Smay
Ventilation
Systems

Pressurization systems

Innovations

for safe evacuation
in high-rise buildings

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Systems

Ventilation safety
of tomorrow.
Today.

- Founded in **Poland** in 1989
- Presence in **34 markets worldwide**
- Focus on **R&D** and innovation
- Hundreds PDS implementations
- Office in the UK
- Office in the UAE soon

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PRUDENTIAL

66m, Warsaw

1933

1945

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Systems

PALACE OF CULTURE AND SCIENCE

237m, Warsaw

1952

…1990

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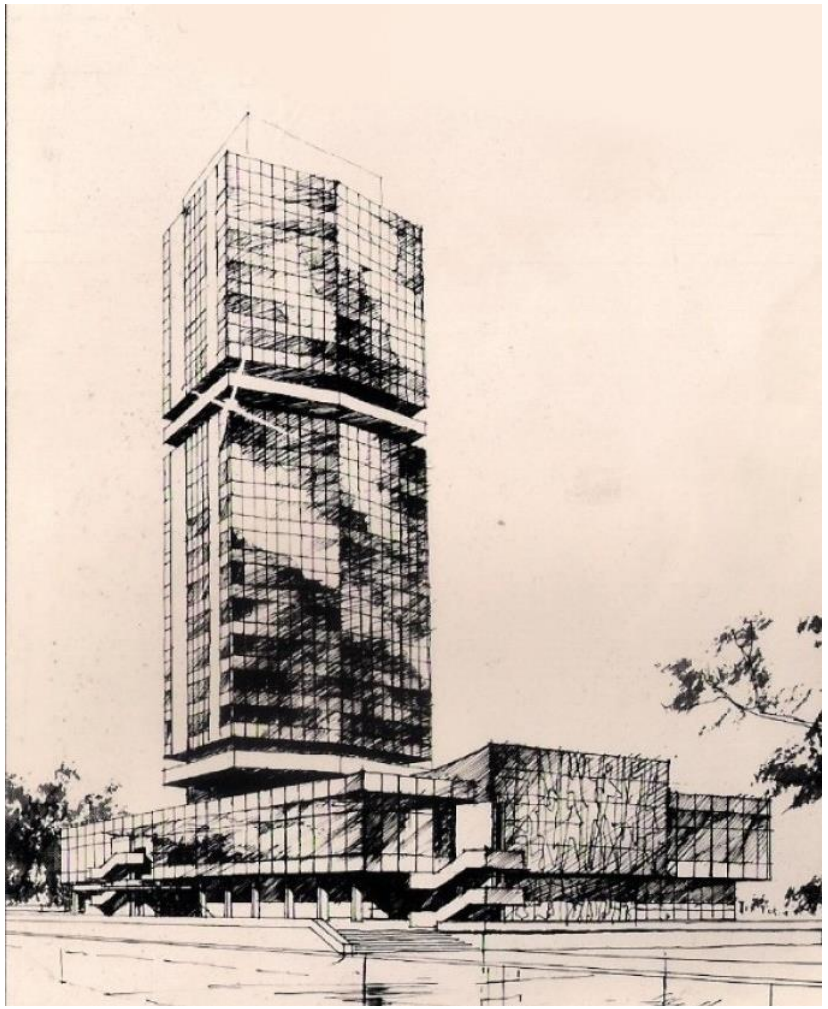
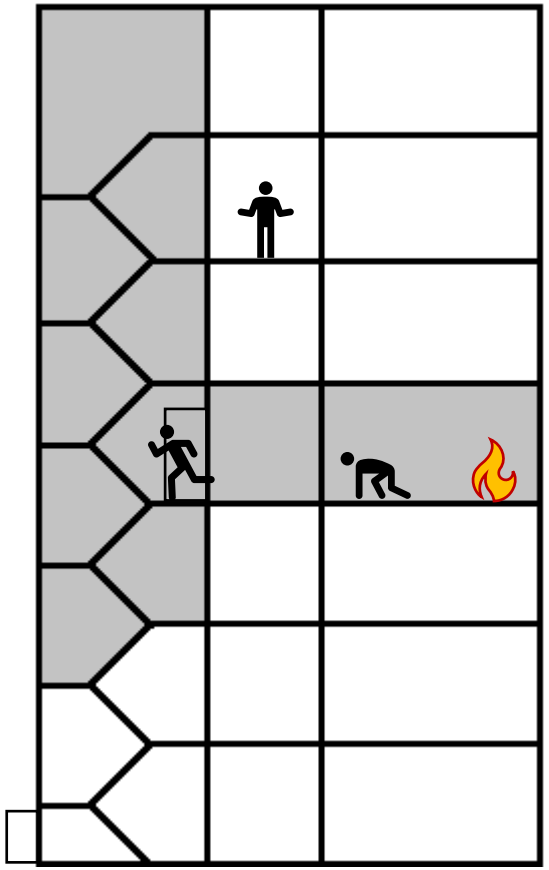
N.O.T. TOWER / SKELETON

90m, Krakow



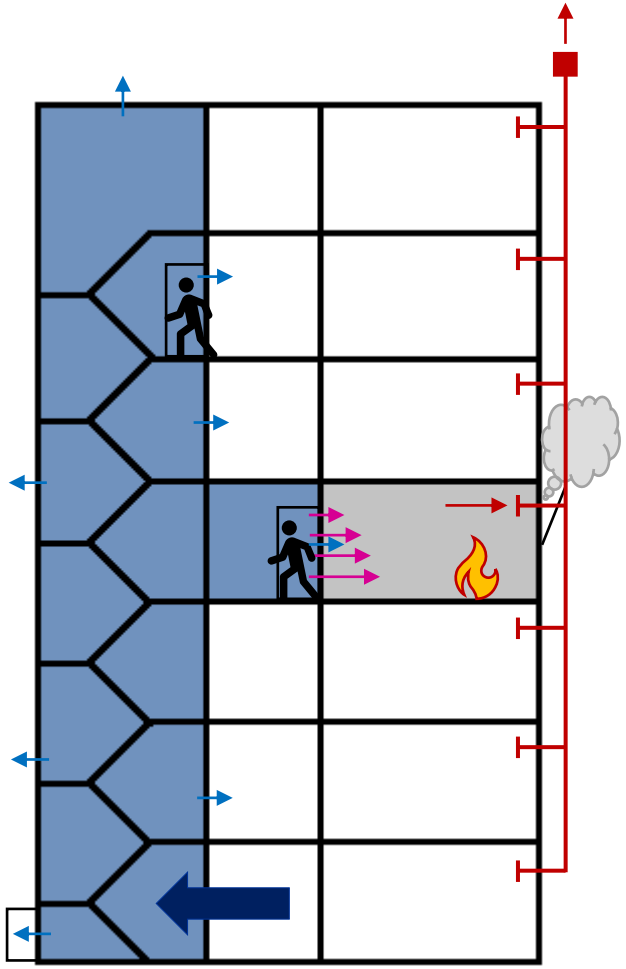
1975

2015



PRESSURE DIFFERENCE CRITERION

AIRFLOW CRITERION



! AIR RELEASE PATH

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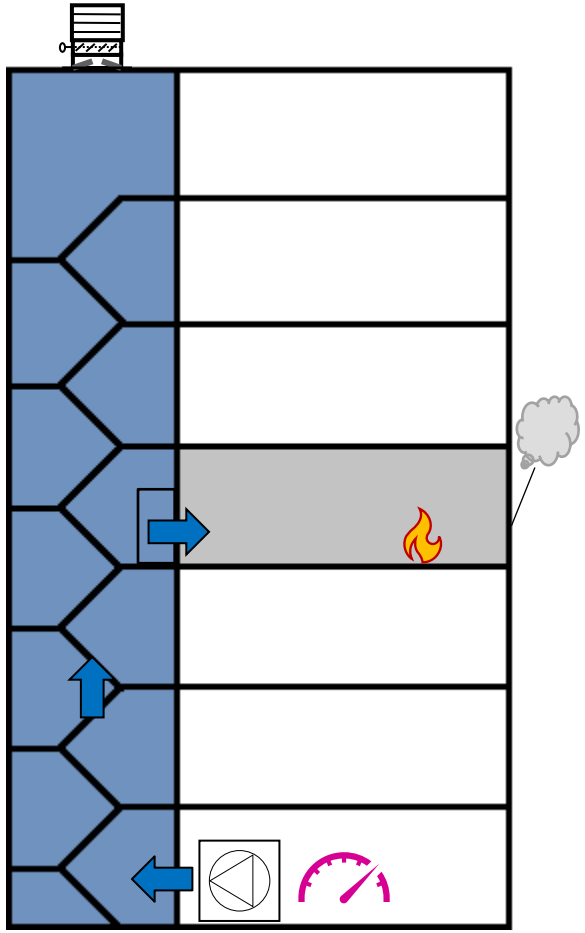
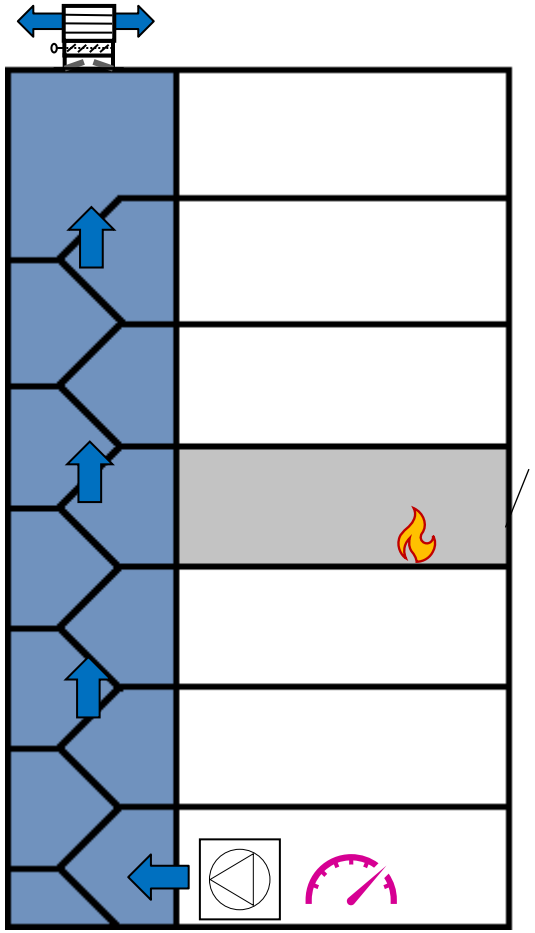
MECHANICAL SYSTEMS



