

## Group standard

**VW 13750**

Issue 2014-05

Class. No.: 50204, 02642

Descriptors: corrosion, anti-rust protection, surface protection (OfI), metal, surface protection type, code, corrosion protection

## Surface Protection for Metal Parts

### Surface Protection Types, Codes

#### Previous issues

VW 13750: 1953-06, 1954-07, 1956-10, 1958-04, 1959-03, 1959-06, 1963-03, 1963-05, 1966-06, 1966-06, 1966-10, 1967-05, 1967-11, 1969-10, 1970-11, 1971-12, 1972-02, 1974-08, 1975-06, 1976-07, 1980-09, 1983-10, 1986-10, 1989-12, 1991-11, 1994-10, 1999-04, 2005-02, 2008-01, 2008-06

#### Changes

The following changes have been made to VW 13750: 2008-06:

- Section 2.2 Description example redefined
- Section 3.1 VW 11628 added
- Section 3.5 VDA 235-203 superseded by VW 01131-1 and VW 01131-2
- Section 3.6 2nd paragraph "Exceptions" changed
- Section 3.7 Wording changed in terms of test requirement
- Section 3.9.1 changed, OfI-a102 added
- Section 3.10 Table 2 "Codes for surface protection types" updated:
  - Surface protection types containing Cr(VI) removed; for an overview, see new section A.2
  - OfI-a102 "oil film dependent on manufacturing and/or material conditions" added
  - Supplements to surface protection type b; b130 removed and added to VW 13750, supplement 1
  - OfI-113 added
  - Reference to heat treatment added as a footnote for OfI-b140 and OfI-b149
  - Supplement in "Post-treatment and appearance" column for surface protection type c: "silver-colored" and "to slightly iridescent blue" and "iridescent color", respectively

Always use the latest version of this standard.

This electronically generated standard is authentic and valid without signature.

The English translation is believed to be accurate. In case of discrepancies, the German version is alone authoritative and controlling.

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- Supplement in "Post-treatment and appearance" column for surface protection type e, f, and g: "silver-colored"
- Ofl-k310 removed and added to VW 13750, supplement 1
- Ofl-q600 and Ofl-q605 as per TL 243 removed and added to VW 13750, supplement 1
- Description of surface protection types and Ofl-r647 and Ofl-r648 from TL 244 added
- "Post-treatment and appearance" column changed for surface protection type r: "with Al-pigmented top coat" and "silver-colored" added
- Ofl-s617 as per TL 196 removed and added to VW 13750, supplement 1
- Description of Ofl-t330 and Ofl-t630 as per TL 233 changed
- Ofl-t615 deleted as "standard surface protection for nuts with non-metallic clamping" as per TL 245
- Ofl-t660 and Ofl-t667 as per TL 180 added
- Ofl-u620 as per TL 184 added
- Supplement in "Post-treatment and appearance" column for surface protection type v: "colorless passivation plus post-dip solution" and "gray"; footnote expanded
- Ofl-w660 and Ofl-w670 as per TL 212 "not permissible for new designs" removed; footnote for Ofl-w660 matte added and description of surface protection type w changed
- Ofl-x130 deleted and description of the coatings as per TL 260 revised
- Ofl-x340 as per TL 256 added
- Ofl-x590 as per TL 178 added
- Ofl-x607 as per VW 60469 added
- Ofl-x635 as per TL 262 added
- Ofl-x640 as per TL 227 added
- Supplement in "Post-treatment and appearance" column for surface protection type z: "silver-colored"
- Footnotes changed from numbers to letters and comparison to previous issue added as an overview in [section A.3](#)
- Changes to footnotes must be taken from [section A.3](#)
- [Appendix A](#) changed:
- Previous section A.1 list "Comparison of "not for new design"/"for new design" of surface protection types containing Cr(VI)" (includes surface protection types containing Cr(VI)) removed
- Previous section A.2 list "Surface protection types without codes" removed
- List "Surface protection types as per VDA 235-104 and VW 13750" became [section A.1](#); table redefined
- [Section A.2 "Deleted surface protection types containing Cr\(VI\)"](#) added
- [Section A.3 "Revision record for footnotes"](#) added

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## 1 Scope

This standard applies to the identification of general surface protection types of vehicle parts and units in drawings and technical documentation.

VW 13750, supplement 1 "Surface Protection for Metal Parts; Invalid OfI Designations" lists all invalid surface protection types that were included in earlier issues of VW 13750.

## 2 Description

### 2.1 Code composition

See figure 1. The abbreviation for surface protection ('OfI-' from the German word for 'surface') is followed by a 4-character code from table 2.

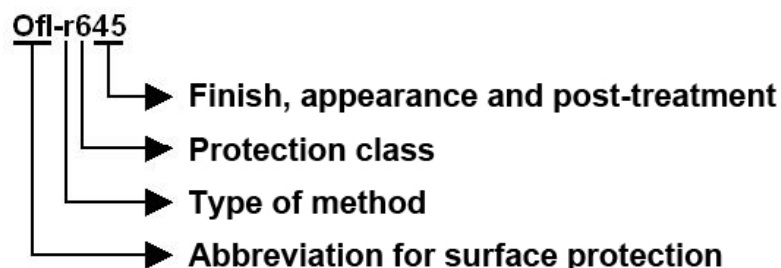


Figure 1

## 2.2 Description example

For surface protection: electrolytically zinc-alloy-plated, heavy protection, silver-colored to slightly iridescent blue, passivated, transparent sealed and treated with lubricant, as per TL 244.

