

# Guidelines for Precast Concrete Grease Interceptors

# Purpose

- Provide an overview of the basic design principals that govern why gravity grease interceptors work
- Provide a forum for discussion of common design issues
- Provide information on various codes and standards

# Topics

- Why are grease interceptors necessary?
- How do grease interceptors work?
- Grease Interceptor best practices
- Key factors affecting FOG removal
- Codes and Standards
- Configuration Considerations
- Structural Considerations
- Interceptor Sizing
- Other Issues



# Why are Grease Interceptors Necessary?

If you have been in a commercial kitchen, it is obvious why grease interceptors are needed.



# Why are Grease Interceptors Necessary?

It is as simple as a disposal problem.





Other sources of oil and grease, but these need a sand and oil separator

Different design

e.g., baffle walls

# Why are Grease Interceptors Necessary?

## Sewer Overflows and Backups

- Grease blockages in sewer lines account for a large % of sewer overflows
- Blockages and sanitary sewer backups are costly to locate, clean out, and clean up after



# Why are Grease Interceptors Necessary?

## Fouled Sewage Treatment Plants

- Grease causes lots of problems for the sewage treatment plants





# How do Grease Interceptors Work?

## Fats, Oils, Greases (FOG) Separation and Retention

- Gravity?
- Buoyancy?
- Retention Time?
- Stokes Law?
- Thermal Effects?



# How do Grease Interceptors Work?

## **Buoyancy & Gravity**

- Gravity is our planet's natural downward force which creates buoyancy.
- Basically buoyancy is why denser fluid or mass sinks to the bottom of a lighter fluid or mass.
- Grease is lighter than water and will therefore rise to the top.

# How do Grease Interceptors Work?

## **Retention Time**

- Retention time is critical in sizing interceptors.
- Why is retention time a key element?
- If the material passes through the interceptor too fast then the grease does not have enough time to rise to the top.

# How do Grease Interceptors Work?

## **Retention Time**

- Any solids entering the interceptor will not have enough time to settle to the bottom.
- More time means more cooling of liquids.
- The more liquids cool, the more effective the grease interceptor.
- Large outdoor grease interceptors provide a longer retention time

# How do Grease Interceptors Work?

## Stokes Law

- Basically think of a skydiver or a balloon
- The wind friction force  $F$  on a falling skydiver or a rising balloon is a factor causing a balance with the gravity force pulling down
- Basic Stokes Equation  
$$F = 6\pi\alpha\eta v$$



# How do Grease Interceptors Work?

## Stokes Law

- Diameter x viscosity x speed
- How fast will they fall or rise?
- $V_s = (2 / 9) \times (r^2 \times g (q_p - q_f) / \mu$
- This is why the skydiver reaches terminal velocity and does not continue to go faster and the balloon does not rise up like a rocket.



# How do Grease Interceptors Work?

## **Thermal Effects**

- Temperatures in excess of 140°F will dissolve grease.
- Typical sink water temperatures will not dissolve grease which allows the grease to be trapped in the interceptor.
- Mechanical dishwashers operate at temperatures in excess of 160°F. Unless the water is allowed to cool, grease will not be removed, and will pass to downstream wastewater treatment components.

# How do Grease Interceptors Work?

## **Balancing the design**

Size the interceptor large enough that when the fluid passes through the system it is slow enough to allow:

- The grease to rise up into the top grease zone
- The heavier food particles to settle down into the bottom 1 ft. solids zone



