Maintenance Guidelines for Aqueous Detergent Tanks

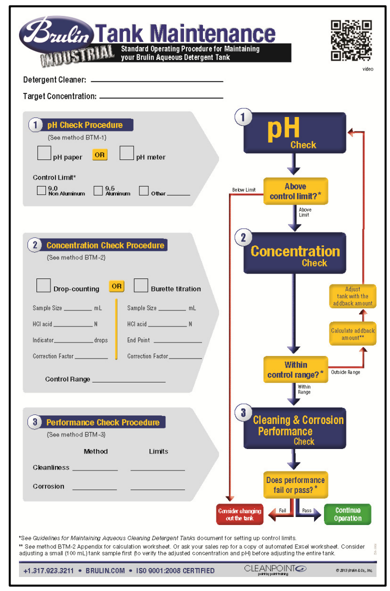
video

This guideline is relevant for wash tanks containing the following Brulin aqueous *alkaline* process detergents:

Formula 815 GD	Brulin 1990 GD	Formula 815MX
Formula 815 GD-NF	AquaVantage 3887 GD	Formula 815 MX-NF
815 QR	AquaVantage 3800 GD	Formula 515DD
815 QR-NF	Brulin 63-G	Alkaline Deruster HD
815 MAXX	Formula 224	

As well as these aqueous *pH neutral* (including near-neutral) process detergents:

AquaVantage HTD	Brulin Non-Silicated HTD
Brulin 1696B	Brulin Non-Silicated SWD
Brulin 1696PNC	



Brulin recommends monitoring three parameters to maintain the detergent solution ("tank"):

1. pH – We recommend simply monitoring the pH (to verify that the safe operational range of the aqueous/alkaline detergents).

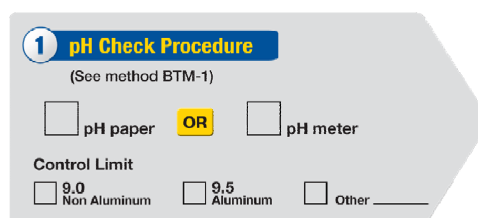
2. Concentration – We recommend monitoring and controlling detergent concentration (by adding detergent concentrate or water).

3. Performance (Cleaning and Corrosion) – pH and concentration are good, easy measures but cleaning and corrosion performance should be the ultimate judge of the tank condition.

See the coordinating flow chart for this recommended monitoring and control sequence.

Explanation of Control Sequence

Check the pH at least once a day (it may be more frequent for cleaning systems with high throughput and/or continuous use)



- using either precision pH paper (see BTM-1A) or
- digital pH meter (see BTM-1B).

Brulin generally recommends keeping the pH of the alkaline detergents above 9.5 for cleaning aluminum to avoid corrosion, and above 9.0 when cleaning other substrates. *(Note: Consult your Brulin representative for pH recommendations when dealing with magnesium substrates).* When the pH of an alkaline detergent falls below the control limit, you should consider changing out the tank.

Note: The true minimum pH at which unacceptable performance occurs in an alkaline detergent may vary depending on the degree of corrosion that can be tolerated, the specific detergent used, concentration level, process conditions and even types of aluminum alloy. Therefore, it may be possible to permit lower control limits (thus extend the tank life) than the above recommended levels as long as the performance check (see #3) for cleaning and corrosion performance is satisfactory.

There is no control limit for the aqueous pH neutral detergents. The pH check for these pH neutral detergents is to monitor for consistency of detergent tank conditions. Record the pH and proceed to the concentration check.

750-100ACOPY

2 Concentration Check

Check the detergent concentration at the same interval as the pH, by using either drop-counting method or standard laboratory burette titration method.

- **The *Drop-Counting method*** (see BTM-2A) is more convenient and suitable for use on the factory floor. Brulin sells a titration kit (part number XTRKIT) manufactured by LaMotte.
- ***Burette titration Method*** (see BTM-2B) is more precise and can be used by facilities that have a laboratory (burette, pH meter, mixer, etc.)

2 Concentration Check Procedure

(See method BTM-2)

____ Drop-counting	OR	____ Burette titration
Sample Size ________ mL		Sample Size ________ mL
HCl acid ____________ N		HCl acid ____________ N
Indicator ____________ drops		End Point ______________
Correction Factor __________		Correction Factor __________

Control Range ____________________

Establish a target detergent concentration and control range based on your cleaning process or the specifications of your client. Each process detergent listed above has a suggested concentration range in its product brand sheet designated as typical dilution. For control range, Brulin generally suggests to start with +/- 2.0% of the target value. (For example, if target is 10%, then use 8 – 12% as the control range).

