Waste water drainage

PRODUCT AND TECHNICAL MANUAL

CONNECT TO BETTER

Wavin AS Premium Low-Noise Soil and Waste system

LOW-NOISE SYSTEM

Wavin AS 25 Years

MADE IN GERMANY

Contents

1. Wavin AS

1.1. System description

Wavin AS is the best in class plastic sound-insulating soil & waste piping system, suitable for drainage of hot and cold waste water and in accordance with all requirements for non pressurized waste water piping as laid down in DIN EN 12056 and DIN 1986-100.

Wavin AS reduces the noise level of the soil and waste system better than any other plastic pipe system. The acoustic properties of the exclusive Astolan material assure premium reduction of unwanted sound emissions by the drainage system inside the building.

Through independent state-of-the-art computation software customized noise prediction can be provided in accordance with the actual building structure and flow parameters of each individual project.

Wavin AS is the most applied plastic low noise drainage system in the world and is recognized as the superior alternative to Cast Iron, offering additional benefits in terms of:

- Enhanced noise insulating properties
- Substantial lower weight of the system
- Fast and secure push-fit jointing
- Outstanding lifetime

1.2. Material specification

Astolan

- Pipes and fittings are manufactured from Astolan (mineral-reinforced polypropylene), which ensures continuous noise insulation by the system from the waste removal facilities down to the below-ground piping.
- Astolan has a special molecular structure and was primarily developed to dempen sound.
- Like all plastics, Astolan is durable, corrosion-resistant and able to withstand the chemical attack of all kinds of aggressive waste waters.
- The smooth surface characteristics of Astolan prevent scaling and incrustation.

Sealing

The elastomeric seal is made from vulcanized SBR rubber in conformity with DIN EN 10 204:2004.

1.3. Fields of application

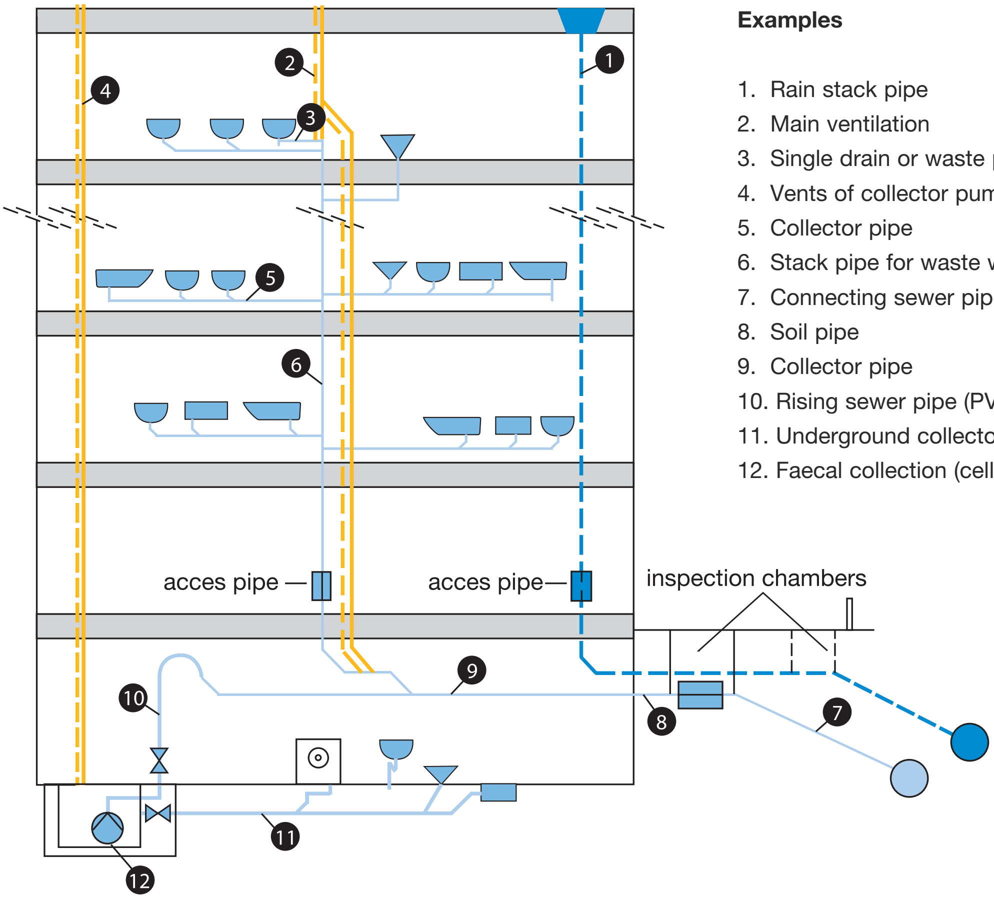
Wavin AS is resistant to hot water and fulfills or exceeds all the requirements of DIN EN 12056 and the associated norms given in DIN 1986-100, i.e. short-term exposure to temperatures of 95°C (peak resistance of 100°C) and long-term exposure to temperatures of 90°C. Wavin AS is suitable for transporting waste water in the range pH 2 - 12.

Low weight in combination with secure and rapid assembly make the system extremely installation-friendly.

1.3.1. Building drainage

The system is designed for professional waste water installations in (multiple storeys) buildings and can be installed as:

- Single waste or drain pipe
- Collector pipe
- Stack pipe
- Ventilation pipe
- Rain stack pipe
- Below ground pipe up to inspection chamber / manhole



Examples

1. Rain stack pipe
2. Main ventilation
3. Single drain or waste pipe
4. Vents of collector pump cellars
5. Collector pipe
6. Stack pipe for waste water
7. Connecting sewer pipe (PVC-U)
8. Soil pipe
9. Collector pipe
10. Rising sewer pipe (PVC-U)
11. Underground collector pipeline
12. Faecal collection (cellar) pit

Figure 1: Examples of waste and ventilation pipes.

1.3.2. Below ground application

Although the system has been primarily designed as sound-insulating domestic waste water discharge piping, Wavin AS can also be used underground as far as the main sewer connecting point. Supported by the DIN EN 12056 and DIN 1986-100 waste water norms, which further endorse DN 90 downpipe specifications, it is possible to install a complete and secure waste water removal system using just two pipe dimensions – DN 56 and DN 90 – from the individual waste water sources (facilities) right up to the main drain cleaning access point or the main sewage connecting point.

1.3.3. Residential and non-residential

Owing to its excellent sound-absorbing properties, Wavin AS is widely used wherever noise protection to DIN 4109 is specified, i.e. in:

- Hospitals
- Hotels
- Rest homes for the elderly
- Schools
- Libraries
- Convalescent homes
- Office buildings
- Multi-occupancy residential properties

Thick external walls and sound-proofed windows are used to keep noise levels at a minimum. However, it is often forgotten that noise is not only generated by external, but also by internal sources. Wavin AS sound-insulating pipe systems are designed to ensure a comfortable environment, meeting the most stringent requirements for noise reduction.

1.3.4. Commercial kitchens and abattoirs

Wavin AS is suitable for the removal and drainage of fat-containing waste water from commercial kitchens and abattoirs. High durability and temperature-resistance (short-term exposure to 95°C; long-term exposure to 90°C) to DIN EN 12056 and the associated norms of DIN 1986 -100 are basic prerequisites. Scaling and incrustation are unable to form, due to the smoothness of the pipe surfaces. When installing Wavin AS in commercial kitchen and abattoirs with high fat-containing waste water, the use of NBR sealing rings is advised.

Where fat-containing waste water is transported by means of collecting pipes and below-ground piping located far from grease-trap facilities, auxiliary heating is recommended to keep the fat liquid. The temperature must not be permanently higher than 70°C.

Wavin AS is approved by the DIBt – the German Institute of Building Technology – for use in below-ground applications as far as to the main sewage connection point (DIBt Z-42.1-228).

1.3.5. Photographic laboratories

Wavin AS pipes and fittings are manufactured from Astolan (a mineral-reinforced polypropylene) and the factory-made sealing rings are resistant to the developing and fixing media used in photographic laboratories over long-term exposures at 60°C. Wavin AS is also approved for short-term exposure to such media at 95°C (information on resistance to chemicals is given in the Resistance Tables in Annex IV). It is recommended that piping is installed with sufficient fall to reduce the contact time between fluid and guiding surface to a minimum.

1.3.6. Dental practices

Wavin AS can be used unreservedly in dental practices, provided the piping downstream of the dentist's chair is fitted with an integrated amalgam separator. Wavin AS (including the sealing ring) is amalgam resistant. In addition, cleaning agents and disinfectants normally used in dental practices, if present in the usual concentrations, are harmless to the pipe system.

1.3.7. Food-processing and chemical industries

Wavin AS pipes and fittings are resistant to media containing lactic acid (at concentrations up to 90%) at liquid temperatures up to 60°C. This also applies to the factory-made SBR sealing ring of the connecting system, especially as contact is marginal. It is recommended that piping is installed with sufficient fall to reduce contact time to a minimum.

1.4. Chemical resistance

The data in the chemical resistance list is intended only as a guide for planning purposes and are not automatically applicable to all conditions of use. Considerable deviations can occur dependent on type of exposure and probable contamination of the chemical medium. Wavin cannot be held liable for any special, indirect or consequential damages irrespective of whether caused or allegedly caused by negligence. No warranty can be derived concerning the data mentioned.

For the complete chemical resistance list see Annex IV.

2. Technical data

2.1. Astolan

Pipes and fittings are made of Astolan; polypropylene, mineral reinforced, resistant to hot water, DIN 4102, B2.

2.2. Physical characteristics

Density	~ 1,9 g/cm³ (DIN 53479)
Elongation at break	~ 29%
Tensile strength	~ 13 N/mm²
E-modulus	~ 3800 N/mm²
Coefficient of thermal linear expansion	~ 0,09 mm/mK
Fire resistance	DIN 4102, B2
Color	Light grey RAL 7035

2.3. Dimensions

Pipe dimensions

DN	d 1)	di 2)	s 3)
56	58	50,0	4,0
70	78	69,0	4,5
90	90	81,0	4,5
100	110	99,4	5,3
125	135	124,4	5,3
150	160	149,4	5,3
200	200	187,6	6,2

1) Outside diameter in mm.
2) Inside diameter in mm.
3) Wall thickness in mm.

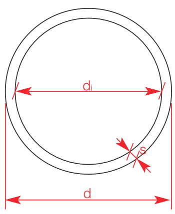


Table 1: Pipe dimensions.

2.4. Marking

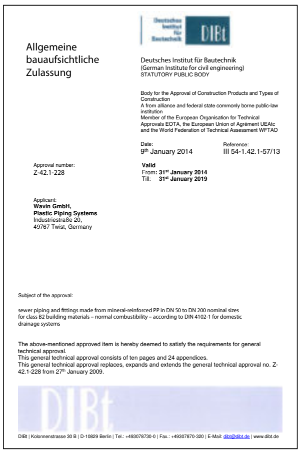
Wavin AS, nominal diameter, production year, quality mark, approval, material, control mark, fire classification.

Example:
Wavin AS, DN 100, 2002, Z.-42.1-228, ASTOLAN, Ü DIN 4102, B2.

2.5. Quality conformity & certification

Wavin AS pipes and Fittings are continually subject to strict quality controls according to DIN Certco in Berlin. Wavin AS pipes & Fittings have been awarded DIBt buildings' inspection approval (DIBt Z-42.1-228) and are, therefore, deemed suitable for use as above and below-ground pipework.

Germany: DiBt, Z.-42.1-228



Allgemeine bauaufsichtliche Zulassung

Deutsches Institut für Bautechnik
(German Institute for civil engineering)
STATUTORY PUBLIC BODY

Body for the Approval of Construction Products and Types of Construction
A from alliance and federal state commonly borne public-law institution
Member of the European Organisation for Technical Approvals EOTA, the European Union of Agrément UEAtc and the World Federation of Technical Assessment WFTAO

Date: 9th January 2014
Reference: III 54-1.42.1-57/13

Approval number: Z-42.1-228

Valid
From: **31st January 2014**
Till: **31st January 2019**

Applicant:
Wavin GmbH,
Plastic Piping Systems
Industriestraße 20,
49767 Twist, Germany

Subject of the approval:

sewer piping and fittings made from mineral-reinforced PP in DN 50 to DN 200 nominal sizes for class B2 building materials – normal combustibility – according to DIN 4102-1 for domestic drainage systems

The above-mentioned approved item is hereby deemed to satisfy the requirements for general technical approval.
This general technical approval consists of ten pages and 24 appendices.
This general technical approval replaces, expands and extends the general technical approval no. Z-42.1-228 from 27th January 2009.

DIBt | Kolonnenstrasse 30 B | D-10829 Berlin | Tel.: +493078730-0 | Fax.: +49307870-320 | E-Mail: dibt@dibt.de | www.dibt.de

Other examples of certified approvals:

Denmark:	ETA Denmark VA 2.14 /18282
Norway:	SINTEF Produktsertifikat Nr. 0701
Sweden:	SITAC 4480/90
Australia:	Watermark Nr.: WM 74530 / WM 74526
Germany:	DiBt, Z.-42.1-228
Turkey:	Turkish Standards Quality Appropriateness Certificate
Poland:	Aprobata techniczna COBRTI INSTAL Nr AT-99-02-0670
UK:	LABC System Approval, Cert. No. 377-9-7038. Tested in accordance with BS EN 1451.
Germany:	RAL – quality mark of the Germany Community of Plastic Pipes (GKR), Bonn German Institute of Building (DiBt) – general building inspection approval

2.6. Wavin AS specification text

For specification purposes a general description of Wavin AS can be found in ANNEX I. In addition to the general description alterations to this specification text might be required to meet local construction codes, regulation or preferences.

3. Acoustics

3.1 Sound insulation by Wavin AS

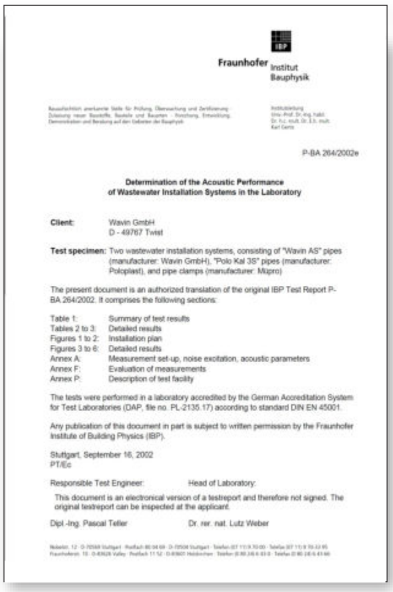
The excellent sound protection properties of Wavin AS are primarily attributed to its thick-walled design as well as special molecular structure and the high density of 1.9 g/cm^3 of the Astolan material. This property enables Wavin AS to absorb airborne sound as well as mechanical vibrations.

A contribution to sound protection is made by the special product design and in particular by:

- Compensator sockets with thick layered rubber sealing to avoid transmittance of structural sounds between pipe connections.
- Swept branches for minimal flow disturbance in the stack pipe.

Figure 2: Compensator socket.

Figure 3: Swept branch.



Fraunhofer Institut Bauphysik

P-BA 264/2002e

Determination of the Acoustic Performance of Wastewater Installation Systems in the Laboratory

Client: Wavin GmbH
D - 49767 Twist

Test specimen: Two wastewater installation systems, consisting of "Wavin AS" pipes (manufacturer: Wavin GmbH), "Polo Kal 3S" pipes (manufacturer: Poloplast), and pipe clamps (manufacturer: Müpro)

The present document is an authorized translation of the original IBP Test Report P-BA 264/2002. It comprises the following sections:

Table 1:	Summary of test results
Tables 2 to 3:	Detailed results
Figures 1 to 2:	Installation plan
Figures 3 to 6:	Detailed results
Annex A:	Measurement set-up, noise excitation, acoustic parameters
Annex F:	Evaluation of measurements
Annex P:	Description of test facility

The tests were performed in a laboratory accredited by the German Accreditation System for Test Laboratories (DAP, file no. PL-2135.17) according to standard DIN EN 45001.

Any publication of this document in part is subject to written permission by the Fraunhofer Institute of Building Physics (IBP).

Stuttgart, September 16, 2002
PT/Ec

Responsible Test Engineer: Head of Laboratory:

This document is an electronical version of a testreport and therefore not signed. The original testreport can be inspected at the applicant.

Dipl.-Ing. Pascal Teller Dr. rer. nat. Lutz Weber

In studies conducted at the Fraunhofer Institut für Bauphysik (Fraunhofer Institute for Building Physics), Stuttgart, Wavin AS has proven its excellent sound absorption properties. The tests were performed in a laboratory accredited by the German Accreditation System for Testing (DAP, file no. PL-3743.26) according to standard EN ISO/IEC 17025.

