SEM approaches the time-to-better business results for its members across the global electronics design and manufacturing supply chain.
50+ Years Later: SEMI is More Than Ever and Growing!

SEMI OVERVIEW

- Thought Leadership
- Expositions/Conferences
- Standards
- EHS/ESG
- Worldwide Offices
- Program Hours
- Market Intelligence Reports
- Strategic Tech Communities: ESDA, FOA, FlexTech, MSIG, SOIC
- Tech partners: imec, Fraunhofer, CEA-Leti, IEEE, ITRI, AIST
- Talent Development, DEI & e-learning
- Global Advocacy
- Supply Chain Management
- Sustainability

SEMI is the only all-encompassing industry association.

>2,500 members worldwide

2,300+ Program Hours

170+ Tech Programs

20+ Tech Communities

1,000+ Standards

Worldwide Offices

EHS/ESG

2023 Top Priorities

CONNECT - COLLABORATE - INNOVATE - GROW - PROSPER
SEMI Connects the Global Electronics Design and Manufacturing Supply Chain

Convergence and new disruptions are driving transformation to the digital era
Bringing the Supply Chain Together through Key SEMI Initiatives

SEMI OVERVIEW

Your gateway to the ~$2.8T electronics supply chain
(Expected to grow to $4.5T+ by 2030)

2022 Market Data Estimates Sources: SEMI, IC Insights and TechInsights
ONE MEMBERSHIP OPENS THE DOOR TO A WORLD OF TECHNOLOGY COMMUNITIES
Supply Chain Issue

Problem Statement: Defects introduced by process-critical OEM components affect final wafer quality resulting in lower yields and higher manufacturing costs.

- Several yield excursions are linked to wide range of component and sub-components induced defectivity.

- Components and sub-components defect traceability lack the rigor for advanced technologies (detectability, sensitivity/methodology).

- Existing standards, if any, are inadequate for addressing advanced process control requirements.
Focus: Establishing a baseline for measuring defects introduced by process-critical components.

- Particle or defect limits will not be defined but will focus on defining consistent methodologies for measuring defects.

SCIS provides a forum that fosters discussion and aligns stakeholders on pre-competitive industry-critical issues.

- Participants are not expected to disclose IP but are expected to provide parameters for standardized measurement.
Participating Companies
SCIS Organizational Structure

SCIS

Executive Advisory Committee

SCIS Steering Committee

- Seals & Valves Group
- Traceability Verification Group
- Gas Delivery Group
- Dry Pumps Group
- Critical Chamber Components Group
- RF Group
- Liquid Delivery Group
- Parts Clean Group
SCIS to Standards – Process Flow

SCIS structure and objectives enables end customer-driven initiatives leading to higher impact standards and shorter development timelines.

SCIS structure and objectives enables end customer-driven initiatives leading to higher impact standards and shorter development timelines.
Semiconductor Components, Instruments and Subsystems (SCIS)
Technology Community

Joint Parts Clean and Critical Chamber Components (CCC) WGs
SCIS Parts Clean & CCC WG

- Participating companies include:
Parts Clean & CCC WG - Status

• Current Activities:
  – Organics
  – Particles
  – “Over-arching” document on parts cleaning
Parts Clean & CCC WG - Status

• The WG has been focusing on:
  – “Over-arching” document on parts cleaning [1/2]
    • WG lead: Victor Chia (Air Liquide/Balazs)

• WG plans to develop over-arching document into a full consensus Standard as a Guide

• The Guide will provide users information on available test methods. It will be up to the user to determine which technique will be used for their needs

• The Guide can also be referenced by users/customers

• Next Meeting: Wednesday, December 7 at 8 AM (Pacific)
Parts Clean & CCC WG - Status

• The WG has been focusing on:
  – **Particles**[^1/3]
    • WG Leads: Tommaso Orzali (ASML), Fuhe Li (Balazs), Erik Vermeulen (Fastmicro)

