



How the European E-Textiles Industry Is Preparing for Mass Production Through Industry Standards

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IPC—Association Connecting Electronics Industries

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About IPC

Formed in 1957, IPC is a global trade association with more than 5,400 member sites worldwide, dedicated to furthering the competitive excellence and financial success of its members, who are participants in the **electronics industry**.

IPC supports the global electronics industry under four primary activity areas

- International Standards
- Education
- Advocacy
- Solutions

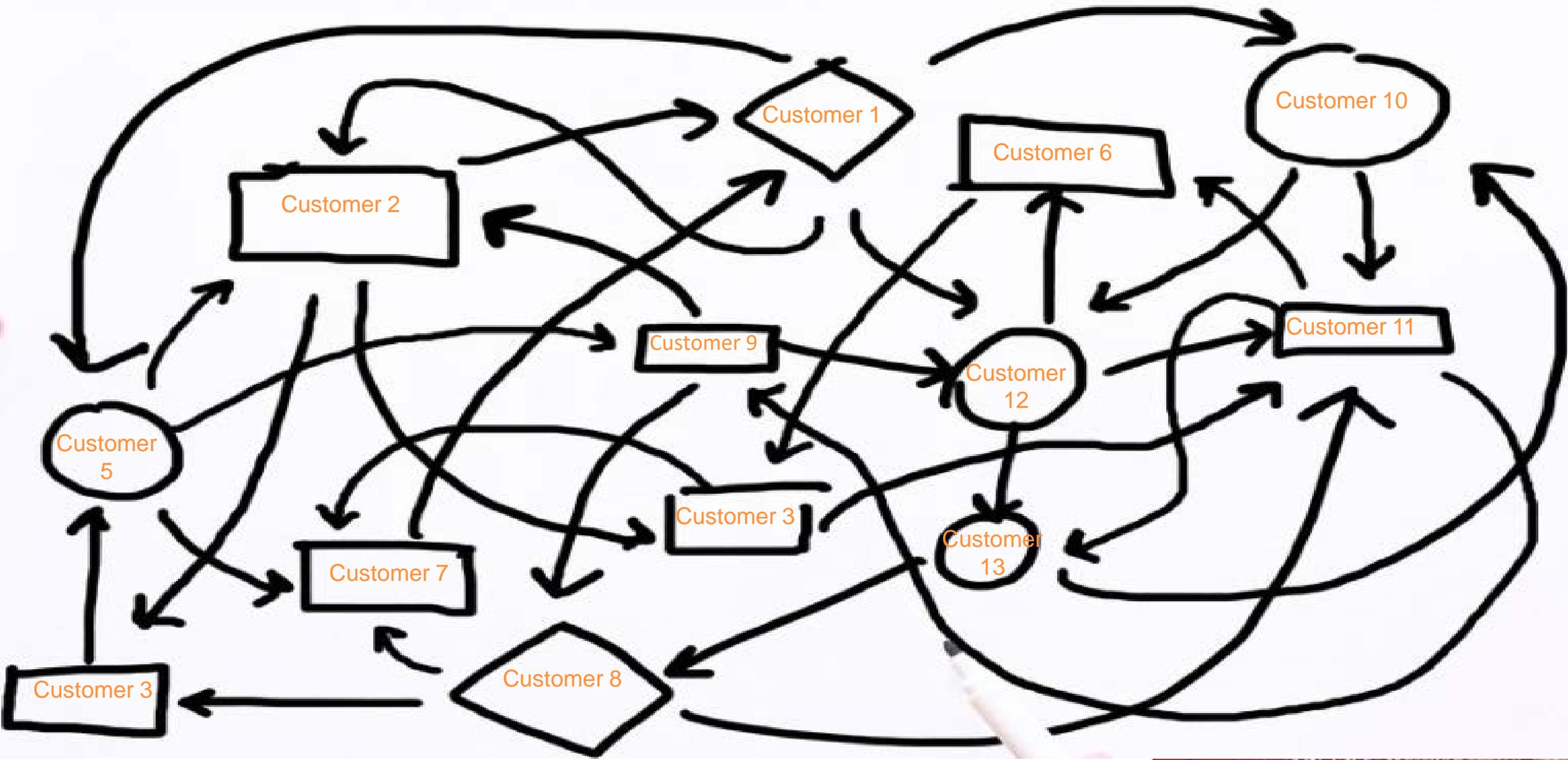


About IPC International Standards

- More than 300 IPC standards for electronics manufacture
 - Translated for multiple languages
- Collective knowledge and best practices
- Used worldwide for designing and manufacturing electrical and electronic products and their materials
- Developed by working groups of volunteers from across the globe
- No cost or obligation to participate in IPC standards groups
- Serve as basis for IPC training and certification programs