DOOR OPEN
AIR VOLUME SELECTED
FOR AIRFLOW CRITERION



DOOR CLOSED
CONSTANT AIR VOLUME.
EXCESS AIR IS RELEASED WITH
THE PRESSURE RELIEF DAMPER

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FDSC INTERNATIONAL
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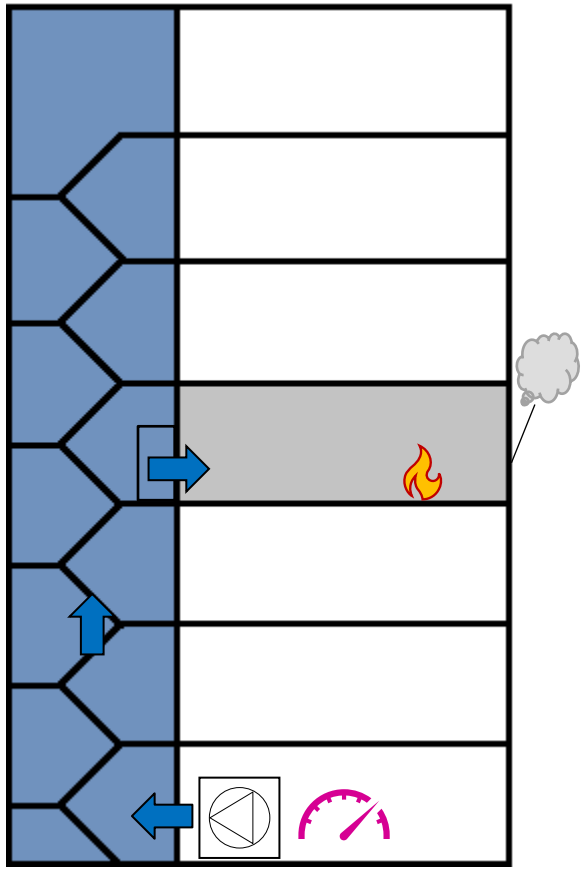
DYNAMIC FAN CONTROL SYSTEMS



DOOR OPEN
AIR VOLUME SELECTED
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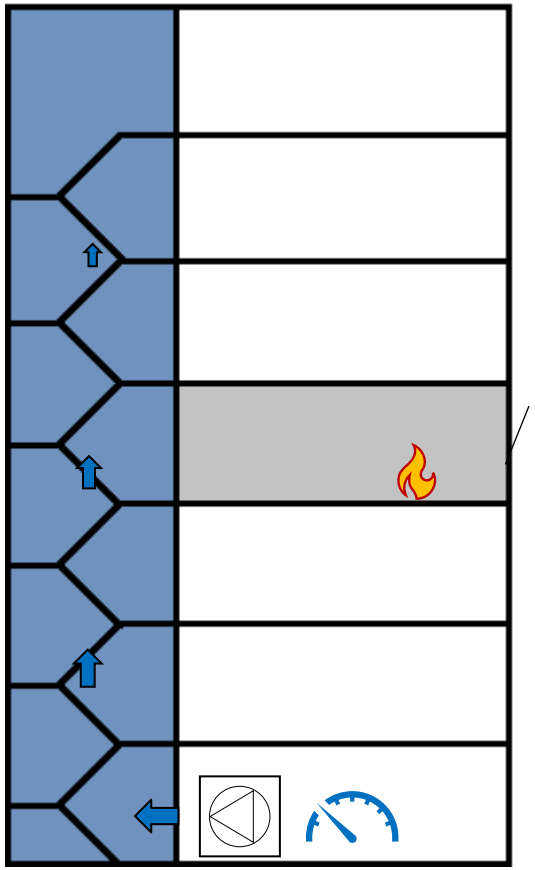
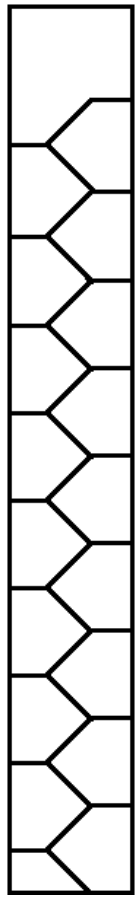


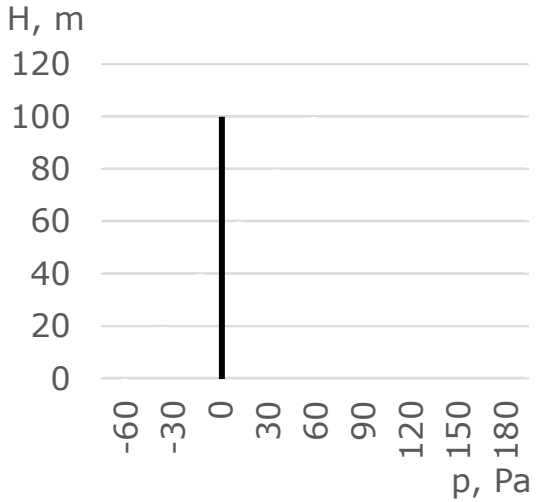
DOOR CLOSED
AIR VOLUME DECREASES
TO COMPENSATE AIR LEAKAGES
AND MAINTAIN OVERPRESSURE

