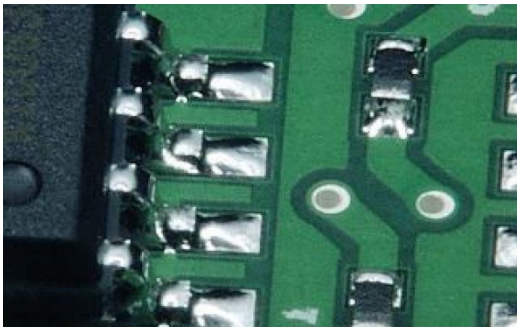
KYZEN
Where Science and Care Converge.

TECHNICAL SUPPLEMENT

AQUANOX® A4625B

Aqueous Cleaning Solution

AQUANOX A4625B is an innovative aqueous chemistry specifically designed to remove all types of electronic flux residues, including the latest Pb-free alloys, in batch washers.



- **Proven Global Install Base**
- **Aerospace and High-Reliability Approved**
- **Excellent Material Compatibility**
- **Brilliant Solder Joints**
- **Effective on Todays Modern Flux Residues**
- **Low VOC**

TABLE OF CONTENTS

Appendix

PRODUCT DESCRIPTION

AQUANOX A4625B is a highly dispersive cleaning agent engineered to remove lead-free no-clean flux residues and is effective on greater than 90% of the solder pastes in production today. A4625B is commonly used to clean rosin and no-clean flux residue types but will also effectively clean water soluble soils.

AQUANOX A4625B is designed for use in spray-in-air cleaning equipment. The operating concentration varies with the soil type. The operating concentration range for water soluble soils is 8-12%, 10-15% for rosin-based soils, and 13-18% for no-clean soils.

AQUANOX A4625B is a low foam cleaning agent that is commonly monitored based on the solvent / water ratio. Wash time is a function of the soil, component geometry and Z-axis gap. Lower Z-axis gaps under components typically require longer wash times.

AQUANOX A4625B solvency make-up is engineered with a mixture of oxygenated alcohol-ether compounds, which are partially soluble in water. The solvents were selected on their ability to dissolve rosin and resin structures. The solvents provide a unique hydrophobic (rosin/resin loving) and hydrophilic (water loving) balance. A4625B is formulated with high dispersive, moderate polarity, and moderate hydrogen bonding forces.

The concentrated AQUANOX A4625B contains no water or inorganic salts. The high level of solvency within the A4625B concentrate provides high dispersive values at the dilution concentration ranges. The solvent micro-droplets at operating wash temperatures ranging from 55-68°C / 130-155°F provide high affinity for non-polar resin and rosin structures.

AQUANOX A4625B contains low levels of a polar organic reactive solvent with one side of the molecule inducing the ion-dipole on non-polar resins and the other portion of the molecule providing dispersive forces. These unique properties provide affinity for both ionic and non-ionic solutes. Functional additives are added to reduce interactions on metallic alloys, anodized aluminum, and conversion coatings. The pH ranges from 9.5-10.5 dependent on the in use concentration.

CHEMICAL AND PHYSICAL PROPERTIES

This KYZEN product is environmentally responsible and operator safe, when handled in accordance with good industrial hygiene and safety practices.

Table 1 summarizes important chemical and physical properties of this product.

Table 1: Typical Chemical and Physical Properties

Parameter	100% Concentrate	5% Dilution	18% Dilution	Special Values
Clarity	Clear			
Color	Light Amber, darkens with age			
Odor	Mild			
Flash Point, °C / °F (TCC)	100°C / 212°F			
Boiling Point, °C / °F	170°C / 338°F			
Volatile Organic Compound (VOC) gm/L EPA Method 24	924.1			150 [1]
Vapor Pressure, VOC Components, mmHg at 20°C	0.05			
Chemical Oxygen Demand, (COD), mg/L (ppm)				229.4 [2]
pH	10.3 – 11.8	9.0 – 10.5		9.5 [3]
Specific Gravity	0.950 – 0.970			
Weight/gallon	8.0			
Refractive Index, ° BRIX	55 – 65			
MEQ to pH 8.3	0.5 – 1.5			
MEQ to pH 4.0	0.9 – 1.9			
Alkalinity Ratio	1 : 1.4			
Non-volatile Residue (NVR) %	2.1	0.11	0.38	

[1] A4625B has a VOC of 150g/L at 16.2% to be in compliance with the *2011 OTC Modeling Rule for Solvent Degreasing*.

[2] Measured at 0.01% dilution.

[3] Measured at 10 g/L dilution.

PRODUCT USE DIRECTIONS

In general, wash concentration, wash temperature, spray impingement energy, wash time and rinsing are five key elements of process optimization. AQUANOX A4625B is designed to be used in spray-in-air cleaning machines. Wash concentration, wash temperature, spray impingement energy and wash time are four key factors to successful cleaning. KYZEN recommends the following process parameters for applications using A4625B:

1. **Wash Concentration:** For Pb-free no-clean and rosin based flux residues, a concentration range from 13-18% is recommended. For organic acid flux residues, a concentration range of >10% is commonly recommended. If the residues are badly charred, a higher concentration level may be needed.
2. **Wash Temperature**: For most Pb-free no-clean, rosin, and organic acid flux residues, a wash temperature range of 55-68°C / 130-155°F is sufficient. The defoaming properties of AQUANOX A4625B are best when operating at 68°C / 130-155°F wash temperatures.
3. **Spray Impingement**: Spray energy is needed to move the cleaning agent under Z-axis components (low stand-off). Fluid dynamics improve cleaning and shorten cycle time. Spray pressures in the range of 50-100 psi using tight fan and coherent spray jets work well.
4. **Wash Time**: Determining the optimum wash time is a function of the residue properties, component density and geometry, Z-axis gap height and cleaning equipment. Planarized inline cleaning machine designs provide high fluid flow and energy. Conveyor belt speeds in the range of 0.5-2.0 FPM work well. Batch spray-in-air designs provide high flow at lower pressures. Wash time in the range of 10-15 minutes is adequate for most applications.

