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Recovery boiler sootblowers: practical guidelines

Scope

The purpose of this TIP is to provide an overview of sootblower cleaning technology and some practical guidelines to optimize sootblower operation.

Safety precautions

A recovery boiler sootblower is connected with high pressure steam piping system and a power supply to drive its motor(s). Before any work is performed on a sootblower, it is important to the sootblower be put in the zero energy state. Zero energy state means that (1) the isolation valve is closed and a lock tag is placed in the valve to prevent the high pressure steam to enter the sootblower, and (2) the power supply to the sootblower is disconnected with a lock tag placed in the power supply to prevent inadvertent or unexpected start-up or energization of the motor.

A sootblower that is stuck inside a recovery boiler for a long period of time while blowing high pressure steam jet may cause boiler tube erosion. In a worst case scenario, a significant amount of water may leak thorough the eroded boiler tube and come into contact with the smelt in the furnace, causing smelt-water explosion. Mill operators need to be observant on the sootblowers that are running beyond the time required to complete a cleaning cycle. Should the operator identified such sootblower, a swift action needs to be carried out to lower the steam pressure supplied to the sootblower and manual sootblower retraction is performed.

Definitions

Poppet valve pressure: The poppet valve pressure is the steam pressure measured at the location immediately downstream of the valve seat. This is the steam pressure supplied to the feed tube.

Nozzle pressure: The nozzle pressure is often used interchangeably with lance pressure or blowing pressure. It is defined as the steam pressure supplied to the sootblower nozzles, and is the pressure measured just before the steam enters the nozzle (Points A shown in Fig. 1). Note that the nozzle pressure is always lower than the poppet valve pressure due to minor losses and the pressure drop in the feed and lance tubes.

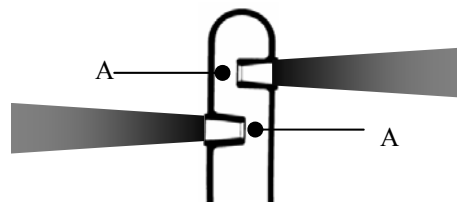


Fig. 1. Nozzle pressure

Impact pressure (IP) and peak impact pressure (PIP). The impact pressure is the pressure of the steam when a sootblower jet is brought to a complete stop. Impact pressure is also called pitot tube pressure as it is often measured

using a pitot tube. PIP is the impact pressure measured along the jet centerline where the pressure is at its peak. The most common parameter used to compare the performance of two different nozzles with the same throat diameter but different design is the PIP measured 30" away from the nozzle exit.

Nozzle throat and exit diameters. The throat diameter is the diameter measured at the smallest opening area of the nozzle. The exit diameter is the nozzle diameter measured right at the nozzle exit (see Fig. 2).

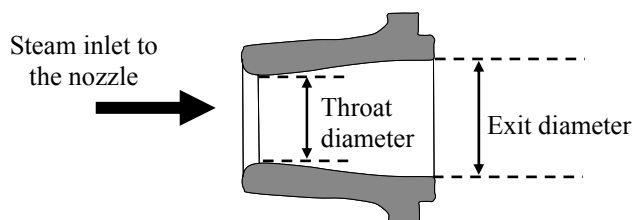


Fig. 2. Nozzle throat and exit diameters

Reverse and rest positions. The reverse position is the point where the limit switch is triggered to send a signal to change the carriage forward direction and retract the sootblower lance. The rest position is the point where the limit switch is triggered to send a signal to stop the carriage retracting movement and park the sootblower.

Helix. The helix is the distance traveled by a nozzle to complete one full rotation (360°). See Figure 3.

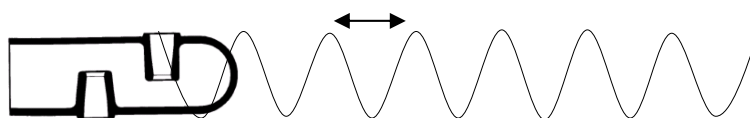


Fig. 3. Helix

Jet progression velocity (JPV). The jet progression velocity (JPV) is defined as the velocity of the upward or downward movement of the jet as it travels in Y-direction, shown in Fig. 4.

