: $3 * 0.1 = 0.3$

$$= 4 + 2 + 2 + 6 + 4 + 6 + 0.3 \\ = 24.3$$

Step 2: Determine Facility Multiplier

Full menu of food prepared onsite restaurant kitchen: 3

Step 3: Calculate gravity grease interceptor size

$$= 24.3 * 3 * 30 \\ = 2,187 \text{ gallons minimum}$$

Step 4: Decide on Size

A 2187-gallon interceptor is not a standard size to purchase, there for a 2500-gallon interceptor may be needed if there is more than a 5% difference between the calculated size and the nearest size below.

$$\frac{(\text{Calculated size} - \text{Interceptor Desired size})}{(\text{Interceptor Desired})} * 100$$

$$\frac{(2187 - 2000)}{2000} * 100\% = 9.35\%$$

This is greater than 5% and therefore must go to the next size larger.