

DIN EN 16602-70-30

ICS 49.140

Einsprüche bis 2014-05-28

Entwurf**Raumfahrtproduktsicherung –
Umhüllung von Kabeln für hochzuverlässige elektrische Verbindungen;
Englische Fassung FprEN 16602-70-30:2013**

Space product assurance –
Wire wrapping of high-reliability electrical connections;
English version FprEN 16602-70-30:2013

Assurance produit des projets spatiaux –
Enveloppe de fils pour connexion électrique à fiabilité élevée;
Version anglaise FprEN 16602-70-30:2013

Anwendungswarnvermerk

Dieser Norm-Entwurf mit Erscheinungsdatum 2014-03-28 wird der Öffentlichkeit zur Prüfung und Stellungnahme vorgelegt.

Weil die beabsichtigte Norm von der vorliegenden Fassung abweichen kann, ist die Anwendung dieses Entwurfes besonders zu vereinbaren.

Stellungnahmen werden erbeten

- vorzugsweise online im Norm-Entwurfs-Portal des DIN unter www.entwuerfe.din.de bzw. für Norm-Entwürfe der DKE auch im Norm-Entwurfs-Portal der DKE unter www.entwuerfe.normenbibliothek.de, sofern dort wiedergegeben;
- oder als Datei per E-Mail an nl@din.de möglichst in Form einer Tabelle. Die Vorlage dieser Tabelle kann im Internet unter www.din.de/stellungnahme oder für Stellungnahmen zu Norm-Entwürfen der DKE unter www.dke.de/stellungnahme abgerufen werden;
- oder in Papierform an den Normenausschuss Luft- und Raumfahrt (NL) im DIN, 10772 Berlin (Hausanschrift: Burggrafenstr. 6, 10787 Berlin).

Die Empfänger dieses Norm-Entwurfs werden gebeten, mit ihren Kommentaren jegliche relevanten Patentrechte, die sie kennen, mitzuteilen und unterstützende Dokumentationen zur Verfügung zu stellen.

Gesamtumfang 50 Seiten

Normenausschuss Luft- und Raumfahrt (NL) im DIN

Nationales Vorwort

Dieses Dokument (FprEN 16602-70-30:2013) wurde vom Technischen Komitee CEN/CLC/TC 5 „Raumfahrt“ erarbeitet, dessen Sekretariat vom DIN (Deutschland) gehalten wird.

Dieses Dokument ist derzeit zum einstufigen Annahmeverfahren vorgelegt.

Dieses Dokument wurde speziell zur Behandlung von Raumfahrtsystemen erarbeitet und hat daher Vorrang vor jeglicher Europäischer Norm, da es denselben Anwendungsbereich hat, jedoch über einen größeren Geltungsbereich (z. B. Luft- und Raumfahrt) verfügt.

Das zuständige deutsche Normungsgremium ist der Arbeitsausschuss NA 131-10-01 AA „Interoperabilität von Informations-, Kommunikations- und Navigationssystemen“ im DIN-Normenausschuss Luft- und Raumfahrt (NL).

Nationaler Anhang NA (informativ)

Begriffe

3 Begriffe und Abkürzungen

3.1 Begriffe aus anderen Normen

Für die Anwendung dieses Dokuments gelten die Begriffe nach ECSS-S-ST-00-01 und ECSS-Q-ST-70-38.

Insbesondere gilt der folgende Begriff nach ECSS-Q-ST-70-38:

Prozessidentifizierungs-Dokument (PID)

ANMERKUNG zum Begriff: Der Inhalt des PID ist in ECSS-Q-ST-70-38 festgelegt.

3.2 Für diese Norm spezifische Begriffe

3.2.1

Drahtwindung

Wicklung, bestehend aus einem einzelnen vollständigen spiralförmigen Drahring, der um 360° um den Wickelstift gewunden ist und alle vier Ecken dieses Stifts berührt

ANMERKUNG zum Begriff: Zum Zwecke der Zählung der Windungen gilt die Anzahl der Durchgänge des gewundenen Drahtes an der Bezugskante des Wickelstifts nach dem ersten Mal, dass sich der nicht isolierte Draht und der Wickelstift schneiden, als Anzahl der Windungen des nicht isolierten Drahts in der Verbindung.

