ASTRAL PIPES

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ASTRAL PIPES

ASTRAL SILENCIO® High Density Low Noise System

FLUSH SHHH!!

DRAINAGE ON SILENT MODE

GERMAN TECHNOLOGY MADE IN INDIA

The Complete Low Noise System

<10DB@2lps

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1.1 About Astral

Established in 1996 with the aim to manufacture best-in-globe plastic piping systems, Astral Pipes fulfils emerging piping needs of millions of houses and adds extra mileage to India's developing real estate fraternity with the hallmark of unbeaten quality and innovative piping solutions. Keeping itself ahead of technology curve, Astral has always been a front runner in the piping category by bringing innovation and getting rid of old, primitive and ineffective plumbing methods. Bringing CPVC in India, and pioneering in this technology, have set Astral apart and enabled it to obtain NSF approval for its CPVC pipes and fittings. Astral went beyond category codes by launching many industry firsts, like launching India's first lead-free uPVC pipes for plumbing as well as for stream water, just to name a few.

Astral Pipes offers the widest product range across this category when it comes to product applications. Astral Pipes is equipped with production facilities at Santej & Dholka in Gujarat, Hosur in Tamil Nadu and Ghiloth in Rajasthan to manufacture plumbing systems, drainage systems, agriculture systems, fire sprinkler piping systems, industrial piping and electrical conduit pipes with all kinds of necessary fittings.

In 2014 Astral forayed into the adhesives category by acquiring UK-based Seal It Services Ltd. and Kanpur based Resinova Chemie Ltd. which manufacture adhesives, sealants and construction chemicals. With six manufacturing facilities now in this business segment, Astral has strengthened its presence in the category and made rapid inroads.

Brand Astral stands for innovation and for setting new trends in the piping industry. Bringing newer piping technologies and continuous innovation in existing as well as new products has been the focal point at Astral. This special emphasis helps the brand set the bar higher and lead amongst others by example. Astral is also known for its compromise-free quality and exceeds consumer's expectations. Right from introducing new piping technologies to innovative brand communications in the category, Astral's brand mission has been to maintain and grow a commanding presence in the minds of customers and to deliver promised values consistently.

1.2 Milestone & Achievements

- First to introduce CPVC piping system in India (1999)
- First to launch lead free uPVC piping system in India (2004)
- First to get NSF Certification for CPVC piping system in India (2007)
- First to launch lead free uPVC column pipes in India (2012)
- India's Most Trusted Pipe Brand Award (2016)
- Fortune India 500 Company (2016)

Valid for the following areas of application:
- Noise-insulated above-ground drainage.
- Highly noise-insulated above-ground drainage.

In addition to any legal warranty and damage claims, upon the agreement of ASTRAL PIPES general terms of business, the company undertakes the following:

WARRANTY

Astral Poly Technik Ltd. hereby warrants the performance of its high quality Silencio piping system. The warranty period shall extend up to 10 years from the date of manufacture for all the standard elements mentioned in this catalogue.

This liability encompasses:

1. Free delivery to the place of employment of the replacement parts required for the repair of the damage.
2. Necessary removal and installation costs, including the expenses incurred for the restoration of the object to its original condition, up to a sum of USD 25000.

Pursuant to this declaration, ASTRAL provides this Warranty when,

1. Laying was completed by trained personnel from a licensed sanitary plumbing company in connection with the installation as contractually intended and all the technical regulations valid at the time of completion were observed.
2. Only ASTRAL original parts were employed and that these were not combined with products of any other origin.
3. The cause of damage did not relate to the parts subject to natural wear and tear, to external mechanical damage, or other external influences on the product.
4. It can be proven that at the time of laying all the current storage, laying, installation and application stipulations were observed in full.
5. All the measures necessary for damage minimization were initiated immediately.
6. The occurrence of damage was reported to ASTRAL without delay and under all circumstances within 10 days of the identification of the damage, complete with information concerning the related facts and circumstances.
7. Prior to repair work, ASTRAL is given an opportunity to determine and appraise the damage itself or through a third party.
8. All the parts relating to the claim are kept for the investigation of the damage occurrence and are provided to ASTRAL upon request.
9. The production and installation dates can be evidenced in the appropriate form.

3.1 System Description

Astral Silencio is a top quality sound insulating low noise drainage and sewerage piping system suitable for drainage of both the commercial and residential waste water. Astral Silencio can endure hot and cold waste water and fulfills all the requirements of non- pressurized waste water piping as laid down in DIN EN 12056 and DIN 1986-100.

Astral Silencio is manufactured from Mineral Reinforced Polypropylene which helps to reduce the noise levels of soil and waste discharge system much better than alternative materials. Apart from the superior acoustic properties, Astral Silencio also offers significantly enhanced mechanical properties and it can be one stop solution for many challenging waste water discharge applications.

Astral Silencio is available in nominal diameter from 40mm to 200mm with comprehensive range of fittings and accessories to accomplish the system. Its joining process is simple push-fit technology with a special co-molded ring. This system is easily compatible with different kinds of piping systems like PVC-U, PP or PE without the need of any special adapters.

Astral Silencio is one of the most advanced plastic drain and waste piping systems and it is established as a superior alternative to cast iron drain pipes with the following additional benefits:

- Fast and easy installation
- Enhanced acoustic properties
- Trouble-free lifelong performance
- Lower weight of piping system

3.2 The Raw Material

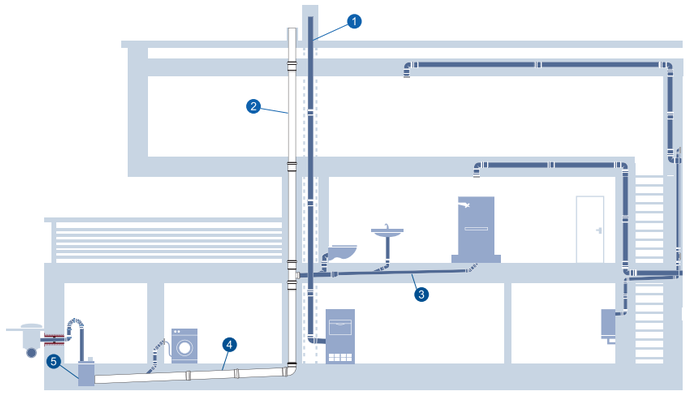
Astral Silencio's polypropylene mineral filled compound has been carefully designed to provide both excellent acoustic and mechanical properties. Astral Silencio has a molecular density of 1.9 gm/cm^3 which is one of the highest in the industry and it significantly improves the sound dampening properties of waste water drainage system.

Our compound offers superior ring stiffness and the impact resistance which are essential for a drainage and sewerage piping system. Apart from these unique properties, Astral Silencio is durable, corrosion-resistant and able to withstand the chemical aggression of various kinds of the waste water. The smooth inner surface of Astral Silencio prevents scaling and incrustation.

3.3 Fields of Application

The sound-insulating Astral Silencio is suitable for gravity drainage system as laid down in DIN EN 12056 and DIN 1986-100. Local - national standards, code of practice and regulations must be followed during the design and installation of drainage system using Astral Silencio.

The pipes, fittings and seals can operate continuously at 90°C (95°C Intermittently). They are suitable for the drainage of chemically aggressive waste water with pH value of 2 (acidic) to 12 (basic). Fire resistance of Astral Silencio corresponds to B2 normal combustibility according to DIN 4102 and B-S1, d0 according to EN 13501-1.
The pipe connections are leak-proof up to an internal excess water pressure of 0.5 bar (5 m water column). The possible usage of Astral Silencio is shown in the following figure:



1. **Rain Stack Pipe**
2. **Soil Pipe**
3. **Waste Drain Pipe**
4. **Underground Pipe to Inspection Chamber**
5. **Inspection Chamber**

3.3.1 Residential Buildings

Due to its excellent sound insulating properties (<10dB @2l/s as per EN 14366), Astral Silencio is the ideal choice for all kinds of residential buildings where noise reduction is required as per DIN 4109 / VDI 4100. It can be used for standard drainage system also. The typical examples of such occupancies are;

- Single Family House
- Condominiums
- Multi-storey Residential Apartments

Apart from the noise generated by external sources, internal sources are also responsible for the noise generation. Astral Silencio meets the increasing need for peace and quietness thereby ensuring a high level of living comfort. The maximum detectable flow noise in this system is less than the noise generated by ticking of a wrist-watch.

3.3.2 Large Commercial Buildings

Astral Silencio also can be installed in buildings with elevated sound insulation requirements (VDI guideline 4100). Thanks to its excellent sound insulation properties, Astral Silencio is ideal choice for Hotels, Office buildings, Restaurants, Hospitals, Rehabilitation Homes, Libraries, Community Centers and Educational Institutes.

Astral Silencio sound-insulating piping system is designed to ensure a comfortable environment. The pipe dimensions are in accordance with EN 1451or EN 1401 and this enables trouble-free transition from other piping system to Astral Silencio without the need of special transition adapters.

3.3.3 Commercial Kitchens

Astral Silencio is ideal for application such as an inlying collecting pipe for draining greasy waste water from commercial kitchens to the grease separator. Due to its high temperature resistance (short-term exposure to 95°C; long-term exposure to 90°C), Astral Silencio would be the ideal choice for commercial kitchens where waste water with high temperature is drained. It has also accomplished the basic prerequisites of DIN EN 12056 and the associated norms of DIN 1986-100.

For grease separators at a great distance, the use of pipe trace heating may be necessary. This prevents premature grease accumulation. The temperature of the pipe trace heating must not be permanently higher than 70°C.

