

0 INTRODUCTION

Based on the REACH regulation EC 1907/2006, which lists chromium VI as particularly worrying in the appendix XIV, it has been determined by KION that the use of components containing chromium(VI) in series products will be phased out from September 2017.

1 SCOPE AND PURPOSE

This standard establishes the coating code depending on the corrosion protection class, the surface appearance and the material rigidity. It includes the possible chromium(VI)-free coatings and applies to drawing parts for which surface protection is required.

The standard makes it simpler to specify the possible coatings on the drawing and gives suppliers the widest possible choice of coatings. Suppliers are free to choose the coatings within the corrosion protection class without consulting the customer.

For applications requiring a coating with a particular property (e.g. layer thickness, colour, resistance, wear properties, coefficient of friction) or where a specific coating is stipulated, the coating shall be clearly indicated on the drawing. This applies in particular to coatings which are not included in this standard.

The general requirements for chromium(VI)-free coatings are specified in WN 10616-1.
This standard applies to all ITS business units of the KION Group.

2 COATINGS AND CORROSION PROTECTION CLASSES

2.1 General

Based on experience, galvanic coatings in accordance with ISO 19598, zinc flake systems in accordance with ISO 10683 and paintwork in accordance with WN 11500 have proven to be effective as protection against corrosion for metallic components.

The coating information depending on the corrosion resistance, the colour of the surface and the material rigidity as per Table 4 shall be specified on the drawing.

Differing coatings, e.g. for special properties (electrical conductivity etc.), shall be indicated separately as plain text on the drawing.

Coating information on the drawing:

Surface protection in accordance with WN10616-3 X Y Z

Component rigidity, see 2.2.3
Surface colour, see 2.2.2
Corrosion protection class, see 2.2.1
Surface protection in accordance with WN 10616-3

2.2 Surface protection for drawing parts

2.2.1 Corrosion protection classes

Depending on the requirements, a distinction can be made between the following four corrosion protection classes:
Table 1

Class / ID-Number X	Corrosion protection class	Resistance to moisture ISO 6270-2 or corrosion resistance in neutral salt spray test ISO 9227 *)
1	Storage capacity	Resistance to moisture ISO 6270-2 test cycle AT; 25 cycles
2	Standard	120h WR / 240h RR according neutral salt spray test ISO 9227
3	Raised	168h WR / 480h RR according neutral salt spray test ISO 9227
4	High	168h WR / 720h RR according neutral salt spray test ISO 9227

*) Evaluation of the level of corrosion in accordance with severity level $R_P = 9$ in accordance with ISO 10289
Class 2 "Standard" corresponds to the corrosion resistance for paintwork in accordance with WN 11500.

In highly corrosive environments, e.g. the fishing or fertiliser industries, class 4 "High" shall be used.

WR = corrosion of coating material

RR = corrosion of base material

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2.2.2 Surface appearance/colour

The following variants can be selected with regard to the surface appearance/colour:

Table 2

ID-Number Y	Surface appearance/colour
1	silver/silver grey without paintwork/primer according to WN 11500
2	black/black grey with paintwork according to WN 11500
3	no requirements
4	black/black grey without paintwork / primer according to WN 11500
5	as class 3 but without paintwork / primer
6	silver/silver grey with paintwork/primer according to WN11500

A precise colour specification, e.g. by RAL number, is not possible for coatings in accordance with ISO 19598 and ISO 10683. For variants 3 and 5, "no requirements", silver, black and other colours of surface are allowed. In corrosion protection classes 3 (raised) and 4 (high), see section 2.2.1, only the colour/surface identification numbers 1, 4, 5 apply, as the standard paintwork in accordance with WN 11500 does not meet the increased corrosion requirements. The usage of multiple coating systems allows an increased corrosion protection effect to be achieved for special coatings. This should be checked on a case-by-case basis.

2.2.3 Component rigidity

The minimum rigidity R_m shall be distinguished as follows:

Table 3

ID-Number Z	Component rigidity
1	$R_{m,max} < 1000 \text{ MPa}$
2	$R_{m,max} \geq 1000 \text{ MPa}$

The application of galvanic coatings can lead to hydrogen embrittlement due to the manufacturing process. This risk is exacerbated by the interaction of high component rigidity and tensile stress. Components are already susceptible to hydrogen embrittlement if they are subject to a tensile strength of $\geq 1000 \text{ MPa}$. As soon as this limit value is exceeded, appropriate measures to prevent hydrogen embrittlement must be put in place. In general, the risk of hydrogen embrittlement can be completely eliminated if coating processes that cannot cause hydrogen absorption are selected. This measure is required for coatings designated with identification number 2.

2.2.4 Galvanic coatings for components with $R_m \geq 1000 \text{ MPa}$ /suffix "+t"

In special cases, components with a higher tensile strength can also be galvanically coated.

