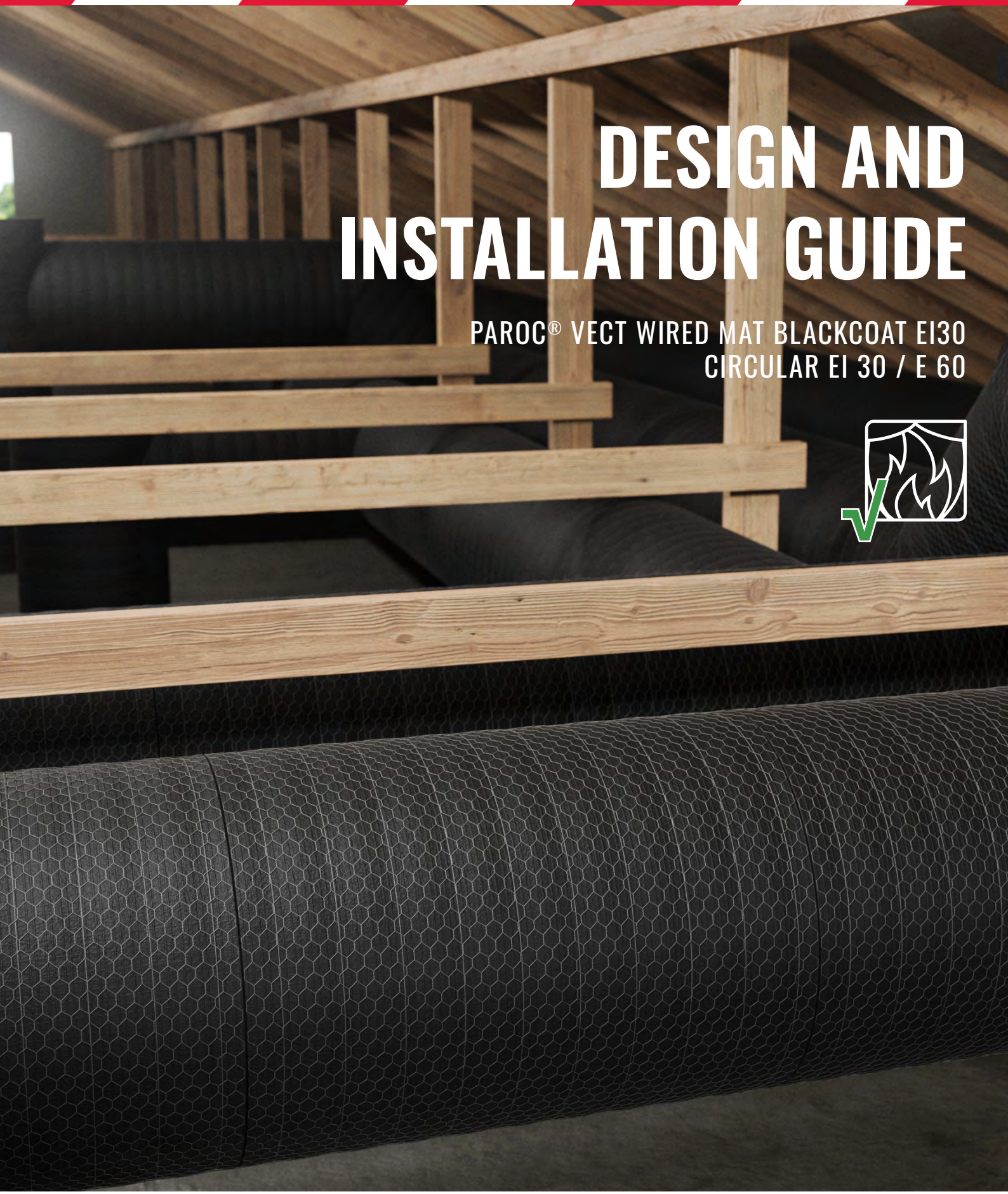


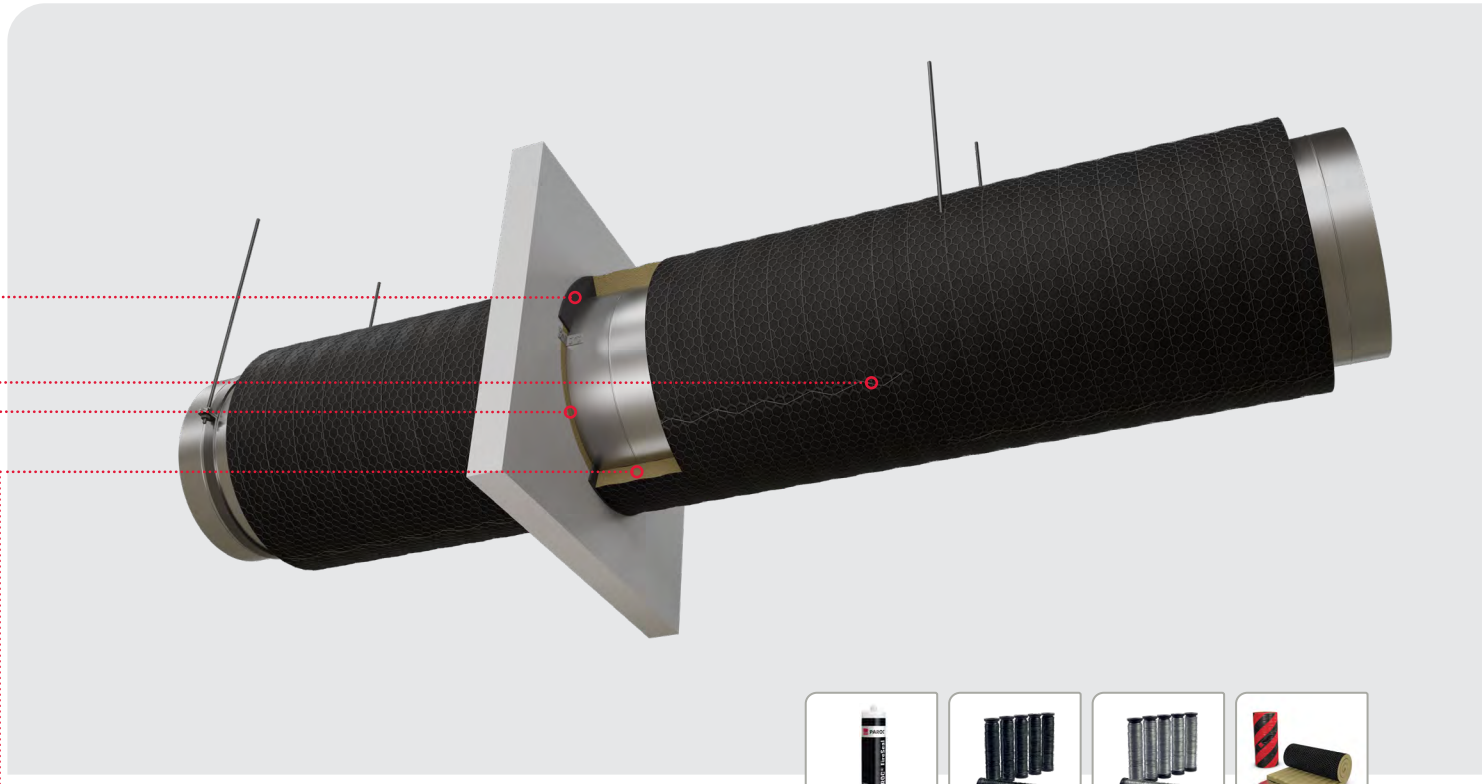
DESIGN AND INSTALLATION GUIDE

PAROC® VECT WIRED MAT BLACKCOAT EI30
CIRCULAR EI 30 / E 60

OWENS CORNING® PAROC®

SYSTEM DEFINITION

System for fire protection of steel ventilation ducts assembled on-site



SYSTEM PARTS

PART NAME	PART DESIGNATION	TECHNICAL SPECIFICATION
Duct insulation	**PAROC® Vect Wired Mat BlackCoat EI30**	EN 14303; PAROC Declaration of Performance; maximum width 1000 mm
Penetration seal gap filler	**PAROC® Stonewool**	Any unfaced PAROC® Stonewool, minimum density 60 kg/m³, reaction-to-fire class A2-s1,d0 or better, EN 14303 or EN 13162
Fire Sealant	**PAROC® FireSeal**	PAROC Technical Datasheet*
Wire	**Steel wire**	Steel wire; minimum thickness 0,7 mm; galvanized, oxidized, stainless steel or coated
Clips	**C-clips or netting clips**	Steel/netting clips; minimum thickness 0,7 mm; galvanized, oxidized, stainless steel or coated
