# CAC, Inc. Technical Data sheet: CAC & CSC (Copper Aluminium Copper / Copper Steel Copper)

**Application:** Printed Circuit Board lamination room

- **CSC Middles** = Middle of book
- **SC Top** = Top of book
- **CS Bottom** = Bottom of book

- **CAC Middles** = Middle of book
- **AC Top** = Top of book
- **CA Bottom** = Bottom of book

**Features**:

- **Copper**
  - Grade 1 Standard ED
  - Grade 3 High Temp Elongation ED
  - Grade 7 Wrought Annealed
  - Grade 8 Wrought Annealable
  - Grade 11 Annealable ED
- **Steel**
  - AISI 1000 series steel - Cold drawn low carbon steel Tin coated
- **Aluminium**
  - 3000 or 5000 series – Strain hardened for improved strength

**When to use: (As a guide)**

- **Sequential** lamination designs, slight image transfer/embossing issues = CAC
- **Complex board** design & thin copper (10> layers with 1/4oz and 1/3oz Cu layers) = CAC or CSC
- **Sequential** lamination designs, greater image reduction, increase book height = CSC
- **High temperature** & high-pressure lamination cycles = CSC

**Benefits of CSC:**

- **Manage stack height -** More panels per book per opening (10/w CSC 0.008" vs. 7/w 0.060" separator)
- **Production Efficiency** gains by reducing the overall mass to heat AND cool in a cycle
- **Consistency** in stack CTE - Steel equals the laminate & Copper CTE rate of rise
- **Reduce Image transfer** - 8 mil steel >2x as effective than 15 mil alum

**Benefits of CAC:**

- **Improved** stack CTE – Aluminum's rate of rise exceeds Copper & glass reducing wrinkles
- **Value** proposition ensures the benefits can be utilized on all jobs, improving panel quality

**Benefits of either CAC or CSC**

- **Layup Efficiency –** No separators to clean, resurface or polish - labor intensive & costly
- **Increase** quality assurance - handling scrap & FOD contamination is minimized
- **Protect** the factory finish copper surface & treatment during layup operation
- **Supports** requirements for thinner foils from 6 µm up to 140 µm available

# CAC, Inc. Technical Data sheet: CAC & CSC (Copper Aluminium Copper / Copper Steel Copper)

- Mechanical and Chemical properties of 1000 series steel

| Physical Properties | Metric | English | Comments |
|---|---|---|---|
| Density | 7.872 g/cc | 0.2844 lb/in³ | |
| **Mechanical Properties** | **Metric** | **English** | **Comments** |
| Hardness, Brinell | 95 | 95 | |
| Hardness, Knoop | 113 | 113 | Converted from Brinell |
| Hardness, Rockwell B | 55 | 55 | Converted from Brinell |
| Hardness, Vickers | 98 | 98 | Converted from Brinell |
| Tensile Strength, Ultimate | 330 MPa | 47900 psi | |
| Tensile Strength, Yield | 285 MPa | 41300 psi | |
| Elongation at Break | 20% | 20% | In 50 mm |
| Reduction of Area | 45% | 45% | |
| Modulus of Elasticity | 206 GPa | 29900 ksi | |
| Bulk Modulus | 163 GPa | 23600 ksi | Estimated from elastic modulus |
| Poissons Ratio | 0.29 | 0.29 | Typical for steel |
| Machinability | 50% | 50% | Based on AISI 1212 steel. as 100% machinability. Group I bar, rod, and wire products machinability can be improved by cold drawing. |
| Shear Modulus | 80.0 GPa | 11600 ksi | Estimated from elastic modulus |
| **Electrical Properties** | **Metric** | **English** | **Comments** |
| Electrical Resistivity | 00174 ohm-cm | .0000174 ohm-cm | Typical steel |
| **Thermal Properties** | **Metric** | **English** | **Comments** |
| CTE, linear | 12.6 µm/m-°C<br>ature 0.000 - 100 °C | 7.00 µin/in-°F<br>mperature 32.0 - 212 °F | |
| | 13.5 µm/m-°C<br>ature 0.000 - 300 °C | 7.50 µin/in-°F<br>mperature 32.0 - 572 °F | |
| | 13.7 µm/m-°C<br>ture 0.000 - 1000 °C | 7.61 µin/in-°F<br>nperature 32.0 - 1830 °F | |
| | 14.2 µm/m-°C<br>ature 0.000 - 500 °C | 7.89 µin/in-°F<br>mperature 32.0 - 932 °F | |
| Specific Heat Capacity | 0.481 J/g-°C | 0.115 BTU/lb-°F | 50-100ºC |
| **Component Elements Properties** | **Metric** | **English** | **Comments** |
| Carbon, C | <= 0.080 % | <= 0.080 % | |
| Iron, Fe | 99.43 - 99.75 % | 99.43 - 99.75 % | As remainder |
| Manganese, Mn | 0.25 - 0.40 % | 0.25 - 0.40 % | |
| Phosphorus, P | <= 0.040 % | <= 0.040 % | |
| Sulfur, S | <= 0.050 % | <= 0.050 % | |

The table below lists "typical" mechanical properties for the different Tempers of Tin Mill Products. Tin Mill Products are produced to meet the specifications called out by the ASTM, Euronorm or JIS standards. Steel mills generally will not, with a few exceptions, guarantee mechanical properties for Tin Mill Products.

| Temper* | P.S.I. Yield Strength | P.S.I. Tensile Strength | % Total Elongation | Rockwell 30-T Scale | R Value |
|---|---|---|---|---|---|
| C.A. T4 | 47,000 to 61,000 | 61,000 to 69,000 | 17% to 27% | 57 to 65 | 1.1 |

*C.A. = Continuous Annealed

Yield Strength = the amount of pull on the metal before it permanently stretches(begins to form).
Tensile Strength = the amount of pull on the metal when it breaks.
% Elongation = the percent change in length when the material is pulled/stretched and broken into two pieces.
Rockwell 30-T scale measures superficial hardness only.
R Value = the materials ability to both stretch and compress without either cracking or wrinkling.



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