Instructions for use

Polychromal
PRODUCTS

Screen printing

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INTRODUCTION

Thank you for choosing anodised aluminium base sheets from Polychromal Products.

These instructions for use explain the method used to produce, for example, text, name and front plates using DuraSeal plus the associated screen-print pastes, inks and chemicals. DuraSeal is ideal for screen printing. With careful use, our complete range of high-quality products guarantees top-quality end results.

GENERAL TERMS AND DEFINITIONS

Anodising
Anodising is an electrolytic process where the surface of ordinary aluminium is converted into aluminium oxide, resulting in the formation of a transparent porous layer on the surface. All or just part of this layer can be coloured and then sealed to form a ceramic layer.

Anodised layer
The transparent porous layer on the surface of the aluminium is the anodised layer. An anodised layer which has been properly anodised and sealed is twenty times more wear-resistant than a good epoxy coating. It is ideal as far as adhesion is concerned as the anodised layer is formed from the aluminium itself. The anodised layer grows from the aluminium underneath as it were.

Absorption
The capacity for dyes and chemicals to be absorbed into the base material through its porous structure.

Quality of the anodised layer
The anodised, but still unsealed, anodised layer has a porous structure which gives it a high capacity for absorption and makes it possible for dyes to penetrate. However, this capacity disappears very quickly. The aluminium oxide reacts with moisture and forms aluminium hydroxide as a result of which the capacity for absorption is reduced. However, it is possible to carry out anodising in such a way that pores with a larger diameter are formed so that the absorption capacity may be preserved longer. This does, however, affect the quality of the anodised layer.

Shelf life
Polychromal BV has developed a method for impregnating the pores and protecting them against external influences. Solvents containing dyes penetrate deep into the pores through this protection. This has made it possible for anodised, unsealed aluminium sheets to be coloured even years after they were anodised by means of screen printing, photomechanical processing or inkjet printing. Years later, any graphic image can still be reproduced in intense colours in an anodised layer without any concessions on quality.

Colouring
Dyes can be adsorbed in the anodised layer in different ways. The whole sheet can be given an intense colour by immersing an anodised aluminium sheet in a bath filled with pigment, for example. The dyes that are used for this are dissolved in water or in solvents. Other methods include screen printing, photomechanical printing and inkjet printing. These are also the principal techniques for applying multiple colours in the anodised layer according to a specific pattern.

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Dyes which are soluble in solvents are the most suitable for screen printing, inkjet printing or the photomechanical application of colours. They quickly penetrate deep into the pores and most are to a great extent lightfast. The choice of solvent and screen-print paste containing the dyes is very important in order to ensure good results. The molecules of pigment should always be smaller than the pores in the anodised layer otherwise the anodised layer will not be able to adsorb them. Pores in an anodised layer have an average diameter of 0.075 microns. As all pure white dyes are bigger than these pores, the anodised layer cannot be coloured white. Colour combinations with white, such as pink, are not possible either.

Sealing

Sealing is a process where the aluminium oxide in the anodised layer is converted into aluminium hydroxide by immersing it in water at 97 °C for 45 minutes. Because the aluminium hydroxide molecules are bigger than the aluminium oxide molecules, the pores are sealed off. As a result, the applied dyes which represent a reproduced text or image are enclosed in the anodised layer where they are no longer accessible to solvents or other chemicals unless the anodised layer itself is affected. Sealing does not improve the hardness of the anodised layer. However, the quality of sealing has a considerable influence on the colourfastness of the colours.

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SCREEN PRINTING DURASEAL AND POROPRINT

Materials

DuraSeal sheets are anodised aluminium sheets with impregnated open pores for a durable and long shelf life.

PoroPrint screen-print paste for colourfast screen printing in DuraSeal or any other anodised aluminium sheet with open pores. During drying, the dye from this screen-print ink penetrates into the pores of the unsealed anodised layer.

Processing and shelf life

DuraSeal sheets can be printed in using PoroPrint screen-print paste or other screen-print inks which are suitable for printing in anodised aluminium with open pores. PoroPrint screen-print paste can also be used for printing in anodised, unsealed aluminium sheets made by other manufacturers.

If PoroPrint screen-print paste is used for printing on sheets other than DuraSeal sheets, those sheets need to be printed on shortly after being anodised. That is because the pores of these other sheets close quickly if they come into contact with moist air. As a result of this, the capacity for absorption slowly perish. Their capacity for absorption and shelf life depend on the parameters and the chemicals used during the anodising process. A loss of 30% within 24 hours is usually the case.

DuraSeal aluminium sheets are anodised in accordance with the highest quality requirements - in an automatic process which is under constant supervision. The impregnation of the open pores, directly after anodising, ensures that the pores can no longer come in contact with air. In addition, DuraSeal sheets are not sensitive to grease or fingerprints.

DuraSeal sheets can be stored and used for years. Only temperatures above 40 °C in conjunction with high atmospheric humidity can affect quality. High temperatures without moisture will not affect the quality.

Screen preparation

All sorts of gauze can be used. Gauze diameters can vary from Mesh 50 to 140. Here, it should be noted that the application of screen-print ink when using a gauze diameter of 140 is extremely thin. You should make sure that the screen-print paste does not dry out before the particles of pigment have had time to penetrate the pores.

