ADVANCED PLASTIC INDUSTRIES

ApiSilent®

PP DRAINAGE PIPES & FITTINGS

THE NEWEST TREND IN DRAINAGE PIPE SYSTEMS

SILENT PIPES

SILENT FITTINGS

COMPANY INTRODUCTION

Nestled in the mountains of Lebanon, Advanced Plastic Industries S.A.L (API) was founded in 1994 as the brainchild of years of experience in the field of plastic materials and machinery. Dedicated to provide the construction industry with the latest developments in the world of piping, the company started with a humble operation and grew organically to the size and capabilities it enjoys today.

API specializes in the manufacture of polyolefin pipes and fittings for the water construction value chain. Our products range from PP-RCT pipes & fittings, HDPE pipes, PP-B pipes & fittings for drainage, and PP-mineral reinforced pipes & fittings for silent drainage applications.

- ApiTherm® Class 2: PP-RCT pipes & fittings for hot and cold water: 70°C at 10 bars/S3.2
- ApiTherm® Class 5: PP-RCT pipes & fittings: In accordance with the DIN and EN ISO standards, and due to its superior PP-RCT raw material, API holds the only approved polypropylene product for high heat radiators until today: >70^{0}C at 10 bars/S2.5
- ApiAlu®: A multilayer pipe of PP-RCT, an overlapped aluminum sheet, and a PE coat – UV resistant for exposed applications with reduced thermal expansion
- ApiFiber® Class 2: A multilayer pipe of PP-RCT and fiber reinforced polypropylene. Reduced thermal expansion: 70°C at 10 bars
- ApiFiber® Class 5: A multilayer pipe of PP-RCT and fiber reinforced polypropylene. Reduced thermal expansion: >70°C at 10 bars
- ApiThene®: HDPE pipes for potable water and irrigation - UV resistant
- ApiTheneFiber®: A multilayer HDPE, fiber reinforced pipe with high pressure resistance for potable water and sewer systems – UV resistant with reduced thermal expansion
- ApiDrain®: B1 halogen-free and flame retardant PP-B drainage pipes & fittings, using certified push-fit rubber seals
- ApiSilence®: Acoustically insulating and mineral reinforced PP drainage pipes & fittings, using certified push-fit rubber seals. Contains halogen-free flame retardant material

With a corporate culture deeply rooted in quality, API has attained worldwide recognition for the superiority of its products. Local, regional, and international certificates are live attestation to the high caliber of workmanship and dedication that is employed during manufacturing (such as SKZ, DVGW and KTW certifications). The quality standards implemented make API proud, and keep its customers confident and gratified.

The manufacturing facilities are equipped with state of the art machinery to produce the highest quality of products, and are operated by qualified personnel. With over 150 employees at present, API works round the clock to meet the demands of its clients around the world. With numerous distributors present locally and globally, API has a broad network of trusted partners who share its values of constant innovation, superior quality, and client satisfaction.

INTRODUCING APISILENCE

Polypropylene is the robust plastic with a wide variety of applications that is replacing conventional materials and plastics in various building applications today.

The ApiSilence brand presents a piping system that is manufactured using the finest mineral reinforced polypropylene for use in drainage and wastewater applications. It provides outstanding acoustic properties against airborne and structure-borne sounds. The system offers ductility, high resistance to impact and abrasion, excellent resistance to chemicals (such as those present in detergents), and is eco-friendly. Taking advantage of push-fit connections with certified rubber seals, installation time and cost can be reduced.

- Outstanding mechanical properties
- Excellent impact resistance
- Lightweight, easy handling & installation
- Enhanced sound protection level III of DIN 4109 & VDI 4100 (17 dB at 4 L/s)
- Utilizes multilayer piping technology
  - Mineral reinforced to reduce sound
  - Resistant to aggressive wastewater
- Connects through push-fit sockets, with certified rubber seals
- Suitable for all domains of civil engineering
- Environmentally friendly

Multilayer Technology

Each layer in the ApiSilence piping system serves its own purpose:

The outer layer of polypropylene provides external protection. With its high tolerance for impact and low crack propagation properties, your drainage system is safeguarded

The middle layer of mineral reinforced polypropylene absorbs the bulk of noise to provide the acoustic insulating character of ApiSilence

The inner layer of polypropylene exhibits a smooth surface to prevent scaling, fouling, and buildup. Its chemical resistant nature, combined with its high temperature tolerance, makes it an ideal selection for your drainage system

** Both the inner and outer layers of the ApiSilence system carry a halogen-free flame retardant additive, to provide additional protection in exposed drainage applications, or in case of fire.*

ApiSilence extends its benefits to developers, who will offer better value to their clients, to contractors, who will enjoy the ease of installation, and to end users, who in turn, will benefit from the quieter ergonomic environment enabled by our products.

