

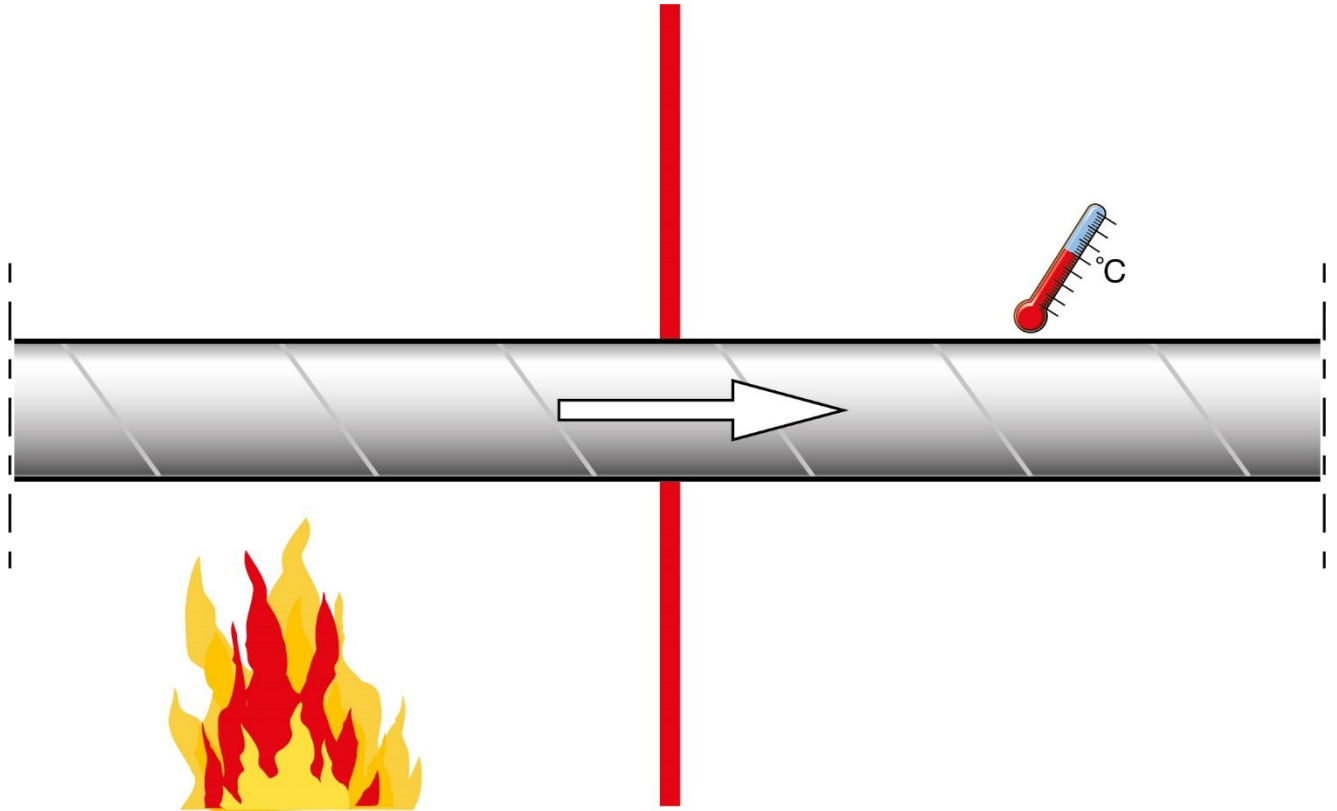
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## A1 - External and internal fire or external fire

This scenario is used to calculate an external fire affecting the duct system in the fire cell as well as crossing fire cells with certain surrounding temperatures. The user can specify the conditions for each part and calculate and analyse result.



### Scenario A1-1 – no insulation – no velocity

- Fire in left fire cell, temperature 945°C
- Circular duct, size 200 mm, length 3 m on each side of fire boundary
- 0 m/s in velocity (external fire)
- No insulation
- Surrounding temperature 20°C in other fire cell

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### Scenario A1-2 – partly insulation – no velocity

- Fire in left fire cell, temperature 945°C
- Circular duct, size 200 mm, length 3 m on each side of fire boundary
- 0 m/s in velocity (external fire)
- EI 30 (100 kg/m<sup>3</sup>, 50 mm, stone wool) insulation, 1 m on each side of fire cell
- Surrounding temperature 20°C in other fire cell

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## Scenario A1-3, no insulation - fan operating during fire

- Fire in left fire cell, temperature 945°C
- Circular duct, size 200 mm, length 3 m on each side of fire boundary
- 6 m/s in velocity, incoming air temperature 945°C (external and internal fire. If you change this to 20°C it's only external fire). See **chapter E** "Air velocity temperature correction" to determine the velocity.
- No insulation
- Surrounding temperature 20°C in other fire cell

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## Scenario A1-4, partly insulation - fan operating during fire

- Fire in left fire cell, temperature 945°C
- Circular duct, size 200 mm, length 3 m on each side of fire boundary
- 6 m/s in velocity, incoming air temperature 945°C (external and internal fire. If you change this to 20°C it's only external fire). See **chapter E** "Air velocity temperature correction" to determine the velocity.
- Surrounding temperature 20°C in other fire cell

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## Scenario A1-5, no insulation - fan operating during fire

- Fire in left fire cell, temperature 945°C
- Circular duct, size 200 mm, length 3 m on each side of fire boundary
- -4 m/s in velocity, incoming air temperature 20°C (external fire). See **chapter E** "Air velocity temperature correction" to determine the velocity.
- No insulation
- Surrounding temperature 20°C in other fire cell

