

ALANOD and MIRO are registered trademarks.



ALANOD Aluminium-Veredlung GmbH & Co. KG
Egerstr. 12, 58256 Ennepetal • Germany • Postfach 1102, 58240 Ennepetal
Telefon +49 23 33 9 86-500 • Fax +49 23 33 9 86-555 • alanod@alanod.de • www.alanod.de
ALANOD Ltd. • Chippenham Drive • Kingston • Milton Keynes MK10 0AN – United Kingdom
Phone +44 1908 282044 • Fax +44 1908 282032-033 • alanod@alanod.co.uk • www.alanod.co.uk

03.04

PROCESSING MANUAL

Processing manual for pre-anodized and PVD-coated (MIRO[®]) aluminium.

Thank you for your interest in our products.

In order to help you avoiding damage on surfaces during refining and production processes for surfaces on ready-to-use coil-anodizing plants and vacuum coating lines, this reference book was prepared.

A useful companion for newcomers, and a help for professionals, this booklet will confirm that you have selected an appropriate manufacturing method and also offers some useful suggestions.

Contents

Cutting	6
Punching	7
Bending	8
Drawing	10
Embossing	11
Perforating	12
Printing	13
Laser machining	14
Cleaning	16
Assembly	17
Storage, transport	18

Cutting

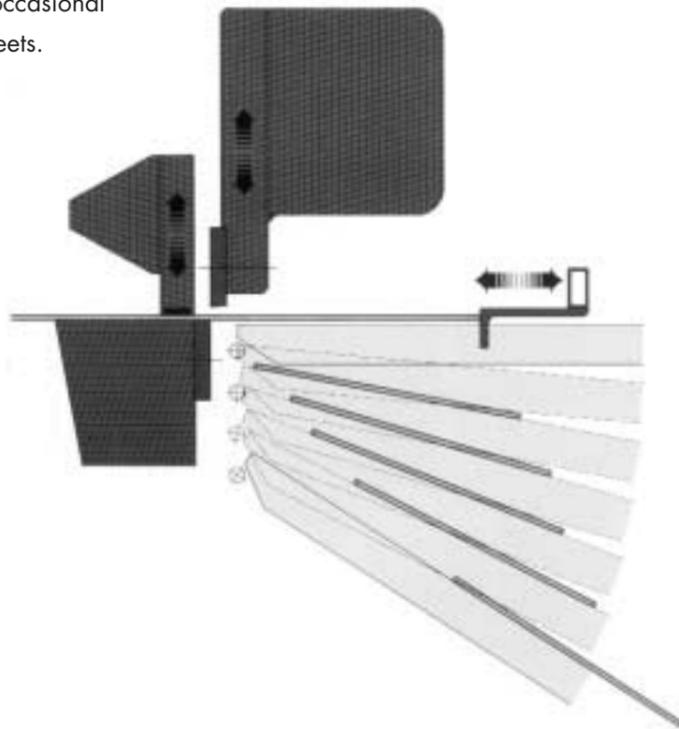
Before deciding to purchase parallel shears, one should consider that tighter cutting angles are required to process aluminium.

These should be in general below $2,5^\circ$, or, if all metal to be cut is 0,6 mm gauge or less, the cutting angle can be reduced to 1° . This will reduce twist in narrow cut sheets.

A tighter cutting angle causes a higher shearing force. There is a limit to the maximum values and thicknesses of material that may be cut, and these are indicated by the machine manufacturer. Machine modifications should only be carried out after consultation with its manufacturer.

To achieve dimensional tolerances when cutting widths greater than 150 mm, support cylinders which retract during actual shearing can greatly assist.

It is not possible to avoid build up of aluminium residue on the shears with some types of aluminium. This can be removed by occasional wiping strokes with thin steel sheets.



Picture: Hans Schröder Maschinenbau GmbH

Lubrication with cutting oil can prolong tool life. However spraying oil on the aluminium to be cut should never be carried out. Lubricant will creep under the protective film requiring later secondary cleaning of the aluminium. Depending on the length of exposure to oil the film adhesive can cause oil spots on the mirror surface.

