



Technical Process Bulletin

ALODINE 5923

CHEMICAL CONVERSION PROCESS FOR ALUMINIUM
CHROME HEXAVALENT FREE

I. PRESENTATION :

ALODINE 5923 is a chemical conversion process for aluminium and its alloys, completely free from hexavalent chromium

It is used to produce, on the metal surface, an amorphous inorganic coating with the following properties :

- * provides an excellent bonding surface for paints with associated good anti-corrosion performances
- * very high corrosion protection on bare metal
- * low electrical contact resistance of the coating

ALODINE 5923 is designed to substitute the chromating process ALODINE 1200 in the applications concerned by the standard MIL-C-5541

ALODINE 5923 is used in immersion or spray application.

The relevant coating is really visible and the colour is more or less pronounced according to the alloys and the operating conditions.

ALODINE 5923 can be used on aluminium and its alloys, including cast alloys and is used in all fields of the industry (automobile, aerospace, electrical equipments, architecture, white goods, transportation, general industry,....).

ALODINE 5923 is an environmental friendly product because it is hexavalent chrome free and so, it complies with European directives:

- * 2000 / 53 / CE relative to end life vehicles
- * 2002 / 95 / CE called RoHS (Restriction on Harmful Substances) for the electric and electronic equipments.

II. MAIN ADVANTAGES

- * compliance with the most severe specifications on bare metal
- * formation of a coloured coating well visible to the naked eye
- * process hexavalent chrome free
- * absence of organic compounds
- * product ready to use and easy analytical survey
- * product not dangerous : not concerned by the labelling regulation
- * active on all kind of alloys and usable with all types of paints
- * complies with the most recent directives applicable in the industry



III. CHARACTERISTICS

- . Appearance : clear liquid
- . Colour : dark green
- . Density at 20 °C : 1,015
- . Easily miscible with water
- . Acidic product
- . pH of the product : about 3,9

IV. PROCESSING

In order to implement the process **ALODINE 5923**, it is necessary that the surface preparation (removal of organic soils and superficial oxides) is efficiently done. This is a critical step because the metal should be reactive to obtain an uniform and good quality coating.

OPERATING RANGE

The conventional process sequence consists of the following steps:

- * Cleaning
- * Cascade rinsing with tap water
- * Acidic deoxidizing
- * Cascade rinsing with tap water
- * Rinse with demineralized water
- * Chemical conversion
- * Final rinse with demineralized water
- * Drying

IMPORTANT COMMENTS ON THE SURFACE PREPARATION

a) Cleaning

For not very greasy parts, the use of soft alkaline cleaners is recommended to avoid any attack of the substrate.

For some specific applications (exemple : marine application for the architecture) , an alkaline etching is used in order to etch the surface.



In this case, the rinse which follows must be particularly efficient to avoid the drag-out of alkaline wastes towards the deoxidizing bath.

In addition, the deoxidizer used then should have an high oxidizing power so as to do a desmutting by removal of the smut due to the alloyed elements (copper, silicium, magnesium,...)

b) Deoxidizing

This step is very important because the surface should be very reactive which means free from all residues of surface oxides.

Generally, a weight loss of 0,5 to 2 g/m² is recommended, except for some cast alloys for which it is better not to etch the substrate.

c) Rinses

The management of the rinse sections should be carefully done with the hexavalent chrome free process.

Effectively, the contaminants could create troubles in the conversion reaction by interaction with the active ingredients of the product.

Therefore, the rinse before conversion should be double : first with tap water cascade, following by a rinse in recycled demineralized water.

The water included in the residual film of the surface should preferably have a conductivity lower than **30 microSiemens/cm** in order to extend the shelf life of the conversion bath.

d) Contaminants to avoid

The process is sensitive, that's why the following elements: phosphates - chlorides mustn't be introduced in the conversion bath.

The surface preparation products, the water and the equipment should integrate these constraints.

Just in case the process is implemented in a tank containing previously a chromic solution, a very effective decontamination is mandatory.

This could be done with a caustic solution used hot and circulated during several hours with partial dumping in between.

The reason is that all traces of hexavalent chromium must be removed to be in accordance with legislation.

EQUIPMENT



The tanks should be in rigid PVC (free of plasticisers), or polypropylène, or steel with acid and fluoride resistant coatings, or stainless steel AISI 316 L.

Process piping, nozzles and pumps should be constructed of PVC, PP, Teflon.

Steel or others metals are banned.

An exhaust line for the vapours is recommended.

CONVERSION BATH MAKE-UP

Add the product ALODINE 5923 in the tank.

Heat up to the working temperature.

Check the operating conditions and adjust if necessary.

USE CONDITIONS

The process **ALODINE 5923** is used in immersion or spray applications with the following parameters:

Concentration :	ready to use
Temperature:	20 to 50 °C
Contact time:	2 to 4 mn (spray) 2 to 10 mn (immersion)

Practical observations

The aluminium is a very reactive substrate, that's why the coating weight and the coating appearance, as well as the anti-corrosion performances are depending on the following factors:

- * alloy composition
- * surface condition of the metal (including thermal treatment)
- * operating conditions of the pretreatment cycle (cleaning and etching/deoxidizing)
- * operating parameters (temperature, treatment time)

The correct operating conditions to use vary according to the coating characteristics requested and in particular of the coating weight which ranges between 0,2 to 1,5 g/m².