Manufacturing a Product in A World Without Standards



IPC Standards Simplify the Process

Customer 1
Requirements



Customer 2
Requirements



Customer 3
Requirements

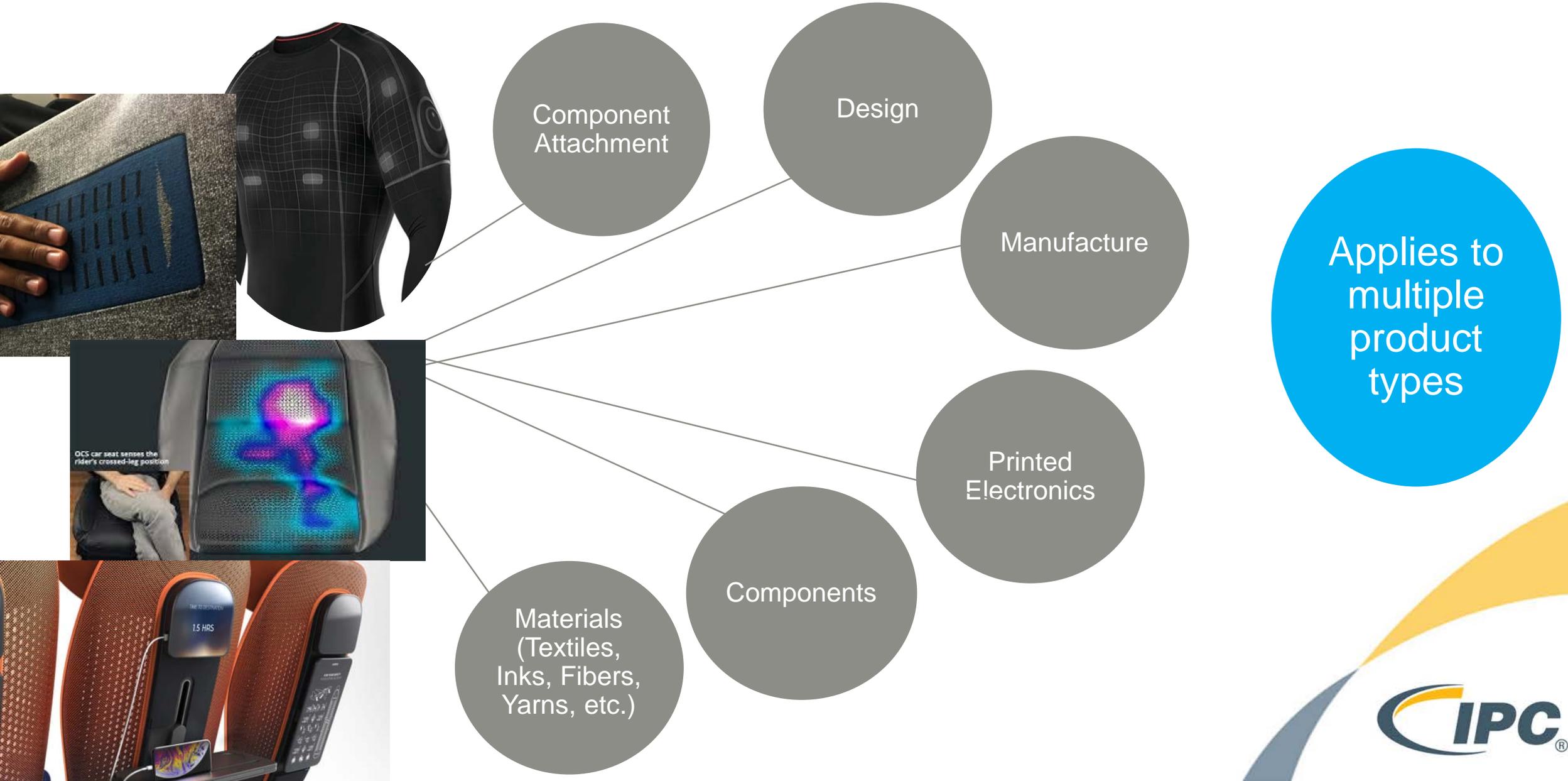


IPC
Standard

- Faster time to market
- Reduced manufacturing costs
- Expected outcome in reliability
- Supply chain validated to industry standards