RAW MATERIAL

ApiSilence is the result of the union of two innovative polypropylene compounds, each serving a specific purpose, to deliver the superiority present in our products.
The outer and inner layers of the pipe are compounded from natural PP-B and a distinct halogen free and flame retardant additive. This combination has been carefully crafted to provide high resistance to flame propagation, without the use of bromine and fluorine chemicals, which are notorious to produce toxic and corrosive fumes in case of fire.
The middle layer is a compound of polypropylene with heavy minerals. Advancements in mineral-filling technology provide increased density for sound absorption, and optimal mineral particle size for sound wave dissipation.
Fittings are also manufactured from a mineral reinforced polypropylene compound, which possesses unique properties to provide optimum noise cancellation, and rigidity in connections. Heavy fittings play an integral role in sound absorption, specifically at directional changes and connections.

ADVANTAGES OF APISILENCE

- Sound insulation performance of ApiSilence meets level III requirements of DIN 4109 and VDI 4100
- Strong and tough pipe with high resistance for impact and mechanical stains, even at sub zero temperatures
- Light in weight; lighter than metal and clay pipes, easing the structural load on buildings, and reducing scaling and corrosion, due to its smooth nature
- High chemical resistance, safe to use with the widest variety of cleaning detergents
- High temperature resistance, excluding softness and/or weaknesses at normal operating conditions
- Safe and easy installation, with push-fit sockets. No need for special tools or for solvent cement, making it safer to install in closed spaces
- Greener installation: Polypropylene is recyclable after its lifetime. Its installation requires no solvents, and therefore, no volatile organic carbon (VOC)
- Greener manufacturing: Manufacture of ApiScilence requires no toxic heavy metal stabilizers
- Thinner pipe walls allowing for larger flow diameters, easier installation, and less embedded carbon and water footprints for a greener product

WHY APISILENCE?

- Full compliance with international standards
- Push-fit connection with certified rubber seals
- Single part fittings; no installation of semi-finished and screw-on parts
- Length gauge to ensure proper installation of fittings
- Chamfered angles on male ends to lock in at length gauges, in order to better prevent leaks and backflows
- Innovative multilayer technology that provides high sound insulation through thinner pipe walls

SOUND AND NOISE

Sound is the pressure wave that is caused by a vibration, which travels through air, water, or other mediums. It triggers a sensation in our ears that the brain processes and understands. Like any wave, it has two characteristics:

Amplitude: The louder the noise, the higher its amplitude

Frequency: The sharper the tone, the higher its frequency

Noise is an aggregate of random and irregular sound waves, with varying amplitudes and frequencies, whose relationships to each other is not easily defined, and can hinder the perception of an expected signal.

ApiSilence is specially designed to reduce the drainage sounds, for a less noisy experience.

Sound Pressure Level

Sound Pressure Level (SPL) is a measurement that compares the pressure generated by a sound wave, to the threshold pressure the human ear can detect (Po = 2 x 5-10 Pa). It is quantified as 20 times the logarithmic ratio of the detected sound, to the reference threshold. It is measured in units of decibels.

$$SPL = 20\log \frac{P}{P_o}$$

Due to SPL's logarithmic nature, doubling the pressure of the sound wave will not double the sound level. A practical rule is applied: If the sound pressure doubles, the sound level increases by 6dB, and vice versa. This is commonly known as the Rule of 6dB, and is used to interpret sound pressure measurements.

Sound Intensity Level

Sound Intensity Level (SIL) is another measurement of sound, often used by engineers. It is also a logarithmic measure of the intensity of the sound wave, compared to the threshold intensity detected by the human ear (Io = 12-10 W/m2). It is quantified as 10 times the logarithmic ratio of the detected sound, to the reference threshold. It is also measured in units of decibels.

$$SIL = 10\log \frac{I}{I_o}$$

Likewise, if the intensity level of the sound doubles, the sound intensity level increases by 3dB.

** Note: Testing according to DIN 4109 and VDI 4100 accounts for SPL, not SIL.*

NOISE IN DRAINAGE SYSTEMS

Sound waves are mechanical waves, thus they do not travel in vacuum, but rather require matter to propagate. The vibrations of water particles flowing through a drainage system causes noise to propagate in their surrounding medium.

