

<b>PROCEDURE: WESTAK RAW MATERIALS SPECIFICATION</b>	<b>Revision</b>	<b>D</b>
	<b>Number</b>	<b>RMS 100</b>

**1. PURPOSE:**

1.1. This procedure is to provide all Westak Vendors (includes all Raw Material Suppliers) with specifications and acceptance criteria.

**2. APPLICABLE REFERENCES:**

- 2.1. IPC-6012 – Current Revision
- 2.2. IPC-A-600 – Acceptability of Printed Boards (Current Revision)
- 2.3. IPC-TM-650 – Test Methods (Current Revision)
- 2.4. CVMP 1.0 – Vendor Selection Process

**3. GENERAL REQUIREMENTS:**

- 3.1. All Vendors must be on the Westak Approved Vendor list (AVL).
- 3.2. All Vendor shipments must have the Westak Part Number referenced on all shipping documentation, including the packing slip.
- 3.3. All vendors must have a Quality System.
- 3.4. Westak reserves the right to perform a first article audit of the Subcontractor’s facility after acceptance of this specification or any time materials or services are in question.

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**5. RAW MATERIALS**

**5.1. Copper Foil**

- 5.1.1. All copper foil shall meet test criteria of IPC-MF-150 F.
- 5.1.2. Each Lot Number must be produced from the same manufacturer. No mixed copper vendors per lot allowed.
- 5.1.3. All copper foils must be High Tensile Elongation (H.T.E.)
- 5.1.4. MHT or comparable copper foil will be used for Polyimide materials.

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- 5.1.5. Copper foil is non DSTF (RTF). Engineering approval is required for DSTF or RTF.
- 5.1.6. The following standard for surface defects shall be used in lieu of the “Pits and Dents” specification of IPC-MF-150:
- Surface defects shall be defined as any of the following: pits, dents, pinholes, resin spots, nicks, cuts, wrinkles, or blebs in copper foil, delaminated areas, or bent corner (these terms are defined in IPC-MF-150, section 3.3).
  - Surface discoloration’s shall be defined as any of the following: spots or stains un-removeable by scrubbing, visible gaps in the conversion coating.
  - No more than three surface defects or discoloration’s within any 12” x 12” area. Any surface defect whose longest dimension is > 0.015”, or any surface discoloration whose longest dimension is > 0.025” shall be cause for rejection of the foil sheet.
    - Wrinkles need to be counted as a surface defect only if they result in a permanent deformation of the copper foil (i.e., are not removed during the lamination cycle.)
    - Surface defects are permissible if they are within 0.0250” of the edge of the foil and do not exceed 0.250” in length.
- 5.1.7. The treated side of the copper shall be of a uniform color and surface texture on a majority of each side. The treated side shall show no visible evidence of contamination.
- 5.1.8. Tooling holes shall meet the following:
- Hole size within +/- .003”
  - Hole location +/- 0.005 within 0.0003” diameter of true position.
- 5.1.9. Panel sizes will be:
- |                 |                |
|-----------------|----------------|
| 1) Preferred:   | 2) Acceptable: |
| 13 1/2 x 19 1/2 | 13 x 19        |
| 15 1/2 x 19 1/2 | 15 x 19        |
| 17 1/2 x 19 1/2 | 17 x 19        |
| 17 1/2 x 22 1/2 | 17 x 22        |
| 19 1/2 x 25 1/2 | 19 x 25        |
| 22 1/2 x 25 1/2 | 22 x 25        |
- 5.1.10. Packages of foil should have support so as to keep foil from bending when package is moved or handled.
- 5.1.11. The following documentation shall be included with each shipment:
- Certificate of Conformance in accordance with IPC 4101.
  - Certificate of Analysis for Group A Quality Conformance.
  - Inspection, per IPC-MF-150 F
  - Packing slip with Westak P.O. # referenced Westak part number.
  - Labeling of packages per IPC 4101, including count, lot # to match certs, copper weight.

