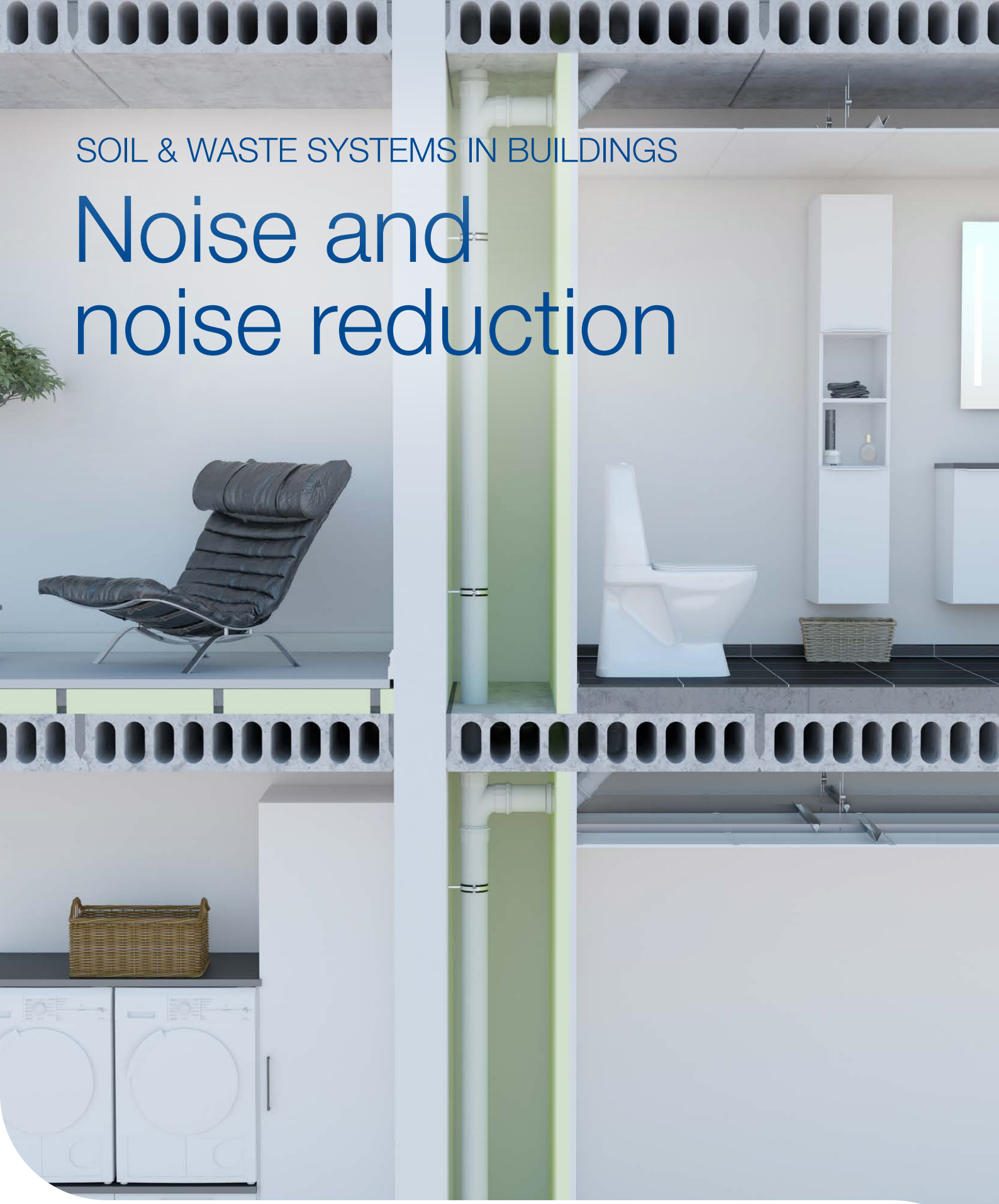
SOIL & WASTE SYSTEMS IN BUILDINGS

Noise and noise reduction



wavin

Do you know the difference between

Are you looking at the right data when choosing low-noise soil and waste pipes? To help you choose the right product, here we explain the difference between different noise measurements.

What are 'structure-borne' and 'airborne' sound?

