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European Foreword

This document (CEN/TR 17603-32-23:2022) has been prepared by Technical Committee CEN/CLC/JTC 5 “Space”, the secretariat of which is held by DIN.

It is highlighted that this technical report does not contain any requirement but only collection of data or descriptions and guidelines about how to organize and perform the work in support of EN 16603-32.

This Technical report (CEN/TR 17603-32-23:2022) originates from ECSS-E-HB-32-23A.

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 mandate 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 TR covering the same scope but with a wider domain of applicability (e.g.: aerospace).

Introduction

- ABSTRACT
  The aim of the present handbook is to assist the structural design engineers by presenting them in a single document with all the information relevant to the use of threaded fasteners in jointed spacecraft components.
- BACKGROUND
  Threaded fastener joints represent critical areas within structures and it is evident that a standardised methodology is needed for their design.

  Thus, the aims of this document are:

  — to bring together into one document a reliable and systematic design procedure to aid the designer and improve the efficiency of the design process, and

  — to provide an approved and reliable design procedure that will reduce the possibility of design errors and subsequent structural failure.

  This document addresses these aims with particular reference to Space Structures and related hardware. This constraint is reflected in the range of joint geometries covered and structural applications, and also the range of fastener types and materials for which data is presented.
- PURPOSE OF THIS ISSUE
  ESA PSS-03-208 “Guidelines for threaded fasteners”, on which this document is based, provided a number of methodologies for analysis of threaded fastener joints in spacecraft structures. This document is an update of the PSS taking into account more recent developments in the field. It is intended to standardise the analysis approach and corresponding documentation for threaded fastener joints developed in ECSS projects. Therefore, this document presents a “Margin of Safety” for each mode of failure that should be considered. All relevant margins of safety should be shown in verification documentation.
- GUIDELINE LIMITATION AND IDENTIFIED PROBLEM AREA
  This handbook does not provide theory for the following types of analysis:

  — Compliance of cantilevered flange joints with non-circular flanges

  — Friction grip of eccentric shear loaded joints

  — No failure criteria are provided for fastener bending, which sometimes should be considered (see Subsection 9.3.2)
- GUIDELINES FOR THE USE OF TERMS AND DEFINITIONS
  Due to the extensive used of threaded fasteners in a multitude of countries and industries, there is a wide variety of terminology in use today. For the purposes of making a clear and coherent handbook it was necessary to adopt a single consistent set of terminology. The terminology that was chosen is presented in 3.2. To avoid confusion, it is recommended to refer to this section frequently when reading the document.

1 Scope

The users of this document are engineers involved in design, analysis or verification of joints on structures used for space missions. It is a guidelines document; therefore it includes advisory information rather than requirements.

This document is intended to be applicable to any type of joint that is mechanically connected by threaded fasteners (e.g. bolts, screws, etc). It is written for joints made from metallic materials. However, subject to the engineering judgement of the user, many of the procedures presented herein may be applicable to joints made from composite materials.

2 References

References are provided at the end of each section.