Dealer Bulletin

PELLERIN MILNOR CORPORATION
P.O. Box 400, Kenner, LA 70063

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Subject: Stainless Steel Is Corrosion Resistant NOT Corrosion Proof!

A few of our CBW washer customers have recently asked our advice concerning corrosion appearing at the discharge end of the tunnel and on certain parts of presses or extractors. Although our expertise is in machinery design and manufacture rather than chemicals and metallurgy, we did investigate the situation and, in conjunction with an expert in corrosion, have come up with some suggestions for preventative measures to render the system as corrosion resistant as possible.

It's important to be vigilant in maintaining a "Healthy Tunnel Washing Profile" described below. Many chemical products used improperly or misused can cause problems. Coupled with a Tunnel Washer that is operated improperly, there are arrays of problems that can manifest and compound. A Healthy Tunnel Washing Profile includes:

1. Proper supply water quality.
2. Industry standard quantity and method of injecting chemicals.
3. Proper water flow in each zone – Refer to "Quick Guide for Setting Counterflow in Milnor CBW Washers" (Attachment A).
4. Proper Levels in each module – Refer to "Quick Guide For Setting Weir Plates & Level Switches On Milnor CBW Washers" (Attachment B).
5. Proper temperature in each zone.
6. Proper pH.
7. No intermixing of sours and bleaches.

Chemical products commonly found in the laundry industry when utilized in **established** dosages and proper tunnel operating parameters under the auspices of an experienced tunnel chemical specialist will produce satisfactory results and no consequential detrimental effects.

It is not the steel!

Improper laundering process conditions can destroy the corrosion resistance of stainless steel. Stainless steel provides resistance to corrosion because of its capacity to be passivated. In simple terms, most scientists explain that a protective oxide film acts as a barrier between the metal and its environment (Handbook of Stainless Steels, Peckner and Bernstein, 1977).

Pitting and stress corrosion cracking can occur when the conditions of the wash liquor break down the passive layer of the steel. These conditions are well known, some of which are: high concentrations of chlorine bleach, improper (low) pH, iron-laden process water, corrosive supply water, and reactions of sours and bleach.

Milnor has manufactured washer-extractors and tunnel washers with the same stainless steel specification since our founding. Every batch of steel we use is certified and documented by the steel mill. We tested samples of the stainless after reports of corrosion. Every instance has proven the steel to be well within the AISI 304 specification.

Corrosion is a complex, multifaceted problem. When some or all of the following factors come into play together, corrosion has occurred.

- **Carboy strength bleach and sours are now routinely directly injected into machines.**

  Even though the chemicals may be injected below the water line, localized chemical reactions may cause corrosive conditions. **Injections must be flushed with water.** Make sure fittings connecting chemical supply lines are not leaking.

- **Excessive quantities of chlorine bleach are being used.**

  The industry has published standards in Riggs and Sherrill, Textile Laundering Technology. We have seen machines programmed with much greater quantities of bleach instead of extending the bleach zone and/or transfer rate to achieve contact time for special fabrics. (Refer “Rust Never Sleeps”, Samuel Garofalo, TRSA, February 2002).

  Exacerbating the issue, some tunnels have been programmed with “first dosing” for bleach. We have seen CBW washers programmed to inject 300% of the maintenance hypochlorite dose when changing from a light soil to heavier soil classification. We do not recommend programming Hypochlorite injections with First Dosing “compatibility”.

- **Acid sours react with Hypochlorite to form corrosive compounds.**

  Acid sours reacting with Hypochlorite form chlorine gas and hydrochloric acid – resulting in corrosive conditions to stainless steel and a potential danger to personnel. This bleach carryover into the sour module(s) can be the result of:

  1. Too much bleach – too much programmed or too small a batch size for the programmed dosage.
  2. Flow rate too low in the rinse zone.
  3. Improper antichlor.
  4. Blocked flow splitter and/or lifters. Normal maintenance is required to keep the screens clean and free flowing. With hard water supply, calcium carbonate will deposit in the wedge wire, blocking the screen.

5. Low water pressure. The counterflow may be interrupted to such a degree to allow chemistry to be present in downstream modules.
6. Using a dual bath (half time for counterflow rinse and half time for standing bath finishing) last module with Hypochlorite bleaching in the adjacent module.

