

DESIGN & INSTALLATION GUIDE

Active
Drainage

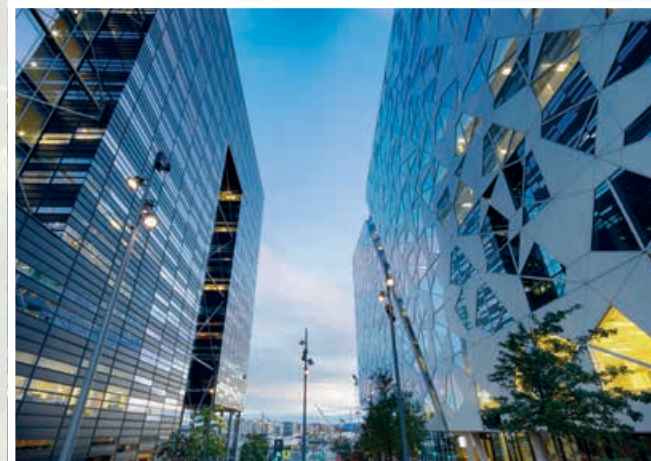


Innovation & Expertise

Active Drainage Ventilation

Marley Plumbing & Drainage offer a choice of drainage ventilation options in the form of secondary ventilation, single stack-aerator or active drainage ventilation.

Studor P.A.P.A. (Positive Air Pressure Attenuator) and Studor air admittance valves provide a complete active drainage ventilation system solution which is particularly suited to high-rise applications.



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Ventilation of soil stacks

Fundamentally, an efficient drainage system design is about managing the mix of air and water. More precisely, it is about managing the air pressure regime within the boundaries that maintain a water seal in the trap. Marley offer 3 different product solutions to manage this.

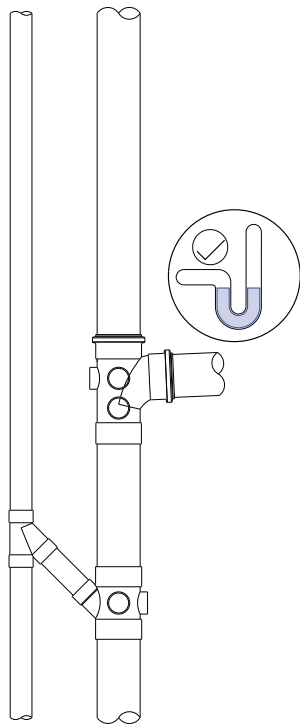
1. Secondary Ventilation

Traditional drainage design incorporates the installation of a secondary ventilation stack and branch pipework system alongside the main stack to ensure this air pressure is maintained.

Soil stack capacity

The capacity of a soil stack can be increased by the installation of a secondary ventilated stack. The following information is taken from tables 11 & 12 of BS EN 12056-2: 2000 which illustrates this increase.

| | Stack size (mm) | Secondary vent (mm) | Maximum capacity (l/s) Swept entries |
|----------------------------|-----------------|---------------------|--------------------------------------|
| Primary ventilated stack | 82 | - | 2.6 |
| | 110 | - | 5.2 |
| | 160 | - | 12.4 |
| Secondary ventilated stack | 82 | 50 | 3.4 |
| | 110 | 50 | 7.3 |
| | 160 | 80 | 18.3 |



2. Single Stack System with Stack-Aerator

An alternative to secondary ventilation in high-rise applications is the use of a stack-aerator.

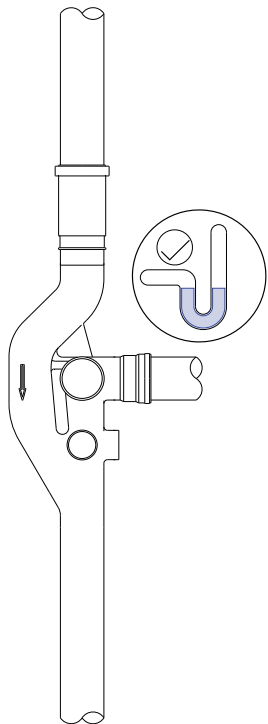
A stack-aerator fitting breaks the discharge fall on each floor and as a consequence the secondary vent pipe is not required as the pressure difference stays well within the limit of 3 mbar.

The unique shape of the stack-aerator increases the capacity of the stack allowing the soil and waste flow from the higher floors to smoothly converge with the flow on the lower floor.

Stack-aerator capacity

Maximum drainage flow for the stack-aerator is illustrated below.

| Stack size (mm) | Maximum capacity (l/s) |
|-----------------|------------------------|
| 110 | 7.6 |
| 160 | 13.5 |



3. Active Drainage Ventilation

An active ventilated system provides relief at the Point Of Need (PON) by removing or attenuating an incoming pressure transient that, if left, could lead to trap seal depletion.

The single stack solution with the Studor P.A.P.A. and AAVs is an ideal solution for high-rise applications, eliminating the need for roof penetrations and secondary ventilation.

The combination of the P.A.P.A., Maxi-Vent and Mini-Vent air admittance valves support a complete system to limit pressure fluctuations, guaranteeing the integrity of the traps.