IPC Standards Approach to E-Textiles Ecosystem

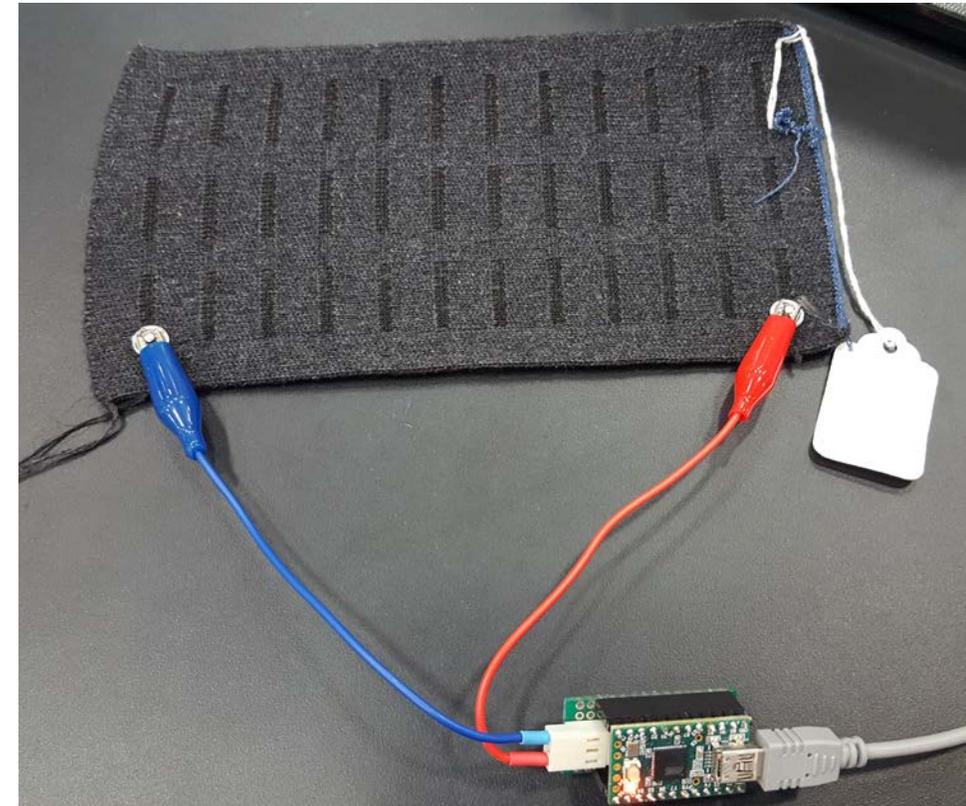


IPC's E-Textiles Committee in Europe

- E-textiles industry approached IPC to develop open international standards
 - D-70 E-Textiles Committee formed in spring 2017
- As word spread, committee membership grew worldwide, including many people from Europe
- In late 2018, representatives from the European e-textiles supply chain launched the D-70 E-Textiles Committee in Europe
- Voice for the European e-textiles community in standards
- Form working groups to lead open standards projects
- Group meets monthly via web meetings

Standard for Functional Characteristics for Woven and Knitted E-Textiles

- IPC-8921, *Requirements for Woven and Knitted Electronic Textiles (E-Textiles) Integrated With, Conductive Fibers, Conductive Yarns and/or Wires*
- Work began in summer 2017
- Standard passed ballot in September
- Will be published in fall



