

TECHNICAL INFORMATION

Rev.06 / April 19th 2024

INFORMATION ON ELECTROPLATING

1. General information

Enclosed you will find an overview of the prerequisites for the optimal electroplating of your parts as well as possible risks. The plating of single parts or strip material (punched and solid strip) is very complex. The following information will help you to avoid a possible error potential.

In the case of special coating combinations, we reserve the right to offer necessary additional pre and/or intermediate treatments and coatings according to the current state of the art. Our initial sample inspection report (ISIR) is the basis for series production.

The following information must be provided when placing the order:

- Specification of the used oils with safety data sheet
- Is it an article for the following sectors? Automotive, aviation industry, aerospace industry, medical technology, railway/train transport or electronics? If yes, please specify for which.
- Is it a safety-relevant component?
- Field of application of the part
- To which country is the article sold? (country/region)
- Are there any applicable legal / official regulations that must be observed in the country of destination?
- Are there any special characteristics that must be observed during the coating?

For a more detailed explanation, we offer electroplating workshops - also on your premises.

2. Characteristics of the base material

The parts must be delivered metallicly bright, free of soldering and welding residues, casting skin, moulding sand, scale, oil carbon, burnt-in grease, graphite, paint coats and other impurities. The parts may be slightly oiled with halogen/silicon-free oils at the most. The oils used must be removable with aqueous alkaline cleaners.

If additional pre-treatment is necessary, it will be carried out separately after approval of the costs according to our offer. Defects in the base material (such as pores, cracks, blowholes, laminations) and corroded material can lead to poor plating results. Foreign parts, turning chips, punching waste etc. must not be mixed with the parts.

Process-related scrap cannot be avoided. The raw parts required for this purpose will be provided by the customer free of charge. Charges relating to this cannot be recognised. In this context, we would be pleased to provide you with our current scrap rate regulation.

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Here is a brief overview of the characteristics:

- no pronounced oxidation
- no silicon
- no blowholes, laminations
- aqueous degreasing of oils
- low greasing level
- no alkaline earth soaps (constituents of some fats and oils, if necessary ask the manufacturer)

3. Process safety and quality management

IMO Oberflächentechnik GmbH is certified according to ISO 9001, ISO 14001, IATF 16949 and ISO 50001 and is subject to annual surveillance audits. The information necessary for IMDS input is provided with the Initial Sample Inspection Report. Entry into the IMDS is usually done by the component supplier.

For lot sizes below the minimum lot size, processing is carried out under near-series conditions without guarantee.

In case of system failures, parts are usually reworked by decoating and recoating. If the base material or special requirements for the part do not allow this rework, the customer must explicitly indicate this. With such parts, please note that an increased scrape rate must be expected. The standard cross-references mentioned in the standards are only taken into account if they are expressly confirmed in the offer or in the confirmation of order or drawing. Standards to be complied with must always be enclosed with the inquiry.

4. Coating thicknesses

The indicated coating thicknesses and the measurements performed always refer to the measuring point(s) – depending on the part geometry, the coating thickness may vary at other points on the part.

This is especially true for endless punched products and selective coating: Coating thicknesses are generally decreasing from the specified measuring point. In the case of contact dome, the coating thickness can decrease on both sides from the measuring point.

Fitting dimensions are not subject to our scope of testing and can only be complied with if there is a sufficiently large dimensional tolerance. If thread/fitting dimension tests are to be carried out, the test equipment must be provided by the customer. Threads must be undercut according to the specified coating thickness.

Depending on the part geometry, uncoated areas, areas with low coating thickness or discolouration may occur (e.g. in blind holes, recesses, inside of pipelines). Reduced corrosion resistance can be expected in these areas. We recommend that the forming of functional surfaces be carried out prior to plating, since depending on the forming radius and the quality of the bending tool, some coating materials tend to crack in the forming area, which in turn can lead to increased corrosion or abrasion.