Apart from this, Astral Silencio can be used for other applications like Industrial Environment, Laboratory Drainage and Chemical Industries. Please contact us for such specific requirements for further guidance.

3.4 Chemical Resistance

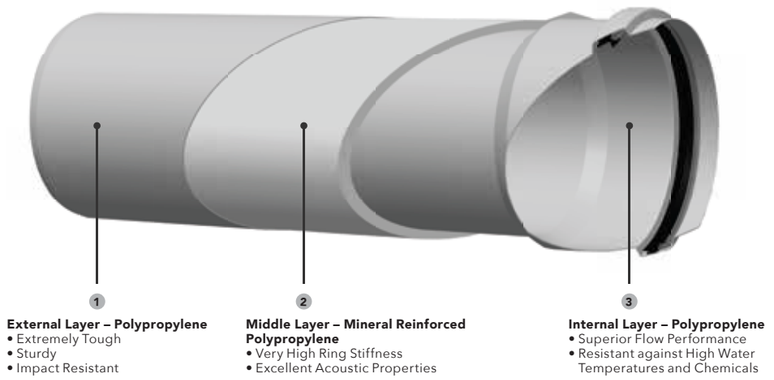
Astral Silencio is resistant to a wide variety of chemicals and can be used for drainage of such harsh chemicals. Please refer section 10 of this catalogue to see the chemical resistance chart of Astral Silencio.

N. B. The data is used for the initial orientation of the chemical resistance of the material (not of the possible influence of the corrosive agent) and can not simply be applied to all usage scenarios. Mechanical behavior can be impaired in cases where tension and the presence of chemicals occur simultaneously (tension-fracture corrosion).

If required, we recommend testing the suitability of the pipe, fitting and seal material in existing systems or have them checked in a laboratory. Contact us for such applications if necessary.

3.5 Pipe Structure

An outstanding feature of Astral Silencio is the 3 layer construction and adaption of each individual layer to its respective requirements. Technically desirable characteristics are optimized in a targeted way. This is achieved with modern design principles of Sandwich construction.



Three separate layers impart unique characteristics to the pipe. The abrasion resistant low friction inner layer ensures the easy transit of waste. The mineral filled mid-layer ensures enhanced sound dampening properties and also offers increased stiffness. Finally, the robust outer layer is tough enough to withstand impacts and shocks.

These ideal characteristics are achieved through the three-layer structure of the pipe and the specialized adaptation of each individual layer to its respective requirement.

1. High ring stiffness
2. Excellent impact strength of the outer layer even at low temperature
3. Increased UV-resistance
4. Abrasion-resistant and smooth inner layer
5. Highly rigid and sound-insulating middle layer made of mineral reinforced polypropylene

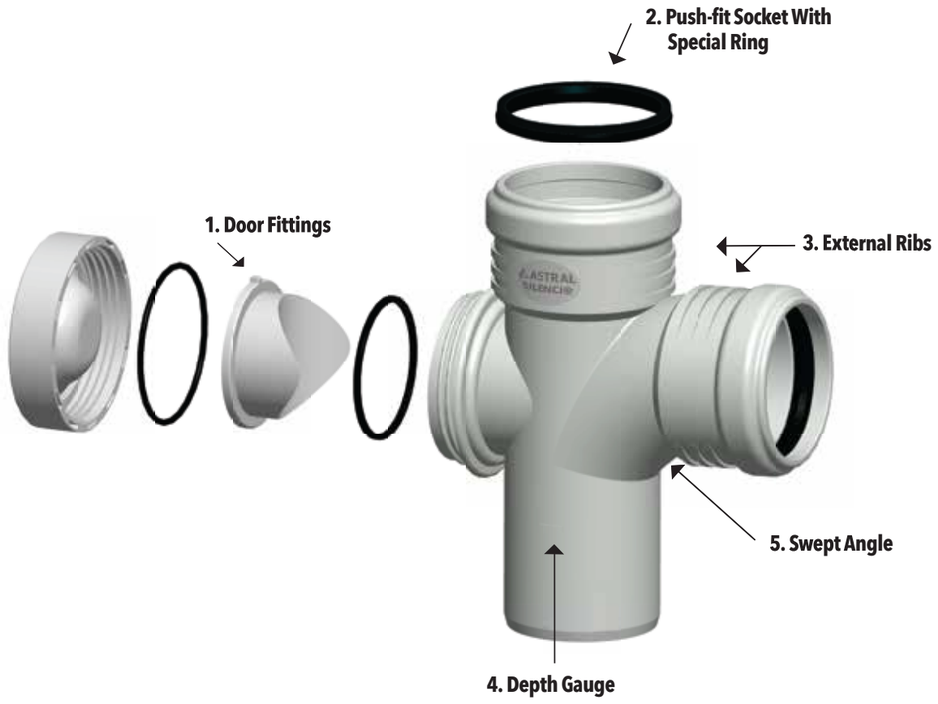
3.6 Fittings

The pipe system would experience local vibrations at redirections due to critical drainage conditions. This can have a negative effect on sound related properties. To minimize this effect and to counter the negative influences, it is very important to have proper design and mass of fittings. Astral Silencio fittings are specifically designed to address this.

The fittings too have the same density of 1.9 gm/cm3 as pipes and are made of identical PP mineral filled compounds. Special fittings are designed like access pipes, Clean out Tees and Bends (Door Tee and Door Bend) with special inner cap that ensures smooth flow as well as minimum sound generation.

3.7 Salient Features of Astral Silencio Fittings

1. **Door Fittings:** Under this system, the threaded door has an additional internal door cap that helps to maintain constant flow, without any obstacles.
2. **Push-fit Socket with Special Ring:** The Ring allows free movement during hydraulic tightness and thermal expansion.
3. **External Ribs:** The External Ribs on the outer side of the socket provide extra strength to the socket.
4. **Depth Gauge:** The spigot area has a stopper mark so that the pipe fits into the fitting socket properly and enables thermal expansion and contraction.
5. **Swept Angle:** A Swept-Angle design is incorporated to ensure a smooth flow, without any barriers.



3.8 Advantages

OUTSTANDING NOISE-INSULATION VALUES

The high molecular formula of middle layer enables the superior acoustic requirement and performance. Excellent soundproofing performance is measured in Fraunhofer laboratory which complies with EN 14366, equal to <10dB with a flow rate of 2 l/s.

EASY INSTALLATION

Without use of any special tools, the push fit joining installation of Astral Silencio is simple, quick and efficient. No solvent cement is needed. Also, joints are leak proof.

HIGH IMPACT RESISTANCE, EXTREMLY TOUGH

Both the external and internal layers of PP have excellent impact strength and abrasion resistance with smooth inner surface. Astral Silencio products show high impact resistance at extremely harsh temperature as low as -20°C

AS STRONG AS METAL

Astral Silencio with its high molecular weight, imparts excellent physical and mechanical properties to the pipe. It gives high ring stiffness to the pipes and hence, can be used as effective alternative to the cast iron drainage pipes.

CHEMICAL RESISTANCE

Astral Silencio can handle the waste liquid with pH value 2 to 12. It has a high resistance to the most common chemical substances. The inner layer of the pipe is made of PP which has natural property to prevent the accumulation of deposits in the pipe.

RESISTANCE TO HOT WATER

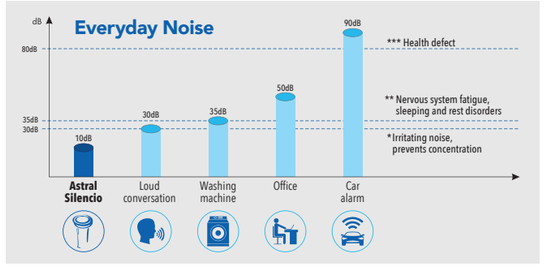
Astral Silencio is hot water resistant - short term 95°C and long term 90°C. Also it has low co-efficient of linear expansion.

SMOOTH INNER SURFACE

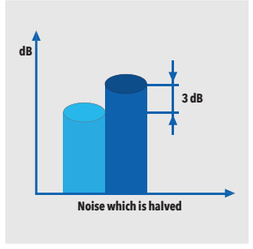
The smooth inner surface does not allow the waste liquid to stick to the surface, enabling superior flow and less chances of blockage.

4.1 What is Noise?

Noise can be described as any unwanted sound. In relation to sound, noise is not necessarily random. The table shows the decibel levels of sounds of common phenomenal observed in day-to-day life.



It is noted that human ear is sensitive to pressure intensity in non-linear way, therefore twice the pressure does not correspond to twice the sensation. In other words, decrease of 3 dB sound level results in reduction of half of the noise.



In every area of building construction, especially the construction of multi-storey apartment blocks, hospitals and rehabilitation homes, sound insulation plays an increasingly important role. One of the most significant sources of sound within buildings is the sanitation set-up and the accompanying drainage water pipe system.

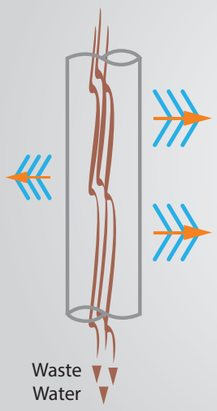
Typical sources of sound include:

• Fitting noises • Filling noises • Draining noises • Inlet noises • Impact noises • Turbulence

Unsuitable drainage pipe system and type of brackets are major contributors to disturbing noises. Generally two types of sounds are differentiated for waste water systems;

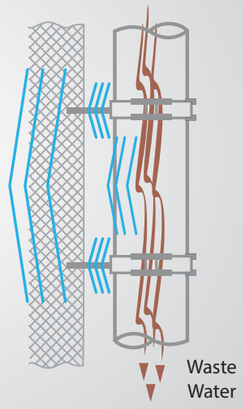
Airborne noise

Airborne noise is present if the noises of a sound source are transferred directly through the air to human ears.

