NALCO Water
An Ecolab Company

Ingredients for Success in Thermal Processing Plants

INDUSTRY OVERVIEW

Key Business Drivers

- Food Safety
- Container Appearance
- Asset Protection
- Brand Protection
- Optimized Total Cost of Operations
- Sustainability

System Assurance Challenges – Common Failure Points

- Check container appearance – look for spots or corrosion on the seam/chime.
- Are corrosion coupons in place? Corrators?
- For hydrostatic sterilizers, are corrosion coupons in place on the chain (especially if mild steel)?
- Is corrosion inhibitor linked to flow in once-through systems? If not, over and under feed are present – 3D TRASAR™ Technology for Canning & Bottling will fix issue.

Nalco Water Contacts

Jacob Madden: Sr. Marketing Manager, Food

Matt Cashner: ITC, Thermal Processing

James Dillon: Metallurgist, Failure Analysis – Cooking/Cooling Equipment

Joan Lewis: Research Scientist, SEM – Container Failure Analysis

System Assurance Challenges (cont'd)

- Inspect cooking and cooling equipment for corrosion under the water line.
- For continuous cookers, is the customer experiencing issues with can jamming or damaged cans exiting the cooker?
- Obtain QA requirements for residual halogen and microbio counts – look for documentation that these standards are being met.
- Is the customer experiencing can swells post process due to spoilage?

Key Customer Prospects

- **QA Manager** – Focused on microbiological counts critical to food safety (specs can vary from customer to customer, but are in the general neighborhood of <500 CFU/mL); oversees residual halogen specifications and container quality
- **Maintenance Manager / Plant Engineer** – Focused on asset protection; oversees the cooking & cooling equipment
- **Production Manager** – Focused on making production schedules and scheduling maintenance downtime; essentially focused on keeping the line running and getting product out the door
- **General / Plant Manager** – Focused on high level priorities and TCO

TOOLS/RESOURCES

Value Proposition

- Improved container quality (protection from corrosion, spotting, and staining due to solids deposition)
- Reliable food safety (protection against post-process spoilage due to cooling water contamination)
- Asset protection of thermal processing units
- Real-time monitoring & automation via 3D TRASAR Technology (for bottling and canning, cooling, boiler, etc.)
- Comprehensive line of chemical products
- Industry expertise and training available
- Extensive analytical capabilities to help troubleshoot can or cooker-related issues
- CMV model

Documentation

- B-735 – Thermal Processing Solutions
- B-1581 – 3D TRASAR Technology for Canning & Bottling Processes
- B-1530 – Nalco Oxidant Controller
- CH-2196 – 3D TRASAR™ Technology for Canning & Bottling Helps Midwest Pet Food Cannery Save 1.6 Million Gallons of Water and Avoid Shutdown
- CH-917: 3D TRASAR™ Technology Increases Reliability KPIs at Midwestern Cannery

FOR INTERNAL USE ONLY

BEST PRACTICES

Water Chemistry

Thermal Processing Zone	Product Category	Best Practice Treatment
Pre-heating & Post-heating Zones with recirculating water loops	Corrosion & Scale Inhibitor	Molybdate/Nitrite (ex: 20428 Plus)
Recirculating Cooling Water Zones	Corrosion & Scale Inhibitor	Zn/Phos (ex: 3DT222)
Cold Zones	Oxidizing Biocide	ACTI-BROM™ Program
Final Cooling Water Zones or Post Process Rinsing	Spotting & Rinse Aids	NALSPERSE™ Program

- Must have good steam/condensate treatment to protect the cans and the steam dome from corrosion; neutralizing amine programs are typically used, and pH levels with neutralizing amine programs should be maintained between 6.5-8.5
  - High pH levels can cause de-tinning or discoloration of the cans
  - Low pH levels can cause corrosion of the equipment and cans
- All products used need to be G5 or G7 approved

Chemistry Control

- For Cold Zones: 3D TRASAR Technology for Canning & Bottling
  - Includes Nalco Oxidant sensor for halogen control
  - Alternatively could use Nalco Oxidant Controller independent of 3D TRASAR technology
- For Pre-heating & Post-heating Zones with recirculating water loops: 3D TRASAR Cooling Water Technology + heat exchanger unit (for cooling the sample)
- NCM on side stream of Hot Zones
- Good Quality Steam: CO_2 < 5 ppm | O_2 < 0.5 ppm | pH 7.0-8.0 | Conductivity < 15 µmhos
- Maximum of 25 ppm of total amines in the steam supply (Cyclohexylamine and Morpholine are limited to 10 ppm each; DEAE is limited to 15 ppm; total combined amine can't exceed 25 ppm)
- Free Residual Halogen (0.5-0.8 ppm preferred, decided by customer QA team)
- Microbio counts: <500 cfu/ml in exit of cooling (unless otherwise specified by customer QA team)
- High localized pH > 8.6 will cause de-tinning – Look for boiler carryover!

