



Infestation Troubleshooting Guide

**Developed by the IAOM
Food Protection Committee**

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Troubleshooting Flour System Infestations

Additional information can be found in IAOM's Integrated Pest Management Manual, which can be purchased through IAOM or downloaded from the IAOM website: www.iaom.org/publications/ipm-manual/

A. Troubleshooting Guide for Insect Issues in Flour Mill Load-out Systems.

Flour mills should have a load-out system with the following Industry best practice components: load-out sifter with screen 600 microns (30 mesh) or tighter, and an entoleter. This set up is likely just prior to the load out bins; with gravity or flood load systems, it's not practical or possible to have them afterward.

Identify the process flow. A typical flow at the flour mill:

Flour from the milling process > bulk house/storage tanks > transfer thru loadout sifter > entoleter > storage tanks or scale tank > transferred through loading equipment into the bulk trailer or railcar, or gravity/flood loaded. Important to note that each system may include various conveyance equipment, collection hoppers, airlocks, aspiration lines, and pneumatic filters. These all should be included as part of the inspection process.

Flour can be pneumatically conveyed or conveyed through bucket elevators and screws or dropped by gravity.

	Inspection of equipment/area/procedure	Observations
1	Identify the insect(s) and stages found. Once identified, study the conditions under which the insect lives (e.g. mold feeder, secondary feeder, field insect, etc.). Use this information to better understand where the infestation may have occurred or may be present.	
2	Check for the presence of a load-out sifter and that screen is sound (verify last time sifter was worked and condition). Review frequency and criteria for changing sifter screen.	
3	Check to see that there is no by-pass around the load-out sifter. There should be no by-pass.	
4	Check sifter screen size (should be tighter than 600 microns to sift out adult, larvae and pupae stages of insects).	
5	Review sifter inspection procedure. Verify that finished product spouts are isolated to prevent contamination from potential insect activity. This may be accomplished by removal of sifter socks or other activities relevant to sifter type, such as covering of spouts.	

	Inspection of equipment/area/procedure	Observations
6	Check sifter tailings history for insects and other insect related foreign materials. Track tailings finding per load. View trends or spikes.	
7	Check for load-out entoletter. Make sure it is operational and is never shut off during load-out. Verify the entoletter reaches recommended operational speed prior to product flow. Verify RPM of entoletter, under product load, vs. manufacturer recommendation. The entoletter should destroy any live insects and insect eggs. There should be no by-pass around the entoletter (quite often there is a choke relief, this should dump to the floor, not route around the device).	
8	Check cleaning frequency of sifter and load-out/scale tank.	
9	Inspect the transfer system from the load-out tanks and/or scale tank to the bulk truck or railcar looking for insects inside the equipment. Further considerations: -Are the tank bins interior or exterior? -Are to bin tops accessible or inspection? -Are bins vented or are pressure relief valves present? -Is there a common dust collection system? -Can connections between bins accessible for inspection? -Is there evidence of product spillage, collection, piles, or scale that may provide potential source or harborage?	
10	Inspect for dead legs (dead ends) in piping where flour is static and can't move.	
11	Inspect the bin vent filter interior on top of the storage tanks (silos), use bins and all other tanks as insects can often get inside and develop there. The bin vent filter and filter socks should be cleaned monthly. Inspect for insects and trails, especially the filters themselves. Remove them, if possible, for better inspection. Note - bin vent filter, bag house and dust collector are sometime used interchangeably.	
12	Each bin vent filter has a clean air plenum where air is exhausted. Open and inspect this plenum. The clean air plenum is always supposed to be clean and free of flour dust. If there is flour dust, check the connection of the filters and the condition of the filters. Flour can only get into the clean air plenum if the filters are torn or misaligned. Look for insects in the plenum.	

