

Table of Contents

Approved Suppliers.....	Section 1
Laminate, Prepreg Requirements.....	Section 2
Drill, Router Requirements.....	Section 3
Flexible Copper Clad Requirements.....	Section 4
Copper Foil Requirements.....	Section 5
Pressure Sensitive Adhesive (PSA) Requirements.....	Section 6
Solder Mask, Hole Plug, Legend, Silver Paste and Serialization Requirements.....	Section 7
Testing and Calibration Service Requirements.....	Section 8
Copper Anodes Requirements.....	Section 9
Nickel Anodes Requirements.....	Section 10
Solder Bar Requirements.....	Section 11
Tin Tin-Lead Requirements.....	Section 12
Wet Process Requirements.....	Section 13
Wet Precious Metals Requirements.....	Section 14
Electroless Nickel Immersion Gold (ENIG) Surface Finish Requirements.....	Section 15
Via Fill Requirements.....	Section 16
Hot Air Solder Level (HASL) Surface Finishing Requirements.....	Section 17
Miscellaneous Outside Services.....	Section 18
Supplier Exceptions/Deviations.....	Section 19
Defense Priorities and Allocations Systems.....	Section 20
Right of Entry & Flow Down Requirements.....	Section 21
Record Retention.....	Section 22

1.0 Approved Suppliers

- 1.1 All Critical & Major Materials and Processes must be purchased from vendors on the TTM ASL-1 Approved Suppliers List.

2.0 Laminate, Prepreg Requirements

- 2.1 All laminate and prepreg must meet the requirements of IPC-4101 or IPC-4103, and those specified on the purchase order or purchasing contract. Test results must be submitted upon request.
- 2.2 All polyimide laminate must meet the requirements of and be certified to IPC-4101/41 unless otherwise stated on the purchase order.
- 2.3 All FR5 materials must be certified to IPC-4101/23.
- 2.4 All PTFE based material (high speed/high frequency) must be certified to IPC-4103.
 - 2.4.1 Exceptions include print specified material
- 2.5 Exotic material that does not meet IPC standards, but is required per a customer specification, shall include a certificate of conformance per the manufacturer's standards.
- 2.6 Sample material may be inspected for acceptability per the requirements specified in this document and the respective IPC specification.
- 2.7 Panels must meet the length, width, and perpendicularity as specified in IPC-4101, except the tolerance on length and width shall meet $+0.000''/-0.062''$. Material certified to IPC-4103 shall have a tolerance on length and width of $+0.000''/-0.125''$.
- 2.8 All materials must be cut so that the grain direction (warp) is in the long direction (48" of a 36"x48" sheet), unless prior approval by North Jackson Engineering Department. For square panels the grain direction must be marked on the panel.
- 2.9 Copper Foil: Reverse Treat Foil (RTF) is the preferred foil for FR4 laminate. "Shiny" side foil, where the treatment is applied to the solution (rough) side and is laminated rough side down to the core, is the preferred foil for polyimide laminate and an acceptable alternative on all other types of laminate. Fukuda T8 and other similar "pink" treatments style foil are not allowed. All foil must meet IPC-4562, Grade III for high temperature elongation (HTE) copper foil.
 - 2.9.1 The copper foil for polyimide and FR4 material shall meet the requirements of IPC-4562/3 CU-E3.
 - 2.9.2 The copper foil for PTFE based material (high speed/high frequency) shall meet the requirements of IPC-4562/01 or /03
- 2.10 Laminate Thickness, Surface Quality, Construction
 - 2.10.1 Laminate 0.030" and less shall be purchased by dielectric thickness per Class "C" of IPC-4101 unless Purchase Order states otherwise.
 - 2.10.2 Laminate 0.031" and thicker shall be purchased by overall thickness per Class "C" of IPC-4101 unless Purchase Order states otherwise.
 - 2.10.3 Laminate certified to IPC-4103 shall be purchased by dielectric thickness per Class "C" unless Purchase Order states otherwise.
 - 2.10.4 For surface Quality Class, laminate certified to IPC-4101 shall be purchased per Class "C". Laminate certified to IPC-4103 shall be purchased per Class "A".
 - 2.10.5 Construction of cores and rigid laminate will be as agreed between North Jackson and the material supplier; and as specified on the Purchase Order.
- 2.11 Prepreg
 - 2.11.1 Standard: Prepreg must be shipped in a vacuum-sealed bag or sealed desiccated container. The shelf life shall be such that the prepreg is certified to meet all specified requirements.

