



BSI Standards Publication

Respiratory protective devices — Human factors

Part 4: Work of breathing and breathing resistance: Physiologically based limits

National foreword

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A list of organizations represented on this committee can be obtained on request to its secretary.

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**Respiratory protective devices —
Human factors —**

**Part 4:
Physiologically based limits**

Appareils de protection respiratoire — Facteurs humains —

*Partie 4: Travail de respiration et de résistance à la respiration:
limites physiologiques*





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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 94, *Personal safety — Personal protective equipment*, Subcommittee SC 15, *Respiratory protective devices*.

This second edition cancels and replaces the first edition (ISO/TS 16976-4:2012), which has been technically revised. The main changes compared to the previous edition are as follows:

- a) adjustment of key-points in [Figures 3, 4 and 7](#) to correspond with the 50 %-reference line;
- b) adjustment of keys in [Figures 3, 4, 7 and 8](#);
- c) adjustment of [Figures 3, 4 and 5](#);
- d) clarification on flow resistance and elastic load given in [7.4](#).

A list of all parts in the ISO/TS 16976 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

A respiratory protective device (RPD) is designed to offer protection from the inhalation of hazardous substances. However, this protection requires extra effort by the respiratory muscles as they need to generate higher pressures to overcome the associated respiratory loads imposed by the RPD.

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Respiratory protective devices — Human factors —

Part 4:

Work of breathing and breathing resistance: Physiologically based limits

1 Scope

This document describes how to calculate the work performed by a person's respiratory muscles with and without the external respiratory impediments that are imposed by RPD of all kinds, except diving equipment. This Document describes how much additional impediment people can tolerate and contains values that can be used to judge the acceptability of an RPD.

NOTE These calculations are explained in some textbooks on respiratory physiology (in the absence of an RPD), but most omit them or are incomplete in their explanations.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 16972, *Respiratory protective devices — Definitions of terms pictograms*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 16972 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1

body temperature pressure saturated

BTPS

standard condition for the expression of ventilation parameters

Note 1 to entry: Body temperature (37 °C), ambient pressure and water vapour pressure (6,27 kPa) in saturated air.

3.2

compliance

change in volume of the human lung that results from a change in pressure

Note 1 to entry: The compliance is measured in l/kPa.

Note 2 to entry: This term is the typical term for the elastic behaviour of the lungs and chest. Compliance is the inverse of elastance.