AQUANOX A4625B works best when the cleaning agent is added to the wash tank using a dosing injection system such as the KYZEN Chemtroller. When the wash tank calls for water make-up, the dosing systems add A4625B at the desired concentration levels. Alternatively, KYZEN's PCS Type II (process control system) automatically controls both cleaning agent and water make-up to the wash tank. Maintaining the concentration within the lower and upper set points reduces variability. KYZEN recommends that the wash concentration be monitored using KYZEN's Chem Control Type II split monitoring method (see section on Bath Maintenance Methods).

Appropriate bath maintenance methods specific to this product are detailed in latter sections of this supplement.

COMPATIBILITY INFORMATION- SUBSTRATES AND EQUIPMENT

All chemicals have the potential to adversely affect substrates and process equipment. As such, the effects of short-term exposure for substrates common to parts and assemblies and the effects of long-term exposure for materials of equipment construction must be considered. *Tables 2, 3 and 4* summarize known compatibility recommendations regarding the use of this product with specific substrates. These compatibility recommendations are based on internet research of A4625B's major formulation materials and internal KYZEN testing on the product as a whole of commonly available materials. Elastomers and plastics can vary greatly in quality. Metals, elastomers and plastics can vary greatly in quality. For the most accurate results on long-term exposure of your materials, it is advised to perform additional testing.

Table 2: Plastics and Elastomers

Brand Name	Generic Description	A4625B
DelrinTM	Acetal	A
Acrylic	Acrylic	D
Nylon 6/6	Polyamide	A
Lexan™	Polycarbonate resin	D
ABS Plastic	Acrylonitrile butadiene styrene	D
PEEK	Polyetherether Ketone	A
PVC	Polyvinyl Co-polymer	B
Natural Rubber	Black rubber	C
NORYL®	PPO™ resin and polystyrene	E
Neoprene	Polychloroprene	C
PPS (Ryton®)	Polyphenylene sulfide	E
PTFE (TeflonTM)	Polytetrafluoroethylene	A
Kalrez® 4079	ASTM D395B: FFKM (FFPM)	A
Kynar™	Polyvinyl fluoride	E
Aflas	Tetrafluoroethylene and Propylene	E
Tefzel™	Ethylene/tetrafluoroethylene copolymer	E
Polypropylene	Polypropylene	A
Hypalon®	Chlorosulfonated Polyethylene (CSPE)	E
Chemraz®	Perfluoroelastomer (FFKM)	A
AlathonTM	High density polyethylene	A
Viton A or B	Fluoroelastomer	D
Low density polyethylene	Polyethylene	A
Ultem	Polyether imide	A
Silicone Rubber	Silicone Rubber	A
CPVC	Chlorinated Polyvinyl Chloride	C
Buna-S	Styrene Butadiene	D
Buna-N	Styrene Nitrile Copolymer	D
Kel-F® / Neoflon®	PolyChloroTriFluoEthylene (PCTFE)	E
EPDM	Ethylene Propylene Diene Monomers	B

COMPATIBILITY INFORMATION- SUBSTRATES AND EQUIPMENT

Table 3: Metals and Alloys	
Substrate	**A4625B**
2024 Aluminum- Bare	C
2024 Aluminum- Alclad	B[3]
2024 Aluminum- Anodized	B[3]
Black Anodized Aluminum	B[3]
3003, 6061 and 7075 Aluminum	B[3]
7075 Aluminum- Alclad	E
Silver	A
Gold	A
Copper	A
Zinc	E
1018 Steel	A
304 and 316 Stainless Steel	A
Titanium	A
Steel, Galvanized	A
Tin-Lead Based Alloys	A[3]
Tin-Copper Based Alloys	A
Tin-Silver-Copper Based Alloys	A
Bismuth-Tin Based Alloys	A

Ratings - Chemical Effect - 168 Hours

A - Excellent
B - Good: Minor Effect, slight corrosion, or discoloration.
C - Fair: Moderate Effect, not recommended for continuous use. Softening or loss of strength, and swelling may occur.
D - Severe Effect: Not recommended for any use.
E – Test / Information not available.

Explanation of Footnotes

1-Satisfactory to 72^{O}F (22^{O}C)

2-Satisfactory to 120^{O}F (48^{O}C)

3-Repeated wash exposure beyond a typical process cycle time can lead to discoloration or etching of the surface. KYZEN Booster 20 is recommended to dose sump side to minimize any reaction.

