IEC 62966-2

Edition 1.0 2020-07

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Mechanical structures for electrical and electronic equipment – Aisle containment for it cabinets –
Part 2: Details of air flow, air separation and air cooling requirements

Structures mécaniques pour équipements électriques et électroniques – Confinement d'allées pour les baies informatiques –
Partie 2: Détails des exigences relatives au flux d'air, à la séparation des flux d'air et au refroidissement par air

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MECHANICAL STRUCTURES FOR ELECTRICAL AND ELECTRONIC EQUIPMENT – AISLE CONTAINMENT FOR IT CABINETS –

Part 2: Details of air flow, air separation and air cooling requirements

FOREWORD

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The text of this International Standard is based on the following documents:

FDIS	Report on voting
48D/722/FDIS	48D/727/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 62966 series, published under the general title *Mechanical structures for electrical and electronic equipment – Aisle containment for it cabinets*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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INTRODUCTION

Cabinets of the IEC 60297 and IEC 60917 standard series are used as enclosures of electronic and electrical equipment in many different fields of application. A wide field of application is represented by enclosures equipped with electronic information technology (IT) equipment. They are frequently set up in large numbers in server rooms and data centres. During their operation, the electronic equipment installed generates a considerable amount of heat that will be removed from the equipment by means of cooling air. Precise adjustment of the supply air temperature and a sufficient cooling air flow are indispensable prerequisites for the fail-safe operation of equipment in information technology.

It is a common practice to set up cabinets in rows. The server cabinets along the rows are usually arranged in such a way that surfaces with cold supply air inlets face each other across an aisle, and surfaces with hot exhaust air outlets also face each other across an aisle. This row configuration is generally known as hot aisle/cold aisle configuration. Moreover, air is supplied and discharged exclusively via the front and rear panels of the server cabinets, which are frequently perforated doors. It is assumed that inside the IT equipment, the cooling air is moved in a horizontal direction, taking it in at the front and discharging it at the rear.

This part of IEC 62966 specifies the quantification of the air separation, in particular the air leak rate that describes the content of the volumetric flow not used for cooling in the aisle containment for information technology (IT) cabinets. The objective of this document is to stipulate properties and requirements of aisle containment ensuring cost effective installation, energy-efficient and user-friendly operation of IT equipment in data centres server rooms.

The fan pressurization method (overpressure at the system and elements) is used to categorize the air tightness of the aisle containment. In doing so, it is used to quantify the air tightness, in order to compare aisle containments with regard to the air tightness. It is also useful for finding leaks, or to determine the improvement due to improving the air tightness. The fan pressurization method cannot measure the air leak rate, but serves as a basis for determining the air leak rate by calculation. The method can be used to determine air leak rates of the aisle containment at low-pressure and overpressure on the inside compared with the surroundings. Thus, this allows a categorization of the elements of an aisle containment – the enclosure – to be determined.

For this purpose, aisle containment is dismantled into typical individual elements, for example enclosures, doors and roof covers. The corresponding characteristic curves of these components are recorded separately and added to the system characteristic curve of the aisle containment.

The quality of the resulting aisle containment is then classified using a differential pressure measurement.

The IEC 62966 series, *Mechanical structures for electrical and electronic equipment – Aisle containment for IT cabinets*, is subdivided into the following parts:

- IEC 62966-1: *Dimensions and mechanical requirements*
- IEC 62966-2: *Details of air flow, air separation and air cooling requirements*
- IEC 62966-3: *Aspects of operational safety of IT equipment and users of aisle containment*

IEC 62966-1 defines geometric dimensions and mechanical properties ensuring undisturbed, energy-efficient and user-friendly operation of the data centre.

IEC 62966-2 provides the methods and process to get the aisle containment air leakage and define the classification (evaluation) system on the aisle containment air leakage, for designers and users of aisle containments for IT cabinets based on the IEC 60297 and IEC 60917 series.

IEC 62966-3 deals with aspects of safely operating IT equipment in aisle containment, with respect to special fire-protection and fire-fighting issues. It also describes the nature of the doors for access to the aisle containment and possible access control.

MECHANICAL STRUCTURES FOR ELECTRICAL AND ELECTRONIC EQUIPMENT – AISLE CONTAINMENT FOR IT CABINETS –

Part 2: Details of air flow, air separation and air cooling requirements

1 Scope

This part of IEC 62966, dedicated to aisle containment techniques for information technology (IT) equipment typically used in data centres, describes the quantification of its air tightness, in particular the air loss ratio that describes the content of the volumetric flow not used for cooling the IT equipment. This ratio provides an index of efficiency, being inversely proportional to efficiency (the lower this ratio, the higher the efficiency). This document provides methods to measure an aisle containment air leakage rate and defines a classification system for aisle containment leakage.