This may be required for geometric reasons, for example. This process is currently used for components such as chain anchors (drawing parts) and is limited to a maximum component tensile strength of 1400 MPa.

For such components, information regarding the coating must be clearly indicated on the drawing with the addition of the suffix "+t", see section 2.4, example 4.

The "+t" appended to the identification number Z=1 means that:

- The maximum component tensile strength is between 1000 MPa and 1400 MPa
- The galvanic coating methods specified in tables 4 and 5 for identification number Z=1 are to be used in accordance with the following requirements:

Requirements

If components with a tensile strength of $\geq 1000 \text{ MPa}$ are galvanically coated, then annealing is considered an appropriate measure for preventing hydrogen embrittlement. Hydrogen effusion treatment must be performed with parameters in accordance with ISO 19598 and ISO 9588. The class to be selected is derived from the maximum permissible tensile strength.

The effectiveness of the annealing must be demonstrated via process or product testing. The tests must meet the requirements of test categories K1 or K2 in accordance with DIN 50969-2.

For components with a maximum tensile strength of 1250 MPa, in accordance with ISO 4042, the manufacturer may omit hydrogen effusion treatment. In this case, the manufacturer is obligated to qualify the coating process so that the components are not subject to any unwanted hydrogen embrittlement. This qualification is demonstrated through suitability tests from test category K1 in accordance with DIN 50969-2. Following a positive evaluation of the coating process, including any tempering process that has been carried out, process monitoring is sufficient for subsequent production batches. The process monitoring method must meet the requirements of test category K3 in accordance with DIN 50969-2.

The combination of the identification number Z=2 with "+t" is not permitted, as the corrosion protection processes assigned to this identification number have no risk of hydrogen embrittlement.

2.2.5 Summary – Specification of the coating

The criteria for applying the coating are described based on sections 2.2.1 to 2.2.3. The following table provides an overview:

Table 4

Class ID-Number X	Surface appearance/colour ID-Number Y	Component rigidity ID-Number Z
1 - Storage capacity 2 - standard 3 - Raised 4 - High	1 - silver/silver grey without paintwork/primer 2 - black/black grey with paintwork/primer 3 - no requirements 4 - black/black grey without paintwork/primer 5 - as 3 but without paintwork/primer 6 - silver/silver grey with paintwork/primer	1 - $R_m < 1000 \text{ MPa}$ 2 - $R_m \geq 1000 \text{ MPa}$
↓ WN 10616 -3- X	↓ Y	↓ Z

Drawing examples are described in section 2.3.

2.2.6 Possible coatings

The possible surface coatings are detailed in the following table in relation to resistance, colour and component rigidity.