• 3 parallel activities:
### Parts Clean & CCC WG - Status

- **The WG has been focusing on:**
  - **Particles** [2/3]

**Guide Document**

- Guide Document would be incorporated into the Over-arching Document effort
Parts Clean & CCC WG - Status

• The WG has been focusing on:
  – **Particles** [3/3]

  *Test Method for Tape Lift-off*
  - Describes a quantitative analysis method for measuring ISO 14644-9 Surface Cleanliness by Particle concentration (SCP) of critical chamber components by using a replacement adhesive substrate to remove particles from the surface of interest and to measure them with a scatterometer or scanning surface inspection system (for particle counting) and then further analysis (via SEM/EDX) to identify elemental composition of particles
  - WG will continue to align on key elements/framework under this SCIS WG
  - This activity will eventually be moved to SEMI Standards for formal standards development

  *Test Method for OPC/LPC/Flushing*
  - Drafting, to be discussed at next meeting

  - **Next meeting:** Wednesday, December 7 at 8 AM (Pacific)
Parts Clean & CCC WG - Status

• The WG has been focusing on:
  – **Organics**
    • In progress – draft circulated among WG members for inputs
      – Approach to structure is similar to SEMI E180, focusing on critical chamber components (CCC)
    • This activity has been transitioned to SEMI Standards for formal development
Semiconductor Components, Instruments and Subsystems (SCIS)
Technology Community

Traceable Verification
Collaboration, Traceability & Standards are key ingredients to ensure alignment.

In-line process monitoring controls and traceability at every stage goes far beyond the outgoing COAs of supply chain.
Requirements

1. Standardized Identification (SNARF# 6448)
   - Easy ID – e.g. 2D Bar code will link to UUID for data reference

2. Standardized Data Format (SNARF# 6449)
   - Standardized scalable Information Exchange templates by commodity
     • ECOC/ECOA templates

3. Data Push method – extensions to Standardized Data Format
   - Deliver information prior to receipt and point of use
   - COU – Certificate of Use back to supplier (Failure modes, lifetime and CIP, etc.)

4. Data Pull method
   - Supplier / Source Web Site

5. History Tracking System (Use and Failure)
   - External (supplier)
   - Internal (customer)
Working Together for a New Data Infrastructure

- Sharing manufacturing data on parts and materials is critical for improvement and excursion containment
- Fabs must use data to find and share learnings with suppliers and IDMs
- Easy look up of “missing” data
### SCIS Traceable Verification Activities to Standards

**SCIS Framework Development Completed:**

- *SCIS Traceable Verification Group*
- Label BC Method
- Quality System Label Content (External, Stored)
- Template Format
  - Data Transport Method
  - Storage Location and Ownership
  - Secure Access Requirements
  - Encryption Requirements
  - Data Backup and Storage

**SEMI Standards Activity Established:**

- *Equipment & Materials Traceability Task Force*
Equipment & Materials Traceability Task Force
Activities & Status [1/2]

• New Standard: Specification for Equipment and Materials Labels (SEMI Draft Document # 6448)
  – Ballot was developed using VDA 4992 - MAT Label and eMat data exchange at the Material Label format.
  – SEMI has held separate meetings with OEM and IDM representatives to discuss concerns as well as efforts to realize material traceability.
  – Status:
    • Current 6448 SNARF will be abolished
      – This will take place at the North America Chapter of the Traceability Technical Committee meeting on November 10
    • The TF plans to start a new activity based on an alternative standardization approach
      – Discussions on the new standardization approach will be taken back to SCIS Traceable Verification WG for re-engineering (this removes 6448 from the balloting process for now)
      – Next SCIS Traceable Verification WG meeting to be announced
    • The TF also plans to continue its other existing activity in parallel (6449 – eCOA)
      – A strawman document will be circulated once drafting is complete
    • OEM stakeholders are requested to engage at the document development level
Equipment & Materials Traceability Task Force
Activities & Status [2/2]