Welding pins	**Cuphead welding pins CD (capacitor discharge)**	Shaft: Ø2,7 mm copper-coated mild steel, insulated with plastic sleeve under the head Shaft tip sharpness: any flattening or radius of the tip cannot exceed 0,5 mm Cuphead: Ø30 mm zinc-coated mild steel, optionally insulated from the shaft side with paper washer

**System components are specified in detail in PAROC Technical Data Sheets.*

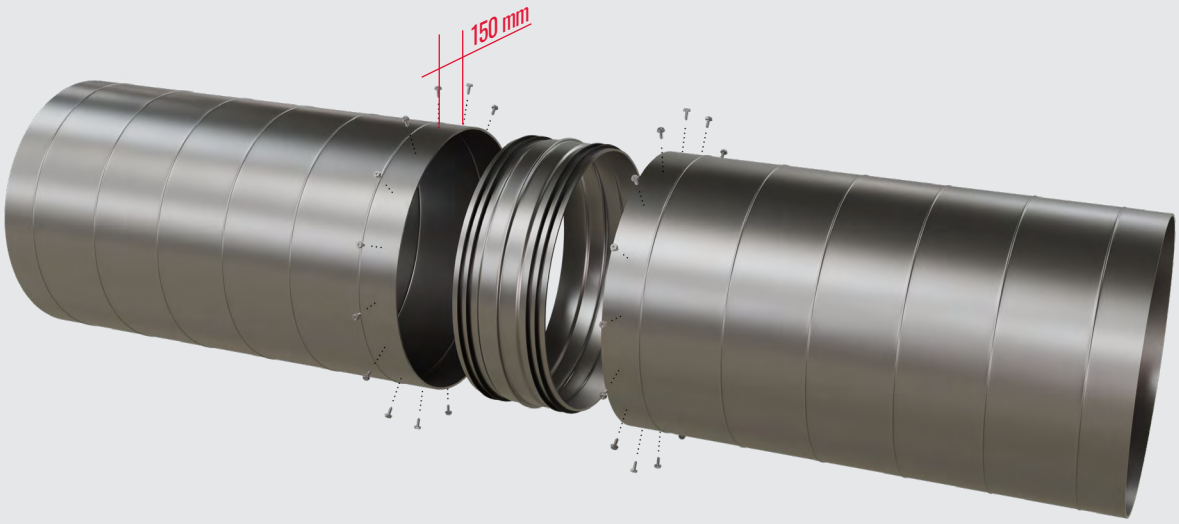
The system declared performance only applies if the specified components are used, the system is installed in accordance with the PAROC Installation Guide, and all the conditions of the the PAROC Design Guide are met regarding specification of the ductwork to be insulated and wall/floor structures that the ductwork is penetrating. Parts, structural elements, and installation operations that are not specified in the PAROC documentation are assumed to follow manufacturers standards and standard practices. Installation operations shall be carried out by installers with an appropriate level of knowledge and experience in the field of insulating steel air ductwork using the technologies: taping, wire and steel mesh binding, capacitor discharge welding.

