IPC-D-620

2015 - December

Design and Critical Process Requirements for Cable and Wiring Harnesses

A standard developed by IPC

Association Connecting Electronics Industries

IPC®

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 publications 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 847/597-2872.

Thank you for your continued support.

IPC-D-620

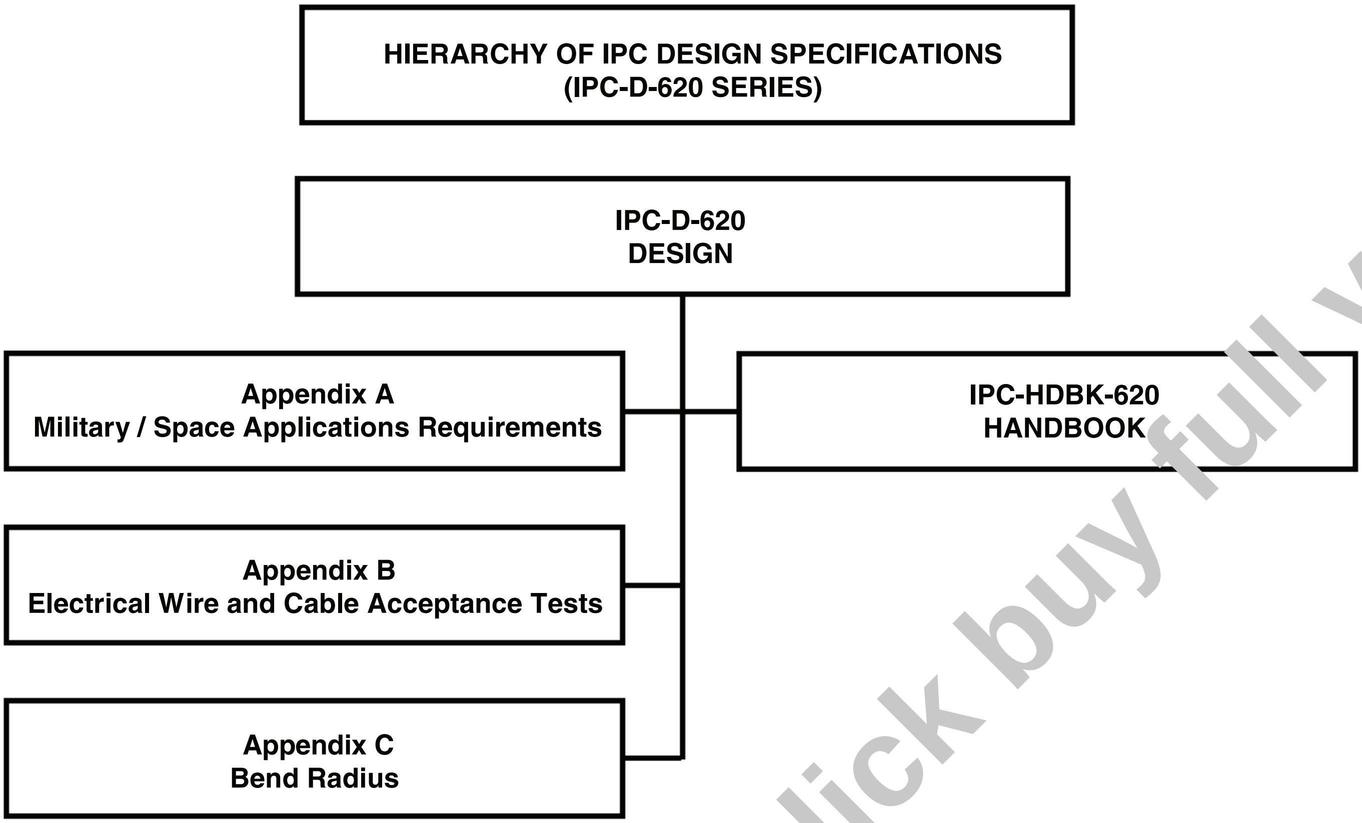
Design and Critical Process Requirements for Cable and Wiring Harnesses

Developed by the Wire Harness Design Task Group (7-31k) and IPC-HDBK-620 Handbook Task Group (7-31h) of the Product Assurance Committee (7-30) of IPC

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



FOREWORD

This standard is intended to provide information on the design requirements for cable and wiring harness design, to the extent that they can be applied to the broad spectrum of cable and wiring harness design.

It is therefore crucial that decisions concerning the choice of product classification, wiring technology, connectorization requirements, and performance and reliability requirements be made as early as possible.

IPC-D-620 is supplemented by Appendices A-C and a handbook (IPC-HDBK-620), which provide the engineering rationale and technical guidance on cable and wiring harness design. The User needs, as a minimum, the Design Requirements document (IPC-D-620), and the engineering description of the final product.

