WSA's Grease Interceptor Product Standards 2019 Editions

IAPMO/ANSI Z1001 – Gravity Grease Interceptors

PDI-G101 – Hydromechanical Grease Interceptors

ASME A112.14.3 – Hydromechanical Grease Interceptors

ASME A112.14.4 – Grease Removal Device

ASME A112.14.6 – FOG Disposal System

CSA B481 Series – Hydromechanical Grease Interceptors

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The Product Standards

In order to better understand the purpose and function of the standards that govern grease interceptors, it is advantageous to understand how grease interceptors are designed to work. Well established principles of operation are the basis for the testing and rating protocols that exist in standards, which ensure that grease interceptors operate at minimum acceptable levels of performance.

All grease interceptors operate based on the principle of gravity-differential separation. Basically, FOG is lighter than water and in a grease interceptor, FOG will separate from the entering waste water, when the velocity of the influent is reduced, because of the difference in specific gravity between water and FOG. To reduce velocity, the most effective designs spread the incoming waste stream throughout the cross-sectional area of the interceptor. Separation can also be enhanced by means of air entrainment introduced through a vented external flow control.

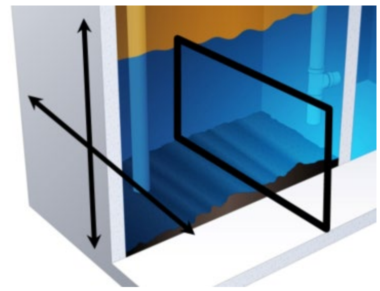


Figure 1: Cross-sectional area of grease interceptor

Regardless of the design for any given type of grease interceptor, product standards ensure that approved devices operate in accordance with minimum performance or design requirements. This section will review each of these standards and their respective requirements governing the construction, testing and rating of grease interceptors.

Labs, Testing and Certification, and Marks

Before reviewing the product standards that govern grease interceptors, it is important to understand what is meant by the terms testing, certification, listing and marks. A grease interceptor that is approved for installation according to model plumbing codes must be tested by an approved laboratory and certified and listed by an approved agency.

A product approval begins with identifying a laboratory (lab) that is accredited to test a product to a required standard by an accreditation service such as A2LA, ANAB, IAS, or NVLAP, etc. CSA, IAPMO R&T and NSF all have accredited lab’s capable of testing to at least one of the product standards that govern grease interceptors.

Product listing is different than testing. All three of these labs offer testing, certification and listing services. Certification and Listing is a service offered by an approved lab or agency that verifies the testing performed by an accredited lab. Products that are confirmed to meet the testing requirements of the required standard are certified and then published where the approval can be verified by interested parties, such as plumbing inspectors.

For example, NSF is accredited for testing, certification, and listing of grease interceptors to ASME A112.14.3 and PDI G101. A manufacturer can have NSF test a grease interceptor to either or both standards. They can also have NSF certify and list their product so interested parties can verify the product has been tested and meets the requirements of approved standard(s).

CSA, IAPMO and ICC will approve grease interceptors that have been tested by an accredited lab and certified and listed by an approved agency. These groups also offer independent certification and listing services. They can provide certification and listing for products tested by their own labs, or will accept testing from independent accredited labs. In this way, there is a lot of flexibility in how a product gets tested, and then certified and listed for verification purposes.

A product that is certified and listed with an agency receives the benefit of using that agencies "mark" of conformance. Agencies rigorously protect and defend their marks because they represent that a product is approved for installation in model plumbing codes. The use of the mark on submittals or specifications allows engineers or plan reviewers to quickly approve products for installation before they are inspected in the field. The use of the mark on a product label provides inspectors with a quick visual method for approving a product that is installed in the field.

A common assumption in UPC territories is that an approved product must have a UPC mark. That is not actually correct. To be UPC listed means that a product has been tested by an accredited lab and certified and listed by IAPMO R&T. Optionally, a product could be tested, and certified and listed by an independent lab, such as NSF, and would be approved in UPC territories so long as the standard the product was certified and listed to was a UPC approved standard. In this case the manufacturer's literature and product labels would bear the NSF mark.

The Standards that Govern Grease Interceptors

The nationally recognized standards in North America that govern commercial grease interceptors are:

- IAPMO/ANSI Z1001-2016
- PDI G101 – 2017
- ASME A112.14.3 – 2018
- ASME A112.14.4 – 2001 (R2017)
- ASME A112.14.6 – 2010 (R2019)
- CSA B481 Series – 2012 (R2017)

Before, moving on to each of these standards, it may be helpful to understand what the dashed and parenthesized numbers mean. The dash immediately following the identification number of the standard represents the year the standard was either adopted and published or amended and republished. For example, ASME A112.14.3 was originally published in 2000. However, it was amended and republished in 2018. When that happened, the 2000 was dropped and the new year the standard was amended and republished was added; 2018.

ANSI based standards are required to be reviewed and amended or "reaffirmed" every five years. When a standard is *reaffirmed,* it means that it was reviewed by the governing committee, no changes were made, and the standard remains valid as of the year indicated in parentheses. For example, ASME A112.14.4 was originally adopted and published in 2001. It was reviewed and reaffirmed without any changes in subsequent years as required and most recently in 2017, as indicated by the parentheses around the number (R2017).

IAPMO/ANSI Z1001 – 2016

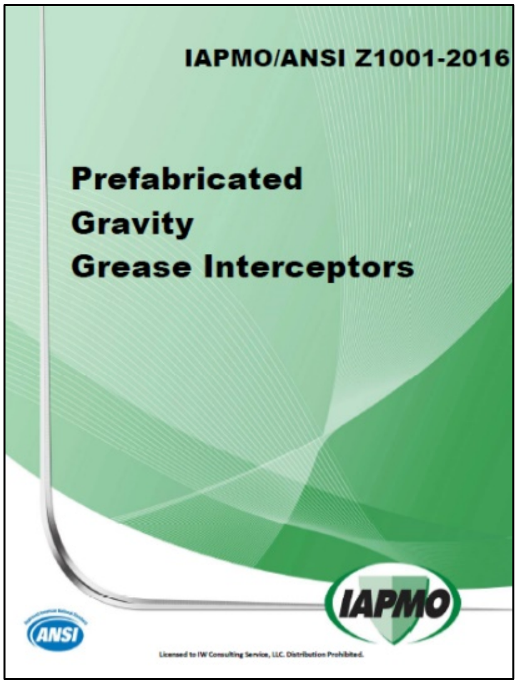
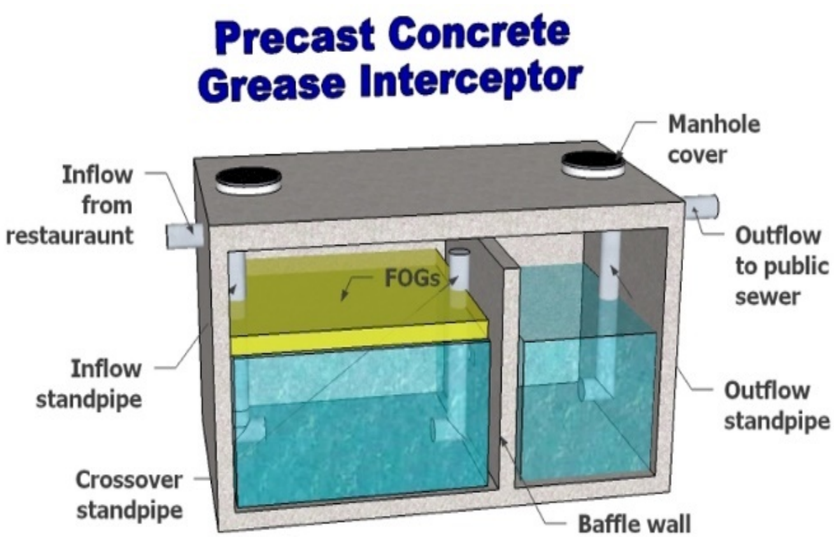


Figure 2: IAPMO/ANSI Z1001 - 2016

This standard has its roots in the IAPMO/ANSI Z1000 standard governing prefabricated septic tanks. Z1001 has become the primary standard governing gravity grease interceptors (GGI), recognized by national model plumbing codes and most independent state or local plumbing codes. Figure 43 illustrates a typical GGI meeting the design requirements of this standard, such as a minimum of two compartments, minimum liquid volume of 300 gallons, minimum free airspace, size and location of manhole covers, and so on. The standard also governs construction material requirements including concrete, fiberglass, polyethylene and coated steel.