The measurements in this test were performed following German standard DIN EN14366 and DIN 52 219:1993-07; noise excitation by stationary water flow with 0.5 l/s, 1.0 l/s, 2.0 l/s., 3.0 l/s and 4.0 l/s. Wavin had been accredited compliance to this test already in 2002.

3.2 Noise calculation software

Determination of the sound level as conducted by Fraunhofer Institut Bauphysik is in general useful to determine the noise level of a pipe system in a static situation. The test method is, however, based on a laboratory set up in which all building parameters are kept the same except for a change in water flow. As a result it is impossible to obtain by this test a realistic figure of the noise levels for the protect chambers of actual projects.

3.3. About Sound

Sound is a sensation felt, a perception of what takes place around us, caused by various compression waves which cross the eardrum and are captured and transformed by the brain; it is composed of different frequencies. The acuteness or intensity of the perception depends on the frequency and range.

Sound is a wave that is:

- Elastic (it needs a medium to be propagated)
- Longitudinal (perturbation takes place parallel to the direction of propagation).

To exist it requires:

- A source (vibrating body)
- An elastic propagation medium (air, water, etc.)

A sound is therefore a method of transmitting mechanical energy. To propagate, a sound needs a medium: any means, whether solid, liquid or gassy, like air, is able to transport sound, influencing its speed according to density.

Sound is propagated through the exchange of air-solid-air or solid-air vibrations (in the second case the solid is the source of the sound). With respect to soundproofing soil and waste systems, we need to think in two different directions: (1) the noise created in the pipes and transmitted by them and (2) noise which is transmitted by the walls or surrounding media.

Sound is measured with a phonometer, an instrument which filters noise and measures intensity at its different frequencies.
It is expressed in decibels.
The decibel is the logarithm of the ratio between the measured sound pressure and a reference sound pressure, multiplied by ten.

dB = 10 log x P / Pa

We need to remember that sound is an energy (just think of when you stand in front of the stereo speakers and you can "feel" the basses) but what we perceive is a processed sensation.

The human ear is sensitive to pressure in a NON LINEAR manner; therefore twice the pressure does not correspond to twice the sensation.

The doubling of acoustic power corresponds to an increase of 3 dB.

Every 10 dB increase is perceived by the human ear as twice as loud (10 cars are perceived as twice as loud as 1 car).

60 dB + 50 dB + 40 dB = 60.5 dB →
The highest dB is in a sum the most important

1 car = 60 dB

2 cars = 63 dB

10 cars of 60 dB = 70 dB
= twice as loud as 60 dB

Sound intensity follows an inverse square law with distance from the source; doubling the distance from a noise source reduces its intensity by a factor of four, or 6 dB.

3.4 Noise

Noise can be described as unwanted sound. In relation to sound, noise is not necessarily random.

Acoustic noise can be anything from quiet but annoying to loud and harmful causing permanent irreversible hearing damage.

World Health Organization

Based on the World Health Organization (WHO) guidelines, European countries have maximized the noise level (in houses, apartments, hospitals, elderly homes, hotels, etc.) during the night to:

$L_{A\ max\ night}$ = 30 to 35 dB(A).

Community noise (also called environmental noise, residential noise or domestic noise) is defined as noise emitted from all sources except noise at the industrial workplace.

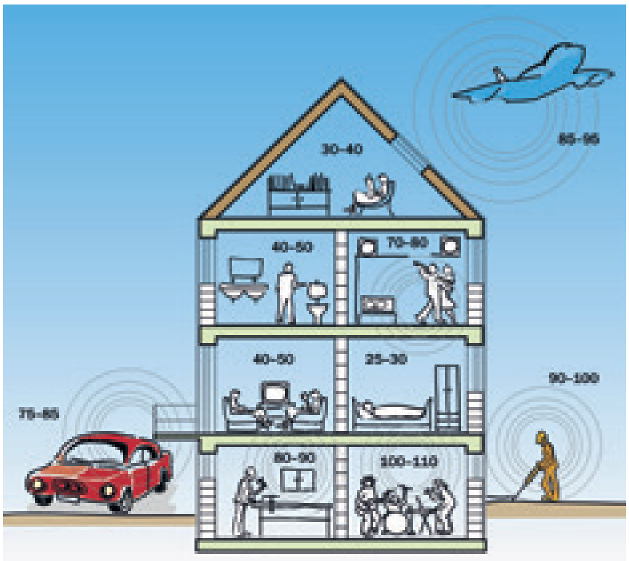


Figure 8: Example of community noise.

In the European Union about 40% of the population is exposed to road traffic noise with an equivalent sound pressure level exceeding 55 dB(A) daytime, and 20% are exposed to levels exceeding 65 dB(A). When all transportation noise is considered, more than half of all European Union citizens is estimated to live in zones that do not ensure acoustical comfort to residents. At night, more than 30% are exposed to equivalent sound pressure levels exceeding 55 dB(A), which are disturbing to sleep. Noise pollution is also severe in cities of developing countries.

In contrast to many other environmental problems, noise pollution continues to grow and it is accompanied by an increasing number of complaints from people exposed to the noise. The growth in noise pollution is unsustainable because it involves direct, as well as cumulative, adverse health effects.

For instance sleep disturbance: measurable effects of noise on sleep begin at sound levels of about 30 dB. However, the more intense the background noise, the more disturbing is its effect on sleep. Sensitive groups mainly include the elderly, shift workers, people with physical or mental disorders and other individuals who have difficulty sleeping.

Table 2 presents the WHO guideline values arranged according to specific environments and critical health effects. The guideline values consider all identified adverse health effects

Specific Environment	Critical Health Effect(s)	Laeq [dB(A)]	Time base (hours)	Lamax fast [dB]
Outdoor living area	Serious annoyance, daytime and evening	55	16	-
	Moderate annoyance, daytime and evening	50	16	-
Dwelling, indoors	Speech intelligibility & moderate annoyance, daytime and evening	35	16	
Inside bedrooms	Sleep disturbance, night-time	30	8	45
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60
School classrooms & pre-schools, indoors	Speech intelligibility, disturbance of information extraction, message communication	35	during class	-
Pre-school bedrooms, indoor	Sleep disturbance	30	sleeping time	45
School, playground outdoor	Annoyance (external source)	55	during play	-
Hospital, ward rooms, indoors	Sleep disturbance, night-time	30	8	40
	Sleep disturbance, daytime and evenings	30	16	-
Hospitals, treatment rooms, indoors	Interference with rest and recovery	#1		
Industrial, commercial shopping and traffic areas, indoors and outdoors	Hearing impairment	70	24	110
Ceremonies, festivals and entertainment events	Hearing impairment (patrons:<5 times/year)	100	4	110
Public addresses, indoors and outdoors	Hearing impairment	85	1	110
Music and other sounds through headphones/ earphones	Hearing impairment (free-field value)	85 #4	1	110
Impulse sounds from toys, fireworks and firearms	Hearing impairment (adults)	-	-	140 #2
	Hearing impairment (children)	-	-	140 #2
Outdoors in parkland and conservation areas	Disruption of tranquility	#3		

#1: As low as possible.
#2: Peak sound pressure (not LAF, max) measured 100 mm from the ear.
#3: Existing quiet outdoor areas should be preserved and the ratio of intruding noise to natural background sound should be kept low.
#4: Under headphones, adapted to free-field values.

Table 2: Guideline values for community noise in specific environments (Source World Health Organization).

for the specific environment. An adverse effect of noise refers to any temporary or long - term impairment of physical, psychological or social functioning that is associated with noise exposure. Specific noise limits have been set for each health effect, using the lowest noise level that produces an adverse health effect (i.e. the critical health effect).

It is not enough to characterize the noise environment in terms of noise measures or indices based only on energy summation (e.g., LAeq), because different critical health effects require different descriptions.

It is equally important to display the maximum values of the noise fuctuations, preferably combined with a measure of the number of noise events. A separate characterization of night-time noise exposures is also necessary.

For indoor environments, reverberation time is also an important factor for things such as speech intelligibility. If the noise includes a large proportion of low - frequency components, still lower guideline values should be applied.

Supplementary to the guideline values given in Table 2, precautions should be taken for vulnerable groups and for noise of certain character (e.g. low - frequency components, low background noise).

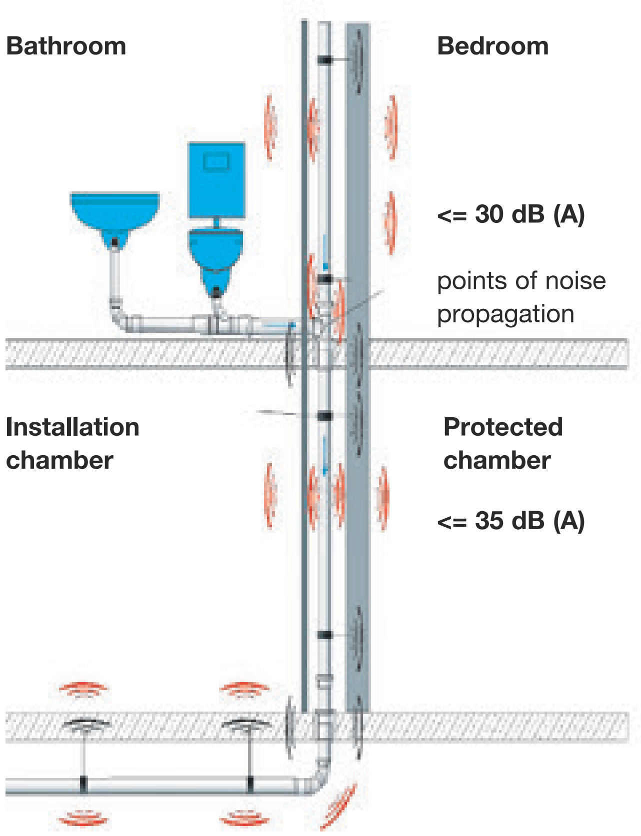


Figure 9: Example of noise propagation during drainage.

3.4.1 Sources of noise in buildings

The noise generated by the building and its utilities may be classified as follows:

- Noise due to filling operations
- Noise generated by control equipment
- Intake noise
- Discharge noise
- Noise due to impact or shock

Noise is generated by moving parts or by flowing media. Waste water discharge pipes are prone to vibration, particularly where water flows through downpipes, or is forced to change direction in joints and elbows (noise due to impact or shock). Experience shows that the greatest problems are typically caused by the transmission of structural noise, particularly in the area of pipe clamps and brackets or where pipe-work is run through walls or ceilings.

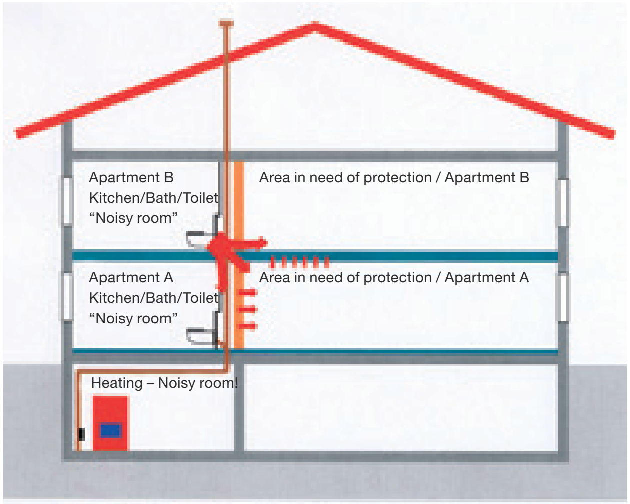
The noise created from waste systems obviously depends greatly on the vertical piping. Here the falling water clashes against the wall of the pipes and fittings. The generated noise is transmitted directly to the pipes and indirectly through the ducts and installation walls. Therefore, the thickness and mass of the solid materials are of great importance, just like the fixing brackets and other elements which connect pipes to their supports.

3.4.2 How noise is measured

If we consider the “installation chamber” to be the room in which the pipes are installed (generally the bathroom), the room next door divided by the installation wall is called the “protected chamber”. The noises emitted are measured in the protected chamber according to EN 14366.

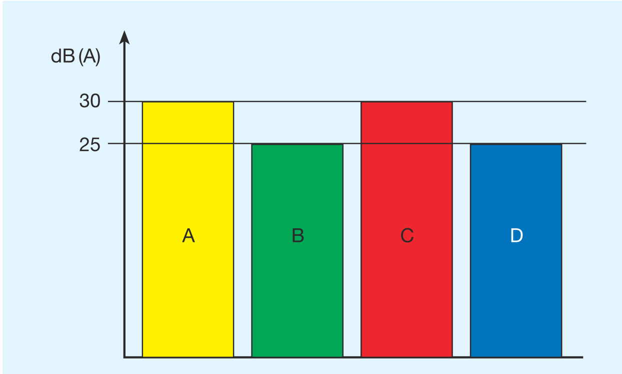
3.5 Acoustic requirements

Local ruling increasingly describe the maximum acceptable sound level inside the living area of a building. Subsequently such noise limitation will then have to be established in contracts between the contractor and the awarding authority. The following technical regulations contain relevant advice and suggestions, which require a contractual agreement to become binding.



Shared floor/ceiling in residential apartment building > 410 kg/sq.m
Single-skin installation wall within domestic living quarters > 220 kg/sq.m

Figure 10: Example of areas requiring protection.



A: DIN 4109 (minimum legal requirements)

B: DIN 4109 Supplement 2

C: VDI 4100 Noise Protection Level II

D: VDI 4100 Noise Protection Level III

Figure 11: Overview Noise Protection Standards and Guidelines

DIN 4109 Supplement 2:
This supplement contains instructions relating to noise levels that lie 5 dB (A) below the values given in DIN 4109/A1: 2001-0.

In accordance with DIN 4109 Supplement 2, increased levels of sound insulation can be arranged, by agreement, to a maximum of 25 dB (A) in other areas requiring noise protection.

VDI 4100
In addition to the requirements of DIN 4109, which was adopted as Noise Protection Level I (NPL I), this guideline contains characteristic values for two additional noise protection levels - NPL II and NPL III.

These two additional noise protection levels specify the arrangements for increased sound insulation.

		Term	*SSt 1 DIN 4109	*SSt 2	*SSt 3
Dwellings and apartment houses					
Noise from	water installations	L'_{in} in dB (A)	30	30	25
	other building services installations	$L'_{F,max}$ in dB (A)	30	30	25
Dwellings in semi-detached and terrace houses					
Noise from	water installations	L'_{in} in dB (A)	30	25	20
	other building services installations	$L'_{F,max}$ in dB (A)	30	25	20
Inside private areas					
Noise from	water installations	L'_{in} in dB (A)	30	30	30
	other building services installations	$L'_{F,max}$ in dB (A)	30	30	25

Table 3: Perception of customary noises from neighboring dwelling and assignment to three Noise Protection Levels or insulation classes (SSt.) Ref. VDI 4100.

Note: SSt I corresponds to legislation in Germany.

3.6 Acoustic design

3.6.1 Advantageous layout

An important factor for the assurance of acoustic insulation is the design and implementation of an acoustically advantageous layout.

The following measures have proven to be of significant influence to the level of noise generated from the soil system inside the building:

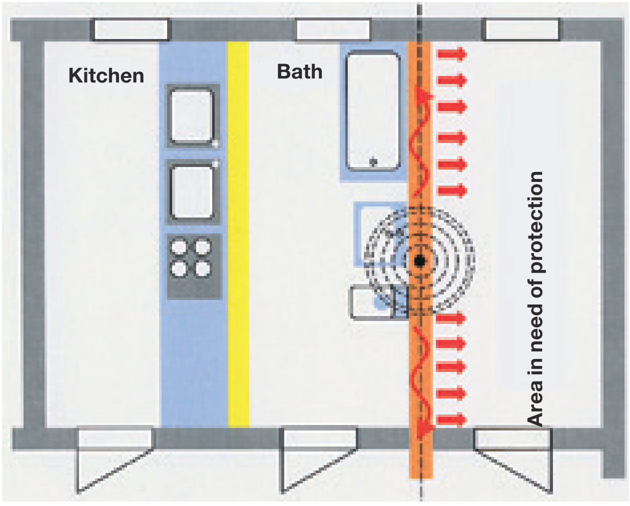
- Noise-sensitive areas should be kept away, as far as possible, from sources of noise
- Non-sensitive areas should, wherever possible, be used as "buffer zones"
- Noise-sensitive areas should not be positioned in the direct vicinity of bathrooms, toilets or stairwells
- Potential sources of noise should be "bundled together" in the same area

The comparison between the two examples of layout shown above demonstrates how the acoustically advantageous layout in the second example contributes to a clear reduction in the acoustic pressure of the systems in the room which demands acoustic insulation.