	Inspection of equipment/area/procedure	Observations
13	Inspect all cloth and rubber connecting sleeves between pieces of equipment. Remove them to see if insects have developed inside the connecting sleeve.	
14	Check for a central dust collection system and verify that flour collected is not returned to the flour stream after the load-out sifter. If re-used it should be reintroduced before the sifter. It is not a good practice to re-use dust that has been collected. Inspect the interior of the dust collector and the clean air plenum if the collected flour is reused.	
15	Check the history on truck washing by reviewing dates of the wash certificates. If trucks are left wet then mold can develop and some insects such as psocids feed on the mold.	
16	Inspect the exterior of truck or railcar hatches for flour left on top of the vehicle	
17	Inspect hatch gaskets for dampness or evidence of having been wet, mold and insects. Gaskets should not be hollow, brittle or cracked.	
18	Inspect one or more trucks/railcars prior to them being loaded. Inspect the loading spout connection. Ensure that trucks are returned empty (truck and unload tubes should be empty). Check belly line, if possible, and both transfer hoses and storage chambers. "Vac" trailers may be equipped with on-board dust collectors. Trailer dust collectors should be thoroughly inspected. Furthermore, dust collectors should not be connected to the main product area of the trailer.	
19	Check for flour that is returned from mill customers. How is that flour put back into the flour system? If re-used it must always go through the load-out sifter and entoletter before loading. Return flour should be considered very cautiously, understanding time, condition, route, and unloading options.	
20	Check to see that all tank tops, truck hatches, railcar hatches and transfer hoses are dry, capped and kept clean. Inspect open ends of hoses for moisture and insects.	

B. Troubleshooting Insect Issues in Bakery/Plant Flour Systems

Flour systems differ in design. The sifter may not always be in the same place in each plant. Therefore, when addressing issues related to elevated insect counts in the sifter tailings, it is important to understand the process flow and the equipment that precedes the sifter. The investigation should include an inspection of the flour sifter and all equipment that precedes the sifter in the process flow and the environment. It is not common for a bakery to have an entoleter.

Identify the process flow here. For example: truck blower > truck > pneumatic transfer lines > silo > sifter > entoleter > use bin.

	Inspection of equipment/area/procedure	Observations
1	Identify the insect(s) and stages. Once identified, study the conditions under which the insect lives (e.g. mold feeder, secondary feeder, field insect, etc.) Use this information to better understand where the infestation may have occurred or may be present.	
2	Check truck wash certificates upon arrival. Look for inconsistencies in the cleaning frequency.	
3	Inspect truck for cleanliness including hatch gaskets and blower filter. Look for signs of insects around hatch gaskets.	
4	Check to see that all tank tops, truck hatches, railcar hatches and transfer hoses are dry, capped and kept clean. Inspect open ends of hoses for moisture and insects. Check idle hoses for frequency of use and cleaning prior to use.	
5	Check to see if plant blower filter is in place and not missing and is not infested. Verify frequency of filter inspection/replacement.	
6	Verify location of sifters in process. Check sifter screen size on all sifters prior to the final use point (e.g. mixer). All sifter screens should be tighter than 600 microns to sift out adult, larvae and pupae stages of insects. Ensure that there is no by-pass around the sifters.	
7	Check sifter tailings history for insects and other foreign materials on each sifter independently.	
8	Check for the presence of an entoleter and if present is it functioning. Ensure that there is no by-pass around the entoleter.	
9	Check to ensure a 2-minute minimum purge time on pneumatic transfer lines after flour is unloaded. Check with maintenance to determine whether flour can sit in the lines even after the air purge. Purge belly lines on trucks and product lines on rail cars.	

	Inspection of equipment/area/procedure	Observations
10	Look for dead legs (dead ends) in piping where flour is static and can't move. Open and inspect the dead legs. Eliminate the dead legs through redesign. Sometimes piping may be abandoned but left connected. If not in use, that would constitute a dead leg. Infested idle pipes can seed insects back into active pipes. Check the connection box from delivery to bakery bin for debris, inspection ability and condition. Check area around connection box for harborage.	
11	Determine whether there is a bagged flour dump station that feeds into the flour silo and check to see if it is used and cleaned regularly. How is it cleaned when it is left idle? Idle equipment can become infested and when used again can infest the rest of the flour system.	
12	Inspect the bin vent filter interior on top of the storage tanks (silos), use bins and all other tanks as insects can often get inside and develop there. The bin vent filter and filter socks should be cleaned monthly. The terms bin vent filter, bag house and dust collector are sometime used interchangeably. Inspect for insects and trails, especially the filters themselves. Remove them, if possible, for better inspection. Interior or Exterior Bins, are the tops accessible, are their vents for pressure relief valves, observe operation if possible.	
13	Each bin vent filter has a clean air plenum where air is exhausted. Open and inspect this plenum. The clean air plenum is always supposed to be clean and free of flour dust. If there is flour dust, check the connection of the filters and the condition of the filters. Flour can only get into the clean air plenum if the filters are torn or misaligned. Look for insects in the plenum.	
14	Check for a central dust collection system for the silos and use bins and verify that flour collected is not returned to the flour stream after the sifter. If re-used it should be reintroduced before the sifter. It is not a good practice to re-use dust that has been collected. Inspect the interior of the dust collector and the clean air plenum if the collected flour is reused.	
15	Determine whether flour collected by the central dust collector is reused or discarded. If reused, dump the contents of the dust collector and look for insects. Use a hand sieve to inspect the flour.	
16	If there is a central dust collector, review the cleaning schedule and compliance to the schedule.	