Table 5 — surface protection for drawing parts with/without thread

Corrosion protection class	Appearance/surface	Rigidity base material		
ID-Number X	ID-Number Y	ID-Number Z	Coating, painting process in accordance with standard ²⁾	Comment
1 - Storage capacity 2 - standard 3 - Raised 4 - High	1 - silver/silver grey without paintwork/primer 2 - black/black grey with paintwork/primer 3 - no requirements 4 - black/black grey without paintwork/primer 5 - as 3 but without paintwork/primer 6 - silver/silver grey with paintwork/primer	1 - Rm < 1000 MPa 2 - Rm ≥ 1000 MPa		
1 Resistance to moisture ISO 6270-2 test cycle AT; 25 cycles	3	1	oiled ISO 9717 - ZnPh10/T4	Phosphating
	3	2	oiled ISO 9717 - ZnPh10/ER(190)8/T4	Phosphating
2 120h WR / 240h RR according neutral salt spray test ISO 9227 severity level Rp = 9 ISO 10289	1	1	ISO 19598-Fe/Zn8/Cn/T2nL/silver ISO 19598-Fe/ZnFe8/Cn/T2nL/silver ISO 19598-Fe/Zn12/Cn/T2nL/silver ISO 19598-Fe/ZnFe12/Cn/T2nL/silver VDMA 24576-K3S2F1 ISO 10683-ñZn/nc/240h/silver	Galvanic coating Zinc flake coating
			plus all procedures from 3/1/1; 3/1/2; 4/1/1; 4/1/2	
	2	1	ISO 19598-Fe/Zn12/Fn/T2nL ISO 19598-Fe/ZnFe8/Fn/T2nL ISO 19598-Fe/ZnFe12/Fn/T2nL ISO 10683-ñZn/nc/240h/black	Galvanic coating Zinc flake coating
			K-A-L WN 11500 RAL7021 black grey ¹⁾ 2-K-L WN 11500 RAL7021 black grey ¹⁾ P-L WN 11500 RAL 7021 black grey ¹⁾	Painting according WN 11500
			plus all procedures from 3/4/1; 3/4/2; 4/4/1; 4/4/2	
	3	1	2-K-G WN 11500 RAL3009HR oxid red ¹⁾ plus all procedures from 2/1/1 and 2/2/1	Galvanic coating
	4	1	ISO 19598-Fe/Zn12/Fn/T2nL ISO 19598-Fe/ZnFe8/Fn/T2nL ISO 19598-Fe/ZnFe12/Fn/T2nL ISO 10683-ñZn/nc/240h/black	Galvanic coating Zinc flake coating
			plus all procedures from 3/4/1; 3/4/2; 4/4/1; 4/4/2	Galvanic coating
	5	1	ISO 19598-Fe/Zn12/Cn/T2nL/silver ISO 19598-Fe/ZnFe8/Cn/T2nL/silver ISO 19598-Fe/Zn12/Cn/T2nL/silver ISO 19598-Fe/ZnFe12/Cn/T2nL/silver VDMA 24576-K3S2F1 ISO 10683-ñZn/nc/240h/silver ISO 19598-Fe/Zn12/Fn/T2nL ISO 19598-Fe/ZnFe8/Fn/T2nL ISO 19598-Fe/ZnFe12/Fn/T2nL ISO 10683-ñZn/nc/240h/black	Galvanic coating Zinc flake coating Galvanic coating Zinc flake coating
			plus all procedures from 3/5/1; 3/5/2; 4/5/1; 4/5/2	
	6	1	ISO 19598-Fe/Zn8/Cn/T2nL/silver ISO 19598-Fe/ZnFe8/Cn/T2nL/silver ISO 19598-Fe/Zn12/Cn/T2nL/silver ISO 19598-Fe/ZnFe12/Cn/T2nL/silver VDMA 24576-K3S2F1 ISO 10683-ñZn/nc/240h/silver P-L WN11500 silver metallic ¹⁾ 2-K-L WN11500 silver metallic ¹⁾	Galvanic coating Zinc flake coating Painting according WN 11500
			plus all procedures from 3/1/1; 3/1/2; 4/1/1; 4/1/2	
	1	2	ISO 10683-ñZn/nc/240h/silver plus all procedures from 3/1/2; 4/1/2	Zinc flake coating
			ISO 10683-ñZn/nc/240h/black	Zinc flake coating
	2	2	K-A-L WN 11500 RAL7021 black grey ¹⁾ 2-K-L WN 11500 RAL7021 black grey ¹⁾ P-L WN 11500 RAL 7021 black grey ¹⁾	Painting according WN 11500
			plus all procedures from 3/4/2; 4/4/2	
	3	2	2-K-G WN 11500 RAL3009HR oxid red ¹⁾ plus all procedures from 2/1/2 and 2/2/2	
	4	2	ISO 10683-ñZn/nc/240h/black plus all procedures from 3/4/2 and 4/4/2	Zinc flake coating
	5	2	ISO 10683-ñZn/nc/240h/silver ISO 10683-ñZn/nc/240h/black plus all procedures from 3/1/2; 3/4/2; 4/1/2; 4/4/2	Zinc flake coating
	6	2	ISO 10683-ñZn/nc/240h/silver P-L WN11500 silver metallic ¹⁾ 2-K-L WN11500 silver metallic ¹⁾ plus all procedures from 3/1/2; 4/1/2	Zinc flake coating Painting according WN 11500
3 168h WR / 480h RR according neutral salt spray test ISO 9227 severity level Rp = 9 ISO 10289	1	1	ISO 19598-Fe/ZnNi5/Cn/T2nL/silver ISO 10683-ñZn/nc/480h/silver plus all procedures from 3/1/2; 4/1/1 and 4/1/2	Galvanic coating Zinc flake coating
	4 ³⁾	1	ISO 19598-Fe/ZnNi5/Fn/T2nL ISO 10683-ñZn/nc/480h/black plus all procedures from 3/4/2; 4/4/1 and 4/4/2	Galvanic coating Zinc flake coating
	5 ³⁾	1	all procedures from 3/1/1 und 3/4/1	
	1	2	ISO 10683-ñZn/nc/480h/silver plus all procedures from 4/1/2	Zinc flake coating
	4 ³⁾	2	ISO 10683-ñZn/nc/480h/black plus all procedures from 4/4/2	Zinc flake coating
	5 ³⁾	2	all procedures from 3/1/2 und 3/4/2	
4 168h WR / 720h RR according neutral salt spray test ISO 9227 severity level Rp = 9 ISO 10289	1	1	ISO 19598-Fe/ZnNi8/Cn/T2nL/silver ISO 19598-Fe/ZnNi12/Cn/T2nL/silver VDMA 24576-K5S6F1 ISO 10683-ñZn/nc/720h/silver	Galvanic coating Zinc flake coating
	4 ³⁾	1	ISO 19598-Fe/ZnNi8/Fn/T2nL ISO 19598-Fe/ZnNi12/Fn/T2nL VDMA 24576-K5S6F3 ISO 10683-ñZn/nc/720h/black	Galvanic coating Zinc flake coating
	5 ³⁾	1	all procedures from 4/1/1, 4/4/1, 4/1/2 and 4/4/2	
	1	2	ISO 10683-ñZn/nc/720h/silver	Zinc flake coating
	4 ³⁾	2	ISO 10683-ñZn/nc/720h/black	Zinc flake coating
	5 ³⁾	2	all procedures from 4/1/2 and 4/4/2	

Grouped according to base metal corrosion (red rust) and bulk goods, rack goods option possible.