# How do Grease Interceptors Work?

## **Balancing the design**

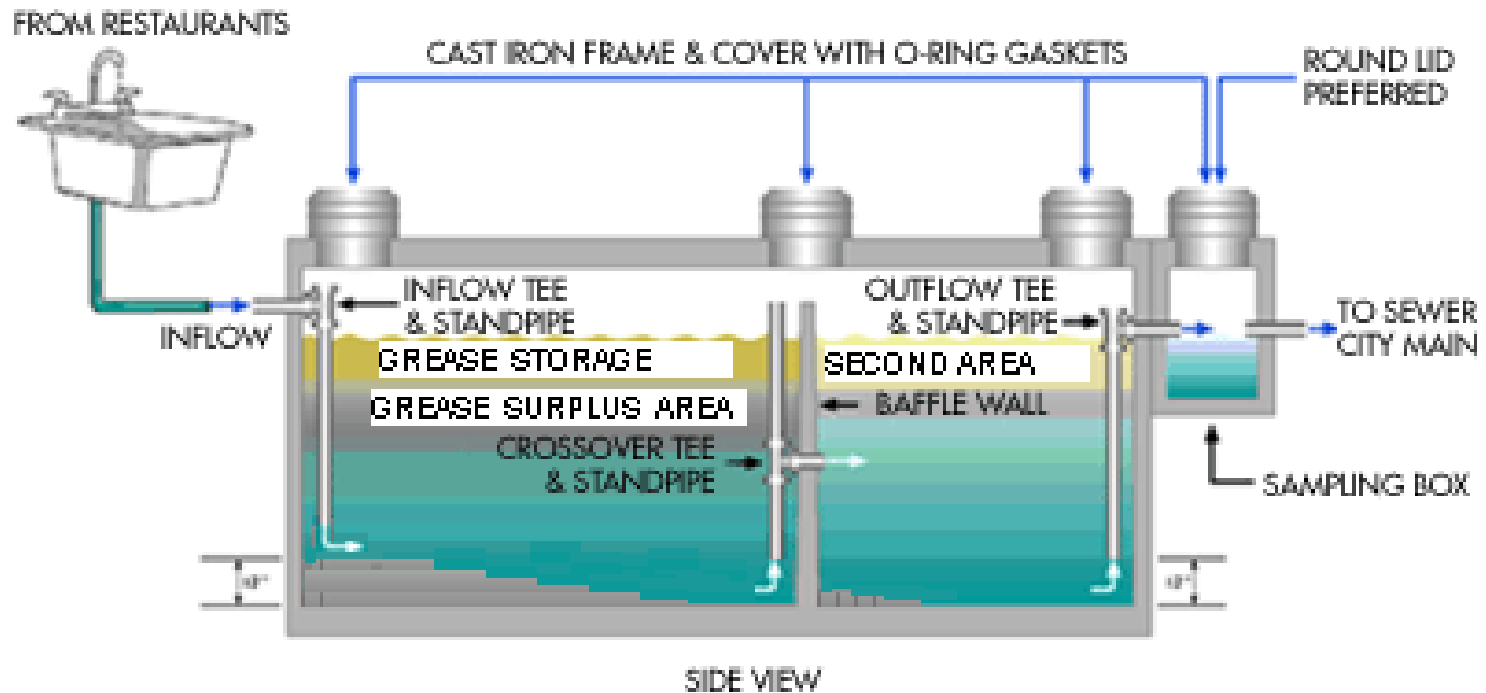
Size the interceptor large enough that when the fluid passes through the system it is slow enough to allow:

- The clear liquids to pass between the upper and lower zones without disturbing them
- In most cases slower is better

# How do Grease Interceptors Work?

## Grease Interceptor

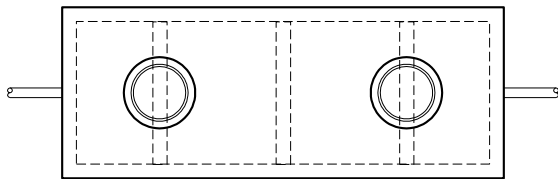
*(Drawing Not to Scale)*



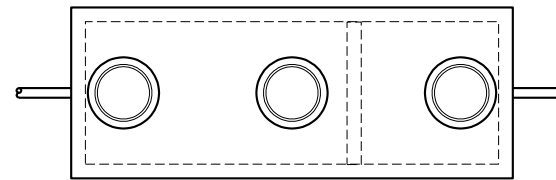
# How do Grease Interceptors Work?