The standard does not require a performance test for certified units, but instead only mandates leakage testing.

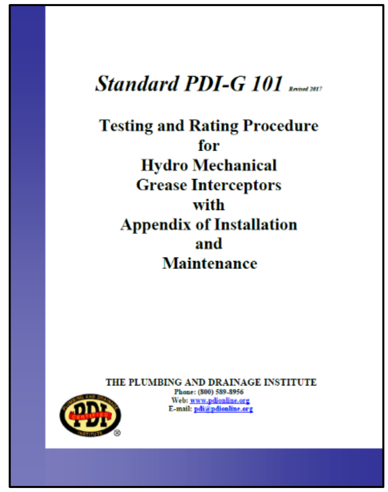


Courtesy of National Precast Concrete Association

Figure 2: Example of Gravity Grease Interceptor

PDI G101 - 2017

In the early 1940’s, prior to the entrance of the United States into World War II, there was no standardized testing protocol for grease interceptors. Each manufacturer determined its own ratings for devices, which varied by size and type to meet engineer’s specifications, to satisfy requirements in plumbing codes or for military installations, specifications approved by the Construction Division, Office of the Quartermaster General.


Standard PDI-G 101 Revised 2017

Testing and Rating Procedure
for
Hydro Mechanical
Grease Interceptors
with
Appendix of Installation
and
Maintenance

THE PLUMBING AND DRAINAGE INSTITUTE
Phone: (800) 589-8956
Web: www.pdionline.org
E-mail: pdi@pdionline.org

Figure 3: PDI G101 - 2017

The lack of uniformity in product ratings ultimately proved unsatisfactory. With the cooperation of the US Army Corp of Engineers, the Research Committee of the Plumbing and Drainage Manufacturer’s Association (now the Plumbing and Drainage Institute), and others, a testing and rating program was developed at the Iowa Institute of Hydraulic Research (Institute). The program established uniform flow rates and minimum efficiency and grease storage capacities for grease interceptors. Subsequently, no grease interceptor could be installed in an Army camp kitchen that did not bear the mark of the Institute.

The Research Committee of the Plumbing and Drainage Manufacturer’s Association continued the testing program developed at the Institute, at the United States Testing Company, Inc., culminating in the first edition of PDI G101 governing commercial grease interceptors in 1949.

The testing protocol developed at the Institute has largely remained unchanged over the past 75 years. Lard was heated to a range between 150°F and 160°F and mixed uniformly with water from a supply tank that was heated to a similar temperature. The mixture was discharged to a grease interceptor at a calibrated flow rate. A grease interceptor was required to separate a minimum of two-times its average flow rate in pounds of lard at a minimum average efficiency of 90 percent for certification.

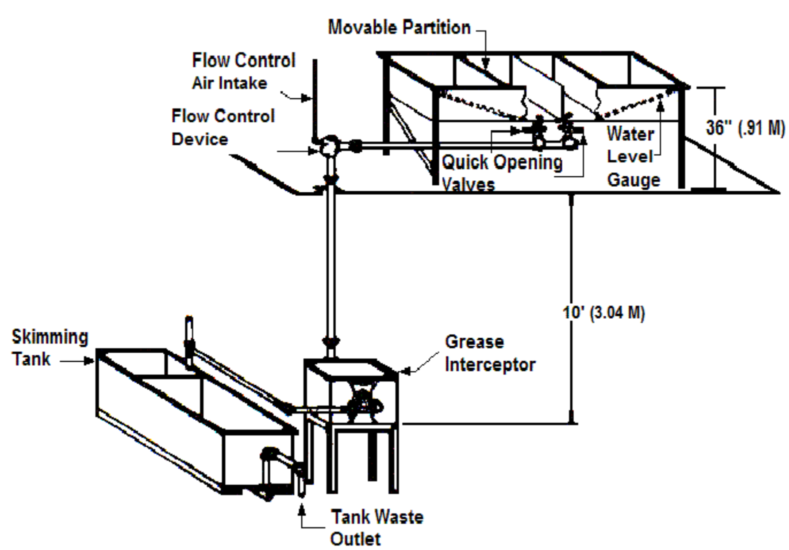


Figure 4: PDI Test Apparatus

PDI G101 adopted a similar test protocol, however instead of mixing hot water from a storage tank with heated lard through a type of funnel, PDI uses partitioned sinks to hold the hot water and introduces the heated lard into those sinks where the contents are discharged simultaneously to a grease interceptor during a test cycle. A skimming tank receives the effluent from the grease interceptor, collecting the grease that bypasses the interceptor during a test cycle. Efficiency of a device is determined by collecting the grease that accumulates in the skim tank after a test cycle, dewatering and weighing it.

$$\text{Efficiency} = \frac{\text{Grease Added} - \text{Grease Skimmed}}{\text{Grease Added}}$$

PDI also differs slightly in performance criteria established at the Institute by requiring a little higher minimum pounds-of-grease per each GPM of flow rate. Here are the minimum performance requirements for grease interceptors under this standard:

- Must have an average efficiency of not less than 90 percent
- Must have an incremental efficiency of not less than 80 percent
- Must retain a minimum of 2-1/4 pounds of grease for each GPM of flow rate

Over the years, PDI G101 has been updated numerous times with revisions to rating requirements. Currently the standard provides for two types of ratings as follows:

Section 7.7 Rated Grease Capacity

The grease shall be removed from the skimming tank and the efficiency of the interceptor shall be computed at the thirteenth (13) increment. This provides at least a twelve and one-half (12.5) percent safety factor on the ratio of the rated grease retention capacity to flow rate, as indicated in the following table (Table 17):

TABLE 1

PDI Size Symbol	2	4	7	10	15	20	25	35	50	75	100
Flow Rate GPM	2	4	7	10	15	20	25	35	50	75	100
L/min	7.6	15.1	26.5	37.9	56.8	75.7	94.6	132.5	189.3	283.9	378.5
Grease Capacity Pounds	4	8	14	20	30	40	50	70	100	150	200
Kg	1.8	3.6	6.4	9.1	13.6	18.1	22.7	31.8	45.4	68.0	90.7

Table 1: PDI G101 Table 1

One of the consequences of allowing a Rated capacity has been misleading reporting from manufacturers. Let's take a look at an example. Figure 33 is an *old* test report from a manufacturer for their 100 GPM thermoplastic HGI. The test report clearly shows that the interceptor was tested only to the 13^{th} increment holding 254.68 pounds of grease. Yet, from the submittal and specification literature published at the time, they claimed that the tank held 1,150 pounds of Grease Design Capacity. Those who do not realize that there is no such thing as *Grease Design Capacity*, would assume that the term refers to *Grease Capacity* as described in the standard, yet that it not the case. The manufacturer added the word *Design* to "clarify" that this was actually an estimate of capacity by the manufacturer.

