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### Revision Record


Department: **Purchasing**

Process Owner: **PURCHASING MGR**

Date	Rev	DCO NO.	Description of Change	Training Required?
2/5/13	A	1231	Original Issue	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
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TITLE	APPROVAL SIGNATURE	DATE
Purchasing Manager		
Quality Representative		

\*Note: If approval signature is typed, original DCO approval signatures on file in the Quality Systems Department.


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## 1.0 Purpose

- 1.1 This document defines Cirexx International's purchasing specification that pertains to Vendors supplying base materials to Cirexx International used for manufacturing printed circuit boards.

## 2.0 Scope


- 2.1 This purchase specification applies to suppliers of base materials purchased by Cirexx International. Deviations from the requirements of this specification must be provide to Cirexx International in writing and submitted to our Purchasing Department for approval or waiver. Cirexx International Purchasing will communicate acceptance of a request for deviation in writing via a revised purchase order or email when appropriate.
- 2.2 Supplier shall manufacture products in accordance with the IPC specification noted on the Cirexx International purchase order when applicable.
- 2.3 Supplier shall utilize the description on Cirexx International's purchase order to determine product characteristics (thickness, size, product type, etc.).
- 2.4 Suppliers shall ensure Cirexx International requirements as stated on the purchase order, this document and applicable specifications are flowed down to sub-tier suppliers to make certain conformance to Cirexx International requirements.

## 3.0 General

- 3.1 Materials and products shipped to Cirexx International shall meet the application performance specification listed below. In most applications, Cirexx will order materials using the supplier's product name and description. For example, Isola FR408 4 core h/h, 12 x 18. These products are known to meet applicable specification sheets.

## 4.0 Applicable Specifications

- 4.1 Suppliers of base/raw materials listed below shall comply with the applicable specification:
  - 4.1.1 Copper-clad laminate and Prepreg
    - 4.1.1.1 **IPC-4101** "Specification for Base Materials for Rigid and Multilayer Printed Boards"
    - 4.1.1.2 **IPC-4103** "Specification for Base Materials for High Speed/High Frequency Applications"
    - 4.1.1.3 **IPC-4104** "Specification for High Density Interconnect (HDI) and Microvia Materials"
  - 4.1.2 Flex Circuit Materials
    - 4.1.2.1 **IPC-4202** "Flexible Base Dielectrics for Use in Flexible Printed Circuitry"
      - 4.1.2.1.1 Supplier shall meet the applicable requirements of section 3 "Requirements, section 4 "Quality Assurance Provisions and section 5 "Packaging."
    - 4.1.2.2 **IPC-4203** "Adhesive Coated Dielectric Films for Use as Cover Sheets for Flexible Printed Circuitry and Flexible Adhesive Bonding Films"
      - 4.1.2.2.1 Supplier shall meet the applicable requirements of section 3 "Requirements, section 4 "Quality Assurance Provisions and section 5 "Packaging."
    - 4.1.2.3 **IPC-4204** "Flexible Metal-Clad Dielectrics for Use in Fabrication of Flexible Printed Circuitry"
  - 4.1.3 Copper foils – **IPC 4562** "Metal Foil for Printed Wiring Applications"

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- 4.1.4 Soldermask – **IPC-SM-840** "Qualification and Performance Specification of Permanent Soldermask and Flexible Cover Materials"
- 4.1.5 Legend – **IPC-4781** "Qualification and Performance Specification of Permanent, Semi-Permanent and Temporary Legend and/or Marking Inks"
- 4.1.6 Copper Anodes – **C10200 per ASTM B152** – 99.95% copper, min .04% Phosphorous

## 5.0 Order of Precedence

- 5.1 In the event of a conflict between the requirements of this specification and the requirements of other procurement documents, the order of precedence which shall be:
  - 5.1.1 4.15.1 The Purchase Order
  - 5.1.2 4.15.2 This specification
  - 5.1.3 4.15.3 Applicable specification


## 6.0 AS 9100 / ISO 9001:2008 Reference Element(s)

Primary element(s)	7.4 Purchasing
Support element(s)	7.4.2 Purchasing Information

## 7.0 PRODUCT REQUIREMENTS

### 7.1 Laminate (C-stage)

- 7.1.1 All laminates shall be manufactured to the following specification:
  - 7.1.1.1 Copper: Type S – RTF
  - 7.1.1.2 Copper weight and dielectric thickness specified on PO
  - 7.1.1.3 Dielectric Thickness
    - 7.1.1.3.1  $\leq 0.039$  – Class C
    - 7.1.1.3.2  $> 0.039$  – Class B
  - 7.1.1.4 Surface Quality – Class C (maximum 5 points table 3-3)
  - 7.1.1.5 There shall be no copper wrinkles as seen under normal or corrected 20/20 vision.
- 7.1.2 Scratches are permissible for sheets or panels when less than 5% of the nominal copper thickness in depth and less than 4 inches long
- 7.1.3 Pits and dents are permissible to a maximum of 5-count per 11.8" X 11.8" for
- 7.1.4 Grade C inspection criteria. Grade C is the minimum grade acceptable to Cirexx International.
- 7.1.5 Edge roughness or scalloping that result in raised copper burrs is not acceptable.
- 7.1.6 Surface and Subsurface Imperfections shall meet the requirements of IPC 4101 paragraph 3.8.3.1.6 or equivalent specification for material supplied.
- 7.1.7 Buried Capacitance (0.002 and less) cores must pass hi-pot testing prior to shipment unless waved by Cirexx International.
- 7.1.8 **Marking laminate**
  - 7.1.8.1 Laminate must be stamped unless specified otherwise on the purchase order. The marking shall contain the material type, lot number, core thickness, and copper weight.

