

# TERRAIN

## Terrain P.A.P.A.<sup>®</sup> and Pleura



Terrain P.A.P.A.<sup>®</sup> and Pleura Alternative Drainage Ventilation System

# Alternative Engineered Ventilation System

Polypipe Building Services, Terrain soil and waste products represent the industry benchmark for quality, installation, flexibility and product innovation, backed by the highest levels of customer service. Terrain systems comprise an extensive range of soil and waste drainage products, including the Terrain Pleura system, a unique alternative ventilation solution for high-rise buildings.

- Unique products offering unrivalled installation options
- High quality finish
- Suitable for all types of commercial and residential high-rise buildings
- Extensive technical experience to support and advise on all aspects of design and installation
- Fully accredited product systems

As you would expect from a market leader, Terrain drainage products come with all relevant standards including:

## Manufacturing Standards

BS EN 12380 AI Air Admittance Valve (Pleura System)

## Quality Management Systems Standards

BS EN ISO 9001:2015 Management Systems

BS EN ISO 14001:2015 Management Systems

BS OHSAS 18001:2007 Management Systems

PAS 99:2012 Integrated Management Registration



Terrain Pleura 50 9301.253



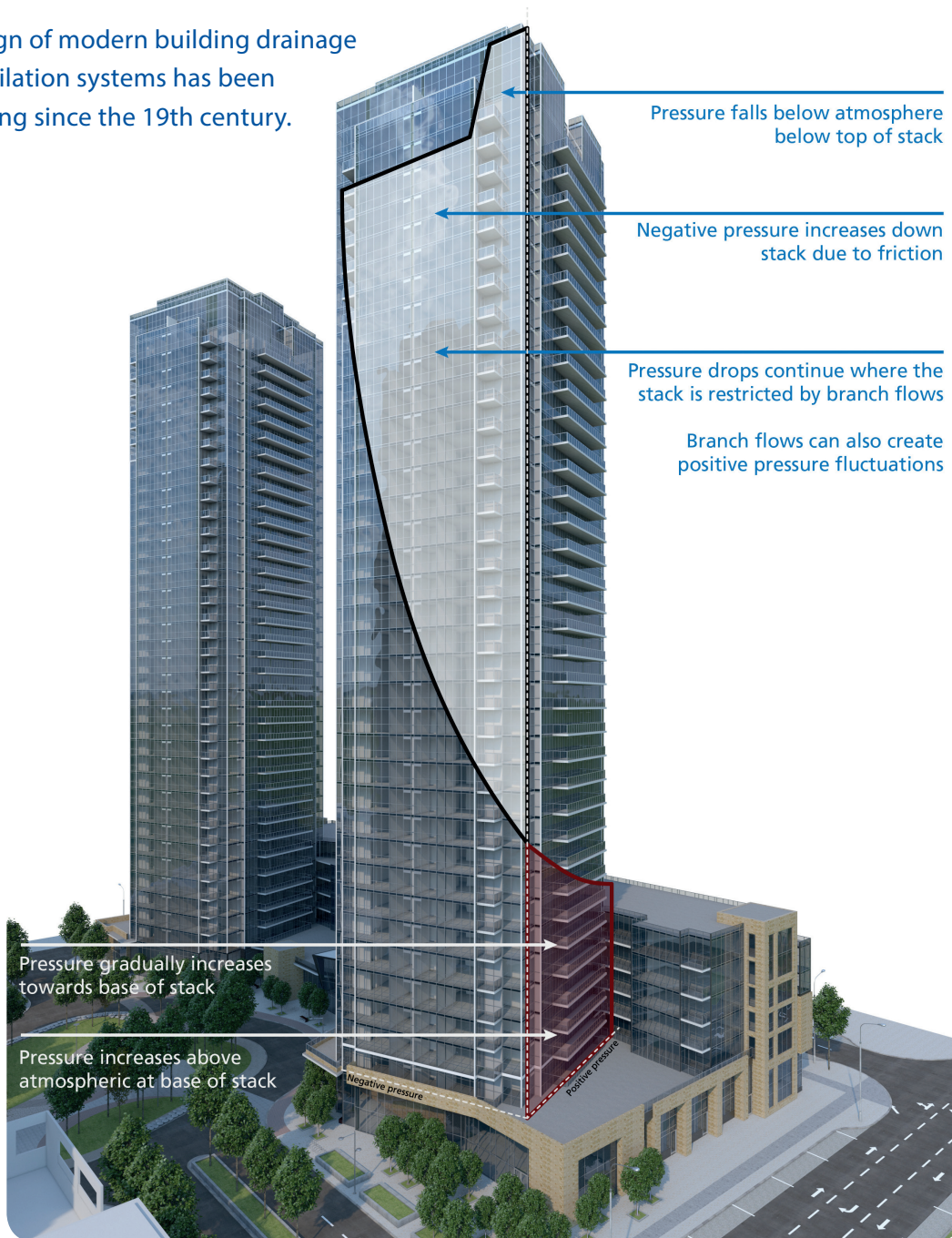
Terrain Pleura 100 9301.34



Terrain P.A.P.A.®9300.4

# Ventilation Drainage Pipework Systems

The design of modern building drainage and ventilation systems has been developing since the 19th century.



A minimum of 50mm of water is all that protects the occupants of a building from potentially harmful sewer gases and 'particulates'. Therefore, a good design must consider the integrity of the trap seal and protect it from being lost. One way of doing this is to consider the air flow within the system, as this is the primary reason for trap seal breach. The flow of air within the drainage pipework system is equally as important as the flow of water in maintaining a safe and

hygienic drainage system. This is because the flow of water creates both positive and negative air fluctuations which can compromise water trap seals and upset the equilibrium in the system. Installation of a secondary stack is traditionally the answer, to help alleviate the pressure within the system. However, the P.A.P.A.<sup>®</sup> and Pleura drainage and ventilation systems negates the need for a second stack and therefore saves on cost, time, floor space and is a more efficient system.