Main causes of generated sound in drainage systems include:

- Fastening of pipes in a vertical direction
- Water turbulence, especially at directional changes | bends and elbows
- Water pressure and velocity
- Improper ventilation and choking

Sound in drainage systems is of two major types:

Airborne sound, which is detected when the particles of water generate a sound that is transferred through the pipe, across the surrounding air, and directly into the human ear

Structure-borne sound, which is detected when the vibration of water particles causes other continuous vibrations in adjacent solid objects, such as clamps and fixture walls and structures. These vibrations in turn, generate their own airborne noise that are detected by human ears

An effective silent drainage system is designed and installed to reduce both airborne and structure-borne sounds. Only by employing a holistic approach in building material selection and overall system design, can engineers achieve desired reduced-noise experiences for their clients.

By using ApiSilence, the amount of airborne noise is reduced significantly. The minerals in the middle layer act as a counter-weight that inhibits vibrations caused by flowing water. The elastic nature of the plastic internalizes the vibrations, and provides less sound throughout the entire pipe system.

Reducing structure-borne noise is a preventative approach that is applied during design, and implemented at installation. Employing adequate principles and utilizing appropriate materials can reduce structure borne noise significantly. Such methods include:

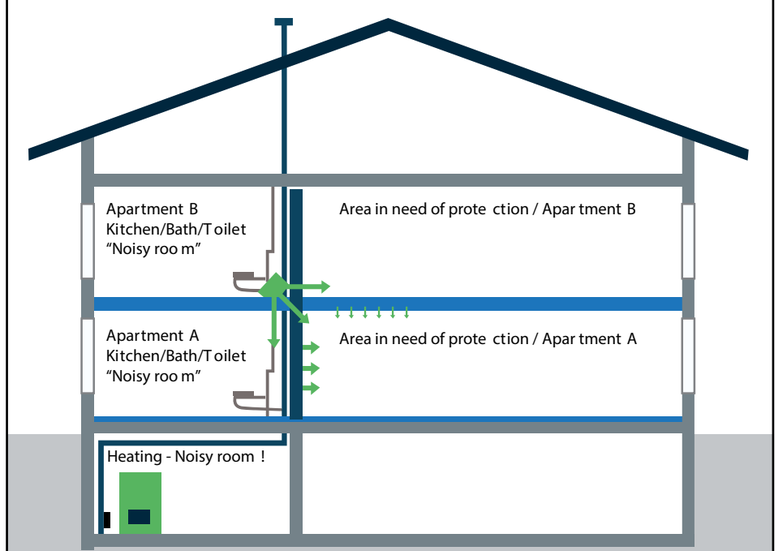
- Usage of sound insulating clamps with rubber or silicone lining and washers to absorb the vibrations transferred out of the pipe, through the clamp, and into the structure
- Usage of acoustical sealant, where pipework runs through walls and ceilings, or when pipe is in close contact with its surroundings
- Eliminating sharp directional changes by reducing the use of °87 bends, where possible, and changing direction from vertical to horizontal with two °45 elbows, interconnected by a short piece of straight pipe with a minimum length of 25cm

SOUND INSULATION: STANDARDS AND TESTING

Standard Requirements

Standards concerned with acoustic insulation in buildings define the maximum SPL that is permitted in areas of protection. An area of protection is a section of a building that would be affected by noise from external sources, like a living room sharing a wall with a bathroom

AREAS OF PROTECTION IN A TYPICAL BUILDING SETUP



** Caption: Areas of protection in a typical building setup*

DIN 4109

According to DIN 4109, the measured SPL in protected areas is determined by the nature of the building and the source of the sound. The combined sound from sanitary installations (both water supply and drainage) should not exceed the level of 35 dB in living areas, bedrooms, workrooms, and teaching rooms.

VDI 4100

VDI 4100 standard sets the maximum SPL permissible in areas in need of sound protection. This standard dictates the sound levels in various building types, and also classifies the sound protection to three levels.