If you are cleaning aluminum, be sure the lower control limit is above the minimum recommended concentration as shown in the product information. *(Note: For the alkaline detergents, a 5% concentration lower limit is broadly safe on aluminum; for pH neutral detergents, there is no required concentration lower limit for aluminum applications).*

Concentration Control – Detergent concentration in the tank can decrease due to the normal consumption of the detergent by soils, due to acidity in the soils, and to some other factors. It can also increase due to evaporation of water. The tank liquid level will also decrease due to evaporation, or “dragout” of liquid with the washed parts. The detergent concentration and liquid level in the tank can be corrected by adding detergent concentrate and/or process water. The worksheet for calculating addback quantities can be found in the Appendix to method BTM-2. An Excel worksheet with automated calculations is also available. Ask your sales rep or Brulin technical service for a copy.

> *Note: If tank concentration adjustment is needed, Brulin recommends first applying the adjustment to a small (e.g. 100 mL) tank sample and then verify that the pH of the adjusted sample will pass.*

After adjusting the detergent concentrate and/or liquid level in the tank, re-test and record the pH and concentrate of the adjusted tank to confirm before proceeding.

3 Cleaning & Corrosion Performance Check

Brulin highly recommends that each cleaning operation establish a standard method for a weekly performance check to verify cleaning and corrosion protection efficacy (see BTM-3).

3 Performance Check Procedure

(See method BTM-3)

	Method	Limits
Cleanliness	__________	__________
Corrosion	__________	__________

The test piece(s) should be representative to the soil type, soil loading, material/alloy type, and sensitivity to corrosion encountered in the actual wash operation. Establish pass/fail criteria for both cleanliness and corrosion protection that correspond to the requirements for parts. Each operation should use the test methods that are most suited (i.e., established, relevant, and/or validated) for its operation. If no such methods have been specified, try the “water break test” for checking the cleanliness and visual inspection for pitting, spotting and/or discoloration (against a reference sample) for checking the corrosion protection. When performance is failing, the detergent should be changed out, regardless of concentration or pH measurements.

Considerations for Emptying and Recharging the Detergent Solution:

The choice of when to change a detergent tank is important, balancing the need to obtain the longest possible service life, while ensuring the optimal performance of the detergent.

The ultimate indication of the end of detergent life is when it no longer cleans or no longer protects the substrates. The length of the detergent life is characteristic of the soil loading, soil type, throughput, substrate type and many factors in process setup (e.g., filtering and skimming) within each operation. Consequently, it will be nearly impossible to predict how long a detergent tank should last without empirical testing under actual use conditions. Once this is known, it becomes a very useful "reasonableness" check: under identical conditions, detergent tank life should be consistent from one tank recharging to the next. (Of course, any changes in parts, soils, throughput and operation conditions will change the detergent tank life). So, each operation unit should maintain a good record of change-out frequency of a particular tank. When concentration, pH and performance checks suggest changing the tank, also check that the age of the detergent is typical.

Tank Maintenance

Brulin INDUSTRIAL

Standard Operating Procedure for Maintaining your Brulin Aqueous Detergent Tank

video

Detergent Cleaner: ____________________

Target Concentration: ____________________

1 pH Check Procedure

(See method BTM-1)

☐ pH paper **OR** ☐ pH meter

Control Limit*

☐ 9.0 Non Aluminum ☐ 9.5 Aluminum ☐ Other ______

2 Concentration Check Procedure

(See method BTM-2)

