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Solderless connections - Part 2: Crimped connections - General requirements, test methods and practical guidance

Lötfreie Verbindungen - Teil 2: Crimpverbindungen - Allgemeine Anforderungen, Prüfverfahren und Anwendungshinweise

Connexions sans soudure - Partie 2: Connexions serties - Exigences générales, méthodes d'essai et guide pratique

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TITLE:

Solderless connections - Part 2: Crimped connections - General requirements, test methods and practical guidance

PROPOSED STABILITY DATE: 2025

NOTE FROM TC/SC OFFICERS:

CONTENTS

| | |
|---|----|
| FOREWORD..... | 10 |
| INTRODUCTION..... | 13 |
| 1 Scope..... | 14 |
| 2 Normative references | 14 |
| 3 Terms and definitions | 16 |
| 4 Workmanship..... | 25 |
| 5 Prerequisites for basic test schedule | 25 |
| 5.1 Classification by end-product class | 25 |
| 5.1.1 General | 25 |
| 5.1.2 Class A – General electrical and electronics products..... | 25 |
| 5.1.3 Class B – Dedicated service electrical and electronics products | 25 |
| 5.1.4 Class C – High performance electrical and electronics products | 26 |
| 5.2 Prerequisites for tools | 26 |
| 5.3 Prerequisites for crimp barrels | 26 |
| 5.3.1 Crimp barrel materials | 26 |
| 5.3.2 Crimp barrel dimensions | 27 |
| 5.3.3 Crimp barrel surface finishes | 27 |
| 5.3.4 Crimp barrel design features..... | 27 |
| 5.4 Prerequisites for wires | 27 |
| 5.4.1 General | 27 |
| 5.4.2 Conductor materials..... | 27 |
| 5.4.3 Conductor dimensions | 27 |
| 5.4.4 Conductor surface finishes | 28 |
| 5.4.5 Wire insulation..... | 28 |
| 5.4.6 Wire stripping | 28 |
| 5.5 Prerequisites for crimped connections..... | 30 |
| 5.5.1 Compatibility of combination | 30 |
| 5.5.2 Conductor location..... | 30 |
| 5.5.3 Crimping location..... | 30 |
| 5.5.4 Contact deformation | 30 |
| 5.5.5 Prerequisites for crimped connections with more than one conductor in the crimp barrel | 30 |
| 5.5.6 Adjustment of conductor cross-sectional area to the crimp barrel..... | 31 |
| 5.5.7 Crimp contacts and terminal ends..... | 31 |
| 5.5.8 Splice crimp barrels | 35 |
| 5.6 Prerequisites for splice crimped connections..... | 36 |
| 5.6.1 General | 36 |
| 5.6.2 Conductor requirements for crimped splices | 36 |
| 6 Testing | 37 |
| 6.1 General..... | 37 |
| 6.2 Standard conditions for testing..... | 38 |
| 6.3 Pre-conditioning..... | 38 |
| 6.4 Recovery | 38 |
| 6.5 Mounting of the specimen | 38 |
| 7 Test methods and test requirements | 38 |
| 7.1 General examination of crimp barrels and wires | 38 |

