# IEEE Recommended Practice for Maintenance of DC Overhead Contact Systems for Transit Systems

## IEEE Vehicular Technology Society

Sponsored by the
Rail Transit Vehicle Interface Standards Committee

IEEE
3 Park Avenue
New York, NY 10016-5997, USA

25 September 2009

**IEEE Std 1628™-2009**

# IEEE Recommended Practice for Maintenance of DC Overhead Contact Systems for Transit Systems

Sponsor

**IEEE Rail Transit Vehicle Interface Standards Committee**

of the

**IEEE Vehicular Technology Society**

Approved 17 June 2009

**IEEE-SA Standards Board**

**Abstract:** This recommended practice provides a set of guidelines that can be used by the operators of new start-up systems seeking guidance in developing manuals, methods, practices, and procedures for the safe and effective maintenance of their Overhead Contact System (OCS), or by the maintenance organizations of existing well-established systems to amplify or refine their existing practices. This recommended practice provides general recommendations for performing maintenance work on dc OCS for transit systems. These recommendations are based on sound engineering principles, engineering safety considerations and field experience by many transit agencies. Included are technical explanations to cover certain testing of tools and equipment; field maintenance and care of tools and equipment; work methods for the maintenance of the OCS; and recommended safety practices and procedures for persons working in the vicinity of energized lines. Since local conditions and circumstances differ from one transit agency to the next, acceptance or rejection of any or all of the recommendations contained therein is left to the discretion of the individual agency, which should determine their applicability to its proposed or existing operating practices and procedures. It is not intended that the guidelines replace present proven transit agency procedures or that the recommended practices form the basis for a mandatory standard.
**Keywords:** auto-tension, backbone, balance weight, cantilever, catenary, contact wire, cross-span, door bridge, electric trolleybus, electrification, ETB, fixed termination, headspan, hi-rail, insulator, jumper, maintenance, messenger wire, OCS, overhead contact system, pantograph, qualified person, section insulator, special work, surge arrester, trolley, trolley pole

The Institute of Electrical and Electronics Engineers, Inc.
3 Park Avenue, New York, NY 10016-5997, USA



**PDF: ISBN 978-0-7381-6000-9 STD95945**
**Print: ISBN 978-0-7381-6001-6 STDPD95945**

**IEEE Standards** documents are developed within the IEEE Societies and the Standards Coordinating Committees of the IEEE Standards Association (IEEE-SA) Standards Board. The IEEE develops its standards through a consensus development process, approved by the American National Standards Institute, which brings together volunteers representing varied viewpoints and interests to achieve the final product. Volunteers are not necessarily members of the Institute and serve without compensation. While the IEEE administers the process and establishes rules to promote fairness in the consensus development process, the IEEE does not independently evaluate, test, or verify the accuracy of any of the information or the soundness of any judgments contained in its standards.

Use of an IEEE Standard is wholly voluntary. The IEEE disclaims liability for any personal injury, property or other damage, of any nature whatsoever, whether special, indirect, consequential, or compensatory, directly or indirectly resulting from the publication, use of, or reliance upon this, or any other IEEE Standard document.

The IEEE does not warrant or represent the accuracy or content of the material contained herein, and expressly disclaims any express or implied warranty, including any implied warranty of merchantability or fitness for a specific purpose, or that the use of the material contained herein is free from patent infringement. IEEE Standards documents are supplied "**AS IS**."

The existence of an IEEE Standard does not imply that there are no other ways to produce, test, measure, purchase, market, or provide other goods and services related to the scope of the IEEE Standard. Furthermore, the viewpoint expressed at the time a standard is approved and issued is subject to change brought about through developments in the state of the art and comments received from users of the standard. Every IEEE Standard is subjected to review at least every five years for revision or reaffirmation, or every ten years for stabilization. When a document is more than five years old and has not been reaffirmed, or more than ten years old and has not been stabilized, it is reasonable to conclude that its contents, although still of some value, do not wholly reflect the present state of the art. Users are cautioned to check to determine that they have the latest edition of any IEEE Standard.

In publishing and making this document available, the IEEE is not suggesting or rendering professional or other services for, or on behalf of, any person or entity. Nor is the IEEE undertaking to perform any duty owed by any other person or entity to another. Any person utilizing this, and any other IEEE Standards document, should rely upon his or her independent judgment in the exercise of reasonable care in any given circumstances or, as appropriate, seek the advice of a competent professional in determining the appropriateness of a given IEEE standard.

Interpretations: Occasionally questions may arise regarding the meaning of portions of standards as they relate to specific applications. When the need for interpretations is brought to the attention of IEEE, the Institute will initiate action to prepare appropriate responses. Since IEEE Standards represent a consensus of concerned interests, it is important to ensure that any interpretation has also received the concurrence of a balance of interests. For this reason, IEEE and the members of its societies and Standards Coordinating Committees are not able to provide an instant response to interpretation requests except in those cases where the matter has previously received formal consideration. A statement, written or oral, that is not processed in accordance with the IEEE-SA Standards Board Operations Manual shall not be considered the official position of IEEE or any of its committees and shall not be considered to be, nor be relied upon as, a formal interpretation of the IEEE. At lectures, symposia, seminars, or educational courses, an individual presenting information on IEEE standards shall make it clear that his or her views should be considered the personal views of that individual rather than the formal position, explanation, or interpretation of the IEEE.

