Hygienic Design for Produce Farms

Introduction

The purpose of hygienic design is to intentionally create or improve spaces and equipment so that they can be cleaned and sanitized as appropriate. The motivation for this is that microorganisms such as human pathogens are small and can persist in even the tiniest of spaces in the right conditions. The role of hygienic design is to prevent this by incorporating, often passive, design features into equipment and buildings to minimize or eliminate harborage of human pathogens when combined with appropriate cleaning, sanitizing, and drying procedures.

The **5 key principles of hygienic design*** related to produce farms include:

1. **Visible and Reachable Surfaces -** If you can't see it and can't reach it... you can't clean or sanitize it.
2. **Smooth and Cleanable Surfaces -** Surfaces should be smooth and cleanable to enable efficient and complete cleaning.
3. **No Collection Points -** Niches, sandwich joints, lap joints, and flat or concave horizontal surfaces should be avoided to prevent the collection of water, food, and material.
4. **Compatible Materials -** Materials should be compatible with the product being handled and the cleaning, sanitization, and drying processes used.
5. **Preventing Contamination -** Handling systems and buildings should protect the product from contamination.

Visible and Reachable Surfaces

A surface must be visible and reachable in order to be adequately maintained and cleaned. This does not mean the surface must *always* be accessible. For example, often drive components of a machine have protective covers to prevent worker injury. However, these covers should be able to be removed to allow for cleaning of equipment on a regular basis.

The inside of this produce brush washer has areas that are hard to reach and see which makes cleaning challenging.

Cleaning procedures may require partial disassembly of equipment for adequate cleaning of food contact surfaces. If tools are required to partially disassemble a machine prior to appropriate cleaning, the tools should be clearly marked for that purpose, a **standard operating procedure (SOP)** should be developed for the steps involved, and employees

This produce rinse conveyor is normally run in a horizontal position, but opens up with a hinge and pneumatic cylinders to allow access, visibility, and cleaning of the conveyor belt and tanks underneath.

* This is a summarized list of hygienic design principles intended for produce growers limited to on-farm washing and packing operations. There are complete courses that address the topic, more detailed publications, and also lengthy industry checklists that can be consulted for more in-depth coverage. For more information, please see the references noted in each section and at the end of this document.

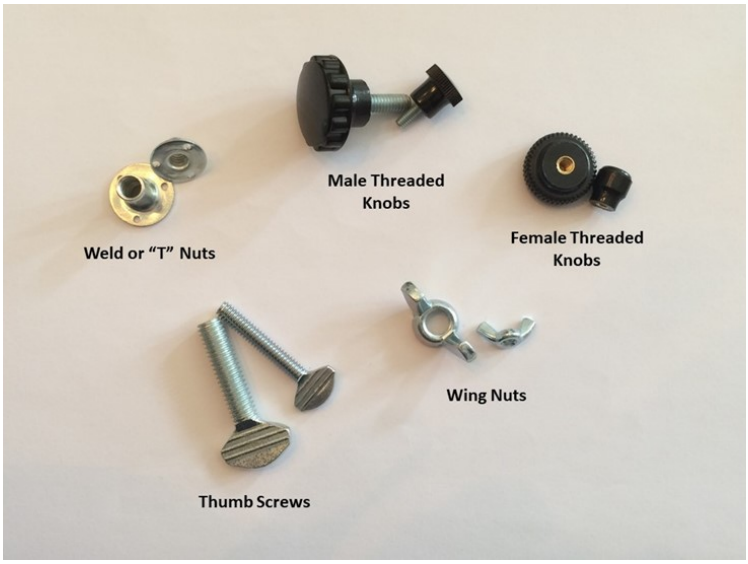
responsible for the process should be trained accordingly.

It may be helpful to purchase a mirror for inspection and a flashlight to improve your ability to see some of the far corners inside and under equipment.

