

Potable Water: Complete Solutions



World Class Technology & Shipboard Service Leads To The Highest Quality Potable Water

World-class technology and shipboard service from Drew Marine provides ship owners and operators with complete solutions for producing high-quality potable water. High-quality water is vital to maintain crew health and well-being. For your ship or fleet, Drew Marine supplies the products, technical expertise, training, and documentation necessary to develop potable water safety plans that conform to maritime regulations, while maintaining the lowest overall operating costs. Our global product supply capability in over 900 ports, and product quality stewardship assure continuity and standardized shipboard practices.

Drew Marine, as the premier water treatment supplier, has developed extensive water treatment expertise while serving the maritime industry for over 90 years. Our technical expertise covers



scale and corrosion inhibition, microbial control, foam prevention, waste treatment, and water testing and analysis. Our water applications expertise includes evaporative distillation, reverse osmosis, high-pressure and auxiliary boilers, heat exchangers, diesel engine cooling systems, chilled water systems, seawater cooling, potable water, and wastewater treatment.

Optimize Water Treatment Results

From incoming seawater to wastewater treatment, Drew Marine technical specialists support the implementation of integrated water treatment programs, troubleshoot when needed, supply training on board or shoreside, and make recommendations to ensure ships' crews take appropriate actions to optimize water treatment results.

Our shoreside technical management and laboratory staff manage analytical testing services, review shipboard and shoreside water analysis, and provide recommendations to restore or maintain systems within their prescribed control limits. With support from Drew Marine, your goals for healthy and compliant potable water are readily obtainable.



The Need For Potable Water Safety Planning

Harmful contaminants may be introduced to shipboard potable water from a variety of sources and causative factors as illustrated in Figure 1. The consequences of allowing potable water contamination are healthrelated (e.g., infectious disease, gastrointestinal illness, brain, liver, and kidney damage); corrosion of metals (e.g., premature equipment failure, staining of sinks, showers, plugging of pipes, and pumps); poor quality (e.g., malodors and bad taste from fouled systems) and scale/deposits (reduced production, increased energy consumption). Individually, or in combination, these contaminants may lead to a loss of a healthy water supply at sea. The contaminants of concern are listed in Table 1.

Table 1

CONTAMINANTS OF CONCERNMicrobial (Bacteria, Viruses, Parasites, Fungi)Scale Forming Minerals (Calcium And Magnesium)Corrosion Byproducts (Iron, Copper, Lead)pH Excursions (Causing Corrosion or Impaired Disinfection)Suspended SolidsInorganic Clays, Silicates, Colloids (Silt)Organics (Oil Or Natural Humic Substances)Dissolved SolidsElectrolytic Salts (Chlorides Or Sulfates) That Cause Corrosion



Potable Water Applications

Drew Marine participates in all phases of shipboard water safety planning and implementation. We focus our programs by application. The key applications in potable water for Drew Marine are evaporative distillation, reverse osmosis, potable water storage, filtration and distribution.

Our offerings in these applications include online chemical treatments to enhance the process, filtration systems, offline chemical treatments for cleaning and maintenance, water analysis tools for monitoring system conditions, and crew training and technical expertise.

The combination of product offerings and technical services form Drew Marine's Complete Solutions for Potable Water. This approach can be envisioned as an iterative process illustrated in Figure 2.



EVAPORATIVE DISTILLATION

Seawater is very high in dissolved solids (~35,000 ppm), and the concentration rises in residual brine as pure water is evaporated. Once the dissolved solids exceed their solubility, insulating deposits form on heat transfer surfaces reducing the capacity of the evaporator. Concentrations of suspended solids and other contaminants also increase in the concentrated brine, and can lead to foaming and carryover of contaminants into the produced water. Polymeric antiscalant formulations can be added to evaporator feedwater to prevent scale and deposit formations from the high dissolved solids. Antifoams incorporated in these formulations prevent foaming and the carryover of contaminants from the raw seawater. Thus, properly formulated antiscalants sustain the quantity of produced water, extend the time between cleanings, prolong the operational lifetime, and produce high-quality distillate. If production drops below 15% of design capacity, supplemental cleaning is required. Cleaning is best accomplished using properly formulated acidic cleaners and a reliable process for safe and effective cleaning operations.