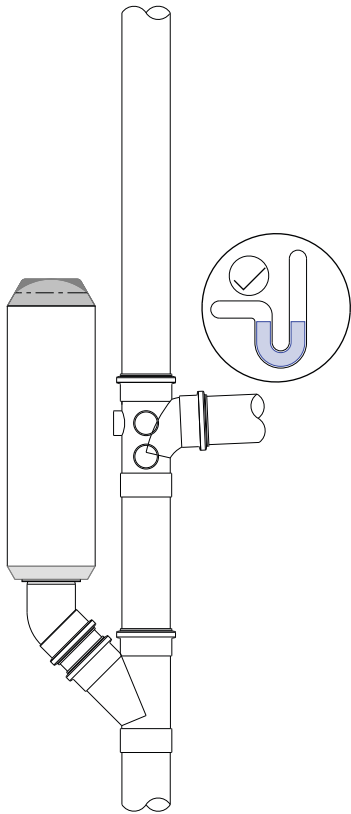
Benefits of single stack with P.A.P.A system:

- Provides effective protection against positive/negative pressures in the drainage system
- Scientifically proven and tested for total peace of mind
- Reduces installed service space, slab & roof penetrations and passive fire protection measures
- Product solutions for new buildings and retrofit projects
- Connects to all Marley Plumbing & Drainage soil systems
- Exclusively designed by in-house technical experts

P.A.P.A. capacity

Maximum drainage flow for P.A.P.A. is illustrated below:

| Stack size (mm) | Maximum capacity (l/s) |
|-----------------|------------------------|
| 110 | 7.3 |
| 160 | 18.3 |



P.A.P.A.



Mini-Vent




Maxi-Vent

Pressure types explained

 Negative pressure

Siphonage from the trap starts to occur when the pressure at the point of drainage exceeds - 400mmWg (- 400Pa)

 Positive pressure

Bubbles start to pass through the trap seal when the pressure at the point of drainage exceeds + 40mmWg (+ 400Pa)

P.A.P.A. (Positive Air Pressure Attenuator)

P.A.P.A. (Positive Air Pressure Attenuator) has been developed through years of research and development to solve the problems of positive pressures within drainage systems of multi-storey developments.

Features:

- Easy to install vertically or horizontally
- Lightweight and strong construction
- Push-fit connection
- Stackable, up to 4 units
- Suitable for multi-storey developments
- Resistant to most chemicals

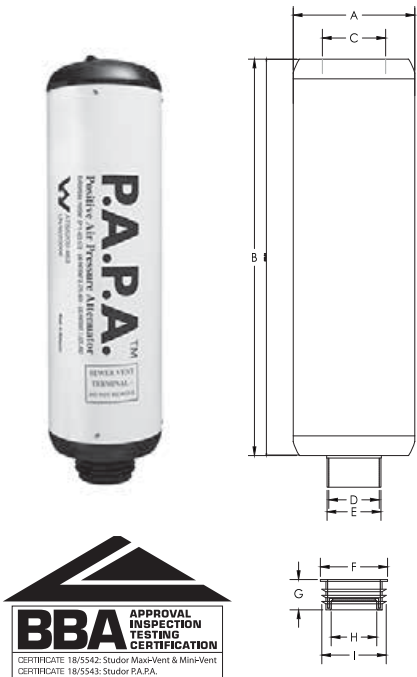
Save even more space:

A Studor Maxi-Vent air admittance valve may be installed on the top of the P.A.P.A. (when installed vertically) turning it into a positive and negative transient protection device.

Installation

For installation instructions, please refer to page 16 or download from marleypd.co.uk. Refer to your local area regulations for open vent requirements.

STUDOR P.A.P.A.



| Size mm | Code | A | B | C | D | E | F | G | H | I | Colour | Qty |
|---------|---------------|-----|-----|-----|----|----|-----|----|----|-----|--------|-----|
| 75/110 | 8F-STU616-WHB | 200 | 652 | 104 | 83 | 89 | 111 | 50 | 75 | 106 | W | 1 |

Installation recommendations

| | |
|----------------|-------------------------------------------------------------------------------------------------------------------------|
| 5 - 10 floors | One unit on the base |
| 11 - 15 floors | One unit on the base, one halfway |
| 16 - 25 floors | One on base, one on 5th floor, one half way or remaining floors above 5th floor |
| 26 - 50 floors | Two units in series on the base, then one unit on every fifth floor up to the 25th floor, and then one every 10th floor |
| 51 or more | Please consult with manufacturer for further information |

Materials

| Component | Material |
|--------------------|----------|
| P.A.P.A. body | UPVC |
| Internal container | Isoprene |
| Connector | Rubber |

Volume Capacity

| Series assembly | (litres) |
|-----------------|----------|
| 1 unit | 3.785 |
| 2 units | 7.570 |
| 3 units | 11.355 |
| 4 units | 15.140 |

| | |
|----------------------|-------------------------------------------------------|
| Temperature range | - 20°C to + 60°C - 40°F to + 150°F |
| Max. pressure rating | 10,000 Pa (1m/40" H ₂ O) at 0 Pa or higher |



Case study O2 Arena

It was local council concerns of the perceived risks from SARS and other airborne viruses that resulted in an innovative, new drainage solution at the iconic O2 arena.

“The O2 was a difficult project because it was breaking new ground and no typical model existed. The data we produced included flow calculations, flow rates and pipe sizing to deal with air and transient pressures. This resulted in the world's first sealed drainage system, totally without the need for any open vents”

Steve White, Studor Technical Director

Air Admittance Valves



Studor Air Admittance Valves (AAVs) eliminate the need for passive pipe venting and roof penetrations with excellent performance as a result of their unique and patented design.

The negative pressure-activated, one-way AAV vents to protect the trap seals in the drainage system by allowing the intake of air, so that the right level of pressure within the drainage system is maintained.

Their unique design guarantees a lifetime performance on quick opening reaction time, zero maintenance and a 100% closing ability that meets all leading international product standards.