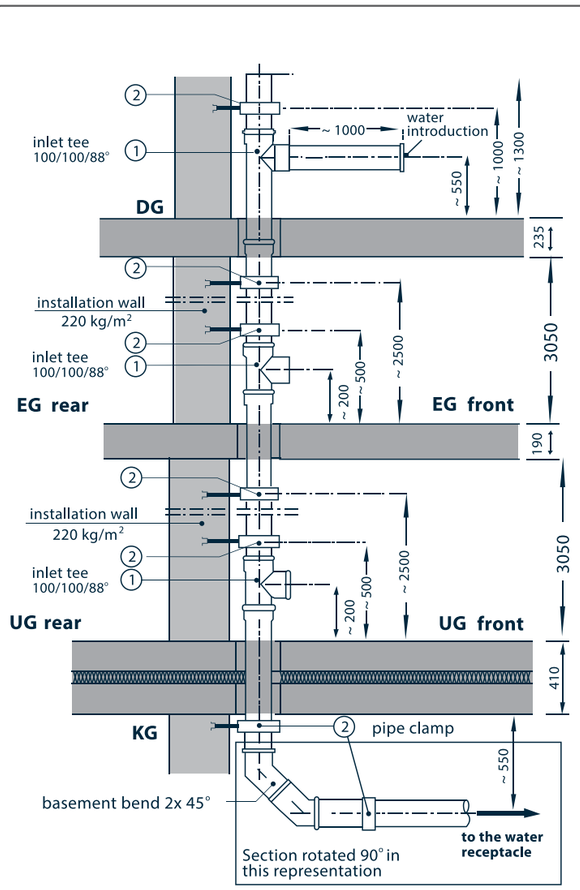
TYPE OF BUILDING	PROTECTION LEVEL I	PROTECTION LEVEL II	PROTECTION LEVEL III
APARTMENT HOUSES	≤ 30 dB	≤ 27 dB	≤ 24 dB
ONE-FAMILY TERRACE HOUSES & ONE-FAMILY SEMI-DETACHED HOUSES	≤ 30 dB	≤ 25 dB	≤ 22 dB

Testing

Testing is conducted in the globally recognized laboratory, Fraunhofer-Instutut Für Bauphysik in Stutgart, Germany, that is certified by the German Accreditation System for Testing (DAP, file no. PL3743.26-) in accordance with EN ISO/IEC 17025.

Determination of the acoustic performance of the wastewater installation system is conducted in line with various standards, such as DIN 4109, VDI 4100, and EN 14366.

During the sound insulation test, a complete drainage pipe and fitting system - including wall fixture clamps - is set up to collect wastewater at pre-determined flow rates (refer to figure). Water flows down a vertical pipe that is fixed to an installation wall (with a mas per unit area of 220 kg/m2). Flowing water induces noise in the system, which is detected using accurate and highly sensitive phonometers. Test procedure and sound pressure calculation methods are performed according to the requirements of the relevant test standards.



** Caption: Installation plan of the setup in the test facility*
Sound measurements are taken at the underground level (UG). This is where drainage water would have accelerated the most, and created the loudest sounds. The measurements labeled as Front are those recorded directly in front of the pipe, in the building shaft, where the pipe vertical is installed. Measurements labeled as Rear, represent sound levels detected behind the installation wall, in areas requiring protection. Such sounds are analogous to the habitual noise that residents would hear in a typical residential setup.

The wall separating the installation site and the protected area is of specific area weight: 220 Kg/m2.

Test Results

ApiSilence's performance attests to the high benchmark of quality that distinguishes API and its wide range of products from the rest.

BASIS OF MEASUREMENTS	LOCATION	FLOW RATE (L/S)			
		0.5	1.0	2.0	4.0
Airborne sound pressure level La,A [dB(A)] **according to EN 14366** for the basement test-room	Underground Front	42	45	48	52
Structure-borne sound characteristic level $_{LSC,A}$ [dB(A)] **according to EN 14366** for the basement test-room	Underground Rear	<10	<10	12	17
Installation sound level $_{LAFeq,n}$ [dB(A)] **following DIN 4109** in the basement test room	Underground Front	42	45	48	52
	Underground Rear	10	10	15	20
Installation sound level $_{LAFeq,nT}$ [dB(A)] **following VDI 4100** in the basement test room	Underground Front	40	43	44	50
	Underground Rear	<10	<10	12	17

Aligned with API's track record of excellence and superiority, ApiSilence's results well-fulfill the requirements of all relevant standards. The measured test results are below the maximum allowable sound levels for their corresponding criteria.

