HVAC Insulation

CLIMAVER® Installation Manual

The pre-insulated ductwork system

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isover
SAINT-GOBAIN

Content

1. Introduction to CLIMAVER® Duct boards

Glass wool duct boards for air conditioning ducts were first developed in the USA more than 50 years ago. They have since been produced by CertainTeed Corporation, a Saint-Gobain company, in the USA, and by other Saint-Gobain companies in other countries, such as Netherlands, Argentina, Colombia, Brazil, Japan,...

ISOVER Spain is a glasswool and stone wool manufacturing company. It has been producing glasswool pre-insulated duct boards since 1967 under the trade name CLIMAVER®.

CLIMAVER® glasswool duct boards are CE certified and manufactured at the Azuqueca de Henares mineral wool factory. This factory is ISO 14001 and ISO 9001 accredited.

Description

CLIMAVER® is a high density glass wool duct board and is faced on both sides. The outer facing, a robust aluminium facing, acts as a vapour barrier and ensures that the duct is airtight. The inner facing of the duct may be either a reinforced aluminium facing or a woven glass facing. The latter, called Neto, ensures an outstanding level of acoustic absorption.

Uses

Heating, Ventilation & Air-Conditioning (HVAC) ductwork

Duct board dimensions		
Length (m)	**Width (m)**	**Thickness (mm)**
3 / 2.4	1.19 / 1.21 (CLIMAVER APTA)	25 / 40 / 50

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	Acoustic absorption	Thermal savings	Fire reaction	Outer facing design
CLIMAVER Plus R	*	**	*	Straight Duct Method (SDM)
CLIMAVER A2 Plus	*	**	**	SDM
CLIMAVER Neto	**	**	*	SDM
CLIMAVER A2 Neto	**	**	**	SDM
CLIMAVER A2 Deco	**	**	**	Aesthetics (colored)
CLIMAVER APTA	***	***	*	SDM
CLIMAVER A2 APTA	***	***	**	SDM
CLIMAVER A1 APTA	***	***	***	SDM
CLIMAVER STAR	***	***	*	Outdoor use

2. Principles of Duct Assembly

Duct Assembly:
This handbook describes the operations that should be performed in order to ensure the correct installation of an air distribution network using the CLIMAVER® System.

The focus of this handbook is the „Straight Duct Method“ (SDM) which allows ductwork to be made much quicker and more efficiently. The method allows the fabrication of a straight duct from a single board, increasing the strength and rigidity of the duct assembly.
The method will be performed using a small number of light and easy-to-use tools.

Definitions:

- Duct assemblies: ductwork sections where the air flow changes speed and/or direction (e.g.: elbows, reductions, branches, shoes etc.)
- Piece: ductwork element that produces a duct assembly when joined to other pieces.
- Separate module/flat piece: flat item or piece that forms a duct assembly or straight duct when joined to other pieces.

Regulations:
CLIMAVER® glass mineral wool duct boards comply to the European voluntary Standard EN13403 Ventilation for buildings – Non-metallic ductwork made from insulation duct boards.

The following are required for manufacturing ducts:

Material	SDM
Perfiver H® profiles	✔
CLIMAVER® Glue for reinforcing the joints of pieces when fabricating duct fittings	✔
MTR tools	✔
CLIMAVER® MM tools	✔
CLIMAVER® MM Square Ruler	✔
CLIMAVER® self-adhesive aluminium Tape for sealing joints externally	✔
CLIMAVER® self-adhesive Neto Tape for sealing joints internally	✔
A marker pen, a measuring tape, a CLIMAVER® Knife (double-edged flat end knife) a spatule and a CLIMAVER® Stapler	✔

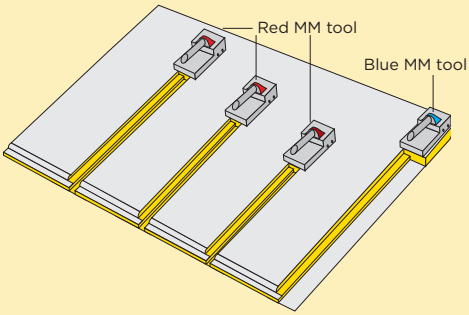
2.1. LAYOUT / SKETCH

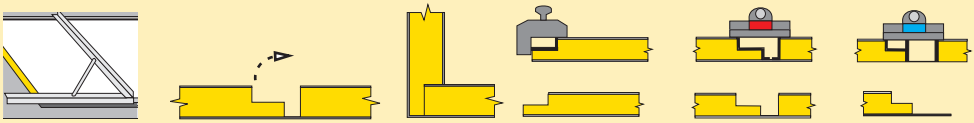
Once the cross sections and the elements of the ductwork (straight duct, elbow, offset, etc.) have been defined, it is necessary to consider the cutting lines on the duct board dependent on the size of the duct itself.
The CLIMAVER® Square Ruler makes the assembly of straight ducts from a flat duct board extremely easy as it is calibrated to allow measurement of the duct dimensions along the bottom of the duct board.
With the CLIMAVER® Square Ruler it is not necessary to mark the duct board with cutting guidelines.

2.2. CUTTING

The following pictures show the dimensions and cuts that should be made depending on the type of duct that we want to obtain.
The square ruler is placed on the duct board, and the cut is performed at the correct dimensions by placing the appropriate CLIMAVER® MM tool against the ruler. This means that the MM tool will be nearest the user at this point. The tool's blades then enter the duct board and the user pushes the tool away from the initial starting position.
CLIMAVER® MM tools are fitted with high quality and easy-to-replace steel blades. They have been especially developed for cutting the inner lining of CLIMAVER® duct boards.
The CLIMAVER® MM tools produce cut grooves with a „chair" shape which allow the duct boards to be folded at an angle of 90°. This produces the joints from a single piece of board.

The glasswool is removed by hand as the groove is made.
This type of cut provides more rigidity to the section. ISOVER recommends this tool rather than other conventional V-shaped cutting tools. The tools are very light and easy to use. They save time sketching as they are calibrated to work with the CLIMAVER® MM Square Ruler. Each CLIMAVER® MM tool has different colors corresponding to different functions. Each of them will be detailed later on.





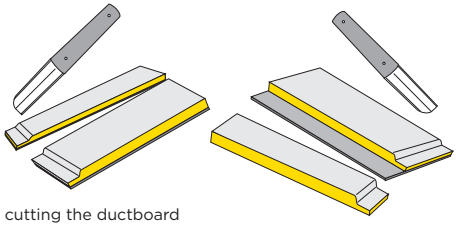
Square ruler | Chair-shape cut | Black MM tool | Red MM tool | Blue MM tool

CLIMAVER® tools have a support to which the blades are screwed.

2.2.1. OTHER CUTTING TOOLS

CLIMAVER® Knife
Another cutting tool is the double bladed CLIMAVER® Knife. The drawings below show the difference in the way the blade is used for cutting duct boards into two parts and for other operations such as cutting out edge flaps.

The MTR tools shown are used to cut straight ducts for the transformation into duct assemblies. They can make accurate and clean cuts because of their particular design. They are manufactured with the proper cutting angles.



cutting the ductboard into two parts

cutting out a flap

White label MTR tool

Yellow label MTR tool

2.2.2. OTHER ESSENTIAL ELEMENTS FOR THE STRAIGHT DUCT METHOD

- **CLIMAVER® Glue,** specially developed for bonding glass wool. It is an essential part of the CLIMAVER® system and is used for sealing joints between duct pieces fabricated using the Straight Duct Method.
- **CLIMAVER® Tape,** self-adhesive aluminium tape for sealing external duct joints. "CLIMAVER®" is printed on the tape as a reference of quality. It is also an essential part of the CLIMAVER® system.