Features:

- 75–110mm pipe sizes (Maxi-Vent)
- 32–63mm pipe sizes (Mini-Vent)
- Prevents the release of foul air from the drainage system
- Can divert condensation away from the sealing membrane
- Double screen protection against foreign material or insects

Benefits

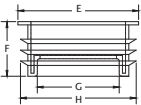
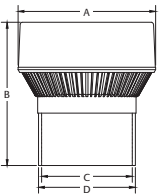
- Constant lifetime opening and closing
- Neutralise any internal condensation for constant membrane opening ability
- Dry membrane for consistent lifetime functioning, not depending on lubrication
- 500K cycle endurance testing
- Connects to all Marley Plumbing & Drainage soil systems

Installation

For full installation instructions, please refer to page 17 or download from marleypd.co.uk. Refer to your local area regulations for open vent requirements.

STUDOR MAXI-VENT WITH CONNECTOR

| Size mm | Code | A | B | C | D | E | F | G | H | Qty |
|----------|-------|-----|-----|----|----|-----|----|----|-----|-----|
| 75 - 110 | 49112 | 126 | 131 | 83 | 89 | 111 | 50 | 75 | 106 | 1 |



Performance parameter

| | |
|--------------------------------|-------------------------------------------------------|
| Temperature range | - 40°C to + 60°C (CE) - 40°F to + 150°F (ASSE) |
| Opening pressure | -70 Pa (-0.010 PSI) |
| Max. pressure rating tightness | 10,000 Pa (1m/40" H ₂ O) at 0 Pa or higher |

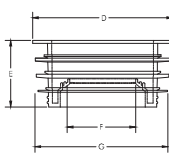
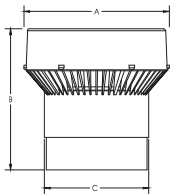
Materials

| Component | Material |
|--------------------|------------------|
| Maxi-Vent body | ABS |
| Maxi-Vent membrane | Synthetic rubber |
| Connector | Rubber |

| Air flow capacity | Branch | Stack |
|-------------------|------------------|-----------------|
| Europe | 32 l/s | 32 l/s |
| AU/NZ | 32 l/s / 1728 FU | 32 l/s / 125 FU |
| USA | 1 to 160 DFU | 72 to 500 DFU |

STUDOR MINI-VENT WITH CONNECTOR

| Size mm | Code | A | B | C | D | E | F | G | Qty |
|---------|-------|----|----|----|----|------|----|----|-----|
| 32-63 | 49017 | 70 | 67 | 47 | 67 | 31.9 | 33 | 64 | 1 |



Performance parameter

| | |
|--------------------------------|-------------------------------------------------------|
| Temperature range | -20°C to +60°C (CE) -40°F to +150°F (ASSE) |
| Opening pressure | -70 Pa (-0.010 PSI) |
| Max. pressure rating tightness | 10,000 Pa (1m/40" H ₂ O) at 0 Pa or higher |

Materials

| Component | Material |
|----------------------|------------------|
| Mini-Vent cap & body | ABS |
| Mini-Vent membrane | Synthetic rubber |
| Connector | TPE |


| Air flow capacity | Branch | Stack |
|-------------------|-----------------|----------------|
| Europe | 7.5 l/s | 7.5 l/s |
| AU/NZ | 7.5 l/s / 94 FU | 7.5 l/s / 7 FU |
| USA | 1 to 160 DFU | 8 to 24 DFU |




Designing the most efficient drainage system for a project is a skill for which the Marley Technical Services team are renowned. Marley Plumbing & Drainage provide technical support to all those involved with the specification and installation of our products.

Our technical team can help you specify the system you need


Years of experience mean that we can support you throughout your design process and assist with any technical and installation requirements.




