

IPC J-STD-001H
September 2020
Supersedes IPC J-STD-001G
October 2017

JOINT INDUSTRY STANDARD

Requirements for
Soldered Electrical
and Electronic
Assemblies



BUILD ELECTRONICS BETTER



participants from
27 countries
contributed to this standard 

The Principles of Standardization

In May 1995 the IPC's Technical Activities Executive Committee (TAEC) adopted Principles of Standardization as a guiding principle of IPC's standardization efforts.

Standards Should:

- Show relationship to Design for Manufacturability (DFM) and Design for the Environment (DFE)
- Minimize time to market
- Contain simple (simplified) language
- Just include spec information
- Focus on end product performance
- Include a feedback system on use and problems for future improvement

Standards Should Not:

- Inhibit innovation
- Increase time-to-market
- Keep people out
- Increase cycle time
- Tell you how to make something
- Contain anything that cannot be defended with data

Notice

IPC Standards and Publications are designed to serve the public interest through eliminating misunderstandings between manufacturers and purchasers, facilitating interchangeability and improvement of products, and assisting the purchaser in selecting and obtaining with minimum delay the proper product for his particular need. Existence of such Standards and Publications shall not in any respect preclude any member or nonmember of IPC from manufacturing or selling products not conforming to such Standards and Publication, nor shall the existence of such Standards and Publications preclude their voluntary use by those other than IPC members, whether the standard is to be used either domestically or internationally.

Recommended Standards and Publications are adopted by IPC without regard to whether their adoption may involve patents on articles, materials, or processes. By such action, IPC does not assume any liability to any patent owner, nor do they assume any obligation whatever to parties adopting the Recommended Standard or Publication. Users are also wholly responsible for protecting themselves against all claims of liabilities for patent infringement.

IPC Position Statement on Specification Revision Change

It is the position of IPC's Technical Activities Executive Committee that the use and implementation of IPC publications is voluntary and is part of a relationship entered into by customer and supplier. When an IPC publication is updated and a new revision is published, it is the opinion of the TAEC that the use of the new revision as part of an existing relationship is not automatic unless required by the contract. The TAEC recommends the use of the latest revision. Adopted October 6, 1998

Why is there a charge for this document?

Your purchase of this document contributes to the ongoing development of new and updated industry standards and publications. Standards allow manufacturers, customers, and suppliers to understand one another better. Standards allow manufacturers greater efficiencies when they can set up their processes to meet industry standards, allowing them to offer their customers lower costs.

IPC spends hundreds of thousands of dollars annually to support IPC's volunteers in the standards and publication development process. There are many rounds of drafts sent out for review and the committees spend hundreds of hours in review and development. IPC's staff attends and participates in committee activities, typesets and circulates document drafts, and follows all necessary procedures to qualify for ANSI approval.

IPC's membership dues have been kept low to allow as many companies as possible to participate. Therefore, the standards and publications revenue is necessary to complement dues revenue. The price schedule offers a 50% discount to IPC members. If your company buys IPC standards and publications, why not take advantage of this and the many other benefits of IPC membership as well? For more information on membership in IPC, please visit www.ipc.org or call 847/597-2809.

Thank you for your continued support.



IPC J-STD-001H

Requirements for Soldered Electrical and Electronic Assemblies

If a conflict occurs between the English and translated versions of this document, the English version will take precedence.

Developed by the J-STD-001 Task Group (5-22A), J-STD-001 Task Group – Europe (5-22A-EU), J-STD-001 Task Group – China (5-22ACN) of the Assembly and Joining Committees (5-20) of IPC

Supersedes:

J-STD-001G - October 2017
J-STD-001F WAM1 -
February 2016
J-STD-001F - July 2014
J-STD-001E - April 2010
J-STD-001D - February 2005
J-STD-001C - March 2000
J-STD-001B - October 1996
J-STD-001A - April 1992

Users of this publication are encouraged to participate in the development of future revisions.

Contact:

IPC
3000 Lakeside Drive, Suite 105N
Bannockburn, Illinois
60015-1249
Tel 847 615.7100
Fax 847 615.7105

ADOPTION NOTICE

J-STD-001, "Requirements for Soldered Electrical and Electronic Assemblies", was adopted on 19-JUL-01 for use by the Department of Defense (DoD). Proposed changes by DoD activities must be submitted to the DoD Adopting Activity: Commander, US Army Tank-Automotive and Armaments Command, ATTN: AMSTA-TR-E/IE, Warren, MI 48397-5000. Copies of this document may be purchased from the The Institute for Interconnecting and Packaging Electronic Circuits, 2215 Sanders Road, Northbrook, IL 60062-6135. <http://www.ipc.org/>

Custodians:

Army - AT
Navy - AS

Adopting Activity:

Army - AT
(Project OCLD-0059)

Reviewer Activities:

Army - AV, MI

AREA SOLD

DISTRIBUTION STATEMENT A: Approved for public release; distribution is unlimited.

Acknowledgment

Any document involving a complex technology draws material from a vast number of sources across many continents. Shown below are the principal members of the J-STD-001 Task Group (5-22A), J-STD-001 Task Group – Europe (5-22A-EU), J-STD-001 Task Group – China (5-22ACN) of the Assembly and Joining Committees (5-20). It is not possible to include all of those who assisted in the evolution of this standard. To each of them, the members of IPC extend their gratitude.

Assembly and Joining Committee

Chair
Daniel Foster
Missile Defense Agency

Vice Chair
Karen Tellefsen
MacDermid Alpha Electronics Solutions

J-STD-001 Task Group (5-22A)

Co-Chairs
Milea Kammer
Honeywell International

Jonathon Vermillion
Ball Aerospace

Vice Chairs
Gaston Hidalgo
Toyota Motor North America

Jarrold Webb
Lockheed Missiles & Fire Control

J-STD-001 Task Group – Europe (5-22A-EU)

Co-Chairs
Tiberiu Baranyi
Flextronics Romania SRL

Debbie Wade
Advanced Rework Technology – A.R.T.

J-STD-001 Task Group – China (5-22ACN)

Co-Chairs
Ren Kang
AVIC Computing Technique
Research Institute

Yabing Zou
The 5th Electronic Institute of MII

Vice Chair
Eric Li
TT Electronics Intermediate Manufacturing
Services (Suzhou) Limited

Technical Liaison of the IPC Board of Directors

Bob Neves
Microtek (Changzhou) Laboratories

Contributing J-STD-001 Task Group Members

Gianluca Esposito
Warren Harper
Bruce Hughes
Kathy Johnston
Evan Levy
Randy McNutt
Mary Muller
Sukhraj Takhar
Allen Thai
Arye Grushka, A. A. Training
Consulting and Trade A.G. Ltd.
Douglas Schueler, AbelConn, LLC
Neil Welford, AbelConn, LLC
Ross Dillman, ACI Technologies, Inc.
Constantino Gonzalez, ACME
Training & Consulting
Pietro Vergine,* Advanced Rework
Technology – A.R.T.

