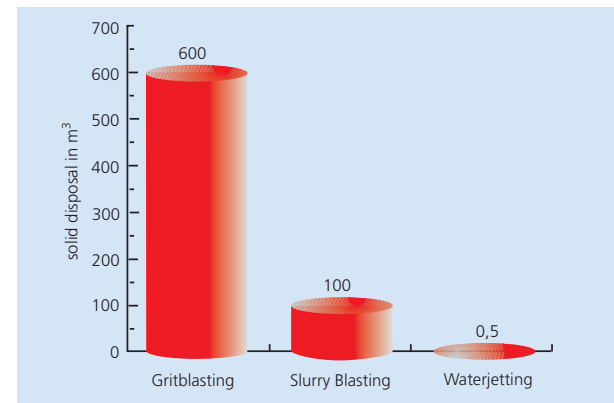
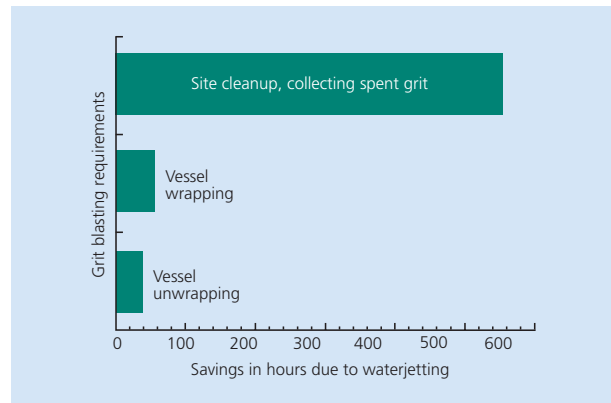


Report

Marine Surface Preparation



► Reduced drydock time

Dramatic savings in time since wrapping, unwrapping and cleanup time are minimized or eliminated. Measurements: Surface preparation of the vessel "Sirius" at Deyten's shipyard.

► Reduction in amount of solid disposal

Dramatic reduction in solid waste. Note the extremely low amount of 0.5m³ for waterjetting compared to the 600 m³ for grit blasting. Measurements: Blohm & Voss, Hamburg, Germany

► WOMA's Waterjetting Guarantees High Efficiency at any Surface Preparation Standard

WOMA's waterjetting guarantees high efficiency and meets the requirements of the basic surface preparation standards.

Standard Condition	STG Guide No. 2222	Fitz' Atlas of Coating Defects	SSPC-VIS 4(I) NACE No. 7	International Hydroblasting	Hempel's Photo Reference	Jotun Degree of Flash Rusting	U.S. NAVY Standards	Cleaning Rates
Coating	Dw 2	DS 1 Wa 2 1/2	No definition	No definition	WJ - 1	No definition	NAVY 5 AC	up to 150 m²/h
Rust Grade (Level: C)	Dw 2	DC 1 Wa 2 1/2	CVIs WJ-2	CHB 2 1/2	WJ - 1	JG - 1	No definition	up to 170 m²/h
Flash Rust	No definition	FR 3	CVIs WJ-2 L	CHB 2 1/2 L	WJ - 1 FR - 1	JG - 3	NAVY - LFR No visual definition	for painters only

WOMA Apparatebau GmbH

Werthausen Str. 77-79 · D-47226 Duisburg
 P.O. Box 14 18 20 · D-47208 Duisburg
 Phone +49(0)2065/304-0 · Fax +49(0)2065/304-200
 Internet: <http://www.woma.de>
 E-mail: info@woma.de

R-M-6/05-E - Subject to change

The high-pressure waterjet technology has now been employed for decades in simple ship cleaning tasks. Today, due to environmental and economical consideration, it is an important tool for surface preparation work on ships prior to coating application.

WOMA-technology generates ultra-high pressure waterjets with operating pressures up to 3,000 bar (43,500 psi). With these high pressures, WOMA's waterjetting technology is accepted by the maritime industry all over the world.

