1.0 SCOPE

1.1 This document defines plating system specifications and inspection requirements for the plating systems required by TE Connectivity (TE).

2.0 PURPOSE

2.1 The purpose of this document is to provide a means of describing a plating system through the use of pre-assigned plating codes which have been developed for specific applications. These codes, described herein as slash sheets, shall be used in conjunction with this parent specification.

3.0 APPLICABLE DOCUMENTS

3.1 Issues of Documents. The purchase order, production drawings and specifications, standards and directives listed in paragraph 3.2 form a part of this document to the extent specified herein. In the event of conflicting requirements, the order of precedence between these documents shall be:

First	Purchasing Order
Second	Production Drawing
Third	Detail Slash Sheets of ES-61400 (ES-61400/xx)
Fourth	ES-61400
Fifth	Referenced Specifications, Standards and Directives

3.2 Specifications, Standards and Directives.

ASTM International

ASTM B488	Standard Specification for Electrodeposited Coatings of Gold for Engineering Uses
ASTM B545	Standard Specification for Electrodeposited Coatings of Tin
ASTM B567	Standard Test Method for Measurement of Coating Thickness by Beta Backscatter Method
ASTM B568	Standard Test Method for Measurement of Coating Thickness by X-Ray Spectrometry
ASTM B571	Standard Practice for Qualitative Adhesion Testing of Metallic Coatings
ASTM B605	Standard Specification for Electrodeposited Coatings of Tin-Nickel Alloy
ASTM B678	Standard Test Method for Solderability of Metallic-Coated Products
ASTM B700	Standard Test Method for Electrodeposited Coatings of Silver for Engineering Use

| Indicates Change

American National Standards Institute (ANSI)

ASQ Z1.4 Sampling Procedures and Tables for Inspection by Attributes

SAE International

AMS-2404 Plating, Electroless Nickel

AMS-2418 Plating, Copper

AMS-C-26074 Coatings, Electroless Nickel Requirements For 1/

AMS-QQ-N-290 Nickel Plating, Electrodeposited

AMS-P-81728 Plating, Tin-Lead, Electrodeposited

1/ SAE International has re-activated AMS-C-26074. This document may be used interchangeably with AMS-2404 in equivalent plating conditions defined in each specification.

European Union

RoHS Directive Restriction of Hazardous Substances (RoHS) Directive (http://ec.europa.eu/environment/index_en.htm)

TE Connectivity Documents (Raychem Products)

ES 51029 Porosity Test for Gold and Nickel Plated Beryllium Components

4.0 SPECIFICATION REFERENCE

4.1 Applicable documents, such as production drawings (PD), shall reference this document with a general note to describe the required plating system and the applicable slash sheets. Example: "Plate and package in accordance with Raychem product specification ES 61400/xx."

4.2 Slash sheets specifications shall be in the format defined herein as “Slash Sheet Plating System Designation: Number ES-61400/XX”.

4.3 Slash sheet dimensions shall be in inches.

4.4 Requirements for Restriction of Hazardous Substances (RoHS) compliance or non-compliance shall be indicated on each slash sheet and updated as RoHS legislation is modified.

4.5 Plating notes may state the following conditions, or other conditions, as required:

- Deviations and/or exceptions to the requirements of this specification. (Reference: Paragraphs 3. and 5.).
- Critical surfaces for plating and inspection.
- Post-plating dimensional requirements.
- Solderability requirements.
- Special adhesion testing requirements.

4.6 Only this specification and detailed slash sheet documents shall apply when referenced on a production drawing. No interpretative application of similar TE specification shall be allowed unless otherwise instructed by the RDO engineering.

