

Metal cleaning

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- Cationic surfactants
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01 / Introduction

Metal cleaning is the industrial process of removing contaminants such as oils, greases, rust and other impurities from metal surfaces. This process is crucial in metal manufacturing and finishing, ensuring that components meet required performance and quality standards. Metal cleaning is used for proper surface preparation, including adhesion improvement, corrosion prevention and ensuring reliable functioning in subsequent manufacturing stages such as painting, plating etc. Depending on the type of metal, contamination and the required level of surface preparation we can distinguish several different methods of metal cleaning: alkaline-based cleaning, acid-based cleaning, emulsion cleaning, solvent-based cleaning. These types of cleaning fluids can be applied by various methods including immersion cleaning, ultrasonic cleaning and mechanical cleaning.

Pretreatment consists of a series of physical and chemical processes designed to remove contaminants, activate the metal surface, and provide suitable interfacial properties. A key role is played by **surfactants**, which **reduce the surface tension** of the cleaning solution, enable proper **wetting of the metal surface**, and **allow efficient emulsification of oils**. A properly designed cleaning process not only ensures a high level of technical cleanliness but also improves corrosion resistance and the durability of subsequent protective layers.

Pretreatment is therefore not merely a washing step, but a precisely controlled engineering process that directly determines the quality, consistency, and reliability of the final product.



02 / General surface treatment

Surface treatment is a crucial step in metal cleaning and metalworking processes. In industrial applications, we can distinguish between pre-treatment processes, such as surface degreasing before painting or coating, and post-treatment processes, which involve cleaning the surface after metalworking operations such as drilling or cutting. Cleaning processes can be carried out using various methods, but this brochure focuses mainly on basic chemical and mechanical cleaning techniques that use surfactants as the primary cleaning agents.

This section is divided into five basic types of chemical and mechanical cleaning:

- Alkaline cleaning
- Acid cleaning
- Emulsion cleaning
- Solvent cleaning
- Ultrasonic cleaning

Each of these subsections consist of two major parts:

- Product portfolio
- Formulation guide

To facilitate understanding of the information presented in this brochure, explanatory tables are provided below.

Foaming properties of surfactants:

Foaming test according to ASTM D1173 using a Ross–Miles foam analyzer.

Foaming properties rating	Average foam height [mm]
Low foaming	< 40
Medium	From 40 to 120
High	> 120

Antifoaming properties of surfactants:

The method evaluates foam decay by measuring the reduction in foam height of an SLES solution before and after the injection of the tested surfactant solution onto the foam surface. Foam decay is monitored using a KRÜSS DFA100 Dynamic Foam Analyzer, and the results are reported as the initial foam height and the foam height after 10 minutes.

Corrosion inhibition properties on given surface:

Steel	Corrosion test using Cast Iron Chip method based on DIN 51360-2.
Copper	Corrosive effect on copper based on ASTM D130-18.
Aluminum	In-house method based on scale below:

Corrosion rate	Description
0	No visible corrosion
1a	Passivation between 1-50% of the plate surface (in gaseous phase)
1b	Passivation between 50-100% of the plate surface (in gaseous phase)
2a	Passivation between 1-50% of the plate surface (in aqueous phase)
2b	Passivation of the plate within a range of 50-100% of the plate surface (in aqueous phase)
3	Passivation of the plate surface in both the aqueous and gaseous phases
4	Plate passivation and exfoliation corrosion, characterized with solid particles in aqueous solution

Solubility in given solvents:

Determination of the solubility of products is carried out by visual evaluation of 1%, 10% and 50% solutions of a given product in a specified solvent, 24 hours after their preparation. Visually, the appearance of the sample is evaluated according to the following scale:

Result	Appearance of the tested sample
1	Homogeneous clear
2	Homogeneous opalescent
3	Homogeneous cloudy
4	Macroscopic phase separation

The results of the samples (1%, 10% and 50%) are added up and on this basis the solubility of the product is determined. The following table gives the solubility scales according to the sum of the appearance scale results:

Sum	Solubility
3 – 6	Soluble
7 – 9	Partially soluble
10 – 12	Insoluble

The typical values presented in this brochure are believed to be accurate; however, they should not be considered as a technical specification.

Alkaline cleaning

Alkaline cleaners are formulated with caustic builders such as sodium hydroxide, potassium hydroxide, sodium carbonate, borax and silicates. These compounds help saponify fats, neutralize acidic contaminants and disperse particulate soils. As a result, alkaline cleaners are widely used as the primary cleaning stage in metal pretreatment due to their excellent oil, grease, and wax removal performance.

Key features that alkaline based cleaners rely on:

- Saponification and emulsification – alkaline cleaners react with oils and greases and emulsify them into the solution.
- Detergency – surfactants are crucial for this role as they reduce the surface tension and enable the fluid to wet the surface and lose any dirt so they can be dispersed.

Key surfactant requirements for alkaline cleaning fluids:

The most important requirement for the surfactants is to remain chemically stable in strong alkaline solutions. Detergency and excellent wetting capabilities are also crucial, they ensure that the solution spreads over metal surfaces, penetrates residues and increases soil removal efficiency. Surfactants must be compatible with other components of final product and of course with the base solvent of the formulation. Other important features are emulsifying properties, low foaming or medium foaming profile (depending on the application) and as much as possible to be chemically inert.



Recommended nonionic surfactants and their physicochemical properties:

Product name	CAS number	Viscosity at 25°C [mm^2/s]	Average cloud point in given method [°C]	Surface tension of 0.1% solution at 25°C [mN/m]	HLB [-]	Alkaline resistance [maximum concentration of NaOH in [g/L]	Foaming properties
ROKAnol GA8	160875-66-1	100	54 – 57 [A]* 42 [B] 32 [C] 76 [D] 74 [E]	28	14.0	40	Low
ROKAnol GA9	160875-66-1	200	67 – 70 [A]* 52 [B] 39 [C] 79 [D] 78 [E]	29	14.5	50	Low
ROKAnol ID7	78330-20-8	50	59 – 62 [A]* 44 [B] 31 [C] 78 [D] 77 [E]	27	13.2	40	Medium
ROKAnol ID8	78330-20-8	50	64 – 68 [A]* 49 [B] 38 [C] 80 [D] 77 [E]	27	13.8	50	Medium
ROKAnol LP200	68439-30-5	100	27 [A] 17 [B] 11 [C] 45 [D] 37 – 41 [E]*	30	10.0	20	Low
ROKAnol LP400	103818-93-5	63	39 – 42 [A]* 23 [B] 21 [C] 55 [D] 49 [E]	29	9.9	20	Low
ROKAnol LP600	130454-91-0	60	31 – 35 [A]* 24 [B] 16 [C] 48 [D] 44 [E]	30	8.8	20	Low
ROKAnol NL5	68439-46-3	33	33-39 [A]*	27	11.6	20	Medium
ROKAnol NL6	68439-46-3	38	50 – 57 [A]* 40 [B] 30 [C] 76 [D] 73 [E]	28	12.5	70	Medium
ROKAnol NL8P4	103818-93-5	73	38 – 48 [A]* 35 [B] 27 [C] 57 [D] 55 [E]	30	9.5	40	Low

* according to TDS

Recommended anionic surfactants and their physicochemical properties:

Product name	CAS number	Viscosity at 25°C [mm^2/s]	Surface tension of 0.1% solution at 25°C [mN/m]	Alkaline resistance [maximum concentration of NaOH in [g/L]	Foaming properties
ROSULfan D911	84501-49-5	21	26	120	Medium
ROSULfan E	126-92-1	27	36	40	Low

Recommended foam control agents and their physicochemical properties:

Product name	CAS number	Viscosity at 25°C [mm^2/s]	Average cloud point in given method [°C]	Surface tension of 0.1% solution at 25°C [mN/m]	HLB [-]	Alkaline resistance [maximum concentration of NaOH in [g/L]	Antifoaming properties [mL/mL]
ROKAmer 2000	9003-11-6	280	23 – 27 [A]* <10 [B] <10 [C] 41 [D] <40 [E]*	39	2.4	10	180 / 10
ROKAmer 2950	9003-11-6	500	54 – 60 [A]* 45 [B] 39 [C] 68 [D] 65 [E]	41	8.1	40	180 / 40

* according to TDS

Recommended anionic phosphate esters and their physicochemical properties:

Product name	CAS number	Viscosity at 25°C [mm^2/s]	Surface tension of 0.1% solution at 25°C [mN/m]	Alkaline resistance [maximum concentration of NaOH in [g/L]	Foaming properties	Corrosion inhibition properties [steel/copper/ aluminum]
EXOfos PB-083	68439-39-4	700	30	80	Low	0 / 1a / 1a
EXOfos PB-103	52019-36-0	250	27	70	Medium	0 / 1a / 1a
EXOfos PB-264	68511-37-5	600	32	180	Medium	0 / 1a / 1a

Ready to use formulation:

EXOclean AL

- Can be used at room temperature temperature
- Fast-acting
- For dip cleaning and mechanical cleaning

Density at 25°C [g/cm^3]	1.11
Kinematic viscosity at 25°C [mm^2/s]	100
Solidification point [°C]	-20
pH [concentration]	13 [100%]
Foaming properties in demineralized water [foam height after 60 s/180 s/300 s in mm]	131.9 / 128.1 / 126.5
Suggested dosage [%]	20

Formulation performance

Overall performance of our ready to use product EXOclean AL is presented in the pictures below. To test the cleaning properties of this product, a dedicated test was conducted – a previously prepared metal plate covered with dyed oil was degreased using approx. 10 g of a 20% EXOclean AL solution.

The plate was manually scrubbed with a sponge according to our in-house cleaning procedure. After the degreasing process, surface tension on the plate surface was measured using surface tension testers; the achieved surface tension was 34 mN/m.

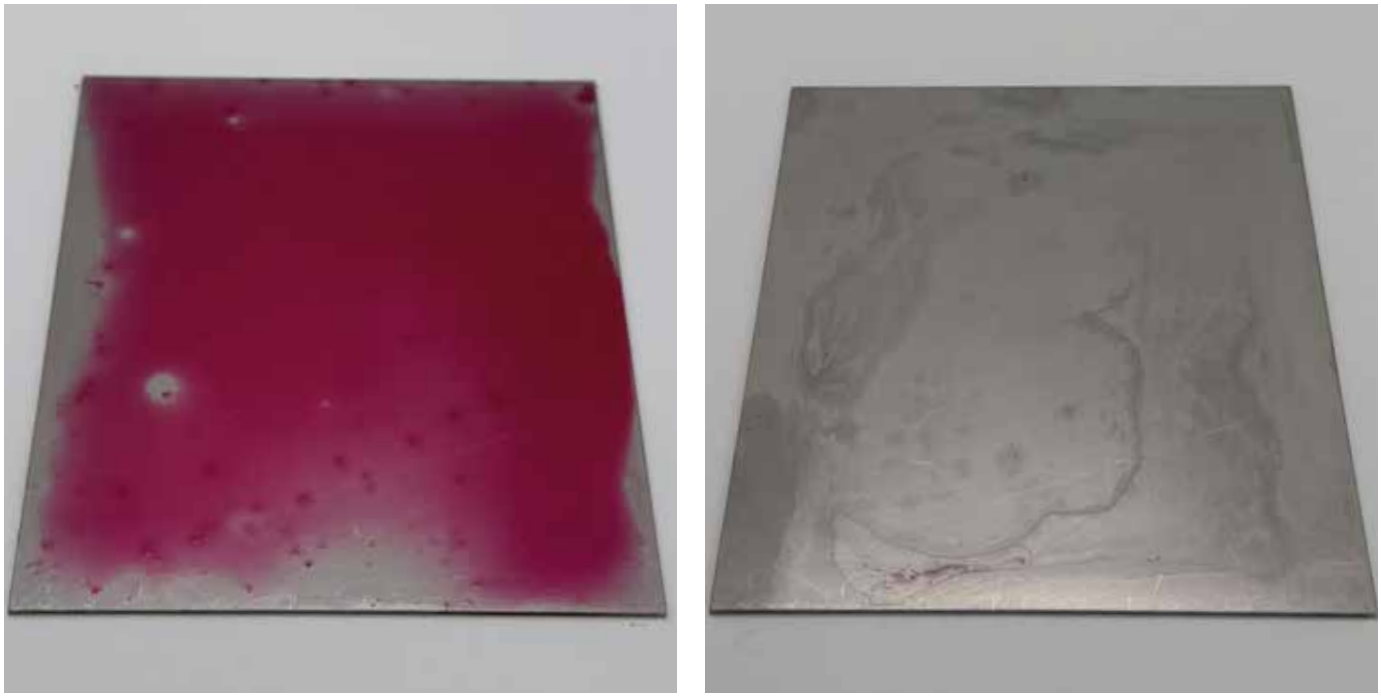


Plate covered with dyed oil before and after degreasing using 20% EXOclean AL solution.