- 2.11.2 Prepreg must not be shipped to North Jackson after five (5) months from date of manufacture unless pre-approved by North Jackson prior to shipment. Any re-testing or re-certification shall be in accordance with IPC-4101 or IPC-4103.
- 2.11.3 Alternate method of shipping: Certain types of prepreg or films (i.e. thermoset, thermoplastic, PTFE, RF Microwave materials) are not required to be vacuum-sealed but shall be in a protective container.
- 2.12 Packaging and Shipping. Each shipment must be packaged in accordance with the following instructions or as specified on the purchase order:
 - 2.12.1 As a minimum, each package of laminate must be individually identified as to dielectric thickness or overall thickness and copper weight.
 - 2.12.2 Any laminate with uneven copper weight must be identified on each panel. Identification on one side is acceptable.
 - 2.12.3 Each material type must be segregated and packaged in individual containers.
 - 2.12.4 Individual packages may be palletized. If so, they must be banded securely.
 - 2.12.5 Packaging must prevent any damages to material shipped. The containers must be able to withstand normal air and surface handling. North Jackson may reject any materials improperly packaged or secured.
- 2.13 The following documentation must accompany each shipment:
 - 2.13.1 Appropriate package label, including as applicable: Vendor name, North Jackson part number, material description (such as material type, glass style or core thickness, copper weight), lot number, and quantity per package.
 - 2.13.2 Certificate of Compliance to the appropriate specification for material type as called out on the Purchase Order, including date of manufacture
 - 2.13.3 Prepreg Certificate of Compliance shall include Date of Manufacture and expiration date OR Shelf Life
 - 2.13.4 Packing slip must reference item description and North Jackson Purchase Order Number
 - 2.13.5 Test reports if required/requested.

3.0 Drill / Router Bits General Purchase / Quality Requirements

3.1 When TTM North Jackson purchases drill / router bits in selected diameter sizes, they must meet established industry standards for Quality. Drill bits are to be supplied within diameter and length tolerances as below:

Diameter Tolerances for Drill Bits:

Tool style/size (in)	Tolerance
UC (undercut)	+ .0004
.0039-.0630	- .0000
Standard Back	+ .0000
Taper .0039-.1250	- .0006
.1260 diameters	+ .0004
and larger	- .0004

Length Tolerances for Drill Bits

Overall Length (in)	Tolerance
1.5	+ .008
	- .004

3.2 Reprint Requirements

- 3.2.1 When drill bits reach their maximum hit usage, bits are packaged to prevent breakage and shipped to the outside source with a Packing List of drill bit sizes and quantity for each size. Bits are inspected by the repointing service prior to repointing. Once the drill reaches lengths specified in the re-pointing specification agreement with the outside source, the drill cannot be resharpened if the flute length is inadequate. Bits with major defects such as chips, burned tips, or insufficient flute lengths will be deemed scrap. All scrap will be disposed of by the repointing service supplier.
- 3.2.2 Each Shipment must be packaged in accordance with the following instruction.
 - * Each tool type must be segregated and packaged in individual containers.
 - * Each container must be labeled with drill / router bit size, lot number and quantity
 - * Packaging must not allow any damages to material shipped. The containers must be able to withstand normal air and surface handling. TTM (North Jackson) will reject any materials improperly packaged or secured.
 - * A packing slip stating drill / router bit size and quantity shipped must accompany all shipments.