DESIGN SERVICES




VALUE ENGINEERING




TECHNICAL ADVICE




FABRICATIONS SERVICE




RAINWATER CALCULATIONS




MATERIAL TAKE-OFFS




CAD FILES




BIM OBJECTS




FIELD AND SITE SUPPORT



SPECIFICATION



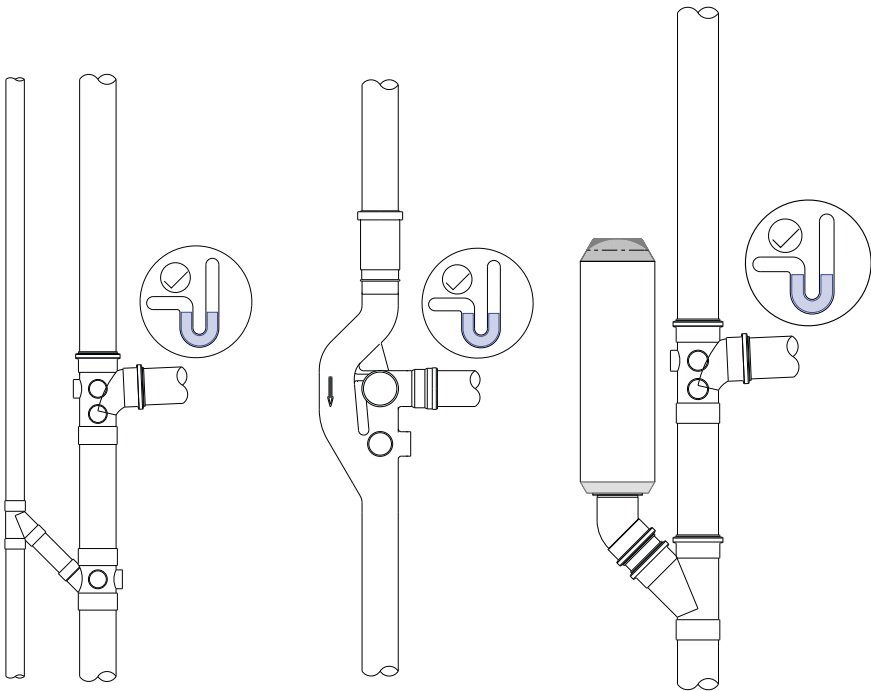
SPECIAL FABRICATIONS



CPD SEMINARS

Venting

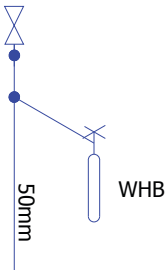
Marley Technical Services design drainage pipework systems using the three methods of soil stack ventilation shown on pages 4-5; secondary ventilation, single stack system with stack-aerator and active drainage ventilation using Studor P.A.P.A. and AAVs.



AAV Venting

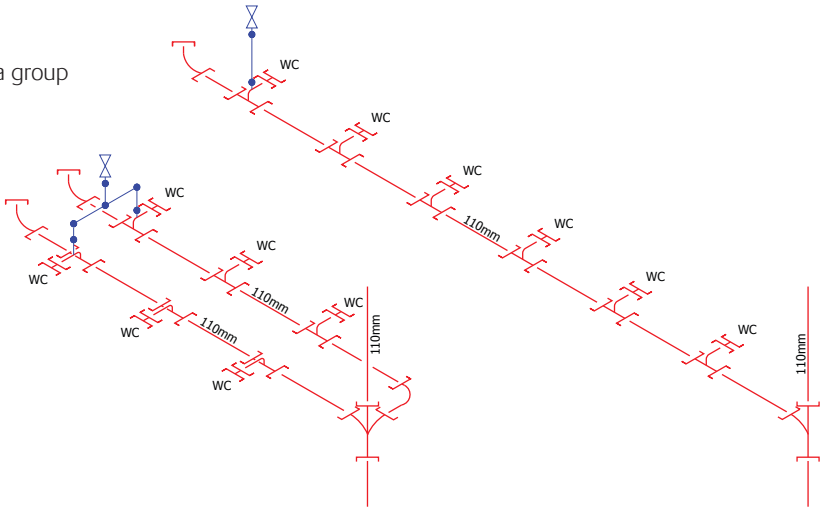
Individual Vent

The individual vent is the most straightforward form of venting. The Mini-Vent acts as an effective method of venting sanitaryware, including those which are in a remote location.



Circuit Vent

The layout to the right shows a single vent serving a group of WCs. The Mini-Vent acts as a circuit vent.



P.A.P.A. design requirements

When designing an active drainage ventilation system, the following should be considered:

- Pressure within the pipework system is constantly changing
- Ensure the water seal in the trap is protected, due to the continual pressure changes in the pipework system

To create an effective active drainage ventilation system, P.A.P.A. should be installed throughout the pipework.

Their position and layout will be designed by our in-house Technical Services team, however the adjacent table provides general guidance on how many P.A.P.A.s may be required:

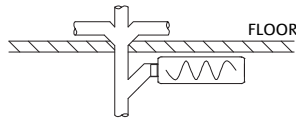
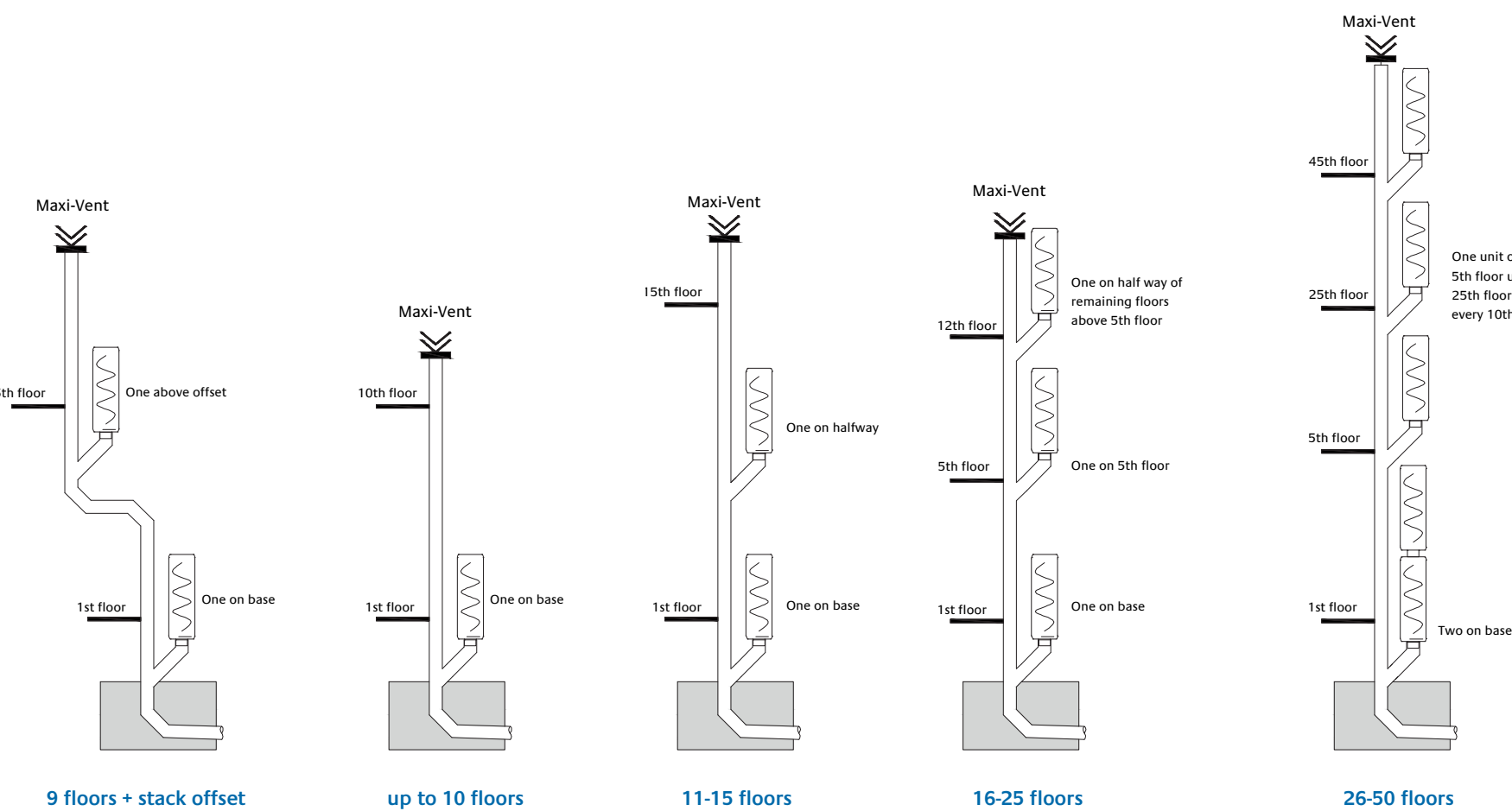
| | |
|--------------|-------------------------------------------------------------------------------------------------------------------------|
| 5-10 floors | One unit on the base |
| 11-15 floors | One on the base, one halfway |
| 16-25 floors | One on base, one on 5th floor, one half way or remaining floors above 5th floor |
| 26-50 floors | Two units in series on the base, then one unit on every fifth floor up to the 25th floor, and then one every 10th floor |
| 51 or more | Please consult with manufacturer for further information |

