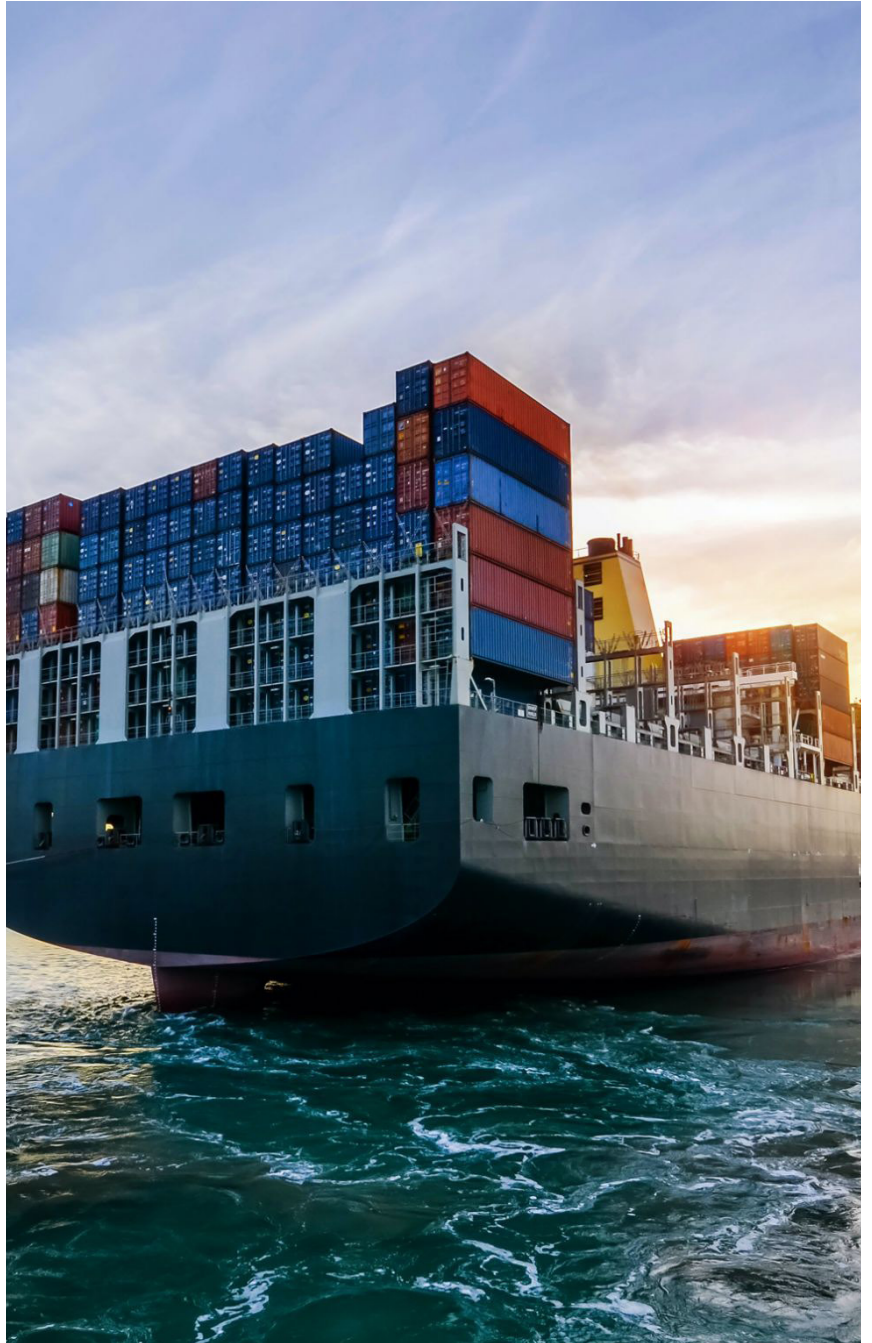




**Drew Marine®**

## Fuel Additive Treatment Guide





# FUEL ADDITIVE TREATMENT GUIDE

## BENEFITS

The amount of additives used for optimizing the value of oil, whether it is applied upstream, during crude oil extraction, or during the refinery process, amounts to hundreds of millions of metric tons worldwide. Oil is continually analyzed to ensure that it is on spec and fit for purpose.

