

**21st. ICEC Zürich  
Session 7, Chapter 07.05**



**Lead-free manufacturing:  
Effects on press-fit connections**

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# Why lead-free?

✧ **Legislation:** directives from EU Commission

- WEEE  
- RoHS } ⇒ 2006 ?

✧ **Market pressure:** primarily from  
“Global Companies”

⇒ 2003 - 2004

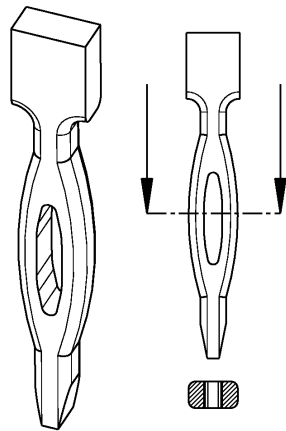
# Consequences:

- ✧ **Soldering processes & solder connections**
- ✧ **Plating layers for components & PCB's**
- ✧ **Solderless connections, e.g. Press-in, IDC, plating finish for separable contacts, ...**

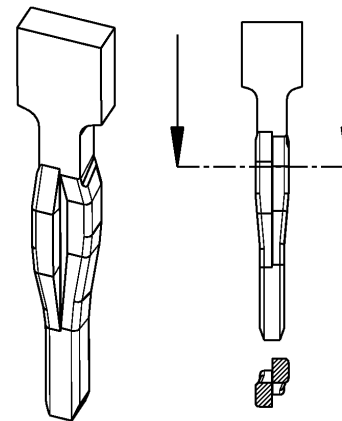
# Subjects of test: Press-in terminations

## ✧ Press-in zones:

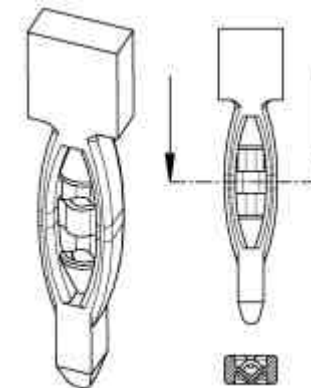
**Eye-of-the-needle**



**Action-pin**



**Multispring**



✧ **Whisker-free satin-bright pure Sn plating with Ni underplate**

✧ **Conventional SnPb plating for reference**

# Subjects of test: Printed Circuit Boards

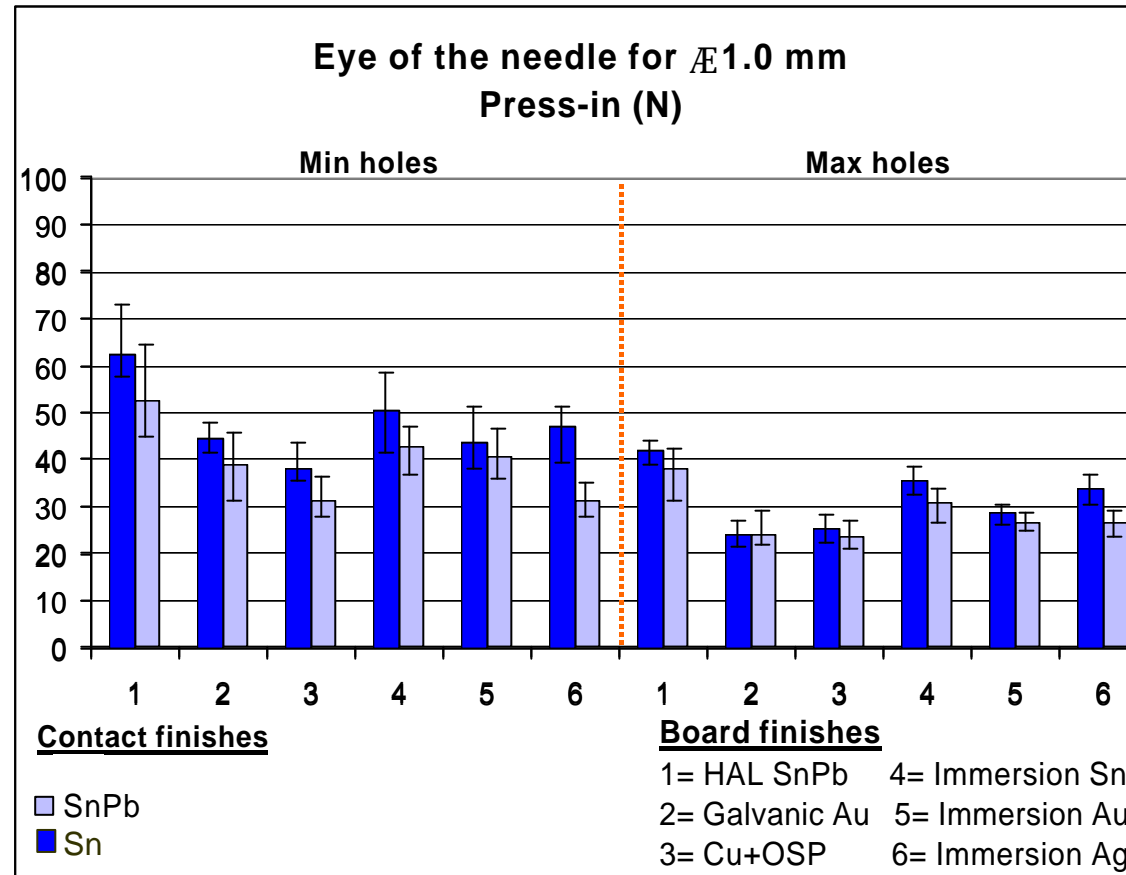
- ✧ **Base material: FR4**
- ✧ **Board thickness: 1,6 mm**
- ✧ **Min. - Nom. - Max. holes**
- ✧ **Underplate: 25-50  $\mu\text{m}$  Cu**
- ✧ **Finishes:**
  - 1) Conventional HAL SnPb for reference
  - 2) Galvanic Au over Ni
  - 3) Cu + OSP (EnteK+)
  - 4) Immersion Sn
  - 5) Immersion Au
  - 6) Immersion Ag