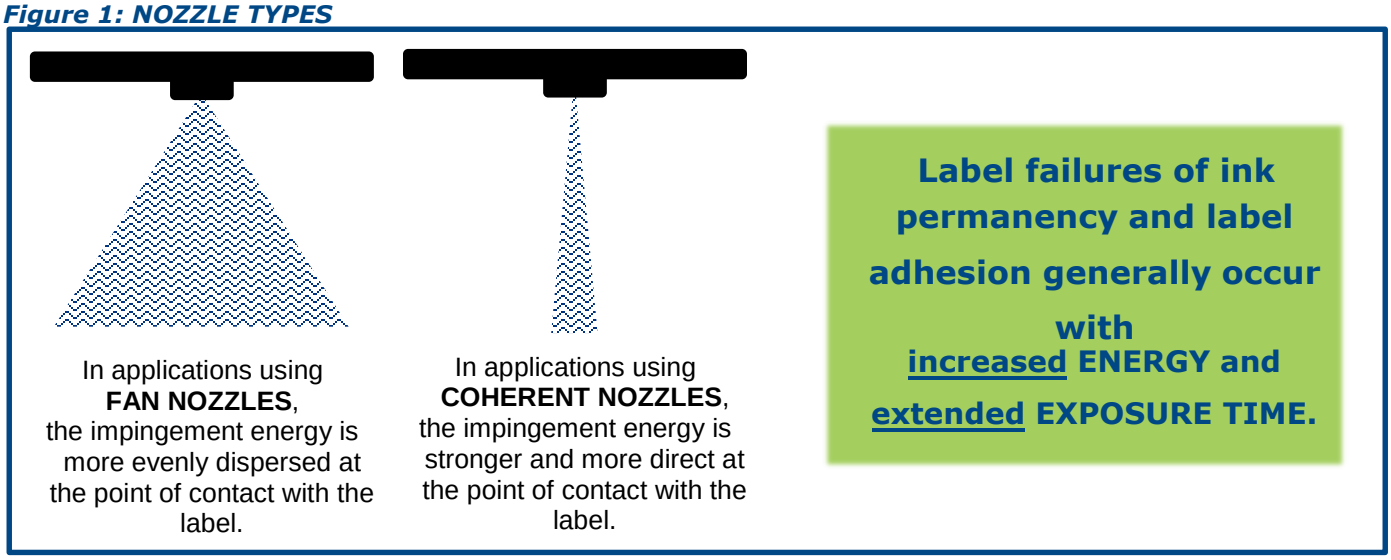
Table 4: Equipment	
When considering long-term exposure for materials of equipment construction, the following materials are generally compatible with chemistries used for inline and batch cleaning systems: *(listed in order of resilience)*	
Type	**Compatibility**
EXHAUST	*Stainless Steel, Polypropylene, PVC**
PUMP SEALS, O-RINGS, GASKETS	*Preferred: Teflon, Kalrez® 4079, Note: VITON is not recommended.*
PLUMBING LINES	*Stainless steel or Polypropylene (machine pip*ing). *PP (drain piping) Note: CPVC is not recommended.*
CURTAINS	*Polypropylene or Reinforced Silicone (red)*
WINDOW / DOOR SEALS	*Silicone Rubber*
RTV	*Dow Corning 732 or similar high grade*

* Suitable for exhaust system due to high dilution ration with water.

COMPATIBILITY INFORMATION- LABELS

KYZEN extensively studies barcode label compatibility with key KYZEN products to assist customers in selecting an appropriate label stock for their application. Additionally, these studies allow KYZEN to determine the effects that certain process parameters can have on ink permanency and label adhesion in general. For example, applications using coherent spray nozzles for extended periods of time are more likely to abrade the label ink and/or shear the label off completely (*Figure 1*).

Figure 1: NOZZLE TYPES



In each barcode label compatibility study, KYZEN uses standard evaluation parameters for wash concentration, temperature, belt speed and nozzle type. Each label is exposed to four wash passes though spray-in-air cleaning machines to determine ink permanency and label adhesion with reflow and non-reflow conditions. *Table 5* summarizes the scoring matrix used in all label compatibility studies.

Statistical evaluation of individual test parameters contributes to a final recommendation based on overall performance. In order to qualify for recommendation, labels must demonstrate appropriate ink permanency (score <3) and label adhesion (score <2) for a minimum of three wash passes.

Table 5: Label Study Scoring Matrix

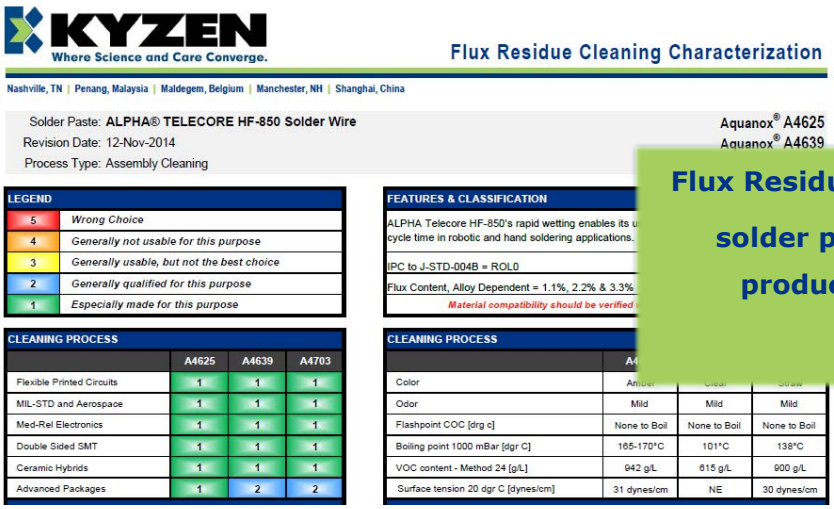
SCORE	INK ADHERENCE	LABEL ADHERENCE
1	No Effect to Ink	Full Adherence
2	Slight Dulling	Peeling at the edges
3	Moderate Dulling	>25% peeling
4	Heavy Dulling	>50% peeling
5	No Ink Remaining	>75% peeling
6	Not Observed	Not Observed (complete shearing)

Please reference the latest revision of the *KYZEN Label Compatibility Supplement* for a listing of labels which qualify for recommendation. KYZEN continues to test a large number of label types from all major barcode label manufacturers and revises this publication on a regular basis. Additionally, your KYZEN Representative is available to assist you in selecting the most appropriate label stock for your particular application. To request a copy of the *KYZEN Label Compatibility Supplement*, please contact your KYZEN Representative.