While marine bunkers are routinely treated with additives in shore tanks to enhance the fuel terminal's profitability, marine fuel oils are seldom treated with fuel additives once they have passed over the ship's rail. This is likely because a fuel analysis report showed that it has met the marine fuel specification (e.g., ISO 8217:2017) as agreed by the bunker buyer and supplier. Fuels meeting this specification, in turn, have presumably also met the engine manufacturer's requirement to use only compliant fuel.

However, it has been estimated that just 35% of ship operators routinely test their fuel oil with an independent shorebased laboratory each time they bunker. The remaining operators presumably trust the bunker supplier in delivering what has been specified in the bunker contract or simply rely on the four parameters as required by IMO on the bunker delivery note: Density, viscosity, water, and sulfur. In cases where the bunker samples are tested, only the residual fuel oil grade is analyzed since distillate fuel oil quality is assumed to be crème de la crème in terms of overall fuel quality and most probably on specification.

The chances of crossover contamination from ultra-low sulfur distillate or on-road diesel fuel oil has increased because of regulations that restrict the sulfur content of fuel oil.

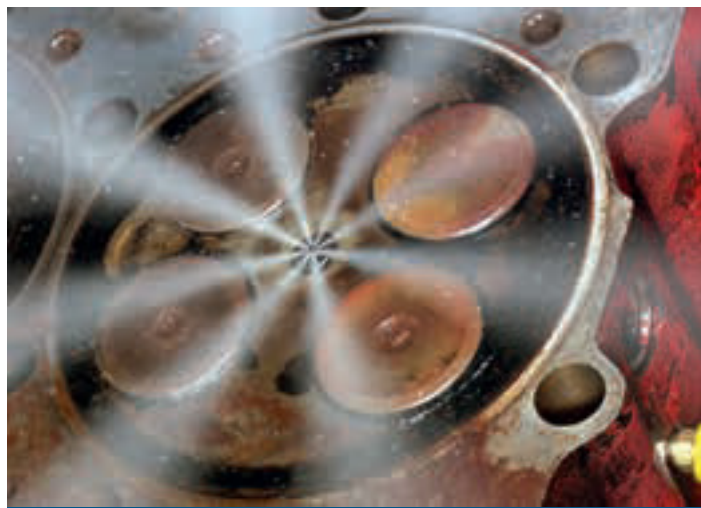
Furthermore, in geographies where on-road diesel fuel oil is increasingly required to be blended with bio-derived components, such as ethanol, the number and complexity of problems that marine engineers are likely to encounter will also increase. Therefore, it is essential that ship operators understand the increased risks associated with all grades of fuel oil, even if they meet spec as determined with shore-based analysis.

The ability of fuel additives with dispersants to recover fuel sludge as usable energy, eliminate fouling of injection components through detergents and to reduce emissions and exhaust deposits that form on turbochargers and economizers with combustion improvers and deposit modifiers has been noted specifically in the Ship Energy Efficiency Management Plan (SEEMP), which identifies fuel additives as one of the measures to improve engine efficiency. Ship operators who regularly analyze their bunker fuel can identify potential problems and select the correct fuel additive to mitigate these problems before they can impact engine operation and subsequently decrease overall plant efficiency.

- **Cost-effective fuel additive treatment programs**
- **Easy to use – dose directly into fuel tanks**
- **Treat problem fuels to improve fuel handling and combustion efficiency**
- **Extend fuel/engine equipment life-cycle**
- **Reduce operation and maintenance costs**
- **Reduce system downtime and fuel costs**



Poor spray pattern from blocked injector holes



Proper spray pattern restored with AMERGY ULS-D

**Did you know that fuel additives can be used to improve engine efficiency?**

## STORAGE TANK TREATMENT – FUEL OIL CONDITIONERS

As more restrictive low sulfur fuel oil regulations come into force, crude oil refineries will be incentivized to blend streams from multiple processing units creating more of the profitable fuel oil grades, such as aviation fuel and gasoline. Relatively less profitable marine distillate and residual fuel oil grades alike may become susceptible to inherent stability issues and cause sludging of the fuel oil while in storage tanks. In certain cases, extremely unstable fuel oil blends can overwhelm cleaning systems, such as centrifuges and filters, resulting in engine starvation and plant shutdown.

Premium fuel oil conditioners from Drew Marine have been formulated to improve fuel oil storage, handling and transfer systems. Powerful solvents, dispersants, and surfactants suspend asphaltic particles and prevent them from precipitating out of the fuel as sludge. When used regularly, the likelihood of encountering problems attributed to accumulated water, sludge and other fuel-borne deposits in storage tanks, centrifuges, and filters during severe weather are eliminated.