3.2.2

Drahtende

Ende der letzten Windung des Drahts am Wickelstift, das tangential ausgerichtet sein kann, statt am Stift anzuliegen

3.2.3

gasdichter Bereich

Kontaktfläche zwischen Wickelstift und Draht, in dem keine Gase vorhanden sind

3.2.4

Bezugsecke

Ecke des Wickelstifts, an der es zum Kontakt mit der ersten Windung des nicht isolierten Drahts kommt, und von der ausgehend die Anzahl der Windungen der Drahtwicklung bestimmt wird

3.2.5

Wickelstift

Stift mit quadratischem oder rechteckigem Querschnitt, um den der Verbindungsdraht gewunden ist

3.2.6

Drahtwickelverbindung

Verbindung, bestehend aus einer Spirale eines durchgehenden, massiven, nicht isolierten Drahts, der eng um den Wickelstift gewunden ist, um eine mechanisch und elektrisch stabile Verbindung herzustellen

ANMERKUNG 1 zum Begriff: Die Anzahl der erforderlichen Windungen ist von der Dicke des verwendeten Drahts abhängig.

ANMERKUNG 2 zum Begriff: Jede vollständige Wicklung weist zusätzlich mindestens eine 3/4 Windung des isolierten Drahts auf, der mit mindestens drei Ecken des Wickelstifts in Kontakt ist (siehe Bild 1-1).

3.3 Abkürzungen

Für die Anwendung dieses Dokuments gelten die Abkürzungen in ECSS-S-ST-00-01 und die folgenden Abkürzungen:

Abkürzung	Bedeutung
AWG	amerikanische Drahtnorm/amerikanische Drahtlehre (en: American wire gauge)
ETFE	Ethylen-Tetrafluorethylen (en: ethylene-tetrafluorethylene (Tefzel))
NCR	Nichtkonformitäten-/Fehler-Bericht (en: nonconformance report)
PFA	Perfluoralkoxy-Polymere (en: perfluoroalkoxy)
PID	Prozessidentifizierungs-Dokument (en: process identification document)
PTFE	Polytetrafluorethylen (en: polytetrafluorethylene)
PVDF	Polyvinylidenfluorid (en: polyvinylidene fluoride (Kynar))
QA	Qualitätssicherung (en: quality assurance)
RFA	Genehmigungsantrag (en: request for approval)
RH	relative Luftfeuchte (en: relative humidity)

October 2013

ICS 49.140

English version

Space product assurance - Wire wrapping of high-reliability electrical connections

Assurance produit des projets spatiaux - Enveloppe de fils
pour connexion électrique à fiabilité élevée

Raumfahrtproduktsicherung - Umhüllung von Kabeln für
hochzuverlässige elektrische Verbindungen

This draft European Standard is submitted to CEN members for unique acceptance procedure. It has been drawn up by the Technical Committee CEN/CLC/TC 5.

If this draft becomes a European Standard, CEN and CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

This draft European Standard was established by CEN and CENELEC in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN and CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN and CENELEC members are the national standards bodies and national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.

Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Warning : This document is not a European Standard. It is distributed for review and comments. It is subject to change without notice and shall not be referred to as a European Standard.



CEN-CENELEC Management Centre:
Avenue Marnix 17, B-1000 Brussels

Table of contents

Foreword	5
1 Scope.....	6
2 Normative references	8
3 Terms, definitions and abbreviated terms.....	9
3.1 Terms defined in other standards	9
3.2 Terms specific to the present standard	9
3.3 Abbreviated terms.....	10
4 Principles	11
5 Requirements.....	12
5.1 Preparatory conditions.....	12
5.1.1 Hazards, health and safety precautions	12
5.1.2 Facilities.....	12
5.1.3 Tools and equipment.....	13
5.1.4 Configuration of process and workpiece.....	15
5.1.5 Wire-wrap process certification	16
5.1.6 Requirements for new combinations of wire-wrap	16
5.2 Material selection.....	17
5.2.1 Wire	17
5.2.2 Terminal post	19
5.3 Wire-wrap operation	22
5.3.1 Preparation for wire-wrapping	22
5.3.2 Process and criteria	22
5.3.3 Number of turns on terminal post	24
5.3.4 Wire routing.....	25
5.3.5 Rework.....	25
5.4 Test methods.....	26
5.4.1 General	26
5.4.2 Stripping force.....	26
5.4.3 Unwrapping test	27