ApiSilence is proudly compliant with:

- DIN 4109 as a high quality silent piping system
- VDI 4100 as a Level III Sound Insulating system; the highest level achievable

Fraunhofer
IBP

Institution for testing, supervision and certification, officially recognized by the building supervisory authority. Approvals of new building materials, components and types of construction

Director
Prof. Dr. Philip Leistner
Prof. Dr. Klaus Peter Sedlbauer

Test Report P-BA 16/2017e

Determination of the Acoustic Performance of a Wastewater Installation System in the Laboratory according to EN 14366

Client: API Advanced Plastic Industries
Dbayeh Highway, Seaside Road
P.O.Box 2161Jounieh
Lebanon

Test object: Wastewater installation system "API SILENCE 110x3.4" (manufacturer: API Advanced Plastic Industries), size OD 110, consisting of straight plastic pipes "API SILENCE 110x3.4 PP/PP-MD/PP" and fittings "API PP" and sound proof pipe clamps "Bismat 1000" (manufacturer: Walraven).

Content:

Results sheet 1:	Summary of test results
Figures 1 to 3:	Detailed results
Figures 4 and 5:	Test set-up
Annex A:	Measurement set-up, noise excitation, acoustic parameters, compliance with requirements
Annex F:	Evaluation of measurements
Annex P:	Description of the test facility
Annex V:	Assessment according to VDI 4100

Test date: The measurement was carried out on January 24, 2017 in the test facilities of the Fraunhofer Institute for Building Physics in Stuttgart.

Stuttgart, February 16, 2017

Responsible Test Engineer: Head of Laboratory:

Dipl.-Ing.(FH) J. Mohr M.Sc. Dipl.-Ing.(FH) S. Öhler

The test was carried out in a laboratory, accredited according to DIN EN ISO/IEC 17025:2005 by DAkkS. The accreditation certificate is D-PL-11140-11-01.

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Determination of the Acoustic Performance of a Wastewater Installation System in the Laboratory according to EN 14366

P-BA 16/2017e
Results sheet 1

Client: API Advanced Plastic Industries, Dbayeh Highway, Seaside Road, P.O.Box 2161Jounieh, Lebanon

Test specimen: Wastewater installation system "API SILENCE 110x3.4" (manufacturer: API Advanced Plastic Industries), size OD 110, consisting of straight plastic pipes "API SILENCE 110x3.4 PP/PP-MD/PP" and fittings "API PP" and sound proof pipe clamps "Bismat 1000" (manufacturer: Walraven). Test object no.: 11049-02; see figure 4 and 5.

Test set-up:
- The pipe system was mounted according to figure 4 (see also Annex A).
- The system consisted of wastewater pipes (nominal size OD 110), three inlet tees (87°), two 45°-basement bends and a horizontal drain section. The inlet tees in the basement and in the ground floor were closed by lids supplied by the manufacturer.
  - Pipe system "API SILENCE 110x3.4": Three-layer pipes: Material PP/PP-MD/PP. Wall thickness 3.4 mm, weight 1.67 kg/m, density 1.4 g/cm³, values measured by IBP. One-layer fittings: Material PP, wall thickness 3.4 mm, density 2.0 g/cm³, values measured by IBP. Connection of the straight pipes by double sockets. Fittings with shaped pipe sockets on one side.
  - Pipe clamps: Sound proof pipe clamps "Bismat 1000": Structure-borne sound insulating support attachment consisting of Bismat SL guidance clamps and Bismat SX socket clamps. In each storey (EG and UG) respectively one double clamp (SL and SX) was installed at the lower wall area and one guidance clamp (SL) at the upper wall area. To prevent contact to the pipe, the guidance clamp (SL) was mounted with 15 mm space between the locking tabs of the clamp (two 7.5 mm spacers on each side). The Bismat 1000 clamps were fixed to the installation wall with an adjustable wall plate with dowels and thread rods (figure 5).

The wastewater installation system was mounted by a technician under the authority of Fraunhofer IBP.

Test facility: Installation test facility P12, mass per unit area of the installation wall: 220 kg/m², mass per unit area of the ceiling: 440 kg/m². Installation rooms: sub-basement (KG), basement (UG) front, ground floor (EG) front and top floor (DG), measuring rooms: UG front, UG rear (details in Annex P and EN 14366: 2005-02)

Test method: The measurements were performed according to EN 14366; noise excitation by steady water flow with 0.5 l/s, 1.0 l/s, 2.0 l/s and 4.0 l/s. Additional evaluation for comparison with requirements following German standards DIN 4109-1:2016-07 and VDI 4100:2012-10 (details in Annexes A, F and V).

