PROCEDURE FOR ACID/ALKALINE PURGING SPRAY WASHERS

Mild Steel or Stainless Steel Construction
Carbonate or Silicate Scale

WARNING: These washer clean-out and purging procedures require the use of concentrated acids and alkali's which will cause severe burns on skin contact or blindness if splashed in the eyes. Breathing acid vapors may be harmful or fatal. Protective clothing, including acid resistant gloves, full face shields and masks capable of removing acid vapors must be worn while performing these procedures.

WARNING: Never add water to concentrated acids, always add acid slowly to water. If you add water to concentrated acid, you will cause a violent reaction with extreme heat and potential for explosive spraying of concentrated acid.

WARNING: Acid solutions will react with non-ferrous metals producing potentially explosive Hydrogen gas. Be certain that your washer is free of chips or residue from non-ferrous metals such as Aluminum or Magnesium, and that the washer is not equipped with piping or nozzles made from potentially reactive metals.

CAUTION: In some cases, where there is significant corrosion of the washer tank, the acid cleaning process may remove scale and debris which is covering holes in the tank and cause the tank to leak. If there is any possibility of this happening, you should have on hand enough absorbent materials to prevent an uncontrolled spill of the acid/water mixture, or establish secondary containment around the washer.

CHEMICALS YOU WILL NEED: (per 100 gallons of washer capacity)

Type of Scale Washer		Mild Steel Washer	Stainless Steel
Carbonate →	Step 1:	5 gal. Inhibited Muriatic Acid (note 1)	5 gal. Phosphoric Acid (note 2)
	Step 2:	8 lbs. of Soda Ash (note 3)	8 lbs. Soda Ash (note 3)

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Silicate ➔	The above plus:		The above plus:
	Step 3:	10 gal. 50% Liquid Caustic Soda (note 4)	10 gal. 50% Liquid Caustic Soda (note 4)
	Step 4:	5 gal. Inhibited Muriatic Acid	5 gal. Inhibited Muriatic Acid

Note 1: **Inhibited Muriatic Acid**
Inhibited Muriatic Acid is also known as Inhibited Hydrochloric Acid (HCl). You should order the appropriate quantity of 20º Baume A Inhibited HCL - Industrial Grade. Be certain it is INHIBITED or it will attack the metal parts of the washer, and could cause structural or functional damage.

Note 2: **Phosphoric Acid**
Phosphoric Acid should be purchased as "Industrial Grade 75% Phosphoric Acid". If 75% is not available, other concentrations will work. Simply adjust the amount you use in proportion to the concentration.

Note 3: **Soda Ash**
Soda Ash is a powdered product, which is available in several different grinds. Any will do. Either natural or synthetic Soda Ash of industrial grade will be sufficient.

Note 4: **Liquid Caustic Soda**
Liquid Caustic Soda is available in industrial grades ranging from 45% to 50%. Any such grade will work

WASHER PREPARATION:

1. Drain all washing solution from the washer tank and then remove all spray nozzles and end caps from the spray piping system inside the washer.

2. Prepare a water/acid mixture to clean the nozzles and caps. Using a clean 5-gallon plastic pail, put in a sufficient quantity of water to cover all the nozzles and caps, then add 10% by volume of the acid you are using in step 1. ***Remember - never add water to concentrated acid! Always add acid slowly to water.*** Leave the nozzles and caps in this acid mixture for 1-2 hours, then dump the acid/water mixture into the washer just prior to step 2. Rinse the nozzles and caps in clean water.

3. Prepare the washer by doing the following:
   a. Turn on the washer's exhaust system.
   b. Charge the washer with fresh water to the level you want cleaned. This must be at least high enough to cover the pump inlet while the pump is running.
   c. If the washer has a separate rinse stage, put 10 lbs. of soda ash into this stage per 100 gal, and turn it on.
   d. Cover the inlet and outlet of the washer with plastic sheeting or plywood to prevent the escape of vapors.

Step 1 ➔ Carbonate Scale Removal

a. Slowly add the concentrated acid to the water already in the washer. ***Remember -always add acid slowly to water! Never add water to concentrated acid!*** Continue until the desired concentration level is reached (5 - 10% by volume).

b. Turn on the washer spray system and heaters. Bring the bath temperature up to at least 140^{o}F.

c. Continue running the washer for 1 to 2 hours after it has reached the temperature. Heavy scale deposits may take more time.

d. Shut down the heater and the pumps for the wash and rinse stages. Keep the exhaust fan running. At this point, any acid mixture made up for cleaning nozzles should be dumped into the wash section.

Step 2 ➔ Neutralizing the Acid

a. Slowly add soda ash to the acid wash water. Foaming will occur as the acid is neutralized and will diminish as the pH approaches neutral. (pH of 6.0 to 8.0 is considered neutral.)

b. Check the pH and when the solution reaches 6.0 to 8.0 turn on the pumps to neutralize pockets of low pH.

c. Re-check the pH and adjust, as necessary, to the 6.0 to 8.0 range.

d. Drain and properly dispose of the wash water.

e. If the scale was primarily carbonate, you are finished at this point. The washer should be filled with fresh water, circulated and dumped prior to filling again with fresh water and cleaning solution. The washer openings may be uncovered at this point and the end caps and nozzles replaced.

f. If there is significant silicate scale, go on to Step 3.

Step 3 ➔ Silicate Scale Removal

a. Picking up from the end of Step 2 d., fill the washer to the desired cleaning level with fresh water.

b. Add 50% liquid caustic soda to a concentration of 10% by volume. ***CAUTION! Caustic Soda will cause severe burns to skin and may cause blindness if splashed in the eyes. Wear protective clothing, gloves and full-face shield when handling this material.***

c. Turn on all pumps and heaters.

d. Continue running for 1 hour after the bath temperature reaches 160^{o}F.

e. Shut down the heater and pumps for the wash stage.

Step 4 ➔ Neutralizing the Caustic Soda

a. Slowly add concentrated acid to the wash stage until the pH reaches 6.0 to 8.0. ***Remember - Never add water to concentrated acid! Always add acid slowly to water.***

b. Turn on the pumps to circulate the wash section and eliminate any pockets of high pH. Check and adjust to pH 6.0 to 8.0.

c. Pump out and dispose of the neutralized mixture.

d. Fill with fresh water and recirculate at room temperature for at least 15 minutes.

e. Pump out and dispose of the water. Replace all end caps and nozzles, remove all closures and refill the wash section with the proper concentration of the cleaner you are using.