2.3. CLOSURE

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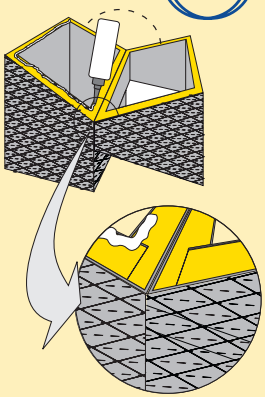
Two closure systems must be used:

Inner closure:
A sealer must be applied to all the joints used to make duct fittings such as elbows, branch, trouser and dynamic branches...

Sealing is achieved by applying a bead of CLIMAVER® Glue on the glass mineral wool surface of one piece, next to the edge of the inner facing and finally to the inner seam of the section.
It is necessary to ensure that the CLIMAVER® Glue dries completely. External closures of the pieces forming the duct fitting should also be completely sealed. The pieces must be securely held together by applying CLIMAVER® Tape across the external joints on each duct face before taping over the inner seam.



Outer closure:
The external closure of ducts from the CLIMAVER® range ensures a high level of air-tightness, with virtually no air leaks, provided that the ducts have been correctly fabricated and assembled.
Important: in order to guarantee duct resistance and durability, the adhesive tape used must be CLIMAVER® Tape which is:

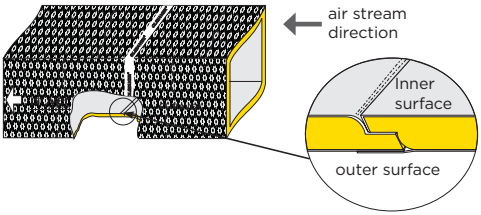
- Pure aluminium tape 50µm thick, with acrylic resin-based adhesive.
- a nominal width of 65mm.

Recommendations for applying aluminium tape: in order to apply the CLIMAVER® Tape, room temperature must be above 0°C. Dirt must be removed from the surfaces to be sealed. It is necessary to press it and rub it firmly with a CLIMAVER® Spatula until the facing reinforcement can be seen clearly through the tape.
Longitudinal duct joints can also be sealed using CLIMAVER® Tape. The tape must be applied so that half the width is placed over the stapled flap (see Chapter 2.4) and the other half over the surface with no flap. The trade name „CLIMAVER®“ appears on the entire length of the tape as a mark of quality at the installations.

2.4. DOVETAILING OF SEPARATE ELEMENTS

As commented in the section on closure, the dovetailing of separate elements to form ductwork sections is achieved by placing the surfaces of two sections of the duct at the same level, stapling the flap of one of the sections on top of the other (with no flap) and sealing the joint with self-adhesive tape. The two sections are easy to assemble because the rims of the two separate sections are shiplap moulded; one section is referred to as the "male" shiplap and the other as the "female" shiplap.

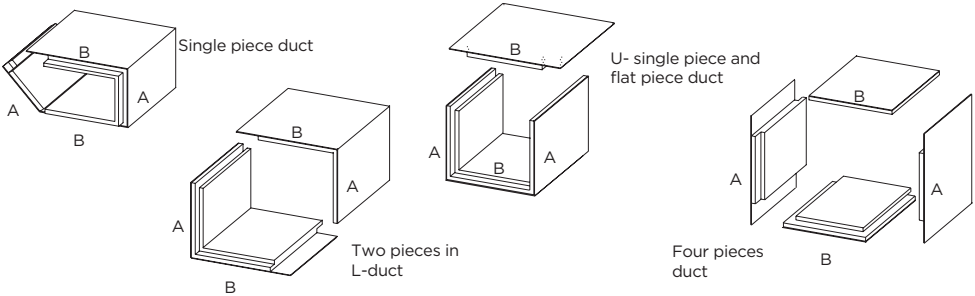
Note:
CLIMAVER® Staples and CLIMAVER® Stapler must be used



CLIMAVER®'s range of duct boards have factory made shiplap moulded edges thus making assembly easier. Thanks to this the density of the glass wool on this edge is far greater enhancing the rigidity of the joint and improving assembly to ensure a perfect interior finish.

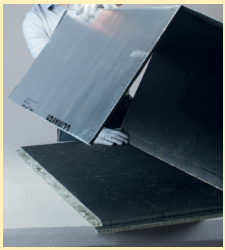
3. Creating a straight duct – General Theory

The easiest and quickest duct assemblies to produce are straight rectangular ducts. CLIMAVER® MM tools and Square Ruler make the fabrication of these ducts much simpler because the duct board does not need any guidelines scribed or marked on the duct board surface. The CLIMAVER® MM Square Ruler is actually used as the cutting guide as described below. The following drawings show different ways to make straight ducts, depending on the size of the duct board and the duct section required.
The layout and the cutting must be done on the inner surface of the duct.



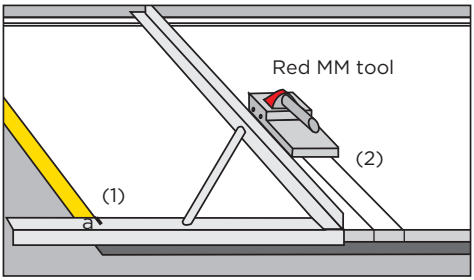
Note: For the whole Chapter 3., in the case of CLIMAVER® APTA ducts, wherever this manual mentions the Blue Tool, it should be substituted by two consecutive cuts by the Red MM Tool.



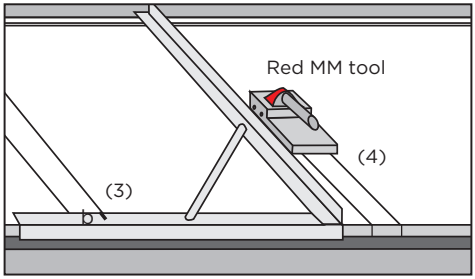

3.1. FABRICATION OF STRAIGHT DUCT WITH ONE BOARD OF CLIMAVER®: THE PROCESS

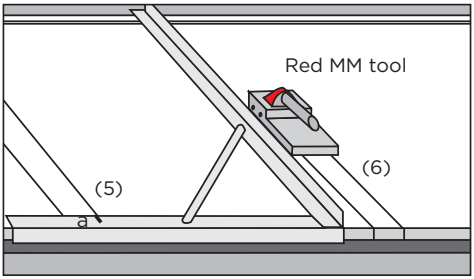
A straight duct with inner dimensions „a“ x „b“ needs to be made.
Every cut must start from the male shiplaped edge of the duct board and work towards to the female shiplaped edge. This would mean that cuts are made from the left hand side of the board and cuts are made progressively to the right.
In the drawing the dimensions are shown in millimeters. The ruler is calibrated to take into account the size of the cut made by the MM tools. The ruler automatically reduces the dimensions by 40 mm so that we can directly use the dimensions of the duct that we require straight from the ruler‘s calibrated surface.



A) First groove
The dimension „a“ is measured from the male shiplaped edge of the duct board using the CLIMAVER®MM Square Ruler. (1) The inner face of the duct board should always be placed upwards. A cut is then made with the CLIMAVER® Red MM tool (2).