Source: Craig Edwards, Linkedin

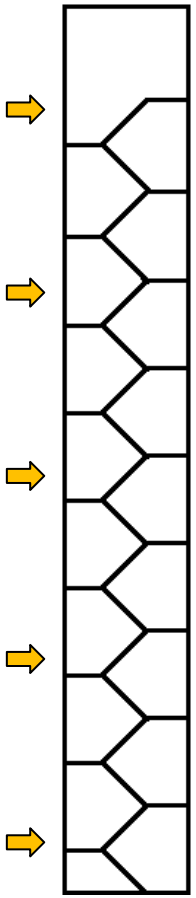
PRESSURE TOO HIGH
>100 N

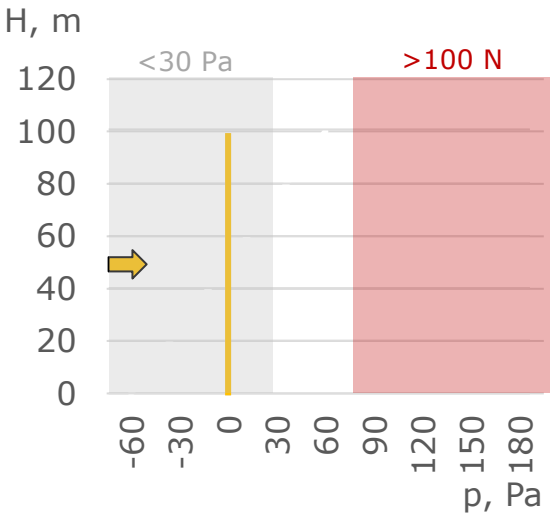
ISOTHERMAL
T_{out}= 20°C





NATURAL DISTRIBUTION





PRESSURIZATION

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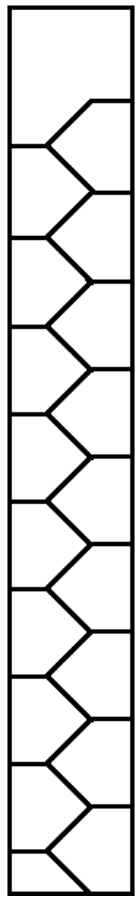
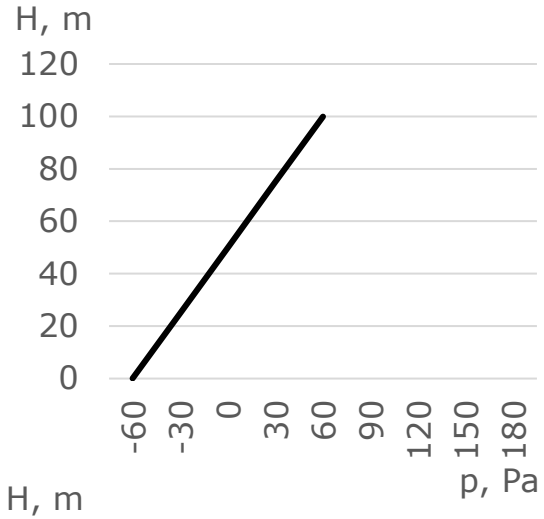
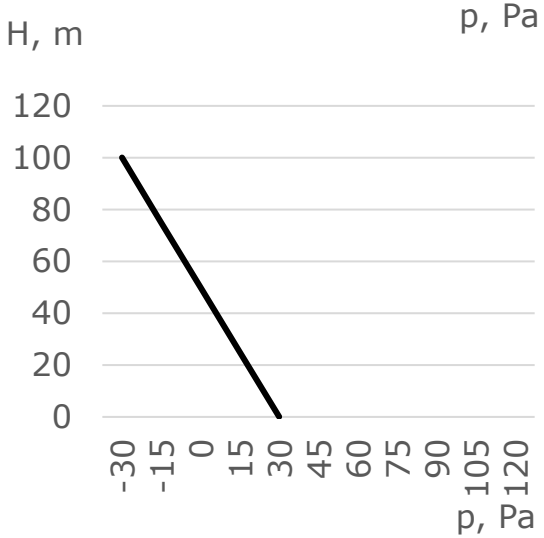
WINTER
T_{out}= -10°C

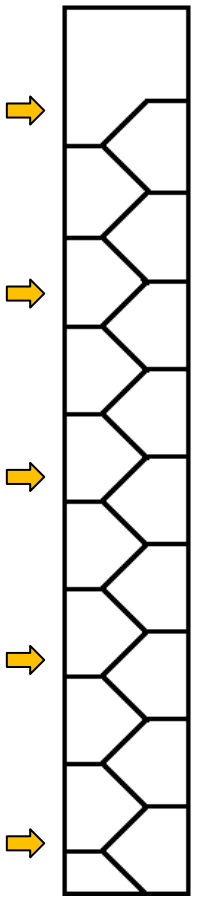


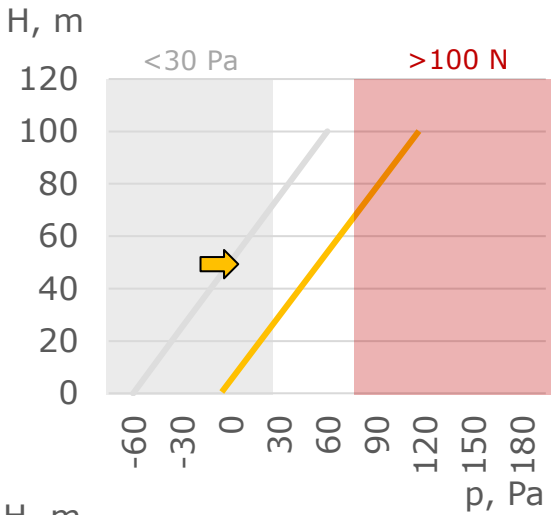


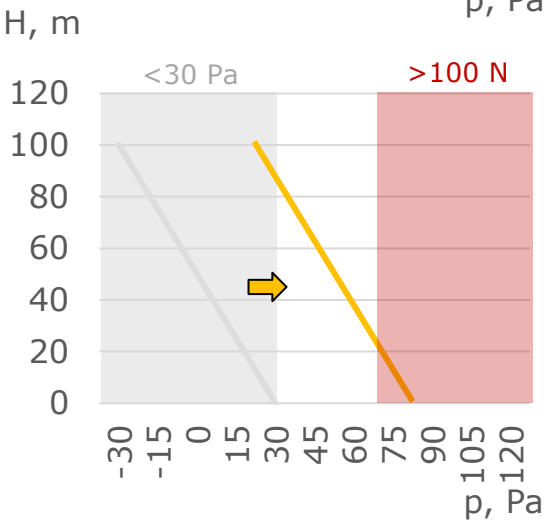
SUMMER
T_{out}= 38°C



NATURAL DISTRIBUTION







PRESSURIZATION

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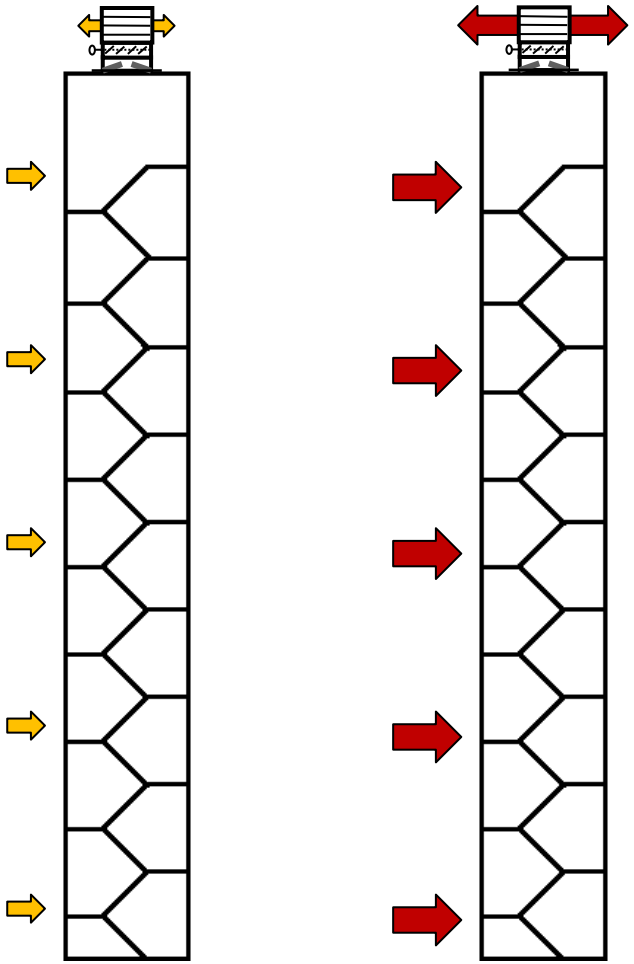
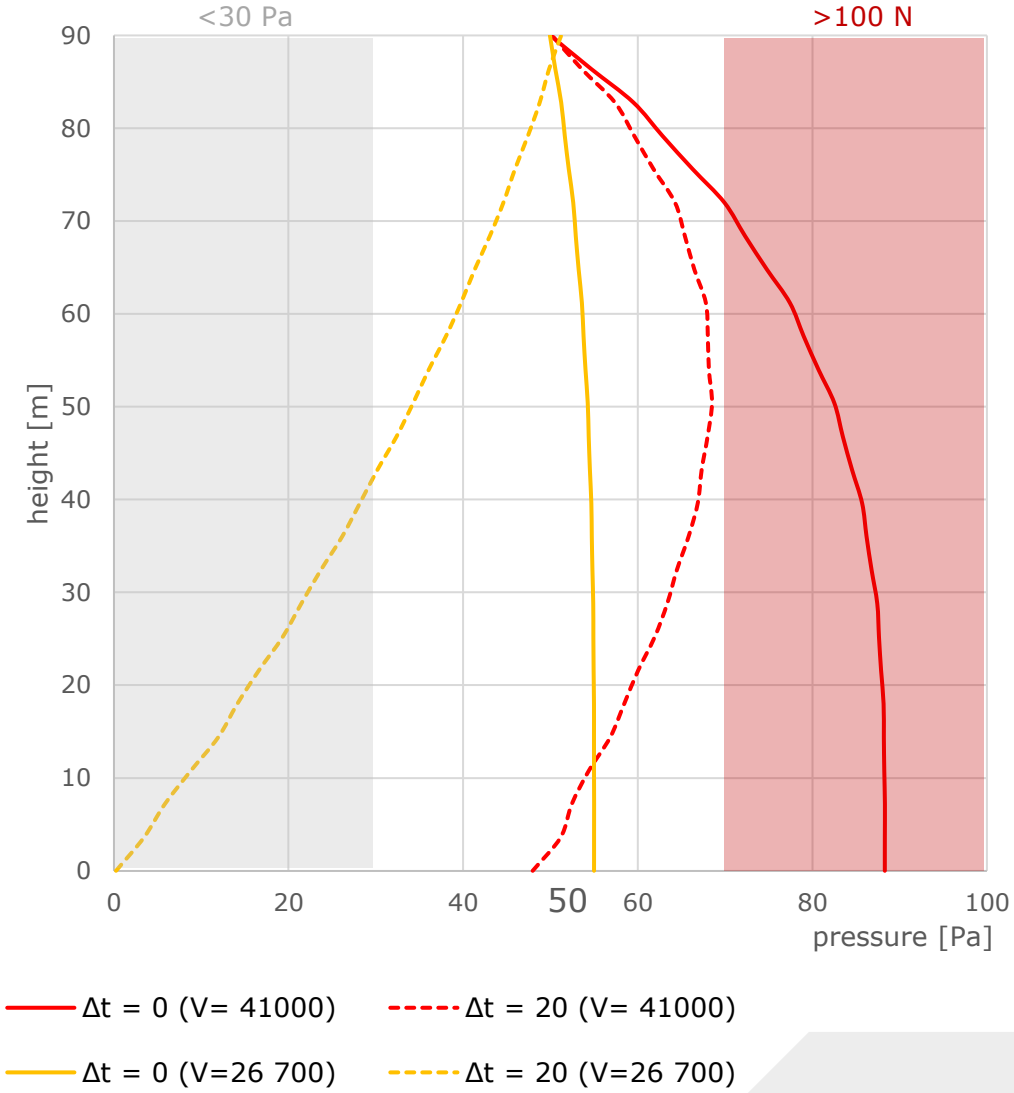
PRESSURE DISTRIBUTION
DIFFERENT PDS, 90m BUILDING



