

# INTERNATIONAL STANDARD

ISO  
1151-5

Second edition  
1987-05-01



---

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION  
ORGANISATION INTERNATIONALE DE NORMALISATION  
МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ

---

## Flight dynamics — Concepts, quantities and symbols —

### Part 5: Quantities used in measurements

*Mécanique du vol — Concepts, grandeurs et symboles —*

*Partie 5: Grandeurs utilisées dans les mesures*

ISO 1151-5:1987

<https://standards.iteh.ai/catalog/standards/iso/802333b6-4794-470a-8244-c8d369a4b745/iso-1151-5-1987>

Reference number  
ISO 1151-5: 1987 (E)

## 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 1151-5 was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*.

This second edition cancels and replaces the first edition (ISO 1151-5 : 1974), of which it constitutes an overall technical revision and to which sub-clause 5.7 has been added.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

ISO 1151, *Flight dynamics — Concepts, quantities and symbols*, comprises, at present, seven parts:

*Part 1: Aircraft motion relative to the air.*

*Part 2: Motions of the aircraft and the atmosphere relative to the Earth.*

*Part 3: Derivatives of forces, moments and their coefficients.*

*Part 4: Parameters used in the study of aircraft stability and control.*

*Part 5: Quantities used in measurements.*

*Part 6: Aircraft geometry.*

*Part 7: Flight points and flight envelopes.*

ISO 1151 is intended to introduce the main concepts, to include the more important terms used in theoretical and experimental studies and, as far as possible, to give corresponding symbols.

In all the parts comprising ISO 1151, the term "aircraft" denotes a vehicle intended for atmosphere or space flight. Usually, it has an essentially port and starboard symmetry with respect to a plane. That plane is determined by the geometric characteristics of the aircraft. In that plane, two orthogonal directions are defined: fore-and-aft and dorsal-ventral. The transverse direction, on the perpendicular to that plane, follows.

When there is a single plane of symmetry, it is the reference plane of the aircraft. When there is more than one plane of symmetry, or when there is none, it is necessary to choose a reference plane. In the former case, the reference plane is one of the planes of symmetry. In the latter case, the reference plane is arbitrary. In all cases, it is necessary to specify the choice made.

Angles of rotation, angular velocities and moments about any axis are positive clockwise when viewed in the positive direction of that axis.

All the axis systems used are three-dimensional, orthogonal and right-handed, which implies that a positive rotation through  $\pi/2$  around the  $x$ -axis brings the  $y$ -axis into the position previously occupied by the  $z$ -axis.

The centre of gravity coincides with the centre of mass if the field of gravity is homogeneous. If this is not the case, the centre of gravity can be replaced by the centre of mass in the definitions of ISO 1151; in this case, this should be indicated.

#### **Numbering of sections and clauses**

With the aim of easing the indication of references from a section or a clause, a decimal numbering system has been adopted such that the first figure is the number of the part of ISO 1151 considered.

## Contents

	Page
5.0 Introduction .....	1
5.1 Fundamental characteristics of the atmosphere .....	1
5.2 Geometric and geopotential altitudes .....	2
5.3 Equivalent altitudes related to a standard atmosphere .....	2
5.4 Physical quantities related to motion of the aircraft in the atmosphere .....	3
5.5 Measurement of quantities related to motion of the aircraft in the atmosphere .....	4
5.6 Speeds and indicated Mach number .....	5
5.7 On-board accelerometer indications .....	6
<b>Annex:</b> Terms used for pressure differences in some countries .....	8

[ISO 1151-5:1987](https://standards.iteh.ai/standards/iso/802333b6-f794-470a-8244-c8d369a4b745/iso-1151-5-1987)

<https://standards.iteh.ai/catalog/standards/iso/802333b6-f794-470a-8244-c8d369a4b745/iso-1151-5-1987>

# Flight dynamics — Concepts, quantities and symbols —

## Part 5: Quantities used in measurements

### 5.0 Introduction

This part of ISO 1151 deals with the quantities used in flight measurements.

ISO 2533, *Standard atmosphere*, is necessary as a reference document for the application of some items in this part of ISO 1151.

### 5.1 Fundamental characteristics of the atmosphere

Among the physical quantities characterizing the atmosphere at the point considered, the following are the most important.

No.	Term	Definition	Symbol
5.1.1	(Air) pressure	The pressure of the air at the point considered in the atmosphere, as measured by a perfect instrument, at rest relative to the air.	$p$
5.1.2	(Air) temperature	The thermodynamic temperature of the air at the point considered in the atmosphere, as measured by a perfect instrument, at rest relative to the air.  NOTE — The thermodynamic temperature is still sometimes called the "absolute temperature".	$T$
5.1.3	(Air) density	The quotient of the mass of the air contained in an infinitesimal volume enclosing the point considered in the atmosphere by this volume.	$\rho$
5.1.4	Relative (air) density	The ratio of the air density (5.1.3), at the point considered in the atmosphere, to a datum density.  In general, this datum density is the density of air at mean sea level in the chosen standard atmosphere.  Using the standard atmosphere specified in ISO 2533:  $\sigma = \frac{\rho}{\rho_n} \text{ where } \rho_n = 1,225 \text{ kg}\cdot\text{m}^{-3}$	$\sigma$

5.2 Geometric and geopotential altitudes

No.	Term	Definition	Symbol
5.2.1	Geometric altitude (with respect to sea level)	A quantity, the modulus of which is equal to the distance between the point considered and the mean sea level.  This quantity is positive for points above mean sea level.	$h$ or $Z_g$ NOTE — Where there is no possibility of confusion with $Z$ (1.5.2), the subscript "g" may be omitted.
5.2.2	Geopotential altitude	The geopotential altitude of a point P, of geometric altitude $h(P)$ (5.2.1), is given by the relationship:  $H = \frac{1}{g_n} \int_0^{h(P)} g(h) dh$ where  $g(h)$ is the acceleration of free fall defined in the standard atmosphere specified in ISO 2533 as a function of the geometric altitude $h$ (5.2.1);  $g_n$ is the standard acceleration of free fall ( $g_n = 9,806\ 65\ \text{m}\cdot\text{s}^{-2}$ according to ISO 2533).  The integral is calculated along the vertical passing through point P.	$H$

5.3 Equivalent altitudes related to a standard atmosphere

The definition of a number of quantities of interest in flight measurements depends on the concept of a standard atmosphere. Such an atmosphere is assumed to comprise a perfect gas, of known molar mass, in aerostatic equilibrium.

The laws of variation of temperature and composition of the gas with geopotential altitude (5.2.2) are chosen according to convention; the laws of variation with geopotential altitude of the different physical parameters which characterize the standard atmosphere adopted are then deduced.

ISO 1151-5:1987

No.	Term	Definition	Symbol
5.3.1	Pressure altitude	The geopotential altitude (5.2.2) at which, in the chosen standard atmosphere, the pressure is equal to the air pressure (5.1.1) at the point considered.	$H_p$
5.3.2	Temperature altitude	The geopotential altitude (5.2.2) at which, in the chosen standard atmosphere, the temperature is equal to the air temperature (5.1.2) at the point considered.	$H_T$
5.3.3	Density altitude	The geopotential altitude (5.2.2) at which, in the chosen standard atmosphere, the density is equal to the air density (5.1.3) at the point considered.	$H_\rho$

NOTE — Similar definitions to those given in 5.3.1 to 5.3.3 can be drawn up by analogy using the geometric altitude; the corresponding symbols are:  $h_p, h_T, h_\rho$ .