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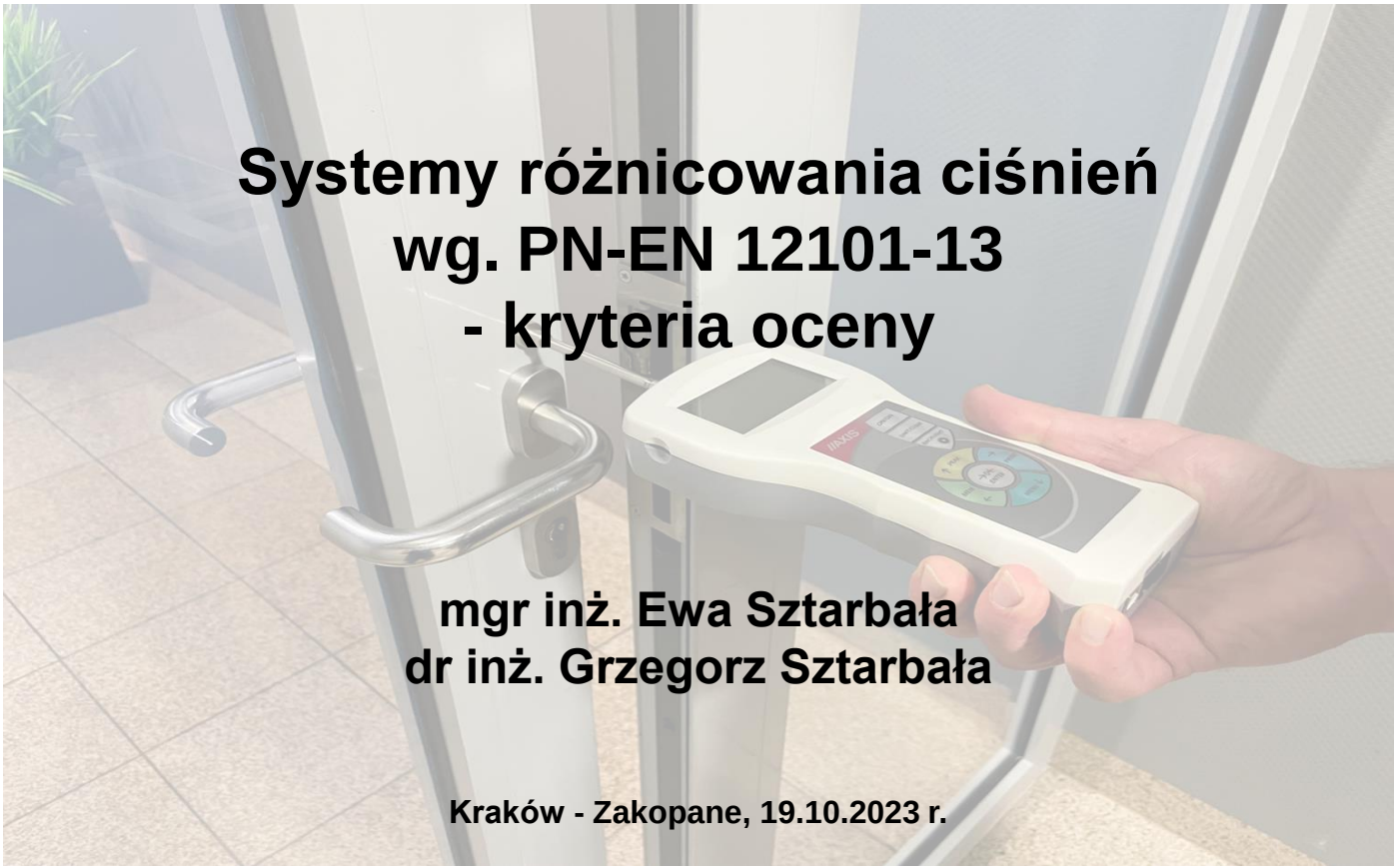


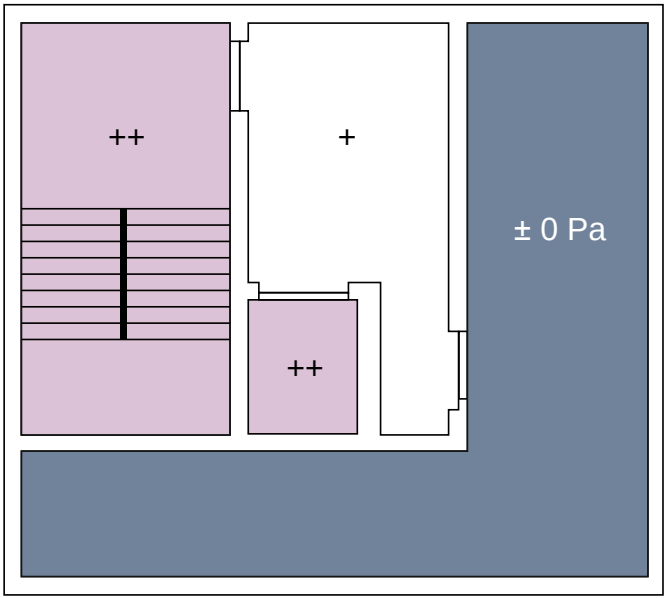
Systemy różnicowania ciśnień wg. PN-EN 12101-13 - kryteria oceny

mgr inż. Ewa Sztarbała
dr inż. Grzegorz Sztarbała

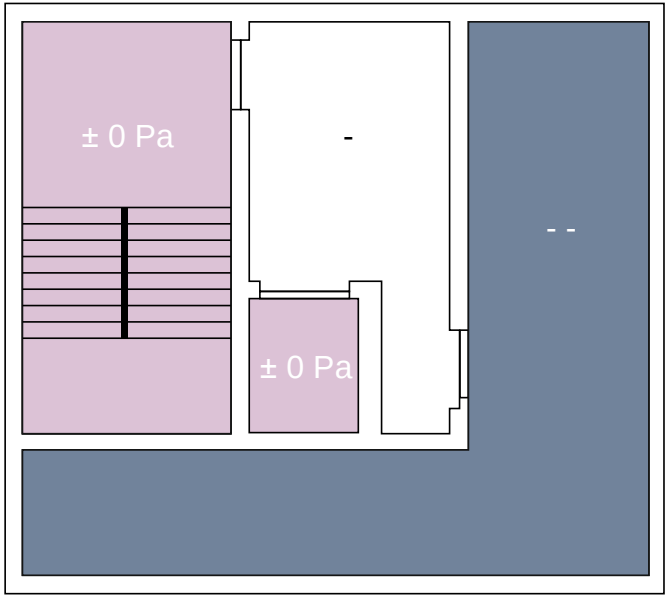
Kraków - Zakopane, 19.10.2023 r.