This document defines:

a) the measurement of the air leakage of the individual components of an aisle containment;

b) a method for calculating the air leakage of an aisle containment based on its individual components;

c) a method for calculating the air leakage rate of an aisle containment in relation to the utilised IT equipment;

d) a classification system for aisle containment leakage.

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.

IEC 62966-1, *Mechanical structures for electrical and electronic equipment – Aisle containment for IT equipment – Part 1: Dimensions and mechanical requirements*

ISO 9972, *Thermal performance of buildings – Determination of air permeability of buildings – Fan pressurization method*

3 Terms and definitions

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

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

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

3.1
air leak rate
ratio of the volumetric air flow not used for cooling to the total volumetric air flow

3.2
aisle containment
boundary that separates the inner volume from the surroundings, usually comprising the base (floor), access doors or end-piece on the front side, roof elements and containment doors of the enclosure (cabinet), that contain the IT equipment

3.3
base
<of an aisle containment> area bounded by the doors of the opposite-facing bayed enclosure (cabinet) suites and the aisle doors or walls

3.4
doors
<of an aisle containment> end piece of an aisle containment on both ends or on one end that ensures access to the inside of the aisle containment

3.5
roof elements
<of an aisle containment> upper construction of the aisle containment as an upper end piece

3.6
enclosure
<of an aisle containment> server and network cabinets that accommodate IT equipment

3.7
inner volume
<of an aisle containment> volumes of the aisle containment limited by doors, roof elements, bases and enclosures

3.8
IT equipment
<of an aisle containment> all (active) components that are installed in an enclosure

3.9
supply air
cooling air before entering the IT equipment and other IT related supporting systems, whose temperature is suitable to absorb the heat flow from the equipment

3.10
supply air temperature
temperature of the supply air to the enclosures.

3.11
exhaust air
heated supply air after exiting the IT equipment that has absorbed the heat flow

3.12
exhaust air temperature
temperature of the exhaust air from the enclosures of an isle containment

3.13
cold aisle
area in front of the enclosures of an aisle containment that is supplied with the supply air

3.14
hot aisle
area behind the enclosures of an aisle containment into which the exhaust air flows

3.15
operation point
work point of the overall system at a specified time, set via the selected operating parameters

3.16
design point
operating parameters that are used as a basis for correct operation

3.17
air flow unit
equipment unit fitted in an aisle containment able to provide for example through air conditioning or forced ventilation, the supply of cooling air mass to the entire aisle containment

4 Determination of the air leak rate

4.1 Determination of the air leak rate of the individual components of an aisle containment

The following description is used to determine the air leak rate of the individual components of an aisle containment. The same method shall be used for special design adaptations.

The individual components are measured on a test rig. A component characteristic curve is recorded (pressure drop Δp versus volumetric air flow). The system characteristic curve is generated by grouping all of the component characteristic curves.

The quality of the technically correct installation of the entire aisle containment has a decisive influence on the air leak rate. For this reason, all interfaces of the individual components shall be made air tight. The individual components are defined in 62966-1:

- roof (see Figure 1)
- door (see Figure 2)
- enclosures (see Figure 3)

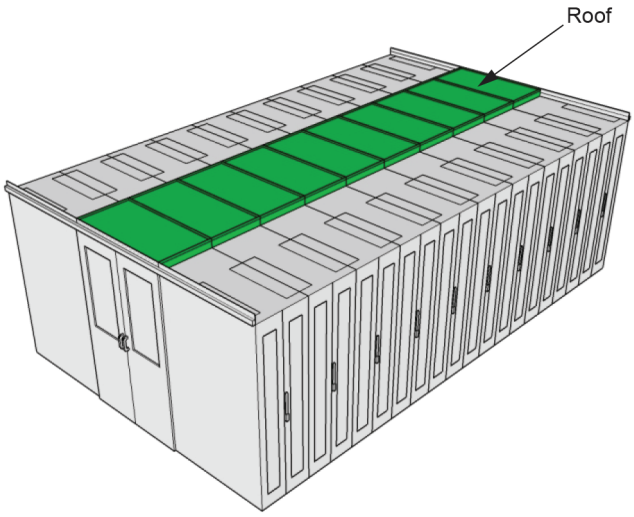

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Figure 1 – Example of the components – Roof

