







PRODUCT SPECIFICATION

Part No: 33002583 **Rev/Chg Level:** 001A

Specification Name: SPEC, MATL, ZINC-ALLOY PLATING

Production Release

DESIGNATED CHARACTERISTICS					QCI	KPC
0		LAST NO USED		FIT/FUNCTION	 CI	 FF
0	0	TOTAL ON DRAWING				
KPC NO	QCI NO	SAFETY/COMPLIANCE			 QS	 SC
		TYPE	DESCRIPTION	RATIONALE		

Substances of Concern and Recycled Content per Nexteer Automotive 23000000

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1.0 SCOPE

1.1 This specification covers the basic requirements for a barrel or rack electrodeposited zinc-alloy plating system over a ferrous substrate. A plating system consists of; zinc-alloy plating, a zinc-alloy surface treatment (e.g. trivalent chromium conversion coating), and may include a post treatment. All zinc alloy surface treatments and post treatments must be hexavalent chromium free. Four alloy platings are covered by this specification: zinc-cobalt, zinc-nickel, zinc-iron and zinc-cobalt-iron. Zinc alloy plating is especially suitable for small to medium ferrous parts such as castings, fasteners, stampings, clips and other parts where levels of corrosion protection exceeding pure zinc are required. Table 1 lists the zinc-alloy finishes covered by this specification and their alloy concentration limits and % nominal.

NOTE: The use of these finishes is not recommended for applications where white corrosion is a cosmetic concern.

1.2 The specification number shown in the title is a generic number for the different zinc-alloy plating finishes. Table 2 shows the grade numbers to be used on the drawings and reflects the basic requirements of the specification. The alloy designation should be included in the call out.

1.2.1 Drawing call out example: Zinc-Iron Alloy Plating per 33002583 Grade 02.

1.2.1.1 This example from Table 2 indicates a zinc-iron. The coating must withstand a minimum of 600 hours neutral salt spray without evidence of base metal corrosion (red rust). A general topcoat is added to enhance the corrosion resistance

1.2.1.2 Specific requirements shown on the part drawing shall take precedence over any requirements in this specification, or may be in addition to the requirements of this specification.

1.3 Some colors are typically obtained by the use of specific zinc-surface treatments, post-treatments or color dyes.

1.4 The use of zinc-alloy plating and related finishes described in this specification on threaded surfaces and/or bearing surfaces of joints could affect the torque-tension relationship. It is recommended that a torque-tension study of the fastener joint be performed before releasing the specified plating and finishes for use on new threaded applications. See Table 3 of this specification.

1.5 Zinc-alloy plated parts or their corrosion products should not come in contact with stressed Polyamides 6 or 66.

2.0 REFERENCED STANDARDS

ASME B1.3	ASTM E 376	ASTM B 117	ASTM B 568
ASME B18.18.5M	DIN 946	DIN 50021	ISO 1463
ISO 9227	SAE/USCAR-5	SAE/USCAR-11	

3.0 ENVIRONMENTAL/SAFETY REQUIREMENTS

3.1 All materials supplied to this specification must comply with the requirements of Nexteer Automotive 23000000, Substances of Concern and Recycled Content.

3.2 This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety concerns associated with its use. It is the responsibility of the user of this specification to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

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4.0 MATERIAL PROPERTIES

4.1 APPEARANCE

The "as-received" appearance and color hue shall be agreed upon between the supplier and Nexteer .

4.1.1 In the case of zinc-alloy surface treatments, a clean commercial finish is required; range of color, iridescence, opaqueness, and sheen are normally not critical unless otherwise specified by Nexteer.

4.1.2 Post-treatments may include coating, rinsing, leaching, drying and dyeing processes, as necessary to meet the customer required salt spray resistance, color, and/or hue.

4.2 THICKNESS/COATING MASS

4.2.1 The minimum plating thickness shall be 8µm on significant surfaces (except for Grade 06 which is 5µm). In the case of finishes with post treatments, the minimum thickness applies only to the thickness of the plating after the zinc-alloy surface treatment. Post treatments such as oils, waxes, or other specified coatings are not applicable to thickness measurements. Unless otherwise stated on the part drawing, the thickness specified represents the final dimension after plating.