**5.2. (Standard) Thin Core Laminates**

- 5.2.1. Unless otherwise specified, material must be certified to meet quality and test requirements of IPC 4101, latest revision.
- 5.2.1.1. Exception: Rogers materials will conform to IPC-4103 Class A**
- 5.2.2. Each lot number must be produced from the same manufacturer. No mixed copper vendors per lot allowed.
- 5.2.3. Unless otherwise requested, thickness requirements will be Class C, IPC 4101, latest revision.

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5.2.4. Panel sizes and grain direction is based on manufacturer standard material cut. Supplier will notify Westak of the standard grain direction.

5.2.5. Material Construction will be single ply for .008 core and under unless unavailable by the manufacturer. All constructions must be noted on the certificate of conformance and package label.

**5.2.5.1. Exception: Rogers materials will comply with their published data sheets**

5.2.6. If consignment from other facility is sent to Westak, construction must be noted on the label. If it does not meet the specification, Westak purchasing must get Engineering approval.

5.2.7. Copper cladding of core material will be DSTF. Standard copper cladding will be acceptable.

**5.2.7.1. Exception: Rogers materials offers various copper cladding and will be specified at the time of order.**

5.2.8. All cores shall be marked with dielectric and cladding by stamping or engraving. (engraving is preferred). Preference is to have lot number noted as well on each panel. If the panel is of unbalanced copper weight, one side must be marked with copper weight and lot number of material will be "right reading" on the same side.

**5.2.8.1. Exception: Rogers materials are marked reading right on the heavier copper side using ink jet.**

5.2.9. The following documentation shall be included with each shipment or available upon request as noted:

- Certificate of Conformance to meet requirements of IPC 4101, latest revision. If cert is not sent with shipment, it must be available upon request.
  - **Exception: Rogers materials will comply with IPC-4103**
- Test data as required by IPC 4101, latest revision must be submitted upon request.
- Packing slip with Westak P.O. number referenced, Westak part number and the standard the material is certified to shall be noted.
- Labeling on all packages to include quantities and lot numbers as well as Westak part number per IPC 4101, latest revision and constructions and be visible on front edge of packaging. Packaging must be able to support the cores with minimal bending. Label must be attached to a permanent part of the package, so that when opened the label is still present.
  - **Exception: Rogers materials labels will be affixed to the shrink wrap of a bundle or a cardboard cover sheet.**

5.2.10. No single package can weigh over 25 lbs.

**5.2.10.1. Exception: Rogers materials will have a maximum box weight of 50 lbs and a maximum bundle weight of 25 lbs.**

**5.3. Rigid Laminates**

5.3.1. Unless otherwise specified, rigid material shall be certified to meet quality and test requirements of IPC 4101.

5.3.2. Unless otherwise specified, the thickness requirement shall be Class II and surface grade shall be Grade A per IPC 4101.

5.3.3. Construction of .059 shall be 7 or 8 ply unless otherwise specified on purchase order (P.O.).

5.3.4. All rigid will be U.V. Block unless otherwise specified on purchase order (P.O.).

5.3.5. The following documentation shall be included with each shipment:

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- Certificate of Conformance to meet IPC 4101.
  - Test Data as required by IPC 4101.
  - Packing Slip with Westak P.O. number referenced.
  - Labeling on all packages showing quantities and lot numbers per IPC 4101.
- 5.3.6. If the panel is of unbalanced copper weight, one side minimum shall be marked with copper weight.
- 5.3.7. On Polyimide rigid, copper cladding shall be HTE foil.
- 5.3.8. Common call out for material shall be overall thickness, however dielectric thickness can be noted on the certificate of conformance.

