FEDS
FIRE EXPOSED DUCT SYSTEM

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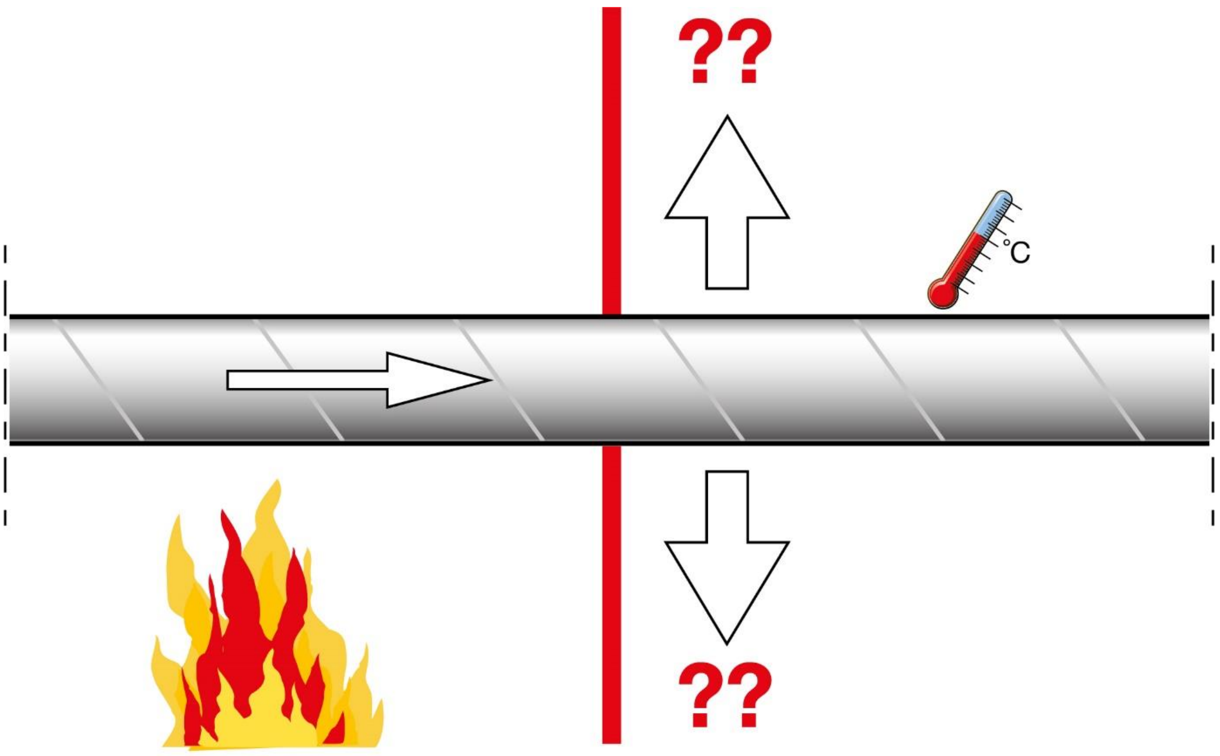
Radiation and emissivity



A heated idealized so-called black body emits all thermal energy. The size of the emitted energy from another body in relation to a black body, i.e. the emissivity of the body depends on the temperature of the body, the characteristics and nature of the material, especially at the surface.

Emissivity is a measure of surface efficiency as a source of radiation. For example, a polished surface has much less emissivity than a rough dark surface. It is the emission number ε for different materials and surfaces that expresses the effective emissivity, i.e. how much of the energy is emitted. For a black body, the emission
rate ε = 1 (100% is issued) and for a real surface is quite variable but always less than 1.

In the **FEDS** program there is the possibility to count on different emissivity, inside and outside duct and insulation. A prerequisite herein is that the issue rate is equal to the absorption rate, which applies normally. It should be noted that a higher emissivity results in a lower surface temperature as the radiation proportion increases.

For insulation, the emissivity is shown for each product under the tab “Insulation type”

Surface layer	ε
Gold, polished	0,02
Silver, polished	0,02
Copper, polished	0,02
Copper, dark, oxidized	0,78
Aluminium, polished	0,05
Aluminium, normal value	0,30
Steel plate, rough oxidized	0,80
Steel plate, rusty	0,61
Steel plate, polished or galvanized	0,27
Glass	0,94
Porcelain	0,92
Brick	0,93
Concret slabs	0,60
Wood	0,94
Painting, matt, black	0,97
Marble	0,55
Paper	0,93
Water	0,95
Ice	0,97

The emission ratio for some materials

Figure 1, Emission ratio for some materials

Surface temperature ˚C	**Surface temperature K**	**Radiation kW/m²**
91	**364**	**1,0**
100	373	1,1
160	**433**	**2,0**
185	**458**	**2,5**
200	473	2,8
208	**481**	**3,0**
300	573	6,1
375	**648**	**10,0**
400	673	11,6
444	**717**	**15,0**
500	773	20,2
580	**853**	**30,0**
600	873	32,9
700	973	50,8
800	1073	74,2
900	1173	107,3
1000	1273	148,9
1100	1373	201,5

Figure 2, Radiation according to surface temperature, ε =1.

For the calculation of emitted heat radiation from ventilation ducts and insulation, the emission number ε =1 should always be used unless otherwise demonstrated by calculation or testing. This is because the emission rate will increase with rising temperature (burnt galvanization, sooty surface) and that results on the safe side are obtained. Often, fire insulation suppliers have measured the emission rate for different products.

Critical radiation intensity for ignition of combustible material varies depending on whether the ignition flame exists or not. When determining safety distances, it is important to choose a critical radiation intensity with sufficient low value so that a change in combustible material to material with higher combustibility does not increase the risk of fire spread.

To be on the "safe" side, safety distances can be determined based on the following critical radiation intensity. Examples of critical radiation intensity without ignition flame shown in the table below. Make sure you choose the proper critical radiation, other values than below is used in other sources.

Radiation towards	Critical radiation kW/m²
Building materials, wood	30
Interial material, fabric, paper	10
Humans	2,5

Table 1, Critical radiation with no pilot flame