CONSTANT AIR VOLUME

V=26700 m³/h **V=41000 m³/h**



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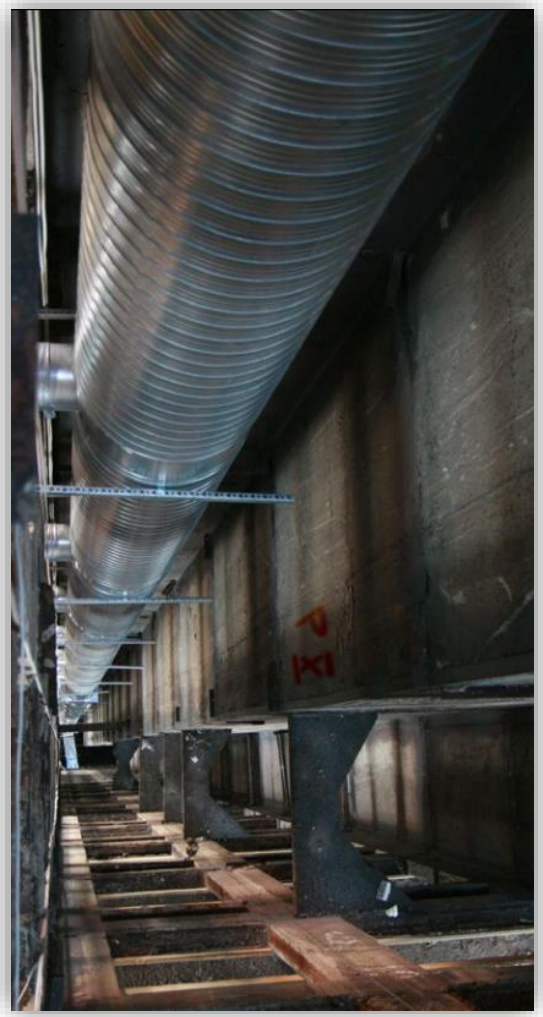

REAL SCALE TESTING	
LOCATION	**CRACOW**
BUILDING	**23°, H=90 m**
TIME	**10.2008 – 09.2010**

CASE STUDY ON RECONSTRUCTION:

SMAY.PL/PDS

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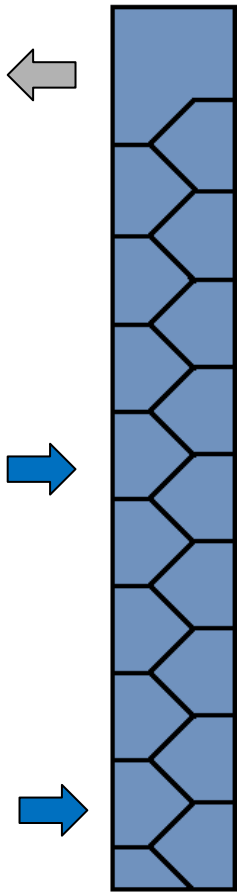
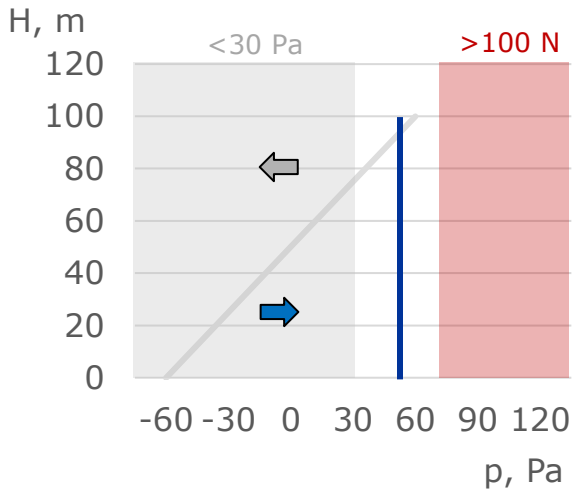
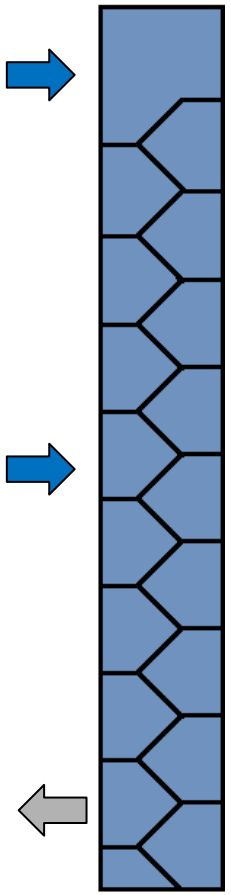
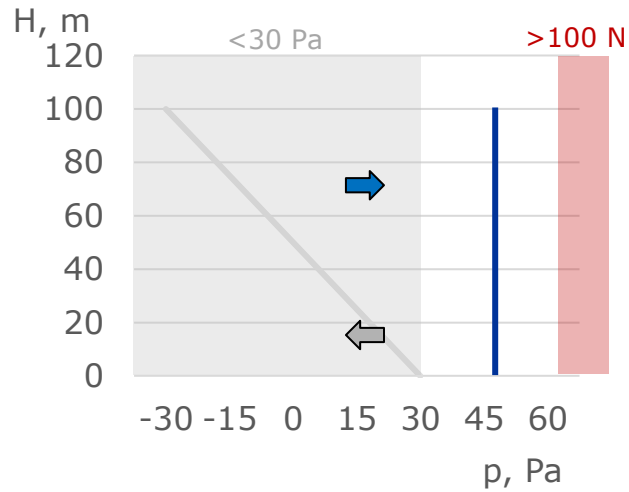