#### 5.4. Pre-Preg

- 5.4.1. Prepreg sizes can be the actual size +0.25/-0.1. Example: 18 x 24 would be 18.25 x 24.25 or 17.9 x 23.9 Exception: Rogers un-punched pre-preg =+.375"
- 5.4.2. Pre-preg grain direction will be specified on the Purchase Order and on the label of the packaging.
- 5.4.2.1. Exception: Rogers grain direction is specified as the first number in the size specification.**
- 5.4.3. Pre-preg must be tooled per drawings approved and supplied by Westak Engineering.
- 5.4.4. Glass style will be indicated on Westak's purchase order.
- 5.4.4.1. Exception: Rogers may select other glass styles based on ordered grade.**
- 5.4.5. For resin content and base yield thicknesses refer to each manufacturers' technical data.
- 5.4.6. Any prepreg shipment must have at least 90 days left before the shelf life expiration date. If possible, the expiration date is indicated on label of pre-preg but must also be on the certificate of conformance.
- 5.4.6.1. Exception: Rogers will have a shelf life of 6 months from the date of shipment.**
- 5.4.7. Approval from Lamination Supervisor/Manager and/or Plant Manager, Materials Manager or Engineering Manager is required if expiration is less than 90 days. Lamination Supervisor/Manager must use the prepreg before the allotted expiration date.
- 5.4.8. Approval from Lamination Supervisor/Manager or Engineering Manager must be obtained if special material is required and has a shorter expiration date.
- 5.4.9. It is the supplier's responsibility to ship the prepreg in proper transit storage conditions.
- 5.4.9.1. Exception: Rogers ships based on carrier selected by Westak.**
- 5.4.10. The following documentation shall be included with each shipment or available upon request:
- Certificate of Conformation to meet requirements of IPC 4101 latest revision.
  - Test data including gel time, resin content and scale flow test data or equivalent
  - Packing slip with Westak P.O. number referenced and Westak part number.
  - Labeling on all packages will include style, date of manufacture, size, Westak part number, quantity, lot number, resin content and IPC 4101/ spec. Expiration date of pre preg may also be on the label.
    - **Exception: Rogers C of C will indicate compliance to IPC-4103 without specific testing data**
- 5.4.11. Monthly quality report (SPC data) on Cp and CpK of the process shall be available upon request.

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5.4.11.1. **Exception: Rogers will provide this information on a case-by-case basis as a means of safeguarding proprietary and confidential information.**

5.4.12. All pre-preg must meet quality and test criteria of IPC 4101 latest revision.

5.4.13. In addition to the criteria of IPC 4101 latest rev, pre-pregs must not exhibit excessive “resin bumps”.

5.4.14. Resin debris between pre-preg is not acceptable.

5.4.15. Pre-preg must be uniformly coated. No thin or thick areas are allowed.

5.4.16. Pre-preg handling damage (exposing glass bundles) must be very minimal.

Pre preg will not be accepted without prior approval if it does not have at least 90 days left before expiring.

5.4.16.1. **Exception: Rogers will conform to IPC-4103 Quality, inspection and test requirements.**

## 5.5. Polyimide Pre-Preg

5.5.1. Unless otherwise specified all pre preg shall meet the test criteria of IPC 4101.

5.5.2. Grain direction of the prepregs must match the supplied grain direction of core materials.

5.5.3. Resin content shall be:

<u>Style</u>	<u>Resin Content</u>
1080	63% +/- 3
2113	57% +/- 3
2116	56% +/- 3
7628	44% +/- 3

5.5.4. The shelf life of this product is considered to be six months from date of manufacture. No pre preg over 90 days old will be accepted without a signed consent from engineering or material control.

5.5.5. No re-test of prepreg allowed.

5.5.6. The following documentation is required with each shipment:

- Certificate of Conformance to meet requirements of IPC 4101.
- Test Data indicating gel time, resin content and scale flow test data.
- Packing Slip with Westak P.O. number and Westak part number referenced.
- Labeling on all packages to include quantities and lot numbers per IPC 4101.

5.5.7. Pre preg shall be packaged in airtight poly bags with desiccant or equivalent.

## 5.6. Copper Anodes

5.6.1. Size and Shape of Anode:

1.5” to 2.0” nugget or ball (1.75” ball preferred)

1” x 4” x 30” bars, slab-section, drilled and tapped for 3/8” hook

5.6.2. Anodes when received shall be free of surface contamination, such as oil, corrosion, or heavy oxide coating.

5.6.3. Chemical Composition - Trace Elements

Phosphorous	0.05 to 0.08%
Selenium	0 to 20 ppm
Tellurium	0 to 20 ppm
Silver	10 to 30 ppm
Silicon	None detectable
Calcium	None detectable

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Boron	None detectable
Iron	Less than 10 ppm
Lead	Less than 5 ppm
Zinc	Less than 5 ppm
Other heavy metals (Co, SN, Ni, Mn, Cr, Cd) less than 5 ppm in aggregate.	