# Terrain P.A.P.A.<sup>®</sup> and Pleura Drainage Ventilation System

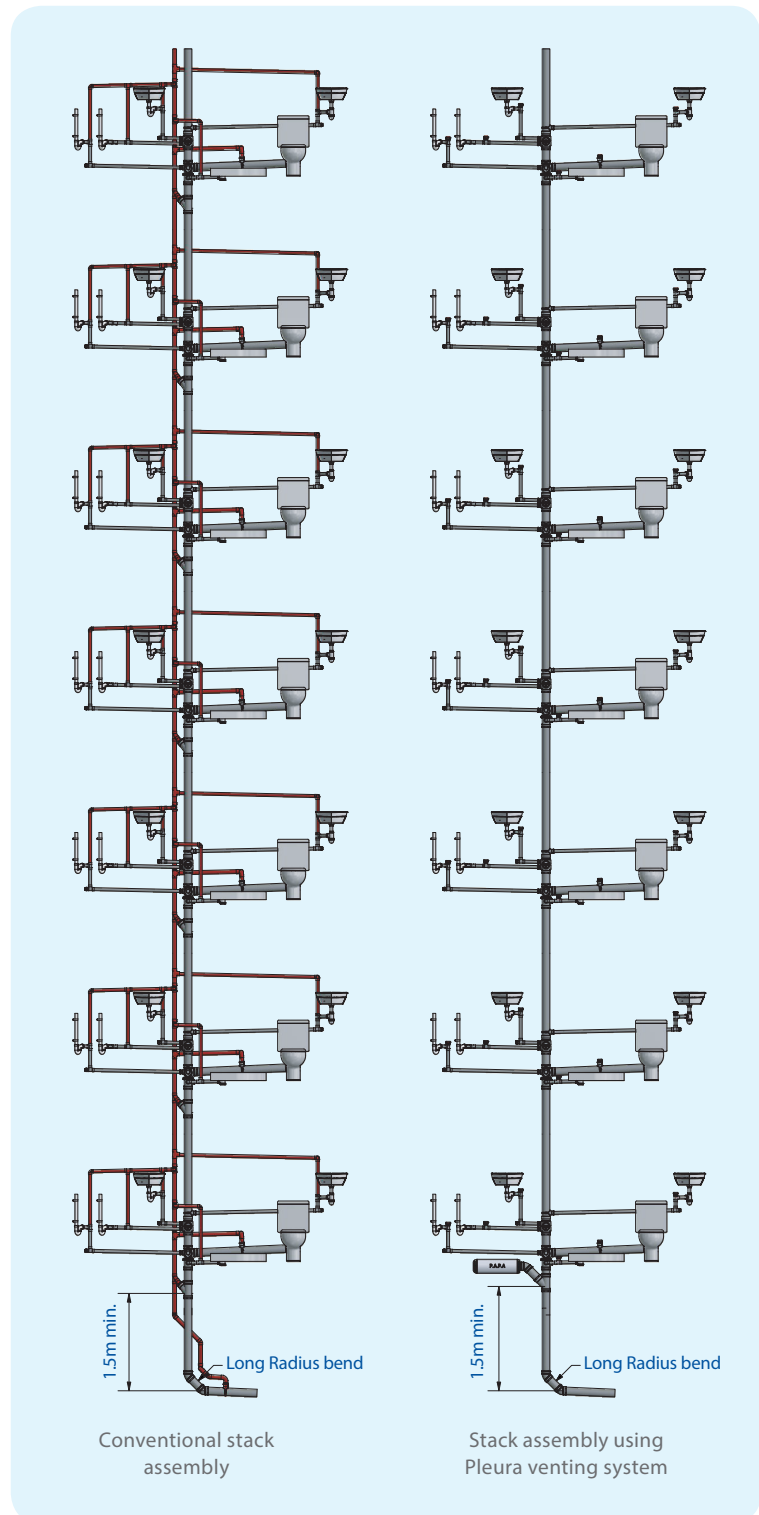
## The smarter air pressure and drainage ventilation system for high-rise buildings.

Following several years of theoretical and practical research into both positive and negative transient pressure fluctuations in drainage systems, the Terrain Pleura system provides both an intelligent and integrated solution for balancing the ambient air pressure within a drainage system.

### Terrain P.A.P.A.<sup>®</sup> and Pleura drainage ventilation system; how it works:

Terrain Pleura regulators balance negative air pressure fluctuations whilst a positive pressure reduction device (P.A.P.A.) balances positive pressures. Together, they protect the water trap seal from damage by forming a highly effective alternative solution for maintaining ambient air pressure within the drainage pipework system – whilst trapping foul air and introducing fresh air into the built environment.

Terrain P.A.P.A.<sup>®</sup> can be installed with all of our fabricated soil and waste drainage stacks. To find out more, visit [www.polypipe.com/terrain-drainage-stacks](http://www.polypipe.com/terrain-drainage-stacks)



## Terrain Pleura 50

The Terrain Pleura 50 air regulator provides ventilation to branch pipework. It is generally installed on the pipe behind the appliance trap.

The Terrain Pleura 50 opens and admits fresh air into the branch pipe when the negative (suction) pressure occurs from an appliance discharging into the pipework system. This equalises the ambient air pressure within the pipework and protects the trap seal.

When the flow stops and the internal ambient air pressure in the pipework balances, the Terrain Pleura 50 closes by gravity and prevents foul air entering the built environment.

## Terrain Pleura 100

The Terrain Pleura 100 air regulator can be fitted to the top of a foul or waste stack or at the end of long low gradient branch drains to provide ventilation.

The Terrain Pleura 100 opens and admits fresh air under condition of reduced pressure in the discharge pipes and prevents trapped water seals being drawn. As the internal ambient air pressure in the pipework balances, the Terrain Pleura 100 closes by gravity and prevents foul air entering the built environment.

## Terrain P.A.P.A.®

The Terrain P.A.P.A.® is a positive pressure reduction device, designed to mitigate the effects of positive air fluctuations in the drainage pipework system. As water descends down the drainage stack it creates a negative pressure; if that flow is interrupted or is approaching a change of direction, the negative pressure changes to a positive pressure and moves up the pipe. This low amplitude air wave typically travels at 320m/s, the speed of sound.

As the positive air fluctuation approaches the branch-off point for the Terrain P.A.P.A.®, the bladder within the unit reacts very quickly, within 0.2 seconds, and starts to expand; this creates a pressure differential at the branch-off point.

The branch to the Terrain P.A.P.A.® then becomes the path of least resistance and the majority of the positive air pressure is absorbed within the unit.

As the ambient air pressure within the pipework starts to equalise, the bladder slowly releases the small volume of air into the pipework system at only 12m/s, which will have no effect on the trap seals.



