AR

Soundproof Evacuation System




Choose well to live better

MOLECOR
Smart water

Soundproof Evacuation System

You will only hear advantages

- Optimum fire resistance in compliance with the CTE (Spanish Technical Building Code).
  Classification **B-s1,d0**
- Range available in DN32 to DN315 mm.
- Service life of over 50 years.
- Optimal soundproofing **10 dB** at a flow rate of 2 l/s
- 100% recyclable environmentally friendly product.

AENOR TUBOS PLÁSTICOS 001/007316
AENOR ACCESORIOS PLÁSTICOS 001/007328
AENOR REACCIÓN AL FUEGO 001/007318
AENOR REACCIÓN AL FUEGO 001/007329
AENOR COMPORTAMIENTO AL RUIDO 001/007332
CERTIFIÉ PAR LNE NF SECURITE FEU : NF Me TUBES ET RACCORDS PVC

Contents

AR® Soundproof Evacuation System
Noise-free innovation

Noise pollution is highly important when it comes to determining quality of life indexes for building projects. Mistakes in **soundproofing** can have major repercussions for builders, installers and project managers, because they are often either impossible or very expensive to resolve. Building regulations in each country establish certain soundproofing requirements as a basis for the construction of optimal homes.

The **AR® soundproof range** from **Molecor** is a system designed specifically to meet the fluid Evacuation needs of networks (drains, downpipes and suspended collectors) with the strictest noise level reduction requirements.

The noise levels produced by the **AR® Soundproof Evacuation System** are better than the maximum ranges demanded by the **Spanish Technical Building Code (CTE)**, guaranteeing increased comfort in homes and a significant reduction in the unpleasant noise generated by Evacuation of liquids.

The “Soundproofing (HR)” basic requirement in the **CTE** specifies that “buildings should be designed, built and maintained such that the construction elements comprising their enclosures have suitable acoustic characteristics to reduce the transmission of airborne noise, the noise of impacts, and the noise and vibrations of the building's facilities, and to limit the reverberating noise of the enclosures.”

The sound level measurement carried out by **Molecor** follows the specifications set out in the **UNE-EN 14366** standard, which describes the test bench and the noise measurement procedure.

Characteristics

• Meets and exceeds all requirements and basic demands established in the Spanish Technical Building Code (CTE).

• Can be installed in any type of building, in any enclosure, in accordance with CTE specifications.

• Totally safe and reliable; fully waterproof and airtight; passes all tests established by the CTE for water, air and smoke.

• Fast and easy installation, at a very low cost.

• Largest range of fittings, offering a solution to any issues that may arise during building works.

• Compatible with other PVC water Evacuation systems manufactured in accordance with UNE-EN 1329 and UNE-EN 1453 standards. No transition pieces needed.

Main advantages

Silent
The design and composition of the **AR® System** reduces the noise produced by liquids inside the system. This silent system is **certified with the N Mark from AENOR** for soundproofing.

No subsequent treatments
The surfaces do not require any anti-corrosion treatment following installation.

Mechanical strength
No need for any additional protection.

Optimal fire resistance
The products have a **B-s1,d0 fire resistance rating**, which is the highest possible for a plastic product.

Durability
The PVC pipes and fittings have a service life of over 50 years.

Easy installation and assembly on site
Installation is very straightforward, ensuring a totally waterproof and airtight system.

Sustainable
PVC is a 100% recyclable material that can be reused and recycled to produce new products. The **AR® System** has a minimal impact on the environment due to the optimisation of energy resources and low atmospheric emissions.

AR® Soundproof Evacuation System

First soundproof system manufactured in Europe using cutting-edge mineral-filled PVC with an AENOR certificate

The evolution of building processes, constant research into new materials and the need to construct buildings that are safer and more comfortable are all factors that **Molecor** takes into account when offering new solutions to the market, with constant improvements and innovations researched and developed by the company's **R&D&I** department.

Only soundproof system manufactured in Spain **with active fire resistance**

The pipes and fittings have a **fire-resistance classification of B-s1,d0**, in accordance with UNE-EN 13501, and the **NF Me Mark** for fire safety, in accordance with the NF 513 regulation, granted by the French Regulatory Association.

The **best noise reduction properties** of all PVC soundproof systems in Europe with an **AENOR certification**

Reduces noise produced by the movement of liquids inside the system due to the **density of the materials, without affecting flow rates** and respecting the thickness of the pipe walls, in accordance with the UNE standards required by the **Spanish Technical Building Code**.

Only soundproof system in Europe with **5 AENOR certifications** and 2 **NF Me** certifications from **LNE, AFNOR**

for rainwater and wastewater

Sustainability
Maximum respect for the environment

Environmental Product Declaration (EPD)
AR® Soundproof Evacuation System

GlobalEPD
A VERIFIED ENVIRONMENTAL DECLARATION

GlobalEPD EN15804-065

As per standards
EN ISO 14025:2010 and
EN 15804:2012+A2:2019

Operation Clean Sweep (OCS)
Member of the voluntary **OCS** programme.
AENOR certification in accordance with the OCS Europe scheme, which promotes and verifies the implementation of good cleaning practices and controls for spills, to manage and minimise accidental release of microplastics into the environment.

Contribution towards Sustainable Development Goals (SDGs)

Through its **Quality, Environment, Energy and Prevention Policy**, **Molecor** undertakes to work towards sustainable development that generates value and a positive impact for all its stakeholders, aligning its management strategies with the **Sustainable Development Goals (SDGs)** from the United Nations' 2030 Agenda, and making all its resources available to achieve this.

Due to the nature of the company and its products, its main contribution is to SDG 6 "Ensure availability and sustainable management of water and sanitation for all", as it is fully in line with the company's purpose.

The company's activities revolve around two main axes: developing and producing production systems that are more and more efficient, and manufacturing PVC pipes and fittings, with the objective of building safer, more sustainable hydraulic networks that supply the entire world.

Optimal water management
Highly durable Evacuation networks for contaminated wastewater due to the chemical strength of PVC.

Efficient use of energy
Renewable energy sources are a key part of our manufacturing processes at **Molecor**.

Innovative technology
Developing new processes and innovative products with a lower environmental impact.

Long service life
The PVC products manufactured by **Molecor** last for a very long time, with a service life of over 50 years.

Responsible use of resources
Only 43% of PVC comes from petroleum, a much lower proportion than other products.

Combating climate change
Lower CO_2 emissions throughout the product's lifecycle.

Protecting the oceans
The OCS programme enables us to minimise the accidental release of microplastics into the environment.

Minimal impact on the ecosystem
Products from **Molecor** have a low environmental footprint, as shown by the environmental product declarations.

Improving together
Molecor is a member of various associations and voluntary initiatives to help achieve the Sustainable Development Goals.

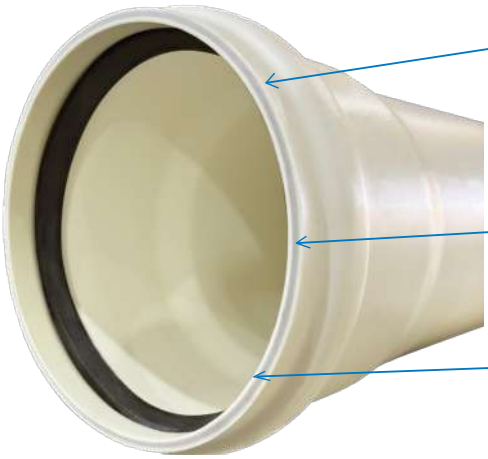
First soundproof system manufactured in Europe with cutting-edge mineral-filled PVC

The **AR® Soundproof System** range of pipes and fittings offers every solution that could be required by designers and installers, for both small and large-scale wastewater and rainwater Evacuation. The **AR® System** is the first soundproof system manufactured in Europe with cutting-edge mineral-filled PVC.

Triple-layer technology

During the **AR® Soundproof Evacuation System** development process, the R&D&I department at **Molecor** achieved optimal fire resistance and excellent noise reduction, demonstrated via numerous laboratory trials.

The pipes in the **AR® Soundproof Evacuation System** are made from PVC, in accordance with the **UNE-EN 1453** standard, and they contain three layers, each one designed specially for a particular purpose:



1-Outer layer: made from PVC with special additives, designed to withstand mechanical forces without any kind of additional protection.

2-Middle layer: made from PVC with high-density mineral content, which gives the pipe incredible soundproofing properties.

3-Internal layer: made from PVC with additives, specially designed to withstand high temperatures and abrasive substances. It also gives the internal surface an extremely smooth finish, thus preventing adherence of residue.

Single-layer PVC fittings produced in accordance with UNE-EN 1329

Available in a wide range of diameters, from ø32 to ø315 mm. The dimensions listed in the **Spanish Technical Building Code**.

• Small Evacuation (diameters 32, 40 and 50 mm)

The assembly system is Female-Female (FF), joined together with synthetic adhesive.

This joint system makes the installer's work easier, minimising loss of material as the 5-metre sections can be cut and adapted to the needs of the construction project.

• Large Evacuation (diameters 75 to 315 mm)

The assembly system is Male-Female (MF), connected with an elastic joint, with the exception of the 315 mm diameter, which is joined together with adhesive to simplify the installation.

The elastic joint in the pipes and the fittings enables them to withstand dilations and contractions produced in the downpipe, and also allows vibrations to be absorbed as liquid flows through the inside of the Evacuation system.

The largest selection of fittings

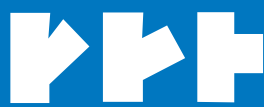
The **AR® Soundproof System** range of pipes and fittings offers every solution that could be required for any installation, in accordance with the requirements of the CTE.
It includes a large selection of special parts for various construction solutions:

1-metre pipes with 2 mouths, to avoid loss of material

Elbow bends 45° - 67° 30´ - 87° 30´

Changes of direction and special parts with inspection vents for downpipes, collectors and joints between the downpipes and the collector

Single branches 45° - 67° 30’ - 87° 30’



Soundproof siphonic canisters in the same material as the rest of the system

Multiconnector graft and secondary vent graft

Plugs

The only soundproof system made in Spain with active fire resistance

The **AR® Soundproof Evacuation System** complies with the highest fire resistance standards for plastic products demanded by the **Spanish Technical Building Code**: **B-s1,d0**, so it can be installed in any type of building and all kinds of enclosures, meeting every single fire safety requirement stipulated by the CTE.

- **AENOR** fire-resistance product certification for structured-wall PVC pipes for rainwater and wastewater Evacuation in accordance with the **UNE-EN 13501-1** standard, with the **B-s1,d0** fire rating.
- **AENOR** fire-resistance product certification for unplasticised PVC fittings for rainwater and wastewater Evacuation in accordance with the **UNE-EN 13501-1** standard, with the **B-s1,d0** fire rating.
- **NF Me** mark fire safety certification for PVC fittings and structured tubes, in accordance with the **NF 513** regulation issued by the **LNE** (the French Laboratoire national de métrologie et d'essais).

The **B-s1,d0 classification**, in accordance with the **UNE-EN 13501-1** standard, signifies the following:

B Fire resistance of the material: combustible and no contribution to fire.

s1 Low smoke production, minimal opacity and slow propagation.

d0 Does not produce flaming droplets or particles, so there is no contribution to the spread of fire.