What IPC-8921 Does and Does Not Cover

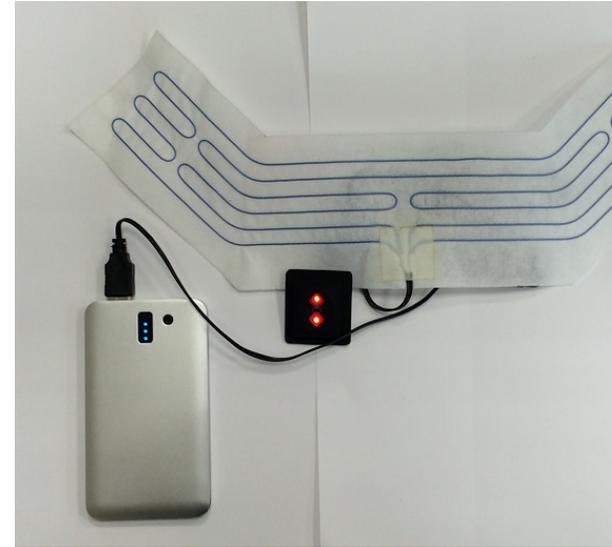
- **Does** establish classifications and designations for e-textiles integrated with e-fibers, e-yarns and e-wires
- **Does** set new terms and definitions specific to IPC-8921
- **Does** standardize Key Characteristics and Durability testing and industry test methods to be used
- **Will** set quality assurance provisions and test frequency
- **Does not** cover requirements for other types of e-textiles
- **Does not** include requirements for non-electronically integrated textiles or nonconductive fibers or yarns

IPC-8921 Key Characteristics & Durability

- Electrical Resistance
- Electromagnetic Immunity
- Thermal Conductivity
- CTE, T_g , Melting Point
- Specific Heat Capacity
- Thermal Shock Resistance
- VOCs, Outgassing
- Laundering
- Dry Cleaning
- Water
- Microbes
- UV Exposure
- Abrasion
- Flexing
- Flexible Endurance
- Tensile Strength
- Bursting Strength
- Stretch
- Temperature and Humidity
- Thermal Shock
- Saltwater (Sea)
- Acid/Alkali
- Perspiration

Guideline on Connectors for E-Textiles

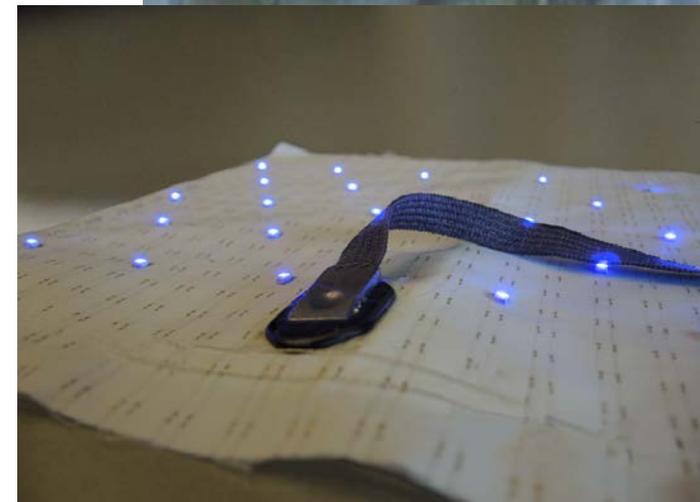
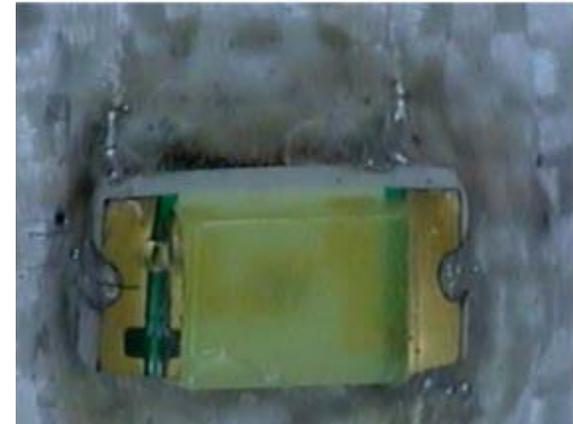
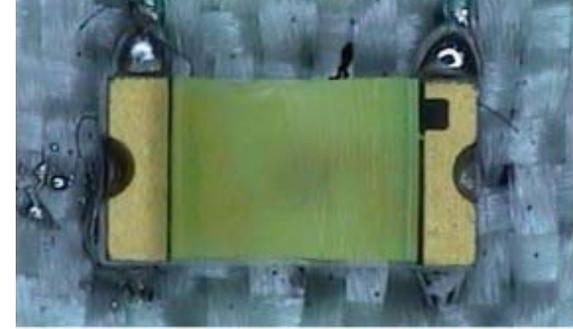
- IPC-8941, *Guideline on Connections for E-Textiles*
- Work began at the beginning of this year
- Standard will provide industry knowledge and best practices for connectors
- Will not be a requirements standard
 - no must or shall statements
- Curating content for a draft standard for comment
- Goal is to publish by January 2021