Result:

Test specimen: Wastewater installation system "API SILENCE 110x3.4" (manufacturer: API Advanced Plastic Industries), size OD 110, consisting of straight plastic pipes "API SILENCE 110x3.4 PP/PP-MD/PP" and fittings "API PP" and sound proof pipe clamps "Bismat 1000" (manufacturer: Walraven).		Flow rate [l/s]			
		0.5	1.0	2.0	4.0
Airborne sound pressure level $L_{a,A}$ [dB(A)] **according to EN 14366** for the basement test-room	UG front	42	45	48	52
Structure-borne sound characteristic level $L_{sc,A}$ [dB(A)] **according to EN 14366** for the basement test-room	UG rear	<10	<10	12	17
Installation sound level $L_{AFeq,n}$ [dB(A)] **following DIN 4109** in the basement test-room	UG front	42	45	48	52
	UG rear	10	10	15	20
Installation sound level $\overline{L_{AFeq,nT}}$ [dB(A)] **following VDI 4100** in the basement test-room	UG front	40	43	46	50
	UG rear	<10	<10	12	17

FRAUNHOFER GESELLSCHAFT ZUR FÖRDERUNG DER ANGEWANDTEN FORSCHUNG E.V. Fraunhofer

Test date: January 24, 2017

Notes:
- For comparing test results with requirements note Annex A.
- Sound levels below 10 dB(A) are not mentioned in the test report, since they are subject to an increased measurement uncertainty and moreover are not noticeable in a normal living environment.
- For the experimental setup investigated in the test facility the used supporting and fixing clips Bismat 1000 normally doesn't guarantee a realistic load transmission. Consequently, in case of practical application in a real building, higher levels of installation noise may be expected.

Fraunhofer IBP

The test was carried out in a laboratory, accredited according to DIN EN ISO/IEC 17025:2005 by DAkkS. The accreditation certificate is D-PL-11140-11-01.

Stuttgart, February 16, 2017
Head of Laboratory:

SEAL

Drainage systems that are of the push-fit category are held together by a special elastomeric seal. The rubber seal is the backbone of this joining system as it:

- Seals and prevents leakage and backwash
- Provides a physical elastomeric grip between the male end and female socket components of the connection
- Compensates for minor misalignment during installation
- Eliminates the need to use chemicals for adhesion during installation, such as solvent cement
- Eliminates the need to use special heavy tools and machinery, as is the case in metallic systems
- Reduces airborne noise by absorbing some of the pipe vibration, owing to its elasticity

Due to their significance, rubber seals are considered a stand-alone engineered product, and therefore are tested and certified according to the requirements of EN 681.

To ensure that the quality of the seals matches the quality promoted by ApiSilence, the following parameters are subjected to rigorous inspection:

- Seal rigidity
- Tensile strength
- Compression
- Ageing
- Volume change
- Chemical resistance

INSTALLATION

The push-fit system is an innovative and secure one that allows for easy installation, and saves both time and cost. By following simple installation steps, a tight and fast installation can be achieved.

1. Preparation Measure the length of the pipe that is needed

2. Marking If a pipe requires cutting, mark a visible line at the desired cutting length, while accounting for the length of pipe that will penetrate the female socket of the fitting. Make sure that the mark is perpendicular to the pipe axis

3. Cutting Cut the pipe uniformly, on a sturdy level surface. Avoid cutting at an angle, as the pipe connection will be sealed at the length gauge of the fitting. Uneven pipe ends may lead to backwash and leakage

4. Cleaning Clean all burrs and debris from the inside and outside of the cut pipe to ensure a tight fit and prevent seal slippage. Use a sharp knife-file or a deburring tool

5. Chamfering It is recommended to further chamfer the end of the pipe using a chamfering or beveling tool. Recommended chamfering angle is at °15-10. Clean burrs again post chamfering

6. Lubricating For a fast and hassle-free installation, apply lubricant on both the chamfered pipe end and the rubber seal on the socket end of the fitting. Do not use oil or grease

7. Installation Insert pipe into the socket until you reach the desired depth

In horizontal installations, clamps should be mounted at intervals equivalent to 10 times the external diameter of the pipe. In vertical installations, maximum interval of 2-1 meters should be considered.

ApiSilence pipes can be cast in concrete. Special attention should be made to ensure the pipes and fittings do not move during the casting. All the gaps between the pipe and socket should be closed off with sealing tape, in order to eliminate seepage of concrete into the fitting connection. Any other open pipe elements or fittings elements should also be capped off. It is recommended to fully cover the piping system using sound insulating material, such as mineral wool, to eliminate any structure borne sounds that may develop as a result of direct contact between the pipe and surrounding concrete.