We are always available to provide you with the names of appropriate machinery, coatings and lubricant companies.

Punching

Low-alloy tool steels should be used for both upper dies and die plates. Build up on tool edges can occur when processing aluminium if highly alloyed tool steel with a high chrome content is used. These alloys should be avoided as tool life will be greatly shortened by their use.

Die clearance should not be more than 5% of material thickness. The coating of cutting edges will also greatly prolong tool life, especially for automatic punching machines with a high stroke rate (Regrinding intervals can then be lengthened).

For wire-EDM and cavity sinking EDM processing: The surfaces on upper dies and die plates can be re-calibrated or dressed with a diamond file.

Volatile lubricants applied in minute quantities in the micron range have proved to be useful. However local workplace regulations must be observed by use of air ventilation removal if these lubricants are to be used regularly.

Punching our products, coated with protective film, must be carried out with the filmed side facing up towards the die. If not the protective film is not sheared cleanly and can cause compression dents in the tool with subsequent strokes.



Picture: Trumpf GmbH & Co.

Bending

Sink-bending:

When forming against air always ensure that the size of the U-shaped die is well matched to the thickness of the metal to be formed and the bending angle. If too small a U-shaped die is selected for an angle of 90° it can cause linear marks on the material even when coated with protective film.

When bending with plastic inserts inside the U – hardness must be matched to the part to be shaped. When necessary the use of hollow tube reduces stress.

With shaped dies exact stroke distance must be achieved to avoid marking on the metal surface.

Folding:

Exact bending can be achieved by this method as the metal to be formed is clamped right at the edge of the bend. However the methodology of clamping only allows defined and fixed sequences and angles to be achieved.

Folding also is relatively slow due to long cycle times (clamping, bending, opening) but even rounded parts (drawn over a hollow tube) can be produced by this method.

Parabolic bending:

Using slip bending machines to form complex reflector shapes and parabolic louver parts has become the most popular system of manufacture in much of the world. It allows the production of asymmetric and other curved reflector shapes; sometimes with multiple progressive radii rolled into one given piece of material. Slip bending roll machines now available allow parabolic forming with a 35 – 45 mm individual minimum radius. To repeat, multiple radii over one formed reflector is commonly achieved. The limits to what is formable in total depends on the mechanical values of the metal to be formed in combination with the limits of the work rolls and the travel time through them. The work side of the metal on to which forming pressure is applied is normally the concave inner reflector surface. If the convex is the work face then cracks in the anodic film can be apparent on the opposite reflector side (although from some viewing angles only). The optical appearance of cracking or more accurately crazing is avoided when PVD coated MIRO is used.

With our products parabolic curves with strengthened edges are achievable by stretch bending.

Again with our products, hardness, thickness together with run off radii combine to determine what is achievable. We can give you more constructive advice based upon our experience with this technology.

Tool bending:

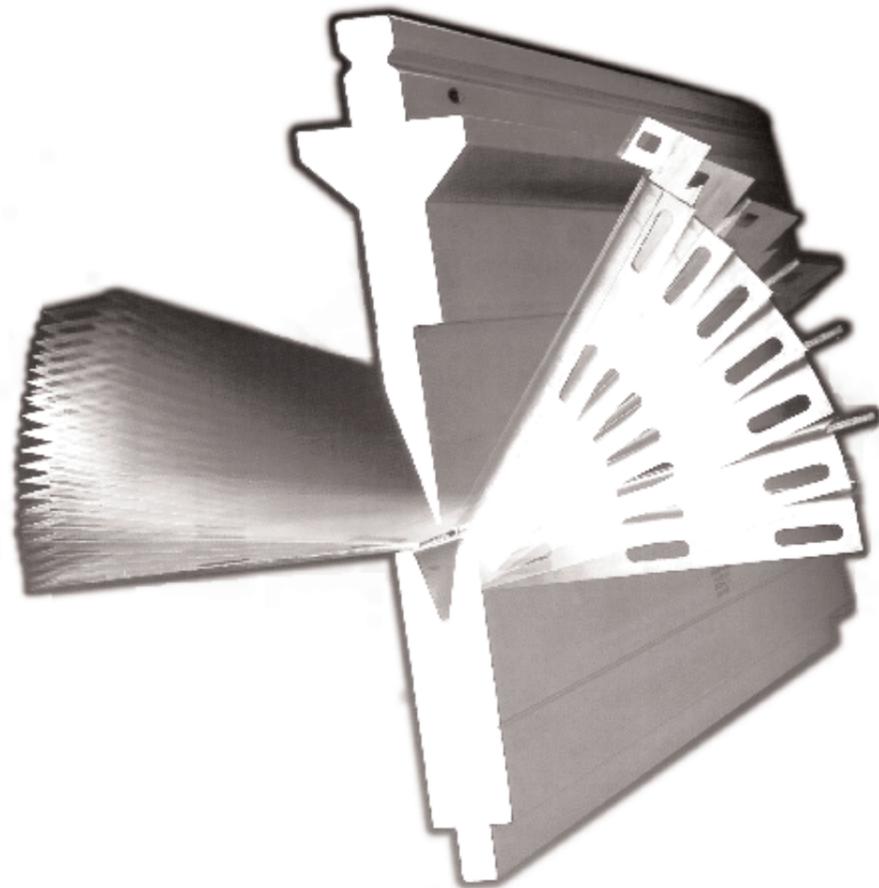
When metal bending is performed together with another process the surface finish of the bending jaws is critical to avoid material abrasion of the surface.

Nitriding of the tool, sintering of the inserts or use of certain engineering plastics avoids problems.

Volatile lubricants, evaporating engineering oils avoid surface scratches.

Some reflectors are comprised of many shallow angle facets which together form an optical reflector. The holding of tolerances with this kind of reflector is difficult as dimensional errors are progressive per facet. Here bead stamping can obtain tolerances of 0,5 mm per facet. Here the surface structure is compressed by a bending blade without disturbing the mirror surface. Flatness from one facet to the next is guaranteed by the upper and lower tool part.

Again we can provide you with detailed information relevant to this production process together with expert manufacturers for this technology.



Picture: Trumpf GmbH & Co.

Drawing

Coil anodized aluminium coil and PVD coated aluminium coil can both be drawn to depths between shallow and deep drawing. Softer metal, thicker gauges, quality of design (for example drawing radii and contour being matched) allow this process to succeed. Most of all deep drawing quality plastic protective film is a great assistance.

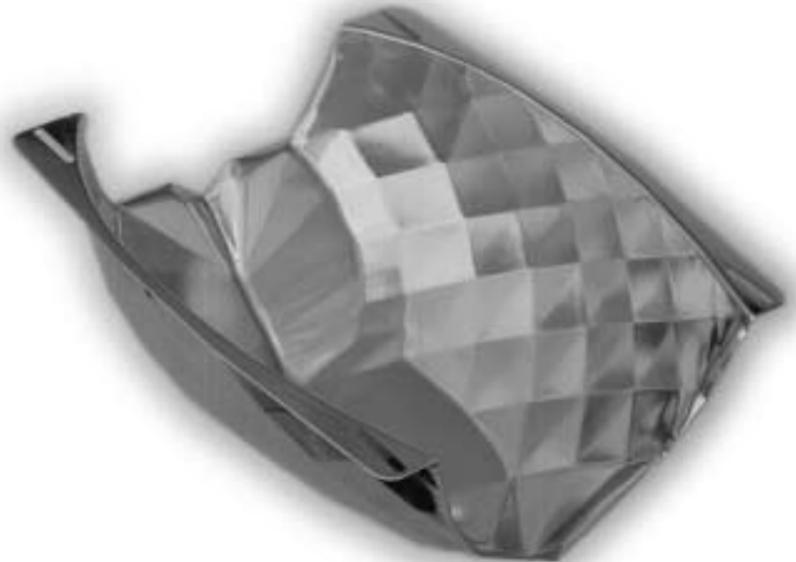
Brittleness of the anodized layer can lead to colour variations.