5.0 GENERAL REQUIREMENTS FOR ALL PLATING PROCESSES:

Supersession of Paragraphs:

Requirement Paragraphs 5.1.1 through 5.1.4.4, formerly defined in previous revisions of this specification, shall be superseded in their entirety as listed below:

5.1.1. Superseded by Paragraph 5.2.

5.1.2. Superseded by Paragraph 5.3.

5.1.3. Superseded by Paragraph 5.4.

5.1.3.1 Superseded by Paragraph 5.4.

5.1.3.2. Superseded by Paragraph 5.4.

5.1.4. Superseded by Paragraph 5.5.

5.1.4.1. Superseded by Paragraph 5.5.

5.1.4.2. Superseded by Paragraph 5.5.

5.1.4.3. Superseded by Paragraph 6.1.

5.1.4.4. Superseded by Paragraph 6.2.

5.1 Certificate of Compliance / Certificate of Conformance. A Certificate of Compliance shall be supplied with each plating lot. As a minimum the Certificate of Compliance shall include:

plating supplier's name,

TE's plating specification and slash sheet number,

TE's component number,

TE's component lot number,

plating supplier's lot number,

purchase order number,

quantity received,

quantity plated,

quantity scrapped,

quantity inspected,

thickness data,

inspection results (accept/reject),

authorized signature and date.

Applicable requirements of Paragraph.

5.2 Sampling Lot Size. Plating materials shall be inspected in accordance with the sampling lot sizes defined in Table 1.

5.3 Visual Examination. Samples shall be inspected using 10x magnification.

5.4 Thickness. Unless otherwise defined by Applicable Documents, plating thickness shall be measured in accordance with ASTM B567 or ASTM B568. Alternative measurement methods may be permissible if it is mutually agreed upon by both the plating supplier and by TE. Actual plating thickness test results, or a copy thereof, shall be included with each lot. Data shall include all plating layers and all thickness readings. Inspection quantities are defined in Table 1.

5.5 Adhesion. Adhesion of the plating materials shall be tested with a Bend Test in accordance with ASTM B571, Paragraph 3.2. In the event that a Bend Test is not viable, and no other adhesion test is defined in the applicable documents, an alternative method of evaluating adhesion shall be mutually agreed upon by both the plating supplier and by TE. The magnification shall be 10x or greater.

5.6 Surface Condition. The finished surface shall be that which results from the final layer of plating. The finished surface shall be uniform in appearance, smooth, free from blisters, pits, nodules, inclusions, excessive or non-uniform build-up, stains, discoloration, cracks or other characteristics that are generally recognized as detrimental to appearance or performance. The finished surface shall meet the surface finish requirements defined on the applicable slash sheet. No mechanical preparation of the plated surface shall be applied to eliminate, flaws, scratches and other defects unless specified by applicable documents.

5.6.1 Surface Finish:

5.6.1.1 Bright: Reflective surface finish which a flat surface such as a coupon reflects clear image. Note: The basis metal surface condition may prevent clear reflective image.

5.6.1.2 Matte: Non-bright surface finish which may range between dull to diffused reflective surface.

5.7 Stripping and Rework. If a stripping or rework process is required, and the process can adversely affect the remaining material, TE Quality Assurance or Engineering shall be contacted prior to performing the stripping or rework process.

5.8 Packaging. As applicable and as appropriate, plated parts are to be returned in the same packaging containers as delivered to the plating supplier with date codes and/or lot numbers intact. Different lots of the same part number component shall not be mixed unless prior approval of is obtained from TE Purchasing.

5.9 Sample Coupons. If used, sample coupons shall be retained by the plating supplier.

6.0 REQUIREMENTS FOR SPECIFIC PLATING PROCESSES

6.1 Solderability. As required by the applicable slash sheet, solderability of the plated component shall be dip tested in accordance with ASTM B678. Prior to testing, specimens shall be aged in accordance with the Procedure section (Paragraph 8) except that aging exposure time shall be 8 hours, ±15 minutes. As required, applicable documents shall define alternative flux requirements.

6.2 Porosity. For gold and nickel plating only, perform porosity testing in accordance with Raychem ES 51029.

6.3 Thickness Measurements on Gold Plating. Non-destructive plating thickness measurements shall be used to determine plating thickness. A minimum of 30 samples shall be used to determine a standard deviation (sigma). The plating thickness shall be a minimum of three-sigma above the minimum requirement.

6.4 Embrittlement Relief. As required, embrittlement relief shall be defined in the Applicable Documents.

6.5 RoHS Compliance. As required by the applicable slash sheet, each plating layer shall meet the compliance requirements of RoHS Directive.

6.6 NADCAP Certified Suppliers: The NADCAP certification for plating (or chemical processing) is preferred but not required except when specifically required by a customer, or other applicable documents or specifications.