To make disassembly and cleaning easier, it may be possible to replace nuts and bolts on guards and shields with other "tool free" fasteners (e.g., weldnuts, weldstuds, wingnuts, camlocks, or twist locks) that are easier to remove or operate. Some fasteners allow for disassembly without resulting in loose parts, which can reduce mechanical contamination risk. Consult with the manufacturer and the equipment manual before making changes. Always disconnect power, shut off equipment water supply, and de-energize all other relevant utilities before cleaning. Let others in the work area know that you will be cleaning the machine and that the utilities are off for a good reason and should not be turned back on until the cleaning is complete. Consider implementing a lock-out, tag-out (LOTO) procedure and training employees in it.

What is an SOP?

A Standard Operating Procedure (SOP) is a document that captures the standard set of steps and actions required to perform a routine task. An SOP is intended to ensure that multiple people can perform the same job, at the same level of quality with a predictable outcome. This document can take many forms include photographic, written, video, wall poster, or permanent labeling on a machine. An SOP is usually accompanied by an activity log to document the activity that was completed with date, time, person responsible and any significant challenges or findings.

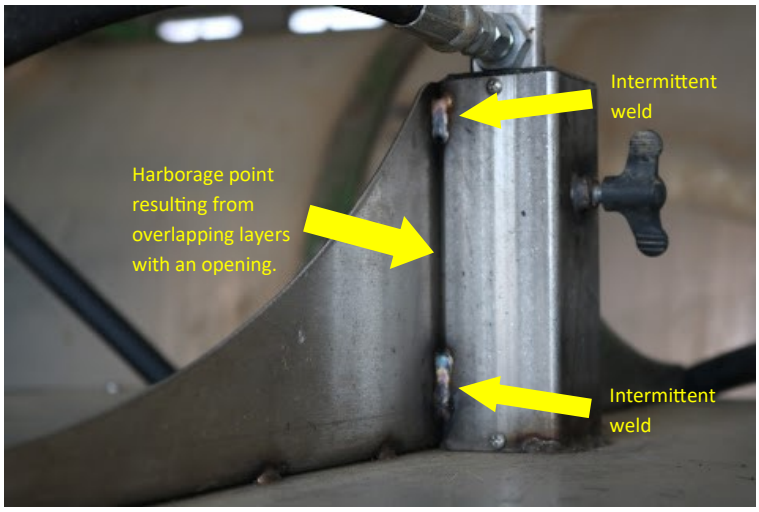


There are fasteners beyond nuts and bolts that can make disassembly and reassembly easier and reduce the risk of losing parts. The fasteners above are available from most hardware stores.

Smooth and Cleanable Surfaces

Often the best hygienic design elements are passive. Investment in a passive feature now will make things easier later and save money over time. Smooth, filleted or rounded welds at the corner of tanks lead to more effective and efficient cleaning. Favor continuous welds over intermittent welds. Grind and sand the welds smooth to improve cleaning. Avoid hollow member construction and areas with

The use of clamping handles can allow for tool-less disassembly and reassembly with fasteners that stay connected to the equipment.



This joint illustrates how intermittent welds lead to a gap, or sandwich joint that can lead to harborage. A continuous weld that is then ground smooth would lead to a seal and be easier to clean, sanitize, and dry completely.