Terrain Pleura 50 9301.253



Terrain Pleura 100 9301.34



Terrain P.A.P.A.® 9300.4

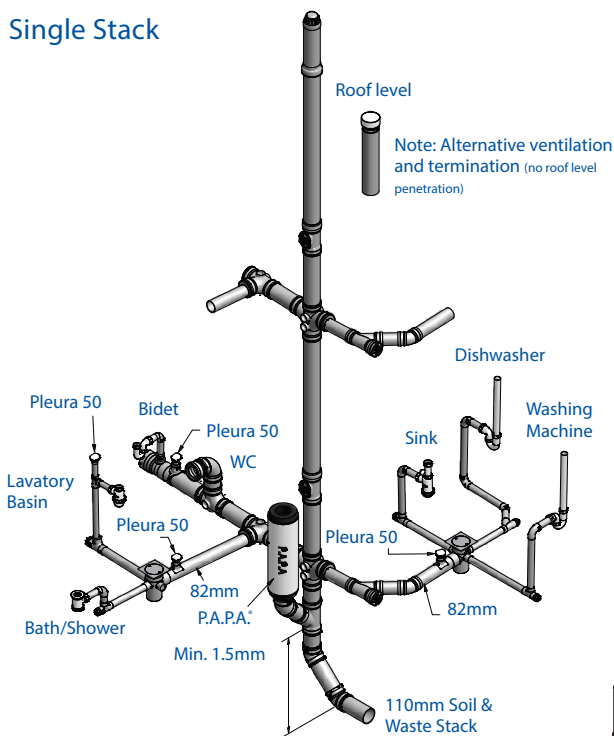
# Benefits of the Terrain Pleura System

There are significant benefits to be obtained when incorporating the Terrain Pleura alternative ventilation system:

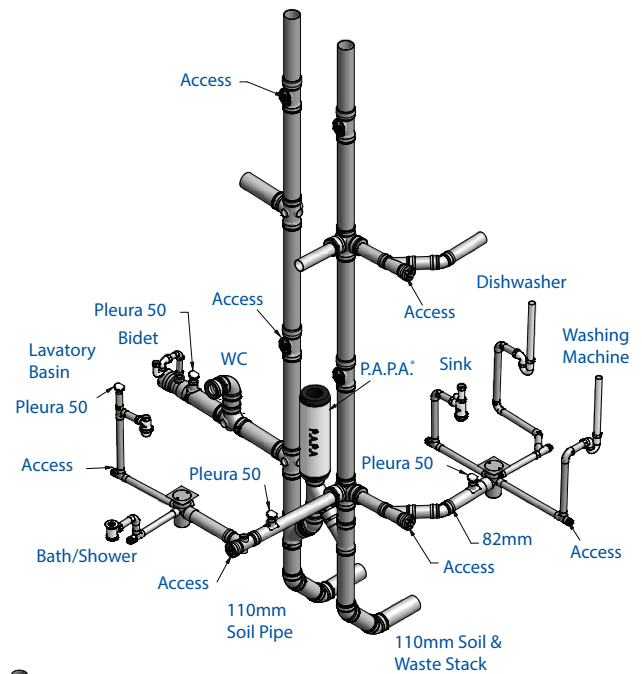
- Improved control and balancing of air pressures within the drainage pipework system
- Traditional vent pipework requirements are replaced, saving costs in materials, installation, testing and time
- More flexibility during the design process for engineers, architects and design professionals
- Reduced risk through the installation of a fully researched and engineered system that enhances overall performance to protect water trap seals

## Alternative Engineered Drainage Ventilation Systems

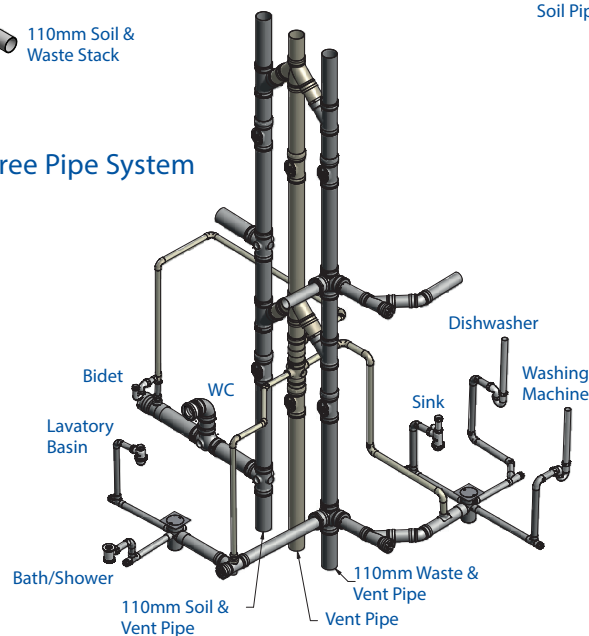
Single Stack



Two Pipe System



Three Pipe System



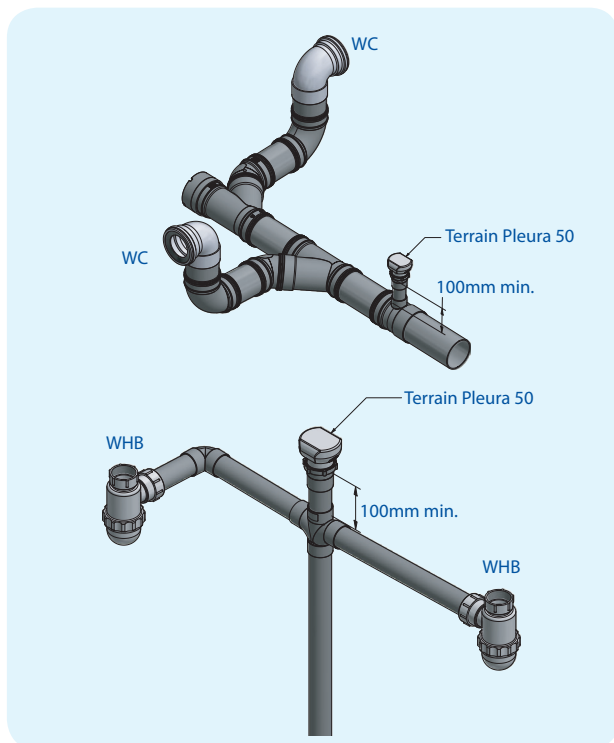
# Design Details – Vents

There are many design applications that can use Terrain Pleura valves.

These isometric drawings are intended to show some of the acceptable applications, however, several alternatives are also acceptable.