Acid cleaning

Acid cleaning uses mineral acids, such as hydrochloric, sulfuric, phosphoric or nitric, to dissolve oxides, light rust and inorganic scale while simultaneously removing oils with the help of water-miscible solvents and surfactants. In stronger forms, such as acid pickling, the reaction becomes more aggressive and lightly etches the metal surface to expose a clean, reactive substrate.

Key features that acid based cleaners rely on:

- Chemical reaction with metal oxides/rust – acidic cleaners react chemically with oxides layers or rust and dissolve them into soluble salts.
- Wetting abilities – it's crucial for this type of cleaners to penetrate contaminants effectively with the use of surfactants.

Key surfactant requirements for acid cleaning fluids:

Surfactants used in acidic cleaners must meet several requirements. The most important one is stability and performance in low pH environment, usually non-ionic surfactants are the main choice in this type of application. Another key feature is effective surface tension reduction, in order to help remove contaminants and enhance cleaning power. Other requirements, such as compatibility with other components like solvents, defoamers etc. or stable micelle formation also play important role in overall performance of the final product.



Recommended nonionic surfactants and their physicochemical properties:

Product name	CAS number	Viscosity at 25°C [mm^2/s]	Average cloud point in given method [°C]	Surface tension of 0.1% solution at 25°C [mN/m]	HLB [-]	Acid resistance [maximum concentration of HCl/H_2SO_4 in [g/L]	Foaming properties
ROKAnol GA7	160875-66-1	200	<10 [A] <10 [B] <10 [C] 72 [D] 67 – 70 [E]*	27	13.0	225 / 225	Low
ROKAnol GA7LA	166736-08-9	102	56 [A] 43 [B] 32 [C] 71 [D] 67 – 70 [E]*	28	13.0	225 / 225	Low
ROKAnol GA7W	160875-66-1	100	<10 [A] <10 [B] <10 [C] 73 [D] 67 – 70 [E]*	27	13.0	225 / 225	Low
ROKAnol GA8	160875-66-1	100	54 – 57 [A]* 42 [B] 32 [C] 76 [D] 74 [E]	28	14.0	225 / 225	Low
ROKAnol IT8	69011-36-5	147	46 [A] 76 – 79 [D]* 76 [E]	28	12.8	225 / 225	Medium
ROKAnol L4P5	68439-51-0	44	24 [A] 15 [B] <10 [C] 50 [D] 44 [E]	30	5.3	225 / 225	Low
ROKAnol L5P5	68439-51-0	60	27 – 31 [A]* 19 [B] 12 [C] 48 [D] 44 [E]	30	6.0	225 / 225	Low
ROKAnol LP2227	166736-08-9	70	22 – 27 [A]* 18 [B] 11 [C] 49 [D] 43 [E]	30	9.6	225 / 225	Low
ROKAnol LP3034	120313-48-6	100	19 [A] <10 [B] <10 [C] 40 [D] 30 – 34 [E]*	31	6.3	225 / 225	Low
ROKAnol LP400	103818-93-5	63	39 – 42 [A]* 23 [B] 21 [C] 55 [D] 49 [E]	29	9.9	225 / 225	Low
ROKAnol LP600	130454-91-0	60	31 – 35 [A]* 24 [B] 16 [C] 48 [D] 44 [E]	30	8.8	225 / 225	Low

Product name	CAS number	Viscosity at 25°C [mm²/s]	Average cloud point in given method [°C]	Surface tension of 0.1% solution at 25°C [mN/m]	HLB [-]	Acid resistance [maximum concentration of HCl/H_2SO_4 in [g/L]	Foaming properties
ROKAnol LP700	196823-11-7	67	23 [A] 13 [B] <10 [C] 54.0 – 57.5 [D]* 51 [E]	28	9.7	225 / 225	Low
ROKAnol NL4	68439-46-3	43	26 [A] 35 [B] 34 [C] 69 [D] 60 – 65 [E]*	27	10.6	225 / 225	Low

* according to TDS

Recommended anionic surfactants and their physicochemical properties:

Product name	CAS number	Viscosity at 25°C [mm²/s]	Surface tension of 0.1% solution at 25°C [mN/m]	Acid resistance [maximum concentration of HCl/ H_2SO_4 in [g/L]	Foaming properties
ROSULfan D911	84501-49-5	21	26	140 / 225	Medium
ROSULfan E	126-92-1	27	36	225 / 225	Low
ROSULfan O	142-31-4	73	34	225 / 225	Low

Recommended foam control agents and their physicochemical properties:

Product name	CAS number	Viscosity at 25°C [mm²/s]	Average cloud point in given method [°C]	Surface tension of 0.1% solution at 25°C [mN/m]	HLB [-]	Acid resistance [maximum concentration of HCl/H_2SO_4 in [g/L]	Antifoaming properties [mL/mL]
ROKAmer 2000	9003-11-6	280	23 – 27 [A]* <10 [B] <10 [C] 41 [D] <40 [E]*	39	2.4	225 / 225	180 / 10
ROKAmer 2950	9003-11-6	500	54 – 60 [A]* 45 [B] 39 [C] 68 [D] 65 [E]	41	8.1	225 / 225	180 / 40
ROKAmer R2800	9003-11-6	550	21 [A] 12 [B] <10 [C] 28 – 31 [D]* 24 [E]	39.8	2.8	225 / 225	180 / 40

* according to TDS

Recommended anionic phosphate esters and their physicochemical properties:

Product name	CAS number	Viscosity at 25°C [mm^2/s]	Acid resistance [maximum concentration of HCl/ H_2SO_4 in [g/L]	Foaming properties	Corrosion inhibition properties [steel/copper/ aluminum]
EXOfos PB-139	9046-01-9	>3000	225 / 225	Medium	2 / 1b / 1b

Ready to use formulation:

EXOclean AC

- For usage at temperature
- Both for dip and mechanical cleaning

Density at 25°C [g/cm^3]	1.12
Kinematic viscosity at 25°C [mm^2/s]	40
Solidification point [°C]	-11
pH [concentration]	2 [100%]
Foaming properties in demineralized water [foam height after 60 s/180 s/300 s in mm]	109.5 / 107.4 / 103.8
Suggested dosage [%]	20



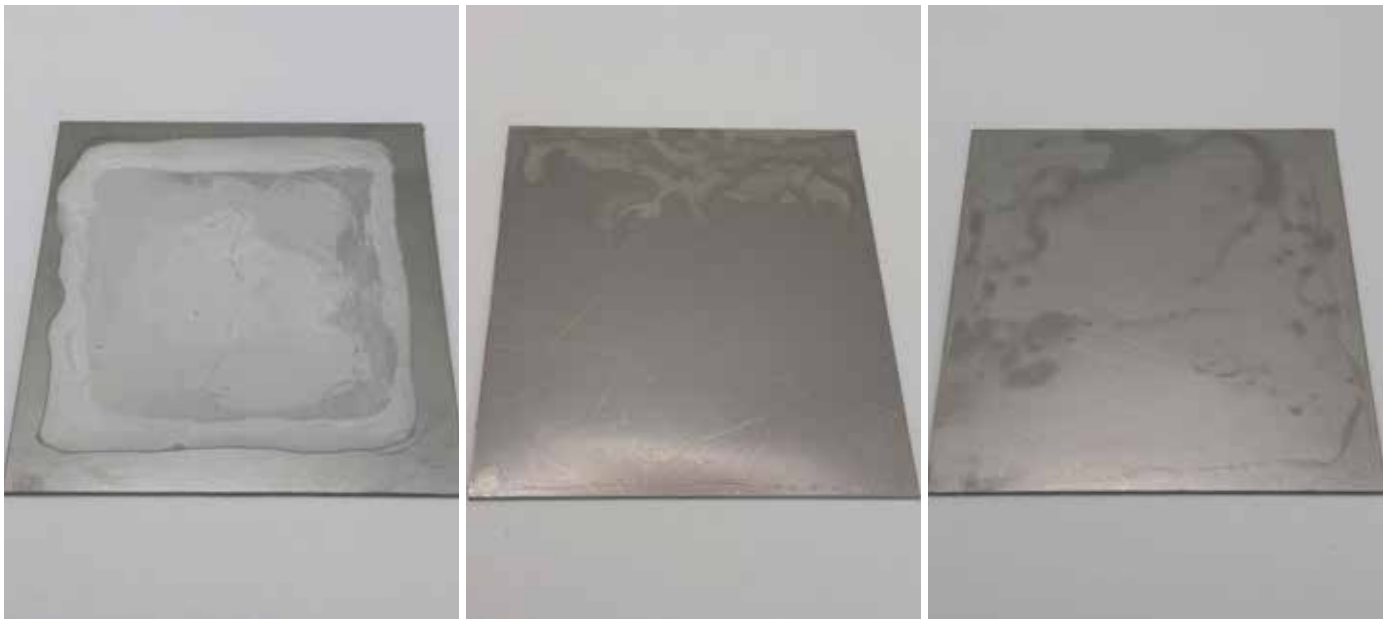
EXOclean CR

- For usage at room temperature
- Very fast-acting
- Mainly for dip cleaning, but can be used for mechanical cleaning as well

Density at 25°C [g/cm^3]	1.20
Kinematic viscosity at 25°C [mm^2/s]	80
Solidification point [°C]	6
pH [concentration]	3 [1%]
Foaming properties in demineralized water [foam height after 60 s/180 s/300 s in mm]	4.3 / 3.3 / 3.2
Suggested dosage [%]	33

Formulation performance

Cleaning performance was evaluated using dedicated in-house test method. Previously prepared plates covered with soil were weighed using analytical scale. After that plates were dipped in given solution for 5 minutes, and then rinse under water. Final result of this test is soil removal efficiency in percentage of removed dirt. In case of our products we achieved approx. 97.08% soil removal for EXOclean CR and 97.40% for EXOclean AC. Visual performance of our products is presented in pictures below.



Prepared plate before and after using 20% solution of EXOclean AC (middle picture) and 33% solution of EXOclean CR (right picture).

Emulsion cleaning

Emulsion cleaning is a process that uses a dispersion of an organic solvent in water, forming a two-phase oil-in-water (O/W) emulsion. In this method, the effective dissolution of oils, greases, and other organic soils by the organic solvent is combined with the wetting and surface-tension-reducing properties of a surfactant, which enables better penetration of contaminants. Surfactants are also used to stabilize the emulsion. It is important to remember that after emulsion cleaning, it is necessary to use an alkaline cleaner to remove any remaining oil or organic solvent residues.

