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Group standard

TL 227

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Single-Layer Paint Coating of Zinc-Coated Metal Surfaces

Surface Protection Requirements

Previous issues

TL 227: 1980-11, 1986-12, 1992-07, 1995-12, 1996-07, 2004-04, 2011-11

Changes

The following changes have been made to TL 227: 2011-11:

- Technical responsibility updated
- Standard restructured
- New surface protection types introduced
- Section 3.2 "Basic requirements" revised
- Section 3.7 "Coating thickness" changed
- Section 3.8 "Adhesion and brittleness": Removal of the adhesion tape added
- Applicable documents updated
- Further technical and editorial changes

1 Scope

This Technical Supply Specification (TL) defines the surface protection requirements for organic coatings (cathodic electrocoating – KTL) on hot-dip galvanized and electro-galvanized parts.

NOTE 1: For cathodic electrocoating of body skin parts made from aluminum semi-finished products, see TL 178. [1)]

1) TL 178 – Cathodic Electrocoating of Body Skin Parts Made from Aluminum Semi-Finished Products; Surface Protection Requirements

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2 Designation

As per Volkswagen standard VW 13750, section "Designation"

Example:

Ofl-x632

If, deviating from the specifications in section 3.1, a single-layer liquid paint is to be used, the addition "liquid paint" (spray or dip painting) must be used in the drawing, e.g.:

Ofl-x632 liquid paint

3 Requirements

3.1 Surface protection types

Cathodic electrocoating is always required. The color must be black or as per the drawing (as per the color combination table). Single-layer liquid paint is possible where necessary, and following agreement with Volkswagen Materials Engineering and/or Audi Materials Engineering.

The surface protection types listed in table 1 apply.

Table 1

Ofl-x632	Batch-galvanization and KTL
Ofl-x633	Zinc-coated semi-finished product and KTL
Ofl-x638	Batch galvanization and KTL with increased layer thickness (thick-layer KTL)
Ofl-x639	Zinc-coated semi-finished product and KTL with increased layer thickness (thick-layer KTL)
Ofl-x640	For after-sales service body components (doors, covers, fenders, roofs, etc.) made from hot-dip galvanized or electro-galvanized semi-finished products

NOTE 2: A paint structure based on alkyd resin is not permissible (aging results in problems with adhesion of the paint coat to zinc layers).

3.2 Basic requirements

Approval of first supply and changes as per VW 01155

Avoidance of hazardous substances as per VW 91101.

Batch-galvanized parts that are not painted immediately after zinc coating (e.g., if zinc-coated parts are shipped to the painting plant) must not be phosphated or sealed, and must correspond to surface protection type Ofl-c310, Ofl-c340, or Ofl-c330 as per TL 217. Any required transport or storage protection of zinc-coated parts, e.g., oiling, must be agreed upon with the painting plant. If painting is carried out at a plant in the Volkswagen Group, the transport or storage protection must correspond to Quality Specification QP A001.

The cutting burr on components must correspond at least to the manufacturing precision "fine" as per VW 01088. Justified deviations must be agreed upon with the Volkswagen and/or Audi Material Engineering department and specified in the respective part drawing.

The coating must have the specified surface protection, with the specified properties, over the entire surface. The coatings must be free of pores, cracks, paint runs, foreign matter inclusions, damage, and other flaws that impair the corrosion protection and/or the specified appearance.

The paintwork must adhere firmly to the base material when the parts are used as intended.

The production process and its control must not impair the use properties of the finished part. Proper installation of parts must not result in damage that impairs the part's function and/or decreases the specified corrosion protection.

The coatings used must be free of compounds containing hexavalent chromium [Cr(VI)] or lead.

Eight finished parts are required for complete testing.

3.3 Base material

Material as per drawing

3.4 Conditioning

If air-drying coating systems are used and/or the paint system is not baked at elevated temperatures (> 60 °C), the components must be conditioned for 24 h at 60 °C before the tests and then cooled down to room temperature (18 to 28 °C).

3.5 Zinc coating

See table 2.

Table 2

Ofl-x632, Ofl-x638	Ofl-c310, Ofl-c330, in exceptional cases Ofl-c340 as per TL 217 [a)]
Ofl-x633, Ofl-x639	Zinc coatings as per DIN EN 10152, DIN EN 10346, VW 50065, or drawing
Ofl-x640	Zinc coating as per drawing

a) An electrolyte with the lowest possible amount of brighteners in the electrolyte must be used for electro-galvanizing to ensure optimal adhesion of the paint finish.