As wiring and connector technology changes, specific requirements will be updated or new requirements added to the document set.

The IPC invites input on the effectiveness of the documentation and encourages User response through

The IPC invites input on the effectiveness of the documentation and encourages User response through completion of "Suggestions for Improvement" forms located at the end of each document.

Acknowledgment

Members of the Wire Harness Design Task Group and IPC-HDBK-620 Handbook Task Group worked together to develop this document. We thank them for their dedication and service to this effort. Any document involving a complex technology draws material from a vast number of sources across many continents. While the principal members of the Wire Harness Design Task Group (7-31k) and IPC-HDBK-620 Handbook Task Group (7-31h) of the Product Assurance Committee (7-30) are shown below, it is not possible to include all of those who assisted in the evolution of this standard. To each of them, the members of the IPC extend their gratitude.

Product Assurance Committee

Chair
Mel Parrish
STI Electronics, Inc.

Vice-Chair
Mike Hill
Viasystems Group, Inc.

Technical Liaison of the IPC Board of Directors

Bob Neves
Microtek (Changzhou) Laboratories

Wire Harness Design Task Group

Chair
Robert W. Cooke
NASA Johnson Space Center

IPC-HDBK-620 Handbook Task Group

Chair
Brett A. Miller
USA Harness, Inc.

A special note of thanks goes to the following individuals for their dedication to bringing this project to fruition. We would like to highlight those individuals who made major contributions to the development of this standard.

Debbie Wade, Advanced Rework Technology-A.R.T

Sean Keating, Amphenol Limited (UK)

Lawrence Joy, Amptech, Inc.

Robert Potysman, AssembleTronics LLC

Agnes Ozarowski, BAE Systems

Joseph Kane, BAE Systems Platform Solutions

Gerald Leslie Bogert, Bechtel Plant Machinery, Inc.

Mary Bellon, Boeing Research & Development

Leo Lambert, EPTAC Corporation

Stephen Fribbins, Fribbins Training Services

Cindy Brenda Hale, Raytheon Company

B.J. Franco, Honeywell Aerospace

Richard Rumas, Honeywell Canada

T. John Laser, L-3 Communications

Darren Cox, Lockheed Martin

Schuyler Williams, Lockheed Martin Missile & Fire Control

Jeff Rowe, Lockheed Martin Mission Systems & Training

Dominik R. Alder, Lockheed Martin Space Systems Company

Gregg Owens, Millenium Space Systems

Robert Humphrey, NASA Goddard Space Flight Center

Robert Cooke, NASA Johnson Space Center

James Blanche, NASA Marshall Space Flight Center

Garry McGuire, NASA Marshall Space Flight Center

Randy McNutt, Northrup Grumman Corp.

Kathy L. Johnston, Raytheon Missile Systems

George Millman, Raytheon Missile Systems

David Hillman, Rockwell Collins

Erik Quam, Schlumberger Well Services

Mel Parrish, STI Electronics, Inc.

Barrie Dunn, Ph, D., University of Portsmouth

Brett Miller, USA Harness, Inc.

Bud Bowen, Winchester Electronics Division

Members of Wire Harness Design Task Group

Doug Rogers

Constantino Gonzalez, ACME Training & Consulting

Rhonda Troutman, Actronix Inc.

Debbie Wade, Advanced Rework Technology-A.R.T

Vu Nguyen, Amphenol Canada Corp

Sean Keating, Amphenol Limited (UK)

Lawrence Joy, Amptech, Inc.

Robert Potysman, AssembleTronics LLC

Gary Lawless, AssembleTronics LLC

Douglas Hooper, Astronics - Luminescent Systems Inc.

Agnieszka Ozarowski, BAE Systems

Thomas Cleere, BAE Systems Platform Solutions

Joseph Kane, BAE Systems Platform Solutions

Dave Harrell, Ball Aerospace & Technologies Corp.

Kenneth Monroe, Barco, Inc.

Gerald Leslie Bogert, Bechtel Plant Machinery, Inc.

Mary Bellon, Boeing Research & Development

Zenaida Valianu, Celestica

Jason Keeping. Celestica

Kevin Denning, Cirris Systems Corporation

Bill Downton, Cirris Systems Corporation

Miguel Dominguez, Continental Temic SA de CV

David Gillies, Data Cable Company, Inc.

Jennifer Warner, Ducommun LaBarge Technologies, Inc.

Mark Northrup, Dynamic Research and Testing Laboratories, LLC

Keith Walker, EEI Manufacturing Services

Gabriel Rosin, Elbit Systems Ltd.

