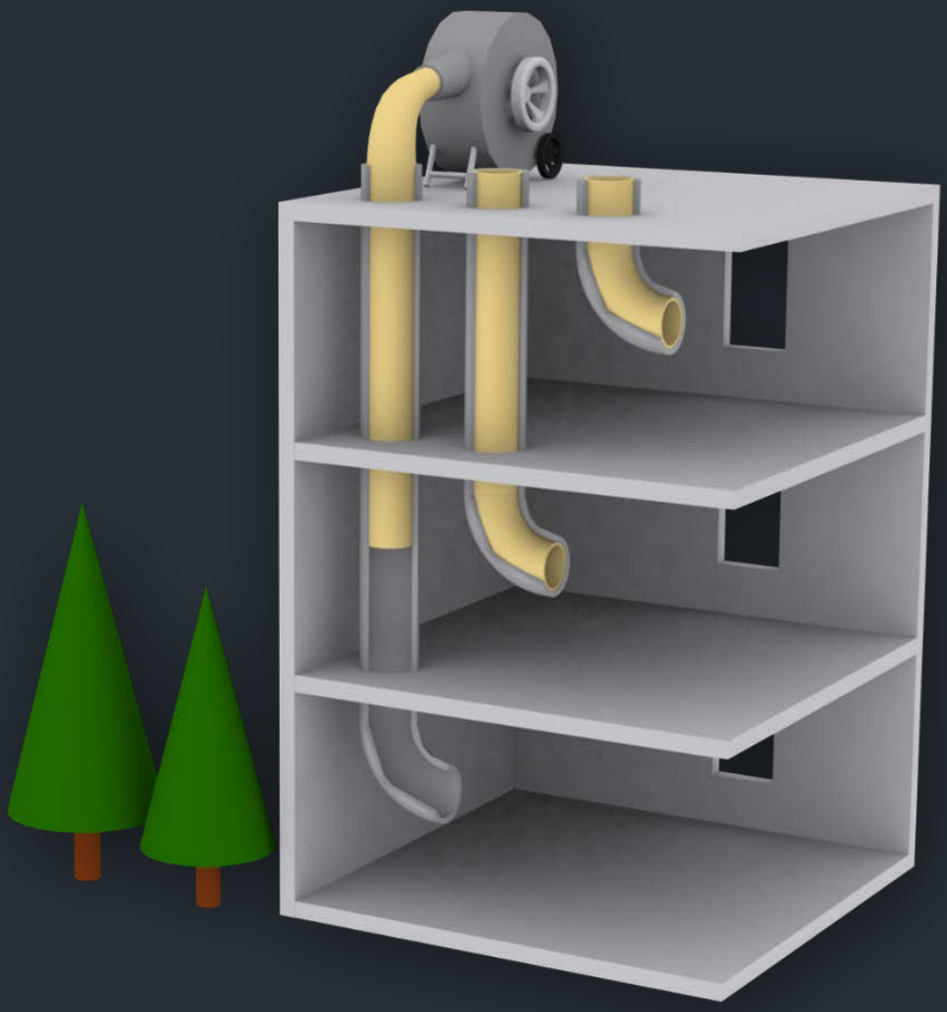
LINERVENT



Installer handbook

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What is the Linervent method

The Linervent method is a way of sealing ventilation ducts from the inside, with a minimum of demolition. The method is based on the same technology that has long been used to line drain pipes on the Swedish market

Linervent's Materials

Liner

The material consists of fire-safe felt impregnated with a specially developed polymer. It forms a fire-safe, airtight layer on the inside of the ventilation duct being sealed.