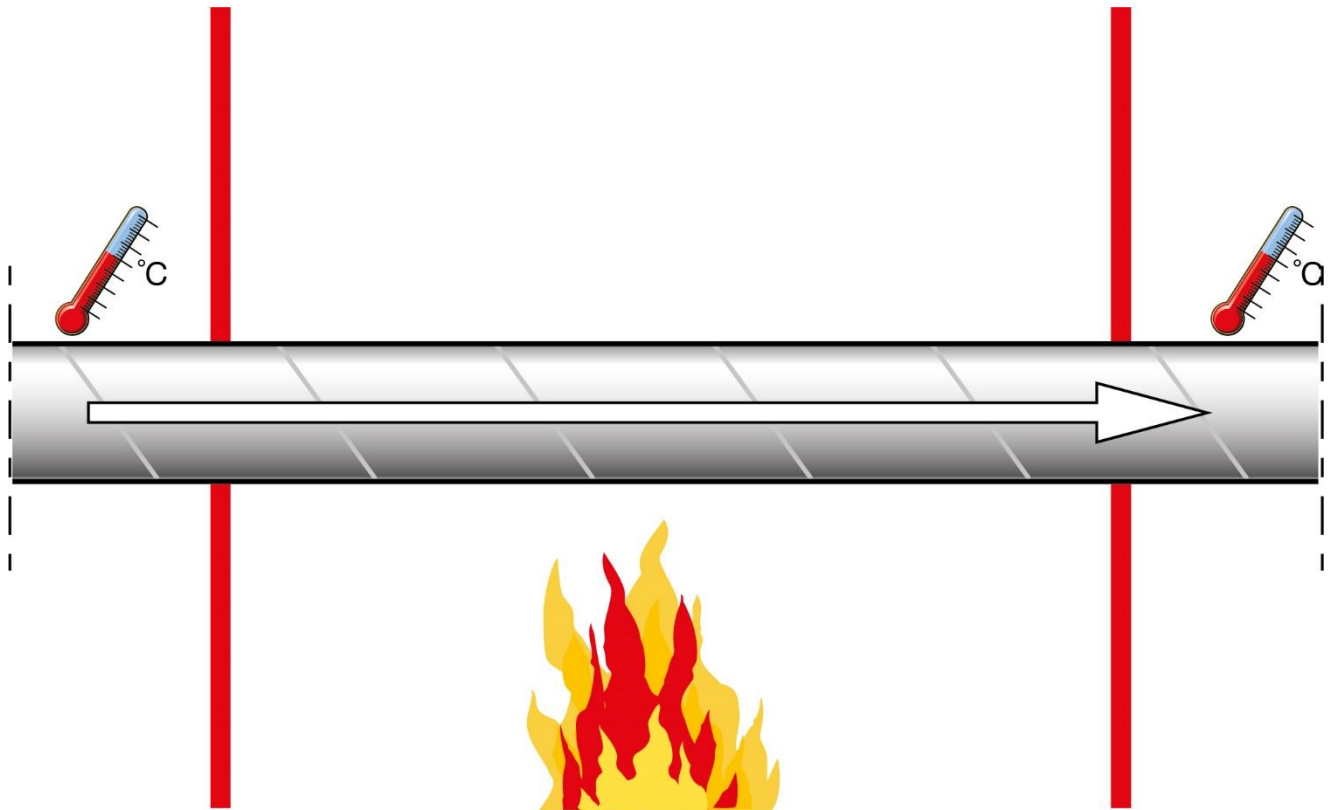
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## Scenario A1-6, partly insulation - fan operating during fire

- Fire in left fire cell, temperature 945°C
- Circular duct, size 200 mm, length 3 m on each side of fire boundary
- -4 m/s in velocity, incoming air temperature 20°C (external fire). See **chapter E** "Air velocity temperature correction" to determine the velocity.
- EI 30 (100 kg/m<sup>3</sup>, 50 mm, stone wool) insulation, 1 m on each side of fire cell
- Surrounding temperature 20°C in other fire cell

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## A2 - External fire - in passing fire cell



### Scenario A2-1, no insulation – no velocity

- Fire in passing fire cell, temperature 945°C
- Circular duct, size 200 mm, length 3 m on each side of fire boundary
- 0 m/s in velocity (external fire)
- No insulation
- Surrounding temperature 20°C in other fire cells

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### Scenario A2-2, partly insulation – no velocity

- Fire in passing fire cell, temperature 945°C
- Circular duct, size 200 mm, length 3 m on each side of fire boundary
- 0 m/s in velocity (external fire)
- EI 30 (100 kg/m<sup>3</sup>, 50 mm, stone wool) insulation, 1 m on each side of fire cell
- Surrounding temperature 20°C in other fire cells

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## Scenario A2-3, no insulation - fan operating during fire

- Fire in passing fire cell, temperature 945°C
- Circular duct, size 200 mm, length 3 m on each side of fire boundary
- 4 m/s in velocity, incoming air temperature 20°C (external fire). See **chapter E** “Air velocity temperature correction” to determine the velocity.
- No insulation
- Surrounding temperature 20°C in other fire cells

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## Scenario A2-4, partly insulation - fan operating during fire

- Fire in passing fire cell, temperature 945°C
- Circular duct, size 200 mm, length 3 m on each side of fire boundary
- 4 m/s in velocity, incoming air temperature 20°C (external fire). See **chapter E** “Air velocity temperature correction” to determine the velocity.
- EI 30 (100 kg/m<sup>3</sup>, 50 mm, stone wool) insulation, 1 m on each side of fire cell
- Surrounding temperature 20°C in other fire cells

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## Scenario A2-5, no insulation - fan operating during fire

- Fire in passing fire cell, temperature 945°C
- Circular duct, size 200 mm, length 3 m on each side of fire boundary
- -4 m/s in velocity, incoming air temperature 20°C (external fire). See **chapter E** “Air velocity temperature correction” to determine the velocity.
- No insulation
- Surrounding temperature 20°C in other fire cells