Footnotes see page 4

For corrosion protection class 1 – storage capacity, it is not permissible to apply a higher quality coating of corrosion protection class 2 to 4 to the component.

Alternative arrangement:

List of possible coatings and information indicating under which coating codes these are possible:

Table 6

	coating code according WN 10616-3																									
Coatings ²⁾	131	132	211	221	231	241	251	261	212	222	232	242	252	262	311	341 ³⁾	351 ³⁾	312	342 ³⁾	352 ³⁾	411	441 ³⁾	451 ³⁾	412	442 ³⁾	452 ³⁾
ISO 19598-Fe//Zn8//Cn//T2nL//silver			x		x		x	x																		
ISO 19598-Fe//Zn12//Cn//T2nL//silver			x		x		x	x																		
ISO 19598-Fe//Zn12//Fn//T2nL//black				x	x	x	x																			
ISO 19598-Fe//ZnNi5//Cn//T2nL//silver			x		x		x	x							x		x									
ISO 19598-Fe//ZnNi8//Cn//T2nL//silver			x		x		x	x							x		x				x		x			
ISO 19598-Fe//ZnNi12//Cn//T2nL//silver			x		x		x	x							x		x				x		x			
ISO 19598-Fe//ZnNi5//Fn//T2nL//black				x	x	x	x									x	x									
ISO 19598-Fe//ZnNi8//Fn//T2nL//black				x	x	x	x									x	x					x	x			
ISO 19598-Fe//ZnNi12//Fn//T2nL//black				x	x	x	x									x	x					x	x			
ISO 19598-Fe//ZnFe8//Cn//T2nL//silver			x		x		x	x																		
ISO 19598-Fe//ZnFe12//Cn//T2nL//silver			x		x		x	x																		
ISO 19598-Fe//ZnFe8//Fn//T2nL//black				x	x	x	x																			
ISO 19598-Fe//ZnFe12//Fn//T2nL//black				x	x	x	x																			
ISO 10683-ßZn/nc/240h/silver			x		x		x	x	x		x		x	x												
ISO 10683-ßZn/nc/240h/black				x	x	x	x			x	x	x	x													
ISO 10683-ßZn/nc/480h/silver				x		x		x	x		x		x	x		x		x		x						
ISO 10683-ßZn/nc/480h/black					x	x	x	x		x	x	x	x			x	x		x	x						
ISO 10683-ßZn/nc/720h/silver			x		x		x	x	x		x		x	x		x		x		x	x		x	x		x
ISO 10683-ßZn/nc/720h/black					x	x	x	x		x	x	x	x			x	x		x	x		x	x		x	x
oiled		x	x																							
ISO 9717 - ZnPh10/T4		x																								
ISO 9717 - ZnPh10/ER(190)8/T4		x	x																							
K-A-L WN 11500 RAL7021 black grey ¹⁾					x	x				x	x															
2-K-L WN 11500 RAL7021 black grey ¹⁾					x	x				x	x															
P-L WN 11500 RAL 7021 black grey ¹⁾					x	x				x	x															
2-K-G WN11500 RAL3009HR oxid red ¹⁾						x					x															
P-L WN 11500 silver metallic ¹⁾						x			x						x											
2-K-L WN 11500 silver metallic ¹⁾						x			x						x											
VDMA 24576-K3S2F1				x		x		x	x																	
VDMA 24576-K5S6F1				x		x		x	x							x		x			x		x			
VDMA 24576-K5S6F3					x	x	x	x									x	x				x	x			

"x" ==> coating fulfils the coating code requirements

2.3 Examples of coating information on the drawing

Example one: sheet metal part in S235JR, silver colour

Surface protection: resistance WR 120h/RR 240h, silver colour, rigidity Rm < 1000 MPa (1000N/mm²):

Information on the drawing: surface protection in accordance with WN10616-3 — **211**

First digit: ID number 2 = resistance WR 120h/RR 240h

Second digit: ID number 1 = silver colour

Third digit: ID number 1 = rigidity Rm < 1000 MPa

Possible surface protection as per Table 5/6:

ISO 19598 Zn8/Cn/T2nL/silver; ISO 19598 Zn12/Cn/T2nL/silver; ISO 19598-ZnNi5/Cn/T2nL/silver;
ISO 19598-ZnNi8/Cn/T2nL/silver; ISO 19598-ZnNi12/Cn/T2nL/silver; ISO 19598-ZnFe8/Cn/T2nL/silver;
ISO 19598-ZnFe12/Cn/T2nL/silver; ISO 10683-ßZn/nc/240h/silver; ISO 10683-ßZn/nc/480h/silver;
ISO 10683-ßZn/nc/720h/silver; VDMA 24576-K3S2F1; VDMA 24576-K5S6F1

Example two: chain anchor for use in the fishing industry, black colour

Surface protection: resistance WR 168h/RR 720h, black colour, rigidity Rm ≥ 1000 MPa (1000N/mm²):

Information on the drawing: surface protection in accordance with WN10616-3 — **422**

First digit: ID number 4 = resistance WR 168h/RR 720h

Second digit: ID number 2 = black colour

Third digit: ID number 2 = rigidity Rm ≥ 1000 MPa

Possible surface protection as per Table 5/6:

ISO 10683-ßZn/nc/720h/black

Footnotes:

- 1) Threads are generally to be lacquer-free; The description is made with the existing sticker in the CAD environment (see WN10538)
- 2) When complying with the requirements for galvanic coatings in accordance with ISO 19598, a version without sealing (T0) is also permitted instead of a version with sealing (T2/T2nL); e.g. as rack goods instead of bulk goods
- 3) ID numbers 2 and 3 for colour/appearance, valid in WN-issue 2.2018 and older, replaced by number 4 and 5
Tables 5 and 6, which applied before this amendment became effective, can be found in Appendix A
Background: Paintwork in accordance with WN 11500 (RR: 240h) does not achieve the minimum corrosion resistance of corrosion protection classes 3 and 4

Example three: sheet metal part in S235JR, no surface colour requirements, surface protection: resistance WR 168h/RR 720h, any colour, rigidity $R_m < 1000 \text{ MPa}$ (1000 N/mm^2):
Information on the drawing: surface protection in accordance with WN10616-3 — **431**

First digit: ID number **4** = resistance WR 168h/RR 720h

Second digit: ID number **3** = any colour

Third digit: ID number **1** = rigidity $R_m < 1000 \text{ MPa}$

Possible surface protection as per Table 5/6:

ISO 19598-ZnNi8//Cn//T2nL//silver; ISO 19598-ZnNi12//Cn//T2nL//silver; ISO 19598-ZnNi8//Fn//T2nL;
ISO 19598-ZnNi8//Fn//T2nL; ISO 10683-flZn/nc/720h/silver; ISO 10683 flZn/nc/720h/black; VDMA 24576-K5S6F1;
VDMA 24576-K5S6F3

Beispiel 4: Chain anchor in 42CrMo4+QT black colour

Surface protection: resistance WR 120h/RR 240h, black colour, rigidity $R_{m,max} \geq 1000 \text{ MPa}$ + tempering/ process control for galvanic coatings (see section 2.2.4):

Information on the drawing: surface protection in accordance with WN10616-3—**241+t**

First digit: ID number **2** = resistance WR 120h/RR 240h

Second digit: ID number **4** = black colour

Third digit: ID number **1+t** = rigidity $R_m \geq 1000 \text{ MPa}$

==> Additional treatment and/or process control to prevent the hydrogen embrittlement of components with galvanic coatings

Possible surface protection as per Table 5/6:

Galvanic coatings + additional treatment and/or process control to prevent the hydrogen embrittlement of components with galvanic coatings, see section 2.2.4:

ISO 19598-Fe//Zn12//Fn//T2nL; ISO 19598 Fe//ZnFe8//Fn//T2nL; ISO 19598-Fe//ZnFe12//Fn//T2nL;
ISO 19598-Fe//ZnNi5//Fn//T2nL; ISO 19598-Fe//ZnNi8//Fn//T2nL; ISO 19598-Fe//ZnNi12//Fn//T2nL;

Zinc-flake coatings:

ISO 10683-flZn/nc/240h/black; ISO 10683-flZn/nc/480h/black; ISO 10683-flZn/nc/720h/black

3 TERMS AND ABBREVIATIONS

3.1 Terms

The terms used are explained in the specified standards; see normative references.

3.2 Abbreviations

The abbreviations listed in WN 10616-1 in Item 4.2 can, if required, be specified as information on the type of coating and colour with reference to WN 10616.

4 REQUIREMENTS

4.1 General

All coatings described in this standard shall be chromium(VI)-free.

4.2 Further requirements

All coatings used in Table 1 in accordance with ISO 19598, ISO 10683 and VDMA 24576 shall be designed without integrated or additional lubricants.

Notwithstanding the coatings specified in Table 1, coatings with a lower corrosion resistance can also be used for connecting elements in certain cases.

Further requirements are outlined in WN 10616-1.