Key features that emulsion cleaners rely on:

- Solvent selection – in emulsion cleaning, organic solvents are crucial for dissolving contamination. Typically, light hydrocarbons, mineral oils, or other specific solvents are used for this purpose.
- Dual use of surfactant – besides stabilizing the emulsion through an appropriate HLB value, surfactants are also responsible for soil penetration and surface wetting. This dual functionality ensures effective removal of all types of contamination.

Key surfactant requirements for emulsion cleaning fluids:

The most crucial requirement for surfactants used in emulsion cleaning is an appropriate HLB value. Typically, an HLB value of around 9–10 (or higher) is recommended for this type of application, as it ensures effective dispersion of organic compounds and stable emulsion formation. Another important feature is, of course, very good wetting properties and the ability to significantly reduce surface tension. Because additives such as foam control agents or corrosion inhibitors are often used, it is also essential that the surfactant is compatible with the other components of the formulation.

Recommended nonionic surfactants and their physicochemical properties:

Product name	CAS number	Viscosity at 25°C [mm^2/s]	Average cloud point in given method [°C]	Surface tension of 0.1% solution at 25°C [mN/m]	HLB [-]	Foaming properties
ROKAnol GA3	160875-66-1	105	<10 [A] <10 [B] <10 [C] 43 [D] 30 – 33 [E]*	28	9.0	Low
ROKAnol GA4LA	166376-08-9	35	<10 [A] <10 [B] <10 [C] 52 [D] 45 – 48 [E]*	28	10.0	Low
ROKAnol ID3	78330-20-8	31	<10 [A] <10 [B] <10 [C] 61 [D] 51 – 55 [E]*	26	9.0	Low
ROKAnol IT5	69011-36-5	120	<10 [A] <10 [B] <10 [C] 66 [D] 60 – 65 [E]*	28	10.0	Low
ROKAnol K5	9005-04-3	24	66 [D] 57 – 63 [E]*	31	9.2	Insoluble in water

Product name	CAS number	Viscosity at 25°C [mm²/s]	Average cloud point in given method [°C]	Surface tension of 0.1% solution at 25°C [mN/m]	HLB [-]	Foaming properties
ROKAnol K7	68920-66-1	62	71 [D] 64 – 68 [E]*	31	10.8	Low
ROKAnol LP42	68002-96-0	64	52 [D] 42 – 46 [E]*	-	9.0	Low
ROKAnol LP66	68002-96-0	160	25 [A] 20 [B] <10 [C] 68 [D] 64 – 68 [E]*	35	11.0	Low
ROKAnol LP200	68439-30-5	100	27 [A] 17 [B] 11 [C] 45 [D] 37 – 41 [E]*	30	10.0	Low
ROKAnol LP400	103818-93-5	63	39 – 42 [A]* 23 [B] 21 [C] 55 [D] 49 [E]	29	9.9	Low
ROKAnol LP700	196823-11-7	67	23 [A] 13 [B] <10 [C] 54.0 – 57.5 [D]* 51 [E]	28	9.7	Low
ROKAnol LP2731	9038-95-3	190	20 [A] 30 [D] 27 – 31 [E]*	39	4.0	Insoluble in water
ROKAnol NL4	68439-46-3	43	26 [A] 35 [B] 34 [C] 69 [D] 60 – 65 [E]*	27	10.0	Low
ROKAnol NL8P4	103818-93-5	73	38 – 48 [A]* 35 [B] 27 [C] 57 [D] 55 [E]	30	9.5	Low
ROKAnol O5	9004-82-2	64	71 [D]	32	9.1	Low

* according to TDS

Recommended foam control agents and their physicochemical properties:

Product name	CAS number	Viscosity at 25°C [mm^2/s]	Average cloud point in given method [°C]	Surface tension of 0.1% solution at 25°C [mN/m]	HLB [-]	Antifoaming properties [mL/mL]
ROKAmer 2950	9003-11-6	500	54 – 60 [A]* 45 [B] 39 [C] 68 [D] 65 [E]	41	8.1	180 / 40
ROKAmer G3500	9082-00-2	870	36 – 42 [A]* 25 [B] 17 [C] 45 [D] 40 [E]	42	7.5	180 / 20

* according to TDS

Recommended anionic phosphate esters and their physicochemical properties:

Product name	CAS number	Viscosity at 25°C [mm^2/s]	Surface tension of 0.1% solution at 25°C [mN/m]	Foaming properties	Corrosion inhibition properties [steel/ copper/aluminum]
EXOfos PB-083	68439-39-4	700	30	Low	0 / 1a / 1a
EXOfos PB-103	52019-36-0	250	27	Medium	0 / 1a / 1a
EXOfos PB-264	68511-37-5	600	32	Medium	0 / 1a / 1a



Ready to use formulation:

Roksol MSL

- For usage in higher temperatures, around 40°C
- Dedicated for mechanical cleaning or long-term dip cleaning
- Good performance alongside with **EXOclean AL**

Density at 25°C [g/cm^3]	1.02
Kinematic viscosity at 25°C [mm^2/s]	190
Solidification point [°C]	-15
pH [concentration]	7 [1%]
Foaming properties in demineralized water [foam height after 60 s/180 s/300 s in mm]	12.7 / 13.0 / 10.3
Suggested dosage [%]	10-20%

Formulation performance

Formulation performance was evaluated using in-house method. Steel plate was prepared by covering its surface smoothly with 3 g of dyed mineral oil (for better visual effect). Emulsion cleaning was conducted in two stages. In stage 1, metal plate is dipped for 5 minutes into prepared 10% **Roksol MSL** emulsion, which is heated up to 40°C. In stage 2, semi-cleaned plate is transferred from emulsion bath to alkaline cleaner bath, and left again for 5 minutes. For purpose of this method we used 20% solution of **EXOclean AL** as an alkaline cleaner. After this time plate is rinsed with demineralized water and left out to dry. Surface of the plate is then tested with surface tension tester, achieved surface tension 34 mN/m.



Plate covered with dyed mineral oil (on the left) and cleaned using two-stage emulsion cleaning with Roksol MSL and EXOclean AL (on the right).

Solvent cleaning

Solvent cleaning is a process that uses organic-based or other solvents as an alternative to water-based formulations. The use of organic solvents is very effective in dissolving and dispersing contaminants such as oils, greases, and waxes. The choice of solvent depends on the type of contamination and the surface being cleaned, as well as safety and environmental considerations. This type of cleaner is often used in aerospace and automotive manufacturing, and because it is water-free, in the electronics industry.

Key features that solvent cleaners rely on:

- Dissolution and solvation – an effective and well-chosen solvent has the ability to penetrate and solvate organic contaminants, reducing their adhesion to the surface and enabling easier removal.
- Interfacial energy reduction – solvents tend to lower the interfacial forces between the contamination and the surface to which it adheres. This process makes it easier to detach residues and soils.

Key surfactant requirements for solvent cleaning fluids:

Solvent-based cleaners have very good and diverse capabilities that support contamination removal, but even in these systems surfactants can be used. The most important role of the surfactant is to lower surface tension and provide good wetting in order to help the solvent reduce interfacial forces. After successful detachment of the contamination, the surfactant is also useful for emulsifying the released contaminants.



Recommended nonionic surfactants and their physicochemical properties:

Product name	CAS number	Viscosity at 25°C [mm²/s]	Average cloud point in given method [°C]	Surface tension of 0.1% solution at 25°C [mN/m]	HLB [-]	Solubility in given solvent [water / methanol / ethyl ether / acetone]	Foaming properties
ROKAnol IT8	69011-36-5	90	42 [A] 30 [B] 22 [C] 76 – 79 [D]* 76 [E]	28	12.8	soluble soluble partially soluble soluble	Medium
ROKAnol L4P5	68439-51-0	44	24 [A] 15 [B] <10 [C] 50 [D] 44 [E]	30	5.3	soluble soluble soluble soluble	Low
ROKAnol L5P5	68439-51-0	60	27 – 31 [A]* 19 [B] 12 [C] 48 [D] 44 [E]	30	6.0	soluble soluble soluble partially soluble	Low
ROKAnol LP200	68439-30-5	100	27 [A] 17 [B] 11 [C] 45 [D] 37-41 [E]*	30	10.0	soluble soluble soluble soluble	Low
ROKAnol LP2227	166736-08-9	70	22 – 27 [A]* 18 [B] 11 [C] 49 [D] 43 [E]	30	9.6	soluble soluble soluble soluble	Low
ROKAnol LP3034	120313-48-6	100	19 [A] <10 [B] <10 [C] 40 [D] 30 – 34 [E]*	31	6.3	soluble soluble soluble soluble	Low
ROKAnol LP3135	154518-36-2	100	31 – 35 [A]* 24 [B] 16 [C] 56 [D] 50 [E]	–	7.9	soluble soluble soluble soluble	Low
ROKAnol LP400	103818-93-5	63	39 – 42 [A]* 23 [B] 21 [C] 55 [D] 49 [E]	29	9.9	soluble soluble soluble soluble	Low
ROKAnol LP600	103454-91-0	60	31 – 35 [A]* 24 [B] 16 [C] 48 [D] 44 [E]	30	8.8	soluble soluble soluble soluble	Low
ROKAnol LP700	196823-11-7	67	23 [A] 13 [B] <10 [C] 54.0 – 57.5 [D]* 51 [E]	28	9.7	soluble soluble soluble soluble	Low
ROKAnol NL8P4	103818-93-5	73	38 – 48 [A]* 35 [B] 27 [C] 57 [D] 55 [E]	30	9.5	soluble soluble soluble soluble	Low

* according to TDS

Recommended foam control agents and their physicochemical properties:

Product name	CAS number	Viscosity at 25°C [mm²/s]	Average cloud point in given method [°C]	Surface tension of 0.1% solution at 25°C [mN/m]	HLB [-]	Solubility in given solvent [water / methanol / ethyl ether / acetone]	Antifoaming properties [mL/mL]
ROKAmer G3500	9082-00-2	870	36 – 42 [A]* 25 [B] 17 [C] 45 [D] 40 [E]	42	7.5	soluble soluble soluble soluble	180 / 20
ROKAmer G3800	9082-00-2	870	18 [A] 25 – 28 [D]* 23 [E]	37	3.0	soluble soluble soluble soluble	180 / 5

* according to TDS

Recommended anionic phosphate esters and their physicochemical properties:

Product name	CAS number	Viscosity at 25°C [mm²/s]	Surface tension of 0.1% solution at 25°C [mN/m]	Solubility in given solvent [water / methanol / ethyl ether / acetone]	Foaming properties	Corrosion inhibition properties [steel/ copper/aluminum]
EXOfos PA-080S	12645-31-7	150	36	insoluble soluble soluble soluble	Low	0 / 1a / 1b
EXOfos PA-1300	52933-07-0	600	30	insoluble soluble soluble soluble	Low	0 / 1a / –
EXOfos PA-810	68186-45-8	200	25	insoluble soluble soluble soluble	Low	0 / 1a / 1b
EXOfos PB-103	52019-36-0	250	27	insoluble soluble partially soluble soluble	Medium	0 / 1a / 1a
EXOfos PB-264	68511-37-5	600	32	insoluble soluble insoluble soluble	Medium	0 / 1a / 1a

Proposed formulation based on our products

Formulation for steel pretreatment

- Low foaming
- For cleaning at room temperature
- Fast-acting
- For dip and mechanical cleaning

Ingredient	Role	Mass percentage [%]
ROKAnol LP200	Wetting agent	5 – 10
ROKAnol LP3034	Wetting agent	5 – 10
Hydrocarbon solvent	Solvent	80 – 90

Ready to use formulation:

EXOdet DNT

- For use with hydrocarbon solvents
- Fast-acting
- For usage at room temperature
- For both dip and mechanical cleaning