5.6.4. In use, the anodes shall form an even and persistent film covering substantially all of the anode surface. There shall be no crumbling or flaking of the copper when the anode film is rubbed away. The anodes shall corrode in a uniform fashion, no nodules or pockets shall be evident.

5.6.5. The following documentation is required for each lot shipped:

5.6.6. Certificate of Analysis showing as a minimum the chemical analysis for the elements.

### 5.7. Nickel Anodes

#### 5.7.1. Size and Shape

Anode - 1" x 4" x 30" bars extended, drilled and tapped for 3/8" hole, or Anode round S.

5.7.2. Anodes as received shall be free of surface contamination, such as oil, corrosion, or heavy oxide coating.

#### 5.7.3. Chemical composition - Trace Elements

Nickel + Cobalt	=	99.0% min.
Iron	=	0.25% max.
Manganese	=	0.10% max.
Copper	=	0.20% max.
Silicon	=	0.05% max.
Sulfur	=	0.02% max.
Carbon	=	0.04% max.
Oxygen	=	0.40% max.

5.7.4. In use, the anodes shall corrode in an even fashion, without crumbling or flaking, and without formation of nodules or pockets. There shall be no pitting or other visible evidence of organic inclusions.

5.7.5. Following documentation is required for each shipment:

- Certificate of Analysis showing a minimum analysis for elements.
- Compliance and certified to Fed Spec. A-A-51177.

### 5.8. Tin Anodes

#### 5.8.1. Size and Shape of Anode

1" x 4" x 30" bars extended, drilled and tapped for 3/8" hole.

5.8.2. Anodes as received shall be free of surface contamination, such as oil, corrosion, or heavy oxide coating.

#### 5.8.3. Chemical composition - Trace Elements:

Composition for Tin:	99.99% +/- .01%
Indium	less than or equal to .003%
Iron	less than or equal to .0001%
Bismuth	less than or equal to .002%
Less than .001% for Nickel, Silver, Copper, Gold, Arsenic, Antimony Cadmium, Zinc, Phosphorous and Sulfur.	

5.8.4. In use, the anodes shall corrode in an even fashion, without crumbling or flaking, and without formation of nodules or pockets. There shall be no pitting or other visible evidence of organic inclusions.

5.8.5. The following documentation is required for each shipment:

- Certificate of Analysis showing a minimum analysis for elements.

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- Compliance and certified to ASTM B339 Grade A.

### 5.9. HAL Bars

5.9.1. Size and Shape:

HAL Solder – 12" Bars

5.9.2. Anodes as received shall be free of contamination, such as oil, corrosion, or heavy oxide coating.

5.9.3. Chemical Composition – Trace Elements:

Composition for Tin-Lead 63.0/37.0 +/- 0.5

Copper (Cu):	Less than .0005%**
Iron (Fe):	Less than .001%
Nickel (Ni):	Less than .0003%
Zinc (Zn):	Less than .0003%
Silver (Ag):	Less than .0003%
Arsenic (As):	Less than .002%
Antimony (Sb):	Less than .005%
Bismuth (Bi):	Less than .0005%
Sulfur (S):	Less than .0005%
Phosphorous(P):	Less than .0006%
Gold (Au):	Less than .0003%
Indium:	Less than .001%
Aluminum:	Less than .0005%
Cadmium:	Less than .0005%

\*\* HAL bars may contain copper up to .0008%

5.9.4. The order shall be marked with the manufacturers name, product name and lot number.

5.9.5. H.A.L. solder shall be palletized in 50lb. boxes whenever possible.

5.9.6. the following documentation is required for each lot shipped.