SOILS REMOVED AND PROCESS LIMITS

An important data point when selecting a cleaning agent is its ability to match up and remove the soil in question. Miniaturization and lead-free soldering are two emerging trends in electronic assembly that have a significant impact on cleaning. Flux compositions must withstand higher soldering temperatures. As components decrease in size, less flux is available to remove oxides, to wet joining alloys and to improve solderability yields. To withstand higher reflow temperatures, flux compositions use higher molecular weight synthetic resins that form a harder resin shell, post soldering.

KYZEN's solubility testing program partners with all major solder paste and flux companies to provide an accurate and predictive method for determining a cleaning agent's effectiveness on a subset of soils.



KYZEN
Where Science and Care Converge.

Flux Residue Cleaning Characterization

Nashville, TN | Penang, Malaysia | Maldegem, Belgium | Manchester, NH | Shanghai, China

Solder Paste: ALPHA® TELECORE HF-850 Solder Wire
Revision Date: 12-Nov-2014
Process Type: Assembly Cleaning

Aquanox® A4625
Aquanox® A4639

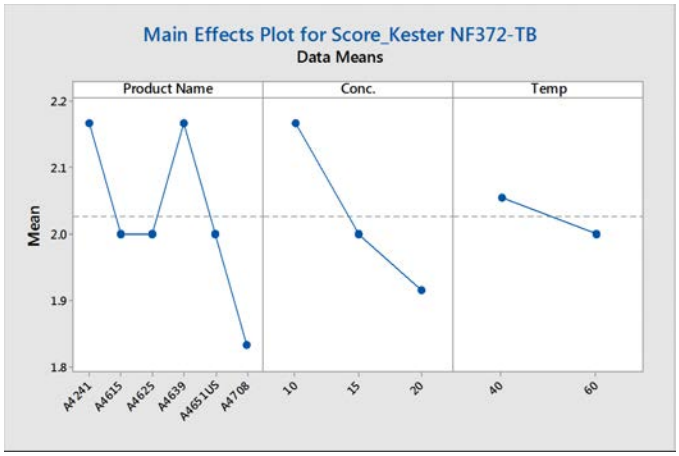
LEGEND	
5	Wrong Choice
4	Generally not usable for this purpose
3	Generally usable, but not the best choice
2	Generally qualified for this purpose
1	Especially made for this purpose

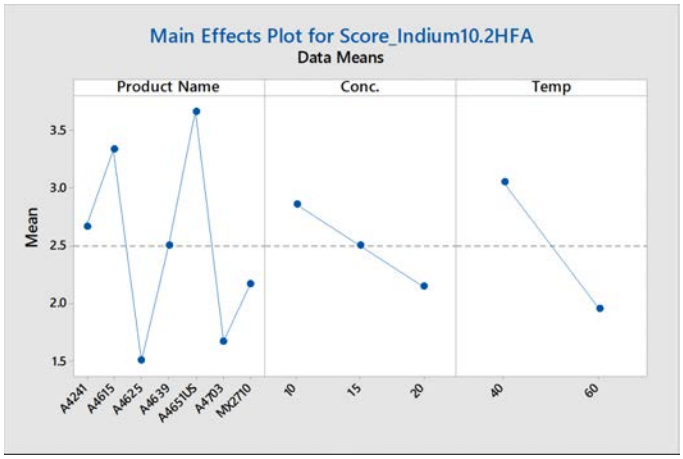
FEATURES & CLASSIFICATION
ALPHA Telecore HF-850's rapid wetting enables its u… cycle time in robotic and hand soldering applications.
IPC to J-STD-004B = ROL0
Flux Content, Alloy Dependent = 1.1%, 2.2% & 3.3%
Material compatibility should be verified …

CLEANING PROCESS	A4625	A4639	A4703
Flexible Printed Circuits	1	1	1
MIL-STD and Aerospace	1	1	1
Med-Rel Electronics	1	1	1
Double Sided SMT	1	1	1
Ceramic Hybrids	1	1	1
Advanced Packages	1	2	2

CLEANING PROCESS	A…		
Color	Amber	Clear	Straw
Odor	Mild	Mild	Mild
Flashpoint COC [drg c]	None to Boil	None to Boil	None to Boil
Boiling point 1000 mBar [dgr C]	165-170°C	101°C	138°C
VOC content - Method 24 [g/L]	942 g/L	615 g/L	900 g/L
Surface tension 20 dgr C [dynes/cm]	31 dynes/cm	NE	30 dynes/cm

Flux Residue Cleaning Characterizations for many solder pastes and fluxes with select KYZEN products are available from your KYZEN Representative.





It is important to recognize that flux materials evaluated by KYZEN have been successfully cleaned only after being applied to the test substrate and processed using an appropriate temperature profile. Tests have shown that excessive heat exposure (peak temperature or extended soak / post-bake / multiple reflow cycle) can render an otherwise easy to remove residue, virtually un-cleanable. Consideration should also be given to the reflow process parameters when establishing or optimizing your cleaning process. Fluid temperature, spray pressure, nozzle type and impingement angle also have a significant impact on the overall cleaning rate. KYZEN Technical Support can assist in evaluating your equipment so as to determine the optimal process parameters for your specific application.

BATH MAINTENANCE AND MONITORING

When a KYZEN bath solution is properly maintained, prolonged bath life can be expected. The results of a bath life study conducted with this product confirm the extended bath life experienced by many KYZEN users. Expended process baths can be a significant and expensive waste stream for facilities. Numerous factors can degrade bath performance, including depletion or imbalance of bath chemistries and buildup of contaminants from drag-in or other sources. Process bath life can be extended through simple process control and contaminant reduction techniques, resulting in significant waste reductions and cost savings.

KYZEN recommends KYZEN TYPE II METHOD to monitor bath concentration.

KYZEN recommends NON-VOLATILE RESIDUE (NVR) to monitor bath life.

There are two NVR methods available; The legacy, oven dry testing method as shown in the Application Note on Page 16 or the newest test method that uses the Mettler-Toledo HE53 Analyzer described on Page 17.