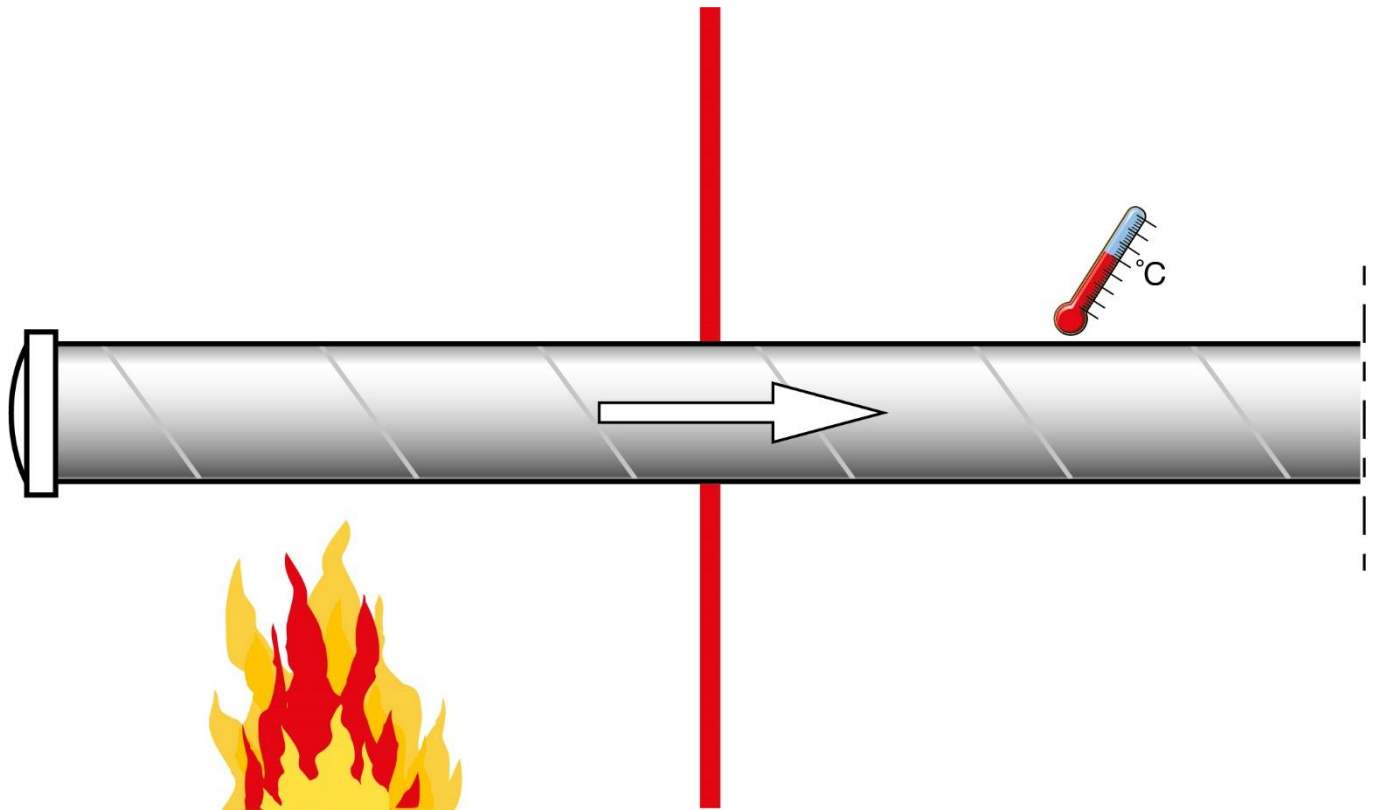
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## Scenario A2-6, no insulation - fan operating during fire

- Fire in passing fire cell, temperature 945°C
- Circular duct, size 200 mm, length 3 m on each side of fire boundary
- -4 m/s in velocity, incoming air temperature 20°C (external fire). See **chapter E** “Air velocity temperature correction” to determine the velocity.
- EI 30 (100 kg/m<sup>3</sup>, 50 mm, stone wool) insulation, 1 m on each side of fire cell
- Surrounding temperature 20°C in other fire cells

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## B1 - External and internal fire or external fire



### Scenario B1-1, no insulation – no velocity

- Fire in left fire cell, temperature 945°C
- Circular duct, size 200 mm, length 3 m on each side of fire boundary
- 0 m/s in velocity (external fire)
- No insulation
- Surrounding temperature 20°C in other fire cell

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### Scenario B1-2, partly insulation – no velocity

- Fire in left fire cell, temperature 945°C
- Circular duct, size 200 mm, length 3 m on each side of fire boundary
- 0 m/s in velocity (external fire)
- EI 30 (100 kg/m<sup>3</sup>, 50 mm, stone wool) insulation, 1 m on each side of fire cell
- Surrounding temperature 20°C in other fire cell

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## Scenario B1-3, no insulation - fan operating during fire

- Fire in left fire cell, temperature 945°C
- Circular duct, size 200 mm, length 3 m on each side of fire boundary
- 6 m/s in velocity, incoming air temperature 945°C (external and internal fire). See **chapter E** “Air velocity temperature correction” to determine the velocity.
- No insulation
- Surrounding temperature 20°C in other fire cell

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## Scenario B1-4, partly insulation - fan operating during fire

- Fire in left fire cell, temperature 945°C
- Circular duct, size 200 mm, length 3 m on each side of fire boundary
- -4 m/s in velocity, incoming air temperature 20°C (external fire). See **chapter E** “Air velocity temperature correction” to determine the velocity.
- EI 30 (100 kg/m<sup>3</sup>, 50 mm, stone wool) insulation, 1 m on each side of fire cell
- Surrounding temperature 20°C in other fire cell