FLOW RATE (GPM)	GREASE DESIGN CAPACITY	LIQUID CAPACITY (GAL)	SHIPPING WEIGHT (Lbs.)
100	1,150Lbs. (160GAL)	300	275

STANDARD PDI-G101 GREASE INTERCEPTOR RATING T

Interceptor ID Manufacter: [redacted]

'Sink Capacity and Flow Rate'			****Lard Data****	
Capacity No. 1	100	gal	Spec. Gravity:	0.876
Capacity No. 2	100	gal	Viscosity:	14.2cP
Separate No. 1	100	GPM		
Separate No. 2	100	GPM		
Simultaneous 1	200	GPM		
Simultaneous 2	200	GPM		

					******** INCREMENTAL ******** (drop-skim / drop)x 100) = efficiency				********ACCUMULATED ******** (drop-skim / drop)x 100) = efficiency			
No.	Test	Clear	Min./Sec.	Rate: GPM	lb. Added	lb. Skimmed	lb. Retained	Efficiency	lb. Added	lb. Skimmed	lb. Retained	Efficiency
1	1	2	1.98	101.01	20.0	0.2	19.80	99.00	20.00	0.2	19.80	99
2	2	1	1.93	103.63	20.0	0.36	19.64	98.20	40.00	0.56	39.44	98.6
3	1	2	1.97	101.52	20.0	0.18	19.82	99.10	60.00	0.74	59.26	98.7667
4	2	1	1.92	104.17	20.0	0.66	19.34	96.70	80.00	1.4	78.60	98.25
5	1	2	1.98	101.01	20.0	0.41	19.59	97.95	100.00	1.81	98.19	98.19
6	2	1	1.92	104.17	20.0	0.82	19.18	95.90	120.00	2.63	117.37	97.8083
7	1	2	1.98	101.01	20.0	0.73	19.27	96.35	140.00	3.36	136.64	97.6
8	2	1	1.93	103.63	20.0	0.22	19.78	98.90	160.00	3.58	156.42	97.7625
9	1	2	1.98	101.01	20.0	0.19	19.81	99.05	180.00	3.77	176.23	97.9056
10	2	1	1.93	103.63	20.0	0.36	19.64	98.20	200.00	4.13	195.87	97.935
11	1	2	1.98	101.01	20.0	0.32	19.68	98.40	220.00	4.45	215.55	97.9773
12	2	1	1.93	103.63	20.0	0.5	19.50	97.50	240.00	4.95	235.05	97.9375
13	1	2	1.97	101.52	20.0	0.37	19.63	98.15	260.00	5.32	254.68	97.9538

2. The "amount retained" is a is a calculation of "Added" minus "Skimmed"

3. All Skimmed weights taken after de-watering by Seperatory funnel and chilling.

Summary and results based on testing per Section 7.7 "rated capacity." The total grease skimmed was taken at the thirteenth increment.

1) Total Skimmed:	5.32
2) Total Retained :	254.68
3) Total Added:	260
Eff. = (line 3 – line1) / line 3 X100	
Efficiency % =	98.0

Figure 5: Misleading Marketing of 100 GPM HGI

Section 7.6 Maximum Grease Capacity

The test failure or breakdown point of the interceptor shall be established at the increment preceding two (2) successive increments in which either the average efficiency is less than ninety (90) percent or the incremental efficiency is less than eighty (80) percent.

Example: Canplas/IPEX Endura XL-75

It is important to understand the difference between these two ratings. First, all HGIs that are tested in conformance with this standard must have the results of the incremental tests recorded on Test Form #1 as required by this standard. Below is a copy of the Endura XL-75 test report from a conforming test conducted by NSF international. It consists of two pages recording the performance of the device for each test cycle (drop) through 47 increments.

In Figure 6 we see the performance of the XL-75 at the 13th increment. If the test were stopped there the unit would be certified to a Rated Grease Capacity, since it meets the minimum average efficiency of not less than 90 percent (see the far-right column under "Accumulated") and the incremental efficiency is not less than 80 percent, and the accumulated grease is not less than 2-1/4 times the flow rate (75 GPM x 2.25 = 168.75 lbs) at 191.95 lbs.

However, we can see from Figure 7, that the 45th increment is the *breakdown point*: the increment before two successive increments in which either the average flow rate is less than 90 percent or the incremental efficiency is less than 80 percent. Since the average efficiency throughout the test does not drop below 95 percent, the incremental efficiency determines the breakdown point. Notice that the incremental efficiency at increments 46 and 47 are both below 80 percent, which establishes the 45th increment as the breakdown point. At that increment, the interceptor has an average efficiency of 96 percent and has accumulated well over the minimum requirement (168.75 lbs) with a total of 649.69 lbs.

STANDARD ASME A112.14.3 GREASE INTERCEPTOR RATING TEST FORM - PAGE 1					
Interceptor Manufacturer: Internal Validation (NSF)	Model Number: ABC	GPM Size: 75	Report No.: J-00230858		
Sink Capacity and Flow	****Lard Data****	****Flow Control Data****	***Test Lab Information***		
Capacity No. 1: 75 gal	Spec. Gravity 0.881	Orifice Size: 2.14	Test Lab: NSF International	Test Date: Oct 26-28,2017	
Capacity No. 2: 75 gal	Viscosity NA			Notes:	
Separate No. 1: 64.0 GPM				1. Drainage gauged on clear compartment	
Separate No. 2: 66.8 GPM					
Simultaneous: 76.1 GPM				2. The "amount retained" is a calculation of "Added" minus "Skimmed"	
Simultaneous: 76.3 GPM				3. All Skimmed weights taken after de-watering by Seperatory funnel and chilling.	

					******** INCREMENTAL ******** (drop-skim)/ drop x 100 = efficiency				********ACCUMULATED ******** (drop-skim) / drop x 100 = efficiency			
No.	Test	Clear	Sec.	Rate:GPM	lb. Added	lb. Skimmed	lb. Retained	Efficiency	lb. Added	lb. Skimmed	lb. Retained	Efficiency
1	1	2	110.80	77.2	15	0.15	14.85	99.0	15.00	0.15	14.85	99
2	2	1	111.26	76.8	15	0.15	14.85	99.0	30.00	0.30	29.70	99
3	1	2	110.07	77.7	15	0.15	14.85	99.0	45.00	0.45	44.55	99
4	2	1	109.29	78.2	15	0.15	14.85	99.0	60.00	0.60	59.40	99
5	1	2	110.86	77.1	15	0.15	14.85	99.0	75.00	0.75	74.25	99
6	2	1	109.57	78.0	15	0.29	14.71	98.0	90.00	1.04	88.96	99
7	1	2	108.70	78.7	15	0.29	14.71	98.0	105.00	1.33	103.67	99
8	2	1	109.64	78.0	15	0.29	14.71	98.0	120.00	1.62	118.38	99
9	1	2	110.39	77.5	15	0.29	14.71	98.0	135.00	1.91	133.09	99
10	2	1	110.54	77.3	15	0.29	14.71	98.0	150.00	2.20	147.80	99
11	1	2	108.62	78.7	15	0.28	14.72	98.0	165.00	2.48	162.52	98
12	2	1	109.86	77.8	15	0.28	14.72	98.0	180.00	2.77	177.23	98
13	1	2	110.10	77.7	15	0.28	14.72	98.0	195.00	3.05	191.95	98
14	2	1	111.95	76.4	15	0.28	14.72	98.0	210.00	3.34	206.66	98