5 DRAWING DATA

5.1 General

Information on the coating is provided near the text field in the form of the coating code or alternatively by clearly specifying the coating, for example coating for a component used in mechatronics.

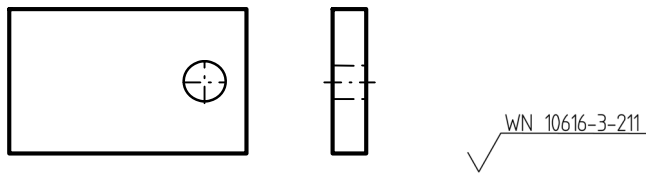
5.2 Types of lines used for identification

The coating areas for drawing parts are to be identified by the following types of lines in accordance with ISO 128-24.

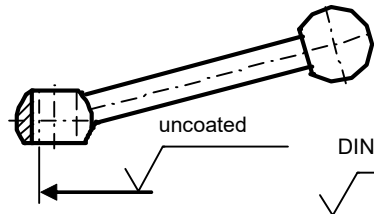
Types of lines in accordance with ISO 128-24	Designation	Meaning
04.2	Lines with thick dashes and single dots	Areas which shall be coated in accordance with the designation; (important surfaces in accordance with EN ISO 2064)
05.1	Lines with thin dashes and two dots between dashes	Areas which shall not be coated

5.3 Examples of data recorded on drawing

5.3.1 All-round coating



5.3.2 Uncoated area



NORMATIVE REFERENCES

WN	10538	Technical documents; delivery information on drawings
WN	10616 Part 2	Corrosion resistance; coatings free of Cr-(VI), mechanical connecting elements
WN	10616 Part 3	Corrosion resistance; coatings free of Cr-(VI), drawing parts
WN	11500	Paints; Paintwork, paint composition, colours, drawing details
DIN	50969 Part1/2	Prevention of hydrogen-induced brittle fracture of high-strength steel building elements – Part 1: Advice on the prevention, Part 2: Test methods
ISO	128 Part 24	Technical drawings; General principles of presentation, Lines on mechanical engineering drawings
ISO	6270 Part 2	Coating material; Determination of the resistance to moisture
ISO	4042	Fasteners; Electroplated coatings
ISO	9227	Corrosion tests in artificial atmospheres; Salt-spray tests
ISO	9588	Metallic and other inorganic coatings - Post-coating treatments of iron or steel to reduce the risk of hydrogen embrittlement
ISO	9717	Metallic and inorganic coatings – phosphate coatings on metals
ISO	10289	Methods for corrosion testing of metallic and other inorganic coatings on metallic substrates - Rating of test specimens and manufactured articles subjected to corrosion tests
ISO	10683	Fasteners; Non-electrolytically applied zinc flake coatings
ISO	15330	Fasteners. Preloading test for the detection of hydrogen embrittlement. Parallel bearing surface method
ISO	19598	Metallic coatings; Electroplated coatings of zinc and zinc alloys on iron or steel with supplementary Cr (VI)-free treatment
VDMA	24576	Fluid technology; Requirements and designations for corrosion protective coatings, free from hexavalent chrome