B-s1,d0

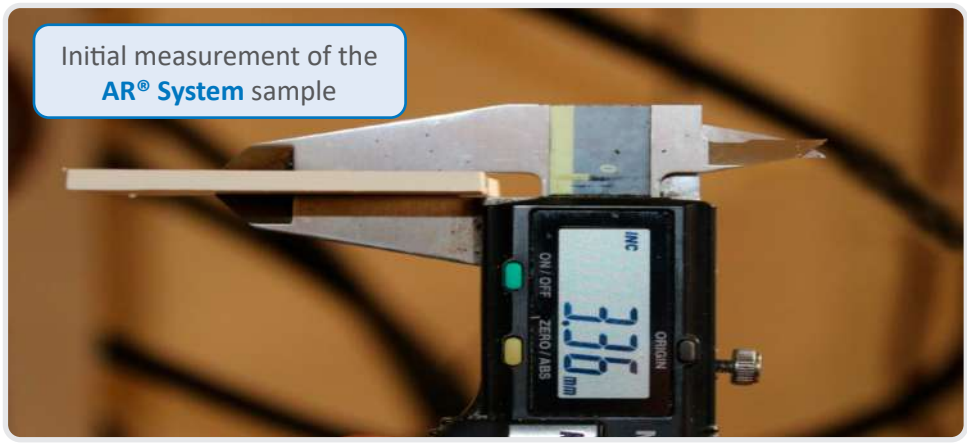
The French NF **Me** mark certifies that the wall of the pipe or fitting expands internally by a minimum of 800%, measuring the expansion rate of the material when submitted to high temperatures produced by a fire.
This expansion helps to seal the downpipes, preventing the passage of smoke between compartments.

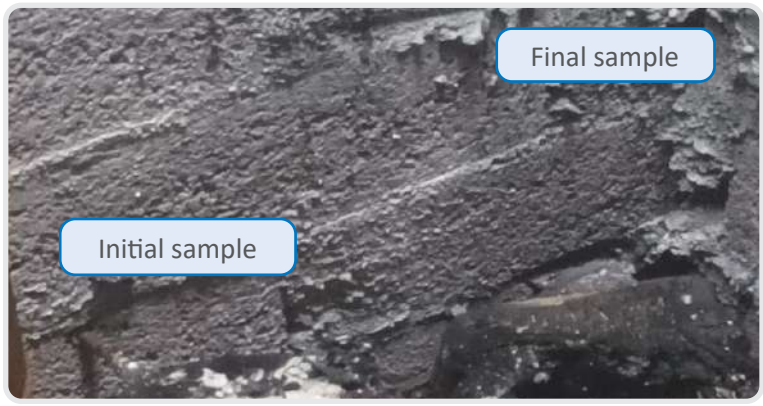
Meringage Test (Me)

The NF-513 regulation approved by AFNOR.
Location: Molecor Factory. Alcázar de San Juan (Ciudad Real).

This regulation indicates that the wall should expand to 8 times its original size within 3 minutes of being exposed to heat. The testing furnace reaches a temperature of 750º.

- **As per the test method**, for an initial thickness of 3.36 mm, the final thickness should expand by 800%, resulting in a thickness of 26.88 mm.
- **AR® Soundproof System Me Test**: for an initial thickness of 3.36 mm, it should expand to 17.09 times the initial size, resulting in a thickness of 57.41 mm within a time of 1 minute and 40 seconds.





Reaction of the AR® System to a fire at a construction site

110 diameter pipe cutting from the affected downpipes.

Condition of the 110 diameter downpipes on the floors affected by fire on the floor where the fire occurred.

Close up view of the affected downpipes; the internal expansion can be seen, preventing the spread of smoke, and the external part is only blackened by the fire.

View of the other affected downpipe that fully closed the installed pipe.

Downpipes on the floor directly below that were not affected as the **AR® System** did not spread the fire through flaming particles or droplets.

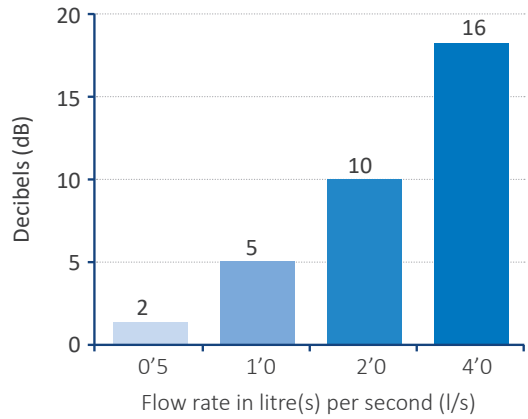
Ground floor and collectors.

The best noise reduction properties of all PVC soundproofing systems in Europe, with an AENOR certification

The range of pipes and fittings that make up the **AR® Soundproof Evacuation System** has been designed specifically to meet the fluid Evacuation needs of networks (drains, downpipes and suspended collectors) with the strictest noise level reduction requirements.

The noise levels obtained by the **AR® System** ensure optimum comfort in homes and a significant reduction in bothersome noise caused by the Evacuation of liquids.

The sound level measurement achieved by the **AR® System** follows the specifications set out in the **UNE-EN 14366** standard, which describes the test bench and the noise measurement procedure. The values indicated are those recorded at the noise measurement site, on the other side of the wall supporting the installation.



10 dB

At a flow rate of 2 l/s

These values for flow rates of 0.5, 1.0, 2.0 and 4.0 litres per second are 2, 5, 10 and 16 dB(A) respectively.

The noise reduction testing was performed at the **Fraunhofer Institute in Stuttgart** (Germany) under the supervision of **AENOR** (Figure 1).

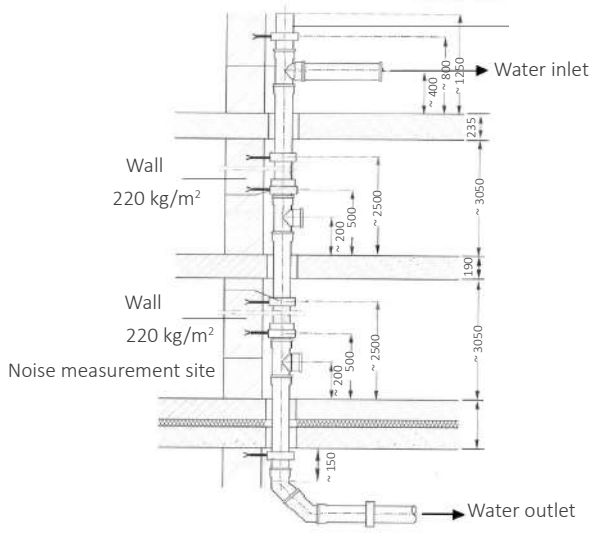


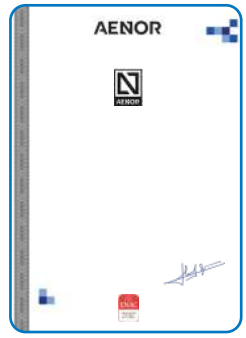
Figure 1. Installation of AR® ø110 pipe and fittings with anti-vibration clamps.

Certificates

Product certificates

The **AR® System** is the only soundproof system in Europe with five AENOR certifications and both NF Me certificates from LNE, AFNOR:

AENOR product certificate for structured-wall PVC pipes for rainwater and wastewater Evacuation, in accordance with the UNE-EN 1453-1 standard.

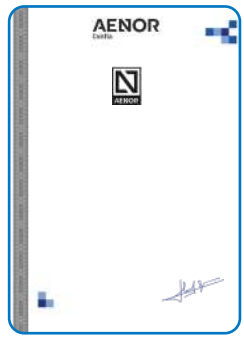


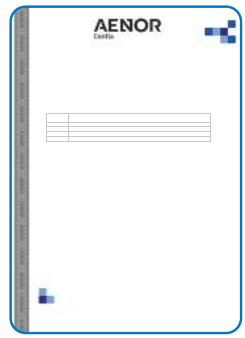
AENOR product certificate for PVC-injected fittings for rainwater and wastewater Evacuation, in accordance with the UNE-EN 1329-1 standard.

AENOR fire-resistance product certificate for structured-wall PVC pipes for Evacuation of rainwater and wastewater, in accordance with the UNE-EN 13501-1 standard, with the B-s1,d0 fire-resistance classification.

AENOR fire-resistance product certificate for PVC-injected fittings for Evacuation of rainwater and wastewater, in accordance with the UNE-EN 13501-1 standard, with the B-s1,d0 fire-resistance classification.

AENOR product certificate for soundproof pipes and accessories, in accordance with the UNE-EN 14366 standard.

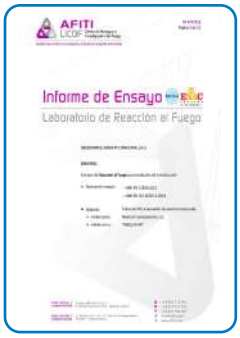




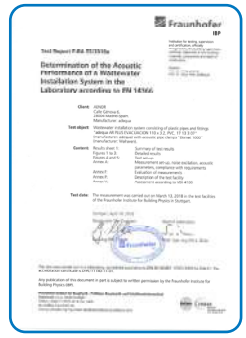
NF Me mark fire-safety certificate for PVC fittings and structured pipes, issued by the LNE (entities mandated by AFNOR).

Test reports

Fire-resistance test report for construction products in accordance with the UNE-EN 13823 and UNE-EN ISO 11925 standards. AFITI-LICOF.



Sound behaviour test report in accordance with the UNE-EN 14366 standard issued by the FRAUNHOFER INSTITUTE.



All the existing and up-to-date certificates can be found on the company website: **www.molecor.com**.

Sustainability
Maximum respect for the environment

Molecor is fully committed to promoting a more sustainable society. As such, we make great efforts to ensure our activities have a positive impact, making decarbonisation and the circular economy core pillars of our business, and working actively to develop initiatives and sustainable and responsible products that help to preserve the environment and mitigate the effects of climate change.

More eco-efficient pipes and fittings

The **AR® pipes and fittings** are **sustainable and eco-efficient products** as, from the earliest stage of development, they are designed to generate the lowest environmental impact possible, producing highly durable and fully recyclable products with efficient consumption of resources during manufacture and use.

Efficient and sustainable use of resources
PVC has a lower dependence on petroleum, which makes up only 43% of its composition. This has a significant effect on its environmental impact as less fossil fuels are used in the manufacturing process.

Molecor is also fully committed to product safety, which is why they do not use additives containing heavy metals like lead or tin in the formulation of their **AR® System** products, and nor do they use other additives containing substances of very high concern (SVHC).

High durability
The **AR® System** has an estimated service life of over 50 years. This is due in large part to the chemical stability of PVC, which means that products made with this material do not break down over time as they are resistant to a wide range of chemical products and are not subject to electrochemical corrosion.

Responsible and circular production

Firstly, it is worth highlighting that PVC is a **100% recyclable** material that can be reused to manufacture new plastic products without losing its original properties.

PVC is the primary waste product generated during our production processes at **Molecor**, as such, to minimise its impact, we have implemented a recycling process for this waste that enables us to reuse materials that for various reasons were not used during the production process, using them to manufacture new products. For this purpose, we have implemented mechanical reprocessing facilities that allow us to reuse practically 100% of the PVC waste generated through our activities, using it as a raw material in the manufacture of new pipes and fittings.