B) Second groove
The CLIMAVER® MM Square Ruler is used to measure the dimension „b“ of the duct inner section (3). This dimension is taken from the last cut of the two made by the Red MM tool. (4) The CLIMAVER® Red MM tool is again used.



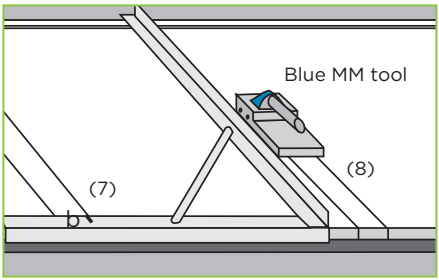


C) Third groove
Step 2 is repeated with the dimension „a“, taking the measurement from the last cut (5) and then a cut is made with the CLIMAVER® Red MM tool (6).

D) Last groove

Finally, as done previously in steps 2 and 3 the dimension „b“ is measured from the last cut (7) of the two made. Instead of using the Red MM tool, we use the CLIMAVER® Blue MM tool (8) in order to make the last „chair-shape“ cut and the flap for the stapling. The CLIMAVER® Knife can then be used for cutting the end of the board.

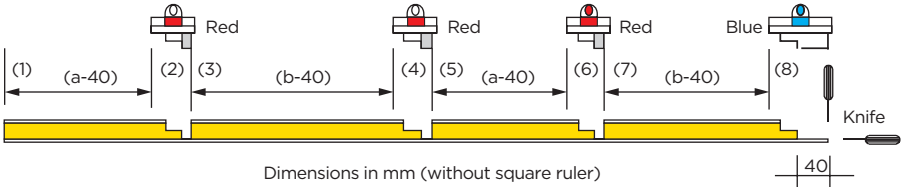
Note: The flap at the end must remain on the end of the board as this used as an overlap.



E) Grooving completion

The CLIMAVER® Knife is then used to separate any loose glass mineral wool from the newly created flap. To remove the cut strips, the duct board is lifted by placing one finger into the cut strip and the waste is easily removed.

Note: The Red MM tool is used three times and the final cut is made with the blue MM tool, as described in the illustration below.

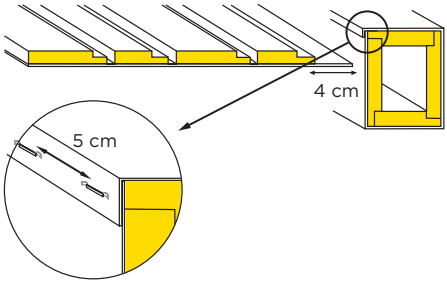


Remark

If the full width of the duct board is used then all the edges will have a pre-formed male-female shiplap junction made to connect it to other straight ducts. If not, then a male or female shiplap joint has to be made using the tool with the round black hilt.

F) Making the duct

The final joint of the assembly must be made. This is done by folding the duct board. Pressure must be added to force the duct so that it is slightly off square. The final flap is pressed over the edge of the corner joint. If this is done then when the pressure is released after stapling the straight duct aligns itself correctly. The junctions at the corners will also be tight and strong.

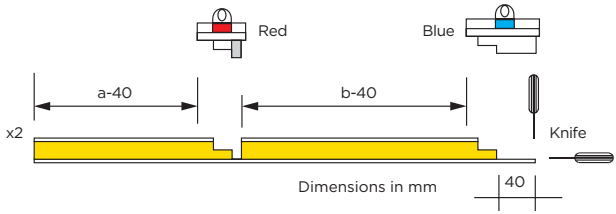


G) Stapling

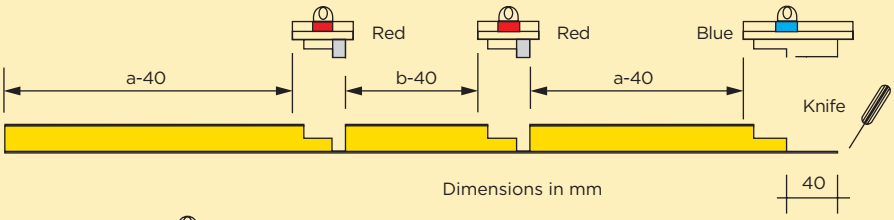
Join the flap to the opposite foil facing (see drawing) by using the CLIMAVER® Stapler and deliver the staples through the foil overlap, separating them by a maximum of 5cm.

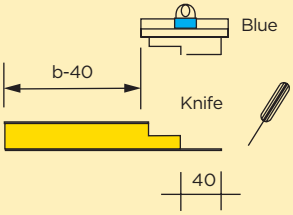
3.2. LARGER DUCT SIZES OR FABRICATION OF A STRAIGHT DUCT IN TWO PIECES

In cases where the duct perimeter is higher than the duct board length, only two grooves are required.
The Red MM tool creates the first cut and the Blue MM tool the second. Use the same method as described in Chapter 3.1 „Fabrication of straight duct with one board of CLIMAVER®: the process“.



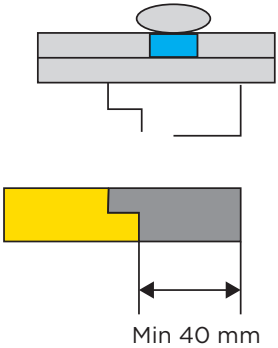
3.3. FABRICATION OF A STRAIGHT DUCT WITH A U SHAPED PIECE AND A FLAT PIECE



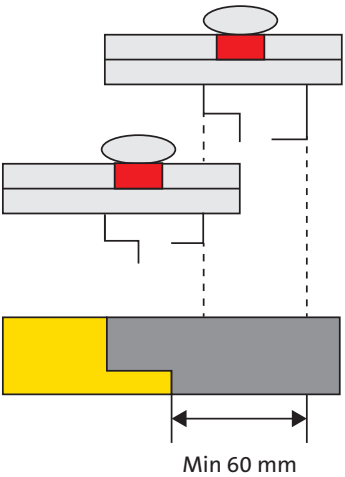


The CLIMAVER® MM Square Ruler is used to measure dimension „a“ of the duct inner section. This dimension is taken from the male shiplaped end of the board. The CLIMAVER® Red MM tool is used to create the first groove. The CLIMAVER® MM Square Ruler is again used to measure dimension „b“ of the duct inner section. The Red tool is used to create the second groove.
The final groove is made with the CLIMAVER® Blue MM tool using dimension „a“ again.
To complete the straight duct a single piece must be placed on top of the U shape. See diagram at the start of Chapter 3.
The flat piece is obtained marking dimension „b“ with the CLIMAVER® MM Square Ruler and cutting with the Blue MM tool. On the two sides where the Blue MM tool is, use the knife to obtain the overlaps in order to staple the U shape piece to the flat piece.

3.4. FABRICATION OF A STRAIGHT DUCT IN FOUR PIECES



CLIMAVER® Plus, Neto, Deco, A2 Plus, A2 Neto



CLIMAVER® APTA, CLIMAVER® STAR

This part is essential for all fittings that are produced using the Separate Pieces Method, although for straight ducts it is only really required for large cross sections. Its design is based on four similar single pieces of different sizes: two of them are „a"-40 mm, and the two others are „b"-40 mm. They will constitute the rectangular duct.

The four sides have one side cut with a blade, with no bevelling, whilst the other side is cut with the Blue MM Tool, leaving an overlap which is used for the sealing of the ducts.

