

# Fire resistant and smoke ducts

PG/DS



## Description

Ducts are one of the possible ways of spreading fire. Reliable fire and smoke extraction ducts and their proper installation are essential to prevent the spread of fire from the fireplace to other areas, to provide safe escape routes, to remove smoke from a burning room and smoke after a fire. First and foremost, giving people enough time to safely leave the building and the firefighters to come, and also to preserve material assets.

Fire-resistant and smoke ducts, round and rectangular steel ducts, with technical specifications other than ventilation ducts, insulated with ULTIMATE Protect mineral wool products, provide a certain fire resistance class. Only a common system between the correct use of the metal part and the use of mineral wool thickness provides the necessary protection in the building. Ducts and ducts shall maintain their geometric dimensions so as to ensure the smooth operation of the smoke extraction air in the event of fire or the protection of other rooms against bursting of fire. Due to the high temperatures prevailing in the fire, ducts and ducts are made stronger than conventional ventilation ducts, and are joined, sealed, and insulated by other materials used in the initial system test and passed the flammability tests in accordance with the standards.

**Fire resistant ducts** - Specially designed sheet steel ducts are covered with special mineral wool. Complex solution Sheet steel duct covered with mineral wool is tested in flammability testing laboratories in accordance with LST EN 1366-1 "Fire Testing of Engineering Network Equipment. Part 1. Ventilation ducts" and are classified according to LST EN 13501-3 "Fire classification of construction products and building elements. Part 3. Classification on the basis of fire resistance tests for products and elements used in building maintenance installations: fire protection ducts and fire

## Description

*dampers*". The structure of the metal part consists of a duct with a sheet steel thickness chosen according to the thickness of the tests. Round ducts are recommended with stiffening edges larger than Ø 315 mm in diameter. And a rectangular duct is always manufactured with a connection flange with a height of 30 mm. The flange connection is fixed to the duct by spot welding or with screws, otherwise no mounting is allowed. The rectangular duct is fitted with internal stiffeners made of non-combustible materials and withstands high temperatures. The duct and duct connection must be sealed with a ceramic gasket which retains its shape and tightness at high temperatures. Standard duct sealing gaskets should not be used in joints.

**Smoke ducts** - special design sheet steel ducts covered with special mineral wool. Complex solution steel sheet duct covered with mineral wool is tested in flammability testing laboratories in accordance with LST EN 1366-1, LST EN 1366-8 "Fire Testing of Engineering Network Equipment. Section 8. Smoke extraction ducts, LST EN 12101-7 "Smoke and heat control systems. Section 7. Smoke duct sections", requirements of standards and classified according to LST EN 13501-4 "Fire classification of construction products and building elements. Part 4. Classification according to fire resistance test data for smoke control system components". Smoke ducts are used to extract hot gas and smoke during fire, extinguishing and post-fire operations to ensure maximum visibility and breathability during evacuation. Smoke ducts are also installed in the air supply system to create positive pressure to facilitate the removal of smoke. Smoke ducts are installed on site using the fire duct installation instructions with additional duct stiffening internal elements. Internal stiffening is performed at a much higher frequency than standard ventilation ducts, due to the fact that the duct must retain its geometric shape in the event of a fire and not allow smoke to spread to other rooms for some time while evacuating and extinguishing the building. Rectangular smoke ducts, according to the fire resistance class, are made of 0.7 mm or 1.0 mm thick sheet steel, stiffened and connected by flanges 30 mm high. The connection flange is fixed to the duct by spot welding or with screws, otherwise no mounting is allowed. The joints must be sealed with a ceramic gasket which retains its shape and tightness at high temperatures. Standard duct seals and silicone sealants should not be used in the joints.





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## Technical data

Fire ducts and smoke ducts for several rooms differ greatly in design and performance from one another and ventilation ducts, so it is always important to choose the right product according to the specifications of the manufacturer who certified and tested the fire product. The following is the technical specification of the duct and duct for the fire system and the metal part of the smoke extraction system according to the requirements of the Isover manufacturer.