CAUTION: Zinc-nickel alloys tend to chip easily when the deposit thickness exceeds 15µm and the nickel content exceeds 8%. This can become a factor on parts with large protrusions where high current density will increase both nickel content and deposit thickness. Use of an alkaline formulation zinc-nickel alloy plating chemistry can improve the plating ductility versus an acid formulation plating chemistry.

4.2.2 Thickness Measurement (ISO 1463, ASTM B 568, ASTM E 376)

The following methods are recommended for determining coating thickness:

ISO 1463 – Microscopic Method, ASTM B 568 - X-Ray Method, ASTM E 376 – Eddy Current/Magnetic.

Other acceptable methods agreed upon by the supplier and Nexteer may also be used.

4.2.3 Thread Inspection (ASME B1.3)

Unless otherwise specified on the drawing, acceptability of screw threads after coating or plating parts shall be determined per ASME B1.3. The fastener supplier is responsible to develop appropriate before coating or plating thread dimensions in order to achieve the after coating or plating thread tolerance class. Threads may be produced undersize or oversize to accommodate coating or plating, provided the finished product meets all specified mechanical properties.

4.2.4 Sampling Plan (ASME B18.18.5M)

Recommended sampling for plating thickness includes but is not limited to ASME B18.18.5M inspection. The supplier shall maintain the test results on file to be submitted upon request by Nexteer .

4.3 CORROSION RESISTANCE

4.3.1 Neutral Salt Spray Testing (ISO 9227, ASTM B 117, DIN 50021)

Parts shall meet the corrosion resistance requirements as specified in Table 2 on all significant surfaces when tested per ISO 9227, ASTM B 117, DIN 50021, or other internationally recognized testing methods agreed upon by the supplier and Nexteer.

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4.3.2 The applicator shall run periodic neutral salt spray (NSS) test of the parts in process on each line running this coating as outlined in the approved supplier quality process control plan. The supplier will maintain the test results on file to be submitted when required by Nexteer .

4.3.3 Fastener Sampling (ASME B18.18.5M)

Recommended sampling of fastener products includes but is not limited to ASME B18.18.5M inspection for NSS test.

4.3.4 Significant surfaces for test evaluation include but are not limited to fastener heads, stems, washers, and external surfaces. Sharp edges are excluded.

4.3.5 Significant surfaces, other than on threaded fasteners, shall be defined as the surface or portion of the part that can be touched with a 13mm sphere unless otherwise noted on the Nexteer drawing. Surfaces on which the specified thickness cannot be readily controlled, such as threads, holes, bases of angles, and sharp edges are normally exempt from minimum thickness requirements unless they are specifically designated not exempt on the engineering drawing and may be masked-off or otherwise covered during salt spray testing.

4.3.5.1 In the case of finishes involving post treatment(s), parts shall be aged at the standard laboratory temperature and humidity ($22^{\circ}\text{C} \pm 2^{\circ}\text{C}$, $50\% \pm 5\% \text{ RH}$) for at least 24 hours before any corrosion test.

4.3.6 Zinc plating with post treatments shall show neither corrosion products of zinc nor base metal corrosion products at the end of the specified test period.

4.3.7 The degree of color change after salt spray test is not a significant parameter unless otherwise agreed upon by Nexteer and the supplier.

4.4 ADHESION CHARACTERISTICS

4.4.1 There shall be no blistering, flaking, or separation of the plating from the base metal at the interface.

4.4.2 The applicator shall run a periodic adhesion test of the parts in process on each line running this coating as outlined in the approved Supplier Quality process control plan. This adhesion test is also required for production part approval submissions. The adhesion test shall be performed as given in 4.4.3. The supplier will maintain the test results on file to be submitted when required by Nexteer .

4.4.3 Parts shall exhibit no blistering or flaking when subjected to heat conditioning of $220^{\circ}\text{C} \pm 5^{\circ}\text{C}$ for 30 ± 5 minutes and quenched in water at room temperature.

4.4.4 Sampling Plan (ASME B18.18.5M)

Recommended sampling inspection of products includes but is not limited to ASME B18.18.5M.

4.5 RELIEF OF EMBRITTLEMENT (SAE/USCAR-5)

4.5.1 All steel parts having a specified hardness of HV353 or greater are subject to embrittlement due to hydrogen absorption and shall be processed per SAE/USCAR-5.