☐ Drop-counting **OR** ☐ Burette titration

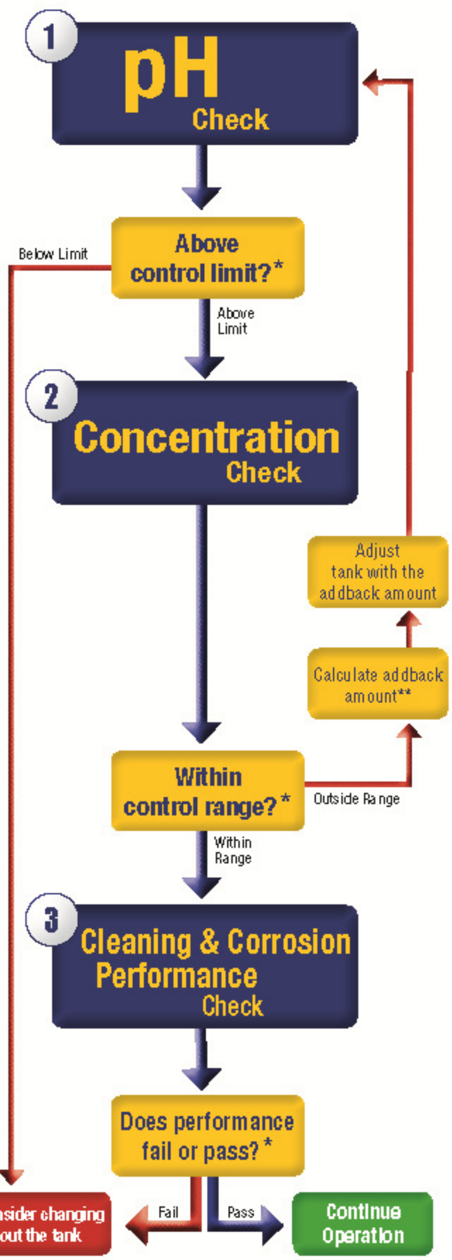
Drop-counting	Burette titration
Sample Size ________ mL	Sample Size ________ mL
HCl acid ________ N	HCl acid ________ N
Indicator ________ drops	End Point ________
Correction Factor ________	Correction Factor ________

Control Range ____________________

3 Performance Check Procedure

(See method BTM-3)

	Method	Limits
Cleanliness	________	________
Corrosion	________	________



*See *Guidelines for Maintaining Aqueous Cleaning Detergent Tanks* document for setting up control limits.

** See method BTM-2 Appendix for calculation worksheet. Or ask your sales rep for a copy of automated Excel worksheet. Consider adjusting a small (100 mL) tank sample first (to verify the adjusted concentration and pH) before adjusting the entire tank.

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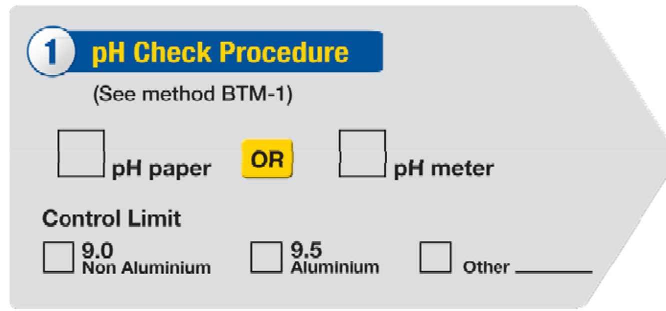
CLEANPOINT point by point training

BTM-1 pH Measurement

This document describes the procedure for measuring pH of the tank solution.

Sampling

Obtain a test sample of the tank solution. Cool to room temperature. (Temperature will affect pH reading)



Testing

Method A: If using pH Paper

1. Dip the pH paper into the sample for 3-5 seconds. Pull out and compare the color of the test strip against the color chart. Record the pH reading from the chart.
2. Record the temperature of the sample solution.

Method B: If using pH meter

1. Put the pH probe in the sample solution and record the pH reading from the meter.
2. Record the temperature of the sample solution.

Verification

Verify the test paper or pH meter by testing a pH calibration standard solution.

BTM-2 Tank Concentration Measurement

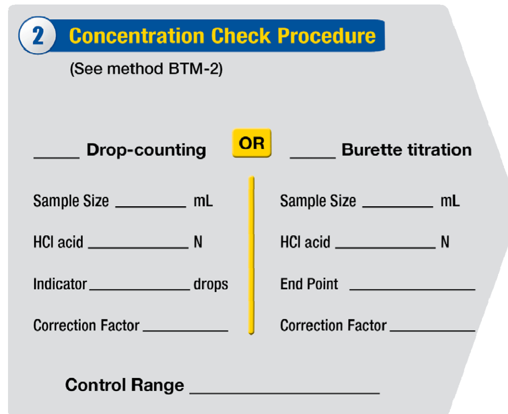
This document describes the test procedure to measure and adjust detergent concentration in the tank.

Sampling

1. Determine required test sample size, normality of Hydrochloric Acid (HCl), number of drops of indicator and correction factor from Brulin's product brand sheet (under 'Concentrate Verification' section).

2. Obtain a sample of the tank solution. Cool the sample to room temperature.

3. Measure out the specified sample size into the provided test tube (for method A), or a beaker (for method B), at room temperature (volume changes with temperature).



Testing

Method A: If Using Drop-Counting Kit

1. Add the required number of drops of indicator (Bromphenol Blue) to the sample and swirl to mix thoroughly. You should have a purple-blue color in the mixture.

2. Hold the provided 1.0 N Hydrochloric Acid (HCl) bottle vertically upside-down and add to the sample, drop by drop, swirling the solution after each drop. Count the number of drops it takes to change the color from purple-blue to yellow.

