Product Supplement

Metalnox® M6440

Mild Chelated Alkaline Aqueous Immersion Cleaner and Brightener

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Mild Chelated Alkaline Aqueous Immersion Cleaner and Brightener

Metalnox M6440 is a mild alkaline aqueous cleaner concentrate containing nonionic and anionic surfactants, oxygenated solvent, organic inhibitor, conditioners and chelators in a water base. It is multi-metal safe and can be used in most immersion, ultrasonic or manual applications for removal of oils and greases, drawing fluids, coolants, metal oxides, light scale and shop dirt found in industrial manufacturing.

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Metalnox Use Directions

The Metalnox cleaners are water-based concentrates designed to be diluted further with water when used in mechanical washing systems. Typically diluted one part cleaner concentrate to three to twenty parts water, Metalnox is used to remove a broad spectrum of oils, greases and shop dirt from metals, plastic, composites and ceramics.

Cleaning Hints:

When working with a water-based cleaner, there are several things to remember. Unlike vapor-degreased parts, the water cleaned parts will come out of the wash stage wet. To minimize the amount of cleaner carry out, parts should be racked or fixtured to maximize water run-off. Slow withdrawal, withdrawal with a jerking motion, or use of an air-knife are methods used to further reduce product carry-out.

Parts allowed to sit for a prolonged amount of time will be protected with an ultra-thin layer of corrosion protection. If this film interferes with subsequent processing or use, a water rinse will readily remove any product solids left on the part.

If water interferes with the next process, a drying step may be needed. Air-knife, recirculating air, hot oven, tumbling or chemical displacement are optional methods used to facilitate the drying process.

Preparing the Equipment:

1. Check the compatibility of all substrates, elastomers and seals. Replace if needed.
2. Clean or replace all filters exposed to previous cleaner.
3. Check and repair all mechanical parts including nozzles, spray arms, eductors, etc.
4. Inspect all visible areas to insure all surfaces are clean and free of scale, soils and cleaner residues.
5. Once all tanks and plumbing are thoroughly clean, close drains and fill with water.
6. Run two to three full cycles to completely clean the entire system.
7. Drain all fluid from wash tanks, rinse tanks and filter cartridges. Verify that the final rinse is neutral pH, clear, free of debris and non-foaming. This will insure that all soils and cleaner residues have been removed.
8. Close all drains, fill the tanks with water and charge the cleaning chemistry to the recommended concentration. Start recirculation.
9. Once the recommended process temperature has been reached, cleaning may commence.

Care should be taken to minimize cleaner drag-out into the rinse solutions.

Bath Maintenance:

For maximum cleaning efficiency, bath concentration, temperature, time or the number of stages may be adjusted as required. A special test kit is available to monitor bath concentration in the field. Refractometers and Conductivity Meters are also available through your Kyzen Representative to assist in bath maintenance.

To assist in controlling the bath, Kyzen offers automatic proportioning systems for “hands-off” control. These include the fully automatic Kyzen PCS, and the semi-automatic *DOSATRON.* Both are recommended for use with Metalnox aqueous products. Your Kyzen representative can assist you in identifying the best unit for your application.

Filtration:

Metalnox cleaners may be filtered and reused. Routine and regular removal of contaminants via skimming, overflow or filtration will prolong sump life. With proper maintenance, Metalnox should last a long time and require periodic makeup only as required to replace chemical drag out.

Disposal:

When an Metalnox bath solution is properly maintained, prolonged bath life can be expected. Actual field experience has shown that this chemistry, when properly maintained, may last indefinitely. Most often the bath is changed out due to mechanical or filtration reasons rather than chemical failure.

Most Metalnox rinse solutions are compatible with typical primary and secondary waste treatment processes. Typical process methods are included in the back of this booklet. The Municipal Sewer District covering the plant location will determine whether the rinse waters can be sewered. Final rinse closed loop operations are the norm, with industry standard carbon and resin systems. In special circumstances, full Closed-loop water treatment for the rinse water is desirable and is accomplished with reverse osmosis (RO) membranes and equipment introduced by Kyzen to the industry over a decade ago.

Your Kyzen Representative is available to assist you throughout your cleaning process.

Metalnox Generic Description

Metalnox is a mild alkaline aqueous cleaner-degreaser concentrate nonionic and anionic surfactants, conditioners and chelators, oxygenated solvent and organic inhibitor in a water base. It is multi-metal safe and can be used in most immersion, ultrasonic, or manual applications for the removal of heavy duty oils and greases, light scale and metal oxides. Metalnox was specially formulated with raw materials that are as people-safe and environmentally friendly as possible while still accomplishing the task at hand.