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## Scenario B1-5, no insulation - fan operating during fire

- Fire in left fire cell, temperature 945°C
- Circular duct, size 200 mm, length 3 m on each side of fire boundary
- -4 m/s in velocity, incoming air temperature 20°C (external fire). See **chapter E** “Air velocity temperature correction” to determine the velocity.
- No insulation
- Surrounding temperature 20°C in other fire cell

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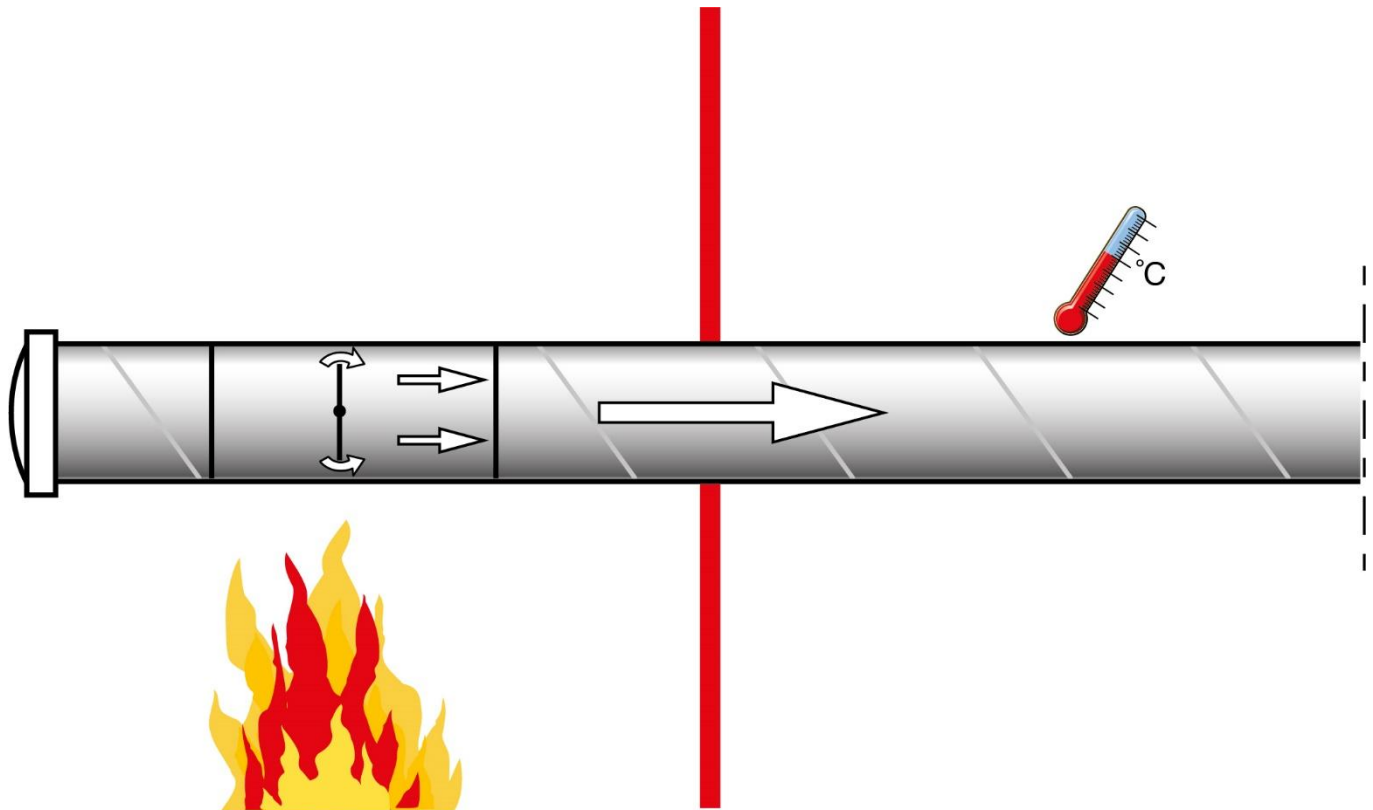
## Scenario B1-6, partly insulation - fan operating during fire

- Fire in left fire cell, temperature 945°C
- Circular duct, size 200 mm, length 3 m on each side of fire boundary
- -4 m/s in velocity, incoming air temperature 20°C (external fire). See **chapter E** “Air velocity temperature correction” to determine the velocity.
- EI 30 (100 kg/m<sup>3</sup>, 50 mm, stone wool) insulation, 1 m on each side of fire cell
- Surrounding temperature 20°C in other fire cell

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## B2 - External fire - fire damper



