IEC 62966-1

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INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Mechanical structures for electrical and electronic equipment – Aisle containment for it cabinets – Part 1: Dimensions and mechanical requirements

Structures mécaniques pour équipements électriques et électroniques – Confinement d'allées pour les baies informatiques – Partie 1: Dimensions et exigences mécaniques

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Structures mécaniques pour équipements électriques et électroniques – Confinement d'allées pour les baies informatiques – Partie 1: Dimensions et exigences mécaniques

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

Part 1: Dimensions and mechanical requirements

FOREWORD

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International Standard IEC 62966-1 has been prepared by subcommittee 48D: Mechanical structures for electrical and electronic equipment, of IEC technical committee 48: Electrical connectors and mechanical structures for electrical and electronic equipment.

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

FDIS	Report on voting
48D/691/FDIS	48D/698/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

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- withdrawn,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 electronical and electric 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 must be dissipated 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.

Currently, it is common use in data centres and server rooms 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 horizontal direction, taking it in at the front and discharging it at the rear.

The required cooling air is provided by room air or row air conditioners. Warm exhaust air is moved by fans usually through a fluid/air heat exchanger that cools it.

In the arrangement described, considerable quantities of cooling air pass by the IT equipment, especially servers, which it is expected to cool, without having any cooling effect. Concurrently, recirculation within and outside the cabinet causes hot exhaust air to be absorbed as cooling air, which results in faulty operation. In order to minimize such recirculation, more cooling air than required needs to be supplied, this adversely affects the energy efficiency of the data centre.

The separation of air flows into enclosed air volumes consisting of either cold supply air or hot exhaust air precludes recirculation to the largest possible extent (see Figure 1). Such separation reduces the required cooling air flow because re-circulations are ruled out. Air flow separation can reduce power consumption by the fans in the cooling units once fan speed control fans are used.

Separation of the cold supply air from the hot exhaust air is achieved by covering the aisles of the same temperature level with top cover elements, adding doors or similar design elements to the end of the aisles, and all openings inside the cabinets at the front 482,6mm (19”) rails shall be closed.

The installations of aisle containments in data centres and IT rooms shall not restrict the air intake demands for the correct usage and operation of servers or other IT equipment. Especially the required supply air temperature and the cooling air flow rate needed shall not be affected by the aisle containment. This can improve the energy efficiency as most of the cooling infrastructure has a higher efficiency with a higher difference between the air intake and the air exhaust temperature.

The temperature difference between supply and exhaust air rises due to the reduced cooling air volume. As the supply air temperature of the cooling air is usually specified, thus being kept constant, an increase in the temperature difference results in an increase of the temperature of the warm exhaust air. This has a positive impact on the temperature difference to the temperature of ambient air, as the energy efficiency of the cooling of the building and infrastructure is improved by the raised temperature gradient.

The period during which system cooling is required to be supported by a mechanical cooling machine is reduced. Both the reduction of the cooling air flow and the reduction of times of mechanical cooling lead to considerable reduction in the consumption of electrical power. This effects significant savings in operating costs for data centres and server rooms. This results in

an environmentally-friendly use of resources, thereby relieving stress on the environment and slowing down global warming by reduced CO_2 emission.

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

Part 2 defines characteristics and requirements of air separation, especially the air leakage rate, and determines the air leakage rate. Besides, operational parameters are determined, especially temperatures at which IT equipment in aisle containment are operated.

Part 3 deals with aspects of safely operating IT equipment in aisle containment, discussing special fire-protection and fire-fighting issues. It also provides required specifications of the doors for access to the aisle containment and possible access control.

In the past years, widely varying forms of aisle containment have been installed in server rooms and data centres. This document is intended to provide confidence by reflecting and structuring the currently most widely used solutions and catering for the energy-efficient operation of IT equipment. This document is also expected to solve probable uncertainties and problems concerning the containment technology