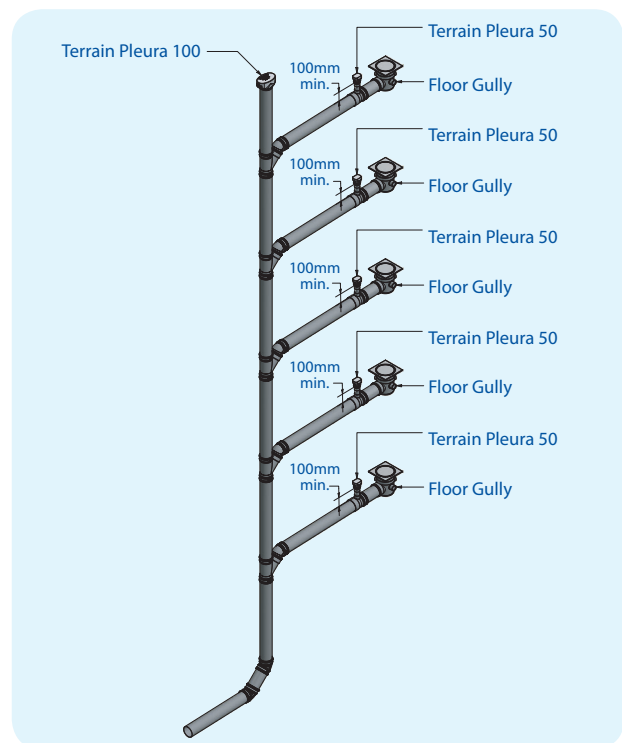
## Common Vent

The common vent serves two or more fixtures. The Terrain Pleura 50 can be located in close proximity to the fixtures being vented.



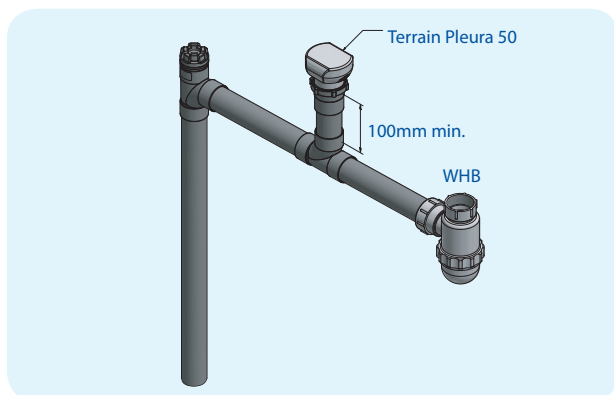
## Stack Vent

The Terrain Pleura 100 can serve as a replacement to a traditional vent.



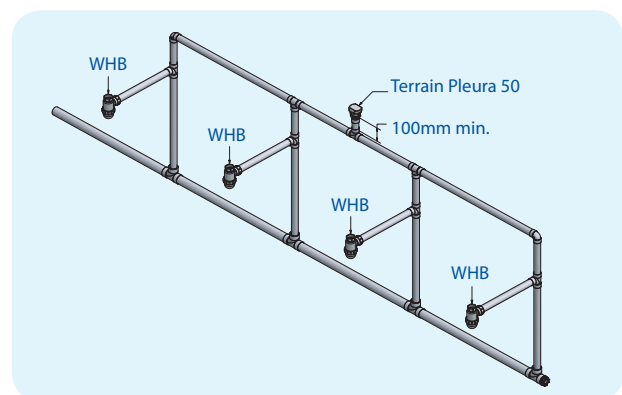
## Individual Vent

The simplest form of venting is an individual vent. With the Terrain Pleura 50, the vent terminal is an effective alternative method to venting fixtures or fixtures located in a remote location.



## Branch Vent

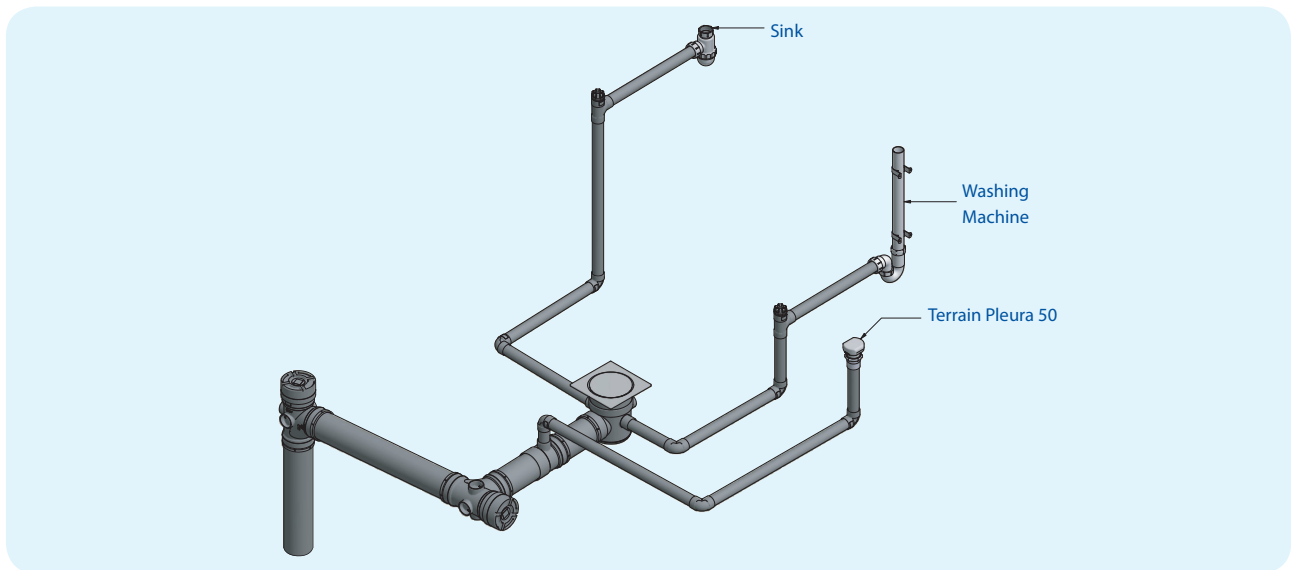
When various vents connect to a branch vent, a Terrain Pleura 50 can serve as a replacement for a traditional vent to the main stack.



