



# Fire technical assessment

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**Name of sponsor:** SAINT-GOBAIN ISOVER

**Product name:** Circular steel ventilation duct systems insulated with U Protect Wired Mat 4.0

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# Introduction

This report presents an appraisal of the fire resistance performance of ISOVER insulated horizontal and vertical circular steel ventilation duct systems for internal duct diameters up to 1000 mm, and for other modifications and alternative construction details as listed in the following.

Standard solution to circular fire resistant ventilation ducts:

- Steel duct
  - Duct sections
  - Stiffening system
  - Duct joints.
- Insulation
  - Type
  - Fixation
  - Aluminum facings
- Penetration
  - Standard rigid wall penetration
  - Standard flexible wall penetration
  - Standard penetration for vertical circular ducts

Alternative solutions to circular fire resistant ventilation ducts:

- Simplified penetration for horizontal and vertical circular ducts up to a resistance to fire time of 60 minutes.
- Use of double layer insulation solution
- Additional insulation on top of fire resistance insulation
- Circular ducts installed close to walls or floors

Solution to circular smoke extraction ventilation ducts

Alternative solutions to circular smoke extraction ventilation ducts

The proposed duct assemblies are required to provide a fire resistance of up to 120 minutes in terms of the integrity [E], insulation [I] and smoke leakage [S] criteria, in horizontal [ho] and vertical [ve] direction for the fire scenarios *fire from inside to outside* and *fire from outside to inside* [i ↔ o] as specified in EN 1366-1:2014 *Fire resistance for service installations - Part 1. Ventilation ducts*.

For the fire from outside to inside scenario, the system is applicable for an under-pressure up to 300 Pa.

The proposed duct assemblies can also be used for multi-compartment smoke extraction ducts as specified in EN 1366-8:2004 *Fire resistance for service installations - Part 8. Smoke extraction ducts*, as specified under the chapter *Solutions to circular smoke extraction ventilation ducts*

This appraisal consists of a main part, that describes the fire resistant ventilation system and the possible variations, technical drawings and specifications, and an annex A that presents the technical arguments for the appraised variations.

## Standard system for fire resistant circular ducts

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### Steel duct sections

- Duct: Duct sections made of spiral folded hot dipped galvanised steel plates  
With tightness class D, according to EN 12237.
- Minimum steel thickness 0.7 mm.
- Duct joint: The circular duct sections should be connected using steel nipples. The nipple should in both ends be fitted with a sealing strip of EPDM-rubber and a 20 x 3 mm inorganic chemistry tape.
- The duct sections should be fixed to the nipples using self tapping screws c/c 150 mm.
- Duct stiffening: For the scenario fire from outside to inside (duct A) a steel duct stiffening shall be added for 120 minutes resistance to fire.
- The exterior of the steel duct is stiffened using steel flanges with minimum dimensions 40 x 5 mm. The flanges are positioned around the duct, midway between the hangers. It is not needed to fix the flanges mechanically to the steel duct in any way.

### Suspension system

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- Hangers: Steel drop rods. The tension in the rods in cold condition should not exceed:
- 9 N/mm<sup>2</sup> for resistance to fire times equal to or lower than 60 minutes and  
6 N/mm<sup>2</sup> for resistance to fire times higher than 60 minutes.
- The maximum distance between the suspensions should not exceed 1500 mm.
- Support profile: Profiles made from minimum 2 x 25 mm galvanized steel plates.

## Cladding

Insulation: Mineral wool mat designated U Protect Wired Mat 4.0 with nominal density 66 kg/m<sup>3</sup>.

The minimum thickness needed for the different application is:

### Ducts penetrating rigid supporting construction:

Horizontal or vertical duct B, EI xx (ve ho i → o)

Insulation Thickness [mm]	35	50	60	75	95	115
RF -time [minutes]	15	30	45	60	90	120

Horizontal or vertical duct A, EI xx (ve ho o → i)

Insulation Thickness [mm]	30	30	30	60	90	100*
RF -time [minutes]	15	30	45	60	90	120

### Ducts penetrating flexible supporting construction:

Horizontal, duct B, EI xx (ho i → o)

Insulation Thickness [mm]	35	50	60	80	100	125
RF -time [minutes]	15	30	45	60	90	120

Horizontal, duct A, EI xx (ho o → i)

Insulation Thickness [mm]	30	30	30	60	90	100*
RF -time [minutes]	15	30	45	60	90	120

\*Steel ducts must be fitted with flanges

### Ducts penetrating rigid or flexible supporting construction (all applications)

Horizontal or vertical direction, duct type A or B, EI xx (ve ho o ↔ i)

Insulation Thickness [mm]	35	50	60	80	100	125
RF -time [minutes]	15	30	45	60	90	120

For all resistance to fire times the smoke criterion (S) is also fulfilled with the thicknesses listed above.