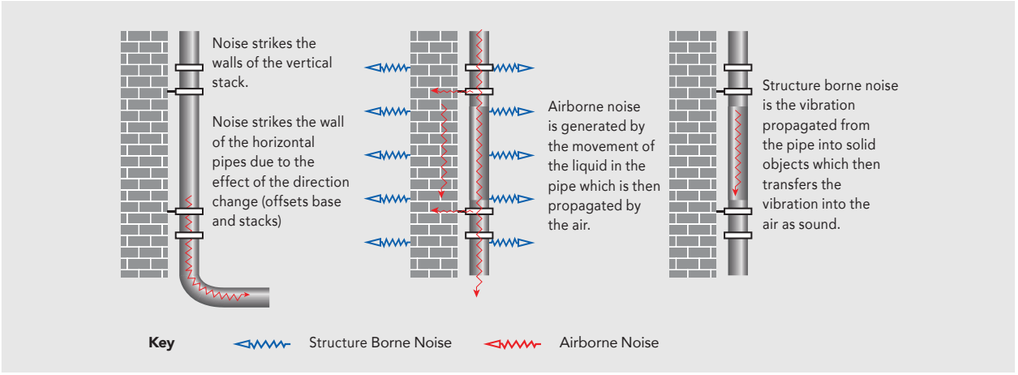


Structure-borne noise

With structure borne noise, the sound transfers through a solid body. This body vibrates and passes the vibration to the human ears as airborne noise.



The impact and flow noises are responsible for airborne and structure borne sounds which develop at the piping wall. The type and intensity of these pipe vibrations depend on a variety of factors, such as the mass of the pipe, the pipe material and its inner damping. The biggest problem with a building's plumbing drainage is with the transfer of structure borne sound at the point of pipe fixing. When developing a sound-insulating drainage water system, both types of noise distribution must be taken into account.



4.2 Sound-insulation Requirements

There are currently two important bodies of rules for sound insulation in residential buildings DIN 4109 (Sound insulation in buildings – Requirements and verifications, and VDI guideline 4100 (Sound insulation between rooms, buildings and proposal for enhanced sound insulation between rooms)

DIN 4109

Building drainage systems are to be planned under observance of DIN 4109. DIN 4109 defines the requirements for rooms in unknown living areas which must be insulated. These include:

• Bedrooms

• Living areas

• Classrooms

• Workspace (offices, treatment rooms, conference rooms etc.)

If there are no requirements for your own living area, maximum 30 dB(A) is stipulated for water installations (water supply and sewer pipe systems together). This standard contains requirements for sound insulation so that the people in living spaces can be protected from the stress caused by unwanted sound transmission.

A sound-insulation level is required which must be maintained to protect against health risks caused from sound.

VDI Guideline 4100

VDI guideline 4100 represents more stringent sound-insulation requirements. It defines three sound-insulation levels and differentiates among apartments, multi-storey apartment blocks, semi-detached houses and row houses. These guidelines, in contrast to DIN 4109, also take living spaces into consideration that include water supply and sewer pipe systems together.

Sound Insulation Level	Apartments In Multistorey Apartment Block	Apartments In Semidetached Houses and Row Houses	Your Own Living Area
I	30 dB (A) (purs. to DIN 4109)	30 dB (A) (purs. to DIN 4109)	30 dB (A)
II	30 dB (A)	25 dB (A)	30 dB (A)
III	25 dB (A)	20 dB (A)	30 dB (A)

Sound-insulation requirements pursuant to VDI guideline 4100

4.3 Sound Insulation by Astral Silencio

The excellent sound insulation properties of Astral Silencio are primarily attributed to its thick-walled design as well as the special molecular structure and the high density of 1.9 g/cm³. This property enables Astral Silencio to absorb airborne sound as well as mechanical vibrations.

The measurements in this test were performed following German standard DIN EN 14366 and DIN 4109; 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.

In order to precisely determine real noise emission of the pipe system in a room, it requires a more dynamic test set up.

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)

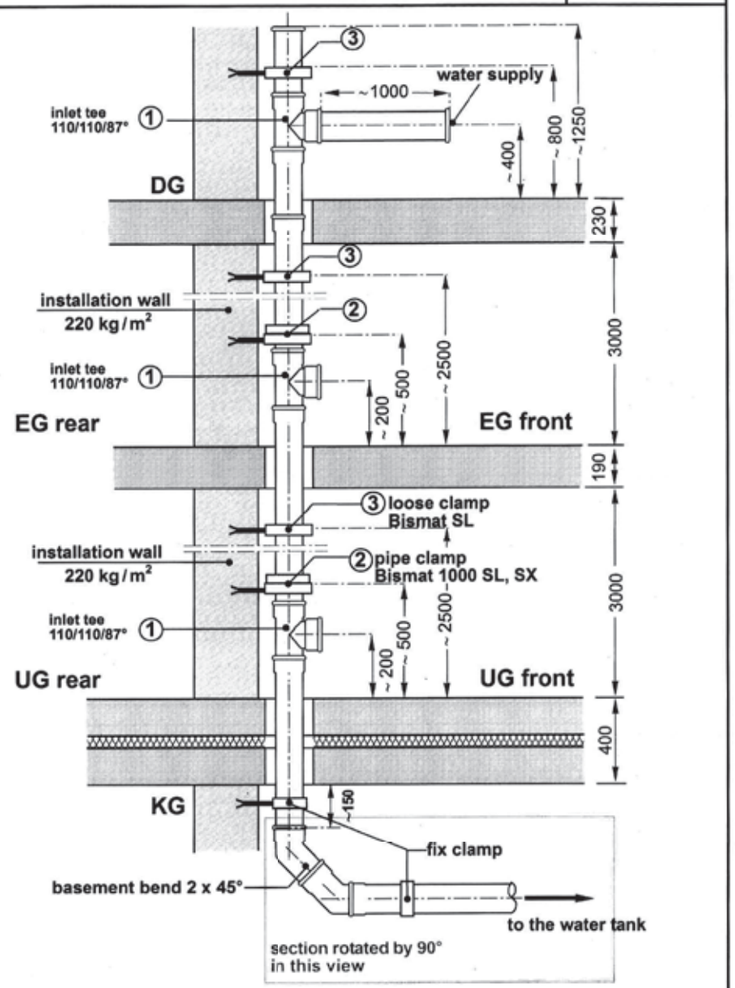
Test method: The measurements were performed according to EN 14366; noise excitation by steady water flow with 0.5 l/s, 1.0 l/s, 2.0 l/s and 4.0 l/s. Additional evaluation for comparison with requirements following German standards DIN 4109-1:2016-07 and VDI 4100:2012-10 (details in Annexes A, F and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

Result:

Test specimen: Wastewater installation system "ASTRAL SILENCIO", size OD 110, consisting of straight plastic pipes "ASTRAL SILENCIO DN 110x5.3mm" (manufacturer: Astral Poly Technik Limited) and fittings "ASTRAL SILENCIO DN 110" (manufacturer: Astral Poly Technik Limited) and pipe clamps with elastic inlay "Bismat 1000" (manufact. 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	40	44	47	50
Structure-borne sound characteristic level $L_{sc,A}$ [dB(A)] **according to EN 14366** for the basement test-room	UG rear	<10	<10	<10	14
Installation sound level $L_{AFeq,n}$ [dB(A)] **following DIN 4109** in the basement test-room	UG front	40	44	47	50
	UG rear	<10	<10	14	18
Installation sound level $\overline{L_{AFeq,nT}}$ [dB(A)] **following VDI 4100** in the basement test-room	UG front	38	42	45	48
	UG rear	<10	<10	10	15

Test date: July 20, 2016

Detailed results P-BA 161/2016e
Client: Astral Poly Technik Limited, Ahmedabad-380059, India figure 4



Installation plan of the test set-up in the test facility.

Test specimen: Wastewater installation system "ASTRAL SILENCIO", size OD 110, consisting of straight plastic pipes "ASTRAL SILENCIO DN 110x5.3mm" (manufacturer: Astral Poly Technik Limited) and fittings "ASTRAL SILENCIO DN 110" (manufacturer: Astral Poly Technik Limited) and pipe clamps with elastic inlay "Bismat 1000" (manufacturer: Walraven).

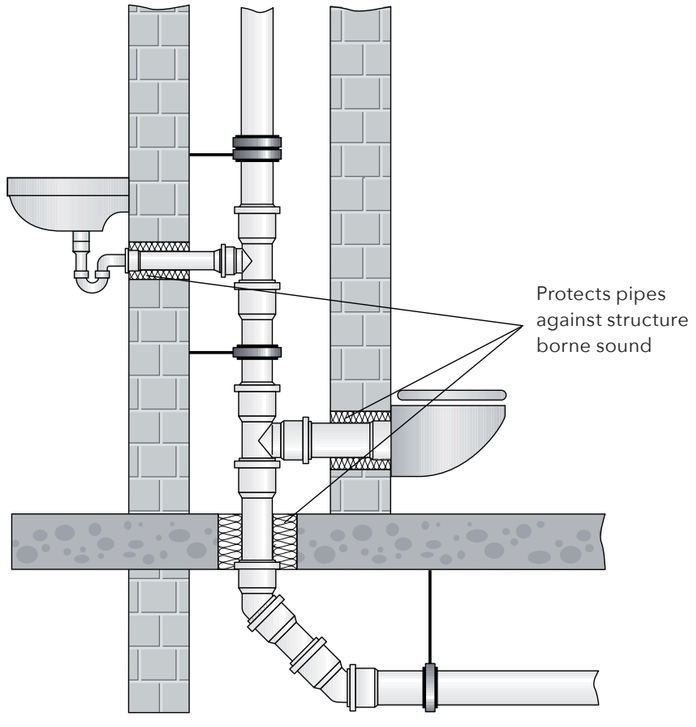
Fraunhofer IBP

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.