4.0 Flexible Copper Clad Laminate Requirements

- 4.1 All material shall meet the requirements of IPC-4203B for cover and bonding material and IPC-4204A for metal-clad dielectrics and those specified on the purchase order or purchasing contract. Test results shall be submitted upon request
- 4.2 Metal Clad Flexible Composites, such as Pyralux AP, LF or equivalent, 18" x 24" standard size or as specified on purchase order, minimum of 4 sheets and a maximum of 25 sheets per pack
- 4.3 Coverlay, Bondply or Sheet Adhesives such as Pyralux FR, LF or equivalent, 24" x various length rolls
- 4.4 Pyralux PC Flexible Photoimageable Coverlay Flexible Composites, varying widths by 500 ft.
- 4.5 Panels must be toleranced to + 1/4"/-0" overall
- 4.6 Packaging and shipping
 - 4.6.1 Each material type must be segregated and packaged in individual containers.
 - 4.6.2 All panels of Metal Clad Flexible Composites must be slip-sheated.
 - 4.6.3 Packaging must prevent damages to material shipped. The containers must be able to withstand normal air and surface handling. North Jackson may reject any material improperly packaged or secured

5.0 Copper Foil Requirements

- 5.1 All foil must meet the requirements of IPC-4562/3 CU-E3 class 2 (at a minimum) and those specified on the purchase order or purchasing contract. Test results must be submitted upon request.
- 5.2 Sample material may be inspected for acceptability per the requirements specified in this document and IPC-4562
- 5.3 Foil size shall be 18" x 24", standard size or as specified on the purchase order.
- 5.4 Material must have lot number and any bond enhancement designator on the shipping containers.
- 5.5 Packaging and Shipping. Each shipment must be packaged in accordance with the following instructions or as specified on the purchase order:
 - 5.5.1 Appropriate label, including: Vendor name, TTM (North Jackson) part number, material type, lot number and quantity per package.

- 5.5.2 Certificate of Compliance to the appropriate specification for material type as called out on the Purchase Order
- 5.5.3 Packing slip, which must reference TTM North Jackson Purchase Order Number, TTM North Jackson item number, and item description.
- 5.5.4 Test reports if required or requested.
- 5.5.5 Foil must be supported and plastic wrapped in quantities of no more than 200.
- 5.5.6 Each material type must be segregated and packaged in individual containers.
- 5.5.7 Packaging must prevent damages to material shipped. The containers must be able to withstand normal air and surface handling. TTM North Jackson may reject any material improperly packaged or secured.

6.0 Pressure Sensitive Adhesive (PSA) Requirements

- 6.1 Roll width size can be 12", 18" or 24", with 18" being the preferred, per the purchase order.
- 6.2 PSA must not be shipped to TTM North Jackson after one (1) year from date of manufacture.
- 6.3 Packaging and Shipping Requirements
 - 6.3.1 Lot number and product description must appear on the shipping containers.
 - 6.3.2 Each material type must be segregated and packaged in individual containers.
 - 6.3.3 Packaging must prevent damages to material shipped. The containers must be able to withstand normal air and surface handling. TTM North Jackson may reject any material improperly packaged or secured.
- 6.4 The following documentation must accompany each shipment
 - 6.4.1 Appropriate label, including: Material type, lot number and roll size.
 - 6.4.2 Certificate of Compliance shall contain product description, lot number, shelf life and date of manufacture.
 - 6.4.3 Packing slip, must reference TTM North Jackson Purchase Order Number and item description.
 - 6.4.4 Test reports if required or requested.

7.0 Solder Mask, Hole Plug, Legend, Silver Paste and Serialization Ink Requirements

7.1 Approved Product List

Product names	Manufacturers	Min. Shelf life
PSR-4000BN	Taiyo	6 months
PSR-4000BN(HV)	Taiyo	6 months
PSR-4000BN Colors (White, Red, Blue, Black, Yellow)	Taiyo	6 months
PSR-4000MP	Taiyo	6 months
PSR-4100WL (HD)	Taiyo	3 months
PSR-4000LDI	Taiyo	6 months
PSR-9000FXT	Taiyo	3 months
PSR-9000LDI	Taiyo	3 months
Techniflex 1000LCL F series	Technic	6 months
SD 2462NB	Peters	6 months
PIHP-200	Taiyo	6 months
Conformask 2500 series	Eternal	12 months
Dynamask 5000 series	Eternal	12 months
UVR-150G	Taiyo	6 months
S-200 (Black, Yellow)	Taiyo	3 months
S-200W LP (White)	Taiyo	6 months
UVR-182E	Taiyo	3 months
UVR-110W	Taiyo	3 months
UVR-120Y	Taiyo	3 months
UVP-100	Enthone	3 months
50 Series CAT-L-INK with only catalyst # 9	Enthone	18 months
IJR-4000 MW300 (Inkjet Legend Ink)	Taiyo	3 months
IJR-4000 FW100, Flexible Inkjet Legend Ink	Taiyo	5 months
102-05F	Creative	12 months
5504N	DuPont	2 months

7.2 Any product with a shorter minimum shelf life than specified above must be approved by TTM North Jackson prior to shipment.