## Why use Baffles or Stand Pipes?

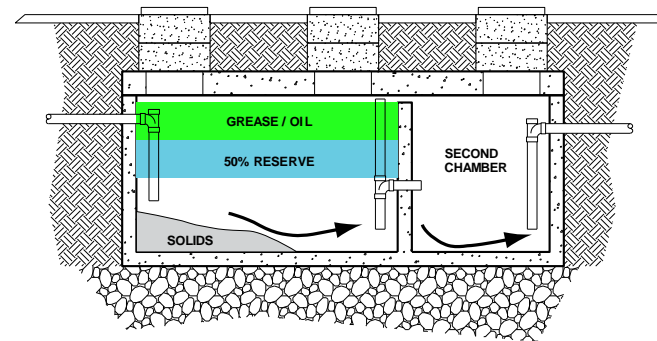
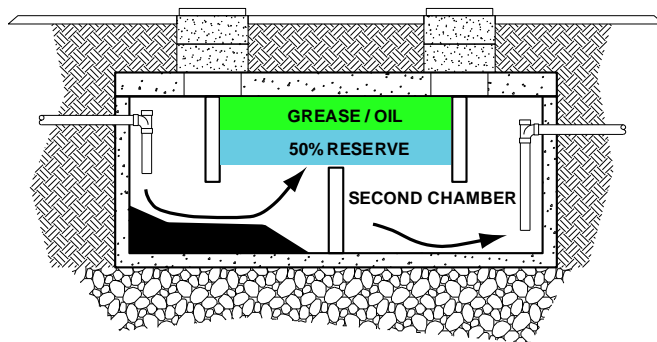
- Both systems use the same principles



**BAFFLE SYSTEM**



**STAND PIPE SYSTEM**



# Grease Interceptor Best Practices

## Interceptors should:

- Provide easy access for maintenance
- Be large enough to hold large quantities of grease
- Be outdoors to facilitate inspection and eliminate the possibility of food contamination



# How do Grease Interceptors Work?

## **What needs to be maintained**

- Cleaning frequency depends on each establishment and will vary from monthly to as seldom as every six months.
- Determine the capacity of the interceptor based upon 50% of the difference in elevation of the internal baffle/stand pipe invert and the outflow invert. This will help determine the frequency needed.
- Pump out the oil and grease from the top of all chambers.

# How do Grease Interceptors Work?

## **What needs to be maintained**

- Pump out the solids from the inflow chamber floor.
- Routine cleaning of the sewer line between the establishment and the interceptor will prevent this line from plugging. Remember Murphy's Law will have the sewer line plug at the most critical time.
- Records must be kept on maintenance work completed in order to keep the establishment in compliance with permit.

# Key Factors Affecting Grease Removal

## Retention Time

- Most important factor is grease separation and retention
- Metcalf & Eddy recommends 30 minutes minimum and is referenced in the Plumbing Code.
- Refer to state or local municipality guidelines for possible differing retention times.