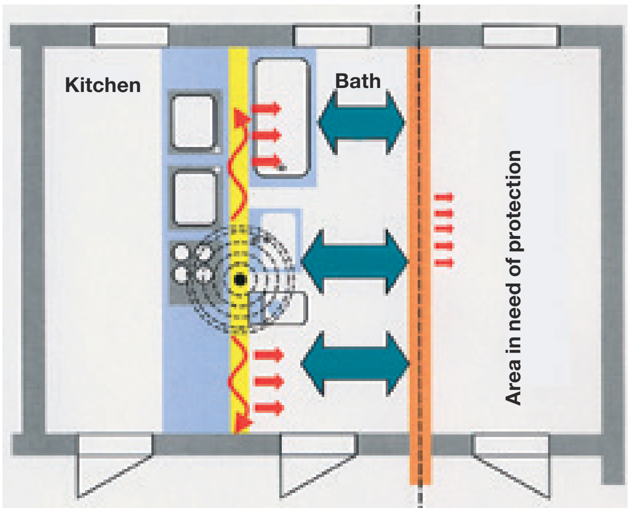
However, even using highly efficient low-noise waste systems like Wavin AS, one always has to seek for the best possible acoustic decoupling. This goes for the whole drainage system and its points of contact with the building (collars, crossings through walls and floors, plaster residues between the pipe and the building, etc…).

In designing piping, moreover, we need to avoid positioning waste pipes in the partition walls between apartments. Special noise-reduction measures also need to be adopted when fixing drain pipes to the partition walls between apartments. Protect the pipes from the propagation of intrinsic noise.

Apartment A Apartment B



Apartment A Apartment B



Room dividing wall Installation in own living room wall

The comparison of the floor plans above demonstrates how good acoustic design in the lower building example can significantly reduce the noise levels to which areas requiring noise protection are exposed.

Figure 12: Examples of good acoustic practice in building design.

3.6.2 Acoustic plumbing design

Wavin AS can significantly reduce noise levels when compared with other piping systems. However, when installing high performance sound-insulating waste water piping systems it is still necessary to consider how effectively the system can be sound-isolated. This applies to the waste water discharge system as a whole, including its points of contact with the building structure (pipe brackets and clamps, the running of pipework through walls and ceilings, mortar droppings between pipes and wall surfaces, etc.).

When planning pipe installation, waste water discharge pipes should not be allowed to run inside the walls separating living areas. The attachment of waste water discharge pipes to partition walls in living areas should only be carried out under application of special noise protection measures. DIN 4109 requires that single-skin walls to which, or in which, water installations or equipment (i.e. waste water pipes) are to be attached must have an area-related mass of at least 220 kg/sq.m. Walls having an area-related mass of less than 220 kg/sq.m may only be used where prior testing has demonstrated that the walls exhibit acceptable properties with respect to the transmission of noise.

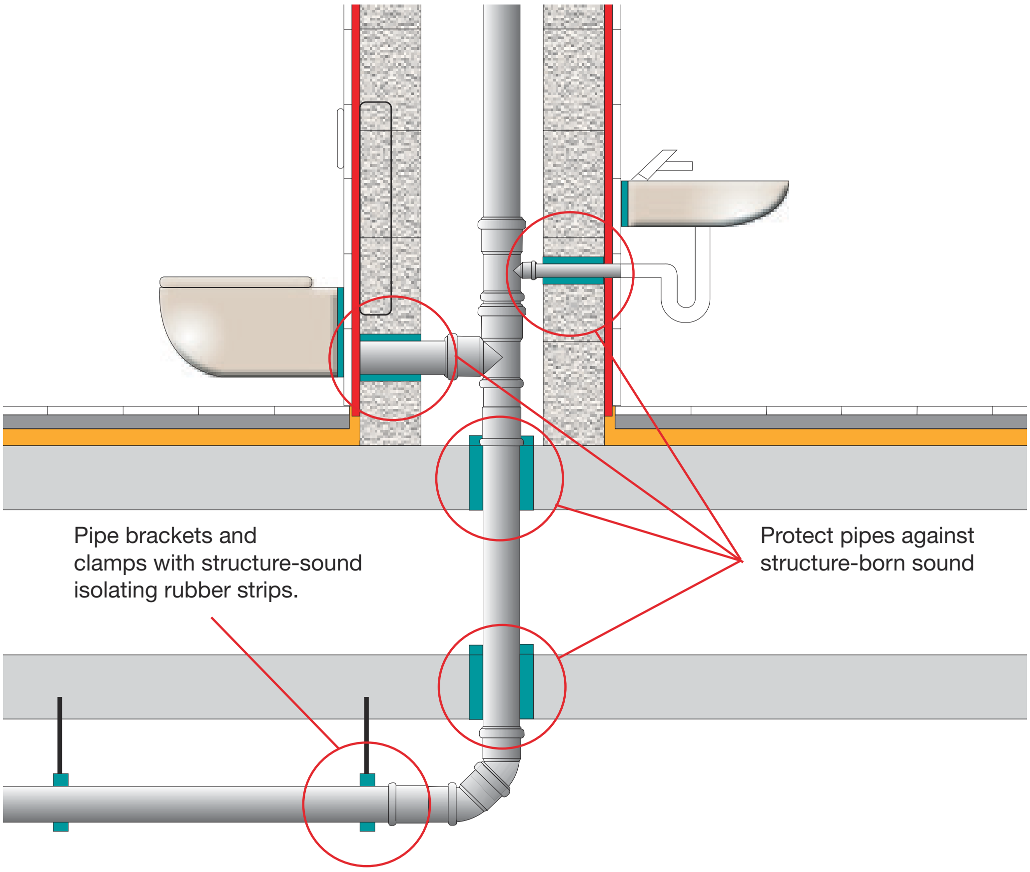


Figure 13: Sound insulation of waste water systems.

4. Design of the waste water system

4.1 Waste water design to DIN EN 12056 and DIN 1986-100

The following principles should be observed with respect to waste water drainage systems:

- The system design should ensure that there are no significant pressure fluctuations which could cause the level of trap water seal to be compromised.
- Reliable ventilation must be provided for the waste water removal system.
- A self-cleaning effect must be achieved.
- Nominal diameters should be kept to a minimum.
- Waste water should discharge at low noise levels.

4.2 Waste water drainage systems

At European level, 4 different waste water drainage systems have been established, which comply with DIN EN 12056-2, Section 4.2.

System I
Single downpipe with partly-filled connecting pipe and a filling factor of 0.5 (mainly used in Germany where this is the only approved waste water system).

System II
Single downpipe with partly-filled connecting pipe, reduced dimensions and a filling factor of 0.7 (mainly used in Scandinavia).

System III
Single downpipe with fully-filled connecting pipe and a filling factor of 1.0 (mainly used in English-speaking countries).

System IV
Consists of two separate pipe systems – sewage and grey-water – (mainly used in France).

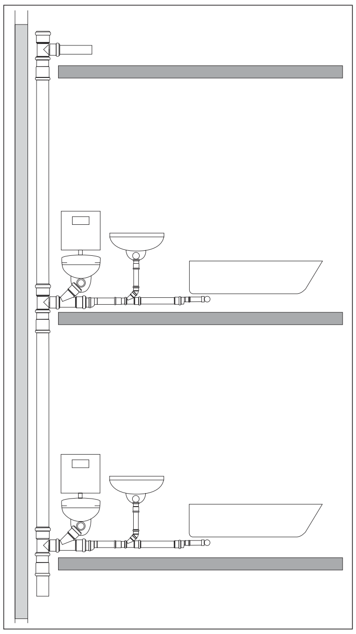


Figure 14: System I (filling factor 0,5) and System II (filling factor 0,7).

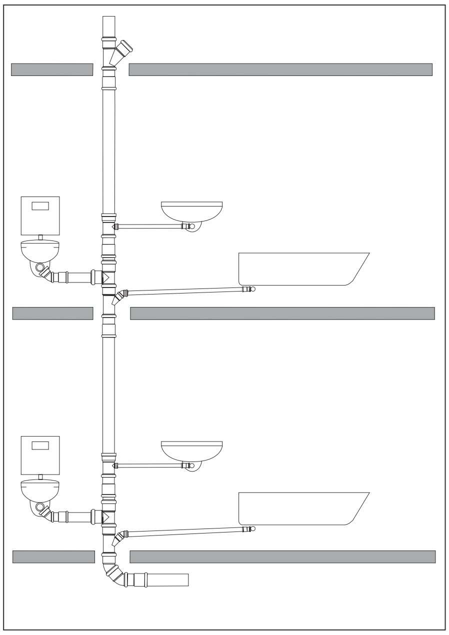


Figure 15: System III (filling factor 1,0).

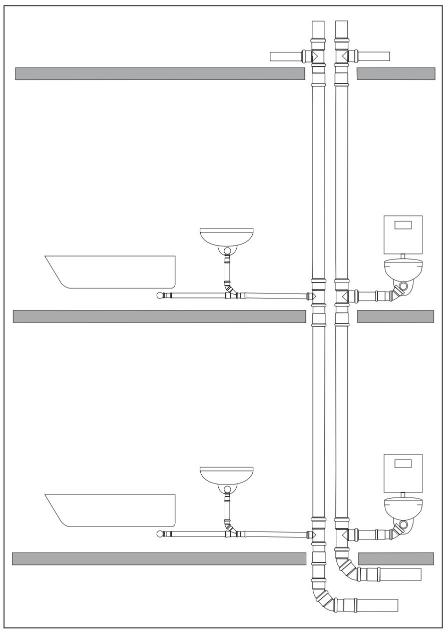


Figure 16: System IV – two separate systems.

4.3 Classification of nominal diameters

In accordance with DIN EN 12056, the nominal diameter (DN) is a suitable round number, more or less equal to the (external) diameter. Each nominal diameter (DN) is allocated a minimum internal diameter, di min (see Table 4). For the purposes of calculation, the minimum internal diameter or actual internal diameter specified by the pipe manufacturer is normally used.

Nominal diameter DN	Minimum internal diameter $D_{i\,min}$
30	26
40	34
50	44
56	49
60	56
70	68
80	75
90	79
100	96
125	113
150	146
200	184
225	207
250	230
300	290

Table 4: Nominal diameters (DN) and their corresponding minimum internal diameters $D_{i\,min}$ (corresponding to Table 1 in DIN EN 12056-2).

Problem: product standards for pipes and fittings are generally specified using the external diameter parameter, even though the outer diameters do not always correspond to the values given in DIN EN 12056 (see DN 100 => DA 110).

Nominal diameter to DIN EN 12056 (new) DN	Wavin system designation DN	$D_{i\,min}$ mm	Previous Wavin designation mm
56	56	50	50
70	70	69	70
90	90	81	80
100	100	99,4	100
125	125	124,4	125
150	150	149,4	150
200	200	187,6	200

Table 5: Designation Wavin AS sizing.

4.4 Downpipes

The term downpipe refers to piping which is arranged vertically and generally leads down through the floors of a building and is ventilated at roof level.

DIN EN 12056 contains no specifications for downpipes but the necessary data can be found in DIN 1986-100. The specifications were principally provided by the now withdrawn DIN 1986 -1. These cover the jointing of connecting pipework into downpipes, or the arrangement of branch pipes in downpipes, when connection toilets.

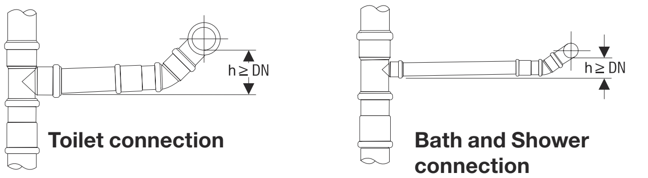


Figure 17: Connection to a downpipe.

Downpipes are rated to the following criteria:

- Downpipes with primary ventilation
- Downpipes with secondary ventilation
- Branch pipe equipped with internal sharp-edging
- Branch pipe equipped with internal radius (higher loading under smaller bore)

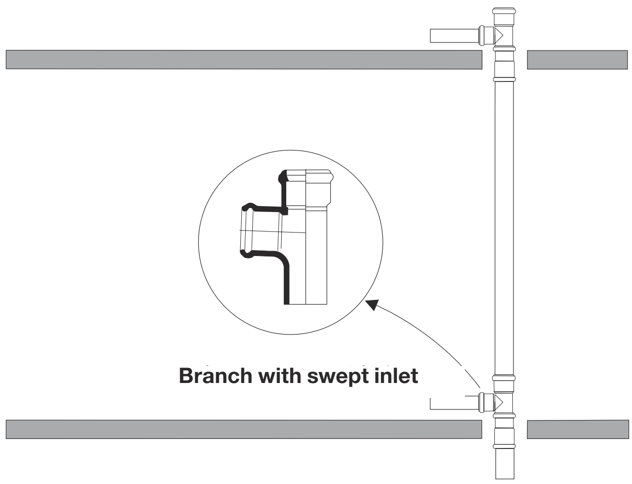


Figure 18: Branch with swept inlet.

Allowable waste water discharge in primary-ventilated downpipes DN	Q_{max} (l/s)	
	Branch	Branch with swept inlet
60	0,5	0,7
70	1,5	2,0
80*	**2,0**	**2,6**
90	**2,7**	**3,5**
100**	4,0	5,2
125	5,8	7,6
150	9,5	12,4
200	16,0	21,0

Table 6: Allowable waste water discharge in primary-ventilated downpipes (corresponding to Table 11 in DIN EN 12056-2).

* Minimum nominal diameter for toilets with flushing volumes of 4 to 6 litres
** Minimum nominal diameter for toilets with flushing volumes > 6 litres

Allowable waste water discharge in primary-ventilated downpipes DN	Secondary Ventilation DN	Q_{max} (l/s)	
		Branch	Branch with swept inlet
60	50	0,7	0,9
70	50	2,0	2,6
80*	**50**	**2,6**	**3,4**
90	**50**	**3,5**	**4,6**
100**	50	5,6	7,3
125	70	12,4***	10,0
150	80	14,1	18,3
200	100	21,0	27,3

Table 7: Allowable waste water discharge in secondary-ventilated downpipes (corresponding to Table 12 in DIN EN 12056-2).

* Minimum nominal diameter for toilets with flushing volumes of 4 to 6 litres
** Minimum nominal diameter for toilets with flushing volumes > 6 litres
*** The corresponding value given in DIN EN 12056 is possibly incorrect. Recommended 8,4

5. Installation and jointing

5.1 Soundproofing

Wavin has designed its low-noise systems to reduce noise emissions in concealed and visible installations. However, to achieve a high level of soundproofing it is strongly recommended to follow the instructions given below. These instructions are the results of extensive experience and consider the strict German standards and regulations (e.g. DIN 4109 and DIN 1053).

Waste pipes should not be used in living, sleeping and working rooms. Should the waste pipe be fixed onto construction walls adjacent to living, sleeping and working rooms, the specific area weight of that wall should be at least 220 kg/m^2.
The same requirement also applies when installed in a shaft and fixed on the intermediate wall. Shafts can be enclosed with a minimum 1,5 cm plaster layer on an appropriate support. The Wavin AS pipe system must be free from the plaster layer, avoiding sound bridges. It is recommended to wrap a layer of mineral wool around the pipe, where contact with the plaster layer can't be avoided.

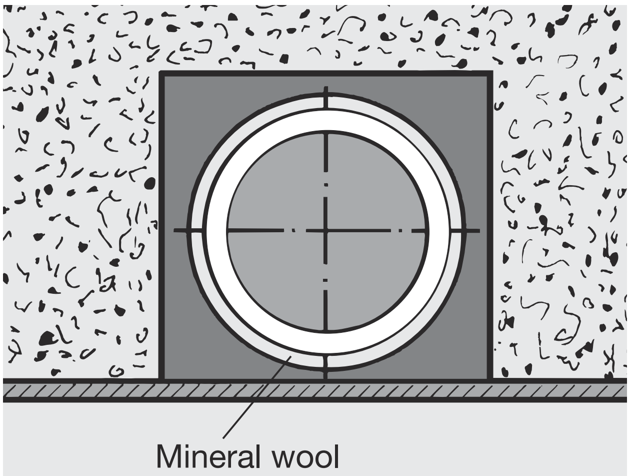


Figure 19: Pipe lagging to avoid sound bridges between pipe and plaster.

Emitted sounds depend highly on the course of the pipe. The prevention or reduction of impact zones leads to less sound emission.