A Caution About Hydrofluosilicic Acid

Comparatively, Hydrofluosilicic (HFS) acid is ***much more*** aggressive to stainless steel than other common laundry sours such as phosphoric, citric, formic and acetic acid. The presence of Hypochlorite increases its corrosive potential. Moreover, HFS is specifically called out in the Handbook of Stainless Steel as aggressive in vapor form.

While HFS acid is successfully used with proper conditions, we have seen a number of instances of misuse of this chemical. Tunnels differ from washer extractors because finishing modules are a "standing bath". Washer extractors flush with fresh water after every use of acid sours.

Thus, it's even more important to have proper washing conditions when using this sour.

- **Sours in vapor form are highly concentrated and thus more corrosive.**

  Formic, HFS and acetic acid have high vapor pressures compared with phosphoric and citric acid, readily forming corrosive vapors.

	Vapor Pressure (mm Hg @20 C)
Formic	44.8
HFS (@25 C)	24.0
Acetic	14.0
Phosphoric	2.2
Citric	Nil

- **Corrosive supply water (low pH and measurable presence of iron) in the presence of certain types of piping and chemistry results in conditions conducive to corrosion of stainless steel.**

  Water with the characteristics of high concentrations of dissolved oxygen, carbon dioxide and low pH is aggressive to carbon steel and galvanized carbon steel piping. Corrosion of this piping releases significant amounts of iron to the process wash liquor.

  Low pH water may also contribute to corrosion by depressing the wash water pH to

levels sufficiently low to accelerate the decomposition of sodium Hypochlorite.

We urge you to:

1. Make sure water flow, level settings, and temperatures are proper. Insure proper and constant maintenance of flow splitters and lifters. Keep the wedge wire screens clean. Refer to "Technical Reference Water Flow and Chemical Injection" Milnor Manual Number MATCBWTRAE.

2. Ensure your chemicals are dosed correctly. Ask your chemist to verify that your bleach and sour concentrations are within industry standard limits.

3. If you have evidence of corrosion near the discharge end of the CBW washer, then speak with your chemist immediately. Get back to a "Healthy Tunnel Washing Profile".

4. Remove corrosion products and re-passivate the steel. Corrosion left untreated in the presence of continuing abnormal process conditions can result in failure and/or staining of laundry. If the observed corrosion is severe enough, after cleaning, you will need to re-passivate the material to prevent future corrosion.

   DeRustit, www.derustit.com and Chemetall Oakite, www.oakite.com offer products for cleaning and passivating stainless steel. Do not skip the passivation step or the stainless will be more susceptible to corrosion than before.

Our goal herein is to prevent the potential for corrosion. And if it does occur help you resolve it. Please contact us with any questions.

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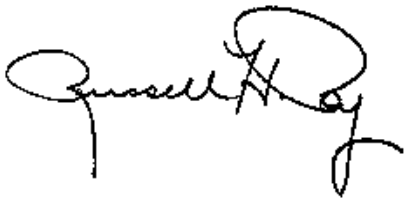

Russell H. Poy
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RHP/kf

Attachment A

Quick Guide for Setting Counter Flow Rates in Milnor Tunnels

To set the Flow Rate into the Rinse Zone, use the following formula:

$$\text{Flow Rate In GPM} = \frac{\text{Lbs Per Hour} * \text{Desired Gal/Lb}}{60}$$

$$\text{Lbs Per Hour} = \text{Soil Weight} * \text{Soil Factor} * \text{Transfers/Hr}$$

$$\text{Transfers Per Hour} = \frac{60 * \#\text{ of Modules}}{\text{CBW Washer Process Time}}$$

Figure 1 illustrates the "flow balance" of a Milnor tunnel. The Milnor CBW washer uses counterflow washing and rinsing. Generally, a CBW washer is configured to have four or five zones, each have an appropriate number of modules for its function and production rate: Wet out And Flush, Wash (may be comprised of two or more zones depending on goods and production rate), Bleach, Rinse, Finishing.

Water counter flows from the Rinse Zone through the Bleach and Wash zones as shown. As a starting point, a typical configuration is shown, based on 1 Gallon per Pound of Goods (Many light soil classifications can be processed with much less than 1 Gal/Lb. Bar mops and other heavy soil goods may use in the range of 1.2 to 1.4 Gal/Lb). Water used in each zone is shown in Gallons per Pound of Goods, Cotton and Polycotton.