Summary & Adjusted Results based on the totals at the increment when Grease retained equals 2 times rated capacity	
Req retention:	150
Increment No:	11
1) Total Skimmed:	2.48
2) Total Retained :	162.52
3) Total Added:	165.00
Eff. = (line 3 – line1) / line 3	
Efficiency % =	98.5

Figure 6: Test Report Endura XL-75, 13th increment

STANDARD ASME A112.14.3 GREASE INTERCEPTOR RATING TEST FORM - PAGE 2					
Interceptor Manufacturer: Internal Validation (NSF)	Model Number: ABC	GPM Size: 75	Report No.: J-00230858		
Sink Capacity and Flow	****Lard Data****	****Flow Control Data****	***Test Lab Information***		
Capacity No. 1: 75 gal	Spec. Gravity 0.881	Orifice Size: 2.14	Test Lab: NSF International	Test Date: Oct 26-28,2017	
Capacity No. 2: 75 gal	Viscosity NA			Notes:	
Separate No. 1: 64.0 GPM				1. Drainage gauged on clear compartment	
Separate No. 2: 66.8 GPM					
Simultaneous: 76.1 GPM				2. The "amount retained" is a calculation of "Added" minus "Skimmed"	
Simultaneous: 76.3 GPM				3. All Skimmed weights taken after de-watering by Seperatory funnel and chilling.	

					******** INCREMENTAL ******** (drop-skim)/ drop x 100 = efficiency				********ACCUMULATED ******** (drop-skim) / drop x 100 = efficiency			
No.	Test	Clear	Sec.	Rate:GPM	lb. Added	lb. Skimmed	lb. Retained	Efficiency	lb. Added	lb. Skimmed	lb. Retained	Efficiency
32	1	2	110.07	77.7	15	0.49	14.51	97.0	480.00	9.87	470.13	98
33	2	1	109.89	77.8	15	0.49	14.51	97.0	495.00	10.35	484.65	98
34	1	2	111.64	76.6	15	0.49	14.51	97.0	510.00	10.84	499.16	98
35	2	1	111.20	76.9	15	0.49	14.51	97.0	525.00	11.33	513.67	98
36	1	2	111.72	76.5	15	1.91	13.09	87.0	540.00	13.24	526.76	98
37	2	1	109.42	78.1	15	1.91	13.09	87.0	555.00	15.15	539.85	97
38	1	2	111.41	76.7	15	1.91	13.09	87.0	570.00	17.07	552.93	97
39	2	1	112.54	76.0	15	1.91	13.09	87.0	585.00	18.98	566.02	97
40	1	2	109.48	78.1	15	1.91	13.09	87.0	600.00	20.89	579.11	97
41	2	1	112.29	76.1	15	0.73	14.27	95.0	615.00	21.62	593.38	96
42	1	2	110.42	77.4	15	0.67	14.33	96.0	630.00	22.29	607.71	96
43	2	1	110.22	77.6	15	0.73	14.27	95.0	645.00	23.02	621.98	96
44	1	2	110.64	77.3	15	0.73	14.27	95.0	660.00	23.75	636.25	96
45	2	1	109.70	77.9	15	1.56	13.44	90.0	675.00	25.31	649.69	96
46	1	2	110.03	77.7	15	3.32	11.68	78.0	690.00	28.63	661.37	96
47	2	1	110.82	77.2	15	9.86	5.14	34.0	705.00	38.49	666.51	95
	1	2										

Summary & Adjusted Results based on the totals at the increment when Grease retained equals 2 times rated capacity	
Req retention:	150
Increment No:	#N/A
1) Total Skimmed:	#N/A
2) Total Retained :	#N/A
3) Total Added:	#N/A
Eff. = (line 3 – line1) / line 3	
Efficiency % =	#N/A

Figure 7: Test Report Endura XL-75, Breakdown Point

Another distinguishing characteristic of PDI G101 over any of the other standards is that it only allows for certification of HGIs with an *external vented flow control* (Figure 36): a device that contains an orifice calibrated to the maximum flow rate of the HGI. As the wastewater passes through the orifice in the flow control device, it creates negative pressure. The negative pressure pulls air in from an air-intake (vent) that is installed downstream of the orifice to mix with the wastewater, which enhances separation.

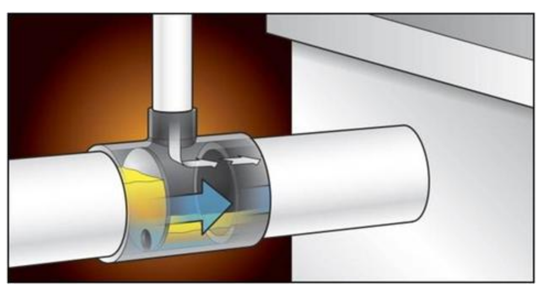


Figure 8: Vented External Flow Control

8.3.1 Sizing Method Based on Pipe Diameter Size and Slope

PDI developed pipe diameter sizing (Table 18) to provide solutions for the following situations:

- When the final configuration of fixtures in a facility is not known
- To allow for additional fixtures in the future
- To size the interceptor for the maximum flow that the drain line from the facility can carry

Pipe Size (inches)	Full Pipe Flow @ 1/4 slope	Interceptor size 1 minute drain	Interceptor size 2 minute drain
2"	19.44 gpm	20 gpm	10 gpm
3"	58.67 gpm	75 gpm	35 gpm
4"	125.77 gpm	-	75 gpm

Table 2: Pipe Diameter Sizing Table

Unlike the pipe diameter sizing included in UPC Table 1014.2.1, PDI G101 does not assign a flow rate for four- inch diameter with a one-minute drainage period, nor does the standard offer sizing for five-inch or six-inch pipe diameters for any drainage period. This is primarily because the flow rates that would be required for these pipe diameters and/or drainage periods all exceed 100 GPM.

Through 2007, this standard did not allow for testing and rating of interceptors for flow rates over 100 GPM. Beginning in 2010, instructions were added that allow for testing of flow rates over 100 GPM. Even so, this standard has made no modification to its sizing method for pipe diameter that would suggest an appropriate flow rate over 100 GPM.

8.3.2 Procedure for Sizing Grease Interceptor

Table 8.3.2 (Table 19) is provided to show the standard formula in steps for sizing grease interceptors to suit requirements of specific fixtures. An example of this sizing formula application is included to illustrate the steps:

To complete the sizing of a grease interceptor using Table 8.3.2, add all of the fixtures together by volume and then add the flow rate from fixtures that do not discharge by volume but instead by a known flow rate, such as dishwashers, then apply the one-minute or two-minute drainage period.

Table 8.3.2
Procedure for Sizing Grease Interceptors

Steps	Formula	Example
1	Determine cubic content of fixture. Multiply length x with x depth.	A sink 48" long by 24" wide by 12" deep. **Cubic content** 48 x 24 x 12 = 13,824 cubic inches.
2	Determine capacity in gallons. 1 gal. = 231 inches.	**Content in gallons.** 13,824 / 231 = 59.8 gallons
3	Determine actual drainage load. The fixuter is normally filled to about 75% of capacity with water. The items being washed displace about 25% of the fixture content, thus actual drainage load = 75% of fixture capacity.	**Actual drainage load** .75 X 59.8 = 44.9 gallons
4	Determine flow rate and drainage period. In general , good practice dictates a one (1) minute drainage period: however, where conditions permit, a two (2) minute dranage period is acceptable. Drainage period is the actual time required to completely drain the fixture. Flow Rate = Actual Dranaige Load / Drainage Period	**Calculate flow rate** **for** one (1) minute period: 44.9 / 1 = 44.9 GPM Flow Rate **for** two (2) minute period: 44.9 / 2 = 22.5 GPM Flow Rate
5	Select Interceptor. From Table 1 select Interceptor which corresponds to the flow rate calculated. Note: Select next larger size when Flow Rate falls between two sizes listed.	**Select Interceptor.** For one (1) minute period - 44.9 GPM requires PDI size 50. For two (2) minute period - 22.5 GPM requires PDI size 25.