Reusing this reprocessed material to manufacture new products enables us to reduce our consumption of raw materials, thus using resources more responsibly and contributing towards the **Circular Economy**.

Reuse of PVC waste in the production process also reduces PVC waste generation to practically zero, demonstrating our firm commitment to responsible waste management.

Protecting ecosystems

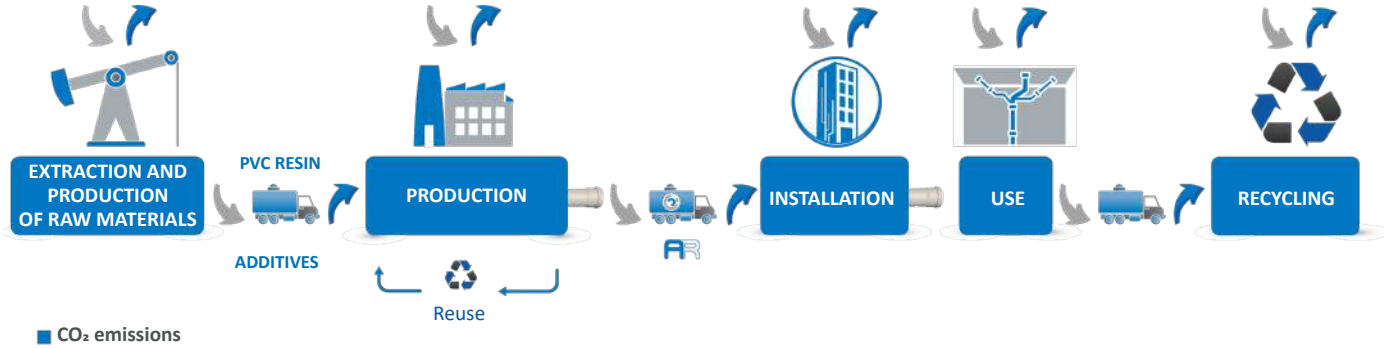
Molecor is conscious of the impact generated by its activities, which is why we are fully committed to continue improving through various **sustainability** initiatives.

Operation Clean Sweep® (OCS) is a global voluntary initiative in the plastics industry whose goal is to prevent involuntary release of plastic particles (chippings, flakes, dust) into the environment, which may occur at any stage of the plastics value chain: production, handling, transport, processing and recycling.

But **Molecor** is not only a member of the ***OCS*** programme, it has also obtained the associated certification, demonstrating its commitment and responsibility when it comes to protecting ecosystems both on land and in water. This certification was issued by **AENOR** in accordance with the requirements of the ***OCS Europe*** scheme, highlighting the organisation's commitment to the environment and certifying the implementation of good practices for the management of plastic materials in all the activities carried out in its facilities, which enable us to control and minimise the involuntary release of microplastics into the environment.

Low environmental footprint. Environmental product information

Molecor has assessed the environmental impact of its **AR®** pipes and fittings in all stages of their life cycle, from the cradle to the grave, for their use in the construction sector, i.e. from the extraction of raw materials to the final installation of the product, including manufacture, distribution and use of the pipes. This life-cycle assessment (LCA) was performed in accordance with the ISO 14040 and ISO 14044 standards.



Life cycle of the AR Soundproof Evacuation System

Environmental Product Declaration

This assessment was used to produce the Environmental Product Declaration (EPD), in accordance with the requirements of the EN ISO 14025 standard, applying the product category rules (PCRs) for construction products, as outlined in the EN 15804:2012 + A2:2019 standard.

GlobalEPD
A VERIFIED ENVIRONMENTAL DECLARATION
GlobalEPD EN15804-065
As per standards
EN ISO 14025:2010 and
EN 15804:2012+A2:2019

We assessed the environmental impact generated by the **AR® System** on 16 environmental indicators that are categorised according to the different areas affected:

Air and atmosphere

Global warming (climate change), ozone depletion, acidification and photochemical ozone formation.

Water

Freshwater eutrophication, marine eutrophication, water use and ecotoxicity in freshwater ecosystems.

Soil

Terrestrial eutrophication, potential depletion of fossil fuels, potential depletion of non-fossil resources and soil quality index potential.

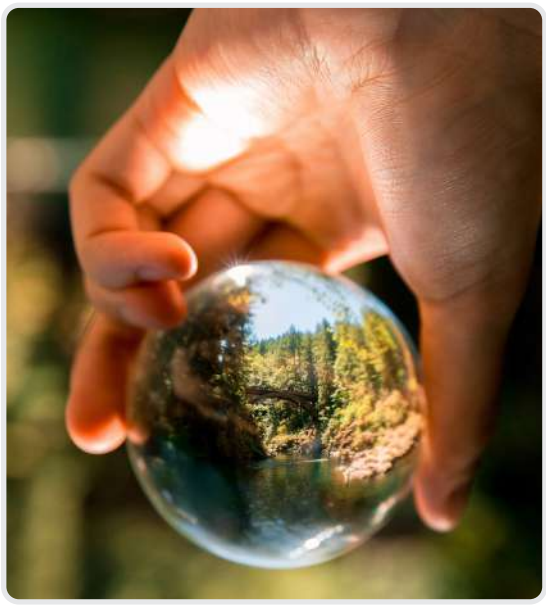
Human health

Human toxicity-Carcinogenic effects, Human toxicity-Non-carcinogenic effects, illnesses caused by emission of particulate matter and HH ionising radiation.

AR®
Declared unit: 1 kilogram

Parameter	Unit	Total
GWP-Total - Global warming (climate change)	kg CO_2 eq	1.46E+00
ODP - Ozone depletion	kg CFC-11 eq	3.57E-07
AP - Acidification	mol H+ eq	4.60E-03
EP-freshwater - Freshwater eutrophication	kg P eq	3.78E-05
EP-marine - Marine eutrophication	kg N eq	1.00E-03
EP-terrestrial - Terrestrial eutrophication	mol N eq	1.01E-02
POCP - Photochemical ozone formation	kg NMVOC eq	4.12E-03
ADP-minerals & metals - Abiotic resource depletion potential	kg Sb eq	5.60E-06
ADP-fossil - Fossil fuel depletion potential	MJ, v.c.n.	2.40E+01
WDP - Water use	m^3 eq	2.73E+00
PM - Illnesses caused by particulate material emission	Incidence of illnesses	4.78E-08
IRP - HH ionising radiation	kBq U235 eq	1.51E-01
ETP-fw - Ecotoxicity in freshwater ecosystems	CTUe	6.34E+00
HTP-c - Human toxicity-Carcinogenic effects	CTUh	4.17E-10
HTP-nc - Human toxicity-Non-carcinogenic effects	CTUh	1.18E-08
SQP - Soil quality potential index	Pt	9.32E+00

Environmental parameters obtained from the Life-Cycle Assessment (LCA) for the production of 1 kilogram of AR® product analysed.



The most well-known environmental parameter is the Carbon Footprint, which takes into account greenhouse gas emissions in the atmosphere expressed as CO_2. This corresponds to the climate change or global warming environmental indicator.

AR® Soundproof Evacuation System

Developments in construction processes, continuous research into new materials and the need to construct safer and more comfortable buildings are requirements that **Molecor** takes into account in order to bring new solutions to the market.

Thanks to these high standards, the **AR® Soundproof System** meets all current regulations regarding the essential requirements and demands for rainwater and wastewater Evacuation systems stipulated in the basic documents of the **Spanish Technical Building Code (CTE)**.

CTE Basic Document on fire safety (SI). Fire resistance

In accordance with **Table 4.1. Fire resistance classifications for construction elements** outlined in *point 4 of Basic Document SI on fire safety - SI 1. Indoor propagation*:

Location of element	Cladding	
	Roofs and walls(*)	Floors(*)
Usable zone	C-s2, d0	E_{FL}
Protected corridors and stairways	B-s1,d0	C_{FL}-s1
Car parks and enclosures at particular risk	B-s1,d0	B_{FL}-s1
Hidden spaces that are not watertight, such as airwells, false ceilings and raised floors (except those that exist within homes), etc., or that, if they are watertight, contain facilities liable to start or spread a fire.	B-s3, d0	B_{FL}-s2

(*) Includes the pipes and conduits that run through the indicated areas without a fire-resistant coating. For pipes with linear thermal insulation, the fire rating will be the one indicated, but including sub-index L.

The **UNE-EN 13501** standard includes the Euroclass classification for construction products and elements based on data obtained from fire-resistance testing.
In accordance with this standard, the **AR® Soundproof Evacuation System** qualifies for the highest possible fire-resistance standard for a plastic product: **B-s1,d0**.

The **B** parameter indicates that the soundproof system is combustible, with practically zero contribution to fire. It is self-extinguishing, so does not generate flames under natural atmospheric conditions.

Parameter **s1** indicates low smoke production, minimal opacity and slow propagation. This is the lowest result in the smoke scale.

Parameter **d0** indicates that it does not produce flaming droplets or particles, thus preventing the fire from spreading inside the building.

The soundproof system can be installed in any kind of building and in all enclosures. Fire rating certified by AENOR for both the pipes and fittings.

and the Spanish Technical Building Code (CTE)

The **UNE-EN 13501** standard includes 3 parameters:

- Combustibility of the material and its contribution to a fire.
- Emission and propagation speed of smoke generated.

SMOGRA classification (speed of smoke) and TSP (total smoke production).

- Generation of flaming particles or droplets.

Current legislation does not regulate the quality or toxicity of smoke

Certificates

The CTE obliges manufacturers and suppliers to provide a copy of the classification certificate containing a full description and identification of the product, and they must also hold test and fire resistance classification certificates.

As per point *VI Testing laboratories for the introduction of Basic Document SI on fire safety- SI 1.*, products without a CE marking supplied on site should be **under 5 years old**. **Molecor** meets said requirement, performing an internal test every two and a half years.

AENOR certificates for **fire performance** of the pipe and fitting

Me NF certificate

The **AR® Soundproof Evacuation System** is the **only soundproof system in Spain that meets the demanding French fire resistance standard**.

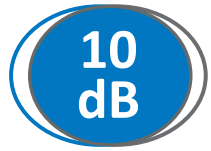
This standard requires that, upon contact with heat, the wall of the pipe and/or fitting expand internally to at least 8 times its original size, thus preventing the spread of smoke between compartments (apartments, premises, buildings, etc.).

The wall of the **AR® System** expands to 17 times its original size. Certificates for both the pipe and fitting from the French Laboratoire national de métrologie et d'essais (LNE), a certification body authorised for the NF mark by AFNOR.

CTE Basic Document on noise protection (HR).

All the pipes in a building should be treated to prevent bothersome noise in adjacent habitable or protected enclosures.

Thanks to the structure of the **AR Soundproof System®, made** with mineral-filled PVC, a perceived noise reduction of 10 dB was achieved at a flow rate of 2 l/s, comparable to the noise produced from the flush of a toilet.



At a flow rate of 2 l/s

The decibel, expressed as dB, is a unit of measurement used to express the power and **intensity of sound**. It is measured with a logarithmic scale, as a human ear's sensitivity to sound variation is more similar to a logarithmic scale than it is to a linear scale.

Being a logarithmic scale, the comparison or summation of acoustic emitters is not linear. As such, twice the sound intensity perceived by the human ear of **10 dB** (**AR® Soundproof System** measurement) is 13 dB.