The measurement of the pieces is „a"-40 mm starting from the left-hand edge of the panel, which is the base of the duct interior cross section. Once this measurement has been marked out, ensure that it coincides with the guide and pass the CLIMAVER® Blue MM tool. Cut the panel along the line you have obtained and clean the overlap. Repeat the process in order to obtain the other pieces 1, 2 and 4, where you will need to substitute the measurement „a"-40 mm by „b"-40 mm.

Finally, in order to obtain the straight section, staple the overlap of each cover to the straight edge of the next and close the duct with the fourth piece, stapling it and sealing each joint with the tape.

We would like to remind the installer here that when using the CLIMAVER® MM Square Ruler, the 40 mm does not need to be deducted. You only need to take the „a" and „b" measurements directly.

4. Creating Elbows and Offsets

4.1. HOW TO FABRICATE ELBOWS

The first duct assembly explained in this handbook is the elbow. The terminology "duct assembly" is used to explain a non-straight duct or ducts which have been joined together.

An elbow is used to change the direction in an airflow network, without dividing the airflow in two.

4.1.1. CREATING A 90° ELBOW USING THE STRAIGHT DUCT METHOD

A straight duct is made as in Chapter 3. A cutting point is chosen at a minimum of 20 cm from the end of the straight duct.
A guideline from the lined outer surface of the CLIMAVER® board is chosen from one of the duct surfaces. The cutting line will follow this CLIMAVER® cutting guideline. On the two adjacent surfaces, two vertical lines are marked on the outer covering.
The subsequent cut will follow the cutting lines which are an integral part of the surface of the CLIMAVER® board. The 22.5° degree cut is made with the White Label Tool (see Chapter 2.2.1). The cuts made at 90° to the direction of the board are made by the Yellow Label Tool.
The same step is repeated at a distance of more than 15 cm from the lines but with an angle of 22.5° symmetrical to the previous line in order to obtain three duct sections.
Once all the lines are cut, the middle piece is rotated by 180° and the elbow is created. It is not necessary to put deflectors. The sealing of the pieces should be done as below.
Please see the layouts on the next page:

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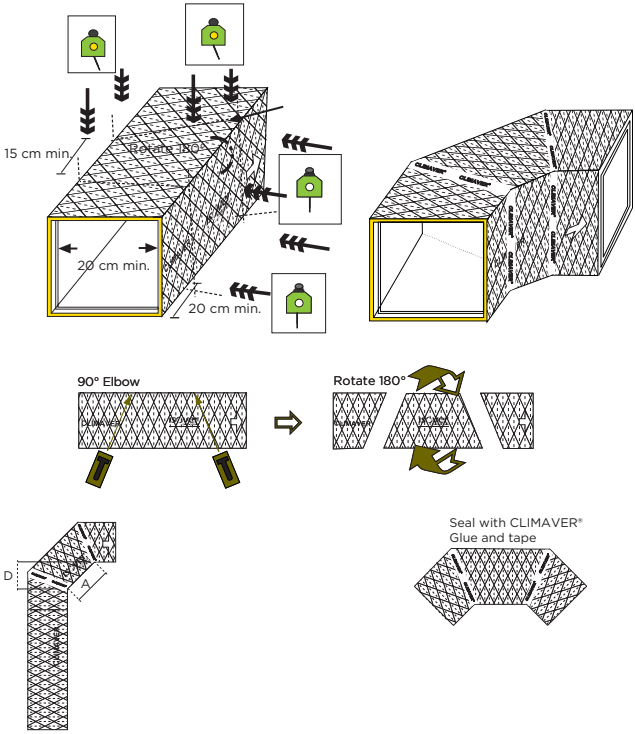
Note: It is essential that one of the guidelines from the outer covering (or an imaginary parallel one), with an angle of 22.5°, is used. If the line were not followed elbows less than 90° (closed elbows) or more than 90° (opened elbows) would be created.



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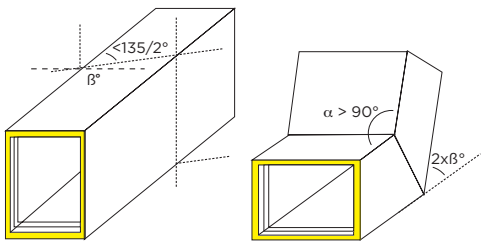
Separation A (cm)	Distance D (cm)
15	10.6
20	14.1
25	17.7
30	21.2
35	24.7
40	28.3
45	31.8
50	35.4
55	38.9
60	42.4

4.1.2. ELBOW WITH ANGLES BIGGER THAN 90°

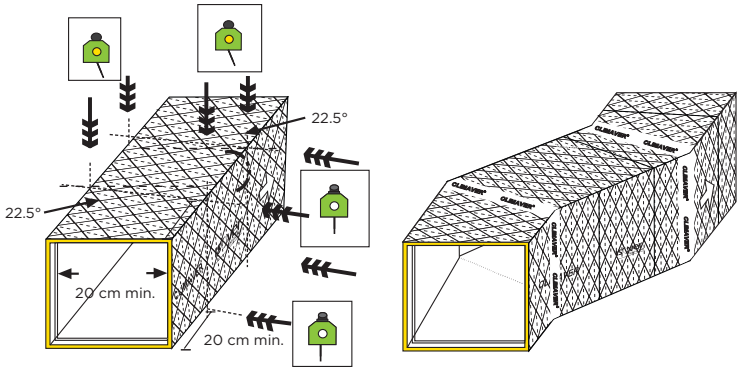
A straight duct is made as in Chapter 3. A cutting point is chosen (see the following drawings). The subsequent cut will follow the cutting lines which are an integral part of the surface of the CLIMAVER® board. The 22.5° degree cut (angle beta) is made with the White Label Tool (see Chapter 2.2.1). The cuts made at 90° to the direction of the board are made by the Yellow Label Tool. One of the pieces made will be rotated at 180° to create the elbow.

There is no male shiplap and female shiplap end to these pieces and therefore no flap through which the pieces can be stapled. A bead of CLIMAVER® Glue is applied all along the rims to join the 2 pieces and to close the inner surface of the duct. After joining the pieces, the CLIMAVER® adhesive tape is applied and any excess glue cleaned off using the CLIMAVER® spatula. See Chapter 2.2.2 for further adhesive and tape information.

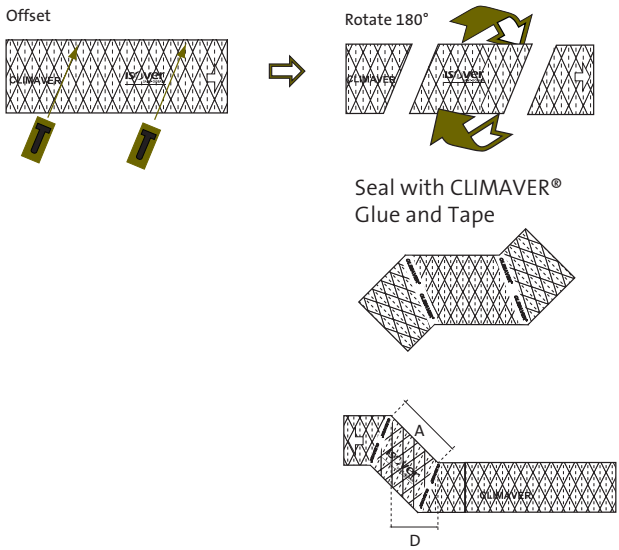


4.2. OFFSET

Offsets are necessary in order to change the direction of the duct or to avoid obstacles in its way. The duct maintains the same size of cross-section along its length. The next drawing shows the construction method.