3.6 Pre-treatment

See table 3.

Table 3

Ofl-x632, Ofl-x638	Zinc phosphating, preferably tri-cation phosphating (zinc, nickel, and manganese); in exceptional cases for electrolytic zinc coating Ofl-c340 with additional Cr(VI)-free passivation layer
Ofl-x633, Ofl-x639	Zinc phosphating, preferably tri-cation phosphating (zinc, nickel, and manganese)
Ofl-x640	Tri-cation phosphating (zinc, nickel, and manganese)

3.7 Coating thickness

See table 4.

Table 4

Ofl-x632, Ofl-x633	15 µm to 30 µm
Ofl-x638, Ofl-x639	30 µm to 60 µm
Ofl-x640	– Outer/inner area 17 µm to 22 µm – Cavities > 10 µm

3.8 Adhesion and brittleness

Testing by cross-cut test as per DIN EN ISO 2409

The test must be performed using adhesive tape with a bond strength of (10 ±1) N per 25 mm width. The adhesive tape must be firmly pressed onto the surface by hand with the cross cut applied, and then pulled off with an abrupt movement perpendicularly to the surface.

Requirement: characteristic value ≤ 1

NOTE 3: For this test, e.g., tesaband 4657 [2)] is suitable.

3.9 Stone-chip resistance

Testing as per DIN EN ISO 20567-1, method B, with visual evaluation

If the test cannot be performed on the components – for example, due to their geometry – a reference examination must be performed on accordingly painted sheets.

Requirement: characteristic value ≤ 2

2) tesaband 4657 is the manufacturer's product designation. It is produced by tesa SE.
This information is only intended for informational purposes for the users of this in-house standard. This does not signify an endorsement of the mentioned product by the Volkswagen Group. Equivalent products may be used if it can be verified that they lead to the same results.

3.10 Corrosion resistance

3.10.1 Corrosion cycle test

Testing as per Test Specification PV 1210 with a scribing line as per DIN EN ISO 9227, section "Application of scribing lines"; evaluation as per DIN EN ISO 4628-8

Requirements for Ofl-x632, Ofl-x633, and Ofl-x640:

- After a test duration of 5 cycles:

  No surface changes, including cut edges and welds
- After a test duration of 15 cycles:

  No blistering and no zinc corrosion on the surface; isolated occurrences of zinc corrosion and blistering are permissible at cut edges and welds, loss of adhesion d at scribing line < 1.5 mm
- After a test duration of 30 cycles:

  No blistering and no zinc corrosion on the surface outside the scribing line; slight zinc corrosion and blistering are permissible at cut edges. The requirement as per section 3.8 must be fulfilled. For Ofl-x633 and Ofl-x640, isolated occurrences of base metal corrosion are permissible at cut edges.

Requirements for Ofl-x638 and Ofl-x639:

- After a test duration of 5 cycles:

  No surface changes, including cut edges and welds
- After a test duration of 30 cycles:

  No blistering and no zinc corrosion on the surface; isolated occurrences of zinc corrosion and blistering are permissible at cut edges and welds, loss of adhesion d at scribing line < 2.5 mm
- After a test duration of 60 cycles:

  No blistering and no zinc corrosion on the surface outside the scribing line; slight zinc corrosion and blistering are permissible at cut edges. The requirement as per section 3.8 must be fulfilled. For Ofl-x639, isolated occurrences of base metal corrosion are permissible at cut edges.

3.10.2 Condensation atmosphere with constant humidity (CH)

Testing in test atmosphere CH as per DIN EN ISO 6270-2, test duration 240 h; the specimens are then acclimatized for 30 min at 18 °C to 28 °C.

Requirements:

- No blistering, no zinc corrosion, no base metal corrosion; the requirement as per section 3.8 must be fulfilled.

3.11 Resistance to chemicals

The paint supplier must test and ensure the resistance to chemicals.

Testing in oils and brake fluid only for parts used in the engine compartment.

As part of the initial sample inspection, resistance to chemicals may also be demonstrated by a certificate issued by the coating material manufacturer.

For test media and requirements, see table 5.

Testing is performed as per DIN EN ISO 2812-3 and DIN EN ISO 2812-4. The evaluation is performed as per DIN EN ISO 4628-1.