Systemy różnicowania ciśnień

Nadciśnienie



Podciśnienie



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Systemy różnicowania ciśnień

PN-EN 12101-6:2005 +AC:2006

Tablica 1 – Klasy systemów

Klasa systemu	Przykłady zastosowania	Warunki projektowe
System Klasy A	Dla środków ewakuacji. Obrona na miejscu	4.2 i Rysunek 2
System Klasy B	Dla środków ewakuacji i akcji gaśniczej	4.3 i Rysunek 3
System Klasy C	Dla środków ewakuacji przy ewakuacji jednoczesną	4.4 i Rysunek 4
System Klasy D	Dla środków ewakuacji. Ryzyko snu	4.5 i Rysunek 5
System Klasy E	Dla środków ewakuacji przy ewakuacji stopniową	4.6 i Rysunek 6
System Klasy F	Urządzenia gaśnicze i środki ewakuacji	4.7 i Rysunek 7

Kryterium różnicy ciśnienia: 50 Pa
(przy klasach systemu C, D i E dodatkowe kryterium 10 Pa);

Prędkość przepływu powietrza: 0,75 m/s (klasa B – 2,00 m/s);

Siła otwierająca drzwi: ≤ 100 N

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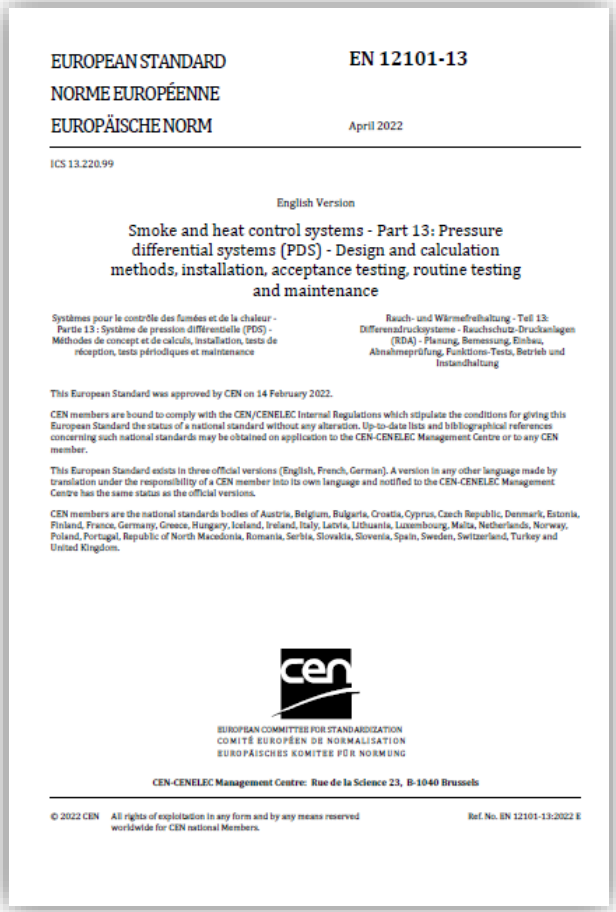
System różnicowania ciśnienia



EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 12101-13

April 2022

ICS 13.220.99

English Version

Smoke and heat control systems - Part 13: Pressure differential systems (PDS) - Design and calculation methods, installation, acceptance testing, routine testing and maintenance

Systèmes pour le contrôle des fumées et de la chaleur - Partie 13 : Système de pression différentielle (PDS) - Méthodes de concept et de calculs, installation, tests de réception, tests périodiques et maintenance

Rauch- und Wärmefreihaltung - Teil 13: Differenzdrucksysteme - Rauchschutz-Druckanlagen (RDA) - Planung, Bemessung, Einbau, Abnahmeprüfung, Funktions-Tests, Betrieb und Instandhaltung

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CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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29 października 2022 r.

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PN-EN 12101-13:2022-09

1 Scope

This document gives calculation methods, guidance and requirements for the design, installation, acceptance testing, routine testing and maintenance for pressure differential systems (PDS).

PDSs are designed to hold back smoke at a leaky physical barrier in a building, such as a door (either open or closed) or other similarly restricted openings and to keep tenable conditions in escape and access routes depending on the application.

It covers systems intended to protect means of escape e.g. staircases, corridors, lobbies, as well as systems intended to provide a protected firefighting space (bridgehead) for the fire services.

It provides details on the critical features and relevant procedures for the installation.

It describes the commissioning procedures and acceptance testing criteria required to confirm that the calculated design is achieved in the building.

This document gives rules, requirements and procedures to design PDS for buildings up to 60 m.

For buildings taller than 60 m the same requirements are given (e.g. Table 1), but additional methods of calculation and verification are necessary. Requirements for such methods and verification are given in Annex D, but the methods fall outside the scope of this document [e.g. Additional mathematical analysis and/or Computational Fluid Dynamics (CFD)].

Routine testing and maintenance requirements are also defined in this document.

In the absence of national requirements and under expected ambient and outside conditions, the requirements in Table 1 are fulfilled by the PDS.

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PN-EN 12101-13:2022-09

1 Scope

This document gives calculation methods, guidance and requirements for the design, installation, acceptance testing, routine testing and maintenance for pressure differential systems (PDS).

Dokument ten podaje zasady obliczeniowe, wytyczne i wymagania do projektowania, wykonywania, prowadzenia testów odbiorczych, testów okresowych i konserwacji systemów różnicowania ciśnienia.

It describes the commissioning procedures and acceptance testing criteria required to confirm that the calculated design is achieved in the building.

This document gives rules, requirements and procedures to design PDS for buildings up to 60 m.

For buildings taller than 60 m the same requirements are given (e.g. Table 1), but additional methods of calculation and verification are necessary. Requirements for such methods and verification are given in Annex D, but the methods fall outside the scope of this document [e.g. Additional mathematical analysis and/or Computational Fluid Dynamics (CFD)].

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It describes the commissioning procedures and acceptance testing criteria required to confirm that the calculated design is achieved in the building.

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Określa on procedury odbiorcze i kryteria akceptacji wyników testów wymaganych do potwierdzenia, że w budynku zostały spełnione założenia projektowe.