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7.1.8.1.1 There must be at least one space between each set of stamped characters. Stamp laminate with unequal copper weight on the heavier side. All cores will be stamped with the grain direction near a corner (3"-5"). The entire lot must be stamped on the same corner and stacked accordingly. Stamp should be stylus type pin-printed, metal stamping (impression) is only allowed if stamping does not curl or damage the core.

7.1.8.1.2 Supplier may use ink stamping method. The Ink must remain on the laminate core through standard inner layer processing including resist stripping. The marking must remain legible.

**7.1.9 Edge Beveling**

7.1.9.1 Laminate with a thickness of  $\geq 0.021$ " shall be beveled on all four sides. The supplier shall obtain a waiver in advance of the shipment if you are requesting to ship product without beveling the edges per this requirement.

**7.1.10 Pre-cut panel tolerance**

7.1.10.1 The preferred dimensional tolerance is  $\pm 0.031$  of stated panel size. We will accept  $\pm 0.062$ , but this can cause resist overhang when dry film resist is laminated to the panel.

**7.2 Prepreg (B-Stage)**

7.2.1 Prepreg material shall meet the requirements of IPC 4101 (or other applicable IPC laminate specification) section **3.8.3.2 Prepreg Visual Properties**.

7.2.2 Resin content will be within  $\pm 1.5\%$  of the nominal specification for the average of measurements for any given roll of material. No signal reading shall exceed  $\pm 1.8\%$ .

7.2.3 Prepreg test data required on package label

- 7.2.3.1 Resin content (%)
- 7.2.3.2 Resin Flow or MF
- 7.2.3.3 Scaled Flow Thickness
- 7.2.3.4 Volatile content

**7.3 Copper Foil**

7.3.1 All copper foils supplied to Cirexx International must be per IPC-4562 Grade III for high temperature elongation (HTE) copper foil.

7.3.2 All copper foils used in the manufacture of laminate must be electro-deposited copper with one side surface treated (unless otherwise specified by Cirexx International)


**7.4 Tooling holes**

7.4.1 Prepreg and copper foil shall be tooled to Cirexx International tooling pin systems. The tooling-hole edge must be clean and free of fibers, burrs and folded metal/flaps. Haloing and fracturing shall not extend beyond .062" from tooled hole-edges.

**7.5 Soldermask**

7.5.1 Soldermask material shall be manufactured and meet the performance requirements of IPC-SM-840 per the applicable class. The class requirement will be specified on the PO.

- 7.5.1.1 Class T – Telecommunication
- 7.5.1.2 Class FT – Flexible Print Board application - Telecommunication
- 7.5.1.3 Class H – High Reliability/Military (**Cirexx Default requirement if not specified on the PO**)
- 7.5.1.4 Class FH - Flexible Print Board application - High Reliability/Military

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**7.6 Legend/Marking Inks**


- 7.6.1 Legend inks supplied to Cirexx International shall comply to the requirements of **IPC-4781** "Qualification and Performance Specification of Permanent, Semi-Permanent and Temporary Legend and/or Marking Inks" and the applicable type listed below:
  - 7.6.1.1 Type 1: Permanent legend and marking ink with direct metal contact – Must be qualified to IPC-SM-840. The PO will indicate Type 1 when this is required.
  - 7.6.1.2 Type 2 (Standard): Permanent legend and marking ink without direct metal contact. This is the classic material for marking printed circuit boards.
  - 7.6.1.3 Legend shall be **non-Nutrient** and indicated on the C of C or in the technical data sheet.

**8.0 Certificate of Conformance (C of C)**

- 8.1 All materials listed above require a C of C be shipped with the product listing the applicable specification, test results as applicable and labeling information outlined in section 8.0. A soft copy of the C of C shall be sent to Cirexx Purchasing.
  - 8.1.1 C of C for laminates and prepregs shall reference the applicable IPC specification sheet.