Density at 25°C [g/cm^3]	0.98
Kinematic viscosity at 25°C [mm^2/s]	42
Solidification point [°C]	11
pH [concentration]	5 [1%]
Foaming properties in demineralized water [foam height after 60 s/180 s/300 s in mm]	38.5 / 36.8 / 33.3
Suggested dosage in hydrocarbon solvent [%]	20

Formulation performance

To evaluate cleaning performance, special in-house test method was created. Steel plate was covered smoothly with 3 g of prepared mixture of petrolatum and engine oil, it was then left until the soil hardened. Prepared plate was dipped in solvent cleaner and left for 5 minutes, bath was occasionally moved in order to ensure liquid flow above the plate surface. The cleaned plate was then removed from the bath and cleanliness level was evaluated visually

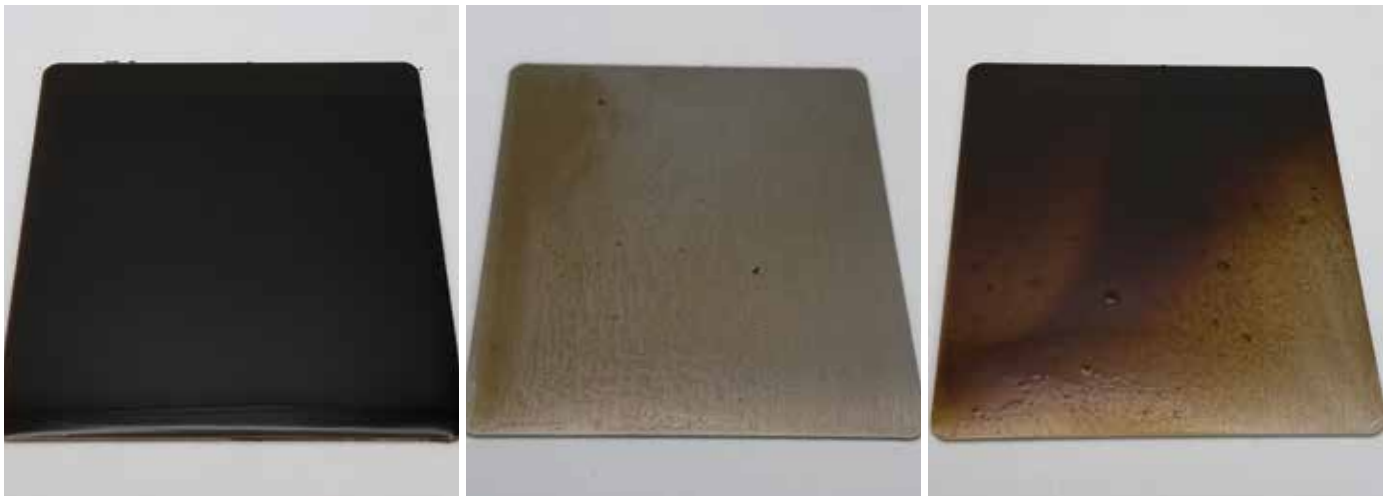


Plate covered with prepared soil (left) and cleaned using a low-foaming solvent cleaner (center) and water (right).

Ultrasonic cleaning

Ultrasonic cleaning is a method that uses high-frequency sound waves in a (usually) water-based cleaning solution to remove contaminants from surfaces. Because of its ability to clean very complex objects, ultrasonic cleaning is widely used in healthcare, electronics, aerospace, automotive, and precision engineering.

Key features that solvent cleaners rely on:

- Generation of ultrasonic waves – choosing the correct frequency is important for the entire process. Ultrasonic cleaning is based on cavitation, so cleaning efficiency strongly depends on this mechanism. Lower frequencies are used for heavy-duty cleaning, whereas higher frequencies are used for more delicate cleaning.
- Cleaning solution compatibility – the liquid used in ultrasonic cleaning strongly affects the cavitation process, which is why selecting the correct one is very important. A crucial parameter in this type of application is surface tension reduction.

Key surfactant requirements for solvent cleaning fluids:

Since surface tension plays a critical role in the cavitation process, good wetting and strong surface-tension-reducing properties are the most important requirements for a surfactant used in this type of cleaning. Significant surface-tension reduction maximizes cavitation efficiency. The surfactant must also remain stable in the operating environment and throughout the process, as ultrasonic cleaning exposes the formulation to continuous mechanical stress. Foaming properties are equally important, because excessive foam may interfere with cavitation and reduce cleaning performance. For this reason, low-foaming surfactants are recommended for this application.

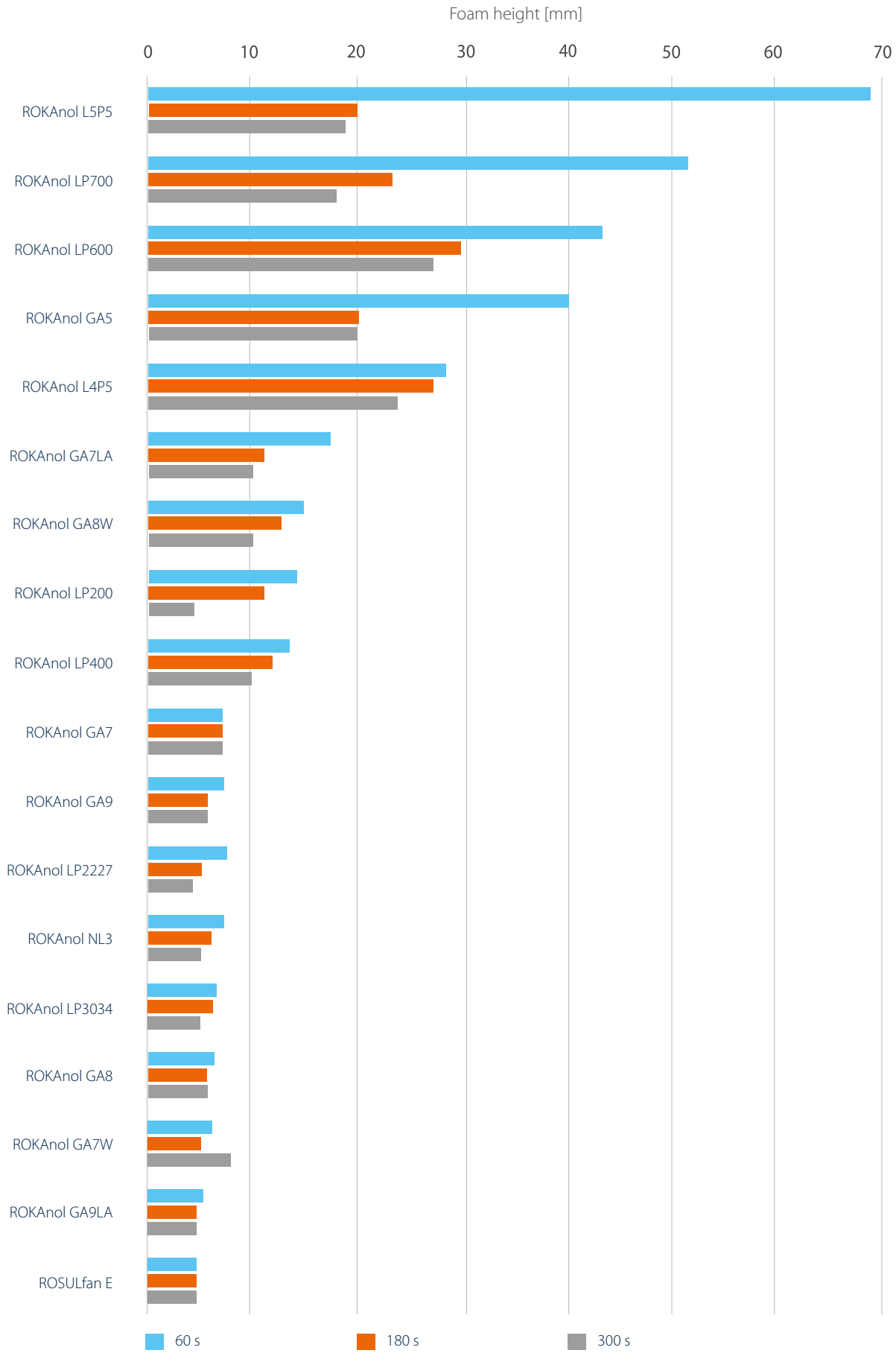
Recommended nonionic surfactants and their physicochemical properties:

Product name	CAS number	Viscosity at 25°C [mm^2/s]	Average cloud point in given method [°C]	Surface tension of 0.1% solution at 25°C [mN/m]	HLB [-]	Foaming properties
ROKAnol GA5	160875-66-1	103	<10 [A] <10 [B] <10 [C] 62 [D] 54 – 57 [E]*	27	11.5	Low
ROKAnol GA7	160875-66-1	200	<10 [A] <10 [B] <10 [C] 72 [D] 67 – 70 [E]*	27	13.0	Low
ROKAnol GA7LA	166736-08-9	100	56 [A] 43 [B] 32 [C] 71 [D] 67 – 70 [E]*	28	13.0	Low
ROKAnol GA7W	160875-66-1	100	<10 [A] <10 [B] <10 [C] 73 [D] 67 – 70 [E]*	27	13.0	Low
ROKAnol GA8	160875-66-1	100	54 – 57 [A]* 42 [B] 32 [C] 76 [D] 74 [E]	28	14.0	Low

Product name	CAS number	Viscosity at 25°C [mm²/s]	Average cloud point in given method [°C]	Surface tension of 0.1% solution at 25°C [mN/m]	HLB [-]	Foaming properties
ROKAnol GA8W	160875-66-1	100	55 – 58 [A]* 37 [B] 17 [C] 75 [D] 74 [E]	28	14.0	Low
ROKAnol GA9	160875-66-1	200	67 – 70 [A]* 52 [B] 39 [C] 79 [D] 78 [E]	30	14.5	Low
ROKAnol GA9LA	166736-08-9	240	67 – 70 [A]* 52 [B] 41 [C] 75 [D] 72 [E]	29	13.9	Low
ROKAnol L4P5	68439-51-0	44	24 [A] 15 [B] <10 [C] 50 [D] 44 [E]	30	5.3	Low
ROKAnol L5P5	68439-51-0	60	27 – 31 [A]* 19 [B] 12 [C] 48 [D] 44 [E]	30	6.0	Low
ROKAnol LP200	68439-30-5	100	27 [A] 17 [B] 11 [C] 45 [D] 37 – 41 [E]*	30	10.0	Low
ROKAnol LP400	103818-93-5	63	39 – 42 [A]* 23 [B] 21 [C] 55 [D] 49 [E]	29	9.9	Low
ROKAnol LP600	130454-91-0	80	31-35 [A]* 24 [B] 16 [C] 48 [D] 44 [E]	30	8.8	Low
ROKAnol LP700	196823-11-7	67	23 [A] 13 [B] <10 [C] 54.0 – 57.5 [D]* 51 [E]	28	9.7	Low
ROKAnol LP2227	166736-08-9	70	22 – 27 [A]* 18 [B] 11 [C] 49 [D] 43 [E]	30	9.6	Low
ROKAnol LP3034	120313-48-6	100	19 [A] <10 [B] <10 [C] 40 [D] 30 – 34 [E]*	31	6.3	Low
ROKAnol NL3	68439-46-3	23	57 [D] 49 [E]	26	8.5	Low

* according to TDS

RMFA foam in hard water (17°dH)



Recommended anionic surfactants and their physicochemical properties:

Product name	CAS number	Viscosity at 25°C [mm²/s]	Foaming properties
ROSULfan E	126-92-1	27	Low

Recommended foam control agents and their physicochemical properties:

Product name	CAS number	Viscosity at 25°C [mm²/s]	Average cloud point in given method [°C]	Surface tension of 0.1% solution at 25°C [mN/m]	HLB [-]	Antifoaming properties [mL/mL]
ROKAmer 2330	9003-11-6	450	21 – 26 [A]* 20 [B] 10 [C] 60 [D] 56 [E]	37	4.9	180 / 35
ROKAmer G3500	9082-00-2	870	36 – 42 [A]* 25 [B] 17 [C] 45 [D] 40 [E]	42	7.5	180 / 20
ROKAmer G3800	9082-00-2	870	18 [A] 25 – 28 [D]* 23 [E]	37	3.0	180 / 5

* according to TDS

Recommended anionic phosphate esters and their physicochemical properties:

Product name	CAS number	Viscosity at 25°C [mm²/s]	Surface tension of 0.1% solution at 25°C [mN/m]	Foaming properties	Corrosion inhibition properties [steel/ copper/aluminum]
EXOfos PA-080S	12645-31-7	150	36	Low	0 / 1a / 1b
EXOfos PB-103	52019-36-0	250	27	Medium	0 / 1a / 1a
EXOfos PA-810	68186-45-8	200	25	Low	0 / 1a / 1b

Ready to use formulation:

Roksol MS

- Can be used at room temperature
- Good performance in cleaning oil based soils

Density at 25°C [g/cm^3]	1.04
Kinematic viscosity at 25°C [mm^2/s]	500
Solidification point [°C]	-10
pH [concentration]	9 [2%]
Foaming properties in demineralized water [foam height after 60 s/180 s/300 s in mm]	6.3 / 4 / 4
Suggested dosage [%]	10%

EXOclean BCK

- Can be used at room temperature
- Good performance in cleaning hard soils

Density at 25°C [g/cm^3]	1.03
Kinematic viscosity at 25°C [mm^2/s]	150
Solidification point [°C]	-12
pH [concentration]	7 [1%]
Foaming properties in demineralized water [foam height after 60 s/180 s/300 s in mm]	8.2 / 6.3 / 6.3
Suggested dosage [%]	10%

Formulation performance:

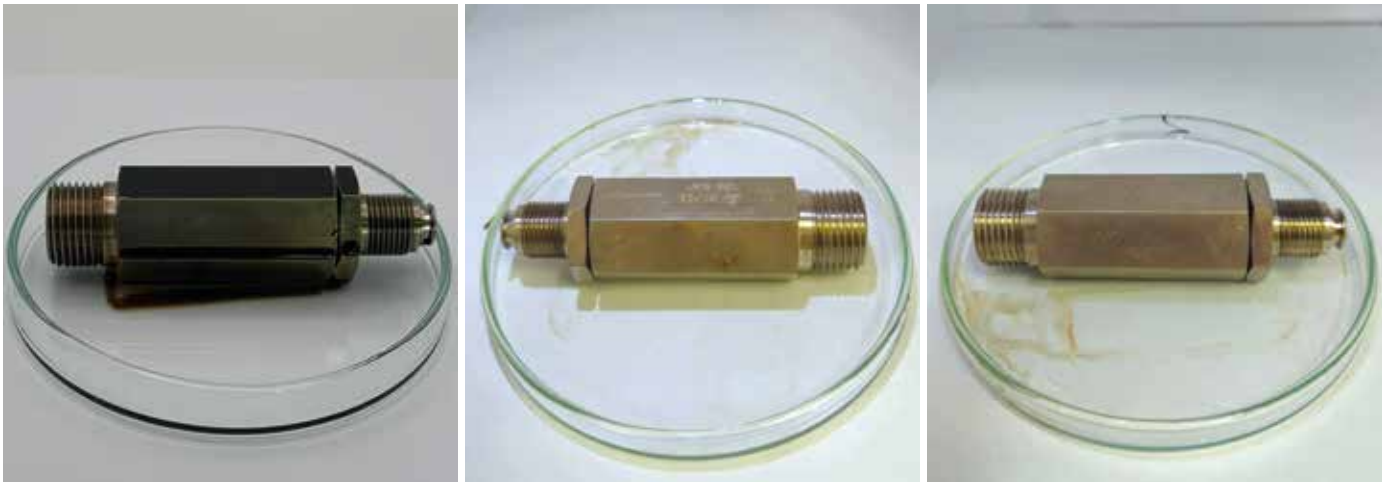
Cleaning performance was evaluated in two separate tests. In both of them metal valves were covered in special soils, then dipped in given product solution, and cleaned for 5 minutes using ultrasonic cleaner. After cleaning process valves were rinsed with water, and then placed in the oven to evaporate any fluids that were left during the process. Dry valves were left to cool down and overall cleaning performance was evaluated visually.

Soil 1 – **calcium carbonate soil.**



Valve before and after ultrasonic cleaning using 10% solution of Roksol MS (middle picture) and 10% solution of EXOclean BCK (right picture).

Soil 2 – **engine oil.**



Valve covered in engine oil (left picture), cleaned using 10% EXOclean BCK solution (middle picture) and cleaned using 10% Roksol MS solution (right picture).

03 / Specialized Applications

Metal cleaning is widely used in many applications as a stage in manufacturing process. In this section of brochure presented products are adjusted for specific applications: Automotive and Aerospace industries, where cleaning of metal surfaces are crucial for processing. Their main function is to wet surface to help with soil-removing, but also to modify foamability or provide corrosion protection. Modern cleaning formulations must deliver not only excellent soil removal capability, but also material compatibility, low residue and operational safety.

As each application has its own specific requirements, the formulations presented in each section are accompanied by performance test results demonstrating their effectiveness.

Each subsection consist of two major parts:

- Product portfolio
- Formulation guide



3.1 Automotive

Metal cleaning in the automotive industry is one of the fundamental stages of metal processing. The cleaning process directly affects assembly quality, the durability of protective coatings, and the reliability of final components. During production, metal parts become contaminated with cutting fluids, cooling liquids, metal filings, and many other residues. Automotive metal cleaning applies not only to 'body-in-white' treatment but also to various automotive components, such as wheels, bumpers, chassis parts, suspension systems, seat components, and others.

Surfactants play a key role in cleaning formulations. These surface-active agents reduce surface tension, emulsify oils, wet the substrate, and stabilize contaminants within the cleaning bath. Their action enables efficient removal of soils from metal surfaces, even under short cycle times and low temperatures, which are increasingly required for energy efficiency and operational cost reduction. They are often used in strongly alkaline environments, typically as low-foaming surfactants, especially when applied in spray systems.

Dip-cleaning

Dip-cleaning surfactants create a bath in a large tank in which the car body or components are submerged to remove oils, greases, particulates, and many other types of soil.

Recommended nonionic surfactants and their physicochemical properties:

Product name	CAS number	pH (water solution)	Average cloud point in given method [°C]	Viscosity at 25°C [mm^2/s]	Alkaline resistance [maximum concentration of NaOH in [g/L]	Acid resistance [maximum concentration of HCl/H_2SO_4 in [g/L]	Foaming properties
ROKAnol D5	68002-97-1	5 – 7 (1%)	40 – 43 [A]* 30 [B] 20 [C] 74 [D] 71 [E]	36	50	225 / 225	High
ROKAnol DB7	68131-39-5	4.6 – 7.4 (1%)	49 [A] 38 [B] 29 [C] 79 [D] 79 [E]	100	50	225 / 225	Medium
ROKAnol GA9	160875-66-1	5 – 7 (1%)	67 – 70 [A]* 52 [B] 39 [C] 79 [D] 78 [E]	200	50	225 / 225	Low
ROKAnol ID3	78330-20-8	5 – 8 (1%)	<10 [A] <10 [B] <10 [C] 61 [D] 51 – 55 [E]*	31	0	0 / 225	Low
ROKAnol ID7	78330-20-8	5 – 7 (1%)	59 – 62 [A]* 44 [B] 31 [C] 78 [D] 77 [E]	40	50	225 / 225	Medium

Product name	CAS number	pH (water solution)	Average cloud point in given method [°C]	Viscosity at 25°C [mm^2/s]	Alkaline resistance [maximum concentration of NaOH in [g/L]	Acid resistance [maximum concentration of HCl/H_2SO_4 in [g/L]	Foaming properties
ROKAnol L5P5	68439-51-0	5 – 7 (1%)	27 – 31 [A]* 19 [B] 12 [C] 48 [D] 44 [E]	60	0	140 / 140	Low
ROKAnol LP66	68002-96-0	5 – 7 (1%)	25 [A] 20 [B] <10 [C] 68 [D] 64 – 68 [E]*	160	0	225 / 225	Low
ROKAnol LP100	120313-48-6	5 – 7 (1%)	72 – 76 [A]* 59 [B] 48 [C] 70 [D] 69 [E]	150	50	225 / 225	Medium
ROKAnol LP220	166736-08-9	5-8 (1%)	36 – 40 [A]* 28 [B] 20 [C] 54 [D] 49 [E]	67	30	225 / 225	Low
ROKAnol LP400	103818-93-5	5 – 7 (1%)	39 – 42 [A]* 23 [B] 21 [C] 55 [D] 49 [E]	63	40	225 / 225	Low
ROKAnol LP600	130454-91-0	6 – 8 (1%)	31 – 35 [A]* 24 [B] 16 [C] 48 [D] 44 [E]	60	50	225 / 225	Low
ROKAnol LP700	196823-11-7	5 – 7 (1%)	23 [A] 13 [B] <10 [C] 54.0 – 57.5 [D]* 51 [E]	67	10	225 / 225	Low
ROKAnol LP2024W/95	Mixture	5 – 7 (1%)	20 – 24 [A]* 15 [B] <10 [C] 51 [D] 41 [E]	60	40	225 / 225	Low
ROKAnol LP2500	120313-48-6	6 – 8 (1%)	31 – 35 [A]* 24 [B] 16 [C] 48 [D] 44 [E]	80	50	225 / 225	Low
ROKAnol LP3034	120313-48-6	5 – 7 (1%)	19 [A] <10 [B] <10 [C] 40 [D] 30 – 34 [E]*	100	10	225 / 225	Low
ROKAnol LP3135	154518-36-2	5 – 7 (1%)	31 – 35 [A]* 24 [B] 16 [C] 56 [D] 50 [E]	100	30	225 / 225	Low

Product name	CAS number	pH (water solution)	Average cloud point in given method [°C]	Viscosity at 25°C [mm^2/s]	Alkaline resistance [maximum concentration of NaOH in [g/L]	Acid resistance [maximum concentration of HCl/H_2SO_4 in [g/L]	Foaming properties
ROKAnol LP3943	120313-48-6	5 – 7 (2.5%)	52 [D] 39 – 43 [E]*	42	0	140 / 0	Low
ROKAnol NL6	68439-46-3	5 – 7 (1%)	50 – 57 [A]* 40 [B] 30 [C] 76 [D] 73 [E]	40	70	225 / 225	Medium
ROKAnol NL8	68439-46-3	5 – 7 (1%)	78 – 85 [A]* 66 [B] 54 [C] 83 [D] 82 [E]	90	80	225 / 225	Medium
ROKAnol NL8P4	103818-93-5	5 – 7 (1%)	38 – 48 [A]* 35 [B] 27 [C] 57 [D] 55 [E]	73	50	225 / 225	Low
ROKAnol NL9	68439-46-3	5 – 7 (1%)	90 [A]	240	120	225 / 225	Medium
ROKAnol SAE3	68131-40-8	5 – 8 (1%)	44 [D] 27 [E]	25	Insoluble in water	Insoluble in water	Low
ROKAnol SAE5	84133-50-6	5 – 8 (5%)	<10 [A] <10 [B] <10 [C] 62 [D] 56 [E]	40	50	225 / 225	Low
ROKAnol SAE12	84133-50-6	5 – 8 (5%)	78 – 88 [A]* 64 [B] 53 [C] 82 [D] 82 [E]	90	80	225 / 225	Medium
ROKAnol SAE40W/70	Mixture	4 – 8 (5%)	73-76 [C]*	1400	50	225 / 225	Medium
ROKAnol TMP7	157627-86-6	5 – 7 (1%)	42 – 45 [A]* 75 [D] 74 – 76 [E]*	78	50	225 / 225	Medium
ROKAnol TMP8	157627-86-6	6 – 7.5 (1%)	49 – 55 [A]* 40 [B] 31 [C] 80 [D] 80 [E]	110	70	225 / 225	Medium