A device that produces a noise of 30 dB is not just slightly louder than one that produces 20 dB, it is 10 times louder, and 100 times louder than one that produces 10 dB.

Table B. Sound quality objectives applicable to habitable indoor spaces in buildings designed for residential, medical, educational or cultural purposes [1], as stipulated in *Spanish Law 37/2003, of 17 November on Noise, as regards acoustic zoning, quality objectives and acoustic emissions*.

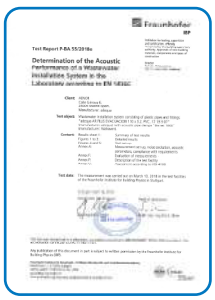
Use of the building	Type of enclosure	Noise indices		
		L_d	L_e	L_n
Home or residential use	Rooms	45	45	35
	Bedrooms	40	40	30
Hospital	Waiting areas	45	45	35
	Bedrooms	40	40	30
Educational or cultural	Classrooms	40	40	40
	Reading rooms	35	35	35

[1] The values in Table B refer to the emission index resulting from the group of acoustic emissions produced inside the enclosure (building facilities, activities that take place inside the building or adjacent to it, ambient noise heard inside the building).

30 dB is the maximum emission index resulting from the group of acoustic emitters inside the rooms of the buildings for private, residential and medical use at nighttime (from 11pm to 7am).
Facilities are just one more acoustic emitter in the group of emitters inside the enclosures.
The facilities, together with all the other emitters, such as the activities carried out inside the building or the adjacent buildings, and the ambient noise heard inside the building, cannot produce noise louder than 30 dB.

The sound pressure produced by the facilities must be as low as possible

The **best noise reduction properties** (soundproofing) for a European PVC water Evacuation system certified by AENOR.



Noise reduction testing performed in accordance with UNE-EN 14366 at the **Fraunhofer Institute** in Stuttgart (Germany) under the supervision of AENOR.

CTE Basic Document on Sanitation (HS). Execution of works

Manufacturing standards

The **AR® System** is manufactured for pipes in accordance with the UNE-EN 1453-1 standard "Plastic piping systems with structured-wall pipes", and for fittings in accordance with the UNE-EN 1329-1 standard "Plastic piping systems for wastewater Evacuation."

Both are outlined in *point 6.2 of the Basic Document HS-Sanitation- HS 5 Water Evacuation* and are considered suitable for wastewater Evacuation systems.

The **pipes** in the AR® Soundproof System are manufactured in accordance with **UNE-EN 1453**, with mineral additives.
certified by AENOR.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Plásticos
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MOLECOR CANALIZACIONES S.L.


AENOR
Certificado AENOR de Producto
001/007328
MOLECOR CANALIZACIONES S.L.

The **fittings** in the AR® Soundproof System are manufactured in accordance with **UNE-EN 1329**.
certified by AENOR.

Execution of downpipes and vents

The AR® range of pipes and fittings are connected using synthetic adhesives and elastic joints.

Both these types of joints are outlined in *point 2 of section 5.3 "Execution of downpipes and vents" in the Basic Document HS Sanitation- HS 5 Water Evacuation*.

The joints approved by the CTE are waterproof synthetic adhesives and elastic joints

Small Evacuation systems of 32, 40, 50 and 315 mm diameters are connected using waterproof synthetic adhesive.
For larger Evacuation systems, with diameters of 75 to 250 mm, elastic joints are used, with the exception of the 315 mm, which is connected with synthetic adhesive to make assembly easier on site.

Connecting the downpipe to the collector

The downpipes are connected to the collectors via special parts with the material technical specifications as specified in *point 1 of section 3.3.1.4.1 Suspended Collectors in Basic Document HS 5 Sanitation*.
The **AR® System** range of elbow bend fittings includes an acoustic elbow bend with inspection hole 87° 30´ M-H, adapting to the requirements of the CTE.
The 87° 30´ angle enables a maximum slope towards the collector.

Collectors

For the installation of compact pipes and collectors, an inspection plug is put on each branch connection and every 15 m in straight sections, which will be installed on the upper half of the pipe. For changes of direction, 45° fittings will be installed with a threaded inspection hole. As indicated in *points 2 and 3 of section 5.4.1. Execution of the suspended horizontal network in Basic Document HS Sanitation- HS 5 Water Evacuation*.
The **AR® Soundproof System** offers a wide range of parts with inspection vents suitable for executing the works required by the CTE.

For changes of direction with inspection vents, the following are used:

Elbow bend with inspection vent F-F 45°

Single branch with inspection vent M-F 45°

For inspection holes in the collector, the following are used:

Single expansion socket with inspection vent M-F

Single branch with inspection vent M-F 45°

Ventilation systems

The main function of the ventilation network is to protect the water seals in the sewer Evacuation system. To ensure that the Evacuation system is working properly, a secondary vent graft from **Molecor** is used. This fitting has the shortest distance between axes on the market and provides ventilation to the downpipe in accordance with the CTE. This is achieved with a pipe (DN63 mm) parallel to the main downpipe (DN110 mm), with a special part developed for this purpose. It allows easy connection between both pipes, promoting a suitable air flow inside the downpipe, and thus preventing excessive overpressure and underpressure, which lead to unpleasant odours.

A solution that optimises secondary ventilation, prevents unpleasant odours and complies with CTE (Spanish Technical Building Code) regulations, guaranteeing efficiency and acoustic comfort in buildings.

Siphoning - Types

In the event of a sudden discharge into a Evacuation column, the discharge water will fill the downpipe and act as a hydraulic piston, compressing all the air underneath it and increasing the pressure. At the same time, it also decreases the pressure of the air above. It is at this point that the water seals are emptied (siphoning).

- **Siphoning by compression:**

When the hydraulic piston lowers, it increases the pressure in the downpipe below higher than the atmospheric pressure, pushing the water from the siphons and forcing it out. This clears the water seal and leaves the path open for the entry of unpleasant odours from the pipes (Figure 2).

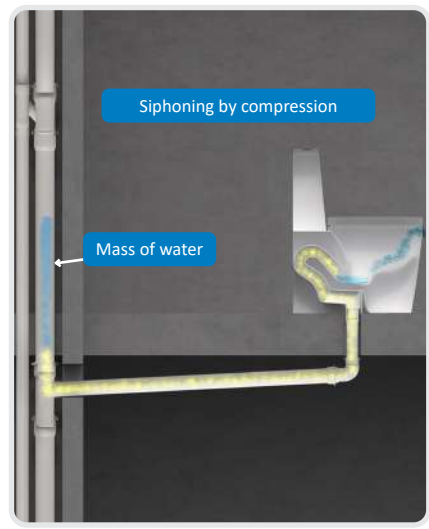


Figure 2. Diagram of a Evacuation system with siphoning by compression.

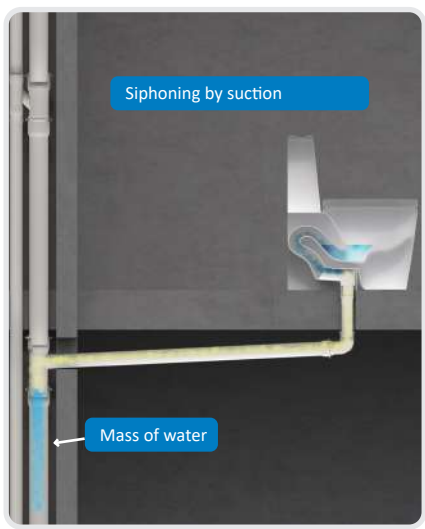


Figure 3. Diagram of a Evacuation system with siphoning by suction.

- **Siphoning by suction:**

If the downpipe is not well ventilated, the air above the water seal undergoes a decrease of pressure and, when it passes quickly through the inlet of a branch, it sucks out the air and and reduces the pressure, which sucks out the water from the siphon, emptying it (Figure 3).

- **Self-siphoning:**

When a branch is long, with a small section, the water that runs through it may cause a suction effect, absorbing the remaining discharge water and emptying the siphon.

Description of a ventilation system

All the Evacuation downpipes and ventilation should maintain the same diameter and verticality. In tall buildings, and to reduce the impact at the bottom of the downpipe, it is possible to intersperse changes of direction at 45°.

Movement of air in Evacuation and ventilation networks

In horizontal and vertical pipes in the Evacuation system, water flows in contact with air. Due to the friction between the water and the air, this circulates at practically the same speed as the water.

When the air passage section is reduced, due to the effect of water entering the Evacuation network or due to the effect of a hydraulic jump, triggered by a reduction in velocity, the pressure suddenly increases, which may have an effect on the water seals, siphoning them.

The air circulates in the stacks in the direction indicated by the arrows in Figure 4, following the flow of water in the downpipe and going back up the secondary vent stack, enabling the compressed air at the bottom (hydraulic jump in Figure 5) to find a release route.

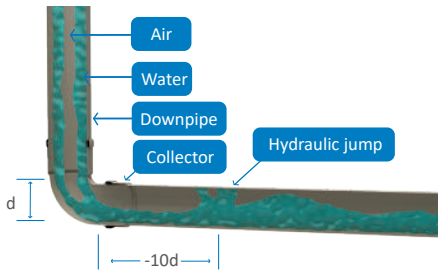


Figure 5. The hydraulic jump.

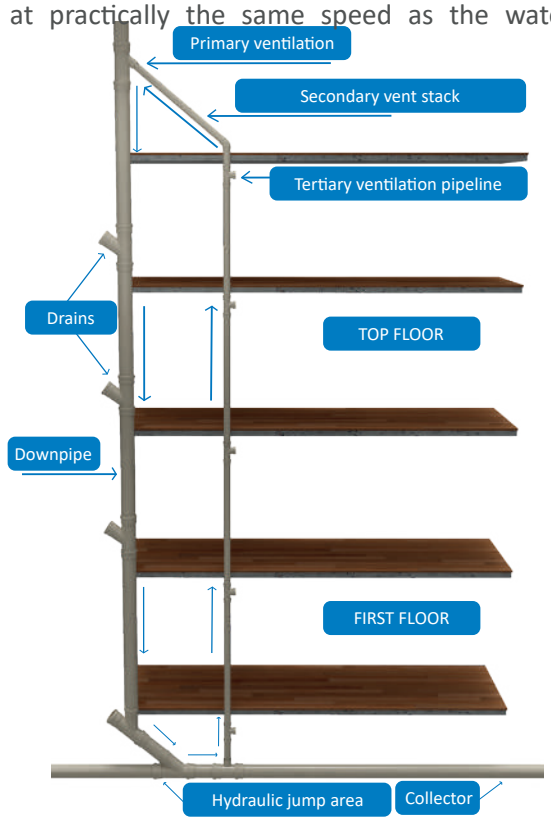


Figure 4. Circulation of air with secondary ventilation.

Hydraulic jump

At the bottom of the downpipe, the flow reaches maximum velocity (from 3 to 4.5 m/s at a height of 3, 4 or 5 m regardless of the height of the downpipe), whereas in the collector the velocity is much lower, generally below 1 m/s. For a short time after the change of direction (around 10 times the diameter of the collector), the water continues flowing at a relative velocity.