TABLE 1

Partial Summary of Plating Supplier's Inspection Requirements
Sample Size vs. Test Requirement

Test	Sample Size
Visual	ASQ Z1.4, Level III, AQL 1.0%
Thickness, Final Layer	20 Pieces
Thickness, Under-layers	4 Pieces
Adhesion	4 Pieces
Solderability	4 Pieces

Slash Sheet Plating System Designation: Number ES-61400/XX

Slash sheets are an integral extension of specification ES-61400. Refer to ES-61400 for typical plating systems requirements. This slash sheet shall apply as required by TE Connectivity specifications and Applicable Documents. As required, refer to Applicable Documents for the location of critical areas, plating zones and other special requirements.

Unless otherwise defined, the plating system shall consist of the following metals plated over the entire part and in the order listed, from the substrate to the final outermost layer.

STRIKE:

Metal		Thickness	
Specification			

LAYER NO. 1:

Metal		Thickness	
Specification			
Surface Finish	Bright ☑	Matte ☐	Other ☐

LAYER NO 2:

Metal		Thickness	
Specification			
Surface Finish	Bright ☑	Matte ☐	Other ☐

FINAL LAYER:

Metal		Thickness	
Specification			
Surface Finish	Bright ☑	Matte ☐	Other ☐

NOTES:

1. RoHS Compliance: Each plating layer defined on this slash sheet is required to be RoHS Compliant. Yes☑ No☐
2. Solderability testing is required. Yes☑ No☐

Summary of Designated Materials and Thickness

Refer to slash sheets for specific plating requirements and inspection details.

/XX	Comply with RoHS	FINAL LAYER		LAYER NO. 2		LAYER NO. 1		STRIKE	
		Metal	Thickness (inches) Plating (Ref) TCPN	Metal	Thickness (inches) Plating (Ref) TCPN	Metal	Thickness (inches) Plating (Ref) TCPN	Metal	Thickness (inches) Plating (Ref) TCPN
/01	Yes	Tin (Acid) Bright	.000050/.000150 ASTM B545 9-2288468-9	N/A	N/A	Copper	.000100/.000200 SAE AMS-2418 9-2288506-9	N/A	N/A
/02	Yes	Gold Matte	.000050/.000100 ASTM B488 9-2288504-7	N/A	N/A	Nickel Matte	.000100/.000200 SAE AMS-QQ-N-290 2288478-2	Copper	.000040/.000100 SAE AMS-2418 9-2288506-9
/03	Yes	Tin (Acid) Bright	.000100/.000400 ASTM B545 9-2288468-9	N/A	N/A	N/A	N/A	Copper	0.000040 Max SAE AMS-2418 9-2288506-9
/04	Yes	Gold Matte	.000050/.000100 ASTM B488 9-2288504-7	N/A	N/A	Copper Matte	.000100/.000200 SAE AMS-2418 2288506-2	N/A	N/A
/05	Yes	Gold Matte	.000030/.000100 ASTM B488 9-2288504-7	N/A	N/A	Nickel Matte	.000050/.000150 SAE AMS-QQ-N-290 2288478-2	Copper	0.000040 Max SAE AMS-2418 9-2288506-9
/06	Yes	Gold Matte	.000050/.000100 ASTM B488 9-2288504-7	N/A	N/A	N/A	N/A	Copper	0.000040 Max SAE AMS-2418 9-2288506-9
/07	Yes	Gold Matte	.000030/.000055 ASTM B488 9-2288504-7	N/A	N/A	Nickel Matte	.000050/.000100 SAE AMS-QQ-N-290 2288478-2	Copper	0.000040 Max SAE AMS-2418 9-2288506-9
/08	Yes	Nickel Bright	.000100/.000200 SAE AMS-QQ-N-290 2288478-1	N/A	N/A	N/A	N/A	N/A	N/A
/09	Yes	Tin (Acid) Bright	.000100/.000400 ASTM B545 9-2288468-9	N/A	N/A	Electroless Nickel	.000050/.000150 SAE AMS-C-26074 or 2404 9-2288505-9	Copper	0.000040 Max SAE AMS-2418 9-2288506-9