However, holding beads in the tool, modifying the drawing axis, matched to the tool pressure can lead to good drawing results for our material.

Pragmatic opinions as to which shapes are drawable in reality and in which materials are paramount in design of drawn parts. We will willingly pass on to you our experience.

Hydro-forming is not practicable for coil anodized and PVD aluminium in most cases where the sensitive surface has to flow beyond its elastic limit.

(However ALANOD new MIRO L technology will lead to further opportunities to draw reflector metals from coil).



Embossing

Our material is very suitable for shallow embossing letters and characters for trophy, point of sale and other advertising applications.

Concave and convex embossed parts can be produced without any cracks or delamination of the surface. Dyed colours or printing inks are readily accepted by the anodised surface. However fine line embossing should be applied to only thin material gauges or softer materials.

Anodised and PVD surfaces work well with the friction presses common in this field.

Tool manufacturing can achieve very long service of tools for aluminium embossing when suitable tool steels and processes are used. We will happily assist you in finding makers of embossed parts and related materials.



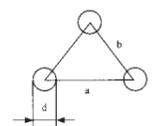
Picture: Rathgeber GmbH & Co. KG

Perforated Reflector Products

Direct/indirect luminaires with modified up- and downlight components of reflected light increasingly need perforated material. Also ceiling tiles manufactured from aluminium are an acoustically hard surface. Perforation attenuates or absorbs sound. Micro-perforations in the range below 1,2 mm are important. Precisely built hole tools with a matched cutting clearance from hole punching die to upper die avoid edge burr around the perforations. These give an aesthetically sharp and pleasing appearance for architectural lighting and ceiling applications.

Correct lubricants are important here. Again volatile (evaporating) oils avoid ingression of oil between plastic film and mirror surface. Again we will readily provide you with names of reputable perforation companies. Our standard matrix of perforation listed below.

Perforation examples



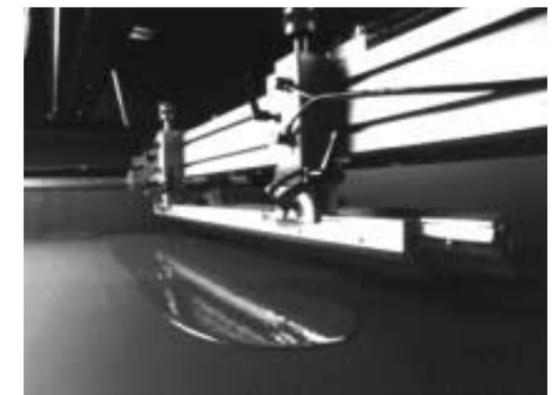
Type	055 – 200	11 – 200	13 – 250	18 – 354	20 – 425
Distance a in mm	2,0	2,0	2,5	5,0	6,01
Distance b in mm	2,0	2,0	2,5	3,54	4,25
Distance d in mm	0,55	1,10	1,3	1,8	2,0
Perforation (%)	6,85	27,4	24,5	20,3	17,4
Angle	30° / 60°	30° / 60°	30° / 60°	45°	45°

Printing

The most frequently applied process is screen printing with air-drying and baking colours. For pre-anodized surfaces, so called coating preventers are used in the final compression, in order to essentially improve the gripping of the coil-anodized surfaces. On the other hand, this addition is a separating agent which leads to deterioration of colour adhesion, especially with air-drying colours. Therefore you should only use colours which slightly etch the surface and thus achieve abrasion resistance after completion of hardening.

For baking colours in forced-air ovens, too high temperature lead to cracks in the anodised layer. It is possible to avoid them by adequately reducing the temperature together with a longer baking duration. *

In connection with the mesh number of the screen, printing of lines with a width of 0.2 mm are possible. Moreover, you can determine the colour thickness. In case of need, we can find suitable companies for you.



Picture: Roos Siebdruck

*Test results for certain grades are on hand.