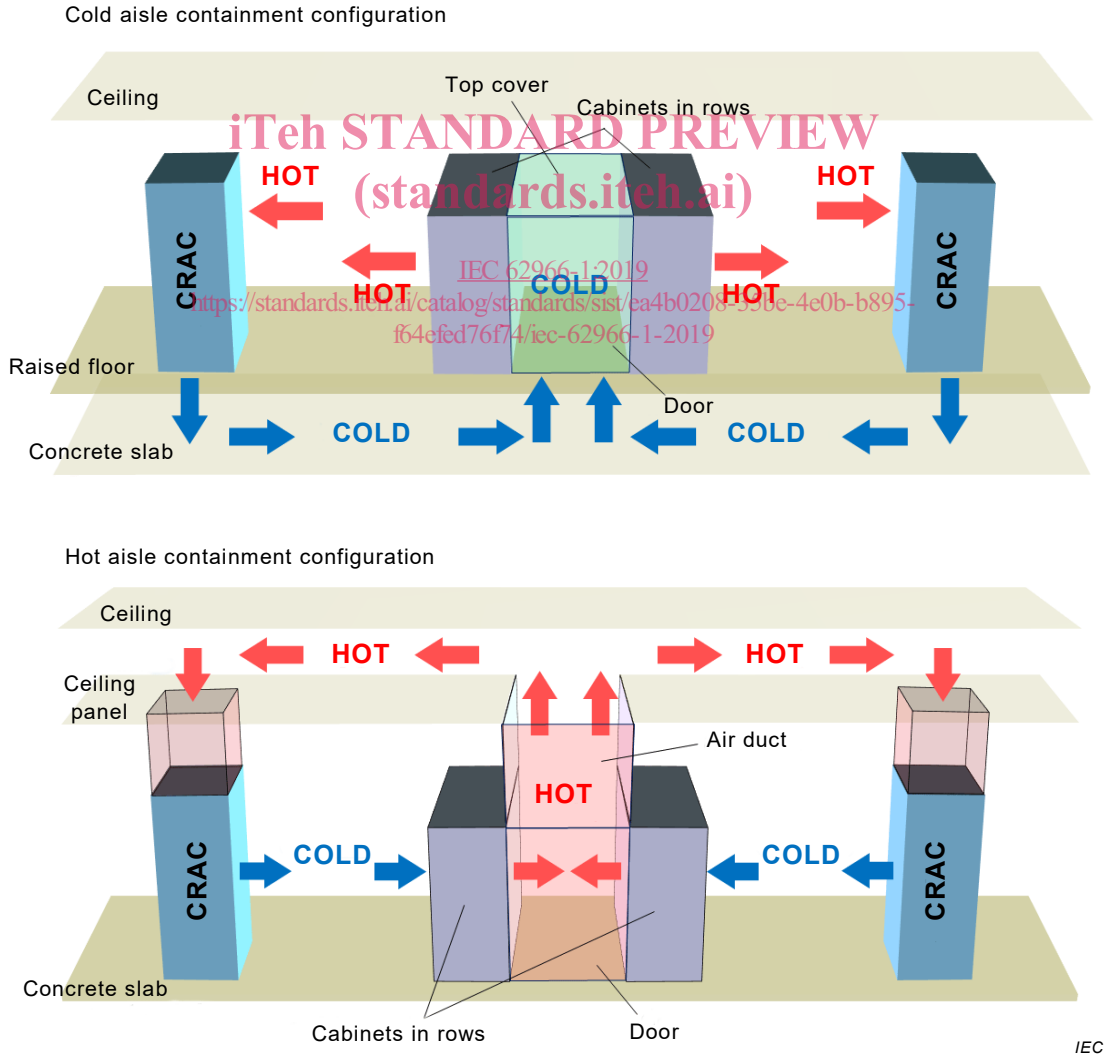

Figure 1 – Examples of an aisle containment

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

Part 1: Dimensions and mechanical requirements

1 Scope

This part of IEC 62966 defines the dimensions and mechanical requirements of aisle containment for information technology (IT) cabinets. The cabinets concerned are dealt with in the standard series IEC 60297 and IEC 60917. 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 and server rooms.

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 61587-1, *Mechanical structures for electronic equipment – Tests for IEC 60917 and IEC 60297 series – Part 1: Environmental requirements, test set-up and safety aspects for cabinets, racks, subracks and chassis under indoor condition use and transportation*

IEC 61587-2, *Mechanical structures for electronic equipment – Tests for IEC 60917 and 60297 – Part 2: Seismic tests for cabinets and racks*

IEC 62966-2: *Mechanical structures for electrical and electronic equipment – Aisle containment for IT cabinets – Part 2: Details of air flow, air separation and air cooling requirements* (to be published)

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
aisle containment
physical containment mainly formed of IT cabinets arranged in parallel rows with a centre aisle, a top cover across the aisle, doors or building structure at the ends of the aisle, and a floor

Note 1 to entry: The main purpose is the cooling air guidance to the IT equipment and the avoidance of bypass air and cooling air re-circulations.