# Testprogram:

## ✧ IEC 60352-5 Rev. March 2001

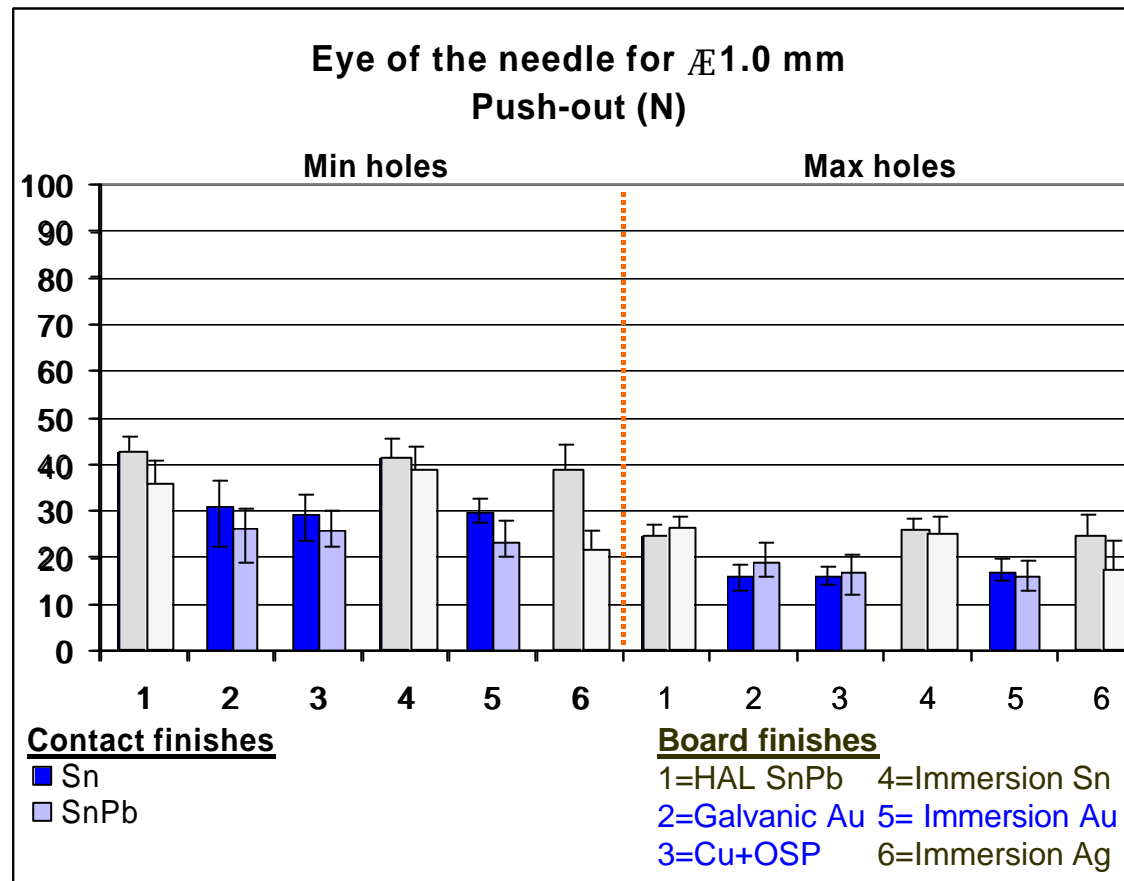
- **Qualification test: on individual press-in connections:**
  - Visual examination / Microsectioning
  - Insertion / Retention forces, incl. repair operations
  - Contact resistance over specified test sequence
  
- **Application test: on component level:**
  - Contact resistance over specified test sequence