Laser cutting

Cutting:

Due to fast development of laser cutting technology, it is now also possible to cut coil-anodized and PVD-coated aluminium surfaces by using a laser. A powerful CO₂ laser (carbon dioxide) in connection with high-pressure gas flushing (at least 10 bars) is classified as suitable.

In order to avoid secondary cleaning of the laser cut parts, due to lifting of the protective foil during the laser process or the merging of the protective foil adhesive in the fringe area of

about 1-2 mm, you should laminate with protective films specially developed for laser machining.

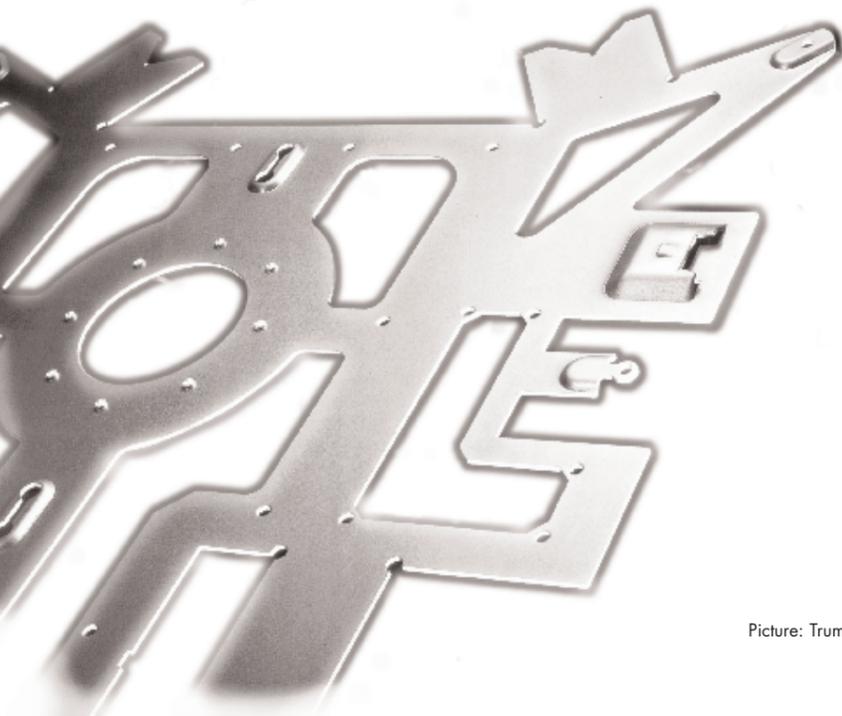
Due to better adhesion, peeling off can be facilitated considerably by warming up, for instance in an IR (infrared) oven. Owing to improved technology, machining times have been reduced substantially. Temperature stress does not lead to deterioration of the surface in the cutting area.

We readily support you in finding machine manufacturers or suitable sub-contractors with adequate machinery and equipment.

Engraving:

Inscription and engraving with laser can be perfectly used also for our coil-anodized aluminium surfaces (anodized or PVD-coated) due to high quality, good reproducibility, high inscription speed, contactless machining independent of the surface structure, wear-resisting inscription tools and fail inscription.

By adequate setting, you can generate various types of textures on the surfaces of our products. In inscription by laser, attention must be paid to optimisation of inscription parameters to our material including refining, as well as in case of deep and wide engraving with formation of burrs and with inclined edges for cutting trenches. CO₂ and NDYAG laser are commonly used. We readily assist you in finding machine manufacturers or suitable sub-contractors.



Picture: Trumpf GmbH & Co.