WINTER





SUMMER

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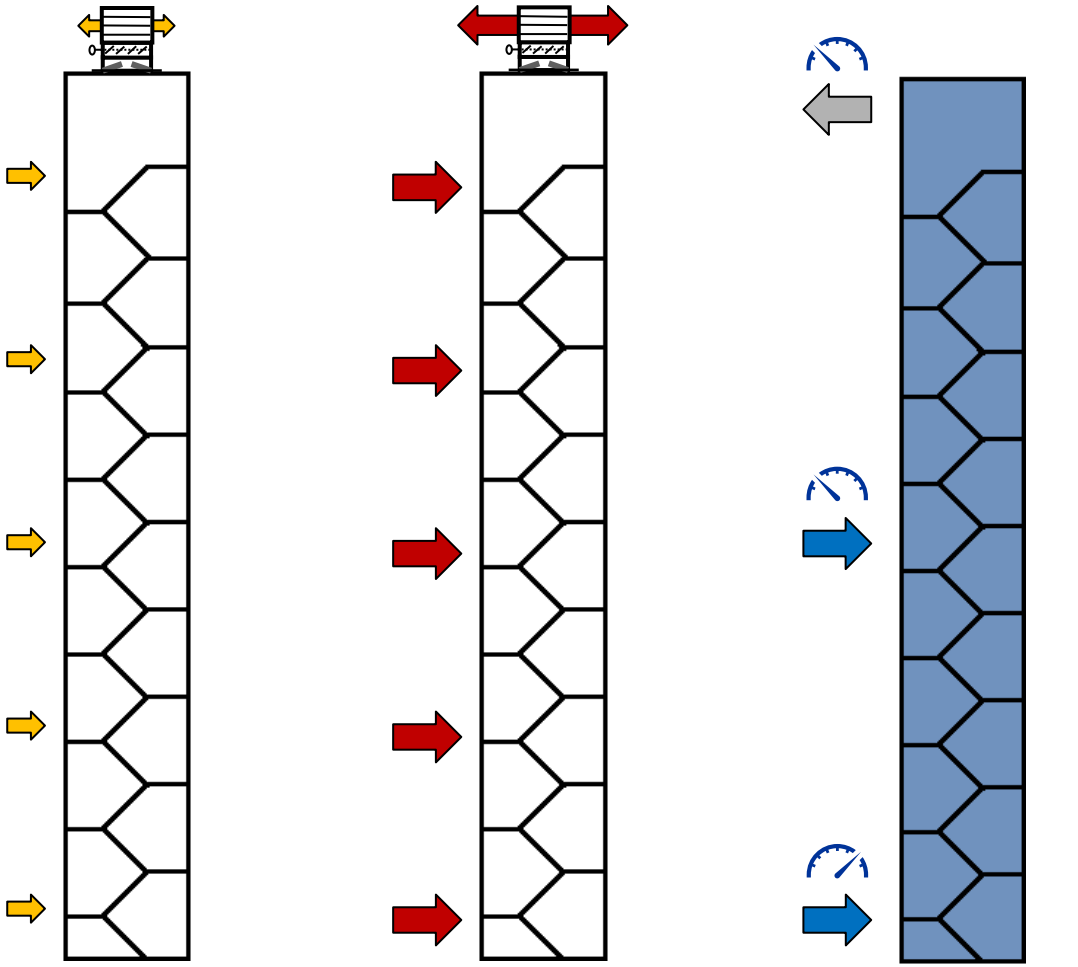
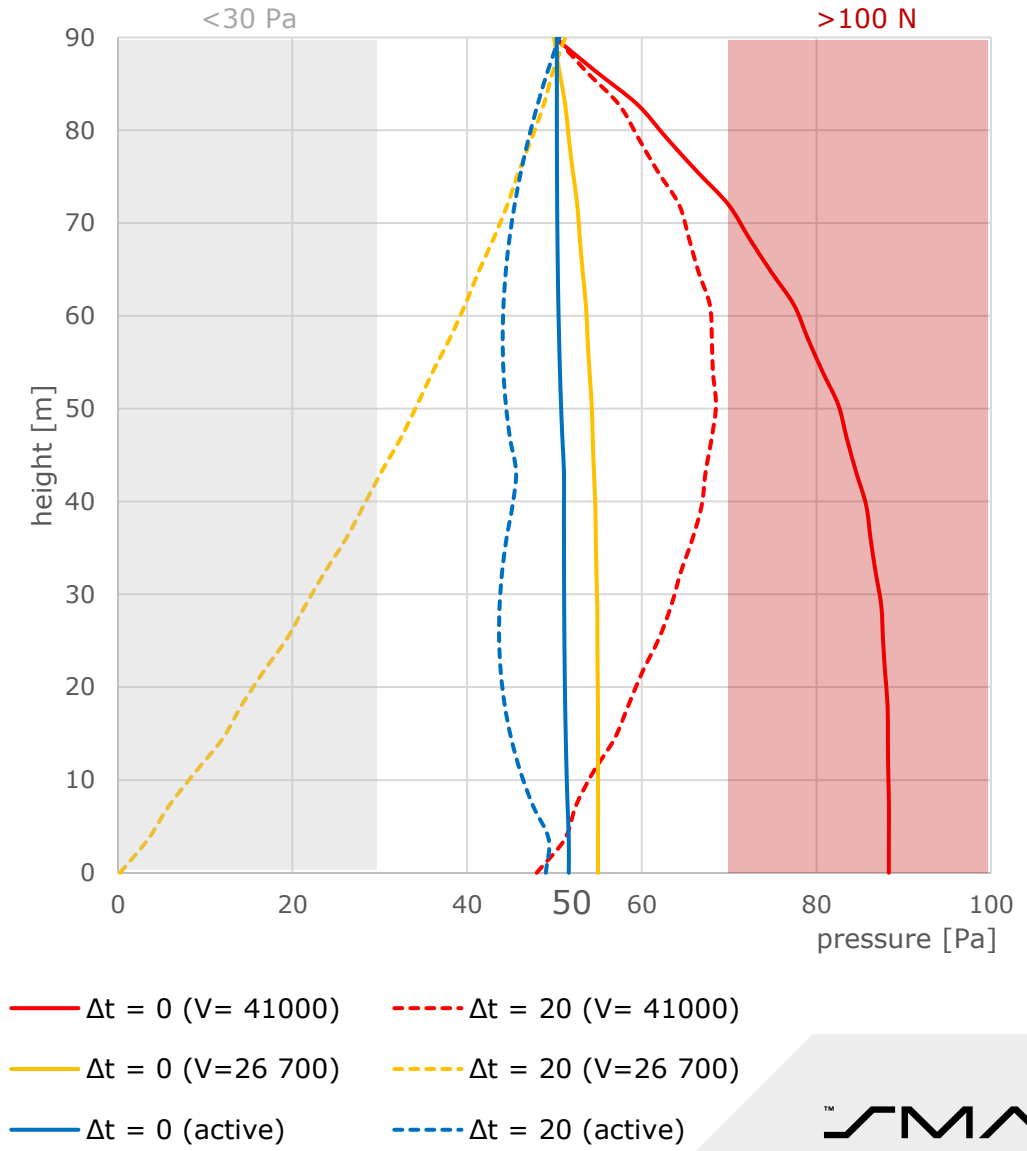
PRESSURE DISTRIBUTION
DIFFERENT PDS, 90m BUILDING



CONSTANT AIR VOLUME
V=26700 m³/h **V=41000 m³/h**

ADAPTIVE
FLOW SYSTEM



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SUPPORT
ADDITIONAL MATHEMATICAL ANALYSIS

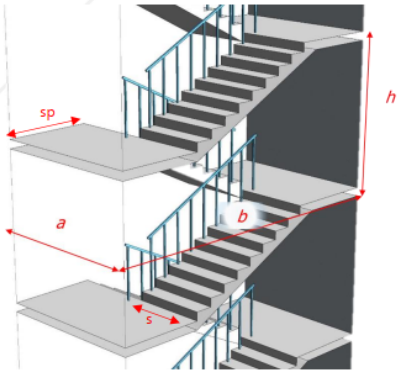
SMAY Sp. z o.o.
Podłęże 678
30-003 Podłęże,
POLAND

VAT UE: PL6782821888

smay.eu

DESCRIPTION AND ASSUMPTIONS FOR ANALYSIS:

- **Goal of the analysis**: determination of pressure distribution in the staircase during the operation of the pressure differentiation system
- Height of the staircase: 87,5 m (82,4 m above ground and 5,1 m underground)
- Tightness level: average in accordance to EN 12101-6
- Method of analysis: analytical calculations of pressure inside the staircase taking into account the stack effect, flow resistance, leakage
- All doors are closed
- The correct operation of the pressure differential system (PDS) requires pressure regulation within the corridors, which was not the subject of the analysis
- Location of air supply points:
  - Reversible top iSWAY unit: L23
  - Additional iSWAY unit: L06, L08, L10, L12, L14, L16, L18, L20
  - Reversible bottom iSWAY unit: LGround, L02, L04,
- the analysis was performed for summer, isothermal and winter conditions
- staircase geometry:
  - a = 3,0 m
  - b = 5,25 m
  - sp = 1,425 m
  - s = 1,40 m
  - h = 3,25 ÷ 4,11 m (above ground)
  - h = 2,95 ÷ 4,32 m (underground)



RESULTS OF THE ANALYSIS:

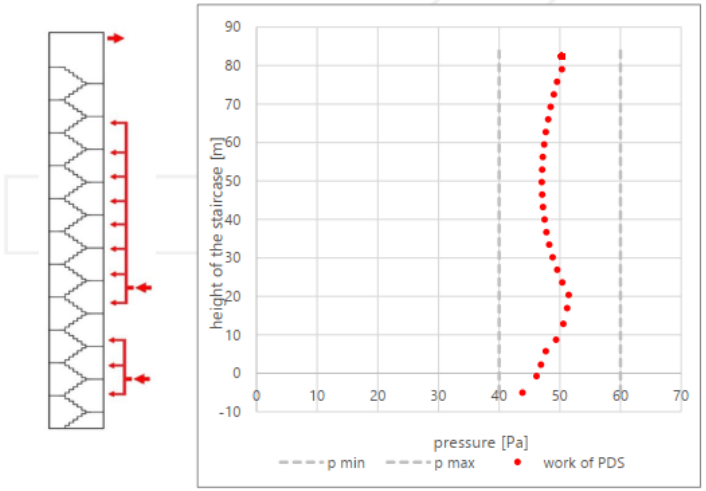
Winter conditions

Pressure differences between staircase and outside

Temperature **outside** in winter	T_{out}	0	[°C]
Temperature **inside** in winter	T_{Inn}	18	[°C]