Enhancing the Process

AMEROYAL and AMEROYAL CF (concentrated formula) evaporator treatments are used to prevent the accumulation of scale and to prevent foaming. Scale reduces heat transfer and the fresh water production rate. Foaming can lead to the carryover of contaminants into produced water. As needed, DREWPLUS ED-795 can be used as supplemental antifoam when system design or operating conditions cause excessive foaming



Cleaning and Maintenance

SAF-ACID is used when the system performance drops below 15% of design capacity. SAF-ACID has a built in color indicator of solution strength. The color indicator aids in determining whether additional SAF-ACID is required. After cleaning and flushing, GC is used to neutralize any remaining SAF-ACID.

Monitoring

The Conductivity Meter Kit Complete or the HP Chloride Test Kit can measure conductivity or chloride concentrations respectively, as an indication of distillate purity, or to measure carryover of contaminants.

Training and Technical Expertise

Drew Marine Service Engineers will aid in the set-up of antiscalant systems and train crew on the proper maintenance of antiscalant programs, cleaning operations, and the proper use of water monitoring tools. They will also advise on proper procedures for safe and effective cleaning operations.



REVERSE OSMOSIS

Reverse osmosis systems become fouled quickly by the concentration of seawater contaminants at the membrane surface. After pure water diffuses across the membrane, all dissolved and suspended matter is left behind. Inorganic salts and particulates, microbes, and naturally occurring organics guickly accumulate on membranes if there is no proper water treatment program. For proper functioning, RO systems need antiscalants to be fed continuously to the feedwater, require periodic alkaline and acidic cleanings, and require the addition of reducing agents for dechlorination and lay-up preservation. The possible leakage of microbial contaminants through breaks in RO membranes or leakage through seals or gaskets must be considered and accounted for with the use of disinfectants as part of the water storage and distribution plan.

Enhancing the Process

AMEROYAL RO is used as an online antiscalant to prevent deposition of calcium or magnesium salts, dissolved and suspended iron, and inorganic silicates, and to disperse naturally occurring organics and particulates. The use of AMEROYAL RO extends the time between cleanings, sustains normalized flow, and maximizes membrane life and permeate quality.

Cleaning and Maintenance

Drew Marine recommends cleaning RO membranes once any of the following are observed: a 15% decrease in permeate production, a 15% increase in transmembrane pressure drop, or a 15% increase in salt passage into the permeate. Drew Marine's RO Cleaning and Maintenance Program is a twostep process starting with an alkaline cleaning using DREWCLEAN RO, followed by acidic cleaning, using DREWCLEAN 2010. It is important to perform an alkaline cleaning prior to an acid cleaning of an RO membrane.

DREWCLEAN RO is an alkaline cleaner that removes a broad range of substances, including organic and microbiological foulants, scale and inorganic deposits, and mixed colloids of iron and silica. DREWCLEAN RO is used offline to restore normalized flow when system production quality or quantity decreases or when transmembrane pressure increases by 15%.

DREWCLEAN 2010 is a citric acid based cleaner that



is used to remove residual calcium, magnesium, and iron deposits. It is especially important to use DREW-CLEAN 2010 after a heavy fouling or if water production continued beyond the recommended allowance of 15% decline in membrane performance. To avoid membrane damage from acidification of organic and silicic foulants, DREWCLEAN 2010 should only be used after an alkaline cleaning.

DREW 6134 is a dechlorinating agent, and offline preservative used for RO system lay-up. DREW 6134 should be used to neutralize active chlorine when chlorinated water is used as source feedwater, or it should be used for the production of cleaning and flushing solutions used on the membrane. Preparations of preservative solutions are described in the DREW 6134 product data sheet.

Monitoring

The Conductivity Meter Kit Complete or the LMP Chloride Test Kit can measure conductivity or chloride ion concentrations, respectively. Increases in conductivity or chloride ions may indicate an integrity breach in the RO membrane or in seals/gaskets or a loss of permeate purity due to membrane fouling.