John Jukes, Advanced Rework
Technology – A.R.T.
Debbie Wade,* Advanced Rework
Technology – A.R.T.
Michael Wierleski, Aerojet
Rocketdyne
Brandy Tharp, AeroTEC Inc.
Fernando Perez Gracia,* Airbus
Defence & Space
Claus Molgaard,* ALPHA-elektronik
A/S
Chris Stuber, American Hakko
Products Inc.
Christopher Sewell, AMETEK
Leo Huang, APCB Electronics
(Thailand) Co., Ltd
Stefan Hanigk,* Ariane Group GmbH
Rob Mullane,* Atek Training
Services Ltd.

Bob Potysman, ATRON Group LLC
Arvind Karthikeyan, Auburn
University
Marino Verderio,* Automotive
Lighting SpA
Xin Chen,** AVIC ACTRI
Bingjin Liu,** AVIC ACTRI
Kang Ren,** AVIC Xi'an
Aeronautics Computing Technical
Research Institute
Liang Jia,** AVIC Taiyuan
Aero-Instruments Co., Ltd.
Caroline Harris, Axis Electronics Ltd.
Chris Jukes,* Axis Electronics Ltd.
Erik Bjerke, BAE Systems
Ana Contreras, BAE Systems
Tim Gallagher, BAE Systems

Greg Hurst, BAE Systems
 Joseph Kane, BAE Systems
 Maan Kokash, BAE Systems
 Kelly Kovalovsky, BAE Systems
 Andrew Leslie, BAE Systems
 Agnieszka Ozarowski, BAE Systems
 Brian Parlman, BAE Systems
 Marie Parlman, BAE Systems
 Marissa Pati, BAE Systems
 Darrell Sensing, BAE Systems
 Jonathon Vermillion, Ball Aerospace & Technologies Corp.
 Sonny Villa, Ball Aerospace & Technologies Corp.
 Gerald Bogert, Bechtel Plant Machinery, Inc.
 Jenny Lee,** Beijing Hangxing Technologies Co.,Ltd.
 Glory Yin,** Beijing Hangxing Technologies Co., Ltd.
 James Barnhart, BEST Inc.
 Jodi Johnson, BEST Inc.
 Norman Mier, BEST Inc.
 Kris Roberson, BEST Inc.
 Dorothy Cornell, Blackfox Training Institute
 Samuel Sorto, Blue Origin, LLC
 David Lee, BMK Professional Electronics GmbH
 Eric Harenburg, Boeing Company
 Karl Mueller, Boeing Company
 Ruby Lei,** BrainPower
 Dawn Cabales, Carlisle Interconnect Technologies
 Tawsha Cabales, Carlisle Interconnect Technologies
 Vesna Delic, Carlisle Interconnect Technologies
 Jason Keeping, Celestica International L.P.
 Weiming Li,** CEI REI Laboratory
 Jie Chen,** Chengshu Yaguang Electronics Co., Ltd.
 Changqing Feng,** China Household Electric Appliance Research Institute
 Stephen Perng, Cisco Systems Inc.
 Sean Keating, Clonfert Solutions Ltd
 Yeung Cheung,** CML EurAsia
 David Adams, Collins Aerospace
 William Cardinal, Collins Aerospace
 Caroline Ehlinger, Collins Aerospace
 David Hillman, Collins Aerospace
 Scott Meyer, Collins Aerospace
 Bonnie Pape, Collins Aerospace
 Douglas Pauls, Collins Aerospace
 Timothy Pearson, Collins Aerospace
 David Rafson, Collins Aerospace
 Debie Vorwald, Collins Aerospace
 Dan White, Collins Aerospace
 Alan Sun,** CommScope Telecommunications (China) Co. Ltd.
 Andreas Gregor,* Consultronica, S.L.
 Michael Haas, Conti Temic Microelectronic GmbH
 Alain Le Grand, Continental Automotive France SAS
 Hans-Otto Fickenscher, Continental Automotive GmbH
 Manuel Tabarez, Continental Automotive Nogales S.A. de C.V.
 Mark Fulcher, Continental Automotive Systems
 Stanton Rak, Continental Automotive Systems
 Catalina Pamatmala, Continental Temic Electronics (Philis.)
 Miguel Dominguez, Continental Temic SA de CV
 Jose Servin Olivares, Continental Temic SA de CV
 Kathleen Kouthong, Crane Aerospace & Electronics
 Danqing Wen,** CSIC Xi'an DongYi Science Technology & Industry Group Co., Ltd
 Robin Bridge, Curtiss-Wright Defense Solutions
 Symon Franklin,* Custom Interconnect Ltd
 Jacqueline Topple, Custom Interconnect Ltd
 David Barastegui, DBMTech
 Wallace Ables, Dell Inc.
 Stuart Longgood, Delphi Technologies
 Nicholas Castro, Delta Group Electronics Inc.
 Tod Cummins, Delta Group Electronics Inc.
 Irene Romero, Delta Group Electronics Inc.
 Brent Wyatt, Delta Group Electronics Inc
 Timothy McFadden, EEI Manufacturing Services
 Emma Hudson, Emma Hudson Technical Consultancy Ltd
 Melissa Holland, EPTAC Corporation
 Leo Lambert, EPTAC Corporation
 Marcia McLaughlin, EPTAC Corporation
 Helena Pasquicelli, EPTAC Corporation
 Ramon Koch, ETECH-training
 Iair M. Zilberstein,* Exmel Solutions Ltd
 Cylind Zhang,** Flextronics Electronics Technology (Suzhou) Co. Ltd.
 Tiberiu Baranyi,* Flextronics Romania SRL
 Sasha Andreas, Flight Critical
 Harald Olsen,* FMC Technologies AS
 Nancy Deng,** Ford Motor Research Engineering Co., Ltd
 Eric Camden, Foresite, Inc.
 Francisco Fourcade,* Fourcad, Inc
 Kurt McLain, Frontier Electronic Systems
 Henrik Jensen,* Gaasdal Bygningsindustri A/S
 Petrel Pang,** Ganzhou Kingsun Technology Co., Ltd.
 Christopher Hunt, Gen3 Systems Limited
 Graham Naisbitt, Gen3 Systems Limited
 Richard Stadem, General Dynamics Mission Systems
 Melby Thelakkaden, General Dynamics Mission Systems
 Francesco Di Maio,* GESTLABS S.r.l.
 Antonio Perna,* GESTLABS S.r.l.