# Design Details – Vents

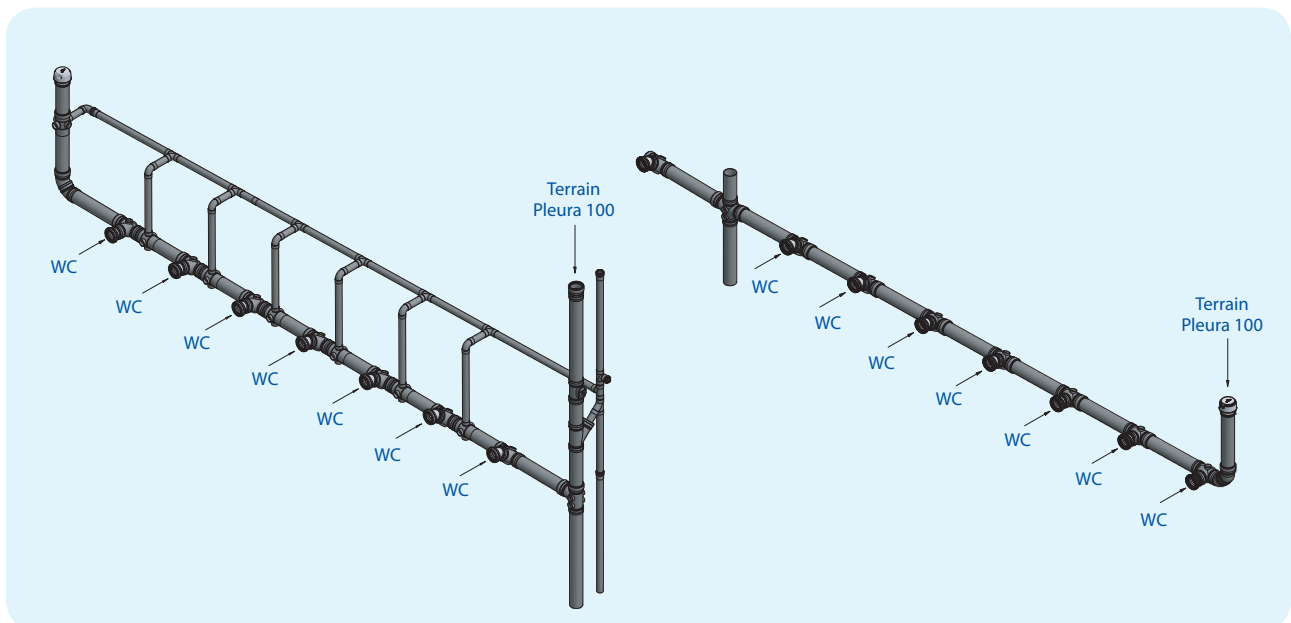
## Washing Machine

This is the ventilation of two or more fixtures connecting into the floor gully. The Terrain Pleura 50 can be located in close proximity to the gully to be vented.



## Circuit Vent

This is a single vent serving as the vent for the group of fixtures. The Terrain Pleura 100 serves as the circuit vent.



For further Technical and Design support please contact,  
[buildingservices.technical@polypipe.com](mailto:buildingservices.technical@polypipe.com), or call 01622 795412

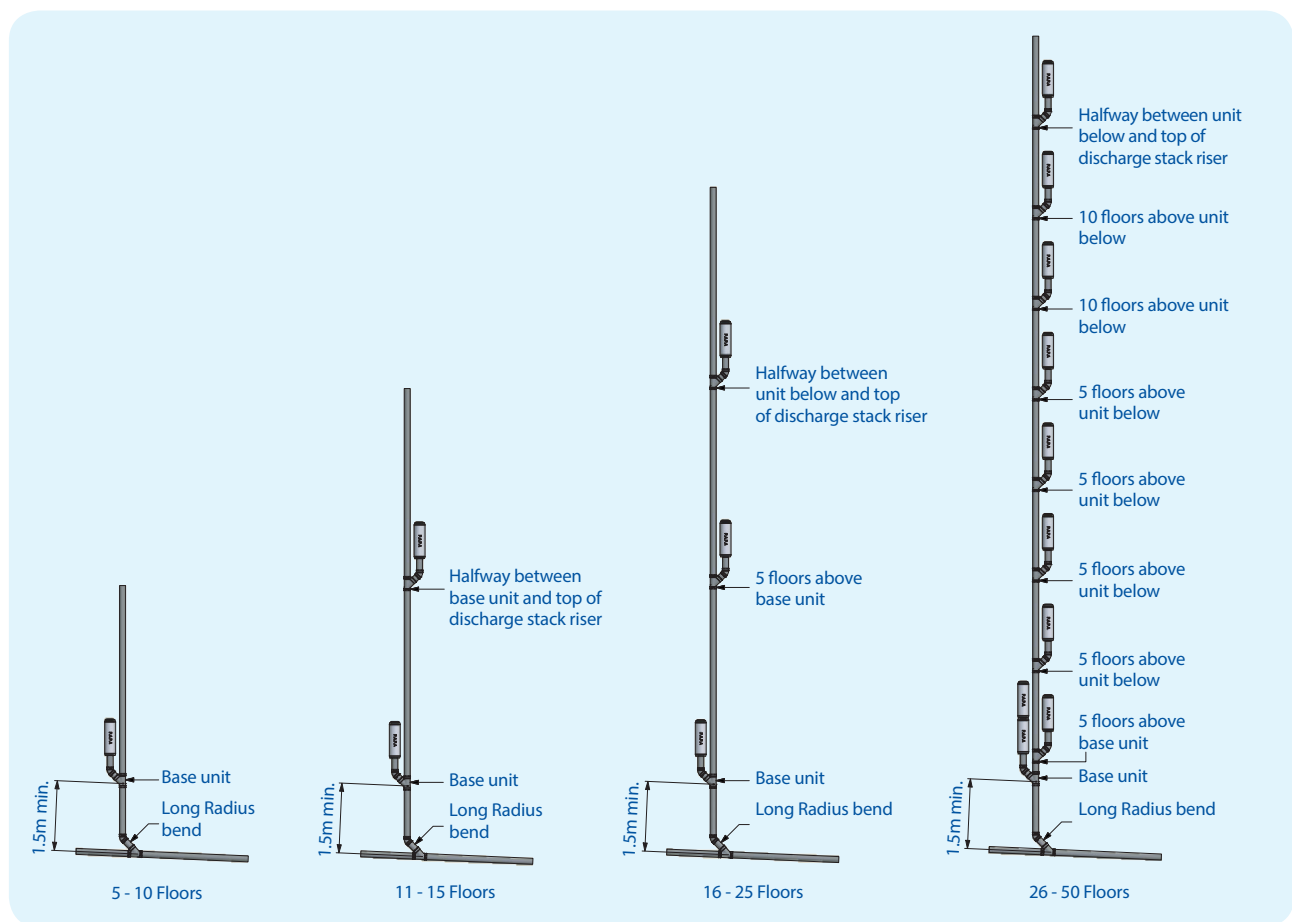


## Terrain P.A.P.A.® Design Criteria

There are several issues which need to be recognised as the drainage and vent system respond to positive transients propagation:

- The pressure profile is constantly changing
- The area of risk to trap water seals is dynamic and constantly changing

To deal with these certainties, the Terrain P.A.P.A.® device should be distributed throughout the system. The following is only a guideline of how many Terrain P.A.P.A.® devices would be required per stack. This would vary depending on the plumbing design. Please consult Polypipe Building Services with any questions regarding the design of the system.