| | | |
|--------|---|----|
| 7.2 | Examination of crimp dimensions | 39 |
| 7.2.1 | Crimp height C_h , crimp width C_w and measurable crimp width C_{wm} | 39 |
| 7.2.2 | Contact deformation after crimping | 41 |
| 7.2.3 | Visual examination of insulation distance and conductor overhang | 42 |
| 7.2.4 | Visual examination of splice crimped connections | 42 |
| 7.2.5 | Visual examination of crimped connections on closed (machined) crimp barrels | 43 |
| 7.2.6 | Visual examination of crimped connections on B-crimp open crimp barrels | 43 |
| 7.2.7 | Visual examination of crimped connections with open crimp barrel with insulation grip | 43 |
| 7.3 | Mechanical tests | 44 |
| 7.3.1 | Tensile strength | 44 |
| 7.3.2 | Microsection | 46 |
| 7.3.3 | Insulation grip effectiveness | 47 |
| 7.3.4 | Bending test (uninsulated crimp barrels with insulation grip) | 47 |
| 7.3.5 | Bending test (pre-insulated crimp barrels with insulation grip) | 48 |
| 7.3.6 | Bending test on splice crimped connections | 49 |
| 7.3.7 | Vibration test | 49 |
| 7.4 | Electrical tests | 50 |
| 7.4.1 | Crimp resistance | 50 |
| 7.4.2 | Voltage proof (crimped connection with pre-insulated crimp barrels) | 53 |
| 7.4.3 | Current-carrying capacity test with temperature rise | 53 |
| 7.5 | Climatic tests | 55 |
| 7.5.1 | General | 55 |
| 7.5.2 | Rapid change of temperature | 55 |
| 7.5.3 | Dry heat | 56 |
| 7.5.4 | Climatic sequence | 56 |
| 7.5.5 | Current loading, cyclic | 57 |
| 7.5.6 | Crimping at low temperature (crimped connections with pre-insulated crimp barrels) | 61 |
| 7.6 | Miscellaneous tests | 61 |
| 7.6.1 | Fluid resistance of pre-insulated crimp barrels | 61 |
| 7.6.2 | Flowing mixed gas corrosion test | 62 |
| 8 | Test schedules | 62 |
| 8.1 | General | 62 |
| 8.1.1 | General | 62 |
| 8.1.2 | Type A specimen (for testing according to 8.2, 8.2.3.3 if required, 8.3.2, 8.3.4 if required) | 63 |
| 8.1.3 | Type B specimen (for tests according to 8.2.3.1 and 8.3.3.2) | 63 |
| 8.1.4 | Type C specimen (for insulation grip effectiveness tests, see 8.2.3.3 and 8.3.4) | 64 |
| 8.1.5 | Type D specimen (for testing of pre-insulated crimp barrels only, see 8.2.3.4, 8.3.9.2 and 8.3.9.3) | 65 |
| 8.1.6 | Type E specimen (for tests according to 8.2.3.2, 8.2.3.4, 8.3.3.5) | 65 |
| 8.1.7 | Type F specimen (for testing of pre-insulated crimp barrels according to 8.3.9.4) | 66 |
| 8.1.8 | Type G specimen (for testing according to 8.2.3.2, 8.3.3.4, 8.3.3.5 and 8.3.6) | 66 |
| 8.1.9 | Type H specimen (for testing according to 8.2.2, 8.2.3.1, 8.2.3.3, 8.3.2, 8.3.3.2, 8.3.3.3 and 8.3.4) | 67 |
| 8.1.10 | Number of specimens required | 67 |

| | | |
|-----------------------|--|-----|
| 8.2 | Basic test schedule | 68 |
| 8.2.1 | General | 68 |
| 8.2.2 | Initial examination..... | 68 |
| 8.2.3 | Testing of crimped connections | 69 |
| 8.3 | Full test schedule..... | 71 |
| 8.3.1 | General | 71 |
| 8.3.2 | Initial examination..... | 71 |
| 8.3.3 | Testing of crimped connections | 72 |
| 8.3.4 | Testing of insulation grip effectiveness, test group F5..... | 74 |
| 8.3.5 | Testing of stability of splice crimped connections under bending | 74 |
| 8.3.6 | Test group F7, if required | 74 |
| 8.3.7 | Test group F8, if required | 75 |
| 8.3.8 | Test group F9, if required | 75 |
| 8.3.9 | Testing of crimped connections with pre-insulated crimp barrels | 75 |
| 8.4 | Flow charts | 76 |
| Annex A (informative) | Practical guidance | 80 |
| A.1 | General information on crimped connections..... | 80 |
| A.1.1 | General | 80 |
| A.1.2 | Advantages of crimped connections..... | 80 |
| A.1.3 | Current-carrying capacity considerations | 80 |
| A.2 | Tool information | 81 |
| A.3 | Crimp barrel information | 81 |
| A.3.1 | General | 81 |
| A.3.2 | Materials | 82 |
| A.3.3 | Surface finishes | 83 |
| A.3.4 | Shapes of crimped connections | 83 |
| A.4 | Wire information..... | 85 |
| A.4.1 | General | 85 |
| A.4.2 | Conductor materials..... | 85 |
| A.4.3 | Conductor surface finishes | 85 |
| A.4.4 | Wire stripping information | 85 |
| A.5 | Crimped connection information..... | 88 |
| A.5.1 | General | 88 |
| A.5.2 | Additional information | 88 |
| A.5.3 | Crimped connections made with more than one wire in a crimp barrel | 92 |
| A.5.4 | Dimensions after crimping | 93 |
| A.5.5 | Conductor and crimp barrel materials and finishes selection..... | 93 |
| A.6 | Crimping process | 93 |
| A.6.1 | Crimping of contacts with open crimp barrel | 93 |
| A.6.2 | Crimping of contacts with open crimp barrel, loose piece contacts..... | 93 |
| A.6.3 | Processing instruction | 93 |
| A.7 | Correct crimped connections (additional information) | 94 |
| A.7.1 | Correct crimped connections of contacts with open crimp barrel | 94 |
| A.7.2 | Measuring of crimp height/depth | 95 |
| A.7.3 | Pull-out force | 96 |
| A.8 | Examination by microsection..... | 102 |
| A.8.1 | Microsection image creation | 102 |
| A.8.2 | Graphical representation of the microsection image requirements | 103 |
| A.8.3 | Microsection terminology | 103 |
| A.8.4 | Porosity ratio of crimped connections in microsections | 105 |