Alejandro Cruz Voost, GPV Americas S.A.P. I de C.V.	Mitsuhiro Asaka, Japan Unix Co., Ltd.	William Fox, Lockheed Martin Missiles & Fire Control
Jesper Djurhuus,* GPV Electronics A/S	Yusaku Kono, Japan Unix Co., Ltd.	Josh Goolsby, Lockheed Martin Missiles & Fire Control
Torben Kruse,* Grundfos Holding A/S	Toshiyasu Takei, Japan Unix Co., Ltd.	Ben Gumpert, Lockheed Martin Missiles & Fire Control
Svein Olav Kolbu,* Hapro AS	Alan Young, Jet Propulsion Laboratory	Alafio Hewitt, Lockheed Martin Missiles & Fire Control
Beverley Christian, HDP User Group	Jose Delgado, Jet Propulsion Laboratory	Joshua Hudson, Lockheed Martin Missiles & Fire Control
Torsten Schmidt, HELLA GmbH & Co. KGaA	Reza Ghaffarian, Jet Propulsion Laboratory	Sharissa Johns, Lockheed Martin Missiles & Fire Control
Thomas Lauer,* HENSOLDT Sensors GmbH	James Toth, Jim Toth Solutions, LLC	Kyle Johnson, Lockheed Martin Missiles & Fire Control
Keith Walker, Honeywell Aerospace	Neal Reek, Johns Hopkins University	Vijay Kumar, Lockheed Martin Missiles & Fire Control
Phil Befus, Honeywell Aerospace	Vicki Hagen, Justice Electronic Training Services	Kevin Boblits, K&M Manufacturing Solutions, LLC
John Mastorides, Honeywell Aerospace	Kevin Boblits, K&M Manufacturing Solutions, LLC	Gerald Adams, KBRwyle
Christina Rutherford, Honeywell Aerospace	Sue Powers-Hartman, Killdeer Mountain Manufacturing, Inc.	Nancy Bullock-Ludwig, Kimball Electronics
Richard Rumas, Honeywell Canada	Nancy Bullock-Ludwig, Kimball Electronics	Eileen Xiang,** Kimball Electronic (Nanjing) Co., Ltd.
Milea Kammer, Honeywell International	Eileen Xiang,** Kimball Electronic (Nanjing) Co., Ltd.	Grunde Gjertsen,* Kitec A/S
Elizabeth Benedetto, HP Inc.	Grunde Gjertsen,* Kitec A/S	Mike Bixenman, Kyzen Corporation
Kristen Troxel, HP Inc.	Mike Bixenman, Kyzen Corporation	Thomas Forsythe, Kyzen Corporation
Jennie Hwang, H-Technologies Group	Thomas Forsythe, Kyzen Corporation	David Lober, Kyzen Corporation
Joe Hughes, Hughes Circuits, Inc.	David Lober, Kyzen Corporation	Augustin Lober,* L&G Advice Serv SRL
Jens Andersen,* HYTEK	Augustin Lober,* L&G Advice Serv SRL	Theodor Laser, L3Harris Communications
Alex Christensen,* HYTEK	Theodor Laser, L3Harris Communications	Frederick Beltran, L3Harris Communications
Poul Juul, HYTEK	Frederick Beltran, L3Harris Communications	Shelley Holt, L3Harris Communications
Jonathan Albriex,* IFTEC	Shelley Holt, L3Harris Communications	Jared Spencer, L3Harris Communications
Jean-Luc Umbdenstock, IFTEC	Jared Spencer, L3Harris Communications	Keld Maaloe,* LEGO Systems A/S
Mirko Giannecchini,* IIS Progress SRL	Keld Maaloe,* LEGO Systems A/S	Rebekah Kovarik, Lockheed Martin
Luca Moliterni,* IIS Progress SRL	Rebekah Kovarik, Lockheed Martin	Jeff Friedman, Lockheed Martin Corporation
Gianluca Parodi,* IIS Progress SRL	Jeff Friedman, Lockheed Martin Corporation	Chris Newton, Lockheed Martin Corporation
Robert Bowden, Impact Centre for Training & Staffing	Chris Newton, Lockheed Martin Corporation	James Erickson, Lockheed Martin Missiles & Fire Control
Stephen Langdon, Impact Centre for Training & Staffing	James Erickson, Lockheed Martin Missiles & Fire Control	Julian Finlaw, Lockheed Martin Missiles & Fire Control
Morgan Miller, Insomware LLC	Julian Finlaw, Lockheed Martin Missiles & Fire Control	
Ana Ferrari Felippo, Instituto de Pesquisas Eldorado		
Ife Hsu, Intel Corporation		
Jaganesh Radhakrishnan, Intel Corporation		
Jose Luis Gonella, INVAP S.E.		
Jeffrey Lee, iST - Integrated Service Technology		