When choosing soil and waste pipes, you need to be sure they will meet noise and technical installation requirements according to the threshold values in the Building Rules. But how can you be sure you are looking at the right noise data when choosing a low-noise pipe? Should you use the data for structure-borne sound or for airborne sound? And what's the difference?

The wall thickness and density of the pipes determine how low-noise a soil and waste pipe is. The thicker and heavier the pipe, the lower the noise. The vast majority of soil and waste pipes are tested in impartial test laboratories – in many cases at the Fraunhofer IBP Institute in Germany. The pipes are installed in a test building to ensure uniform testing methods for all types of pipe.

Why is the difference important?

Fraunhofer IBP reports give two test results: **structure-borne sound** and **airborne sound**.We know that not everyone differentiates between the two measurements. Instead they choose a pipe based on the lowest measurement, which is structure-borne sound. In many cases, this represents no problem. But because the results from Fraunhofer IBP reports are taken from a test environment with specific materials from the building's construction, structure-borne sound cannot be used as a direct indicator of structure-borne sound in any building. Depending on the choice of materials, structure-borne sound in an actual building will differ from the test results.

Following is an explanation of the two types of measurements and the consequence of basing your choice of pipe on the wrong data. We will also give you an insight into the Fraunhofer IBP test environment, and where the two results are measured.

Did you know?

WHAT A FRAUNHOFER IBP REPORT REVEALS

A Fraunhofer IBP report gives different noise measurements. Apart from structure-borne sound and airborne sound, Fraunhofer IBP also tests different flow rates in the pipes.

The figures normally used are for a noise measurement taken at a flow rate of two litres, which is the amount of water passing through the pipe from a standard toilet flush.

A Fraunhofer IBP report also shows the test construction in detail. For instance, it states which pipe supports and wall thicknesses are used, and describes the standards the test conforms to.

The difference between structure-borne and airborne sound

Airborne sound is the amount of noise that can be heard if standing in the same room in which the pipe is installed. airborne sound is reduced via the net weight of the material, or the encapsulation.

Structure-borne sound is the amount of noise that can be heard from the pipe after the noise from water passing through it has permeated into the building construction (walls, pipe supports, brackets). Structure-borne sound is reduced via the material's elasticity and insulation in the pipe supports and penetrations.

Structure-borne sound is not a certainty

Measurements for structure-borne sound often look good on paper, as they are often much lower than airborne sound, and lower than the requirement for noise from technical installations. But they offer no guarantee that you are complying with noise requirements overall throughout a given building project. Firstly, the pipe supports, wall brackets and wall materials have considerable influence on how much noise from the pipe is reduced. Structure-borne sound can only be used in those rooms where it permeates through the building construction, and not on the actual installation side of the pipes. Secondly, the test result can only be used if the pipes in a given building project are installed in the same materials as in Fraunhofer IBP's test facility.

Airborne sound is used during installation

Airborne sound can be used on the installation site, as it is a much more reliable figure. The noise that the pipe emits itself will be the same, regardless of how it is installed. But you can only use airborne sound on the installation site if the pipe runs in a shaft, or is enclosed in some other way. However, what you can do, is calculate how and with what you can encapsulate it to meet the building rule requirements.

Do not simply accept the test results

If using structure-borne sound as the benchmark when choosing low-noise soil and waste pipes, you can risk choosing a solution that cannot meet the building rule requirements in all rooms. However, if you use the airborne sound measurement, you have a certain amount of control over the project yourself. When it comes to reducing noise in those rooms where noise permeates through the construction, a calculation based on the materials to be used for a given project will be the best way of ensuring noise requirements are met.

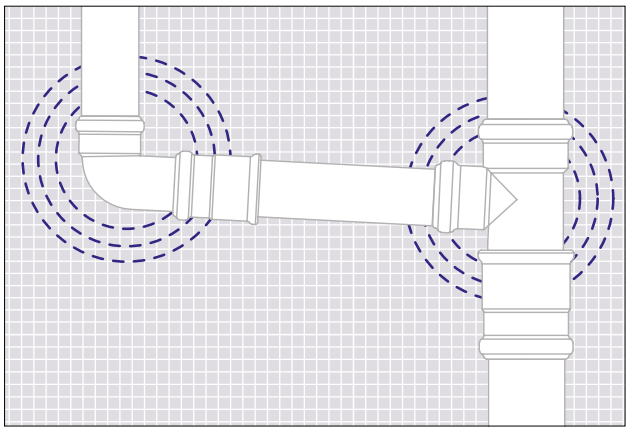
The risk of simply accepting test results is that a test performed at an inspection may result in you being required to replace the pipes, or provide additional noise insulation around them – which takes time and money. **Using airborne sound from the pipe as benchmark** means that the reduction value for the building materials is deducted if, for instance, the pipe is installed behind plasterboard, a wall or a ceiling. The result is the level of noise the pipe will emit in a room on the installation side.