Separation A (cm)	Distance D (cm)
15	10.6
20	14.1
25	17.7
30	21.2
35	24.7
40	28.3
45	31.8
50	35.4
55	38.9
60	42.4
65	46
70	49.5
75	53
80	56.6



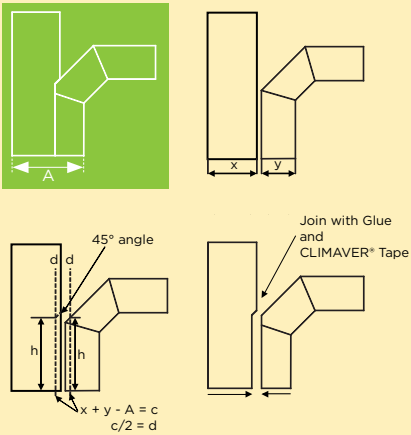
5. Creating Dynamic Branches

Branches are duct assemblies that divide a single airflow into separate airflows. Double branches split the airflow into two within the ductwork. It can change the direction of one of the circulating air flows (single or "R" branch) or both (double branch).

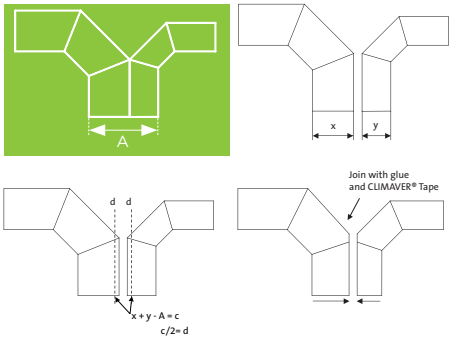
Note: The main branch will have the biggest proportion of any airflow within it.

5.1. SIMPLE DYNAMIC BRANCH OR „R" BRANCH

„A" is the overall dimension of the finished dynamic branch. A dynamic branch is made of a straight duct and an offset duct with dimensions „x" and „y" respectively. B=x+y with B>A. Subtract A to B (B-A) to get the intersected size which then leads to the calculation of the dimension „c". This measurement „c" is to be divided by 2 which are then called „d". This dimension „d" is then marked on each of the faces of the duct which will eventually be joined. The dimension „d" will intersect with the other marked line „h". „h" is simply the point at which the two ducts need to meet. This intersected area needs to be cut out using the CLIMAVER® Knife or White Label Tool. The joints are sealed with CLIMAVER® Glue and then CLIMAVER® Tape is used to overlap the joint to increase the joint strength.



5.2. DOUBLE DYNAMIC BRANCH USING STRAIGHT DUCTS



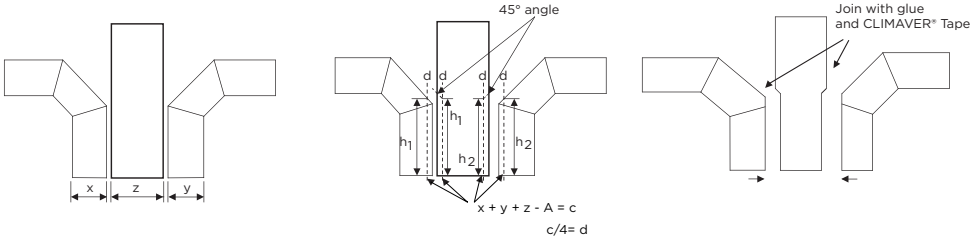
This assembly separates a single airflow into two airflows. „A" is still the overall dimension of the finished dynamic branch.

Elbows of the branches for this duct assembly are built using the instructions from the previous chapters. The two elbows can have different sections and the sum of both sections can be greater that the one from the main duct, but the height of the point at which the offset begins must be the same. See the illustration.

The principle of assembly is the same as the one of the Simple Dynamic Branch.

The joints are sealed with glue and then CLIMAVER® Tape is used to the overlap the joint to increase the joint strength.

5.3. TRIPLE DYNAMIC BRANCH USING STRAIGHT DUCTS



The triple dynamic branch is a duct assembly that divides airflow into three.
„A“ is the overall dimension of the finished dynamic branch. It is made from a straight duct with dimension „z“ and also two offset ducts with dimensions „x“ and „y“ respectively.
Firstly, add the external measurements of the three airflow exits „B“ which is „x“ added to „y“ and added to „z“. Subtract the measure „A“ to get the resultant size which then leads to the calculation of the dimension „c“.
This measurement „c“ is to be divided by 4 which is then called „d“.

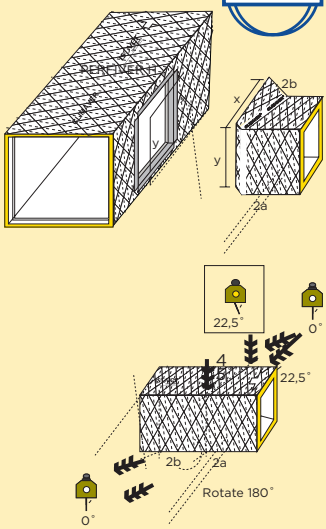
This dimension „d“ is then marked on each of the faces of the duct which will eventually be joined. The dimension „d“ will intersect with the other marked lines „h“ and „h2“. „h“ and „h2“ are the points at which the ducts intersect. This intersected area needs to be cut out using the CLIMAVER® Knife or White Label Tool.
The joints are sealed with CLIMAVER® Glue and then CLIMAVER® Tape is used to overlap the joint in order to increase the joint strength.

5.4. DYNAMIC BRANCH FROM ONE OF ITS 4 SIDES: COMMONLY KNOWN AS A „SHOE“

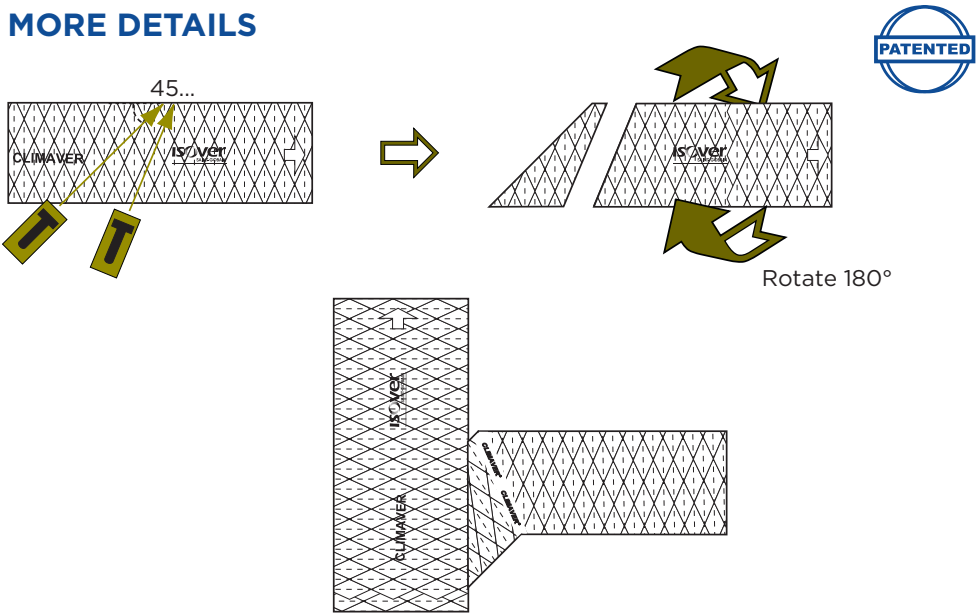
PATENTED

In case the dynamic branch cannot be made, there is an alternative method that can be used for connections to diffusers, grilles or other installations, and is a quick and simple method.