### VW 13750 – OfI-r645

## 3 Requirements

### 3.1 General requirements

The vehicle parts and units are classified according to their corrosion load and assigned to a protection class with grade (as per table 1) by the appropriate Design Engineering department in agreement with the Volkswagen AG Laboratory (GQL-M/1) and/or the Audi AG Laboratory (I/GQ-31).

The restrictions as per VW 60361 must be observed for mechanical fasteners.

The following standards apply to thread dimensions before surface treatment: VW 11610, VW 11614, VW 11624, VW 11625, and VW 11627. The following standards apply to thread dimensions after surface treatment: VW 11611, VW 11615, and VW 11628.

Avoidance of hazardous substances as per VW 91101.

All-metal clamping nuts must always be treated with additional or integrated lubricants. Nuts with non-metallic clamping may be treated with lubricant in order to ensure the defined functional characteristics. The lubricant must be neither hazardous to the user nor emit an unpleasant odor during the fastening process. It must also be suitable for automatic tightening. The functional characteristics of nuts treated with protective coating and/or lubricants must not deteriorate within a storage period of 6 months in weather-sheltered rooms. The storage temperature must be between -5 °C and +40 °C.

Fasteners made of stainless or high-temperature resistant materials may require an additional lubricant treatment in order to fulfill the requirements of VW 01129.

**Table 1 – Classification of vehicle parts**

Part groups	Corrosion load	Protection class
Parts which are not visible in the installed condition, the corrosion protection of which only serves as transit protection and is not required for proper function.	Low load level.	Light protection grade 1
Components in the vehicle interior and in the exterior that are in a protected installation position. Not for fasteners (for exceptions, see VW 01110-1).	Medium load level.	Medium protection grade 3
Parts that are exposed to direct open-air weathering (e.g., chassis, engine, transmission). Parts that are visible in the installed condition (also from vehicle underside). Parts that require corrosion protection in order to ensure proper function. Parts, such as fasteners, that may be used in the vehicle interior or exterior for reasons of reducing variants.	Heavy load level.	Heavy protection grade 6

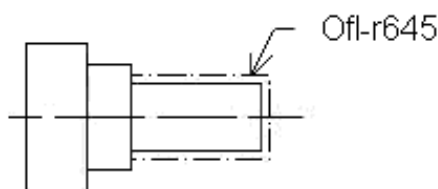
### 3.2 Specifications in drawings

If a certain surface protection is required for the entire part or for several parts in the ASSY, the code must be entered in the "Surface protection" title block; e.g. OfI-t650 (see also VW 01058). If several surface protection types are approved for elective application, then the codes of all approved treatments must be indicated,

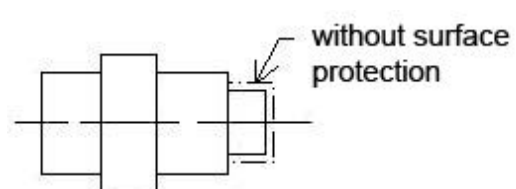
e.g., OfI-r673/x630.

If only partial protection is applied to a workpiece, "see drawing" must be entered in the "Surface protection" title block; the affected area on the part must be marked with a wide dash-dot line (figure 2) and the code indicated with a datum line.

If only a small area on the part has no surface protection, then the unprotected area must be marked (figure 3). In this case, "see drawing" must be entered in the "Surface protection" title block.



**Figure 2**



**Figure 3**

If different surface treatments are specified on a single part, "see drawing" must be entered in the "Surface protection" title block. The affected areas on the part must be clearly delineated.

If parts from one ASSY are coated individually (one or several different surface treatments), then "see drawing" must be entered in the "Surface protection" title block of the assembly drawing. The surface treatments will then be listed individually on a parts-related basis in the respective drawing.

### 3.3 Weldability

If parts with surface protection will be welded to one another or to other metal parts, then the parts must be tested for weldability. Provision must be made for Ofl-c340 as the standard surface protection type in car body manufacture (e.g., for weld nuts).

### 3.4 Agents impairing wetting ability

Lubricants and slushing oils must be free of silicone oils and other agents that significantly impair wetting ability.

### 3.5 Friction behavior

The influence of the surface protection on the friction behavior, particularly for parts with metric ISO threads, must be determined by tests and matched to the performance characteristics (see VW 01131-1 and VW 01131-2).

### 3.6 Zinc and zinc alloy coatings

Electrodeposited/galvanized coatings are not permissible for high-strength steel and/or standard parts with a tensile strength of  $R_m > 1\,000$  MPa and threaded parts with a property class  $\geq 10.9$ . The use of zinc flake coatings as per code letter t is preferred.

Exceptions are possible for Zn/Ni coatings as per TL 244 and TL 196 for steel parts with a tensile strength of 1 000-1 200 MPa (max. Vickers hardness 370 HV), but also for components that are only loaded with compression stresses arising during installation, e.g., for nuts with a property class  $\leq 10$ . The same applies to PT screws as per VW 60358 and self-tapping screws as per DIN EN ISO 1478. In all mentioned use cases, a heat treatment as per DIN EN ISO 4042 is required.

Electrolytically zinc-plated or electrolytically zinc-alloy-plated parts may be post-treated in passivation solutions in order to improve corrosion resistance. Yellowish passivation treatment corresponding to the appearance of yellow chromating with Cr(VI) is not permissible.

Electroplated zinc systems without additional coatings (e.g., paintwork or sealants) are only permissible for the vehicle interior area.

The appearance of zinc/nickel alloy coatings must be matched to their immediate environment. Only transparent passivation is permissible for electrically conducting connections.