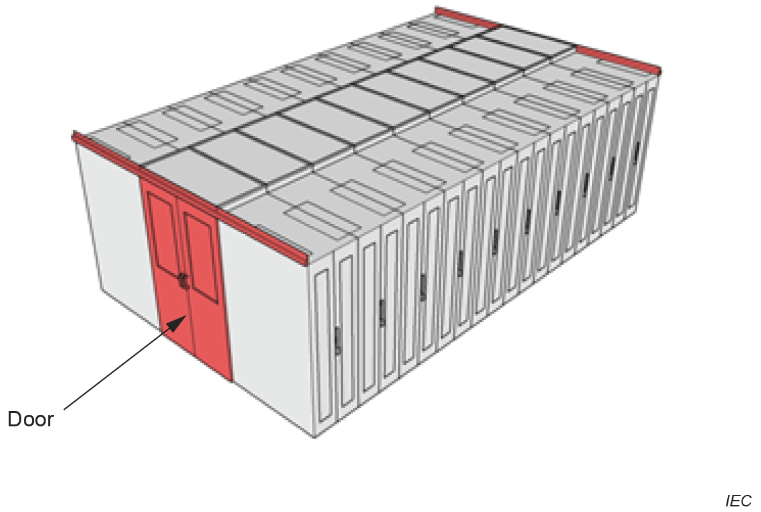

Figure 2 – Example of the components – Door

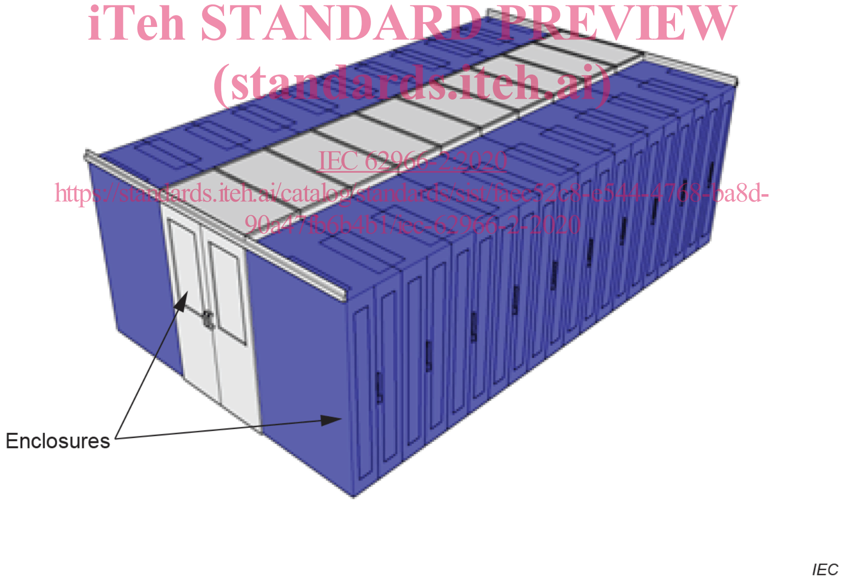

Figure 3 – Example of the components – Enclosures

4.2 Components and system characteristic curves

4.2.1 General

The determination of the system characteristic curves shall be carried out based on ISO 9972.

4.2.2 Equipment requirements

4.2.2.1 Air flow unit for supplying mass air flow

The relationship of mass air flow to the volumetric flow shall be established via the air density (mean value with reference to supply air temperature and exhaust air temperature). The unit shall generate a differential pressure across the specimen that can be evaluated, and shall be able to supply a constant volumetric flow over the overall measurement range. The air flow unit shall be able to generate overpressure as well as negative pressure in the aisle containment.

In some cases, the existing climate control components can also be used as long as they fulfil the same requirements.

4.2.2.2 Differential pressure measuring instrument

An instrument for measuring the pressure difference of the air with a preferred measuring accuracy of ±1,0 Pa in a range of 0 Pa to 30 Pa.

4.2.2.3 Volumetric flow measuring instrument

An instrument for measuring the volumetric air flow with a preferred measuring accuracy of ±5 % of the measured volumetric air flow.

4.2.2.4 Temperature sensors

A measuring instrument for determining the temperature with a preferred measuring accuracy of ±0,5 K.

4.3 Measurement procedure

4.3.1 Measurement conditions

The accuracy of the measurement described is strongly dependent on the measuring instruments used. The total error of the measurement shall be a maximum of 5 %.