Always check the requirements of the manufacturer whose fire protection system you are installing. The manufacturer's installation and operating instructions are always preferred. When installing fire protection systems, it is important to insulate the systems with mineral wool, since metal ducts and ducts alone cannot maintain the required EI class. The exception is the single smoke duct system. It is also important to order the correct product from the duct manufacturer to produce the fire system element.

| Performance   |  | Fire resistant element  |   | Smoke duct element  |   |
|---|--|---|---|---|---|
|   |  |  |          |  |              |
| EI30 – EI120 flammability class for installation of fire ducts and smoke ducts together with mineral wool ISOVER Ultimate | Maximum duct dimension, mm                                       | Ø1000   | 1250x1000   | Ø1000   | 1250x1000   |
|   | Maximum duct length, mm  | 3000  | 1500 (EI30 - EI90)<br>1250 (EI120)  | 3000  | 1500  |
|   | Allowable pressure, Pa   | ± 300   | ± 300   | + 500<br>-1000  | ± 500   |
|   | Duct tightness class   | <b>D</b> (LST EN 12237)   | <b>B</b> (LST EN 1507)  | <b>D</b> (LST EN 12237)   | <b>B</b> (LST EN 1507)  |
|   | Metal sheet thickness, mm  | 0,5 – up to Ø315<br>0,6 – up to Ø450<br>0,7 – up to Ø1000                         | 0,7   | 0,5 – up to Ø315<br>0,6 – up to Ø450<br>0,7 – up to Ø1000                           | 1,0 (EI120)<br>0,7 (EI30-EI90)  |
|   | Connection flange  | -   | 30x30x0,8   | -   | 30x30x0,8   |
|   | Additional stiffening rings on the duct, mm                      | 40x5 (2 pieces in duct length 3 m) only EI120                                     | -   | 40x5 (2 pieces in duct length 3 m) only EI120                                       | -   |
|   | Sealing gasket, mm   | Duct gasket EPDM + ceramic tape 20x3  | Ceramic tape 20x3   | 40x5 (2 pieces in duct length 3 m) only EI120                                       | Ceramic tape 20x3   |
|   | Flange connecting technology                                     | -   | Spot welding or screw in steps 100 mm   | -   | Spot welding or screw in steps 100 mm   |
|   | Connection of elements   | Screw in steps 150 mm   | Joint clamps, bolts   | Screw in steps 150 mm   | Joint clamps, bolts   |
|   | ISOVER Ultimate mineral wool thickness                           | 30-120 mm, refer to ISOVER installation manual                                    | 30-120 mm, refer to ISOVER installation manual  | 30-120 mm, refer to ISOVER installation manual                                      | 30-120 mm, refer to ISOVER installation manual  |
|   | Inside stiffening  | -   | Stiffening rods 1 piece, when connection dimension >500mm                                 | -   | Stiffening rods 1 piece/0,3m2, when connection dimension >500mm                                 |
|   | Hanging elements   | Circular suspension 25x2  | U steel profile 30x30x3   | Circular suspension 25x2  | U profile 30x30x3   |
|   | Support elements for stiffening the opening                      | L steel profile 30x30x3<br>If EI30-EI60 – not needed                              | L profile 30x30x3   | L steel profile 30x30x3<br>If EI30-EI60 – not needed                                | L profile 30x30x3   |
|   | Additional stiffening inside the duct when crossing wall opening | -   | When side connection >500 mm, M8 rod and nut system or ø16x2 steel tube and M6 rod system | -   | Recommend use rod in the middle of wall. Tube ø17,5x2,35, rod M8, washers and nuts must be used |

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## Dimensions

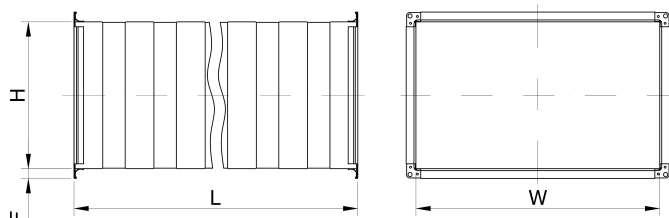
When calculating pressure drop of a rectangular fire resistant duct, it is necessary to calculate the hydraulic diameter and take all the system resistance, air velocity and air volume figures from the circular duct data. To calculate the pressure drop of smoke dampers use graphs below. The formula can be used to calculate the hydraulic diameter of any duct:

$$d_h = 2 \cdot W \cdot H / (W + H), [m]$$

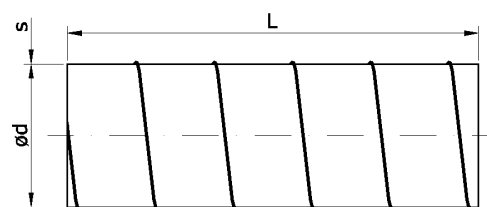
Below in table are shown dimensions of cross area  $A_c$  [m<sup>2</sup>], hydraulic diameter  $d_h$  [mm], equivalent diameter  $d_e$  [mm], and duct surface area  $A_i$ , 1 meter duct length [m<sup>2</sup>/m] according LST EN 1505 requirements.