### 3.7 Screws, bolts, nuts, threaded parts and molded parts

For screws, bolts, nuts, and similar threaded parts and molded parts, more stringent test requirements apply to the thread-free areas and also to the thread profile and shank. Details in terms of the test requirements are described in the respective standards.

The application of the protective layers must not result in the h-position being exceeded in the case of external threads or the H-position not being reached in the case of internal threads.

### 3.8 Commercial surface protection types

Commercial surface protection types may be used for less important applications (e.g., steel wire). However, they are not subject to corrosion resistance testing. If such protection is sufficient for a

given part, only the code letter of the respective procedure and the numbers 010 must be indicated. The designation then reads, e.g., for commercial paintwork: OfI-x010. A distinction can also be made between procedure and finish; e.g., for commercial hot-dip tinning:

OfI-g020.

The commercial surface protection types, e.g. OfI-c010 "commercial zinc coating" and OfI-r010 "commercial electroplated zinc alloy coating" must not contain any Cr(VI) compounds.

The avoidance of hazardous substances as per [VW 91101](#) also applies to commercial surface protection types.

### 3.9 Parts without surface protection

#### 3.9.1 Fasteners with metric ISO threads

The following surface protection types are used here:

OfI-a100: corresponds to "not oiled".  
OfI-a101: corresponds to "lightly oiled" as per [DIN ISO 8992](#).  
OfI-a102: oil film dependent on manufacturing and/or material conditions permissible.

#### 3.9.2 Other parts

For parts without surface protection and with surface protection designation "without" or "plain, oiled", [QP A001](#) applies. If, in exceptional cases, unoiled parts must be supplied, this must be indicated in the drawing by means of the entry "not oiled". The use of surface protection types introduced for fasteners is permissible.

### 3.10 Assignment of surface protection types and codes

The specifications in [table 2](#) apply. Surface protection types with codes shown in italics and bold are preferred for fasteners; surface protection types with codes with gray backgrounds are standard surface protection for components without threads.

[Table A.1](#) lists the surface protection types as per VW 13750 that correspond to the surface protection types as per [VDA 235-104](#).

**Table 2 – Codes for surface protection types**

Code letter	Coating process	Surface protection type		Codes for protection class		
		Type or system; Requirements	Post-treatment and appearance	1 light	3 medium	6 heavy
<b>a</b>	<b>untreated</b>	none	not oiled	a100	-	-
		see footnote <sup>a)</sup>	lightly oiled	a101	-	-
		oil film dependent on manufacturing and/or material conditions permissible		a102	-	-

Code letter	Coating process	Surface protection type		Codes for protection class		
		Type or system; Requirements	Post-treatment and appearance	1 light	3 medium	6 heavy
b	phosphated	phosphated in any way see footnote <sup>b)</sup>	not oiled, gray	b100 <sup>c)</sup>	-	-
			passivated, gray	b101	-	-
			oiled, greased, gray	b110 <sup>d)</sup>	-	-
		thin-layer zinc phosphated; <b>TL 240<sup>b)</sup></b>	coat containing zinc, silver-gray (for interior area)	b111	-	-
			zinc flake coating plus top coat (lubricant additive (GZ)) dark gray	b113 <sup>b)</sup>	-	-
			oiled, gray	<b>b140</b>	-	-
			not oiled, gray	b149 <sup>c)</sup>	-	-
c	hot-dip zinc-plated	<b>TL 217</b>	without post-treatment, silver-colored	-	c330	c630
	electrolytically zinc-plated <sup>e)</sup>	any method; for high-strength parts, but restricted as per section 3.6; <b>TL 217</b>	without post-treatment <sup>f)</sup> , silver-colored	-	c310	c610
			passivated <sup>g)</sup> , silver-colored	-	c340 <sup>c)</sup>	c640 <sup>c)</sup>
			passivated and sealed <sup>g)</sup> , silver-colored to slightly iridescent blue	-	c341	c641
			thick-layer passivated <sup>g)</sup> , silver-colored, iridescent color	-	c342	c642
			thick-layer passivated and sealed <sup>g)</sup> , silver-colored, iridescent color	-	c343	c643
			thick-layer passivated, treated with lubricant <sup>g)</sup>	-	c347 <sup>h)</sup>	c647 <sup>h)</sup>
		weakly acidic, for contact with Mg; for high-strength parts, however, restricted as per section 3.6; <b>TL 194</b>	passivated and sealed <sup>g),i)</sup> , silver-colored	-	-	c696
			passivated and sealed, treated with lubricant <sup>g),i)</sup> , silver-colored	-	-	c697 <sup>h)</sup>
e	electrolytically nickel-plated <sup>e)</sup>	semi-bright nickel-plated	without post-treatment, silver-colored	-	e310 <sup>i)</sup>	e610 <sup>i)</sup>
		bright nickel-plated	without post-treatment, silver-colored	-	e320 <sup>i)</sup>	e620 <sup>i)</sup>
f	electrolytically chrome-plated	bright chrome-plated; <b>TL 203</b>	high-gloss, with micro-cracks, silver-colored	-	-	f620
			high-gloss, silver-colored	-	f350	f650