As no influence shall be present from external ambient influences (weather) during the measurement, to standardise the measurement only the geodetic altitude of the location and the temperature of the surrounding rooms shall be determined. The atmospheric pressure in Pa shall be reported.

4.3.2 Preparing the elements of the test housing for measurement

For the measuring procedure described in this part of the document, it is a requirement that the area in which the IT equipment will typically be installed shall be sealed air tight (see Figure 4).

The doors and roof elements shall correspond with the finished state of the aisle containment, and be closed. The individual elements of the test housing shall be equipped with the respective construction elements of the connecting components for the measurement in such a manner that the interfaces of the individual elements correspond with the future assembly. The interfaces to other elements that are joined air tight do not need to be considered during the test (see Figure 5, Figure 6, Figure 7).

In accordance with the manufacturer’s instructions, gaps and mounting spaces shall be covered with the appropriate covers, brushes, foam seals, etc.

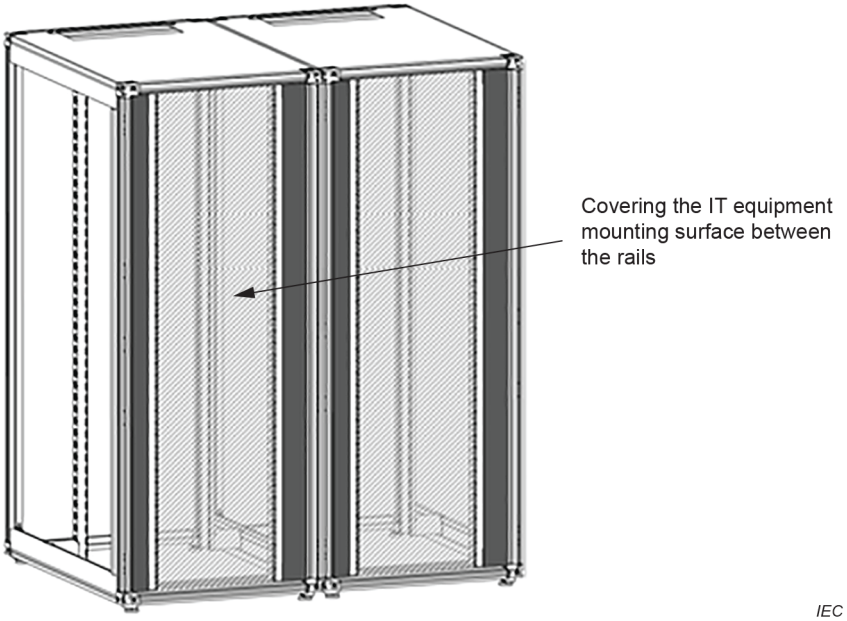

Figure 4 – Sealing the installation level

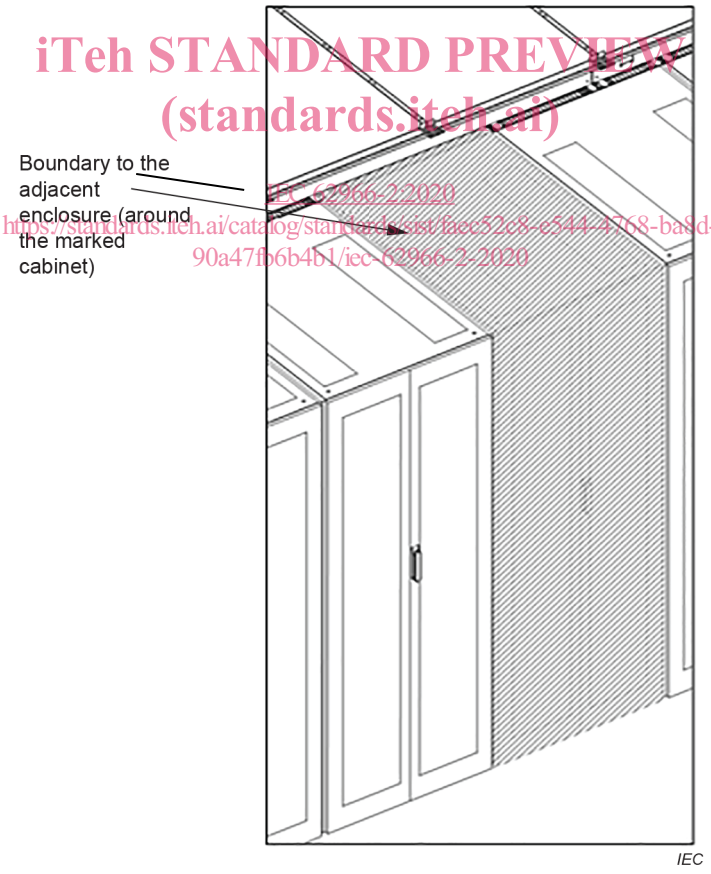

Figure 5 – Example of a connecting design to the neighbouring enclosure

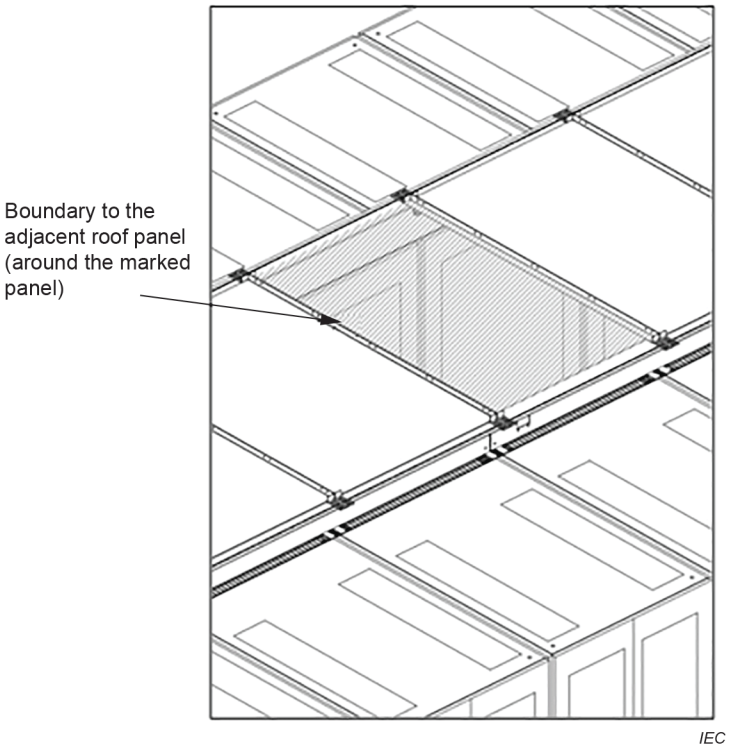

Figure 6 – Example of a connecting design to the roof

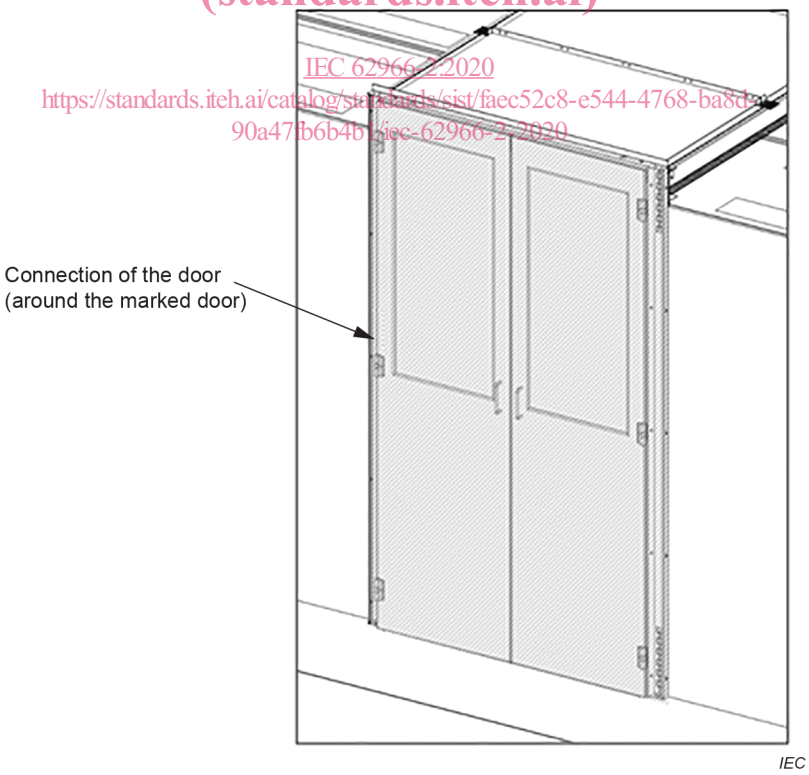

Figure 7 – Example of a connecting design to the end door

4.3.3 Measurement of the air leak rate

To carry out corrections according to the density of the air, temperatures shall be documented before, during and after the measurement. During the measurement, the flow rate and pressure difference shall be recorded.