Corrosion Rate Norms

- Corrosion measurement – DO ALL!
  - NCM
  - Bypass coupon rack – every 90 days
  - Chain coupons if Hydrostatic – every 90 days

Corrosion Rate Guidelines						
Zone	Mild Steel		Copper		Aluminum	
	No Treatment	Proper Treatment	No Treatment	Proper Treatment	No Treatment	Proper Treatment
Hot	35 mpy	<8 mpy	3 mpy	< 1 mpy	3 mpy	< 1 mpy
Cold	10 mpy	<3 mpy	3 mpy	< 1 mpy	3 mpy	< 1 mpy

Equipment Inspections / Service Visit:

- Filler Rinse
- Final Rinse
- Chain Condition (Hydrostatic Sterilizer)
- Internals (Retort)
- Containers (Spots? Corrosion? Dents?)
- Blowers (Minimum residual of water left on can at labeler)

FOR INTERNAL USE ONLY

Product Selection Guide - Thermal Processing in Food Canning Facilities

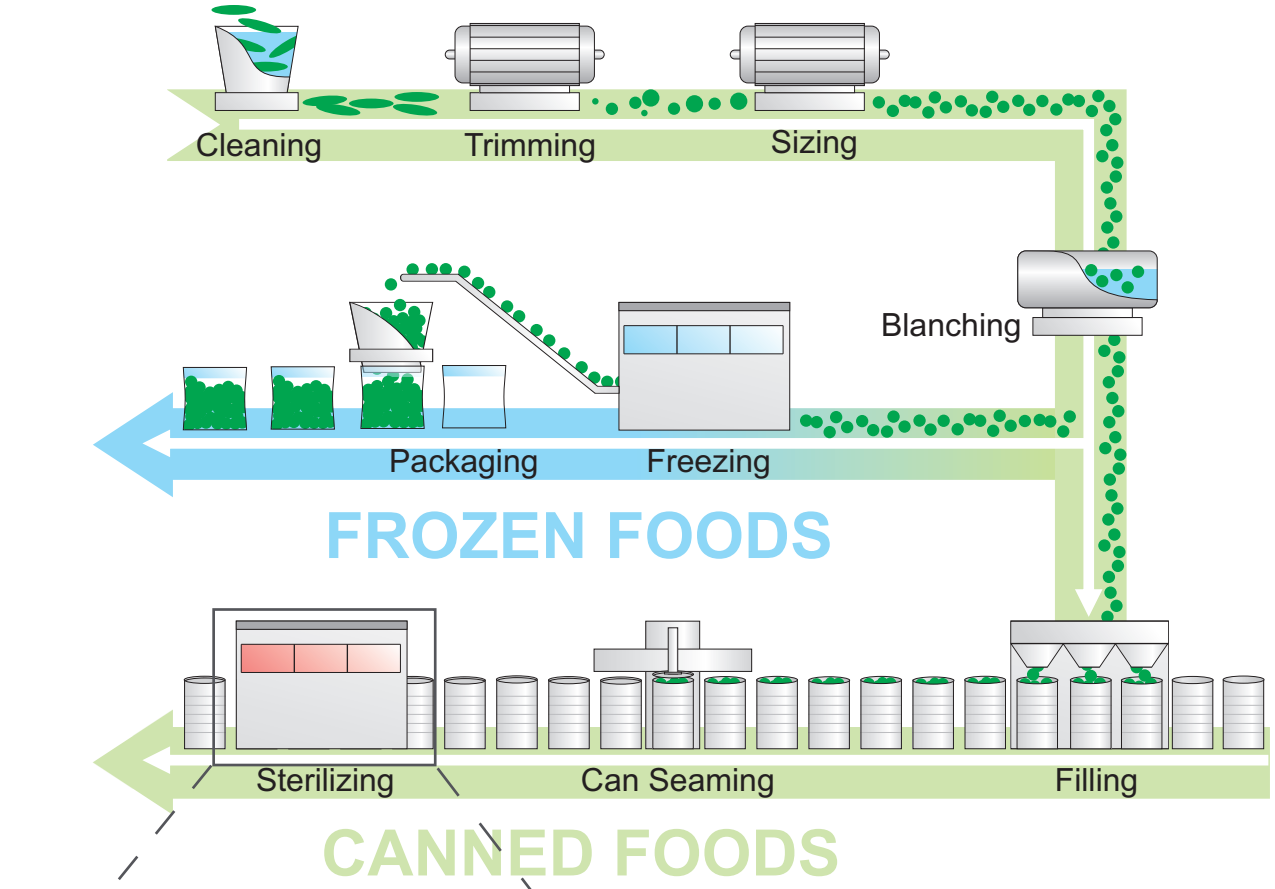
Category	Program	Product	Typical Dosage	Availability	US Regulatory	Canada Regulatory	Comments
Corrosion & Scale Inhibition	**Moybdate / Nitrite / TT / PMA**	**20428 Plus**	**250 ppm***	**US**	**G5, G7**	**---**	• For hydrostatic sterilizers only • For use in the infeed and discharge legs • Must not be fed in conjunction with an oxidizer
Corrosion & Scale Inhibition	THCP (Tagged High Charge Polymer) & BZT	3DT304	55 ppm*	US & Canada	G5, G10	see note^	• Copper corrosion inhibitor & dispersant • No mild steel protection • Replacement for 3DT104
Corrosion & Scale Inhibition	**Zinc / Orthophosphate / BZT / PBTC / THSP**	**3DT222**	**100 ppm***	**US & Canada**	**G5, G7**	**CFIA LOA, W2**	• For systems where Zn is allowed
Corrosion & Scale Inhibition	Stabilized PO_4 / PSO / THSP / Azole	3DT231	100 ppm*	US & Canada	G5, G7	CFIA LOG	• For systems where Zn is **not** allowed • Similar to 3DT461, but for water systems with greater scaling tendency (higher alkaline water)
Corrosion & Scale Inhibition	Stabilized PO_4 / PSO / THSP / Azole	3DT461	100 ppm*	US & Canada	G5	CFIA LOG	• For systems where Zn is **not** allowed • Similar to 3DT231, but geared towards water that is more corrosive
Corrosion Inhibition	Pyrophosphate	7396	15 ppm*	US & Canada	G2, G5, G7	CFIA LOA, W1	• Supplemental Corrosion Inhibitor • For systems where Zn is **not** allowed • Feed in conjunction with 3DT139 scale inhibitor
Corrosion Inhibition	Zinc / Orthophosphate	7390	25 ppm*	US & Canada	G2, G5	CFIA LOA, W1	• For systems where Zn is allowed • No yellow metal protection • For systems with once through cooling
Corrosion Inhibition	Zinc / Orthophosphate / PSO	3DT129	40 ppm*	US & Canada	G5, G7	CFIA LOA, W2	• For systems where Zn is allowed • No yellow metal protection
Corrosion Inhibition	Molybdate	7357	40 ppm*	US & Canada	G5	see note^	• Supplemental Corrosion Inhibitor
Corrosion Inhibition	BZT	3DT199	6 ppm*	US & Canada	G5, G7	none	• Supplemental Yellow Metal Corrosion Inhibitor
Scale Inhibition	PSO / THSP	3DT133	60 ppm*	US & Canada	G5, G7	CFIA LOG	• Supplemental Scale Inhibitor
Scale Inhibition	THSP	3DT120	30 ppm*	US & Canada	G5	CFIA LOG	• Supplemental Scale Inhibitor