Typical Chemical and Physical Properties

Parameter	100% Concentrate	10% Dilution	0.01% Dilution
Clarity	clear	Clear	
Color	straw	Colorless	
Odor	mild	None	
Flash Point, °C (COC)	None to boiling	None	
Boiling Point, °F/C	212/100		
Volatile Organic Compound (VOC) gm/L EPA Method 24	14.8	1.5	
Vapor Pressure, VOC Components, mmHg at 20°C	5.59		
Chemical Oxygen Demand (COD) ppm			34.6
Biochemical Oxygen Demand (BOD), 5-day, ppm			7.2
pH	7.8-9.8	7.8-9.8	
Specific Gravity	1.118	1.00	
Weight/gallon	9.31#	8.35#	
Refractive Index, ° BRIX	25-35	3.9	
MEQ to pH 8.3	0.02-0.12		
MEQ to pH 4.0	0.48-0.88		
Alkalinity Ratio	1:11.3		
Surface Tension, dynes/cm		26-36	
Conductivity, mSiemens	38-48		

Substrate Compatibility

All chemicals have the potential to adversely effect substrates and equipment. Kyzen conducts short term, up to 48 hour testing on materials typically found on industrial parts. Additionally, Kyzen conducts longer term 2 week and 3 month exposure on the materials of construction typically found in cleaning systems such as tanks, fixtures, plumbing, filtration, etc. Materials have been tested for compatibility under the following conditions: Immersed, unagitated at 100% and at 150°F for the appropriate time frame. Specimens were examined for changes in weight, dimension, hardness and appearance. Based on these results the following suggestions are made regarding the use of Metalnox and these substrates.

Plastics and Elastomers:

Brand Name	Generic Description	M6440
Delrin™	Acetal	R
Phenolics	Phenol	R
Teflon	Fluorinated Elastomer	R
PVDF	Fluorinated Elastomer	R
Nylon	Synthetic Fiber	R
Kalrez	Fluorinated Elastomer	R
Neoprene	Chloroprene	R
Polypropylene	Polypropylene	R
Butyl	Isobutylene Isoprene	R
EP Rubber	Ethylene Propylene	R
Thiokol	Polysulfide	T
Hypolon	Chlorosulfonated PE	T
Viton A or B	Fluoroelastomer	R
CPVC	Chloro Polyvinyl Chloride	R
Polyurethane	Polyester/Polyether	NR
EPDM	EP Diene Monomer	R
Low density polyethylene	Polyethylene	T
Latex Rubber, natural and synthetic	Polyisoprene	NR
Silicone Rubber	Silicone Rubber	R
PVC	Polyvinyl Chloride	R
Lexan™	Polycarbonate resin	T
Buna-S	Styrene Butadiene	T
Buna-N	Styrene Nitrile Copolymer	T
Ceramics	Composites	R
Glass	Glass	R

Metallics:

Substrate	M6440
2024 Aluminum- Bare	R
2024 Aluminum- Alclad	R
6061 Aluminum	R
Copper	R
1018 Steel	R
304 Stainless Steel	R
316 Stainless Steel	R
Cast Iron	R

R = Recommended
NR = Not Recommended
T = Test Before Use

Soils Removed by Metalnox Cleaners

Typical soils removed by Metalnox cleaners include the following lubricants and oils used in the manufacturing process:

Soils Removed	
♦ Straight mineral oil, i.e., vanishing oil, spindle oil	♦ Tapping fluids
♦ Straight fatty oil, i.e., lard oil	♦ Drawing fluids
♦ Mineral oil plus fatty oil	♦ Mineral seal oil
♦ Mineral oil plus additives	♦ Cutting fluids
♦ Mineral oil plus chlorine and sulfur EP additives	♦ Sulfo-chlorinated mineral oil
♦ Sulfurized mineral oil	♦ Sulfo-chlorinated mineral and fatty oil
♦ Chlorinated mineral oil	♦ Sulfurized soluble oil
♦ Sulfo-chlorinated mineral oil	♦ Chlorinated soluble oil
♦ Sulfurized mineral and fatty oil	♦ Sulfo-chlorinated fatty soluble oil
♦ Chlorinated mineral and fatty oil	♦ Synthetic coolant
♦ Sulfurized mineral oil	♦ Honing oil
♦ Light tarnish	♦ Grinding fluids
♦ Light scale	♦ Hard water spots

The above list of soils is being expanded daily. If your soil is not listed above, contact Kyzen for updated information and assistance.

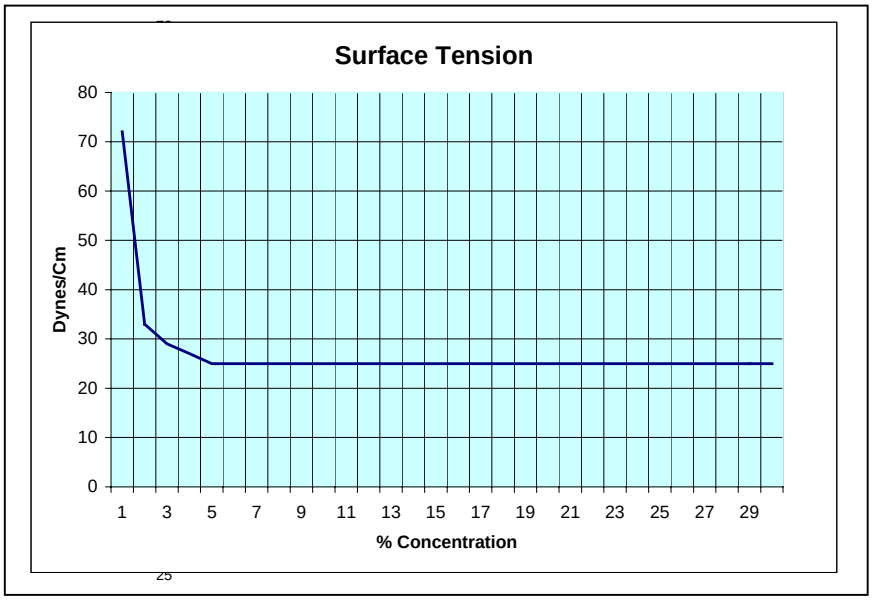
Soils Influence on Metalnox Cleaners

Contaminants have varying effects on aqueous cleaner baths. The following is a list of soil types and the chemical effects expected and the potential recyclability of the bath.