Dokument zawiera zasady, wymagania i procedury do projektowania SRC w budynkach o wysokości do 60 m.

W odniesieniu do budynków wyższych niż 60 m mają zastosowanie te same wymagania (patrz Tabela 1), ale niezbędne są dodatkowe metody obliczeniowe i metody weryfikacji. Wymagania dla tych metod i ich weryfikacji zostały opisane w Załączniku D, jednakże same metody są poza zakresem niniejszego dokumentu.

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Kryteria projektowe wg. PN-EN 12101-13:2022-09

Table 1 — Design requirements of a PDS

Parameter	Class 1	Class 2
Door opening force	≤ 100 N	
Pressure differential	≥ 30 Pa	
Airflow velocity	≥ 1 m/s	≥ 2 m/s
Initiation time	≤ 60 s	
Operation time	≤ 120 s	
Response time	≤ 5 s	

NOTE Refer to Clause 8 when measuring the normative requirements given in Table 1.

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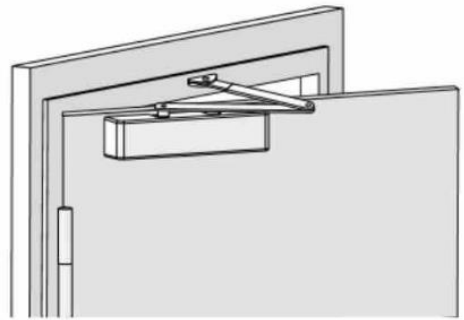
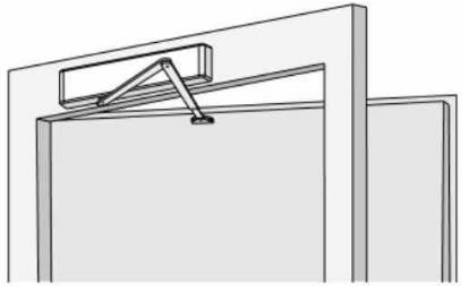
Kryteria projektowe wg. PN-EN 12101-13:2022-09





Moment siły zamykania drzwi przez samozamykacz wg: PN-EN 1154:1999/A1:2004

1	2	3	4	5	6
Door closer power size	**Recommended door leaf width**	**Test door mass**	**Closing moment**		
			between 0° and 4°		**between 88° and 92°**
	mm max.	kg	Nm min.	Nm max.	Nm min.
1	<750	20	9	<13	3
2	850	40	13	<18	4
3	950	60	18	<26	6
4	1 100	80	26	<37	9
5	1 250	100	37	<54	12
6	1 400	120	54	<87	18
7	1 600	160	87	<140	29

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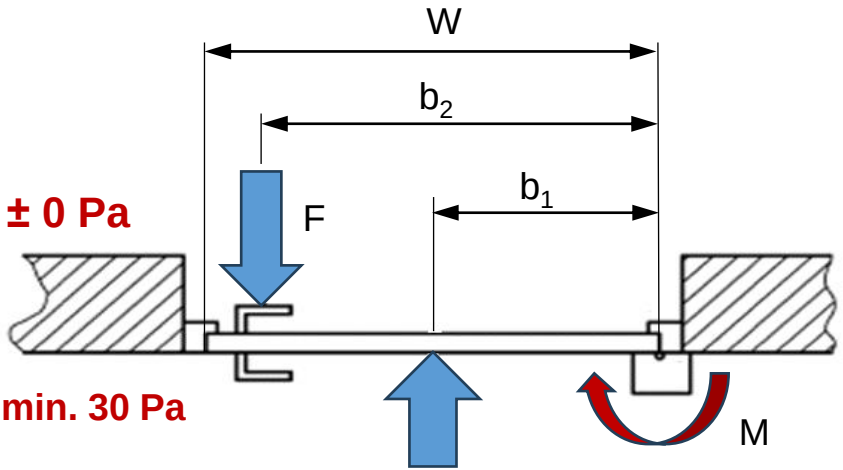
Kryteria projektowe wg. PN-EN 12101-13:2022-09

Siła otwarcia drzwi ≤ 100N



$$F_p = \Delta p \cdot W_d \cdot H_d$$

$$F = \frac{F_p \cdot b_1 + M}{b_2}$$

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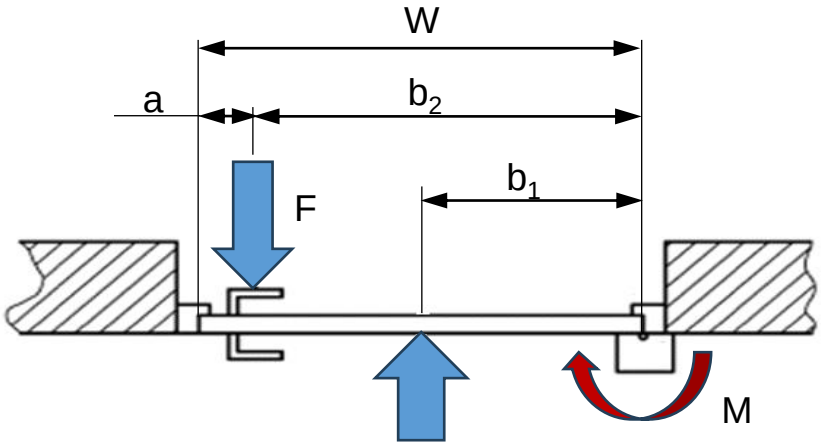
Kryteria projektowe wg. PN-EN 12101-13:2022-09



Dane do obliczeń:	
Szerokość skrzydła drzwi (W)	0,98 m
Wysokość drzwi (H)	2,05 m
Odległość do osi drzwi (b_1)	0,49 m
Odległość do klamki (b_2 = W - a)	0,86 m
Moment siły zastosowanego samozamykacza (M)	26,00 Nm

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Jaką trzeba przyłożyć siłę do otwarcia drzwi, jeżeli różnica ciśnienia po obu stronach drzwi wynosi 30 Pa ?