WOMA's ultra-high pressure waterjet technology is used for the following applications:

- Cleaning of ship hulls.
- Cleaning of superstructures and on-board equipment.
- Cleaning of ballast tanks.
- Cleaning of tanks, vessels and internal pipe systems.
- Surface preparation prior to coating application.
- Removal of deteriorated protective coating systems.
- Spot repair on partially deteriorated coating systems.

- Selective paint stripping.
- Cleaning and descaling of weld seams.
- Emission-free surface preparation on ship hulls and superstructures.
- Large-scale surface preparation with mechanically guided tools.
- Cutting of steel.
- Cutting of internal pipe systems.



Why using WOMA's Waterjetting Technology?

Why should customers use WOMA's waterjet-technology?

Because WOMA's technology offers distinct advantages over other methods for surface preparation.

Here are ten reasons you can not run away from:

- WOMA's waterjetting significantly reduces the amount of deposit. Compared to grit blasting, up to 98 percent less solid waste material needs to be considered. WOMA's customers save large amounts in disposal costs.
- WOMA's waterjetting significantly reduces the time required for cleanup because no grit needs to be collected and removed at the end of the job. WOMA's customers save hundreds of hours of time and labor.
- WOMA's waterjetting is dust-free, allowing different trades, to work side by side. Moreover, dust-sensitive areas can be maintained while the waterjetting is carried out. WOMA's customers save expensive time in drydocks.
- WOMA's waterjetting does not require wrapping or unwrapping of

vessels. WOMA's customers save large amounts of time, labor and material costs related to wrapping and unwrapping a vessel.

- WOMA's waterjetting generates very low impact forces on surfaces; working almost vibration-free. No substrate material will be removed. WOMA's customers avoid damage on their structures.
- WOMA's waterjetting is used in rainy or windy environment. WOMA's customers are not dependent on weather conditions and can readily schedule work with a high reliability.
- WOMA's waterjetting guarantees the highest possible cleanliness level among all surface preparation methods. The remaining level of salt, chloride and other elements is minimized. There is no embedded grit as found after grit blasting being a source for new corrosion. WOMA's customers therefore offer an excellent surface to

the painter with minimal risk of osmotic blistering.

- WOMA's waterjetting ensures excellent adhesion conditions between substrate and coating even if flash rust is present. WOMA's customers guarantee limits set by regulatory bodies (such as 3.5 N/mm² required by the U.S. Navy).
- WOMA's waterjetting exposes the original profile. In contrast, grit blasting reduces the original profile height due to particle impact. WOMA's customers offer an excellent surface profile to the painter giving a good mechanical bond between substrate and coating.
- WOMA's waterjetting operates emission-free in closed loop systems. Sealed tools connected to vacuum and water treatment systems prevent any exposure to paint particle dust, fume or water mist. WOMA's customers contribute to a safe and clean environment.

See the Most Complete High Pressure Waterjet Programm for Marine Surface Preparation



Spot repair on ship hulls with the 3000-bar Modular Gun System.



Ballast tank cleaning with the 3000-bar Modular Gun System.