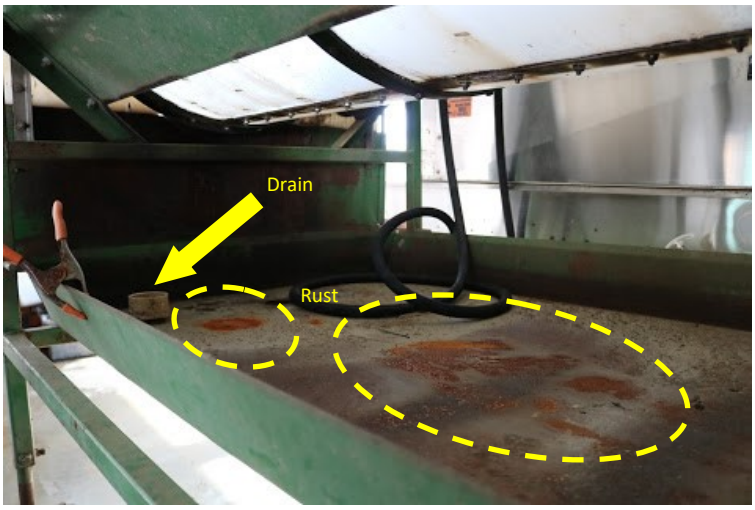
sandwiched or lapped layers of material such as the space inside the top edge of tank formed by rolled or crimped sheet metal. Another common practice is to avoid flat horizontal surfaces in structural members of a machine opting for circular tube construction or rotated square stock instead. Rotating square stock to a 45° angle reduces areas where water, food and other material can collect.

No Collection Points

A key principle of hygienic design is avoiding spaces where water, food, and other material can collect. This includes niches and sandwich joints. Sandwich joints are common where two surfaces are brought together in an assembly and are not completely sealed with a continuous weld that is then ground smooth. A narrow harborage site results between two surfaces. These harborage sites allow water and solids to accumulate. This provides conditions that support the growth of microorganisms including human pathogens.

What is harborage point?

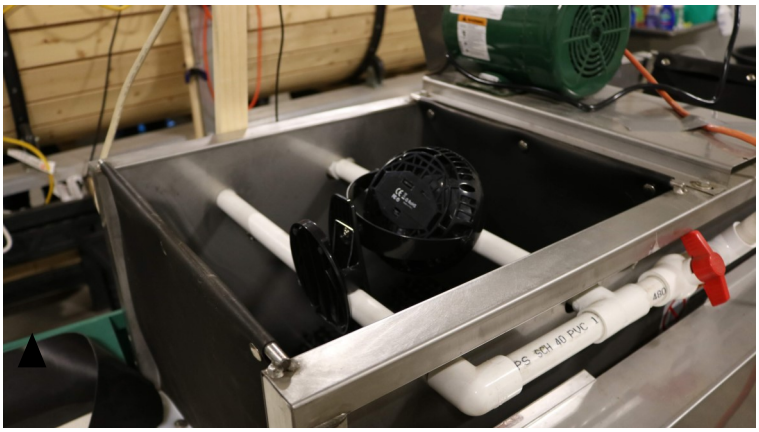
Harborage sites are places where water and pathogens can enter and be protected from cleaning, and sanitizing, and drying. This can lead to cross-contamination between batches and can also lead to premature corrosion and rot of equipment materials.



This collection pan is an intentional collection point that should allow for collected water to easily drain. The rust spots are evidence that it doesn't drain completely and therefore doesn't dry easily. An increased pitch in the pan or a "break" in the sheet could create more aggressive draining and better cleaning, sanitizing and drying as a result. The rust also suggests the material isn't compatible with the use.

Hollow spaces, such as the interior of tube or square stock structural members, can also become harborage locations if they are not completely sealed. A little bit of seepage of water and organic matter with each day of produce washing can accumulate in a hollow space over time. These spaces hold moisture and also promote rusting of steel equipment.

Collection points are, unfortunately, very common on produce equipment. They result from assembly practices that are favored because they are relatively inexpensive and easy. Some ways to address existing collection points may include adjusting the legs on equipment to achieve a slight pitch to encourage flow to a drain, re-breaking (bending with cross diagonals) or replacing sheet metal collection pans with



A small clip-on fan is attached to this brush washer following a cleaning and sanitizing procedure to push air into the enclosed portion of the machine to promote drying.