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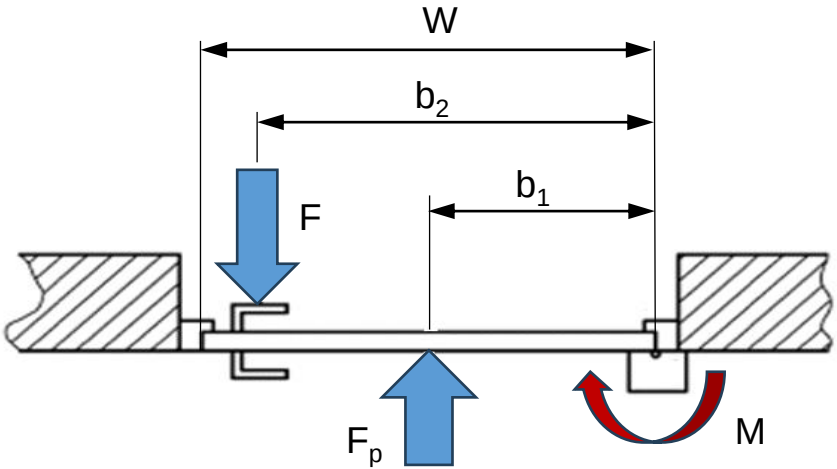
Kryteria projektowe wg. PN-EN 12101-13:2022-09



$$F_p = \Delta p \cdot W_d \cdot H_d = 30 \cdot 0,98 \cdot 2,05 = 60,27\ \text{Pa}$$

$$F = \frac{F_p \cdot b_1 + M}{b_2} = \frac{60,27 \cdot 0,49 + 26,00}{0,86} = 64,57\,\text{N}$$

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Jaka może być maksymalna różnica ciśnienia po obu stronach drzwi aby nie przekroczyć siły otwarcia 100 N ?

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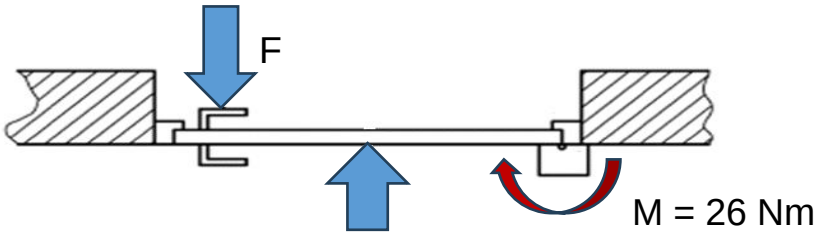
Kryteria projektowe wg. PN-EN 12101-13:2022-09



$$\Delta p_{max} = \frac{(100\,N - F_{dc}) \cdot 2 \cdot (W_d - a)}{W_d^2 \cdot H_d}$$

$$\Delta p_{max} = \frac{(100 - \frac{26,0}{0,86}) \cdot 2 \cdot (0,98 - 0,12)}{0,98^2 \cdot 2,05} = 60,95\ Pa$$

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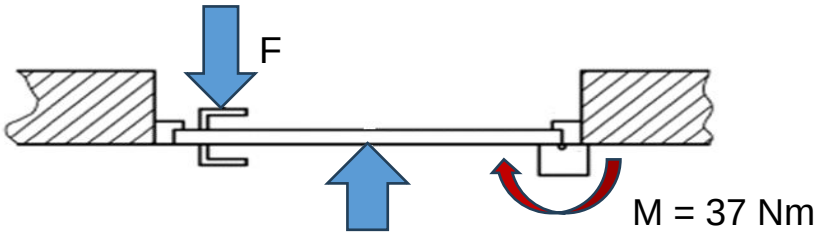

$$\Delta p_{max} = \frac{(100 - \frac{37,0}{0,86}) \cdot 2 \cdot (0,98 - 0,12)}{0,98^2 \cdot 2,05} = 49,78 \text{ Pa}$$

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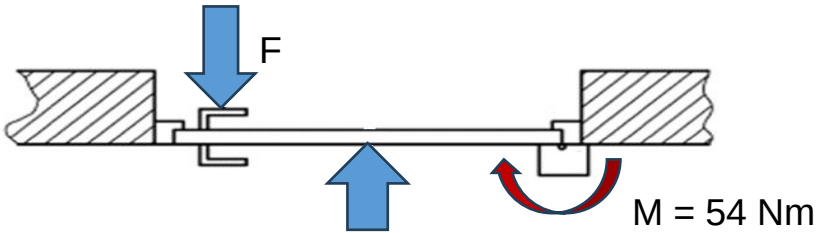
Kryteria projektowe wg. PN-EN 12101-13:2022-09



$$\Delta p_{max} = \frac{(100 - \frac{37,0}{0,86}) \cdot 2 \cdot (0,98 - 0,12)}{0,98^2 \cdot 2,05} = 49,78 \text{ Pa}$$

$$\Delta p_{max} = \frac{(100 - \frac{54,0}{0,86}) \cdot 2 \cdot (0,98 - 0,12)}{0,98^2 \cdot 2,05} = 32,5 \text{ Pa}$$

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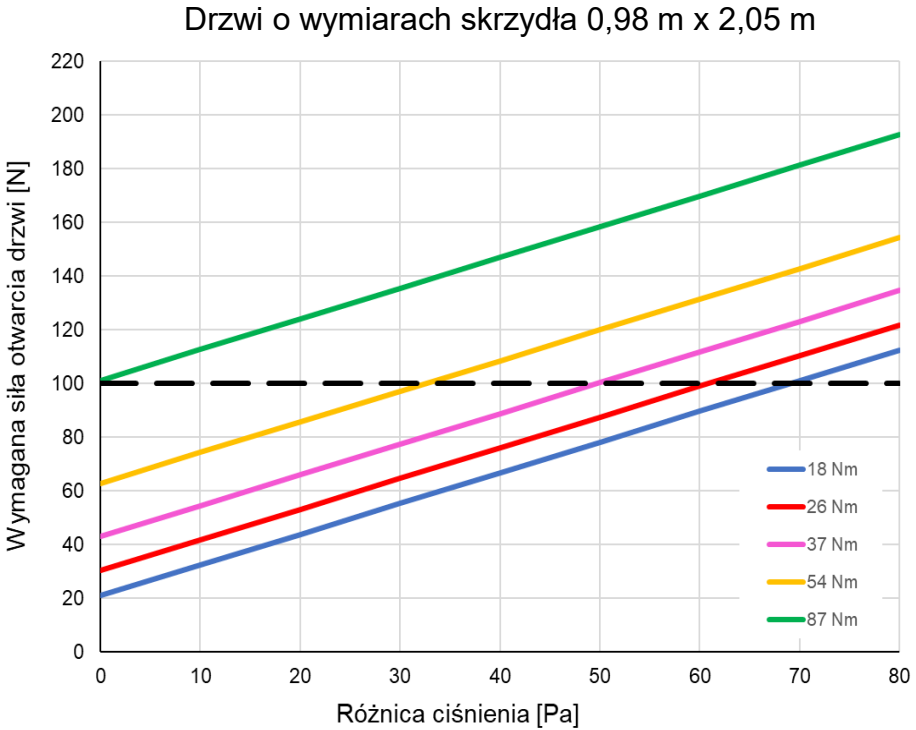
Kryteria projektowe wg. PN-EN 12101-13:2022-09