Microbio Control	**Liquid Bromide + Biodisperant**	**ACTI-BROM™ 1338**	**Applied with Chlorine***	**US & Canada**	**G5, G7**	**CFIA LOA, W2**	• Requires activation with bleach
Microbio Control	**Liquid Bromide**	**ACTI-BROM™ 1318**	**Applied with Chlorine***	**US & Canada**	**G5, G7**	**CFIA LOA, W2**	• Requires activation with bleach
Microbio Control	Sodium Hypochlorite (12.5% bleach)	7341	1.5 to 2.5 ppm FRO*	US	G5, G7	---	• Can be fed alone or in conjunction with 1338 / 1318 • Feeding with 1338 / 1318 is recommended best practice
Microbio Control	Sodium Hypochlorite (12.5% bleach)	MMD-3404	1.5 to 2.5 ppm FRO*	Canada	---	CFIA LOA, W1	• Can be fed alone or in conjunction with 1338 / 1318 • Feeding with 1338 / 1318 is recommended best practice • Canadian replacement for 7341
Microbio Control	Solid BCDMH	7346 TAB	1.5 to 2.5 ppm FRO*	US & Canada	G5	CFIA LOA, W2	• Requires appropriate feeder
Microbio Control	Glutaraldehyde	H-550	See CPP	US & Canada	G5, G7	CFIA LOA, W2	• Non-oxidizing biocide for holdover • Longer holding time
Spotting & Rinse Aids	**Nonionic Surfactant**	**NALSPERSE™ 7308**	**10 ppm***	**US & Canada**	**G5, G7**	**CFIA LOA, W2**	• Oil & Grease Dispersant
Spotting & Rinse Aids	Anionic Surfactant	CC1090	60 ppm*	US & Canada	G5, G7	see note^	• Can Spotting Inhibitor
Offline Cleaning	**Hydrochloric Acid Cleaner**	**NALCLEAN™ 8940**	**pH target of 2.0-2.5***	**US**	**A3**	**---**	• Used to clean $CaCO_3$/$CaPO_4$ • Not for use with stainless steel • Contains corrosion inhibitor
Offline Cleaning	**Sulfuric Acid Cleaner**	**3155**	**pH target of 2.0-2.5***	**US**	**A3**	**---**	• Used to clean $CaCO_3$/$CaPO_4$ • For use with Stainless Steel
Offline Cleaning	**Citric Acid Cleaner w/ Phosphonate**	**3185**	**pH target of 2.0-2.5***	**US & Canada**	**A3**	**see note^**	• Used to clean Iron Oxide • Recommended for Stork Hydrostatic Units • Contains a little corrosion inhibitor
Offline Cleaning	Organic Acid Cleaner	3180	pH target of 2.0-2.5*	US	A3, G5	see note^	• Used to clean Iron Oxide
Offline Cleaning	**Alkaline Peroxide Cleaner**	**3400**	**2000 ppm as H_2O_2***	**US**	**A1**	**---**	• Used to clean Oil & Grease • Use in conjunction with 3770 for better effectiveness
Offline Cleaning	**Neutral Cleaner**	**3770**	**10-25 ppm***	**US & Canada**	**A1, G5**	**see note^**	• Used to clean Hydrocarbon based deposits • Use in conjunction with 3400
Passivation	**Sodium hexametaphosphate / TT / PMA**	**NALPREP™ IV**	**2700 ppm***	**US & Canada**	**G7**	**see note^**	• Off-line with **no** heat load • Check phosphate discharge limitations
Passivation	Sodium Nitrite / TT / HSP	NALPREP™ 8349	3200 ppm*	US	none	---	• Off-line with heat load • Contains **non-tagged** polymer; tagged version of 8349 is 3DT452
Passivation	Sodium Nitrite / TT / THSP	3DT452	3200 ppm*	US & Canada	none	none	• Off-line with heat load • Contains **tagged** polymer; non-tagged version of 3DT452 is 8349