Note:
- *Holding the bottle at an angle affects the drop size and will skew results causing significant error.*
- *The endpoint of a highly dyed cleaner at a high concentration may be green in color.*

3. Calculate the concentration of tank solution by using the following equation.

% (v/v) Concentration = (number of HCl drops) x (correction factor)

Method B: If Using Burette Titration Setup

1. Titrate the sample with Hydrochloric Acid (HCl), constantly swirling the sample solution. Record the number of mL it takes to reach the end of pH = 3.8.

2. Calculate the concentration of tank solution by using the following equation.

% (v/v) Concentration = (number of HCl mL) x (correction factor)

Verification

Verify the titration method, chemicals and calculation by testing a known-concentration sample.

Worksheet 1

Calculation of Addback to INCREASE Concentration

(If using Excel Spreadsheet, enter the values into lines: 1, 3, 5 and 9)

To Increase Detergent Concentration in the Tank

1	Desired concentration, Cd (%) ………………………………………	**1**			
2	Subtract line 1 from 100, (100 - Cd)		……………………	2	
3	Measured concentration, Cm (%) ………………………………………	**3**			
4	Subtract line 3 from 1, Cd – Cm		……………………	4	
5	Current tank volume*, Vc (in gallon, Liter, or mL) …………………	**5**			
6	Multiply line 4 by line 5, (Cd – Cm)xVc		……………………	6	
7	Divide line 6 by line 2. Round off to 0.1 (**This is the amount of <u>detergent concentrate</u> needed to raise the concentration in the tank, D1**)		……………………	**7**	

If you <u>do NOT need to adjust liquid level at the same time</u>, then just add the **detergent concentrate** in the amount listed on **line 7** to the tank **to increase** the concentration. Otherwise, wait after completing steps 8 through 13 below.

To Further Raise Liquid Level in the Tank

8	Add up lines 5 and 7 above, Vc + D1 ………………………………	8			
9	Desired tank volume*, Vd (in gallon, mL or Liter) …………………	**9**			
10	Subtract line 8 from line 9, Vd – (Vc + D1). ……………………… If less than zero, enter zero.	10			
11	Multiply line 10 by line 1 and by 0.01. Round off to 0.1 (**This is the additional amount of <u>detergent concentrate</u> needed to raise the liquid level in the tank, D2**)		……………………	11	
12	Add up lines 7 and 11, D1 + D2. (**This is the <u>total</u> amount of <u>detergent concentrate</u> needed to raise concentration <u>and</u> liquid level in the tank, DA**)		……………………	**12**	
13	Subtract line 11 from line 10, Vd - (Vc + D1) - D2. (**This is the <u>total</u> amount of <u>water</u> needed to raise the liquid level in the tank, WA**)		……………………	**13**	

Add the **detergent concentrate** in the amount listed on **line 12** to the tank to increase the concentration and then add **water** in the amount listed on **line 13** to the tank to bring the liquid level up.

* The addback volume (unit) must be the same as the unit used in lines 5 and 9. For example, if lines 5 and 9 are in gallons, the addbacks must be in gallons. The calculation can also be used to adjust tank sample; enter the sample size in line 5.

Worksheet 2
Calculation of Addback to REDUCE the Concentration

(If using Excel Spreadsheet, enter the values into lines: 1, 2, 4 and 8)

To Reduce Detergent Concentration in the Tank

1	Desired concentration, Cd (%) ……..…………………………..….	**1**			
2	Measured concentration, Cm (%) ……………………………….....	**2**			
3	Subtract line 1 from 2, Cm – Cd.	…………………………..		3	
4	Current tank volume*, Vc (in gallon, Liter, or mL) …………………	**4**			
5	Multiply line 4 by line 3, (Cm – Cd)xVc	…………………………..		5	
6	Divide line 5 by line 2. Round off to 0.1 **(this is the amount of <u>water</u> needed to reduce concentration in the tank, W1)**	…………………………..		**6**	

If you <u>do NOT need to adjust liquid level at the same time</u>, then just add the **water** in the amount listed on **line 6** to the tank **to reduce** the concentration. Otherwise, wait after completing steps 7 through 12 below.