Fixing: The insulation is fixed by winding steel wire around the edges of the wire net.

or

by using C-rings or hooks made of galvanized steel with a diameter 2 mm on condition that the distance between fixation points is set to maximum 6 wire net masks (a distance of approx. 150 mm).

Facing: Black reinforced aluminium foil type Alu1 or Glass tissue type V1 can be added to the surface of the insulation.

The insulation with aluminium foil is named U Protect Wired Mat 4.0 Alu1

The insulation with glass tissue is named U Protect Wired Mat 4.0 V1

Joints between wired mats can be covered with ISOVER Protect Black Tape.

**Penetration through rigid walls**

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- Distance: The distance from the steel duct to the penetrated wall cannot exceed 50 mm but can be decreased.
- Wall: Rigid walls with density higher than 575 kg/m<sup>3</sup> and a resistance to fire equal to or greater than the resistance to fire of the ducts.
- For ducts with fire resistance equal to or lower than 90 minutes, the wall thickness must be minimum 100 mm.
- For ducts with fire resistance of 120 minutes, the wall thickness must be minimum 150 mm.
- Drawing: The penetration must be constructed as shown on enclosure 1.1 and the part list on enclosure 1.0

**Penetration through flexible walls**

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- Distance: The distance from the steel duct to the penetrated wall can not exceed 50 mm but can be decreased.
- Wall: Flexible walls consisting of steel studs with boards on both sides with a resistance to fire equal to or greater than the resistance to fire of the ducts.
- Drawing: The penetration must be constructed as shown on enclosure 1.1 and the part list on enclosure 1.0

**Penetration through rigid floors**

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- Distance: The distance from the steel duct to the penetrated floor can not exceed 50 mm but can be decreased.
- Floor: The duct can penetrate rigid floors with density higher than 575 kg/m<sup>3</sup> and a resistance to fire equal to or greater than the resistance to fire of the duct and a thickness equal to or greater than 150 mm.
- Drawing: The penetration must be constructed as shown on enclosure 1.2 and the part list on enclosure 1.0

## Alternative solutions for circular fire resistant duct system

This chapter describes alternative solutions that can be used in combination with the standard system for circular ducts, on the conditions required for each of the solutions.

### **Simplified penetration seals for horizontal and vertical circular ducts**

The simplified penetration seals described in the following two tables and shown on enclosure no. 1.3 and 1.4 can be used for insulated circular steel duct with fire resistance up to and including 60 minutes. The duct can be installed in horizontal direction or vertical direction, penetrating a rigid supporting construction.

#### **Simplified penetration through rigid walls**

Distance:	The distance from the steel duct to the penetrated wall cannot exceed 20 mm but can be decreased.
Wall:	Rigid walls with density higher than 575 kg/m <sup>3</sup> and a resistance to fire equal to or greater than the resistance to fire of the ducts.  The wall thickness must be minimum 100 mm.
Drawing:	The penetration must be constructed as shown on enclosure 1.3 and the part list on enclosure 1.0

#### **Simplified penetration through rigid floors**

Distance:	The distance from the steel duct to the penetrated floor can not exceed 20 mm but can be decreased.
Floor:	The duct can penetrate rigid floors with density higher than 575 kg/m <sup>3</sup> and a resistance to fire equal to or greater than the resistance to fire of the duct and a thickness equal to or greater than 150 mm.
Drawing:	The penetration must be constructed as shown on enclosure 1.4 and the part list on enclosure 1.0

### **Use of double layer insulation**

A double insulation layer solution can be used for the insulation described under Cladding for Standard system for fire resistant circular ducts on the following conditions:

- The total thickness of the double layer is equal to or larger than the thickness of the single layer.
- A distance of minimum 200 mm is used between the joints in the two layers.

### **Additional insulation on top of the fire protection insulation**

Additional insulation can be added on top of the fire protection insulation for the standard system under the following conditions:

- The additional insulation fulfils the requirements for an A2-s1,d0 material.
- The additional insulation is mounted independently of the fire protection insulation.
- The weight of the additional insulation shall not subject the suspension devices to a higher tensile or shearing stress than specified for the hangers as described under the standard system.