7.3 Purchase Requirements

7.3.1 All Dry Film Solder Mask must be 17.75” minimum in width unless otherwise specified on the purchase order.

7.4 Quality Requirements

7.4.1 All Dry Film Solder Mask must meet or exceed IPC-SM-840 Class H/FH spec and must meet NASA Outgassing requirements, and UL flammability must be rated 94V-0.

7.4.2 All Liquid Solder Mask must meet or exceed IPC-SM-840 Class H/FH spec. Also, must meet NASA Outgassing requirements and UL flammability must be rated 94V-0: except the following liquid masks are not required to meet outgassing requirement, nor UL flammability rating of 94V-0: PSR-9000FXT, UVR-150G.

7.4.3 All Legend and Serialization inks must meet or exceed performance criteria of MIL-PRF-55110 spec and AA-56032-II spec. Also must meet NASA Outgassing requirements, except the following legend inks are not required to

meet AA-56032-II spec, or NASA Outgassing requirements: S-200 series, UVR-182E, UVR-110W, UVR-120Y.

7.5 Packaging and Shipping

- 7.5.1 Each package, container, or roll must be labeled with type of material, lot number, net weight (liquid material), and number of containers in the package, if applicable, width dimension (rolls), manufacturing date, expiration date, or warranty period
- 7.5.2 Packaging must prevent damage to material shipped. The packages or box containers must be able to withstand normal air and surface handling. TTM North Jackson may reject any material improperly packaged or secured.
- 7.5.3 All materials are sensitive to UV light, therefore materials must be covered in UV blocking film (dry film material), or packaged in UV blocking containers (liquid material), and labeled per paragraph 7.5.1.
- 7.5.4 Each item and individual lot must be shipped with a Certificate of Conformance.
- 7.5.5 The Packing slip must reference TTM North Jackson's Purchase Order Number and Item description.
- 7.5.6 Test reports will be provided upon request.

8.0 Testing and Calibration Services Requirements

- 8.1 Calibration and testing suppliers will submit their current certificate of accreditation to be kept on file with TTM North Jackson.
- 8.2 Calibration and testing suppliers shall maintain an accredited quality system complying with ISO 17025:2005 or similar standard from an accreditation body serving the laboratory community.
 - 8.2.1 Suppliers should also meet any additional program requirements in the field of calibration and quality system guidance of ISO 10012:2003.
- 8.3 Calibration suppliers will be required to provide the following information for each piece of measuring/test equipment or each measuring standard which is calibrated and for each time it is calibrated:
 - 8.3.1 A statement or certificate signed by a responsible official of the subcontractor's management, that all calibrations are performed in accordance with ANSI/NCSL Z540.3-2006, using equipment or standards which are calibrated and traceable to standards maintained by the National Institute of Standards and Technology (NIST).
 - 8.3.2 Reference to the method of calibration.
 - 8.3.3 A description of the equipment used to perform the calibration such as may be traceable to the calibration performed.
 - 8.3.4 The actual recorded values of the North Jackson equipment as received.
 - 8.3.5 If repair or adjustment of North Jackson equipment is required, these repairs and adjustments should be described.
 - 8.3.6 The actual recorded values of the North Jackson equipment after any necessary repairs.
 - 8.3.7 The accuracy of measurement or calibrations performed (either TTM North Jackson or manufacturer's requirements.)
 - 8.3.8 The environmental conditions (temperature and relative humidity, as a minimum.)
 - 8.3.9 The date when calibration was performed
 - 8.3.10 The date when the next calibration is due.