4.5.2 When a zinc surface treatment is specified for a part that requires baking after plating, the zinc surface treatment shall be applied after the hydrogen baking operation, unless otherwise agreed upon between Nexteer Engineering and the supplier.

4.5.3 Electrolytically coated components produced from aqueous solutions must satisfy the mechanical property requirements of the uncoated parts.

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4.6 ALLOY COMPOSITION

4.6.1 Concentration limits for the zinc-alloys covered by this specification are shown in Table 1.

4.6.2 Accurate control of the alloy composition and alloy ratios, within the limits given in Table 1, are essential for optimum corrosion resistance and plating performance.

4.7 POST TREATMENTS

These post-treatments may be required for certain applications over electrolytically zinc coated components. These may be applied with or without zinc surface treatment, and include lubricants, waxes, dipping solutions or other materials. In these cases the following suffix codes apply:

G: General Clear Topcoat

H: When a finish is to be heat conditioned prior to salt spray testing, the character H shall be shown as the last character of the plating code. Samples shall be heat conditioned for 1 hour \pm 5 minutes @ 150°C \pm 5°C.

J: Dipping solution with coefficient of friction 0.28 ± 0.10 (± 3 sigma)

M: General Topcoat with colorant

S: Lubricated with coefficient of friction 0.13 ± 0.03 (± 3 sigma)

T: Dipping solution with integrated lubrication, coefficient of friction 0.13 ± 0.03 (± 3 sigma)

V: Lubricated with coefficient of friction 0.11 ± 0.03 (± 3 sigma)

W: Waxed

X: Dipping solution with integrated lubrication, coefficient of friction 0.11 ± 0.03 (± 3 sigma)

Z: Other material, as approved by the Nexteer Product Engineering

4.8 PHYSICAL REQUIREMENTS

4.8.1 Torque-Tension Test (SAE/USCAR-11)

Threaded fasteners that are post-treated to codes J, S, T, V and X shall have 30 surrogate fasteners per Table 2 processed with the production parts. The ± 3 sigma torque values must be within the listed range of Table 2 when tested per SAE/USCAR-11, except tightening speed shall be 30 ± 3 RPM. This requirement is for Initial Source Approval and PPAP. The test results shall be maintained on file to be submitted when required by Nexteer.

4.8.2 Coefficient of Friction (DIN 946)

Threaded fasteners that are post-treated to codes J, S, T, V and X shall have 30 surrogate fasteners per Table 2 processed with the production parts. The ± 3 sigma coefficient of friction values must be within the range listed in section 4.6 when tested per DIN 946. This requirement is for Initial Source Approval only.

4.8.3 Torque-tension or coefficient of friction tests shall be run on a minimum of 10 fasteners per finish line per shift for routine production testing.

5.0 MATERIAL CONFORMANCE REQUIREMENTS:

5.1 GENERAL REQUIREMENTS

5.1.1 Any changes in material, material ingredients, processing aids, processes, or manufacturing location shall require prior approval of Nexteer Product Engineering Department and meet the requirements of PPAP.

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5.1.2 Fabricated parts shall be uniform in color, texture, finish, and free of checks or cracks, runs, chipped edges, blisters, and uneven surfaces. Any exceptions to these criteria must be documented with standards agreed upon by the supplier and the receiving plant metallurgist. The standards may consist of defined parameters, boundary samples and/or photos.

6.0 CERTIFICATION OF COMPLIANCE:

6.1 No shipment shall be made by any supplier until a submission of representative initial production samples to the purchaser's laboratory and/or engineering department has been approved as meeting the requirements of this specification.

6.2 Each lot of material supplied under this material specification must have proper documentation available certifying material conformance to the specification. After initial qualification, reduced frequency of test requirements is at the discretion of the receiving plant metallurgist. The certification information must be supplied to the appropriate quality or metallurgical laboratory departments as agreed upon between purchaser and supplier.

6.3 Certification must include purchaser's material specification number, name of manufacturer, product name and grade number, supplier lot size, date and location of manufacture, and production batch control number.

7.0 PACKAGING:

7.1 The material shall be suitably packaged to prevent loss or damage during shipment, storage, or handling. The packaging shall be specified on the purchase specification and/or order.

7.2 The following information shall appear on each container: Purchaser's material specification number, name of manufacturer, product name and grade number, net weight, date and location of manufacture, and production batch control number.