Table 3: PDI G101 Fixture Volume Sizing Table

8.3.3 Sizing by Known Compartment Size

Table 20 is included as a selection chart for standard PDI Certified grease interceptors applicable to various size fixtures commonly used by domestic, commercial and institutional installations. The selections listed are based on the sizing formula covered in Table 18 by GPM.

Although PDI G101 recommends a separate grease interceptor for each commercial dishwasher, there has been no definitive scientific basis for this recommendation presented to date. PDI has evaluated the impact of temperature, testing up to 200^{0}F, concluding that there was no detrimental effect on the separation process. In fact, the lower viscosity and hence greater buoyancy of the FOG at elevated temperatures actually benefits the process of separation. Thus, a dishwasher could be connected along with multiple other fixtures to the same grease interceptor without a detrimental effect on efficiency.

Table 8.3.3

Selection Chart (Metric Equivalents Omitted for Simplicity)

Fixture Compartment Size (inches)	Number of Compartments	Drainage Load (Gallons)	Recommended PDI Size Grease Interceptor	
			1-minute Drainage period	2-minute Drainage period
18 x 12 x 6	1	4.2	7	4
16 x 14 x 8	1	5.8	7	4
20 x 18 x 8	1	9.4	10	7
18 x 16 x 8	2	15.0	15	10
20 x 18 x 8	2	18.7	20	10
30 x 20 x 8	1	15.6	20	10
24 x 20 x 12	1	18.7	20	10
22 x 20 x 8	2	22.9	25	15
22 x 20 x 12	2	34.3	35	20
24 x 24 x 12	2	44.9	50	25
22 x 20 x 12	4	68.6	75	35
24 x 24 x 12	4	89.8	100	50

Table 4: PDI Table of Known Fixtures Sizes

ASME A112.14.3 - 2018

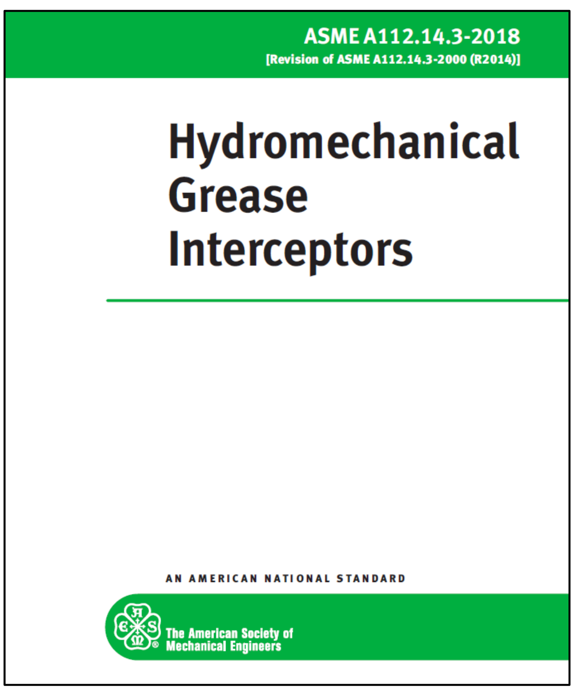


Figure 9: ASME A112.14.3-2018

As far back as 1994, PDI agreed to work with ASME to develop the first ever ANSI based consensus standard governing grease interceptors. At the time, the devices covered by PDI G101 and those to be covered by this standard were called *grease traps*. It wasn't until the 2006 edition of the UPC that the term was changed to *hydromechanical grease interceptor*. Beginning with the 2007 edition, PDI G101 used the new term, however this standard has only recently been updated to add this terminology.

One of the main differences between PDI G101 and this standard is that it is a true ANSI based consensus standard. In order to maintain ANSI accreditation, standards developers are required to consistently adhere to a set of requirements or procedures known as the "ANSI Essential Requirements", which govern the consensus development process. Due process is the key to ensuring that American National Standards (ANS) are developed in an environment that is equitable, accessible and responsive to the requirements of various stakeholders. The open and fair ANS process ensures that all interested and affected parties have an opportunity to participate in a standard's development. It also serves and protects the public interest since standards developers accredited by ANSI must meet the Institute's requirements for openness, balance, consensus and other due process safeguards.

While PDI G101 only approves and certifies grease interceptors with a vented external flow control, this standard approves four different configurations as follows:

Type A – External flow control, with air intake (vent): directly connected

Type B – External flow control, without air intake (vent): directly connected

Type C – Without external flow control, directly vented

Type D – Without external flow control, indirectly connected

Directly or indirectly connected are defined as follows:

Directly Connected: A grease interceptor that is designed to receive the discharge directly from fixtures without an air gap or air break and which is directly or indirectly connected to the plumbing drainage system.

Indirectly Connected: A grease interceptor that is designed to receive the discharge from fixtures through an air gap or air break and which is directly or indirectly connected to the plumbing drainage system.

3.4.7.2 Minimum Grease Capacity

The efficiency shall be established at the increment preceding the increment in which either the average efficiency is less than 90% or the incremental efficiency is less than 80%. If the average efficiency has not yet dropped below 90% or the incremental efficiency has not yet dropped below 80%, the efficiency shall be reported at the 12th increment.

3.4.6.2 Maximum Grease Capacity

The test failure or breakdown point of the interceptor shall be established at the increment preceding two (2) successive increments in which either the average efficiency is less than ninety (90) percent or the incremental efficiency is less than eighty (80) percent.

Example: Schier Great Basin GB-250

In Figure 10, we see the 2018 test report for the Schier Products Great Basin GB-250. The standard allows for certification at a *Minimum Capacity* in section 3.4.7.2, at the 12th increment so long as the average efficiency has not dropped below 90% and the incremental efficiency has not dropped below 80%. While it is less costly for a manufacturer to test their grease interceptor to a minimum capacity, modern production-based sizing methods rely on manufacturers to test their devices to their breakdown point. Grease interceptors tested to their breakdown point are certified to a *Maximum Capacity* in accordance with section 3.4.6.2.

As you can observe in Schier's test report for the GB-250, it was tested to its breakdown point, which was the 92nd increment. Both the 93rd and 94th increments dropped below 80% efficiency making the 92nd increment, the increment preceding two successive increments below 80%, the maximum capacity. In this case the unit was certified at 1751 pounds of grease storage capacity at an average efficiency of 95.1%.