Code letter	Coating process	Surface protection type		Codes for protection class		
		Type or system; Requirements	Post-treatment and appearance	1 light	3 medium	6 heavy
g	electrolytically tin-plated <sup>k)</sup> bright tin-plated		without post-treatment <sup>l)</sup> , silver-colored	g100	g300	g600
			without post-treatment <sup>l)</sup> , treated with lubricant, silver-colored	-	-	g605 <sup>h)</sup>
	hot-dip tin-plated <sup>k)</sup>		without post-treatment, silver-colored	g120	g320	g620
k	electrolytically copper-plated		without post-treatment	k110 <sup>m)</sup>	-	-
r	electrolytically zinc-alloy-plated <sup>e)</sup>	Fe-alloyed; <b>TL 153</b>	transparent passivated <sup>g)</sup> , silver-colored	-	r301	-
			passivated, sealed, black	-	r302	-
		Ni-alloyed, alkaline; <b>TL 244</b>	transparent passivated (silver-colored to slightly iridescent blue) <sup>g)</sup>	-	-	r642 <sup>c)</sup>
			transparent passivated and sealed <sup>g)</sup> (silver-colored to slightly iridescent blue)	-	-	r643 <sup>n)</sup>
			transparent passivated, sealed, treated with lubricant <sup>g)</sup> (silver-colored to slightly iridescent blue)	-	-	r645 <sup>h)</sup>
			transparent passivated (silver-colored to slightly iridescent blue), flexible <sup>g)</sup>	-	-	r647
			transparent passivated with Al-pigmented top coat, silver-colored, treated with lubricant <sup>g)</sup>	-	-	r648
		Ni-alloyed, weakly acidic; <b>TL 244</b>	transparent passivated, silver-colored, only for castings <sup>g)</sup>	-	-	r649
		Ni-alloyed, alkaline; <b>TL 244</b>	passivated, black	-	-	r672 <sup>c)</sup>
			passivated, sealed, black	-	-	r673 <sup>n)</sup>
			passivated, sealed, treated with lubricant, black	-	-	r677 <sup>h)</sup>

Code letter	Coating process	Surface protection type		Codes for protection class		
		Type or system; Requirements	Post-treatment and appearance	1 light	3 medium	6 heavy
s	duplex coating (zinc or zinc/nickel plus cathodic electrocoating (KTL))	TL 196	zinc coating as per TL 217, phosphated plus KTL, jet black	-	-	s611
			Zn/Ni alloy coating as per TL 244, phosphated plus KTL, jet black	-	-	s621
			Zn/Ni alloy coating as per TL 244, phosphated plus KTL, treated with lubricant, jet black	-	-	s627 <sup>h)</sup>
t	zinc flake coating	without post-treatment, silver-gray; TL 245		-	-	t601
		with top coat, silver-gray; TL 245		-	-	t602
		without post-treatment, silver-gray; TL 245		-	-	t610 <sup>c)</sup>
		like OfI-t602, but with reduced baking temperature, silver-gray; TL 245		-	-	t611
		like OfI-t610, treated with lubricant as per TL 52165, silver-gray; TL 245		-	-	t615 <sup>o)</sup>
		with top coat <sup>p)</sup> ; preferably black; TL 233		-	t330	-
		with top coat containing lubricant <sup>p)</sup> ; preferably black; TL 233		-	-	t630
		with top coat, silver gray; standard surface protection for threaded parts with metric ISO threads; TL 245		-	-	t647
		with top coat; preferably black <sup>p)</sup> ; TL 233		-	t350	t650
		optionally with silicate intermediate layer and black top coat, without integrated lubricant; TL 180		-	-	t660
		optionally with silicate intermediate layer and black top coat and integrated lubricant; TL 180		-	-	t667
b	Self-oxidation	DIN 50938	oiled	u110	-	-
	Zn-ThD layer	passivated, silver-gray; TL 184		-	-	u610
		passivated, treated with lubricant, silver-gray; TL 184		-	-	u615 <sup>h)</sup>
		with additional organic coating (KTL), jet black; TL 184		-	-	u620
v	Passivation	colorless passivated, gray		v111 <sup>q)</sup>	-	-
		colorless passivated plus post-dip solution, gray		v112 <sup>r)</sup>	-	-

Code letter	Coating process	Surface protection type		Codes for protection class		
		Type or system; Requirements	Post-treatment and appearance	1 light	3 medium	6 heavy
w	Anodization	decorative application; <b>TL 212</b>	transparent, anodized, matte, silver-colored <sup>s)</sup>	-	-	w610
			transparent, anodized, gloss, silver-colored	-	-	w620
			transparent, anodized, gloss; inorganic coating, silver-colored; <b>TL 182</b>	-	-	w625
			transparent, anodized, dyed, matte <sup>s)</sup>	-	-	w630
			transparent, anodized, dyed, gloss	-	-	w640
			transparent, anodized, matte <sup>s)</sup> , silver-colored	-	-	w660
			transparent, anodized, dyed, gloss			w670
		technical functional application; <b>TL 212</b>	transparent anodized; color dependent on material	w180	-	w680
			hard anodized; color dependent on material	-	-	w690
			hard anodized and impregnated; color dependent on material	-	-	w695