* according to TDS

Recommended anionic surfactants and their physicochemical properties:

Product name	CAS number	pH (water solution)	Viscosity at 25°C [cP]	Alkaline resistance [maximum concentration of NaOH in [g/L]	Acid resistance [maximum concentration of HCl/H_2SO_4 in [g/L]	Foaming properties
ABSNa 50	Mixture	7 – 9.5 (1%)	5000	10	30 / 140	High
ROSULfan D911	84501-49-5	10 – 11 (10%)	21	120	140 / 225	Medium
ROSULfan E	126-92-1	9 – 11 (25%)	27	170	225 / 225	Low
ROSULfan L	Mixture	5.5 – 9 (5%)	305	10	115 / 140	Medium
SULFOROKAnol L270/1	Mixture	7 – 10 (5%)	20 000	70	225 / 140	High

Recommended foam control agents and their physicochemical properties:

Product name	CAS number	Viscosity at 25°C [mm^2/s]	Average cloud point in given method [°C]	Surface tension of 0.1% solution at 25°C [mN/m]
ROKAmer 2950	9003-11-6	500	54-60 [A]* 45 [B] 39 [C] 68 [D] 65 [E]	40.6
ROKAmer PP450	25322-69-4	70	89[A] 58[B] 39[C] 66[D] 59[E]	50.2

* according to TDS

Recommended anionic phosphate esters and their physicochemical properties:

Product name	CAS number	pH (water solution)	Viscosity at 25°C [mm2/s]	Alkaline resistance [maximum concentration of NaOH in [g/L]	Acid resistance [maximum concentration of HCl/H_2SO_4 in [g/L]	Foaming	Corrosion inhibition properties [steel/copper/aluminum]
EXOfos PA-810	68186-45-8	1.5 – 2.5 (3%)	200	Insoluble in water	Insoluble in water	Low	0 / 1a / 1b
EXOfos PB-083	68439-39-4	2 (1%)	700	80	0 / 0	Low	0 / 1a / 1a
EXOfos PB-139	9046-01-9	2 (5%)	>3000	150	225 / 225	High	2 / 1b / 1b

Proposed formulation based on our products:

Acidic steel components dip cleaner

Appearance	Clear liquid
pH (solution 1%)	2 – 4

- Moderate foaming
- Dip cleaning, acidic cleaning
- Effective for rust removal/inhibition

Ingredient	Mass percentage [%]	Function
ROKAnol NL4	8	Wetting agent
ROSULfan L	3	Cleaning agent
EXOfos PB-139	2	Corrosion inhibitor
Citric acid	15	pH regulator
DMP (1-methoxy-2-propanol)	10	Solvent
Water	Up to 100	Solvent



Formulation performance:

Cleaning performance was assessed using an in-house methodology based on two types of soils on steel plates.

Soil 1. – **Process deposit:** plate was covered with soil and dipped in given solution for 5 minutes, bath was occasionally moved in order to ensure liquid flow above the plate surface. Cleaned plate was then removed from the bath and rinsed under water. Cleanliness level was evaluated visually.



Plate covered with preapred soil (left top) and cleaned using 10% solution of the acidic dip cleaner formulation designed for Automotive applications (right top) in comparison with water – soiled (bottom left), cleaned (bottom right)

Soil 2. – **Rust deposit:** plate covered with rust was submerged in the test solution and left for 24 hours without agitation. After the exposure period, the plate was removed and rinsed with water. Cleanliness was assessed visually.

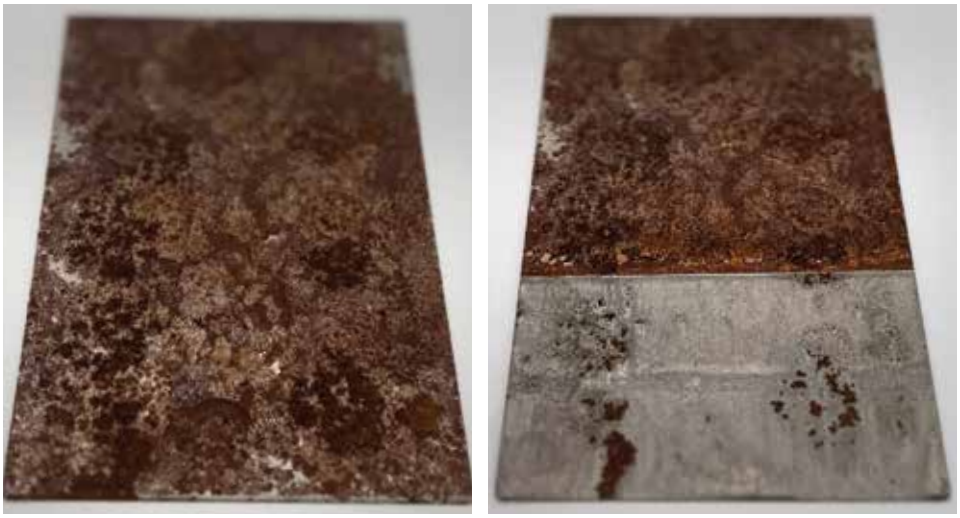


Plate covered with rust deposit before cleaning (on the left) and cleaned using 10% solution of the acidic dip cleaner formulation designed for Automotive applications (on the right).

Body – in-white cleaning

Phase 1: **Emulsion body-in-white cleaner**

Appearance	Cloudy liquid
pH (solution 1%)	8.76

- For usage in higher temperatures – around 40°C
- Dedicated for dip cleaning – Suitable for mechanical cleaning

Ingredient	Mass percentage [%]	Function
ROKAnol ID3	15	Wetting agent
ROKAnol LP66	10	Emulsifier
ROKAnol LP400	3	Cleaning gent
TEA (triethanonoloamine)	1	pH regulator
Mineral Oil	71	Solvent

Phase 2: **Alkaline body-in-white cleaner**

Appearance	Clear liquid
pH (solution 1%)	12.06

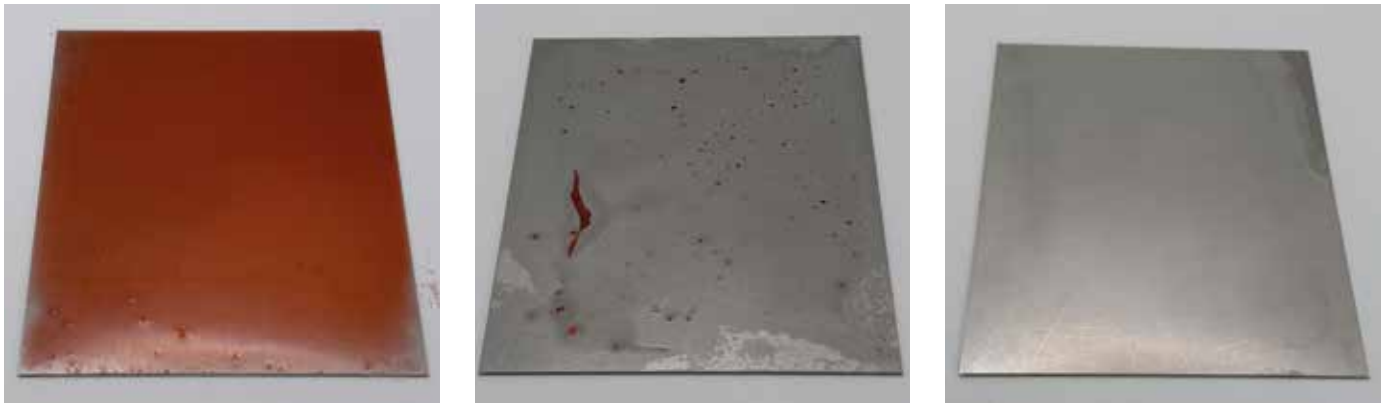
- For usage after emulsion cleaner

Ingredient	Mass percentage [%]	Function
ROSULfan D911	10	Cleaning agent
ROSULfan E	5	Cleaning, wetting agent
ROKAmer PP450	3	Foam control
EXOfos PB-083	3	Corrosion inhibitor
Sodium hydroxide (50%)	10	pH regulator
EDTA (Sodium salt, 40%)	10	Chelating agent
Sodium metasilicate	4	Detergency enhancer
Water	Up to 100	Solvent

Formulation performance:

Formulation performance was evaluated using an in-house method. Steel plate was prepared by covering its surface smoothly with 3 g of dyed mineral oil (for better visual effect). Emulsion cleaning is conducted in two phases. In phase 1, metal plate is dipped for 5 minutes into prepared 10% emulsion, which is heated up to 40°C.

In phase 2, semicleaned plate is transferred from emulsion bath to alkaline cleaner bath, and left again for 5 minutes. After this time plate is rinsed with demineralized water and left out to dry. Surface of the plate is then tested with surface tension tester, achieved surface tension 38 mN/m.



Plates covered with dyed mineral oil (left) and after cleaning with the two-phase emulsion formulation: after emulsion treatment (center) and after alkaline cleaning (right).

Spray cleaning

This method of cleaning used to clean components using spraying nozzles with solution of cleaning agent under the pressure.

Recommended nonionic surfactants and their physicochemical properties:

Product name	CAS number	pH (water solution)	Cloud point in given method [°C]	Viscosity at 25°C [mm^2/s]	Alkaline resistance [maximum concentration of NaOH in [g/L]	Acid resistance [maximum concentration of HCl/H_2SO_4 in [g/L]	Foaming properties
ROKAnol EH5	27252-75-1	5 – 7 (1%)	69 [D] 63 [E]	120	60	225 / 225	Low
ROKAnol L5P5	68439-51-0	5 – 7 (1%)	27 – 31 [A]* 19 [B] 12 [C] 48 [D] 44 [E]	60	0	140 / 140	Low
ROKAnol LP100	120313-48-6	5 – 7 (1%)	72 – 76 [A]* 59 [B] 48 [C] 70 [D] 69 [E]	149	50	225 / 225	Medium
ROKAnol LP220	166736-08-9	5 – 8 (1%)	36 – 40 [A]* 28 [B] 20 [C] 54 [D] 49 [E]	67	30	225 / 225	Low