- 8.4 Testing suppliers will be required to provide the following information for each sample tested, as a minimum:
- 8.4.1 A statement or certificate signed by a responsible official of the supplier's management that all testing is performed in accordance with ANSI/NCSL Z540.3-2006, using equipment or standards which are calibrated and traceable to standards maintained by the National Institute of Standards and Technology (NIST).
 - 8.4.2 Reference to the method used to test the sample(s).
 - 8.4.3 A description of the equipment used to perform the testing such as may be traceable to the testing performed.
 - 8.4.4 The actual recorded values of the sample(s) tested.
 - 8.4.5 The accuracy of the test measurement(s).
 - 8.4.6 The environmental conditions (temperature and relative humidity, as a minimum.)
 - 8.4.7 The date the test(s) was performed.
 - 8.4.8 The name of the person performing the test(s).
 - 8.4.9 Samples for PCB evaluations are requested to be returned after testing.
- 8.5 Packaging & Shipping
- 8.5.1 Packaging must prevent any damages to testing and measuring equipment shipped. The containers must be able to withstand normal air and surface handling. TTM North Jackson may reject any equipment improperly packaged or secured.
- 8.6 Competence, Training and Awareness
- 8.6.1 Unless otherwise specified, procedures shall be implemented to ensure that eye examinations, including visual acuity and color vision, as applicable, are administered by a medically qualified / trained person to all individuals performing visual inspection, other product acceptance and/or M&TE calibration that require visual acuity. Intervals shall not exceed one year. Individuals shall be tested in at least one eye, either corrected or uncorrected. Color perception testing is required one time only and individuals shall be capable of adequately distinguishing and differentiating colors used in the method for which the certification is required, the process being performed or inspection activity. Records shall be retained for each individual.

9.0 Copper Anodes Requirements

9.1 Purchase Requirements

- 9.1.1 All copper anodes must be per size specified on the purchase order.

9.2 Quality Requirements

- 9.2.1 All copper anodes must meet or exceed the following specifications

9.2.1.1 Copper Anode Balls

Purity	99.935% minimum copper
Phosphorus Content	0.040 to 0.065%
Manufactured Sizes	Cast and then hot rolled and forged as specified on the purchase order

9.2.1.2 Copper Anode Bars

Purity	99.935% minimum copper
Phosphorus Content	0.040 to 0.065%
Manufactured Sizes	Cast and then hot rolled and forged as specified on the purchase order

9.3 Packaging and Shipping

- 9.3.1 Each package, container or shipment must be labeled with Type of Material, Lot number, Net Weight, number of containers in the package if applicable, Size, Manufacturing date, Expiration date or Warranty period.
- 9.3.2 Packaging must prevent damage to material shipped. The packages or box containers must be able withstand normal handling. North Jackson may reject any material improperly packaged or secured.
- 9.3.3 All shipments must include Certificate of Analysis for each lot.
- 9.3.4 Each item and individual lot must be shipped with Certificate of Compliance.
- 9.3.5 Packing slip must reference North Jackson Purchase Order Number and Item description.
- 9.3.6 Test report will be provided upon request.

10.0 Nickel Anodes Requirements

- 10.1 Purchase Requirements
 - 10.1.1 All Nickel Anodes must be per size specified on the purchase order.
- 10.2 Quality Requirements
 - 10.2.1 All Nickel Anodes must meet or exceed the following specifications:

Purity	Nickel	99.95%
	Sulfur	0.02 – 0.04%
Sizes	As specified on the purchase order	
- 10.3 Packaging and Shipping
 - 10.3.1 Each package, container or shipment must be labeled with Type of Material, Lot number, Net Weight, number of containers in the package if applicable, Size, Manufacturing date, Expiration date or Warranty period.
 - 10.3.2 Packaging must prevent damage to material shipped. The packages or containers must be able to withstand normal handling. North Jackson may reject any material improperly packaged or secured.
 - 10.3.3 Each item and individual lot must be shipped with Certificate of Compliance.
 - 10.3.4 All shipments must include Certificate of Analysis for each lot.
 - 10.3.5 Packing slip must reference TTM North Jackson Purchase Order Number and Item description.
 - 10.3.6 Test report will be provided upon request.