- Certificate of Analysis showing as a minimum the chemical analysis for the elements listed in section 6.9.3.
- Complies and is certified to ASTM-B-32 and Military Standard QQS 571E for plating application and solder leveling.

### 5.10. Soldermask

5.10.1. Certificate of Conformance must be submitted with each lot number shipped.

5.10.2. Expiration date must be identified on the container.

5.10.3. Certification of Conformance must have results written on the property's tested. It must also contain the test method and specification. The mask properties tested are as follows:

- Viscosity
- Thixotropic Index
- Fineness Of Grind
- Screenability
- Tack Dry
- Imaging (Exposure)
- Resistance To Soldering
- Solvent Resistance
- Pencil Hardeners
- Adhesion

5.10.4. Certification of Analysis must confirm to meet the requirement for IPC SM-840 current revision.

5.10.5. MSDS may or may not be required on each shipment.

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**5.11. General Chemicals**

- 5.11.1. Generic chemicals for use in the lab are to be “reagent grade” or “ACS grade”.
- 5.11.2. Generic chemicals such as HCL, ammonia for use in critical applications are to be microprocess or semi-conductor grade “reagent grade”, “ACS grade”, “electronic grade or “Chemically Pure”. Critical applications are:
  - Any electroplating bath
  - P.T.H. line
  - Oxide line
  - Pre-plate cleaning line
- 5.11.3. Generic chemicals for use in non-critical applications may be “Industrial Grade” or “Technical Grade” in addition to one of the more purified grades above.
- 5.11.4. Vendors shall be able to supply a Certificate of Analysis for each shipment upon request.

**5.12. Drill Bits and Re-Points**

- 5.12.1. The ring depth is 0.800 with a tolerance of +/- 0.003.
- 5.12.2. Type of drill bit
  - 5.12.2.1. Undercut drill bits are used for drill sizes 0.1mm to 1.30 mm. Other sizes used standard (ST3)
  - 5.12.2.2. Controlled depth drill bit must be BH or similar with 30 deg point angle
- 5.12.3. Number of Repoints:
  - 5.12.3.1. How many times a drill is repointed is based on the number of repoints and/or overall length (OAL) of the drill. The drill should be scrapped based on the reference table in PDF file (See separate file).
- 5.12.4. Changing Rings:
  - 5.12.4.1. All rings should be the same color as the drill size on the drill chart. If not, the ring needs to be taken off and correct ring installed.
- 5.12.5. Scrap Sorting:
  - 5.12.5.1. Any drills which have OAL (or repoint level) less than or equal to the number in the “SCRAP” column of the table below should be separated and labeled as scrap
- 5.12.6. Inspection
  - 5.12.6.1. Inspection is done by vendor.
- 5.12.7. New Tool Part Number Profile – See separate Drill Chart for Vendor

**5.13. Lamination Press Pad**

- 5.13.1. Tooling locations will be per Westak latest Drawing to be sent to vendor.
- 5.13.2. The thickness will be .035 and .055 as requested.
- 5.13.3. Hole size must fit over tooling pins.
- 5.13.4. Sizes to be as follows:
  - 13 x 19,
  - 15 x 19
  - 17 x 19
  - 17 x 22
  - 19 x 22
  - 22 x 25
  - 22 x 27



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**6. REVISION HISTORY**

<b>Rev.</b>	<b>Change</b>	<b>Date</b>	<b>Originator</b>
A	First release. Consolidated various Raw Material Specifications into one corporate document.	9/5/18	L. Cano
B	Added various exception clauses to accommodate Rogers material specifications (Section 5.2, 5.3, 5.4). Also revised Section 5.5.3 to reflect Polyimide Resin Content spec to current practice.	1/11/19	Robert Lupfer
C	Revised Section 5.10.4 to remove reference to revision level on IPC SM-840 Spec.	1/23/19	Robert Lupfer
D	Remove standard prepreg glass styles in section 5.4.4 and updated to state glass style will be indicated on Westak's purchase order. Fixed typos	3/23/22	Jason Cisneros