DESIGN RULES

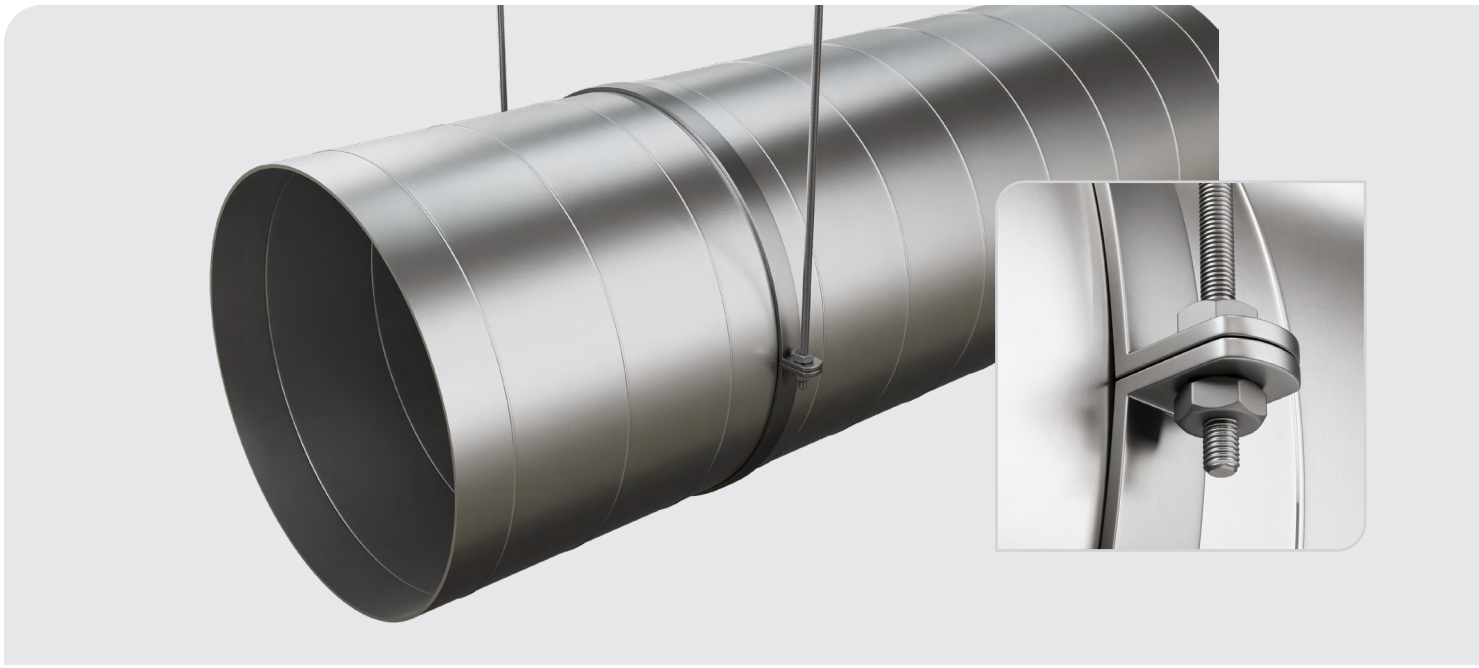
This fire protection duct system is designed for circular ducts, horizontal and vertical, standard sizes to EN 1366-1, tested at standard conditions for fire inside the duct (3 m/s air flow rate) and -500 Pa for fire outside the duct.

THE FIRE PROTECTION SYSTEM CAN BE APPLIED TO CIRCULAR DUCTS THAT COMPLY WITH THE FOLLOWING PARAMETERS

- Tightness class D or higher according to EN 12237 and maximum 500 Pa overpressure and underpressure.
- The maximum duct diameter is 1000 mm.
- The duct sections are made tight with a polymeric rubber gasket used between the duct sections and the connector coupling. The connector coupling is fixed into the duct section with self-drilling screws with 150 mm spacing, minimum 4,2 mm screw size, or by pressure-tight steel rivets with a minimum size of 3,2 mm.



- Horizontal ducts are suspended using clamps and pairs of steel threaded-rod hangers, with the two rods of each pair placed on the opposite sides of the duct. The tension in the hangers in cold conditions must not exceed 9 N/mm². The threaded rods are attached to the ceiling by anchoring elements with the proven loadbearing capacity to carry the insulated ductwork for the same or higher fire resistance time than the duct system in standard fire conditions (ISO 834 / EN 1363-1 standard fire curve).