| Side wall length H/W, mm | Dimension | 100   | 200   | 300   | 400  | 500  | 600  | 800  | 1000 | 1200 |
|--------------------------|-----------|-------|-------|-------|------|------|------|------|------|------|
| 200                      | $A_c$     | 0,020 | 0,040 | 0,06  | 0,08 | 0,10 | 0,12 | 0,16 | -    | -    |
|                          | $d_h$     | 133   | 200   | 240   | 267  | 286  | 300  | 320  | -    | -    |
|                          | $d_e$     | 149   | 218   | 267   | 305  | 337  | 366  | 414  | -    | -    |
|                          | $A_i$     | 0,60  | 0,80  | 1,0   | 1,2  | 1,4  | 1,6  | 2,0  | -    | -    |
| 300                      | $A_c$     | 0,030 | 0,060 | 0,090 | 0,12 | 0,15 | 0,18 | 0,24 | 0,30 | -    |
|                          | $d_h$     | 150   | 240   | 300   | 343  | 375  | 400  | 436  | 462  | -    |
|                          | $d_e$     | 180   | 262   | 327   | 378  | 421  | 458  | 521  | 575  | -    |
|                          | $A_i$     | 0,30  | 1,00  | 1,20  | 1,4  | 1,6  | 1,8  | 2,2  | 2,6  | -    |
| 400                      | $A_c$     | -     | 0,080 | 0,12  | 0,16 | 0,20 | 0,24 | 0,32 | 0,40 | 0,48 |
|                          | $d_h$     | -     | 267   | 343   | 400  | 444  | 480  | 533  | 571  | 600  |
|                          | $d_e$     | -     | 299   | 373   | 436  | 489  | 534  | 610  | 675  | 732  |
|                          | $A_i$     | -     | 1,20  | 1,40  | 1,60 | 1,8  | 2,0  | 2,4  | 2,8  | 3,2  |
| 500                      | $A_c$     | -     | -     | 0,15  | 0,20 | 0,25 | 0,30 | 0,40 | 0,50 | 0,60 |
|                          | $d_h$     | -     | -     | 375   | 444  | 500  | 545  | 615  | 667  | 706  |
|                          | $d_e$     | -     | -     | 413   | 483  | 545  | 599  | 688  | 763  | 829  |
|                          | $A_i$     | -     | -     | 0,60  | 1,80 | 2,00 | 2,2  | 2,6  | 3,0  | 3,4  |
| 600                      | $A_c$     | -     | -     | -     | 0,24 | 0,30 | 0,36 | 0,48 | 0,60 | 0,72 |
|                          | $d_h$     | -     | -     | -     | 480  | 545  | 600  | 686  | 750  | 800  |
|                          | $d_e$     | -     | -     | -     | 524  | 592  | 654  | 757  | 842  | 916  |
|                          | $A_i$     | -     | -     | -     | 2,00 | 2,20 | 2,40 | 2,8  | 3,2  | 3,6  |
| 800                      | $A_c$     | -     | -     | -     | -    | -    | 0,48 | 0,64 | 0,80 | 0,96 |
|                          | $d_h$     | -     | -     | -     | -    | -    | 686  | 800  | 889  | 960  |
|                          | $d_e$     | -     | -     | -     | -    | -    | 745  | 872  | 978  | 1068 |
|                          | $A_i$     | -     | -     | -     | -    | -    | 2,80 | 3,20 | 3,6  | 4,0  |
| 1000                     | $A_c$     | -     | -     | -     | -    | -    | -    | 0,80 | 1,00 | 1,2  |
|                          | $d_h$     | -     | -     | -     | -    | -    | -    | 889  | 1000 | 1091 |
|                          | $d_e$     | -     | -     | -     | -    | -    | -    | 965  | 1090 | 1199 |
|                          | $A_i$     | -     | -     | -     | -    | -    | -    | 3,60 | 4,00 | 4,4  |