How does noise occur?

Noise is mechanical vibrations that can be defined as a pressure variation in air, water or vibrations of building elements.

How does noise occur?

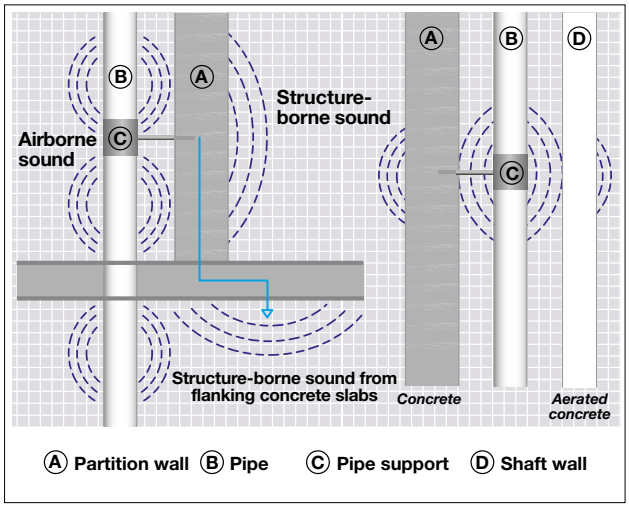
- When water and air pass each other
- When waste water changes direction at branch pipes and in bends, or passes a reduction
- When water falls through a vertical soil and waste pipe, and hits a solid surface, such as the bend at the bottom.
- Examples of where noise can occur.



Examples of where noise can occur.

How does noise travel?

- Through water
- Through pipe walls
- Noise radiation from soil and waste pipes
- Via pipe support to building constructions
- Via radiation from surrounding building constructions



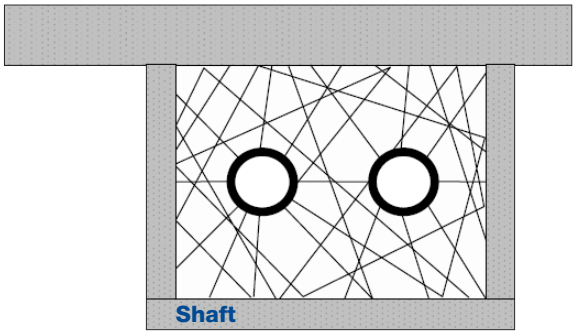
Example of noise radiation from flanking building constructions

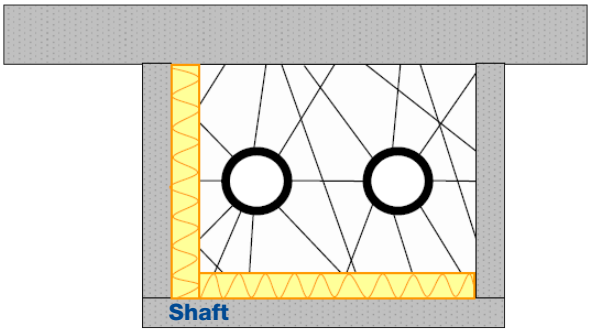
How noise can be further reduced:

- Reduce the water flow rate if possible
- Reduce water speed as much as possible
- Use soft direction changes, e.g. 2 x 45° bends, instead of 1 x 88.5° bend
- A 250mm pipe should be installed between two 45° bends when space permits in buildings with more then three storeys
- Use pipe supports with rubber inlays (reduce noise by up to 3dB(A))
- Mount pipe supports on the heaviest wall, which is most resistant to vibration
- Use the lowest possible number of pipe supports to limit transfer of noise to the wall. However, the max. distance between supports must be observed
- Avoid fixed connections between pipe and floor slabs as much as possible
- Separate pipes from building elements, e.g. by wrapping two or three layers of needle felt or fibre sheeting around the pipe.