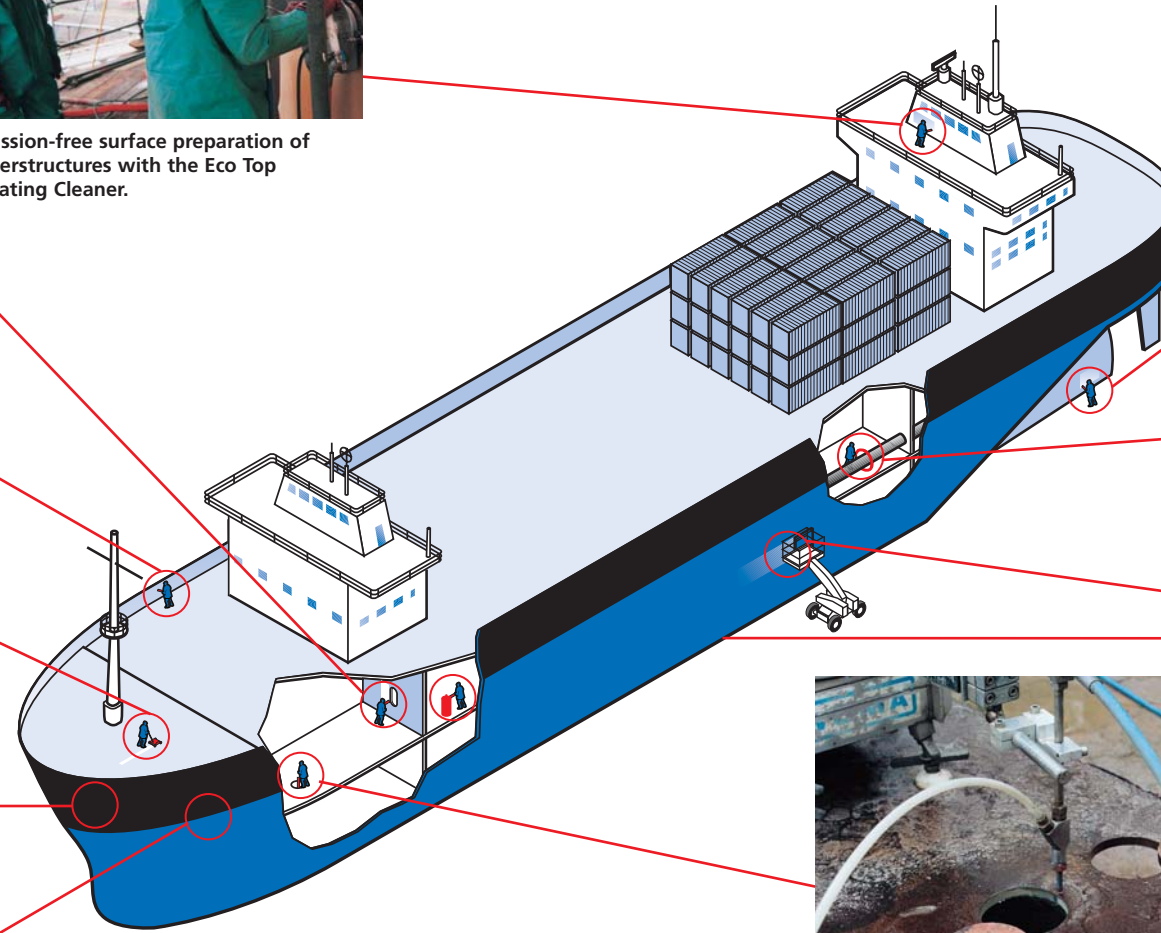
Emission-free surface preparation of superstructures with the Eco Top Rotating Cleaner.



Weld seam cleaning and scale removal with the 3000-bar Modular Gun System.



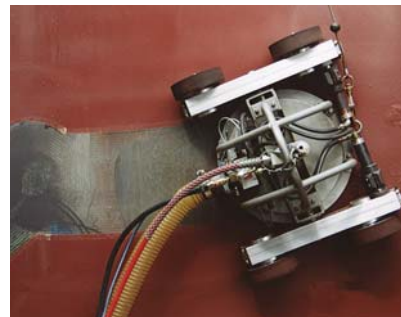
Emission-free deck cleaning, paint stripping and surface preparation with the 2500-bar jetting tool Vacu Jet 2500.



On-site pipe cutting with the 3000-bar abrasive system Eco Top Cutter 3000.



The Magnetic Lizard M2500 is a self-propelled cleaning system which is adhered onto the surface via permanent magnet.



The Vacuum Lizard V2500 with remote control for emissions-free large-scale surface preparation.



On-site cutting of openings in walls and ceilings with the 3000-bar circular abrasive cutter Eco Top Cutter.