As the slope of the collector is not sufficient to maintain such a high velocity, it drops suddenly and sometimes the increased water level may fill the pipe section, producing a hydraulic plug that causes a change in the air pressure. This may lead to a potential loss of water seals, causing unpleasant odours to be released into homes or businesses. After the hydraulic jump, the flow will return to normal due to the resistance provided by the pipes.

Ventilation subsystems of the facilities

Depending on the type of building and its air requirements in the Evacuation system, there are 3 types of ventilation networks available:

- **Primary ventilation**: this extends out of the Evacuation downpipe, connecting the system to the outside.
- **Secondary ventilation**: this is the column that runs parallel with the downpipe and connects to it, enabling air to circulate between them.
- **Tertiary ventilation**: this is the network that connects the secondary network with the upper part of the elements that act as the water seals.

- **Primary ventilation**

As mentioned above, primary ventilation extends out of the Evacuation downpipe, connecting the system to the outside. It should meet the following requirements:

- The downpipe should extend to the roof, maintaining the same diameter.
- An aeration valve should be installed (Figure 6).

1. It is considered sufficient as the only ventilation system in buildings with less than 7 floors, or those with less than 11 if the downpipe is large enough, and the drain pipelines are shorter than 5 m.
2. The wastewater downpipes should extend for at least 1.30 m outside the roof of the building, if it is not crossable. If it is crossable, they should extend for at least 2.00 m on the roof paving.
3. The primary ventilation outlet should not be located less than 6 m from any external air conditioning or ventilation air inlet and should be higher.
4. When there are habitable enclosures less than 6 m from the primary ventilation outlet, said outlet should be located at least 50 cm above the maximum level of these openings.
5. The ventilation outlet should be suitably protected to prevent the entry of foreign bodies and it should be designed to allow the wind to expel gases to the outside.
6. The ends of columns cannot be under canopies or terraces.

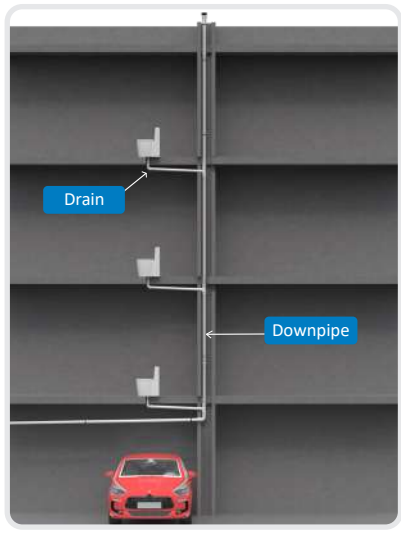


Figure 6. Primary ventilation diagram.

The primary ventilation must have the same diameter as the downpipe that it is extending from, even if a secondary vent stack is connected to it.

- **Secondary ventilation**

The purpose of the secondary ventilation is to prevent excessive underpressure, particularly in the area below the downpipe, in order to allow the compressed air at the bottom of the column to find an outlet (Figure 7).

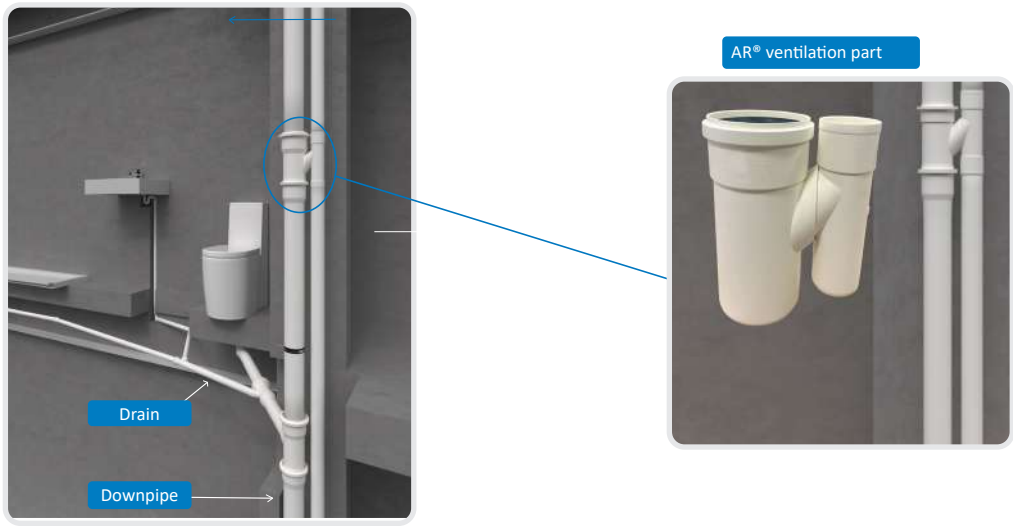


Figure 7. Secondary ventilation diagram.

The connection between the downpipe and the ventilation network should be below the last pipeline, or the vent stack could be connected directly to the collector, at a maximum distance of ten times the diameter of the collector (Figure 8).

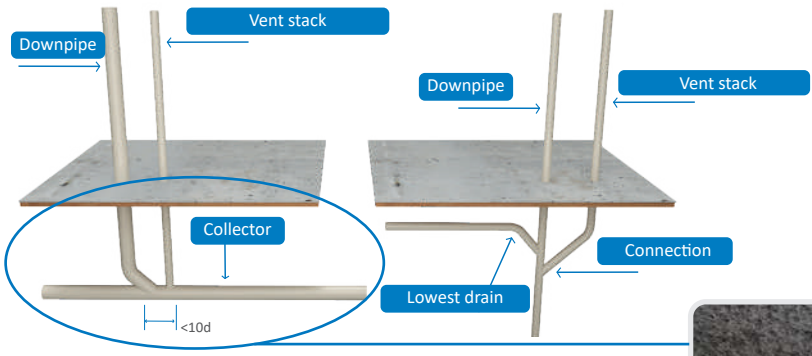


Figure 8. Connections between drain and vent stacks at the bottom of the building.

Secondary ventilation should be installed in buildings where primary ventilation is insufficient, if they have 11 floors or more, for example, or if they have 7 but do not have a large enough downpipe and pipelines longer than 5 metres.

It involves installing pipes in parallel to the connected downpipe, and is designed to prevent excessive underpressure, particularly in the area below the downpipe, in order to allow the compressed air at the bottom of the column to find an outlet.

The vent stacks should have the same diameter along their entire length. At the upper end they can be connected to the downpipe above the level of the last sanitary appliance or they can go outside through the roof. **At the lower end, they can** be connected to the last pipeline or **directly to the collectors**, with the latter being the most suitable option, connected to the collector **at a maximum distance of 10 times the diameter of the collector**.

The following conditions should be met:

- The **connections** should be **above the connections for the sanitary appliances**.

- At the upper part, the connection must be at least 1 m above the final sanitary appliance, and at the lower part it must be connected to the horizontal network collector, at the upper generatrix and at the closest possible point, at a distance of no more than 10 times the diameter of the collector. If this is not possible, the lower connection should be below the final pipeline.

- The **vent stack must be connected to the downpipe at the end**, beyond the aforementioned height, or extended above the roof of the building at least as high as the downpipe.

- If there is a deviation of more than 45° in the downpipe, this should be considered a horizontal section and each section of the downpipe should be ventilated separately. **The ventilation and the downpipe should be connected with a very short pipe section in the same diameter as the vent stack, and sloped towards the downpipe**, to prevent solid material entering and blocking the vent stack.

• When there are deviations in the downpipe, the vent stack for the section before the deviation shall be sized to handle the load of this section, and the stack corresponding to the section after the deviation shall be sized to handle the load of the entire downpipe.
• The diameter of the pipes joining the downpipe to the vent stack should be the same as the stack.
• The diameter of the vent stack should be at least the same as half the diameter of the downpipe that it serves.
• The fire-resistance requirements of the vent stack pipe should correspond to those laid out in the CTE for the other pipes installed.

Molecor has designed the secondary ventilation part in compliance with the CTE.
The diameter of the downpipe is 110 mm and the diameter of the ventilation pipe is 63 mm, in compliance with *Table 4.11 Diameters of secondary vent stacks with joints at every floor, outlined in Basic Document HS Sanitation- HS 5 Water Evacuation.*
The beginning and the end of the ventilation part shall be closed with a 63 mm diameter closing plug.

Diameter of the downpipe (mm)	Diameter of the vent stack (mm)
40	32
50	32
63	40
75	40
90	50
110	63
125	75
160	90
200	110
250	125
315	160

Molecor offers the entire range in a diameter of 63 mm at its commercial rates, both for the 3 m series B pipes and for the corresponding range of fittings. EVAC+® Evacuation system.

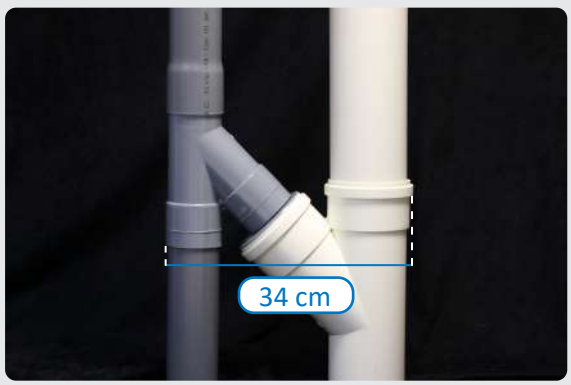
Size of traditional solutions compared to the new solution from Molecor

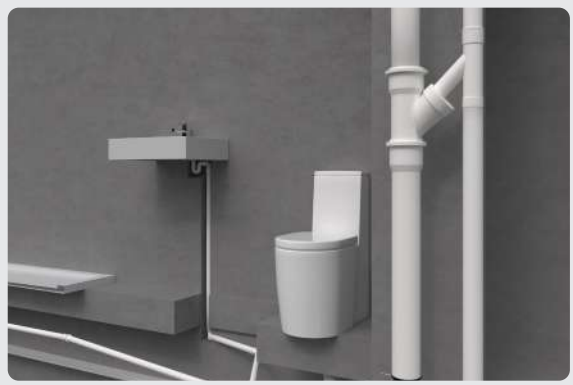
As part of its constant commitment to innovative and efficient plastic solutions for water Evacuation, **Molecor** has expanded its product catalogue with a specific fitting for secondary ventilation that meets the growing need to optimise spaces dedicated to facilities, such as airwells or passages between formwork, in order to maximise the enclosure designed for residential use.

Until now, the only option available was to install a 76 mm diameter stack in parallel, using a 45° double single branch: one inserted at the 110 mm downpipe and the other at the 75 mm downpipe, rotated 180° in respect to the previous one so that the two sockets are facing each other. They would be connected with a plug reduced from 110 to 75 mm and a reel to join both single branches.

Aside from the handling, which takes a significant amount of time and requires a specialist, there is considerable dead space remaining between the two pipes, with the total width of the installation exceeding 34 cm, without taking into account the clamps.