5.4.4	Connection resistance.....	27
5.4.5	Gas-tightness test	28
5.4.6	Metallography	28
5.4.7	Records of tests	29
5.5	Workmanship and acceptance criteria	29
5.5.1	Visual inspection	29
5.5.2	Replacement and rework	30
5.5.3	Performance tests	31
5.6	Quality assurance	32
5.6.1	General	32
5.6.2	Traceability	32
5.6.3	Data	33
5.6.4	Nonconformance.....	33
5.6.5	Calibration.....	35
5.6.6	Workmanship standards.....	35
5.6.7	Operator and inspector training and certification	35
5.6.8	Inspections.....	36
5.7	Document requirements.....	37
Annex A	(informative) Procedure for wire-rapping	38
Bibliography		46
 Figures		
Figure 1-1:	Single wire-wrapped connection to square terminal and reference corner	7
Figure 5-1:	Minimum wrapping length on terminal post for each wire gauge.....	21
Figure 5-2:	Terminal post dimensions over minimum wrapping length for each terminal size	21
Figure 5-3:	Position and regularity of wrap connection	24
Figure 5-4:	Wire-wrap rejection criteria which require reworking of the connection.....	31
Figure 5-5:	Guide to quality assurance during wire wrapping.....	34
Figure 5-6:	Guide to quality assurance during wire wrapping.....	34
Figure A-1 :	Examples of approved wire-wrapping tools	39
Figure A-2 :	Wire-wrap connection process	40
Figure A-3 :	Hand unwrapping tools	41
Figure A-4 :	Example of a daily process control sheet for test samples	43
Figure A-5 :	Stripping force test fixture	44
Figure A-6 :	Connection resistance test.....	44
Figure A-7 :	Typical cross-section of wire-wrap (×64).....	45

Figure A-8 : Gas-tightness test result	45
--	----

Tables

Table 5-1: Wire size to terminal post combinations.....	22
Table 5-2: Minimum number of wire turns on terminal post	25
Table 5-3: Minimum stripping force	27
Table 5-4: Test current for connection resistance	28

Foreword

This document (FprEN 16602-70-30:2013) has been prepared by Technical Committee CEN/CLC/TC 5 "Space", the secretariat of which is held by DIN (Germany).

This document (FprEN 16602-70-30:2013) originates from ECSS-Q-ST-70-30C.

This document is currently submitted to the Unique Acceptance Procedure.

This document has been developed to cover specifically space systems and will therefore have precedence over any EN covering the same scope but with a wider domain of applicability (e.g. : aerospace).

1

Scope

This Standard specifies requirements for preparing and assembling parts to be joined by wire wrapping, as well as the selection, calibration, use and certification of wire wrapping tools.

The covered wire-wrapped connections are illustrated in Figure 1-1.

This type of connection is similar to “Class A preferred” or “modified” connection detailed in MIL-STD-1130, and NASA NHB 5300.4(3H).