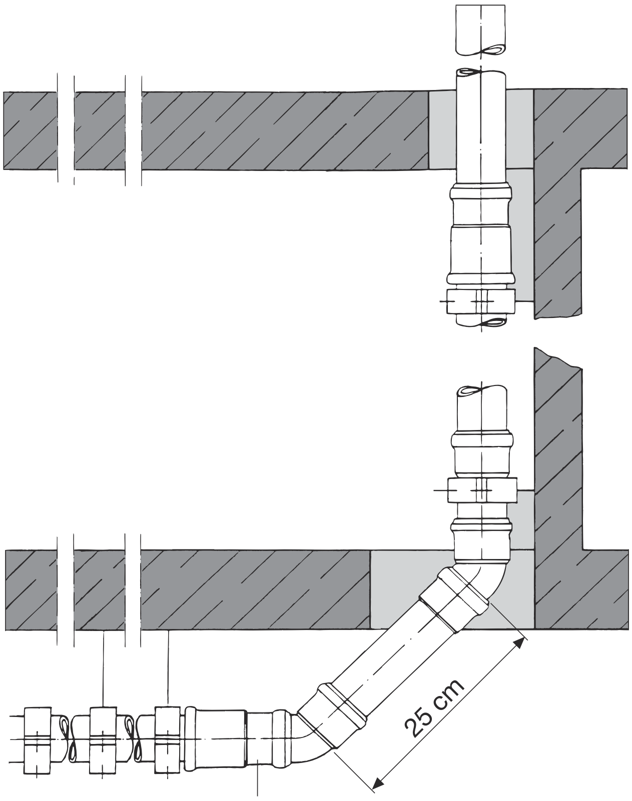


Figure 20: 45° bends and short pipe length for less sound emission.

It is therefore recommended to prevent abrupt directional changes. Instead of installing a 90° elbow it is far better to change direction from vertical to horizontal with two 45° elbows, interconnected by a short piece of straight pipe with a minimum length of 25 cm. For this purpose the 45° long bend is included in the Wavin AS program (see figure 21). For optimal sound insulation, use full encircling brackets with inserts of corrugated rubber.

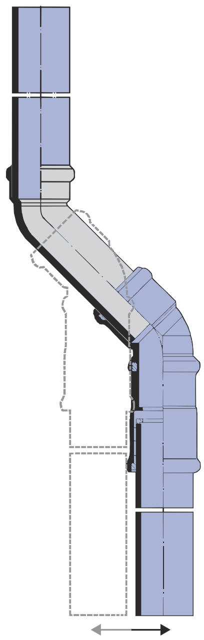


Figure 21: Wavin AS Long Bend.

5.2 Wavin recommendations

The pipe network is a key source of noise. Measures need to be taken to reduce the noise caused by contact sound of flowing fluids.

- Wall cavities must be carefully insulated to prevent noise diffusion. Contact must be avoided between the waste system and the framework to prevent the transmittance of noise. Where contact with the cavity wall cannot be avoided, the pipe can be wrapped in a layer of insulation material.
- Noise intensity depends greatly on the pipe configuration; avoid sharp changes in direction. Use 45° elbow joints with a short pipe extension (min. length 25 cm) rather than a 90° elbow. To ensure soundproofing use circular brackets
- with corrugated rubber inserts. Make sure that the brackets are fixed tightly and do not move.

Note: design and installation should comply with local regulation.

5.3 Crossings through building structure

In compliance with building provisions concerning acoustic insulation in buildings with more than one floor, waste pipes must not be laid visibly in living rooms and bedrooms. It is recommended to conceal the pipework in or install behind solid walls with a surface mass of at least 220 kg/m^2 (ref. DIN 4109).

The housing or wall spaces must be coated with a layer of plaster with a thickness of at least 1.5 cm. Acoustic bridges between the piping and the adjacent wall are not permitted. As a precaution it is recommended to use vibration-damping materials such as rock wool or glass wool or synthetic insulating materials. Pipe insulation to avoid acoustic bridges between the pipe and the adjacent wall with rock or glass wool or synthetic insulating materials.

5.4 Installation

In buildings with more than 3 storeys, (>10 m) it is necessary to use 250 mm slow-down stretches to pass the vertical waste pipe into the horizontal pipe. To do this it is possible to use, for example, two 45° bends and a coupler (see fig. 22). Alternatively it is possible to use a 45° long bend.

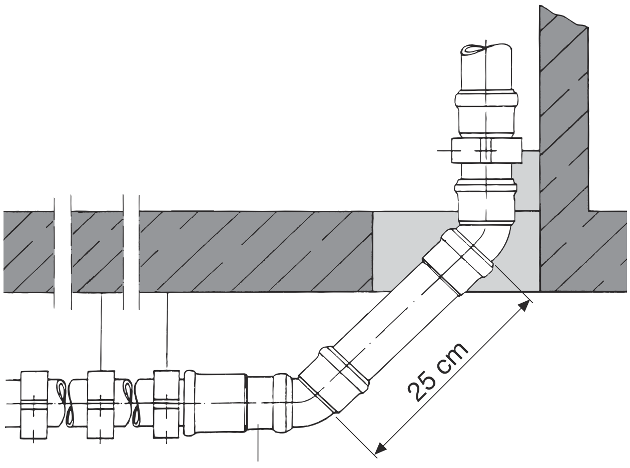


Fig. 22: 45° bends and coupler to create a slow-down stretch.

Moreover, the waste pipe must be sized and laid to allow both the sewage water and the air to circulate freely. When faced with acoustic insulation requirements, we need to use circular pipe brackets with rubber inserts (see fig. 23)

Figure 23: Pipe collar with rubber insert.

If a containment structure is built around the waste pipe, make sure that the pipes are fixed to the load bearing wall and not to the structure. Passages through walls and floors must be elastic.

5.5 Pipe cutting

Pipes can be cut to size using standard pipe cutters or saws. Wavin AS can be cut simply with a professional pipe cutter or saw. Make sure that the cut is at a 90° angle on the pipe axis. Remove any burrs, cutting residues, sharp edges, and clean the pipe end.

For connections to Wavin AS fittings or sockets bevel the pipe end – do not chamfer – see figure 24.

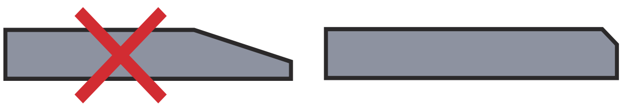


Figure 24: Cutting and beveling.

5.6 Push-fit joints without compensator socket

To cope with variations in length due to thermal factors in between connections of pipe and fitting, with maximum pipe length of 3 meters, a maximum 10 mm slid out of the sleeve has to be considered.

For push-fit connections between fittings no variations in length due to thermal factors have to be considered, and it is therefore possible to slot the fittings completely.
The push-fit coupling is done as follows:

- Check the position and the condition of the lip seal in the coupler channel. If necessary, clean the fitting and the gasket
- Clean the push-fit end of the pipe and the fitting
- Apply a thin uniform layer of Wavin lubricant on the end of the coupling. Do not use oil or grease!
- Place the end into the coupler and push in firmly
- Slide the pipe, not the fitting, 10 mm out of the coupling

When positioning pipes vertically, to avoid slipping and the elimination of the dilatation space of 10 mm, fix the individual pipes with collars immediately after assembly.

5.7 Joints with the compensator socket

The Wavin AS compensator socket is used to connect two pipes as well as a pipe and fitting where compensation for axial movement is required. For conventional plastic soil and waste pipe systems the expansion margin is created by marking and withdrawing the pipe to the expansion length. This is not required for Wavin AS, as the compensator socket adapts to temperature changes in the system. This doesn't only save working time, but also gives additional technical security to the system.

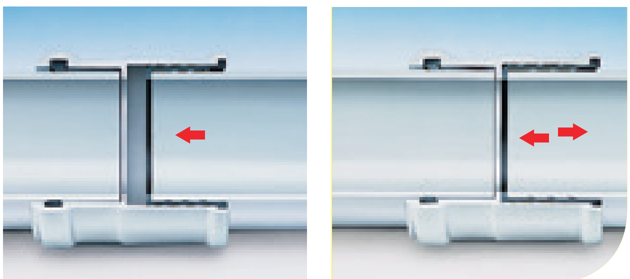


Figure 25: Connection to compensator socket.

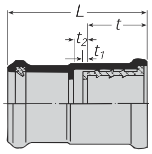
Mounting instructions

When making the connection with the compensator socket the following instruction rules should be adhered to:

- Clean pipe end.
- Check the position and condition of the elastomeric sealing ring in the groove. Further check the condition of the elastomeric expansion collar. If necessary, clean fitting, sealing ring and collar.
- Push the expansion collar over the pipe end (1). ATTENTION: The expansion collar may only be pushed over the plain pipe ends, never over the spigot end of fittings.
- Apply Wavin lubricant* sparsely inside compensator socket of fitting (2).
- Apply and distribute Wavin lubricant evenly on outside of elastomeric compensator collar (3).
- Push fitting over compensator collar to full insertion depth. Check final position of compensator collar** (4-6).
- Apply Wavin lubricant on the next pipe end or spigot fitting and insert in the socket end to full depth.

*) Never use oil or grease!

**) For insertion depth for pipe with collar into the compensator socket, see table 8.



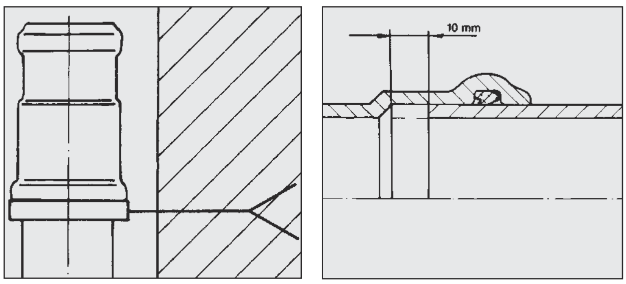
DN	L	t	t_1	t_2
(mm)	(mm)	(mm)	(mm)	(mm)
56	126	49	5	15
70	119	48	6	16
90	123	47	6	16
100	124	48	6	16
125	132	63	6	16
150	144	63	6	16

Table 8: Insertion depth for expansion collar.

5.8 Connection to an installed pipe

This can easily be executed using standard Wavin AS fittings. Installation instructions using double socketed sleeves:

1. Cut out a sufficient length of pipe (length of fitting plus 2,5 x OD of pipe)
2. Cut required pass length
3. Deburr and bevel cutting edges
4. Slide branch or access pipe on upper pipe end
5. Fit one double socketed sleeve, over its full length, on pass length
6. Fit one double socketed sleeve, over its full length, on lower pipe end
7. Fit in pass length and close the pipe by sliding the double socketed sleeves in position
8. Fix double socketed sleeves as pictured in figure
   Alternatively Wavin compression couplers or Wavin AS long socket (only DN 100) can also be used.



5.9 Fixation

In principle Wavin AS soil and waste systems should be installed tension free and with free lateral allowance for temperature compensation. Use sound absorbing brackets, dimensionally compatible to the pipe diameter. The pipe brackets should have inserts of corrugated rubber and be fixed to the wall using screws and plastic plugs*. For pipe systems in which inner-pressures can arise, the joints have to be secured to prevent them from sliding apart and deviating from the centre axis.

The Wavin safety clips prevent the joints from sliding apart. Alternatively the fixing brackets can be arranged appropriately to achieve the same effect.

(*) Metal plugs can be used, but will lead to disadvantageous sound emission.

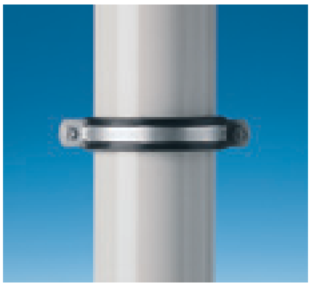


Figure 26: Fixing bracket.

Figure 27: Wavin Safety Clip.

5.9.1 Fixing bracket

The fixed bracket creates a fixed point in the pipe system. With fixed brackets the pipe or fitting cannot be moved through the bracket after the screws are tightened (no longitudinal movement is possible). In order to prevent sliding down of the vertical stack, each individual pipe length must be secured on one point by a fixed bracket. Fittings or groups of fittings must always be secured as fixed points. Also every horizontally installed pipe should always be fixed with one fixed bracket. All remaining pipe brackets – in the vertical as well as in the horizontal installation – must be sliding brackets. The prescribed bracket distances should not be exceeded.

5.9.2 Sliding bracket

By using sliding brackets the pipe can still be moved through the bracket after the screws are tightened (longitudinal movement is possible once installed).

5.9.3 Arrangements of the brackets

During installation of Wavin AS pipes, the following should be considered:

- In case of horizontal installation, the pipe bracket distances are 10 x the outside of the pipe (see figure 28B). This becomes, in case of vertical pipe installation, depending on outside diameter, 1-2 metres (see figure 28A).
- Generally pipe brackets should not be installed in impact areas (eg diameter reductions and changes of directions in the system).
- Pipe brackets to be fixed to building materials with high specific area weight.
- For stack pipes in open mounting shafts and high rooms (storey height over 2,5 metres) it is advised to use one fixed bracket and one sliding bracket per pipe length.
- The fixed bracket must be installed directly above the fitting at the bottom of the pipe end. The sliding bracket must be installed at a distance of maximum of 2 metres above the fixed bracket (see figure 28B).
- In multiple storey buildings (from 3 storeys and more) the stack pipes of DN 100 or bigger must be secured by additional fixing (stack pipe support) against sliding (see figure 28B). In this case we advise using the Wavin AS socketed short length with a fixed bracket. Stack segments with fittings or short pipes are to be secured in such short distances with pipe brackets, so that they cannot slide apart.

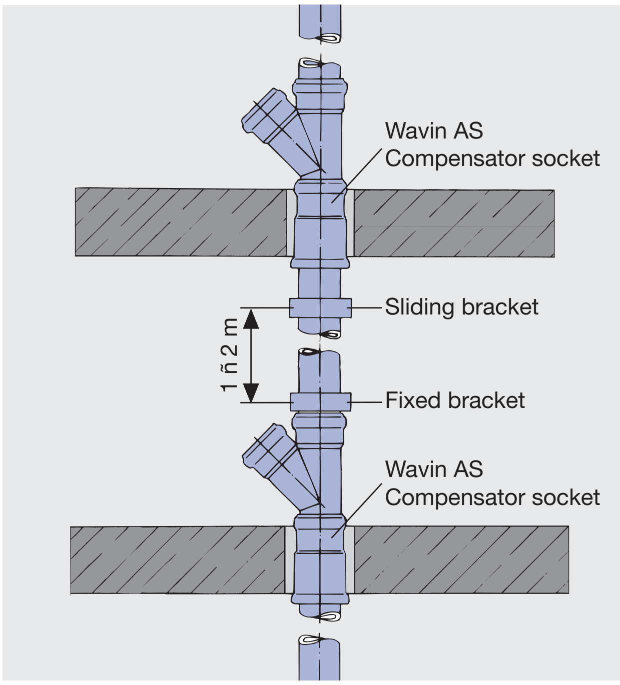


Figure 28A: Fixation Wavin AS.

In exceptional cases, where connecting elements other than the compensator socket are used (eg double socketed sleeve), per maximum allowable pipe length (3 metres), one fixed bracket and one sliding bracket should be installed in line with the illustrations (see figure 28A) and (see figure 28B) shown on this page. The double socketed sleeves are to be fixed.

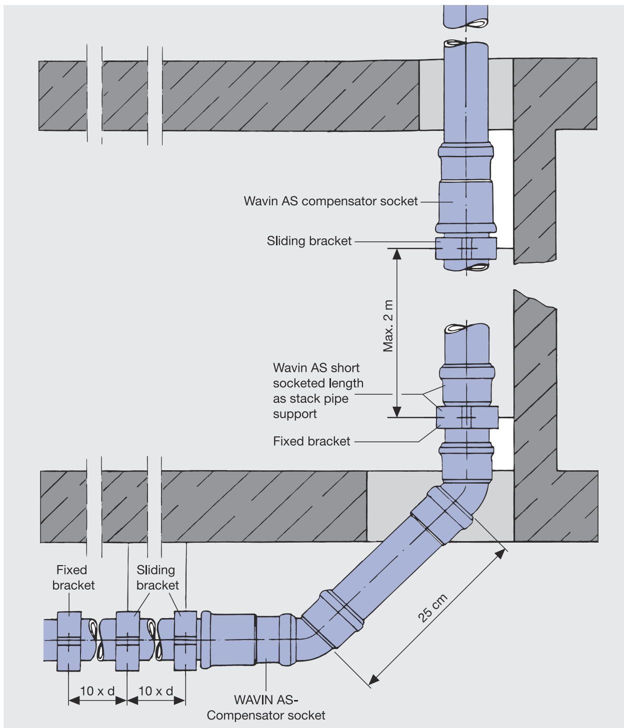


Figure 28B: Fixation Wavin AS.

5.10 Wall mounting

In case Wavin AS is to be installed against a wall with a separate decorative top layer (e.g. plaster boards), the brackets must be fixed to the construction wall and not to the decorative layer. Passing holes in the decorative layer can be mended by using elastic filler. As long as stability and bearing capacity are not impaired, it is allowed to cut shafts and channels in brick work walls. External heating of Wavin AS pipes should be limited by heat insulating the source; eg central heating pipes as well as hot tap water pipes. Pipe and shaft dimensions are to be taken from table 9 below and figure 29.

DN	OD of pipe d_a	OD of socket d_m	Min. required spacing*, t_{erf}
(mm)	(mm)	(mm)	(mm)
56	58	79	125
70	78	96	142
90	90	110	156
100	110	132	179

* The stated depths are not including pipe crossings

Table 9: Space requirements for Wavin AS pipes DN 56 – DN 100 mm.