A P.A.P.A. requires no maintenance, but must be installed so that it is accessible.

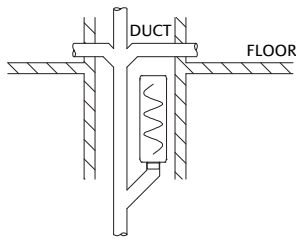
Sizing of soil stacks

It is recommended that the guidance given within BS EN 12056, part 2 be adopted when sizing soil stacks. Marley Technical Services Department offer design and installation advice, including the sizing of soil stacks, for those customers who make a commitment to use Marley Plumbing & Drainage products.

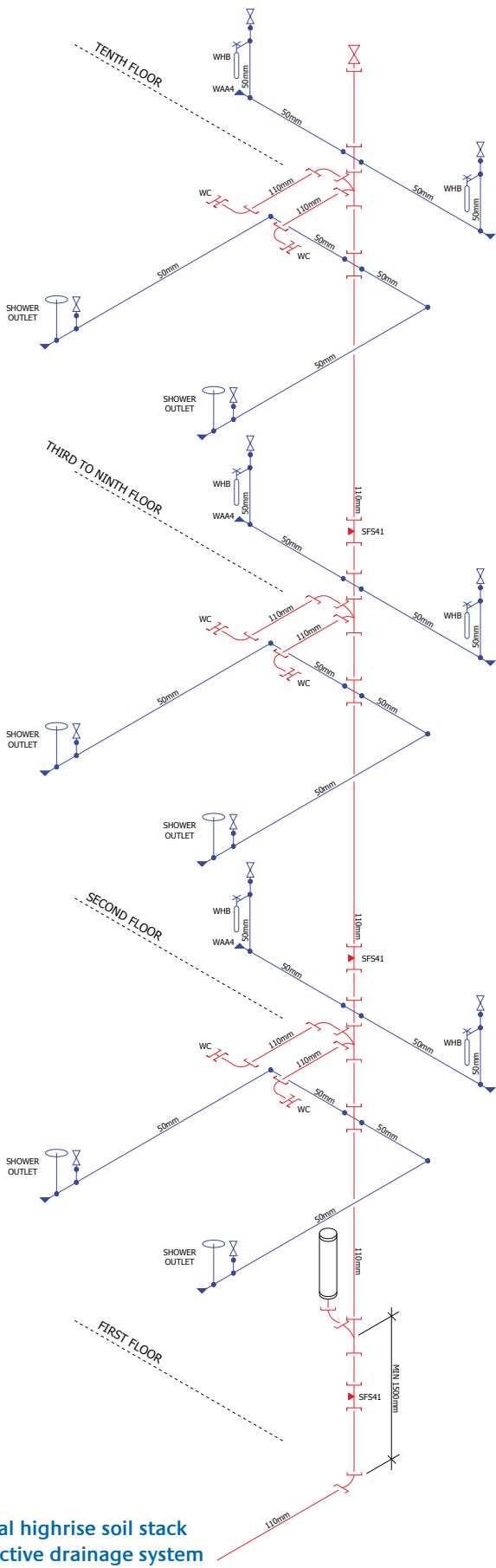
Accurate design and correct installation is key to the continuous efficiency of the drainage system. Please refer to full installation information in conjunction with the above standard.