3.2
aisle width
nominal horizontal distance between the cabinet frames which are contained by the aisle containment, whereas the referential vertical surface is oriented towards the interior of the aisle

3.3
aisle height
vertical distance between the floor and the outside of the aisle containment top cover

3.4
aisle ceiling height
height clearance inside the aisle

3.5
aisle length
longest horizontal distance along the cabinets of the aisle arrangement

3.6
elevated aisle top cover height
difference between cabinet height and the vertical distance between the floor base of installation and the top cover of the aisle containment

3.7
cooling air flow
air flow per time unit mainly moved horizontally through the IT equipment, removing heat caused by ohmic loss in IT equipment by means of mass heat transfer from the equipment

Note 1 to entry: The cooling air flow may be related to mass as cooling air mass flow, but is usually related to volume as cooling air volume flow.

3.8
supply air
cooling air prior to entering the cabinet mounted IT equipment, whose low temperature is capable of absorbing heat from the equipment

3.9
exhaust air
heated cooling air after leaving the cabinet mounted IT equipment, which, due to an increase in temperature, is discharging heat from the equipment

4 Design of a containment

4.1 Preferred arrangement setup of aisle containment

When setting up aisle containment, the cabinets for receiving IT equipment are arranged in rows. The cabinets along the rows are oriented in such a way that the surfaces with supply air inlets and those with exhaust air outlets face each other respectively, thus forming an aisle (see Figure 2). These surfaces are usually formed by perforated doors of the cabinets. The air flow inside the cabinets along the row of cabinets is similarly oriented. This arrangement is known as hot aisle/cold aisle arrangement, and is widely used.

In some cases, older data centres are still arranged in foot print patterns where surfaces with supply air inlets face surfaces with exhaust air outlets. Such arrangement with a similarly oriented air flow in each row of cabinets is not suited for being enclosed by aisle containment.

Both ends of cabinet rows in aisle containment are formed by doors or other structural elements that are suitable for reliably separating the air flow into supply air and exhaust air.

The aisle containment is set up on a raised floor or solid ground. For the proper functioning of the aisle containment, air flow separation between supply and exhaust air shall be guaranteed between the floor and the cabinet. Likewise, the aisle top cover shall provide the separation between supply and exhaust air. Thus the aisle is contained by cabinets at its long sides, by doors at its front faces, by the floor from below and by the top cover from above.

The length of the containment is determined by the number of cabinets to be integrated into the containment. Thereby, it is deemed economical not to design the length of the aisle too short. Too long an aisle is regarded counter-productive to user-friendly operation. Principally, aisle lengths can be designed in such a way as if the server room or data centre were set up without any aisle containment. A number of cabinets between three and twelve units per row of containment is suitable for optimal aisle length. It may be necessary, due to building layout or IT requirements, to differ from the optimal aisle length.