| | | |
|--------|--|-----|
| A.8.5 | Crimp compression ratio of the crimped connection in the microsection | 106 |
| A.8.6 | Ratio of crimp height to crimp width in the microsection | 106 |
| A.8.7 | Requirements for B-crimped connections in the microsection | 107 |
| A.8.8 | Condition of microsections..... | 108 |
| A.8.9 | Insulation grip..... | 110 |
| A.9 | Faults with crimped contacts having open crimp barrels | 111 |
| A.10 | Splices..... | 112 |
| A.11 | Crimp resistance test | 112 |
| A.11.1 | General | 112 |
| A.11.2 | Notes on specimen preparation and measurement..... | 115 |
| A.12 | General information about crimp contacts as part of a multipole connector | 116 |
| A.12.1 | Insertion of crimped contacts into the contact cavities of the connector insert | 116 |
| A.12.2 | Removal of inserted contacts..... | 116 |
| A.12.3 | Mounting and bending of wire bundles/cables with crimped contacts | 117 |
| A.12.4 | Mating and unmating of multipole connectors with crimped contacts | 118 |
| A.13 | Final remarks | 118 |
| | Bibliography..... | 119 |
| | Figure 1 – Examples of crimp contact | 17 |
| | Figure 2 – Examples of splice | 18 |
| | Figure 3 – Example of insulation support | 18 |
| | Figure 4 – Examples of insulation grip | 19 |
| | Figure 5 – Examples of crimping tool | 19 |
| | Figure 6 – Example of positioner holding the crimp barrel | 20 |
| | Figure 7 – Example of positioner holding the stripped wire..... | 20 |
| | Figure 8 – Open crimp barrel | 21 |
| | Figure 9 – Closed crimp barrels | 22 |
| | Figure 10 – Pre-insulated crimp barrel | 22 |
| | Figure 11 – Crimping zones | 23 |
| | Figure 12 – Example of crimp funnel | 24 |
| | Figure 13 – Concentricity of wire insulation | 28 |
| | Figure 14 – Concentricity ratio of wire insulation | 28 |
| | Figure 15 – Diameter ratio when crimping wires with different single conductor strand diameters..... | 31 |
| | Figure 16 – Examples of open stamped crimp contacts for automatic production | 31 |
| | Figure 17 – Stamped open B-crimp contact with anvil and punch shapes | 32 |
| | Figure 18 – Designations on open B-crimp contact | 32 |
| | Figure 19 – Examples of crimping dies (press dies) | 32 |
| | Figure 20 – Stamped closed crimp barrel (crimp cable lug) | 33 |
| | Figure 21 – Different crimp shapes | 33 |
| | Figure 22 – Examples of crimping dies for closed crimp barrels | 33 |
| | Figure 23 – Tubular cable lugs for class 5 conductors | 34 |
| | Figure 24 – Tubular cable lugs for class 6 conductors..... | 34 |
| | Figure 25 – Crimping process of 4-indent crimping with adjustable tools | 34 |
| | Figure 26 – Pre-insulated stamped close crimp barrel, area definitions | 35 |
| | Figure 27 – Pre-insulated closed crimp barrels of various designs | 35 |