11.0 Solder Bar Requirements

- 11.1 Purchase Requirements
 - 11.1.1 All Solder Bars must be per size specified on the purchase order.
- 11.2 Quality Requirements
 - 11.2.1 All Solder Bars must meet or exceed the following specifications:

J-STD-606		
MIL-STD-2000		
WS-6536E		
Composition	63/37 (63% Tin / 37% Lead)	
Purity	Tin 62.50 – 63.50%	
	All other metal impurities < 0.03%	
Sizes	As specified on the purchase order	
- 11.3 Packaging and Shipping
 - 11.3.1 Each package, container or shipment must be labeled with Type of Material, Lot number, Net Weight, number of containers in the package if applicable, Size, Manufacturing date, Expiration date or Warranty period.

- 11.3.2 Packaging must prevent damage to material shipped. The packages or containers must be able to withstand normal handling. North Jackson may reject any material improperly packaged or secured.
- 11.3.3 All shipments must include Certificate of Analysis for each lot.
- 11.3.4 Each item and individual lot must be shipped with Certificate of Compliance
- 11.3.5 Packing slip must reference TTM North Jackson Purchase Order Number and Item description
- 11.3.6 Test report will be provided upon request.

12.0 Tin Tin-Lead Requirements

- 12.1 Purchase Requirements
 - 12.1.1 All Tin or Tin/Lead anodes must be per size specified on the purchase order.
- 12.2 Quality Requirements
 - 12.2.1 All Tin or Tin/Lead anodes must meet or exceed the following specifications
 - 12.2.1.1 Tin Anodes
 - Purity 99.94% minimum
 - Sizes as specified on the purchase order
 - 12.2.1.2 Tin/Lead Anodes
 - Composition 63/37 (63% Tin / 37% Lead)
 - Purity Tin 62.50 – 63.50%
 - Sizes As specified on the purchase order
- 12.3 Packaging and Shipping
 - 12.3.1 Each package, container or shipment must be labeled with Type of Material, Lot number, Net Weight, number of containers in the package if applicable, Size, Manufacturing date, Expiration date or Warranty period.
 - 12.3.2 Packaging must prevent damage to material shipped. The packages or containers must be able to withstand normal handling. North Jackson may reject any material improperly packaged or secured.
 - 12.3.3 All shipments must include Certificate of Analysis for each lot
 - 12.3.4 Each item and individual lot must be shipped with Certificate of Compliance.
 - 12.3.5 Packing slip must reference North Jackson Purchase Order Number and Item description.
 - 12.3.6 Test report will be provided upon request.

13.0 Wet Process Requirements

- 13.1 Purchase Requirements
 - 13.1.1 All Chemistry must be per size specified on the purchase order
- 13.2 Quality Requirements
 - 13.2.1 All Chemicals required will meet that vendor’s quality specifications
 - 13.2.2 Materials will be identified on the packing slip by batch or lot number and test data must be available upon request

Generic Name	Trade Name	Description
Oxide	Multibond	Provides a finely etched copper topography embedded with a conversion coating. (Organo-Metallic Coating)
Organic Solder Preservative	CU-56	Provides corrosion protection of the copper surfaces
Electroless Copper	MacDermid HDI Process	Provides copper interconnect for all PTH applications.
ENIG	Uyemura; Nimuden MPR8 /GoBright TWX 40, MFD-5 A	Final finish using Electroless Nickel and Immersion Gold

- 13.3 Packaging & Shipping
 - 13.3.1 Each package, container or shipment must be labeled with Type of Material, Lot number, Net Weight, number of containers in the package if applicable, Size, Manufacturing date, Expiration date or Warranty period.
 - 13.3.2 Packaging must prevent damage to material shipped. The packages or containers must be able to withstand normal handling. TTM North Jackson may reject any material improperly packaged or secured.
 - 13.3.3 Each item and individual lot must be shipped with Certificate of Compliance.
 - 13.3.4 Packing slip must reference TTM North Jackson Purchase Order Number and Item description.
 - 13.3.5 Test report will be provided upon request.

14.0 Wet Precious Metals Requirements

- 14.1 Purchase Requirements
 - 14.1.1 All Precious Metals must be per size specified on the purchase order.
- 14.2 Quality Requirements
 - 14.2.1 All Precious Metals required will meet that vendor’s quality specifications
 - 14.2.2 All shipments must include Certificate of Analysis for each lot.