Soil	Chemical Effect	Bath Effect	Recyclability
Chlorinated paraffins	Little effect	Mostly soils sink; chlorides may accelerate corrosion	Rejected soils may be filtered out
Emulsified oils	Little effect	Soils float or sink; may emulsify more soils; soaps may cause foam	Rejected soils can be filtered out
Fatty acids	Saponification occurs	Lowers pH; lowers titration; due to adhesion properties, cleaning performance may be reduced	Product components are consumed; pH adjustment may be needed to facilitate filtration
Hard water salts	Sequestration occurs	Lowers pH; lowers titration	Product components are consumed; soils are not filtered out
Napthenic oils	Little effect	Soils float or sink	Rejected soils can be filtered out
Particulates	Little effect	Soils float, disperse or sink	Soils can be filtered out

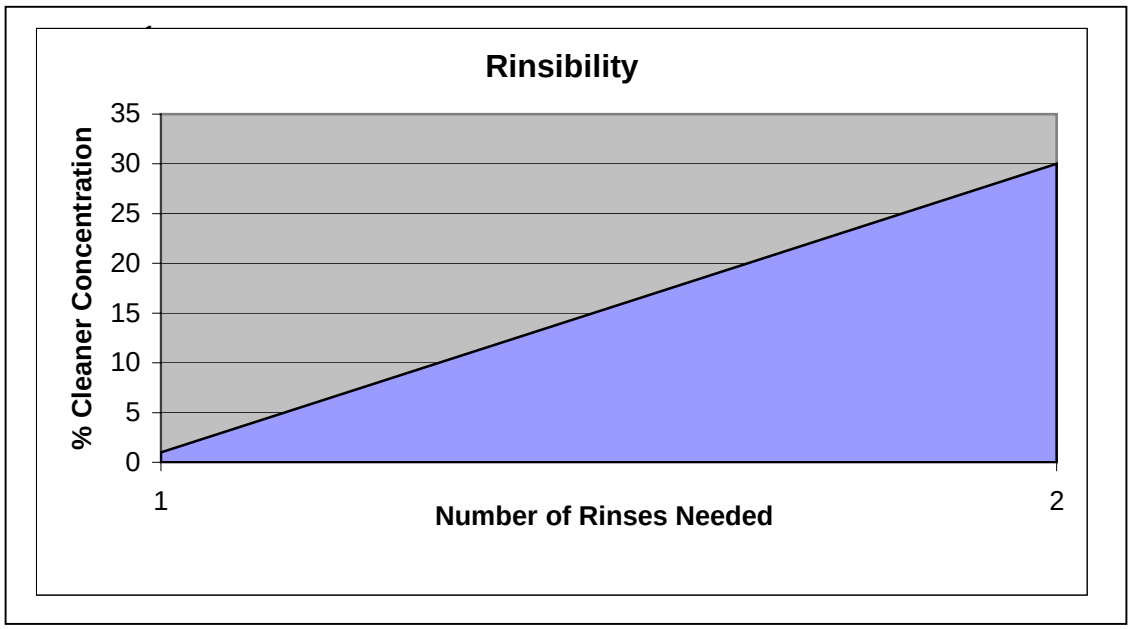
Metalnox Surface Tension

Surface Tension measures the tendency of a liquid to “wet out” on a surface. Water has poor wetting properties with a typical surface tension of 72 dynes/cm. As shown below, aqueous cleaners use surface active agents, commonly called surfactants, to reduce the surface tension and enhance wetting. Formulated to function at the ppm level, note the immediate reduction in surface tension even low concentrations of cleaner have in a water solution.