To Further Raise Liquid Level in the Tank

7	Add up lines 4 and 6 above, Vc + W1 ………………………..……	7			
8	Desired tank volume*, Vd (in gallon, mL or Liter) ..………………..	**8**			
9	Subtract line 7 from line 8. Vd – (Vc + W1)………………………... If less than zero, enter zero.	9			
10	Multiply line 9 by line 1 and by 0.01. Round off to 0.1 (**this is the <u>total</u> amount of <u>detergent concentrate</u> needed to raise the liquid level in the tank, DA)**	…………………………..		**10**	
11	Subtract line 10 from 9, Vd - (Vc + W1) - DA. (**this is the additional amount of <u>water</u> needed to raise liquid level in the tank, W2**)	…………………………..		11	
12	Add up lines 11 and 6, W1 + W2. **(this is the <u>total</u> amount of <u>water</u> neded to reduce the concentration <u>and</u> raise the liquid level in the tank, WA)**	…………………………..		**12**	

Add the **detergent concentrate** in the amount listed on **line 10** to the tank to bring increase the concentration and then add **water** in the amount listed on **line 12** to the tank to bring the liquid level up.

* The addback volume (unit) must be the same as the unit used in lines 4 and 8. For example, if lines 4 and 8 are in gallons, the addbacks must be in gallons. The calculation can also be used to adjust tank sample; enter the sample size in line 4.

BTM-3 Tank Performance Evaluation

Each operation should use the test methods that are most suited (i.e., established, relevant, and/or validated) for its operation. If no such methods are specified, consider the two common methods described below.

Sampling

1. Select a flat panel made of the same/similar alloy as found in the manufacturing process.
2. Soil the test panel with the same/similar soils as found in the manufacturing process.
3. Clean and rinse the test panel in the process tank under the same control parameters.
4. Cool to room temperature. (Do not oven dry parts).

3 Performance Check Procedure

(See method BTM-3)

	Method	Limits
Cleanliness	____________	______________
Corrosion	____________	______________

Evaluation

Cleanliness – Water Break Test

1. Immerse the test panel in a container of room temperature, distilled or DI (de-ionized) water. Do not use softened or hard water.
2. Lift the test panel vertically from the container and allow it to drain for a minute while looking for breaks in the film of water as it sheets off the part. Record the number of seconds it takes for the water to break the uniform film. (Surface roughness can affect the break time.)

Corrosion – Metal Staining Test

1. Thoroughly air-dry the cleaned test panel. (Do not oven dry parts)
2. Inspect for and record signs of discoloration, rust and/or pitting, and compare against established reference samples.

Verification

Each operation should establish “pass” or “fail” criteria for cleanliness and corrosion performance that corresponds to the requirements of the parts. A common approach for the water break test is to set a break time (say 30 seconds). A common approach for the corrosion test is to check against established “pass” or “fail” reference samples.

Correction Factors for LaMotte Test Kit Method Using Bromphenol Blue* Endpoint

Cleaner	Sample Size (ml)	# of Indicator Drops	Correction Factor
Aquavantage HTD	20	4	0.56
Aquavantage 3800B[3]	10 20	3 4	0.83 0.40
Aquavantage 3800GD	10	3	0.31
Aquavantage 3887GD[3]	10 20	3 4	0.78 0.39
Brulin Non-Silicated[3] HTD	5 10	2 3	0.98 0.48
Brulin Non-Silicated SWD	20	4	0.41
Brulin 63-G	10	3	0.49
Brulin 1696B	20	4	0.40
Brulin 1696PNC	20	4	0.42
Brulin 1990GD	20	4	0.34
Brulin 1990GD-T	20	4	0.34
Formula 224[2]	5	2	0.15
Formula 515DD	5	2	0.66
Formula 815GD & GD-NF[4]	5 10	2 3	0.81 0.42
Formula 815MX & MX-NF[4]	10 20	3 4	0.75 0.38
815MAXX	5	2	0.49
815QR & QR-NF	5	2	0.46

2 = This is a heavy-duty caustic formula. Its intended use makes the Phenol Red endpoint method preferable over the Bromphenol Blue* endpoint.

3 = Use the larger sample size when tank strength is 0 – 10%(v/v) and the smaller sample size when it is > 10%(v/v)

4 = Use the larger sample size when tank strength is 0 – 15%(v/v) and the smaller sample size when it is > 15%(v/v)

Correction Factors for LaMotte Test Kit Method Using Phenol Red Endpoint

Cleaner	Sample Size (ml)	# of Indicator Drops	Correction Factor
Formula 224	5	2	0.18

<u>Note:</u> Alkaline Deruster HD is too highly concentrated to test with the LaMotte Alkalinity kit and should be monitored by either Conductivity or Free Alkalinity titration with precision lab equipment. See Alkaline Deruster HD's Brand Sheet for titration control parameters. Contact your Brulin Service Representative for Conductivity control parameters.