Caitlin Samples, Methods Automation
 Matt Garrett, Microsemi
 Donald Tyler, Micross Components, LLC
 William Pfingston, Miraco, Inc.
 Daniel Foster, Missile Defense Agency
 Bill Kasprzak, Moog Inc.
 Edward Rios, Motorola Solutions
 Jungu Zhang,** Nanjing Future Mobility New Energy Vehicle Technology Development Co., Ltd.
 Alvin Boutte, NASA Goddard Space Flight Center
 Chris Fitzgerald, NASA Goddard Space Flight Center
 Bhanu Sood, NASA Goddard Space Flight Center
 Robert Cooke, NASA Johnson Space Center
 James Blanche, NASA Marshall Space Flight Center
 Charles Gamble, NASA Marshall Space Flight Center
 Adam Gowan, NASA Marshall Space Flight Center
 Garry McGuire, NASA Marshall Space Flight Center
 Zackary Fava, NAVAIR
 Kim Mason, Naval Surface Warfare Ctr
 William May, Naval Surface Warfare Ctr
 Joseph Sherfick, Naval Surface Warfare Ctr
 Nicholas Walton, Naval Surface Warfare Ctr
 Scott Wise, Navy Special Emphasis Operations, EXTAD
 Qiuju Yan,** Ningbo CRIT Times Transducer Technique Co., Ltd.
 Russell Nowland, Nokia
 Torgim Nordhus, Noratron AS
 Randy Breiner, Northrop Grumman
 Steven Ferris, Northrop Grumman
 Stephanie Stork, Northrop Grumman
 Larry Handseadal, Northrop Grumman Corporation
 Adi Lang, Northrop Grumman Corporation
 Doris McGee, Northrop Grumman Corporation
 Kaitlyn Skillman, Northrop Grumman Corporation
 Tana Soffa, Northrop Grumman Corporation
 Ryan Staffen, Northrop Grumman Corporation
 Carlo Viola, Northrop Grumman Corporation
 LaKia Williams, Northrop Grumman Corporation
 Luke Bycroft, Northrop Grumman Innovation Systems
 Daniel Morin, Northrop Grumman Innovation Systems
 Patrick Phillips, Northrop Grumman Innovation Systems
 Ceferino Reyes, Northrop Grumman Innovation Systems
 Mark Shireman, Northrop Grumman Innovation Systems
 Mahendra Gandhi, Northrop Grumman Space Systems
 Rene Martinez, Northrop Grumman Space Systems
 Bernard Ecker, Northrop Grumman Systems Corporation
 Callie Olague, Northrop Grumman Systems Corporation
 Chen Yan, WEK Kunshan Testing Co., Ltd.
 William Graver, NTS - Baltimore
 Angela Pennington, NuWaves Engineering
 Joshua Huang, Nvidia Corporation
 Hoa Nguyen, OK International
 Ken Moore, Omni Training Corp.
 Toshiyuki Sugiyama, Omron Corporation-Inspection Systems Business Division
 Tristan Campbell, Out of the Box Manufacturing
 Gustavo Arredondo, PARA TECH Parylene Services
 Jose de Jesus Montanez Ortiz, Phoenix Industrial Supply
 Wim Bodelier, PIEK International Education Centre (I.E.C.) BV
 Ron Fonsaer, PIEK International Education Centre (I.E.C.) BV
 Frank Huijsmans, PIEK International Education Centre (I.E.C.) BV
 Rob Walls,* PIEK International Education Centre (I.E.C.) BV
 Kirk Van Dreel, Plexus Corp.
 James Taylor, Plexus Corp.
 See Thao, Plexus Corp.
 Joseph Rousseau, Precision Analytical Laboratory, Inc.
 Catherine Hanlin, Precision Manufacturing Company, Inc.
 Steven Corkery, Raytheon Company
 James Daggett, Raytheon Company
 Michael Jowitz, Raytheon Company
 David Wallace, Raytheon Company
 Anthony Martinelli, Raytheon Company
 James Saunders, Raytheon Company
 Fonda Wu, Raytheon Company
 Matthew Abbott, Raytheon Missile Systems
 Lance Brack, Raytheon Missile Systems
 Maria Colon, Raytheon Missile Systems
 George Millman, Raytheon Missile Systems
 Mark Northrup, Raytheon Missile Systems
 Martin Scionti, Raytheon Vision Systems
 Nichole C. Thilges, Raytheon Missile Systems
 Pascal Dumontet,* RENAULT
 Marcin Sudomir,* Renex Electronics Education Center
 Rama Murthy, PBV Research Centre Imarat, DRDO, Ministry of Defence
 Gunter Gera, Robert Bosch GmbH
 Lothar Henneken, Robert Bosch GmbH
 Norbert Holle, Robert Bosch GmbH

Patrick Leidich, Robert Bosch GmbH	Qin Chen,** Suzhou Eunow Co., Ltd.	Taylor Abrahamian, TTM Technologies, Inc.
Theresia Richter, Robert Bosch GmbH	Yanqi Chen,** Suzhou Meixin Testing Technology Co., Ltd.	Marc Emmons, TTM Technologies, Inc.
Udo Welzel, Robert Bosch GmbH	Rainer Taube, Taube Electronic GmbH	Daniel Koss, TTM Technologies, Inc.
Alisha Asbell, SAIC	Lynda Pelley, Teledyne Dalsa	Ryan Mastriani, TTM Technologies, Inc.
Gary Latta, SAIC	Monica Tucker, Teledyne Electronic Manufacturing Services	James Monarchio, TTM Technologies, Inc.
Xingquan Dong,** SAIC Motor	Michael Collier, Teledyne Leeman Labs	John Wood, TTM Technologies, Inc.
Rodney Doss, Samtec, Inc.	Angelica Joston-Eltanal, Teradyne Philippines Ltd	Tapas Yagnik, TTM Technologies, Inc.
Jon Roberts, Sanmina Corporation	Marian Johnson, Thales Defense & Security, Inc.	Paul Zutter, U.S. Army Aviation & Missile Command
Mark Kostinovsky, Schlumberger Well Services	Julien Vieilledent, Thales Global Services	Irving Lee, UL LLC
Henry Rekers, Schneider Electric Systems USA, Inc.	Ying Yang,** The Fifth Research Institute of MIIT, P.R. China	Crystal Vanderpan, UL LLC
Norma Low, SCI Technology, Inc.	Yabing Zou,**The Fifth Electronics Research Institute of Ministry of Industry and Information Technology	Alan Chinnias, Ultra Electronics Communication & Integrated Systems
Robert Jackson, Semi-Kinetics	James Parke, The Aerospace Corporation	Baillie Dunn, University of Portsmouth
Jie Yuan,** Shanghai Quick Turn Electronics Co., Ltd.	Gildardo Jimenez-Munguia, The Chamberlain Group, Inc.	Rachel Grinvalds, UTC Aerospace
Jiong (Crystal) Dai,** Shennan Circuits Co. Ltd.	John O'Neill,* The Electronics Group Ltd	Russell Kaunas, UTC Aerospace Systems
Chengyan Cui,** Shenyang Railway Signal Co., Ltd.	Doug Wilson, The Electronics Group Ltd.	Jason Nipper, UTC Aerospace Systems
Suzhong Liu,** Shenzhen Hengzhiyuan Technology Corporation Ltd	Satoshi Kashiwabara, Toyota Motor Corporation	Constantin Hudon, Varitron Technologies Inc.
Yangchun Zhang,** Shintech	Shohei Mishima, Toyota Motor Corporation	Jack Zhu,** Veoneer China Co., LTD
Kevin Syverson, Silicon Forest Electronics, Inc.	Kazunori Nishihara, Toyota Motor Corporation	Dave Harrell, Viasat Inc.
Vern Solberg, Solberg Technical Consulting	Ken Yamamoto, Toyota Motor Corporation	Stephen Meeks, ViaSat
Gerard O'Brien, Solderability Testing & Solutions, Inc.	Joaquin Cuevas, Toyota Motor North America	Gerjan Diepstraten, Vitronics Soltec
Fatima Johnson, Solve Direct Electronics	Gaston Hidalgo, Toyota Motor North America	Luis Dias,* West Control Solutions
Neil Johnson, Solve Direct Electronics	Eric Li,** TT Electronics Integrated Manufacturing Services (Suzhou) Limited	Jeffrey Black, Westinghouse Electric Co., LLC
Lamar Young, Specialty Coating Systems Inc.		Andrew Goddard, ZF Automotive UK Limited
Paul Pidgeon, STEM Training		Colin Wang,** Zestron
Robert Fornefeld, STI Electronics, Inc.		Zhiman Chen,** Zhuzhou CRRC Times Electric Co., Ltd.
Frank Honyatski, STI Electronics, Inc.		Mingsheng Long,** Zhuzhou CRRC Times Electric Co., Ltd
Mark M. Meier, STI Electronics, Inc.		Zhe (Jacky) Liu,** ZTE Corporation
Patrick Scott, STI Electronics, Inc.		