• New Standard: Specification for Equipment and Materials Part Traceability (SEMI Draft Document# 6449)
  – Purpose: Specification for communicating part quality
    • Standardized scalable electronic Information Exchange templates by commodity – eCOC/ECOA Templates
  – Status: Drafting in progress
  – Looking for samples of suppliers’ eCOA to ensure all information is captured in the new Standard
  – Ballot contributors always welcome!
SCIS Seals Group
Leak Rate Project [1/4]

• Focus: Seal Leak Rate
  – Rationale: Seal failure can generate defects through atmospheric leaks into process environments or from degraded seal material. There is a need to develop a standardized way for measuring a seal’s ability to hold vacuum when exposed to elevated temperatures and/or process and clean chemistries.

Test Methodology

Goal: use Alpha testing to see how o-rings perform to determine measurement objectives at each temp

• Step 1
  – Room temp / 21°C
  – 5 measures during dwell time

• Step 2
  – Ramp Temp to 200°C
  – this temp may be a variable depending on material type post Alpha

• Step 3
  – 5 measures at ramped temperature
  – Dwell time 24hrs

• Step 4
  – Cool down to 21°C/room temp
  – Fan control is OKAY for faster cooling

• Step 5
  – 5 measures to be taken within (maximum) first few hrs of the cool down to 21°C/room temp
SCIS Seals Group
Leak Rate Project [2/4]

- BOM

CAD Courtesy of ASNA
SCIS Seals Group
Leak Rate Project [3/4]

• Operating Procedures
  – Provides detailed, step-by-step procedures for conducting seal leak rate alpha test

• Alignment needed on key requirements
  – O-ring prep prior to testing
  – Room temperature range
  – # of leak rate measurements taken
  – Ramp temperature, gradient
  – Dwell time
  – Conditioning

Operating Procedures – Contents:
1) Safety
2) Background Information
3) O-Ring Test Jig Facilities & Hardware Requirements
4) Configuring the O-Ring Test Jig for Operation
5) Calibrating the O-Ring Test Jig for Operation
6) Preparing an O-Ring for Leak-Rate Test on the Jig
7) Running an O-Ring Leak-Rate Test on the Jig
8) Recording an O-Ring Leak-Rate Test Result
9) Calculating Gauge Repeatability & Reliability
10) Alpha Testing Sampling Requirements
SCIS Seals Group
Leak Rate Project

SCIS Seal Suppliers

Test Jig Manufacture

Leak Detector Provider

Alpha Test Production Flow

Seals Alpha Testing

Testing Site
SCIS Seals Group  
Project Contributions - Update

<table>
<thead>
<tr>
<th>Item / Resource</th>
<th>Contributor</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Testing Site</td>
<td>TEL US</td>
<td>Confirmed</td>
</tr>
<tr>
<td>Leak Detector</td>
<td>Edwards</td>
<td>Confirmed</td>
</tr>
<tr>
<td>Valves</td>
<td>CKD USA</td>
<td>Confirmed</td>
</tr>
<tr>
<td>Fittings</td>
<td>Swagelok</td>
<td>Confirmed</td>
</tr>
<tr>
<td>PLC</td>
<td>Festo</td>
<td>Confirmed</td>
</tr>
<tr>
<td>Test Fixture - Assembly</td>
<td>TEL US</td>
<td>Confirmed</td>
</tr>
<tr>
<td>Test Fixture - Materials</td>
<td>TEL US</td>
<td>Fixture (machined) parts done – early Nov 2022</td>
</tr>
</tbody>
</table>
| Firestop Material / Thermal Insulation | ??? | Discussion in progress  
Ongoing discussion re: material details|

Many thanks to our contributors!!
Semiconductor Components, Instruments and Subsystems (SCIS)
Technology Community

Dry Pumps
Dry Pumps

- **Background:**
  - Critical pump data can be utilized for predictive pump failure detection. Some of this data can be obtained today while others are not yet widely available.