Outlet volume flow (top)	V_{out}	- 12 600	[m³/h]
Additional volume flow (middle)	V_{add}	5 000	[m³/h]
Inlet volume flow (down)	V_{Inn}	21 200	[m³/h]

Figure 01. Pressure differences between staircase and outside due to work of Pressure Differential System (PDS) in winter conditions



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ADDITIONAL MATHEMATICAL ANALYSIS

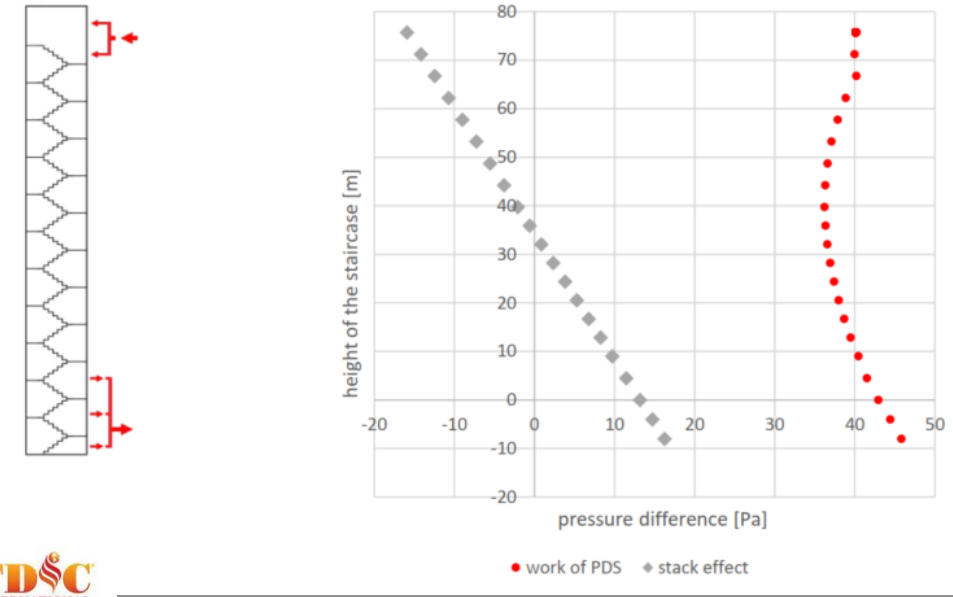
Summer conditions - staircase

Pressure differences between staircase and outside

Temperature **outside** in summer	$T_{out,s}$	32	[°C]
Temperature **inside** in summer	$T_{ins,s}$	22	[°C]

Outlet volume flow (down)	V_{out}	-9 700	[m³/h]
Inlet volume flow (top)	V_{inn}	40 000	[m³/h]

Figure 03. Pressure differences between staircase and outside due to stack effect and due to work of Pressure Differential System (PDS) in summer conditions



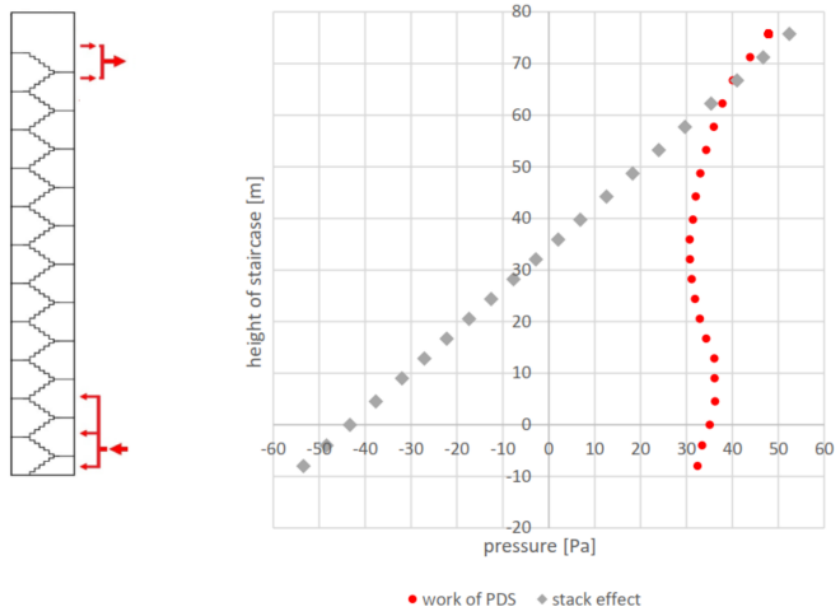
Winter conditions - staircase

Pressure differences between staircase and outside

Temperature **outside** in winter	$T_{out,w}$	-10	[°C]
Temperature **inside** in winter	$T_{ins,w}$	18	[°C]

Outlet volume flow (top)	V_{out}	-32 500	[m³/h]
Inlet volume flow (down)	V_{inn}	61 000	[m³/h]

Figure 02. Pressure differences between staircase and outside due to stack effect and due to work of Pressure Differential System (PDS) in winter conditions



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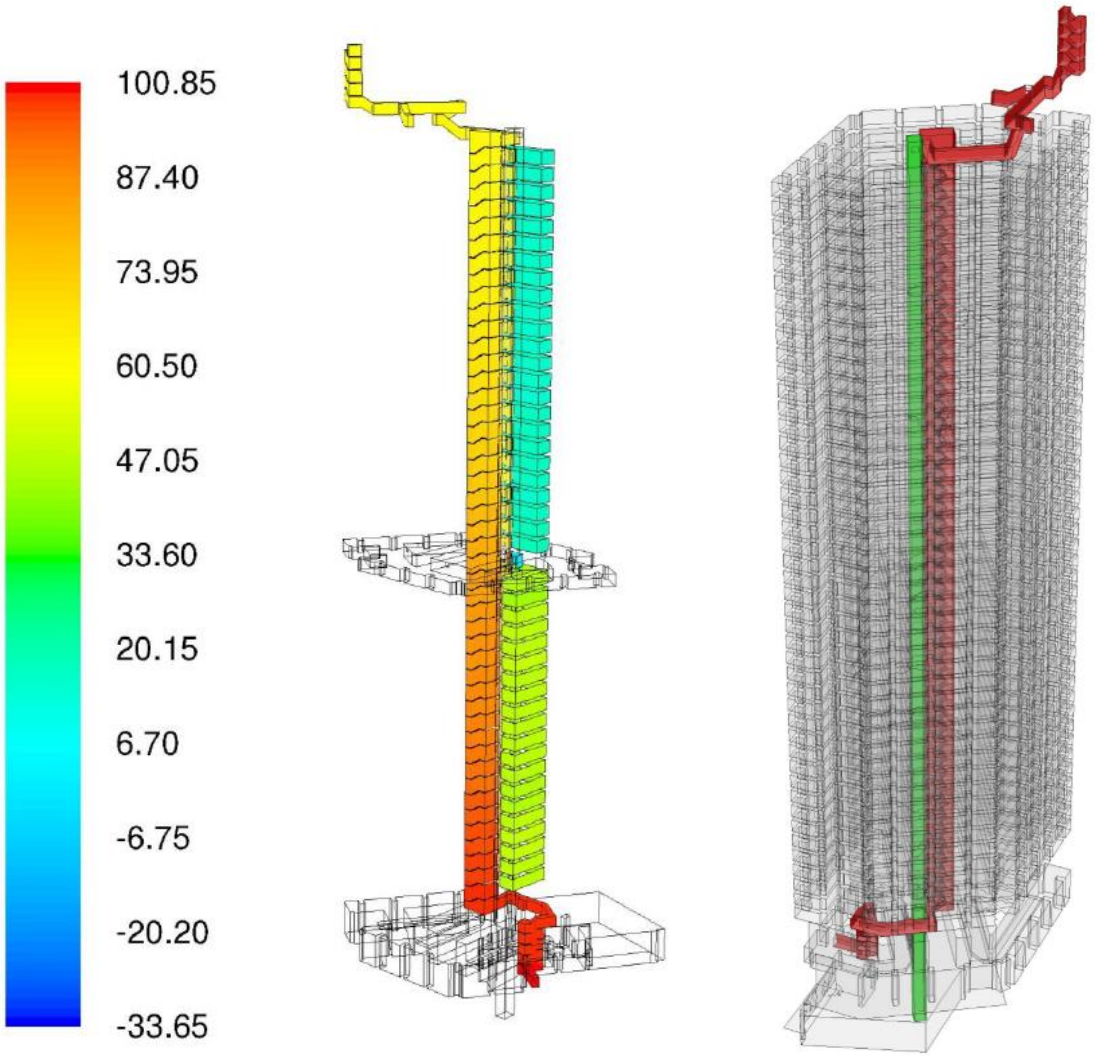
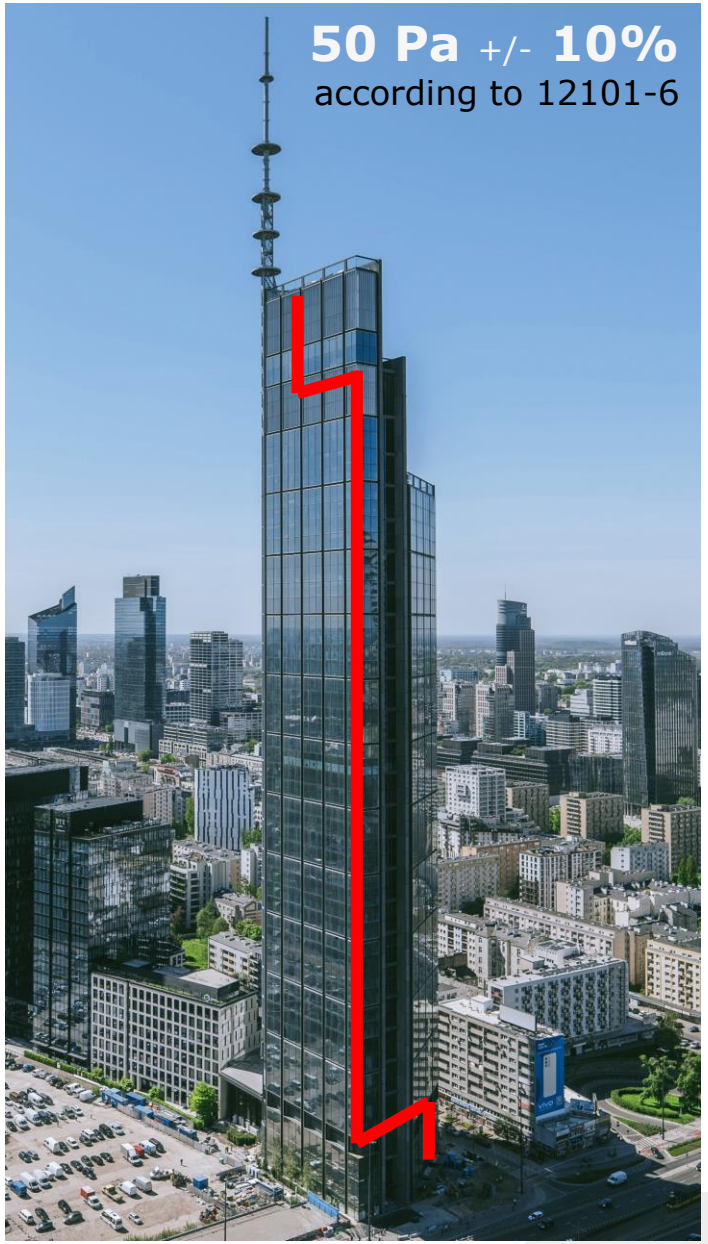
CFD SIMULATIONS