Waxy fuel in storage tank



Heavy fuel oil centrifuge overloaded



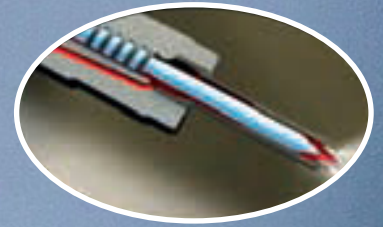
Diesel fuel filter blocked



## DISTILLATE FUEL OIL SERVICE TANK TREATMENT – COMBUSTION IMPROVERS

In order to reduce NOx emissions and increase overall combustion efficiency, engine manufacturers have improved injector designs by replacing traditional fuel injectors with high-pressure common rail fuel injectors. However, the tight clearances and tolerances found in these injectors are more susceptible to internal deposit fouling when certain contaminants, such as zinc and copper, are present in the fuel oil. Next generation detergent additive chemistry from Drew Marine cleans injector fouling and restores proper injection for improved combustion.

AMERGY ULS-D next generation detergent cleans & restores



High-pressure common rail fuel injectors



Internal injector deposit fouling



Traditional fuel injectors

## RESIDUAL FUEL OIL SERVICE TANK TREATMENT – COMBUSTION IMPROVERS

Problems attributable to the presence of certain contaminants in fuel oil, such as vanadium and sulfur, can cause high-temperature and low-temperature corrosion. High carbon content in fuel and poor ignition quality can lead to excessive carbon buildup in the combustion chamber and turbochargers as well increased soot and smoke formation in the exhaust gas.

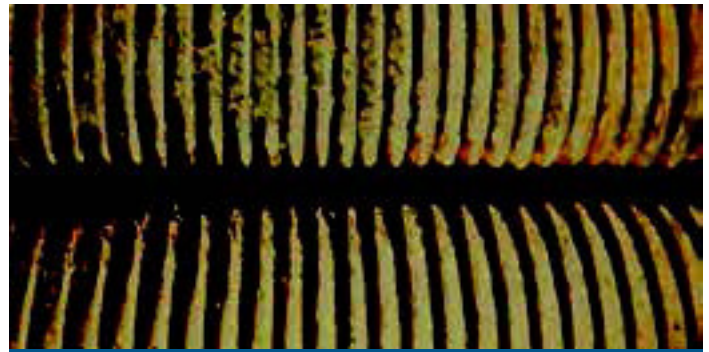
Advanced combustion improvers from Drew Marine consist of oil soluble organometallic chemistry. Combustion improvers can lead to a cleaner combustion chamber to less fouling of the turbocharger and exhaust gas areas, including exhaust gas cleaning systems (e.g., SOx scrubber), from soot and particulate matter, and to better overall engine/system efficiency.

The vanadic corrosion inhibiting properties in Drew Marine's organometallic chemistry also aids in minimizing the formation of ammonium (bi)sulfates that can block NOx selective catalytic reduction (SCR) pore structures and foul downstream heat exchangers.



## POST-COMBUSTION TREATMENT – DEPOSIT MODIFIERS

Unburned carbon deposits found in the exhaust gas economizer, auxiliary boilers and incinerators can, over time, create an insulating effect on heat transfer surfaces, eventually leading to reduced efficiency, and premature corrosion. Specifically designed for use in these systems, deposit modifiers from Drew Marine effectively change the crystalline form of the soot deposit so that it becomes light, friable, and easily dislodged through soot blowing. Available in both solid powder and liquid form, deposit modifiers are effective in low system temperatures typically encountered in the economizer area.