**Circular ducts installed close to walls or floors**

The specific installations described in the following should be used when the distance to the wall or floor is less than 200 mm which prevents the standard installation for circular ducts.

The solution for circular ducts installed close to walls or floors is divided into two options.

Option 1, when the distance from the wall or floor is between 200 mm to insulation thickness (with this distance it is still possible to wrap the insulation all the way around the duct) and option 2, when the distance from the wall or floor is equal to or less than insulation thickness.

*Option 1 Distance from the wall or floor between 200 mm to insulation thickness*

The drawings for this solution are shown in enclosure 1.5 and 1.6.

For ducts with internal diameter more than 400 mm the solution shown on enclosure 1.5 should be used.

The duct is fixed to the aperture wall using two sets of suspension profiles with steel angles fixed to the duct with self drilling screws (not screwed to the wall but only to the duct).

If it is possible to work from the inside of the duct, the duct can be fixed to the aperture wall as shown on enclosure 1.9 using M8 x 50mm bolts and nuts, casted into the mortar.

For ducts with diameter equal to or less than 400 mm, the fixation from the mortar is sufficient to hold the duct, and the suspension profile and steel angles can therefore be omitted.

The solution is shown on enclosure 1.6.

The insulation is fixed to the aperture wall using ISOVER Protect BSK for all duct diameters.

Because of lack of installation space, situations can occur, where the insulation joints perpendicular to the duct direction can not be stitched together all the way around. In this situation, the joint shall be stitched together for the length possible. In this case, it shall be secured that the wall and floor surface have reaction to fire properties as minimum classification B-s1,d0.

*Option 2 Distance from the wall or floor equal to or less than the insulation thickness*

The drawings for this solution are shown in enclosure 1.7 and 1.8.

For ducts with internal diameter more than 400 mm, the solution shown on enclosure 1.7 should be used.

The duct is fixed to the aperture wall using two sets of suspension profiles with steel angles fixed to the duct with self drilling screws.

If it is possible to work from the inside of the duct, the duct can be fixed to the aperture wall as shown on enclosure 1.9 using M8 x 50mm bolts and nuts, casted into the mortar.

For ducts with diameter equal to or less than 400 mm, the fixation from the mortar is sufficient to hold the duct, and the suspension profile and steel angles can therefore be omitted.

The solution is shown on enclosure 1.8.

Because the distance to the wall or floor may not allow the insulation to be warped all around the duct, it should be glued to the wall or floor as shown on enclosure 1.7 and 1.8. The width of the glue band should be equal to minimum the thickness of the insulation. The insulation should be fixed to the duct using steel welding pins positioned with c/c 300 mm in the longitudinal direction of the ducts. This apply for all duct diameters.

The insulation is fixed to the aperture wall using ISOVER Protect BSK for all duct diameters.

Because a part of the steel duct is uninsulated, the wall and floor "seeing" the steel duct must have a minimum resistance to fire EI classification equal to that of the duct.

In addition to the fixations methods shown on enclosure no. 1.5 – 1.8, the suspension profiles used can be exchanged with internally fixed bolts as shown on enclosure 1.9.

## Standard system for circular smoke extraction ducts

This chapter describes a standard system for circular multi-compartment smoke extraction ducts with pressure level 2.

The smoke extraction duct equals the standard system for fire resistant ducts with the exception that the flanges shall be used for all resistance to fire times.

Duct stiffening: The exterior of the steel duct is stiffened using steel flanges with minimum dimensions 40 x 5 mm. The flanges are positioned around the duct, midway between the hangers. It is not needed to mechanical fix the flanges to the steel duct in any way.

## Alternative solutions for circular smoke extraction ducts

This chapter describes alternative solutions that can be used in combination with the standard system for circular multi-compartment smoke extraction ducts, on the conditions required for each of the solutions.

All the alternative solutions described for fire resistant circular ducts apply to circular smoke extraction ducts with the exception of.

- Circular ducts installed close to walls or floors

## Remarks

This assessment is issued on the basis of test data and information to hand at the time of issue. If contradictory evidence becomes available to the assessing authority the assessment will be unconditionally withdrawn and the applicant will be notified in writing. Similarly the assessment is invalidated if the assessed construction is subsequently tested since actual test data is deemed to take precedence over an expressed opinion. This assessment is only valid for a period of 5 years, after which time it is recommended that it be submitted to the assessing authority for re-appraisal.

This assessment is only valid for the country where it is produced and as far as national rules are satisfied. Validity in other countries is subject to acceptance by the relevant national authorities/regulations.

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