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EXAMPLES OF RELIABLE **PDS** in **>60m**

hello@smay.eu

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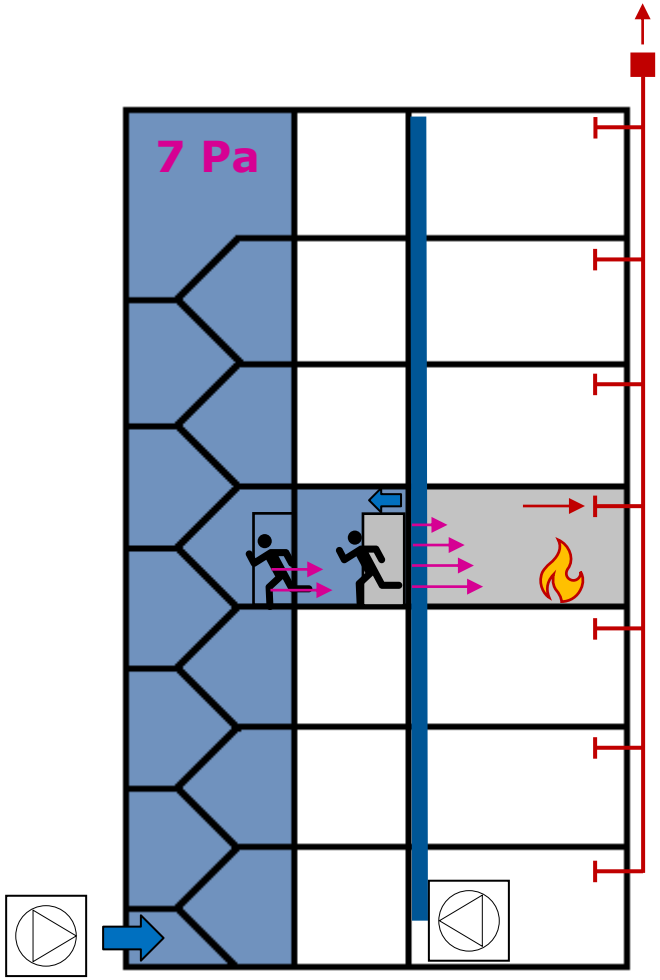
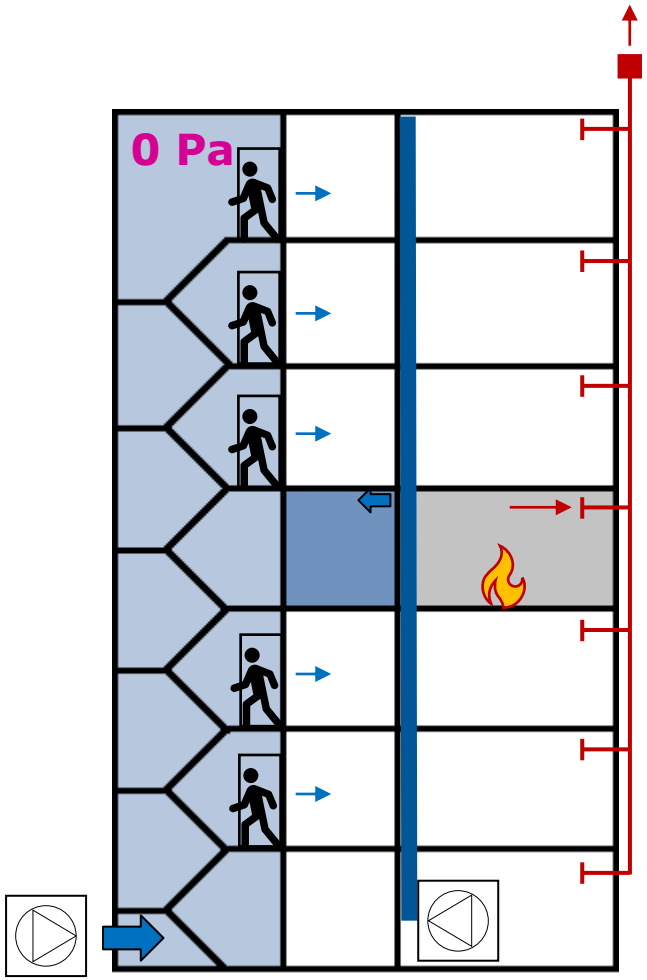
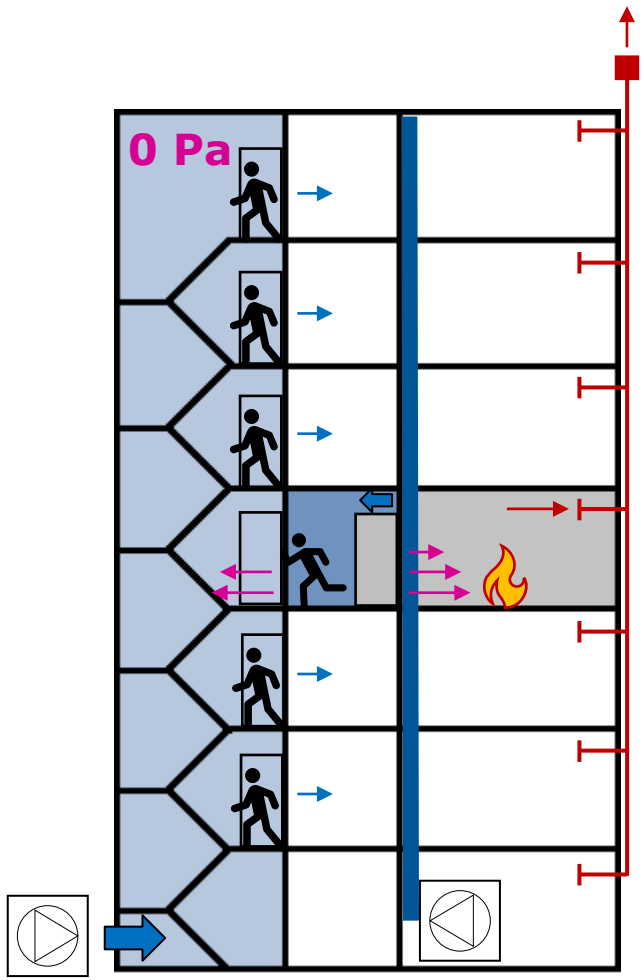
DOES PRESSURISATION WORK
DURING **SIMULTANEOUS EVACUATION**?