- **Parameters evaluated include:**
  - Inlet Pressure
  - Vibration Noise
  - Temperature
  - Speed
  - Exhaust Pressure
  - Pump Run Hours
  - Power, Current
  - N2 Purge

- **Reviewed existing standards**
  - ISO (vibration on rotational equipment)
  - SEMI (data communication, specific device model)
    - SEMI E73, Specification for Vacuum Pump Interfaces - Dry Pumps
    - SEMI E54.18, Specification for Sensor/Actuator Network Specific Device Model for Vacuum Pump Device

---

### Pump Data Survey (excerpt)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Input 1</th>
<th>Input 2</th>
<th>Input 3</th>
<th>Input 4</th>
<th>Input 5</th>
<th>Input 6</th>
<th>Input 7</th>
<th>Cumulative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inlet Pressure</td>
<td>N</td>
<td>Y (on fail)</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Vibration</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Noise</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Temperature</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooling Water Flow, Temperature</td>
<td>Y</td>
<td>Y</td>
<td>Y &amp; N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td><strong>Y</strong></td>
</tr>
<tr>
<td>Lack of Cooling Water</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td><strong>Y</strong></td>
</tr>
<tr>
<td>Speed</td>
<td>Y/N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td><strong>Y</strong></td>
</tr>
<tr>
<td>Exhaust Pressure</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td><strong>Y</strong></td>
</tr>
<tr>
<td>Pump Run Hours</td>
<td>Y/N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td><strong>Y</strong></td>
</tr>
<tr>
<td>Power, Current</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>N2 Purge*</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td></td>
</tr>
</tbody>
</table>
Dry Pumps

• Status: Drafting completed on guide for measuring vibration

• Guide for Measuring Vibration of Dry Pumps
  – There are many pump parameters that can be used to determine its health → Vibration is just one of these parameters
  – Draft provides guidance on how vibration measurements are taken for dry pumps
  – Draft also provides guidelines for evaluating pumps for use at customer sites
  – Elements considered include:
    • Sensor Considerations
      • Type
      • Location
      • # of Sensors
    • Data Collection
      • Interface
      • Frequency
    • Sampling Rate
    • Communication
  – This guide does not address how the data is processed to determine the health of the pump
Inputs Received

• WG Discussion
  – Input received calls for 2 parts (signal, alarm)
  – Most customers want the signal and they do their own processing
  – WG to take a closer look at SEMI E54.18 and SEMI E54.1 standards
    • SEMI E54.18 — Specification for Sensor/Actuator Network Specific Device Model for Vacuum Pump Device
    • SEMI E54.1 — Standard for Sensor/Actuator Network Common Device Model
    • Revision to incorporate vibration signal
  – Current vibration draft:
    • Refers to E54.18 (or other accepted methods) for communicating vibration signal
    • Acknowledges data processing, but does not address it (outside of scope, IP sensitivity)
Dry Pumps - Status

- **Next Steps**
  - WG soliciting inputs on whether to take on pump communication or move on to next parameter
  - If on pump communication, should the efforts focus on new tools vs on backwards compatibility for old tools?
Semiconductor Components, Instruments and Subsystems (SCIS)
Technology Community

Valves WG
SCIS Valves Activity

- Particle Contribution from Slit Valves (Wafer Transfer Valves)
  - **Rationale**: There is interest in minimizing particles generated by either elastomer or valve assembly
    - Traditionally, at qualification the particle contribution of valves & original elastomer are considered
    - Usually, the next step is the introduction of CIP elastomer
    - If CIP elastomer proves superior (i.e., less particle shed) than original elastomer, then focus can shift to optimizing valve operation parameters (if performance improvement of elastomer is deemed insufficient)
    - And/or if CIP elastomer still fails to meet performance criteria, then focus shifts to changing valve design, valve operation
SCIS Activities in Development

• Particle Contribution from Slit Valves (Wafer Transfer Valves)
  – Status: Drafting in Progress