Horizontal floor installation



Vertical duct installation



Typical highrise soil stack using active drainage system

Minimum distance

- Stack extending no more than 5 floors above the base of the stack or offset: 0.60 metres
- Stack extending more than 5 floors above the base of the stack or offset : 1 metre
- Stack receiving suds discharges: as close as possible to the first horizontal branch
- Minimum distance shall be measured from centre to centre

Seeing is believing

See how water and air interacts in a true high-rise setting. The ‘Seeing is Believing’ experience is available in two unique testing facilities located in the UK and the Netherlands. They utilise clear pipe and completely visible products and fittings to demonstrate the occurrences within a real high-rise drainage system and how they are managed by the P.A.P.A. System versus a conventional vent pipe system.

Please contact our team via marketing@marleypd.co.uk to arrange your visit.



The National Lift Tower

The National Lift Tower

The National Lift Tower hosts the world’s tallest drainage testing installation, comprising a 96 metre soil stack fitted with the P.A.P.A. System (P.A.P.A. and AAVs) for active ventilation. Electronic pressure sensors in the test rig allow readings in the pipework to be recorded and used to objectively analyse the performance of the P.A.P.A. System versus alternative configurations.



Hydro-Dynamics Experience Centre

Hydro-Dynamics Experience Centre

The state-of-the-art Hydro-Dynamics Experience Centre (HDEC) combines a testing facility with a customer experience centre, where customers can see precisely how water and air actually flow through our pipe systems. The HDEC is instrumental in testing new solutions and also simulates the performance of systems in specific situations for increasingly complex and/or high-rise buildings.

Heriot-Watt University

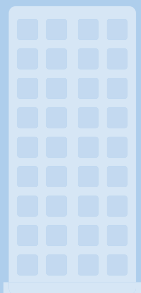
Founded in 1821 in Edinburgh, Scotland, and has established a reputation as a leading research-led university and provider of education around the world, with campuses in several locations including Dubai and Malaysia. Heriot-Watt and Studor have collaborated for over 20 years on research and development on a range of innovative new products. The P.A.P.A. (Positive Air Pressure Attenuator) is one of the results of this partnership; many other developments are currently in process, with the potential to revolutionise the high-rise building drainage market.



Where to use active drainage ventilation

Low-rise buildings

In low-rise buildings (up to 4 floors) the standardised plumbing design has proven to work without using active drainage ventilation. Typical residential roof penetrations, can be avoided using a Maxi-Vent; keeping the roof intact and the plumbing system internal for better insulation.

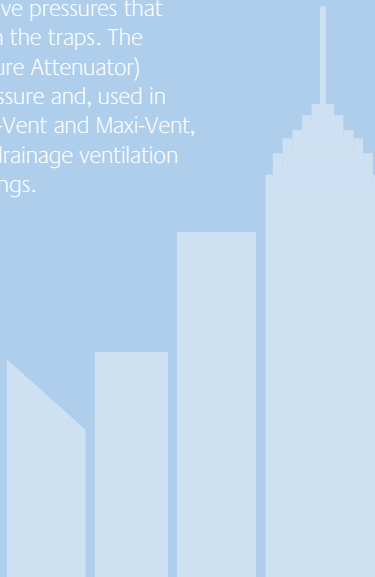


Medium-rise buildings

In medium-rise buildings (4 to 12 floors) traps can be depleted by induced siphonage, a phenomena in which a flush on one level causes negative pressures in the pipe system which acts on traps of other levels. The Mini-Vent placed on each horizontal branch will eliminate any negative pressure and protect the traps. The Maxi-Vent will avoid a roof penetration.

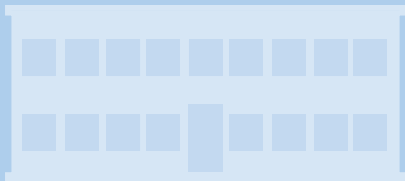
High-rise buildings

In high-rise buildings (above 12 floors) there will be negative and positive pressures that influence the water seal in the traps. The P.A.P.A. (Positive Air Pressure Attenuator) dampens the positive pressure and, used in conjunction with the Mini-Vent and Maxi-Vent, offers a complete active drainage ventilation system for high-rise buildings.



Retro-fit buildings

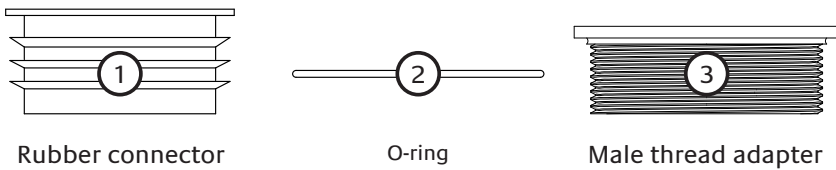
In existing buildings, drainage problems like slow wastewater drainage, gurgling noises, foul odours and trap seal depletion are largely due to negative pressures and can be solved by adding air admittance valves (AAVs). Retrofitting vertical stacks with P.A.P.A.s. will combat existing positive pressure problems in high rise buildings.



Studor P.A.P.A. (Positive Air Pressure Attenuator)

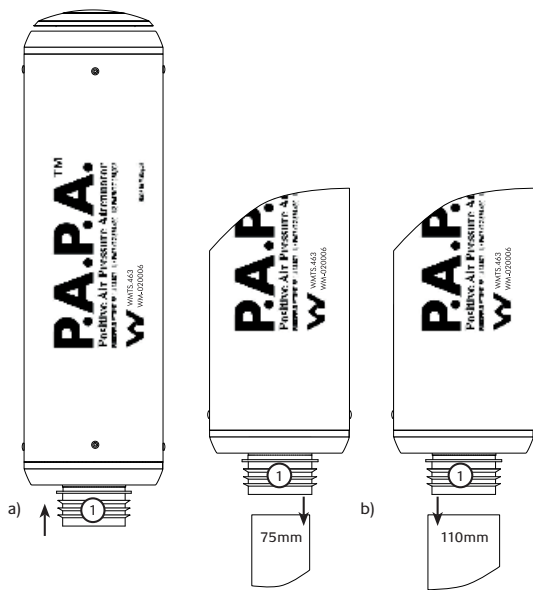
P.A.P.A. is a device used to eliminate the harmful effects of positive transients generated in gravity fed systems in multi-storey buildings

The P.A.P.A. is provided with a rubber connector on the base and with a separate O-ring and male thread adapter to allow greater versatility.