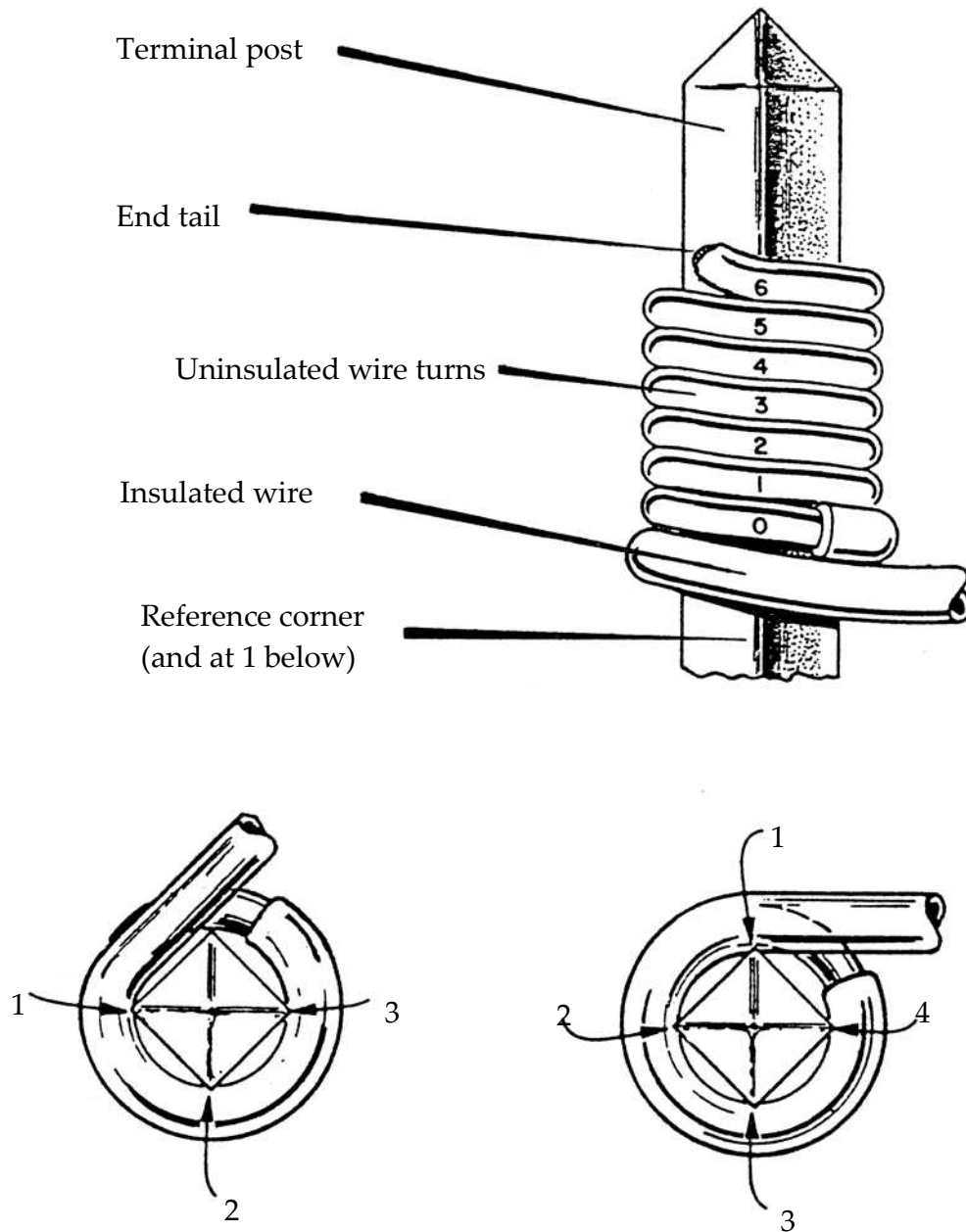
Only previously tested and qualified wire-wrapped connections are covered by this Standard, which includes four wire sizes from 24 AWG to 30 AWG, and three terminal post sizes up to 1,78 mm maximum diagonal. A step-by step procedure is covered in the informative Annex A.

The use of heavier gauge wire and larger terminals is not generally prohibited, but it is considered unlikely that for such dimensions the method of wire-wrapping would be chosen as the electrical interconnection technique. Instead it is assumed that wire larger than 24 AWG will be multi-stranded and terminated by soldering in conformance with ECSS-Q-ST-70-08, or by crimping in conformance with ECSS-Q-ST-70-26.

Training and certification requirements for operators and inspectors are defined in clause 5.6.7 and in ECSS-Q-ST-20.