Comments for revision of IEEE Standards are welcome from any interested party, regardless of membership affiliation with IEEE. Suggestions for changes in documents should be in the form of a proposed change of text, together with appropriate supporting comments. Recommendations to change the status of a stabilized standard should include a rationale as to why a revision or withdrawal is required. Comments and recommendations on standards, and requests for interpretations should be addressed to:

Secretary, IEEE-SA Standards Board
445 Hoes Lane
Piscataway, NJ 08854
USA

## Introduction

This introduction is not part of IEEE Std 1628-2008, IEEE Recommended Practice for Maintenance of DC Overhead Contact Systems for Transit Systems.

The vast majority of the presently operating electrified rail transit systems use overhead contact systems (OCS) or third rail to supply direct-current (dc) power to the rail vehicles. The OCS Sub-Committee for Rail Transit Systems was formed in 2001 with the purpose of developing standards and guidelines governing the design, construction, and maintenance of OCS for transit systems. One of the primary concerns of the committee, regarding OCS for light rail and electric trolleybus (ETB) systems, was the lack of uniform practices for the maintenance of the OCS, including but not limited to the structural supports, components and hardware, system parameters and operating procedures, and equipment.

The purpose of this recommended practice is to provide a set of guidelines that can be used by the operators of new start-up systems to develop manuals, safety guidelines, practices, and procedures for effective maintenance of their OCS, or by the maintenance organizations of existing well-established systems to amplify or refine their existing practices. It is not intended that these recommended practices form the basis for a mandatory standard. Acceptance or rejection of any or all of the recommendations contained herein is left to the discretion of the individual agency, which should determine their applicability to its proposed or existing operating practices and procedures.

## Acknowledgments

The Overhead Contact System Maintenance Working Group wishes to thank the following individuals who were responsible for the preparation of the figures in this recommended practice.

Figure 1 – Balance weight assembly, Michael N. Lewis, P.E., C.Eng., I.Mech.E (Retired)

Figure 2 – Single contact wire (SCW) OCS, Michael N. Lewis, P.E., C.Eng., I.Mech.E (Retired)

Figure 3 – Simple catenary OCS, Michael N. Lewis, P.E., C.Eng., I.Mech.E (Retired)

Figure 4 – Typical impedance bond arrangement, Philip F. Shepley, Senior Vice President – Transit, Mass. Electric Construction Company

Figure 5 – Method of applying temporary rail jumpers in electrified territory when connections from impedance bond to one or both rails are to be removed or when neutral bond (center tap) is to be opened, Philip F. Shepley, Senior Vice President – Transit, Mass. Electric Construction Company

Figure 6 – Method of applying temporary rail jumpers in electrified territory when rail to which impedance bond is connected is to be removed from track, Philip F. Shepley, Senior Vice President – Transit, Mass. Electric Construction Company

Figure 7 – Method of applying temporary rail jumpers in electrified territory when rail is to be removed from jointed track, Philip F. Shepley, Senior Vice President – Transit, Mass. Electric Construction Company

Figure 8– Method of applying temporary rail jumpers in electrified territory when rail is to be removed from continuous welded rail track, Philip F. Shepley, Senior Vice President – Transit, Mass. Electric Construction Company

Figure 9 – Mobile track ladder, Santiago Muniz, Vice President, STS EL Division, Siemens Transportation Systems, Inc.

Figure 10 – Contact wire twisting tool, Santiago Muniz, Vice President, STS EL Division, Siemens Transportation Systems, Inc.

## Notice to users

## Laws and regulations

Users of these documents should consult all applicable laws and regulations. Compliance with the provisions of this standard does not imply compliance to any applicable regulatory requirements. Implementers of the standard are responsible for observing or referring to the applicable regulatory requirements. IEEE does not, by the publication of its standards, intend to urge action that is not in compliance with applicable laws, and these documents may not be construed as doing so.

## Copyrights

This document is copyrighted by the IEEE. It is made available for a wide variety of both public and private uses. These include both use, by reference, in laws and regulations, and use in private self-regulation, standardization, and the promotion of engineering practices and methods. By making this document available for use and adoption by public authorities and private users, the IEEE does not waive any rights in copyright to this document.

## Updating of IEEE documents

Users of IEEE standards should be aware that these documents may be superseded at any time by the issuance of new editions or may be amended from time to time through the issuance of amendments, corrigenda, or errata. An official IEEE document at any point in time consists of the current edition of the document together with any amendments, corrigenda, or errata then in effect. In order to determine whether a given document is the current edition and whether it has been amended through the issuance of amendments, corrigenda, or errata, visit the IEEE Standards Association Web site at http://ieeexplore.ieee.org/xpl/standards.jsp, or contact the IEEE at the address listed previously.

For more information about the IEEE Standards Association or the IEEE standards development process, visit the IEEE-SA Web site at http://standards.ieee.org.