**9.0 Packaging Requirements**

- 9.1 There must be a unique lot/batch number identified for each lot of material supplied and included on the C of C. This provides lot traceability through the supplier's processes and documents.
- 9.2 **The labeling for each box shall contain the following information:**
  - 9.2.1 Manufacturer Name
  - 9.2.2 Manufacturer's site Location
  - 9.2.3 Purchase Order #
  - 9.2.4 Cirexx Part Number if applicable
  - 9.2.5 Lot/Batch #
  - 9.2.6 Date Produced (manufactured date)
  - 9.2.7 **Laminate only**
    - 9.2.7.1 Thickness
    - 9.2.7.2 Copper weight and type
  - 9.2.8 **Prepreg only**
  - 9.2.9 Expiration Date – Prepreg Only
  - 9.2.10 **Laminates and Prepregs**
    - 9.2.10.1 Width X Grain (Grain direction marked "G" designation or other method AABUS)
    - 9.2.10.2 Resin Type
    - 9.2.10.3 Construction/Glass Style.
  - 9.2.11 **Copper Foil**
    - 9.2.11.1 weight and type
- 9.3 **Packaging**
  - 9.3.1 Packages shall not weigh more than 50 pounds unless approved by Cirexx Purchasing in advance.

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- 9.3.2 Prepreg must be packaged in moisture resistant material and be vacuum sealed to prevent moisture absorption.
- 9.3.3 Prepreg packages quantities are as follows:
  - 9.3.3.1 50 pieces for all glass styles except 106 and 1080 or equivalent.
  - 9.3.3.2 106 and 1080 or equivalent – 100 pieces.
- 9.3.4 Non-standard prepregs (low resin/high resin content or low flow/no flow) must be clearly marked on the package. A color code system is preferred.


## 10.0 Shipping Requirements

- 10.1 Order quantity – Cirexx International expects to receive the quantity ordered on the purchase order. Under shipping is not acceptable. Overage shall be approved in advance by Cirexx Purchasing.
- 10.2 Certificates of Conformance are required for each lot of material shipped to Cirexx International. The certificate of conformance shall contain the same information described in section 8.0.
- 10.3 **Prepreg – Minimum shelf-life required**
  - 10.3.1 Cirexx International purchasing shall be notified prior to shipping any Prepreg that does not have at least ninety days of usable shelf-life remaining. Cirexx International reserves the right to reject any Prepreg that is shipped with less than 90 days usable shelf-life without prior authorization by Cirexx purchasing.
- 10.4 The delivery method shall be specified on the purchase order.
- 10.5 Early shipments shall be preapproved by Cirexx purchasing.

## 11.0 General

- 11.1 **Process Changes**
  - 11.1.1 Supplier shall provide written notification to Cirexx International Purchasing and Quality Assurance Manager of any changes to the supplier's product and/or processes that may have a potential impact on the quality of the finished product delivered to Cirexx. Reportable changes include, but are not limited to, changes in facilities, equipment and critical raw material suppliers.
- 11.2 **Non-conforming product**
  - 11.2.1 If the supplier suspects, or becomes aware, that non-conformance product has been shipped to Cirexx International, the supplier shall immediately notify Cirexx International purchasing and quality management of the issue and the purpose resolution. The supplier is expected to will work closely with Cirexx to quickly purge and replace the defective material.
- 11.3 **Supplier facility access**
  - 11.3.1 Cirexx International shall be allowed access to the suppliers facilities for the purpose of audits or to investigate quality, delivery or other issues that adversely affect Cirexx International. The supplier shall “grant right of access” to all facilities and applicable records pertaining to Cirexx International orders.
  - 11.3.2 This applies to sub-tier suppliers whose product/materials are used as part of the end-product supplied to Cirexx International.
- 11.4 **Quality/Process Data**
  - 11.4.1 When requested, the supplier shall provide quality and or process data to validate their process capability and conformance to specifications. The following data shall be provided upon request:



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**11.4.2 Laminate thickness**

11.4.2.1 Statistical Process Control (variables XbarR chart) showing mean, upper and lower control limits, standard deviation, Cpk, Cp and Cpm values. The reports should include a process capability analysis on critical dielectrics defined as  $\leq 0.005$  and by construction prepreg types provided.

**11.4.3 Prepreg resin content**

11.4.3.1 Statistical Process Control (variables XbarR chart) showing mean, upper and lower control limits, standard deviation, Cpk, Cp and Cpm values. The reports should include a process capability analysis on critical characteristics agreed to by the supplier and Cirexx International quality/engineering management. The following are examples of attributes for reporting.

- 10.1.1.1.1 Resin content
- 10.1.1.1.2 Scaled Flow thickness

**10.2 Military Orders (“DX” or “DO” rated)**

10.2.1 Material orders may be rated as “DX” under the Defense Priorities and Allocations System regulation (15 CFR 700). Cirexx International purchase order will be clearly marked on any applicable purchase orders as “DX” rated. 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 you reject a “DX” rated order, you shall notify Cirexx International immediately via email or telephone and provide notification in writing within two (2) business days.

10.2.2 Material orders may be rated as “DO” under the Defense Priorities and Allocations System regulation (15 CFR 700). Cirexx International purchase order will be clearly marked on any applicable purchase orders as “DO” rated. 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 you reject a “DX” rated order, you shall notify Cirexx International immediately via email or telephone and provide notification in writing within two (2) business days.

**10.3 Record Retention**

10.3.1 Supplier shall maintain records on file for a minimum of 3 years from date of shipment. Records shall include, but are not limited to, test data, inspection results, Certificate of Compliances (C of C’s), etc. Records shall be made available to Cirexx International within 24 hours when requested.