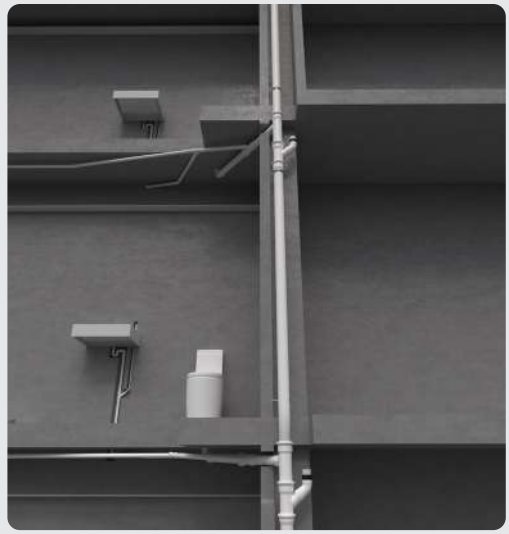
Secondary ventilation without a specific ventilation part





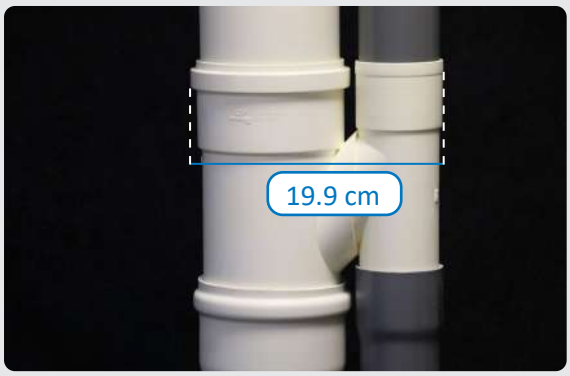
Another alternative is to replace the downpipe with aeration valves. This solution is not common, because it does not provide a substantial improvement in the required space and is much more expensive, when comparing just the materials. The joint here should be done with a single branch and an elbow bend, both 45°.

Secondary ventilation with an aeration valve



Therefore, having a solution that saves up to 50% of the space needed in a downpipe with secondary ventilation is a substantial improvement, either because this space can be used for the residence or because it frees up essential space within the airwells, especially on the upper floors, due to the fact that it is shared with other facilities, such as the ventilation for the residence, DHW, etc.

Secondary ventilation with a specific ventilation part - Molecor



Size comparison for the three solutions

Secondary ventilation with a specific ventilation part - Molecor

Secondary ventilation without a specific ventilation part

Secondary ventilation with an aeration valve

- **Tertiary ventilation**

Water seals should be protected against siphoning and self-siphoning by means of a tertiary ventilation system.

1. Tertiary ventilation should be installed when the length of the Evacuation pipelines is greater than 5 m, or if a building has more than 14 floors.
2. When tertiary ventilation is installed, this should be connected at a distance from the water seal of 2 to 20 times the diameter of the pipe.
3. The horizontal sections of the tertiary ventilation pipes should be at least 20 cm above the overflow for the sanitary appliance whose siphon they vent.
4. These ventilation pipe sections should be sloped towards the Evacuation pipe to collect any condensation that may form (minimum slope of 1%).
5. The ventilation opening should not be below the siphon crown. The socket should be above the vertical axis of the transversal section, rising vertically at an angle no greater than 45° in respect to the vertical axis.

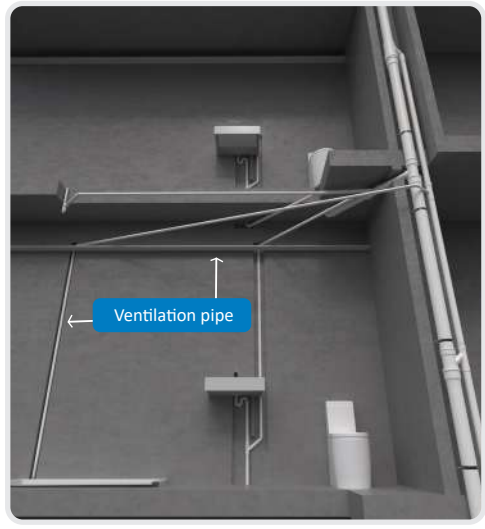


Figure 9. Tertiary ventilation diagram.

Ventilation with aeration valves

The ventilation systems described above may occasionally be complicated to install. As outlined in *Section 3.3.3.4 Ventilation subsystem with aeration valves from Basic Document HS Sanitation- HS 5 Water Evacuation*, the installation of aeration valves is authorised to replace ventilation systems, allowing air to enter when there is underpressure in the system and preventing the release of odours from the system when the pressure inside the downpipe is positive. It must meet the installation criteria described in the current legislation, as well as a series of design criteria specific to these devices.

The **UNE-EN 12056-2** standard "Sanitary pipework, layout and calculation" defines an aeration valve as follows: *a valve that allows air to enter into a system, but not to leave, in order to limit fluctuations in pressure within the discharge pipework.*

The CTE only allows the option to substitute different ventilation solutions with aeration valves; it does not allow for any other system

In all cases, the installation should always be vertical. The valves must be protected from any kind of splashes coming from the downpipe, so it must be kept away from the pipeline connection. Likewise, since they shall be confined to an inaccessible enclosure, either in a false ceiling or behind walls, an external air outlet must be provided, ensuring that it cannot be accessed by birds or insects, which may block the air intake membrane to the downpipe.

It is important to distinguish between two models of valves: those that replace primary and secondary ventilation, known as high-flow valves, and those that replace tertiary ventilation, known as low-flow valves. In the case of primary ventilation, the extension that emerges from the roof could be replaced with a valve that emerges in the downpipe, although this can only cover a maximum of 5 floors, ending in the final false ceiling without needing to extend outside.

For secondary ventilation, the vent stack parallel to the downpipe should be replaced by branches with aeration valves inserted inside. The required airflow for each installation should be calculated and no more than 4 floors should ever be separated.

To replace the tertiary ventilation, an aeration valve should be installed in each of the appliances via a branch, or all the appliances should be connected to the same collector and the valve should be installed in the pipeline, preferably between the last and second-to-last appliance.

In all of these three cases, the total necessary flow shall be calculated in accordance with the EN 12056 standard, which specifies that this flow can be obtained using the following equation:

$$Qww = K \sqrt{\Sigma DU}$$

The result of this formula should be checked against the minimum air intake value for the valve model being tested (Qadm). For the most common valves on the market, the high-flow versions range from 23-25 l/s for diameters of 75-110 mm, and the low-flow versions range from 6-7 l/s for diameters of 32-50 mm.

When aeration valves are used for primary ventilation in downpipes with a secondary ventilation network, said aeration valves shall be calculated in accordance with the EN 12056-2 standard, ensuring that the minimum air flow is greater than 8 times the air flow required by the installation:

$$Qadm > 8K \sqrt{\Sigma DU}$$

As for ventilation pipelines and sanitation appliances, the minimum air flow should be more than double the air flow required by the installation:

$$Qadm > 2K \sqrt{\Sigma DU}$$

Where:

- Qww is the total air flow required by the facilities and Qadm is the minimum intake flow for the valve.
- K is a coefficient called usage rate; K=0.5 is generally used for residential purposes.
- ΣDU is the set of unit demands, resulting from the sum of all the flow rates required for each appliance, which can be obtained individually from this table:

Sanitation appliance	Flow (l/s)
Toilet	2.0
Sink	0.5
Bath	0.8
Shower	0.6
Washing machine	0.8
Dishwasher	0.8

Range of pipes and fittings from the

Pipes

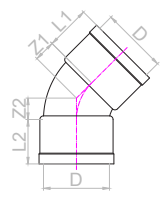
DN (mm)	Length (m)	Thickness (mm)	No. of Pipes/Pallet	Code
32	5	3.0	95	2141155
40	5	3.0	80	1122180
50	5	3.0	65	1122181
110	5	3.2	34	2130266
63	3	3.0	50	2142505
75	3	3.0	35	2141129
90	3	3.0	29	1122185
110	3	3.2	34	1122182
125	3	3.2	30	1122183
160	3	3.2	17	1122186
200	3	3.9	9	1122187
250	3	4.9	7	2133984
315 (adhesive joint)	3	6.2	5	2141090
110	1	3.2	29	1127359
90 - 2 mouths	1	3.0	29	2142312
110 - 2 mouths	1	3.2	26	2131833
110	1.5	3.2	29	2142368

• 32, 40 and 50 diameter pipes are supplied without mouths.

The pipes and fittings marked with a icon have an AENOR product certification, in accordance with UNE-EN 1453-1 and UNE-EN 1329-1, and fire resistance (Euroclass B-s1,d0) in accordance with UNE-EN 13501-1.
The pipes and fittings marked with a icon have a fire-resistance classification of Euroclass B-s1,d0, in accordance with UNE-EN 13501-1.

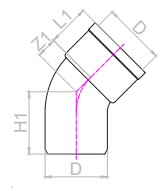
Elbow bend F-F 45°

Code	Ref.	Box/units	D	Z1	Z2	L1	L2
2141156	CF-44-AR	H-15	32	13	13	23	23
1122163	CH-44-AR	C-130	40	13	13	27	27
1122166	CJ-44-AR	C-70	50	18	18	32	32



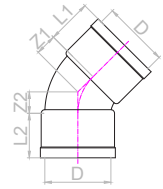
Elbow bend M-F 45°

Code	Ref.	Box/units	D	Z1	L1	H1
2141159	CF-4-AR	H-15	32	10	23	33
2136939	CH-4-AR	D-80	40	13	27	40
2136940	CJ-4-AR	C-85	50	18	32	50



Elbow bend F-F 67° 30’

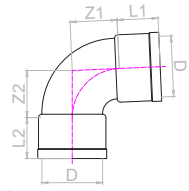
Code	Ref.	Box/units	D	Z1	Z2	L1	L2
2141157	CF-66-AR	F-15	32	17	17	24	24
1126194	CH-66-AR	E-30	40	21	21	27	27
1126195	CJ-66-AR	E-15	50	26	26	32	32



AR® Soundproof Evacuation System

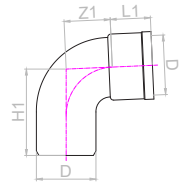
Elbow bend F-F 87° 30’

Code	Ref.	Box/units	D	Z1	Z2	L1	L2
2141158	CF-88-AR	I-15	32	24	24	23	23
1122164	CH-88-AR	C-110	40	31	31	27	27
1122165	CJ-88-AR	C-65	50	39	39	32	32



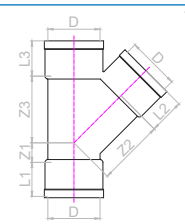
Elbow bend M-F 87° 30’

Code	Ref.	Box/units	D	Z1	L1	H1
2141160	CF-8-AR	I-15	32	24	23	47
2136941	CH-8-AR	C-110	40	31	27	58
2136942	CJ-8-AR	E-15	50	39	32	71



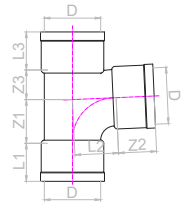
Single branch F-F 45°

Code	Ref.	Box/units	D	Z1	Z2	Z3	L1	L2	L3
2141161	BF-144-AR	E-25	32	10.5	45	45	24	24	24
1122172	BH-144-AR	C-50	40	15	51	51	27	27	27
1122173	BJ-144-AR	C-40	50	16	63	63	32	32	32



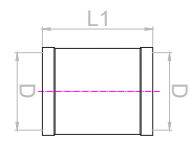
Single branch F-F 87° 30’

Code	Ref.	Box/units	D	Z1	Z2	Z3	L1	L2	L3
2141162	BCF-188-AR	E-30	32	25	17	25	24	24	24
1122155	BCH-188-AR	C-65	40	31	21	31	27	27	27
1122156	BCJ-188-AR	C-40	50	39	26	39	32	32	32



Single socket F-F

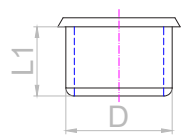
Code	Ref.	Box/units	D	L1
2141163	KF-AR	H-15	32	47
1122139	KH-AR	E-30	40	57
1122140	KJ-AR	E-25	50	65



Closing plug

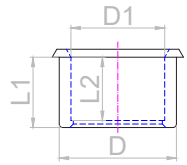
Code	Ref.	Box/units	D	L1
1122138	TH-AR	H-30	40	26
2141167	TJ-AR	I-30	50	30

- Diameter 40 & 50 with male closing plug.