Design Criteria	
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 5F, one half way or remaining floors above 5F
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	To be advised on consultation with manufacturer for best practice

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

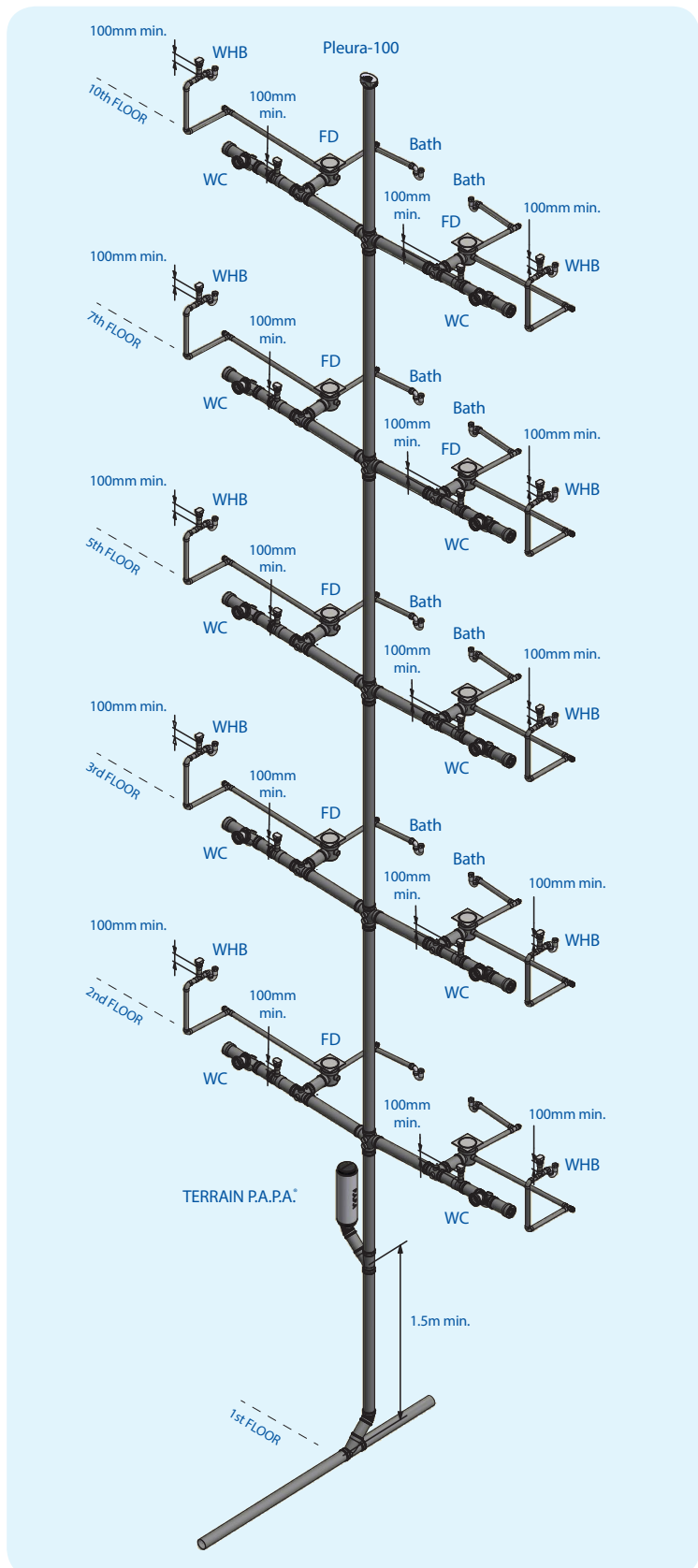
# Design Details – Vents

The Terrain P.A.P.A.® unit is a maintenance free product however, we recommend that it is accessible.

Fluids and suds entering the device will not restrict the device's ability to neutralise the negative effects of pressure transients, nor will they compromise the life expectancy of the device. The use of the Terrain P.A.P.A.® devices in conjunction with Terrain Pleura valves, when correctly designed and installed, is necessary to ensure full warranty of the system.

## Terrain Pleura Riser – with Terrain P.A.P.A.® device and Pleura valves

The following standard details have been prepared to demonstrate Polypipe Building Services's recommended installation of its Terrain drainage products. In addition to Polypipe Building Services's recommendations, there may be other national, state or local specifications that are pertinent to this application. Polypipe Building Services's standards do not supersede any national, state or local specification and recommends that those requirements must be reviewed and consulted with Polypipe Building Services prior to the installation of Terrain drainage products. Polypipe Building Services has not authorised, and it bears no responsibility for, any revisions, alterations or deviations from this. There must be a minimum of one vent to open atmosphere per building system.