1) Firstly, the branch dimension required is cut out of the side of the duct using the CLIMAVER® Knife.
2) The profile Perfiver H is placed on the main duct (see Chapter 7 for more details on CLIMAVER® Metal).
3) The branch is then added and inserted into the main duct which creates a friction fit connection with the Perfiver H. The branch cannot pass into the inside of the main duct due to the fact that the Perfiver H has a lip on the inside.
4) Finally, CLIMAVER® Tape is applied along the perimeter of the branch and the Perfiver H.



MORE DETAILS



6. Creating Reductions

Reductions are very commonly found in ductwork systems. They are defined as changes in the duct cross sectional area dimension and are used to alter the airflow direction and speed. Reductions are the only kind of duct fittings that should be made with the Flat Pieces Method.
There are different kinds of reductions depending on the number of sides to be reduced (1, 2, 3 or 4 sides) and the axis of its two entrances (centred or off-centre).

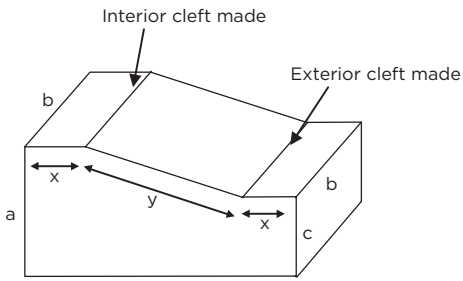
Some common aspects to the fabrication of reductions:

- The straight part of the reduction (called dimension „x“) must be taken into account and must be a minimum of 10cm in size. This ensures a suitable amount of CLIMAVER® material onto which the principal duct leading to the final reduction can be fixed.
- It is better if the reduction is as long as possible (min 30 cm), in order to avoid sudden impacts within the airflow.
- When possible, start with the flat piece, which provides a good guide for building the reduction.
- All the faces which are folded must have transversal cuts (clefts). Try to avoid leaving open cuts that may weaken the duct board.
- If the reduction is to impel the airflow, the male side of the CLIMAVER® board must be reduced, or conversely, the female side must be reduced.
- In bending the flat pieces, an inner angled cut (cleft) at a dimension of „x“ from the edge is made and bent into place. It should always be on the side of the module. Similarly another cut is made on the other edge of the module, also with dimension „x“.
- Sometimes a sharp change in direction or in the duct section requires to cut segments (bevel cuts on the duct board).
- All clefts and cuts must always be glued or taped.

6.1. REDUCTION ON ONE SIDE: U-SHAPE AND A FLAT PIECE

6.1.1. GENERAL

To fabricate the U shape, two cuts are made with the Red MM tool at distances „a+1cm“ and „b+1cm“ from the edges; **remember that if the Square Ruler is used to make the cuts, then it is not necessary to add one centimetre because the ruler is calibrated to do this automatically.**
Two lines also have to be marked and should be parallel to the shiplaped ends at distance „x“ on both sides.



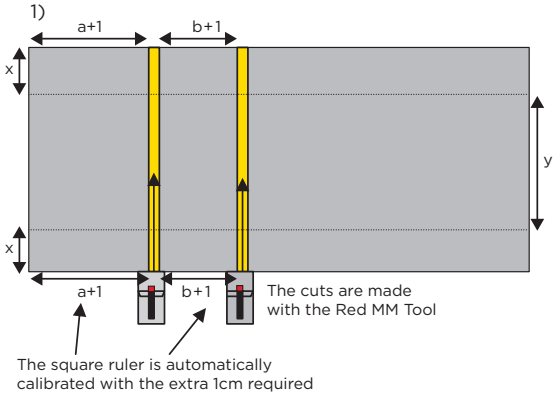
y ≥ 30 cm
x ≥ 10 cm
Please note that the two „x“ do not have to be the same at the two edges of the duct.

6.1.2. FABRICATION

1) First of all, cut the panel twice with the Red MM tool at the dimensions „a+1cm“ and then „b+1cm“. The extra 1cm is taken into account when using the square ruler.

2) To the left hand side of the first cut, a line of „x“ cm length is traced at a distance of „c+1 cm“.

Note: „c“ is the dimension or height at the end of the reduction. Another line of „x“ cm length is traced at a distance of „c+2 cm“ on the opposite side of the second cut.

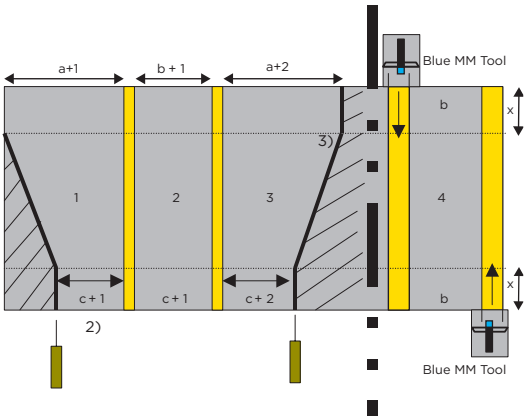


3) After the second cut another line of „x“ cm length is traced at a distance of „a+2 cm“. The two lines can then be joined together, on both sides of the duct. The lines you will make will create the reduction effect, as illustrated.

4) The reduction's lid can now be cut.

Cut the last piece using the Blue MM tool with dimension „b“ as shown. There is no exact starting point for this cut as it just needs to be on the side of the „U-shape“ template already cut out.

The blue tool is used as it creates the foil flaps through which the 2 pieces can be stapled together.



5) An internal cut is realized on one side and an external one on the other. This lid will be shorter than the other three: just cut off what is not necessary from one side of the U-shape by reducing the distance „x“. Then, use the Black MM Tool to create ship-lap on this side.

6) Finally, staple and tape the two pieces together.

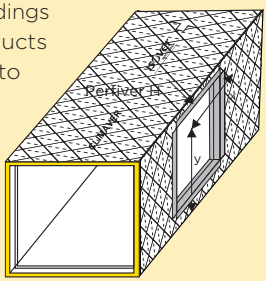
7. Machine Attachments and Reinforcements

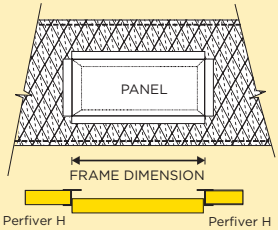
This chapter will focus on different auxiliary operations to be performed on a CLIMAVER® duct in order to complete the installation; for example, connections to machinery, connections to grilles or diffusers, supports and reinforcements.

7.1. FABRICATION OF AN ACCESS HATCH

PATENTED

Thermal installation regulations in buildings stipulate that the access hatches in ducts must be thermally efficient, in order to enable the inspections of duct installations.
In order to fabricate an access hatch, we have to cut a window of the chosen dimensions with the CLIMAVER® Knife. A frame must be placed in this window; this frame is made using the profile Perfiver H. In order to cut the profiles and shape the frame for the inspection cover, the profile must be cut at a straight angle.