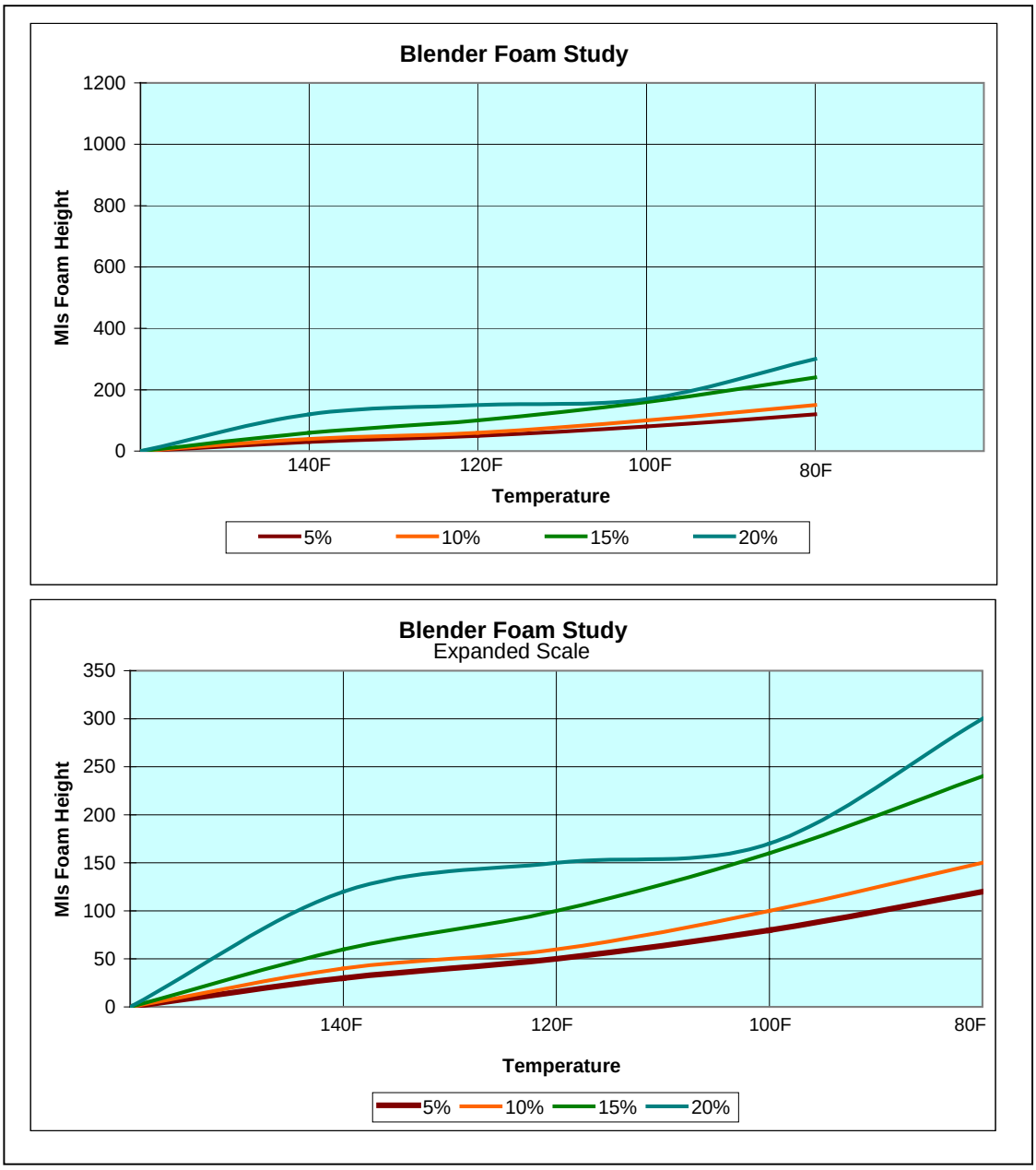
Rinsibility

The number of 7 second rinse stages required to obtain zero conductivity in the final rinse demonstrates the ease of rinsibility. As cleaner concentration is increased, additional rinse time, agitation or stages may be required. Metalnox is very free rinsing and requires a minimal amount of rinsing for total residual removal.



Metalnox Blender Foam Study

Blender foam measurements depict the effect concentration, temperature and shear have on the foaming properties of the aqueous cleaner chemistry. Two hundred mls of a dilute solution in deionized water is heated to the prescribed temperature, blended at high speed for 30 seconds and transferred to a 1000 ml graduated cylinder. The foam height is recorded in mls. Results are graphically illustrated below.



Bath Maintenance Methods
Metalnox Concentration: Titration Test Kit Dropper Method

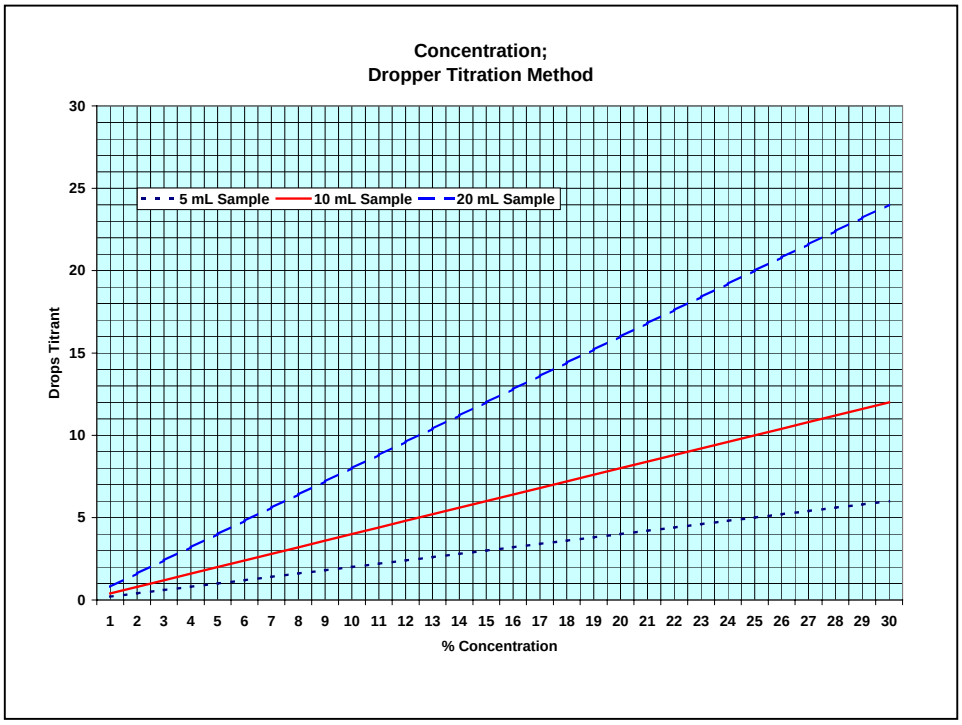
This procedure defines the equipment and preferred field test method used to measure and maintain bath concentration. A Test Kit is available from Kyzen Corporation, Nashville, TN.