# Installation Details

## Installation of the Terrain Pleura 50 & 100

- Terrain Pleura valve location must allow for adequate air to enter the valve. Locating the valve in a sink or vanity cabinet is acceptable
- The valves must not be located in a sealed void or within solid walls
- Terrain Pleura valves must be accessible
- Terrain Pleura valves must be installed in a vertical, upright position. A maximum deviation (in either direction) from plumb of 5 degrees is acceptable
- Terrain Pleura valves must be located a minimum of 100mm above the horizontal branch discharge levels
- The Terrain Pleura 100 must be installed 100mm above the highest flood level of the fixtures being vented in stack applications
- A minimum of one vent pipe must be extended to the open atmosphere for each building drainage system for relief of positive pressure. The size of this vent is not specified because this single vent does not determine the total amount of aggregate cross sectional area of the vent system. The total amount of the cross sectional area of vents combined on the system must equal the aggregate cross sectional area of the building drain. When properly installed, a Terrain Pleura valve in the system is equivalent to an open vent pipe having the same cross sectional area as any other vent. It is recommended that this kind of open air vent be located as close as possible to the connection between the building drain and building sewer

## Installation of the Terrain P.A.P.A.®

- The Terrain P.A.P.A.® can be connected directly to the 100mm branch bend or socket by slipping its synthetic rubber connector (provided) onto the fitting
- The Terrain P.A.P.A.® can be installed as a stand-alone unit with or without the Terrain Pleura 100
- The Terrain P.A.P.A.® unit can be mounted vertically or horizontally
- When mounted vertically (parallel to the waste stack), the P.A.P.A.® unit should be independently supported by an anchor connected to its housing
- When horizontally mounting the Terrain P.A.P.A.® unit, it is advisable to maintain a minimum of a 10-degree slope so as to induce self-draining
- When the Terrain P.A.P.A.® unit is configured horizontally, the Terrain Pleura 100 vent can be fitted, but the Terrain Pleura 100 vent must be in a vertical position

Note: The Terrain P.A.P.A.® unit does not solve the problem of a slow build-up of pressure or a sustained positive pressure originating from deposits blocking the pipes, the blockage of a public sewer, or an overloaded septic tank, for example. This is an inherent problem that must be resolved with or without the installation of Terrain P.A.P.A.® unit(s) or Terrain valve(s).



Terrain Pleura 50 9301.253



Terrain Pleura 100 9301.34



Terrain P.A.P.A.® 9300.4

# Product Specification

## Terrain Pleura 100 – Drainage Ventilation System

The Terrain Pleura 100 is an accepted alternative to replace all forms of conventional stack venting, using active air pressure control, and allowing the air to enter the system at the point of need.

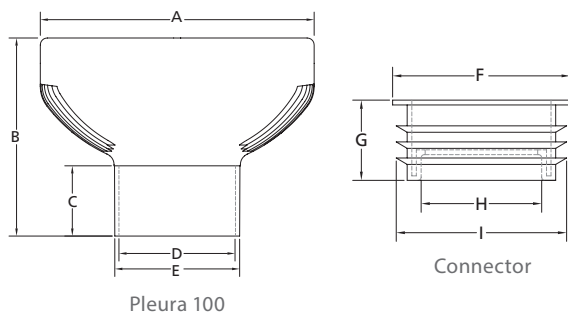
The Terrain Pleura 100 admits air under conditions of reduced pressure in the discharge pipes and prevents water seals in traps from being drawn, thus contributing to the ventilation of the main drain to which the discharge stacks incorporating the Terrain Pleura 100 are connected.

### Features

- Includes screening on the inside and outside of the Terrain Pleura 100 to protect the sealing membrane from foreign objects
- Has a protective cover for the air intake and additional insulation against extreme temperatures
- Can divert condensation away from the sealing membrane
- Prevents the release of foul air from the drainage system
- Available in white ABS

### Installation

The Terrain Pleura 100 should be connected to the piping in accordance with Polypipe Building Services's installation instructions.



Pleura 100

Connector

Terrain Pleura 100 9301.34

Pipe Sizes		
Europe	AU/NZ	USA
DN 75-110	DN 80-100	3" - 4"

Terrain Pleura 100 Dimensions for line drawings

Dimensions		
Dimension	Metric (mm)	Imperial (inches)
A	195	7 <sup>15</sup> / <sub>16</sub>
B	141	5 <sup>5</sup> / <sub>8</sub>
C	50	2 <sup>1</sup> / <sub>16</sub>
D	83	3 <sup>3</sup> / <sub>8</sub>
E	89	3 <sup>5</sup> / <sub>8</sub>
F	111	4 <sup>1</sup> / <sub>2</sub>
G	50	2 <sup>1</sup> / <sub>16</sub>
H	75	3 <sup>1</sup> / <sub>16</sub>
I	106	4 <sup>1</sup> / <sub>16</sub>

Performance Parameter			
Temperature Range	-20° C to +60° C (CE) -40° F to +150° F (ASSE)		
Open Pressure	-70 Pa 0.0072		
Max. pressure rating tightness	10,000 Pa (1m/40" H <sub>2</sub> O) at 0Pa or higher		
Air Flow Capacity	Europe	AU/NZ	USA
Branch	32 l/s	32l/s/1000FU	1 to 160 DFU
Stack	32 l/s	32l/s/140FU	72 to 500 DFU

Materials	
Pleura 100 Body	ABS
Pleura 100 Valve	POM
Seal	NBR
Internal insulation	PEIX
Connector	Rubber

# Product Specification

## Terrain Pleura 50 – Drainage Ventilation System

The Terrain Pleura 50 is an accepted alternative to replace all forms of conventional branch and stack venting. With localised active ventilation of the building drainage system it has been proven that the Terrain Pleura 50 provides greater protection to prevent induced and self-siphonage of the fixture traps.

The Terrain Pleura 50 opens and admits fresh air when the negative (suction) pressure occurs from a fixture discharging into the system. This equalises the pressure within the system and protects the trap seal. When the flow stops, the Terrain Pleura 50 closes by gravity, preventing any transmission of foul air.

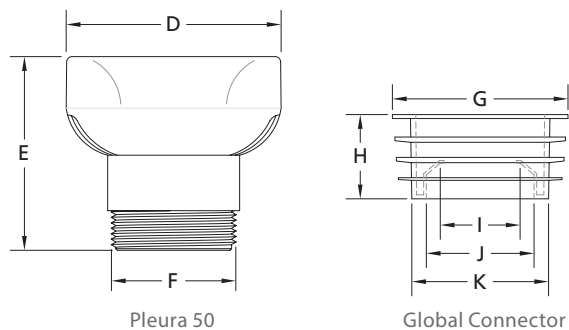
The Terrain Pleura 50 is used as an alternative to extending the vent pipes through the roof or side wall.

### Features

- Includes screening on the inside and outside of the Terrain Pleura 50 to protect the sealing membrane from foreign objects
- Has a protective cover for the air intake and additional insulation against extreme temperatures
- Can divert condensation away from the sealing membrane
- Prevents the release of foul air from the drainage system
- Available in white ABS

### Installation

The Terrain Pleura 50 should be connected to the piping in accordance with Polypipe Building Services's installation instructions. Refer to you local area regulations for open vent requirements.