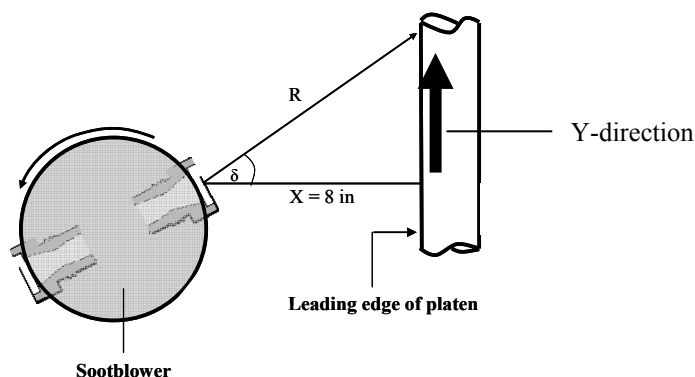


Fig. 4. Jet progression velocity.

Cooling and cleaning flows. The cooling flow is the minimum steam flow rate required to cool and keep the lance from overheating. The cleaning flow is the steam flow rate required to clean the boiler.

Sootblower major components. See Fig. 5

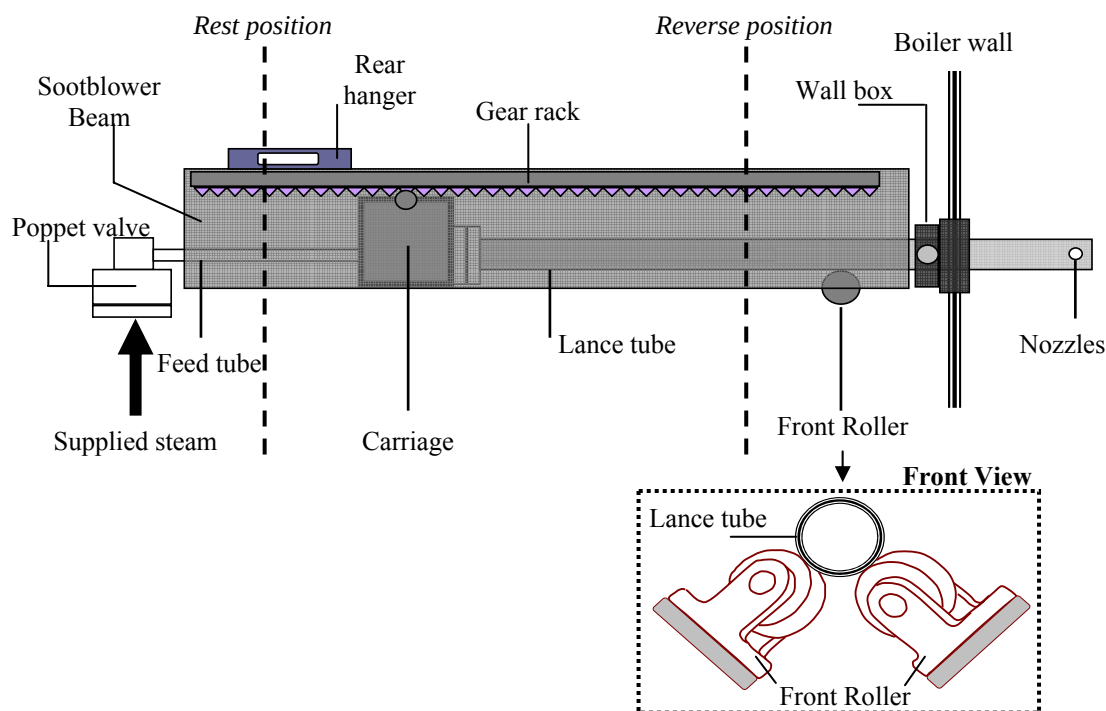


Fig. 5. Sootblower major components

Sootblowing strategy

Constant jet progression velocity

Sootblowers generally rotate at a constant angular velocity (ω). The JPV can be calculated as:

$$JPV = \omega R \quad (1)$$

where R is the distance that the jet has to travel to reach the leading edge of the platen (Fig. 4). At a constant angular velocity ω , the JPV is constantly changing as the sootblower rotates due to the change in R .

Fig. 6 shows the profile of the R and the JPV at $\omega = \frac{2}{3}\pi$ per second and $X = 8$ in. as a function of the blowing angle (δ). Note that X is closest distance between the nozzle exit and the leading edge of the platen (i.e., X is equal to R when the blowing angle (δ) is 0 degree).

The R and JPV increase significantly at δ between -45° to -90° and $+45^\circ$ to $+90^\circ$, (shaded areas) while R and V do not significantly change between δ of -45° and 45° .

The force that is exerted by the jet on a deposit that is sitting on the platen surface decreases markedly as R increases. The probability of the deposit being removed by the jet is further lowered in the region where the JPV is