| | |
|--|----|
| Figure 28 – Examples of pre-insulated crimp cable lugs as strip parts..... | 35 |
| Figure 29 – Uninsulated splice variants..... | 36 |
| Figure 30 – Diameter ratio when crimping wires with different single conductor strand diameters in splices | 37 |
| Figure 31 – Crimp height measurement on open crimp barrel (B-crimp)..... | 40 |
| Figure 32 – Crimp height measurement on closed crimp barrel (mandrel crimping) | 40 |
| Figure 33 – Crimp height measurement on closed crimp barrel (4-indent crimping)..... | 40 |
| Figure 34 – Example of holding and measuring points for contact deformation | 41 |
| Figure 35 – Insulation distance and conductor overhang..... | 42 |
| Figure 36 – Examples of insulation grip die shapes..... | 44 |
| Figure 37 – Examples of insulation grip | 44 |
| Figure 38 – Bending test of crimped connections with uninsulated crimp barrels | 48 |
| Figure 39 – Bending test of crimped connections with pre-insulated crimp barrels | 48 |
| Figure 40 – Bending test on splice crimped connections | 49 |
| Figure 41 – Arrangement for vibration test | 50 |
| Figure 42 – Test arrangement for measurement of crimp resistance | 50 |
| Figure 43 – Measuring of crimp resistance of splice crimped connections | 51 |
| Figure 45 – Crimp resistance R_C of crimped connections with copper barrels and copper conductor ($K = 1$) | 52 |
| Figure 46 – Test setup for temperature rise measurements under current load | 54 |
| Figure 47 – Temperature chamber with ventilation opening for current-temperature derating measurements | 55 |
| Figure 48 – Examples of test arrangements | 59 |
| Figure 49 – Test current for crimped connections..... | 60 |
| Figure 50 – Examples of type A specimens..... | 63 |
| Figure 51 – Examples of type B specimens..... | 64 |
| Figure 52 – Examples of type C specimens..... | 64 |
| Figure 53 – Example of type D specimen (pre-insulated) | 65 |
| Figure 54 – Examples of type E specimen..... | 66 |
| Figure 55 – Example of type F specimen | 66 |
| Figure 56 – Type G specimen (splice)..... | 67 |
| Figure 59 – Type H specimen (splice)..... | 67 |
| Figure 58 – Basic test schedule (see 8.2) | 78 |
| Figure 59 – Full test schedule (see 8.3) | 79 |
| Figure A.1 – Open crimp barrels | 82 |
| Figure A.2 – Closed crimp barrels | 82 |
| Figure A.3 – Crimping shape in the wire axis | 83 |
| Figure A.4 – Crimping shape 90° angled to the wire axis | 83 |
| Figure A.5 – Crimping shape without insulation grip..... | 84 |
| Figure A.6 – Crimping shape with pre-insulated crimp barrel..... | 84 |
| Figure A.7 – Crimping shape without pre-insulated crimp barrel..... | 84 |
| Figure A.8 – Crimped connections using solid round conductors | 85 |
| Figure A.9 – Stripping length | 86 |
| Figure A.10 – Crimping process of an open crimp barrel (B-crimp)..... | 94 |
| Figure A.11 – Correct crimped connections of contacts with open crimp barrel | 94 |