# Key Factors Affecting Grease Removal

## Retention Time

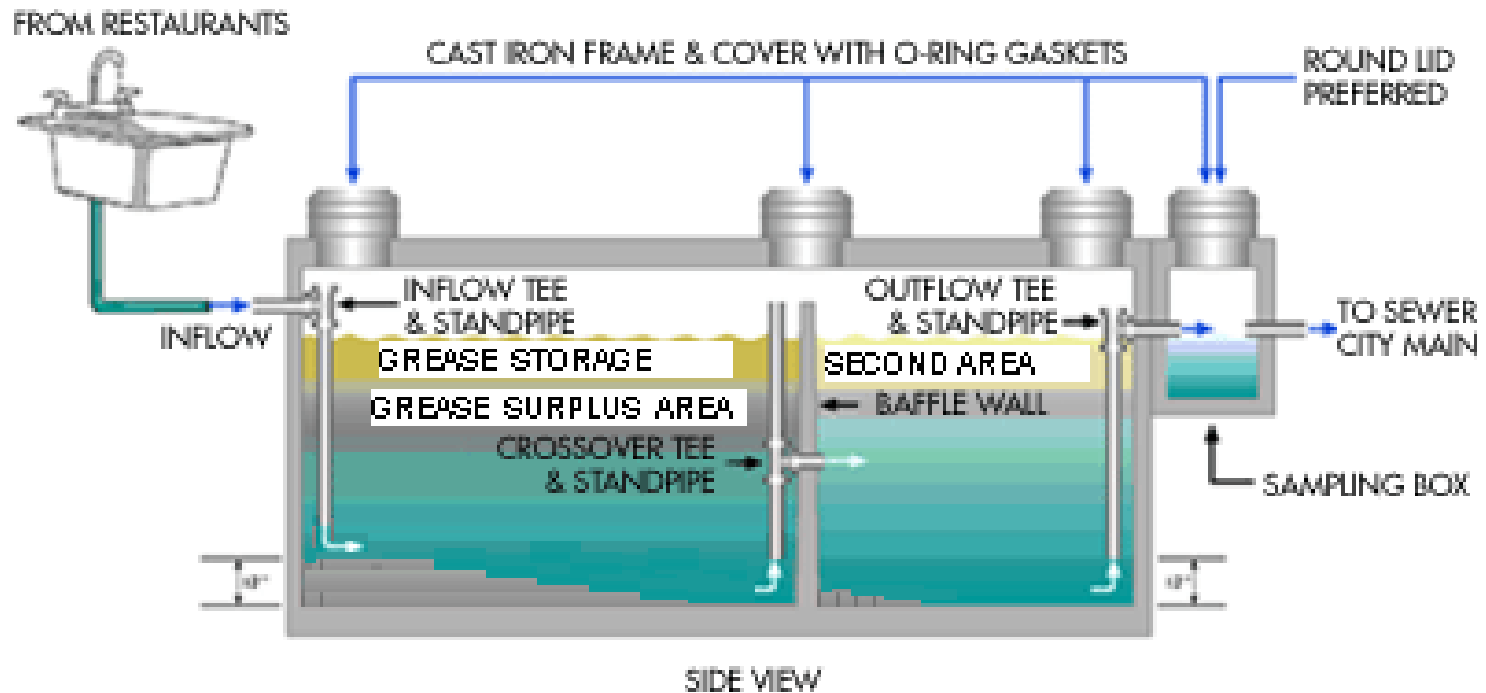


- Depends on the size and the influent flow rate
- Baffles increase retention time and prevent short-circuiting
- Size increases retention time and promotes cooling of liquids
- Proper interior “T” length or baffle depth



# General Example Configuration

## Grease Interceptor (Drawing Not to Scale)



# Configuration Considerations

- The design of the interceptor should promote flow patterns that act to prevent eddy currents in the interceptor.
- An inlet baffle or diverter is necessary to increase the retention time and avoid short-circuiting.
- An outlet baffle or tee is necessary.