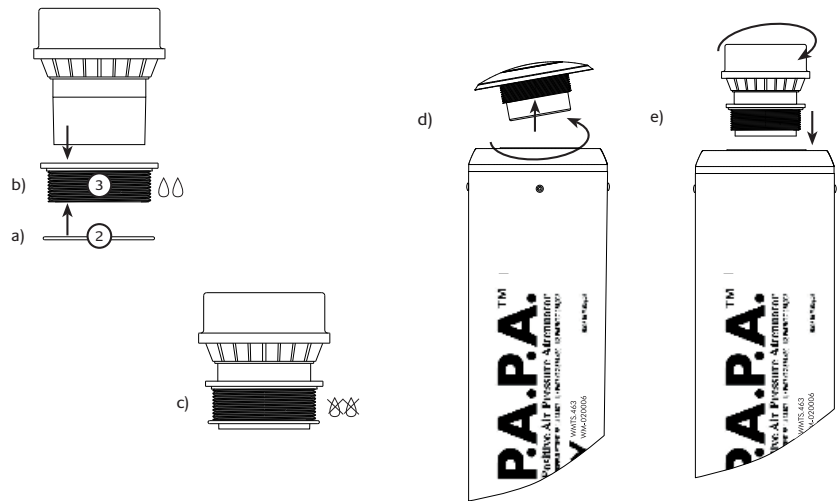
1. Installing P.A.P.A. with a rubber connector:

- a) Ensure the rubber connector is securely fitted to the base of the P.A.P.A.
- b) Push-fit the rubber connector fitted to the base of the P.A.P.A. onto a 75mm or into a 110mm pipe connection.



2. Installing a Maxi-Vent on top of a P.A.P.A.:

- a) Fit O-ring to the male thread adapter.
- b) Fit the male thread adapter to the base of the Maxi-Vent and glue into place sparingly using ABS solvent.
- c) Wipe away any excess solvent to ensure this does not get into the Maxi-Vent, as this will affect its operation.
- d) Unscrew the cap on the top of the P.A.P.A..
- e) When the solvent has fully dried, screw the male thread adapter fitted to the base of the Maxi-Vent into the top of the P.A.P.A.



Studor Maxi-Vent

- 1. The Studor Maxi-Vent must be installed vertically and upright to permit its correct operation (within 5° of vertical).

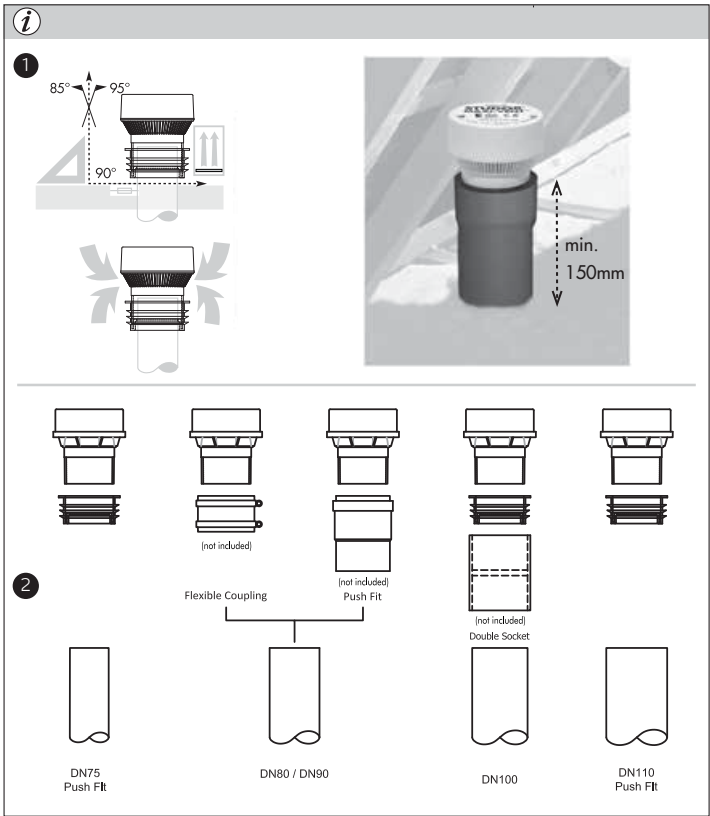
Place the valve in an accessible location, allowing free air movement.

Install 150mm above the insulation in attic installations.