/XX	Comply with RoHS	**FINAL LAYER**		**LAYER NO. 2**		**LAYER NO. 1**		**STRIKE**	
		Metal	Thickness (inches)	Metal	Thickness (inches)	Metal	Thickness (inches)	Metal	Thickness (inches)
			Plating (Ref)		Plating (Ref)		Plating (Ref)		Plating (Ref)
			TCPN		TCPN		TCPN		TCPN
/10	Yes	Tin Matte	.000200/.000400	N/A	N/A	Nickel Matte	.000050/.000150	Copper	0.000040 Max
			ASTM B545				SAE AMS-QQ-N-290		SAE AMS-2418
			9-2288468-9				2288478-2		9-2288506-9
/11	Yes	Nickel Bright	.000200/.000300	N/A	N/A	Copper Bright	.000100/.000200	N/A	N/A
			SAE AMS-QQ-N-290				SAE AMS-2418		
			2288478-1				2288506-1		
/12	No	Tin-Lead	.000300 Min Average	N/A	N/A	Nickel Matte	.000100/.000200	N/A	N/A
			SAE-AMS-P-81728				SAE AMS-QQ-N-290		
			9-2288470-9				2288478-2		
/13	No	Tin-Lead Dull	.000100/.000300	N/A	N/A	Nickel Matte	.000100/.000200	Copper	0.000080 Max
			SAE-AMS-P-81728				SAE AMS-QQ-N-290		SAE AMS-2418
			9-2288470-9				2288478-2		9-2288506-9
/14	Yes	Nickel Matte	.000100/.000200	N/A	N/A	N/A	N/A	N/A	N/A
			SAE AMS-QQ-N-290						
			2288478-2						
/15	Yes	Nickel Matte	.000200/.000300	N/A	N/A	N/A	N/A	Copper	0.000040 Max
			SAE AMS-QQ-N-290						SAE AMS-2418
			2288478-2						9-2288506-9
/16	Yes	Electroless Nickel Bright	.000200/.000400	N/A	N/A	N/A	N/A	Copper	0.000040 Max
			SAE AMS-C-26074 or 2404						SAE AMS-2418
			9-2288505-9						9-2288506-9
/17	Yes	Tin Matte	.000100/.000400	N/A	N/A	Electroless Nickel	.000050/.000150	Copper	0.000040 Max
			ASTM B545				SAE AMS-C-26074 or 2404		SAE AMS-2418
			9-2288468-9				9-2288505-9		9-2288506-9
/18	Yes	Tin Matte	.000100/.000200	N/A	N/A	Electroless Nickel	.000100/.000200	Copper	0.000040 Max
			ASTM B545				SAE AMS-C-26074 or 2404		SAE AMS-2418
			9-2288468-9				9-2288505-9		9-2288506-9

/XX	Comply with RoHS	**FINAL LAYER**		**LAYER NO. 2**		**LAYER NO. 1**		**STRIKE**	
		Metal	Thickness (inches) Plating (Ref) TCPN	Metal	Thickness (inches) Plating (Ref) TCPN	Metal	Thickness (inches) Plating (Ref) TCPN	Metal	Thickness (inches) Plating (Ref) TCPN
/19	Yes	Tin Matte	.000500/.000700 ASTM B545 9-2288468-9	N/A	N/A	Electroless Nickel	.000100/.000200 SAE AMS-C-26074 or 2404 9-2288505-9	N/A	N/A
/20	Yes	Nickel Bright	.000050/.000100 SAE AMS-QQ-N-290 2288478-1	N/A	N/A	N/A	N/A	Copper	0.000040 Max SAE AMS-2418 9-2288506-9
/21	Yes	Gold Bright	.000030 Min. ASTM B488 9-2288504-7	N/A	N/A	Nickel Matte	.000050/.000100 SAE AMS-QQ-N-290 2288478-2	N/A	N/A
/22	Yes	Electroless Nickel Bright	.000050/.000150 SAE AMS-C-26074 or 2404 9-2288505-9	N/A	N/A	N/A	N/A	N/A	N/A
/23	Yes	Nickel Bright	.000200/.000400 SAE AMS-QQ-N-290 2288478-1	N/A	N/A	N/A	N/A	Copper	0.000040 Max SAE AMS-2418 9-2288506-9
/24	No	Zone A: Tin-Lead	.000200/.000500 SAE-AMS-P-81728 9-2288470-9	N/A	N/A	Nickel Matte	.000050/.000100	Copper	.000005/ .000025
		Zone B: Hard Gold Over Soft Gold	.000020/.000040 .000030/.000060 ASTM B488 9-2288504-7 / 9-2288504-8				SAE AMS-QQ-N-290 2288478-2		SAE AMS-2418 9-2288506-9
/25	Yes	Tin (Acid) Bright	.000250/.000500 ASTM B545 9-2288468-9	N/A	N/A	Electroless Nickel	.000050/.000150 SAE AMS-C-26074 or 2404 9-2288505-9	Copper	0.000040 Max SAE AMS-2418 9-2288506-9
/26	N/A	Obsolete	N/A	N/A	N/A	N/A	N/A	N/A	N/A
/27	Yes	Silver Matte	.000050/.000100 ASTM B700 9-2288480-9	N/A	N/A	N/A	N/A	Copper	0.000040 Max SAE AMS-2418 9-2288506-9