Thank you to the 5-22a J-STD-001 Team Skeleton for their efforts in developing the x-ray criteria for this document.

David Bernard	Timothy Pearson, Collins Aerospace	John Mastorides, Honeywell Aerospace
Kathy Johnston	Tiberiu Baranyi, Flextronics Romania SRL	
David Hillman, Collins Aerospace		

Vijay Kumar, Lockheed Martin
Missiles & Fire Control
Jarrod Webb, Lockheed Martin
Missiles & Fire Control
Daniel Foster, Missile Defense
Agency

Bhanu Sood, NASA Goddard Space
Flight Center
Robert Cooke, NASA Johnson Space
Center
James Blanche, NASA Marshall
Space Flight Center

James Daggett, Raytheon Company
Maria Colon, Raytheon Missile
Systems
Thorsten Rother, YXLON
International GmbH

A special thank you to the 5-22A J-STD-001 A-Team for their dedication and commitment to this effort. Their support and time during the development of this document is greatly appreciated.

Jonathon Vermillion, Ball Aerospace
& Technologies Corp.
Scott Meyer, Collins Aerospace
Symon Franklin, Custom Interconnect
Ltd
Milea Kammer, Honeywell
International
Sue Powers-Hartman, Killdeer
Mountain Manufacturing, Inc.

Shelley Holt, L3Harris
Communications
Josh Goolsby, Lockheed Martin
Missiles & Fire Control
Ben Gumpert, Lockheed
Martin-Missiles & Fire Control
Jarrod Webb, Lockheed Martin
Missiles & Fire Control
Chris Fitzgerald, NASA Goddard
Space Flight Center

Garry McGuire, NASA Marshall
Space Flight Center
William May, Naval Surface Warfare
Ctr
James Parke, The Aerospace
Corporation
Gaston Hidalgo, Toyota Motor North
America

* Members of 5-22A and 5-22A-EU

**Members of 5-22A and 5-22ACN

1. Figure 7-12A Image Credit: NASA
2. Figure 4-4 is © Omni Training, used
by permission.

Table of Contents

1.0 GENERAL	1	1.12 Inspection Methodology	6
1.1 Scope	1	1.12.1 Process Verification Inspection.....	6
1.2 Purpose.....	1	1.12.2 Visual Inspection.....	6
1.3 Classification	1	1.13 Facilities	7
1.4 Measurement Units and Applications	1	1.13.1 Environmental Controls	7
1.4.1 Verification of Dimensions	2	1.13.2 Field Assembly Operations.....	8
1.5 Definition of Requirements	2	1.13.3 Health and Safety	8
1.5.1 Hardware Defects and Process Indicators	2	1.14 Electrostatic Discharge (ESD).....	8
1.5.2 Material and Process Nonconformance	2	2.0 APPLICABLE DOCUMENTS	9
1.5.3 Procedures for Specialized Technologies.....	2	2.1 IPC	9
1.6 Process Control Requirements	3	2.2 JEDEC	9
1.6.1 Opportunities Determination	3	2.3 Joint Industry Standards	10
1.6.2 Statistical Process Control.....	3	2.4 ASTM	10
1.7 Order of Precedence	4	2.5 EOS/ESD Association, Inc.	10
1.7.1 Appendices.....	4	2.6 International Electrotechnical Commission	10
1.8 Terms and Definitions.....	4	2.7 SAE International	10
1.8.1 Circumferential Solder Separation (Area Void of Solder)	4	2.8 Military Standards	10
1.8.2 Diameter	4	2.9 Aerospace Industries Association / National Aeronautics Standards	10
1.8.3 Disposition	4	3.0 MATERIALS, COMPONENTS AND EQUIPMENT REQUIREMENTS	11
1.8.4 Electrical Clearance	4	3.1 Materials.....	11
1.8.5 Engineering Documentation	4	3.2 Solder	11
1.8.6 FOD (Foreign Object Debris)	4	3.2.1 Solder – Pb-Free	11
1.8.7 High Voltage	4	3.2.2 Solder Purity Maintenance	11
1.8.8 Manufacturer	5	3.3 Flux	12
1.8.9 Objective Evidence	5	3.3.1 Flux Application	12
1.8.10 Process Control.....	5	3.4 Adhesives	12
1.8.11 Proficiency.....	5	3.5 Chemical Strippers.....	12
1.8.12 Solder Destination Side	5	3.6 Components.....	13
1.8.13 Solder Source Side	5	3.6.1 Component and Seal Damage	13
1.8.14 Solder Void.....	5	3.6.2 Coating Meniscus	13
1.8.15 Supplier	5	3.7 Tools and Equipment.....	13
1.8.16 Tempered Leads	5	4.0 GENERAL SOLDERING AND ASSEMBLY REQUIREMENTS	15
1.8.17 User	5	4.1 Solderability	15
1.8.18 Wire Overlap.....	5	4.2 Solderability Maintenance	15
1.8.19 Wire Overwrap.....	5	4.3 Removal of Component Surface Finishes	15
1.9 Requirements Flowdown	6	4.3.1 Gold Removal.....	15
1.10 Personnel Proficiency	6	4.3.2 Other Metallic Surface Finishes Removal	15
1.10.1 X-Ray Specific Personnel Proficiency	6		
1.11 Acceptance Requirements.....	6		