ONE DOOR OPEN
6 Pa ➔ 2 m/s
IN THE LOBBY



ALL OTHER DOORS OPEN
>30 Pa
IN THE LOBBY



ALL DOORS OPEN
1 m/s ← 1 Pa ➔ 1 m/s
IN THE LOBBY

MECHANICAL SMOKE EXTRACTION WILL FORCE FLOW TO THE FIRE FLOOR
~2 m/s

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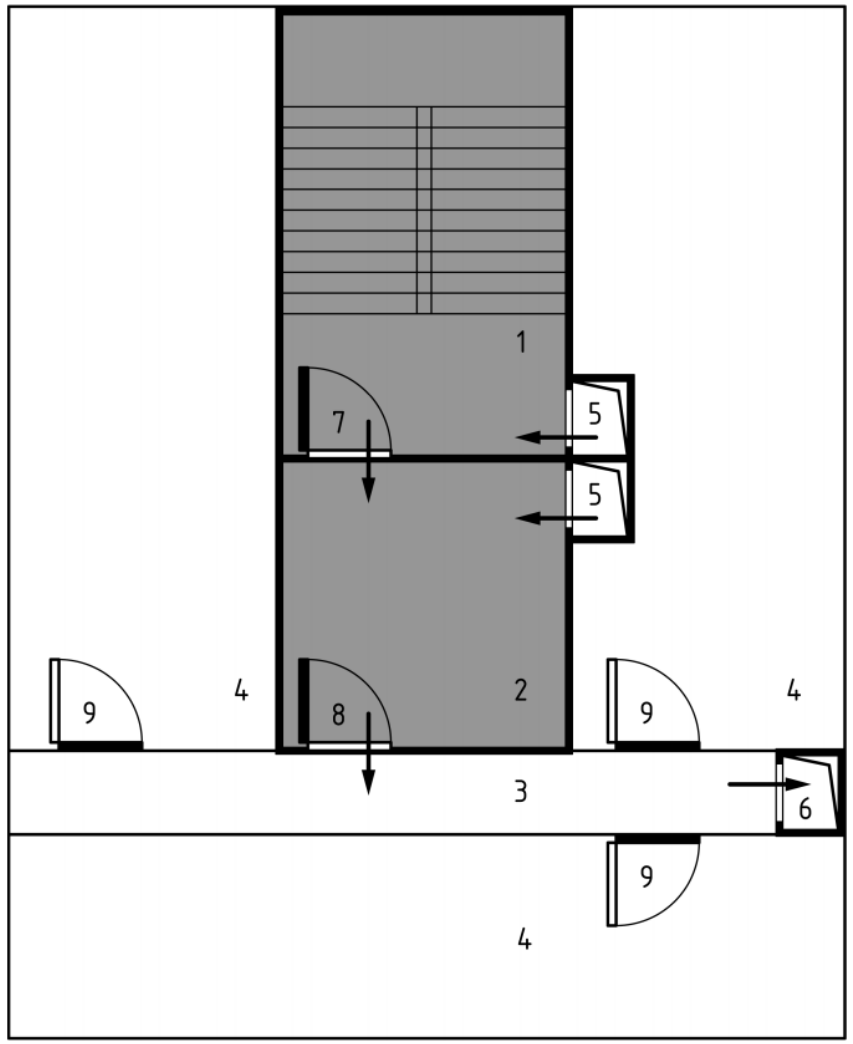
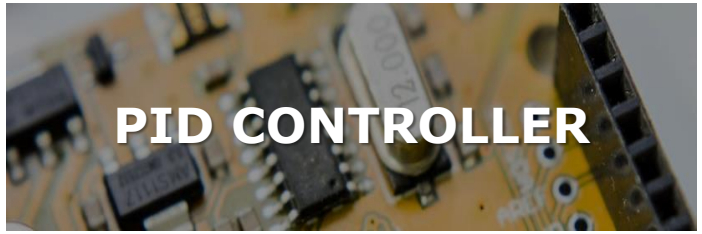
LOBBY PRESSURIZATION

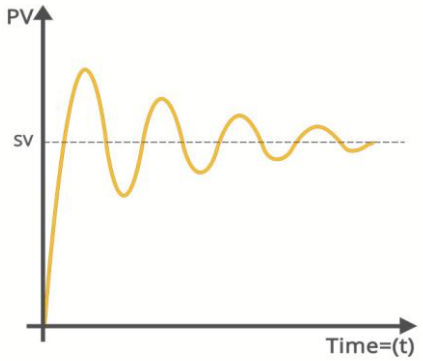
1. ADDITIONAL PROTECTION
REDUCES THE RISK OF SINGLE-POINT FAILURE
MAKES THE SYSTEM RESILIENT TO UNFORESEEN SCENARIOS

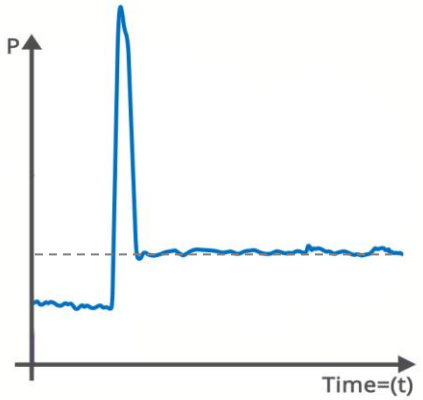
2. BEST CONDITIONS FOR FIRE-FIGHTERS
IMPROVED VISIBILITY
FIGHTING FIRE IN A STREAM OF COOL AIR

3. ASYLUM FOR PEOPLE WITH DISABILITY
SAFE PLACE
ADDITIONAL SPACE









PID CONTROLLER
PRESSURE-BASED
CONTROL ONLY

EXAMPLE RANGES, m³/h:
1300 – 9000
15 000 – 55 000

PREDICTIVE-ADAPTIVE CONTROLLER
BASED ON NEURAL NETWORK

EXAMPLE RANGES, m³/h:
200 – 50 500
1500 – 75 000

LABORATORY TESTS

1. DYNAMIC BEHAVIOUR TEST
   PERFORMANCE WHEN DOOR IS OPENED AND CLOSED

2. FIRST FUNCTIONALITY TEST
   20 CYCLES WITH CHECKING TIMES TO ACHIEVE SET VALUES

3. DURABILITY TEST
   10000 CYCLES TO CHECK THE COMPONENTS' RELIABILITY

4. SECOND FUNCTIONALITY TEST
   FUNCTIONALITY TEST AFTER DURABILITY TEST

5. OSCILLATION TEST
   10 SUBTESTS OF 20 OPENING AND CLOSING DOOR CYCLES WITHOUT WAITING TIME

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FDSC INTERNATIONAL
IFI Institut für Industrieaerodynamik
ITH®

SELF-TEST ABILITY

iSWAY makes a brief test of its funcionality every 24h:

- Cut-off damper is opened
- Fan starts operation at low frequency (for few secs)
- Data is collected and recorded in the device memory

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BENEFITS:

- Potential failure can be quickly identified and eliminated
- Reports can be easily printed
- Allows to reduce the duration of periodic inspections
- Reduce operating costs

SMAY Sp. z o.o.
ul. Ciep łownicza 29

31-587 Kraków
NIP: 6782821888

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ALL STAGE SUPPORT

CONCEPT OF THE SYSTEM

TECHNICAL CONSULTING

CALCULATIONS

SELECTION OF EQUIPMENT

CFD &
MATHEMATICAL ANALYSIS

START-UP
COMMISSIONING SUPPORT

KEY TAKEAWAYS:

1. PRESSURE-CONTROLLED FAN
DYNAMIC RESPONSE TO THE CURRENT CONDITIONS, SELF-ADAPTATION

2. FLOW SYSTEM FOR HIGH-RISE BUILDINGS
STACK EFFECT MITIGATION

3. FLEXIBILITY IN DESIGN
LOBBY PROTECTION, COOPERATION WITH OTHER SYSTEMS, EXPERIENCED TEAM READY TO HELP

4. PREDICTIVE-ADAPTIVE REGULATOR
FASTEST RESPONSE, OSCILLATION RESISTANCE

5. RELIABILITY
SELF-TEST EVERY 24h
KIT'S OF DEVICES TEST

iSWAY-WFC®

iSWAY-RFC®

iSWAY-FC®

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™ SMAY

Smay
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Systems

PRUDENTIAL

66m, Warsaw

2024

1945

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PALACE OF CULTURE AND SCIENCE

237m, Warsaw

2024

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N.O.T. TOWER / SKELETON / UNITY TOWER

90m, Krakow

2024

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SMAY

Get in touch!

✉ hello@smay.eu

RADEK SIKORSKI

INTERNATIONAL BUSINESS DEVELOPMENT MANAGER

r.sikorski@smay.eu | +48 502 163 302