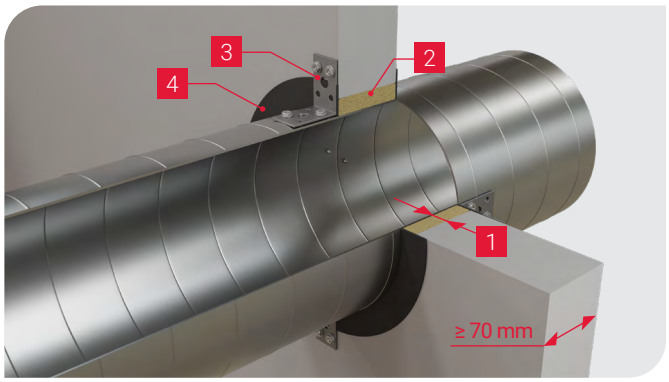
- The maximum length of the duct sections is 6000 mm.
- Horizontal installation: The maximum distance between hangers is 1800 mm.
- Position of hangers and insulation joints relative to duct joints: any.
- Vertical installation: The distance between floor levels / duct supports shall not exceed eight times the duct diameter, with a maximum of 5 m.

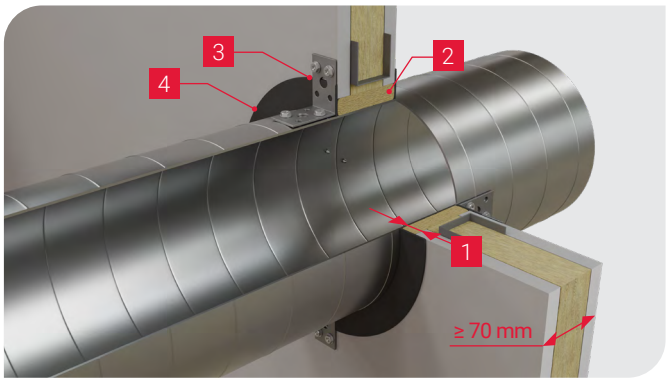
THE DUCTS MAY PENETRATE

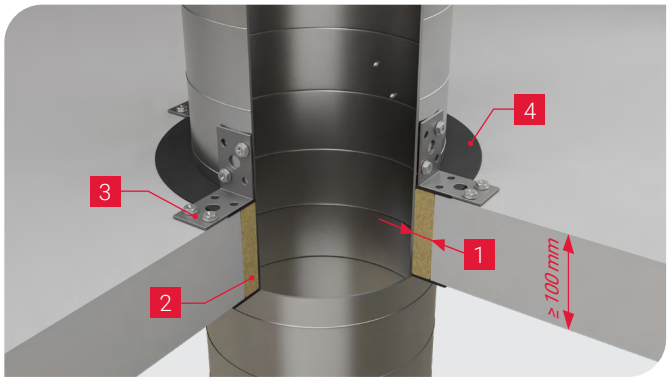
- Walls – flexible wall construction of plasterboard faced steel stud partition containing mineral wool insulation in the void, fire rated at a minimum of the same as or higher than the duct system, minimum wall thickness 70 mm. Reinforcing steel studs shall be applied in horizontal and vertical direction at all the edges of the aperture.
- Other types of walls – light aerated concrete, concrete, masonry, all with a minimum fire resistance rating the same as or higher than that of the duct system, minimum wall thickness 70 mm.
- Floors – light aerated concrete with a minimum fire resistance rating the same as or higher than that of the duct system, minimum floor thickness 100 mm.
- Other types of floors – concrete, masonry, all with a minimum fire resistance rating the same as or higher than that of the duct system, minimum floor thickness 100 mm.

PENETRATION SEAL THROUGH WALLS/FLOORS – GAP FILLED WITH PAROC® STONEWOOL

- The maximum gap between the duct and the wall/floor is 30 mm.
- The duct is attached to the wall/floor using four steel L-angles, minimum size 50 x 50 x 35 x 2 mm and maximum size 105 x 60 x 90 x 2 mm (oriented so that the bracket will not extend further than the insulation thickness).
- In the wall, two L-angles are positioned on each side of the wall with an angular spacing of 180°. The pairs of the L-angles are shifted by 90° on the opposite sides of the wall.
- On the floor, four L-angles are placed on the top with an angular spacing of 90°.
- Each steel L-angle is screwed to the duct by two self-drilling screws with a minimum size of 4,2 mm, placed diagonally across the L-angle.
- The design of the penetration seal system is otherwise identical for all types of walls/floors.
- Gap filler: any unfaced PAROC® Stonewool, minimum uncompressed density 60 kg/m³, reaction-to-fire class A2-s1,d0 or better, tightly stuffed in the cavity to fill it completely and flush with wall/floor/ceiling surfaces.
- The stone wool filler is covered by a layer of fire sealant 3–5 mm thick that may extend to the adjacent surfaces of the wall/floor/ceiling. An additional layer of the fire sealant approximately 1 mm thick is applied to the interface between the stone wool insulation and the wall/floor/ceiling surface if the insulation is applied after the first layer of the fire sealant has dried out.







1. Max. gap 30 mm
2. Gap filler, PAROC® Stonewool
3. Steel L-angles, min. size 50 x 50 x 35 x 2 mm
4. PAROC® FireSeal

PENETRATION SEAL THROUGH FLOORS – ZERO DISTANCE BETWEEN THE CAST-IN CONCRETE AND THE STEEL DUCT

If the gap between the uninsulated steel duct and the edges of the opening in a floor is larger than 30 mm, it can be cast with concrete. The thickness of the concrete layer is a minimum of 100 mm.

