
Engineering Guidelines

by **WILSON ENGINEERING**

Section 2 - Blowdown Systems EG 2.1

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Engineering Guidelines are offered by WILSON ENGINEERING to assist in the application, sizing and selection of deaeration and feed water conditioning systems. If you have questions on any of the topics discussed or about the information provided, please contact one of our people in our sales or engineering groups for assistance.

Blowdown Tank Application & Selection

A blowdown tank is designed to collect the **intermittent blowdown** from the bottom blow off connections (or mud drum) and from the surface blow off connections. The term "intermittent blowdown" is stressed because the blowdown tank is best suited for intermittent operation.

The blowdown tank provides a safe method of collecting the water which is removed from the boiler during blowdown. Blowdown water can present house keeping challenges and safety concerns if not handled properly. The blowdown water is at the saturation temperature of the boiler. If for example, water is removed from a boiler operating at 100 psig, the water is at 338° F. If water at 338° F is drained to atmosphere, it must give up heat in order to lower it's temperature to the boiling point at atmospheric pressure. In other words, the water must be cooled from 338° F to 212° F in order to exist at atmospheric pressure at sea level. The water is cooled by giving up heat in the form of steam. The amount of steam generated will depend on the operating pressure of the boiler. In the example above, the water will give up approximately 126 BTU/lbm of water drained. If the water is sent to a drain, a substantial amount of steam will be generated and released to the boiler room. The water entering the drain will be at 212° F.

Existing codes prohibit the discharge of hot water over 140° F to the sewer systems. Safety concerns prohibit the uncontrolled release of flash steam into a boiler room. The use of a blowdown tank can satisfy both of these requirements.

The Blowdown tank provides a safe method of collecting the blowdown water while allowing the flash steam generated to be safely vented to atmosphere. The water which remains in the blowdown tank is held in the tank until it cools to acceptable levels before it is discharged to drain. When properly sized for intermittent blowdown, the water discharged will be less than the 140° F maximum allowed by the prevailing codes. Since the water is cooled through conduction and convection, no cooling water is required.

Why use a Blowdown Tank?

A blowdown tank is used if required by the local codes. Michigan and New Jersey require blowdown tanks. These states will not allow the use of blowdown separators.

Some clients or industries use blowdown tanks in lieu of separators due to habit.

Some facilities will use a blowdown tank to conserve water. If a blowdown tank is used for intermittent blowdown, in lieu of a blowdown separator, the facility will reduce the use of water since no cooling water will be used. This will also reduce the volume of water sent to the sewer which can reduce water treatment expenses and sewer

Sizing Blowdown Tanks:

The "National Board of Boiler and Pressure Vessel Inspectors" recommends the following method for determining the size of a blowdown tank; **"The tank shall be of a volume equal to twice the volume of water removed from the boiler when the normal water level is reduced by not less than 4 inches."**

When sizing a blowdown tank for a firetube boiler, calculate the volume based on the area at the normal water level. When calculating the size for a watertube boiler, use the diameter of the steam drum to calculate the area.

Example:

70,000 pph watertube boiler
 150 psig operating pressure
 Drum Diameter = 42"
 Drum Length = 21' (252")
 Blowdown Connections = 1-1/2"

$$\begin{aligned} \text{Volume} &= \text{Drum Diameter} \times \text{Drum Length} \times 4" \text{ drop in water level} / \\ 1,728 & \\ &= (42" \times 252" \times 4") / 1728 \\ &= 24.5 \text{ ft}^3 \text{ in each blowdown cycle} \end{aligned}$$

Convert to gallons of storage:

Note :The tanks requires twice the capacity in storage volume.

$$\begin{aligned} \text{Tank Volume} &= \text{volume} \times 2 \times 7.48 \text{ gallons/ft}^3 \\ &= 24.5 \text{ ft}^3 \times 2 \times 7.48 \text{ gallons/ft}^3 \\ &= 366 \text{ gallons} \end{aligned}$$

Select a tank with at least 366 gallons of storage capacity for each operating boiler.

Compare the Cost of a Blowdown Tank to a Separator:

Use previous example which requires at least 366 gallons.

1. 36" x 72" Blowdown Tank	380 gallons	\$5,708
2. 16" Blowdown Separator	(same flow rating)	\$2,163

Additional investment required by blowdown tank = \$3,545

Savings with blowdown tank:

- Assume: 1. Blowdown once each day
 2. worst case of 4" drop per blowdown cycle
 3. 366 gallons of cooling water required daily

$$\begin{aligned} \text{Annual Cooling Water Use} &= 366 \text{ gal/day} \times 365 \text{ days/year} \\ &= 133,590 \text{ gallons/year} \end{aligned}$$

$$\text{Annual Sewer Use saving} = 133,590 \text{ gallons/year}$$

Will the savings in water and sewer use justify the initial investment required of \$3,545?

"The tank shall be of a volume equal to twice the volume of water removed from the boiler when the normal water level is reduced by not less

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