TABLE 1 – Test Results per ASME A112.14.3-2000 (Reaffirmed 2014)

"GB-250" (100 gpm)	Grease Interceptor				INCREMENTAL				ACCUMULATED			
Test No.	Grease Sink	Water Sink	Drop Time (sec)	Flow Rate (GPM)	Lbs added	Lbs skimmed	Lbs retained	Efficiency (%)	Lbs added	Lbs skimmed	Lbs retained	Efficiency (%)
1	1	2	114	100.0	20	0.00	20.00	100	20	0.00	20.00	100
2	2	1	114	100.0	20	0.19	19.81	99.1	40	0.19	39.81	99.5
3	1	2	114	100.0	20	0.52	19.48	97.4	60	0.71	59.29	98.8
4	2	1	114	100.0	20	0.52	19.48	97.4	80	1.23	78.77	98.5
5	1	2	114	100.0	20	0.55	19.45	97.3	100	1.78	98.22	98.2
6	2	1	113	100.9	20	0.40	19.60	98.0	120	2.18	117.82	98.2
7	1	2	113	100.9	20	0.45	19.55	97.8	140	2.63	137.37	98.1
8	2	1	113	100.9	20	0.43	19.57	97.9	160	3.06	156.94	98.1
9	1	2	114	100.0	20	0.55	19.45	97.3	180	3.61	176.39	98.0
10	2	1	113	100.9	20	0.39	19.61	98.1	200	4.00	196.00	98.0
11	1	2	113	100.9	20	0.48	19.52	97.6	220	4.48	215.52	98.0
12	2	1	114	100.0	20	0.44	19.56	97.8	240	4.92	235.08	98.0

"GB-250" (100 gpm)	Grease Interceptor				INCREMENTAL				ACCUMULATED			
Test No.	Grease Sink	Water Sink	Drop Time (sec)	Flow Rate (GPM)	Lbs added	Lbs skimmed	Lbs retained	Efficiency (%)	Lbs added	Lbs skimmed	Lbs retained	Efficiency (%)
86	2	1	113	100.9	20	2.08	17.92	89.6	1720	71.71	1648.29	95.8
87	1	2	112	101.8	20	2.90	17.10	85.5	1740	74.61	1665.39	95.7
88	2	1	113	100.9	20	1.87	18.13	90.7	1760	76.48	1683.52	95.7
89	1	2	113	100.9	20	2.94	17.06	85.3	1780	79.42	1700.58	95.5
90	2	1	112	101.8	20	2.58	17.42	87.1	1800	82.00	1718.00	95.4
91	1	2	113	100.9	20	3.70	16.30	81.5	1820	85.70	1734.30	95.3
92	2	1	114	100.0	20	3.57	16.43	82.2	1840	89.27	1750.73	95.1
93	1	2	111	102.7	20	4.72	15.28	76.4	1860	93.99	1766.01	94.9
94	2	1	111	102.7	20	5.50	14.50	72.5	1880	99.49	1780.51	94.7

Figure 10: Schier GB-250 Test Report

Example: Thermaco Trapzilla TZ-1826

TABLE 1 – Test Results per ASME A112.14.3-2000

TZ-1826 Grease Interceptor					INCREMENTAL				ACCUMULATED			
Test No.	Grease Sink	Water Sink	Drop Time (sec)	Flow Rate (GPM)	Lbs added	Lbs skimmed	Lbs retained	Efficiency (%)	Lbs added	Lbs skimmed	Lbs retained	Efficiency (%)
1	1	2	110	103.6	-	-	-	-	20	-	-	-
2	2	1	111	102.7	-	-	-	-	40	-	-	-
3	1	2	112	101.8	-	-	-	-	60	-	-	-
4	2	1	111	102.7	-	-	-	-	80	-	-	-
5	1	2	111	102.7	100	0.96	99.04	99.0%	100	0.96	99.04	99.0%
6	2	1	112	101.8	-	-	-	-	120	-	-	-
7	1	2	110	103.6	-	-	-	-	140	-	-	-
8	2	1	110	103.6	-	-	-	-	160	-	-	-
9	1	2	110	103.6	-	-	-	-	180	-	-	-
10	2	1	113	100.9	100	0.74	99.26	99.3%	200	1.70	193.30	99.2%
11	1	2	110	103.6	20	0.10	19.90	99.5%	220	1.80	218.2	99.2%
12	2	1	110	103.6	-	-	-	-	240	-	-	-
13	1	2	109	104.6	-	-	-	-	260	-	-	-
14	2	1	111	102.7					280			
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												

TZ-1826 Grease Interceptor					INCREMENTAL				ACCUMULATED			
Test No.	Grease Sink	Water Sink	Drop Time (sec)	Flow Rate (GPM)	Lbs added	Lbs skimmed	Lbs retained	Efficiency (%)	Lbs added	Lbs skimmed	Lbs retained	Efficiency (%)
90	2	1	112	101.8	20	0.35	19.65	98.3%	1800	12.41	1787.59	99.3%
91	1	2	111	102.7	20	0.48	19.52	97.6%	1820	12.89	1807.11	99.3%
92	2	1	111	102.7	20	0.38	19.62	98.1%	1840	13.27	1826.73	99.3%
93	1	2	111	102.7	20	19.99	0.01	0.1%	1860	33.26	1826.74	99.2%
94	2	1	111	102.7	20	9.35	10.65	53.3%	1880	42.61	1837.39	97.7%

Performance Requirement

Maximum Capacity

Figure 11: Trapzilla TZ-1826 Test Report

In Figure 11, we have the test report for the Thermaco Trapzilla TZ-1826. If the manufacturer had decided to certify the unit to a minimum capacity it would have been rated at just 218.2 pounds total grease storage capacity. Instead, the manufacturer opted to test the unit to its breakdown point, which was the 92nd increment. Again, we can observe that both the 93rd and 94th increments dropped below 80% efficiency, making the 92nd increment the maximum capacity. In this case the unit was certified at 1826 pounds of grease storage capacity at an average efficiency of 99.3%.

This is why it is important to understand what an HGI test report looks like and how to read them. When you understand the difference between *minimum capacity* and *maximum capacity*, as well as incremental test data and accumulated test data, you can understand how the ratings are determined.

<u>Section 5. Sizing and Maintenance of Grease Interceptors</u>

The standard includes a pipe diameter sizing method (Table 21) with a one-minute or two-minute sizing method. For an explanation of which to use and why refer to page 45, "One-Minute or Two-Minute Drainage Period."

This section also allows for a fixture volume sizing method (Figure 39). It converts the capacity of the sinks and converts them into a volume in gallons and then allows for sizing the HGI based on a one-minute or two-minute drainage period as well.

Table 3 Interceptor Sizing Method Utilizing Maximum Pipe Capacity

Pipe Size, in.	Full Pipe Flow at ½ in. Slope, gpm	Interceptor Size one-minute Drain, gpm	Interceptor Size two-minute Drain, gpm
2	19.44	20	10
3	58.67	75	35
4	125.77	...	75

GENERAL NOTE: Based on ¼ in. (240) slope per foot based on Manning's formula with friction factor N = 0.012; Cast Iron Soil Pipe and Fittings Handbook and nCh8, Flow Theory and Capacity; pp: 130-134 [Full Pipe]; Cast Iron Soil Pipe Institute (CISPI); 2401 Fieldcrest Drive, Mundelein, IL 60060.

Table 5: ASME A112.14.3 Pipe Diameter Sizing

Table 2 Procedure for Sizing Grease Interceptors

Step	Formula	Example
1	Determine cubic content of fixture. Multiply length × width × depth.	A sink 48 in. long × 24 in. wide × 12 in. deep. Cubic content: 48 × 24 × 12 = 13,824 in.^{3}
2	Determine capacity in gallons. 1 gal. = 231 in.^{3}	Content in gallons: $\frac{13,824}{231} = 59.8$ gal
3	Determine actual drainage load. The fixture is normally filled to about 75% of capacity with water. The items being washed displace about 25% of the fixture content; thus, actual drainage load = 75% of fixture capacity.	Actual drainage load: 0.75 × 59.8 = 44.9 gal
4	Determine flow rate and drainage period. In general, good practice dictates a one-minute drainage period; however, where conditions permit, a two-minute drainage period is acceptable. Drainage period is the actual time required to completely drain the fixture. $\text{Flow rate} = \frac{\text{actual drainage load}}{\text{drainage period}}$	Calculate flow rate for one-minute period: Drainage period = $\frac{44.9}{1} = 44.9$ gpm flow rate. For two-minute period = $\frac{44.9}{2} = 22.5$ gpm flow rate
5	Select interceptor. From Table 1 select interceptor that corresponds to the flow rate calculated; see Note (1).	Select interceptor: For one-minute period: 44.9 gpm = ASME size 50. For two-minute period: 22.5 gpm = ASME size 25.