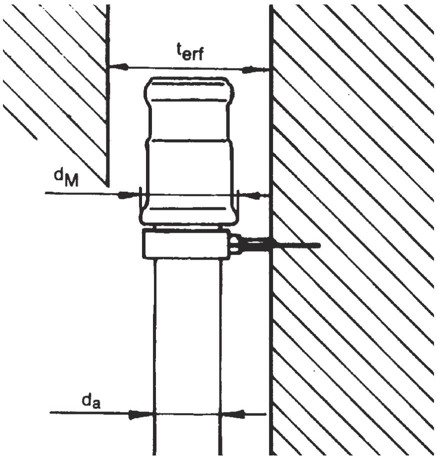


Figure 29: Space requirements for Wavin AS.

5.11 Installation in concrete

Wavin AS pipes and fittings can be casted in concrete. Thermal induced lateral movements have to be dealt with, according to previous instructions. Pipes and fittings must be secured properly in order to prevent lateral movement during casting of the concrete. Close the annular gap between pipe and socket with sealing tape to prevent ingress of mortar in the sealing ring.

5.12 Floor crossings

Floor crossings should be made leak resistant and sound absorbent. In the case of the floor being concreted, Wavin AS pipes and fittings should be protected by using a protection sleeve or heat insulating wrapping material.

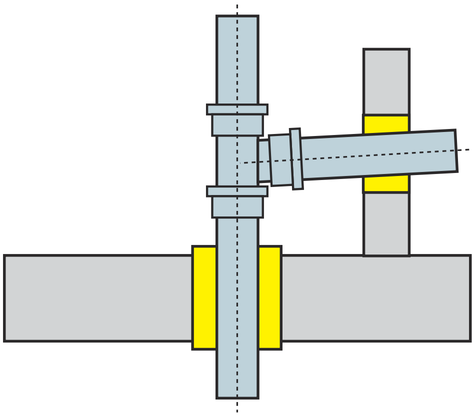


Figure 30: Floor and wall crossings.

5.13 Roof drainage pipes

Roof drainage pipes projected through living, sleeping and working rooms can be installed as pictured in figure X. The specific area weight of the casting should be at least equal to the wall and preferably for both at least 220 kg/m^2. Although the formation of condensation on the outside of Wavin AS pipes is less than on metallic pipes, it is recommended to insulate the pipes and fittings.

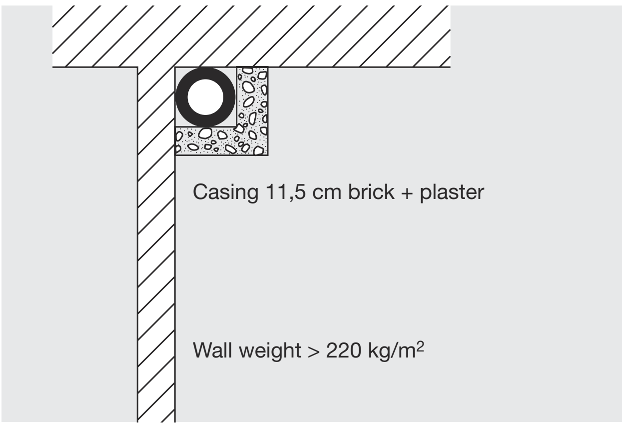


Figure 31: Internal roof drainage pipes.

5.14 Pipe installation in confined spaces

The Wavin AS long bend is designed for making simple leg-length adjustments in confined spaces, where 45° bends or step-wise changes in direction are required.

5.15 Air circulation pipework

The Wavin AS air circulation bend simplifies the installation of air circulation pipework.

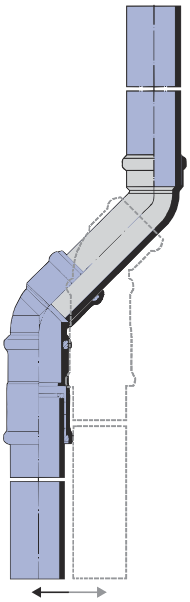


Figure 32: Wavin AS Long Bend.

5.16 Finished floor level assembly and pre-wall installations

When assembling onto finished floor levels in pre-wall installations, the use of the parallel branch matched to the pre-wall installation dimensions (WC element) is recommended.

5.17 Below-ground piping and collector pipes

Below-ground piping is normally connected to downpipes or directly into waste water facilities located at basement level. Such piping is normally to be found buried within the confines of the building or below the foundations.

Collecting pipes are installed above-ground and used to collect waste water from downpipes or other connecting pipework.

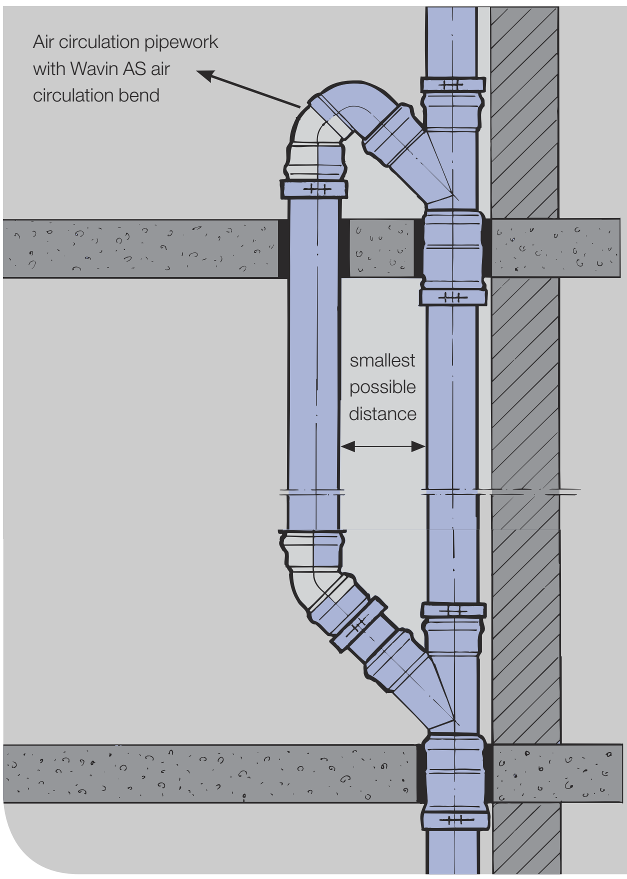


Figure 33: Wavin AS air circulation pipework with the air circulation bend.

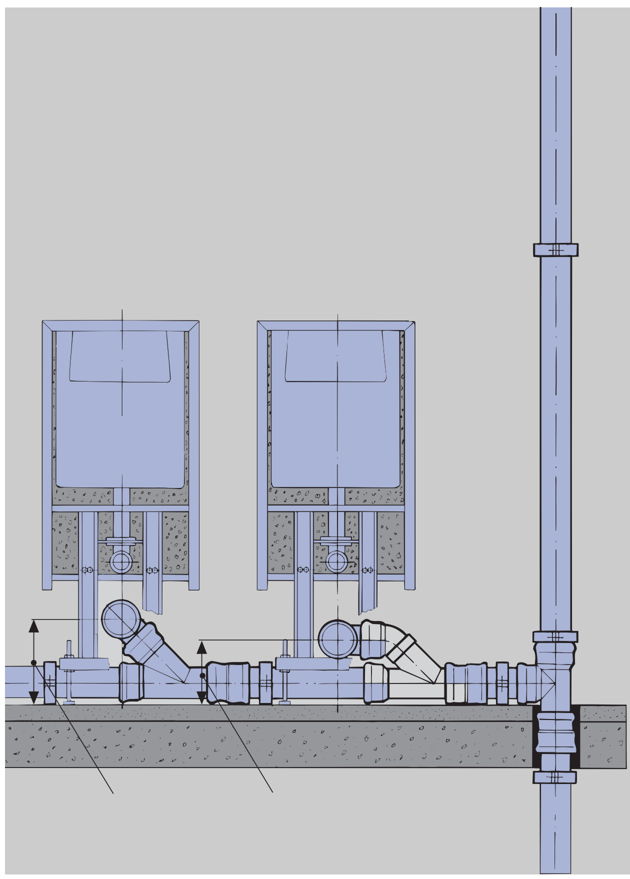


Figure 34. Wavin AS parallel branch for pre-wall installations.

Recommendation:

Avoid below-ground piping located within building confines and install collecting pipes (DIN 1986 -100, Section 5.7) as an alternative. Below-ground piping with minimum DN 80 nominal diameter can be laid outside buildings and allowed to run as far as main sewer connection point, provided hydraulic calculations permit. The design of below-ground and collecting pipe circuits is based on figures calculated using the Prandtl-Colebrook equation.

Advice:

In order to guarantee self-cleaning capacity for every 4 - 6 flushes, collecting pipes with nominal DN 90 diameters must be used wherever peak flow is greater than the design unit value of the given water-saving toilet facility. Nominal DN 90 diameters can be installed without resorting to any calculations provided a minimum fall of at least 1 cm/m is available.

Since the new DIN EN 12056 and DIN 1986-100 waste water norms, which further endorse DN 90 downpipe specifications, have come into force, it is possible to install a complete and secure waste water removal system by using just two pipe dimensions – DN 56 and DN 90 – from the individual waste water sources (facilities) right up to the main drain cleaning access point or the mains sewage connecting point.

Gradient	DN 56 AS d_i=50		DN 70 AS d_i=69		DN 90 AS d_i=81		DN 100 AS d_i=99,4		DN 125 AS d_i=124,4		DN 150 AS d_i=149,4		DN 200 AS d_i=187,6	
J	Q	v	Q	v	Q	v	Q	v	Q	v	Q	v	Q	v
cm/m	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
0,20	0,19	0,19	0,45	0,24	0,70	0,27	1,21	0,31	2,20	0,36	3,60	0,41	6,60	0,48
0,30	0,23	0,24	0,56	0,30	0,86	0,33	1,49	0,38	2,71	0,45	4,42	0,50	8,12	0,59
0,40	0,27	0,27	0,64	0,34	0,99	0,39	1,72	0,44	3,14	0,52	5,12	0,58	9,39	0,68
0,50	0,30	0,31	0,72	0,39	1,11	0,43	1,93	0,50	3,52	0,58	5,73	0,65	10,52	0,76
0,60	0,33	0,34	0,79	0,42	1,22	0,47	2,12	0,55	3,86	0,63	6,29	0,72	11,54	0,83
0,70	0,36	0,37	0,86	0,46	1,32	0,51	2,29	0,59	4,17	0,69	6,80	0,78	12,47	0,90
0,80	0,38	0,39	0,92	0,49	1,41	0,55	2,45	0,63	4,46	0,73	7,28	0,83	13,34	0,97
0,90	0,41	0,42	0,98	0,52	1,50	0,58	2,60	0,67	4,74	0,78	7,72	0,88	14,16	1,02
1,00	0,43	0,44	1,03	0,55	1,58	0,61	2,74	0,71	5,00	0,82	8,15	0,93	14,93	1,08
1,10	0,45	0,46	1,08	0,58	1,66	0,65	2,88	0,74	5,24	0,86	8,55	0,98	15,67	1,13
1,20	0,47	0,48	1,13	0,60	1,74	0,67	3,01	0,78	5,48	0,90	8,93	1,02	16,37	1,18
1,30	0,49	0,50	1,18	0,63	1,81	0,70	3,13	0,81	5,71	0,94	9,30	1,06	17,04	1,23
1,40	0,51	0,52	1,22	0,65	1,88	0,73	3,25	0,84	5,92	0,97	9,65	1,10	17,69	1,28
1,50	0,53	0,54	1,26	0,68	1,95	0,75	3,37	0,87	6,13	1,01	10,00	1,14	18,32	1,33
2,00	0,61	0,63	1,46	0,78	2,25	0,87	3,89	1,00	7,09	1,17	11,56	1,32	21,18	1,53
2,50	0,69	0,70	1,64	0,88	2,52	0,98	4,36	1,12	7,94	1,31	12,93	1,48	23,69	1,71
3,00	0,75	0,77	1,80	0,96	2,76	1,07	4,78	1,23	870	1,43	14,17	1,62	25,97	1,88
3,50	0,82	0,83	1,94	1,04	2,98	1,16	5,16	1,33	9,40	1,55	15,31	1,75	28,06	2,03
4,00	0,87	0,89	2,08	1,11	3,19	1,24	5,52	1,42	10,05	1,65	16,38	1,87	30,00	2,17
4,50	0,93	0,94	2,20	1,18	3,39	1,31	5,86	1,51	10,67	1,76	17,38	1,98	31,83	2,30
5,00	0,98	0,99	2,32	1,24	3,57	1,39	6,18	1,59	11,25	1,85	18,32	2,09	33,56	2,43

Table 10: Allowable waste water discharge, filling factor 50% (h/di = 0,5).

Gradient	DN 56 AS d_i=50		DN 70 AS d_i=69		DN 90 AS d_i=81		DN 100 AS d_i=99,4		DN 125 AS d_i=124,4		DN 150 AS d_i=149,4		DN 200 AS d_i=187,6	
J	Q	v	Q	v	Q	v	Q	v	Q	v	Q	v	Q	v
cm/m	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
0,20	0,32	0,22	0,76	0,27	1,17	0,30	2,03	0,35	3,70	0,41	6,03	0,46	11,05	0,53
0,30	0,39	0,27	0,94	0,33	1,44	0,37	2,49	0,43	4,54	0,50	7,41	0,57	13,58	0,66
0,40	0,45	0,31	1,08	0,39	1,67	0,43	2,89	0,50	5,26	0,58	8,57	0,65	15,71	0,76
0,50	0,51	0,35	1,22	0,43	1,87	0,49	3,24	0,56	5,89	0,65	9,60	0,73	17,59	0,85
0,60	0,56	0,38	1,33	0,48	2,05	0,53	3,55	0,61	6,46	0,71	10,53	0,80	19,29	0,93
0,70	0,61	0,41	1,44	0,52	2,22	0,58	3,84	0,66	6,99	0,77	11,38	0,87	20,85	1,01
0,80	0,65	0,44	1,54	0,55	2,37	0,62	4,11	0,71	7,48	0,82	12,18	0,93	22,30	1,08
0,90	0,69	0,47	1,64	0,59	2,52	0,65	4,36	0,75	7,94	0,87	12,92	0,99	23,67	1,15
1,00	0,73	0,49	1,73	0,62	2,66	0,69	4,60	0,79	8,37	0,92	13,63	1,04	24,96	1,21
1,10	0,76	0,52	1,82	0,65	2,79	0,72	4,83	0,83	8,78	0,97	14,30	1,09	26,19	1,27
1,20	0,80	0,54	1,90	0,68	2,92	0,76	5,04	0,87	9,18	1,01	14,94	1,14	27,36	1,32
1,30	0,83	0,57	1,98	0,71	3,04	0,79	5,25	0,91	9,56	1,05	15,56	1,19	28,49	1,38
1,40	0,86	0,59	2,05	0,73	3,15	0,82	5,45	0,94	9,92	1,09	16,15	1,23	29,57	1,43
1,50	0,89	0,61	2,12	0,76	3,27	0,85	5,65	0,97	10,27	1,13	16,72	1,28	30,62	1,48
2,00	1,03	0,70	2,46	0,88	3,78	0,98	6,53	1,13	11,87	1,31	19,33	1,47	35,39	1,53
2,50	1,16	0,79	2,75	0,98	4,23	1,10	7,30	1,26	13,29	1,46	21,63	1,65	39,59	1,92
3,00	1,27	0,86	3,02	1,08	4,63	1,20	8,01	1,38	14,56	1,60	23,70	1,81	43,39	2,10
3,50	1,37	0,93	3,26	1,17	5,01	1,30	8,65	1,49	15,74	1,73	25,61	1,95	46,88	2,27
4,00	1,47	1,00	3,49	1,25	5,36	1,39	9,26	1,60	16,83	1,85	27,39	2,09	50,13	2,43
4,50	1,56	1,06	3,70	1,32	5,68	1,48	9,82	1,69	17,86	1,96	29,06	2,22	53,19	2,57
5,00	1,64	1,12	3,90	1,40	5,99	1,56	10,35	1,78	18,83	2,07	30,64	2,34	56,07	2,71

Table 11: Allowable waste water discharge, filling factor 70% (h/di = 0,7).