4.4	Thermal Protection	15	5.4.1	General Requirements	23
4.5	Rework of Nonsolderable Parts	16	5.4.2	Turret and Straight Pin Terminals	24
4.6	Preprocessing Cleanliness Requirements	16	5.4.3	Bifurcated Terminals	25
4.7	General Part Mounting Requirements.....	16	5.4.4	Slotted Terminals	26
4.7.1	General Requirements.....	16	5.4.5	Hook Terminals.....	27
4.7.2	Lead Deformation Limits	16	5.4.6	Pierced or Perforated Terminals.....	27
4.8	Hole Obstruction.....	16	5.4.7	Cup and Hollow Cylindrical Terminals – Placement	27
4.9	Metal-Cased Component Isolation	16	5.4.8	Series Connected.....	28
4.10	Adhesive Coverage Limits	16	5.5	Soldering to Terminals.....	28
4.11	Mounting of Parts on Parts (Stacking of Components)	16	5.5.1	Bifurcated Terminals.....	28
4.12	Connectors and Contact Areas	16	5.5.2	Slotted Terminal.....	28
4.13	Handling of Parts.....	16	5.5.3	Cup and Hollow Cylindrical Terminals – Soldering	28
4.13.1	Preheating.....	17	5.6	Jumper Wires	29
4.13.2	Controlled Cooling	17	5.6.1	Insulation.....	29
4.13.3	Drying/Degassing.....	17	5.6.2	Wire Routing.....	29
4.13.4	Holding Devices and Materials.....	17	5.6.3	Wire Staking	29
4.14	Machine Soldering.....	17	5.6.4	Unpopulated Land or Via – Lap Soldered.....	29
4.14.1	Nonreflow Soldering	17	5.6.5	Supported Holes	29
4.14.2	Reflow Soldering	17	5.6.6	SMT	29
4.15	Solder Connection.....	17	6.0	THROUGH-HOLE MOUNTING AND TERMINATIONS	31
4.15.1	Exposed Surfaces.....	18	6.1	Through-Hole Terminations – General	31
4.15.2	Solder Connection Anomalies	18	6.1.1	Lead Forming.....	32
4.15.3	Partially Visible or Hidden Solder Connections.....	18	6.1.2	Termination Requirements.....	32
4.16	Heat Shrinkable Soldering Devices	18	6.1.3	Lead Trimming	33
4.17	Threaded Fasteners	19	6.1.4	Interfacial Connections	33
4.18	Torque	20	6.2	Supported Holes	33
5.0	WIRES AND TERMINAL CONNECTIONS	21	6.2.1	Solder Application	33
5.1	Wire and Cable Preparation	21	6.2.2	Through-Hole Component Lead Soldering.....	33
5.1.1	Insulation Damage	21	6.2.3	Coating Meniscus in Solder	34
5.1.2	Strand Damage.....	21	6.3	Unsupported Holes	34
5.1.3	Tinning of Stranded Wire – Forming	21	6.3.1	Lead Termination Requirements for Unsupported Holes	34
5.2	Solder Terminals	22	7.0	SURFACE MOUNTING OF COMPONENTS	35
5.3	Bifurcated, Turret and Slotted Terminal Installation	22	7.1	Surface Mount Device Lead	35
5.3.1	Shank Damage	22	7.1.1	Plastic Components.....	35
5.3.2	Flange Damage	22	7.1.2	Forming.....	35
5.3.3	Flared Flange Angles.....	22	7.1.3	Unintentional Bending.....	36
5.3.4	Terminal Mounting – Mechanical.....	22	7.1.4	Flat Pack Parallelism	36
5.3.5	Terminal Mounting – Electrical	22	7.1.5	Surface Mount Device Lead Bends	36
5.3.6	Terminal Mounting – Soldering	23	7.1.6	Flattened Leads	36
5.4	Mounting to Terminals	23	7.1.7	Parts Not Configured for Surface Mounting	36

7.2	Leaded Component Body Clearance.....	36	8.3.2	Level 2 – Minor Changes with Supporting Objective Evidence	64
7.2.1	Axial-Leaded Components	36	8.4	Foreign Object Debris (FOD)	64
7.3	Parts Configured for Butt/I Lead Mounting	36	8.5	Visible Residues.....	65
7.4	Installation of Surface Mount Components	36	8.6	Non-ionic Residues.....	65
7.5	Soldering Requirements.....	36	8.7	Ultrasonic Cleaning Processes	65
7.5.1	Misaligned Components	37	8.8	Guidance Documents.....	65
7.5.2	Unspecified and Special Requirements.....	37	9.0	PRINTED BOARD REQUIREMENTS	67
7.5.3	Bottom Only Chip Component Terminations... ..	38	9.1	Printed Board Damage	67
7.5.4	Rectangular or Square End Chip Components – 1, 2, 3 or 5 Side Termination(s).....	39	9.1.1	Blistering/Delamination	67
7.5.5	Cylindrical End Cap Terminations.....	41	9.1.2	Weave Exposure/Cut Fibers	67
7.5.6	Castellated Terminations.....	43	9.1.3	Haloing.....	67
7.5.7	Flat Gull Wing Leads	44	9.1.4	Edge Delamination	67
7.5.8	Round or Flattened (Coined) Gull Wing Leads	45	9.1.5	Land/Conductor Separation	67
7.5.9	J Lead Terminations.....	46	9.1.6	Land/Conductor Reduction in Size	67
7.5.10	Butt/I Terminations	47	9.1.7	Flexible Circuitry Delamination.....	67
7.5.11	Flat Lug Leads.....	49	9.1.8	Flexible Circuitry Damage	67
7.5.12	Tall Profile Components Having Bottom Only Terminations	50	9.1.9	Burns	67
7.5.13	Inward Formed L-Shaped Ribbon Leads.....	51	9.1.10	Non-Soldered Edge Contacts	67
7.5.14	Surface Mount Area Array Packages	52	9.1.11	Measles.....	67
7.5.15	Bottom Termination Components (BTC).....	55	9.1.12	Crazing	68
7.5.16	Components with Bottom Thermal Plane Terminations (D-Pak).....	56	9.2	Marking	68
7.5.17	Flattened Post Terminations	57	9.3	Bow and Twist (Warpage).....	68
7.5.18	P-Style Terminations.....	58	9.4	Depanelization.....	68
7.5.19	Vertical Cylindrical Cans with Outward L-Shaped Lead Terminations.....	59	10.0	COATING, ENCAPSULATION AND STAKING (ADHESIVE).....	69
7.5.20	Wrapped Terminals	61	10.1	Conformal Coating	69
7.5.21	Flexible and Rigid-Flex Printed Circuitry with Flat Unformed Leads	62	10.1.1	Materials.....	69
7.6	Specialized SMT Terminations.....	62	10.1.2	Masking.....	69
8.0	CLEANING AND RESIDUE REQUIREMENTS	63	10.1.3	Application.....	69
8.1	Qualified Manufacturing Process	63	10.1.4	Thickness.....	69
8.1.1	Cleaning Designator	63	10.1.5	Uniformity.....	69
8.2	Ionic Process Monitoring	63	10.1.6	Bubbles and Voids	69
8.2.1	Sampling Plan.....	63	10.1.7	Delamination	70
8.2.2	Control Limits.....	63	10.1.8	Foreign Objects Debris.....	70
8.2.3	Exceeding the Control Limits	64	10.1.9	Other Visual Conditions	70
8.3	Re-qualification Requirements	64	10.1.10	Inspection	70
8.3.1	Level 1 – Major Changes Requiring Validation	64	10.1.11	Rework or Touchup	70
			10.2	Encapsulation	70
			10.2.1	Application.....	70
			10.2.2	Performance Requirements.....	70