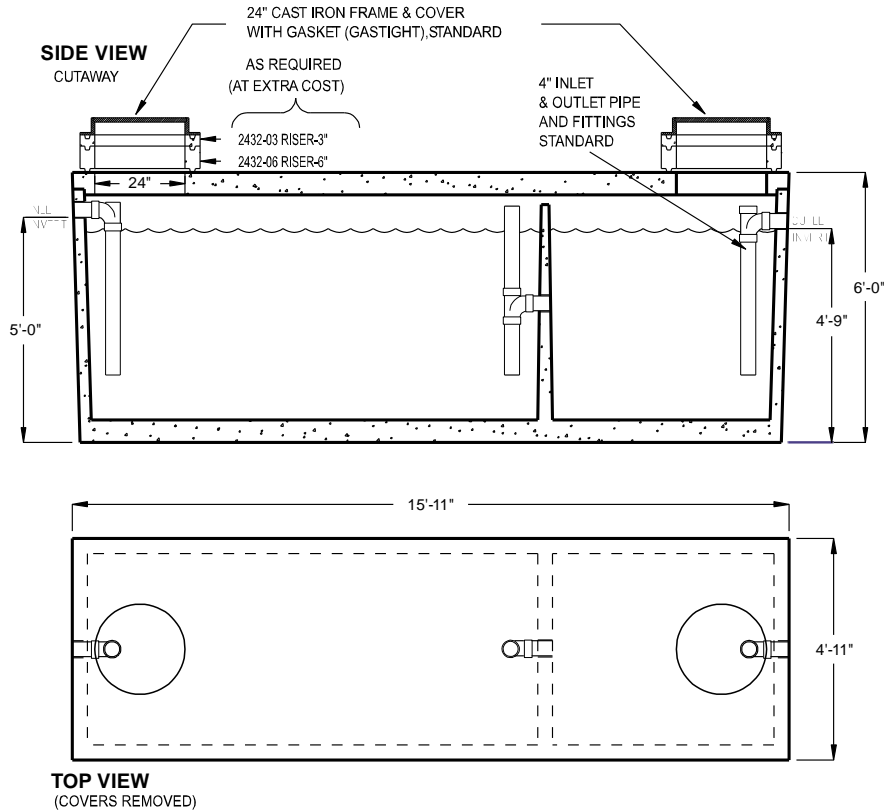


# Configuration Considerations

- A rectangular interceptor is believed to be the optimum shape.
- There should be clear space above the water level to allow for venting.
- A space is needed at the bottom for sludge accumulation.
- A sample port allows easy sampling.

