SLOVENSKI STANDARD
SIST EN 16602-70-39:2019

01-februar-2019

Zagotavljanje varnih proizvodov v vesoljski tehniki - Varjenje kovinskih materialov za letalsko strojno opremo

Space product assurance - Welding of metallic materials for flight hardware

Raumfahrtproduktsicherung - Teil 70-39: Anforderungen an Verarbeitung und Qualitätssicherung für das Metallschweißen in Flug-Hardware

Assurance produit spatiale - Soudure de matériaux métalliques pour matériel de vol

Ta slovenski standard je istoveten z: **EN 16602-70-39:2018**

ICS:

25.160.10	Varilni postopki in varjenje	Welding processes
49.140	Vesoljski sistemi in operacije	Space systems and operations

SIST EN 16602-70-39:2019 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 16602-70-39

November 2018

ICS 25.160.10; 49.140

English version

Space product assurance - Welding of metallic materials for flight hardware

Assurance produit des projets spatiaux - Soudage de matériaux métalliques pour matériel de vol

Raumfahrtproduktsicherung - Metallschweißen in Flug-Hardware

This European Standard was approved by CEN on 3 September 2018.

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. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN and CENELEC member.

This European Standard exists 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, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.

CEN-CENELEC Management Centre:
Rue de la Science 23, B-1040 Brussels

Table of contents

Figures

Tables

European Foreword

This document (EN 16602-70-39:2018) has been prepared by Technical Committee CEN/CLC/JTC 5 “Space”, the secretariat of which is held by DIN.

This standard (EN 16602-70-39:2018) originates from ECSS-Q-ST-70-39C.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2019, and conflicting national standards shall be withdrawn at the latest by May 2019.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a standardization request given to CEN by the European Commission and the European Free Trade Association.

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

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: 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, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1
Scope

This Standard specifies the processing and quality assurance requirements for the different types of metallic welding (manual, automatic, semi-automatic and machine) for space flight applications. This standard can also be used for weld activities on space related ground equipment and development models for flight hardware. The Standard covers all welding processes used for joining metallic materials for space applications. This includes, but is not limited to:

- Gas Tungsten Arc Welding (GTAW) / Tungsten Inert Gas (TIG), (process 14)
- Gas Metal Arc Welding (GMAW) / Metal Inert Gas (MIG) (process 13)
- Plasma Arc Welding (PAW) / Plasma of Transferred Arc (PTA), (process 15)
- Electron beam welding (EBW), (process 51)
- Laser beam welding (LBW), (process 52)
- Friction Stir welding (process 43)
- Magnetic Pulse welding (process 442)
- Linear friction welding (process 42)
- Rotary friction welding (process 42)

The specific process numbers mentioned above are listed according to the standard ISO 4063:2009.

This Standard does not detail the weld definition phase and welding pre-verification phase, including the derivation of design allowables.

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

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 revision 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 more 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 16603-32-01	ECSS-E-ST-32-01	Space engineering –Fracture control
EN 16601-40	ECSS-M-ST-40	Space management – Configuration and information management
EN 16602-10-09	ECSS-Q-ST-10-09	Space product assurance – Nonconformance control system
EN 16602-20	ECSS-Q-ST-20	Space product assurance – Quality assurance
	AMS 2644:2006	Inspection material, penetrant
	ASTM E164-13:2013	Standard Practice for Contact Ultrasonic Testing of Weldments
	ASTM E3:2007	Standard Guide for Preparation of Metallographic Specimens
	ASTM E340:2013	Standard Test Method for Macroetching Metals and Alloys
	ASTM E407:2007	Standard Practice for Microetching Metals and Alloys
	AWS D18.2:2009	Guide to weld discoloration levels on inside of austenitic stainless steel tube
	DIN 29595:2007-04	Fusion welded metallic components – requirements
	DIN 65153:1997-06	Acceptance testing of plasma arc welding equipment.
	EN 4179:2009	Aerospace series. Qualification and approval of personnel for non-destructive testing
	EN 60974 Part 1:2012 Part 2:2013	Arc welding equipment Welding power sources Liquid cooling systems