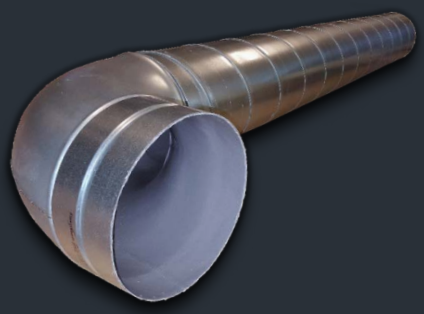
The material cures in place inside the previously leaking ducts and forms a new airtight surface layer, which can bridge even large cracks and other forms of leakage.

A new lining with a flexible liner creates an airtight layer about 3mm thick. The liner is available in a number of dimensions up to about 400mm in diameter.



Bends

Linervent's liner is extremely flexible and therefore handles bends very well. Multiple 90 degree bends are passed through easily.



Changes in dimension

Changes in duct diameter are a challenge for many sealing methods, but the Linervent method allows changes in dimension of up to 40%. This means the method can be used even when several dimensions occur in the same duct.



T-junctions

In some cases T-junctions may need reinforcing. The Linervent method handles this as well.

Tools required

A number of special tools are needed to carry out sealing with the Linervent method.

Relining drum/Extruder

Linervent's material is inverted into the ventilation duct. To do this, a so-called relining drum, also called an extruder, is needed.



Compressor

A compressor that can supply the drum with compressed air is required. The compressor's capacity should match how many liners are to be installed, and also how long the liners are and their diameter.

Mixer / Stirrer

A powerful mixer / stirrer is required.

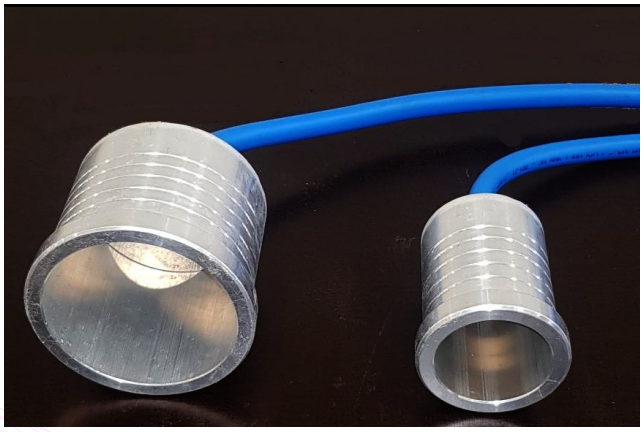


Roller

Most installers who are used to working with Linervent prefer to use an ordinary garden roller to impregnate Linervent's material. (we know that sounds strange....)

Adapters

To increase productivity, adapters can be used to keep the liner under pressure during curing.



Purchasing

Linervent's materials are ordered by email to **info@linervent.se**

State dimension and length.

Components of Linervent's materials

Polymer: Sikaflex 404 inliner+booster
Textile: Felt made from meta-aramid fibres
Film: Stretchable polyurethane that is removed after installation



Mixing and open times

The polymer material is normally mixed as 14.9kg (one bucket) of base material to 1/4 of a booster pack (75 grams). Mix for at least 2-3 minutes with a powerful low-speed mixer. Stirring must continue until a uniform colour and consistency has been reached.

This normally gives a time window for inversion of 45 minutes. The open time is set at 23C and 50% humidity. The open time is normally halved if the temperature rises by 10C.

Viscosity

The viscosity of the polymer varies with how much booster is added. It also varies with temperature. At 23°C the viscosity is about 12800 mPa/s, while at 30°C it is 8400mPa/s. In other words, the viscosity can drop by 30% when impregnation takes place at warmer temperatures. The same changes occur to a lesser degree when the temperature is colder.

The temperature kept during impregnation can therefore have a large effect on the result! Linervent recommends a minimum of 20C during impregnation.

Inversion pressure, curing pressure and burst pressure

The textile in Linervent's liner is designed to be inverted continuously at 0.3Bar.