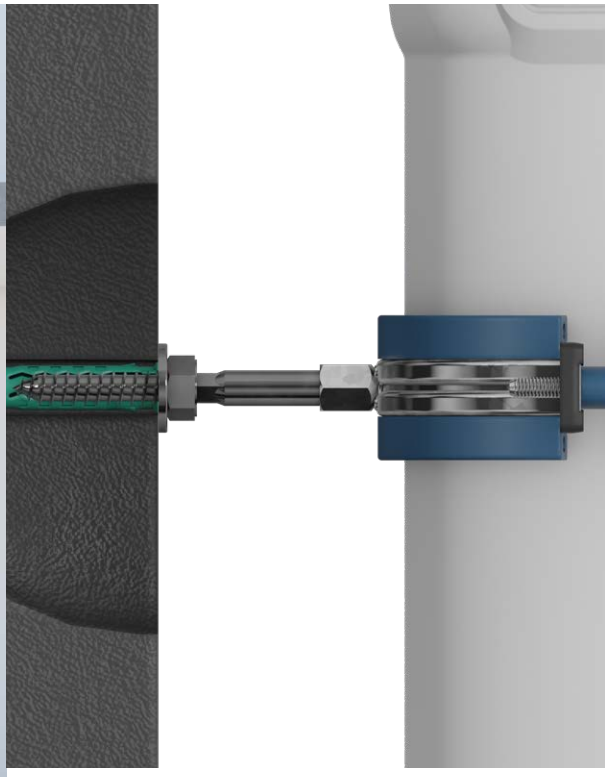
Airborne sound in shafts

Noise in shafts increases by 10dB(A) due to reflection from the shaft. By insulating two of the shaft sides with 30 mm mineral wool, improved absorption will prevent this.





Fraunhofer IBP test environment



The Fraunhofer IBP test environment

Noise measurements are performed in the test environment at the Fraunhofer IBP institute in Stuttgart, Germany on soil and waste pipes on the installation side, and in a room behind the installation wall two floors under the water inlet.

The importance of knowing the test environment for noise measurement lies quite simply in knowing the difference between the materials, dimensions, location and set-up of the elements in the test environment, compared to the situation the installer faces when you choose a low-noise pipe.

Soil and waste pipes are installed in the Fraunhofer IBP test environment on a 115mm plastered concrete wall with a density of 220kg/m^2, and a floor or reinforced concrete with a density of 440kg/m^2. The rooms are empty and closed.

How to calculate noise reduction

All types of soil and waste pipes should be insulated on the installation side, or encapsulated in some other manner to meet the requirement.

Wavin's low noise pipes have the following noise level at a **flow rate of 2.0L/s**, which is the noise occurring from a standard toilet flush, and can be used approximately as a benchmark for building rule noise requirement:

Product	Airborne Flow rate 2,0 ltr/s	Structure-borne Flow rate 2,0 ltr/s
Wavin AS+ with Wavin system pipe supports	48 dB(A)	< 10 dB(A)
Wavin AS+ with standard pipe support	48 dB(A)	12 dB(A)
Wavin SiTech+ with Wavin system pipe supports	52 dB(A)	12 dB(A)
Wavin SiTech+ with standard pipe support	52 dB(A)	20 dB(A)

Calculating airborne sound

Once you know the airborne sound measurement for your soil and waste pipe, you can calculate how to reduce it through encapsulation and the building construction to meet the requirements for each room.

Using the benchmark for airborne sound from the pipe, deduct the reduction value for building materials if, for example, the pipe is behind plasterboard, a wall or a ceiling. The result is the level of noise the pipe will emit in a room on the installation side.

The table shows the reduction values for different material types in walls and ceilings – or how much they attenuate airborne sound from the pipe.

Example

If noise from soil and waste pipes must not exceed 30dB(A), none of the pipes can meet the requirement themselves. But airborne sound can be reduced using other materials to be able to meet the requirement.

- Wavin AS+ has an airborne sound of 48dB(A), and if you install it behind a 13mm plasterboard, the noise level is reduced by 20dB(A). You thus reach a level of 28dB(A) and meet the requirement.
- If using Wavin SiTech+, 13mm plasterboard is not sufficient. This pipe has an airborne sound measurement of 52dB(A), and even with 13mm plasterboard, the noise level will not be under 30dB(A). Two 13 mm plasterboards (-25dB(A)) will solve the problem, as will 16 mm chipboard (-24dB(A)).