	Part 3:2013	Arc striking and stabilizing devices
	Part 4:2010	Periodic inspection and testing
	Part-5:2013	Wire feeders
	Part 6:2010	Limited duty equipment
	Part 7:2013	Torches
	Part 8:2009	Gas consoles for welding and plasma cutting systems
	Part 9: 2010	Installation and use
	Part 10:2014	Electromagnetic compatibility (EMC) requirements
	Part 11:2010	Electrode holders
	Part 12:2011	Coupling devices for welding cables
	Part 13:2011	Welding clamp
	ISO 2553:2013	Welding and allied processes -- Symbolic representation on drawings -- Welded joints
	ISO 3452	Non-destructive testing - Penetrant testing
	Part 1:2013	General principles
	Part 2:2013	Testing of penetrant materials
	Part 3:2013	Reference test blocks
	Part 4:1998	Equipment
	Part 5: 2008	Penetrant testing at temperatures higher than 50 degrees C
	Part 6:2008	Penetrant testing at temperatures lower than 10 degrees C
	ISO 4063:2009	Welding and allied processes - Nomenclature of processes and reference numbers
	ISO 4136:2012	Destructive tests on welds in metallic materials - Transverse tensile test
	ISO 6848:2004	Arc welding and cutting - Nonconsumables tungsten electrodes - Classification
	ISO 6947:2011	Welding and allied processes - Welding positions
	ISO 9015	Destructive tests on welds in metallic materials - Hardness testing (Part 1 and 2)
	Part 1:2001	Hardness test on arc welded joints
	Part 2:2003	Microhardness testing of welded joints
	EN 10204:2004	Metallic products - Types of inspection documents
	ISO 11611:2007	Protective clothing for use in welding and allied processes
	ISO 14731:2006	Welding coordination - Tasks and responsibilities
	ISO 14732:2013	Welding personnel – Qualification testing of welding operators and weld setters for mechanized and automatic welding of metallic materials
	ISO 14744	Acceptance inspection of electron beam welding machines

	Part 1:2008	Principles and acceptance conditions
	Part 2:2000	Measurement of accelerating voltage characteristics
	Part 3:2000	Measurement of beam current characteristics
	Part 4:2000	Measurement of welding speed
	Part 5:2000	Measurement of run-out accuracy
	Part 6:2000	Measurement of stability of spot position
	ISO 15614-2:2005	Specification and qualification of welding procedures for metallic materials - Welding procedure test - Part 2: Arc welding of aluminium and its alloys
	ISO 15616	Acceptance tests for CO2-laser beam machines for high quality welding and cutting
	Part 1:2003	General principles, acceptance conditions
	Part 2:2003	Measurement of static and dynamic accuracy
	Part 3:2003	Calibration of instruments for measurement of gas flow and pressure
	Part 4:2008	Acceptance tests for CO2-laser beam machines for high quality welding and cutting - Part 4: Machines with 2-D moving optics
	ISO 17636:2013	Non-destructive testing of welds - Radiographic testing
	Part 1:2013	X- and gamma-ray techniques with film
	Part 2:2013	X- and gamma-ray techniques with digital detectors
	EN-ISO 17637:2011	Non-destructive testing of welds - Visual testing of fusion-welded joints
	ISO 17640:2010	Non-destructive testing of welds - Ultrasonic testing - Techniques, testing levels, and assessment
	ISO 22826:2005	Destructive tests on welds in metallic materials - Hardness testing of narrow joints welded by laser and electron beam (Vickers and Knoop hardness tests)
	ISO 22827:2005	Acceptance tests for Nd: YAG laser beam welding machines - Machines with optical fibre delivery
	Part 1:2005	Laser assembly
	Part 2:2005	Moving mechanism
	ISO 24394:2008	Welding for aerospace applications - Qualification test for welders and welding operators - Fusion welding of metallic components
	ISO 25239-3:2011	Friction stir welding - Aluminium - Part 3: Qualification of welding operators
	ISO 25239-5:2011	Friction stir welding - Aluminium - Part 5: Quality and inspection requirements

3 Terms, definitions and abbreviated terms

3.1 Terms from other standards

a. For the purpose of this Standard, the terms and definitions from ECSS-S-ST-00-01 apply and in particular the following:

1. critical

b. For the purpose of this Standard, the terms and definitions from ECSS-E-ST-32-01 apply.