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Kryteria projektowe wg. PN-EN 12101-13:2022-09

Dopuszczalna maksymalna różnica ciśnienia po obu stronach drzwi wyposażonych w samozamykacz aby nie przekroczyć maksymalnej dopuszczalnej siły otwarcia drzwi wynoszącej 100 N,

Siła zamykający drzwi N	Szerokość drzwi w świetle ościeżnicy				
	Wysokość drzwi H=2,00 m				
	0,90 m	1,00 m	1,10 m	1,20 m	1,30 m
20	79.0	72.0	66.1	61.1	56.8
25	74.1	67.5	62.0	57.3	53.3
30	69.1	63.0	57.9	53.5	49.7
35	64.2	58.5	53.7	49.7	46.2
40	59.3	54.0	49.6	45.8	42.6
45	54.3	49.5	45.5	42.0	39.1
55	44.4	40.5	37.2	34.4	32.0
65	34.6	31.5	~~28.9~~	~~26.7~~	~~24.9~~
70	~~29.6~~	~~27.0~~	~~24.8~~	~~22.9~~	~~21.3~~

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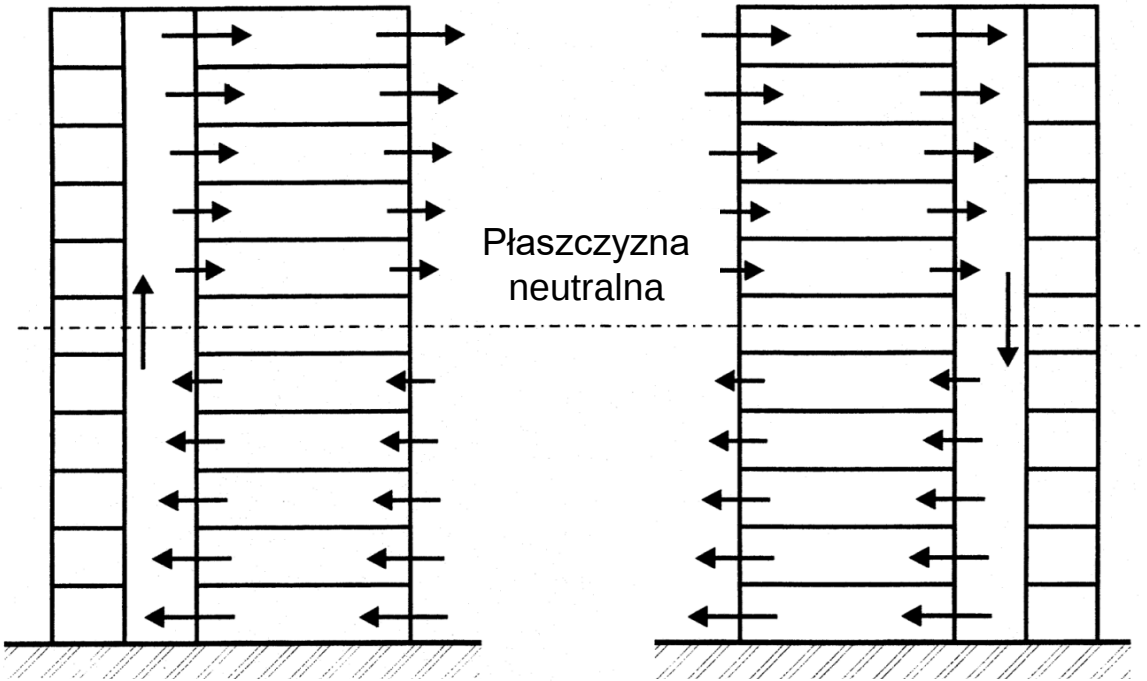
Kryteria projektowe wg. PN-EN 12101-13:2022-09

Warunki zimowe

Warunki letnie



Normalny efekt kominowy

Odwrócony efekt kominowy

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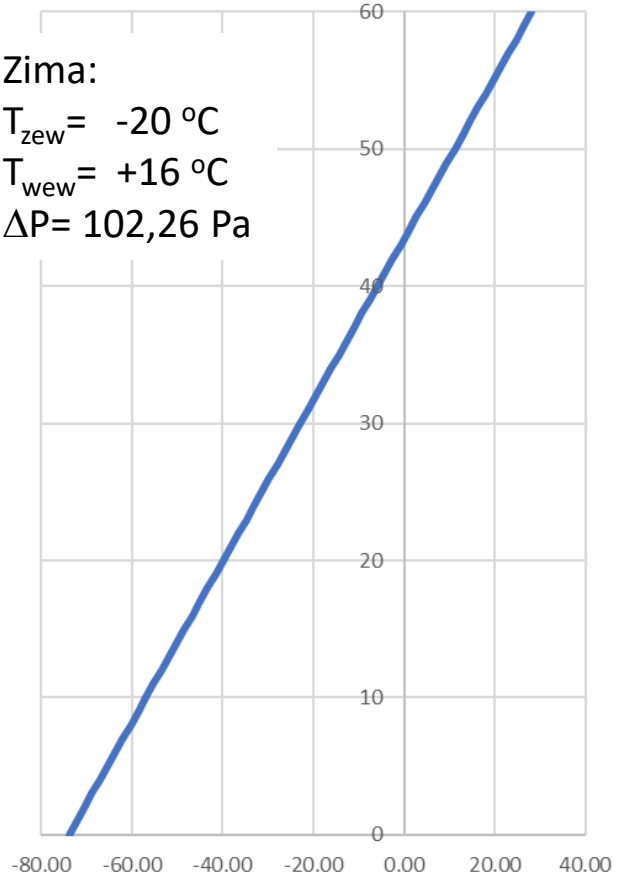
Zima:

T_{zew}= -20 °C

T_{wew}= +16 °C

ΔP= 102,26 Pa

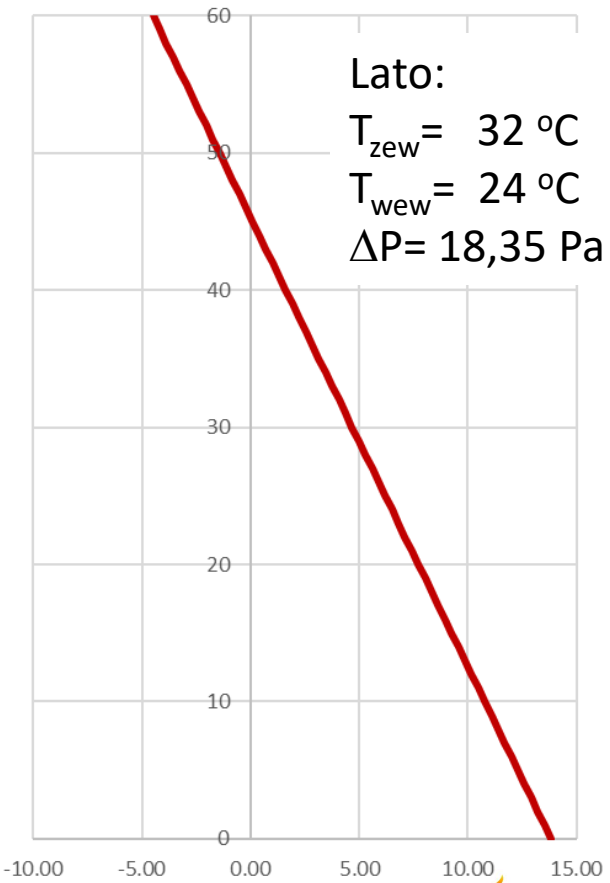


Lato:

T_{zew}= 32 °C

T_{wew}= 24 °C

ΔP= 18,35 Pa



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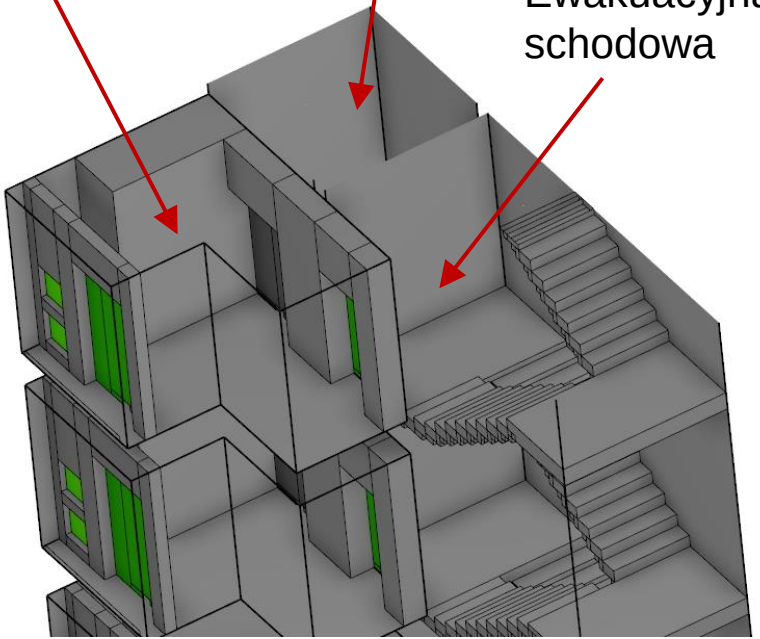
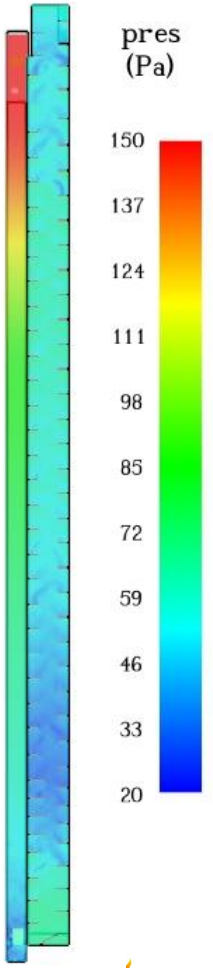
Kryteria projektowe wg. PN-EN 12101-13:2022-09

Przedsionek przeciwpożarowy

Szyb wind dla ekip ratowniczych

Ewakuacyjna klatka schodowa





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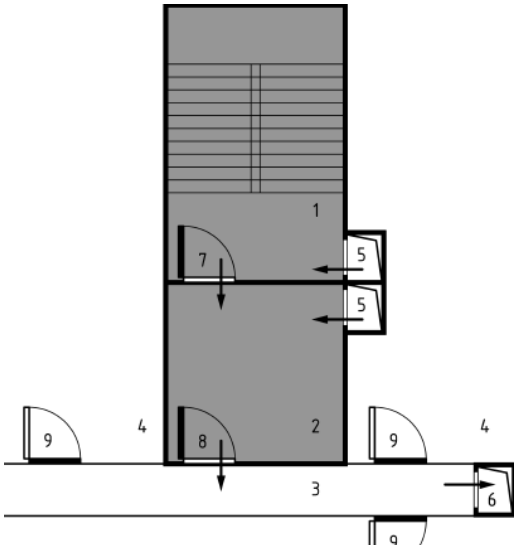

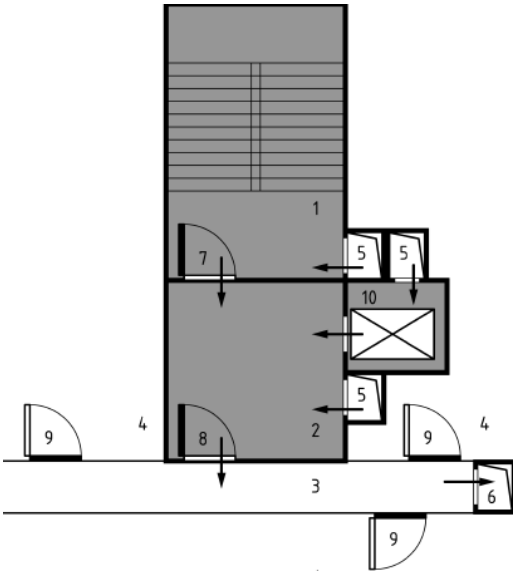

Preconditions

— PDS is activated and air release (6) is open on the fire floor only;

— between staircase (1) and lobby (2) and between lobby and corridor (3) Air Transfer Dampers (ATD)s may be installed (in accordance with national requirements);

— doors (7, 8) shall be equipped with door closers;

— in the absence of national requirements door(s) (9) may be equipped with door closers;

— if openings in the façade are used for air release, refer to the specific subclause 5.6.7.