NOTE: (1) Select next larger size when flow rate falls between the two sizes listed.

Figure 12: ASME A112.14.3 Fixture Volume Sizing

ASME A112.14.4 – 2001 (R2017)

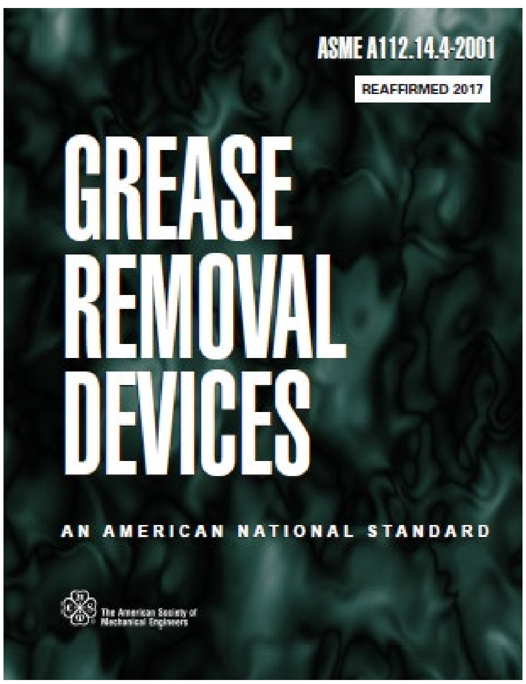


Figure 13: A112.14.4-2001 (R2017)

This standard was originally published in 2001 and reaffirmed in 2017. It establishes requirements for grease interceptors that are equipped with automatic grease removal devices (GRD).

It's important to understand that these devices are considered hydromechanical grease interceptors first and as such must be tested and rated for performance in accordance with ASME A112.14.3. This ensures that the device will operate efficiently as a grease interceptor even if its primary automatic grease removal functions are non-operational.

Additional testing ensures that the removal process is such that the removed FOG is 95 percent free of water by volume.

While specific design elements vary by manufacturer, there are several general design elements that most GRDs share:

- Heating element – keeping the contents of the GRD liquefied makes transporting the FOG to a collection chamber easier.
- Motorized skimming device - the means of transporting the accumulating FOG from the GRD to a collection chamber.
- Attached exterior collection container - where the accumulated FOG is transported to by the skimming device.

The nature of the collection container being attached to the side of the unit requires it to be readily accessible for removal and replacement. Normally this restricts the installation of these devices to above the floor or inside of a vault when buried.

ASME A112.14.6 – 2010 (R2019)

This is an ANSI based consensus standard governing FOG Disposal Systems published in 2010 and reaffirmed in 2019. This standard was developed to address a growing category of interceptors that not only separate and retain FOG, but internally dispose of retained FOG by means of mass and volume reduction through thermal, chemical, electrical, and biological processes without the use of internal mechanical devices or manual FOG removal.

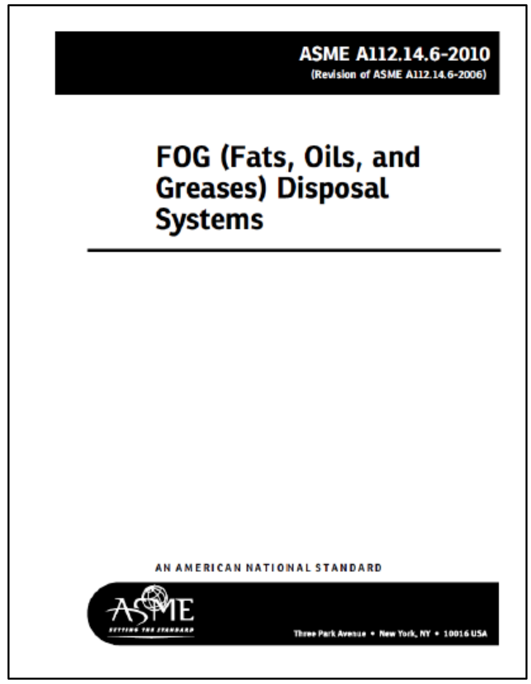

ASME A112.14.6-2010
(Revision of ASME A112.14.6-2006)
FOG (Fats, Oils, and Greases) Disposal Systems
AN AMERICAN NATIONAL STANDARD
ASME
Three Park Avenue • New York, NY • 10016 USA

Figure 14: A112.14.6-2010 (2019)

Figure 41 is a drawing of a bioremediation type of interceptor from ASPE’s *Plumbing Engineering Design Handbook 4, Plumbing Components and Equipment, Chapter 8, Grease Interceptors*.

FOG Disposal Systems based on the HGI principles shall have minimum separation and retention efficiency in accordance with PDI G101 or ASME A112.14.3. FOG disposal systems based on the GGI principles shall be designed in accordance with IAPMO/ANSI Z001.

Acceptable performance, under the test parameters of this standard, is an effluent concentration limit of 100 mg/L as determined using EPA Method 1664A.

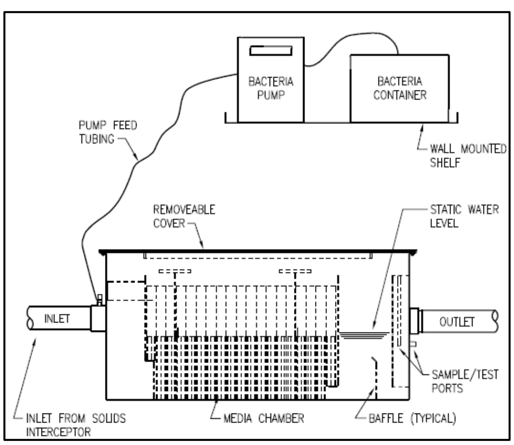


Figure 15: Example of FOG Disposal System

Though FOG disposal systems significantly reduce the frequency of manual FOG removal or the handling of mechanically removed FOG materials, these systems still require effort to ensure they are operating properly. Attention should be given to monitoring effluent quality, routine maintenance to remove undigested materials, and inspections to ensure that all components are clean and functioning properly. Furthermore, it is essential that specifiers coordinate all electrical and equipment space allocation requirements with the appropriate trades to allow for the proper installation and functioning of a FOG disposal system.

CSA B481 Series - 2012 (R2017)

In 2012, the second edition of the CSA B481 series of standards was published, replacing the previous edition published in 2007. The Canadian Standards Association (operating as "CSA Group") develops standards through a consensus standards development process approved by the Standards Council of Canada. The process helps ensure a balanced approach and outcome in the development of standards similar to ANSI based standards.