9.1.2.2 Material properties to be provided by elastomer supplier
  • Hardness
  • Tensile modulus and strength
  • Elongation
  • Coefficient of thermal expansion
  • Compression set
  • Operating temperature range
  • Tg or Tg for low temperature elastomers
  • Plasma resistance (wt.% loss)
  • Filler material
  • He permeation
  • Outgassing

12.2 Baseline Measurements from Released Valve & Elastomer
12.2.1 The valve is tested against three different cycle conditions:
  • ~2000 cycles to immediately assess CIP elastomer performance
  • ~25,000 cycles to account for non-linear behavior of seal under test
  • ~50,000 cycles for a lifetime evaluation test

7.2 Test Wafers
7.2.1 There is a total of 18 test wafers needed for this test method
  • 2 valves (original vs CIP)
  • 3 tests (quick test vs lifetime vs intermediate)
  • 3 measurements for each set up

Figure 1
Testing Apparatus for Valve Particle Measurement
SCIS Activities in Development

• Particle Contribution from Slit Valves (Wafer Transfer Valves)
  – Status: Drafting in Progress

7.2 Test Wafers
7.2.1 There is a total of 18 test wafers needed for this test method
  • 2 valves (original vs CIP)
  • 3 tests (quick test vs lifetime vs intermediate)
  • 3 measurements for each set up

7.3 Measurement Equipment
7.3.1 Wafer Inspection Tool with SP5 Capability

Current draft calls for wafer inspection tool with SP5 capability.

There are concerns regarding accessibility of such equipment.

Are there other alternative measurement approaches that still meet current (and emerging) process needs?
Status

• Previous outreach efforts to other valve manufacturers (SMC, V-Tex, GNB Group), unfortunately, did not lead to new participation
• Valves WG is in search for stakeholders willing to drive working particles draft to completion
• In the mean time, the WG continues to solicit feedback on the working draft
New SCIS Activity Proposed for 2023

• Subfab Data Integration
  – It would help Fabs to address a scaling challenge when seeking to contextualize the data. The general intent would be to address known missing FMEA signals (for vacuum health and other key parameters). Therefore, there is a desire for either a new standard or clearer guidelines.

• Suggested Next Steps
  – Sub-fab is a broad topic, encompasses multiple components. There are also environmental/regulatory considerations
  – Before forming any dedicated WGs (e.g., on abatement, on chillers), an SCIS community-wide survey will be issued to specifically identify key subfab areas of concern, pain points, etc.
    • Survey would be issued YE2022 or early 2023
SCIS Meeting Calendar 2023 *(Proposed)*

### SCIS F2F Meetings

**April 3**  
10:00 AM to 2:00 PM, Pacific

**July 12 @ SEMICON West 2023**  
12:00 Noon to 2:00 PM, Pacific

**Late-Oct, early-Nov 2023**  
10:00 AM to 2:00 PM, Pacific

- SEMI Industry Strategy Symposium (ISS)  
  (January 8-11) in Half Moon Bay, CA
- NA Standards Spring 2023 Meetings  
  (April 3-6) in Milpitas, CA
- SEMI Advanced Semiconductor Manufacturing Conference (ASMC)  
  (May 1-4) in Saratoga Springs, NY
- SEMICON West 2023  
  (July 11-13) in San Francisco, CA
Contact Information

Paul Trio
Director, Standards, SEMI
673 S. Milpitas Boulevard
Milpitas, CA  95035
Phone: 1.408.943.7041
Email: ptrio@semi.org

Mayura Padmanabhan
Technical Project Manager, SEMI
673 S. Milpitas Boulevard
Milpitas, CA  95035
Phone: 1.979.739.0690
Email: mpadmanabhan@semi.org
Published SCIS Standards

SEMI F51
Guide for Elastometric Sealing Technology

November 2015 (1115 Update)
Provided Test Methods on Seal Impurities – TOC, surface extractable metallics, ash metals, outgassing, ionics