7.3 All material shall be shipped in accordance to the Hazardous Materials Transportation Act, C.F.R. 49, and the Toxic Substance Control Act.

8.0 INSPECTION AND REJECTION:

8.1 All shipments of material or parts under contract or purchase order manufactured to this specification shall be equivalent in every respect to the initial samples approved by Nexteer Product Engineering. Lack of notification of changes by the supplier constitutes grounds for rejection of any shipment.

9.0 APPROVED SOURCES:

9.1 Engineering qualification of an approved source is required for this specification. Approved source to be documented and maintained with PPAP submission.

10.0 REVISION RECORD:

10.1 The revision history page contains the documentation for revisions to the body of the material specification.

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TABLE 1 - ALLOY COMPOSITIONS AND CONCENTRATION RANGES

Alloy Element	Wt. % Alloy Element	Nominal % Alloy Element
Cobalt (Zn-Co)	0.5-1.5	1.0
Nickel (Zn-Ni)	6-15	10.0
Iron (Zn-Fe)	0.4-0.8	0.5
Cobalt, Iron (Zn-Fe-Co)	0.3-1.2 Fe, 0.5-1.2 Co, 1.0-1.6 Total	0.5 Fe, 0.7 Co, 1.2 Total

TABLE 2 - CORROSION PERFORMANCE ZINC ALLOYS

Grade Number	Alloy Type	Zinc Alloy Surface Treatment	Post Treatment	Typical Appearance	Hours to White Rust (min)	Hours to Red Rust (min)
01	Zinc-Cobalt	Trivalent Chromium	G	Clear	--	500
02	Zinc-Iron	Trivalent Chromium	G	Clear	--	600
03	Zinc-Nickel	Trivalent Chromium	G	Clear	--	600
04	Zinc-Iron-Cobalt	Trivalent Chromium	G	Clear	--	500
05	Zinc-Iron	Trivalent Chromium	G	Black	--	500
06	Zinc-Iron	Trivalent Chromium	None	Clear	--	480
07	Zinc-Iron	Trivalent Chromium	None	Clear	--	288
08	Zinc-Nickel	Trivalent Chromium	Z	Gray	--	480
09	Zinc-Nickel	Molybdenum Based	G	Black	--	400
10	Zinc-Nickel	Trivalent Chromium	None	Clear[1]	--	400
11	Zinc-Nickel	Trivalent Chromium	G	Yellow	--	480
12	Zinc-Iron	Trivalent Chromium	G	Black	--	480
13	Zinc-Nickel	Trivalent Chromium	G	Clear	--	336
14	Zinc-Iron	Trivalent Chromium	G	Clear	--	480
15	Zinc-Nickel	Trivalent Chromium	T	Black	--	480
16	Zinc-Nickel	Trivalent Chromium	T	Clear	--	480
17	Zinc-Nickel	Trivalent Chromium	None	Clear	--	480
18	Zinc-Nickel	Trivalent Chromium	G	Clear	--	400
19	Zinc-Iron	Trivalent Chromium	G	Black	--	288
20	Zinc-Iron	Trivalent Chromium	T	Clear	--	600
21	Zinc-Nickel	None	G	Clear	200	400
22	Zinc-Iron	Trivalent Chromium	G	Black	120	600
23	Zinc-Nickel	Trivalent Chromium	G	Black	--	500
24	Zinc-Nickel	Trivalent Chromium	GW	Clear	--	400
25	Zinc-Nickel	Trivalent Chromium	G	Clear	96	168
26	Zinc-Nickel	Trivalent Chromium	G	Black	144	720
27	Zinc-Nickel	Trivalent Chromium	None	Clear[1]	240	720
28	Zinc-Nickel	Trivalent Chromium	None	Clear[1]	120	720

Note [1]: Light iridescent blue is acceptable (if negotiated between the supplier and Nexteer).

TABLE 3 - STANDARD M10X1.5 TEST FASTENERS

Surrogate Bolt Part Number	Test Nut Part Number	Test Washer Part Number	Torque @ Tension (N.m) @ (kN)	Coefficient of Friction	Suffix Codes
18046040	18046042	18046043	37 ± 5 @ 28.3	0.11 ± 0.03	V, X
18046040	18046042	18046043	48 ± 8 @ 28.3	0.13 ± 0.03	S, T

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Revision History

[illegible]