Training and Technical Expertise

Drew Marine Service Engineers are trained on the proper application of all Drew Marine RO treatment products. They are able to train and assist the crew in the establishment of online treatment programs, equipment set-up, and to develop RO membrane cleaning procedures.

Potable Water Storage & Distribution Systems

To assure crew safety, frequent testing of potable water tanks and distribution systems is required. The measurement of pH, disinfectant residual, and testing for the presence of microorganisms should be performed weekly or as required by the ship's flag administration. For system protection, a disinfectant residual should be maintained in storage tanks and in distribution systems. Downstream residuals should be sufficient for disinfection at the furthest point in the distribution system.

Tanks and distribution systems should be cleaned based on flag administration requirements or, in the absence of a stated frequency, a minimum of once per year. Cleaning should be initiated as soon as possible in the event of upsets including: Detection of systemwide microbial contamination, difficulty maintaining a free chlorine residual, observation of turbidity, foul odors/tastes, or other triggering event.

Potable water that is produced on board (distillation/ reverse osmosis) tends to be low in hardness, alkalinity (buffering capacity), and is considered "corrosive". Corrective treatments are required to elevate and stabilize pH and to provide corrosion inhibition while also being safe for drinking water.





Enhancing the Process

CIL is a NSF/ANSI Standard 60 approved drinking water treatment that reduces corrosion in potable and fresh water storage tanks and distribution piping by forming a protective barrier-film on metal surfaces. It does not impart color, odor, or taste to treated water.

Drew Marine supplies the HDrewO Drinking Water System. The HDrewO Drinking Water system is a four stage ultra-filtration unit that serves a vital function in the supply of drinking water at the point of consumption. The unit provides an added layer of protection for drinking water when the unit is optimally located prior to drinking fountains or ice machines. Filtration of potable water with the HDrewO Drinking Water System will effectively reduce chlorine, solids, impurities, and microorganisms, resulting in fresh drinking water that is suitable for the crew's consumption.

Drew Marine supplies sodium hypochlorite as a disinfectant for potable water tanks and distribution systems. The standard grade is a Sodium Hypochlorite Food Grade 12.5% (available chlorine). It is normally fed to achieve 2 ppm (as residual Cl₂) in a potable water storage tank, which should maintain a residual of 0.2 ppm Cl₂ throughout the system. Variations on sodium hypochlorite specifications may exist based on local availability and regulations.

Cleaning and Maintenance

Drew Marine recommends a two-step process of cleaning and disinfecting. LAC is used in step one for tank cleaning, and Sodium Hypochlorite Food Grade 12.5% (available chlorine) is used in step two, disinfection.

LAC is a liquid formulation based on fast-acting detergents, wetting agents, and alkaline cleaners. LAC is applied as a highly diluted solution to clean potable water tanks. When use as directed, LAC cleans and freshens potable water tanks.

Sodium Hypochlorite is used in the second step to disinfect potable water tanks using relatively high levels (50-100 ppm as Cl_2) to superchlorinate; this solution is held for 4 hours. Afterwards, the tank is drained and flushed with clean potable water prior to refilling the tank and treating at normal residual levels.

Monitoring

As with most water treatment practices, analytical testing on board is an integral part of measuring the current condition of water. Results from potable water testing enable the responsible officer to determine the proper course of action to maintain safe drinking water conditions.

The Potable Water Test Kit–C contains all of the components necessary for shipboard potable water monitoring. The kit includes a pH/temperature meter, a U.S. EPA approved Free and Total Chlorine Test Kit, and the components for a simultaneous Total Coliform/E.coli Test that is approved under the U.S. EPA Total Coliform Rule. An incubator is available separately to assure adequate temperatures are maintained during the 18-24 hour incubation period for the coliform tests.

Some vessels may have equipment configurations and/or conditions (elevated temperatures) that present a risk of legionella contamination. Drew Marine offers the Legionella Test Kit to verify absence/presence of legionella whose presence would require corrective action.

