Informationen on surface coatings

1. Preamble

Considering the customers' demands for "optimal coatings" at the lowest possible cost, the overall conditions must be right to establish and maintain a supply relationship that is acceptable to both the customer and MVN as the coating provider.

2. General

This document outlines the properties, characteristics, complexity and associated risks of the electroplating process, as well as the resulting prerequisites for the optimal plating of customer materials. The aim is to prevent known potential **sources of error** in advance, particularly those that are **not within the responsibility of the electroplating facility**. Pre-treatment and electroplating are performed using state-of-the-art technology. To plan these processes effectively, the following information must be provided before placing an order:

- Last processing step BEFORE electroplating: rolling, cutting, punching, tumbling, heat treatment, plastic overmolding …
- Expected contaminants: rolling, cutting or punching oil with technical and safety data sheets, abrasion, dust, abrasive media, scale, plastic residues with safety data sheets for all components …
- Application area and safety level: automotive, aerospace, medical, electrical engineering …
- Destination countries and relevant legal requirements (local laws, regulatory requirements, etc.)
- Special characteristics that may be relevant to surface coating
- Acceptance of unavoidable, process-inherent scrap rates (process-related scrap)

3. Condition of raw material

The raw material must meet the following requirements:

- bare metal, no significant oxidation, slightly oiled surface, as free as possible from metal oxides
- Free of solder/weld residues, casting scale, molding sand, scale, oil carbon, baked-on grease, graphite, paint coatings, plastic residues and other contaminants
- Light wetting with halogen- and silicone-free oils must be washable with an aqueous-alkaline solution; no alkaline earth metal grease soaps (inquire with the manufacturer regarding the oil's components)
- Free of defects in the base material such as pores, cracks, cavities, laminations, mill scale, corroded areas, punching/cutting burrs and minimal sabre-shaped distortion in strip products
- Free of foreign particles, turning chips, punching scrap, etc

4. Process Reliability and Quality Management

MVN is ISO 9001 certified and is subject to annual surveillance audits. Supporting information regarding the definition of electroplated surfaces for entry into the international IMDS is provided in the initial sample report or upon customer request. According to a statement by the IMDS Committee, the drawing owner (component supplier) is responsible for data entry into the IMDS.

The minimum quantities defined in a quote represent the lower limit for series production. For order quantities below these minimums, processing is carried out under conditions similar to series production, but without guarantee.

Should quality deviations occur, parts can be reworked by stripping the coating and re-coating them. If this is not possible due to the combination of the coating and the base material or due to special requirements for the part, the customer must indicate this in the request for quotation. This may result in an increase in the scrap rate.

Required standards (especially non-public in-house standards!) and any cross-references to other standards contained therein must be proactively included with the request for quotation. These will be considered if they are declared and confirmed in the quotation and in the order confirmation.

5. Effect of Geometry on Measurements (Coating Thicknesses)

During the electroplating process, metal deposition follows the underlying field line pattern. Because the local field strength depends on the geometry, the following rule applies to the increasing deposition rate and thus the growth of coating thickness *(known as the bone effect):*

Very slow				**Very fast**
Cavities	Center of surface	Edges	Corners	Tips (pins)

Consequently, coating thicknesses vary depending on the geometry, so that uncoated areas and thin coatings can sometimes cause discoloration, e.g., blind holes, depressions, and the inner surfaces of hollow cylinders. This reduces corrosion resistance.

The faster deposition described above also occurs on cutting and punching burrs. This can lead to buildup on these burrs, which may alter the geometry or subsequently break off and contaminate the material as debris. Due to increased cutting burrs, tight winding of the strip material cannot be guaranteed. MVN will not accept claims resulting from these causes.

Geometries that trap material—such as contact sockets, blind holes, folds with gaps, or inaccessible cavities—make it difficult to remove existing residues, which can cause staining and subsequent corrosion. Flushing holes can remedy this and facilitate the drainage of residues.

Coating thickness measurements are taken at the defined measurement points (as specified in the technical drawing and marked in the initial sample report). Due to geometric variations, coating thicknesses at other locations may differ.

Fit dimensions are not tested by MVN and cannot be guaranteed; a sufficiently large pre-dimension tolerance must be factored into the geometry of the raw material. If fit for gauges is to be tested, the test equipment must be provided by the customer.

Mechanical forming of functional surfaces should be performed prior to electroplating, since-depending on the forming radius and the properties of the bending tool—both the base material and the coating may develop cracks, thereby compromising corrosion protection at these locations and allowing corrosion or abrasion to occur unimpeded.

6. Silver and it´s characteristics

If silver coatings with an underlying nickel layer are subsequently exposed to temperatures > 160 °C, adhesion problems may arise due to the oxidation of the nickel. Silver coatings on a copper substrate tend, over time (at a rate dependent on temperature and the thickness of the silver coating), to allow copper to diffuse through the silver coating to the surface. This results in discoloration and, presumably, changes in the surface properties of the silver coating. This phenomenon is inherent to the Ag/Cu coating system and cannot be influenced. Therefore, complaints regarding this issue will **not be accepted.**

7. Inspections and Initial Sample Processing

To ensure delivery quality, inspections of the finished parts are conducted throughout the production process and as part of the outgoing goods inspection. Such sampling inevitably results in shortfalls, which are accounted for within the scrap rate or governed by individual contracts.

The following tests are performed as standard:

- Coating thickness measurement (X-ray fluorescence, DIN EN ISO 3497)
- Adhesion strength tests (DIN EN ISO 2819)

Upon customer request, the following tests are also performed:

- Solderability testing of silver and tin coatings (DIN EN 60068-2-20)
- Sulfide test (testing of passivation on silver surfaces)

In specific cases (e.g., sample testing), additional tests are governed by individual agreements between MVN and the customer.