### Scenario B2-1, damper - no insulation – no velocity

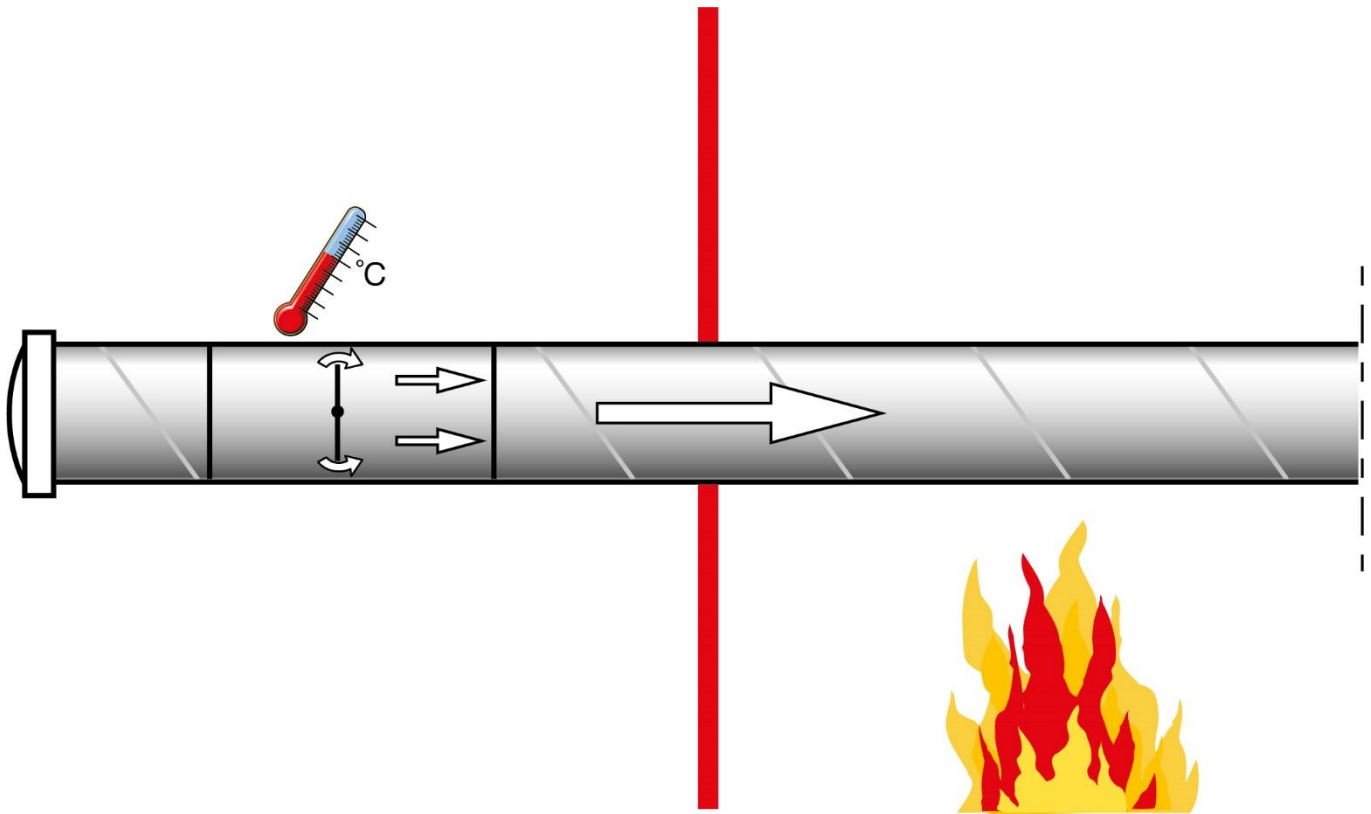
- Fire in left fire cell, temperature 945°C
- Fire damper (E-S)
- Circular duct, size 200 mm, length 3 m on each side of fire boundary
- 0 m/s in velocity (no leakage assumed). By adding a leakage, it's both external and internal fire
- No insulation
- Surrounding temperature 20°C in other fire cell

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## Scenario B2-2, damper – partly insulation – no velocity

- Fire in left fire cell, temperature 945°C
- Fire damper (E-S)
- Circular duct, size 200 mm, length 3 m on each side of fire boundary
- 0 m/s in velocity (no leakage assumed). By adding a leakage, it's both external and internal fire
- EI 60 (100 kg/m<sup>3</sup>, 100 mm, stone wool) insulation, 1 m on damper side
- Surrounding temperature 20°C in other fire cell

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### Scenario B2-3, damper – no insulation – no velocity

- Fire in right fire cell, temperature 945°C
- Fire damper (E-S)
- Circular duct, size 200 mm, length 3 m on each side of fire boundary
- 0 m/s in velocity (no leakage assumed), external fire
- No insulation
- Surrounding temperature 20°C in other fire cell

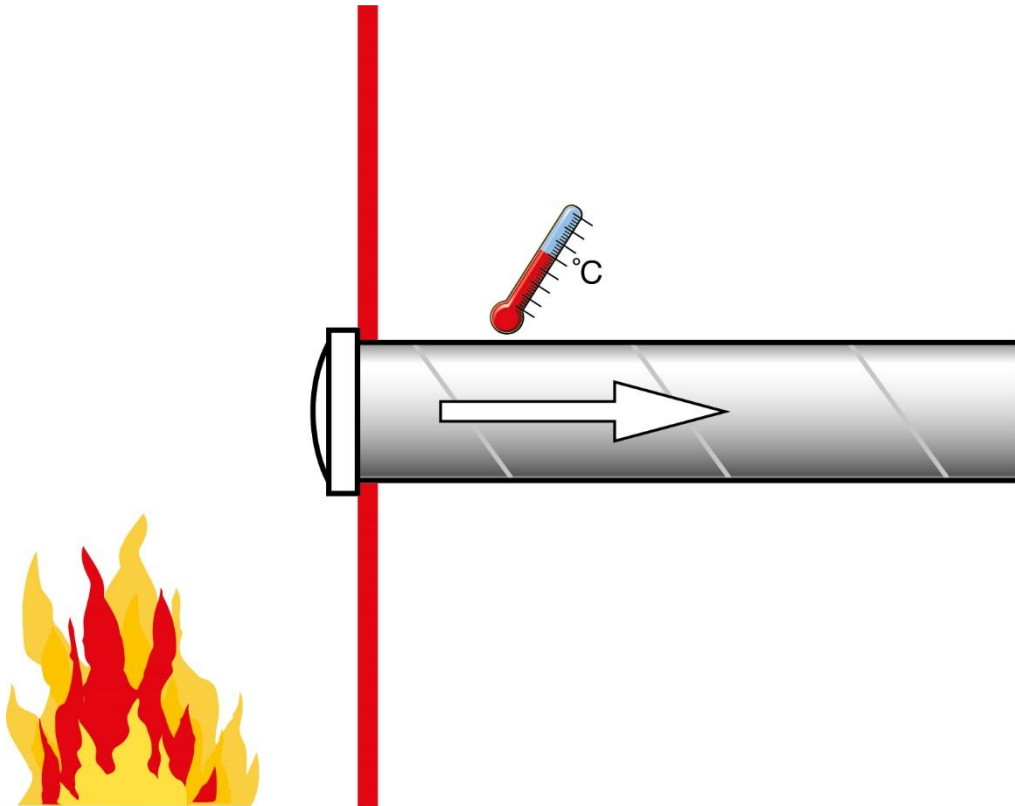
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## Scenario B2-4, damper – partly insulation – no velocity