Topics IPC-8941 Will Cover

- Mechanical Attachment Interfaces
- Electrical Attachment Interfaces
- Designations for Connectors
- Protective Elements for Use Environments
- Interconnect Characteristics
- Applications and Markets

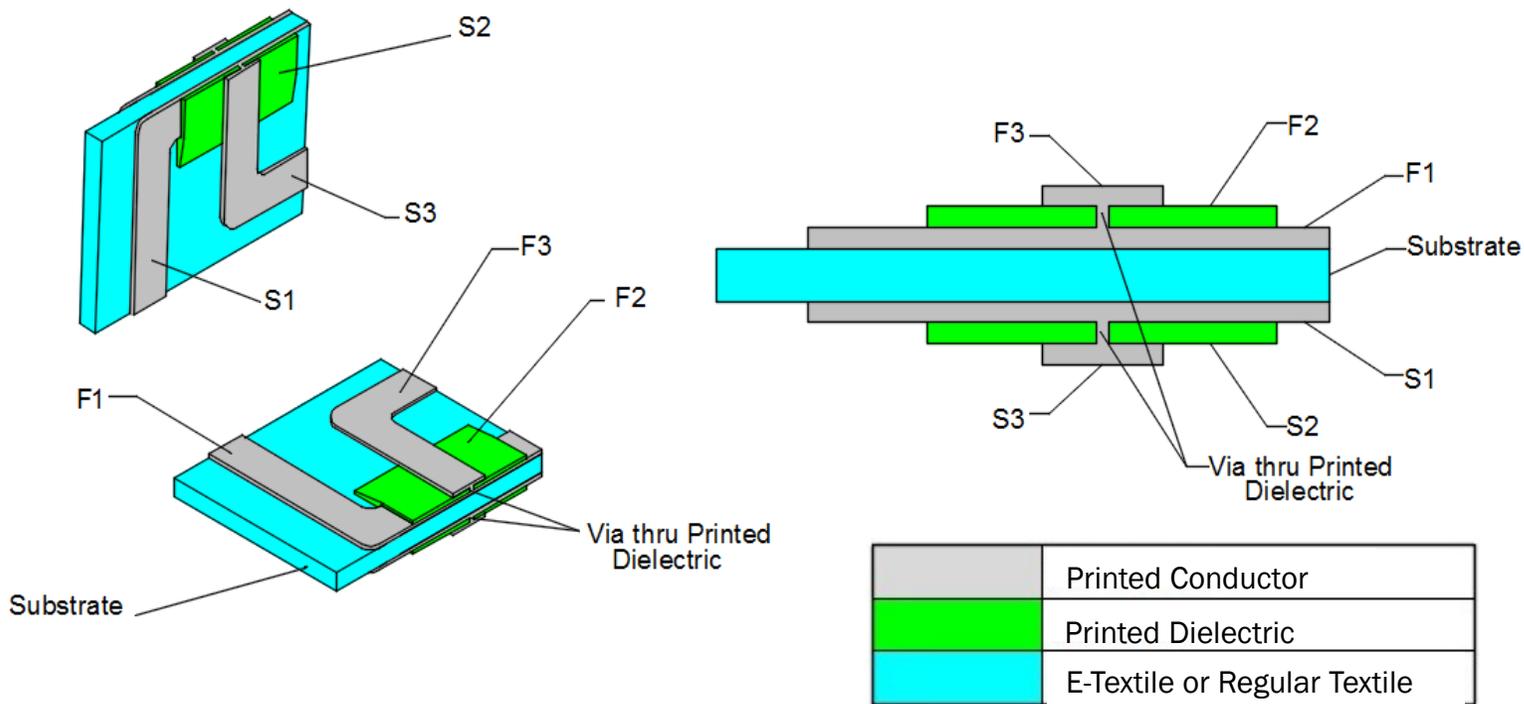
Need volunteers to submit write-ups on connector types using committee template