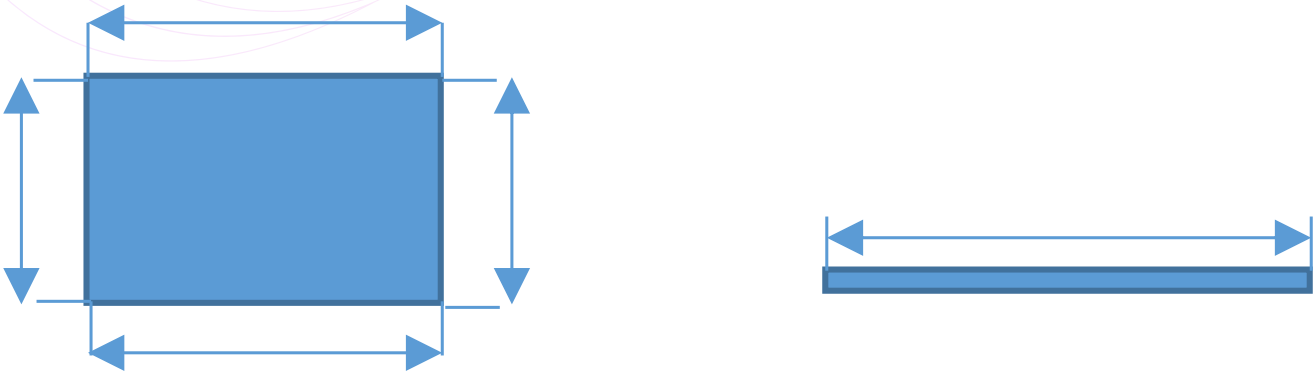
It withstands shorter periods of higher pressure (different depending on diameter), but will expand and burst at higher pressure if the pressure acts for longer periods. For good adhesion, Linervent recommends curing the liner at 0.2bar.

Sizing

Linervent's material is normally sized slightly smaller than the duct to be sealed. The material can increase its diameter by about 40%. It is however recommended to choose a liner that does not need to expand to the maximum, to keep some safety margin.

How do I know which liner fits?

For square ducts: Measure the circumference. To find the right liner, divide the circumference by two. The layflat width of the liner must be smaller than the duct's circumference divided by two.



For round ducts: Measure the diameter. Compare with the diameter of the liner. The liner diameter must be smaller. The liner can expand up to 50 % in diameter and circumference.

Linervent's sizes

As ventilation ducts can be both round and rectangular/square, we work with circumference instead of diameter to determine size. The circumference of a round pipe is calculated as Pi (3.14) x diameter.

For a rectangular/square duct, all 4 sides are added.

Layflat	Diameter	Circumference
120	76-101	240-320
160	102-142	320-450
225	143-190	450-600
300	191-254	600-800
400	255-318	800-1000
500	318-400	1000-1250

Sizes 160, 225 and 300 layflat are normally in stock with 2 weeks delivery time. Other dimensions are normally ordered specially, and may have a longer delivery time.

If there are nails/screws in the duct, choose a liner with minimal stretch to minimise puncturing during installation.

Impregnation

Impregnation with a roller

Linervent's liner cannot be impregnated with a traditional relining roller. The reason is that the liner and the plastic are not attached to each other as in a traditional relining material. Because the polymer used is so thick, the felt material is dragged along and large lumps of felt and polymer form, while some parts of the liner become stretched and thin.

Dosage

The dosage is recommended. In some cases consumption can go down and also up depending on viscosity. The basic rule is that with cold impregnation the amount goes up, and with warm impregnation the amount goes down.

Layflat (mm)	Polymer (Kg/m)
120	1
160	1,8
225	2,7
300	3,3
400	4,7
500	5,9

Impregnation by hand

If a belt roller is not available, the liner can be impregnated by hand. The same dosage is recommended as with belt rolling.

Hand impregnation is done as follows:

Tool: Roller, e.g. a garden roller, at least 30cm in diameter

Step 1. Measure the length of liner to be impregnated.

Step 2. Weigh out the recommended amount of polymer for the length of liner to be done.