- Fire in right fire cell, temperature 945°C
- Fire damper (E-S)
- Circular duct, size 200 mm, length 3 m on each side of fire boundary
- 0 m/s in velocity (no leakage assumed), external fire
- EI 60 (100 kg/m<sup>3</sup>, 100 mm, stone wool) insulation, 1 m on damper side
- Surrounding temperature 20°C in other fire cell

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## B3 External and internal fire or external fire



### Scenario B3-1, air valve - no insulation – no velocity

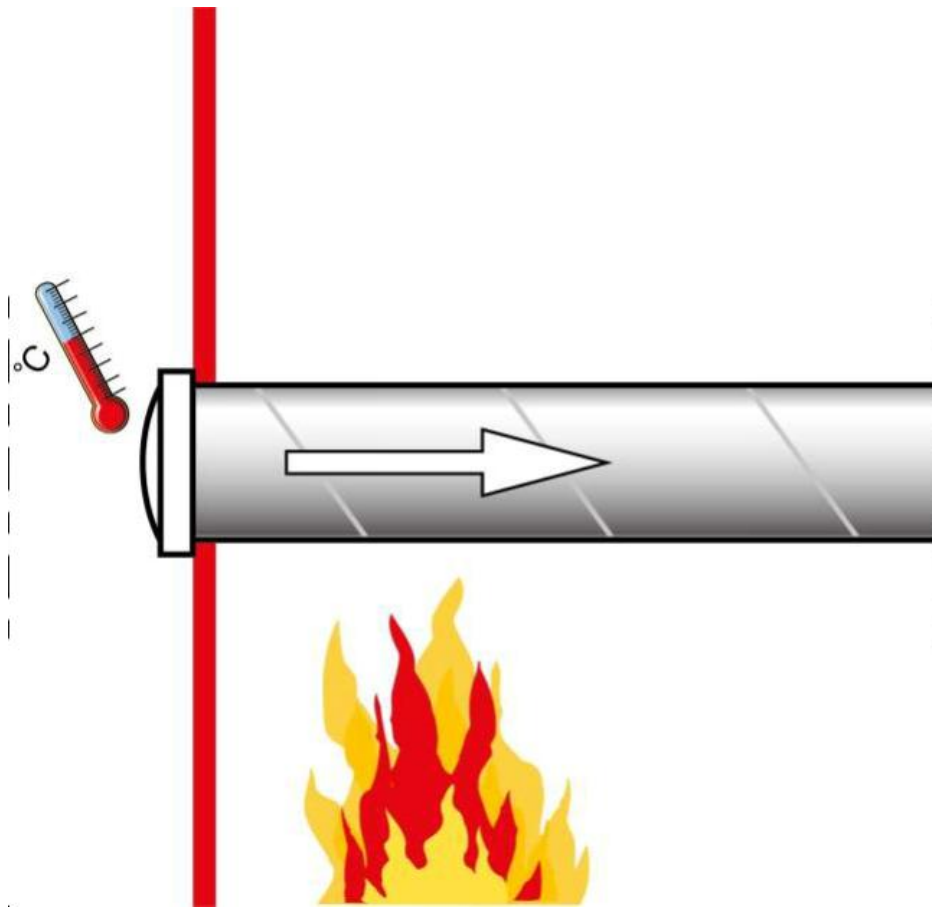
- Fire in left fire cell, temperature 945°C
- Circular duct, size 200 mm, length 3 m
- 0 m/s in velocity (external fire)
- No insulation
- Surrounding temperature 20°C in other fire cell

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### Scenario B3-2, air valve – partly insulation - fan operating during fire

- Fire in left fire cell, temperature 945°C
- Circular duct, size 200 mm, length 3 m
- 6 m/s in velocity, incoming air temperature 945°C (external and internal fire). See **chapter E** “Air velocity temperature correction” to determine the velocity.
- EI 30 (100 kg/m<sup>3</sup>, 50 mm, stone wool) insulation, 1 m on right side of fire boundary
- Surrounding temperature 20°C in other fire cell

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### Scenario B3-3, air valve - no insulation – no velocity

- Fire in right fire cell, temperature 945°C
- Circular duct, size 200 mm, length 3 m
- 0 m/s in velocity (external fire)
- No insulation
- Left Opening Screen Ei "Yes"
- Surrounding temperature 20°C in other fire cell