| | |
|---|-----|
| Figure A.12 – Measuring instructions | 95 |
| Figure A.13 – Crimp height measuring procedure | 96 |
| Figure A.14 – Pull-out force test for crimped connections with pull speed 50 mm/min | 97 |
| Figure A.15 – Determination of the intrinsic tensile strength of the conductor (50 mm/min) | 99 |
| Figure A.16 – Relationships between crimp height (C_H), pull-out force, crimp force (indentation depth), and electrical conductivity | 101 |
| Figure A.17 – Pull-out force test of splice crimped connections (50 mm/min) | 102 |
| Figure A.18 – Illustration of the parting plane on the crimp barrel centred in the crimping zone (X)..... | 102 |
| Figure A.19 – Cutting the crimped connection | 103 |
| Figure A.20 – Dimensions on the microsection for B-crimp barrels | 104 |
| Figure A.21 – Dimensions on the microsection for closed tube and crimped cable lugs | 104 |
| Figure A.22 – Dimensions on the microsection for 4-indent closed crimp barrels..... | 104 |
| Figure A.23 – Dimensions on the microsection for hexagonal crimp barrels | 105 |
| Figure A.24 – Dimensions on the microsection for crimp barrels (also pre-insulated) | 105 |
| Figure A.25 – Examples of microsections of crimp barrels | 105 |
| Figure A.27 – Ratio V_{cr} of crimp height $C_h = H$ to crimp width $C_w = B$ | 106 |
| Figure A.28 – Ratio of distance between crimp face ends CFE and base material thickness S | 107 |
| Figure A.29 – Support angle α_w of the crimp flanks | 107 |
| Figure A.30 – Support height L_a of the crimp flanks..... | 107 |
| Figure A.32 – Crimp edge distance to floor F_a | 107 |
| Figure A.33 – Resulting bottom thickness S_b after crimping | 108 |
| Figure A.34 – Requirements for the acceptance of a burr formation | 108 |
| Figure A.35 – Diagrams for resistance values (A and B) for electrolytic copper conductors ($K = 1$) and for material with $K = 3,8$ | 113 |
| Figure A.36 – Formulas for calculating initial crimp resistance (A), maximum change in crimp resistance (B) and final crimp resistance (R_C) | 113 |
| Figure A.37 – Replacement circuit diagram for the crimp resistance | 114 |
| Figure A.38 – Formula for calculating the K factor..... | 114 |
| Figure A.39 – Insertion of crimped contacts into contact cavities..... | 116 |
| Figure A.40 – Mounting of wire bundles/cables with crimped contacts | 117 |
| Figure A.41 – Bending of wire bundles of connectors | 117 |
| Figure A.42 – Mating and unmating of multipole connectors..... | 118 |
| | |
| Table 1 – Allowable strand damage | 29 |
| Table 2 – Prerequisites of 5.3 for crimp barrels to access the basic test schedule of 8.2 | 37 |
| Table 3 – Prerequisites of 5.4 for wires to access the basic test schedule of 8.2 | 38 |
| Table 4 – Magnification aids for visual examination | 39 |
| Table 5 – Example of permissible tolerances for crimp height measurements | 41 |
| Table 6 – Insulation distance and conductor overhang on closed crimp barrels | 42 |
| Table 7 – Pull-out force of crimped connections | 45 |
| Table 8 – Vibration, preferred test severities | 50 |
| Table 9 – Example of other materials | 53 |
| Table 10 – Wire length L as a function of conductor cross-sectional area S | 55 |

| | |
|--|-----|
| Table 11 – Current values (tentative) – alternative current loading, cyclic method..... | 61 |
| Table 12 – Number of specimens..... | 67 |
| Table 13 – Test group B0..... | 69 |
| Table 14 – Test group B1..... | 69 |
| Table 15 – Test group B2..... | 69 |
| Table 16 – Test group B3..... | 70 |
| Table 17 – Test group B4..... | 70 |
| Table 18 – Test group B5..... | 71 |
| Table 19 – Test group F0..... | 72 |
| Table 20 – Test group F1..... | 72 |
| Table 21 – Test group F2..... | 73 |
| Table 22 – Test group F3..... | 73 |
| Table 23 – Test group F4..... | 73 |
| Table 24 – Test group F5..... | 74 |
| Table 25 – Test group F6..... | 74 |
| Table 26 – Test group F7..... | 74 |
| Table 27 – Test group F8..... | 75 |
| Table 28 – Test group F9..... | 75 |
| Table 29 – Test group F10..... | 76 |
| Table 30 – Test group F11..... | 76 |
| Table 31 – Test group F12..... | 76 |
| Table A.1 – Stripping of stranded conductors (good to sufficient requirements)..... | 87 |
| Table A.2 – Stripping of stranded conductors (faults or conditions according to Table 1) | 88 |
| Table A.3 – Condition of closed machined crimp barrels..... | 90 |
| Table A.4 – Condition of open crimp barrels (B-crimp)..... | 91 |
| Table A.5 – Minimum dimensions and tolerances for input funnel on a B-crimping zone..... | 92 |
| Table A.6 – Condition of position of wire insulation in the insulation grip..... | 92 |
| Table A.7 – Pull-out force recommended minimum values for electrolytic copper conductors with tensile strength 200 N/mm ² (e.g. according to EN 13602) | 98 |
| Table A.8 – Examples of tensile strength values (break) of commercially available European stranded conductors | 99 |
| Table A.9 – Examples of pull-out force values (fracture) of commercially available American stranded conductors..... | 99 |
| Table A.10 – Determination of the minimum pull-out forces in relation to the respective cross-sectional area and the intrinsic tensile strength of the conductor | 100 |
| Table A.11 – Pull-out force values for butt splice crimped connections | 102 |
| Table A.12 – Values for the support height L_a | 107 |
| Table A.13 – Condition of microsections | 109 |
| Table A.14 – Condition “Good” of insulation grip for B-crimp and O-crimp (asymmetrical and symmetrical overlap and enclosure crimp)..... | 110 |
| Table A.15 – Condition “PID” of insulation grip for B-crimp and O-crimp (asymmetrical and symmetrical overlap and enclosure crimp)..... | 111 |
| Table A.16 – Condition “Fault” of insulation grip for B-crimp, O-crimp (asymmetrical and symmetrical overlap and enclosure crimp) | 111 |
| Table A.17 – Features of splice crimped barrels | 112 |
| Table A.18 – Crimp resistance (maximum allowed initial values) for $K = 1$ (electrolytic copper)..... | 114 |