A gauze diameter of Mesh 120 combined with an indirect masking film gives extremely sharp printing and sufficient colour transfer. Proper squeegeeing is highly recommended and if necessary painting twice after squeezing. Make sure that sufficient colour transfer is achieved. Maskings should be solvent-resistant as is customary when printing using PVC foil.

PoroPrint screen-print paste can be used directly without using additives.

Make sure that you stir it well before use.

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Blending

PoroPrint screen-print paste comes in a highly concentrated form. Its high pigment concentration also makes it ideal for the intense colouration of very thin anodised layers.

BLENDING

Use PoroPrint Transparent to reduce colour intensity.

Colour intensity when printing

PoroPrint screen-print paste can be blended with PoroPrint Transparent in order to reduce colour intensity. The aluminium colour swatch which was brought onto the market by Polychromal Products is an exact reproduction of PoroPrint screen-print paste in DuraSeal20 sheets with an anodised layer of 19-21 microns.

With PoroPrint screen-print paste, it is possible to achieve full colour intensity even with very thin anodised layers (from about 8 microns depending on the anodising process); however, the anodised layer needs to be fairly fresh.

Drying

The drying process is an important factor which influences the final colour intensity. The pigment migrates from the screen-print paste into the pores of the anodised layer. The pores exert a suction force on the pigment (absorption). This process stops as soon as the PoroPrint screen-print paste is dry. The longer the drying time, the more pigment can penetrate the pores. So faster drying results in lighter colours. The temperature during the drying process is also an important factor; it can be used to control the colour intensity precisely.

If drying is carried out on screen-print racks, at room temperature, you have to be careful for for ‘false’ air flows, e.g. as a result of a draught across the drying rack or placement too close to a heat source. These can cause colour irregularities.

The ink on the sheet needs to be “wet” for at least 45 minutes.

The anodised layer is coloured by the dyes. The screen-print paste used for printing is only a vehicle for the dyes to allow them to be taken up by the anodic layer in the right place. The screenprint paste is removed after sealing.

Sealing

Sealing is extremely important. Suspend the printed sheet in water at a minimum temperature of 97 °C and move the sheet back and forth for 1 to 2 minutes. After ten minutes, the surface is sealed and the image is no longer accessible to solvents. For colourfast results: 45 minutes at a constant temperature of 97-100 °C.

Sealing is a chemical process. Aluminium oxide binds with water molecules (hydration) and is then converted into aluminium hydroxide. The walls of the pores grow as it were and seal in the image. This process only works properly at temperatures above 97 °C and in water with a pH value of between 5.5 and 6.3. Other values can result in the ‘bleeding’ of the pigment. Therefore check the pH value of the sealing water regularly:

- pH < 5.5 : correct value by using sodium carbonate.
- pH > 6.3 : correct value by using acetic acid.

Placing large quantities of sheets in the sealing tank can cause the pH value of the sealing bath to increase considerably. In addition, the temperature will drop if a large quantity of sheets are immersed in the bath at the same time. The risk of 'bleeding' is highest at this time. It is recommended for the sheets to be moved around during the first minute of the sealing process. The contents of the bath can also be agitated using a circulation system. Compressed air is not suitable for use as it causes too much movement. You can also overheat the bath as the boiling will cause sufficient movement in the bath.

Cleaning

Surplus screen-print paste should be removed using solvent after sealing. Non-printed sections should also be cleaned using a solvent as the impregnating agent from the pores is pressed onto these sections during sealing. Various solvents can be used to do this. For instance isopropanol (moderate evaporation rate) and methoxypropanol (PoroClean). This is the best solvent for cleaning. In addition, PoroClean is extremely suitable for other purposes such as cleaning the masking and reopening the masking after a long break from printing.

PoroClean is not flammable (however it is highly flammable and ignitable under certain circumstances) and has a boiling point of 120 °C and a flash point of 36 °C. Although relatively harmless, you should comply with the customary warnings as specified on the label (Directive 67/548).

If there are still any spots on the surface after cleaning, then these are to be removed using household abrasive cleaner and water. Metal polishes such as Brasso can also be used. Liquid paraffin is an excellent after-care agent. To maintain anodised aluminium: periodically remove dirt, wash and then rub in a small amount of liquid paraffin.

100% PoroClean consists of:
1-Methoxy-2-Propanol (CAS no. 107-98-2)

Other names:
Propylene glycol monomethyl ether (PGME)

Trade names:
Methylproxitol (Shell) and Dowanol PM (Dow)

Almost all alcohols, glycol ethers and esters are good solvents for cleaning. Ketones and hydrocarbons are also suitable but to a lesser extent. Solvents can be mixed together to form a cleaner which can be used to remove surplus screen-print paste by hand or which is suitable for automatic cleaning.

All these solvents are flammable and therefore need to be used in well-ventilated areas where there are no open fires and where smoking is prohibited.

Mechanical processing: cutting, sawing, punching and milling

DuraSeal sheets can be cut without the risk of mayor hair cracks forming.
However, the cutting clearance should be set for the correct thickness:

- clearance for sheets from 0.25 through 1.50 mm = 0.15 mm
- clearance for sheets from 1.50 through 3.00 mm = 0.25 mm

Cutters and punching tools are to be well-sharpened. Strippers are to be set so that they closely surround the punches. As soon as the material is slightly bent, hair cracks will occur the anodised layer.

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