	Inspection of equipment/area/procedure	Observations
17	Inspect beneath the air-pad or air slide at the bottom of the flour silos. Inspect the space beneath the air pad or air slide canvas and the steel tank exterior. Look for the presence of flour. If there is no opening for inspection, then try to determine whether there is flour under the pad by knocking on it and listening. A dull sound will generally indicate the presence of flour beneath the pad. This is not acceptable since the flour would be static and subject to infestation. Inspect the cone design, is it accessible, does the bin have expansion joints, are they inspectable?	
18	Determine whether silos are mass-flow (FIFO) or whether flour “rat holes” and gets stuck on the sides of the tank. Lack of mass flow means the flour will stay in the silo longer and will be more susceptible to infestation. This cannot be corrected unless air-blasters are installed on the tank. Flour should move from top to bottom without sticking to the sides of the tank. Sticking is a result of a tank design, moisture or tank lining failure.	
19	Inspect the inside of the diverter valves. Some older Reimelt models (1980s and 90s) have a hollow cavity and flour can get past the seals and into the cavity. This can lead to infestation inside the valve.	
20	Inspect the inside of the silo for any catwalks, platforms, safety screens or other structures. Inspect to see if flour is bridging on these structures. Check to see if any of the structures have hollow structural members or angle iron that could retain flour. Look for broken welds on tubular steel structures within the silo or use bin. Insects can develop inside hollow structures that have openings.	
21	Inspect pressure equalization tubes. These tubes are normally 4” (10 centimeters) in diameter and connect silos or use bins to relieve pressure from the vessel being filled. The pressure and some flour may move from one silo to another. This design should be avoided.	
22	Inspect flexible connectors (sleeves or socks) between vessels (tanks) or between screw conveyors and vessels. Remove the flexible connectors and inspect for insects. It is common to find larvae in the cloth.	

	Inspection of equipment/area/procedure	Observations
23	Open the screw conveyors and inspect the drive end and discharge end of the auger. There is often a small shelf on the end of the screw conveyor where flour can become static which increases the possibility of infestation. Drop the bottoms on flour conveyors, inspect the gap between the screw and housing and each end past the discharge. Does the conveyor reverse?	
24	Inspect pieces of equipment that are not typically opened or cleaned.	
25	Determine the silo and use bin cleaning schedules and correlate sifter tailings insect counts to the cleaning cycle.	
26	Correlate sifter tailings insect counts to the cleaning cycle, to a specific tank or set of tanks, to a specific flour vendor. Trend the findings.	
27	Review flour receiving protocols. A silo should be emptied, cleaned, and inspected every 21 to 28 days at minimum. New flour loads should not be placed into silos when cleaning is due. Scheduling and unloading protocols must accommodate the cleaning schedule. Review the operating protocols. Note – frequency should be based on previous findings, observations, environment, and season.	
28	Look for leaks from flange gaskets on the silos/use bins. If gasketing is worn away, flour will take its place and insects can live in the flange joint. Is the bin/sifter room dusty, look for leaks.	
29	Check to see if there are flour return lines from mixers back to the silo. If there are then inspect the delivery and return system.	
30	Check the frequency of changing the filters on the silo/use bin dust collectors. Determine how the plant knows when to clean/change the filters. How was the frequency established?	
31	If silos/use bins have hard explosion ducting, check the inside of the duct for insect activity. If explosion doors/membranes leak, infestations can develop in the duct and move back into the dust collector and then into the flour stream.	
32	Check for slide gate valves/knife valves. Ensure that they fully open on the backstroke. Inspect the valve body for product residue and infestation. If valves don't open completely, static flour can accumulate on top of the valve and become infested. Rotary valves do not have this issue.	