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from experience

Correlating Waste Flows with Drain Capacities

When waste flows exceed drain capacity, the resulting overflow creates unpleasant work conditions, potential slip hazards, and may pose a food safety risk. To avoid drain overflows, it is helpful to coordinate waste pipe flows and drain capacities.

The first task is to estimate the capacity of the drain by determining its size and slope. Because drains are constructed with minimum slopes, the capacity of a drain of unknown slope can be estimated. Minimum slope requirements are mandated by Code and vary by pipe size. These slopes are the minimum that allow for self-scouring:

- 3" and smaller pipe has a minimum slope of ¼" per foot (2% slope)
- 4"-6" pipe has a minimum slope of 1/8" per foot (1% slope)
- 8" and larger pipe has a minimum slope of 1/16" per foot (0.5% slope)

Although some facilities opt for higher slopes in select areas (effectively trading higher cost for increased drain flows), these minimum slopes are the standard for most drains. Pipe size and the associated minimum slope can then be used to identify flow capacity, which is shown in Figure 1 below.

The second task is to estimate the volume of waste sent to the drain. A self-draining discharge line uses gravity draw without the assistance of a pump. To avoid inconsistent flow and the possible creation of vacuum forces, the discharge line must be self-venting. The flow of a self-venting discharge line can be correlated to a standard drain flow capacity as also shown in the chart.

Perhaps more problematic is estimating the flow from a pressurized line. A pipe draining the bottom of a vented tank is pressurized by the height of the fluid in the tank and other pressure sources such as a Nitrogen blanket. The height of the fluid will directly impact the flow in the pipe, and can result in significantly more flow than might be expected. Because the flow rate is dependent upon both the size of the drain line and the height of the fluid, a thorough analysis is needed. Figure 2 below shows one such analysis, showing the maximum flow rates through 1" and 2" schedule 10 pipes with water heights from 5 to 30 ft. and no other pressure sources. Note that a 1" schedule 10 drain pipe pressurized with 10 ft. of water pressure could have a flow rate as high as 60 GPM, which could overflow a standard 4" drain line.

Self Venting Lines and Drain Capacity			
Nominal Pipe	Sanitary Tubing	Drain Size	Flow GMP
	2.00		5.94
2.00			7.63
		2	8.40
	2.50		10.70
		2.50	15.30
	3.00		17.30
3.00			20.50
		3	24.80
	4.00		35.80
		4	37.80
4.00			40.40
		5	68.30
		6	111
6.00			113
		8	170
8.00			224
		10	308

Figure 1

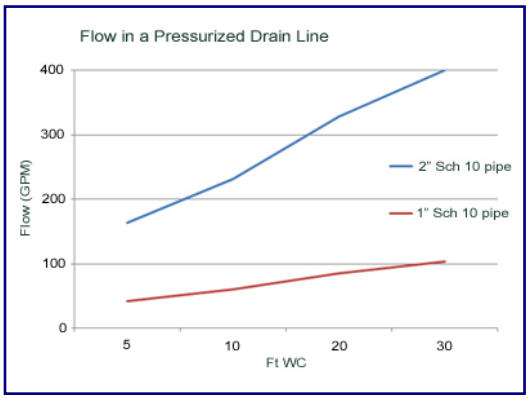

Figure 2

experience in brief

Factors to remember when determining the linear speed of fluids in a pipe:

Drain capacities listed in the main article are for unobstructed drains operating properly. Many factors can reduce drain capacity, including solidified Fats, Oils and Grease (FOGs), physical obstructions, or drain pipe damage and collapse. In addition, since drain pipes connect to each other, drain pipe sizes need to increase as necessary to accommodate the cumulative flows. Otherwise, the combination of multiple waste streams overcoming the overall drainage system design capacity may result in an overflow.

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