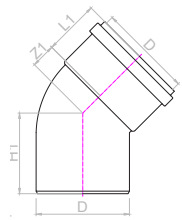
Reduction cap

Code	Ref.	Box/units	D	D1	L1	L2
2141164	IH-AR	H-15	32	40	25	25
1122116	IJ-AR	F-30	40	50	30	30



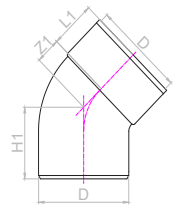
Elbow bend M-F 45° elastic joint

Code	Ref.	Box/units	D	Z1	L1	H1
2141130	CP-4-K-AR	D-15	75	23.5	55	75.5
1126216	CS-4-K-AR	B-30	90	25	59.5	91
1122168	CV-4-K-AR	A-40	110	29	65.5	95
1122170	CX-4-K-AR	A-25	125	34	70.5	105
1126219	CZ-4-K-AR	A-15	160	39	81	131
1126222	CA-4-K-AR	A-8	200	55	93	151.5
2133981	CB-4-K-AR	A-4	250	69	126	183



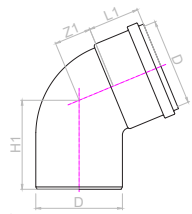
Elbow bend M-F 45° adhesive joint

Code	Ref.	Box/units	D	Z1	L1	H1
2141089	CC-4-AR	A-1	315	83	133	216



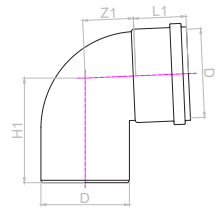
Elbow bend M-F 67° 30’ elastic joint

Code	Ref.	Box/units	D	Z1	L1	H1
2141141	CP-6-K-AR	C-12	75	38	54	86.5
1126215	CS-6-K-AR	B-25	90	37	66	96
1126217	CV-6-K-AR	A-35	110	47	65.5	113
1126218	CX-6-K-AR	A-25	125	53	70.5	123



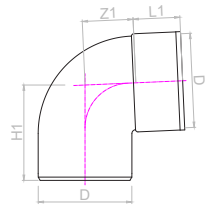
Elbow bend M-F 87° 30’ elastic joint

Code	Ref.	Box/units	D	Z1	L1	H1
2141142	CP-8-K-AR	D-10	75	53	53.5	100
1126196	CS-8-K-AR	B-20	90	58	56	110
1122167	CV-8-K-AR	A-30	110	63	65.5	130
1122169	CX-8-K-AR	A-20	125	74	70.5	145
1126220	CZ-8-K-AR	A-8	160	87	87	165
1126221	CA-8-K-AR	A-6	200	108.5	93	207
2133982	CB-8-K-AR	A-3	250	154	126	280



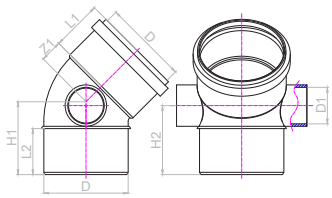
Elbow bend M-F 87° adhesive joint

Code	Ref.	Box/units	D	Z1	L1	H1
2142346	CC-8-AR	A-1	315	125	133	258



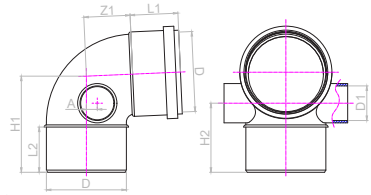
Elbow bend M-F 45° with side socket and elastic joint

Code	Ref.	Box/units	D	D1	L1	L2	Z1	H1	H2
2142332	CV-4-K-DT-AR	B-15	110	50	56	59	37	137.3	92



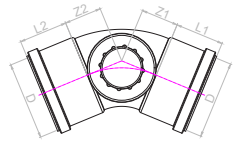
Elbow bend M-F 87° with side socket and elastic joint

Code	Ref.	Box/units	D	D1	L1	L2	Z1	A	H1	H2
2142333	CV-8-K-DT-AR	B-12	110	50	56	62	67	12	125	97



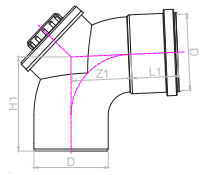
Elbow bend with inspection vent F-F 45°

Code	Ref.	Box/units	D	Z1	Z2	L1	L2
2135210	CV-45-K-AR	B-10	110	53.7	53.7	69	69



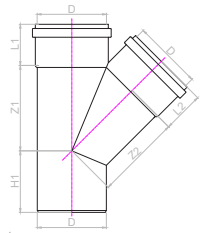
Acoustic elbow bend with inspection vent M-F 87° 30’

Code	Ref.	Box/units	D	Z1	L1	H1
2135216	CV-8-BC-K-AR	B-10	110	89	69.4	173.3



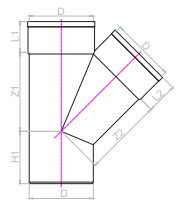
Single branch M-F 45° elastic joint

Code	Ref.	Box/units	D	Z1	Z2	L1	L2	H1
2141143	BP-14-K-AR	C-12	75	96	96	56	56	76
1126182	BS-14-K-AR	A-25	90	113	113	59.5	59.5	85
1122160	BV-14-K-AR	A-15	110	136	136	65.5	65.5	98
1122162	BX-14-K-AR	A-12	125	153	153	70.5	70.5	105
1126189	BZ-14-K-AR	A-6	160	197	197	69	69	108
1126191	BA-14-K-AR	A-3	200	258	258	94	94	147



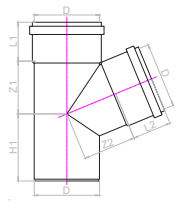
Single branch M-F 45° adhesive joint

Code	Ref.	Box/units	D	Z1	Z2	L1	L2	H1
2136580	BB-14-AR	Y-1	250	307	307	126	126	185
2141087	BC-14-AR	G-1	315	435	435	145	145	320



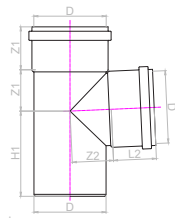
Single branch M-F 67° 30’ elastic joint

Code	Ref.	Box/units	D	Z1	Z2	L1	L2	H1
2141144	BP-16-K-AR	C-8	75	69	68.5	42	42	76
1126181	BS-16-K-AR	B-15	90	73	73	62	62	99
1126185	BV-16-K-AR	A-15	110	89	89	65.5	65.5	113



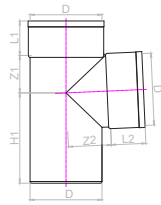
Single branch M-F 87° 30’ elastic joint

Code	Ref.	Box/units	D	Z1	Z2	L1	L2	H1
2141145	BP-18-K-AR	C-8	75	69	69.5	42	42	76
1126180	BS-18-K-AR	B-15	90	51	51	59.5	59.5	110
1122159	BV-18-K-AR	A-20	110	63	63	65.5	65.5	130
1122161	BX-18-K-AR	A-15	125	70	70	70.5	70.5	139.5
1126188	BZ-18-K-AR	A-8	160	92	92	76	76	172
1126190	BA-18-K-AR	A-4	200	112	112	97	97	206



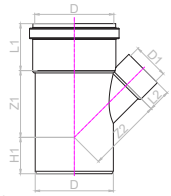
Single branch M-F 87° 30’ adhesive joint

Code	Ref.	Box/units	D	Z1	Z2	L1	L2	H1
2141088	BB-18-AR	A-2	250	136	136	126	126	255
2141774	BC-18-AR	A-1	315	235	235	145	145	380



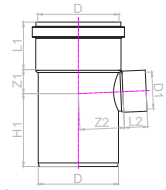
Reduced single branch M-F 45°

Code	Ref.	Box/units	D	D1	Z1	Z2	L1	L2	H1
2141146	BP-145-K-AR	C-15	75	50	78.5	81	46.5	37	47.5
1122158	BV-145-K-AR	A-30	110	50	95	107	63	37	50



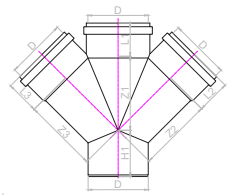
Reduced single branch M-F 87° 30´

Code	Ref.	Box/units	D	D1	Z1	Z2	L1	L2	H1
2141147	BP-185-K-AR	B-15	75	50	28	49	46.5	37	81
1122157	BV-185-K-AR	A-30	110	50	30	66	63	37	99



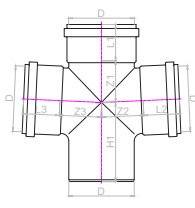
Double single branch M-F 45°

Code	Ref.	Box/units	D	Z1	Z2	Z3	L1	L2	L3	H1
2141153	RP-14-K-AR	C-5	75	96	96	96	56	56	56	76
2142347	RS-14-K-AR	B-10	90	109	109	109	50	50	50	73
1126183	RV-14-K-AR	A-12	110	136	136	136	61	61	61	85
1126187	RX-14-K-AR	A-10	125	153	153	153	65	65	65	90



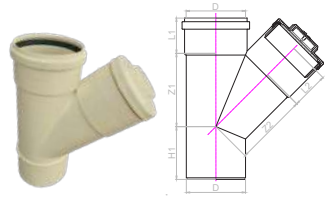
Double single branch M-F 87° 30’

Code	Ref.	Box/units	D	Z1	Z2	Z3	L1	L2	L3	H1
1126920	RS-18-K-AR	B-15	90	58	58	58	50	50	50	109
1126192	RV-18-K-AR	A-15	110	70	70	70	61	61	61	133
1126186	RX-18-K-AR	A-10	125	79	79	79	61	61	61	134.5

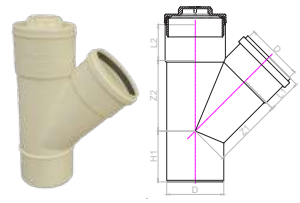


Single access branch 45°

Code	Ref.	Box/units	D	Z1	Z2	L1	L2	H1
2136945	VVA-4-K-AR (1)	Q-5	110	136	136	65.5	69	98
2136946	VVL-4-K-AR (2)	Q-5	110	136	136	65.5	69	98
2136948	VXA-4-K-AR (1)	Q-4	125	153	153	70.5	74	105
2136949	VXL-4-K-AR (2)	Q-4	125	153	153	70.5	74	105
2140254	VZA-4-K-AR (1)	B-2	160	197	197	69	75	107
2140255	VZL-4-K-AR (2)	B-2	160	197	197	69	75	107