4.4 Acoustic Plumbing Design

Astral Silencio is the high-performance sound-insulating waste water piping system, however 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 the 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/m². Walls having an area-related mass of less than 220 kg/m² may only be used where prior testing has demonstrated that the walls exhibit acceptable properties with respect to the transmission of noise.



5. Fire Protection

5.1 Fire Behaviour Classification

Fire behaviour of construction materials, e.g. piping systems and isolation materials, has been defined in fire classification classes as per DIN 4102-1. Construction materials are classified as combustible and non-combustible materials. Astral Silencio is listed as B2 as per DIN 4102-1.

Criteria	Old Classification as per DIN 4102-1	New European classification according to DIN EN 13501-1		
		Additional criteria		
Non-combustible	A1	A1		
	A2	A2	s1	d0
Non-readily ignitable (low flame spread)	B1	B	s1	d0
		C	s1	d0
		A2	s2/s3	d0
		B	s2/s3	d0
		C	s2/s3	d0
		A2	s1	d1/d2
		B	s1	d1/d2
		C	s1	d1/d2
		A2	s3	d2
		B	s3	d2
		C	s3	d2
Normally ignitable (normal fire behaviour)	B2	D	s1/s2/s3	d0
		E	-	d0
		D	s1/s2/s3	d2
		E	-	d2
Readily ignitable	B3	F	-	-

Fire behaviour classification according to DIN 4102-1 and DIN EN 13501-1.

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 Single-Burning-Item-Test (SBI) in conformity with DIN EN 13823.

5.2 Fire Resistance Classification

The fire resistance classification provides the fire resistance duration of a specific construction material.

Fire resistance classification	Fire resistance duration in minutes
F30	≥ 30 = fire retardant
F60	≥ 60 = high fire retardant
F90	≥ 90 = fire resistant
F120	≥ 120 = high fire resistant
F180	≥ 180 = extreme fire resistant

Fire resistance classification.

Possible additions to these fire resistance classes, e.g. z.B. F90 A or F90 AB, can be explained as follows:

A Made of non-combustible materials

B Made of combustible materials

AB in principle made of non-combustible materials

5.3 Function of Fire Protection Collar

When exposed to fire and heat, the plastic pipe becomes malleable and deforms. The Astral Fire Protection Collar fully seals the wall or ceiling corridor and helps in case of fire. Due to special fire protection material, which strongly expands by increase in temperature, the fire collar provides fire resistant sealing for wall and ceiling installation of the Astral Silencio acoustic insulation systems and to other selected soil and waste systems.

5.4 General Recommendations

(1) Positioning of the collars: On both sides of a wall; on one side under/in a ceiling.

(2) Wall & ceiling types: At least 10 cm thick solid concrete, aerated concrete and sand-lime brick walls as well as light dividing walls (stud walls: both sides clad with 12.5 mm plasterboard) and solid concrete and aerated concrete ceilings at least 15 cm thick.

(3) Structural acoustic insulation: The acoustic insulation mat provided must be wrapped around the pipe where it passes through the wall or ceiling.

(4) Joint sealing between pipe and wall/ceiling: To be packed to the full thickness of the wall or ceiling using mineral materials such as concrete, cement or plaster.

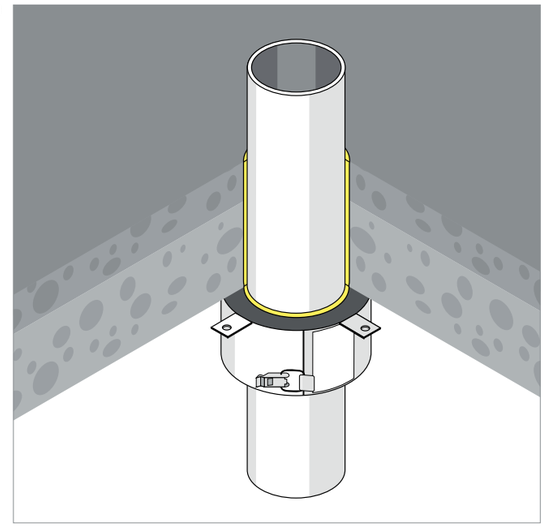
5.5 Types of Installation

Ceiling Installation

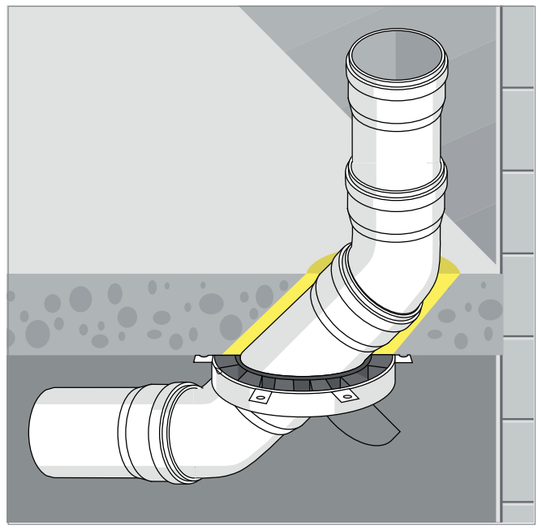
Minimum requirements of the ceiling: minimum 150 mm thick concrete ceiling.

Flush/Straight Ceiling Installation

- Wrap insulating mat around the pipe.
- Open the collar and position it around the pipe, whilst hooking in the push-in fastening.
- Bend or angle the collar mounting tabs.
- Install the collar flush with the ceiling.
- Fill the remaining ceiling gap with cement or concrete.
- Hold the collar firmly against the ceiling and mark the positions of the mounting holes.
- Rotate the collar and drill the holes.
- Insert plugs and fix the collar using screws and washers. (Mounting the collar using the washers, plugs and screws provided).



Installation of fireproofing collar on ceiling



Installation of fireproofing collar in angled ceiling

Angled Ceiling Installation

- Wrap insulating mat around the pipe.
- Open the collar and position it around the pipe, whilst hooking in the push-in fastening.
- Fill the remaining gap with cement or concrete.
- Hold the collar firmly against the ceiling and mark the positions of the mounting holes.
- Rotate the collar and drill the holes.
- Insert plugs and fix the collar using screws and washers. (Mounting the collar using the washers, plugs and screws provided).

Installation Distances Between Fire Protection Collars e.g. to External Systems.

The distance to external, tested systems (inspected and approved) must be at least 50 mm between partitioned sections. If two Astral feedthroughs are installed next to each other, the distance between the pipes must be at least 100 mm in the case of special partitioned sections (sloping pipes, partition via sleeve/socket or for ceiling installations). In the case of straight pipes without sleeve/ socket in the partition area, the collar casings can adjoin each other (distance 0 mm).

Wall installation

Minimum wall specifications: wall must be at least 100 mm thick, made from concrete, aerated concrete, lime sandstone or lightweight partition walls (two-layer panelling on both sides with 12.5 mm plasterboard panels and mineral wool infill). The pipe must be clamped on both sides at a distance of ≤ 50 cm. For wall feedthroughs, a collar should always be fitted on both sides of the wall.

NOTE

The presented data, especially recommendations for the processing and use of our products are based on our knowledge and experience. Due to differences in material and working conditions that are outside the scope of our influence, we recommend that sufficient internal trials be conducted in each case to ensure the suitability of our product to the intended method and processing purposes. No liability will be accepted either on the basis of these instructions or from an oral advice, unless we are accused of gross negligence or deliberate malice.

Overview of possible installation situations:

6. Technical Specification

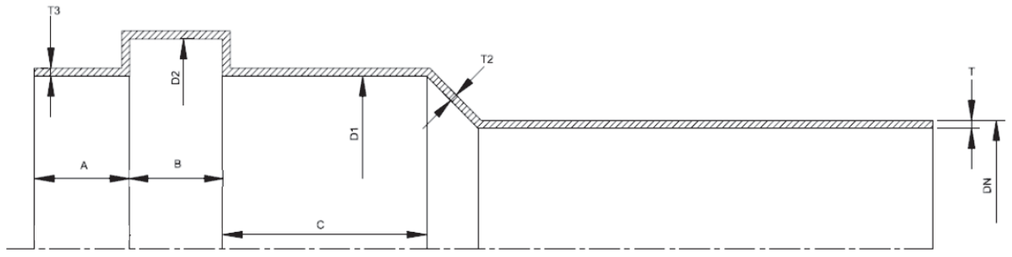
6.1 Technical Data

Property	Unit	Value
Material	Pipe : PP/PP mineral filled/PP	
	Fitting : PP mineral filled	
	Rubber Seal: SBR/EPDM	
Colour	Light grey, RAL 7035	
Area of application	Drainage pipes in building and above ground installation	
Density	g/cm^3	1.9
Elongation@break	%	30
Tensile strength	N/mm^2	16.8
Modulus of elasticity	N/mm^2	3800
Coefficient of linear expansion	Mm/mk	0.09
Ring stiffness	KN/ M^2	21
Fire resistancy		DIN 4102 EN 13501-1:D-S2, d1 B2 Normally ignitable (normal fire behaviour)
MFR	gm / 10 min	2.1
Connections	Push Fit sockets with factory-inserted lip seals	
Application Environment	Waste water with pH 2-12	
Operating Temparature	Water Temp. upto 95°C (Intermittent) or 90°C (continuous)	
Pipe marking	Astral Silencio, nominal diameter, production year, quality mark, approval, material, control mark, fire classification.	
Life Expectancy	50 years	

