INTERNATIONAL STANDARD

ISO 16454

First edition
2007-11-01

Space systems — Structural design — Stress analysis requirements

Systèmes spatiaux — Conception des structures — Exigences relatives à l'analyse des contraintes

Reference number
ISO 16454:2007(E)

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Published in Switzerland

Contents

Page

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

ISO 16454 was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 14, *Space systems and operations*.

Introduction

From the beginning of the space age, structural integrity verification has been one of the main fields of mechanical specialists' activity. Mission failure and potential danger to human life, expensive ground constructions and other public and private property are the most probable consequences in the case of space structural integrity failure. Static strength is one of the most important critical conditions for structural integrity analysis. It is usually the main criteria for space structure weight evaluation. If the space structure is too heavy, the mission could be extremely expensive or impossible to achieve. If the space structure is underdesigned, it could result in structural failure, leading to high risk associated with safety of life, and loss of expensive hardware and other property. It is therefore necessary to specify unique requirements for static strength analysis in order to provide cost effective design and light-weight, reliable and low risk structures for space application.

The analysis and design of space structures has a long history. This International Standard establishes the preferred requirements related to these techniques for static strength critical condition.

Space systems — Structural design — Stress analysis requirements

1 Scope

This International Standard is intended to be used for the determination of the stress/strain distribution and margins of safety in launch vehicles and spacecraft primary structure design. Liquid propellant engine structures, solid propellant engine nozzles and the solid propellant itself are not covered, but liquid propellant tanks, pressure vessels and solid propellant cases are within the scope of this International Standard.

This International Standard provides requirements for the determination of maximum stress and corresponding margin of safety under loading, and defines criteria for static strength failure modes, such as rupture, collapse and detrimental yielding. Critical conditions associated with fatigue, creep and crack growths are not covered. Notwithstanding these limitations in scope, the results of stress calculations based on the requirements of this International Standard are applicable to other critical condition analyses.

In accordance with the requirements of this International Standard, models, methods and procedures for stress determination can also be applied to the displacements and deformation calculations, as well as to the loads definition, applied to substructures and structural members of structures under consideration. When this International Standard is applied, it is assumed that temperature distribution has been determined and is used as input data.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 14622, *Space systems — Structural design — Loads and induced environment*

ISO 14623, *Space systems — Pressure vessels and pressurized structures — Design and operation*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
A-basis allowable
mechanical strength value above which at least 99 % of the population of values is expected to fall, with a confidence level of 95 %

3.2
allowable load
allowable stress
allowable strain
maximum load (stress, strain) that can be accommodated by a material/structure without potential rupture, collapse or detrimental deformation in a given environment

NOTE Allowable loads (stresses, strains) commonly correspond to the statistically based minimum ultimate strength, buckling strength and yield strength, respectively.