The parameters : temperature and treatment time , have an influence on the coating weight in the same way, that is to say, the increase of each parameter leads to a more important coating formation .

Remember also that the alloy composition and the pre-treatment of the surface have an important influence.



For the applications prior to painting, the essential target is to have an adhesion of the organic finishing, which means a protective coating with a good flexibility in order to allow a perfect adhesion of the paint.

In this case, the coating weight deposited is voluntarily limited to about 0,5 to 1 g/m², which corresponds to the best compromise adhesion/anti-corrosion.

On the contrary, on bare metal, the anti-corrosion performance is improved by the increase of the coating weight.

V. CONTROLS AND REPLENISHMENTS :

1) pH determination

Measure directly the pH of the bath using a freshly calibrated pH meter (temperature adjusted)

2) Titration

- . Take a sample of the solution and let it cool to room temperature
- . With a pipet, transfer a 2 mL aliquot into an erlenmeyer flask
- . Add :
 - 10 mL of 30 % hydrogen peroxide
 - 25 mL of 1 N sodium hydroxide
 - 35 mL of deionised water
- . Cover the flask with a watch glass.
- . Heat slowly to boiling and maintain this temperature during 30 minutes.
- . Cool down at room temperature.
- . Add :
 - about 50 mL of deionised water
 - 2 to 3 g of potassium iodide
 - 10 mL of 6 N sulfuric acid solution
- . Mix , then let it rest 3 minutes. The solution becomes red-brown.
- . Titrate with a 0,1 N sodium thiosulfate solution until discoloration to straw coloured / orangy yellow
- . Add a touch of starch, the solution becomes very dark
- . Continue the titration until discoloration
- . Record the volume V of 0,1 N sodium thiosulfate solution added

Result expression

The result is represented by a point number corresponding to the volume V added

A new bath titrates **8,1 points**.

ALODINE 5923 concentration (% vol/vol) = $V \times 12,3$

3) Others controls



For the starting-up of a line, complementary analysis (see the survey plan of the installation) are made in order to be sure that the bath equilibrium is reached according to the line characteristics and the operating conditions (speed line, drag-out, ...) and specify the replenishment.

Particularly, the fluoride content of the bath can be checked. The method consists in measuring the total fluorides content in the bath with a selective electrode.

Others analysis are regularly made by the technical department to save any drift and to control the level of contamination of the bath.

Maintenance and Replenishment of the bath

1) pH

The pH of the bath should be kept between 3,80 and 4,00

It should be controlled each day and corrected if necessary, slowly with diluted solutions of sulfuric acid or potassium hydroxide - then, let the pH stabilize and remeasure it.

2) Concentration

The level of the bath is kept by regular additions of **ALODINE 5923**.

The chemical equilibrium is maintained in these conditions if the operating conditions will allow it (consumption of the active principles by chemical reaction compensated by additions to complete the bath level - the working temperature being the key condition). Otherwise, specific additives are added.

The useful life varies according to the contamination level by the named pollutants and the content of aluminium and others dissolved metals.

FINAL TREATMENT

The components of the bath completely react to the aluminium surface and the solution excess should be removed by a rinse with demineralized water.

The conductivity of the water dropping from the metal should be lower than 30 microsiemens/cm.

Finally, it is necessary to finish the operations by the drying of the parts before the entrance into the painting tunnel (from 60 to 90 °C for 5 to 20 mn).

The parts should be handled with gloves to save tracks which cause painting defaults.



The painting of the treated parts should be preferably made during the day.

VI. PRECAUTIONARY INFORMATION :

ALODINE 5923 is an acidic product containing fluorides.

The event of splashes or contact with skin or eyes could cause burns.

In case of contact with the skin, wash immediately and thoroughly with water then apply a 2,5 % calcium gluconate gel and massage during several minutes.
Pay attention in particular under the fingernails.

In case of splashes on the eyes, rinse immediately with plenty of clean water, then apply a 2 % triethanolamine eye drops.
Consult immediately an ophthalmologist.

For the handling, the gloves, protection glasses, protection clothes, security shoes are advised.

It is recommended to have a shower and eye fountain near the work station.

Don't use glass container or material with silica.

Nota : For more information, see the material safety data sheet

VII. STORAGE CONDITIONS :

ALODINE 5923 must be kept in the original and closed container, in a well ventilated place.

The product is sensitive to frost and may be irreversibly damaged.

Keep the product away from alkaline products.

VIII. EFFLUENTS

For the used solutions disposal, the procedure is the following :

- * Neutralization by the lime to precipitate the fluorides and metal salts and bring the pH between 6,5 and 9
- * Allow the constituted sludge to settle

Check the compliance of the effluent with the existing legislation .



Henkel Technologies France
Division Industrie
3, Allée E. Reynaud
77200 Torcy
Tél : 01 60 17 02 02
Fax : 01 60 17 32 91

Henkel Technologies France
Division Automobile
82, Av. du 85è de Ligne
58200 Cosne-sur-Loire
Tél : 03 86 28 70 00
Fax : 03 86 28 12 37

Henkel Concorde S.A.S.
43 route de Ruaudin
72230 Arnage Cedex
Tél : +33 (0) 2 43 21 60 93
Fax : +33 (0) 2 43 21 63 72

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