Step 3. Pour the polymer into the end that will be attached to the drum.

Step 4. Place the roller behind the pile of polymer that has formed. Under pressure, roll the roller forward over the liner. The pressure required is up to 50kg for a 30cm roller.

Step 5. If the polymer has been underdosed, pour in more polymer from the other end and spread it in the same way until the liner is fully saturated.

Inversion

The liner is normally inverted at 0.2-0.3bar pressure. It is recommended to invert from the top down, i.e. with the drum placed on the roof or in the attic.

Inversion procedure

1. Inspect the duct to be sealed and measure how long a piece of liner is needed to reach through the duct. Add about 30cm to stick out at the end if the duct is open at both ends. Also add the material needed to reach from the drum to the duct opening.

2. Measure out and cut the piece of liner. Mark the part that will run between the drum and the opening. That part does not need to be impregnated.

3. Impregnate the liner (see the chapter on impregnation)

4. Close the end of the liner with tape and hose clamps. A pre-tied strap for attaching to the line in the drum can also be fitted. Then tie the end to the line that runs to the drum and wind the liner into the drum.

5. Fasten the end of the liner around the end of the drum with ratchet straps and tape. At least two straps are recommended

6. Put a burst cover/calibration hose over the drum to bridge any gap between the drum and the duct opening. The burst cover stops the liner from expanding too much where it has no support from the duct walls.

7. The liner is inverted step by step. The operator should now and then pull the liner back a little (a few centimetres) to make sure it runs out evenly and smoothly in the duct. This is especially important when bends and 90 degree corners are to be passed.

8. When the liner has been inverted to the end it can be caught with a home-made funnel. The funnel is made of drain pipe cut into pieces about 3-4 cm wide. These are placed in the end of burst bags. The piece of drain pipe makes it easy to catch the liner. The burst bag then supports the part of the liner that is outside the duct during the curing time.

To increase productivity, the liner can be released from the drum and inflated with an adapter. To do this, the liner must be secured so it cannot fall down the shaft. This can be done, for example, with a longer clamping tool. During transfer the liner is clamped so that no air can pass. It is then cut loose from the drum, and an adapter is inserted into the liner and fastened from the outside with ratchet straps and tape. The pressure in the liner is then regulated with a throttle valve leading to the adapter.

Installation requirements

Cleaning

Ducts normally need no cleaning before installation. If a lot of grease has built up in the duct, it is best removed. The same applies if there are large amounts of debris in the duct that could stop the liner from moving through it.

General tips for contracts

The following are things that earlier installations have shown are worth keeping in mind, plus some tips and tricks.

1. If the inversion is to be done from the attic, make sure the drum to be used can be brought up into the attic. Sometimes an opening in the roof combined with some form of mechanical lift may be needed to get the drum in place.

2. If the duct to be sealed is a spiral duct, there is a risk of screws going into the duct. Linervent's material normally copes with screws, but if there are any, the liner should be chosen so that the expansion needed to fill the pipe is as small as possible.

3. Where there are accessible horizontal ducts in the attic, it is often worth looking at the alternatives. It is often cheaper and gives a better result to install new spiral ducts instead of relining accessible ducts.

4. To connect new spiral ducts to sealed ducts properly, about 50cm of spiral duct can be placed at the end of the duct being sealed. After sealing, the transition from the spiral duct to the old duct is completely airtight.

Sealing asbestos ducts

The Linervent method is often used to seal ventilation ducts made of asbestos cement (eternit). Inversion does no damage inside the duct and no asbestos is released. Asbestos already floating freely inside the duct may possibly be pushed down through the duct. It is up to each installer to make sure the rules for working with asbestos are followed.

The Swedish Work Environment Authority has a guide for working with asbestos that is good to know and fo
https://www.av.se/produktion-industri-och-logistik/asbest/forebyggande--arbete-med-asbest/

The Swedish Work Environment Authority also accepts applications for permits to handle asbestos where this still becomes necessary.