SEMI E135
Test Method for RF Generators to Determine Transient Response for RF Power Delivery Systems Used in Semiconductor Processing Equipment

September 2017 (0917 Update)
Seal Cleaning, Handling, and Packaging

September 2018 (0918 Update)
• Define nominal load, high impedance load and low impedance load
• Add new Related Information section covering:
  ➢ Rationale for the limited number of required test loads
  ➢ Expected control system gain variation as a function of load impedance on a linear load
  ➢ Nonlinear (plasma) loads
Published SCIS Standards

SEMI Standards Published

SEMI E180
Test Method for Measuring Surface Metal Contamination Through ICP-MS of Critical Chamber Components Used in Semiconductor Wafer Processing

New Standard
• Provides a method for a quantitative analysis for surface trace-metal concentration of critical chamber components (CCCs) by using inductively coupled plasma-mass spectrometry (ICP-MS)

SEMI Standards Published
Published SCIS Standards

SEMI F70.1 - Test Method for Determination of Particle Contribution of Gas Delivery System

- Provides a standardized methodology and procedure for measuring the particle contribution performance of a gas delivery system in terms of number of particles added to gas flowing through the system.
- Applies to surface mount and conventional gas delivery systems used in semiconductor manufacturing equipment.


- Defines a test method for determining organic compounds on the wetted surfaces of ultra high purity (UHP) chemical delivery systems and components.
- Examples of test samples include valves, regulators, filters, and mass flow controllers, tubing, weld fittings, and face seal fittings.

SEMI F115 - Test Method for the Determination of Metallic Elements Present on Wetted Surfaces of Ultra High Purity Chemical Delivery Systems and Components

- Defines a test method for determining metallic elements present on the wetted surfaces of ultra high purity (UHP) chemical delivery systems and components.
SCIS Activities in Development

• Seal Leak Rate
  – Rationale: Seal failure can generate defects through atmospheric leaks into process environments or from degraded seal material. There is a need to develop a standardized way for measuring a seal’s ability to hold vacuum when exposed to elevated temperatures and/or process and clean chemistries.

• Particle Contribution from Slit Valves (Wafer Transfer Valves)
  – Rationale: There is interest in minimizing particles generated by either elastomer or valve assembly
    • Traditionally, at qualification the particle contribution of valves & original elastomer are considered
    • Usually, the next step is the introduction of CIP elastomer
    • If CIP elastomer proves superior (i.e., less particle shed) than original elastomer, then focus can shift to optimizing valve operation parameters (if performance improvement of elastomer is deemed insufficient)
    • And/or if CIP elastomer still fails to meet performance criteria, then focus shifts to changing valve design, valve operation

• Pump Data for Predictive Pump Failure Detection
  – Rationale: Critical pump data can be utilized for predictive pump failure detection. Some of this data can be obtained today while others are not yet widely available.

• Organic Contamination from Critical Components in Relevant Solvents
  – Rationale: Evidence from end-users has linked organic contamination to wafer quality. To date, no standards exist for determining relative organic levels from critical components — most preferably on a bulk and specific basis.

• RF Generator Reliability – SCIS is revisiting topic and plans to identify key contributing issues
SCIS Activities in Development

• Parts Cleaning
  – Rationale: Defectivity can be introduced by various sources during parts cleaning process. There is a need for guidance on available test methodologies and other considerations that impact part cleanliness.
  • Activities on organics, particles as well as development of an over-arching guide for achieving and maintaining chamber component defectivity performance
Dry Pumps
Survey Results [1/2]