Leo Lambert, EPTAC Corporation

Stephen Fribbins, Fribbins Training Services

Frederick Santos, General Dynamics Mission Systems

Carl Olson, Harting, Inc. of North America

Cory Jenkins, Harting, Inc. of North America

B.J. Franco, Honeywell Aerospace

Loshniban Thavasigamani, Honeywell Aerospace Avionics Malaysia Sdn Bhd

Richard Rumas, Honeywell Canada

Bob Teegarden, Honeywell International - Torrance

Riley Northam, Honeywell Technology Solutions Inc.

Stephen Tisdale. Intel Corporation

Ife Hsu, Intel Corporation

Alan Young, Jet Propulsion Laboratory

Theodore John Laser, L-3 Communications

Brooke Archuletta, L-3 Communications

Shelley Holt, L-3 Communications

Robert Fornefeld, L-3 Communications

Kim Selva, L-3 Communications Telemetry-West

Darren Cox, Lockheed Martin

Schuyler Williams, Lockheed Martin Missile & Fire Control

Daniel Eifert, Lockheed Martin Missile & Fire Control

Vijay Kumar, Lockheed Martin Missile & Fire Control

Robert Stringer, Lockheed Martin Missiles & Fire Control

Steven Nolan, Lockheed Martin Mission Systems & Training

Dominik Alder, Lockheed Martin Space Systems Company

Gregg Owens, Millennium Space Systems

Mary Lou Sachenik, Moog Inc.

William Draper, Moog Inc.

Edward Rios, Motorola Solutions

Robert Humphrey, 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

Garry McGuire, NASA Marshall Space Flight Center

Blanca Janet Canales, Northrop Grumman

Mahendra Gandhi, Northrop Grumman Aerospace Systems

Randy McNutt, Northrop Grumman Corp.

Sandra Fortune, Northrop Grumman Corporation

Michael Kunysz, Northrop Grumman SSES

Toshiyasu Takei, NSK Co., ltd.

Patrick Ryan, Panduit Corp.

Kevin Schuld, Peregrine Semiconductor

Matt Garrett, Phonon Corporation

Cindy Brenda Hale, Raytheon Company

Roger Miedico, Raytheon Company

Kathy Johnston, Raytheon Missile Systems

Martin Scionti, Raytheon Missile Systems

Steve Musante, Raytheon Missile Systems

Lance Brack, Raytheon Missile Systems

George Millman, Raytheon Missile Systems

Charles Scharnberg, Raytheon Missile Systems

Gilbert Shelby, Raytheon Systems Company

Paula Jackson, Raytheon UK

Caroline Ehlinger, Rockwell Collins

Debie Vorwald, Rockwell Collins

David Hillman, Rockwell Collins

Gaston Hidalgo, Samsung Electronics America

Erik Quam, Schlumberger Well Services

Christopher Sowards, Sikorsky Aircraft

Mel Parrish, STI Electronics, Inc.

Terry Clitheroe, Surface Mount Circuit Board Association

Rick Hawthorne, TE Connectivity

Guy Murphy, TE Connectivity Canada Ltd.

John Tinker, Teledyne Reynolds

Jennifer Day, U.S. Army Aviation & Missile Command

Sharon Ventress, U.S. Army Aviation & Missile Command

Dave Scidmore, Unlimited Services, Inc.

Daniel Adducchio, US Air Force Research Lab

Brett Miller, USA Harness, Inc.

Bud Bowen, Winchester Electronics Division

Members of IPC-HDBK-620 Handbook Task Group

Constantino Gonzalez, ACME Training & Consulting

Rhonda Troutman, Actronix Inc.

Debbie Wade, Advanced Rework Technology-A.R.T

Vu Nguyen, Amphenol Canada Corp

Sean Keating, Amphenol Limited (UK)

Robert Potysman, AssembleTronics LLC

Agnieszka Ozarowski, BAE Systems

Thomas Cleere, BAE Systems Platform Solutions

Dave Harrell, Ball Aerospace & Technologies Corp.

Gerald Leslie Bogert, Bechtel Plant Machinery, Inc.

Zenaida Valianu, Celestica

Kevin Denning, Cirris Systems Corporation

Bill Downton, Cirris Systems Corporation

Miguel Dominguez, Continental Temic SA de CV

David Gillies, Data Cable Company, Inc.

Mark Northrup, Dynamic Research and Testing Laboratories, LLC

Gabriel R[illegible]sin, Elbit Systems Ltd.