Code letter	Coating process	Surface protection type		Codes for protection class		
		Type or system; Requirements	Post-treatment and appearance	1 light	3 medium	6 heavy
x	Paintwork	pretreated and KTL, <b>TL 178</b>		-	-	x590
		pretreatment not specified <sup>t)</sup> , single-layer liquid paint or KTL; <b>TL 260</b>		x100	x300	x600
		conversion layer with top coat containing lubricant as per <b>VW 60469</b>		-	-	x607
		zinc phosphated and painted	multi-layer structure; <b>TL 218</b>	-	-	x610
			piano lacquer structure; <b>TL 218</b>	-	-	x611
		zinc-plated and painted	multi-layer structure; <b>TL 218</b>	-	-	x612
			piano lacquer structure; <b>TL 218</b>	-	-	x613
		Alternative pre-treatment (based on zirconium oxide), Fe, Zn, or Mn phosphated, single-layer liquid paint or KTL <sup>t)</sup> ; <b>TL 260</b>		-	x330	-
		zinc phosphated or tri-cationically phosphated, KTL <sup>t)</sup> ; <b>TL 260</b>		-	-	x630 <sup>u)</sup>
		zinc phosphated, double-layer painted <sup>t)</sup> ; <b>TL 260</b>		-	-	x631
		zinc phosphated; electrolytically zinc-plated (individual parts) and painted <sup>t),v)</sup> ; <b>TL 227</b>		-	-	x632
		zinc phosphated (passivated in exceptional cases); hot-dip zinc-plated (semi-finished product) and painted; <sup>t),v)</sup> ; <b>TL 227</b>		-	-	x633
		zinc phosphated, thick-layer KTL or KTL plus dip paint; <b>TL 260</b>		-	-	x634
		tri-cationic phosphated, KTL, for chassis parts; <b>TL 262</b>				x635
		tri-cationic phosphated, KTL, for after-sales service body components; <b>TL 227</b>		-	-	x640
	Powder coating	any pretreatment <sup>t)</sup> ; <b>TL 256</b> , for vehicle interior parts in non-visible areas		-	x340	-
		layer-forming <sup>t)</sup> ; <b>TL 256</b>		-	-	x650
		layer-forming and primed <sup>v)</sup> ; <b>TL 256</b> , application, e.g., in visible areas		-	-	x651

Code letter	Coating process	Surface protection type		Codes for protection class		
		Type or system; Requirements	Post-treatment and appearance	1 light	3 medium	6 heavy
y	Paintwork with zinc dust paint	base layer, e.g., for leaf springs; <a href="#">TL 214</a>		-	-	y600
		heat-resistant zinc dust paint; <a href="#">TL 214</a>		-	-	y650
z	electroplated tin/zinc coating	transparent passivated, silver-colored		-	z300 <sup>w)</sup>	-

- a) No base metal corrosion after 4 hours in the condensation test atmosphere with constant humidity as per [DIN EN ISO 6270-2](#).
- b) After phosphating, steel parts with tensile strength values greater than 1 200 MPa may be subjected to appropriate heat treatment up to a max. of 200 °C to avoid brittle fractures induced by hydrogen ([DIN EN ISO 9717](#)).
- In addition to the specifications as per table 2, the following periods of time must be taken into account for the individual protection classes when performing the salt spray test NSS as per [DIN EN ISO 9227](#):
- |                    |   |
|--------------------|---|
| OfI-b100, OfI-b101 | 2 hours, without base metal corrosion,  |
| OfI-b110           | 6 hours, without base metal corrosion,  |
| OfI-b111, OfI-b113 | 48 hours, without base metal corrosion. |
- NOTE 1: OfI-b111 = OfI-b100 + (2 to 4) µm zinc flake coating; light abrasion, high susceptibility to soiling of other parts in the event of contact.
- NOTE 2: OfI-b113 = OfI-b149 + (2 to 4) µm zinc flake coating + (2 to 3) µm top coat (GZ); less abrasion than for OfI-b111.
- c) Suitable for fasteners used in the body-in-white and for fasteners with adhesive coatings as per [DIN 267-27](#), locking coatings as per [DIN 267-28](#), and sealing coatings as per [TL 195](#).
- d) For threaded parts, only oil or oil emulsion permissible.
- e) Immediately after surface treatment, steel parts that are subject to tensile stress and have tensile strength values greater than 1 000 MPa must be subjected to an appropriate heat treatment to avoid brittle fractures induced by hydrogen. This must be verified by means of the bracing test as per [DIN 50969-1](#) and [DIN 50969-2](#).
- f) For parts to be painted in-house.
- g) Electrolytically zinc-plated parts with Cr(VI)-free passivation must not appear yellowish in order to be able to distinguish the parts from the yellow chromating containing Cr(VI) often used in the past.
- h) Metric ISO threaded parts must be treated with lubricant as per [TL 52132](#).
- i) Preferably for steel parts in assemblies with magnesium in order to avoid bimetallic corrosion.
- j) OfI-e310, OfI-e320 = coating thickness > 10 µm,  
OfI-e610, OfI-e620 = coating thickness > 20 µm.
- k) Requirements in:  
Protection class 1 = [DIN 50965](#)-Fe/Sn4, coating thickness > 4 µm, [DIN 50965](#)-Cu/Sn4 > 4 µm;  
Protection class 3 = [DIN 50965](#)-Fe/Sn4, coating thickness > 4 µm, [DIN 50965](#)-Cu/Sn4 > 8 µm;  
Protection class 6 = [DIN 50965](#)-Fe/Sn4, coating thickness > 4 µm, [DIN 50965](#)-Cu/Sn4 > 15 µm.
- l) For steel parts in assemblies with magnesium in order to avoid bimetallic corrosion, but only when electrical conductivity is required.
- m) OfI-k110 = coating thickness (3 + 3) µm.
- n) Preferred surface protection type for self-tapping screws and PT screws.
- o) Metric ISO threaded parts must be treated with lubricant as per [TL 52165](#).
- p) Contains PTFE, not suitable for adhesive bonds.
- q) No change to surface after 120 h of salt spray test NSS as per [DIN EN ISO 9227](#) (e.g., no zinc corrosion of zinc die-castings).
- r) No change to surface after 240 h of salt spray test NSS as per [DIN EN ISO 9227](#) (e.g., no zinc corrosion of zinc die-castings; this is a passivation layer plus post-dip solution containing phosphate, e.g., by Hillebrand with the designation "Premium Diecast Finish").
- s) In order to create a special surface structure, a special pickling stage, e.g., EO/E6, is required.
- t) Color specification as per drawing; otherwise, black.
- u) Requirements also apply to dip-primed body components.
- v) Instead of single-layer liquid paint, KTL may be required; if this is the case, the suffix "KTL" must be added to the code.
- w) Sn: (70 ± 12)%, Balance: Zn. Coating thickness ≥ 5 µm. Without base metal corrosion after 360 h of salt spray test NSS as per [DIN EN ISO 9227](#).