Gradient	DN 56 AS d_i=50		DN 70 AS d_i=69		DN 90 AS d_i=81		DN 100 AS d_i=99,4		DN 125 AS d_i=124,4		DN 150 AS d_i=149,4		DN 200 AS d_i=187,6	
J	Q	v	Q	v	Q	v	Q	v	Q	v	Q	v	Q	v
cm/m	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
0,20	0,38	0,19	0,90	0,24	1,39	0,27	2,41	0,31	4,41	0,36	7,19	0,41	13,21	0,48
0,30	0,46	0,24	1,11	0,30	1,71	0,33	2,97	0,38	5,42	0,45	8,85	0,50	16,24	0,59
0,40	0,54	0,27	1,29	0,34	1,99	0,39	3,44	0,44	6,28	0,52	10,24	0,58	18,79	0,68
0,50	0,60	0,31	1,44	0,39	2,23	0,43	3,86	0,50	7,03	0,58	11,47	0,65	21,04	0,76
0,60	0,66	0,34	1,59	0,42	2,44	0,47	4,23	0,55	7,71	0,63	12,58	0,72	23,07	0,83
0,70	0,72	0,37	1,72	0,46	2,64	0,51	4,58	0,59	8,34	0,69	13,60	0,78	24,94	0,90
0,80	0,77	0,39	1,84	0,49	2,83	0,55	4,90	0,63	8,93	0,73	14,55	0,83	26,68	0,97
0,90	0,82	0,42	1,95	0,52	3,00	0,58	5,20	0,67	9,47	0,78	15,45	0,88	28,32	1,02
1,00	0,86	0,44	2,06	0,55	3,17	0,61	5,48	0,71	9,99	0,82	16,29	0,93	29,86	1,08
1,10	0,91	0,46	2,16	0,58	3,32	0,65	5,76	0,74	10,49	0,86	17,09	0,98	31,34	1,13
1,20	0,95	0,48	2,26	0,60	3,47	0,67	6,01	0,78	10,96	0,90	17,86	1,02	32,74	1,18
1,30	0,99	0,50	2,35	0,63	3,62	0,70	6,26	0,81	11,41	0,94	18,60	1,06	34,09	1,23
1,40	1,02	0,52	2,44	0,65	3,76	0,73	6,50	0,84	11,85	0,97	19,31	1,10	35,39	1,28
1,50	1,06	0,54	2,53	0,68	3,89	0,75	6,73	0,87	12,27	1,01	19,99	1,14	36,64	1,33
2,00	1,23	0,63	2,93	0,78	4,50	0,87	7,79	1,00	14,18	1,17	23,11	1,32	42,35	1,53
2,50	1,37	0,70	3,27	0,88	5,04	0,98	8,72	1,12	15,87	1,31	25,86	1,48	47,38	1,71
3,00	1,51	0,77	3,59	0,96	5,52	1,07	9,56	1,23	17,40	1,43	28,34	1,62	51,93	1,88
3,50	1,63	0,83	3,88	1,04	5,97	1,16	10,33	1,33	18,80	1,55	30,63	1,75	56,11	2,03
4,00	1,74	0,89	4,15	1,11	6,39	1,24	11,05	1,42	20,11	1,65	32,76	1,87	60,01	2,17
4,50	1,85	0,94	4,41	1,18	6,78	1,31	11,72	1,51	21,34	1,76	34,75	1,98	63,67	2,30
5,00	1,95	0,99	4,65	1,24	7,15	1,39	12,36	1,59	22,50	1,85	36,64	2,09	67,13	2,43

Table 12: Allowable waste water discharge, filling factor 100% (h/di = 1,0).

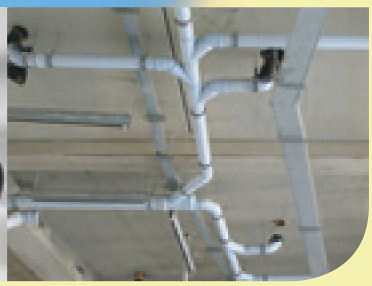
The most installed plastic low-noise soil & waste system worldwide

Wavin AS

Wavin AS is the complete low-noise soil and waste system made of Astolan. Astolan is especially developed to dempen sound.

With Wavin AS the noise levels inside buildings can be reduced to an absolute minimum. High density, large wall thickness and the use of Astolan material make the Wavin AS system unique and best in class. No wonder Wavin AS is the most installed plastic low-noise system worldwide with a proven track record of 25 years.

Wavin AS is suitable for all buildings: hotels, offices, residential buildings, hospitals, etc.



8.2 Floor Trap

The highly functional Floor Trap completes the existing Wavin AS range. The Wavin AS Floor Trap has unique features such as an air tight baffle construction and the incorporation of proven Wavin AS seals. The Wavin AS Floor Trap can be directly applied within the Wavin AS soil and waste system design.

In the design of the Wavin AS Floor Trap, 50 years of Wavin knowledge has been integrated from both a functional installation as well as a hydraulic perspective.

Important aspects in the designing process were:

- Knock-out prevention
- SBR seals
- Absorb/correct installation mistakes
- Durability
- Resistance to difficult installation circumstances

Benefits

Seal construction

The already proven Wavin AS seal construction is included in not only the top inlet but on all inlets and even on the outlet. This seal construction gives the Floor Trap the same performances/ reliability as the already established Wavin AS fittings and pipes and gives maximum freedom in installing this Floor Trap.

Baffle construction

The baffle construction is air tight under all circumstances. The high tolerances during production guarantee the functionality during the installed life time. A specially designed inspection plug enables to access the area under the baffle in order to inspect and clean this area. The Floor Trap volume is designed in such a way that a maximal discharge capacity is reached.

Blind plugs

In case not all the inlets are used two PP-blind plugs are added to the Floor Trap. These blind plugs are easy to mount to the inlets of the Floor Trap and secure a leakage free sealing of unused connections to the Floor Trap.

Connections and relation between DN and OD			
	Number	DN	OD [mm]
Inlets	3	56	58
Outlet	1	70	78
Top inlet	1	100	110

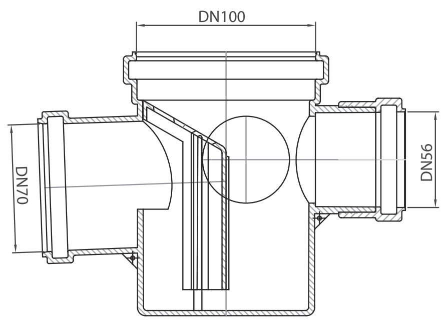
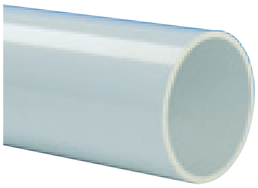


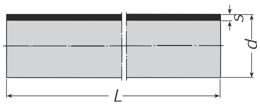
Figure 48: Floor trap configuration and dimensions.

Quality requirements

The Wavin AS Floor Trap complies with the respective standard EN1455 (EN1451 for the pipes). The seals comply with standard EN 681-1.

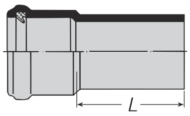
8.4 Product range





Wavin AS - plain ended pipe

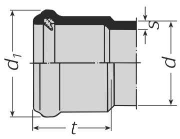
Dim. DN	Article No.	d mm	s mm	L mm	Weight kg/m
56	71595000	58	4,0	3000	1,40
70	34045000	78	4,5	3000	2,10
90	03087786	90	4,5	3000	2,30
100	34053000	110	5,3	3000	3,55
125	34096000	135	5,3	3000	4,40
150	34100000	160	5,3	3000	5,15
200	03014592	200	6,2	3000	7,50



Wavin AS - socketed short length

Dim. DN	Article No.	L mm	Weight kg/pc.
56	71609000	150	0,30
70	36641000	150	0,45
90	31178000	150	0,55
100	36668000	150	0,78
125	36676000	150	1,01
150	36706000	150	1,20

Other short lengths (250, 500, 1000, 2000, 3000 mm) on request.

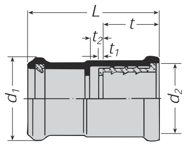


Socket dimension

Dim. DN	d mm	d1 mm	s mm	t mm
56	58	75	4,0	54
70	78	96	4,5	56
90	90	110	4,5	55
100	110	132	5,3	61
125	135	161	5,3	64
150	160	181	5,3	66
200	200	227	6,2	85

All fittings with sockets are pre-assembled with sealing rings.

For spare sealing rings see page 55.

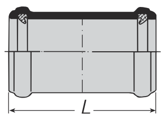


Wavin AS - compensator socket

Dim.	Article	d1	d2	t	t1	t2	L	Weight
DN	No.	mm	mm	mm	mm	mm	mm	kg/pc.
56	71617000	175	172	49	5	15	126	0,20
70	34410000	196	184	48	6	16	119	0,30
90	31062000	110	104	47	6	16	123	0,30
100	34428000	132	116	48	6	16	124	0,49
125	34436000	161	141	63	6	16	132	0,66
150	34665000	181	166	63	6	16	144	0,75

All compensator sockets are pre-assembled with collars and sealing rings.

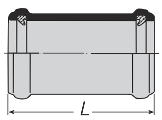
For spare collars and sealing rings see page 55.



Wavin AS - double socketed sleeve, with central register

Dim.	Article	L	Weight
DN	No.	mm	kg/pc.
200	3014606	168	1,33

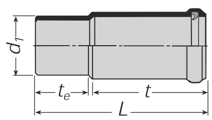
Connecting element between pipes as well as between pipes and fittings.

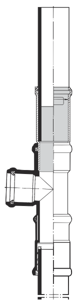


Wavin AS - double socketed sleeve

Dim.	Article	L	Weight
DN	No.	mm	kg/pc.
56	71625000	105	0,18
70	35351000	107	0,26
100	35360000	117	0,43
125	35432000	124	0,56
150	35440000	143	0,62
200	3050998	168	1,30

Only for subsequent installation or repair purposes.

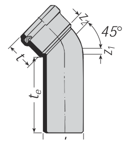


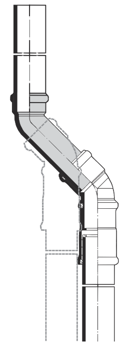


Wavin AS - long socket

Dim.	Article	d1	t	te	L	Weight
DN	No.	mm	mm	mm	mm	kg/pc.
100	84743000	110	127	74	210	0,80

For constructing a branch or prefabrication at a later date.

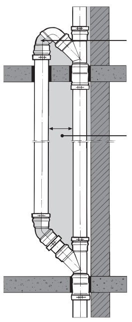


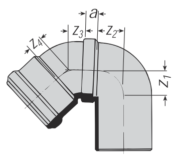


Wavin AS - long bend 45°

Dim.	Article	d1	t	te	Z1	Z2	Weight
DN	No.	mm	mm	mm	mm	mm	kg/pc.
100	84735000	110	57	250	24	28	1,42

For a simple adjustment of long leg bend (or long leg elbow 45°) in narrow installation with 45° change of direction, or stepped 90° change of direction.

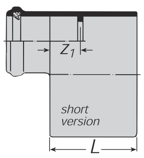


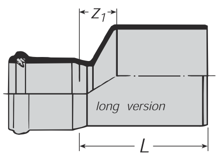


Wavin AS - air circulation bend 135°

Dim.	Article	Z1	Z2	Z3	Z4	a	Weight
DN	No.	mm	mm	mm	mm	mm	kg/pc.
100	34312000	78	58	44	28	19,5	1,24

For secondary venting systems





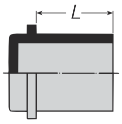
Wavin AS - reducer

Dim.	Article	z1	L	Weight
DN	No.	mm	mm	kg/pc.
56/40	73563000	-18	60	0,03
70/56*	76570000	-28	76	0,05
70/56	73555000	-28	76	0,20
90/56	30929000	-32	84	0,30
90/70	30902000	-29	82	0,40
100/56	73547000	-10	87	0,45
100/70	36560000	-10	87	0,47
100/90	30872000	-35	87	0,36
125/100	36579000	-13	90	0,63
150/100**	36587000	-44	115	0,98
150/125**	36595000	-33	125	1,00
200/150**	3014630	-32	142	1,32

*Internal diameter of socket: 50 mm (PP)

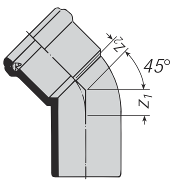
** long version

Wavin AS - socket plug

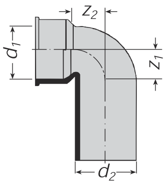


Dim. DN	Article No.	L mm	Weight kg/pc.
56	73601000	49	0,11
70	36714000	52	0,20
100	36722000	57	0,37
125	36749000	60	0,51
150	36986000	49	0,54

Wavin AS - bends 15°, 30°, 45°, 67° and 87°



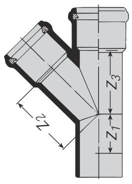
Dim. DN	°	Article No.	z1 mm	z2 mm	Weight kg/pc.
56	15°	71633000	19	8	0,22
56	30°	72290000	24	16	0,21
56	45°	72508000	28	17	0,22
56	67°	72540000	43	21	0,23
56	87°	72680000	47	32	0,25
70	15°	36099000	26	10	0,33
70	30°	36170000	30	17	0,37
70	45°	36331000	37	21	0,39
70	67°	36374000	48	31	0,42
70	87°	36412000	62	42	0,46
90	15°	30996000	8	8	0,33
90	30°	31003000	15	14	0,35
90	45°	31011000	22	20	0,36
90	87°	31054000	49	42	0,41
100	15°	36102000	27	15	0,61
100	30°	36188000	37	19	0,65
100	45°	36340000	44	28	0,71
100	67°	36382000	60	44	0,74
100	87°	36420000	78	58	0,89
125	15°	36110000	29	16	0,81
125	30°	36315000	38	45	0,91
125	45°	36358000	50	34	0,98
125	87°	36536000	96	102	1,17
150	15°	36129000	13	19	0,89
150	30°	36323000	24	30	1,00
150	45°	36366000	36	42	1,28
150	87°	36544000	83	89	1,62
200	45°	3014622	47	42	1,99
200	87°	3014649	103	93	2,51



Wavin AS - trap conversion bend

Dim. DN	Article No.	d1 mm	d2 mm	Z1 mm	Z2 mm	Weight kg/pc.
56/40	80942000	50	58	30,5	25	0,08

item is delivered without sealing

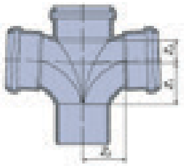


Wavin AS - branches 45°, 67°, 87°

Dim. DN	°	Article No.	Z1 mm	Z2 mm	Z3 mm	Weight kg/pc.
56/56	45°	72770000	28	74	74	0,43
56/56	67°	72850000	36	45	45	0,38
56/56	87°	73369000	48	32	32	0,37
70/56	45°	75248000	17	83	79	0,58
70/56	67°	75809000	31	54	46	0,51
70/56	87°	76317000	48	42	28	0,49
70/70	45°	35467000	38	99	99	0,75
70/70	67°	35629000	47	61	60	0,64
70/70	87°	5785000	62	43	43	0,59
90/56	45°	30970000	-3	97	84	0,70
90/56	87°	3087824	32	48	31	0,58
90/70	87°	3087832	43	49	40	0,69
90/90	45°	30961000	19	113	106	0,70
90/90*	87º	03087840	72	72	37	0,79
100/56	45°	73687000	1	110	97	0,94
100/56	67°	73695000	24	75	52	0,82
100/56	87°	74187000	47	61	27	0,78
100/70	45°	35483000	21	122	115	1,22
100/70	67°	35661000	40	81	67	1,00
100/70	87°	35840000	60	61	43	0,94
100/70*	87º	03141659	72	90	47	1,00
100/100	45°	35491000	44	136	136	1,50
100/100	67°	35670000	58	84	84	1,32
100/100	87°	35882000	78	58	58	1,10
100/100*	87º	03141667	100	88	47	1,23
125/100	45°	35505000	31	155	152	1,90
125/100	87°	37621000	78	73	59	1,59
125/125	45°	35513000	49	169	169	2,04
125/125	87°	37630000	90	72	72	1,56
150/100	45°	35564000	2	168	159	2,14
150/150	45°	35599000	36	194	194	2,82
200/200	45°	3014614	42	247	239	4,40

* Swept

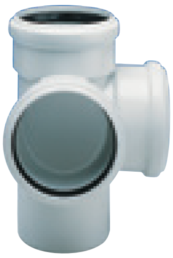
Wavin AS - double branch 87°

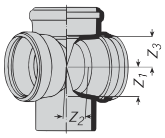


Dim. DN	Article No.	Z1 mm	Z2 mm	Z3 mm	Weight kg/pc.
90/90/90*	03139107	79	72	39	0,97
100/70/70*	03141632	72	90	47	1,20
100/100/100*	03141675	100	88	47	1,50
100/100/100	37664000	78	58	58	1,58

* Swept

Wavin AS - corner branch 87°

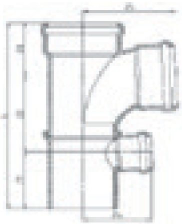




Dim. DN	Article No.	Z1 mm	Z2 mm	Z3 mm	Weight kg/pc.
90/90/90*	03139115	79	72	60	1,06
100/100/100	37672000	78	58	58	1,58