Reference: Kyzen Standard Operating Procedure KM-034

Concentration Range	15-25%	10-20%	5-10%
Sample Size	5 ml	10 ml	20 ml
Indicator	Phenolphthalein	Phenolphthalein	Phenolphthalein
Titrant	0.5N Acid	0.5N Acid	0.5N Acid
Factor	5.0	2.5	1.25

Procedure:

1. Using a cup, take about 500 mls cleaning solution from a thoroughly agitated tank.
2. Using a graduated cylinder or syringe, transfer sample to an Erlenmeyer flask.
3. Dilute to the 50 ml mark with water as desired to make the endpoint easier to see. Volume is not critical.
4. Add 2-10 drops indicator as needed to get good color development. Solution will turn a dark pink.
5. While swirling, hold acid titrant bottle exactly vertical and add dropwise until pink just disappears.
6. Record the number of drops of titrant used.
7. Calculate: % Concentration = drops titrant X factor or see chart below:



Bath Maintenance Methods;
Metalnox Concentration: Burette Titration, Colorimetric Method

This procedure defines the laboratory equipment and method used to more precisely measure bath concentration versus a dropper test kit method.

Reference: Kyzen Standard Operating Procedure KM-035

Equipment: Analytical balance, graduated cylinder, syringe or pipette
Beaker or Erlenmeyer flask, 125 ml or equivalent
Burette, 25 or 50 ml with 0.1 ml graduations
Magnetic stirrer with Teflon magnet (optional)

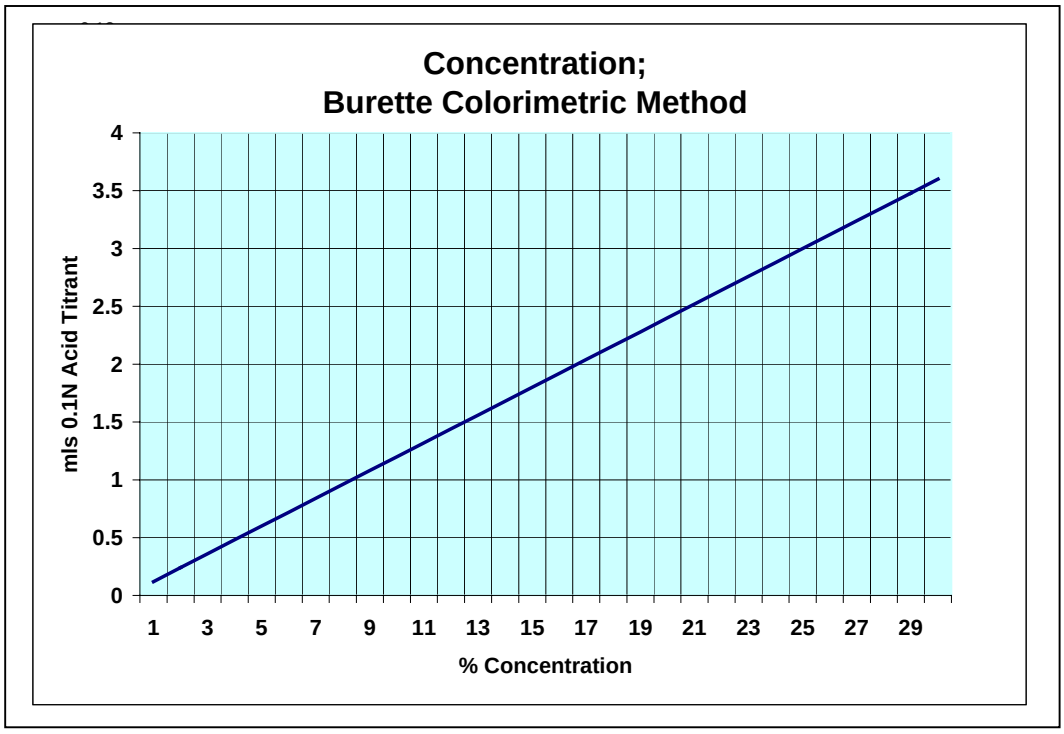
Reagents: Phenolphthalein Indicator
Deionized water
0.1N (HCl) Acid titrant

Procedure:

1. Transfer 10.0 ml well-agitated sample to a clean beaker or flask. Add deionized water for volume as desired. Volume is not critical.
2. Add 2-10 drops BP Indicator. Solution will turn a dark pink color.
3. While mixing, titrate with 0.1N acid until the color just disappears.
4. Record the number of mls acid titrant used. (Subtract the initial burette reading from the final reading.)
5. Calculate: % Concentration = mls titrant X average factor*

** To generate the average factor to be used in this calculation, proceed as follows:*

a. Make up three known concentrations by adding a measured amount of Metalnox to a measured amount of water.
b. Follow steps 1 through 4 above.
c. Calculate the factor for each standard solution by dividing the known concentration by the mls acid titrant used.
d. Determine the average factor by dividing the sum of the factors by the number of prepared solutions, or use the Kyzen generated factor of “8.3 “.