PREVIOUS ISSUES

02.2017; 03.2017, 06.2017; 02.2018; 01.2020

REVISION

Section 2.2.4	Process description changed
Editorial changes	

Corrosion protection class	Appearance/surface	Rigidity base material							
1 - Storage capacity 2 - standard 3 - Raised 4 - High	1 - silver/silver grey without paintwork/primer 2 - black/black grey with paintwork/primer 3 - no requirements 4 - black/black grey without paintwork/primer 5 - as 3 but without paintwork/primer 6 - silver/silver grey with paintwork/primer	1 - Rm < 1000 MPa (N/mm²) 2 - Rm ≥ 1000 MPa (N/mm²)	Resistance to moisture ISO 6270-2 or corrosion resistance in neutral salt spray test ISO 9227	Coating, painting process in accordance with standard	Comment				
1	3	1	Resistance to moisture ISO 6270-2 test cycle AT, 25 cycles	oiled ISO 9717 - ZnPh10/T4 ISO 9717 - ZnPh10/ER190/8/T4	Phosphating				
	3	2		oiled ISO 9717 - ZnPh10/ER190/8/T4	Phosphating				
2	1	1	120h WR / 240h RR according neutral salt spray test ISO 9227	ISO 19598-Fe/Zn8/Cn/T2nL/silver ISO 19598-Fe/ZnFe8/Cn/T2nL/silver ISO 19598-Fe/Zn12/Cn/T2nL/silver ISO 19598-Fe/ZnFe12/Cn/T2nL/silver VDMA 24576-K3S2F1 ISO 10683-4Zn/nc/240h/silver	Galvanic coating Zinc flake coating				
	plus all procedures from 3/1/1; 3/1/2; 4/1/1; 4/1/2								
	2			ISO 19598-Fe/Zn12/Fn/T2nL ISO 19598-Fe/ZnFe8/Fn/T2nL ISO 19598-Fe/ZnFe12/Fn/T2nL ISO 10683-4Zn/nc/240h/black	Galvanic coating Zinc flake coating				
				K-A-L WN 11500 RAL7021 black grey ¹⁾ 2-K-L WN 11500 RAL7021 black grey ¹⁾ P-L WN 11500 RAL 7021 black grey ¹⁾ plus all procedures from 3/2/1; 3/2/2; 4/2/1; 4/2/2	Painting according WN 11500				
				2-K-G WN 11500 RAL3009HR oxid red ¹⁾ plus all procedures from 2/1/1 and 2/2/1					
				3	ISO 19598-Fe/Zn12/Fn/T2nL ISO 19598-Fe/ZnFe8/Fn/T2nL ISO 19598-Fe/ZnFe12/Fn/T2nL ISO 10683-4Zn/nc/240h/black	Galvanic coating Zinc flake coating Galvanic coating			
	4			ISO 19598-Fe/Zn12/Cn/T2nL/silver ISO 19598-Fe/ZnFe8/Cn/T2nL/silver ISO 19598-Fe/Zn12/Cn/T2nL/silver VDMA 24576-K3S2F1 ISO 10683-4Zn/nc/240h/silver	Galvanic coating Zinc flake coating				
				ISO 19598-Fe/Zn12/Fn/T2nL ISO 19598-Fe/ZnFe8/Fn/T2nL ISO 19598-Fe/ZnFe12/Fn/T2nL ISO 10683-4Zn/nc/240h/black	Galvanic coating Zinc flake coating				
				plus all procedures from 3/2/1; 3/2/2; 4/2/1; 4/2/2					
				ISO 19598-Fe/Zn8/Cn/T2nL/silver ISO 19598-Fe/ZnFe8/Cn/T2nL/silver ISO 19598-Fe/Zn12/Cn/T2nL/silver ISO 19598-Fe/ZnFe12/Cn/T2nL/silver VDMA 24576-K3S2F1 ISO 10683-4Zn/nc/240h/silver	Galvanic coating Zinc flake coating				
	5			ISO 19598-Fe/Zn12/Fn/T2nL ISO 19598-Fe/ZnFe8/Fn/T2nL ISO 19598-Fe/ZnFe12/Fn/T2nL ISO 10683-4Zn/nc/240h/black	Galvanic coating Zinc flake coating				
				plus all procedures from 3/1/1; 3/1/2; 4/1/1; 4/1/2					
				ISO 19598-Fe/Zn8/Cn/T2nL/silver ISO 19598-Fe/ZnFe8/Cn/T2nL/silver ISO 19598-Fe/Zn12/Cn/T2nL/silver ISO 19598-Fe/ZnFe12/Cn/T2nL/silver VDMA 24576-K3S2F1 ISO 10683-4Zn/nc/240h/silver	Galvanic coating Zinc flake coating				
				P-L WN11500 silver metallic ¹⁾ 2-K-L WN11500 silver metallic ¹⁾ plus all procedures from 3/1/1; 3/1/2; 4/1/1; 4/1/2	Painting according WN 11500				
	ISO 10683-4Zn/nc/240h/silver plus all procedures from 3/1/2; 4/1/2								
	3			1	2	168h WR / 480h RR according neutral salt spray test ISO 9227	ISO 10683-4Zn/nc/240h/silver ISO 10683-4Zn/nc/240h/black K-A-L WN 11500 RAL7021 black grey ¹⁾ 2-K-L WN 11500 RAL7021 black grey ¹⁾ P-L WN 11500 RAL 7021 black grey ¹⁾ plus all procedures from 3/2/2; 4/2/2	Galvanic coating Zinc flake coating Zinc flake coating Zinc flake coating	
				2			2-K-G WN 11500 RAL3009HR oxid red ¹⁾ plus all procedures from 2/1/2 and 2/2/2		
				3			ISO 10683-4Zn/nc/240h/black plus all procedures from 3/2/2 and 4/2/2	Zinc flake coating	
				4			ISO 10683-4Zn/nc/240h/silver ISO 10683-4Zn/nc/240h/black	Zinc flake coating	
				5			ISO 10683-4Zn/nc/240h/black plus all procedures from 3/1/2; 3/2/2; 4/1/2; 4/2/2	Zinc flake coating	
				6			ISO 10683-4Zn/nc/240h/silver P-L WN11500 silver metallic ¹⁾ 2-K-L WN11500 silver metallic ¹⁾ plus all procedures from 3/1/2; 4/1/2	Painting according WN 11500	
							ISO 19598-Fe/ZnNi5/Cn/T2nL/silver ISO 10683-4Zn/nc/480h/silver plus all procedures from 3/1/2; 4/1/1 and 4/1/2		Galvanic coating Zinc flake coating
							ISO 19598-Fe/ZnNi5/Fn/T2nL ISO 10683-4Zn/nc/480h/black plus all procedures from 3/2/2; 4/2/1 and 4/2/2		Galvanic coating Zinc flake coating
				1			1	all procedures from 3/1/1 and 3/2/1 ISO 10683-4Zn/nc/480h/silver plus all procedures from 4/1/2	Zinc flake coating
2		ISO 10683-4Zn/nc/480h/black plus all procedures from 4/2/2	Zinc flake coating						
3	all procedures from 3/1/2 and 3/2/2								
1	ISO 19598-Fe/ZnNi8/Cn/T2nL/silver ISO 19598-Fe/ZnNi12/Cn/T2nL/silver VDMA 24576-K5S6F1 ISO 10683-4Zn/nc/720h/silver	Galvanic coating Zinc flake coating							
4	2	1	168h WR / 720h RR according neutral salt spray test ISO 9227	ISO 19598-Fe/ZnNi8/Fn/T2nL ISO 19598-Fe/ZnNi12/Fn/T2nL VDMA 24576-K5S6F3 ISO 10683-4Zn/nc/720h/black	Galvanic coating Zinc flake coating				
	3			all procedures from 4/1/1, 4/2/1, 4/1/2 and 4/2/2					
	1			ISO 10683-4Zn/nc/720h/silver	Zinc flake coating				
	2			ISO 10683-4Zn/nc/720h/black	Zinc flake coating				
	3			all procedures from 4/1/2 and 4/2/2					
	1			ISO 10683-4Zn/nc/720h/silver	Zinc flake coating				