10.2.3 Rework of Encapsulant Material..... 70

10.2.4 Encapsulant Inspection 70

10.3 Staking..... 70

10.3.1 Staking – Application 71

10.3.2 Staking – Adhesive 73

10.3.3 Staking (Inspection)..... 73

11.0 WITNESS (TORQUE/ANTI-TAMPERING) STRIPE..... 75

12.0 REWORK AND REPAIR..... 77

12.1 Rework 77

12.2 Repair 77

12.3 Post Rework/Repair Cleaning 77

APPENDIX A Guidelines for Soldering Tools and Equipment..... 79

APPENDIX B Minimum Electrical Clearance – Electrical Conductor Spacing 81

APPENDIX C J-STD-001 Guidance on Objective Evidence of Material Compatibility .. 83

APPENDIX D X-Ray Guidelines 87

Figures

Figure 1-1 Wire Overlap..... 5

Figure 1-1 Wire Overwrap..... 5

Figure 4-1 Hole Obstruction..... 16

Figure 4-2 Acceptable Wetting Angles..... 18

Figure 4-3 Hardware Sequence and Orientation..... 19

Figure 4-4 Example of Hardware Sequence and Orientation 19

Figure 5-1 Insulation Thickness 21

Figure 5-2 Flange Damage 22

Figure 5-3 Flared Flange Angles 22

Figure 5-4 Terminal Mounting – Mechanical..... 22

Figure 5-5 Terminal Mounting – Electrical 23

Figure 5-6 Insulation Clearance Measurement..... 23

Figure 5-7 Service Loop for Lead Wiring..... 23

Figure 5-8 Stress Relief Examples 24

Figure 5-9 Insulation Sleeving 24

Figure 5-10 Wire and Lead Placement..... 24

Figure 5-11 Bifurcated Terminal Side Route Placement with Wrap 25

Figure 5-12 Bifurcated Terminal Side Route Placement – Straight Though and Staked 25

Figure 5-13 Bifurcated Terminal Top and Bottom Route Connection..... 26

Figure 5-14 Slotted Terminal..... 26

Figure 5-15 Hook Terminal Wire Placement..... 27

Figure 5-16 Acceptable Pierced or Perforated Terminal Wire Placement 27

Figure 5-17 Wires on Intermediate Turret, Bifurcated, and Pierced Terminals..... 28

Figure 5-18 Solder Depression 28

Figure 5-19 Cup and Hollow Cylindrical Terminals – Vertical Fill of Solder 29

Figure 6-1 Component Lead Stress Relief Examples 31

Figure 6-2 Lead Bends 32

Figure 6-3 Lead Trimming..... 33

Figure 6-4 Vertical Fill Example 34

Figure 7-1 Surface Mount Device Lead Forming 35

Figure 7-2 Surface Mount Device Lead Forming 35

Figure 7-3 Bottom Only Terminations 38

Figure 7-4 Rectangular or Square End Chip Components 39

Figure 7-4A Rectangular or Square End Chip Components – 1, 2, 3 or 5 Side Termination(s) Center Termination (When Present) 40

Figure 7-5 Cylindrical End Cap Terminations 41

Figure 7-5A Cylindrical End Cap Terminations Center Termination (When Present)..... 42

Figure 7-6 Castellated Terminations 43

Figure 7-7 Flat Gull Wing Leads..... 44

Figure 7-8 Round or Flattened (Coined) Gull Wing Leads..... 45

Figure 7-9 J Leads..... 46

Figure 7-10 Butt/I Terminations for Modified Through-Hole Leads..... 47

Figure 7-11 Butt/I Terminations for Solder Charged Leads..... 48

Figure 7-12 Flat Lug Leads..... 49

Figure 7-12A SMD-4 LED 49

Figure 7-13 Tall Profile Components Having Bottom Only Terminations..... 50

Figure 7-14 Inward Formed L-Shaped Ribbon Lead..... 51

Figure 7-15 BGA Solder Ball Clearance 53

Figure 7-16 Bottom Termination Component..... 55

Figure 7-17 Bottom Thermal Plane Termination 56

Figure 7-18 Flattened Post Termination..... 57

Figure 7-19 P-Style Termination 58

Figure 7-20 Examples of Vertical Cylindrical Cans with Outward L-Shaped Lead Terminations..... 60