A variety of cleaning tools may be needed to easily reach and completely clean produce wash equipment. From left to right: extension sticks with scrubbers on the end, stiff short brush, toilet brushes, large bottle brush, paint scraper, scrub pads, assorted bottle brushes large to small, long scrub brush, inspection mirror, small bottle brushes, assorted test strips.

more aggressive drain pitch, adding bottom drain ports to equipment with difficulty draining from existing side ports, and including a squeegee and towel dry step to a cleaning SOP for particularly challenging areas.

Fans and blowers can be very helpful in promoting drying of equipment after cleaning and sanitizing. This drying step is very important as a means to remove the availability of water that can promote pathogen survival and growth. The wash/pack area can be warmed slightly with a space heater to reduce the relative humidity of the air and increase the air's capacity to carry water away as vapor which speeds and deepens the drying. Floor fans or blowers designed for drying floors and carpets are portable and inexpensive tools for supplying large amounts of air flow to the inside of equipment that may otherwise be difficult to dry. It is also important to provide some ventilation of the wash/pack area to encourage air exchange. The air that is made humid from drying equipment needs to be exhausted outside and fresh, relatively dry air needs to be drawn in from outside. The relative humidity of the air can be reduced by heating to improve rate and efficacy of drying.

Special cleaning tools may be helpful in reaching far corners that are not easily accessible or for fitting into small areas that are otherwise hard to clean. It may take some experimentation and ingenuity to find the right tool. Ladders may also be helpful for getting above the equipment to inspect for cleanliness and to complete the cleaning process. Finally, it may be helpful to turn certain machines on their side or upside down to access certain hard to reach areas. Take care not to place any food contact surfaces on the ground or result in other contamination in the process. Some of this work may require a second or third partner to be completed safely.

Compatible Materials

The materials used in the construction of equipment must be compatible with both the product the machine is handling and also the cleaning, sanitizing, and drying procedures used. Appropriate materials are generally smooth, durable, corrosion resistant, and impermeable to water. This includes being compatible with cleaners and sanitizers and generally favors stainless steels and food grade plastics since these materials have been developed specifically for this type of use.

Incompatible materials will degrade more quickly due to nicks, cracks, corrosion and other wear. Painted carbon steel may not hold up well to water and eventually the paint will flake and the steel will rust. Both of these could become mechanical and/or chemical contaminants and will result in the surfaces not being cleanable.

Consider the chemicals in the cleaners and sanitizers you use relative to the materials in your equipment. Think beyond the obvious food contact surfaces and consider rubber seals, bearings, drive components, electrical housings, etc.

Preventing Contamination

The siting, layout, construction, and materials used in handling equipment and buildings should prevent the contamination of product from the environment, the building, the equipment, people, vehicles, and by cross-contamination among the product itself.

This includes excluding animals that may introduce fecal or other contaminants. Passive measures can be very effective at excluding birds (rafter netting) and rodents (wire mesh or hardware cloth in framing). Maintaining a clean area around the building helps to reduce attraction and cover for wildlife pests. Removing culls from packing area daily and locating away from the wash/pack area, trimming grass, and keeping items in storage at least 6” from the walls can all help to reduce attraction and cover for pests. Exterior baiting and exterminating can be used as a final option.

Evaluating Equipment and Buildings for Hygienic Design

The principles of hygienic design can be readily applied to any piece of equipment or building. The accompanying checklist has been developed specifically for farm-based produce handling equipment and buildings. It is based on other, more extensive guides from the processing industry. This checklist provides a focused evaluation against the principles outlined above. The checklist is available as a spreadsheet that will sum the ratings based on the reviewer’s assessment. It is also attached as the last pages of this guide as a hand-written sheet.

Conclusion… It is Never Done.

Hygienic design is a process of continual improvement. This guide and the checklist are meant to aid in evaluating equipment and buildings as a “snapshot” of one point in

time. The act of reviewing the equipment or building should motivate a plan for improving certain areas of design. Once those changes are made and put into practice, the team can review the equipment again. These checklists can also be helpful in identifying either preventive or reactive maintenance of equipment and buildings that may not be obvious during normal operation. A team approach to review is encouraged to provide multiple perspectives from multiple users with different skills and ideas.