Contact KYZEN Technical Support if you have any questions on wash bath monitoring or bath life testing.

NOTES AND COMMENTS

- Recommended procedures for bath life maintenance and monitoring are appended to this supplement.
- KYZEN Chem Control Kit Type II / PN# FF16910
- KYZEN's **Bath Profile Kit** / PN# F00206 can help determine NVR by analyzing wash bath samples collected over the life of a SUMP charge. Please contact your KYZEN Representative for more information.
- A Single Sample Wash Bath Analysis / PN# F00212 is also available to test physical properties and NVR.
- There are two NVR methods available; The legacy, oven dry testing method as shown in the Application Note on Page 16 or the newest test method that uses the Mettler-Toledo HE53 Analyzer described on Page 17.
- Contact KYZEN Technical Support if you have any questions on wash bath monitoring or bath life testing.
- The Mettler-Toledo HE53 Moisture Balance Analyzer and its supporting items can be purchased direct from Mettler-Toledo or an authorized distributor.

SHELF-LIFE, PRODUCT COLOR, STORAGE AND HANDLING

SHELF-LIFE

Retain samples are taken from every product batch and kept for a minimum of five years. Additionally, randomly selected retain samples of key products are maintained indefinitely. KYZEN determined the shelf life of our aqueous and non-aqueous products by closely monitoring the quality of product samples stored in these retain samples over time. The results of this study provided valuable information on the stability of our products over time.

With few exceptions*, KYZEN products are acceptable for use up to FIVE (5) years, when packaged in sealed containers of five gallons or greater.

Conversely, it is more difficult to predict the long-term integrity of a product in containers holding less than five gallons, as well as unsealed containers of any size. Smaller product containers and unsealed containers are more susceptible to contamination and evaporation, which preclude extended expiration dates. Capping opened containers when not in use can minimize contamination and evaporation. Exceptions to shelf-live are clearly documented on product-specific Certificates of Compliance.

PRODUCT COLOR

For all KYZEN products, *color does not indicate product quality*; therefore, color is not used as a quality control parameter or specification for final product evaluation. KYZEN products are made from a blend of raw materials, some of which are organic solvents derived from agricultural materials. After 20 years of collecting data on KYZEN products containing these raw materials, studies have shown that these materials can contribute to color variances in concentrated and diluted product, as well as slight color variations over time. These same studies confirm that while *color changes may occur, product quality is unaffected*. To assure product quality, KYZEN evaluates each lot of these raw materials to verify integrity before blending.

STORAGE

Store this product in the original container at temperatures between 5-50°C / 41-122°F indoors, or out of direct sunlight. Most products have a freezing point much lower than water and a very high boiling point; therefore, most KYZEN products do not require any special handling to address temperature changes. KYZEN conducts freeze/ thaw studies on all products to determine if product quality is affected by such factors and completes further testing if necessary. Following best practices always use the oldest inventory first and keep your stock rotating. *Exceptions to storage temperature requirements are clearly documented on product-specific Certificates of Compliance.*

HANDLING

This product is environmentally responsible and operator safe, when handled in accordance with good industrial hygiene and safety practices. Refer to the Safety Data Sheet (SDS) regarding safe handling practices with this product. It is always a good practice to wear safety glasses or goggles and nitrile gloves whenever handling AQUANOX.

ENVIRONMENTAL CONSIDERATIONS

KYZEN products are generally compatible with common primary and secondary waste treatment processes; however, the addition of soils removed during the cleaning process can significantly escalate environmental concerns. These environmental considerations vary widely depending on the cleaning machine and the operating parameters of your particular cleaning process. As such, the selection of the cleaning agent must incorporate the inherent impact on air emissions, water discharges and waste generation from your facility. Each of these three environmental mediums may require a permit depending on the usage rate and existence of other air emissions, water discharges and waste generation at your facility.

What are KYZEN's responsibilities for proper disposal?

- The *United States OSHA Hazard Communication Standard* requires suppliers to provide a GHS compliant Safety Data Sheet (SDS) for all products.
- KYZEN is responsible for providing known information on toxicity testing, health hazards, waste disposal, safe work practices, protective equipment, material reactivity and flammability, etc.
- Note: All information needed to properly classify a product for disposal, wastewater treatment or discharge into a wastewater stream can be found in the product SDS, specifically in Sections Three (3), Nine (9), Twelve (12) and Thirteen (13). Therefore, KYZEN does not disclose proprietary, non-hazardous product constituents for this purpose.

What are the end user's responsibilities for proper disposal?

- It is the user's responsibility to seek guidance and rule interpretation from appropriate authorities before applying for any required permits. This is usually accomplished by providing a copy of the product SDS, supplied by KYZEN, to local authorities. Because local regulations are often more stringent than federal regulations, it is imperative for the user to consult with local regulatory agencies before starting a waste water discharge, or introducing new chemicals or chemical processes to an existing permitted waste water discharge stream.
- The three regulatory agencies that a user must review are federal (national), state (regional), and local. Each company must meet the minimum federal standards. The state regulations may be the same or even more restrictive than the federal. Finally, the local community's regulations will be at least as restrictive as state regulations.
- The discharge of any wastewater stream, both by total flow and by chemical make-up must conform to national, regional and local regulations in all nations. Such regulations vary from very strict limits with little derogation to relatively flexible conditions. Many nations, particularly in Europe, have very strict legal requirements dictated on a national scale, covering many aspects of waste water quality. Other nations have less comprehensive regulations, covering only the more important considerations. Local authorities may offer derogations to national legislation if the local treatment plant is able to handle the otherwise out-of-tolerance waste.

The end user is ultimately responsible for compliance with all applicable regulations.