NOTE Non-firefighters' lift shafts, connected to a protected lobby, do not have to be pressurized.

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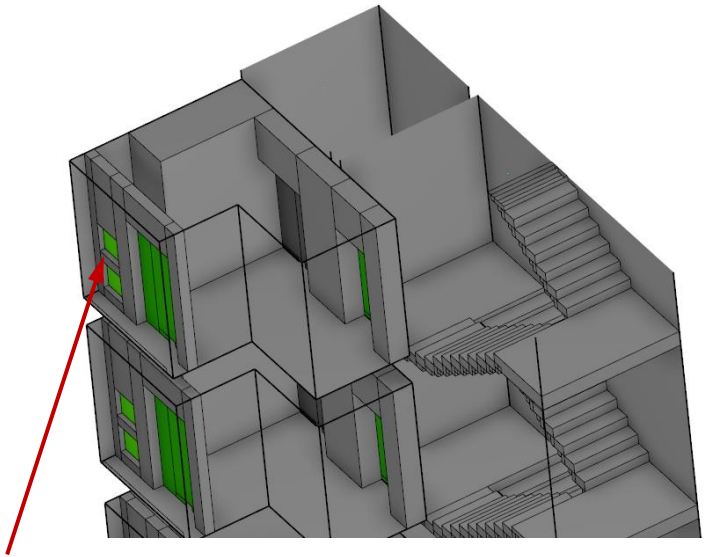
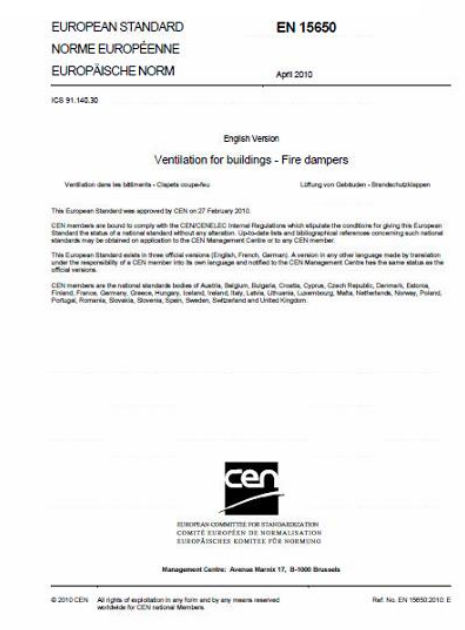
Kryteria projektowe wg. PN-EN 12101-13:2022-09

7.5.14 Air transfer damper and backdraft damper (ATD, BDD)

The air transfer damper (ATD) assembly is used for producing a defined leakage between staircase and lobby or lobby and accommodation to create defined pressure differences and/or air exchange rates within the lobby.

The ATD shall comprise of a fire damper in accordance with EN 15650 and have the correct classification to meet national requirements where required.





EUROPEAN STANDARD **EN 15650**
NORME EUROPÉENNE
EUROPÄISCHE NORM April 2010

ICS 91.140.30

English Version

Ventilation for buildings - Fire dampers

Ventilation dans les bâtiments - Clapets coupe-feu — Lüftung von Gebäuden - Brandschutzklappen

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Ref. No. EN 15650:2010: E

Air Transfer Damper

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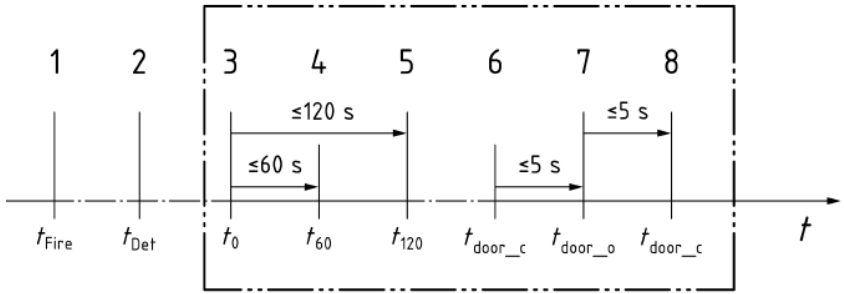
Kryteria projektowe wg. PN-EN 12101-13:2022-09



5.3.5 Initiation time (t_{60})

The initiation time is the time period which starts at the activation of the PDS (t_0) and ends after 60 s, by which time all the necessary components shall be in the correct operating position (e.g. damper, vents) - see Table 1 and Figure 2 - and the fan shall have started.

5.3.6 Operation time (t_{120})

The operation time is the time period which starts at the activation of the PDS (t_0) and ends after 120 s, by which time the PDS shall be in its fully operational status (see Table 1 and Figure 2).

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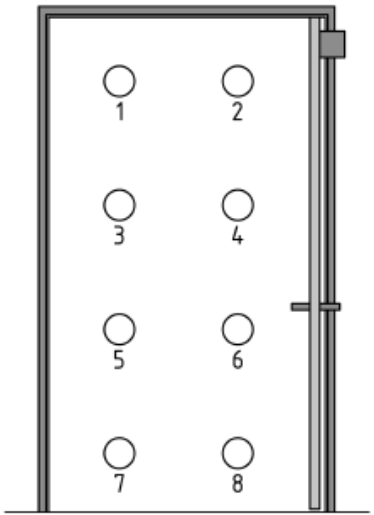
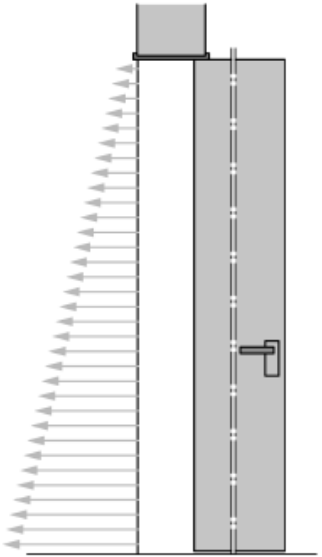
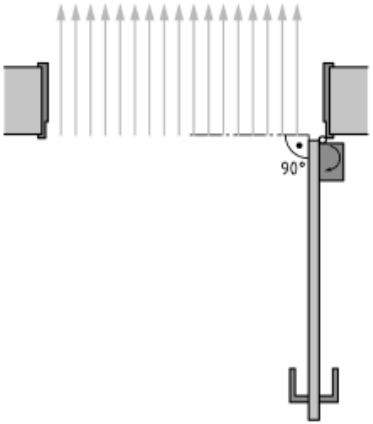
Kryteria projektowe wg. PN-EN 12101-13:2022-09







The velocity shall be determined as follows. Take a minimum of eight measurements, uniformly distributed over the doorway, within the plane of the door opening, where the measurement is taken. Each velocity measurement shall have a positive result in the desired direction of air flow in accordance with the arrows in Figures 16 to 20. Calculate the mean value of these measurements to determine the mean velocity through the door.