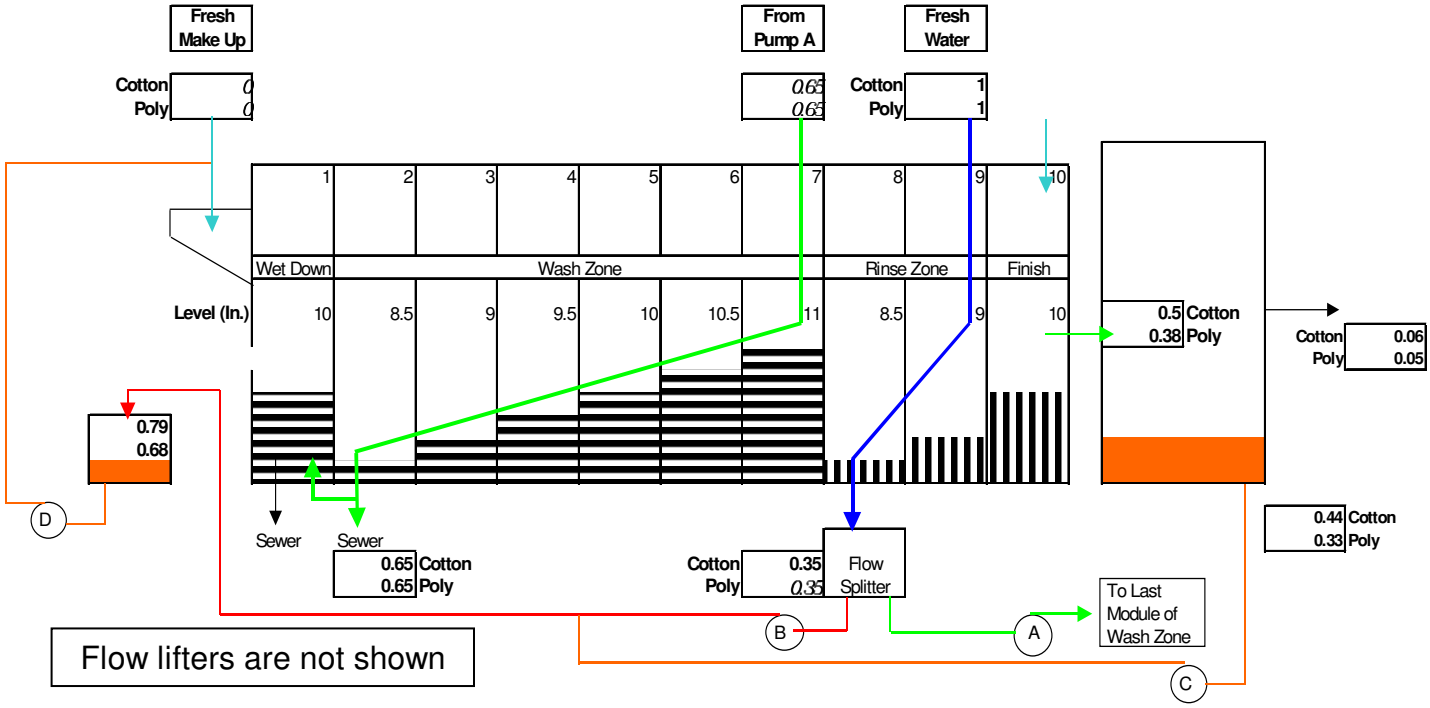

Figure 1

Attachment B

Quick Guide for Setting Weir Plates and Level Switches on MILNOR CBW Washers

1. Make sure the bottom of the float tube is positioned as shown in Figure 2. Water will be just at the bottom of the drum and also at the bottom of the float tube. This is set at the factory and generally does not need to be readjusted.

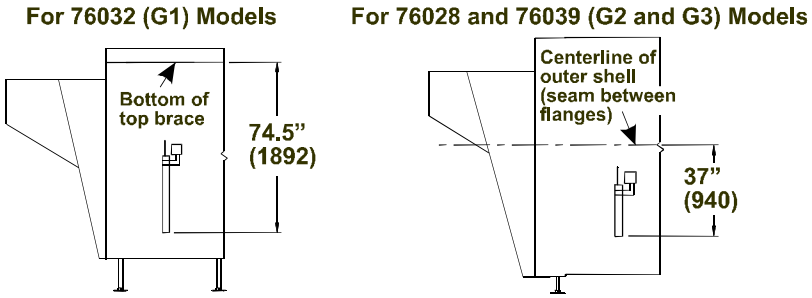

Figure 2

2. Level switches are used to insure proper water level for successful transfer in the CBW washer. Whenever a tunnel goes into "hold" for a prolonged period, water is pumped over the weir. The low level switch has to be set so that it can accurately sense level even with the undulation of water due to drum rotation. **It's essential to precisely follow these instructions in order to prevent potential jamming.**

   Set Output Time, "Maximum Time in Hold" to 3 minutes (applicable to Mentor and Serial Miltron Software Date Code 0000D.)