Wall and ceiling construction	Recommended reduction figures
12mm hard-pressed mineral	10 dB(A)

Calculating structure-borne sound

Structure-borne sound is a much more complicated affair, as it can vary in relation to the materials around the pipe.

As referred to earlier, structure-borne sound in a Fraunhofer IBP report is solely based on tests performed in its own test environment. The noise level will be different in any other construction. Therefore, no single formula or rule of thumb can be composed that will indicate whether the requirement for noise will be met using a given pipe. It will always depend on a specific calculation for each project based on the materials chosen for walls, ceilings etc.

How much influence do you have on noise level?

The actual noise level will depend on a number of criteria which you may or may not be able to influence. You can see which you do have influence on, and which are given beforehand, but that are part of your calculations and choice of pipe. To ensure your installation meets the noise requirements, you should therefore obtain information on those factors you can influence.

IMPORTANT!

Noise and insulation are a complex affair. If in doubt whether reduction is sufficient, contact our Technical Support Department for advice. You can also talk to a

Pipe system	
✓	Type of pipe system
✓	Type of pipe supports
✗	Pipe diameter

Shaft/suspended ceiling	
✓	Material choice for shaft wall-cladding
✓	Material choice for suspended ceiling
✗	Weight of the load-bearing wall structures
✓	Installation of noise-absorbent insulation in the shaft
✗	Shaft size

Water volume	
✗	Dimensioning water volume
✗	Fall height of downpipe

Other factors	
✓	Use noise insulation materials
✗	Room size

✓ Factors you can influence

✗ Factors you cannot influence

[7] *DS 490 is used for homes, including hotels, student accommodation, boarding houses, inns, club apartments, boarding schools, nursing homes, homes for the elderly, childcare institutions and similar buildings used for accommodation. The benchmark for noise classification is Noise Class C, equivalent to the former minimum requirement of building legislation for terraced houses. 'Accommodation rooms' are lounge/dining room and bedrooms etc., in a home. NB: small rooms such as a hall, foyer, kitchen, bathroom etc.*

Wavin SoundCheck Tool

Use our free tool to calculate noise reduction of Wavin SiTech+ and Wavin AS+ for your building project.

Find the Wavin SoundCheckTool at wavin.com.

Wavin low-noise soil and waste pipes in buildings

Wafix PP | SiTech+ | AS+

Standard and low-noise

Wavin produces and supplies three soil and waste pipe systems. All three can be used in all types of buildings, but depending on the noise requirements for a given building, it may be an advantage (or a necessity) to choose a low-noise pipe.

Wafix PP is Wavin's standard pipe with no actual noise reduction. Wafix PP is especially suited to detached houses, basements in multistorey buildings, places where soil and waste pipes are installed in the floor decks or where they are insulated.

Weight and wall thickness							
Dimensions (mm)	Ø32	Ø40	Ø50	Ø75	Ø90	Ø110	Ø160
Weight (kg) per m smooth pipe	0,17	0,21	0,27	0,52	080	1,11	2,72
Wall thickness (mm)	1,8	1,8	1,8	2,3	3,0	3,4	4,9

Wavin SiTech+ is used for installation in multistorey buildings and buildings that are exceptionally sensitive to noise, such as residential homes, hotels, offices, hospitals, nursing homes and libraries.

Weight and wall thickness						
Dimensions (mm)	Ø50	Ø75	Ø90	Ø110	Ø125	Ø160
Weight (kg) per m smooth pipe	0,44	0,78	1,09	1,54	2,11	3,20
Wall thickness (mm)	2,1	2,6	3,1	3,6	3,9	5,0

Wavin AS+ is, thanks to its excellent noise reduction, ideal for buildings with very high requirements for low noise level, such as blocks of flats, nursing homes, hospitals, offices, hotels etc. Because Wavin AS+ is produced in a light colour, the system is also suitable for installation where visible, e.g. in kitchens and bathrooms.