Design Standard for Printed Electronics E-Textiles

- IPC-8952, Design Standard for Printed Electronics on Coated and Treated E-Textiles
- Requirements for
 - Materials and thermal management
 - Mechanical and physical properties
 - Electrical properties and quality assurance
 - Assembly and connectors
- Starting point content is consensus design standard for printed on flexible substrates

Standard Printed Electronics Designs (SPEDs)



Designers and manufacturers to have standardized way of balancing design with process steps

Focuses on printed layers only

Next Steps for IPC-8952

- Project A-Team developing working draft for task group review by November 2020
- During this time, A-Team will call on task group members to help with action items, review sections, etc.
- Task group currently at 80 people
- Like all other IPC standards activities, the task group is open to anyone to participate
- Goal: Publish by November 2021

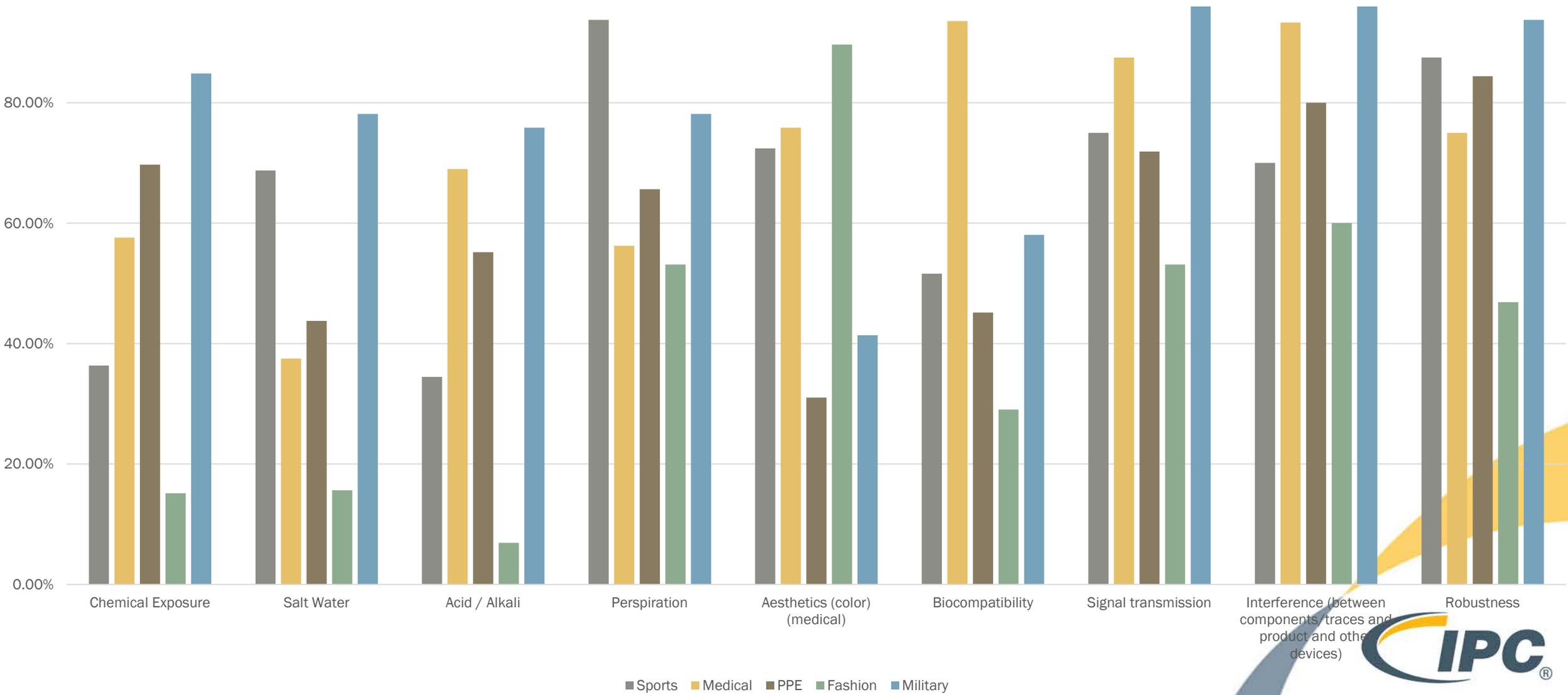
IPC Printed Electronics Committee also laying groundwork for quality and reliability specification for Type 1