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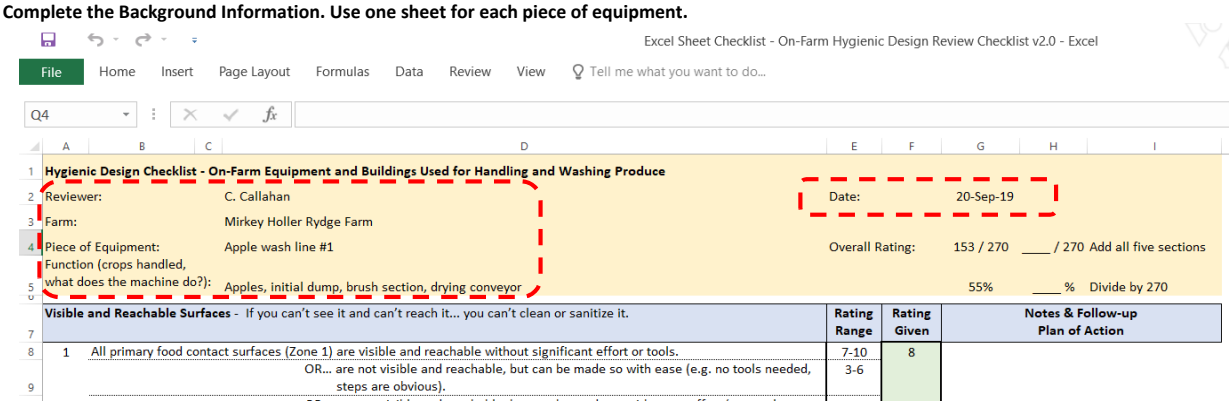
Hygienic Design Checklist - On-Farm Equipment and Buildings Used for Handling and Washing Produce

INSTRUCTIONS

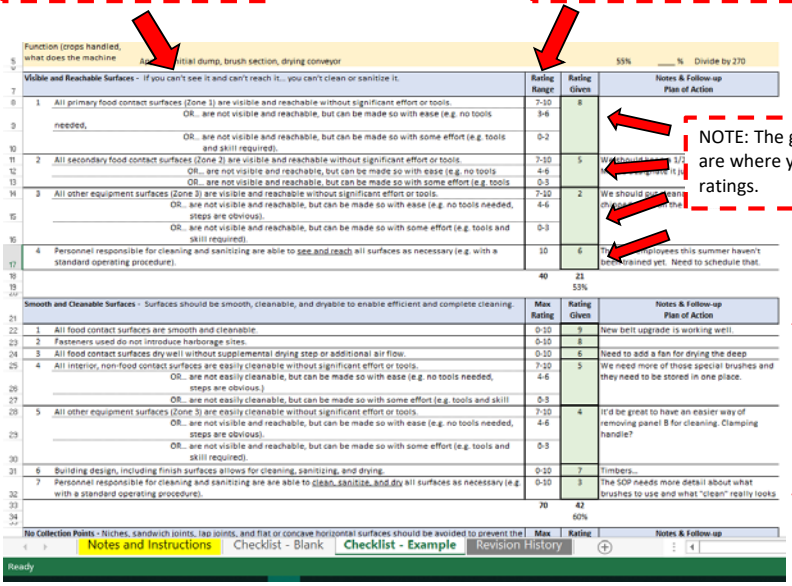
Step 1 - Complete the Background Information. Use one sheet for each piece of equipment.



Step 2 - Evaluate the piece of equipment and its surroundings following the prompts.

These prompts are to help you think about which category of hygienic design to consider.