Table A2: Possible old versions of coatings based on WN 02.2018

	coating code according WN 10616-3																									
	131	132	211	221	231	241	251	261	212	222	232	242	252	262	311	321	331	312	322	332	411	421	431	412	422	432
ISO 19598-Fe//Zn8//Cn//T2nL//silver			x		x		x	x																		
ISO 19598-Fe//Zn12//Cn//T2nL//silver			x		x		x	x																		
ISO 19598-Fe//Zn12//Fn//T2nL//black				x	x	x	x																			
ISO 19598-Fe//ZnNi5//Cn//T2nL//silver			x		x		x	x								x	x									
ISO 19598-Fe//ZnNi8//Cn//T2nL//silver			x		x		x	x								x	x				x		x			
ISO 19598-Fe//ZnNi12//Cn//T2nL//silver			x		x		x	x								x	x				x		x			
ISO 19598-Fe//ZnNi5//Fn//T2nL//black				x	x	x	x										x	x								
ISO 19598-Fe//ZnNi8//Fn//T2nL//black				x	x	x	x										x	x				x	x			
ISO 19598-Fe//ZnNi12//Fn//T2nL//black				x	x	x	x										x	x				x	x			
ISO 19598-Fe//ZnFe8//Cn//T2nL//silver			x		x		x	x																		
ISO 19598-Fe//ZnFe12//Cn//T2nL//silver			x		x		x	x																		
ISO 19598-Fe//ZnFe8//Fn//T2nL//black				x	x	x	x																			
ISO 19598-Fe//ZnFe12//Fn//T2nL//black				x	x	x	x																			
ISO 10683-ßZn/nc/240h/silver			x		x		x	x	x		x		x	x												
ISO 10683-ßZn/nc/240h/black				x	x	x	x			x	x	x	x													
ISO 10683-ßZn/nc/480h/silver			x		x		x	x	x		x		x	x	x		x	x		x						
ISO 10683-ßZn/nc/480h/black				x	x	x	x			x	x	x	x				x	x		x						
ISO 10683-ßZn/nc/720h/silver			x		x		x	x	x		x		x	x	x		x	x		x	x		x	x		x
ISO 10683-ßZn/nc/720h/black				x	x	x	x			x	x	x	x				x	x		x	x		x	x		x
oiled		x	x																							
ISO 9717 - ZnPh10/T4		x																								
ISO 9717 - ZnPh10/ER(190)8/T4		x	x																							
K-A-L WN 11500 RAL7021 black grey ¹⁾				x	x					x	x															
2-K-L WN 11500 RAL7021 black grey ¹⁾				x	x					x	x															
P-L WN 11500 RAL 7021 black grey ¹⁾				x	x					x	x															
2-K-G WN11500 RAL3009HR oxid red ¹⁾				x							x															
P-L WN 11500 silver metallic ¹⁾					x			x							x											
2-K-L WN 11500 silver metallic ¹⁾					x			x							x											
VDMA 24576-K3S2F1			x		x			x	x																	
VDMA 24576-K5S6F1			x		x			x	x							x		x				x		x		
VDMA 24576-K5S6F3				x	x	x	x										x	x					x	x		