Bold/Blue = Recommended program
CFIA = Canadian Food Inspection Agency
LOA = Letter of Acceptance (provided by CFIA)
LOG = Letter of Guarantee (provided by Nalco Water)

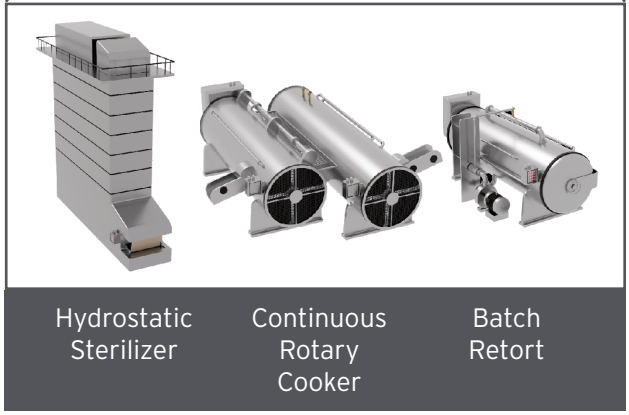
* See CPP for details
^ CFIA Letter of Guarantee (LOG) can be created by Nalco Water Regulatory upon request

FOR INTERNAL USE ONLY

Thermal Processing in Food Canning Facilities



Can Sterilization and Cooling Equipment



Boiler (Steam Supply)

Cooling

- For most cookers / retorts, sterilizer steam is direct injection. However, some batch retorts use a heat exchanger as opposed to direct steam injection.
- Cooling is typically either open recirculation or heat exchanger loop. Cooling may also be once-through, but this is becoming increasingly rare with the growing emphasis on water savings.

FOR INTERNAL USE ONLY