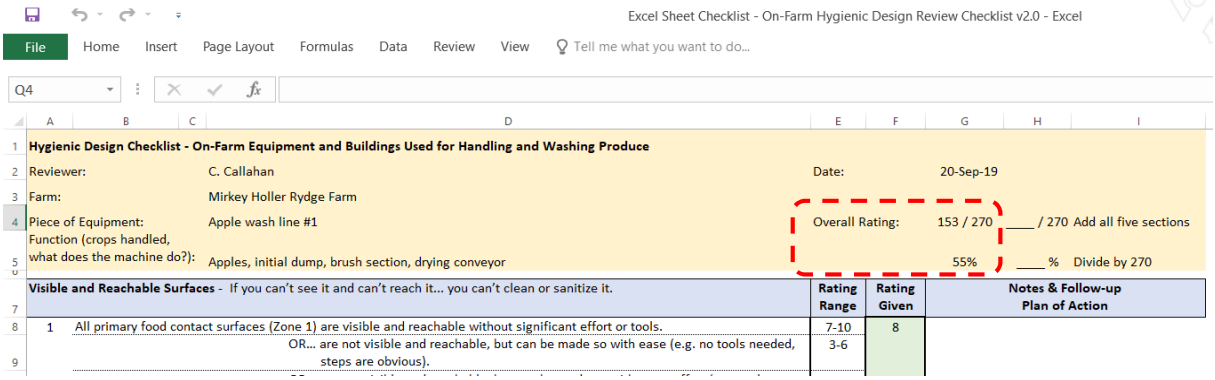
The rating ranges are provided to guide your assessement of the hygienic design.



NOTE: The green boxes are where you enter your ratings.

The "Notes and Follow-up Plan of Action" section is a place to make note of specific things you considered in determining your rating and/or specific action you plan to take to improve the hygienic design.

Step 3 - Review each section's total score and the overall score. Take stock of your notes and develop an overall action plan to implement improvements.



On-Farm Hygienic Design Checklist

Hygienic Design Checklist - On-Farm Equipment and Buildings Used for Handling and Washing Produce

Reviewer: _____ Date: _____

Farm: _____

Piece of Equipment: _____ Overall Rating: 0 / 270 ____ / 270 Add all five sections

Function (crops handled, what does the machine do?): _____ 0% ____ % Divide by 270

	Visible and Reachable Surfaces - If you can't see it and can't reach it... you can't clean or sanitize it.	**Rating Range**	**Rating Given**	**Notes & Follow-up Plan of Action**
1	All primary food contact surfaces (Zone 1) are visible and reachable without significant effort or tools.	7-10		
	OR... are not visible and reachable, but can be made so with ease (e.g. no tools needed, steps are obvious).	3-6		
	OR... are not visible and reachable, but can be made so with some effort (e.g. tools and skill required).	0-2		
2	All secondary food contact surfaces (Zone 2) are visible and reachable without significant effort or tools.	7-10		
	OR... are not visible and reachable, but can be made so with ease (e.g. no tools needed).	4-6		
	OR... are not visible and reachable, but can be made so with some effort (e.g. tools required).	0-3		
3	All other equipment surfaces (Zone 3) are visible and reachable without significant effort or tools.	7-10		
	OR... are not visible and reachable, but can be made so with ease (e.g. no tools needed, steps are obvious).	4-6		
	OR... are not visible and reachable, but can be made so with some effort (e.g. tools and skill required).	0-3		
4	Personnel responsible for cleaning and sanitizing are able to <u>see and reach</u> all surfaces as necessary (e.g. with a standard operating procedure).	10		
		40	**0** 0%	

