Background Statement for SEMI Draft Document 6123
Reapproval of SEMI F81-0611, SPECIFICATION FOR VISUAL INSPECTION AND ACCEPTANCE OF GAS TUNGSTEN ARC (GTA) WELDS IN FLUID DISTRIBUTION SYSTEMS IN SEMICONDUCTOR MANUFACTURING APPLICATIONS

Notice: This background statement is not part of the balloted item. It is provided solely to assist the recipient in reaching an informed decision based on the rationale of the activity that preceded the creation of this Document.

Notice: Recipients of this Document are invited to submit, with their comments, notification of any relevant patented technology or copyrighted items of which they are aware and to provide supporting documentation. In this context, “patented technology” is defined as technology for which a patent has issued or has been applied for. In the latter case, only publicly available information on the contents of the patent application is to be provided.

Background
Per SEMI Regulations ¶ 8.9.1, the Originating TC Chapter shall review its Standards and decide whether to ballot the Standards for reapproval, revision, replacement, or withdrawal by the end of the fifth year after their latest publication or reapproval dates.

The Facilities & Gases NA TC Chapter reviewed and recommended to issue for reapproval ballot.

Per SEMI Procedure Manual (NOTE 21), a reapproval Letter Ballot should include the Purpose, Scope, Limitations, and Terminology sections, along with the full text of any paragraph in which editorial updates are being made.

Voter requests for access to the full Standard or Safety Guideline must be made at least three business days before the voting deadline. Late requests may not be honored.

The ballot results will be reviewed and adjudicated at the meetings indicated in the table below. Check www.semi.org/standards under Calendar of Events for the latest update.

Review and Adjudication Information

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<th>Group:</th>
<th>Task Force Review</th>
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<td>Materials of Construction of Gas Delivery Systems Task Force</td>
<td>Facilities &amp; Gases Joint TC Chapter</td>
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| Date: | Monday, April 3, 2017 | Tuesday, April 4, 2017 |
| Time & Time Zone: | 09:00 – 10:00 PST | 09:00 – 12:00 Noon PST |
| Location: | SEMI Headquarters | SEMI Headquarters |
| City, State/Country: | Milpitas, California/USA | Milpitas, California/USA |
| Leader(s): | Bill Kiikvee (AP Tech) | Steve Lewis (LPCiminelli) Mohamed Saleem (Fujikin) |
| Standards Staff: | Laura Nguyen Inguyen@semi.org | Laura Nguyen Inguyen@semi.org |

This meeting’s details are subject to change, and additional review sessions may be scheduled if necessary. Contact Standards staff for confirmation.

Telephone and web information will be distributed to interested parties as the meeting date approaches. If you will not be able to attend these meetings in person but would like to participate by telephone/web, please contact Standards staff.
SEMI Draft Document 6123
Reapproval of SEMI F81-0611, SPECIFICATION FOR VISUAL INSPECTION AND ACCEPTANCE OF GAS TUNGSTEN ARC (GTA) WELDS IN FLUID DISTRIBUTION SYSTEMS IN SEMICONDUCTOR MANUFACTURING APPLICATIONS

This Standard was technically approved by the global Gases Committee. This edition was approved for publication by the global Audits & Reviews Subcommittee on May 13, 2011. Available at www.semiviews.org and www.semi.org in June 2011; originally published November 2003.

1 Purpose
1.1 The purpose of this Specification is to provide visual inspection and acceptance criteria for gas tungsten arc (GTA) welds of stainless steel and other corrosion resistant metals and alloys (CRAs) in fluid (liquid or gas) distribution systems in semiconductor manufacturing applications. These criteria are meant to ensure that the required system purity, weld integrity, and weld strength for use in semiconductor manufacturing applications.

2 Scope
2.1 This Specification defines inspection and acceptance criteria for GTA autogenous butt joint welds of stainless steel and other CRAs in fluid distribution systems. The fluid distribution system includes tubing, pipe, fittings, valves, subassemblies and components that contain and distribute fluid.

NOTICE: SEMI Standards and Safety Guidelines do not purport to address all safety issues associated with their use. It is the responsibility of the users of the documents to establish appropriate safety and health practices, and determine the applicability of regulatory or other limitations prior to use.

3 Limitations
3.1 The stainless steels covered by this specification are limited to the austenitic and superaustenitic grades of stainless steel.

3.2 Corrosion resistant metals and alloys covered by this specification are limited to solid solution grades of nickel alloys and solid solution grades of titanium alloys.

3.3 This Specification applies only to autogenous GTA circumferential butt joint welds performed on fluid distribution system components 6 inches (150 mm) or less in diameter.

3.4 This Specification applies only to automatic, mechanized, or machine GTA welding processes.

3.5 This Specification applies only to welds performed with no fillers and no fluxes.

3.6 This Specification does not apply to pressure vessel or process chamber welds.

4 Referenced Standards and Documents
NOTE 1: The following documents become part of the specification to the extent that they are included herein.

4.1 SEMI Standards and Safety Guidelines
SEMI F78 — Practice for Gas Tungsten Arc (GTA) Welding of Fluid Distribution Systems in Semiconductor Manufacturing Applications

4.2 ASME Standards
ASME BPE — Bioprocessing Equipment Standard

1 American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016-5990, USA; Telephone: 973.882.1170, Fax: 973.882.1717, http://www.asme.org
4.3 *ASNT Standards*\(^2\)
ASNT SNT-TC-1A — Personnel Qualification and Certification in Nondestructive Testing

4.4 *AWS Standards*\(^3\)
AWS QC-1 — Standard for AWS Certification of Welding Inspectors
AWS A3.0 — Standard Welding Terms and Definitions Including Terms for Adhesive Bonding, Brazing, Soldering, Thermal Cutting, and Thermal Spraying

**NOTICE:** Unless otherwise indicated, all documents cited shall be the latest published versions.

5 **Terminology**\(^4\)

5.1 **Definitions**

5.1.1 *angular misalignment* — the condition that exists when the tubing angle is changed at the weld.

