



**IPC-4103**  
**Amendment 1**  
**2011 – August**  
**Specification for Base**  
**Materials for High Speed/**  
**High Frequency Applications**

*A standard developed by IPC*

*Association Connecting Electronics Industries*



**The Principles of Standardization**

In May 1995 the IPC's Technical Activities Executive Committee (TAEC) adopted Principles of Standardization as a guiding principle of IPC's standardization efforts.

**Standards Should:**

- Show relationship to Design for Manufacturability (DFM) and Design for the Environment (DFE)
- Minimize time to market
- Contain simple (simplified) language
- Just include spec information
- Focus on end product performance
- Include a feedback system on use and problems for future improvement

**Standards Should Not:**

- Inhibit innovation
- Increase time-to-market
- Keep people out
- Increase cycle time
- Tell you how to make something
- Contain anything that cannot be defended with data

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Revision Date: August 2011

| <b>SPECIFICATION SHEET</b>  |  |  |  |                               |                      |
|---|--|--|--|-------------------------------|----------------------|
| Specification Sheet #   | :  | IPC-4103/17  |  |                               |                      |
| Reinforcement   | :  | Woven E-Glass  |  |                               |                      |
| Resin System  | :  | Hydrocarbon  |  |                               |                      |
| Filler  | :  | None   |  |                               |                      |
| Permittivity Range**  | :  | 2.5 – 3.6  |  |                               |                      |
| Permittivity Test Frequency   | :  | 10 <sup>10</sup> Hz  |  |                               |                      |
| Nominal Permittivity  | :  | A – 2.5, B – 2.8, C - 3.0, D - 3.2, E-3.25, F-3.33, G-3.38, H-3.45, X – AABUS* |  |                               |                      |
| ID Reference  | :  | N/A  |  |                               |                      |
| Glass Transition Range  | :  | N/A  |  |                               |                      |
| <b>LAMINATE REQUIREMENTS</b>  |  |  |  |                               |                      |
| Laminate Requirement  | Specification<br><0.76 mm<br>[<0.030 in] | Specification<br>≥0.76 mm<br>[≥0.030 in]                                       | Units  | Test Method                   | Ref. Para.           |
| 1. Peel Strength, minimum   |  |  |  |                               |                      |
| A. Low profile copper foil and very low profile copper foil—all copper weights greater than 17µm [0.669mil] | AABUS*                                   | AABUS*   |  | 2.4.8                         | 3.9.1.1              |
| B. Standard profile copper foil   |  |  | N/mm<br>[lb/inch]                            | 2.4.8.2                       | 3.9.1.1.1            |
| 1. After Thermal Stress   | 0.54 [3.0]                               | 0.54 [3.01]  |  | 2.4.8.3                       | 3.9.1.1.2            |
| 2. At 125°C [257°F]   | –  | –  |  |                               | 3.9.1.1.3            |
| 3. After Process Solutions  | –  | –  |  |                               |                      |
| C. All other foil – composite   | AABUS*                                   | AABUS*   |  |                               |                      |
| 2. Volume Resistivity, minimum  |  |  |  |                               |                      |
| A. C-96/35/90   | 10 <sup>6</sup>                          | 10   | MΩ-cm  | 2.5.17.1                      | 3.11.1.3             |
| B. After moisture resistance  | –  | –  |  |                               |                      |
| C. At elevated temperature E-24/125   | –  | –  |  |                               |                      |
| 3. Surface Resistivity, minimum   |  |  |  |                               |                      |
| A. C-96/35/90   | 10 <sup>5</sup>                          | 10 <sup>5</sup>  | MΩ   | 2.5.17.1                      | 3.11.1.4             |
| B. After moisture resistance  | –  | –  |  |                               |                      |
| C. At elevated temperature E-24/125   | –  | –  |  |                               |                      |
| 4. Moisture Absorption, maximum   | 0.4                                      | 0.4  | %  | 2.6.2.1                       | 3.12.1.1             |
| 5. Dielectric Breakdown, minimum  | 20                                       | 20   | kV   | 2.5.6                         | 3.11.1.6             |
| 6. Permittivity at 10 <sup>10</sup> Hz, maximum<br>(Laminate & Prepreg as laminated)                        | As Specified<br>Above                    | As Specified<br>Above  | –  | 2.5.5.3<br>2.5.5.5<br>2.5.5.6 | 3.11.1.1<br>3.11.2.1 |
| 7. Loss Tangent at 10 <sup>10</sup> Hz, maximum<br>(Laminate & Prepreg as laminated)                        | 0.005                                    | 0.005  | –  | 2.5.5.3<br>2.5.5.3<br>2.5.5.9 | 3.11.1.2<br>3.11.2.2 |
| 8. Flexural Strength, minimum   |  |  |  |                               |                      |
| A. Length direction   | –  | 276 [40,000]   | N/mm <sup>2</sup><br>[lb/inch <sup>2</sup> ] | 2.4.4                         | 3.9.1.3              |
| B. Cross direction  | –  | 207 [30,000]   |  |                               |                      |
| 9. Thermal Stress 10 s at 288°C [550°F], minimum  |  |  |  |                               |                      |
| A. Unetched   | Pass Visual                              | Pass Visual  | s  | 2.4.13.1                      | 3.10.1.2             |
| B. Etched   | Pass Visual                              | Pass Visual  |  |                               |                      |
| 10. Electric Strength, minimum<br>(Laminate & Prepreg as laminated)   | 15,748 [400]                             | 15,748 [400]   | V/mm<br>[V/mil]                              | 2.5.6.2                       | 3.11.1.6<br>3.11.2.3 |
| 11. Flammability<br>(Laminate & Prepreg as laminated)   | V-0                                      | V-0  | rating                                       | UL-94                         | 3.10.2.1             |
| 12. CTE, average maximum<br>X, Y Axes<br>Z Axis   | –  | –  | ppm/°C                                       | 2.4.41<br>2.4.41.1            | 3.10.1.8             |
| <b>BONDING LAYER REQUIREMENTS</b>   |  |  |  |                               |                      |
| Bonding Layer Requirement   | Specification                            | Units  | Test Method                                  | Ref. Para.                    |                      |
| 1. Shelf Life, minimum (Condition 1/Condition 2)  | N/A                                      | DAYS   | AABUS  | 3.17                          |                      |
| 2. Reinforcement  |  | AABUS  |  |                               |                      |
| 3. Volatile content maximum   | N/A                                      | %  | 2.3.19                                       | 3.9.2.3.3                     |                      |
| 4. Flammability (as laminated)  | V-0                                      | rating   | UL94   | 3.10.2.1                      |                      |

\*AABUS = As Agreed Between User and Supplier

\*\*Dependent on glass-to-resin ratio