As a general rule: In the case of parts in the form of rolled pins, contact sockets or a geometry with blind holes, folds with a gap and inaccessible cavities, residues present on the inside cannot be completely removed. This may lead to corrosion - a remedy can be flushing hole.

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5. Precious metals and properties

Silver

Silver platings with nickel sublayer or copper sublayer: Silver platings with a nickel sublayer and a subsequent temperature load of $>160^{\circ}$ Celsius can cause adhesion problems due to oxidation of the nickel. Furthermore, a silver plating with a copper sublayer and a subsequent temperature load can cause copper to diffuse to the surface depending on the duration. This leads to discolouration and changes in the surface properties of the silver coating. Complaints to this effect cannot be accepted by IMO.

Hard gold

Hard gold layers tend to crack when deformed.

6. Testing and initial sampling procedure

In accordance with our framework control plans, tests are carried out during production. Production-related missing quantities arise during processing (e.g. adjustment samples, retained samples, test parts or, in the case of endless goods, strip joints, etc.). Our current scrap quota regulation applies and can be requested if required.

Depending on agreement and effort, the following tests can be carried out free of charge: Coating thickness measurement (X-Ray), adhesion test, bending/squeezing test, KS test (passivation test for silver surfaces), solderability test DIN 60068-2-20 and surface tension tests (with Arco test ink). Further tests, such as hardness tests, residual dirt analyses, salt spray tests etc. will be listed and charged separately, if required.

Our initial sampling is carried out as standard according to VDA, volume 2. Upon customer request, we also carry out initial sampling according to AIAG PPAP procedures.

7. REACH

IMO Oberflächentechnik GmbH is a downstream user of chemicals according to REACH and therefore not responsible for the registration and authorisation of chemicals used. IMO Oberflächentechnik GmbH has obliged its chemical suppliers to comply with the REACH regulations.

Special features of punched / solid strip

An additional empty spool/coil core is required for each strip order. Insofar as the winding direction after electroplating is not evident from the drawing, an additional winding instruction is required.

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1. Geometric requirements

- strip width up to max. 150 mm
- strip thickness up to 1.5 mm; by arrangement up to max. 2 mm
- maximum deflection (3D) up to 6 mm, by arrangement up to 12 mm
- free from coil set / torsion (rotation) / waviness
- minimum camber / minimum burr
- suitable part geometry for selected strip finishing process
- no bent / missing parts
- stable connection of the parts (continuous carrier strip)
- optimum running direction when electroplating inclined contacts, if necessary by arrangement

2. Coil and spool preparation / packaging

Coils

- coil width = strip width plus 2-3 mm
- stable coils (no constriction of the coil flanges, no defective coils)
- no too tight or too loose winding
- observe winding direction (1 or 2 line passes)
- maximum outside diameter 1,000 mm
- bore diameter of at least 20 mm

Punched grid with paper interleaving

- optimum paper width = coil width minus 1-2 mm
- paper thickness depending on material (no piercing)
- do not stick interleaving paper to material

Solid strip coils

- coil inside diameter 300 - 400 mm
- maximum outside diameter 1,400 mm
- maximum coil weight 350 kg (higher coil weights by arrangement)
- maximum pallet weight 1000 kg

Suitable packaging with fixing system

- spool racks (vertical transport)
- pallets (horizontal transport)

3. Initial samples and prototypes

For initial samples of punched or solid strips, please consult our contact person regarding the required delivery quantity. The strip length should be at least 300 m.

4. Product-specific devices and tools

The calculated prices are based on the use of standard equipment. If product-specific devices and tools such as spot masks are required, the costs for these spot masks and devices must be borne by the customer. Therefore you will receive separate quotations.

In order to provide the necessary plant periphery in spot process, we need an additional lead time of about six to eight weeks. The prerequisites for this are a corresponding order and a sample strip of the finished material of at least 50 cm. Please note that we recommend an additional pilot hole for mask transport. See also the corresponding contract "Agreement on the development/design of a resource-saving spot technology".