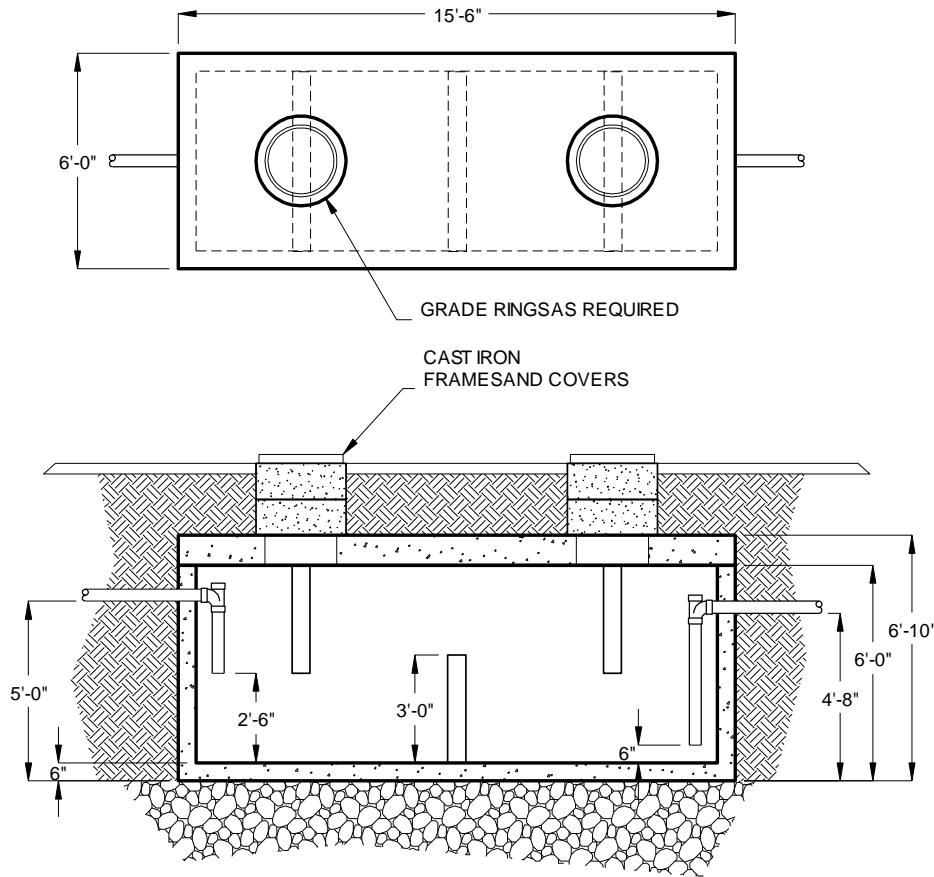


# Stand Pipe Configuration



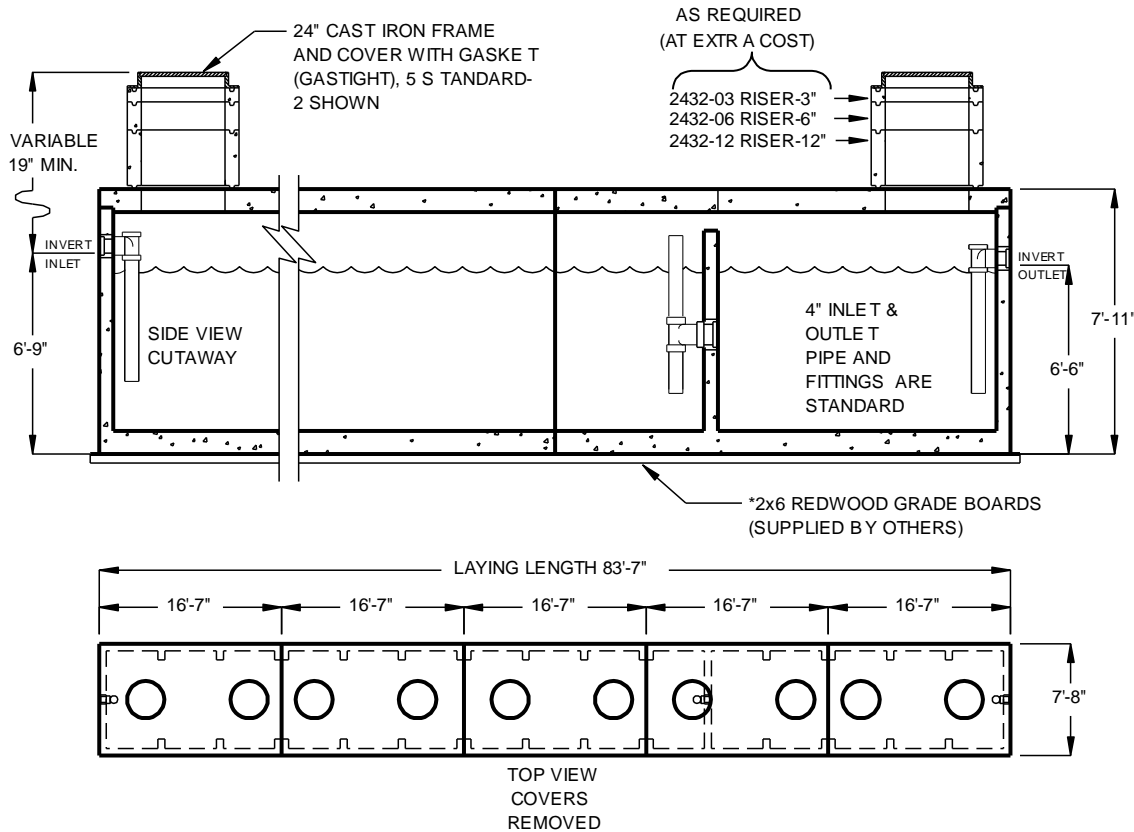
## 2,000 Gallon Stand Pipe Tank

# Baffle Configuration



## Baffle Design

# Interceptors in Series



**25,000 Gallon  
Grease Interceptor  
In Series**

# Placement Considerations

The following two facts help determine placement of an interceptor:

**Grease interceptors are large, heavy and contain a wide variety of contaminants.**

- *Consequently, interceptors should be located outdoors of an establishment, especially food preparation establishments.*

**Grease-laden water should flow to the interceptor driven by gravity.**

- *Consequently, the interceptor should be placed at a lower elevation than the establishment*

# Codes and Standards

## **ASTM International**

- *ASTM C1613*

*“Standard Specification for Precast Concrete Grease Interceptor Tanks”*

- Materials and Manufacture
- Structural Design Requirements
- Physical Design Requirements
- Quality Control
- Watertightness Requirements



# Codes and Standards

## International Association of Plumbing and Mechanical Officials (IAPMO)

- *IAPMO/ANSI Z1001 (formerly PS-80)*
- *2009 & 2006 UPC Chapter 10*
- *Locally imposed or Municipal Codes (may or may not be more stringent)*

# Structural Considerations

## **Traffic Loading**

- All interceptors should be designed for traffic loading
- At a minimum, use loads from ASTM C890 (A-16)

# Interceptor Sizing

- Provide adequate retention time for all types of FOG
- Longer retention times equals larger interceptor
- Emulsified oils require the longest retention times
- Vegetable oils require longer retention times than animal fats

# Interceptor Sizing

- Provide enough grease storage capacity to meet cleaning requirements
- Promote longer time between cleaning to reduce maintenance costs
- Higher FOG concentrations require longer retention times

# Interceptor Sizing

## Factors Affecting Sizing:

- **Retention Time:** Retention time is the amount of time it takes one particle of influent to travel through the system and discharge out of the interceptor.
- **Flow rates:** Wastewater flow rates and retention times are inversely proportional.
- **Concentration:** An effective interceptor should be large enough to accumulate a significant amount of grease without affecting the retention effectiveness.