General microbial conditions and trends can be monitored using Drew Microbial Dual Assay Slides as a semi-quantitative measure of heterotrophic organisms to establish a baseline Heterotropic Plate Count (HPC) and thereafter to monitor HPC. Comparison of samples from a storage tank to point of furthest distribution and/or a comparison of results of subsequent tests provide trending information about disinfection effectiveness.

To effectively measure CIL levels in potable water, Drew Marine offers the Silica Ampoule Test Kit. The test assures that proper residuals of CIL are present to protect potable water tanks and distribution systems from corrosion. The test is an easy to use snap and compare colorimetric method. Chloride ion concentrations can be monitored using the LMP Chloride Test Kit. Chloride ions indicate possible carryover of seawater in distillation equipment, holes in RO membranes, breaches from RO system seals/gaskets, or cross contamination of potable water from seawater sources.

The DREWCHECK CLN METER KIT is U.S. EPA approved to test for free or total available chlorine in potable water. The DREWCHECK CLN Meter is able to detect low levels of total residual chlorine in turbid or colored samples and is also U.S. EPA approved for wastewater and ballast water under the VGP Rule.

The effectiveness of remineralization systems that add calcium and magnesium (hardness ions) to potable water can be checked using Total Hardness Titrets. Total Hardness Titrets detect for the presence of hardness ions from 20 - 200 ppm.

TRAINING AND TECHNICAL EXPERTISE

Drew Marine has a global network of corporatetrained Service Engineers who are available to provide training on board or shoreside and to provide on board service and process guidance. Our Service Engineers are trained to understand system and environmental variables, regulatory requirements, and procedures for effective treatment, cleaning, and testing. Service Engineers have full access to Drew Marine technical resources that are coordinated at our headquarters and laboratories in Connecticut, USA.

Customers are encouraged to contact Account Executives and/or Service Engineers for developing water safety plans and to obtain the appropriate training and supplies for safe and reliable potable water on board.



DREW MARINE PRODUCT SUMMARY							
MONITORING	PCN	DESCRIPTION					
Potable Water Test Kit-C	1AB1973	Industry leading test kit for monitoring potable water. Evaluates biological activity (E. coli, total coliforms) free and total chlorine, and pH in potable water. Enables compliance with Maritime Labor Convention 2006.					
Total Coliform/E.coli Tests	Included with Potable Water Test Kit-C and its associated refill kits	Complete kit for testing for E. Coli & total coliforms - U.S. EPA approved under the Total Coliform Rule. Includes 20 Readycult coliforms, sterile sample collection bottles, UV lamp, and safety glasses. Part of the Potable Water Test Kit-C and its refills.					
Chlorine Ampoule Test Kit	Included with Potable Water Test Kit-C or sold separately using PCN 364018	U.S. EPA approved DPD colorimetric method for testing free and total available chlorine in drinking water.					
pH Tester 30	Included with Potable Water Test Kit-C; avail- able separately as PCN 1AA8884	Pocket sized electronic pH meter with auto-temperature cal- ibration. pH buffer calibration standards available. Measures pH for maintaining disinfectant efficacy and water quality.					
PWTK-C Incubator	1AB2328	Used to provide consistent temperature control (34.5° to 37.0° C) for the incubation of samples for biological testing.					
Free And Total Chlorine Refill	1AB2191	Refill for the Chlorine Ampoule Test Kit, includes 30 ampoules and Total Chlorine Activator Solution.					
Potable Water Test Kit – C Refill	1AB2190	Includes Chlorine Ampoule Refills, pH buffers, Readycult Coliform Test Refills, and Sterile Bottles					
Legionella Test Kit - 5	0358011	Test Kit for rapid detection of pathogenic Legionella (viable and non-viable)					
Silica Ampoule Test Kit	0376013	Measures silica concentration to support proper dosage of CIL corrosion inhibitor in potable water.					
Conductivity Complete Test Kit	0173062	Used for evaporated water, reverse osmosis testing, or wherever seawater contamination is possible or suspected.					
Total Hardness Test Kit	0378019	Tests for hardness in remineralized drinking water; tests range is 20-200 ppm of combined calcium and magnesium.					
Chloride HP Test Kit	0372011	Used for evaporated water testing which requires detec- tion of trace levels (2 ppm) of chloride ions; titrates in 1 ppm increments.					
Chloride LMP Test Kit	0737019	Use for reverse osmosis testing or wherever seawater con- tamination is suspected. For 0-100 ppm titrates in 10 ppm increments; for samples over 100 ppm, titrates in 50 ppm increments					
DREWCHK CLN Meter	1AA9702	Designed to detect trace levels of chlorine in turbid or col- ored samples, such as ballast water or wastewater; U.S. EPA approved for Drinking Water and for VGP testing purposes.					
DREW Microbiological Dual Assay Slides	6923016	Provides semi-quantitative measurement of bacterial and fungal levels in a water sample.					
pH Meter Kit P06	0246117	A high-quality test instrument that can be used for potable water pH testing. Frequently used for high-pressure boiler water testing.					
Coliform/E. coli Refill	0394106	Includes 20 Readycult Coliform Test Refills & 20 Sterile Bottles					