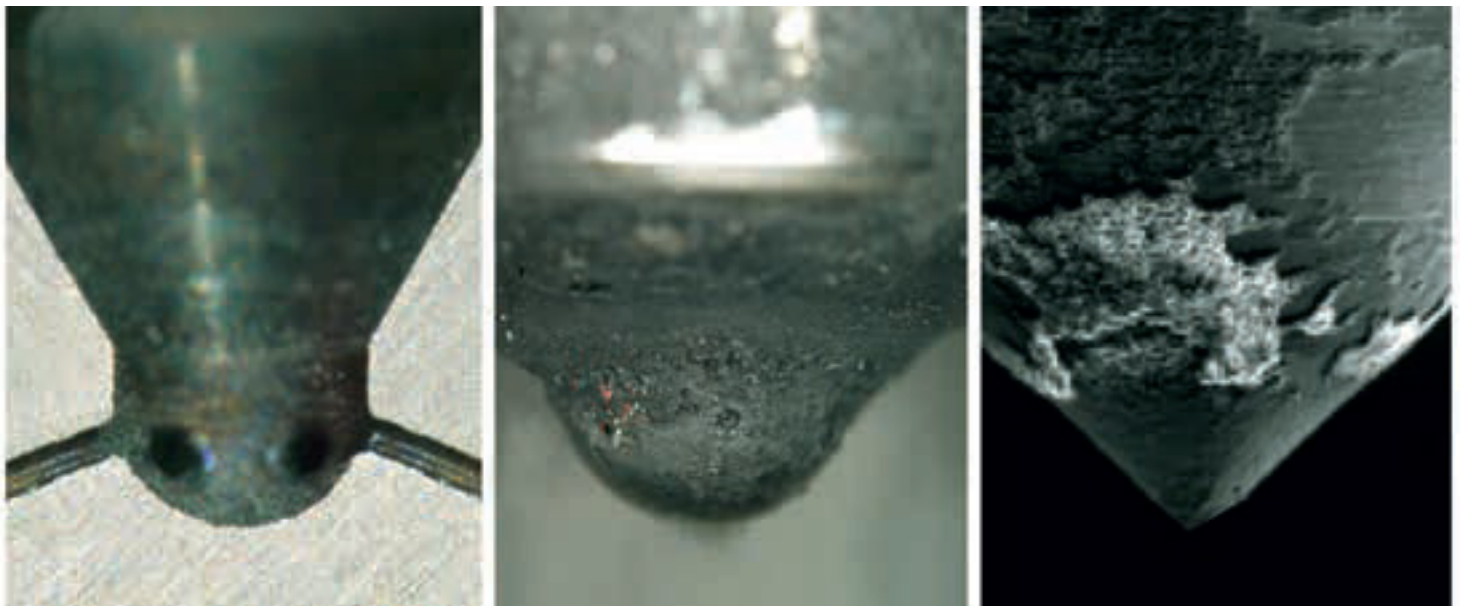
Exhaust gas deposits on heat recovery transfer surfaces decrease overall engine efficiency.

## FUEL ANALYSIS

**To begin routine fuel oil testing of every bunker per ISO 8217:2017 specification, order the Fuel Oil Sample Bottle Kit (PCN 1AA9829).**

Special testing for specific fuel contaminants, such as chemical acid wastes, polymers, and biofuel are also available through independent shore-based analytical service providers. Based on the fuel analysis report, which is typically available by email 24 hours after receipt of the sample by the laboratory, ship operators are advised of specific fuel properties that have been tested and found to be off spec or potentially problematic during fuel handling and use. Participation in routine oil testing will allow the selection of the correct fuel additives to mitigate any potential problems that have been identified on the fuel analysis report.

While fuel additives may be selected based on a specific system location and type of problem, selection of the most appropriate fuel additive can be further decided based on the type of fuel oil and tested parameter result. To determine whether the use of a fuel additive is necessary, compare the test results against the criteria for the type of fuel oil analyzed. In cases where more than one product is recommended, refer to the respective product data sheets for additional information and guidance. For handling of significant and/or a multitude of off spec parameters, contact your nearest Drew Marine representative for further discussion and advice.









Residual Fuel Oil Product Selection Guide			Storage Tank Treatment Fuel Oil Conditioners			Service Tank Treatment Combustion Improvers			Post-Combustion Treatment Deposit Modifiers		
System ISO 8217:2017 Test Parameter	Unit	Result	AMERSTAT 25DM	AMERGY PPD NF	AMERGY XLS PLUS	AMERGY ULS-D	AMERGY 1000	MAXIBURN	LT-SOOT RELEASE	DREWCLEAN EST	SOOTS STICKS
Acid Number	mg KOH/g	> 2.5									
Ash	% m/m	> 0.04									
Aluminium + Silicon	mg/kg	> 25									
Calcium	mg/kg	> 30									
Phosphorus	mg/kg	> 15									
Sodium	mg/kg	>50									
Vanadium	mg/kg	>50									
Zinc	mg/kg	> 15									
CCAI	-	>850									
Hydrogen Sulfide	mg/kg	>2.00									
Micro Carbon Residue (MCR)	% m/m	>2.50									
Sulfur	% m/m	≤ 1.00									
		>1.00									
Total Sediment Aged (TSA)	% m/m	>0.10									
Water	% v/v	> 0.30									