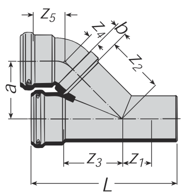
* Swept

Wavin AS - shower branch



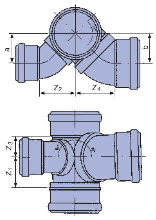
Dim. DN	Article No.	Z1 mm	Z2 mm	Z3 mm	Z4 mm	Z5 mm	L mm	Weight kg/pc.
90/90/56	03171400	99	113	89	103,00	128	301	1,11
100/100/56	03171396	107	142	100	109,00	148	349	1,78

Wavin AS parallel branch



Dim. DN	Article No.	Z1 mm	Z2 mm	Z3 mm	Z4 mm	Z5 mm
100/100	34363000	44	136	136	44	28

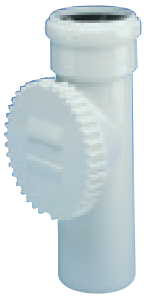
a mm	b mm	L mm	Weight kg/pc.
129	19,5	320	1,93

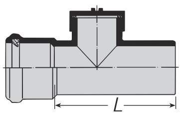


Wavin AS – combination branch 87°

Dim DN	Article No.	Z1 mm	Z2 mm	Z3 mm	Z4 mm	Weight kg/pc.
100/100/70	3165043	80	80	58	104	1,92

Double socket means a single fitting for both right-handed or left-handed installations

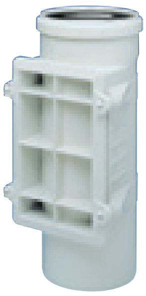


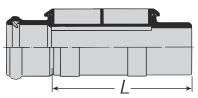


Wavin AS - access pipe type RU

Dim. DN	Article No.	L mm	Weight kg/pc.
56	73571000	151	0,30
70	36609000	187	0,91
90	3087859	148	1,93

With round access lid

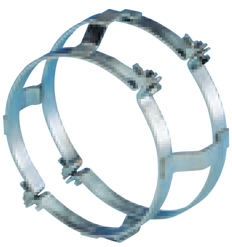




Wavin AS - access pipe type RE

Dim. DN	Article No.	L mm	Weight kg/pc.
100	36617000	298	2,17
125	36625000	316	3,26
150	36633000	345	3,60

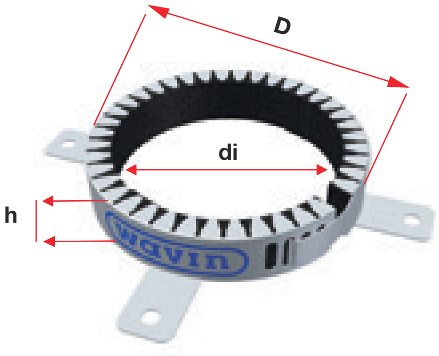
With rectangular access lid



Safety clip for socket plug

Dim. DN	Article No.
56	73628000
70	37168000
90	03093336
100	37176000
125	37184000
150	37192000

Axially fixed



Fire protection collar type BM-R90

Dim. mm	Article No.	h	D	di
40	3161366	30	56	40
50	3161374	30	70	50
63	3161382	30	75	63
75	3161390	30	99	75
90	3161404	30	117	90
110	3161412	30	141	110
125	3161420	50	154	125
140	3161439	50	178	140
160	3161447	50	200	160
180	3161455	50	228	180
200	on request	50	253	200

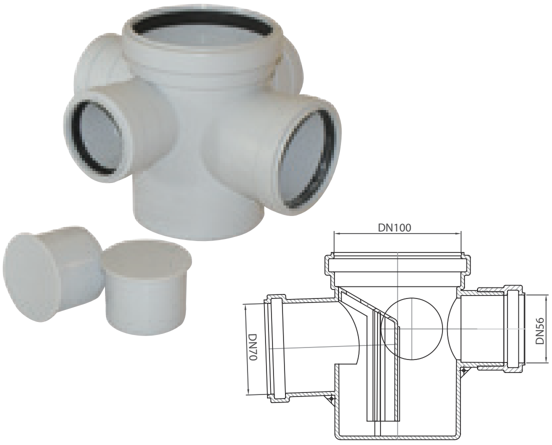
See page 35 for choice of correct collar size.

Fire protection tape BB-R90

Dim. mm	Article No.
90/110	90501254

BSF-30 Escape route solution

DN mm	Article No.	L m
100	0317100	3



Wavin AS – Floor Trap

Dim. DN	Article No.	OD mm
100/70/56 (3x)	03169103	110/78/58 (3x)

Total height (without lid/ cover): 164 mm

Spare collar and sealing ring

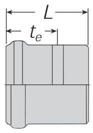
Dim. DN	Collar Art.-No.	Sealing rings Art.-No.
56 (58 mm)	73652000	73636000
70 (78 mm)	36021000	34401000
90	38920000	38911000
100	36030000	34444000
125	36048000	34479000
150	36056000	24619000
200	-	24627000

Sealing ring in NBR-quality

Dim. DN	Collar Art.-No.
56	7363.6001
70	3440.1001
100	3444.4001

Standard sealing is made of Styrene Butadiene Rubber (SBR). When installing Wavin AS in commercial kitchens and abattoirs with high fatcontaining waste water, we advise the use of sealing rings in NBR-quality (see also page 6).

Connection to PP, PVC-U and PE spigot end

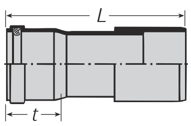


Dim. DN	Article No.	te mm	L mm	Weight kg/pc.
56*	38350000	-	50	0,04
70	76562000	77 1	30	0,07

* Short version

Wavin AS DN		OD	Other Plastic Systems
56	X	50	
70	X	75	

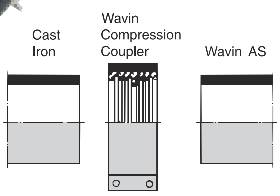
Connection to PP, PVC-U and PE spigot end



Dim. DN	Article No.	t mm	L mm	Weight kg/pc.
125	3060263	64	70	0,30

Wavin AS DN		OD	Other Plastic Systems
125	X	110	

Connection from Cast Iron to Wavin AS



Dim. DN	Article No.
56	73610000
90	03093310
70	37508000
100	37575000
125	37583000
150	37591000

Can also be used for subsequent installation of pipes and fittings.

ANNEX I
Wavin AS, low noise soil & waste system specification clauses

Contents list

Wavin AS, low noise soil & waste system

1000 Application

Low noise soil and waste system for waste water drainage inside the building.

2000 System description

Gravity drainage (Soil and waste) system with noise insulating properties and high temperature resistance for drainage of waste water at high temperature and inside the building in accordance, DIN EN 12056 and DIN 1986-100.

3000 Materials, Fittings

Pipe:

Material:	Astolan, mineral filled PP, density 1.9 g/cm³ (DIN 53579)
Colour:	white / grey RAL 7035
Stiffness:	DN 58 - 70 > SN 32
	DN 90 - 125 > SN 16
	DN 160 - 200 > SN 10

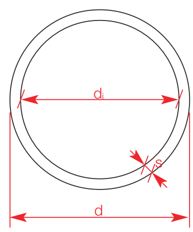
Fittings:

Material:	Astolan, mineral filled PP, density 1.9 g/cm³ (DIN 53479)
Colour:	white / grey RAL 7035
Seal:	SBR or NBR

Diameters:

DN	d1)	di2)	s3)
56	58	50.0	4.0
70	78	69.0	4.5
90	90	81.0	4.5
100	110	99.4	5.3
125	135	124.4	5.3
150	160	149.4	5.3
200	200	187.6	6.2

1) Outside diameter in mm.
2) Inside diameter in mm.
3) Wall thickness in mm.



Sealing ring:
The elastomeric seal is made from vulcanized Styrene Butadiene Rubber (SBR) in conformity with DIN EN 10 204:2004. Nitrile Butadiene Rubber (NBR) is advised for permanent drainage of high fat-containing waste water.

4000 Performance objectives

Mass per m²:
To secure a maximum sound absorption, the system needs to comply with the following minimum mass per surface area for pipes as well as for the fittings:

- 56 mm 7.5 kg/m²
- 70 & 90 mm 8.5 kg/m²
- 100, 125, 150 mm 10.0 kg/m²
- 200 mm 11.5 kg/m²

Temperature resistance:
The pipe system needs to be resistant against continuous temperatures of 90°C and peak temperatures of 100°C.

5000 Fire protection

Fire resistance of the drainage system should be classified in conformity with DIN EN 13501-1*.

The soil and waste pipe system needs to be installed with suitable fire collars where the pipes and fittings cross walls and floors, as per the minimum requirements of 90 minutes fire resistance as per the fire protection classification F90 in accordance with EN 13501-1.

Additional recommendation:

- Above escape routes, the Wavin BSF-30 solution for escape routes need to be installed.
- To maintain the fire resistance of walls and floors when they are penetrated by the Wavin AS soil system, either a Wavin BB-R90 or Wavin BM-R90 fire collar needs to be installed.
- When a fire collar needs to be installed at an angled crossing or on a socket, only the Wavin BM-R90 can be used.
- Installation according to the installation instructions of Wavin.

*In line with European standardization the fire classification classes as per DIN 4102-1 are translated into the European DIN EN 13501. The accreditation is based on the standardized Singl-burning-Item-Test (SBI) in conformity with DIN EN 13823.

6000 Installation

Expansion provision:
For each pipe length a Wavin AS expansion compensator socket needs to be installed.

Jointing:
Unless stated otherwise system components are joined through a spigot socket connection with rubber ring gasket.

Brackets:
Use full encircling Wavin AS brackets with rubber inserts.

Each pipe section between floors must be secured by a fixed bracket unless the pipe is casted into the concrete floors.

Installation:
Installation according to the Wavin AS installation instructions and in line with 'Recommended practice for installation EN ONR CEN/TR 13801'.

7000 Documents to be provided to client

Sound level:
The contractor needs to demonstrate via an independent programmethat the sound level in the rooms shall not exceed the required sound levels. Unless stated otherwise the maximum sound level is: 30 dB(A).

Explanation:
The sound level is dependent on amongst others the material of the pipe system, the wall thicknesses of the pipe and fittings, the diameter of the system, the flow capacity, the duct material and construction, the type of brackets and mass of the fixation wall and room size. When one of the variables changes, the calculation needs to be repeated with the new input values.

ANNEX II Wavin AS Sound check support tool

Support Tool WAVIN Sound check - version 14/05/2013 -

Date: ____

Project: ____

Reference: ____

Room: ____

The following parameters have to be filled in to run the Sound check calculation.

1. Selection of room position

☐ Vertical stack pipe — Please move to No. 2

☐ Collector pipe horizontally installed below ceiling — Please move to No. 15

2. Type of pipe (material, SDR, jointing technique)

The sound emission of the soil stack depends on the pipe system material and design.
The bases of the calculation are sound emission generated with 3 l/s in a laboratory environment.

____

____

3. Type of brackets (material description, with/without rubber inlays)

Due to pipe vibration, the type of brackets has a major influence on the structure borne sound level.

____

____

4. Offset (yes/no)

Offset is horizontal displacement of the vertical pipe by using two 45 degree bends.
An offset in the soil stack will result in higher sound emissions.

____

____

5. Drop height

The drop height is the difference between the inflow in the soil stack and the floor level of the room for which the calculation is made.

☐ 3 m ☐ 9 m

☐ 6 m ☐ >10 m

6. Flow rate

When one lavatory is connected to the downpipe, the flow rate should be > 3 l/s.
A lavatory flush of 1,75 – 2,0 l/s resembles a continuous flow of 3 l/s.

☐ 2 l/s (according to DIN 4109)

☐ ______ l/s (between 0,5 – 16 l/s)

7. Pipe diameter (OD)

_________ mm (between 70 – 200 mm)

8. Pipe insulation

Insulation blankets can reduce sound emission. This depends on the insulation material used and the properties of the pipe material. A flexible material with an open structure and high mass is the most effective at reducing the sound level. Insulation blankets with a closed cell structure, however, can increase the sound level.

☐ without pipe insulation

☐ with pipe insulation

Pipe insulation type: ________________

Insulation thickness: ________________ mm

Insulation strenght: ________________ kg/m²

9. Duct/Shaft material

Sound emission of piping is influenced by the construction and material of the pipe duct area.

☐ No pipe shaft

☐ Pipe installed in shaft

Shaft material: ________________

Thickness: ________________ mm

Density: ________________ kg/m²

10. Total duct surface area

The total duct surface area is the total internal surface measurement multiplied by the room height: e.g. with a rectangular duct take 2 x (width + depth) x room height.

_______ *m²*

11. Sound insulation material in duct surface area

☐ No insulation

☐ Duct surface area covered by sound insulation

Insulation material: ________________

Thickness: ________________ mm

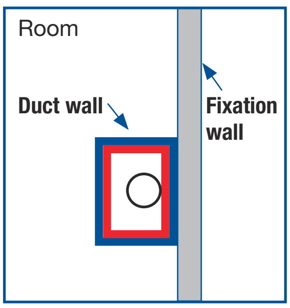
Density: ________________ kg/m²

12. Duct area exposed to room

12.a _______m²

12.b Here a small sketch of the room and duct design is requested to provide in order to get good understanding of the situation:

Example room



Project room

Blue: total duct wall surface area

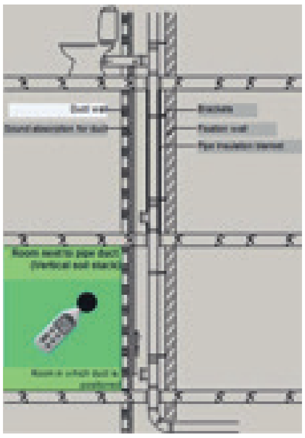
Red: duct wall surface area exposed to room

13. Fixation wall

Material: ______________

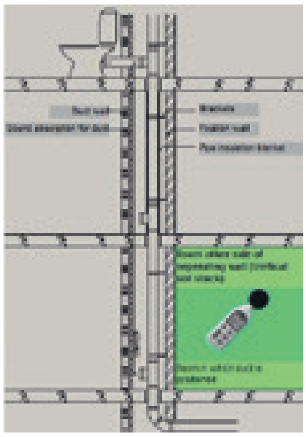
Mass fixation wall: ________ kg/m²

14. Room surface (select a/b)



(a) _____ m³ Room next to pipe duct (vertical soil stack)

(b) _____ m³ Room at other side of separating wall (vertical soil stack)



Calculation sound emission level for room below suspended ceiling (horizontal pipe installation)

15. Type of pipe (material description, SDR class, jointing technique)

The sound emission of the soil stack depends on the pipe system material and design. The bases of the calculation are sound emission generated with 3 l/s in a laboratory environment.

____

____

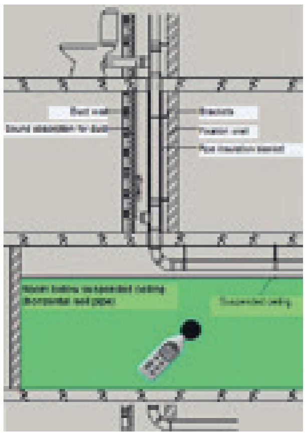
____

____

____

____

____



16. Type of brackets (material description, with/without rubber inlays)

Due to pipe vibration, the type of brackets has a major influence on the structure borne sound level.

17. Drop height

The drop height is the difference between the inflow in the soil stack and the floor level of the room for which the calculation is made.

- ☐ 3 m
- ☐ 6 m
- ☐ 9 m
- ☐ >10 m

18. Flow rate

When one lavatory is connected to the downpipe, the flow rate should be > 3 l/s. A lavatory flush of 1,75 – 2,0 l/s resembles a continuous flow of 3 l/s.

☐ 2 l/s (according to DIN 4109)

☐ ______ l/s (between 0,5 – 16 l/s)

19. Pipe diameter (OD)

_________ mm (between 70 – 200 mm)

20. Pipe insulation

Insulation blankets can reduce sound emission. This depends on the insulation material used and the properties of the pipe material. A flexible material with an open structure and high mass is the most effective at reducing the sound level. Insulation blankets with a closed cell structure, however, can increase the sound level.

☐ without pipe insulation

☐ with pipe insulation   Pipe insulation type: _________________

Insulation thickness: _________________ mm

Insulation strength: _________________ kg/m²

21. Pipe casing

The sound emission can be reduced by applying a casing.

☐ No pipe casing

☐ Yes, casing material: ______________

Thickness: ______________ mm

Density: ______________ kg/m²

22. Suspended ceiling

Select the type of suspended ceiling material.