Measures when sealing supply air

When sealing supply air ducts, the odour produced during curing can bother the end customer. The odour disappears over time, but in some cases it may be an option to try to get rid of it faster. The sealed supply air duct can then be treated with ozone. A unit spreads ozone in the duct while the duct outlet is blocked. The ozone removes most odours. Units of this type can be hired from specialist shops.

Energy saving calculations a simple introduction

Linervent helps its installers make energy saving calculations, but as an installer it can still be good to have an idea of how a calculation is done and what you as an installer need to help with for the calculation to go well.

What the installer normally has to provide (with help from Linervent) is

1. You need to know the total flow of air out of the building (litres/second)

2. You need to know how much of the total flow is leakage (leakage litres/second)

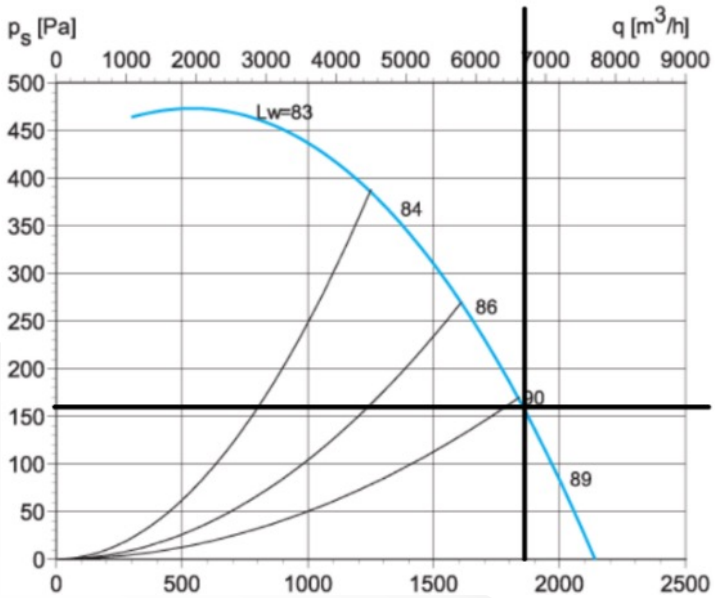
There are a number of ways to find this out. Which way you choose depends entirely on what kind of information is already available

a. Measure the flow at the fans. Then compare with the design flows from the OVK report. Every building in Sweden has an OVK report. A rule of thumb for the design flow is about 25 litres/second per apartment. 15 litres/second from the kitchen and 10litres/second from the bathroom. In some cases the flow may also be stated in the OVK report.

Example: You measure that a fan extracts 125litres/second. The OVK report states that the design flow is 100 litres/second. We then have a leakage of 125-100=25litres per second.

b. If it is not possible to measure or measuring equipment is not available. Find out what type of fan is installed (make, model, model designation). Find out what speed/setting the fan runs at. Possibly also what pressure it runs at. Then, using a curve the manufacturer provides in the fan's documentation, you can find out how large the flow is. You can then often compare the flow from the curve with the flows written in the OVK report. The difference you arrive at is the leakage in litres per second.