KYZEN is the industry leading provider of environmentally friendly cleaning chemistries and processes and contributes this knowledge and experience to a number of industry publications. For more detailed information on environmental considerations, please reference Section Nine (9) of the *IPC-CH-65B Guidelines for Cleaning of Printed Boards and Assemblies, July 2011.*

APPENDIX

KYZEN Type II Method Procedures

NVR Testing Procedures

KYZEN Booster 20 Clarification of Use

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

KYZEN Technical Support

1-800-845-5524

www.KYZEN.com

Materials furnished under all KYZEN orders are manufactured in accordance with KYZEN Corporation specifications. KYZEN maintains documentation of conformance to these specifications, which is available for review upon request. All raw materials used in KYZEN products are obtained from suppliers on KYZEN's Approved Vendor List (AVL), pursuant to ISO certified standard operating procedures for raw material quality control.

KYZEN
Where Science and Care Converge.

APPLICATION NOTE

KYZEN TYPE II TEST KIT PROCEDURE
AQUANOX® A4625 | AQUANOX® A4625B

USE PERSONAL PROTECTION EQUIPMENT (PPE) | WASH SOLUTION IS HOT | TYPE II REAGENT POWDER MAY IRRITATE SKIN, EYES AND/OR NOSE | AVOID DIRECT CONTACT

STEP 1: Add one scoop of KYZEN Type II Reagent to a clean KYZEN Flask.

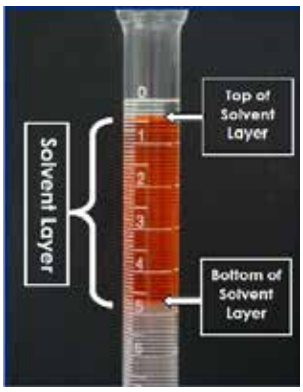
STEP 2: Allow wash pump/process mixer to run for five (5) minutes for routine measurement. A new bath may need to run for up to sixty (60) minutes.

STEP 3: From the sample port, pull a 500mL sample to purge the sample line. Repeat if necessary to completely purge the sample line.

STEP 4: Immediately fill the KYZEN Flask with bath solution directly from the sample port. *Do not fill the KYZEN Flask above the "0" line.* Cork the flask with a standard taper size 13 stopper. Holding the stopper in place, rotate the flask 3 to 4 times to dissolve reagent powder.

STEP 5: Immediately remove stopper. Wait five (5) to ten (10) minutes for the sample to separate (split) in the flask. Sample is complete when large bubbles completely rise to the surface.

- Some small bubbles may cling to the glass or the solution may have a pink tint.
- Total volume may decrease as the solution cools in the flask, but will not affect split calculation.



STEP 6: View the flask at eye-level and determine the volume of the top and bottom of the solvent layer in milliliters (mL). Subtract the top reading from the bottom reading to determine the total volume of the solvent layer.

EXAMPLE CALCULATION

Bottom Reading **4.8mL**
Top Reading **- 0.5mL**
Total Split Volume **= 4.3 mL**

= 16% Bath Concentration

CONVERSION CHART ON REVERSE SIDE

KYZEN
Where Science and Care Converge.

APPLICATION NOTE

CONCENTRATION CHART

Use the calculated split volume (mL) to determine concentration (%).

mL	Concentration (%)	mL	Concentration (%)	mL	Concentration (%)
0.3	**5.0**	2.8	**13.4**	5.3	**17.7**
0.4	**5.5**	2.9	**13.6**	5.4	**17.9**
0.5	**6.5**	3.0	**13.8**	5.5	**18.0**
0.6	**7.5**	3.1	**14.0**	5.6	**18.2**
0.7	**8.3**	3.2	**14.1**	5.7	**18.4**
0.8	**8.8**	3.3	**14.3**	5.8	**18.5**
0.9	**9.3**	3.4	**14.5**	5.9	**18.7**
1.0	**9.9**	3.5	**14.6**	6.0	**18.9**
1.1	**10.1**	3.6	**14.8**	6.1	**19.1**
1.2	**10.3**	3.7	**15.0**	6.2	**19.3**
1.3	**10.5**	3.8	**15.2**	6.3	**19.5**
1.4	**10.8**	3.9	**15.3**	6.4	**19.7**
1.5	**11.0**	4.0	**15.5**	6.5	**19.8**
1.6	**11.2**	4.1	**15.7**	6.6	**19.9**
1.7	**11.4**	4.2	**15.9**	6.7	**20.2**
1.8	**11.6**	4.3	**16.0**	6.8	**20.6**
1.9	**11.8**	4.4	**16.2**	6.9	**21.0**
2.0	**12.0**	4.5	**16.4**	7.0	**21.5**
2.1	**12.2**	4.6	**16.5**	7.1	**21.9**
2.2	**12.4**	4.7	**16.7**	7.2	**22.4**
2.3	**12.6**	4.8	**16.9**	7.3	**22.9**
2.4	**12.7**	4.9	**17.0**	7.4	**23.5**
2.5	**12.9**	5.0	**17.2**	7.5	**24.0**
2.6	**13.1**	5.1	**17.4**	7.6	**24.5**
2.7	**13.3**	5.2	**17.5**	7.7	**24.9**

ADDITIONAL INFORMATION

- **Reference the KYZEN Type II Reagent SDS for complete safety and performance considerations.**
- **A well-mixed bath solution is required for accurate measurement.**
- **If no sample port is available, pull solution from spray nozzles. Contact your KYZEN Representative to purchase a Sample Port Kit.**
- **Failure to clean and dry the KYZEN Flask before use can decrease the accuracy of results.**
- **Using extra powder will not cause the solution to split more quickly and excessive amounts of powder may cause inaccurate measurements.**
- **Do not shake flask after separation has occurred. This will cause a long delay for the solution to split again.**
- **The initial calibration of the KYZEN Flask is certified by the flask manufacturer and does NOT require further calibration. Please contact your KYZEN Representative should you require a Certificate of Compliance to further validate calibration certification.**

KYZEN
Where Science and Care Converge.