/XX	Comply with RoHS	**FINAL LAYER**		**LAYER NO. 2**		**LAYER NO. 1**		**STRIKE**	
		Metal	Thickness (inches) Plating (Ref) TCPN	Metal	Thickness (inches) Plating (Ref) TCPN	Metal	Thickness (inches) Plating (Ref) TCPN	Metal	Thickness (inches) Plating (Ref) TCPN
/28	Yes	Silver Semi-Bright	.000050/.000100 ASTM B700 9-2288480-8	N/A	N/A	N/A	N/A	Copper	0.000040 Max SAE AMS-2418 9-2288506-9
/29	Yes	Hard Gold	.000020/.000040 ASTM B488 9-2288504-7	Soft Gold	.000030/.000050 ASTM B488 9-2288504-8	Nickel Matte	.000050/.000100 SAE AMS-QQ-N-290 2288478-2	Copper	.000005/ .000025 SAE AMS-2418 9-2288506-9
/30	Yes	Gold	.000050/.000100 ASTM B488 9-2288504-7	N/A	N/A	Copper	0.000030 Min SAE AMS-2418 9-2288506-9	N/A	N/A
/31	Yes	Tin Matte	.000200/.000300 ASTM B545 9-2288468-9	N/A	N/A	Electroless Nickel	.000400/.000600 SAE AMS-C-26074 or 2404 9-2288505-9	N/A	N/A
/32-1	Yes	Tin Nickel Bright (Aluminum Substrate)	.000050/.000100 ASTM B605 2288507-1	Nickel Bright	.000050/.000150 SAE AMS-QQ-N-290 2288478-1	Electroless Nickel	.000050/.000150 SAE AMS-C-26074 or 2404 9-2288505-9	N/A	N/A
/32-2	Yes	Tin Nickel Bright (Brass / Cu Substrate)	.000050/.000100 ASTM B605 2288507-1		.000050/.000150 SAE AMS-QQ-N-290 2288478-1		.000050/.000150 SAE AMS-C-26074 or 2404 9-2288505-9	Nickel	.000040/.000100 SAE AMS-QQ-N-290 2288478-1
/32-3	No	Termination Zone: Tin-Lead	.000050/.000100 SAE-AMS-P-81728 9-2288470-9	N/A	Plate per /32-2 and apply selectively plated solderable surface treatment. See detail specification sheet for additional requirements.				
/33	Yes	Low Stress Nickel	.000050/.000100 SAE AMS-QQ-N-290 9-2288478-9	N/A	N/A	Copper	.000100/.000200 SAE AMS-2418 9-2288506-9	N/A	N/A
/34	Yes	Electroless Nickel	.000200/.000400 SAE AMS-C-26074 or 2404 9-2288505-9	N/A	N/A	Copper	.000100/.000200 SAE AMS-2418 9-2288506-9	N/A	N/A
/35	Yes	Tin Bright	.000100/.000400 ASTM B545 9-2288468-9	Electroless Nickel	.000050/.000150 SAE AMS-C-26074 or 2404 9-2288505-9	Copper	.000100 Min SAE AMS-2418 9-2288506-9	N/A	N/A