Example: Fan curve for fan EBM PABST MKXC 50M 1120

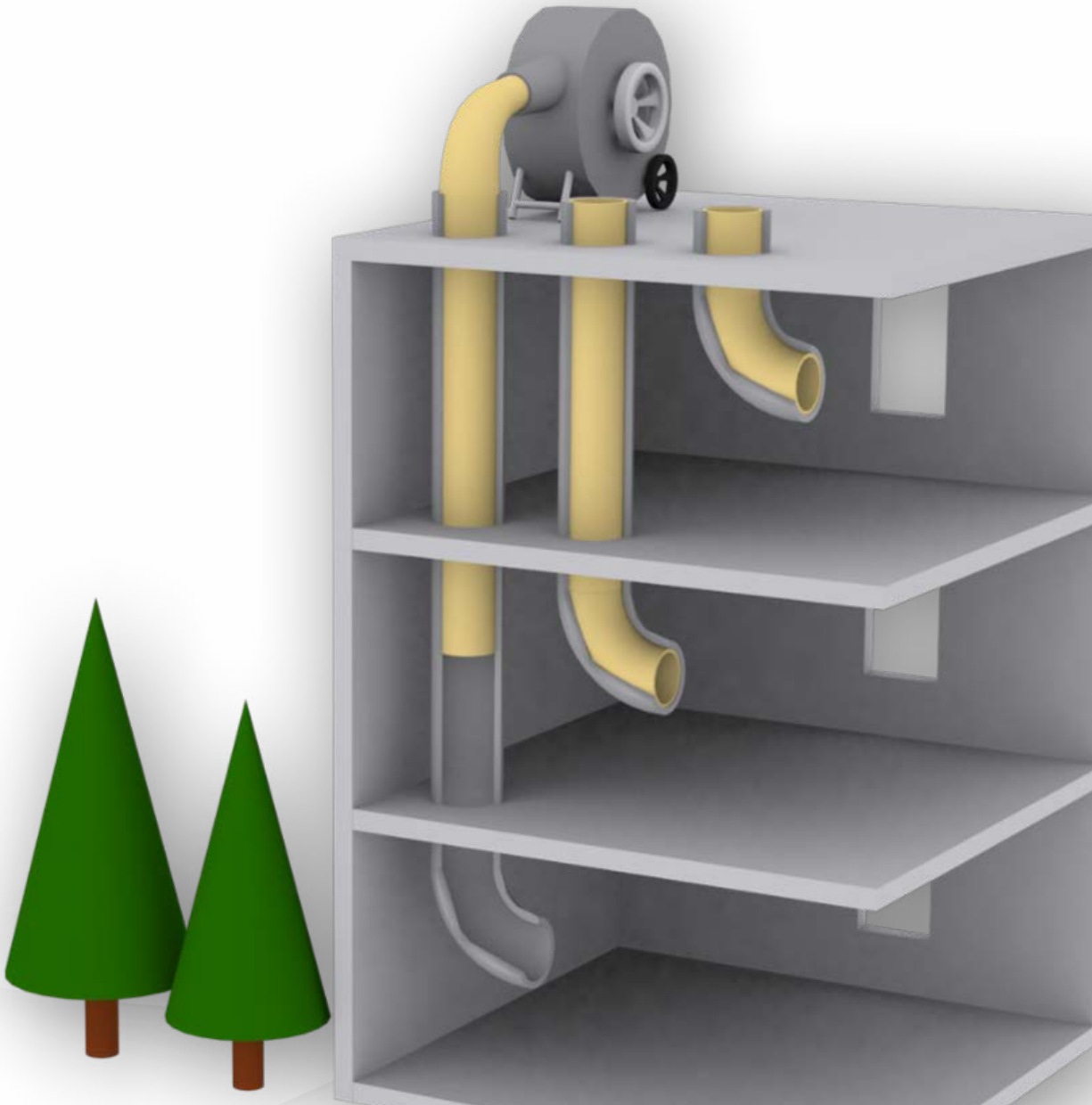


c. Do a pressure test (e.g. by hiring a chimney sweep). A pressure test gives a leakage factor that tells how much the duct leaks at different pressures, per square metre of duct wall. Then you calculate the building's total duct wall area, and calculate the total leakage at the pressure the ventilation system is expected to work at.

Once you have found how much air is extracted from the building and how much of that air is leakage, two steps remain in the energy calculation

3. You calculate how much each litre of air out of the building costs
4. You compare the cost of the air before and after sealing

This is not something you as an installer normally need to do yourself. With the information found in steps 1 and two, Linervent can help you produce an energy calculation for all kinds of properties.

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