Product name	CAS number	pH (water solution)	Cloud point in given method [°C]	Viscosity at 25°C [mm^2/s]	Alkaline resistance [maximum concentration of NaOH in [g/L]	Acid resistance [maximum concentration of HCl/H_2SO_4 in [g/L]	Foaming properties
ROKAnol LP400	103818-93-5	5 – 7 (1%)	39 – 42 [A]* 23 [B] 21 [C] 55 [D] 49 [E]	63	40	225 / 225	Low
ROKAnol LP600	130454-91-0	6 – 8 (1%)	31 – 35 [A]* 24 [B] 16 [C] 48 [D] 44 [E]	60	50	225 / 225	Low
ROKAnol LP700	196823-11-7	5 – 7 (1%)	23 [A] 13 [B] <10 [C] 54.0 – 57.5 [D]* 51 [E]	67	10	225 / 225	Low
ROKAnol LP1822	37251-67-5	5 – 7 (10%)	20 [A] 42 [D] 36 [E]	40	20	225 / 225	Low
ROKAnol LP2500	120313-48-6	6 – 8 (1%)	31 – 35 [A]* 24 [B] 16 [C] 48 [D] 44 [E]	80	50	225 / 225	Low
ROKAnol LP2731	9038-95-3	5 – 8 (5%)	20 [A] 30 [D] 27 – 31 [E]*	190	0	225 / 0	Low
ROKAnol LP3034	120313-48-6	5 – 7 (1%)	19 [A] <10 [B] <10 [C] 40 [D] 30 – 34 [E]*	100	10	225 / 225	Low
ROKAnol LP3135	154518-36-2	5 – 7 (1%)	31 – 35 [A]* 24 [B] 16 [C] 56 [D] 50 [E]	100	30	225 / 225	Low
ROKAnol LP3943	120313-48-6	5 – 7 (2.5%)	52 [D] 39 – 43 [E]*	42	0	140 / 0	Low
ROKAnol LP2024W/95	Mixture	5 – 7 (1%)	20 – 24 [A]* 15 [B] <10 [C] 51 [D] 41 [E]	60	40	225 / 225	Low
ROKAnol NL8P4	103818-93-5	5 – 7 (1%)	38 – 48 [A]* 35 [B] 27 [C] 57 [D] 55 [E]	73	50	225 / 225	Low

Product name	CAS number	pH (water solutiuon)	Cloud point in given method [°C]	Viscosity at 25°C [mm^2/s]	Alkaline resistance [maximum concentration of NaOH in [g/L]	Acid resistance [maximum concentration of HCl/H_2SO_4 in [g/L]	Foaming properties
ROKAnol SAE3	68131-40-8	5 – 8 (1%)	44 [D] 27 [E]	25	Insoluble in water	Insoluble in water	Low
ROKAnol SAE12	84133-50-6	5 – 8 (5%)	78 – 88 [A]* 64 [B] 53 [C] 82 [D] 82 [E]	90	80	225 / 225	Medium
ROKAnol SAE40W/70	Mixture	4 – 8 (5%)	73 – 76 [C]*	1400	50	225 / 225	Medium

* according to TDS

Recommended anionic phosphate esters and their physicochemical properties:

Product name	CAS number	pH (water solution)	Viscosity at 25°C [mm^2/s]	Alkaline resistance [maximum concentration of NaOH in [g/L]	Acid resistance [maximum concentration of HCl/H_2SO_4 in [g/L]	Foaming properties	Corrosion inhibition (steel/copper/ aluminium)
EXOfos PB-083	68439-39-4	2 (1%)	700	80	0 / 0	Low	0 / 1a / 1a
EXOfos PB-139	9046-01-9	2 (5%)	>3000	150	225 / 225	High	2 / 1b / 1b
EXOfos PD-103LP	Mixture	1 – 3 (1%)	200	130	0 / 0	Medium	2 / 2a /2a

Proposed formulation based on our products:

Alkaline steel components cleaner

Appearance	Clear liquid
pH (solution 1%)	12 – 13

- Moderate foaming
- Manual or machine spray cleaning – Alkaline cleaning

Ingredient	Mass percentage [%]	Function
ROKAnol SAE12	8	Cleaning agent
EXOfos PB-139	2	Corrosion inhibition
Sodium hydroxide (50%)	8	pH regulator
EDTA (Sodium salt, 40%)	5	Chelating agent
Sodium metasilicate	1.5	Detergency enhancer
Sodium carbonate	1.5	Detergency enhancer
Water	Up to 100	Solvent

Formulation performance:

To evaluate the performance of the formulation, an in-house method was developed. Soiled plate with carbon particles was cleaned by spraying specific amount of evaluated product. Results were compared with the cleaning efficiency achieved using water alone. Photos before and after cleaning are used to determine the efficiency of evaluated formulation.

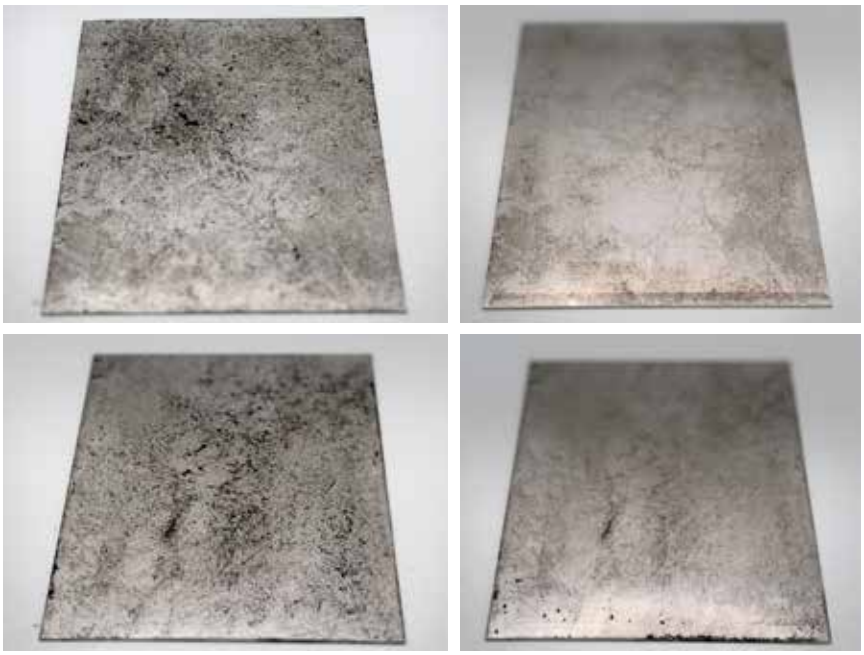


Plate covered with preapred soil (left bottom) and cleaned using alkaline steel components cleaner (right bottom) in comparison with water – soiled (top left), cleaned (top right).

Defect detection

Defect detection is the process of finding issues such as cracks, misalignments, surface blemishes. Surfactants are used here as wetting agents, which helps penetrate the fluorescents or dying agents into the defects and could be visible.

Product name	CAS number	pH	Wetting capability (in s) at product concentrations of 0.5 g/L, 1.0 g/L and 1.5 g/L
ROKAnol LP2500	120313-48-6	6 – 8 (1%)	37 / 15 / 11
ROKAnol LP3943	120313-48-6	5 – 7 (2.5%)	213 / 116 / 66



3.2 Aerospace

Metal cleaning in the aerospace refers to the specialized removal of contaminants from metallic components used in aircraft and spacecraft, carried out to meet extremely strict safety, performance, and regulatory standards. Cleanliness is not just a quality step – it is a critical requirement, because even microscopic residues can compromise structural integrity, coating adhesion, or the reliability of propulsion and hydraulic systems.

Manufacture

Manufacturing refers to the production stage in which surfactants are used to remove oils, cutting fluids, particles, and residues that soil parts during processing. Their main functions include degreasing, wetting, and providing corrosion prevention.



Recommended nonionic surfactants and their physicochemical properties:

Product name	CAS number	pH	Cloud point in given method [°C]	Viscosity at 25°C [mm^2/s]	Alkaline resistance [maximum concentration of NaOH in [g/L]	Acid resistance [maximum concentration of HCl/H_2SO_4 in [g/L]	Foaming properties
ROKAnol EH5	27252-75-1	5 – 7 (1%)	70[D] 63[E]	300	60	225 / 225	Low
ROKAnol IT9	69011-36-5	5 – 7 (1%)	56 – 60 [A]* 42 [B] 31 [C] 80 [D] 79 [E]	<100	50	225 / 225	Medium
ROKAnol LP1822	37251-67-5	5 – 7 (10%)	20 [A] 42 [D] 36 [E]	40	20	225 / 225	Low
ROKAnol LP2731	9038-95-3	5 – 8 (5%)	20 [A] 30 [D] 27 – 31 [E]*	240	Insoluble in water	225 / 0	Low
ROKAnol NL3	68439-46-3	5.5 – 7.5 (1%)	56[D] 49 [E]	<100	80	225 / 225	Low
ROKAnol SAE3	68131-40-8	5 – 8 (1% solution C)	44 [D] 27 [E]	13	Insoluble in water	Insoluble in water	Low
ROKAnol SAE7	84133-50-6	5 – 8 (5%)	28 – 38 [A]* 25 [B] 19 [C] 72 [D] 69 [E]	50	50	225 / 225	Medium
ROKAnol SAE9	84133-50-6	5 – 8 (5%)	51 – 61 [A]*	<100	70	225 / 225	Medium
ROKAnol SAE12	84133-50-6	5 – 8 (5%)	78 – 88 [A]* 64 [B] 53 [C] 82 [D] 82 [E]	90	80	225 / 225	Medium

* according to TDS

Recommended anionic phosphate esters and their physicochemical properties:

Product name	CAS number	pH	Viscosity at 25°C [mm^2/s]	Alkaline resistance [maximum concentration of NaOH in [g/L]	Acid resistance [maximum concentration of HCl/H_2SO_4 in [g/L]	Foaming	Corrosion inhibition [aluminium]
EXOfos PB-083	68439-39-4	2 (1%)	700	270	0 / 0	Low	1a
EXOfos PB-103	52019-36-0	2 (1%)	250	70	0 / 0	Medium	1a
EXOfos PB-264	68511-37-5	<1.2 (100%)	600	180	0 / 0	Medium	1a
EXOfos PD-103LP	Mixture	1 – 3 (1%)	200	130	0 / 0	Medium	2a

Proposed formulation based on our products:

Formulation for component pretreatment – 1

Appearance	Straw-colored liquid

- Insoluble in water
- Fast acting
- Moderate foaming
- Dip cleaning

Ingredient	Mass percentage [%]	Function
ROKAnol LP2731	10	Cleaning agent
ROKAnol SAE7	7	Cleaning agent
ROKAnol IT9	3	Wetting agent
Hydrocarbon solvent	80	Solvent

Formulation performance:

To evaluate cleaning performance, special in-house method was created. Steel plate was covered smoothly with 3 g of prepared mixture of petrolatum and engine oil, it was then left until the soil hardened. The prepared plate was dipped in solvent cleaner and left for 5 minutes, bath was occasionally stirred in order to ensure liquid flow above the plate surface. The cleaned plate was then removed from the bath and cleanliness level was evaluated visually.



Plate covered with preapred soil (left) and after cleaning using formulation for component pretreatment – 1 (right).

Formulation for component pretreatment – 2

Appearance	Straw-colored liquid

- Insoluble in water
- Fast acting
- Moderate foaming
- Dip cleaning

Ingredient	Mass percentage [%]	Function
ROKAnol SAE12	15	Cleaning agent
ROKAnol NL3	15	Wetting agent
Hydrocarbon solvent	70	Solvent

Formulation performance:

To evaluate cleaning performance, special in-house method was created. A steel plate was covered smoothly with 3 g of prepared mixture of petrolatum and engine oil, it was then left until the soil hardened. The prepared plate was dipped in solvent cleaner and left for 5 minutes, bath was occasionally moved in order to ensure liquid flow above the plate surface. After cleaning, the plate was removed from the bath and the level of cleanliness was evaluated visually.



Plate covered with preapred soil (left) and after cleaning using formulation for component pretreatment – 2 (right).

Acidic de-smutting spray cleaner

Appearance	Clear liquid
pH (solution 1%)	2 – 4

- Machine spray cleaning
- Suitable for dissolving inorganic scale
- Acidic cleaning, removing smut from aluminum
- Effective for rust removal from steel

Ingredient	Mass percentage [%]	Function
EXOfos PB-103	5	Cleaning, wetting agent
ROKAnol LP1822	10	Cleaning agent
Citric acid	20	pH adjuster
1-methoxy-2-propanol	15	Solvent
Water	Up to 100	Solvent

Formulation performance:

Cleaning performance was assessed using an in-house methodology based on two types of soils on steel plates.

