Verified Mortality Rate in Flour and Semolina

Impact machine Matador MJZH from Bühler destroys insect eggs with top efficiency.

Insects and their eggs should not be in flour and semolina nor in the resulting food products. Milling operations have various options for keeping their product and plants free of insects and insect eggs. To destroy insects and their eggs in the product, the use of an impact machine is imperative.

Mill operators and their customers can only produce successful products if they have top quality flour or semolina. One of the big challenges in the effort to achieve the highest quality is producing end products that are free of living insects and destroying the insect eggs which put food safety at risk. To reliably destroy insect eggs, solutions are needed which can be seamlessly integrated into the processing flow while providing maximum throughput capacity and process safety with minimal energy input. Most importantly, however: The functionality of the flour and semolina cannot be altered.

Risks lurk everywhere
Insects and their eggs are insidious ‘opponents’. They can pose problems not only in mills but in other food processing operations as well, and it is difficult to bring them under 100 percent control with just prophylactic and stringent sanitation measures alone. Only constant and preventative monitoring can provide the protection needed from unpleasant surprises. When pests get imported in the raw material, or there is an insect migration, populations can quickly explode. Even a relatively small density of pests can lead to a vexing insect infestation in the finished product, limiting both sanitation and storage life.

Avoid and remove
The best measure for avoiding insect and insect egg contamination in the product is to keep the pests out of the mill to begin with. Structural measures are things such as installing windows that cannot be opened, making building structures easy to clean without corners or having excess pressure in production rooms which prevents migration. Operational measures are things such as regular and thorough cleaning of the plant and, above all, purchasing high quality raw materials. If the pests have been discovered within the mill, various chemical or thermal-based methods can be applied to decontaminate the plant. These different approaches, however, vary a lot in terms of time, organizational and financial outlays and efficacy and potential 'side effects' (see "Measures" box).

Contamination in the raw product
The risk of an insect infestation in grain does not just lurk on the surface of the grain, but also 'inside' the grain. For instance, when insects bore into them, the kernels can become contaminated. Certain types of beetles drill into the grain to make a 'home' or develop further. If such grain is then milled, the insect eggs end up in the flour, which can be verified using filth analyses. To avoid such contaminants as much as possible, the finished, prepared wheat is ‘impacted’ in an impact machine before the first grist, and aspirated. If a kernel has been drilled into by insects, it bursts under impact and can be mechanically separated from the rest.

Final possibility
Insect eggs are characterized by enormously high resistance. They can withstand the entire,
multi-staged milling process without any damage. The last chance to permanently destroy them is either before storing the flour or semolina or before the bagging or bulk load. Impact machines can be used in the same way as for the grain at this step in the process as well to destroy the insect eggs. The machines can be installed either in the gravity spouting or in the pneumatic pressure conveying system.

**Advantages of an impact machine**

Impact machines are amazingly efficient when it comes to destroying insect eggs. Compared to other technologies for combating insect eggs, the success rate of the impact machines is very high. In contrast to thermal or chemical methods, impact machines can also be used directly for the end product as well – in other words, right before shipping. Finally, the ‘impacting’ method is completely safe for humans and animals, and is very inexpensive.

**Using Matador to counter eggs in flour and semolina**

Bühler developed the Matador MJZH impact machine specially for use before bagging or storing the flour or semolina. This impact machine is a new development for killing insects and their eggs in flour or semolina. More than 99.5 percent of the insects and eggs found in flour are killed with absolute certainty.

The Matador MJZH impact machine is available in five finely differentiated sizes, with throughput capacities of 1 - 45 t/h. All sizes share high efficiencies with a mortality rate of over 99.5 percent, reliable, long-term operation and low operating and maintenance costs. The process safety is ensured with a sensor system which monitors for optimal operating condition.

The new MJZH impact machine is designed according to the cross-flow principle. This allows high product performance with a low specific energy use and makes the Matador significantly different from previous impact machines designed on the radial principle. The advantages of the cross-flow principle: Flow relationships remain unchanged even with broader machines; functioning is optimal at any installation location; impeller and housing shapes favor flow; functionability is long-lasting because of sturdy construction; can be positioned outside of the conveyor; and is low in energy use.

**Validated mortality rates**

The most important argument for using the Matador MJZH impact machine is the 99.5% mortality rate, which is extremely high. This has been verified by an external institute through an extensive procedure. Besides Bühler, no other supplier offers this documented and certified efficiency through a competent and independent institute.

In summary, effectively combating pests in a mill requires a combination of different but coordinated methods. An impact machine is imperative for destroying insect eggs in the product. To select the right one, factors such as a validated mortality rate, energy use and options for flexibly designing it into the existing building are decisive.

![The new Matador MJZH impact machine from Bühler destroys insect eggs with 99.5% certainty.](https://example.com/impact-machine.jpg)
**Combating pests**
The various options for combating and removing pests in milling operations have advantages and disadvantages.

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<tr>
<th>With chemicals</th>
<th>With heat</th>
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<td><strong>Method:</strong> For decades, entire flour and feed mills have been gassed in an effort to eliminate pests from supplies for sanitation reasons. Hydrogen phosphide or sulfuryl fluoride is currently being used. Some preparation is needed before gassing. All openings towards the exterior must be sealed tightly for the gas. All interior rooms, cupboards, machines and duct systems must be opened. After allowing it to work for three or four days, the mill must be thoroughly aired. The mill may only be entered once any residue gas measurements are negative.</td>
<td><strong>Method:</strong> Thermally combating pests is based on the fact that beetles, moths, mites, fleas and bugs, as well as their larvae, are destroyed in temperatures of approx. 43-45°C through a process of protein coagulation (denaturing), which causes their own enzymes (=biocatalyzers) to be irreversibly destroyed.</td>
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<td><strong>Advantages:</strong> High mortality rate for pests throughout the entire plant.</td>
<td><strong>Advantages:</strong> Relatively low outlays, the quality of flour or supplies is not impacted, no risks to humans, animals or the environment.</td>
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<td><strong>Disadvantages:</strong> Process lasts several days, the substances employed are more toxic and harmful to the environment, expensive experts need to be brought in, and it is prohibited in ‘organic’ mills.</td>
<td><strong>Disadvantages:</strong> The process lasts several days and is expensive because it is very energy intensive.</td>
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<th>With inert gas</th>
<th>With beneficial organisms</th>
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<td><strong>Method:</strong> Carbon dioxide (CO₂) is pressed into the product under high pressure in a disinfection chamber. This pushes out the oxygen needed by the pests to survive. When the pressure in the chamber then quickly drops, any animal protein which might be present bursts.</td>
<td><strong>Method:</strong> Introducing beneficial organisms (ichneumon wasps) against moth eggs. The ichneumon wasps lay their eggs in the eggs of the pests which in turn kills the moth eggs. After about eight to ten days, new ichneumon wasps hatch. This process is stopped as soon as the ichneumon wasps find no more new moth eggs.</td>
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<td><strong>Advantages:</strong> Pests are completely destroyed, product is completely free of any residues at the end.</td>
<td><strong>Advantages:</strong> Completely harmless for humans and animals, inexpensive, nature cycle, no residue problems.</td>
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<td><strong>Disadvantages:</strong> What is less known and communicated is that reaction times for the CO₂ must be adjusted to the product and the temperature; it is inefficient at high outputs; and, it is barely implementable and invalid for insect eggs.</td>
<td><strong>Disadvantages:</strong> Not a very wide-spread method; cannot be combined with pesticides because the beneficial organisms would die; and in worst case, the dead beneficial organisms end up in the end product.</td>
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