1. fail-safe

3.2 Terms specific to the present standard

3.2.1 acceptable weld

weld that has no defects and passes all acceptance criteria

3.2.2 all weld metal tensile test specimen

test specimen with the reduced section composed of only weld metal

3.2.3 alpha sample

weld sample produced prior to the start of a production run, used to verify selected aspects of the quality of the weld to be produced during production

NOTE The term "pre-weld sample" is synonymous.

3.2.4 base metal

part of the welded joint which remains un-melted or un-stirred for friction stir welding, and unaffected by the heat of the process, such that the microstructure and mechanical properties are unaffected

3.2.5 beta sample

weld sample produced at the end of a production run, used to verify selected aspects of the quality of the weld to be produced during production

NOTE The term "post-weld sample" is synonymous.

3.2.6 critical structure

structure or component, the single failure of which cause significant danger to personnel, loss of system, loss of major component, or loss of control, thus resulting in an operation penalty, or loss of the system, or abortion of the mission

3.2.7 defect

<CONTEXT: welding>

unacceptable feature of the weld

NOTE This term is defined in the present standard with a different meaning than in ECSS-S-ST-00-01. The term with the meaning defined herein is applicable only to the present standard.

3.2.8 delta verification

welding trials performed to extend the range of a previously approved WPS

3.2.9 design authority

responsible for the detailed design of the welded part in compliance to an approved specification and authorized to sign certificates of design or certified sealed drawings in accordance with procedures

3.2.10 engineering authority

contracting agency or corporate organisation that acts for and on behalf of the customer and responsible for the structural integrity or maintenance of airworthiness of the hardware and compliance with all business agreement documents

3.2.11 fabrication

structure manufactured by assembling various parts together

3.2.12 feature

geometric or microstructural non-uniformity in the weld or weld zone

3.2.13 filler metal

metal supplied in the form of a welding rod, sometimes flux coated, melted by a heat source into a joint between components to be joined

3.2.14 heat affected zone (HAZ)

portion of the base metal that was not melted during fusion welding or stirred during friction stir welding but whose microstructure and mechanical properties were altered by the heat applied during the welding process

3.2.15 hybrid welding

type of welding process that combines the principles of laser beam welding and arc welding

3.2.16 in process correction

see "re-weld"

3.2.17 job card

see "shop traveller"

3.2.18 machine welding

welding with equipment that performs the welding operation

3.2.19 maintenance book

record of maintenance performed on equipment including any modifications

3.2.20 manual welding

welding operation performed and controlled completely by hand

3.2.21 mission critical

item whose failure generates a significant operational impact by jeopardizing the ability to successfully complete the assigned mission.

NOTE This includes parts which have failure effects that adversely impact mission effectiveness.

3.2.22 non-critical structure

structure or component which is non-critical and is contained so that failure does not affect other flight elements or personnel

3.2.23 piece part

individual metallic parts to be welded

NOTE The term of "piece part" is commonly used in welding. Examples are: sheets, plates and extrusions.

3.2.24 post weld sample

see "beta sample"

3.2.25 process

<CONTEXT: welding>

material or joint type and dimension or welding process combination which is covered by a WPS

NOTE This term is defined in the present standard with a different meaning than in ECSS-S-ST-00-01. The term with the meaning defined herein is applicable only to the present standard.

3.2.26 production run

welding run corresponding to the same sample coupons, the same material lot and the same thermal treatment, pre- or post- batch as the flight or production hardware itself