The concrete is cast on a board supporting the concrete from the bottom side of the floor. The supporting board may be

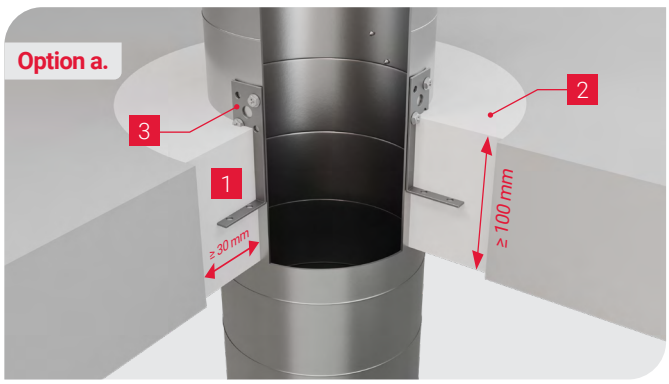
a. Used as temporary formwork and removed after the cast-in portion of the floor is completed – in that case, the reaction-to-fire class of the board is irrelevant.
b. Left in place as a permanent part of the floor – in that case, its reaction-to-fire class shall be A1 or A2-s1,d0.

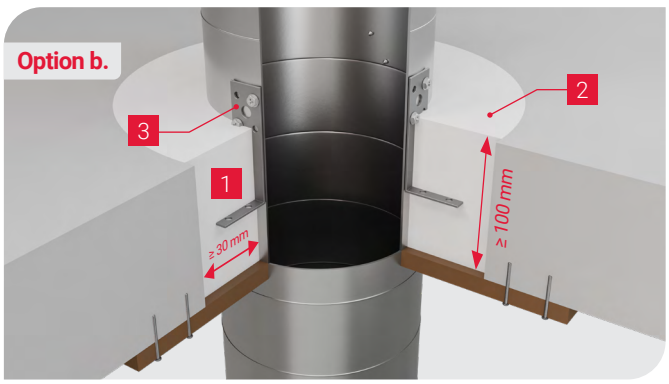
The penetration seal of ducts passing through hollow concrete floors can be made only if the gap between the duct surface and the edge of the opening is a minimum of 100 mm. In this case, the thickness of the concrete layer is the same as that of the surrounding floor.

Use of reinforcements within the floor opening is optional. PAROC takes no responsibility for loadbearing properties of the floor.

The duct is attached to the floor using steel L-angles, which are positioned approximately at the mid-depth of the floor.

- The minimum sizes of the L-angles: width 35 mm, thickness 2 mm, depth 30 mm, height 50 mm. The height may extend above the floor; it is useful if there is no access to screw the L-angle to the duct inside the floor opening.
- Each steel L-angle is screwed to the duct by two self-drilling screws with a minimum size of 4,2 mm, placed diagonally across the L-angle.
- The maximum diameter of the duct is 630 mm.
- Four L-angles are placed approximately at the mid-thickness of the floor, oriented upward, with an angular spacing of 90°.
- A layer of the fire sealant approximately 1 mm thick is applied to the interface between the stone wool insulation and the floor/ceiling.





1. Min. gap 30 mm
2. Cast-in concrete
3. Steel L-angles, min. size 35 x 50 x 30 x 2 mm

INSULATING LAYER ON THE DUCT SURFACES

- Insulation product PAROC® Vect Wired Mat BlackCoat EI30, nominal thickness 60 mm.
- Offset of longitudinal joints by a minimum of 100 mm.
- Fixing the insulation to the duct – four optional methods of connecting the wire mesh joints:
  1. The wire mesh is twisted approximately each 150 mm.
  2. The wire mesh is sewn by wire with a minimum thickness of 0,7 mm.
  3. The wire mesh is connected with clips, approximately each 150 mm.
  4. The wire mesh is stitched by small steel wire loops with a minimum thickness of 0,7 mm, approximately each 150 mm.

The longitudinal joints of the wire mesh shall be connected using any of the methods described above. Connecting the transverse joints is optional. If the transverse joints are twisted (method 1), the mesh wires may be twisted; the perimeter wire shall not be twisted.

Material of the wire mesh and wires: steel with any surface finishing or stainless steel.

As an additional measure, to further secure the installation, the insulation may be attached to the duct by welding pins. The pins must be placed a minimum of 50 mm from the joints of the mats.

INSTALLATION PROCEDURE

Before starting the installation, ensure that the wall or floor openings are clean and comply with the design rules in this document.

INSTALLATION OF THE PENETRATION – GAP FILLED WITH PAROC® STONEWOOL

1. Fill the gap tightly and completely with unfaced PAROC® Stonewool. The resulting surface of stone wool filling must be flush with both surfaces of the wall/floor.
2. Prime the surface of the stone wool filling and surrounding wall/floor surfaces with clean water.
3. Apply a continuous layer of fire sealant on both sides of the stone wool filler compressed in the gap, thickness 3 to 5 mm; this may extend to adjacent surfaces of wall/floor.
4. Make the fire sealant surface even and smooth using a wet brush or spatula.
5. Stabilize the duct by attaching steel L-angles (if not installed already).

Screws used to fix the L-angles to the wall/floor shall be made of steel and shall be of a type appropriate for the wall/floor material. Two screws shall be used to attach each L-angle to the wall/floor. The minimum size is 5 mm for aerated concrete, and 3,5 mm for lightweight partitions – screwed to the steel structure of the drywalls. They may include dowels or other type of anchors suitable for fire resistance of the duct.