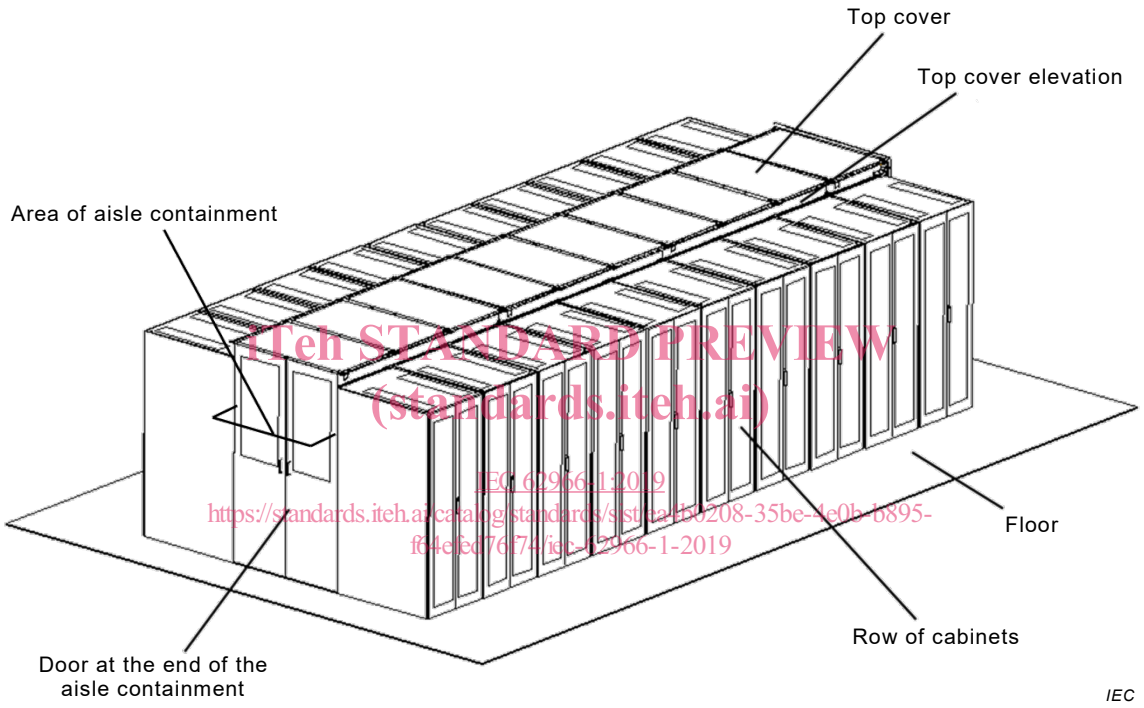

Figure 2 – Preferred arrangement setup of an aisle containment

4.2 Optional arrangement set up of aisle containment

4.2.1 Arrangement of different sized cabinets for an aisle containment

The cabinet surfaces oriented towards the inner side of the aisle containment are expected to be arranged in line. If -in exceptional cases- an aligned arrangement cannot be formed, the requirements of escape and rescue paths shall be fulfilled. That includes swinging of all doors of the rescue path in all possible escaping directions. The details of dimensions of the escape and rescue paths are defined in national and local regulations and may be detailed in future parts of IEC 62966.The cabinets should be aligned laterally in such a way that air flow separation between supply and exhaust air is guaranteed between the cabinets. To that end, the cabinets are placed immediately next to each other. Arrangements with all depth of IT cabinets are possible to form containment (see Figure 3).

An aisle containment should be formed by cabinets of the same cabinet height. However, an aisle containment should be designed in such a way that cabinets of various heights can be optionally integrated into the containment. For that purpose, vertical barriers are installed in the cabinet surfaces oriented towards the contained aisle for balancing differences in height and providing for air flow separation between supply and exhaust air.

Especially in cabinet arrangement without a raised floor, plinths/base can be applied underneath the cabinets, accommodating supply lines and cabling. Such plinths shall also be designed in a way as to guarantee air separation between supply and exhaust air.

For air-tight design of an aisle containment at the end of the row, it is necessary that both rows of aisle-contained cabinets are of the same length. If this proves impossible, due to varying cabinet widths, space-filling elements shall be inserted to achieve similar lengths of cabinet rows.

