

In Line Cleaning for Cold Heading Operations

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In-line Cleaning Solution for Cold Headers

Of all the metal forming industries doing business in today's manufacturing world, cold heading is one of the most competitively cost driven. Sheer volume of parts turned out against paper-thin margins constantly drive cold headers to re-evaluate and look for alternative methods of processing parts faster and less costly.

One of the cold heading areas being evaluated more intensely now is the part cleaning systems which are charged with removing the incredible soil residue left from the forming process. What is the most efficient way to clean soil from each part, dry each part, and prepare each part for shipment to the customer. Due to legislation that prohibits the use of solvent degreasing units, a myriad of methods striving to remove the metal forming lubricants from the bolts, nuts, screws, bearings, washers etc., have been introduced to this industry. The following are some of the more traditional cleaning process examples:

- Hand loaded baskets for agitated dip tanks
- Rotary Baskets
- Baskets on a standard belt conveyor

Hand Loaded Agitation Tanks

A basket of parts are hand loaded onto a grated shelf. This shelf lowers into a tank which is agitated by a pump or ultrasonic transducer. The action of the chemistry's surfactant and the multiple mechanical action of the lifting, lowering and submersed spray will lift the soil from the substrate.

This cleaning must be done in time consuming batches and is very labor intensive. In addition, when oils are separated from the part, they pop to the surface due to the specific gravity differential between oil and water. This creates a problem. When the table rises with the basket of clean parts, it lifts them right through the layer of oil on the water's surface. Thus, the parts become re-contaminated and very wet.

Benefits

- Dual mechanical action

Disadvantages

- Labor intensive
- Batch Style limits production rate
- Re-contamination of parts
- Part layering shields middle layer parts from mechanical action
- Parts exit wet
- Dirty inventory stored in baskets

Rotating Basket System

Similar to agitated dip tanks in function with an additional mechanical action of turning the baskets of parts over. Rotating basket systems can be relatively simple operations that send fluid from different tanks to a single process area and then blow off and dry the parts in that same process area. They can also become large systems with a series of multiple dip tanks and complex material handling designs to transfer the

basket, while it turns, from one stage to the next, including a separate drying stage.

A combination of multiple mechanical actions (i.e. spinning baskets, pump spray, ultrasonics) and an aggressive chemical surfactant package removes the soil from the part surfaces. Production rates can increase and labor can decrease when a sophisticated, automated material handling system is engineered into the system. Experience suggests caution, however, with such a transfer system. Each component is sensitive to wear, yet all rely on each other. Any variation in these components can generate problems for getting the parts through the system. In addition, like the Dip Tank, as baskets are rolled in and out of the baths they cross the water surface. Each time this is done, they are brought through the layer of soil the process is trying to remove.

Benefits

- Increase production
- Labor decrease
- Multiple mechanical action
- Automated material handling
- Parts exit dryer than in dip tank.

Disadvantages

- Part layers shield middle layer of parts
- Recontamination of parts as they are moved from stage to stage.
- Inventory stored in dirty baskets

Baskets on a standard belt conveyor

Another traditional method of washing cold headed parts uses a standard multiple stage belt washer. Parts are loaded into baskets and then transferred to the washer via hand, gravity roller conveyor, powered roller conveyor, or a pick and place gantry.

Pump fed spray jets deliver fluid in a 360 degree spray pattern to flush the system with heavy spray impingement. This mechanical action of the spray and the surfactant package in the cleaning compound work in conjunction to remove the soil. The major improvement of this method over the previous two is that in this system the parts are never brought up through a soil layer. Thereby eliminating the threat of recontamination.

Similar to other methods, though, parts are set in baskets on top of each other. As they travel through the system the outside parts are hit with spray, but there is not guarantee of consistent spray reaching the middle layer of parts. Therefore, it is impossible to guarantee a cleanliness level will be maintained.

Benefits

- High production rate potential
- No recontamination when moving parts from stage to stage.
- Labor decrease
- Automated material handling system

Disadvantages

- Parts exit wet
- No consistency of spray impingement on all parts
- Dirty parts stored in baskets waiting to be processed
- Single mechanical action

Evaluation proves the search for the best cleaning system should consider one that has the ability to include the following:

- Automatically and continuously transfer parts to the washer, through the washer and away from the washer.
- Use multiple mechanical action with surfactant based cleaner that is formulated to lift that particulate soil from the substrate.
- Avoid any operation that will drag the parts back through the floating soil that has already been removed

from the parts.

- Process through consistently so each part is exposed to the cleaning action.
- Dry parts
- Limit inventory of dirty parts. The longer the part sits dirty, the more mechanical and chemical action is required to clean it.