Bath Maintenance Methods;
Metalnox Concentration: Burette Titration, Potentiometric Method

This procedure defines the laboratory equipment and method used to more precisely measure bath concentration using a pH meter versus a colorimetric method. This is the most accurate method for concentration maintenance of this product.

Reference: Kyzen Standard Operating Procedure KM-035

Equipment: Analytical balance, graduated cylinder, syringe or pipette
Beaker or Erlenmeyer flask, 125 ml or equivalent
Burette, 25 or 50 ml with 0.1 ml graduations
pH Meter and Probe
Magnetic stirrer with Teflon magnet (optional)

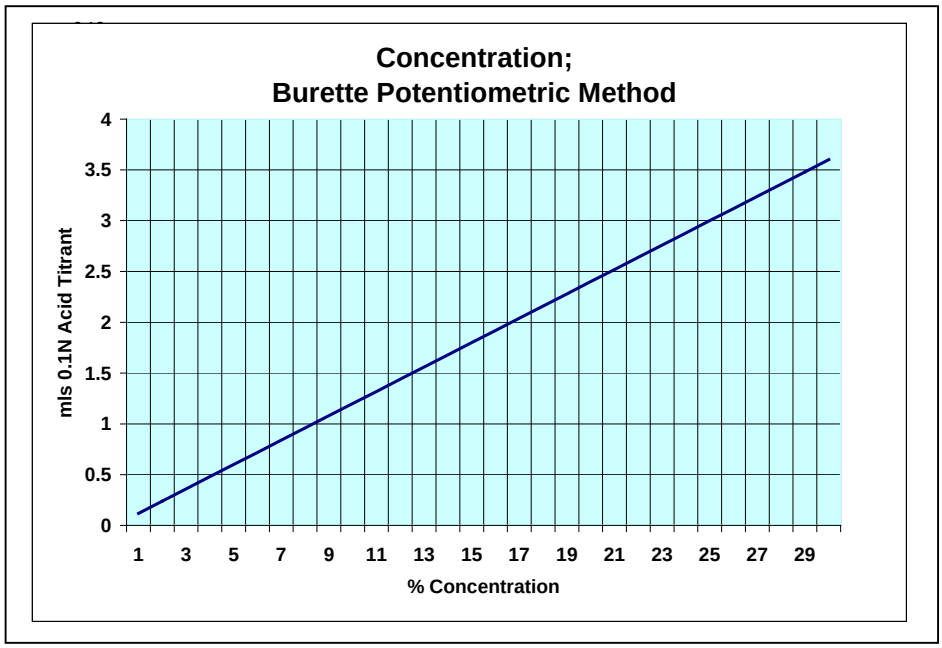
Reagents: pH Buffer Solutions, 7 and 4
Deionized water
0.1N (HCl) Acid titrant

Procedure:

1. Transfer 10.0 mls well-agitated sample to a clean beaker. Add deionized water for volume as required to adequately immerse probe. Volume is not critical.
2. While mixing, titrate with 0.1N acid to pH 4.0. Record the number of mls acid titrant used. (Subtract the initial burette reading from the final reading.)
3. Calculate: % Concentration = mls titrant X average factor*

** To generate the average factor to be used in this calculation, proceed as follows:*

1. Make up three known concentrations by adding a measured amount of Metalnox to a measured amount of water.
2. Follow steps 1 and 2 above.
3. Calculate the factor for each standard solution by dividing the known concentration by the mls acid titrant used.
4. Determine the average factor by dividing the sum of the factors by the number of prepared solutions, or use the Kyzen generated factor of “8.3 “.



Bath Maintenance Methods;
Metalnox Concentration: Conductivity Method

This procedure defines the equipment and field method used to measure cleaner concentration based on electrolyte content.

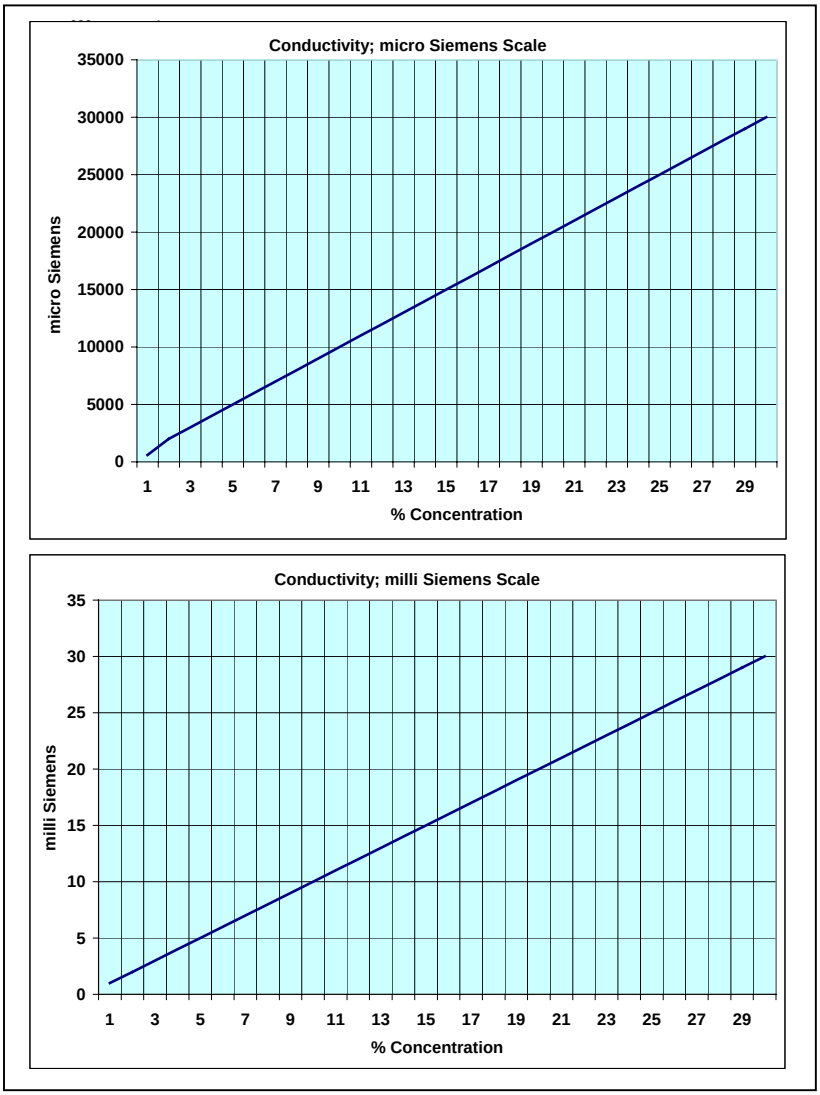
Reference: Kyzen Standard Operating Procedure KM-033