| | |
|--|-----|
| Table A.19 – Crimp resistance (after loading) for $K = 1$ (electrolytic copper) | 115 |
| Table A.20 – Crimp resistance (maximum allowed initial values) for $K = \text{approx. } 3,8$ (nickel-brass, bright) | 115 |
| Table A.21 – Contact resistance (after loading) for $K = \text{approx. } 3,8$ (nickel-brass, bright).... | 115 |
| Table A.22 – Contact resistance (maximum allowed initial values) for $K = 6,4$ (tin-plated bronze) | 115 |
| Table A.23 – Contact resistance (after loading) for $K = 6,4$ (tin-plated bronze)..... | 115 |

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

SOLDERLESS CONNECTIONS –**Part 2: Crimped connections –
General requirements, test methods and practical guidance**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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This third edition cancels and replaces the second edition published in 2006 and Amendment 1:2013. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) the "former Clauses 6 through 15 have been moved into a new informative Annex A titled "Practical guidance";
- b) several definitions have been added (wire, cable, crimping, crimped connection, crimp contact, terminal, terminal end, pre-insulated terminal end, termination, connecting device, splice, insulation support, insulation grip, pre-insulated crimped connection, crimping tool, locator, positioner, full cycle crimp mechanism, crimp anvil, crimp indenter, crimp height, crimp inspection hole, crimp barrel wire range, nominal cross-sectional area, geometric (actual) cross-sectional area, stranded conductor, crimp funnel, foreign object damage (FOD), crimp depth, manufacturer, user);