- Compiled (a)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Input #1</th>
<th>Input #2</th>
<th>Input #3</th>
<th>Input #4</th>
<th>Input #5</th>
<th>Input #6</th>
<th>Input #7</th>
<th>Cumulative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inlet Pressure</td>
<td>N</td>
<td>Y (as fab)</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>~N</td>
</tr>
<tr>
<td>Vibration</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Noise</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>~N</td>
</tr>
<tr>
<td>Temperature</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>Cooling Water Flow,</td>
<td>Y</td>
<td>Y</td>
<td>Y &amp; N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>~Y</td>
</tr>
<tr>
<td>Temperature</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of Cooling Water</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>~Y</td>
</tr>
<tr>
<td>Speed</td>
<td>Y/N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>~Y</td>
</tr>
<tr>
<td>Exhaust Pressure</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>~Y</td>
</tr>
<tr>
<td>Pump Run Hours</td>
<td>Y/N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>~Y</td>
</tr>
<tr>
<td>Power, Current</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>N2 Purge*</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>
Dry Pumps
Survey Results [2/2]

- Compiled (b)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>(b) Is this data useful?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Input #1</td>
</tr>
<tr>
<td>Inlet Pressure</td>
<td>Y</td>
</tr>
<tr>
<td>Vibration</td>
<td>Y</td>
</tr>
<tr>
<td>Noise</td>
<td>N</td>
</tr>
<tr>
<td>Temperature</td>
<td></td>
</tr>
<tr>
<td>- Cooling Water Flow,</td>
<td>Y</td>
</tr>
<tr>
<td>Temperature</td>
<td></td>
</tr>
<tr>
<td>- Lack of Cooling Water</td>
<td>Y</td>
</tr>
<tr>
<td>Speed</td>
<td>Y/N</td>
</tr>
<tr>
<td>Exhaust Pressure</td>
<td>Y</td>
</tr>
<tr>
<td>Pump Run Hours</td>
<td>Y/N</td>
</tr>
<tr>
<td>Power, Current</td>
<td>Y</td>
</tr>
<tr>
<td>N2 Purge*</td>
<td>Y</td>
</tr>
</tbody>
</table>
• New Standard: Specification for Equipment and Materials Labels (SEMI Draft Document # 6448)
  – To define material Bar Code Label (BCL) standard for all incoming direct materials, parts, and consumables for semiconductor manufacturing.
  – Addresses traceability requirements along the incoming material and parts supply chain to enable effective isolation of defects in the manufacturing process or post manufacturing quality investigation.
  – For suppliers and Original Equipment Manufacturers (OEMs) of direct materials, parts, consumables, repaired parts, clean parts and refurbish parts that have a Certificate of Analysis (COA) or Certificate of Conformance (CoC).
  – Specifies data that is included in Equipment and Material Labels for both machine readable 2D barcode and human readable format in accordance with VDA 4992 - MAT Label and eMat data exchange.

![Example MAT Label (Small Format – 20mm x 50mm)](image-url)
**Equipment & Materials Traceability Task Force**  
**Activities & Status [2/5]**


### Label Information
- Label Version
- Label Revision (of VDA’s spec)

### Part Information
- Customer Part Number
- Manufacturer Part Number
- Ordering Code
- Part Description (Part Name)
- Manufacturer ID
- Manufacturer Location
- Revision Level / Index
- Additional Part Information

### More Part Information
- Date of Manufacturing
- Expiration Date
- RoHS
- Moisture Sensitivity Level

### Logistic and Traceability Information
- Supplier Name
- Supplier ID (or DUNS number)
- Package ID
- Quantity
- Unit of Measure
- Batch-No (e.g., volume, production)
- Batch-No (for clean or repair)
- Order Number
- Delivery Note Number
- Supplier Data

---

**Table 1 VDA 4992 Material Label Data Fields**

<table>
<thead>
<tr>
<th>No.</th>
<th>Data Field</th>
<th>Definition / Description</th>
<th>Length</th>
<th>Format</th>
<th>Status</th>
<th>Examples</th>
<th>Missing / Null Data</th>
<th>Index</th>
<th>Previous Years Data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Type of label, identifies this label as MAT-Label based on VDA 4992 recommendations.</td>
<td></td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Label Version</td>
<td>Revision level is a fixed entry and serves the recognition of the label or its version.</td>
<td>12F</td>
<td>N</td>
<td>M</td>
<td>yes  no</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Label Revision (of VDA’s spec.)</td>
<td>The revision level is a fixed entry and serves the recognition of the label or its version.</td>
<td>5K</td>
<td>N</td>
<td>M</td>
<td>yes  no</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Equipment & Materials Traceability Task Force
Activities & Status [3/5]