Equipment: Conductivity Meter
Beaker or jar capable of holding 100 mls or more.

Procedure:

1. Transfer approximately one cup well-agitated bath solution to a clean beaker or jar.
2. Follow manufacturer's directions on the proper use of the conductivity meter.
3. Calculate: % Concentration from the chart below:

Note: If reading is off-scale, dilute the sample 1:1 with fresh water and multiply reading times two.



Bath Maintenance Methods;
Metalnox Concentration: Refractive Index Method

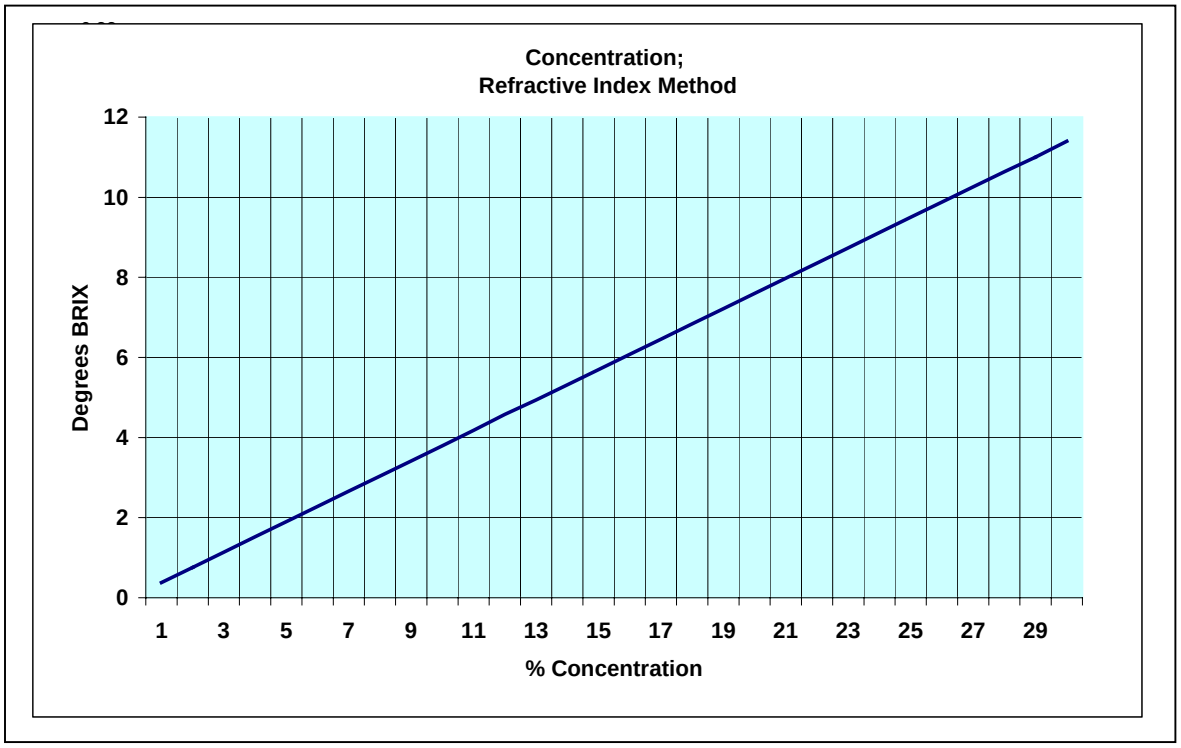
This procedure defines the equipment and field method used to measure cleaner concentration based on refraction of light. Many flux and paste-type soils interfere with refractive index measurement. As soil load increases, this measurement will give artificially high results. The factor must be adjusted downward routinely as soil load increases or the concentration will be presumed higher than it actually is.