Soil 1. – **Process deposit:** plate was covered with soil and dipped in given solution for 5 minutes, batch was occasionally moved in order to ensure liquid flow above the plate surface. Cleaned plate was then removed from the batch and rinsed under water. Cleanliness level was evaluated visually.

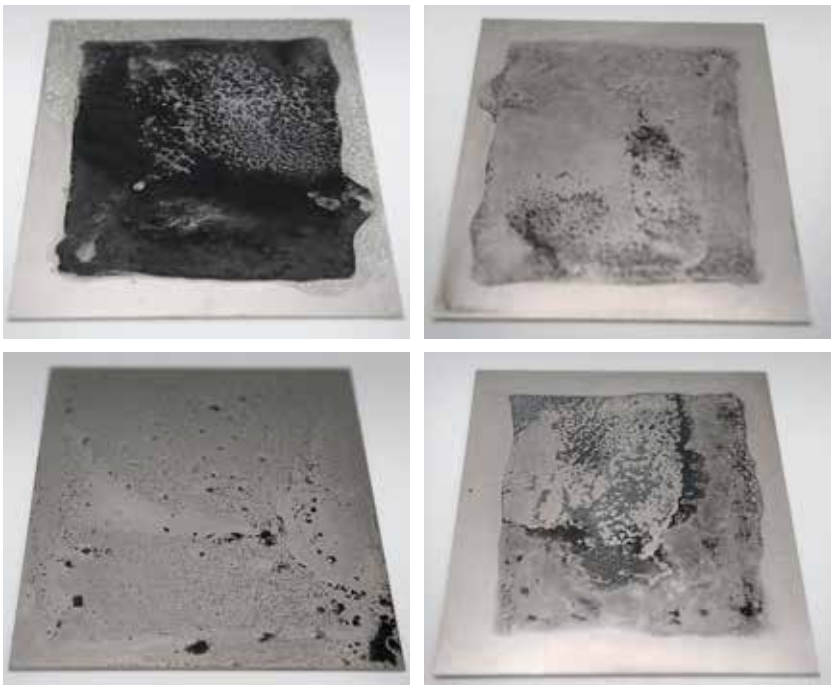


Plate covered with prepared soil (on the left top) and cleaned using 10% solution of acidic de-smutting spray cleaner (right top) in comparison with water – soiled (bottom left), cleaned (bottom right).

Soil 2. – **Rust deposit:** plate covered with rust was submerged in the test solution and left for 24 hours without agitation. After the exposure period, the plate was removed and rinsed with water. Cleanliness was assessed visually.

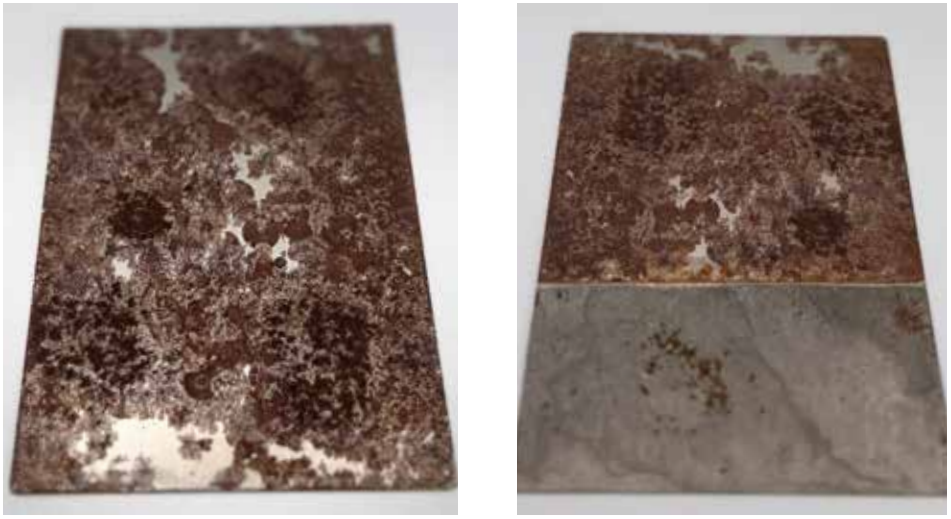


Plate covered with rust deposits before cleaning (left) and after cleaning with a 10% solution of the acidic de-smutting spray cleaner designed for Aerospace applications (right).

Aircraft Line Maintenance

Aircraft Line Maintenance involves the day-to-day exterior cleaning of the aircraft. The role of surfactants is to remove oils, soot, hydraulic fluids, and other operational residues.

Recommended surfactants and their physicochemical properties:

Product name	CAS number	pH	Cloud point in given method [°C]	Viscosity at 25°C [mm^2/s]	Alkaline resistance [maximum concentration of NaOH in [g/L]	Acid resistance [maximum concentration of HCl/H_2SO_4 in [g/L]	Foaming
ROKAnol DB7	68131-39-5	4.6 – 7.4 (1%)	49 [A] 38 [B] 29 [C] 79 [D] 79 [E]	100	50	225 / 225	Medium
ROKAnol EH5	27252-75-1	5.0	70 [D] 63 [E]	<200	60	225 / 225	Low
ROKAnol GA4	160875-66-1	5 – 7 (1%)	53 [D] 42-45 [E]*	40	50	225 / 225	Low
ROKAnol ID5	78330-20-8	5 – 7 (1%)	31 [A] 22 [B] 15 [C] 72 [D] 66 – 69 [E]*	<100	70	225 / 225	Low

Product name	CAS number	pH	Cloud point in given method [°C]	Viscosity at 25°C [mm^2/s]	Alkaline resistance [maximum concentration of NaOH in [g/L]	Acid resistance [maximum concentration of HCl/H_2SO_4 in [g/L]	Foaming
ROKAnol IT6	69011-36-5	5 – 7 (1%)	<10 [A] <10 [B] <10 [C] 67 – 72 [D]* 68 [E]	<100	20	225 / 225	Low
ROKAnol ID8	78330-20-8	5 – 7 (1%)	64 – 68 [A]* 49 [B] 38 [C] 80 [D] 77 [E]	<100	60	225 / 225	Medium
ROKAnol IT9	69011-36-5	5 – 7 (1%)	56 – 60 [A]* 42 [B] 31 [C] 80 [D] 79 [E]	<10	50	225 / 225	Medium
ROKAnol L5P5	68439-51-0	5 – 7 (1%)	27 – 31 [A]* 19 [B] 12 [C] 48 [D] 44 [E	60	0	140 / 140	Low
ROKAnol L7	68439-50-9	4.6 – 7.4 (1%)	60 [A] 44 [B] 30 – 40 [C]* 81 [D] 80 [E]	78	80	225 / 225	Medium
ROKAnol LP100	120313-48-6	5 – 7 (1%)	72 – 76 [A]* 59 [B] 48 [C] 70 [D] 69 [E]	149	50	225 / 225	Medium
ROKAnol LP1822	37251-67-5	5 – 7 (10%)	20 [A] 42 [D] 36 [E]	40	20	225 / 225	Low
ROKAnol LP2024W/95	Mixture	5 – 7 (1%)	20 – 24 [A]* 15 [B] <10 [C] 51 [D] 41 [E]	60	40	225 / 225	Low
ROKAnol SAE5	84133-50-6	5 – 8 (5%)	<10 [A] <10 [B] <10 [C] 62 [D] 56 [E]	40	50	225 / 225	Low
ROKAnol TMP7	157627-86-6	5 – 7 (1%)	42 – 45 [A]* 75 [D] 74 – 76 [E]*	78	50	225 / 225	Medium
ROSULfan E	126-92-1	9 – 11 (25%)	–	<100	170	225 / 225	Low
ROSULfan L	Mixture	5.5 – 9.0 (5%))	–	305	10	115 / 140	Medium
SULFOROKAnol L227/1	68891-38-3	10.0 – 11.4 (10%)	–	100	280	225 / 225	High

* according to TDS

Proposed formulation based on our products:

Aircraft surface cleaner

Appearance	Clear liquid
pH (solution 1%)	10 – 12

- For usage in room temperature
- Low foaming
- Suitable for manual or machine spray cleaning

Ingredient	Mass percentage [%]	Function
ROKAnol SAE5	2.5	Degreasing, cleaning agent
ROKAnol GA4	2	Degreasing agent
ROKAnol LP100	2	Detergency, low foam agent
Sodium cumenosulphonate	5	Hydrotrope
Sodium carbonate	1	Builder
Sodium metasilicate	1	Builder
Water	Up to 100	Solvent



Formulation performance:

To evaluate cleaning performance, dedicated in-house test method was developed. Steel plate was soiled with 'hydrophobic dirt' which is mixture of organic, hydrophobic substances and inorganic particles. The soil was applied to the surface by spraying. The cleaning process was carried out by spraying a specific amount of the test product onto the contaminated plate surface. The results were compared with the cleaning performance achieved using water alone. Cleaning efficacy was assessed through visual observation of the plates before and after cleaning.

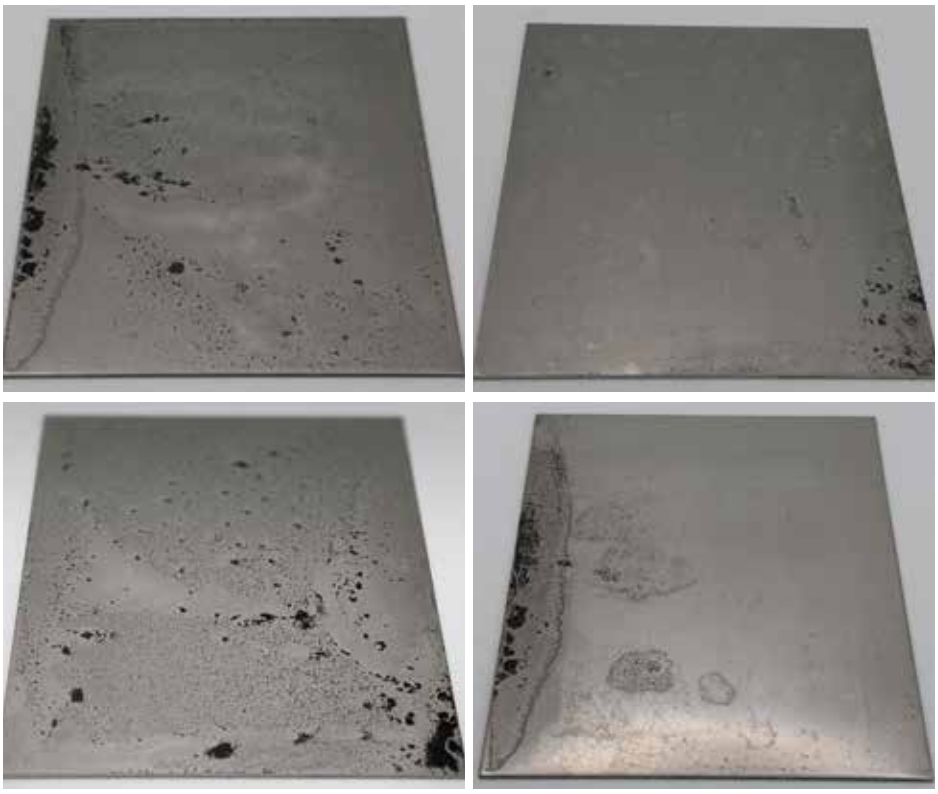


Plate covered with preapred soil (top left) and cleaned using Aircraft surface cleaner (top right) in comparison with water – soiled (left bottom), cleaned (right bottom).



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