Table 5

No.	Test medium	Requirement	
		Single-layer liquid paint	KTL
1	For all parts		
1.1	E10 gasoline as per DIN EN 228 (blend of premium unleaded gasoline as per DIN EN 228 with 10 volume percent ethanol p.a.) Testing as per DIN EN ISO 2812-4, method A, 10 min at room temperature	Characteristic value ≤ 2, but characteristic value ≤ 1 after rest period of 5 h	Characteristic value ≤ 1
1.2	B7 diesel fuel as per TL 788-B Testing as per DIN EN ISO 2812-4, method A, 10 min at room temperature		
2	Only for parts in the engine compartment		
2.1	Factory-fill engine oil as per TL 52167 Testing as per DIN EN ISO 2812-4, method A, 60 min at room temperature	Characteristic value ≤ 2, but characteristic value ≤ 1 after rest period of 5 h	Characteristic value ≤ 1
2.2	Hydraulic fluid as per TL 52146 Testing as per DIN EN ISO 2812-3 16 h at room temperature, filter		
2.3	Brake fluid as per TL 766 Testing as per DIN EN ISO 2812-3 60 min at room temperature, filter		Characteristic value ≤ 1; instances of swelling that have receded after 24 h are permissible
3	Only for coolant pipes		
3.1	Coolant as per TL 774-C 500 h aging at 130 °C	-	Detachment or blistering of the coating and fading of the coating to gray are not permissible.

4 Applicable documents

The following documents cited in this standard are necessary to its application.

Some of the cited documents are translations from the German original. The translations of German terms in such documents may differ from those used in this standard, resulting in terminological inconsistency.

Standards whose titles are given in German may be available only in German. Editions in other languages may be available from the institution issuing the standard.

PV 1210	Body and Add-On Parts/Hang-On Parts; Corrosion Test
QP A001	Prelube, Hot Melt, Blank Washing Oil, Drawing Compound, Slushing Oil (General); Quality Requirements
TL 217	Zinc Coatings; Surface Protection Requirements
TL 52146	Central Hydraulic System Fluid; Lubricant Requirements
TL 52167	Factory-Fill Engine Oil SAE 5W-40; Lubricant Requirements
TL 766	Brake Fluid; Material Requirements
TL 774	Ethylene-Glycol-Based Coolant Additive; Materials Requirements
TL 788	Diesel Fuel; Fuel Requirements
VW 01088	Workpiece Edges; Definitions, Drawing Specifications
VW 01155	Vehicle Parts; Approval of First Supply and Changes
VW 13750	Surface Protection for Metal Parts; Surface Protection Types, Codes
VW 50065	Flat Products Made of Steel for Cold Working; Materials Requirements
VW 91101	Environmental Standard for Vehicles; Vehicle Parts, Materials, Operating Fluids; Avoidance of Hazardous Substances
DIN EN 10152	Electrolytically zinc coated cold rolled steel flat products for cold forming - Technical delivery conditions
DIN EN 10346	Continuously hot-dip coated steel flat products for cold forming - Technical delivery conditions
DIN EN 228	Automotive fuels - Unleaded petrol - Requirements and test methods
DIN EN ISO 20567-1	Paints and varnishes - Determination of stone-chip resistance of coatings - Part 1: Multi-impact testing
DIN EN ISO 2409	Paints and varnishes - Cross-cut test
DIN EN ISO 2812-3	Paints and varnishes - Determination of resistance to liquids - Part 3: Method using an absorbent medium
DIN EN ISO 2812-4	Paints and varnishes - Determination of resistance to liquids - Part 4: Spotting methods
DIN EN ISO 4628-1	Paints and varnishes - Evaluation of degradation of coatings - Designation of quantity and size of defects, and of intensity of uniform changes in appearance - Part 1: General introduction and designation system
DIN EN ISO 4628-8	Paints and varnishes - Evaluation of degradation of coatings - Designation of quantity and size of defects, and of intensity of uniform changes

	in appearance - Part 8: Assessment of degree of delamination and corrosion around a scribe or other artificial defect
DIN EN ISO 6270-2	Paints and varnishes - Determination of resistance to humidity - Part 2: Procedure for exposing test specimens in condensation-water atmospheres
DIN EN ISO 9227	Corrosion tests in artificial atmospheres - Salt spray tests