	Smooth and Cleanable Surfaces - Surfaces should be smooth, cleanable, and dryable to enable efficient and complete cleaning.	**Max Rating**	**Rating Given**	**Notes & Follow-up Plan of Action**
1	All food contact surfaces are smooth and cleanable.	0-10		
2	Fasteners used do not introduce harborage sites.	0-10		
3	All food contact surfaces dry well without supplemental drying step or additional air flow.	0-10		
4	All interior, non-food contact surfaces are easily cleanable without significant effort or tools.	7-10		
	OR... are not easily cleanable, but can be made so with ease (e.g. no tools needed, steps are obvious.)	4-6		
	OR... are not easily cleanable, but can be made so with some effort (e.g. tools and skill required)	0-3		
5	All other equipment surfaces (Zone 3) are easily cleanable without significant effort or tools.	7-10		
	OR... are not visible and reachable, but can be made so with ease (e.g. no tools needed, steps are obvious).	4-6		
	OR... are not visible and reachable, but can be made so with some effort (e.g. tools and skill required).	0-3		
6	Building design, including finish surfaces allows for cleaning, sanitizing, and drying.	0-10		
7	Personnel responsible for cleaning and sanitizing are are able to <u>clean, sanitize, and dry</u> all surfaces as necessary (e.g. with a standard operating procedure).	0-10		
		70	**0** 0%	

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On-Farm Hygienic Design Checklist

No Collection Points - Niches, sandwich joints, lap joints, and flat or concave horizontal surfaces should be avoided to prevent the collection of water and material. Identify any collection points on this equipment and in the building and plan how to ensure these are removed with a design change or that personnel know how to address the risk with cleaning, sanitizing, and drying procedures.		**Max Rating**	**Rating Given**	**Notes & Follow-up Plan of Action**
1	Equipment is designed to allow for removal of all food and debris and allows drainage of all water and complete drying.	6-10		
	OR… has relatively few points where food and/or water can occassionally collect.	0-5		
2	Utilities such as electrical, air and water supplies do not introduce harborage areas.	0-10		
3	Personnel responsible for cleaning and sanitizing are aware of any specific harborage potential on this equipment and how to mitigate this risk (e.g. with a standard operating procedure).	0-10		
		30	**0**	
			0%	

Compatible Materials - Materials should be compatible with the product being handled and the cleaning and sanitization processes used. Assess the compatibility of the materials used and the inspection and maintenance they will require over their life.		**Max Rating**	**Rating Given**	**Notes & Follow-up Plan of Action**
1	Equipment is made of materials that are compatible with use and planned cleaning materials and methods.	6-10		
	OR… includes coatings (e.g. paint) over base material that are compatible with use and planned cleaning materials and methods.	0-5		
3	Moving parts are supported by bearings designed for long-term use in food applications.	0-10		
4	Equipment is made of materials that will not chip, flake, or otherwise break off and become a contaminant in food.	0-10		
5	Equipment is inspected on a regular basis for wear and repair needs, and maintenance is completed in a timely and skillful manner.	0-10		
		40	**0**	
			0%	

Preventing Contamination - Handling systems and buildings should protect the product from contamination. Assess surrounding areas, building location, adjacent uses, pedestrian and vehicle traffic nearby and through the space, and also potential wildlife that could introduce contamination.		**Max Rating**	**Rating Given**	**Notes & Follow-up Plan of Action**
1	Water supply is from a known source of safe and adequate sanitary quality.	0-10		
2	Condensation, dripping, leaks, and pooling / standing water are avoided and/or managed to prevent food contact (e.g. cooler evaporator drains, cold water supplies).	0-10		
3	Animal intrusion is prevented (e.g. birds, rodents, domesticate animals).	0-10		
4	Ventilation and pneumatic air systems do not introduce contaminants (e.g. filters and screens).	0-10		
5	Drains are functional and cleanable.	0-10		
6	Drains do not direct effluent water to production areas (e.g. fields), handling areas (e.g. other washing areas), traffic areas, storage areas, bodies of water, or other areas that could result in produce contamination.	0-10		
7	Product flow is conducted in a manner that prevents cross contamination.	0-10		
8	The movement of people and/or vehicles is conducted in a manner that prevents cross contamination.	0-10		
9	Buildings are in good repair, free of chipping, flaking or other loose matter that could become product contamination.	0-10		
		90	**0**	
			0%	

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