APPLICATION NOTE

Non-Volatile Residue (NVR) Procedure

KYZEN recommends Non-Volatile Residue (NVR) testing for soil contaminant as a tool for bath life monitoring of certain KYZEN products. A sample of a used wash bath is placed into an aluminum weighing dish and dried at 105°C / 221°F for a minimum of four hours. The residue that remains in the dish is allowed to cool in a desiccator and is re-weighed. The weight of the bath residue is then compared to the residue of a virgin sample of the cleaning product at the same concentration and dried in the same manner.

APPARATUS

Forced Air Oven set at 105°C / 221°F Aluminum weighing dish
(See Tip Number 1 'Tips for Successful Use' at the end of the procedure) Analytical Balance
Desiccator

REAGENTS AND MATERIALS

Transfer pipettes
Virgin sample of the product to be tested

HAZARDS AND PRECAUTIONS

For specific safety information, reference the Material Safety Data Sheet for the product you are testing.

STATISTICAL CONTROL

Samples should be analyzed in triplicate. The average of the three analyses is reported.

CALCULATIONS

%NVR = [(c-a)/b] x 100

a = Initial weight of the aluminum dish, b = Initial weight of the sample, c = Weight of weighing dish and residue after heating

% NVR resulting from soil contamination = %NVR of sample - % NVR of virgin sample

PREPARATION

A. Set the forced air oven to 105°C / 221°F for a minimum of two hours to allow the temperature to stabilize.
B. Place the aluminum weighing dishes to be used into the forced air oven at 105°C / 221°F for a minimum of one hour to dry.
C. Place the dried weighing dishes into a desiccator and allow to cool.

PROCEDURE

A. Place a cool weighing dish on the analytical balance. Record the weight (*this is weight 'a'*).
B. Tare the balance and add approximately 10 grams of sample to the weighing dish [2]. Record the weight of the sample to the nearest 0.0001g (*weight 'b'*).
C. Place the dish in the oven at 105°C / 221°F for a minimum of four hours [3]. Remove the dish to a desiccator and allow to cool.
D. Weigh the cooled dish on the analytical balance and record the weight to the nearest 0.0001g (*weight 'c'*).
E. Repeat Procedure steps A through D a total of three times for both the sample and the virgin product.

TIPS FOR SUCCESSFUL USE

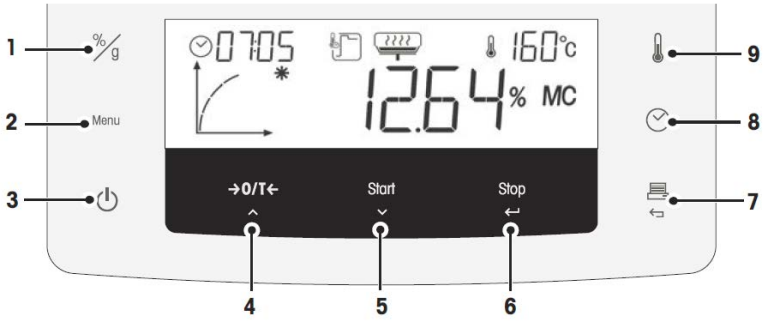
1. A beaker or ceramic dish can be used in place of the aluminum pan; however, these must be compatible with the cleaning product and able to withstand the required oven temperatures.
2. The amount of sample used for testing is not critical, but must be weighed accurately.
3. A dirtier bath will require longer than 4 hours to completely dry. To ensure that your sample is completely dry, return the sample to the oven for 30 minutes after taking the first weight. Cool in the desiccator and reweigh. Continue this until there is less than 5% change in the weight.

APPLICATION NOTE

NVR Measurement by HE53 Moisture Analyzer Method
KYZEN® AQUEOUS PRODUCTS

This Application Note provides instructions on how to use the Mettler Toledo HE53 Moisture Analyzer to measure the Non-Volatile Residue (NVR) of KYZEN® Aqueous Products.

1. Follow instructions in Section 4 of the *HE53 Operating Instructions* to appropriately setup the moisture analyzer and prepare for measurement.
2. Program the moisture analyzer to the settings below to begin the measurement procedure.



   a. Press Menu [2]. Use the Up [4] and Down [5] arrows to select **PROG** and press Stop [6]. Again, using either of the arrows, select **RAPID** and press Stop [6]. This selects the RAPID DRYING MODE.
   b. Press Thermometer [9]. Adjust temperature, using arrows, to **120^{0}C** and press Stop [6].
   c. Press Clock [8]. Use arrows to select **TIMED** and press Stop [6]. Use arrows to adjust to **1 hour** then press Stop [6].
   d. Press %/g [1]. Use arrows to select **%DC** and press Stop [6]. The results will be displayed in % DRY CONTENT.
3. Place the empty sample pan in the sample pan handler and place the sample pan handler in the draft shield. Ensure that the tongue of the sample pan handler lies in the slot of the draft shield.
4. Place the provided Glass Fiber Pad in the sample pan. *Note: the pads are designed for single use and a new pad should be used for each test in ensure accuracy of the test.*
5. Close the heating module and press O/T [4] to tare.
6. Open the heating module cover and add approximately 2 grams of sample directly to the Glass Fiber Pad in the sample pan.
7. Close the heating module and press Start [5]. The **%NVR** results will display on the screen when finished.

Condensation may collect and pool in the chamber- this is normal. Follow instructions in Section 9.1 of the HE53 Operating Instructions to clean and thoroughly dry equipment between each use.

KYZEN
Where Science and Care Converge.