8. Legal requirements

REACH

Under REACH, MVN is a downstream user of chemicals and is therefore not responsible for the registration and authorization of the chemicals it uses. MVN has required its suppliers to comply with REACH regulations.

Special considerations solid and punched bands

For each order, the customer must provide at least one empty spool or inner core. For thin strips it needs to be less than 0.3 mm thick. Where applicable, a clear specification —such as a technical drawing— is also required for the winding direction. In addition, the customer must provide interleaving paper of the appropriate size and in sufficient quantity before production begins

1. Geometric Requirements	Background
Strip width up to 75 mm, up to 90 mm upon consultation	Machine dimensions
Strip thickness up to 1.5 mm, up to 2 mm upon consultation	Machine dimensions
Deviation from strip alignment up to 3 mm, up to 5 mm upon consultation	Machine dimensions
Free of roll curvature, torsion (twist), waviness	Contact
Minimal sabre curvature, minimal cutting/punching burrs	Contact
Delivery only lying flat on a pallet	Lifting the Coil
Maximum outer diameter 1.200 mm (depending on the pallet)	Machine dimensions
Inner ring diameter from 300–500 mm	Machine dimensions
Maximum ring weight up to 250 kg	Lifting the Coil
Maximum pallet weight up to 1.000 kg	Pallet Standards
Pallet must be suitable for pallet jacks	Pallet Standards
Part geometry suitable for the selected strip coating process	Contact
No bent or missing parts	Contact
No separation points, only upon consultation **before** delivery	Additional costs
Stable connection of the parts (continuous carrier strip)	Strip guidance
Optimal running direction for angled geometry upon consultation	Contact

2. Spool and Coil Preparation / Packaging	Background
Spool width = Suitable spool cores / Tape width + approx. 2 mm	Smooth running
Sturdy spool cores (not defective, not constricted)	Core standards
No overly loose winding	Lifting the Coil
Winding direction: delivery vs. pickup from electroplating plant	Subsequent process
Interlayers: Paper width = coil width – approx. 1 mm	Smooth running
Interlayers: Suitable paper thickness (no punctures)	Bends
Interlayers: Avoid sticking to the metal strip	paper enters the machine

3. Initial Sampling	Background
Delivery quantity for sampling to be determined by mutual agreement, typically at least 150 m	Machine dimensions

4. Product-Specific Fixtures and Tools	Background
If item-specific fixtures or tools are required, the customer is responsible for the costs. We will discuss this during the preliminary discussions.	Item-specific usage Options

Special considerations individual parts

1. Geometric Requirements	Background
Prevent sticking together or snagging through appropriate design	Contacting, spacing
Mechanical stability (drum, vibration, frame)	Bending
Frame: Define contact points	Layer thickness
Enable flushing, flushing holes (depends on geometry; e.g., blind holes, interior areas are difficult to flush)	Dispersion, contamination

2. Packaging	Background
Incoming packaging = shipping packaging or new packaging provided by the customer in accordance with packaging instructions	Requirements of the end-customer
Packaging must be oil-free, rust-free and free of contamination, sulfur-free for silver surfaces	Contamination of finished goods
Stackable containers, max. 15 kg gross weight	Workplace Safety
For packaging instructions specifying exact quantities: Deviations are permitted by weighing the finished parts (up to ±3%)	No counting is performed!

3. Special considerations for drum processing		
Phenomenon	Risk	Risk Mitigation
Flat geometries can cause sticking or adhesion to the drum wall -> perforation marks or rinsing and drying spots	Impact on appearance, corrosion resistance and contact properties	Incorporating asymmetrical nubs or raised areas on smooth surfaces
Parts jamming or becoming interlocked	Uneven coating, spots	Geometry adapt
Rotational movement necessary for mixing	Deformations possible in external areas (threads, individual pins)	Sturdy, durable, and not overly heavy parts
While borderline cases can be coated using the barrel coating process, the part geometry may lead to deformation or defects in some parts. This scrap rate can only be identified during sample processing that closely simulates mass production (quantities close to mass production levels).		

4. Special considerations for frame processing		
Phenomenon	Risk	Risk Mitigation
Geometries that are not suitable for barrel finishing are hung up and removed by hand.	Risk of bending is nearly zero	Labor-intensive and therefore costly
Contact points are necessary for current flow.	Enables current flow	Coating thickness, appearance and adhesion at contact points, as well as corrosion resistance and solderability, are compromised
These phenomena can only be detected and evaluated during sample processing that closely resembles mass production (quantities close to mass production levels).		

5. Special considerations for vibration processing		
Phenomenon	Advantage	Disadvantage
Batch size smaller than with the drum process	Low risk of bending	More costly than drum processing
Part movement caused by vibration of the work basket	Tighter layer thickness distribution and variation	Limited volume of the work basket
These phenomena can only be identified and evaluated during prototype production that is close to mass production (quantities close to mass production levels).		

6. Initial samples and prototypes		
Due to required destructive testing, fewer parts are shipped than were originally supplied.		
Required Tests	Destructive?	Test method
Coating thickness measurement	Depends on geometry, choice of measurement point	X-ray fluorescence
Adhesion	Destructive	Verbiegen, Anfeilen
Solderability	Destructive	Immersion in solder bath DIN EN 60068-2-20
Aging	Destructive	Temperature program 16 h / 155 °C
The number of test specimens per test must be agreed upon in advance.		

7. Product-specific fixtures and galvanization frames	Background
If product-specific fixtures or racks are required, the costs must be borne by the customer. We will discuss this during the preliminary consultations.	Product-specific usage options

We reserve the right to make technical changes to this document.