## Errata

Errata, if any, for this and all other standards can be accessed at the following URL: http://standards.ieee.org/reading/ieee/updates/errata/index.html. Users are encouraged to check this URL for errata periodically.

## Interpretations

Current interpretations can be accessed at the following URL: http://standards.ieee.org/reading/ieee/interp/index.html.

## Patents

Attention is called to the possibility that implementation of this recommended practice may require use of subject matter covered by patent rights. By publication of this recommended practice, no position is taken with respect to the existence or validity of any patent rights in connection therewith. The IEEE is not responsible for identifying Essential Patent Claims for which a license may be required, for conducting inquiries into the legal validity or scope of Patents Claims or determining whether any licensing terms or conditions provided in connection with submission of a Letter of Assurance, if any, or in any licensing agreements are reasonable or non-discriminatory. Users of this recommended practice are expressly advised that determination of the validity of any patent rights, and the risk of infringement of such rights, is entirely their own responsibility. Further information may be obtained from the IEEE Standards Association.

## Participants

At the time this recommended practice was submitted to the IEEE-SA Standards Board for approval, the Overhead Contact System Maintenance Working Group had the following membership:

**Michael N. Lewis,** *Chair*
**Jeffrey Wharton,** *Co-Chair*

Bill Ackehurst
Michael Acosta
Peter Bartek
Craig Berger
Rosalie Berger
Michael R. Bertoty
Alan Blatchford
Jerome Bochantin
Gilbert Cabral
Butch Campbell
John Ceciliani
Ron Clark
Gary Clarner
Dan Collins
Larry Davis
Ray Davis
Ramesh Dhingra
Binh V. Dinh
Andrew J. Gillespie
Fred Greenberg
Andy Grey
Richard Hahn
H. Ian Hayes
David G. Horne
Brian Kalvaitis
Kenneth A. Knight
Geoff Longworth
Jim McCarty
Rodolfo Middelmann
Matthias Moos
Alan Murphy
Bob G. Newton
Stephen Norton
Thomas F. O'Hara
Chris Pagni
Christopher O. Perry
Frederick J. Perry
Frederick M. Rooney
Calvin Shankster
Philip F. Shepley
Suresh Shrimavle
Ash Siddiq
Jeffrey N. Sisso
John Sm lak
Bradl Sto e
Bi Str II
aren zekely
Je Woodruff
Arthur Yuen

The following members of the individual balloting com itte voted on this recommended practice. Balloters may have voted for approval, disapproval, or abs atio

Steven Adkins
Roger Avery
Ronald Bennell
Steven Bezner
Alan Blatchford
Yunxiang Chen
Keith Chow
Robert Fisher
Paul Forquer
Fred Greenberg
Randall Groves
Lee Herron
Werner Hoelzl
Paul Jamies n
Mladen Je tic
Andrew Jo es
Wal Ke l
Ta Khandelwal
ersonsky
Et n Kim
Michael Lewis
Ahmad Mahinfallah
Michael S. Newman
Chris Pagni
D. Phelps
Gilbert Kevin Ratnasingham
Charles Ross
Edward Rowe
Bartien Sayogo
Alexander Sinyak
Jeffrey N. Sisson
James E. Smith
Ralph Stell
John Vergis
Jeffrey Wharton
Paul White

When the IEEE-SA Standards Board approved this recommended practice on 17 June 2009, it had the following membership:

**Robert M. Grow,** *Chair*
**Thomas Prevost,** *Vice Chair*
**Steve M. Mills,** *Past Chair*
**Judith Gorman,** *Secretary*

John Barr
Karen Bartleson
Victor Berman
Ted Burse
Richard DeBlasio
Andy Drozd
Mark Epstein
Alexander Gelman
Jim Hughes
Richard H. Hulett
Young Kyun Kim
Joseph L. Koepfinger*
John Kulick
David J. Law
Ted Olsen
Glenn Parsons
Ronald C. Petersen
Narayanan Ramachandran
Jon Walter Rosdahl
Sam Sciacca

*Member Emeritus

Also included are the following nonvoting IEEE-SA Standards Board liaisons:

Howard L. Wolfman, *TAB Representative*
Michael Janezic, *NIST Representative*
Satish K. Aggarwal, *NRC Representative*

Lorraine Patsco
*IEEE Standards Program Manager, Document Development*

Patricia Gerdon
*IEEE Standards Program Manager, Technical Program Development*

## Contents

# IEEE Recommended Practice for Maintenance of DC Overhead Contact Systems for Transit Systems



## 1. Overview

### 1.1 Scope

This recommended practice provides overhead contact system maintenance practices and procedures including maintenance techniques, site inspection and test procedures, and maintenance tolerances, for heavy rail, light rail, and trolley bus systems.

### 1.2 Purpose

There are no known industry-wide guidelines. Guidelines will result in improved reliability and reduced maintenance costs of overhead contact systems for transit.

### 1.3 Application

The OCS Sub-Committee for Rail Transit Systems was formed in 2001 with the purpose of developing standards and guidelines governing the design, construction, and maintenance of overhead contact system