TECHNICAL BRIEF

KYZEN® Booster 20 Clarification of Use

INTRODUCTION:

KYZEN® Booster 20 is a cost-effective sump-side additive that passivates the metal alloys while protecting solder joint appearance and increasing cleaning performance for those hard to clean applications.

SUBJECT:

Aqueous-Based cleaning agents when used in single chamber batch washers have shown to dull solder joints comprised of leaded (Sn63Pb37) alloys.

FORMATION MECHANISM:

Aqueous-Based cleaning agents are designed to be effective on the newer fluxes used for SAC305 and other lead-free alloy variants. On lead-free high tin alloys, dull solder joints are rarely seen at normal operating parameters.

KYZEN's AQUANOX series of products are highly effective on many other difficult to clean flux residue sets.

When washing flux from standard eutectic Sn/Pb solder, a solder joints dulling effect happens when the assembly is processed for long or multiple wash exposures. Aqueous-based cleaning agents contain mild alkaline builders that bind to the oxide layer (now Pb) present in the soldered/flux activated Sn/Pb solder joints, which renders this oxide matrix caused by the flux a little more soluble (able to dissolve). These cleaned up (by the flux) oxides are mostly tied up in the flux layer.
In addition, these proprietary materials are part of what makes aqueous based cleaning agents so effective.

Longer wash cycles required in a single chamber batch washer cause this dull solder joint appearance to occur due to longer wash exposure times.

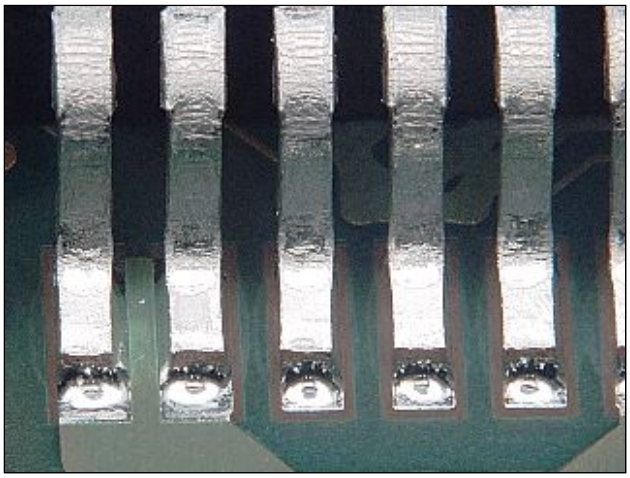
On many occasions, for example a mixed technology board will show a duller effect on the wave solder or selective solder side verses the SMT solder joints. This is due to the flux residue on wave solder joints having a thinner and easier to clean flux layer "protecting" the joint from the effects of the aqueous based cleaning agent.

To expand on this, the wave soldered joint may take 2-minutes of wash exposure to successfully clean, now the solder joint is not protected from further oxidation (etching) by its flux layer and must remain in the wash for the duration of the cycle needed to remove the SMT flux residue.

Progress forward in the batch washing process, the solder joints are now all clean of flux residue after x-minutes of heated wash time. Now the Sn/Pb solder joints must further endure more aqueous cleaning agent exposure (although at a reduced level) through the following rinse cycles until the rinse is clear, usually at rinse cycle #5 and above.

Note: Important that each rinse cycle should be only 25 to 30 seconds in duration.

The Booster 20 sump side inhibitor prevents this dulling from occurring by forming an extremely thin layer (around 1 nanometer or less) on the surface of the metal that is much more resistant to the aforementioned chemicals.



Dulling of the solder joints is rarely seen when using aqueous based cleaning agents with in-line conveyor washers as the wash stage exposure time is typically around 3-minutes. Then the PCB is quickly removed of the aqueous based cleaning agent starting with the Chem-iso stage then to a fresh water rinse stage.

Booster 20 is also beneficial for use when difficult flux residues are noted especially between the leads of fine pitch devices. Testing and customer testimonial has proved that Booster 20 aids in cleaning the most tenacious flux residues.

PREVENTION AND REMEDY MECHANISM:

Inhibition technology is already a part of the concentrate formula within many of KYZEN's Aquanox cleaning agents. Further compatibility or singular testing on this ingredient is typically not required.

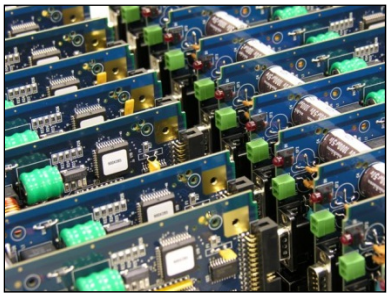
Inhibitors such as Booster 20 require a certain level of water in the formulation to achieve a stable composition. Since water has a dilutive effect, aqueous concentrated cleaning agents may not have enough water to incorporate the inhibitor into the formulation. Since the aqueous concentrated is diluted with 8-9 parts water, the addition of an inhibitor, such as Booster 20, adds additional corrosion resistance and is stable in the ready to use wash chemistry.

Once the aqueous cleaning agent is added at the proper proportion, there is a much higher proportion of water to easily accept the small sump-side add of Booster 20. This addition will enhance the protection capability during the wash cycle as described in chapter four in question #1.

Note: The typical dosing amount for most single chamber batch washers is 200ml of Booster 20 for the initial charge followed by 50ml on a weekly schedule.

Once the wash step is completed, the wash chemistry and inhibitors are easily rinsed with DI water.

A control marker to verify the specific amount of Booster 20 in the wash tank is not possible. Strict adherence to the dosing schedule and record keeping to the exact dosing amount is the recommended maintenance method.



It is important to note that a higher percent addition of Booster 20 from the recommendations outlined in the product data sheet will cause no harmful effects to the PCB's or washer.

Do not hesitate to contact your KYZEN representative if further questions arise.