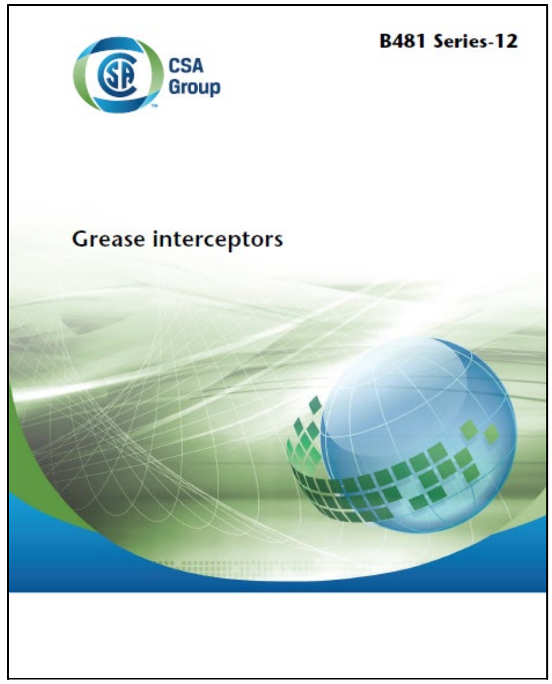


Figure 16: B481 Series-2012 (R2017)

CSA B481 contains the following standards:

- B481.0, *Material, design, and construction requirements for grease interceptors*
- B481.1, *Testing and rating of grease interceptors using lard*
- B481.2, *Testing and rating of grease interceptors using oil*
- B481.3, *Sizing, selection, location, and installation of grease interceptors*
- B481.4, *Maintenance of grease interceptors*
- B481.5, *Testing and rating of grease interceptors equipped with a grease removal device*

While the current edition uses the generic term 'grease interceptor' throughout, this standard is understood to apply only to hydromechanical grease interceptors, either passive (manual removal of contents required) or those equipped with a grease removal device. There are three possible ratings available for certification as follows:

CSA B481.1 Testing and rating of grease interceptors using lard

This certification requires grease interceptors to be tested and rated in accordance with ASME A112.14.3 for the interceptors' flow rate and rated capacity and requires the interceptor to be marked with its removal efficiency, flow rating, and maximum grease containment capacity.

CSA B481.2 Testing and rating of grease interceptors using oil

NOTE: This standard is not in use. DO NOT ADOPT. This certification uses effluent concentration sampling for testing the interceptor. The test requires the interceptor to be filled with water first, then have crushed granite added up to the interceptor's maximum solids capacity (unless the interceptor is not designed to capture and contain solids), then fill the interceptor with sunflower oil to the point at which 5 test cycles of 12,000 mg/L will fill the interceptor to its rated capacity. Then the interceptor is tested 5 cycles with the oil mixture in the prescribed concentration and the interceptor's effluent is sampled multiple times during the cycle. Whatever the average is of the concentration of oil in the effluent grab samples is recorded as the average efficiency for the interceptor in mg/L. There is no predetermined concentration limit that triggers a pass or fail. The test simply requires the manufacturer to list the grease concentration limit as an average of the recorded test results.

There are NO grease interceptors certified to this standard at this time, primarily because it is impossible to uniformly apply the test. There are simply too many variables to allow for consistent, repeatable and reliable results. More importantly, this standard has been universally rejected by the committee working to amend the standard and will be removed in future editions.

CSA B481.3 Sizing, selection, location, and installation of grease interceptors

Unlike PDI G101 and ASME A112.14.3, the sizing requirements in this standard focus on establishing the PEAK flow rate for a system. If a model or local plumbing code allows for a two-minute drainage period, the standard permits it, however, its preference and recommendation is to use a one-minute drainage period.

As with the PDI G101 and ASME A112.14.3, this standard allows for both pipe diameter and fixture volume sizing methods.

Table 22 illustrates the pipe diameter sizing method and the maximum flow rate that can flow by gravity through each size using cast iron pipe at a 2% slope (1/4" per foot or 6mm per 30cm).

The problem with using the maximum flow rate as the peak flow rate is that is assumes that the piping for the kitchen is sized to discharge the maximum volume of flow the pipe is rated for at peak discharge periods. That is not the case. Gravity drainage systems require air to function correctly. It is so essential to system performance that piping selection criteria selects pipe diameters that will not be more than 50% full at peak discharge periods.

Table 1
Maximum flow rate for cast iron soil pipe with a 20 mm/m (0.25 in/ft) slope
(See Clauses 5.1 and 5.2.1.)

Nominal pipe size	Maximum flow rate, L/min (gpm)
1-1/2	28 (7.5)
2	76 (20)
3	227 (60)
4	473 (125)
5	867 (229)
6	1420 (375)

Note: *Values are taken from ASTM A888 and CISPI 301 and are for pipe with a 2% slope.*

Table 6: B481.3 Table 1

Figure 42 provides the fixture volume method contained in the standard. While it uses slightly different dimensions from PDI G101 or ASME A112.14.3, the mathematical calculations are the same.

5.2.2 Example

The following example shows the calculation of peak flow rate for a two-sink system, according to the size of the sinks:

(a) Assume the sinks have the following characteristics:
  (i) one three-compartment sink, with each compartment measuring 0.40 × 0.40 × 0.40 m (16 × 16 × 16 in); and
  (ii) one one-compartment preparation sink measuring 0.46 × 0.46 × 0.40 m (18 × 18 × 16 in).

(b) Calculate the peak flow rate for the three-compartment sink, using 75% of the volume of each compartment, as follows:
  (i) 3 × (0.40 × 0.40 × 0.40 m) = 0.192 m^3
  (3 × [16 × 16 × 16 in] = 12 288 in^3)
  (ii) 0.192 m^3 × 1000 L/m^3 = 192 L
  (12 288 in^3 ÷ 231 in^3/gal = 53.2 gal)
  (iii) 192 L × 0.75 = 144 L
  (53.2 gal × 0.75 = 39.9 gal)
  (iv) Approximate the volume in Item (iii) to 150 L (40 gal).

(c) Calculate the peak flow rate for the one-compartment sink, using 75% of the volume of the compartment, as follows:
  (i) 1 × (0.46 × 0.46 × 0.40 m) = 0.085 m^3
  (1 × [18 × 18 × 16 in] = 5184 in^3)
  (ii) 0.085 m^3 × 1000 L/m^3 = 85 L
  (5184 in^3 ÷ 231 in^3/gal = 22.4 gal)
  (iii) 85 L × 0.75 = 63 L
  (22.4 gal × 0.75 = 16.8 gal)
  (iv) Approximate the volume in Item (iii) to 65 L (17 gal).

(d) The total peak flow is 150 L + 65 L = 215 L (40 gal + 17 gal = 57 gal).

(e) Using a drain down time of 1 min, the peak flow rate is 215 L ÷ 1 min = 215 L/min (57 gal ÷ 1 min = 57 gpm).

Note: *The drain down time is typically* 1 *or* 2 min *and is established by the local building or plumbing code. However, if no code requirement is available, a* 1 min *drain down time should be used.*

Figure 17: B481.3 Fixture Volume Sizing

CSA B481.5 Testing and rating of grease interceptors equipped with a grease removal device

This certification requires grease interceptors equipped with a GRD to be tested and rated in accordance with ASME A112.14.4 for the interceptors' flow rate, rated capacity and efficiency at removing FOG from its separation chamber to ensure that the removed FOG is 95% free of water, by volume.

Name of manufacturer

CSA B481.5
Grease interceptor

Flow rating:	135 L/min (35 gpm)
Grease removal efficiency:	90.0%
Maximum grease containment capacity:	32 kg (70 lb)
Access cover load rating:	H
Inlet size:	50 mm (NPS-4)
Flow control device:	Required (part number)

Figure 18: B481.5 Sample Label