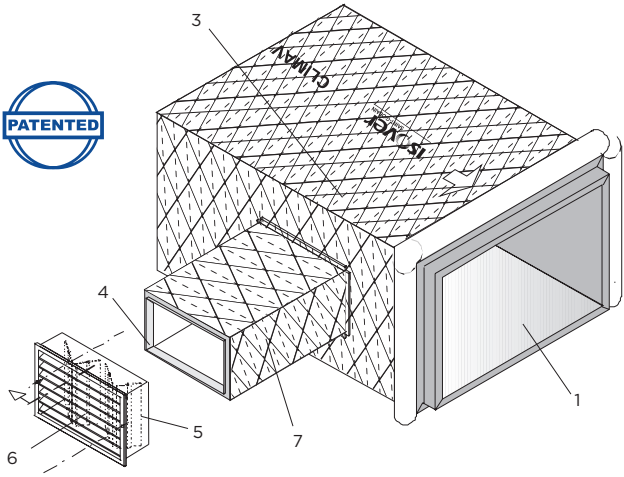
Note: CLIMAVER® can be adapted to fit standard access hatches. The profile Perfiver H can be used to fabricate connections to machines for all types of CLIMAVER® ducts.

7.2. CONNECTION TO A GRILLE OR DIFFUSER

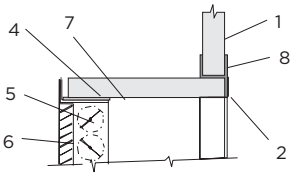
In order to make a connection from a duct, a frame is made using the profile Perfiver H as described previously, and with the same dimensions as the grille. A straight duct also has to be made with the same length as the distance between the false ceiling (in which the grille has been fitted) and the air conditioning duct (which it will be connected to). The maximum distance should be 20cm.
In order to make the connection, the straight section from the duct frame to the grille is made and joined with CLIMAVER® Tape. This ensures that the straight duct is airtight.
A similar process is used for connecting diffusers, but in this case the duct must be connected to a plenum (this plenum has to be placed before the outlet of the diffuser). This connection will be made this way: the angle between the duct and the diffuser air outlet has to be 90°, so that the kinetic energy of the fluid can turn into static pressure in the plenum.

	Installation	Duct direction	Objective of the duct
GRILLE	Directly	Parallel to the air outlet	Maximise kinetic energy
DIFFUSER	Through the plenum	Perpendicular to the air outlet	Maximise static pressure

The process is similar if a pipe is used for making the connection. In this case, we make a circular cut on the main duct, with similar dimensions to the coupling to attach. Then we place a ring or support bar on it in which the crown coupling will be installed. We place the flexi duct on top of this coupling. The other end of the coupling is connected to the diffuser or grille by a clamp.



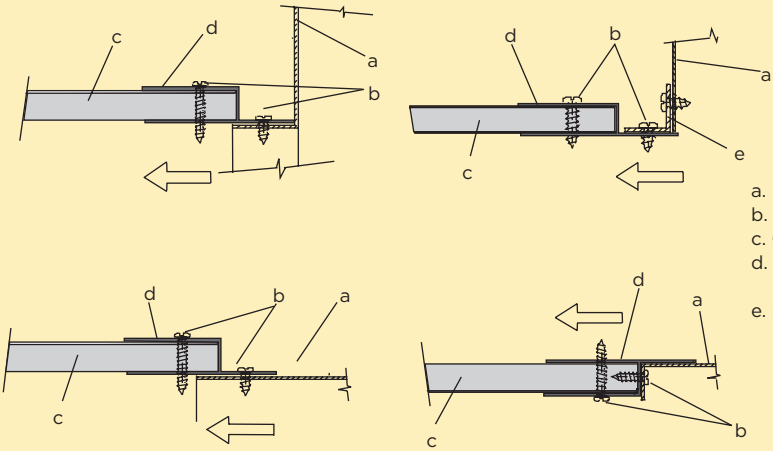
1. CLIMAVER® duct
2. CLIMAVER® Tape
3. Deflector
4. Metal frame
5. Hatch
6. Grille
7. Rectangular CLIMAVER® collar
8. Perfiver profile connection frame



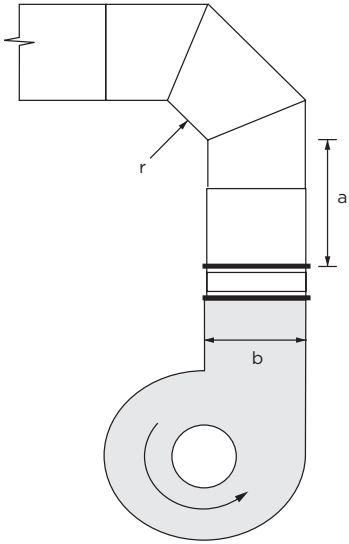
Section

7.3. CONNECTION TO A MACHINE

The outlet connecting the air conditioning equipment to the ducts is one of the most critical points in the installation due to the air speed, which is at its maximum at this point, and also due to the fact that normally there is little free space available at this stage.



a. Equipment clamp
b. Sheet metal screw
c. CLIMAVER® duct
d. Perfiver H profile joint
e. Sheet metal angle



Dimensions:
a = from 1.5* b to 2.5* b
where b is the maximum dimension of the fan mouth
r = minimum of 15 cm

There are different methods for connecting the main duct to the air conditioning unit.
Nevertheless, it will always be necessary to use the Perfiver H profile and screws to ensure that the connection is safe.

The following instructions must be observed when making the connection:

1) The fan outlet must remain in a straight duct with a length between 1.5 and 2.5 times the maximum length of the fan entrance.
2) If reductions are made after the outlet, they must have a maximum angle of 15°.
3) If an elbow is built, the direction of the airflow in the elbow must correspond to the direction of the fan.
4) The connection to the air conditioning unit must be adjusted using a flexible coupling; this will prevent the spread of vibrations.
5) Finally, and depending on the relative position of the equipment clamp and the air duct, it may be necessary to place a sheet metal angle to reinforce the connection.

7.4. REINFORCEMENTS

7.4.1. GENERAL

The distance between reinforcements is determined by the duct section and the maximum air flow pressure, with the intention not to reach maximum deflection, which is equivalent to one percent of the measurement of the side of the duct.

Normally there are two types of reinforcement:

1) Rods, which we do not recommend the use of due to the fact they go through the duct and make cleaning difficult.
2) C-shaped profiles, in order to make external perimeter and to reinforce each side.

The fabrication of reinforcements is explained in this chapter using this latter method.
In order to fabricate a reinforcement, the following components are needed:

- C-shaped profile to wrap around the entire duct
- sheet metal pieces of minimum dimensions 50x150mm
- sheet metal screws
- adhesive tape

7.4.2. FABRICATION METHOD

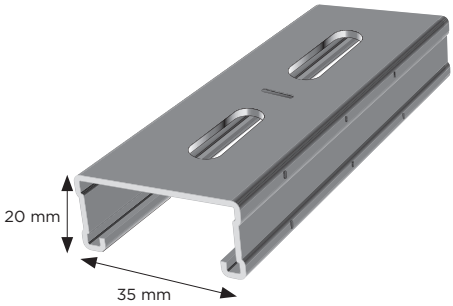
1) The exterior measurements of each duct side are taken: the length of the C profile will be the equivalent of the sum of the sides.

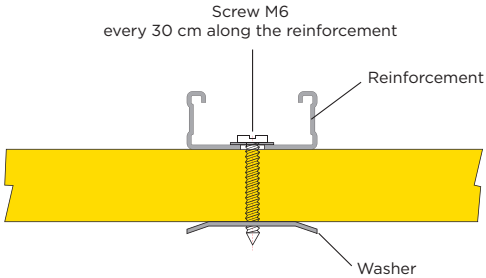
2) The legs of the C profile should be cut with tin snips to allow easy bending. In this way, the profile can be bent in order to adapt it to the exterior brim of the duct.