| Duct Ød, mm | Dimension | 100   | 125   | 160   | 200   | 250   | 315   | 400   | 500   | 560   | 630   | 710   | 800   | 900   | 1000  |
|-------------|-----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|             | $A_c$     | 0,008 | 0,012 | 0,020 | 0,031 | 0,049 | 0,078 | 0,126 | 0,196 | 0,246 | 0,312 | 0,396 | 0,503 | 0,636 | 0,785 |
|             | $A_i$     | 0,314 | 0,392 | 0,502 | 0,628 | 0,785 | 0,989 | 1,256 | 1,57  | 1,76  | 1,98  | 2,23  | 2,51  | 2,83  | 3,14  |



| Performance       | W, [mm]              | H, [mm] |
|-------------------|----------------------|---------|
| Minimum dimension | 100                  | 100     |
| Maximum dimension | 1250                 | 1000    |
| Flange F          | F30                  |         |
| Duct length L, mm | 1250-(PG), 1500-(DS) |         |



| Ød <sub>nom</sub> , mm              | s, mm | L, mm |
|-------------------------------------|-------|-------|
| 100 <sup>1</sup> - 250 <sup>1</sup> | 0,5   | 3000  |
| 315 <sup>*1</sup>                   | 0,5   | 3000  |
| 355 <sup>*</sup> - 450 <sup>*</sup> | 0,6   | 3000  |
| 500 <sup>*</sup> - 900 <sup>*</sup> | 0,7   | 3000  |
| 1000 <sup>*</sup>                   | 0,9   | 3000  |

<sup>1</sup> With protection blinds

<sup>\*</sup> With stiffening grooves

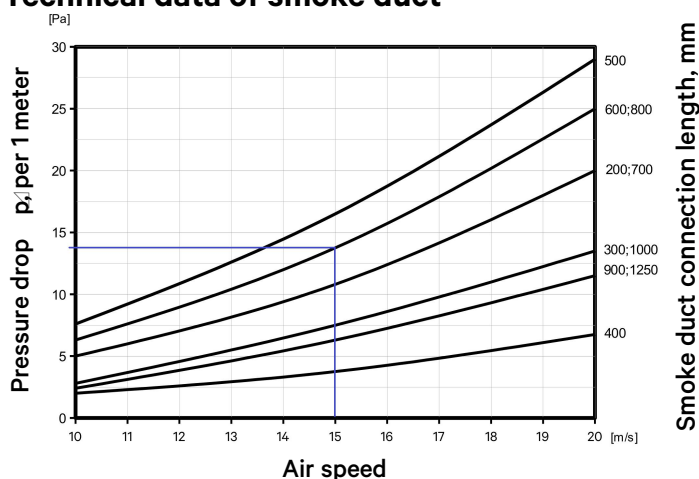
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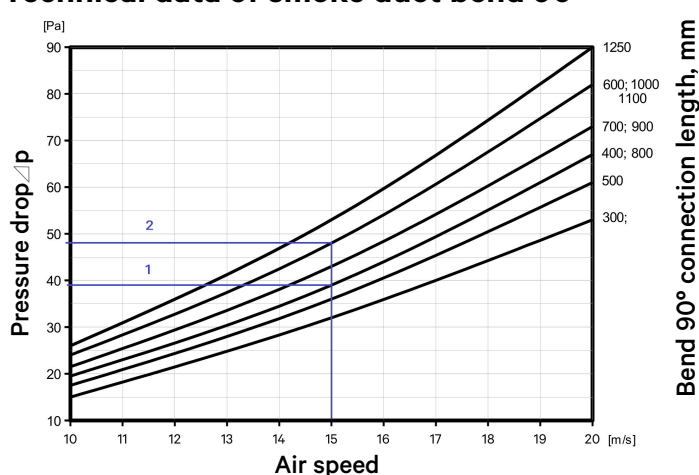
The technical data of the circular ducts, elbows and transitions of the fire resistant and smoke duct must be calculated from the graphs of the circular duct systems. The technical data of the rectangular ducts, elbows and transitions of the fire resistant duct system must be taken from the graphs of the circular air duct systems converted into hydraulic diameter.

The technical data of the rectangular ducts and elbows of the smoke duct shall be taken from the graphs below. Due to the specific design of the ducts, the resistances are slightly higher than for standard ventilation ducts.