Weight and wall thickness							
Dimensions (mm)	Ø50	Ø75	Ø90	Ø110	Ø125	Ø160	Ø200
Weight (kg) per m smooth pipe	0,83	1,49	2,37	3,41	3,90	5,33	7,49
Wall thickness (mm)	3,0	3,5	4,6	5,3	5,3	5,6	6,0

Complete range for any installation

Wafix PP

One material all the way through
Impact- and chemical resistant, smooth and easy-to-clean surface with optimum flow all the way through a construction

SiTech+

Inside
Chemical resistant, smooth surface for optimum flow

Centre
Low-noise core

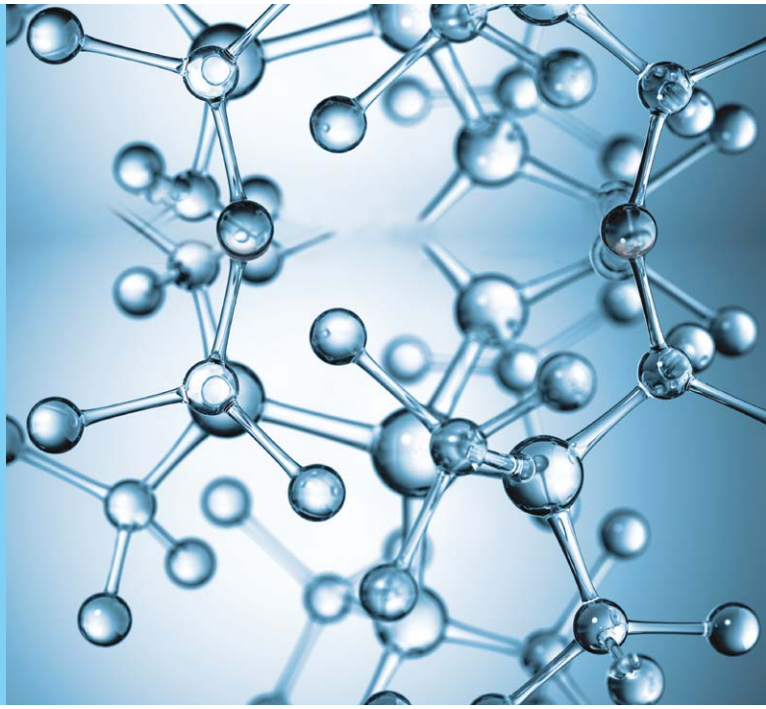
Wavin AS+

Outer
Impact-resistant, smooth

Construction

Wafix PP is a solid wall polypropylene pipe (PP-B), with no built-in noise reduction. Typically used in detached houses and bungalows with no enhanced requirements for noise reduction.

SiTech+ and Wavin AS+ are both three-layer pipes consisting of mineral-reinforced polypropylene. Both types are typically used for projects in multistorey and office buildings, institutions, hotels and hospitals. Where SiTech+ is often a good alternative to Wafix PP, Wavin AS+ is the system of choice when requirements for noise reduction are enhanced according to law, or when the building's construction prevents several layers of encapsulation or insulation.



Technical details

Wavin produces and supplies three product systems within soil and waste pipes. All three can be used in all types of buildings, but depending on the noise requirements for a given building, it may be an advantage (or a necessity) to choose a low-noise pipe.

The table below provides the most relevant technical details for all three systems. For information on installation and fireproofing,

	Standard	Low-noise	
	Wafix PP	SiTech+	AS+
Airborne sound	–	52 dB(A)	48 dB(A)
Material	Polypropylene (PP-B)	Mineral-reinforced polypropylene (PP)	Mineral-reinforced polypropylene (PP)
Seal material	TPE	SBR rubber	EPDM rubber (NBR seals can be ordered)
Heat expansion coefficient	0,15 mm/mK	0,12 mm/mK	0,06 mm/mK
Max. permitted temperature, short term	100°C (< 30l/m, max. 2 mins.)	100°C (< 30l/m, max. 2 mins.)	100°C (< 30l/m, max. 2 mins.)
Max. permitted temperature, continuous	90°C	90°C	90°C
Colour (approx. value)	Ø32-Ø160 Grey (RAL 7037) Ø32-Ø50 White (RAL 9003)	Matt black	Light grey (RAL 7035)
Density	0,9 g/cm^3	1,3 g/cm^3	1,9 g/cm^3
Can be glued	No	No	No
Can be welded	No	No	No
Number of layers in pipe	1	3	3
Assembly method	Sleeve assembly	Sleeve assembly	Sleeve assembly
Approvals	–	–	–

Water management | Heating and cooling | Water and gas distribution
Waste water drainage | Cable ducting

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