Standards for E-Textiles for Wearables

- Ad hoc group Identifying performance requirements and test methods
- Will attempt to identify common denominators in testing
 - Reduce repeat testing for multiple-market products
 - Would allow for generic product standard and addenda for specific markets
- Launched industry survey during summer to collect data on performance characteristics and test methods for multiple product lines

Sampling of IPC Survey Responses



Next Steps for This Activity

- Ad hoc group is reviewing all survey data to find common ground in requirements based on product type
- Major focus on setting washability requirements
- Will determine if a generic standard or set of requirements can be established for multiple product lines
- Group will deliver proposal to the D-70 Committee for standards development by year end
- Based on that proposal, one or more new standards groups will be established
- Anticipate one or more working groups in Europe

Upcoming Projects With European Involvement

- **Washability** performance expectations based on product types
- **Standardized categories** for wearables – instead of sports, medical, PPE
- **High-power applications** and requirements (e.g., automotive)
- **Conductive fibers/wires** specification
- **New test methods** to support standards groups for wearables, conductive wires, printed electronics, etc.
- **Round robin** testing for data collection on materials according to IPC-8921 as well as other testing as industry requests it
- Form groups to develop mirror IPC-8921 standards for **braided, embroidered**, etc.

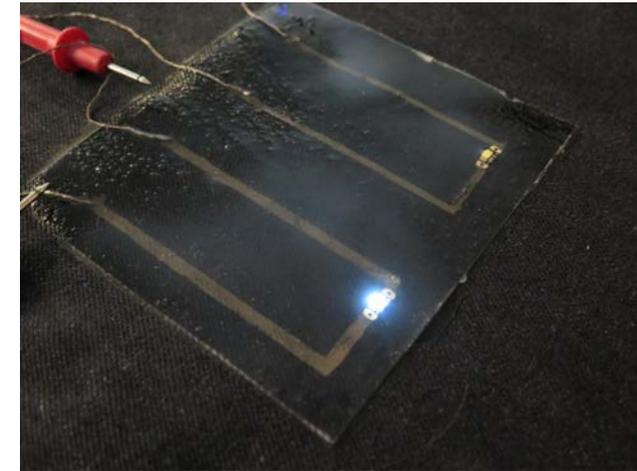
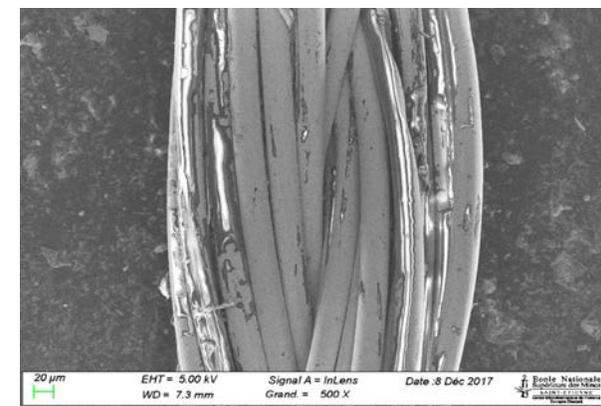
How You Can Get Involved

- Join the E-Textiles Committee in Europe and participate in their monthly web meetings
 - Group will meet face to face for the first time in November!
- Propose new standards topics for the D-70 Committee
 - IPC provides full staff support to help you volunteer for or lead a working group
- Submit topic ideas for additional white papers
 - Identify an issue and propose a solution
 - Ideal opportunity for academia to showcase their work

Two Educational White Papers

- IPC-WP-023: **washability** study of e-textiles structures with silver-coated yarn
 - Author: Vladan Koncar, ENSAIT GEMTEX Lab, D-70 Europe Chair
- IPC-WP-025: **framework—stack—that can be used for e-textile development**
 - Author: Madison Maxey, LOOMIA

Seeking proposals from industry for additional white papers
Ideal opportunity for academia





Sample listing of the 150+ organizations on the IPC E-Textiles Committee

IPC E-TEXTILES EUROPE 2019



Technical
Presentations

November 12-13

Networking

Novotel Hotel Muenchen Messe

Munich, Germany

Collaboration

Standards
Meeting

Register at www.ipc.org/E-Textiles-EU19