INSTALLATION OF THE PENETRATION – ZERO DISTANCE BETWEEN THE CAST-IN CONCRETE AND THE STEEL DUCT USING A SUPPORTING BOARD AS TEMPORARY FORMWORK

1. Install the board that supports the concrete on the bottom surface of the floor.
2. Attach the steel L-angles to the duct.
3. Pour the concrete into the gap between the floor and the steel duct and let it dry out and harden.
4. Remove the supporting board.

INSTALLATION OF THE PENETRATION – ZERO DISTANCE BETWEEN THE CAST-IN CONCRETE AND THE STEEL DUCT USING A NON-COMBUSTIBLE SUPPORTING BOARD AS A PERMANENT PART OF THE FLOOR

1. Install the board that supports the concrete on the bottom surface of the floor.
2. Attach the steel L-angles to the duct.
3. Pour the concrete into the gap between the floor and the steel duct and let it dry out and harden.

BASIC RULES FOR HANDLING THE INSULATION MATS

- The mats must be handled with care to avoid damage to the insulation or facing.
- Unpack and unfold the mat on a flat surface, remove the plastic foil and shake the mat gently and let it rest for a minimum of 10 minutes, until it regains its original thickness and releases any tension due to packing compression.
- The insulation layer must have a uniform thickness; therefore, avoid too much stress or pinching fingers during product handling and installation.

The insulation material compensates surface irregularities of the duct through its material properties. Therefore, cuts for L-angles or flanges are not required. Bends and T-joints can be insulated by cutting segments of the insulation material.

INSTALLATION OF THE MATS ON THE DUCT

Before installing the insulating layer, ensure that:
- The ductwork fulfils air tightness criteria.
- The ductwork is assembled according to design, with proper quality, without visible holes or gaps or mechanical damage.
- The duct joints are tight and properly fit together.
- All the sizes and components comply with this guide.
- The penetration seal is installed in compliance with this guide.

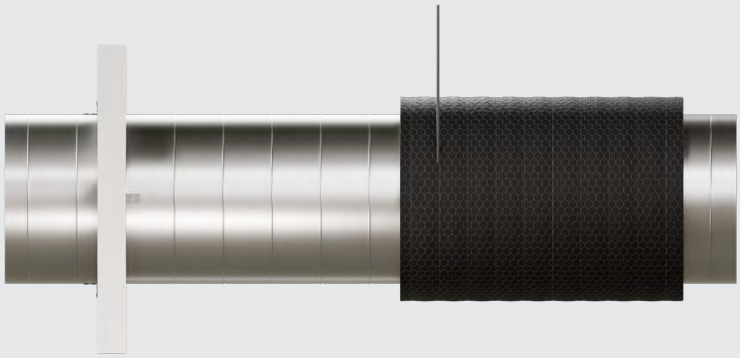
The mat length is calculated as: 3,14 x (steel duct diameter + 2 x insulation thickness + addition for mat compression). The addition for mat compression is approximately 20 mm or a minimum 2% of the mat length. If the mat is too short to wrap the duct in a single piece, the correct final length can be made by connecting several pieces of the mat. The minimum size of any single piece of mat in any direction is 200 mm.

INSTALLATION OF THE MATS ON A HORIZONTAL DUCT

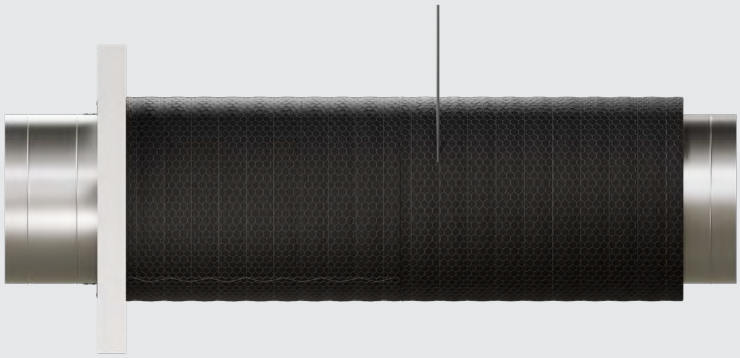
1. Cut the mat to the correct length corresponding to the circumference of the duct, leaving a minimum of 100 mm extra facing and mesh for overlapping.