With effect from the date of approval, this Standard announces the adoption of the external document on a restricted basis for use in the European Cooperation for Space Standardization (ECSS) system.

This standard may be tailored for the specific characteristic and constraints of a space project in conformance with ECSS-S-ST-00.



Shows either 3 or 4 corners of contact of insulation minimum $\frac{3}{4}$ turn of insulated wire

Figure 1-1: Single wire-wrapped connection to square terminal and reference corner

2

Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this ECSS Standard. For dated references, subsequent amendments to, or revisions of any of these publications do not apply. However, parties to agreements based on this ECSS Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references the latest edition of the publication referred to applies.

EN reference	Reference in text	Title
EN 16601-00-01	ECSS-S-ST-00-01	ECSS system – Glossary of terms
EN 16602-20	ECSS-Q-ST-20	Space product assurance – Quality assurance
EN 16602-70-02	ECSS-Q-ST-70-02	Space product assurance – Thermal vacuum outgassing test for the screening of space materials
EN 16602-70-38	ECSS-Q-ST-70-38	Space product assurance – High-reliability soldering for surface-mount and mixed technology
	ESSCC Generic specification 3903	Solid wires, electrical 350V, for wire wrapping

Terms, definitions and abbreviated terms

3.1 Terms defined in other standards

For the purpose of this Standard, the terms and definitions from ECSS-S-ST-00-01 and ECSS-Q-ST-70-38 apply.

In particular from ECSS-Q-ST-70-38 the following term:

process identification document (PID)

NOTE The content of the PID is specified in ECSS-Q-ST-70-38.

3.2 Terms specific to the present standard

3.2.1 a turn of wire

a wrap consisting of one complete single helical ring of wire wrapped 360 degrees around the terminal post, touching all four corners of the post.

NOTE For the purpose of counting turns, the number of times the wrapped wire passes and intercepts the reference edge of the terminal post after the first intercept of uninsulated wire and terminal post, constitutes the number of turns of uninsulated wire in the connection.

3.2.2 end tail

end of the last turn of wire on the terminal post which can extend in a tangential direction instead of resting against the post

3.2.3 gas-tight area

contact area between the terminal post and wire which excludes gas fumes

3.2.4 reference corner

corner of the terminal post at which the first turn of uninsulated wire contacts, and from which the number of turns of the wrapped wire are counted.

3.2.5 terminal post

post of square or rectangular section onto which the interconnection wire is wrapped.

3.2.6 wire-wrapped connection

connection consisting of a helix of continuous, solid, non-insulated wire tightly wrapped around the terminal post to produce a mechanically and electrically stable connection.

NOTE 1 The number of turns required will depend on the gauge of wire used.

NOTE 2 All completed wraps have an additional minimum of 3/4 turn of the insulated wire that is in contact with at least three corners of the terminal post (see Figure 1-1).

3.3 Abbreviated terms

For the purpose of this Standard, the abbreviated terms from ECSS-S-ST-00-01 and the following apply:

Abbreviation	Meaning
AWG	American wire gauge
ETFE	ethylene-tetrafluorethylene (Tefzel)
NCR	nonconformance report
PFA	perfluoroalkoxy
PID	process identification document
PTFE	polytetrafluorethylene
PVDF	polyvinylidene fluoride (Kynar)
QA	quality assurance
RFA	request for approval
RH	relative humidity

4 Principles

The production of wire-wrapped connections is a relatively simple yet precision method of fusion. Its use for high reliability space conditions affords high skills of operators and inspectors as well as tooling and environmental controls to produce continued high level quality. The following principles are laid down in this Standard:

- Each tool is certified for each wire to post configuration; regular calibration is mandatory.
- All material, including wire and post, requires approval and rigorous inspection.
- A well-defined and documented process control document (PID) to ensure consistency of production over extended periods.
- Operators and inspectors need experience and regular training and certification.
- Frequent inline inspection and testing of wire-wraps validate continued quality levels for the intended high reliability application.

Formal Quality Assurance and documentation will substantiate the achieved level of compliance to the requirements within this Standard.

It is important to perform the work taking into account health and safety regulations and in particular the national standards on this subject.