• New Standard: Specification for Equipment and Materials Labels (SEMI Draft Document # 6448)
  – Material Label Use Case Scenarios (as part of Related Information Section)

**Cleaned Part**

<table>
<thead>
<tr>
<th>VDA 4992 Field Number</th>
<th>VDA 4992 Data Field</th>
<th>Mapping</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Manufacturer Part Number</td>
<td>Part Number:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• A cleaned or repaired part number can be different than the original OGM part number.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• A supplier may choose to use a different part number to indicate it is refurbished.</td>
</tr>
<tr>
<td>5</td>
<td>Order No. Code</td>
<td>Secondary Part information such as drawing number, software revision on controllers, etc.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>It could also include a cleaning supplier’s assigned part number, which may reference part and/or cleaning procedure.</td>
</tr>
<tr>
<td>10</td>
<td>Additional Part Info</td>
<td>Information agreed to between Customer and Supplier. (e.g. number of times the part was cleaned)</td>
</tr>
<tr>
<td>11</td>
<td>Date of Manufacturing</td>
<td>Date of cleaning or refurbishment</td>
</tr>
<tr>
<td>20</td>
<td>Batch No. #1</td>
<td>Information about the original material or part.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• If the cleaned or repaired part number is different than the original part number, this field contains the original part number as the first piece of information in this data field.</td>
</tr>
<tr>
<td>21</td>
<td>Batch No. #2</td>
<td>Information about the cleaning process (e.g. cleaning batch information).</td>
</tr>
<tr>
<td>22</td>
<td>Order Number</td>
<td>Customer PO Number.</td>
</tr>
</tbody>
</table>

**New Part**

<table>
<thead>
<tr>
<th>VDA 4992 Field Number</th>
<th>VDA 4992 Data Field</th>
<th>Mapping</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Ordering Code</td>
<td>Secondary Part information such as drawing number, software revision on controllers, etc.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The GTIN or EAN manufacturer part number is recorded in this field.</td>
</tr>
<tr>
<td>20</td>
<td>Batch No. #1</td>
<td>Information about the material or part.</td>
</tr>
<tr>
<td>21</td>
<td>Batch No. #2</td>
<td>Hardcoded value as an empty string (**).</td>
</tr>
<tr>
<td>22</td>
<td>Order Number</td>
<td>Customer PO Number.</td>
</tr>
</tbody>
</table>

**Consumable Material**

<table>
<thead>
<tr>
<th>VDA 4992 Field Number</th>
<th>VDA 4992 Data Field</th>
<th>Mapping</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Ordering Code</td>
<td>Secondary Part information such as drawing number, software revision on controllers, etc.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The GTIN or EAN manufacturer part number is recorded in this field.</td>
</tr>
<tr>
<td>20</td>
<td>Batch No. #1</td>
<td>Information about the material.</td>
</tr>
<tr>
<td>21</td>
<td>Batch No. #2</td>
<td>Hardcoded value as an empty string (**).</td>
</tr>
<tr>
<td>22</td>
<td>Order Number</td>
<td>Customer PO Number.</td>
</tr>
</tbody>
</table>
Contact Information

Mayura P
Technical Project Manager
673 S. Milpitas Boulevard
Milpitas, CA 95035
Phone: 1.979.739.0690
Email: mpadmanabhan@semi.org

Paul Trio
Director, Standards
673 S. Milpitas Boulevard
Milpitas, CA 95035
Phone: 1.408.943.7041
Email: ptrio@semi.org