2. Wrap the insulation around the duct tightly, so that no gaps occur at the insulation joints.

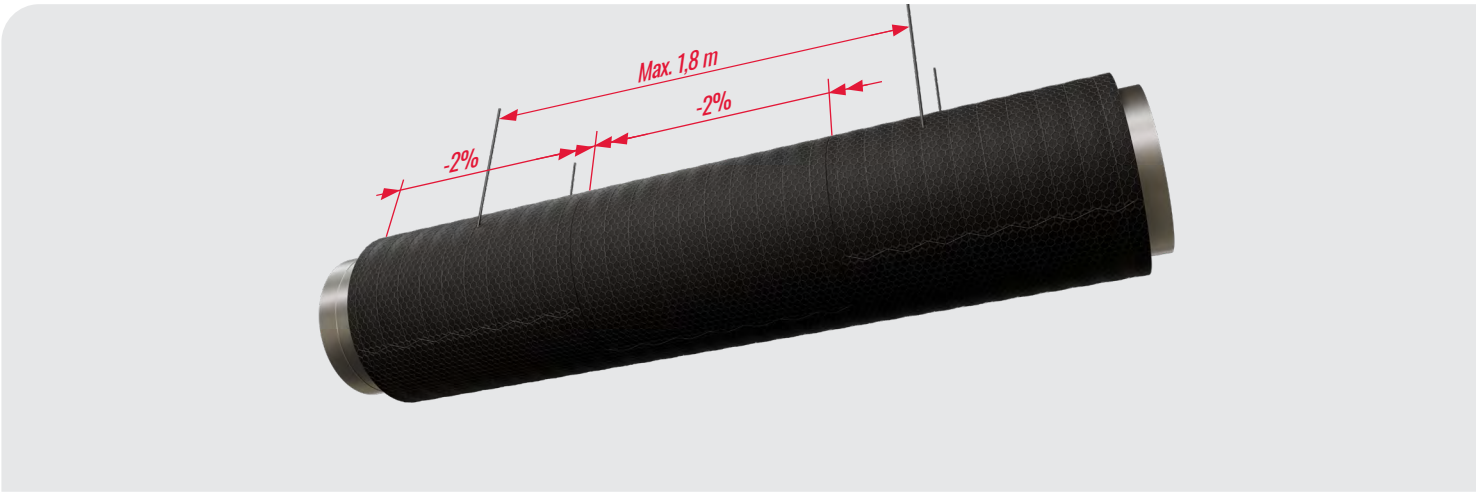
3. First install the second mat, leaving the space on the duct between the second mat layer and wall -30 mm or a minimum 2% of actual size of the gap, to allow the first mat to be adequately compressed against the wall.



4. Install and stabilize the first mat adjacent to the wall. Unless the fire sealant is still wet, the wall surface must be primed with clean water and another layer of fire sealant applied where the edge of the insulation is in contact with the wall. Spread the fire sealant with a wet brush or spatula to make a soft layer approximately 1 mm thick. Immediately after, while the fire sealant is still wet, compress the insulation against the wall.



5. Place the following mats on the duct after one another compressing all the mats to the final installed width 20 mm or a minimum of 2% less than the original mat width.



6. Place the remaining mats on the duct. The longitudinal joints of the adjacent mats are to be offset by a minimum of 100 mm. The last mat must be compressed against the wall with the fire sealant following the principles of 4.

7. Where suspension rods penetrate the insulation, make a cut in insulation up to the point where the suspension rod will be placed; a new joint will be created this way.

8. If there are any visible gaps between the mats and the walls, apply an appropriate amount of fire sealant therein so that the insulation edge is compressed against the wall on all its edge area. Excess fire sealant needs to be removed.

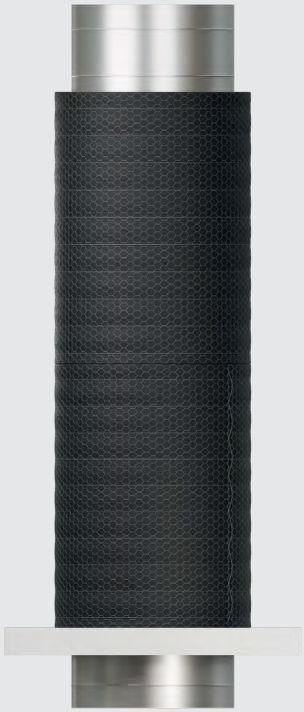
INSTALLATION OF THE MATS ON A VERTICAL DUCT

1. Cut the mat to the correct length corresponding to the circumference of the duct, leaving a minimum of 100 mm extra facing and mesh for overlapping.

2. Wrap the insulation around the duct tightly, so that no gaps occur at the joints.

3. Install the first mat adjacent to the floor/ceiling. Unless the fire sealant is still wet, the floor/ceiling surface must be primed with clean water and another layer of fire sealant applied where the edge of the insulation is in contact with the wall. Spread the fire sealant with a wet brush or spatula to make a soft layer approximately 1 mm thick. Immediately after, while the fire sealant is still wet, compress the insulation against the floor/ceiling.

4. Place the remaining mats on the duct after one another compressing all the mats to the final installed width 20 mm or a minimum of 2% less than the original mat width. The longitudinal joints of the adjacent mats are to be offset by a minimum of 100 mm. The last top/bottom mat must be compressed against the ceiling/floor with the fire sealant following the principles of 3.