Terrain Pleura 50 9301.235

Pipe Sizes		
Europe	AU/NZ	USA
DN 32-63	DN 32-63	1¼" - 2"

Terrain Pleura 50 Dimensions for line drawings

Dimensions		
Dimension	Metric (mm)	Imperial (inches)
D	81	3 <sup>1</sup> / <sub>16</sub>
E	73	3
F	DN40	1 <sup>1</sup> / <sub>2</sub>
G	67	2 <sup>3</sup> / <sub>4</sub>
H	32	5 <sup>1</sup> / <sub>16</sub>
I	30	1 <sup>1</sup> / <sub>16</sub>
J	40	1 <sup>5</sup> / <sub>16</sub>
K	52	2 <sup>1</sup> / <sub>8</sub>

Performance Parameter			
Temperature Range	-20° C to +60° C (CE) -40° F to + 150° F (ASSE)		
Open Pressure	-70 Pa -0.001PSI		
Max. pressure rating tightness	10,000 Pa (1m/40" H <sub>2</sub> O) at 0Pa or higher		
Air Flow Capacity	Europe	AU/NZ	USA
Branch	5.7 l/s	5.7 l/s/60FU	1 to 160 DFU
Stack	5.7 l/s	5.7 l/s/7FU	8 to 24 DFU

Materials	
Pleura 50 Body	ABS
Pleura 50 Membrane	Synthetic Rubber
Global Connector	TPE

# Product Specification

## Terrain P.A.P.A.®

The Terrain P.A.P.A.® (Positive Air Pressure Attenuator) is a revolutionary, first-of-its-kind product developed to solve the problems of positive pressures (transients, back pressure) within drainage systems of multi-storey developments.

Research and development into the solution over several years resulted in this intelligent product, which allows multi-storey building designers to simplify their design of sanitary waste systems. The Terrain P.A.P.A.® – in conjunction with the approved Terrain Pleura valves – manages negative and positive pressures.

### Features

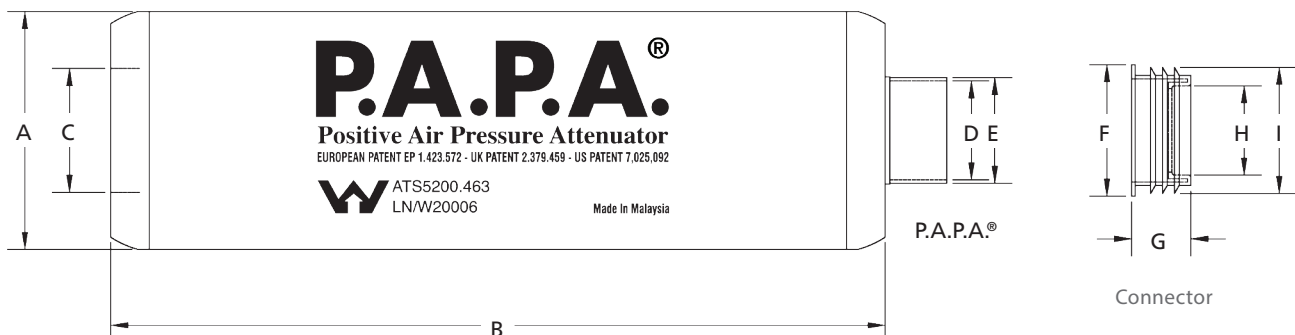
- Light in weight
- Easy to install
- Includes push-fit connector
- Suitable for installation on commercial sites
- Robust construction
- Resistant to many chemicals
- Can be installed vertically or horizontally

A Terrain Pleura 100 may be installed on the top of the Terrain P.A.P.A.® (when installed vertically) turning it into a positive and negative transient protection device.

### Installation

The Terrain P.A.P.A.® should be connected to the piping in accordance with Polypipe Building Services's installation instructions. Refer to your local area regulations for open vent requirements.

## Terrain P.A.P.A.® 9300.4



Pipe Sizes	
Europe	USA
DN 75-110	3" - 4"

### Terrain P.A.P.A.®

Dimensions		
Dimension	Metric (mm)	Imperial (inches)
A	200	ø7 <sup>7</sup> / <sub>8</sub>
B	652	25 <sup>1</sup> / <sub>16</sub>
C	104	ø4 <sup>1</sup> / <sub>8</sub>
D	83	ø3 <sup>1</sup> / <sub>4</sub>
E	89	ø3 <sup>1</sup> / <sub>2</sub>
F	111	ø4 <sup>3</sup> / <sub>8</sub>
G	50	1 <sup>1</sup> / <sub>16</sub>
H	75	ø2 <sup>1</sup> / <sub>16</sub>
I	106	ø4 <sup>3</sup> / <sub>16</sub>

Performance Parameter	
Temperature Range	-20° C to +60°C -40° F to +150°F (ASSE)
Max. pressure rating tightness	10,000 Pa (1m/40" H <sub>2</sub> O) at 0Pa or higher

Volume Capacity	
Series Assembly	Litres
1 unit	3.785
2 units	7.570
3 units	11.355
4 units	15.140

Materials	
P.A.P.A.® Body	ABS
Internal Container Connector	Rubber

# Case Studies

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## Owen Street Towers, Manchester, UK

A range of Polypipe's ventilation, drainage and soil and waste systems are installed at Owen Street Towers – one of Manchester's most prestigious residential developments. The 1,508-apartment luxury development has been fitted with a Terrain P.A.P.A.® and Pleura Vent System, eliminating the need for a secondary vent system, while Terrain FUZE drainage stacks and our PVC piping systems helped meet the project's drainage and soil and waste requirements.



## InterContinental London O<sup>2</sup> Hotel, London, UK

A Terrain FUZE system has been installed in the InterContinental London O2 Hotel, providing an innovative drainage solution for the 19-storey luxury property. Using an electro-fusion welding process together with a positive pressure reduction device, P.A.P.A.®.The system ensures the risk of leaks throughout the building is significantly reduced.



## Ferrari World, Yas Island, Abu Dhabi, UAE

Terrain P.A.P.A.® is installed in the first theme park designed around the Ferrari brand. The leisure complex which opened in 2010 features a racetrack, theatre, and a variety of driving activities.



## D1 Tower, Dubai, UAE

Terrain P.A.P.A.® is installed in D1 Tower, an 80-floor luxury residential building, providing a simplified, but efficient drainage ventilation system.

# Terrain P.A.P.A.<sup>®</sup> and Pleura

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Alternative Drainage Ventilation System



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