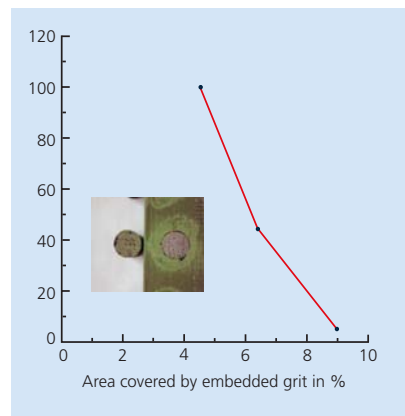


Internal vessel and tank cleaning with the tank cleaning head TankMaster® and the corresponding positioning device.



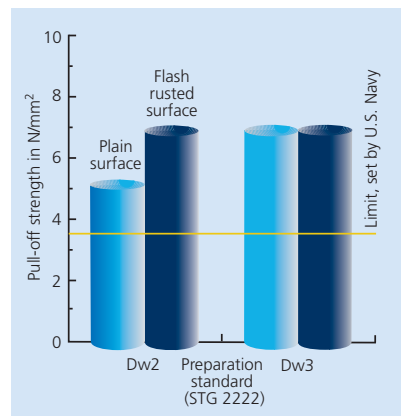
Emission-free mechanised large-scale surface preparation with the mechanical Triple Vacu Jet.

► WOMA's Waterjetting Guarantees Highest Surface Quality



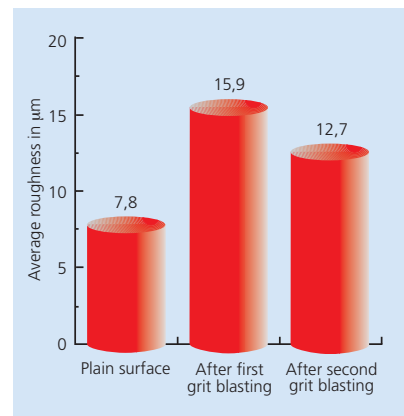
► No embedded grit

Grit blasting embeds particles in the substrate which drastically reduces the adhesion of the applied coating to the surface.
Measurements: Brunel University, UK



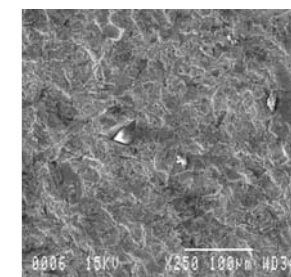
► Exellent pull-off strength

WOMA's waterjetting produces excellent adhesion conditions, even if flush rusting appears.
Measurements: W&J Leigh & Co, Bolton, UK

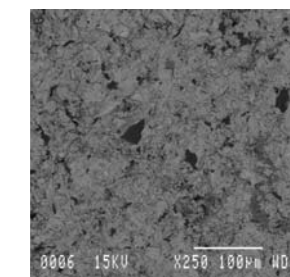


► No profile reduction

Grit blasting reduces the initial roughness obtained after the first grit blasting job. Note the 20%-reduction.
Measurements: Swinburne University of Technology, Melbourne, Australia



SEM-image of a grit blasted steel surface with embedded grit.



Backscattered SEM-image of a grit blasted steel surface.
Photo: IRIS, Melbourne, Australia

► No microscopic impurities

Grit blasting produces non-visible residue (dark appearing areas) on the substrate surface generating areas of subsequent coating failure.
Measurements: Swinburne University of Technology, Melbourne, Australia

Element	Soluble Substance in µg/cm³	
	Waterjetting	Grit blasting
Aluminium	0.003	0.352
Calcium	0.121	1.989
Chloride*	0.846	62.55
Copper	0.033	0.250
Iron	0.018	9.450
Lead	0.015	0.045
Magnesium	0.021	0.672
Manganese	0.003	0.031
Nickel	0.006	0.057
Potassium	0.414	0.513
Sodium	0.855	42.03
Sulfate	0.211	1.260
Zinc	0.063	1.512
Total	2,611 (100%)	120,71 (4.650%)

► Minimal residues

WOMA's waterjetting most reliably removes any residues (especially salts) from the substrates and, therefore, minimises the probability of osmotic blistering.
Measurements: Navy Sea Systems Comm., 1997