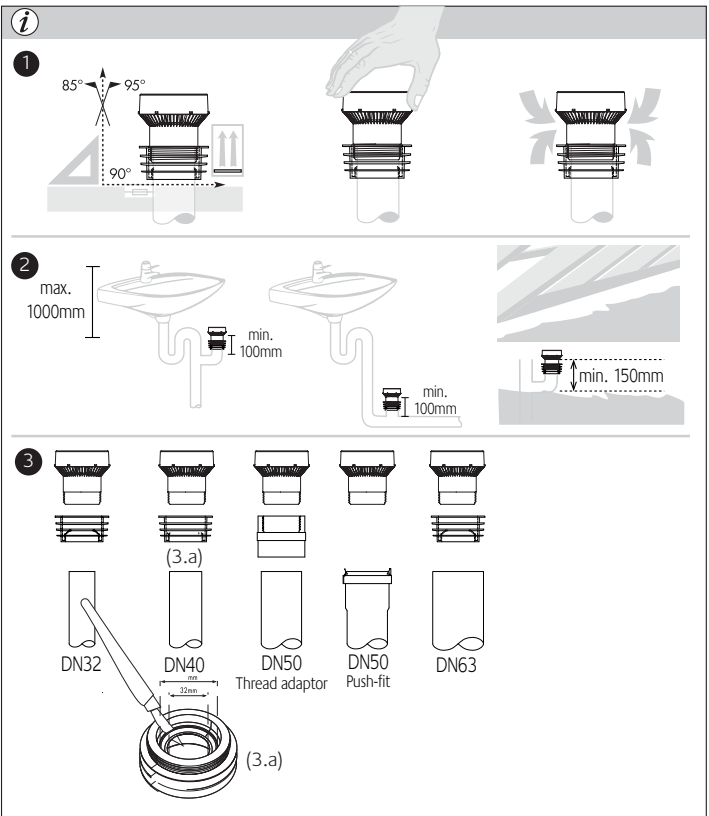
Install the Maxi-Vent after the drainage system has been tested.

- 2. As standard, the Studor Maxi-Vent is provided with a push-fit connector allowing its fixture to stack pipes sized 75mm to 110mm.

When installed outside, place the (optional) aluminium cover over the insulating cap to protect the Maxi-Vent from animals/birds and the environment, i.e. inclement weather and the sun's ultraviolet rays.



Studor Mini-Vent



- 1. The Studor Mini-Vent must be installed vertically and upright to permit its correct operation (within 5° of vertical).

Place the valve in an accessible location, allowing free air movement.

- 2. Install the Studor Mini-Vent no more than 1,000mm below the flood level of the fixture to which it is connected.

The valve must be installed 100mm above the horizontal waste.

In attic installations, place the valve 150mm above the insulation.

Install the valve after the drainage system has been tested.

- 3. To prepare the connector to fit to DN40 pipe: on the underside of the connector (3.a) use a cutter to make a small incision in the indentation of the second marked ring. Tear off excess material.

British & European Standards

BS EN 1329-1: 2014

Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure – PVCu.

BS EN 1451-1: 2000

Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure – polypropylene.

BS EN 1519-1: 2000

Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure – polyethylene.

BS EN 12380: 2002

Air admittance valves for drainage systems – requirements, test method and evaluation of conformity.

BS 4514: 2001

Specification for PVCu soil and ventilating pipes, fittings and accessories.

BS EN 1566-1: 2000

Specification for thermoplastics waste pipe and fittings.

BS 5255: 1989

Specification for thermoplastics waste pipe and fittings.

BS EN 1455-1: 2000

Plastics piping systems for soil and waste (low and high temperature) within the building structure – ABS.

BS 5627: 1984

Specification for plastics connectors for use with horizontal outlet vitreous china WC pans.

BS EN 14680: 2015

Specification for adhesives for non-pressure thermoplastics pipe systems.

BS EN 681-1: 1996

Elastomeric seals. Material requirements for pipe joint seals used in water and drainage applications. Part 1 vulcanised rubber.

BS EN ISO 9001: 2015

Quality systems. Model for Quality Assurance in Design, Development, Production, Installation and Servicing.

BS EN ISO 14001: 2015

Environmental management systems. Requirements with guidance for use.



Standard PVCu soil systems to BS EN 1329: 2000. Ideal for domestic and commercial applications, including branch connections to other materials. Available in 82mm, 110mm and 160mm, ring seal and solvent weld jointing variants.



An acoustic soil and waste range with a layered pipe providing quick, hygienic removal of sanitary waste water. The noise generated by the flow of water is dramatically reduced – making it perfect for multi-occupancy apartment blocks and high specification developments.



Marley Akatherm HDPE is a drainage system which offers an alternative solution to cast iron. It is particularly suited for commercial applications or where a product with high impact or abrasion resistance is required, such as hospitals, hotels, schools, as well as residential buildings. HDPE will also cope with temperature variations of -40°C to 100°C making it ideal for external as well as internal installations.



The Multikwik brand is known and trusted by plumbers for its sanitary frames, cisterns, traps, compression waste systems and market leading range of pan connectors. Complementing the Marley range it provides an excellent solution to modern bathroom design with a wide choice of product options.



The Marley Plumbing & Drainage range of underground systems include the solid wall range, predominately for round the house drainage and Quantum structured wall range for sewer and highway drainage applications.



Nine gutter profiles and six downpipe options provide a rainwater solution for any application. Advanced Life⁴ technology on four of the key profiles, coupled with the benefits of the Easyclip and notching capability combine to make the Marley rainwater range the most comprehensive available.

Accreditations





marleypd.co.uk

For general enquiries and details of your nearest stockist please call the customer services department:

Tel: 01622 852585

Email: customerservice@marleypd.co.uk

To place an order

For delivery to **England & Wales**

Email: orders.lenham@marleypd.co.uk

Fax: 01622 851111

For delivery to **Scotland**

Email: orders.uddingston@marleypd.co.uk

Fax: 01698 810307

For all estimate requests

Email: estimates@marleypd.co.uk

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