6.2 Pipe Dimension

Nominal Outside Diameter DN (mm)	Mean Outside Diameter (mm)		Wall Thickness (mm)
	Min	Max	
40	40.0	40.3	1.9
50	50.0	50.3	4.0
63	63.0	63.3	4.0
75	75.0	75.3	4.5
110	110.0	110.4	5.3
125	125.0	125.4	5.3
160	160.0	160.5	5.3
200	200.0	200.6	6.2

6.3 Socket Dimension

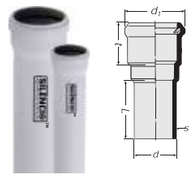


Nominal Outside Diameter DN (mm)	Wall Thickness T (mm)	Wall Thickness T2 (mm)	Wall Thickness T3 (mm)	Inside Diameter of Soc. D1 (mm)	Inside Diameter of Bending D2 (mm)	Neck of Soc. A (mm)	Length of Bending And Neck B (mm)	Length Beyond Bending C (mm)
40	1.9	1.7	1.5	40.3 +0.8	50 +/- 0.6	5.0	10.3	18.0
50	4.0	3.6	2.6	50.3 +0.8	60 +/- 0.6	5.0	10.3	28.0
63	4.0	3.6	2.6	63.3 +0.8	73 +/- 0.6	5.0	10.3	28.0
75	4.5	4.2	3.0	75.4 +0.8	85 +/- 0.6	5.0	10.3	33.0
110	5.3	4.8	3.0	110.4 +0.8	121 +/- 0.6	6.0	12.1	34.0
125	5.3	4.8	3.5	125.4 +1.0	138 +/- 0.7	6.0	13.3	39.0
160	5.3	4.8	3.5	160.5 +1.0	174.5 +/- 0.7	9.0	13.3	41.0
200	6.2	5.4	5.0	200.6 +1.0	216.5 +/- 1.2	11.5	15.6	45.0

ASTRAL SILENCIO High Density Low Noise System

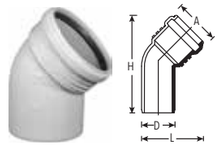
PIPES

Dim. DN	Article No.	d (mm)	d1 (mm)	s (mm)	t (mm)	L (mm)
40*	500035.A	40	54	1.8	48	3000
50	M241270305	50	68	4.0	51	3000
63	M241270306	63	79	4.0	67	3000
75	M241270307	75	94	4.5	53	3000
110	M241270309	110	130	5.3	60	3000
125	M241270310	125	146	5.3	87	3000
160	M241270312	160	184	5.3	68	3000
200	M241270314	200	227	6.2	78	3000



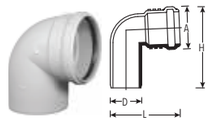
BEND 45°

Dim. DN	Article No.	A (mm)	H (mm)	L (mm)	W.T.	Std. Pkt.
40*	504017.A	53	135	84	--	--
50	M242001105	68	146	91	4.2	56
63	M242001106	81	159	107	4.2	70
75	M242001107	94	173	119	5.2	36
110	M242001109	130	209	158	5.5	16
125	M242001110	147	229	177	5.5	10
160	M242001112	184	263	214	5.6	10
200	M242001114	227	307	262	6.2	04



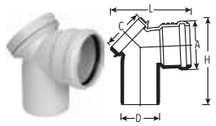
BEND 87.5°

Dim. DN	Article No.	A (mm)	H (mm)	L (mm)	W.T.	Std. Pkt.
40*	504023.A	54	102	98	--	--
50	M242001205	68	129	111	4.2	64
63	M242001206	81	114	123	4.2	60
75	M242001207	94	161	136	5.2	33
110	M242001209	130	205	176	5.5	12
125	M242001210	147	226	195	5.5	10
160	M242001212	184	273	230	5.6	09
200	M242001214	227	323	283	6.2	03



DOOR BEND 87.5°

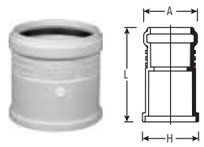
Dim. DN	Article No.	A (mm)	H (mm)	L (mm)	C (mm)	W.T.	Std. Pkt.
75	M242001307	94	168	156	95	5.2	24
110	M242001309	130	213	199	130	5.5	--
125	M242001310	147	226	213	130	5.5	--
160	M242001312	184	273	230	130	5.6	07



COMPENSATOR COUPLER

Dim. DN	Article No.	A (mm)	H (mm)	L (mm)	W.T.	Std. Pkt.
50	M242004105	68	71	119	4.2	70
63	M242004106	81	121	84	4.2	40
75	M242004107	94	95	123	5.2	48
110	M242004109	130	132	127	5.5	24
125	M242004110	147	136	139	5.5	22
160	M242004112	184	185	152	5.6	16

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

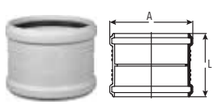


COUPLER

Dim. DN	Article No.	A (mm)	L (mm)	W.T.	Std. Pkt.
40*	-	54	95	--	125
200	M242001614	227	173	6.2	06

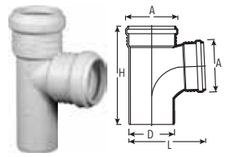
Connecting element between pipes as well as between pipes and fittings.

* Trading Item



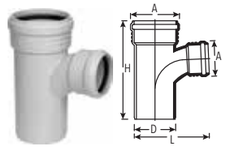
TEE (SWEPT)

Dim. DN	Article No.	A (mm)	H (mm)	L (mm)	W.T.	Std. Pkt.
40*#	508011.A	54	145	102	--	--
50	M242000105	68	175	115	4.2	40
63	M242000206	81	191	130	4.2	27
75	M242000207	94	222	161	5.2	20
110	M242000909	130	270	210	5.5	10
125	M242000910	147	304	238	5.5	--
160	M242000912	184	345	281	5.6	04
200	M242000914	227	417	353	6.2	01



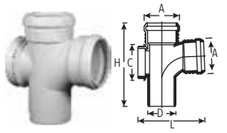
REDUCER TEE (SWEPT)

Dim. DN	Article No.	A (mm)	H (mm)	L (mm)	W.T.	Std. Pkt.
110x50	M242004244	130	262	176	5.5	12
110x63	M242004232	130	262	186	5.5	12
110x75	M242004229	130x94	262	209	5.5	09
125x110	M242004234	147	280	230	5.5	--
160x75	M242004235	184	311	261	5.6	06
160x110	M242004231	184x130	311	271	5.6	05



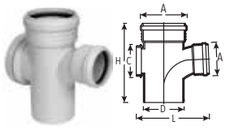
DOOR TEE (SWEPT)

Dim. DN	Article No.	A (mm)	H (mm)	L (mm)	C (mm)	W.T.	Std. Pkt.
75	M242001007	94	222	178	95	5.2	15
110	M242001009	130	270	230	130	5.5	07
125	M242001010	147	304	255	130	5.5	--
160	M242001012	184	345	297	130	5.6	04



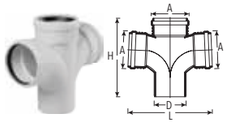
REDUCER DOOR TEE (SWEPT)

Dim. DN	Article No.	A (mm)	H (mm)	L (mm)	C (mm)	W.T.	Std. Pkt.
100x50	M242004344	130	262	196	130	5.5	09
100x63	M242004332	130	262	206	130	5.5	--
110x75	M242004329	130x94	257	229	130	5.5	09
125x110	M242004334	147	280	248	130	5.5	--
160x75	M242004335	184	311	277	130	5.6	05
160x110	M242004331	184x130	311	287	130	5.6	05



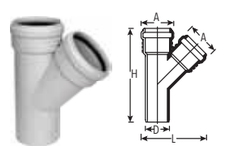
DOUBLE TEE (SWEPT)

Dim. DN	Article No.	A (mm)	H (mm)	L (mm)	W.T.	Std. Pkt.
110	M242005409	130	270	290	5.5	06



SINGLE Y

Dim. DN	Article No.	A (mm)	H (mm)	L (mm)	W.T.	Std. Pkt.
40*	508007.A	54	161	115	--	--
50	M242001905	68	195	135	4.2	32
63	M242001906	81	217	160	4.2	--
75	M242001907	94	241	182	5.2	16
110	M242001909	130	301	244	5.5	09
125	M242001910	147	331	274	5.5	06
160	M242001912	184	392	338	5.6	04
200	M242001914	227	461	419	6.2	01



* Trading Item

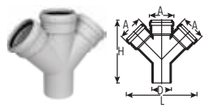
No Swept

REDUCER SINGLE Y

Dim. DN	Article No.	A (mm)	H (mm)	L (mm)	W.T.	Std. Pkt.
110x75	M242002129	130x94	255	218	5.5	12
160x110	M242002131	184x130	321	299	5.6	04
125x110	M242002134	147x130	309	261	5.5	08

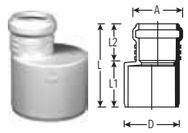
DOUBLE Y

Dim. DN	Article No.	A (mm)	H (mm)	L (mm)	W.T.	Std. Pkt.
75	M242002307	94	241	270	5.2	12
110	M242002309	130	301	358	5.5	08
125	M242002310	147	331	401	5.5	04



REDUCER

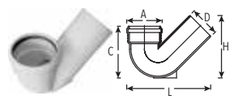
Dim. DN	Article No.	A (mm)	L (mm)	L1 (mm)	L2 (mm)	W.T.	Std. Pkt.
50x40*	513001.A	53	47	30	17	--	100
50x40	M242004841	53	47	30	17	--	--
58x50	F242004836	--	--	--	--	--	As Req.
63x50	M242004839	68	113	60	52	4.2	72
75x50	M242004837	68	113	63	50	5.2	52
75x63	M242004836	81	115	60	54	4.2	50
75x78	F182005907	--	--	--	--	--	As Req.
110x50	M242004844	68	138	88	50	5.5	40
110x63	M242004832	81	140	82.5	57	4.2	36
110x75	M242004829	94	139	84	55	5.5	36
125x75	M242004842	147	146	88	58	5.5	18
125x110	M242004834	147	166	88	77	5.5	27
160x110	M242004831	130	196	136	60	5.6	18
160x125	M242004833	147	196	94	102	5.5	21
200x110	M242004846	130	198	138	60	6.2	12
200x160	M242004847	184	202	131	71	6.2	12



P TRAP

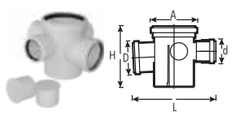
Dim. DN	Article No.	A (mm)	H (mm)	L (mm)	C (mm)	W.T.	Std. Pkt.
110x110	M242003509	130	229	308	190	5.5	12

With rectangular access lid.