Residual Fuel Oil Product Selection Guide			Storage Tank Treatment Fuel Oil Conditioners			Service Tank Treatment Combustion Improvers			Post-Combustion Treatment Deposit Modifiers		
Additional Test Parameter	Unit	Result	AMERSTAT 25DM	AMERGY PPD NF	AMERGY XLS PLUS	AMERGY ULS-D	AMERGY 1000	MAXIBURN	LT-SOOT RELEASE	DREWCLEAN EST	SOOTS STICKS
Copper Strip Corrosion	-	> 3									
Microbial Contamination	CFU per ml	≥ 10 <sup>2</sup>									
	moderate-heavy										
Stability (Compatibility)	spot rating	≥ 2									



## Ordering Information

Fuel Additives		
Description	PCN	Application
AMERSTAT 25DM	6981402	Kill and control microbial growth and H2S formation; minimize the sludging effects from microbiological contamination (microbiocide)
FOT	0036401	Minimize the sludging effects of incompatibility and instability such as system blocking and overloading; and cleaning solution (standard treatment)
AMERGY 222 PLUS	1105403	Minimize the sludging effects of incompatibility and instability such as system blocking and overloading (premium treatment)
AMERGY PPD NF	5751400	Low temperature flow improver that modifies wax crystal formation to prevent filter blocking and to restore flow
AMERGY XLS PLUS	1402403	Minimize the sludging effects of incompatibility and instability such as system blocking and overloading; fuel injector tip fouling; and restore and guarantee sufficient fuel injection equipment lubricity
AMERGY ULS-D	1410406	Clean the effect of metal soap deposition from biofuel and used lube oil contamination; restore proper fuel metering, timing, and atomization for more complete combustion and restore system operation
AMERGY 1000	4139409	Promote more complete combustion and reduce system carbon deposit build-up to restore system operation and efficiency
AMERGIZE	0098401	Promote more complete combustion and reduce system high temperature and carbon deposit build-up to restore system operation and efficiency
MAXIBURN	0092403	Provides more complete combustion, reduces ignition delay, carbon deposit build-up smoke opacity and specific fuel consumption
LT-SOOT RELEASE	0045626	Promote more complete combustion of unburned hydrocarbons and reduce system carbon deposit build-up; restore system efficiency (powder treatment)
DREWCLEAN EST	1706409	Promote more complete combustion of unburned hydrocarbons and reduce system carbon deposit build-up; restore system efficiency (liquid treatment)
SOOT STICKS	0041400	Promote more complete combustion of unburned hydrocarbons and reduce system carbon deposit build-up; restore system efficiency

Fuel Additive Dosing Units		
Description	PCN	Application
DREW Beta 1605	1AA8978	Service tank treatment – manual operation 16 bar (232 psi), 5 liter/hr (1.3 gal/hr) capacity
DREW GMXA 1604 PVT	1AB5496	Service tank treatment – externally controlled or timed operation 16 bar (232 psi), 2.5 liter/hour, (0.95 gph) capacity
LT-SOOT RELEASE Dosing Unit	0162016	Post-combustion treatment – manual operation (pneumatically driven) 4.9 bar-6.9 bar (70 – 100 psi), 1 kg capacity
DREW EGT	1AA2623	Post-combustion treatment – automatic operation when exhaust gas temperature > 220°C; 2-3 liter/day, dosed every 4-6 hours, 25 liter capacity

Related Products		
Description	PCN	Application
DREWCAT Fines Tester	1AB5967	Onboard test kit for determining the presence of aluminum and silicon using basic wet chemistry and ascertaining the extent of catalyst fines presence from 20, 50, 100 and 200 ppm
Fuel Oil Compatibility Tester	1AB2185	Onboard test kit for determining stability and compatibility of up to six residual and distillate fuel oils as per ASTM D 4740, simultaneously
Drew XP Wear Debris Analyzer	1AB2768	Onboard test kit for detecting and measuring ferrous (magnetic) wear debris in lubricating oils, regardless of particle size
DREW XP Wear Corrosion Tester	1AB4425	Onboard test kit that detects the level of non-ferrous iron compounds caused by corrosive wear found in lubricating oils; complements ferrous wear debris analyzer results for total iron determination

**For handling off spec parameters, contact your nearest Drew Marine representative for advice.**



**Drew Marine**

## 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.



**Drew Marine**<sup>®</sup>

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