#### 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.

QP A001	Prelube, Hot Melt, Blank Washing Oil, Drawing Compound, Slushing Oil (General); Quality Requirements
TL 153	Zinc/Iron Coatings; Surface Protection Requirements
TL 178	Kathodische Elektrotauchlackierung (KTL) von Karosserieaußenhautteilen aus Aluminiumhalbzeug; Oberflächenschutzanforderungen
TL 180	Non-Electrolytically Applied Zinc Flake Coatings with Black Top Coat; Surface Protection Requirements
TL 182	Inorganic Protective Coating on Aluminum Parts; Surface Protection Requirements
TL 184	Zinc Thermal Diffusion Layers(Zn-ThD Layers); Surface Protection Requirements
TL 194	Coating for Joining Elements when in Contact with Magnesium; Surface Protection Requirements
TL 195	Mechanical Joining Elements; Steel Metric Bolts with Sealing All-Around Coating (KLD); Material Requirements
TL 196	Duplex Coating Systems for Small Parts and Bulk Parts; Surface Protection Requirements
TL 203	Decorative Chrome-Plating (Ni-Cr Coatings) on Metallic Components; Surface Protection Requirements
TL 212	Oxide Coatings on Aluminum Parts; Surface Protection Requirements
TL 214	Zinc Dust Paint Coating; Surface Protection Requirements
TL 217	Zinc Coatings; Surface Protection Requirements
TL 218	Body Color Multicoat Paint on Metallic Exterior Body Components; Requirements
TL 227	Single-Layer Paint of Zinc-Coated Metal Surfaces; Surface Protection Requirements
TL 233	Non-Electrolytically Applied Zinc Flake Coatings with Top Coat; Surface Protection Requirements
TL 235	Manganese Phosphated Surfaces; Requirements
TL 240	Thin-Layer Zinc Phosphating; Surface Protection Requirements
TL 244	Zinc/Nickel Alloy Coatings; Surface Protection Requirements
TL 245	Non-Electrolytically Applied Zinc Flake Coatings; Surface Protection Requirements

TL 256	Powder Paint on Metal Surfaces; Surface Protection Requirements
TL 260	Paint Coating of Metal Surfaces; Requirements for Surface Protection
TL 262	Paint Finish of Chassis Parts; Corrosion Protection
TL 52132	Lubricant for Threaded Fasteners with Electrolytically Applied Coatings or those of Stainless Steel; Requirements
TL 52165	Lubricant (greenish) for Threaded Fasteners; Material Requirements
VW 01058	Engineering Drawings; Lettering
VW 01110-1	Threaded Joints; Design and Assembly Specifications
VW 01129	Limit Values for Coefficients of Friction; Mechanical Fasteners with Metric ISO Threads
VW 01131-1	Determination of Coefficients of Friction; Practice- and Mounting-Oriented Testing
VW 01131-2	Determination of Coefficients of Friction; Release of New Surface Coating Systems
VW 11610	Metric ISO Thread; Limit Dimensions for Medium Tolerance Class; External Threads 6g / Internal Threads 6H
VW 11611	Metric ISO Thread; Limit Dimensions with Protective Coating for Medium Tolerance Class; External Threads 6gh / Internal Threads 6H
VW 11614	Metric ISO Thread; Limit Dimensions for Coarse Tolerance Class, External 8g, Internal 7H
VW 11615	Metric ISO Thread; Limit Dimensions with Protective Coating for Coarse Tolerance Class (8g/7H)
VW 11624	Metric ISO Thread; Limit Dimensions for Tolerance Class 6f/6G
VW 11625	Metric ISO Threads; Limit Dimensions for Tolerance Class 8f/7G; External Thread 8f, Internal Thread 7G
VW 11627	Metric ISO Thread; Limit Dimensions for Medium Tolerance Class; External thread 6e
VW 11628	Metric ISO Thread; Limit Dimensions for External Threads, Tolerance Class 6g with Galvanic Protective Coating
VW 13750, supplement 1	Surface Protection for Metal Parts; Invalid OfI Designations
VW 60358	Self-Tapping Screws for Thermoplastics; Dimensions, Requirements, Tests
VW 60361	Mechanical Joining Elements; Parts Reduction; General Guidelines
VW 60469	Aluminum Alloy AL9 for Screws and Bolts; Mechanical Properties
VW 91101	Environmental Standard for Vehicles; Vehicle Parts, Materials, Operating Fluids; Avoidance of Hazardous Substances
DIN 267-27	Fasteners - Part 27: Steel screws, bolts and studs with adhesive coating, Technical specifications