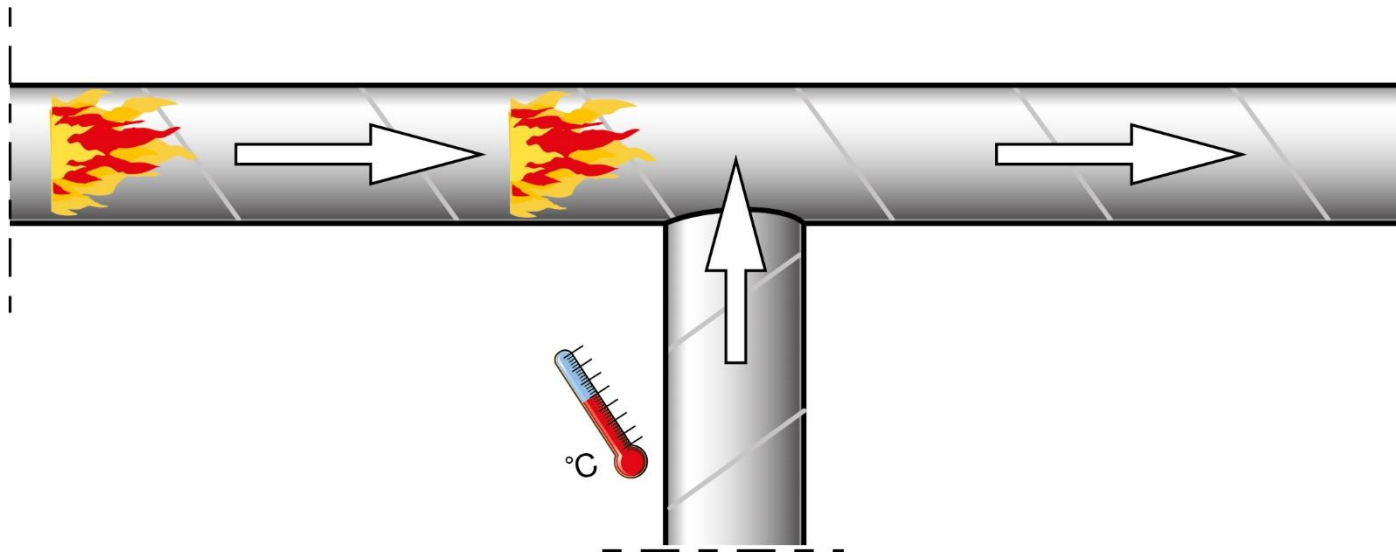
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## Scenario B3-4, air valve – partly insulation - fan operating during fire

- Fire in right fire cell, temperature 945°C
- Circular duct, size 200 mm, length 3 m
- 4 m/s in velocity, incoming air temperature 20°C (external fire). See **chapter E** “Air velocity temperature correction” to determine the velocity.
- EI 30 (100 kg/m<sup>3</sup>, 50 mm, stone wool) insulation, 1 m on right side
- Left Opening Screen Ei "Yes"
- Surrounding temperature 20°C in other fire cell

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## C1 - Junction



### Scenario C1-1, junction – no insulation – no velocity

- Fire inside the duct, assumed air temperature, intersection, 945°C
- Junction, circular duct, size 200 mm, length 3 m
- Junction, 0 m/s in velocity
- Junction, no insulation
- Junction, surrounding temperature 20°C

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### Scenario C1-2, junction – no insulation – fan operating during fire

- Fire inside the duct, assumed air temperature, intersection, 500°C
- Junction, circular duct, size 200 mm, length 3 m
- Junction, -4 m/s in (incoming air temperature 20°C). See **chapter E** “Air velocity temperature correction” to determine the velocity.
- Junction, no insulation
- Junction, surrounding temperature 20°C

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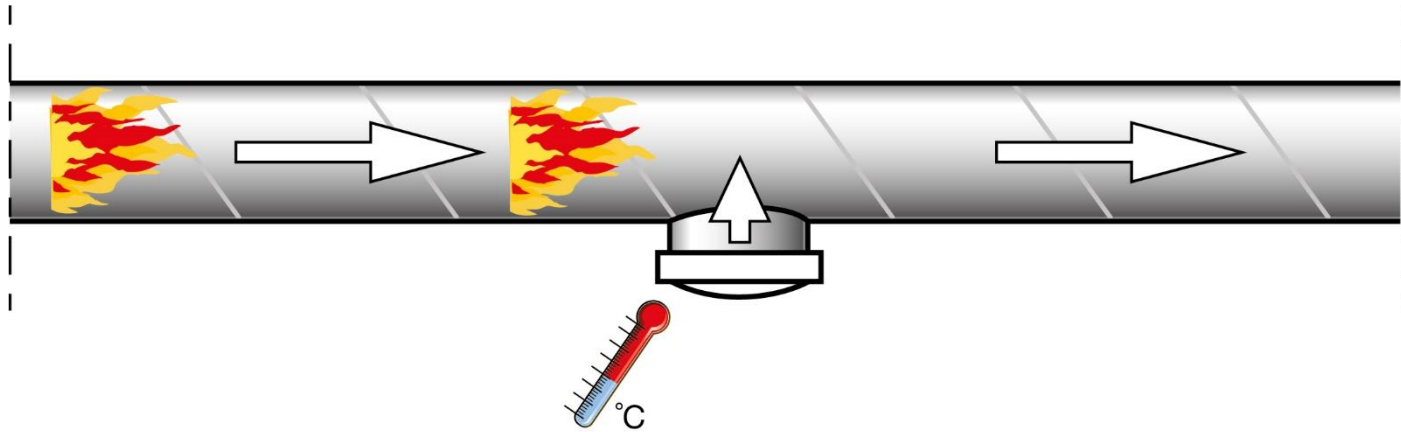


## Scenario C1-3, junction – partly insulation - fan operating during fire

- Fire inside the duct, assumed air temperature, intersection, 500°C
- Junction, circular duct, size 200 mm, length 3 m
- Junction, -4 m/s in (incoming air temperature 20°C). See **chapter E** “Air velocity temperature correction” to determine the velocity.
- Junction, EI 30 (100 kg/m<sup>3</sup>, 50 mm, stone wool) insulation, 1 m
- Junction, surrounding temperature 20°C

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## C2 - Junction - air valve in junction