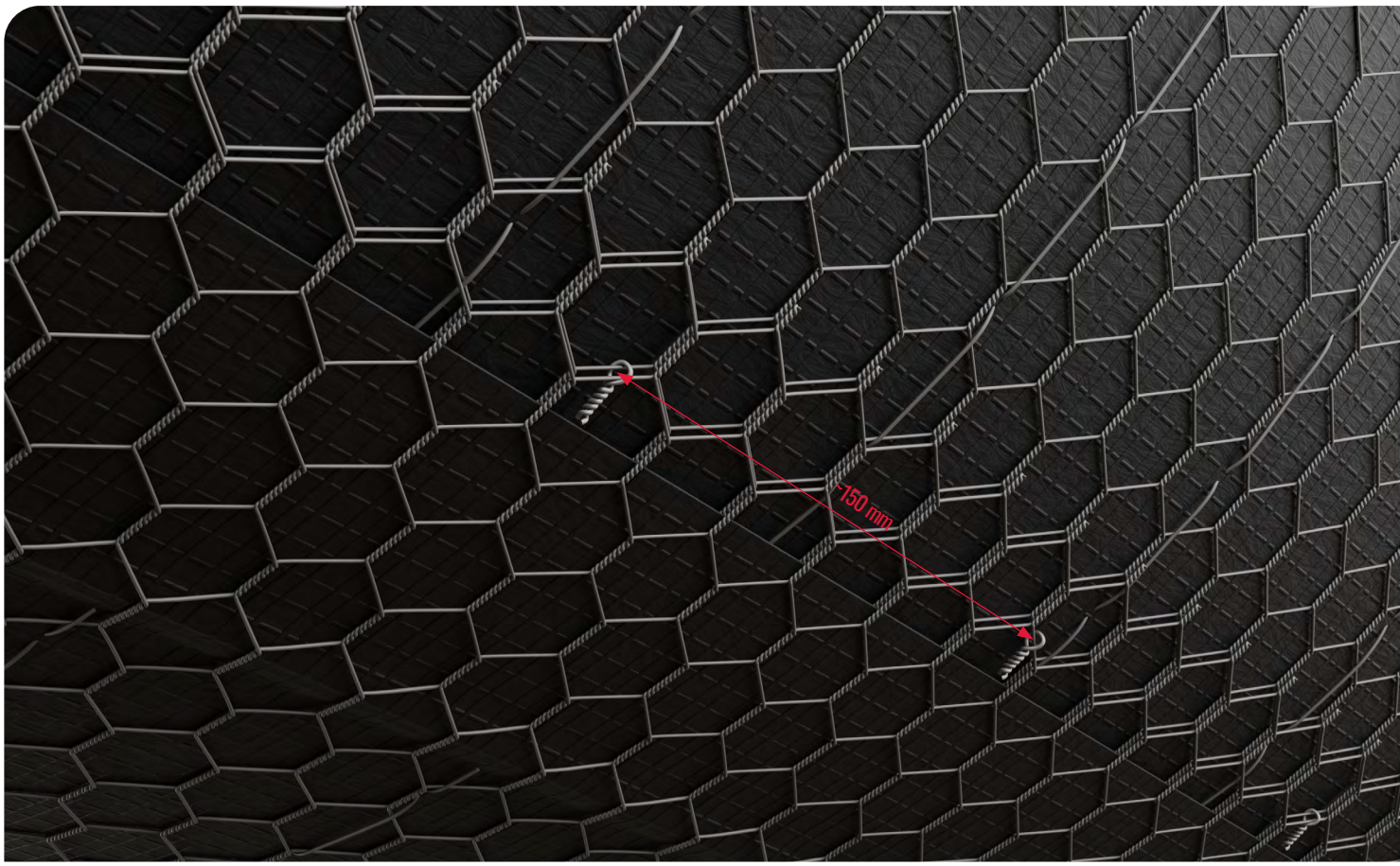


5. If there are any visible gaps between the mats and the floor/ceiling, apply an appropriate amount of fire sealant therein so that the insulation edge is compressed against the floor/ceiling on all its edge area. Excess fire sealant needs to be removed.

SECURING THE INSULATION LAYER ON THE DUCTWORK

Fixing the insulation to the duct – four optional methods of connecting the wire mesh joints:

1. Twist the wires in the longitudinal joints approximately each 150 mm. Connecting the transverse joints is optional. If the transverse joints are twisted, the mesh wires may be twisted; the perimeter wire shall not be twisted.
2. Sew the longitudinal (optionally also transverse) joints by wire with a minimum thickness of 0,7 mm.
3. Connect the longitudinal (optionally also transverse) joints with clips, approximately each 150 mm.
4. Stitch the longitudinal (optionally also transverse) joints by small steel wire loops with a minimum thickness of 0,7 mm, approximately each 150 mm.



GUIDANCE ON CUP HEAD PIN WELDING

To deliver the required fire performance of insulated duct systems, the quality of components and capacitor discharge welding process are crucial. The following parameters are critical to deliver the required weld quality. Good weld quality must be tested prior to attaching insulation on the duct.

Test of the weld quality

- Weld a minimum of five pins to the same material, steel thickness, and surface as those of the insulated duct.
- Visually inspect the weld. The pin tip should be properly melted with the steel sheet, without any visible reduction of pin diameter at the weld or radial burn patterns from the weld.
- Bend the pin using a pair of pliers until the pin breaks. The pin must not detach from the steel sheet at the weld, but from slightly above. The weld must be stronger than the pin shaft.
- Repeat the test whenever the weld parameters change (pin type, steel thickness) or whenever there is a doubt about the weld quality based on sensory perceptions during welding.

NOTE: As certain conditions to achieve good weld are affected by the insulation product (points 4 and 5 below), it is recommended to perform this test with the insulation product and remove it before testing the weld quality by bending of pins.

Conditions to achieve good weld quality

1. Sharp tip of the pin; any flattening or radius of the tip cannot exceed 0,5 mm.
2. Optimal setting of the welding machine
   - Voltage
   - Spring tension in the hand tool
3. Avoiding excess manual force on the pin during welding. There must be only light touch of the pin to the steel duct surface, and when the hand tool is triggered, the pin must only be pushed against the steel duct surface by the spring force in the hand tool.
4. Sufficient pin length so that there is minimum 3 mm clearance between the insulation surface and the pin head before welding.
5. Avoiding any stray currents and additional electrical resistance for the current flowing between the pin and the steel duct surface during the welding.
   - Place the negative electrode on the same duct segment where welding is performed.
   - Keep both electrodes clean and make sure there is good contact between the pin and the hand tool and between the negative electrode clip and the duct surface.

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