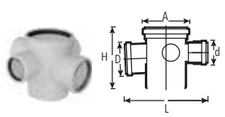
MULTY FLOOR TRAP

Dim. DN	Article No.	A (mm)	H (mm)	L (mm)	D (mm)	d (mm)	W.T.	Std. Pkt.
110	M242003209	127	164	223	91	66	5.5	12



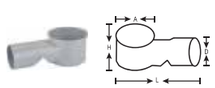
MULTY FLOOR TRAP HIGH RISER

Dim. DN	Article No.	A (mm)	H (mm)	L (mm)	D (mm)	d (mm)	W.T.	Std. Pkt.
110	F242003209	127	160	223	91	66	5.5	12



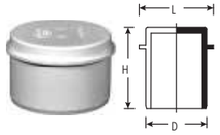
NAHANI TRAP

Dim. DN	Article No.	A (mm)	H (mm)	L (mm)	D (mm)	d (mm)	W.T.	Std. Pkt.
3' Height	M242003129	126	85	250	110	75	3.2	30



END PLUG

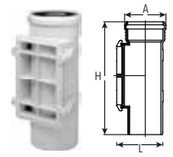
Dim. DN	Article No.	H (mm)	L (mm)	W.T.	Std. Pkt.
50	M242002905	66	60	4.2	100
63	M242002906	79	134	4.2	100
75	M242002907	69	84	5.2	60
110	M242002909	74	119	5.5	46
125	M242002910	67	73	5.5	--
160	M242002912	52	175	5.6	20
200	M242002914	60	216	6.2	12



ACCESS PIPE

Dim. DN	Article No.	A (mm)	H (mm)	L (mm)	W.T.	Std. Pkt.
110	M242005309	130	356	148	5.5	06
125	M242005310	147	370	145	5.5	04
160	M242005312	184	400	200	5.6	04
200	M242005314	227	480	240	6.2	01

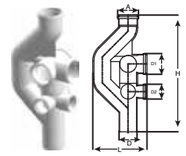
With rectangular access lid.



ASTRAL SOVENT

Dim. DN	Article No.	A (mm)	H (mm)	L (mm)	D1 (mm)	D2 (mm)	W.T.	Std. Pkt.
110	M112003509	127	715	332	110 x3	75x3	4.0	03

With rectangular access lid.



COMPENSATOR RUBBER RING

Dim. DN	Article No.	Std. Pkt.
50	RM06510050	As Required
75	RM06510075	As Required
110	RM06510110	As Required
160	RM06510160	As Required

RUBBER SEALING RING

Dim. DN	Article No.	Std. Pkt.
50	RM06590009	As Required
75	RM06590075	As Required
110	RM06590110	As Required
160	RM06590160	As Required
200	RM06590200	As Required

BRACKETS / CLAMPS

Dim. DN	Article No.	Std. Pkt.
75	T 3 NC WR	As Required
110	T 4 NC WR	As Required
160	T 6 NC WR	As Required

Bracket / Clamp with ruber insert

SAFETY CLIP FOR SOCKET PLUG

Dim. DN	Article No.	Std. Pkt.
75	SC75	As Required
110	SC110	As Required
160	SC160	As Required
200	SC200	As Required

CONNECTION FROM CAST-IRON TO SILENCIO

Dim. DN	Article No.	Std. Pkt.
75+	9112421	As Required
110+	9112422	As Required
160+	9112424	As Required

FIRE PROTECTION COLLAR TYPE MB-90+

Dim. DN	Article No.	Std. Pkt.
56/70+	9112530	As Required
90/100+	9112532	As Required

RUBBER LUBRICANT

Dim. DN	Article No.	Std. Pkt.
100 GRM	S TINS-100	As Required
250 GRM	S TINS-250	As Required
500 GRM	S TINS-500	As Required

+ On Demand Trading Item

8.1 Pipe Cutting

Astral Silencio can be cut simply with a professional pipe cutter or a 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 making a connection to the compensator or end of compensator, pipe ends may not be chamfered. For making a connection to other fittings, the pipe requires to be chamfered.

8.2 Push-fit Joints Without Compensator Socket

To cope with variations in length due to thermal factors in pipe-fitting connections, when the maximum pipe length is 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 ASTRAL 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 and not the fitting just 10 mm out of the coupling. When pipes are positioned vertically, leave space of 10 mm to avoid slipping and for elimination of the dilatation. Then fix the individual pipes with collars immediately after assembly.

8.3 Joints With The Compensator Socket

The Astral Silencio compensator socket is used to connect two pipes as well as a pipe and the fitting where compensation for axial movement is required. For conventional plastic soil and waste pipe systems, the expansion margin is created by marking and with drawing the pipe to the expansion length. This is not required in case of Astral Silencio, 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.

8.4 Steps for Joining Compensator Socket

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

1. Pull the expansion collar from the compensator socket.
2. Push the expansion collar over the pipe end.
3. Apply lubricant inside compensator socket of the fitting. Never use oil or grease.
4. Apply and distribute lubricant evenly on outside of elastomeric compensator collar. Push the fitting over compensator collar to full insertion depth.
5. Check final position of compensator collar. Ensure pipe end is flushed with gasket tip.

8.5 Fixation

In principle, Astral Silencio soil and waste system should be installed tension-free and with free lateral allowance for temperature compensation. Use rubber-line brackets. The pipe brackets should have inserts of corrugated rubber and should 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 center axis. The ASTRAL safety clips prevent the joints from sliding apart. Alternatively the fixing brackets can be arranged appropriately to achieve the same effect.

Vertical Support

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.

Sliding Bracket

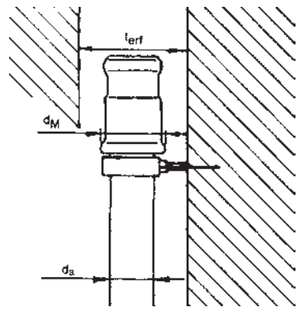
By using sliding brackets, the pipe still can be moved through the bracket after the screws are tightened (longitudinal movement is possible once installed).

Correct

Incorrect

External heating of Astral Silencio Pipes should be limited by heat insulating the source; e.g. central heating pipes as well as hot tap water pipes. Pipe and shaft dimensions are to be taken from the table below.

DN (mm)	OD of Pipe da (mm)	OD of Socket dm (mm)	Min. Required Spacing* (mm)
40	40	54	125
50	50	68	125
63	63	81	140
75	75	95	155
110	110	130	190
125	125	147	210
160	160	184	244
200	200	228	288

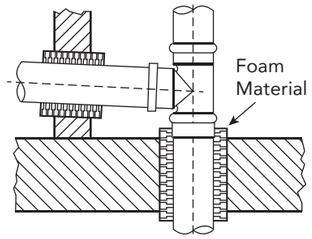


* The stated depths are not including pipe crossings
Space requirements for Astral Silencio pipes DN 40 – DN 200 mm.

8.6 Installation in Concrete

Astral Silencio pipes and fittings can be cast in concrete. Thermal induced lateral movements have to be dealt according to the instructions.

- Attach pipe component in such a way that a change in position during concrete application is prevented.
- Seal the sleeve gap with adhesive strips to prevent the penetration of concrete.
- Seal the pipe opening before concrete application.

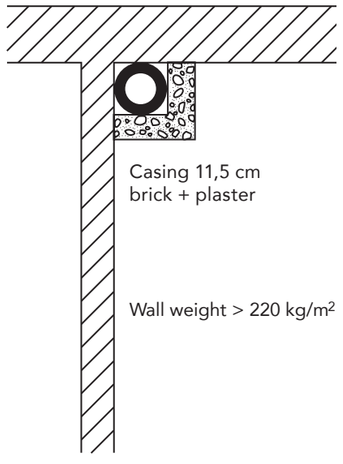


8.7 Wall and Ceiling Installations

Wall and ceiling installations are to be made moisture tight and should also be sound absorbing and leak proof. If a flooring substitute is to be applied, then the exposed pipe components are to be secured in protecting tubes or encased in soft materials (e. g. glass wool or foam material).

8.8 Roof Drainage Pipes

Roof drainage pipes projected through living, sleeping and working rooms can be installed as shown in the diagram. 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 Astral Silencio pipes is less than that of metallic pipes, it is recommended to insulate the pipes and fittings.