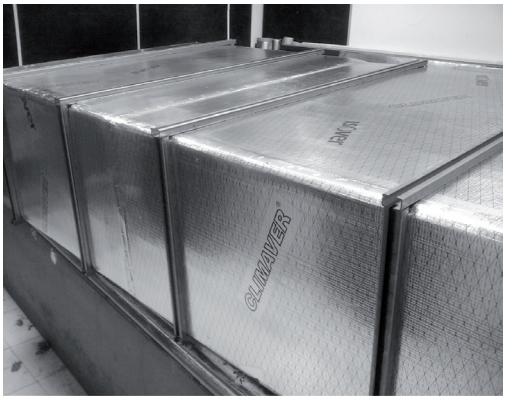
3) Holes are then drilled on the C profile. The holes are spaced at enough long intervals to guarantee no deflection.

4) The C profiles are held in place on the internal surface of the CLIMAVER® system using the washers. In supply: 1 washer per side is needed. In extract: 1 washer every 40 mm.

5) The cut profile is placed on the joint between the duct boards (male-female shiplap joint). Then the sheet metal screws are introduced into the holes of the profile, passing through the duct board and the C profile offcuts.







7.4.3. TABLES

The table below indicates the types of reinforcement and the distance between each reinforcement.

<table>
<tr><th rowspan="2">Duct inside dimensions</th><th colspan="3">Working pressure (positive and negative)</th></tr>
<tr><th>≤200 Pa</th><th>201 - 400 Pa</th><th>> 400 Pa</th></tr>
<tr><td>≤ 600 mm</td><td rowspan="3">No reinforcement needed</td><td rowspan="3">No reinforcement needed</td><td>No reinforcement needed</td></tr>
<tr><td>601 - 750 mm</td><td rowspan="4">≥ 601 mm
One reinforcement every 600 mm</td></tr>
<tr><td>751 - 900 mm</td></tr>
<tr><td>901 - 1050 mm</td><td rowspan="2">≥ 901 mm
One reinforcement every 1200 mm</td></tr>
<tr><td>1051 - 1200 mm</td><td rowspan="2">≥ 1051 mm
One reinforcement every 1200 mm</td></tr>
<tr><td>1201 - 1500 mm</td><td>≥ 1201 mm
One reinforcement every 600 mm</td></tr>
<tr><td>> 1500 mm</td><td colspan="3">Contact ISOVER team</td></tr>
</table>

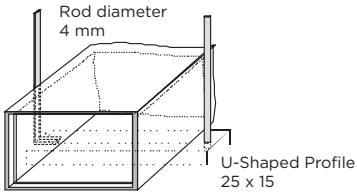
7.5. SUPPORTS

7.5.1. HORIZONTAL SUPPORTS

The final installation of ducts on the ceiling is made using supports. The distance between the supports is calculated according to the section of duct indicated in the following table.

It must also be remembered that only two transversal joints may be placed between supports. When the duct rim is less than 2m in length and has no reinforcement, a maximum of two transversal joints may exist between supports.

Inner distance (mm)	Maximum distance (m)
< 900	2.4
900 to 1500	1.8
> 1500	1.2

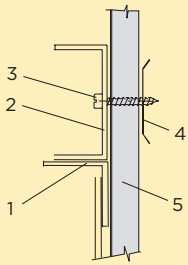


- The most common method of supporting ducts is by using horizontal „U-shaped“ profiles of 25 x 15 and made from galvanised 0.8 mm-thick sheet metal.
- This U-shaped profile is held to the ceiling by two threaded rods of at least 4mm diameter.
- When the duct is reinforced, it is recommended that the support coincides with the reinforcement, provided that the maximum distance stipulated in the previous table is not exceeded. In this case, two bars and screws to the reinforcement frame would join the vertical support elements.
- It is also possible to use the gripple-type cable suspension system, with the distance between them being the same as that using profiles.

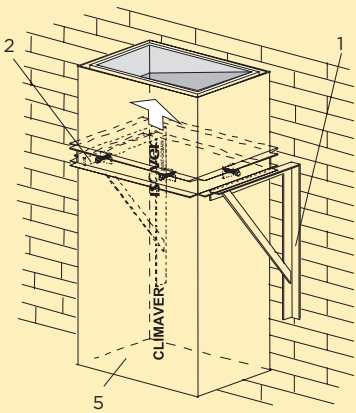
7.5.2. VERTICAL SUPPORTS

The vertical supports will be placed at a maximum distance of 3m.

1. L-shaped profile support bracket
2. Clamp for built vertical installation by L-shaped profile
3. Sheet metal screw
4. 40mm washer
5. CLIMAVER® duct



Cross-section

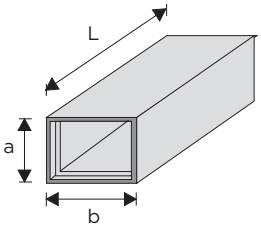


When a vertical wall supports the duct, the anchoring must coincide with the reinforcement. In this case, a sheet metal coupling must be attached to the reinforcement.
The support is made using an angle support of at least 30 x 30 x 3 (mm).

7.6. MEASUREMENT OF CLIMAVER® DUCT

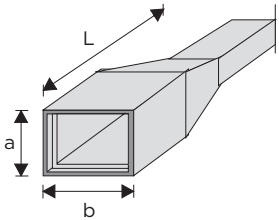
This part is a guide for calculation of square meters of CLIMAVER® ductwork depending on duct dimensions (with 0.025m thickness).
The following diagrams show the different elements with their concerning calculation terms in meters.

STRAIGHT DUCT



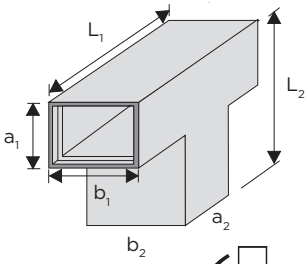
$S = 2 \cdot (a + b) \cdot L$

REDUCTION

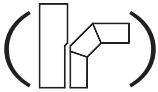


$S = 2 \cdot (a + b) \cdot L$

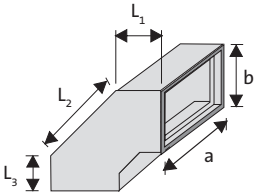
SIMPLE DYNAMIC BRANCH



$S = 2 \cdot (a_1 + b_1) \cdot L_1 + 2 \cdot (a_2 + b_2) \cdot L_2$

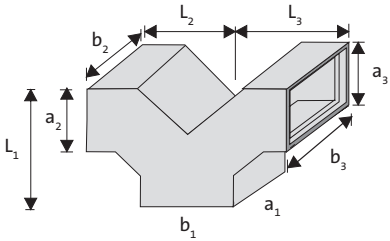


ELBOW



$S = 2 \cdot (a + b) \cdot (L_1 + L_2 + L_3)$

DOUBLE BRANCH



$S = 2 \cdot (a_1 + b_1) \cdot L_1 + 2 \cdot (a_2 + b_2) \cdot L_2 + 2 \cdot (a_3 + b_3) \cdot L_3$

Learn more about CLIMAVER® installation: visit our YouTube channel and watch the CLIMAVER® videos.

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