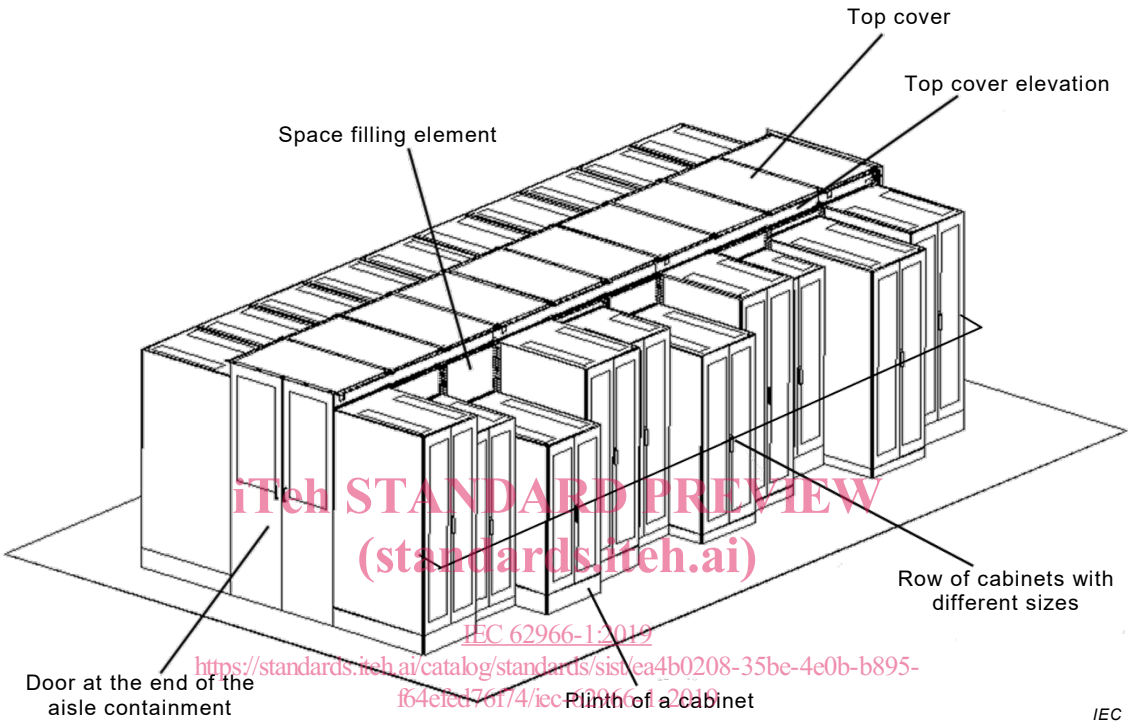

Figure 3 – Possible arrangement of an aisle containment

4.2.2 Arrangement for an aisle containment with building structure elements

It can occur that vertical structural elements of a building, such as columns or supports, are required to be integrated into the aisle containment within one row of cabinets (see Figure 4). Covers are expected to facilitate air flow separation between the structural element and the components of the aisle containment in such a way that air flow separation between supply and exhaust air is guaranteed. Horizontal structural elements in the building, such as beams or trusses, should not be included in the containment.

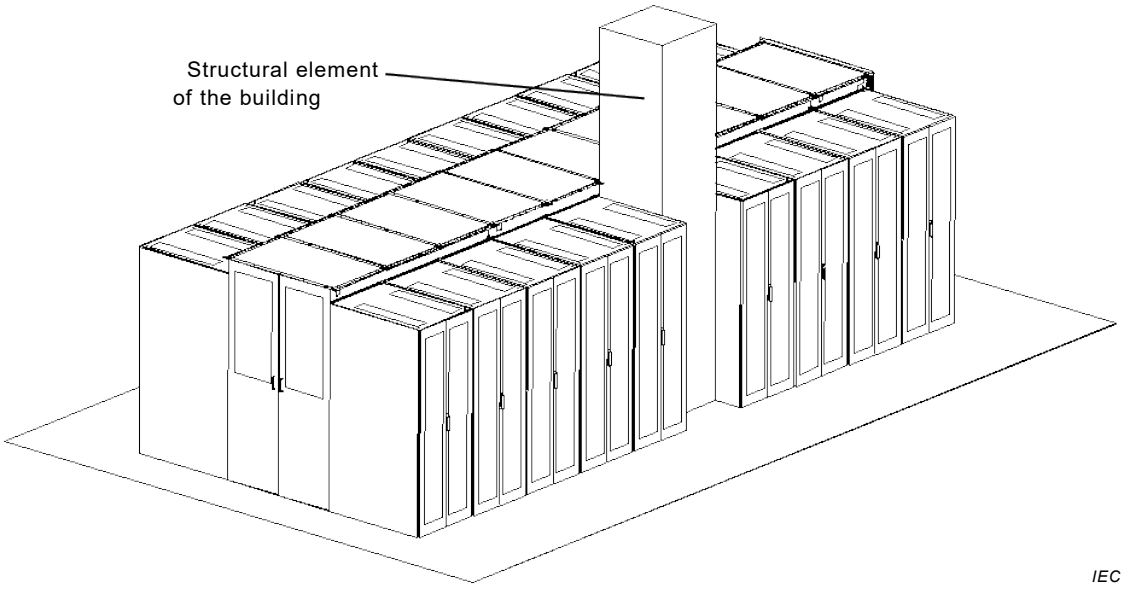

Figure 4 – Aisle containment with an integrated structural element

Structural elements may be located not in line with the cabinet front in an aisle containment. Additional elements are required to ensure the warm / cold separation (see Figure 5).

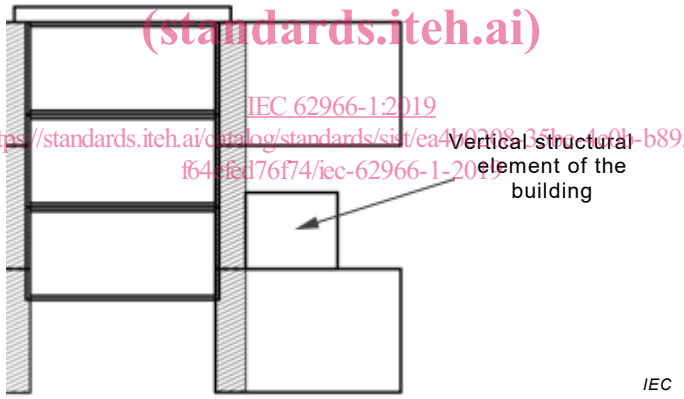

Figure 5 – Top view of aisle containment with an integrated structural element not in line with the cabinet front

4.2.3 Aisle containment at walls of buildings

When attaching the aisle containment, care shall be taken to create an air-tight connection between the wall of the building and the aisle containment. This arrangement provides the containment only for one row of IT cabinets (see Figure 6). It is possible to arrange one front end of an aisle containment to be flush to a wall. In this case a door at this end of the aisle containment is not necessary.