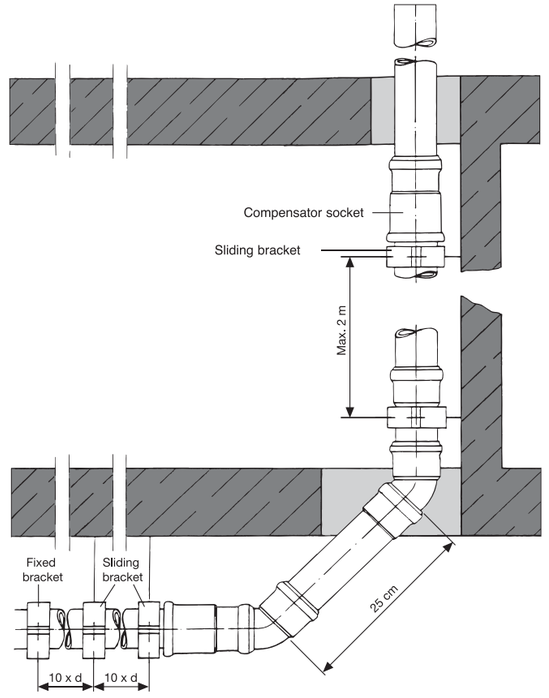
8.9 Below-ground Piping and Collector Pipes

Below-ground piping is normally connected to down pipes 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 foundation. Collecting pipes are installed above-ground and are used to collect waste water from down pipes or other connecting pipe work.

8.10 Arrangements of the Brackets

During installation of Astral Silencio pipes, the following should be considered:

- In case of horizontal installation, the pipe bracket distances are 10x the outside of the pipe. This becomes, in case of vertical pipe installation, depending on outside diameter, 1 - 2 meters.
- Generally pipe brackets should not be installed in impact areas (e.g. diameter reductions and changes of directions in the system).
- Pipe brackets are to be fixed to building materials with high specific area weight.
- For stacking pipes in open mounting shafts and high rooms (storey height over 2.5 meters), 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 meters above the fixed bracket.
- 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. In this case, we advise using the Astral Silencio 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 can not slide apart.
  In exceptional cases, where connecting elements other than the compensator socket are used (e.g. double socketed sleeve), per maximum allowable pipe length (3 meters), one fixed bracket and one sliding bracket should be installed in line as per the illustrations shown on this page. The double socketed sleeves are to be fixed.

8.11 Support Spacing Distances

Vertical Pipe Routing

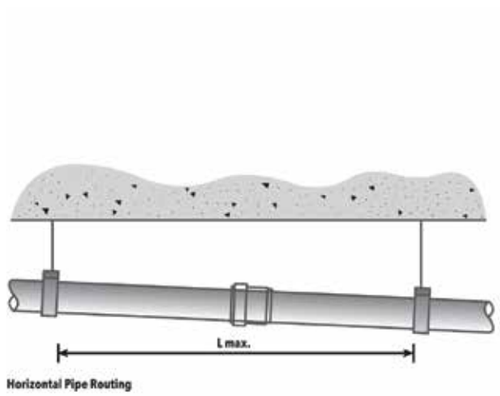
As a principle, 2 brackets are fitted for each floor-level. One fixed bracket is fitted to the pipe running below a socket in the lower floor level. The sliding bracket is attached loosely to the plain pipe to allow the linear expansion of the pipe run.

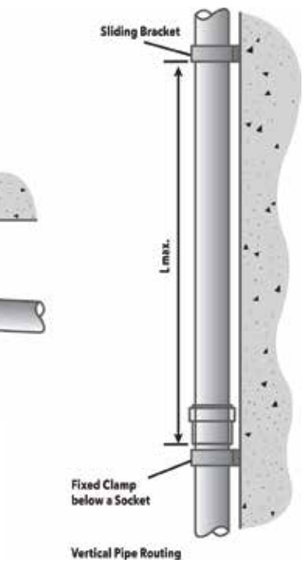
Horizontal Pipe Routing

The pipe run must be secured against lateral shifting or axial movement in the proximity of all points of directional changes.

Maximum Distances between the Brackets for Horizontal and Vertical Installation

Pipe DN (external diameter)	Max. brackets distance for Horizontal installing – L Max mtr.	Max. brackets distance for Vertical installing - L Max mtr.
Ø 40	0.7	1.30
Ø 50	0.80	1.50
Ø 63	0.95	1.75
Ø 75	1.10	2.00
Ø 110	2.00	2.00
Ø 125	2.00	2.00
Ø 160	2.00	2.00
Ø 200	2.40	2.00





9. Cleaning and Maintenance

9.1 Special Fittings For Easy Maintenance

Cleaning the Waste Pipe System

Installing access pipes enables mechanical cleaning of the waste pipe system. Door fittings give the ability to access the cleaning at any point in the system.

P Trap Siphon

Astral Silencio P trap Siphon provides 50 mm water seal to prevent foul odour coming out of the drainage line. The P trap Siphon is to be used together with DN 110 bend 45°. While installing the P trap, it is important to install the pipe support properly to ensure the safe operation of drainage system.

Socket Plug / Safety Clip

The socket plug can be used to plug-off the pipe ends if they are not in use. The socket plug is to be used together with the securing clip to ensure a safe and tight jointing.

Floor Trap

The highly functional Floor Trap design by ASTRAL complies with low noise system.

Seal Construction

The proven seal construction gives not only the top inlet but on inlets and outlets on all branches to perform with the reliability and maintain functionality.

Baffle Partition

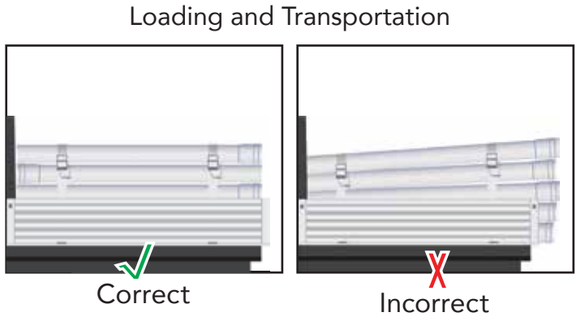
Baffle construction is air tight at all working condition of trap. Specially designed inspection plug enables to access the area under the baffle in order to inspect and clean this area.

End Plug

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.

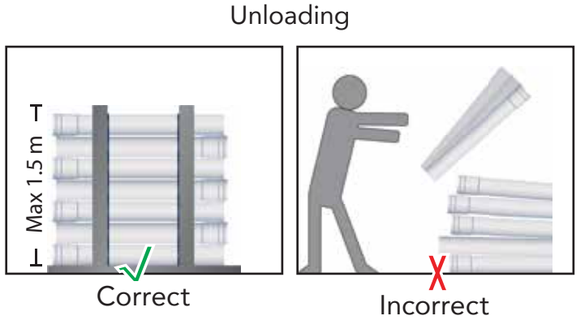
9.2 Loading and Transportation

When loading pipes and fittings take care that no damage should occur during transportation. Wherever possible during transportation, the pipes should rest in their entire length on top of each other, so that sagging can be avoided. Avoid sudden and abrupt stresses on pipes and fittings, especially with temperatures in the frost range.



9.3 Unloading and Storage

Unloading is to be carried out with appropriate care. Do not drop pipes or drag them over the ground. Furthermore, make sure that the pipes are not pulled over sharp edges (e.g. tailgate). Unpalletized pipes should not be stacked higher than 1.5 m. Pipe stacks must be secured against rolling apart.



Fittings are packed in cartons. Protect carton-packed fittings against moisture.

9.4 Outdoor Exposure

Astral Silencio pipes and fittings are designed to withstand outdoor storage:
Longer outdoor storage periods and intense exposure to direct sunlight might lead to decoloration of the surface and to a slight deterioration of the mechanical material properties.

10. Chemical Resistance Chart

Pipe and Fitting

The specifications are used for the initial orientation of the chemical resistance of the material (not of the possible influence of the corrosive agent) and cannot simply be applied to all usage scenarios. Mechanical behaviour can be impaired in cases where tension and the presence of chemicals occur simultaneously (tension-fracture corrosion).

Rubber Sealing Ring

The types of rubber used generally exhibits quite good chemical resistance, but components of esters, ketones, aromatic and chlorinated hydrocarbons in sewer water expand heavily, which can lead to damage of the connection. If required, we recommend testing the suitability of the pipe, fitting and seal material in existing systems or have them checked in a laboratory. Contact our applications department if necessary.