Cleaning

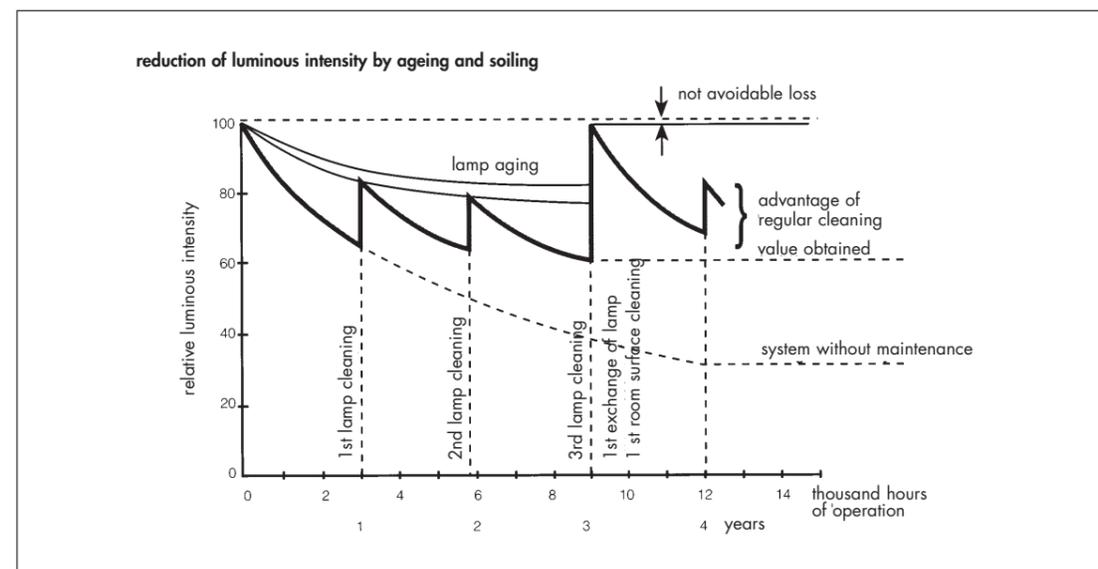
Despite very careful treatment during production and especially when assembling, it is possible that material is soiled by lubricants or finger marks. Here, bonded fibre fabrics specially developed for mirror surfaces are suitable for cleaning without liquid additions. If dry cleaning should not be successful contrary to expectation, low-surface-tension water for prewashing and rubbing dry with a special bonded fibre fabric cloth is sufficient.

In general, the liquid cleansing agent should have a neutral pH value. You can avoid fringe formation due to residues by using a fresh, clean cloth for each wiping action.

For lighting installations, in which the reflectors and grids were exposed to soiling for a long time, we recommend you to perform cleaning by ultrasonic method. Most of all, this method is most suitable for rooms with high nicotine concentration.

For dry cleaning, we can give you the names of suppliers and tell you all about suitable materials: Furthermore, we can give you the addresses of companies performing ultrasonic cleaning operations.

Table: Parkersell GmbH



Assembly

When putting together lighting louvers with their crossblade parts, close attention must be paid to the detail of assembly. This is especially the case with matt surfaces. The plane in which each series of parts was first bent or rolled must remain common in assembly. Similarly the rolling direction (grain directionality) of each assembled part must also be identical in the way it is mounted. If not a dark/bright patchwork of parts can appear when viewed. To assist, an extra facet or hole is often added in manufacture as an indexing point to assure uniform assembly.

All brackets and connectors should be attached to flat areas on the reverse side of the reflector so that structural cracks and non uniform bends do not appear as light breaks on the mirror side.

Gloves should always be worn in assembly and in mounting to avoid finger printing.

The gloves should be changed periodically to avoid dirt build up on them.

Louvres should be packed in polythene sheeting to avoid dust accumulation.

However the polythene must not be airtight to avoid possible condensation.



Picture: Jordan Reflektoren GmbH & Co.

Storage, transport

In general coil anodised and PVD-coated materials have unlimited stability in storage. However, this depends on certain conditions being avoided: permanent humidity, drastic temperature change and particularly the avoidance of unheated rooms and dusty environments.

There is one limitation for transport and storage of plastic coated materials. Adhesion of the film and also the film's hardness are affected by UV-light. If exposed to UV light, most commonly sunlight but also certain artificial lighting, the film can harden and become impossible to remove. Please always store our material in places where the metal is covered –

where possible in its original packing – but always in a shaded internal environment with temperature control.

Therefore please read and observe the plastic film manufacturers notes regarding conditions and limits to storage time.