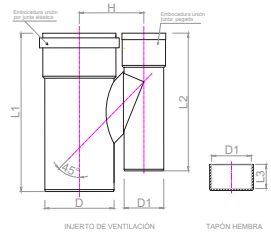
ACCESS IN BRANCH (1)



ACCESS IN LINE (2)

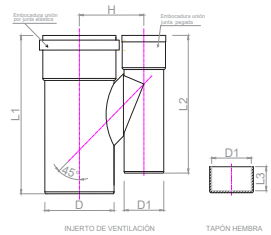
Secondary vent graft

Code	Ref.	Box/units	D	D1	H	L1	L2	L3
2142448	VSV-146-K-AR	C-6	110	63	102.5	246	214	37.5



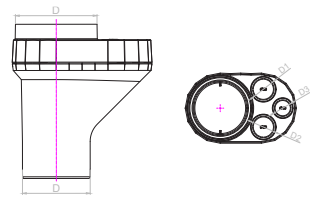
Mixed secondary vent graft

Code	Ref.	Box/units	D	D1	H	L1	L2	L3
2142504	VSV-146-K-MX	C-6	110	63	102.5	246	214	37.5



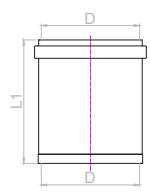
ND110 multi-connection

Code	Ref.	Box/units	D	D1	D2	D3
2135283	IMV-554-AR	B-10	110	50	50	40



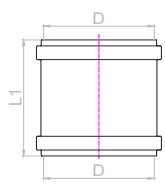
Transition single socket F-F joint glued to elastic joint

Code	Ref.	Box/units	D	L1
2142343	JS-K-AR	B-45	90	121
2136943	JV-K-AR	B-25	110	138.5
2136944	JX-K-AR	B-20	125	144.5
2142344	JZ-K-AR	A-22	160	167



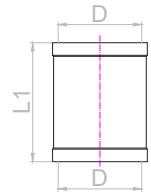
Single expansion socket F-F

Code	Ref.	Box/units	D	L1
2141148	KP-2-K-AR	D-20	75	107
1126176	KS-2-K-AR	B-40	90	126
1122142	KV-2-K-AR	A-55	110	125
1122153	KX-2-K-AR	A-35	125	139
1126177	KZ-2-K-AR	B-8	160	157
1126178	KA-2-K-AR	B-4	200	190
2133983	KB-2-K-AR	B-2	250	252



Single socket F-F without glued joint plug

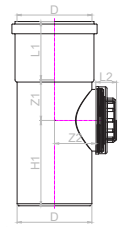
Code	Ref.	Box/units	D	L1
2141181	KC-AR	Z-3	315	309



Expansion single socket with inspection vent M-F

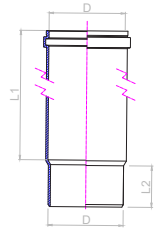
Code	Ref.	Box/units	D	Z1	Z2	L1	L2	H1
2135212	VV-9-K-AR	B-12	110	59.5	60.8	85.5	30.5	125

• The expansion single socket with inspection vent can be installed in both a horizontal and vertical position.



Extension sleeve

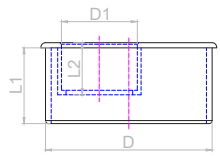
Code	Ref.	Box/units	D	L1	L2
2142443	PV-K-AR	B-10	110	288	60.5



Reduction plug

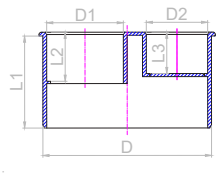
Code	Ref.	Box/units	D	D1	L1	L2
2141150	P-4-AR	E-15	75	40	41	26
2141149	P-5-AR	E-15	75	50	45	31
1126171	S-4-AR	D-30	90	40	50	27
1126173	S-5-AR	D-30	90	50	50	31
1122119	V-4-AR	C-35	110	40	54	27
1122117	V-5-AR	C-35	110	50	50	34.4
2142450	V-6-AR	D-15	110	63	51	37.5
2141154	V-7-AR	D-15	110	75	50	41.5
2142311	V-9-AR	D-15	110	90	49.5	49
2142579	V-10-AR	D-15	110	100	59.8	57
1122121	X-4-AR	C-25	125	40	60	37
1122120	X-5-AR	C-25	125	50	60	32
1126193	X-7- AR	C-25	125	75	54.5	44
2142345	X-9-AR	C-25	125	90	54.5	46
2142321	X-11-AR	C-25	125	110	54.5	48
2142319	Z-11-AR	C-15	160	110	59.5	48.5
2142318	Z-12-AR	C-15	160	125	60	51
2142317	A-11-AR	C-10	200	110	67	48.5
2142342	A-12-AR	C-10	200	125	67	51.5
2142316	A-16- AR	C-10	200	160	67	58
2142583	TB-20-AR	C-10	250	200	59.2	60
2142581	TC-25-AR	C-10	315	250	59.5	60

• Smallest open diameter.



Double reduction plug

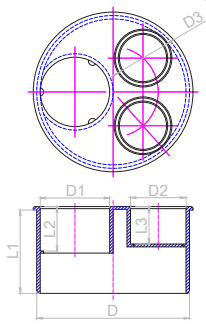
Code	Ref.	Box/units	D	D1	D2	L1	L2	L3
2141165	V-43-AR	D-15	110	40	32	51	26	23.5
2131254	V-44-AR	C-40	110	40	40	50	25	25



- Smallest open diameter.

Triple reduction blind plug

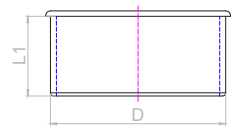
Code	Ref.	Box/units	D	D1	D2	D3	L1	L2	L3
2135208	TV-444-AR	C-35	110	40	40	40	60	27	-
2135206	TV-544-AR	C-35	110	50	40	40	60	32	27



- Smallest open diameter.

Closing plug

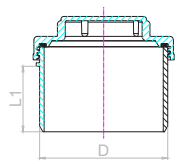
Code	Ref.	Box/units	D	L1
2142449	BL-AR	F-20	63	37.5
2141152	TP-AR	E-15	75	44
1126172	TS-AR	D-30	90	50
1122134	TV-AR	C-35	110	50
1122136	TX-AR	C-25	125	55
1126174	TZ-AR	C-15	160	60
1126175	TA-AR	C-10	200	67



- Do not install in elastic joints as they are at risk of being overloaded.
- Diameters from 75 to 200 with a male blind plug, whereas ø63 is with a female blind plug.

Access plug

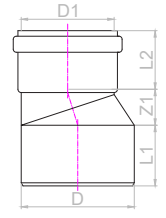
Code	Ref.	Box/units	D	L1
2141166	FF-AR	H-15	32	13.5
2141151	FP-AR	D-30	75	24
2135217	FS-AR	C-60	90	46
1126752	FV-AR	D-15	110	48
1126751	FX-AR	D-15	125	55



- Do not install in elastic joints as they are susceptible to overloading.

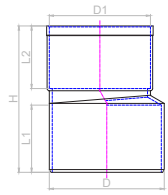
Pipe extension M-F

Code	Ref.	Box/units	D	D1	Z1	L1	L2
2142341	IS-2-K-AR	B-50	90	75	21	56	50
1126224	IV-2-K-AR	B-25	110	90	35	59	57
1126223	IX-3-K-AR	B-20	125	90	19	70	58
1122171	IX-1-K-AR	C-10	125	110	15	77	68
1126225	IZ-3-K-AR	B-15	160	110	24	85	86
1126226	IZ-2-K-AR	B-15	160	125	27	82	68
1126227	IA-3-K-AR	B-5	200	125	11	100	57
1126229	IA-1-K-AR	B-6	200	160	29	107	84



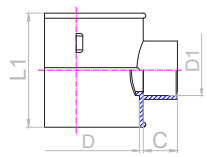
Pipe extension M-F with adhesive joint

Code	Ref.	Box/units	D	D1	L1	L2	H
2141085	IB-1-AR	B-4	250	200	125	99	264
2141086	IC-1-AR	A-4	315	250	128	126	295



Single branch to pipe 90°

Code	Ref.	Box/units	D	D1	C	L1
1122174	ITTVX-4-AR	C-35	100-110-125	40	28	90
1122175	ITTVX-5-AR	C-35	100-110-125	50	32	90
1126179	ITZ-11-AR	B-15	160	110	49	162

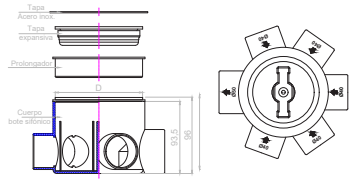


Soundproof siphonic canister drain

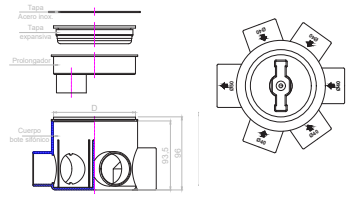
Code	Ref.	Box/units	D	High	Inlets/outlets
1122177	B-S-AR	C-10	110	93.5	I=5 of 40 / O=50
2142440	B-SS-AR	C-10	110	93.5	I=5 of 40 / O=50

5 inlets Ø40, 1 outlet 50.
Siphonic canisters come with two Ø40 closing plugs.
Stainless steel caps.

B-S-AR



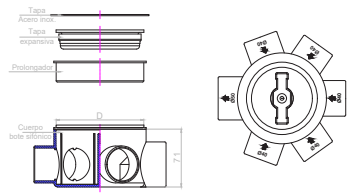
B-SS-AR



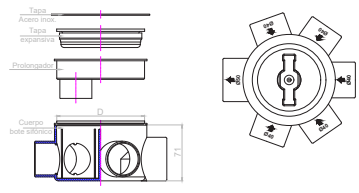
Short-slot soundproof siphonic canister drain

Code	Ref.	Box/units	D	High	Inlets/outlets
2142513	B-S-BA-AR	C-10	110	71	I=5 of 40 / O=50
2142569	B-SS-BA-AR	C-10	110	71	I=5 of 40 / O=50

B-S-BA-AR



B-SS-BA-AR





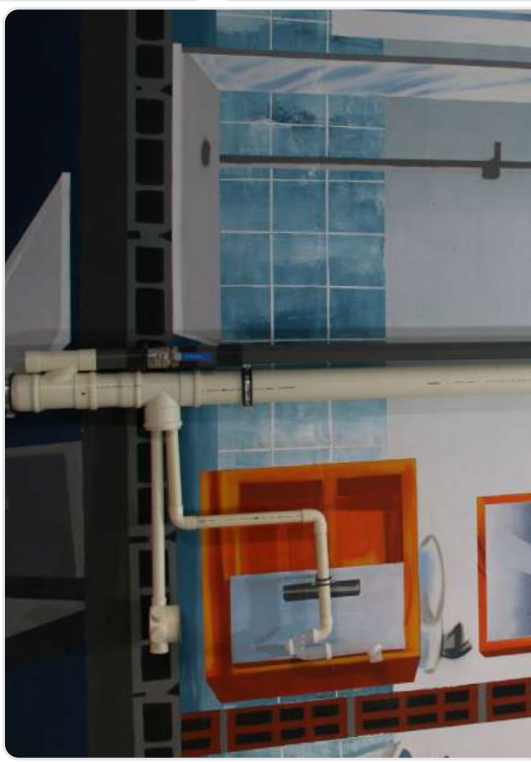










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