5.1.2 *autogenous weld* — a fusion weld made without filler metal.\(^2\)

5.1.3 *automatic arc welding downslope* — the time during which the welding current is reduced continuously from the final level until the arc is extinguished.

5.1.4 *axial misalignment* — the distance between the axes of the two parts joined by a weld, measured perpendicularly to those axes.

5.1.5 *bead* — non-standard term for *weld bead*.\(^2\)

5.1.6 *bead overlap* — in a pulsed weld the amount of coverage of a weld pulse of the previous weld pulse, usually measured in percentage of the diameter of the pulse.

5.1.7 *bead width* — the width of the weld bead on the ID, normally measured in units of \(T\), where \(T\) is the nominal tube wall thickness.

5.1.8 *centerline shrinkage* — a profile-reducing defect or discontinuity normally formed by shrinkage during solidification.

5.1.9 *concavity* — a condition in which the surface of a weld is depressed relative to the surface of the tube or pipe. Concavity is measured as a maximum distance from the outside or inside diameter surface of a weld along a line perpendicular to a line joining the weld toes.\(^3\)

5.1.10 *convexity* — a condition in which the surface of a weld is extended relative to the surface of the tube or pipe. Convexity is measured as a maximum distance from the outside or inside diameter surface of a weld along a line perpendicular to a line joining the weld toes.\(^3\)

5.1.11 *coupon* — weld sample which is inspected to insure that the weld meets specifications.

5.1.12 *discoloration* — any change in surface color from that of the base metal. Usually associated with *oxidation* occurring on the weld and heat affected zone on the outside and inside diameter of the weld joint as a result of heating the metal during welding. Colors may range from pale bluish-gray to deep blue, and from pale straw color to a black crusty coating.\(^3\)

5.1.13 *downslope* — see automatic arc welding downslope.

5.1.14 *electrode* — non-standard term for tungsten electrode.\(^2\)

5.1.15 *examiner* — a person who performs examination of a particular object, or evaluates an operation, for compliance to a given standard. The examiner performs quality control for the manufacturer, fabricator, or erector.

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\(^2\) The American Society for Nondestructive Testing, PO Box 28518, 1711 Arlington Gate, Columbus, OH 43228-0518, USA; Telephone: 800.222.2768; Fax: 614.274.6899; [http://www.asnt.org](http://www.asnt.org)

\(^3\) American Welding Society, 550 N.W. LeJeune Road, Miami, FL 33135, USA; Telephone: 800.443.9353; [http://www.aws.org](http://www.aws.org)

\(^4\) The terminology has been derived from the following sources: (1) Webster’s New World College Dictionary Fourth Edition; (2) ANSI/AWS A3.0 Standard Welding Terms and Definitions; (3) ASME BPE Bioprocessing Equipment Standard.
5.1.16 fluid — liquid or gas.¹

5.1.17 gas — the fluid form of a substance in which it can expand indefinitely and completely fill its container; form that is neither liquid or solid.¹

5.1.18 gas tungsten arc welding (GTAW) — an arc welding process that uses an arc between a tungsten electrode (nonconsumable) and the weld pool. The process is used with a shielding gas.³

5.1.19 heat-affected zone (HAZ) — the portion of the base metal whose mechanical properties or microstructure have been altered by the heat of welding.²

5.1.20 inclusion — entrapped foreign solid material, such as slag, flux, tungsten, or oxide.²

5.1.21 inert gas — a gas that normally does not combine chemically with materials. A protective atmosphere.

5.1.22 liquid — having its molecules moving freely with respect to each other so as to flow readily, unlike a solid, but because of cohesive forces not expanding infinitely like a gas.¹

5.1.23 meandering — of or pertaining to a weld bead that deviates from side to side across the weld joint rather than tracking the joint precisely.³

5.1.24 orbital welding — automatic or machine welding of tubes or pipes in-place with the electrode rotating (or orbiting) around the work. Orbital welding, as it applies to this standard, is a fusion process without the addition of filler.³

5.1.25 oxidation — the formation of an oxide layer on a metal surface.³

5.1.26 profile defect — any defect or discontinuity that reduces the wall thickness below that of the parent metal.

5.1.27 pulsed gas tungsten arc welding — a gas tungsten arc welding process variation in which the current is varied in regular intervals.

5.1.28 purge — the application of an inert gas, or gas mixture, to the OD or ID surface of the weld joint to displace non-inert atmospheric gases. A block purge is a non-flowing purge with positive pressure.

5.1.29 purge gas — an inert gas, or gas mixture, used to displace the ambient atmosphere from the inside (ID) of the weld joint.

5.1.30 root surface — the exposed surface of a weld opposite the side from which the welding was done.²

5.1.31 shield gas — inert gas, or gas mixture, that protects the electrode and molten puddle from atmosphere and provides the required arc characteristics.

5.1.32 slag — a non-metallic product resulting from the mutual dissolution of non-metallic impurities in some welding processes.²

5.1.33 tack weld — a weld made to hold the parts of a weldment in proper alignment until the final welds are made.²

5.1.34 tungsten — non-standard term for tungsten electrode.

5.1.35 tungsten electrode — a non-filler electrode used in arc welding, made principally of tungsten.²

5.1.36 undercut — a groove adjacent to the base metal at the edge of the weld left unfilled by weld metal.²

5.1.37 weld bead — a weld resulting from a weld pass.²

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