# Interceptor Sizing

## Factors Affecting Sizing:

- **Pumping Frequency:** The size shall be sufficient to optimize cleaning and pump outs
- **Chemistry:** Wastewater temperatures and emulsifying chemicals affect the rate at which greases and oils will separate from the wastewater.

# Interceptor Sizing

## Using Sizing Codes

- Do not ASSUME anything
- Talk to the governing agency/municipality and find out what equation they use
- Different agencies/municipalities have different codes

# Interceptor Sizing

## UPC – Appendix H (pre-2006)

$$\left( \frac{\#Meals}{peak.hour} \right) * (flow.rate) * (retentiontime) * (storage.factor)$$

where:

# meals/peak hr. = total number of seats (assume =100 meals/hr.)

Flow rate (with dishwasher) = 6 gallons

Retention time (with dishwasher) = 2.5

Storage factor (16 hours of operation) = 2

**Example Tank Capacity** = 100 x 6 x 2.5 x 2 = 3,000 gallons



# Interceptor Sizing

## UPC – Appendix H (2006-2009)

### *Gravity Grease Interceptor Sizing*

<u>DFUs</u>	<u>Interceptor Volume (2)</u>
8	500 gallons
21	750 gallons
35	1,000 gallons
90	1,250 gallons
172	1,500 gallons
216	2,000 gallons
307	2,500 gallons
342	3,000 gallons
428	4,000 gallons
576	5,000 gallons
720	7,500 gallons
2112	10,000 gallons
2640	15,000 gallons

#### *Notes*

- 1) The maximum allowable DFUs plumbed to the kitchen drain lines that will be connected to the grease interceptor.
- 2) This size is based on: DFUs, the pipe size from this code; Table 7-5; Useful Tables for flow in half-full pipes (ref: Mohinder Nayyar Piping Handbook, 3rd Edition, 1992). Based on 30-minute retention time (ref: George Tchobanoglous and Metcalf & Eddy, Wastewater Engineering Treatment, Disposal and Reuse, 3rd Ed. 1991 & Ronald Crites and George Tchobanoglous, Small and Decentralized Wastewater Management Systems, 1998). Rounded up to nominal interceptor volume.
- 3) When the flow rate of directly connected fixture(s) or appliance(s) have no assigned DFU values, the additional grease interceptor volume shall be based on the known flow rate (gpm) multiplied by 30 minutes.

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# Interceptor Sizing

## U.S. E.P.A.

$$(\#seats) * \left( \frac{gal}{meal} \right) * (storage.factor) * \left( \frac{hours.open}{2} \right) * (loading.factor)$$

where:

# seats (assume = 100 seats)

# gal / meal = 5

Storage Factor = 1.7

Hours Open = 8

Loading factor = 1

**Example Tank Capacity** =  $100 \times 5 \times 1.7 \times 8/2 \times 1 = 3,400$  gallons

# Other Issues

## **Odors**

- Poor ventilation
- Extended time periods between service
- Sporadic use
- Sanitary waste should not be routed into a grease interceptor

# Precast Advantage

- **Built Tough by quality manufacturers**
- **Locally sourced materials – keeps it green**
- **Ready to deliver and install**
- **Not affected by weather**
- **Easy to maintain**
- **Heavy – resists the buoyant forces of water**
- **Made from environmentally safe precast**

# NPCA Plant Certification

## NPCA Plant Certification Program



**NPCA**<sup>TM</sup>  
CERTIFIED PLANT

# Other Solutions



**Set it on fire and  
go to jail.**

**Do nothing but pay a  
severe fine.**



# Additional Information Sources

- Operation & Maintenance Manual

[Operations & Maintenance](#)

- Grease Interceptor Design Document

[Design Paper](#)

- NPCA website

[NPCA](#)

# Questions?

# QUESTIONS?

# Have A Great Day!