Generic Name	Trade Name	Description
Hard Gold	Engold 2010 C	A moderate speed, cobalt hardened gold plating system. Meets MIL-G-45204-C. (Note: E-56 Gold Salts may be substituted for 2010C Gold Salts)
Soft Gold	E-56 Pure Gold Process	Plates a high purity gold electroplate that is smooth, lustrous, highly ductile and relatively free from porosity. Meets MIL-G-45204C.
Palladium	Pallaspeed S	Palladium plating process that produces a highly ductile deposit.

14.3 Packaging & Shipping

- 14.3.1 Each package, container or shipment must be labeled with Type of Material, Lot number, Net Weight, number of containers in the package if applicable, Size, Manufacturing date, Expiration date or Warranty period.
- 14.3.2 Packaging must prevent damage to material shipped. The packages or containers must be able to withstand normal handling. North Jackson may reject any material improperly packaged or secured.
- 14.3.3 Each item and individual lot must be shipped with Certificate of Compliance.
- 14.3.4 Packing slip must reference North Jackson Purchase Order Number and Item description.
- 14.3.5 Test report will be provided upon request.

15.0 Electroless Nickel Immersion Gold (ENIG) Surface Finish Requirements

- 15.1 This specification also applies to the ENIG process variant commonly referred to as ENEPIG (Electroless Nickel, Electroless Palladium, Immersion Gold).
- 15.2 Suppliers must maintain documented procedures and controls for routine operation of their ENIG process line.
- 15.3 Suppliers must maintain procedures and test equipment in current calibration suitable for the testing of ENIG deposits and verification of compliance to IPC-4552, Specification for Electroless Nickel/Immersion Gold (ENIG) Plating for Printed Circuit Boards.
- 15.4 Suppliers must agree to provide evidence of current calibration or documented procedures upon request.
- 15.5 Suppliers will be required to provide the following information for each job processed, as a minimum:
 - 15.5.1 A statement or certificate signed by a responsible official of the supplier's management that the ENIG deposit is in compliance with the requirements of IPC-4552.
 - 15.5.1.1 Statement or certificate must include purchase order number, nickel thickness range obtained, gold thickness minimum obtained, and acceptability of deposit adhesion.
- 15.6 Packaging and Shipping
 - 15.6.1 Packaging of processed panels or parts must include slip sheeting between panels/parts and overall construction so as to prevent any product damage when return shipped. The containers must be able to withstand normal air and surface handling.

16.0 Via Fill Requirements

- 16.1 Suppliers must maintain documented procedures and controls for routine operation of their Via Fill process line.
- 16.2 Suppliers must maintain procedures and test equipment in current calibration suitable for the testing and Inspection of Via Fill Services to Printed Circuit Boards.
- 16.3 Suppliers must agree to provide evidence of current calibration or documented procedures upon request.
- 16.4 Suppliers will be required to provide the following information for each job processed, as a minimum:
 - 16.4.1 A statement or certificate signed by a responsible official of the supplier's management that the Via Fill is in compliance with the requirements listed on the TTM North Jackson Purchase Order, Customer Specification and this SPS Document.
 - 16.4.1.1 Statement or certificate must include purchase order number, Via Fill Material Certification.
- 16.5 PERIMETER TOOLING HOLES ARE NOT TO BE FILLED.
- 16.6 Via Fill and Surface Copper must meet requirements of IPC-6012, Class 3, or as specified on purchase order.
- 16.7 Packaging and Shipping
 - 16.7.1 Packaging of processed panels or parts must include slip sheeting between panels/parts and overall construction so as to prevent any product damage when return shipped. The containers must be able to withstand normal air and surface handling.

