Bond Testing
Find Every Failure™

www.nordsondage.com
Complete Integration

For over fifty years DAGE has been the market leading provider of award winning Bond Test Systems.

Produced at our state of the art production facility in Aylesbury, UK and engineered for excellence to ensure ultimate accuracy and repeatability, DAGE Bondtesters are at the forefront of technology to meet the wide range of applications required by our customers.

Pioneers of Bond Testing

- **1960s**: DAGE established
- **1970s**: First dedicated Bondtesters introduced
  - BST12 pull system launched with pull capability up to 100g
- **1980s**: Introduction of Bondtesters with selectable destruct and non-destruct modes
  - Adjustable load rate introduced
- **1990s**: MCT20/22 introduces microprocessor control
  - First intelligent tool landing and ball shear
  - BT22A increases load range to 20kg
- **2000s**: First PC controlled Bondtester, the PC2400
  - Hot bump pull load cartridge invented by DAGE
  - Industry standard 4000 Bondtester launched
- **2010s**: Series 5000 launched pioneering 25µm ultra-fine pitch
  - Cold bump pull test patented by DAGE
  - Patents granted on DAGE load cartridge
  - Rotating shear load cartridge introduced
  - 4000Plus Bondtester launched, industry first dual Bondtester and Micro-materials tester
  - Paragon™ software introduces camera assist automation
  - 4800 INTEGRA™ with EFEM integration and SECS/GEM
The Right Product for the Right Application

Production

4000

The Gold Standard Bondtester

400 OPTIMA

Production Bondtester

4000PLUS

Advanced Bondtester

Operator-Free

4600

Automated Bondtester

4600-W, LF

Automated Parts Handler

4800 INTEGRA™

Semiconductor Wafer Tester

R&D

4000 HS

CLEAN ROOM

High Strain Rate Tester

“HIPSPECTOR”

Micro-Materials Tester

Bond Testing

Automated Bond Testing

Materials Testing
Gold Standard Bondtester - Series 4000

Fast set-up, easy to learn, maximum comfort.

“\[\text{I spend a lot of time manually testing. I chose the 4000 as it is the most ergonomic and easy-to-use system.}\]”

Advanced Bondtester - 4000Plus

Superior accuracy for complex samples and advanced test types.

“\[\text{My samples are complex with a wide variety of components. The 4000Plus gives me the accuracy and flexibility I need.}\]”
Automated Testing - 4600 Series

Maximum repeatability for the most demanding applications.

Highest complexity products
Maximum repeatability and accountability
Ultimate precision

"My interconnects are extremely small and it is crucial to remove operator influence. The 4600 ensures each test is 100% reproducible."

Automated Applications

Automatic parts handling with the 4600-W and 4600-LF.

Remove handling errors and operator influence with automated benchtop product handling. Applicable for lead frames and wafers up to 200mm.

Automatic battery cell inspection and testing - 4600 Battery.

Test every connection before your batteries leave the factory. The 4600 Battery non-destructively tests 100% of welds.
Dedicated Wafer Tester - 4800

High density interconnect quality control.

I perform front end testing on bumps and pillars for a range of wafer sizes. The 4800 even handles my extremely warped wafers.

Semiconductor Wafer Tester - 4800 INTEGRA™

Integrated wafer handling that’s clean room compatible.

I test a high volume of wafers and achieve the highest throughput with the 4800 INTEGRA.
High Strain Rate Tester – 4000HS

Characterize lead free solder and replicate board drop testing using high strain rate tests.

I need to qualify the performance of new solder. I can only achieve this with high strain rate testing.

Made for Micro™ – Prospector™

Bend, fatigue, creep testing and more with our advanced miro-materials tester.

I qualify new devices and materials before they are transferred to production. Now I can characterize every component and even do lifetime testing.