DIN 267-28	Fasteners - Part 28: Steel screws, bolts and studs with locking coating, Technical specifications
DIN 50938	Black oxide coatings on iron or steel - Requirements and test methods
DIN 50965	Electroplated coatings - Tin-coatings on iron steel and on copper and copper alloys
DIN 50969-1	Prevention of hydrogen-induced brittle fracture of high-strength steel building elements - Part 1: Advice on the prevention
DIN 50969-2	Prevention of hydrogen-induced brittle fracture of high-strength steel building elements - Part 2: Test methods
DIN EN ISO 1478	Tapping screw thread
DIN EN ISO 4042	Fasteners - Electroplated coatings
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
DIN EN ISO 9717	Metallic and other inorganic coatings - Phosphate conversion coating of metals
DIN ISO 8992	Fasteners - General requirements for bolts, screws, studs and nuts
VDA 235-104	Cr(VI)-free surface protection for mechanical fasteners with metric thread



## Appendix A (informative)

### A.1 Surface protection types as per VDA 235-104 and VW 13750

Table A.1 compares the Cr(VI)-free surface protection types for fasteners with metric ISO threads described in VDA 235-104 with comparable surface protection types from VW 13750.

**Table A.1**

Type of surface protection layer	Description	
	as per VDA 235-104	as per VW 13750
Thin-layer phosphating	VDA 235-104.10	Ofl-b140
Electroplated zinc coating, transparent passivated	VDA 235-104.20	Ofl-c347
Electroplated zinc alloy coating, transparent passivated	VDA 235-104.25	Ofl-r645
Electroplated zinc alloy coating, black passivated	VDA 235-104.30	Ofl-r302 or Ofl-r677, no direct assignment possible
Zink flake coating, silver-colored	VDA 235-104.40	Ofl-t610
Zinc flake coating with top coat, silver-colored	VDA 235-104.42	Ofl-t647
Zinc flake coating with top coat, black	VDA 235-104.50	Ofl-t667, Ofl-t630

## A.2 Deleted surface protection types containing Cr(VI)

For an overview of the deleted surface protection types containing Cr(VI), see [table A.2](#).

**Table A.2**

<b>Code letter c:</b>	<b>Code letter r:</b>	<b>Code letter t:</b>	<b>Code letter v:</b>
(OfI-c350)	(OfI-r600)	(OfI-t300)	(OfI-v110)
(OfI-c351)	(OfI-r605)	(OfI-t320)	
(OfI-c355)	(OfI-r610)	(OfI-t345)	
(OfI-c360)	(OfI-r620)	(OfI-t600)	
(OfI-c385)	(OfI-r630)	(OfI-t620)	
(OfI-c650)	(OfI-r650)	(OfI-t645)	
(OfI-c651)	(OfI-r660)		
(OfI-c660)	(OfI-r665)		
(OfI-c683)	(OfI-r670)		
(OfI-c685)	(OfI-r675)		
(OfI-c686)			
(OfI-c687)			

### A.3 Revision record for footnotes

The following changes to the footnotes have been made as compared to the previous issue VW 13750: 2008-06; see table A.3:

- Footnote numbering changed from numbers to letters and
- text changes have gray backgrounds.

Table A.3

VW 13750: 2008-06		VW 13750: 2014-02	
No.	Footnote text	No.	Footnote text
1	No base metal corrosion after 4 cycles in the condensation test atmosphere with constant humidity as per DIN EN ISO 6270-2.	a	No base metal corrosion after <b>4 hours</b> in the condensation test atmosphere with constant humidity as per DIN EN ISO 6270-2.
2	Suitable for fasteners used in the body-in-white and for fasteners with adhesive coatings as per DIN 267-27, locking coatings as per DIN 267-28, and sealing coatings as per TL 195.	c	Suitable for fasteners used in the body-in-white and for fasteners with adhesive coatings as per DIN 267-27, locking coatings as per DIN 267-28, and sealing coatings as per TL 195.
3	For threaded parts, only oil or oil emulsion permissible.	d	For threaded parts, only oil or oil emulsion permissible.
4	<p>After phosphating, steel parts with tensile strength values greater than 1 200 MPa may be subjected to appropriate heat treatment up to a max. of 200 °C to avoid brittle fractures induced by hydrogen (DIN EN 12476).</p> <p>In addition to the specifications as per table 2, the following periods of time must be considered for the individual protection classes when performing the salt spray test NSS as per DIN EN ISO 9227:</p> <p>OfI-b100, OfI-b101, OfI-b130:</p> <p>2 hours, without base metal corrosion,</p> <p>OfI-b110:</p> <p>6 hours, without base metal corrosion,</p> <p>OfI-b111:</p> <p>48 hours, without base metal corrosion.</p> <p>NOTE</p> <p>OfI-b111 = OfI-b100 + (2 to 4) µm zinc flake coating.</p>	b	<p>After phosphating, steel parts with tensile strength values greater than 1 200 MPa may be subjected to appropriate heat treatment up to a max. of 200 °C to avoid brittle fractures induced by hydrogen (<b>DIN EN ISO 9717</b>).</p> <p>In addition to the specifications as per table 2, the following periods of time must be considered for the individual protection classes when performing the salt spray test NSS as per DIN EN ISO 9227:</p> <p>OfI-b100, OfI-b101:</p> <p>2 hours, without base metal corrosion,</p> <p>OfI-b110:</p> <p>6 hours, without base metal corrosion,</p> <p>OfI-b111, <b>OfI-b113</b>:</p> <p>48 hours, without base metal corrosion.</p> <p>NOTE 1</p> <p>OfI-b111 = OfI-b100 + (2 to 4) µm zinc flake coating; <b>light abrasion, high susceptibility for soiling of other parts in the event of contact.</b></p> <p><b>NOTE 2</b></p> <p><b>OfI-b113 = OfI-b149 + (2 to 4) µm zinc flake coating + (2 to 3) µm top coat (GZ); less abrasion than for OfI-b111.</b></p>
5	Not for new designs.	N/A	-
6	For characterization of the layer, see TL 235. No longer permissible for new fastener designs, superseded by OfI-b140.	N/A	-
7	For parts to be painted in-house.	f	For parts to be painted in-house.