☐ No supsended ceiling

☐ Room and pipe separated by suspended ceiling:

Ceiling material: ______________

Thickness: ______________ mm

Density: ______________ kg/m²

23. Mass fixation ceiling

_______ kg/m²

24. Room volume below suspended ceiling

_______ m³

ANNEX III Declaration of conformity

Declaration of conformity for the Wavin BM-R90 fire collar

Name and address of the installing company:

____
____
____
____
____
____

Site / building:

____
____

Date of manufacture:

____
____

Required fire safety class for pipe seal: R90

Declaration:

We hereby state that:

all details of the manufacture and installation of R90 fire resistant pipe seals for installation in walls and ceilings of fire class F90 have been carried out properly and according to the requirements of the Deutsche Institut für Bautechnik (DIBt / German Institute of Building Technology) National Technical Approval No.: Z-19.17-1924 dated 21.10.2008.

The signatories confirm that the products used in the manufacture of the object being certified (e.g. the pipe collar or the fitting kit, fire protection insert etc.) have been accredited according to the National Technical Approval standards.

Place, Date

Company / Signature

______________________________________ ______________________________________

This declaration is to be given to the builder to be forwarded to the relevant building authorities if required.

ANNEX IV
Chemical resistance list

Legend

+ = Resistant
o = Limited resistance
– = Not resistant
SA = Saturated, aqueous solutions
TP = Technically pure
D = Diluted
C = Commercial

Corrosive agent	Concentration	20°C PP	40°C PP	60°C PP
Acetaldehyde	TP	o	–	
Acetic acid	60%	+	+	
Acetic acid	10%			
Acetic acid	25%			
Acetic acid	60-95%	o		
Acetic anhydride	TP	+		
Acetone	TP	+	+	
Acetophenone	TP	+	o	
Acrylonitrile	TP	+	+	
Adipic acid	SA	+	+	
Air	–	+	+	+
Allyl alcohol	96%	+	+	+
Aluminium chloride	SA	+	+	
Aluminium fluoride	SA			
Aluminium sulphate	SA	+	+	
Alums	SA	+	+	
Ammonia, aqueous	SA	+	+	
Ammonia, gas	TP	+	+	
Ammonia, liquid	TP	+		
Ammonium acetate	SA	+	+	
Ammonium carbonate and bi	SA	+	+	
Ammonium chloride	SA			
Ammonium fluoride	20%			
Ammonium fluoride	SA	+	+	
Ammonium fluoride	>10%			
Ammonium hydroxide	SA	+	+	
Ammonium nitrate	SA			
Ammonium phosphate, including meta	SA	+	+	+
Ammonium sulphide	SA	+	+	
Amyl acetate	TP	o		
Amyl alcohol	TP	+	+	+
Aniline	SA			
Aniline	TP	o	o	
Aniline hydrochloride	SA	+	+	
Anisole	TP	+	o	
Anthraquinone sulphonic acid, suspension	SA			
Antimony trichloride	90%	+		
Apple juice	C	+		
Aqua regia (HCl/HNO3)	03:01	–	–	–
Arsenic acid	SA			
Barium salts	SA	+	+	+
Beer	C	+	+	
Benzaldehyde	0.1%	+	+	
Benzaldehyde	TP			
Benzine — super (fuel for internal combustion engines)	C	o	–	–
Benzine (cleaning agent)	C	o		
Benzine-benzol mixture	80/20	o	–	–
Benzoic acid	SA	+	+	
Benzol	TP	o	–	–
Benzoyl chloride	TP	o		
Benzyl alcohol	TP	+	o	
Borax	D	+	+	
Borax	SA			
Boric acid	SA	+	+	
Brandy	C	+		
Bromic acid	10%			
Bromine gas	–	o	–	–
Bromine water	SA	o	–	–
Bromine, gas, dry	TP			
Bromine, liquid	TP	–	–	–
Butadiene	TP	o	–	–
Butane, gas	TP	+		
Butanol	TP	+	o	o
Butyl acetate	TP	o	–	–
Butyl glycol (butane diol)	TP	+		
Butyl phenol	SA	+		
Butyl phenol	TP			
Butyl phthalate	TP	+	o	o
Butyric acid	20%	+		
Butyric acid	TP			
Calcium carbonate	SA	+	+	+
Calcium chlorate	SA			
Calcium chloride	SA	+	+	+
Calcium hydroxide	SA			
Calcium hypochloride	SA	+		
Calcium nitrate	50%			
Calcium nitrate	SA	+	+	
Calcium sulphate	SA			
Calcium sulphide	SA			
Camphor oil	TP	–	–	–
Carbon dioxide	100%			
Carbon dioxide	SA	+	+	
Carbon dioxide, gas, wet/dry	TP	+	+	
Carbon disulphide	TP	+	–	–
Carbon monoxide	TP			
Carbon tetrachloride	TP	–	–	–
Castor oil	TP	+	+	
Caustic soda solution	Up to 60%	+	+	+
Caustic soda, see caustic soda solution		+	+	+
Chlorinated lime, slurry	–			
Chlorine ethanol	TP	+	+	
Chlorine water	SA	+	o	
Chlorine, gas, dry	TP	–	–	–
Chlorine, liquid	TP	–	–	–

Corrosive agent	Concentration	20°C PP	40°C PP	60°C PP
Chloroacetic acid	85%	+	+	
Chloroacetic acid	TP			
Chloromethane	TP			
Chlorosulphonic acid	D	–	–	–
Chlorosulphonic acid	TP			
Chrome alum	SA	+	+	
Chromic acid	1–50%	+	0	–
Citric acid	D	+	+	+
Citric acid	SA			
Coconut oil	TP	+		
Cooking salt, see sodium chloride		+	+	+
Copper chloride	SA	+	+	
Copper cyanide	SA	+	+	
Copper fluoride	2%			
Copper nitrate	30%	+	+	+
Copper nitrate	SA			
Copper sulphate	SA	+	+	
Cotton-seed oil	TP	+	+	
Cresol	Up to 90%	+	+	
Cresol	>90%	+		
Cresylic acid	SA			
Crotonic aldehyde	TP	+		
Cyclohexane	TP	+		
Cyclohexanol	TP	+	0	
Cyclohexanone	TP	0	–	–
Decahydronaphthalene (decalin)	TP	0	–	–
Developers	C			
Dextrin	D	+	+	
Dibuthyl phtalate	TP	+	0	–
Dichloroacetic acid	TP	0		
Dichloroethylene	TP	0		
Dichloromethane (methylene chloride)	TP	0	–	–
Diethanolamine	TP	+		
Diethyl ether	TP	+	0	
Diglycolic acid	30%			
Diglycolic acid	SA	+	+	
Diisooctyl phthalate	TP			
Dimethylamine	30%			
Dimethylamine	TP	+		
Dimethylformamide	TP	+	+	
Dioctyl phthalate	TP	+	0	
Dioxane	TP	0	0	
Disodium phosphate	SA	+	+	
Drinking water, chlorinated	TP	+	+	+
Ethanediol	TP	+	+	+
Ethanol	40%			
Ethanol	TP	+	+	+
Ethanolamine	TP	+		
Ether, see diethyl ether		+	0	
Ethyl acetate	TP	0	–	–
Ethylene chloride, mono and di	TP	0	0	
Ethylene glycol, see ethanediol		+	+	+
Fluorine	TP	–		
Fluorosilic acid	40%			
Formaldehyde (formalin)	40%	+	+	
Formic acid	1–50%	+	+	0
Formic acid	TP	+	–	
Fructose	C	+	+	+
Fruit juices	C	+	+	
Furfuryl alcohol	TP	+	0	
Gelatine	D	+	+	+
Glacial acetic acid	TP	+	0	–
Glucose	20%	+	+	+
Glucose	SA			
Glucose	D	+	+	+
Glycerin	TP	+	+	+
Glycolic acid	30%	+		
Glycolic acid	SA	+	–	
Heptane	TP	+	0	–
Hexadecanol	TP			
Hexane	TP	+	0	
Hydrobromic acid	10%			
Hydrobromic acid	50%	+	–	–

Corrosive agent	Concentration	20°C PP	40°C PP	60°C PP
Hydrobromic acid	TP			
Hydrochloric acid	20%	+	+	
Hydrochloric acid	Up to 35%	+	0	0
Hydrochloric acid, aqueous	Conc.			
Hydrocyanic acid	10%	+	+	
Hydrofluoric acid	40%	+	+	
Hydrofluoric acid	70%	+	0	
Hydrogen	TP	+	+	
Hydrogen chloride gas, dry	TP	+	+	
Hydrogen chloride gas, wet	TP	+	+	
Hydrogen peroxide	30%	+	0	
Hydrogen peroxide	90%			
Hydrogen sulphide	100%			
Hydrogen sulphide	SA			
Hydrogen sulphide	TP	+	+	
Iodine tincture	C	+	0	
I-propanol, see isopropanol		+	+	
Iron II chloride	SA	+	+	
Iron II sulphate	SA			
Iron III chloride	SA	+	+	
Iron III nitrate	D			
Iron III sulphate	SA			
Isopropanol	TP	+	+	+
Isopropyl ether	TP	0	–	
Lactic acid	10%			
Lactic acid	TP			
Lanolin (wool fat)	C	+	0	
Lead acetate	SA	+	+	0
Linseed oil	TP	+	+	+
Magnesium carbonate	SA	+	+	+
Magnesium chloride	SA	+	+	+
Magnesium hydroxide	SA	+	+	
Magnesium nitrate	SA	+	+	
Magnesium sulphate	SA	+	+	+
Maize germ oil	TP	+		
Maleic acid	SA	+	+	
Malic acid	SA	+		
Mercuric chloride	SA	+	+	
Mercuric cyanide	SA	+	+	
Mercuric nitrate	D	+	+	
Mercury	TP	+	+	
Methanol (methyl alcohol)	TP	+	+	–
Methyl acetate	TP	+	+	
Methyl bromide	TP	–	–	–
Methyl ethyl ketone	TP	+	+	
Methyl methacrylate	TP			
Methylamine	Up to 32%	+		
Methylene chloride, see dichloromethane		0	–	–
Milk	C	+	+	+
Mineral oils	C			
Mineral water	C	+	+	+
MolaSAes	C	+	+	+
Naphtha	C	+	–	–
Naphthalene	TP	+	–	–
Nickel salts	SA	+	+	
Nicotinic acid	D			
Nitric acid	10%	+	+	
Nitric acid	25%			
Nitric acid	Up to 40%			
Nitric acid	10–50%	0	–	–
Nitric acid	Over 50%	–	–	–
Nitric acid	75%			
Nitric acid	98%			
Nitrobenzene	TP	+	0	
N-propanol	TP	+	+	
Oils and fats (vegetable/animal)	–	+	0	
Oleic acid	TP	+	0	
Olive oil	TP	+	+	0
Oxalic acid	SA	+	+	–
Oxygen	TP			
Ozone	TP			
Paraffin oil	TP	+	0	
Peanut oil	TP	+	+	

Corrosive agent	Concentration	20°C PP	40°C PP	60°C PP
Peppermint oil	TP	+		
Perchloric acid	10%			
Perchloric acid	20%	+	+	
Perchloric acid	70%			
Perchloric acid, see perchloric acid				
Perhydrol, see hydrogen peroxide	30%		+	0
Petroleum ether	TP	+	0	
Phenol	D			
Phenol, aqueous	90%	+		
Phenylhydrazine	TP	0	0	
Phenylhydrazine chlorhydrate	TP	+	0	–
Phosphine	TP			
Phosphoric acid	50%			
Phosphoric acid	Up to 85%	+	+	+
Phosphorus oxychloride	TP	0		
Phosphorus trichloride	TP	0		
Picric acid	SA	+		
PotaSAium bichromate	40%			
PotaSAium bichromate	SA	+	+	
PotaSAium borate	SA	+	+	
PotaSAium bromate	SA			
PotaSAium bromate	10%	+	+	
PotaSAium bromide	SA	+	+	
PotaSAium carbonate and bi	SA	+	+	
PotaSAium chlorate	SA	+	+	
PotaSAium chloride	SA	+	+	
PotaSAium chromate	40%	+		
PotaSAium cyanide	>10%			
PotaSAium cyanide	SA	+	+	
PotaSAium fluoride	SA	+	+	
PotaSAium hexacyanoferrate (II+III)	SA			
PotaSAium hydroxide	Up to 50%	+	+	+
PotaSAium hydroxide	60%			
PotaSAium hydroxide solution, see potaSAium hydroxide				
PotaSAium hypochloride	D			
PotaSAium iodide	SA	+	+	
PotaSAium nitrate (potash)	SA	+	+	
PotaSAium orthophosphate	SA			
PotaSAium perchlorate	1%			
PotaSAium perchlorate	10%	+	+	
PotaSAium perchlorate	SA			
PotaSAium permanganate	SA	+	–	
PotaSAium permanganate	20%			
PotaSAium persulphate	SA	+	+	
PotaSAium sulphate	SA	+	+	
PotaSAium sulphide	D			
Potash, see potaSAium nitrate		+	+	
Propane, gas	TP	+		
Propionic acid	50%	+		
Propionic acid	TP			
Pyridine	TP	0	0	
Saccharic acid	SA	+	+	
Salicylic acid	SA			
Salt water, see sea water		+	+	+
Sea water	C	+	+	+
Silicon acid	D			
Silicon oil	TP	+	+	+
Silver acetate	SA			
Silver cyanide	SA			
Silver nitrate	SA	+	+	0
Soap	D			
Soda, see sodium carbonate		+	+	0
Sodium acetate	SA	+	+	+
Sodium benzoate	SA	+	+	
Sodium bicarbonate	SA	+	+	+
Sodium biphosphate	SA			
Sodium borate	SA	+	+	
Sodium bromide	SA			
Sodium carbonate	SA	+	+	0
Sodium chlorate	SA	+	+	
Sodium chloride	SA	+	+	+
Sodium chlorite	20%	+	0	–

Corrosive agent	Concentration	20°C PP	40°C PP	60°C PP
Sodium cyanide	SA			
Sodium dichromate	SA	+	+	+
Sodium fluoride	SA			
Sodium hexacyanoferrate (II+III)	SA			
Sodium hydrogen sulphite (sodium bisulphite)	SA	+	+	+
Sodium hydroxide, see caustic soda solution		+	+	+
Sodium hypochlorite	13% effec. Chlorine	+	0	–
Sodium nitrate	SA	+	+	
Sodium nitrite	SA	+	+	
Sodium orthophosphate	SA			
Sodium perborate	SA	+		
Sodium phosphate	SA	+	+	
Sodium silicate (water glaSA)	D	+	+	
Sodium sulphate and bi	SA	+	+	
Sodium sulphide	SA	+	+	
Sodium sulphite	40%	+	+	+
Sodium thiosulphate	SA	+	+	
Soybean oil	TP	+	0	
Strength	D	+	+	
Sugar	SA	+	+	
Sulphur dioxide, dry, wet	TP	+	+	
Sulphur dioxide, liquid	TP	+		
Sulphur trioxide	TP			
Sulphuric acid	Up to 10%	+	+	–
Sulphuric acid	10-80%	+	+	
Sulphuric acid	96%	0	–	
Sulphurous acid	SA	+	+	
Sulphurous acid	30%			
Tannic acid (tannin)	D	+	–	
Tartaric acid	D			
Tartaric acid	SA	+	–	
Tetraethyl lead	TP	+		
Tetrahydrofuran	TP	0	–	–
Tetrahydronaphthalene (tetralin)	TP	–	–	–
Thionyl chloride	TP	0	–	–
Thiophene	TP	+	0	
Tin chloride II+IV	SA	+	+	
Toluene	TP	0	–	–
Trichloroacetic acid	50%	+	+	
Trichloroethylene	TP	–	–	–
Tricresyl phosphate	TP	+	0	
Triethanolamine	D	–		
Trimethyl propane	Up to 10%			
Turpentine	TP	+	–	–
Urea	33%			
Urea	>10%			
Urea	SA	+	+	
Urine	C			
Vinegar (wine vinegar)	C	+	+	
Vinyl acetate	TP	+	0	
Whisky	C	+		
Wine vinegar	C	+	+	
Wines and spirits	C	+		
Xylene	TP	0		
Yeast	D	+		
Yeast	SA	+		
Zinc carbonate	SA			
Zinc chloride	SA	+	+	
Zinc oxide	SA	+	+	
Zinc sulphate	SA	+	+	

Material Comparison

Property Parameter	PVC	Cast Iron	Wavin AS
Jointing Methology	Solvent	Stainless Coupling	Push-fit
Installation Convenience	Easy	Difficult	Very Easy
Jointing Time	Few minutes	Several Minutes	Few minutes
Inner Surface	Smooth	Semi-smooth	Excellent smoothness
Corrosion Resistance	Does Not Corrode	Corrodes	Does not corrode
Chemical Resistance	Average	Good	Excellent
Brittleness Characteristic	High	Low	Low
Material Price	💰	💰 💰 💰	💰 💰 💰
Labor	👷	👷 👷 👷	👷
Machines	🛠	🛠 🛠 🛠	🛠
Service Life	10 years	15-25 years	> 50 years

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