Figure 7-21 Vertical Cylindrical Cans with Outward L-Shaped Lead Terminations 60

Figure 7-22 Wrapped Terminal – SMT Inductor – Bottom View 61

Figure 7-23	Wrapped Terminal – SMT Inductor – Top View	61	Table 6-2	Components with Spacers	31
Figure 7-24	Wrapped Terminal – SMT Component.....	61	Table 6-3	Lead Bend Radius.....	32
Figure 7-25	Wrapped Terminals.....	61	Table 6-4	Protrusion of Leads in Supported Holes	33
Figure 7-26	Flexible and Rigid-Flex Circuitry with Flat Unformed Leads.....	62	Table 6-5	Protrusion of Leads in Unsupported Holes	33
Figure 10-1	Radial Leded Components Whose Height Is Greater Than or Equal to Their Length or Diameter – Individual Rectangular Shaped Component	71	Table 6-6	Supported Holes with Component Leads, Minimum Acceptable Conditions, Note 1	34
Figure 10-2	Radial Leded Components Whose Height Is Greater Than or Equal to Their Length or Diameter – Individual Cylindrically Shaped Component	72	Table 6-7	Unsupported Holes with Component Leads, Minimum Acceptable Conditions, Notes 1, 4.....	34
Figure 10-3	Radial Leded Components Whose Longest Dimension Is Their Diameter or Length, e.g., TO5 Semiconductors.....	72	Table 7-1	SMT Lead Forming Minimum Lead Length (L)	35
Figure 10-4	Radial Leded Components Whose Height Is Greater Than or Equal to Their Length or Diameter – Closely Spaced Arrays	72	Table 7-2	Surface Mount Components Soldering Requirements	37
Figure 11-1	Torque Stripe on Fastener – Acceptable.....	75	Table 7-3	Dimensional Criteria – Bottom Only Chip Component Terminations.....	38
Figure 11-2	Torque Stripe on Fastener – Defect.....	75	Table 7-4	Dimensional Criteria – Rectangular or Square End Chip Components – 1, 2, 3 or 5 Side Termination(s)	39
Figure D-1	Circumferential Solder Separation	87	Table 7-4A	Dimensional Criteria – Center Termination (When Present) – Rectangular or Square End Chip Components – 1, 2, 3 or 5 Side Termination(s).....	40
Figure D-2	Solder Voids	87	Table 7-5	Dimensional Criteria – Cylindrical End Cap Terminations	41
Tables			Table 7-5A	Dimensional Criteria – Center Termination (When Present) – Cylindrical End Cap Terminations	42
Table 1-1	Design, Fabrication and Acceptability Specifications.....	1	Table 7-6	Dimensional Criteria – Castellated Terminations	43
Table 1-2	Magnification Aid Applications for Solder Connections.....	7	Table 7-7	Dimensional Criteria – Flat Gull Wing Leads	44
Table 1-3	Magnification Aid Applications for Wires and Wire Connections, Note 1	7	Table 7-8	Dimensional Criteria – Round or Flattened (Coined) Gull Wing Leads	45
Table 1-4	Magnification Aid Applications – Other.....	7	Table 7-9	Dimensional Criteria – J Leads	46
Table 3-1	Maximum Limits of Solder Bath Contaminant	12	Table 7-10	Dimensional Criteria – Butt/I Connections	47
Table 4-1	Solder Connection Anomalies	18	Table 7-11	Dimensional Criteria – Butt/I Terminations – Solder Charged Terminations.....	48
Table 5-1	Allowable Strand Damage, Notes 1, 2, 3.....	21	Table 7-12	Dimensional Criteria – Flat Lug Leads, Note 5.....	49
Table 5-2	Terminal Mounting Minimum Soldering Requirements	23	Table 7-13	Dimensional Criteria – Tall Profile Components Having Bottom Only Terminations	50
Table 5-3	Turret and Straight Pin Wire Wrap.....	24	Table 7-14	Dimensional Criteria – Inward Formed L-Shaped Ribbon Leads, Note 5.....	51
Table 5-4	AWG 30 and Smaller Wire Wrap	25	Table 7-15	Dimensional Criteria – Ball Grid Array Components with Collapsing Balls.....	53
Table 5-5	Bifurcated Terminal Wire Placement – Side Route with Wrap	25	Table 7-16	Ball Grid Array Components with Noncollapsing Balls	54
Table 5-6	Bifurcated Terminal Side Route Straight-Through Staking.....	25	Table 7-17	Column Grid Array	54
Table 5-7	Bifurcated Terminal Wire Placement – Bottom Route.....	26	Table 7-18	Dimensional Criteria – BTC.....	55
Table 5-8	Hook Terminal Wire Placement.....	27	Table 7-19	Dimensional Criteria – Bottom Thermal Plane Terminations.....	56
Table 5-9	Pierced or Perforated Terminal Wire Placement.....	27			
Table 5-10	Solder Requirements Lead/Wire to Post.....	28			
Table 6-1	Component to Land Clearance	31			

Table 7-20	Dimensional Criteria – Flattened Post Terminations	57
Table 7-21	Dimensional Criteria – P-Style Terminations	58
Table 7-22	Dimensional Criteria – Vertical Cylindrical Cans with Outward L-Shaped Lead Terminations	59
Table 7-23	Dimensional Criteria – Wrapped Terminals....	61
Table 7-24	Dimensional Criteria – Flexible and Rigid-Flex Circuitry with Flat Unformed Leads	62
Table 8-1	Designation of Surfaces to be Cleaned	63
Table 8-2	Residue Testing For Process Control	63
Table 8-3	Maximum Acceptable Rosin, Note 1	65
Table 10-1	Coating Thickness	69

Requirements for Soldered Electrical and Electronic Assemblies

1.0 GENERAL

1.1 Scope This standard describes materials, methods and acceptance criteria for producing soldered electrical and electronic assemblies. The intent of this document is to rely on process control methodology to ensure consistent quality levels during the manufacture of products. It is not the intent of this standard to exclude any procedure, such as for component placement or for applying flux and solder used to make the electrical connection.

The soldering operations, equipment, and conditions described in this document are based on electrical/electronic circuits designed and fabricated in accordance with the specifications listed in Table 1-1.

Table_1-1 Design, Fabrication and Acceptability Specifications

Board Type	Design	Fabrication/Acceptability Specification
Generic Requirements	IPC-2221	IPC-6011
Rigid Printed Boards	IPC-2222	IPC-6012 IPC-A-600
Flexible Circuits	IPC-2223	IPC-6013
Rigid Flex Board	IPC-2222 IPC-2223	IPC-6013

1.2 Purpose This standard prescribes material requirements, process requirements, and acceptability requirements for the manufacture of soldered electrical and electronic assemblies. For a more complete understanding of this document's recommendations and requirements, one may use this document in conjunction with IPC-HDBK-001, IPC-AJ-820 and IPC-A-610. Standards may be updated at any time, including with the addition of amendments. The use of an amendment or a newer revision is not automatically required.

1.3 Classification This standard recognizes that electrical and electronic assemblies are subject to classifications by intended end-item use. Three general end-product classes have been established to reflect differences in manufacturability, complexity, functional performance requirements, and verification (inspection/test) frequency.

Use of this standard requires agreement on the class to which the product belongs. The User has the responsibility for identifying the class to which the assembly is produced. The product class should be stated in the procurement documentation package. If the User does not establish and document the acceptance class, the Manufacturer may do so.

CLASS 1 General Electronic Products

Includes products suitable for applications where the major requirement is function of the completed assembly.

CLASS 2 Dedicated Service Electronic Products

Includes products where continued performance and extended life is required, and for which uninterrupted service is desired but not critical. Typically the end-use environment would not cause failures.

CLASS 3 High Performance/Harsh Environment Electronic Products

Includes products where continued high performance or performance-on-demand is critical, equipment downtime cannot be tolerated, end-use environment may be uncommonly harsh, and the equipment must function when required, such as life support or other critical systems.

1.4 Measurement Units and Applications This standard uses International System of Units (SI) units per ASTM SI10, IEEE/ASTM SI 10, Section 3 [Imperial English equivalent units are in brackets for convenience]. The SI units used in this standard are millimeters (mm) [in] for dimensions and dimensional tolerances, Celsius (°C) [°F] for temperature and temperature tolerances, grams (g) [oz] for weight, and lux for illuminance.

Note: This standard uses other SI prefixes (ASTM SI10, Section 3.2) to eliminate leading zeroes (for example, 0.0012 mm becomes 1.2 μm) or as alternative to powers-of-ten (3.6 x 10³ mm becomes 3.6 m).