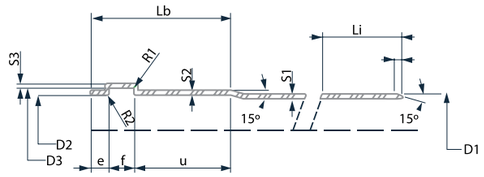
TRANSPORTATION AND STORAGE

- ApiSilence pipes are arranged according to type and size, and are packaged into bags at the API factory
- Pipes and fittings should remain stored in API bags until time of use, to avoid debris and weathering factors
- When removed from the packaging, ApiSilence pipes should never be stored in direct sunlight
- ApiSilence pipes can be stacked on top of each other, along their full length. The height of the stack should never exceed 1.5 meters
- During transportation, bending of the pipes should be avoided, as well as impacts and all unnecessary mechanical stresses
- It is recommended not to store parts with rubber seals out of their original API packaging for a duration exceeding 2 years

PARTS AND DIMENSIONS

DN/OD	D1	S1	S2min	S3min	D2	D3	f	e	u	LB	R1max	R2max	B	Li
50	$50^{+0.3}$	$1.8^{+0.4}$	1.6	1.0	$50.3^{+0.8}$	$59.6^{+1.0}$	$8.5^{\pm0.5}$	$6.0^{+1.0}$	$30^{+1.0}$	$45.5^{+2.5}_{-0.5}$	1.0	3.0	3.5	50
75	$75^{+0.4}$	$2.3^{+0.5}$	2.1	1.3	$75.4^{+0.8}$	$84.5^{+1.0}$	$8.5^{\pm0.5}$	$6.0^{+1.0}$	$34^{+1.0}$	$48.5^{+2.5}_{-0.5}$	1.0	3.5	3.5	53
110	$110^{+0.4}$	$3.4^{+0.5}$	3.1	2.6	$110.4^{+0.9}$	$120.6^{+1.8}$	$10.0^{\pm0.6}$	$7.5^{+1.2}$	$37^{+1.0}$	$54.5^{+2.8}_{-0.5}$	1.5	4.5	4.5	60
160	$160^{+0.5}$	$4.9^{+0.7}$	4.5	3.7	$160.5^{+1.0}$	$174.3^{+1.8}$	$12.5^{\pm0.8}$	$11.0^{+1.8}$	$42^{+1.0}$	$65.5^{+3.6}_{-0.8}$	1.5	5.0	6.5	74

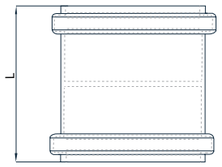
Pipes are fitted with a female socket on one end to assist with connection to other pipes. A rubber seal is fitted into every pipe to allow for immediate usage. The other end of the pipe is a plain male end, with a chamfered edge, that is designed to align with the female socket of the recipient part.



COUPLER

Ø	L
50	93
75	104
110	113
160	152

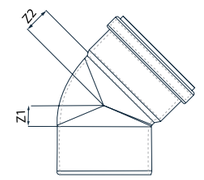
A fitting with double female sockets, to connect straight lengths of pipes. Each side is fitted with a rubber seal in order to grip the joint and prevent leakage and backwash.



BEND 45 °

Ø	Z1	Z2
50	12	15
75	18	25
110	25	32
160	32	48

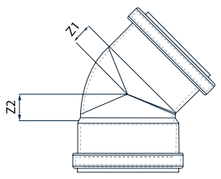
A bend between a male end and a female socket, to allow directional change in flow. The directional angle is at 45° to allow continuous flow of drainage water and to prevent stagnation and backflow.



BEND 45 ° (DOUBLE FEMALE)

Ø	Z1	Z2
110	32	32

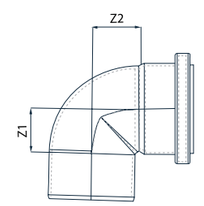
A bend between two female sockets, to allow directional change in flow. The directional change angle is at 45° to allow continuous flow of drainage water and to prevent stagnation and backflow. The female sockets on both ends replace the need to install a coupler, ultimately lowering the overall cost of the installation.



BEND 87 °

Ø	Z1	Z2
50	27	30
75	37	41
110	57	58
160	86	96

A bend between a male end and a female socket, to allow directional change in flow. The angle is at 87.5° to allow continuous fl ow of drainage water and to prevent stagnation and backflow.