Special features of single parts / bulk material

1. Geometric requirements

- avoid sticking together / interlocking or entanglement through suitable design
- mechanical stability for selected process (barrel / Vibrobot / rack)
- rack goods: specify contact points and / or mounting options
- flushability / electrolyte exchange e.g. flushing holes in blind holes

2. Packaging

The goods are delivered in the delivery packaging or in packaging material provided by the customer. Please do not supply rusty, oily or dirty containers. Clean plastic boxes, which are lined with a PE foil before the electroplated parts are filled in, are to be preferred. Please use environmentally friendly and, in the case of silver-plated parts, sulphur-free packaging material.

If possible, the delivery should be made in stackable containers. Small containers may weigh a maximum of 15 kg for occupational health and safety reasons. A deviation of +/- 3 percent is possible in the case of packing instructions that are precise in terms of the number of pieces.

3. Exclusions and limitations of barrel plating

Barrel processing is the simplest and most cost-effective technique for refining bulk material parts and is therefore the preferred method. It is used for stable, insensitive and not too heavy parts. Due to the rotary motion required for mixing the parts and for electrolyte exchange, the parts can be deformed. This can occur especially with external threads. It must be pointed out that under certain circumstances this cannot be avoided. A thread test can be carried out by prior agreement but the test equipment must be provided by the customer free of charge. For larger parts, we recommend using the rack technique.

Parts with flat geometry tend to stick or adhere to the barrel wall (perforation spots). The extent to which the appearance, corrosion resistance and/or contact properties are impaired by this must be checked by means of a test, if necessary. This can be remedied by inserting a non-symmetrical knob or elevation on the smooth surface. The same applies to parts which, due to their geometry, tend to jam or interlock.

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Occasionally there are borderline cases, i.e. some articles can still be finished in the barrel, but due to their part geometry, deformation and/or defects of a few parts are unavoidable. Then the question arises whether an increased proportion of defects (depending on the part geometry) can be accepted. If not, only the more cost-intensive refinement by means of Vibrobot or rack can be considered. If it is possible to sort out the deformed parts during further processing, the barrel process is preferable from a cost point of view. The decision as to which method is to be used must ultimately be weighed up on a case-by-case basis.

Mixing with foreign parts cannot be 100 percent excluded with barrel plating.

4. Exclusions and limitations of rack plating

Parts that are not suitable for the barrel due to their size and shape are finished on the rack. The parts must be hung on the racks in time-consuming manual work and removed again after finishing, which is a significant cost factor in the processing costs. The error rate due to bending, mechanical damage as with barrel processes is almost zero with this technique.

Due to the process, contact points (suspension points) with reduced layer thickness and optical impairment cannot be avoided. If necessary, contact points must be defined before production begins. If areas are heavily deformed after electroplating, such as crimp contacts, contact points must be avoided in these areas, since adhesion problems can occur if the deformation is severe.

5. Exclusions and limitations of Vibrobot plating

Sensitive small parts, which could deform or get stuck in the barrel and are too small for racks, are refined using a process that is material-friendly. The parts are lightly moved by vibration in a work basket, which means that the risk of bending is very low due to their own weight. A further advantage of this process is a more precise coating thickness distribution and scattering. This makes the process particularly suitable for finishing parts with deep holes or contact sockets. Compared to barrel plating, the batch sizes are significantly smaller and the processing costs are higher.

6. Initial samples and prototypes

In the case of prototype plating of single parts, destructive tests mean that fewer parts are delivered than originally provided. Please take this into account in the delivery quantity.

7. Product-specific fixtures or plating racks

The calculated prices are based on the use of standard racks. If product-specific fixtures or racks are required, these costs must be borne by the customer.

A lead time of approx. six weeks is required for ordering plating racks. The customer must first provide at least two sample parts or drawings in CAD format.

We reserve the right to make technical changes.