Reference: Kyzen Standard Operating Procedure KM-039

Equipment: Refractometer, Brix Scale
Plastic droppers

Procedure:

1. Taking care not to collect any floating soils, using a dropper transfer a drop of well-agitated bath fluid onto the refractometer lens.
2. Hold refractometer up to a light source and read degrees Brix.
3. Calculate: % Concentration = Reading X 2.6 or use chart below:



Bath Life and Corrective Action Methods

Alkalinity Ratio

This procedure defines the laboratory equipment and method used to measure soil loading and chemical consumption of an aqueous cleaner bath.

Due to the neutral properties of this cleaner, alkalinity ratio is not a strong indicator of bath condition. Proceed with Oil Loading and Solids measurements.

Oil Loading

This procedure defines the equipment and method used to calculate the amount of non-emulsified soil in an aqueous cleaner bath.

Equipment: 100 ml graduated cylinder

Procedure:

1. Take approximately a 500 ml sample from a well-agitated cleaner bath.
2. Transfer 100 mls to the graduated cylinder.
3. Allow to sit undisturbed for 30-60 minutes.
4. Record the number of mls oil floating on the surface.

Corrective Action:

……3 mls or less, no corrective action needed unless soil redeposition is a problem.
……over 3 mls, filter or skim bath to remove floating oils.

Suspended (Undissolved) Solids/ Particulates

This procedure defines the equipment and method used to calculate the amount of suspended (undissolved) soils in the cleaner bath.

Equipment: 100 ml graduated cylinder

Procedure:

1. Using the same sample as for oil loading above, record the mls sediment on the bottom of the cylinder.

Corrective Action:

……2 mls or less, no corrective action needed.
……greater than 2 mls, filter or bleed-off.

Dissolved Inorganic Solids

This procedure defines the equipment and field method used to measure cleaner contamination based on electrolyte content. These soils may lead to dendrydic growth, scale or subsequent product failure. Salts such as silicates, phosphates, calcium, magnesium, sodium, potassium, etc. contribute to inorganic dissolved solids.

Equipment: Dissolved Solids Meter
Beaker or jar capable of holding 100 mls or more

Procedure:

1. Transfer one cup well-agitated bath solution to a clean beaker or jar.
2. Follow Manufacturer's directions on the proper use of the dissolved solids meter.
3. Calculate: Dissolved solids is a direct reading expressed in milliSiemens or microSiemens

Corrective Action:

……2X control solution or less, no corrective action is needed.
……greater than 2X control solution, bleed-off or recharge with deionized water and fresh product.

Primary Waste Treatment of Rinse Water; Acid-Alum Method

This process outlines the basic steps used in initial treatment of rinse waters using a standard acid-alum treatment method.

Phase A: Separation of Unemulsified Oils

1. Allow the wastewater to stand undisturbed for 24 hours, or as long as possible.
2. Skim, overflow, vacuum or filter off the surface. (This oil can be hauled away, burned, or reclaimed according to local regulations.

Phase B: Oil Split: Separation of Oils and Organic Materials

1. Slowly, with mild agitation, add acid (citric, sulfuric or similar) to the diluted waste solution to reduce the pH to the range of 3.5 to 4.5.
2. Slowly, with mild agitation, add 1.5 gallons of 17% alum (aluminum sulfate) solution per 1000 gallons of acidified waste.
3. Allow the mixture to set undisturbed for 24 to 48 hours until there is clear separation with a top floating layer of organic and oil contaminants and a bottom hazy water layer.
4. Decant off the top layer by skimming, vacuuming or overflowing. Dispose of this material according to local regulations.

Phase C: Neutralization of Water Layer

1. To the lower water layer, slowly and with mild agitation add liquid caustic, either 50% sodium hydroxide or 45% potassium hydroxide, as needed to raise the pH to the range of 6.5 to 6.8. Take care not to exceed pH 6.9 or a portion of the aluminum slurry may become soluble.
2. Allow the neutralized waste to remain undisturbed for a minimum of 24 hours to allow the aluminum hydroxide slurry to settle to the bottom of the tank. This flock should contain any residual organics not removed in Phase B.
3. The flock can be removed as solid waste in accordance to local regulations or it can be reacted with sulfuric acid to form aluminum sulfate in the next phase of waste treatment.
4. The clear water layer can be recycled or be disposed of as plant effluent.

Primary Waste Treatment of Rinse Water; Alum-Polymer Method

This process outlines the basic steps used in initial treatment of rinse waters using a standard alum-polymer treatment method.

Phase A: Separation of Unemulsified Oils

1. Allow the wastewater to stand undisturbed for 24 hours, or as long as possible.
2. Skim, overflow, vacuum or filter off the surface. (This oil can be hauled away, burned, or reclaimed according to local regulations.

Phase B: Oil Split: Separation of Oils and Organic Materials

1.Slowly, with mild agitation, add 1.5 gallons of 17% alum (aluminum sulfate) solution per 1000 gallons of acidified waste. Mix until it is completely dispersed.
2.Slowly with mild agitation, add cationic polymer at one gallon per 1000 gallons of wastewater or according to the manufacturer's recommendations.
3.Allow the mixture to set undisturbed for 24 to 48 hours until there is clear separation with a top floating layer of organic and oil contaminants and a bottom hazy water layer.

Phase C: Disposal

1. Decant off the top layer by skimming, vacuuming or overflowing. Dispose of this material according to local regulations.
2. The clear water layer can be recycled or be disposed of as plant effluent.