17.0 Hot Air Solder Level (HASL) Surface Finishing Requirements

- 17.1 Suppliers must maintain documented procedures and controls for routine operation of their HASL process line.
- 17.2 Supplier must provide evidence of routine solder analysis, alloy control and purity controls upon request.
- 17.3 Suppliers must maintain procedures and test equipment in current calibration suitable for the testing of HASL deposits and verification of compliance to current revision of IPC-6012, Qualification and Performance for Rigid Printed Boards.
- 17.4 Suppliers must agree to provide evidence of current calibration or documented procedures upon request.
- 17.5 Suppliers will be required to provide the following information for each job processed, as a minimum:
 - 17.5.1 A statement or certificate signed by a responsible official of the supplier's management that the HASL deposit is in compliance with the requirements of IPC-6012 and the applicable Purchase Order specifications.
 - 17.5.1.1 Statement or certificate must include purchase order number, HASL thickness range obtained, and manufacturer and lot number of tin/lead or lead free solder applied.
- 17.6 Packaging and Shipping
 - 17.6.1 Packaging of processed panels or parts must include slip sheeting between panels/parts and overall construction so as to prevent any product damage when return shipped. The containers must be able to withstand normal air and surface handling.

18.0 Miscellaneous Outside Services

- 18.1 Suppliers must maintain documented procedures and controls for routine operation of their process line.
- 18.2 Suppliers must maintain procedures and test equipment in current calibration suitable for the testing and inspection of services to Printed Circuit Boards.

- 18.3 Suppliers must agree to provide evidence of current calibration of process equipment.
- 18.4 Suppliers will be required to provide the following information for each job processed, as a minimum:
 - 18.5 A statement or certificate signed by a responsible official of the supplier's management that the services provided are in compliance with the requirements of the applicable Purchase Order, specification, and this SPS Document.
 - 18.5.1 Statement or certificate must include, Name of Service, Date Service was provided, Signature of Quality Representative, Purchase Order Number, Work Order Number, Any industry specific specifications listed on the Purchase order.
- 18.6 Packaging and Shipping
 - 18.6.1 Packaging of processed panels or parts must include slip sheeting between panels/parts and overall construction so as to prevent any product damage when return shipped. The containers must be able to withstand normal air and surface handling.

19.0 Supplier Exceptions/Deviations

- 19.1 Any deviation or exception from this specification must be approved by TTM North Jackson in writing.
- 19.2 Any construction change, process change or material change other than what is specified on the Purchase Order "or purchase contract" must be approved by TTM North Jackson in writing.
- 19.3 A formal correction action plan will be required from the supplier if materials received do not conform to this specification and/or the purchase order
- 19.4 In the event supplier suspects, or is made aware of a potential non-conformance in product already shipped to TTM, the supplier shall issue a quality alert to the TTM Director Supply Chain and the Corporate Quality Director for dissemination to all TTM sites. Supplier will work with TTM to immediately remove and replace, as warranted, such material.
- 19.5 Supplier shall notify TTM, in writing at least 90 days in advance, of any changes to suppliers product, raw materials and/or process that may have a potential impact on the quality of supplier's and/or TTM's finished product. This includes but is not limited to, changes in facilities, equipment and critical material suppliers.

20.0 Defense Priorities and Allocations System

- 20.1 TTM orders may be rated as "DX" or "DO" under the DPAS regulation (15 CFR 700).
- 20.2 TTM North Jackson will clearly mark applicable purchase orders as such. Supplier is required to follow all the provisions of that regulation in filling the order and in obtaining items needed to fill the order. If the supplier rejects such an order, the supplier must notify TTM in writing within 2 business days.

21.0 Right of Entry & Flow Down Requirements

- 21.1 The supplier's Quality Management System, records, materials and manufacturing processes are subject to review, analysis and verification by TTM personnel, TTM customer representatives, and/or a regulatory agency including an authorized government representative. The supplier shall flow-down all applicable specifications to any and all lower tier sub-contractors performing work or providing material to a North Jackson purchase order.
- 21.2 When requested by TTM, TTM's customer or a regulatory agency, and when provided with reasonable written notice from TTM, the supplier shall grant right of access to all facilities and applicable records pertaining to TTM's orders.

21.3 Supplier shall ensure TTM requirements as outlined on the Purchase Order, this document and applicable documents, as well as additional key characteristics are provided to sub-tier suppliers, as applicable, to ensure conformance to TTM's requirements.

22.0 Record Retention

22.1 Supplier shall maintain records on file for a minimum of 7 years from date of shipment per MIL-PRF-31032. Records include but are not limited to test data, inspection results, certificate of compliances (C of C's), etc. Records shall be available within 24 hours of request.