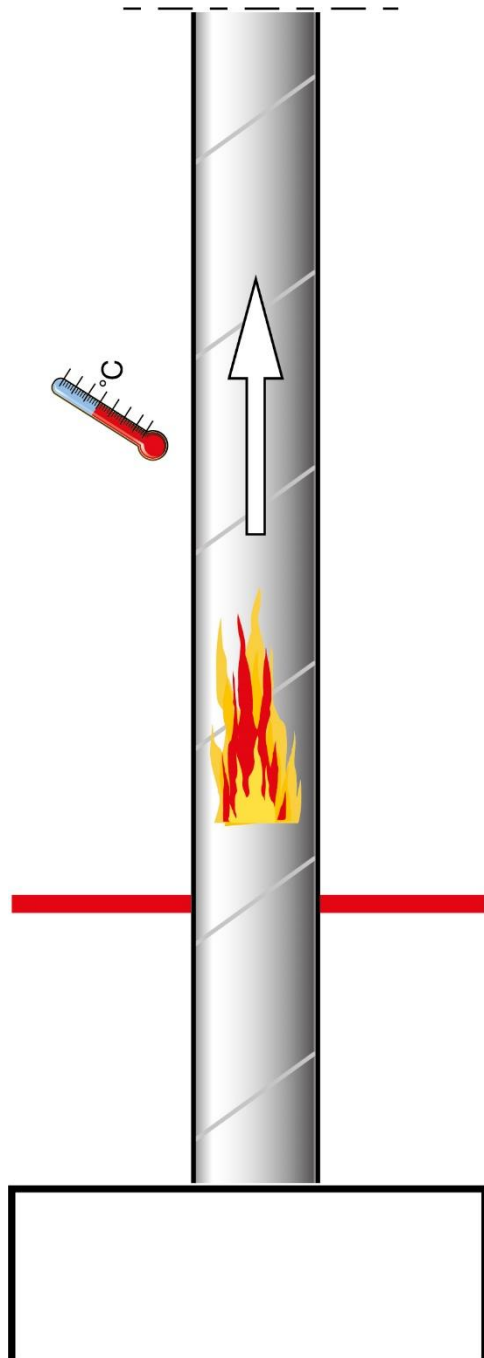


### Scenario C2-1, junction – air valve – no insulation - fan operating during fire

- Fire inside the duct, assumed air temperature, intersection, 500°C
- Junction, circular duct, size 200 mm, 0.2 m
- Junction, -4 m/s in (incoming air temperature 20°C). See **chapter E** “Air velocity temperature correction” to determine the velocity.
- Junction, no insulation
- Junction, Right Opening Screen Ei "Yes"
- Junction, surrounding temperature 20°C

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## D1 - Kitchen duct - internal combustion



## Scenario D1-1, internal combustion – no insulation

- Fire inside duct
- Circular duct, size 200 mm, length 1 m in fire cell and 5 m in other fire cell
- Combustible deposits in duct, starts at 1 m and ends at 2 m
- Oxygen usage, 0.5
- Heat part to air, 0.8
- 3 m/s in velocity (incoming air temperature 20°C)
- No insulation
- Surrounding temperature 20°C in other fire cell

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## Scenario D1-2, internal combustion - insulation

- Fire inside duct
- Circular duct, size 200 mm, length 1 m in fire cell and 5 m in other fire cell
- Combustible deposits in duct, starts at 1 m and ends at 2 m
- Oxygen usage, 0.5
- Heat part to air, 0.8
- 3 m/s in velocity (incoming air temperature 20°C)
- Insulation, EI 60 (100 kg/m<sup>3</sup>, 100 mm, stone wool) the last 5 m
- Surrounding temperature 20°C in other fire cell

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## E - Example – Air velocity temperature correction

See document “Air velocity temperature correction” under the tab “About”.

This correction factors can be applied on system with constant pressure. The correction factor goes from 0.5 to 2.2 depending on the temperatures  $T_a$  °C and  $T_i$ °C.

$$f_T = [T_a + 273] / [T_i + 273]^{0.5} \quad (-) \quad (1)$$

$$v_c = f_T v_n \quad (\text{m/s}) \quad (2)$$

**Internal fire**, (exhaust air system) assumed main air temperature, +20°C ( $T_i$ ) (normal temperature). Assumed average duct air temperature, +100°C ( $T_a$ ), velocity correction factor 1.1 ( $f_T$ ).

- This means if the normal velocity (+20°C) is 3 m/s ( $V_n$ ), the velocity increase to 3 (m/s) x 1.13 ( $f_T$ ) = 3.4 m/s ( $V_c$ ). Use velocity 3.4 m/s in the FEDS program.

**External fire**, (exhaust air system) assumed main air temperature, +20°C ( $T_i$ ) (normal temperature). Assumed average duct air temperature, +50°C ( $T_a$ ), velocity correction factor 1.05 ( $f_T$ ).

- This means if the normal velocity (+20°C) is 3 m/s ( $V_n$ ), the velocity increase to 3 (m/s) x 1,05 ( $f_T$ ) = 3.1 m/s ( $V_c$ ). Use velocity 3.1 m/s in the FEDS program.

**External fire**, (supply air system) assumed main air temperature, +20°C ( $T_i$ ) (normal temperature). Assumed average duct air temperature, +30°C ( $T_a$ ), velocity correction factor 1.02 ( $f_T$ ).

- This means if the normal velocity (+20°C) is 3 m/s ( $V_n$ ), the velocity increase to 3 (m/s) x 1,02 ( $f_T$ ) = 3.1 m/s ( $V_c$ ). Use velocity 3.1 m/s in the FEDS program.

Ta	Ti	fT	Vn	Vc
100	20	1,13	3,0	3,4
50	20	1,05	3,0	3,1
30	20	1,02	3	3,1

You can also use the **PFS program** for proper values.