# Results: Focus on press-in forces



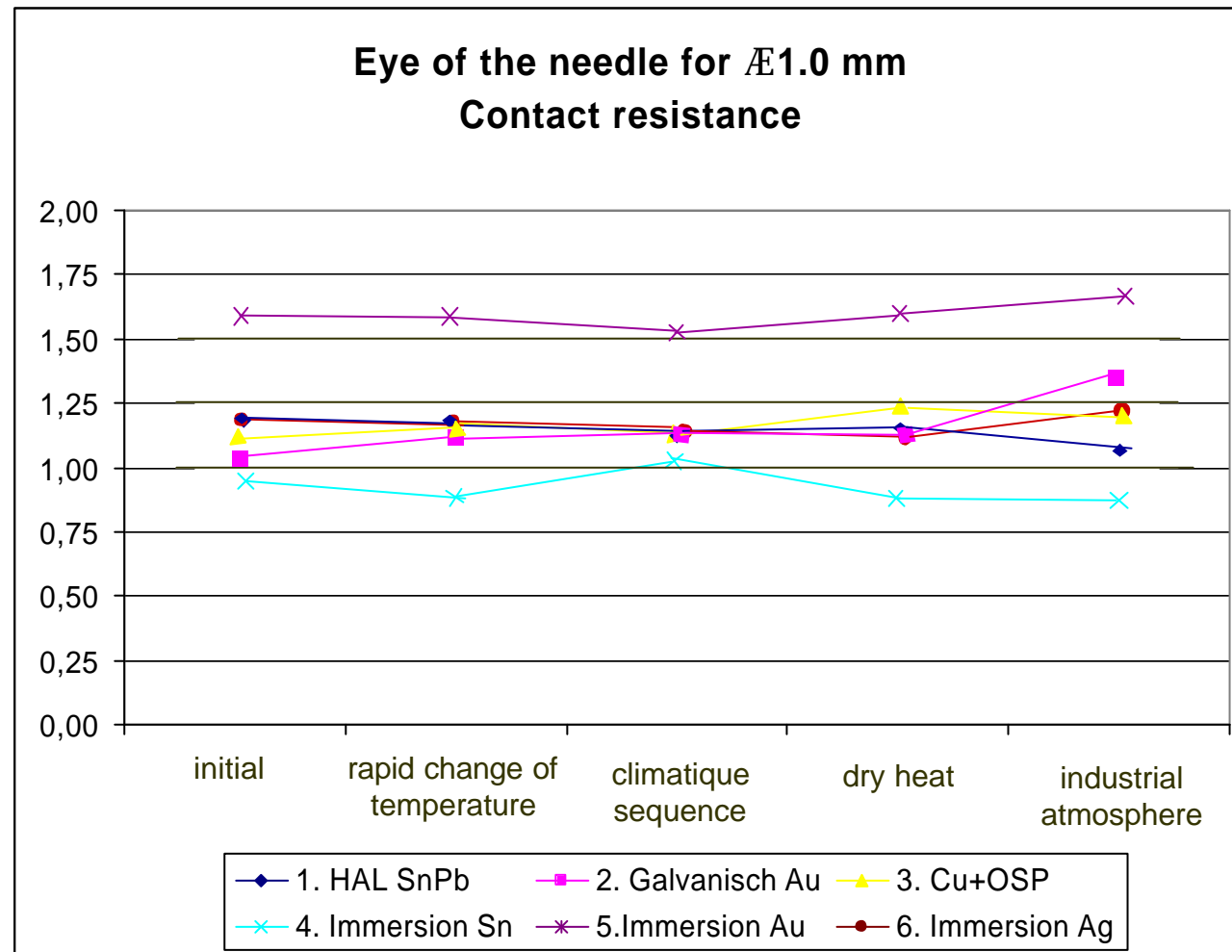
✧ **Press-in forces ca. 15% higher for Sn vs. SnPb plated contacts**

# Results: Focus on push-out forces:



- ✧ Push-out forces are generally slightly higher for Sn vs. SnPb plated contacts
- ✧ PCB's with Galvanic Au, Cu+OSP and immersion Au show push-out forces of approx. 60% compared to HAL SnPb

# Results: Focus on contact resistance:



◇ All combinations show contact resistance variations < 0.5 mOhm

## General conclusions:

*All tested combinations of pure-Sn plated press-in terminations with lead-free board finishes show:*

- ✧ **All visual examination / microsectioning: O.K. !**
- ✧ **Repair operations: O.K. !**
- ✧ **Electrical performance / reliability: O.K. !**
- ✧ **Retention force requirements might become critical for Galvanic Au and OSP board finishes BUT: Electrical performances guaranteed !**

## Specific conclusions and points of attention:

***Pure-Sn versus tin-lead plated press-in terminations show:***

✧ **Slight to moderate increase of insertion and retention forces:**

⇒ **Attention at Flat rock press-in !**

⇒ **Attention to hole damage / deformation**



✧ **For more details:**

- **See Abstract in the proceedings of this Conference**
- **Complete Report, issued July 2002, upon request**

**QUESTIONS ?**