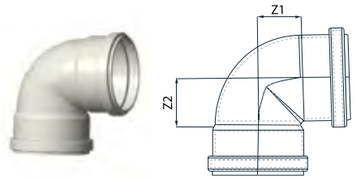


ALL SEALS ARE DESIGNED AND CERTIFIED ACCORDING TO EN 681 REQUIREMENTS

BEND 87.5° (DOUBLE FEMALE)

Ø	Z1	Z2
110	58	58
160	82	82

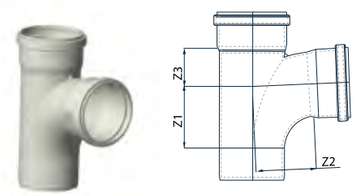
A bend between a male end and a female socket, to allow directional change in flow. The angle is at 87.5° to allow continuous fl ow of drainage water and to prevent stagnation and backflow.



SANITARY TEE JOINT

Ø	Z1	Z2	Z3
110	79	91	64

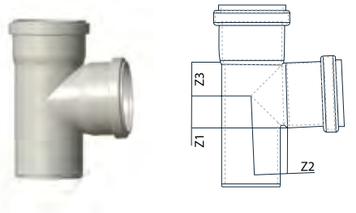
A fitting with double female sockets and one male end. All female sockets are fitted with a rubber seal. The angle between the female sockets is curved to prevent the buildup of backpressure when utilized on a multi-floor main.



BRANCH 87 °/ TEE JOINT

Ø	Z1	Z2	Z3
50	26	28	28
75	39	41	41
110	57	67	67
160	81.5	96	96

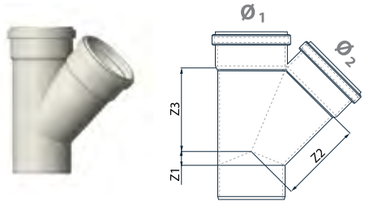
A fitting with double female sockets and one male end. All female sockets are fitted with a rubber seal. The 87.5° angle between the female sockets is inclined to prevent the buildup of backpressure when utilized on a multi-floor main.



BRANCH 45 °

Ø 1	Ø 2	Z1	Z2	Z3
50	50	11	62	62
75	75	18	88	88
110	110	25	136	136
160	110	2.5	184	176

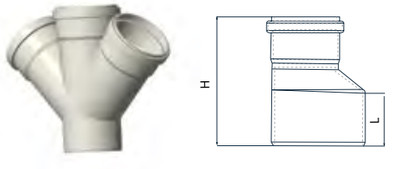
A fitting with double female sockets and one male end. All female sockets are fitted with a rubber seal. The angle between the female socket arms is 45°.



DOUBLE BRANCH 45 °

Ø	Z1	Z2	Z3	Z4
110	25	136	136	136

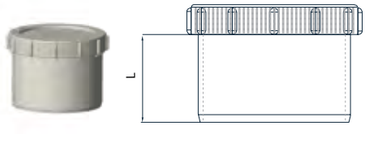
A fitting with triple female sockets and one male end. All female sockets are fitted with a rubber seal. The angle between the female socket arms is 45° on each side of the vertical axis.



END CAP

Ø	L
110	66

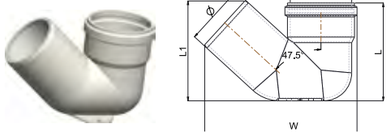
A fitting used at the end of a line, to be inserted into the female end of a part. It is provided with a screw-on cap that can be detached for cleaning purposes.



P-TRAP BASE

Ø	Z1	Z2	W
110	158	165	267

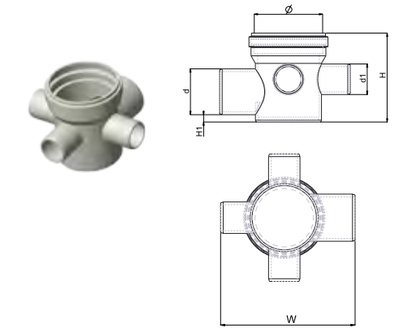
A fitting with one female socket and one male end. The female socket is fitted with a rubber seal. This fitting prevents sewer gas from entering the home. It can be used under the discharge of a drain, or plumbing fixture.



FLOOR TRAP

Ø	d	d1	H	H1	W
110	75	50	142	14	214

A fitting with one female socket at the top, and four male ends around its body. The female socket is fitted with a rubber seal. This fitting feeds from several branches and retains a body of water, which acts as an odor seal. Used to collect wastewater from the bathroom, wash area, washbasin, kitchen sinks etc.



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