## Technical data of smoke duct



## Technical data of smoke duct bend 90°

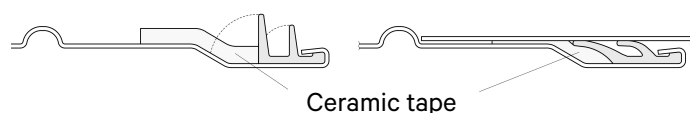


Calculation the pressure drop:

From the graph we determine the pressure drop of 1 meter duct length according to the width W and height H of the duct. For example: The smoke duct is 800x600 mm, in the graph pressure drop at 15 m/s is the same through both dimensions - 14 Pa. The bend 800x600 pressure drop from the graph for the dimension 800 mm - 39 Pa, and for the dimension 600 mm - 48 Pa. The total pressure drop of the bend is  $(\text{channel W} + \text{channel H})/2 = (39 + 48)/2 = 43.5 \text{ Pa}$ .

## Applying ceramic tape on round ducts

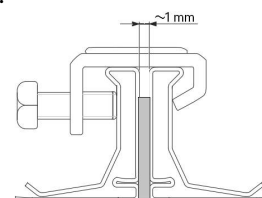
Probably one of the most important components is the ceramic tape, which is why it is very important to properly apply it to the ducts when preparing fire or smoke systems. Bonding on circular ducts is difficult, as the ceramic tape itself is easily damaged, which requires careful handling with gentle movements into the duct to keep as much tape as possible between the element joints. The picture below shows the ceramic tape gluing on the circular duct element. The tape is easier to glue on the coupling type product next to the rubber gasket.



A ceramic tape is glued to each connection of the smoke duct or fire duct. When there is a coupling between the ducts then the tape is glued to both ends of the duct for each duct connection. The essence of the ceramic tape is that when the temperature rises and the duct and other elements move due to the temperature, it maintains its original state and ensures that the duct is sealed while the smoke is being extracted. Otherwise, the system will become leaky, venting air through spaces and greatly reducing smoke extraction from the required room.

## Applying ceramic tape on rectangular ducts

Installing a ceramic tape, when installing rectangular smoke ducts or fire ducts is quite simple and not much different from the standard ventilation duct installation. The tape is glued to one part of the flange closer to the inside so that the gasket will also adhere to the inner corner element of the duct. At the corners, ceramic tape should be overlapped then cut diagonally from the inner corner to the outer, then slightly delayed to remove the trimmings and align them nicely with the edge, or in practice may be used to cut in length and glue ceramic tape with compressing tape in the corners on the fire duct or smoke duct but this is a method that requires precision in the length of the cut, since the gasket is not elastic and cannot be pulled but only slightly compressed. Unlike on standard ventilation porous polyethylene gasket where it is recommended to cross and leave without cutting.



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## Technical data

Smoke ducts are made of non-combustible materials of flammability class A1 except for sealing system in cold state. Cold rolled and chemically passivated sheet steel is used for the production of fire resistant and smoke duct components. The smoke duct system consists of different system elements: ducts, elbows, reducers, branches, t-bends, couplings, saddles.

## Ordering code

Product AO250PG  
 Size  
 DS – smoke extraction duct  
 PG – fire resistant duct

Sample: AO250PG – made of galvanized steel circular duct, diameter 250 mm, for fire resistant duct construction.

| Product name   |   | Codes and names of the product  |  |   |   |
|----------------|---|---|--|---|---|
|                |   | Fire resistant element  |  | Smoke duct element  |   |
|                |   |  |  |  |  |
| Duct           |     | AO250PG   | OFI500400-1250PG   | AO250DS   | OFI500400-1250DS  |
| Bend 30° - 90° |   | AL250-90PG  | AF90-500400PG  | AL250-90DS  | AF90-500400DS   |
| Reducer        |   | PER160125SIMPG  | FPS500400/100100-1-300PG   | PER160125SIMDS  | FPS500400/100100-1-300DS  |
| Transition     |    | -   | FPD500400/d160-1-300PG   | -   | FPS500400/d160-1-300DS  |
| Take-offs      |   | APL250PG  | FPA500400PG  | APL250DS  | FPA500400DS   |
| End caps       |   | AKL250PG  | FAK500400PG  | AKL250DS  | FAK500400DS   |
| S bend         |    | -   | FAP500400-400-150PG  | -   | FAK500400-400-150DS   |
| T pieces       |    | TR250200PG  | -  | TR250200DS  | -   |
| Saddle         |   | BA250160PG  | FBA500400/d630PG   | BA250160DS  | FBA500400/d630DS  |
| Couplings      |    | NI250PG   | -  | NI250DS   | -   |