Leo Lambert, EPTAC Corporation

Frederick Santos, General Dynamics Mission Systems

Carl Olson, Harting, Inc. of North America

Cory Jenkins, Harting, Inc. of North America

B.J. Franco, Honeywell Aerospace

Loshniban Thavasigamani, Honeywell Aerospace Avionics Malaysia Sdn Bhd

Richard Rumas, Honeywell Canada

Bob Teegarden, Honeywell International - Torrance

Riley Northam, Honeywell Technology Solutions Inc

Alan Young, Jet Propulsion Laboratory

Theodore John Laser, L-3 Communications

Brooke A[illegible]uletta, L-3 Communications

Shelley Holt, L-3 Communications

Robert Fornefeld, L-3 Communications

Kim Souva, L-3 Communications Telemetry-West

William Fox, Lockheed Martin Missile & Fire Control

Schuyler Williams, Lockheed Martin Missile & Fire Control

Daniel Eifert, Lockheed Martin Missile & Fire Control

Vijay Kumar, Lockheed Martin Missile & Fire Control

Steven Nolan, Lockheed Martin Mission Systems & Training

Dominik Alder, Lockheed Martin Space Systems Company

Gregg Owens, Millennium Space Systems

Daniel Foster, Missile Defense Agency

Mary Lou S[illegible]chenik, Moog Inc.

Edward Rios, Motorola Solutions

Robert Humphrey, 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

Garry McGuire, NASA Marshall Space Flight Center

Blanca Janet Canales, Northrop Grumman

Randy McNutt, Northrop Grumman Corp.

Sandra Fortune, Northrop Grumman Corporation

Michael Kunysz, Northrop Grumman SSES

Toshiyasu Takei, NSK Co., ltd.

Patrick Ryan, Panduit Corp.

Kevin Schuld, Peregrine Semiconductor

Cindy Brenda Hale, Raytheon Company

Kathy Johnston, Raytheon Missile Systems

Martin Scionti, Raytheon Missile Systems

Steve Musante, Raytheon Missile Systems

Lance Brack, Raytheon Missile Systems

George Millman, Raytheon Missile Systems

Charles Scharnberg, Raytheon Missile Systems

Paula Jackson, Raytheon UK

Caroline Ehlinger, Rockwell Collins

Debie Vorwald, Rockwell Collins

Gaston Hidalgo, Samsung Electronics America

Mary James, Schlumberger Well Services

Erik Quam, Schlumberger Well Services

Mel Parrish, STI Electronics, Inc.

Terry Clitheroe, Surface Mount Circuit Board Association

Rick Hawthorne, TE Connectivity

Guy Murphy, TE Connectivity Canada Ltd.

John Tinker, Teledyne Reynolds

Jennifer Day, U.S. Army Aviation & Missile Command

Sharon Ventress, U.S. Army Aviation & Missile Command

Dave Scidmore, Unlimited Services, Inc.

Daniel Adducchio, US Air Force Research Lab

Brett Miller, USA Harness, Inc.

Table of Contents

Figures

Tables

This Page Intentionally Left Blank

Design and Critical Process Requirements for Cable and Wiring Harnesses

1 GENERAL

1.1 Scope This document provides design and critical process requirements and technical insight that have been removed from the acceptance standards for cable and wire harness assemblies. Reference materials listed in this text are among those considered as required reading. The User is encouraged to obtain all relevant referenced materials as this document cannot (nor can any single document) cover every material, process, environment, performance, or safety aspect that affect a given design.

1.2 Purpose ''Design Requirements for Cable and Wiring Harnesses'' is the cable and wiring harness and systems-level design requirements companion to IPC/WHMA-A-620, ''Requirements and Acceptance for Cable and Wire Harness Assemblies,'' and its associated space addendum.

The intent of this document is to set forth the general design requirements for electrical wiring harnesses and cable assemblies. This document is intended for use by the design engineer, manufacturing engineer, quality engineer, or other individual responsible for the tailoring of specific requirements of this document to the applicable performance class.

It is not the intent of this document to exclude any alternate or contractor-proprietary documents or processes that meet or exceed the baseline of requirements established by this document. Use of alternate or contractor-proprietary documents or processes **shall [A1A2A3]** require review and prior approval of the User.

For purposes of this document:

- The Designer is the design agent for the User.
- The User is the individual, organization, company, contractually designated authority, or agency responsible for the procurement or design of electrical/electronic/electromechanical (EEE) hardware, and having the authority to define the class of equipment and any variation or restrictions to the requirements of this document (i.e., the originator/custodian of the contract detailing these requirements). The User is considered the Design Authority.
- The Supplier is considered the individual, organization or company which provides the Manufacturer (assembler) components (electrical, electronic, electromechanical, mechanical, printed boards, etc.) and/or materials (solder, flux, cleaning agents, etc.).
- The Manufacturer is considered the entity that provides a service or product to the User.

1.3 Performance/Product Classification This document recognizes that electrical wiring harnesses and cable assemblies are subject to performance/product classifications by intended end-item use. Three general end-product classes have been established to reflect differences in producibility, complexity, functional performance requirements, and verification (inspection/test) frequency. It **should** be recognized that there may be requirement overlaps between classes.

The User is responsible for defining the product class required, whether compliance to any of the A through C Appendices is required, and to indicate any exceptions to specific parameters where appropriate.

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.