- c) a three-level classification by end-product level has been introduced in Clause 4 Workmanship, based on the expected level of reliability of the end-use application for which the crimped connections under subject are suitable, similar to what was done in 4.3 of IEC 61191-1:2018 for soldered electrical and electronic assemblies;
- d) for better clarification, former subclause 4.5 Crimped connections, now renumbered and renamed 5.5 Prerequisites for crimped connections, has been split in several third level subclauses with assigned title;
- e) allowable strand damage has been introduced with reference to the classification in three levels by end-use application, for the production of test specimens;
- f) based on industry experience, in 5.3.1 the minimum copper content of a copper alloy suitable for making crimp barrels has been lowered to 57 % from original 60 %;
- g) the elongation at break of annealed copper suitable for conductors to be crimped has been increased to 15 % from original 10 %;
- h) the cross-sectional area of conductors for testing purposes is allowed to be the nominal (commercial) one, instead of the geometric (actual) one for wires with nominal cross-sectional area larger than 2,5 mm² (see 5.4.3), the geometric (actual) one being the reference in case of dispute on test results;
- i) consideration about wire insulation concentricity has been added in 5.4.5;
- j) former subclause 5.2.1 General examination is now renumbered and renamed as 7.1 General examination of crimp barrels and wires (examination of parts as called later) and a new subclause 7.2 Examination of crimp dimensions has been added, to cover examination of dimensions after crimping, with several new third level subclauses: 7.2.1 Crimp height C_h , crimp width C_w and measurable crimp width C_{wm} , 7.2.2 Contact deformation after crimping, 7.2.3 Visual examination of insulation distance and conductor overhang, 7.2.4 Visual examination of splice crimped connections, 7.2.5 Visual examination of crimped connections on closed (machined crimp barrels, 7.2.6 Visual examination of crimped connections on B-crimp open crimp barrels, 7.2.7 Visual examination of crimped connections with open crimp barrel with insulation grip;
- k) the pull-out force (tensile strength) requirements covering safety requirements of crimped connections in Edition 2 Table 1 have been kept, here renumbered Table 5; interpolated values for most used cross-sectional areas 0,34 mm² and 0,37 mm² have been added. Reference to IEC 61210 as source for these safety values has been removed, as partially inaccurate. Optional specification of higher pull-out force requirements, based on classification by end-use product as specified in 5.1, and more representative of what can be achieved based on the type of crimp barrel, the form of the crimping, the material and plating of barrel and wire, has been introduced in A.7.3;
- l) a microsection test (optional) has been added in 7.3.2;
- m) a vibration test (optional) has been added in 7.3.7;
- n) a current-carrying capacity test (optional) has been added in 7.4.3;
- o) an alternative current loading, cyclic test method added in 7.5.5;
- p) a flowing mixed gas corrosion test (optional) has been added in 7.6.2;
- q) crimping at low temperature (former subclause 5.4.2.5) has been completed in 7.5.6 by re-entering the test method already present in Edition 1 subclause 11.4.5;
- r) types of test specimens have been expanded: a new type A specimen is added, type B is former type A, type C is former type B, type D is former type C, type E is former type D modified with addition of reference wires, type F is former type E, and new specimen types G and H were added to perform tests on splices;
- s) normative references, as well as Bibliography have been updated and expanded as required;

The text of this International Standard is based on the following documents:

| | |
|-------------|------------------|
| Draft | Report on voting |
| 48B/XX/FDIS | 48B/XX/RVD |

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the IEC 60352 series, published under the general title *Solderless connections*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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1

INTRODUCTION

2 This document includes requirements and relevant tests as well as practical guidance in Annex A
3 for crimped connections.

4 Two test schedules are provided:

- 5 – the basic test schedule which applies to solderless crimped connections which conform to all
6 of the prerequisites of Clause 5. It is derived from experience with successful applications of
7 such connections;
- 8 – the full test schedule which applies to solderless crimped connections which do not fully
9 conform to all prerequisites of Clause 5, for example which are made with solid wires, using
10 materials or finishes not included in Clause 5.

11 This philosophy permits cost- and time-effective performance verification using a limited basic
12 test schedule for established crimped connections and an expanded full test schedule for
13 connections requiring more extensive performance validation.

14 A detail product specification or the manufacturer's specification for crimped connections or
15 associated cable assemblies or both, as well as for crimp contacts, terminal ends or splices, can
16 include additional tests to verify enhanced performance and/or conformance with specified
17 product classes. It can also reference this document with test severities and acceptance criteria
18 other than those provided by either one of the two test schedules, as well as foresee an
19 intermediate test schedule. The requirements of the detail product specification or the
20 manufacturer's specification prevail.

21 The suitability of the crimped connection implies that the specified requirements and tests apply
22 to all factors involved in producing a suitable crimped connection, namely:

- 23 – the crimp barrel, which can be part of a crimp contact or terminal end, the contact deemed to
24 be used in a single-pole or multipole connector;
- 25 – the wire (or range of wires) for which the termination is suitable;
- 26 – the tools required to produce that type of solderless connection.

27 The practical guidance in Annex A serves as a guideline for the required workmanship. Attention
28 is drawn to the fact that some industries (e.g. automotive, aerospace, nuclear, military) can have
29 specific workmanship standards and/or quality requirements, which are outside the scope of this
30 document.

31 IEC Guide 109 advocates the need to minimize the impact of a product on the natural environ-
32 ment throughout the product life cycle.

33 It is understood that some of the materials permitted in this document can have a negative
34 environmental impact.

35 As technological advances lead to acceptable alternatives for these materials, they will be
36 eliminated from future editions of IEC 60352-2.

37