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Nozzle maintenance and clogging

Scope

This TIP will provide guidance to paper mill personnel in procedures necessary for proper inspection, maintenance and replacement of spray nozzles.

Safety precautions

Safety is an important consideration in every task performed in the paper industry. This includes routine functions like servicing showers. Before servicing a shower: Flush the system to remove residual chemicals. Isolate and lock out to a zero energy state. Use proper tools for the job and always employ appropriate personal protective equipment. Frequently shower must be removed and nozzles accessed while the machine is operating. Trained personnel following established written procedures should only perform these operations.

Content

Experience tells us that nozzles require regular inspection and maintenance, and eventually require replacement in order to preserve final product quality and to maintain production processes on a cost-efficient basis. There is probably no other single production component in a plant whose cost is relatively small but whose proper performance affects the final product quality and overall production costs in such a significant way. Worn and damaged nozzles can become ineffective for many production processes.

Costs from worn nozzles can add up in many ways. These include the cost of water, effluent treatment, electrical power consumption due to excess water pumped, and excess chemicals sprayed.

Spray nozzles are precision components designed to perform specific functions. These functions include: metering liquid flow, generating spray patterns, generating atomized drops (non-solid stream nozzles), providing spray impact and providing spray velocity. Nozzle performance can be compromised and rendered totally ineffective if routine nozzle maintenance isn't performed correctly.

Here are some problems that can occur when a nozzle is not well suited for an application and/or not properly maintained. Erosion or wear of the orifice and internal flow passages, chemical corrosion, temperature damage, caking, clogging, improper assembly and accidental damage. All of these factors can cause the spray performance of the nozzle to be ineffective.

As shown in the adjacent photographs nozzles can be attacked in several ways. In Fig.1, a hollow cone nozzle is eroded from the inside out by the internal whirling action of the liquid. In Fig 2, a hollow cone nozzle is completely caked on the outside from the mist generated by the chemical it was spraying. In Fig. 3, a flat spray nozzle has been a victim of chemical attack. This is most likely the result of contact with an acid and using an incompatible nozzle material. In Fig. 4, a full cone nozzle appears to be damaged from chemical attack and possibly excessive heat exposure. In Fig. 5, this flat spray nozzle is simply damaged from being constantly banged against a hard abrasive surface.

Here are some suggestions for making nozzles wear and last longer. Prevent damage to the orifice during routine cleaning by using cleaning probes made of materials softer than the nozzle surface. Bristle brushes or wooden and plastic probes are generally appropriate. Avoid wire brushes, pocketknives, or welders tip cleaning rasps. Before cleaning, soak nozzles in a non-corrosive chemical to soften and dissolve clogs. Use filters to reduce

the amount of abrasive solid particles in the sprayed liquid. Use materials with better corrosion resistance such as 316 stainless steel, Hastelloy, ceramic and Kynar.

In order to keep nozzles operating at peak performance, it is necessary to do regular inspection, maintenance and replacement. Nozzle problems are not always obvious. Regular inspection of the orifice, flow rates, quality and appearance of the spray pattern should be performed. This will preserve final product quality and maintain production processes on a cost-efficient basis.

When replacing nozzles do not overlook the need for nozzle alignment. Many nozzle manufacturers offer self-aligning nozzles and showers, which will overcome the difficult task of trying to align the spray nozzles. Additionally it would be wise to consider the use of double coverage in critical applications. This will help insure full coverage in case one nozzle should become clogged.

Additionally the use of automatic brush-type shower headers should be considered. These are automatic self-cleaning shower headers with an internal brush that periodically rotates to clean both the inside of the shower and the nozzle orifice. The frequency and duration of the cleaning cycle will of course depend on the amount of fiber in the water supply.

Also on a separate issue of shower header maintenance, showers that appear outwardly in good condition may actually have been subject to inter-granular corrosion. To prevent potential problems with pipes rupturing, close examination should be done to look for evidence of these types of corrosion.

The best way to keep track of the performance of your spray nozzles would be to conduct a nozzle audit of all the spray nozzles in the plant. It is typically a good idea to check with your nozzle supplier to see if they offer this service. Record shower headers and nozzles, their part numbers, dates of installation, when nozzle maintenance was done and when replacement of any nozzles is required. Spray nozzles are identified for flow rate and spray angle. Worn nozzles can be sent back to the supplier for wear analysis in the lab. Creating and maintaining a reference file of nozzles and showers is a useful tool to keep them operating at peak efficiency.

Finally the best approach to optimize your spray nozzles would be to initially match the proper nozzle to suit the intended application. This includes choosing the nozzle material with the suitable wear resistance to match the abrasiveness of the liquid sprayed and using nozzle materials, which offer enough corrosion resistance to match the corrosive properties of the liquid sprayed.

By implementing the aforementioned guidelines, nozzle maintenance problems may be kept to a minimum and save thousands of dollars from inefficient production processes.

Keywords

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Additional information

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