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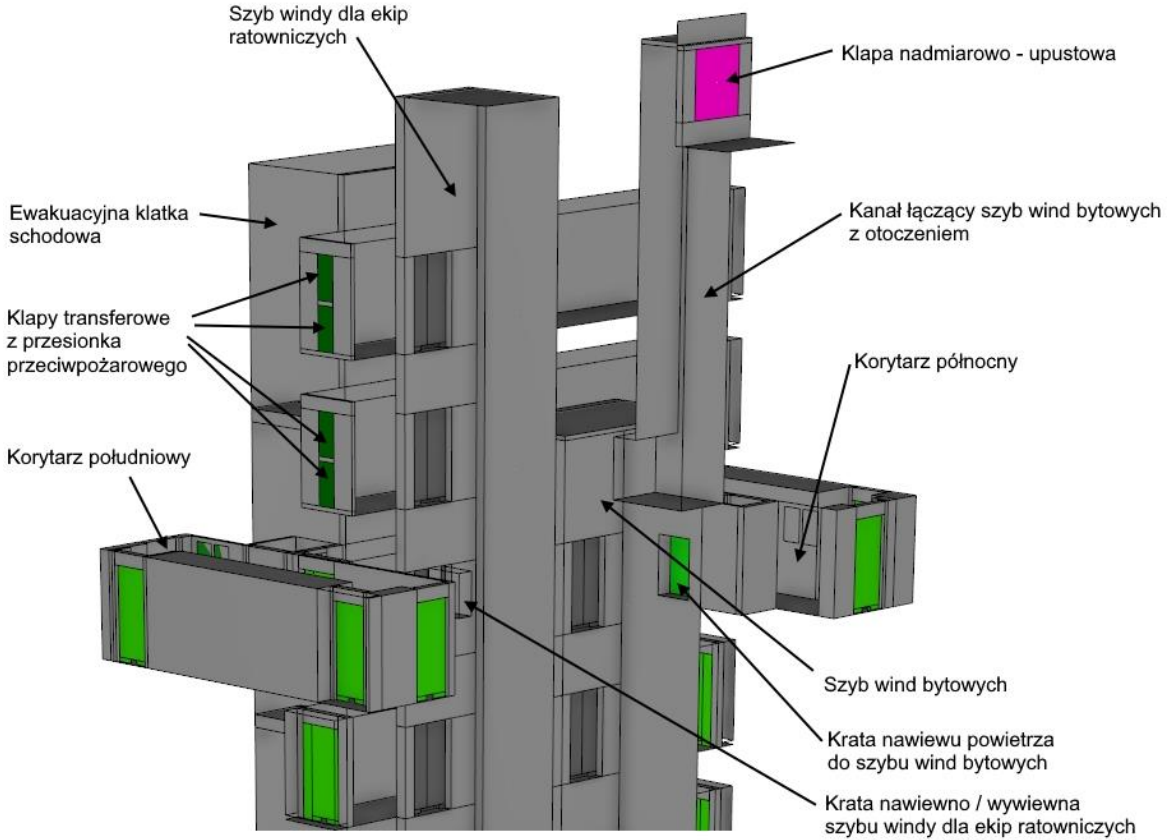

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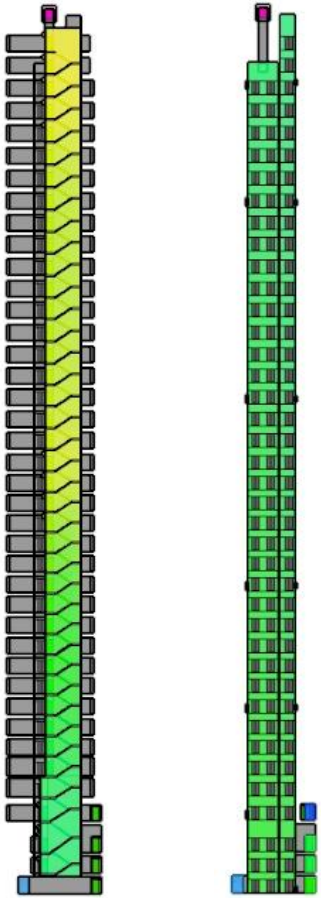

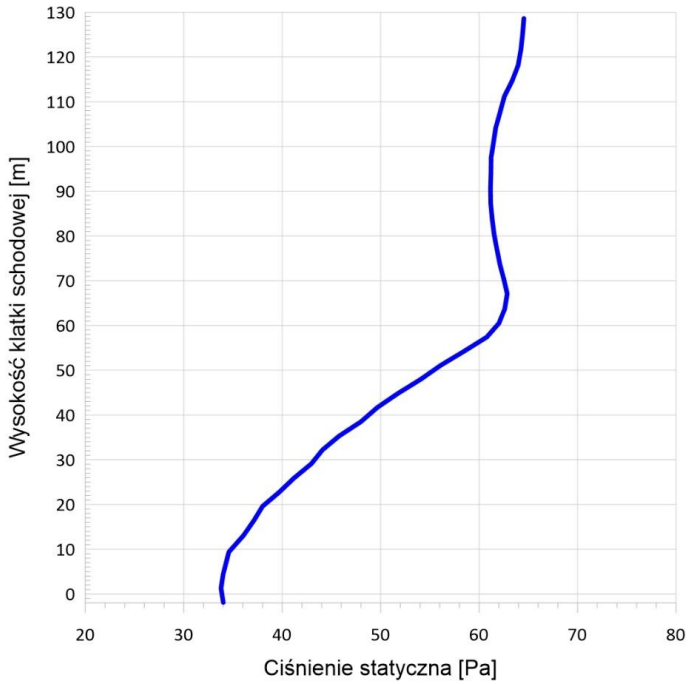

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Dziękujemy za uwagę.

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