Recommended washer model to achieve these goals - Rotary Auger Drum System.

This style foregoes the popular basket containment and transfer method and provides a continuous flow of parts through each of the washer stages. As each bearing, bolt, nut, screw or washer, etc. comes off the forming line, it is fed, via conveyor, to the washer and dropped into the system. From there, the part is submersed, sprayed and pushed along to the next stage by an auger style fin that rotates with the drum. The part is pushed along and either turned over or swished back and forth depending on how much part on part contact the piece can handle without being damaged.

The key factor in this system is its ability to move parts along at the speed they are introduced to the system. Obviously, it is easier to clean one item at a time then it is to clean a basket of the same items. In order to facilitate this thin layer, often times a cap is welded onto the top of the auger to limit the amount that is fed through the rest of the system at one time. Even if an entire load is dumped into the front of the wash area, this cap will only allow the auger to take a bite out of so much of the pile of parts. This capped auger driven drum creates a consistent layer or line of parts that are all receiving the same spray impingement, turn over action and chemical surfactant package.

This method of thin layer, one at a time, continuous washing is much like what you would do if you were charged with the task of painting a rope. If you balled the rope up or wound it up and placed it in a basket, you could paint the rope by turning it over and hitting it from all sides, but you would not have a consistent coat of paint on it. Whether you sprayed the rope or dipped the rope, there would always be areas that were thicker and some that were thinner. Also, you would never be sure you painted the entire rope until you took it out of the basket and unrolled it.

Conversely, stretching the rope out gives you a confident process control so you are sure the entire rope is not only painted, but also painted evenly.

Advantages

- No re-contamination
- Little or no operator interface
- Small washer due to washing one at a time
- No dirty inventory of parts
- No baskets to clean or store
- Parts have a chance of being drying upon exit from the system because heat is allowed to get at all parts and thin layers can drain more easily.

Traditionally, the argument against a rotating drum style washer is its inability to guarantee batch integrity. When one style of parts are washed immediately after another, the rotating drum has always had difficulty making sure all of the previous parts exit before the next style come through.

As the standard rotating drum has evolved, certain manufacturing methods have been discovered which eliminate this concern:

- Wedgewire drum
- Dimpled perforated steel for drum
- Continuously welding auger in place rather than stitch welding
- Wavey auger design
- Chain octopus

Use of wedgewire as the major material from which the drum is made limits the surface area parts can adhere to. Similarly, the use of dimpled perforated steel removes the smooth flat surface that causes these parts to stick. For example, if one was to place a penny in a standard rotating drum washer, the combination

of water and a smooth surface would create a surface tension that would be hard to break, even by hand. Wedgewire or dimples limit that surface area so there is not much tension and, consequently, no adhesion.

Continuously welding the auger fin to the drum surface is a time consuming, labor intensive and difficult task. It is much easier to weld a stitch in place every 6" or so. Every spot where there is no weld, however, creates a spot where a small part can become caught under the fin. The only way to avoid this is to run a continuous weld bead on both sides of the fin, the entire length of the drum.

If the part is thin and flat enough, like a small washer, it can even adhere to the flat fin. Using dimpled surface steel for the auger fin or welding the fin in place so it gives the impression of having a wavy configuration diminishes the area to which it can adhere.

Finally, just to be sure, some customers feel more confident if they can throw a chain octopus through the system between batches. A chain octopus is simply a 2" – 5" diameter steel ball with roller chains woven around it. This item is heavy enough and loose enough to "scrub" the inside of the drum and loosen up any parts that may be caught inside.

After all of the parts have gone through, a cold header must remember the reason for the washer is to take the by-product of the metal forming process, remove it and send each and every part on to shipping. Even though the rotating drum allows cold headers to perform this washing within a smaller footprint, all the soil is still dumped into the washer.

A smaller footprint for the washer, also means a smaller tank capacity. This means soil saturation in that tank will occur sooner than in a larger washer. In order to avoid frequent dump and recharges of the bath, some type of "in-process" fluid treatment methods must be used.

Disk wheels, skimmer belts and coalescers have been sold in the past with little success of keeping the bath clear of oil build up. Experience has proven to Midbrook that the best way to control the amount of soil in the washer bath is to combine a good oil popping cleaning compound with the Suparator thin film oil removal system. The chemistry will help separate the water from the oil, while the Suparator will take the separated fluid and remove it from the system.

Success in a competitive industry like cold heading means maintaining total control of each manufacturing process. The best method of controlling the wash process is to continuously wash a few parts at once, using multiple actions and make sure you are washing with clean water. The Rotary Auger Drum with the optioned Suparator will allow you to do this.