   On modules equipped with drains and fast fill valves, the level switch is also used for opening and closing the fast fill valve. Also in this case please refer to the special case described in the "Weir Plate section, Item 4".

3. Here's the simple way to set the level switches:
   a) Remove the clips from the rod and insert the rod through the level switch lever.
   b) Let the float sit on the bottom of the float tube. If the machine is full of water, push the rod to the bottom of the float tube.
   c) Hold down the level switch actuator, marking the rod at the top of the level switch actuator. See Figure 3A. Cut the rod.
   d) Place the float rod clips as illustrated below in Figure 3B or 3C, whichever applies.

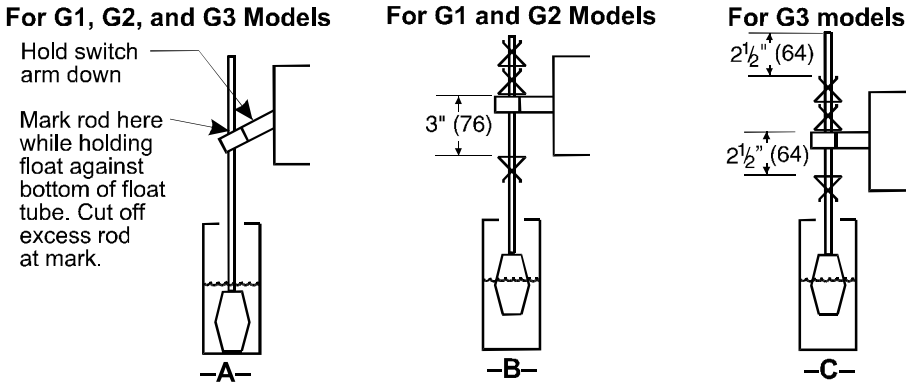

Figure 3

4. Here's how to set weir plates:

   a) The weir plate, not the level switch, sets the level in a module.

   b) Module 1 is normally set at a 10" (254) level. However, if Module 2 has a "Flow Not" valve, set Module 1 at the 8½" (216) weir setting and Module 2 at 9" (229), etc.

   c) Start at the front of the next zone (i.e. first module of the zone) at an 8½" (216) weir setting. Each subsequent module will have a weir plate setting ½" (013) higher than the previous module. Example: Module 2 is set at 8½" (216), Module 3 will be set at 9" (229), Module 4 set at 9½" (241) (considering that these modules flow to each other).

      A flow lifter is employed when a zone exceeds 4 to 5 modules. In this case, the module flowing to a flow lifter defines the beginning of a "sub" zone – thus a 8½" (216) weir setting.

      See Figure 1 in "Quick Guide for Setting Counter Flow Rates in Milnor Tunnels."

   d) If a module is equipped with a drain and fast fill valve, start the zone at a 9½" (214) weir setting. Otherwise, the level switch may not sense high level and therefore leave the fast fill valve on.

   e) Set the standing bath finishing module(s) at a 10" (254) weir setting.

   f) When flowing water through a CBW washer, there must be level over the weir in order to flow. As flow rates increase, the resultant level in each module goes higher. In some cases, the resultant level may be as much as 3" (076) higher than the weir setting in a given module. On G2 and G3 CBW washers, the divider plate, between modules, is at the 14" (356) water level. If the weir plate in a module is set at 12" (305) and the flow through the zone is set such that the level in the module is 3" (76) higher than the weir plate, then obviously water would be able to flow over the divider in the module. This is counterproductive to washing and should always be avoided.

   g) This issue is most likely to surface in the last module of the rinse zone where water flow is highest and water level is traditionally set high. The result is sometimes water splashing or flowing over the divider into the last module where sour, softener (and sometimes starch) is applied. The result is a dilution of this bath, which sometimes requires increased chemical dosing. If the weir setting is reduced in the rinse zone, this problem will simply disappear.