TREATMENT CHEMICALS & FILTRATION SYSTEMS							
PRODUCTS	PCN	Evaporation Distillation	Reverse Osmosis	Storage & Distribution	DESCRIPTION		
HDrewO Drinking Water System	2101012	\checkmark	 ✓ 	 ✓ 	Water filtration system installed prior to drink- ing fountains. HDrewO is a multiple stage, ultra filtration system delivering quality drink- ing water. Removes impurities, chemicals, waterborne microorganisms, and mineral- izes water making it fit for human consump- tion. Eliminates the need to manage drinking water delivered in single use plastic bottles.		
LAC	1AB1973			\checkmark	Alkaline cleaner for potable water tanks		
CIL	0065400			\checkmark	Corrosion inhibitor for potable water tanks and distribution systems - NSF approved		
Sodium Hypochorite 12.5% ¹	3029403			\checkmark	Disinfectant suitable for treatment of potable water		
AMEROYAL®	0024406	\checkmark			Antiscalant for evaporative distillation equipment		
AMEROYAL® CF	4907400	\checkmark			Concentrated antiscalant for evaporative distillation equipment, excellent high-temperature stability		
DREWPLUS ED-795	1679408	\checkmark			Antifoam for evaporative distillation - NSF approved		
AMEROYAL® RO	0025628		\checkmark		Antiscalant for reverse osmosis equipment - NSF approved		
DREWCLEAN RO	0173062		\checkmark		Alkaline cleaner for reverse osmosis - removes organic, inorganic & biological contaminants		
DREWCLEAN 2010	6625331		\checkmark		Citric acid based formulation for removing residual calcium/magnesium or iron salts on RO membranes		
DREW 6134	5985405		\checkmark		Sodium bisulfite (Food Grade) for dechlorination of RO feedwater & cleaning solution water, and as a preservative for RO systems in lay-up. Can also be used for dechlorination of waste and ballast water		
SAF-ACID	0062349	\checkmark			Sulfamic acid based formulation for acid cleaning of scale deposits in evaporative distillation equipment. Contains wetting agent, corrosion inhibitor, and dye indicator of solution strength		
GC	0007402	\checkmark			Alkaline neutralizer for use after acid clean- ing of evaporative distillation equipment		

¹ DREW Marine typically supplies food grade or drinking water grade sodium hypochlorite in 12.5% (available chlorine). Depending on geographic location, local regulations may affect product specifications and availability. Your Drew Marine Service Engineer or Account Executive will provide technical assistance as needed to accommodate any required changes.

For More Information,

Contact your local Drew Marine representative or visit: www.drew-marine.com

OUR VISION

Drew Marine is the most trusted brand and preferred global resource for marine solutions that enhance the longevity and operating efficiency of ocean vessels.

OUR MISSION

To sustain the superiority of the Drew Marine brand by bringing environmentally and technologically superior products and services for the benefit of vessel owners and operators while increasing shareholder value.



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