VW 13750: 2008-06		VW 13750: 2014-02	
No.	Footnote text	No.	Footnote text
8	Electrolytically zinc-plated parts with Cr(VI)-free passivation must not appear yellowish in order to be able to distinguish the parts from the yellow chromating containing Cr(VI) often used in the past.	g	Electrolytically zinc-plated parts with Cr(VI)-free passivation must not appear yellowish in order to be able to distinguish the parts from the yellow chromating containing Cr(VI) often used in the past.
9	Metric ISO threaded parts must be treated with lubricant as per TL 52132.	h	Metric ISO threaded parts must be treated with lubricant as per TL 52132.
10	Immediately after surface treatment, steel parts that are subject to tensile stress and have tensile strength values greater than 1 000 MPa must be subjected to an appropriate heat treatment to avoid brittle fractures induced by hydrogen. This must be verified by means of the bracing test as per DIN 50969.	e	Immediately after surface treatment, steel parts that are subject to tensile stress and have tensile strength values greater than 1 000 MPa must be subjected to an appropriate heat treatment to avoid brittle fractures induced by hydrogen. This must be verified by means of the bracing test as per <u>DIN 50969-1</u> and <u>DIN 50969-2</u> .
11	Mainly for vehicles of the German Federal Armed Forces.	N/A	-
12	Preferably for steel parts in assemblies with magnesium in order to avoid bimetallic corrosion.	i	Preferably for steel parts in assemblies with magnesium in order to avoid bimetallic corrosion.
13	Coating thickness > 10 µm.	j	<u>OfI-e310, OfI-e320</u> = coating thickness > 10 µm, <u>OfI-e610, OfI-e620</u> = coating thickness > 20 µm.
14	Coating thickness > 20 µm.		
15	Requirements in protection class 1 = DIN 50965-Fe//Sn4, coating thickness > 4 µm; protection class 3 = DIN 50965-Fe//Sn12, coating thickness > 12 µm; in protection class 6 = DIN 50965-Fe//Sn20, coating thickness > 20 µm.	k	Requirements in: protection class 1 = DIN 50965-Fe/Sn4, coating thickness > 4 µm; <u>DIN 50965-Cu/Sn4 &gt; 4 µm</u> ; protection class 3 = DIN 50965-Fe/Sn4, coating thickness > 4 µm, <u>DIN 50965-Cu/Sn4 &gt; 8 µm</u> ; protection class 6 = DIN 50965-Fe/Sn4, coating thickness > 4 µm, <u>DIN 50965-Cu/Sn4 &gt; 15 µm</u> .
16	For steel parts in assemblies with magnesium in order to avoid bimetallic corrosion, but only when electrical conductivity is required.	l	For steel parts in assemblies with magnesium in order to avoid bimetallic corrosion, but only when electrical conductivity is required.
17	OfI-k110: coating thickness (3 + 3) µm, OfI-k310: coating thickness (12 + 4) µm.	c	OfI-k110 = coating thickness (3 + 3) µm.
18	Preferred surface protection type for self-tapping screws and PT screws.	n	Preferred surface protection type for self-tapping screws and PT screws.
19	Metric ISO threaded parts must be treated with lubricant as per TL 52165.	t	Metric ISO threaded parts must be treated with lubricant as per TL 52165.
20	Contains PTFE, not suitable for adhesive bonds.	p	Contains PTFE, not suitable for adhesive bonds.
21	Treated with blue lubricant, only for fasteners of LT2.	N/A	-
22	No change to surface after 240 h of salt spray test NSS as per DIN EN ISO 9227 (e.g., no zinc corrosion of zinc die-castings).	q	No change to surface after <u>120 h</u> of salt spray test NSS as per DIN EN ISO 9227 (e.g., no zinc corrosion of zinc die-castings).

VW 13750: 2008-06		VW 13750: 2014-02	
No.	Footnote text	No.	Footnote text
23	No change to surface after 120 h of salt spray test NSS as per DIN EN ISO 9227 (e.g., no zinc corrosion of zinc die-castings).	r	No change to surface after 240 h of salt spray test NSS as per DIN EN ISO 9227 (e.g., no zinc corrosion of zinc die-castings; this is a passivation layer plus post-dip solution containing phosphate, e.g., by Hillebrand with the designation "Premium Die-cast Finish").
-	-	s	In order to create a special surface structure, a special pickling stage, e.g., EO/E6, is required.
24	Color specification as per drawing; otherwise, black.	t	Color specification as per drawing; otherwise, black.
25	Requirements also apply to dip-primed body components.	b	Requirements also apply to dip-primed body components.
26	Instead of single-layer liquid paint, KTL may be required; if this is the case, the suffix "KTL" must be added to the code.	v	Instead of single-layer liquid paint, KTL may be required; if this is the case, the suffix "KTL" must be added to the code.
27	Sn: (70 ± 12)%, Balance: Zn. Coating thickness ≥ 5 µm. Without base metal corrosion after 360 h of salt spray test NSS as per DIN EN ISO 9227.	w	Sn: (70 ± 12)%, Balance: Zn. Coating thickness ≥ 5 µm. Without base metal corrosion after 360 h of salt spray test NSS as per DIN EN ISO 9227.