Materials

Unique test modes

Electrical

Thermal

Find complex and unique failure modes

Entire PCBA

Solder and bumps

Solder characterization

Drop testing simulator
Find Every Failure

**Test Components**

- Wirebond
- Solder Ball
- Ribbon
- Tab
- Die
- Surface Mount Device
- Surface Pad
- Micro-pillar

**Advanced Tests**

- Cavity Shear
- Passivation Shear
- Micro-pillar Shear (base)
- Micro-pillar Shear (cap)

**Standard Pull Tests**

- Wirebond Pull
- Ribbon Pull
- Cold Bump Pull

**Standard Shear Tests**

- Wirebond Shear
- Ribbon Shear
- Ball Shear

**Variable heights and dimensions.**

- For difficult to grip or small dimensions.
  - Stud Pull
  - Hot Bump Pull
  - Micro-pillar CBP

**Larger components and higher forces.**

- Surface Mount Device Shear
- Die Shear
- High Force Shear
- Vector Pull
Micro-Materials Testing

Component dimensions vary significantly for micro-materials testing (mm – µm).

Defining the test geometry and sample dimensions enables measurement of underlying materials properties.

Knowing the sample shape and size is critical for data analysis.

Micro-Materials Test Types

- Material Properties
- Component Lifetime
- Load and Displacement Control
- Stress and Strain
- Statistical Analysis

4 Point Bend
3 Point Bend
Cantilever Bend
Torsion Conversion Rotate

90° Peel
Spherical Bend
Die Bend
Scratch

Creep
Shear
Compress
Heated Die Shear
Bond Test Failure Modes

Solder Ball Shear Testing

<table>
<thead>
<tr>
<th>Failure Mode</th>
<th>Description</th>
<th>Illustration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ductile</td>
<td>Solder ball fracture at or above the surface of the solder mask within the bulk solder material.</td>
<td><img src="image" alt="Ductile Illustration" /></td>
</tr>
<tr>
<td>Pad Lift</td>
<td>Solder pad lifts with solder ball; lifted pad may include ruptured base material.</td>
<td><img src="image" alt="Pad Lift Illustration" /></td>
</tr>
<tr>
<td>Ball Lift</td>
<td>Solder ball lifts from pad; pad is not completely covered by solder/intermetallic and the top surface of the pad plating is exposed.</td>
<td><img src="image" alt="Ball Lift Illustration" /></td>
</tr>
<tr>
<td>Interfacial Break</td>
<td>The break is at the solder/intermetallic interface or intermetallic/base metal interface. The interfacial fracture may extend across the entire pad or be the dominant failure mode at the tool contact region.</td>
<td><img src="image" alt="Interfacial Break Illustration" /></td>
</tr>
</tbody>
</table>

Solder Ball Pull Testing

<table>
<thead>
<tr>
<th>Failure Mode</th>
<th>Description</th>
<th>Illustration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type A: Ductile</td>
<td>A – Ductile: Solder ball fracture at or above the surface of the solder mask within the bulk solder material.</td>
<td><img src="image" alt="Ductile Illustration" /></td>
</tr>
<tr>
<td>Type B: Quasi-Ductile</td>
<td>B – Quasi-Ductile: Mixed ductile/brittle fracture with the dominant failure mode (&gt;50% area) being ductile.</td>
<td><img src="image" alt="Quasi-Ductile Illustration" /></td>
</tr>
<tr>
<td>Type A: Pad Lift</td>
<td>A – Pad Lift: Solder pad lifts with solder ball.</td>
<td><img src="image" alt="Pad Lift Illustration" /></td>
</tr>
<tr>
<td>Or Type B: Pad Crater</td>
<td>B – Pad Crater: Lifted pad includes ruptured base material.</td>
<td><img src="image" alt="Pad Crater Illustration" /></td>
</tr>
<tr>
<td>Non-wet</td>
<td>Solder ball lifts from pad and any portion of the pad top-surface plating is exposed.</td>
<td><img src="image" alt="Non-wet Illustration" /></td>
</tr>
<tr>
<td>Type A: Brittle</td>
<td>A – Brittle: The break is at the solder/intermetallic interface or intermetallic/base metal interface.</td>
<td><img src="image" alt="Brittle Illustration" /></td>
</tr>
<tr>
<td>Type B: Quasi-Brittle</td>
<td>B – Quasi-Brittle: Mixed brittle/ductile fracture with the dominant failure mode (&gt;50% area) being brittle.</td>
<td><img src="image" alt="Quasi-Brittle Illustration" /></td>
</tr>
<tr>
<td>Ball Extrusion</td>
<td>Solder ball is stretched but not fractured. Invalid failure – repeat test with replacement solder ball samples after appropriate adjustments.</td>
<td><img src="image" alt="Ball Extrusion Illustration" /></td>
</tr>
</tbody>
</table>
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