Table Legend

r = resistant

cr = conditionally resistant

nr = not resistant

- = not tested

Chemical	Concentr, %	Temp. °C	Silencio PP
2-Propen-1-ol	96	20	r
	96	60	r
Acetaldehyde + acetic acid	90/10	20	–
Acetaldehyde, aqueous	40	40	r
Acetaldehyde, concentrated	100	20	–
Acetate ether	100	20	–
Acetic acid, aqueous	up to 25	40	r
	up to 25	60	r
	25–60	60	r
	80	40	r
Acetic acid, concentrated	95	40	–
Acetic anhydride	100	20	r
	100	40	cr
	100	60	cr
Acetone	100	20	r
	100	60	r
Acetone, aqueous	traces	20	r
Acronal dispersions	com. avail.	20	–
Acronal solutions	com. avail.	20	–
Acrylic acid ethyl ester	100	20	–
Adipic acid, aqueous	saturated	20	r
	saturated	60	–
Aluminium chloride	diluted	40	r
	diluted	60	r
	saturated	60	r
Aluminium sulfate, aqueous	diluted	40	r
	diluted	60	r
	saturated	60	r
Alums, aqueous	diluted	40	r
	diluted	60	r
	saturated	60	r
Ammonia, gas	100	60	r
Ammonia, liquid	100	20	r
Ammonium chloride, aqueous	diluted	40	r
	diluted	60	r
	saturated	60	r
Ammonium Fluoride, aqueous	up to 20	20	r
	up to 20	60	r
Ammonium hydroxide	warm sat.	40	r
	warm sat.	60	r
Ammonium nitrate, aqueous	diluted	40	r
	diluted	60	r
	saturated	60	r
Ammonium sulfate, aqueous	diluted	40	r
	diluted	60	r
	saturated	60	r
Ammonium sulfide, aqueous	diluted	40	r
	diluted	60	r
	saturated	60	r

Chemical	Concentr, %	Temp. °C	Silencio PP
Aniline hydrochloride, aqueous	saturated	20	r
	saturated	60	r
Aniline, aqueous	saturated	20	r
	saturated	60	r
Aniline, pure	100	20	r
	100	60	r
Animal glue	custom. co	20	r
	custom. co	60	r
Anthraquinonesulfonic acid, aqueosuspension 30			r
Antiformin, aqueous	2	20	–
Antimony chloride, aqueous	90	20	r
Arsenic acid, aqueous	diluted	40	r
	diluted	60	r
	80	40 r	
	80	60 r	
Beef tallow emulsion, sulphonated	com. avail.	20	–
Beer	com. avail.	20	r
Beer colourinzzg agent	com. avail.	60	r
Benzaldehyde, aqueous	0,1	60	–
Benzene	100	20	cr
Benzoic acid, aqueous	any	20	r
	any	40	r
	any	60	r
Bisulphite solution, w/ SO	warm sat.	50	r
Bleaching liquour, containing 12.5 % active chlorine	usage conc.	40	–
	usage conc.	60	cr
Borax, aqueous	diluted	40	r
	diluted	60	r
	saturated	60	r
Boric acid, aqueous	diluted	40	r
	diluted	60	r
	saturated	60	r
Brandy	com. avail.	20	r
Bromine fumes	minimal	20	nr
Bromine, liquid	100	20	nr
Butadiene	100	60	–
Butane, gaseous	50	20	r
Butanediol	up to 100	20	–
Butanediol, aqueous	up to 10	20	r
	up to 10	40	r
	up to 10	60	r
Butanol	up to 100	20	r
	up to 100	40	r
	up to 100	60	cr
Butyl acetate	100	20	cr
Cider	com. avail.	20	r

Chemical	Concentr, %	Temp. °C	Silencio PP
Citric acid, aqueous	up to 10	40	r
	up to 10	60	r
	saturated	60	r
Clophene	com. avail.	20	–
	com. avail.	60	–
Coconut fat alcohol	100	20	r
	100	60	cr
Copper Fluoride, aqueous	2	50	r
Copper sulfate, aqueous	diluted	40	r
	diluted	60	r
	saturated	60 r	
Cresol, aqueous	up to 90	45	–
Crotonaldehyde	100	20	r
Cyclohexanol	100	20	r
Cyclohexanone	100	20	r
Cyclohexanone	100	20	r
Densodrin W	com. avail.	60	–
Dextrin, aqueous	saturated	20	r
	18	60	r
Diethylether	100	20	cr
Diglycol acid, aqueous	30	60	r
	saturated	20	r
Dimethyl sulfate, aqueous	up to 50	20	r
	up to 50	40	r
	100	40	–
	100	60	–
Dimethylamine, liquid	100	30	–
Disulfuric acid	10	20	nr
Ethanol (fermentation mash)	common	40	r
	common	60	–
Ethanol, aqueous	any	20	r
	96	60	r
Ethanol, denatured (with 2 % tolulene)	96	20	cr
Ethanol+ acetic acid (fermentation mash)	common	20	r
Ethyl acetate	100	20	cr
	100	60	nr
Ethylene chloride	100	20	nr
Ethylene oxide, liquid	100	20	–
Exhaust gas, w/COH	any	60	r
Exhaust gas, w/ HF	traces	60	r
Exhaust gas, w/ NOX	traces	60	r
	higher	60	–
Exhaust gases, w/S O7H	lower	20	–
	higher	20	nr
Exhaust gases, w/SOH, moist	any	60	r
Exhaust gases, w/ HCl	any	60	r
Exhaust gases, w/ SO	lower	60	r

Chemical	Concentr, %	Temp. °C	Silencio PP
	50	50	–
Fatty acids	100	60	cr
Ferric chloride, aqueous	up to 10	40	r
	up to 10	60	r
	saturated	60	r
Fertilizer salts, aqueous	up to 10	40	r
	up to 10	60	r
	saturated	60	r
Fluorsilicic acid, aqueous	up to 32	60	–
Formaldehyde, aqueous	diluted	40	r
	diluted	60	r
	40	30	r
Formic acid	100	20	r
	100	60	cr
Formic acid, aqueous	up to 50	40	r
	50	60	r
Frigen	100	20	cr
Fruit pulp	custom. conc	20	r
Glucose, aqueous	saturated	20	r
	saturated	60	r
Glycerine, aqueous	any	60	r
Glycine, aqueous	10	40	r
Glycol, aqueous	com. avail.	60	r
Glycolic acid, aqueous	37	20	r
Hexantriol	com. avail.	60	r
Hydrobromic acid, aqueous	up to 10	40	r
	up to 10	60	r
	48	60	r
Hydrochloric acid, aqueous	up to 30	40	r
	up to 30	60	r
	over 30	20	r
	over 30	60	r
Hydrofluoric acid, aqueous	up to 40	20	r
	40	60	r
	60	20	r
	70	20	r
Hydrogen	100	60	r
Hydrogen peroxide, aqueous	up to 30	20	r
	up to 20	50	r
Hydrogen phosphide	100	20	–
Hydrogen sulfide, dry	100	60	r
Hydrogen sulfide, aqueous	warm sat.	40	r
	warm sat.	60	r
Hydrosulfite, aqueous	up to 10	40	r
	up to 10	60	r
Hydroxylamine sulfate, aqueous	up to 12	35	r
Lactic acid, aqueous	up to 10	40	r
	up to 10	60	r
	90	60	r

Chemical	Concentr, %	Temp. °C	Silencio PP
Lead acetate, aqueous	warm sat.	50	r
Butylene, liquid	100	20	–
Butylphenol	100	20	r
Butynediol	up to100	40	–
Butyric acid, aqueous	20	20	r
	concentr.	20	r
Calcium chloride, aqueous	diluted	40	r
	diluted	60	r
	saturated	60	r
Calcium nitrate, aqueous	50	40	r
Carbolineum, aqueous	usage conc.	20	–
Carbon dioxide, aqueous under 8 atmospheric pressures	saturated	20	–
Carbon dioxide, dry	100	60	r
Carbon dioxide, moist	any	40	r
	any	60	r
Carbon disulfide	100	20	cr
Carbon tetrachloride, technical	100	20	nr
Caustic potash solution, aqueous	up to 40	40	r
	up to 40	60	r
	50/60	60	r
Caustic soda, aqueous	up to 40	40	r
	up to 40	60	r
	50/60	60	r
Chloramine, aqueous	diluted	20	–
Chloric acid, aqueous	1	40	–
	1	60	–
	10	40	–
	10	60	–
	20	40	–
	20	60	–
Chlorine water	saturated	20	cr
Chlorine, gaseous, dry	100	20	nr
Chlorine, gaseous, moist	0,5	20	nr
	1	20	nr
	5	20	nr
Chlormethyl	100	20	–
Chloroacetic acid (mono)	100	40	r
	100	60	–
Chloroacetic acid (mono) aqueous	85	20	r
Chlorosulfonic acid	100	20	nr
Chromic acid, aqueous	up to 50	40	–
	up to 50	60	cr
Chromic acid/Sulphuric acid/ Water	50/15/35	40	nr
	50/15/35	60	nr
	diluted	40	r
	diluted	60	r
	saturated	60	r
Lead tetraethyl	100	20	r
Magnesium chloride, aqueous	diluted	40	r
	diluted	60	r
	saturated	60	r
Magnesium sulfate, aqueous	diluted	40	r
	diluted	60	r
	saturated	60	r
Maleic acid, aqueous	saturated	40	r
	saturated	60	r
	35	40	r
Malic acid, aqueous	1	20	r
Mersol D	custom. conc	40.	–
Methanol	100	40	r
	100	60	r
Methyl amine	32	20	r
Methylene chloride	100	20	nr
Milk	com. avail.	20	r
Mixed acid (Sulfuric acid/Nitric acid/Water)	48/49/3	20	nr
	48/49/3	40	nr
	50/50/0	20	nr
	50/50/0	40	nr
	10/20/70	50	cr
	10/87/3	20	nr
	50/31/19	30	nr
Molasses	custom. conc	20	r
	custom. conc	60	r
Molasses wort	custom. conc	60	r
Mowilith D	com. avail.	20	–
Nekal, BX, aqueous	diluted	40	–
	diluted	60	–
Nickel sulfate, aqueous	diluted	40	r
	diluted	60	r
	saturated	60	r
Nicotine compounds, aqueous	usage conc.	20	–
Nicotine, aqueous	usage conc.	20	–
Nitric acid, aqueous	up to 30	50	r
	30/50	50	nr
	98	20	nr
	98	60	nr
Nitrous gasses	concentr.	20	r
	concentr.	60	–
Oils and greases	com. avail.	60	cr
Oleic acid	com. avail.	60	cr
Oleum vapour	lower	20	cr
	higher	20	nr
Oxalic acid, aqueous	diluted	40	r
	diluted	60	r
	saturated	60	r
Oxygen	any	60	–
Ozone	100	20	cr
	10	30	r
Palm kernel oil acid	100	60	–
Paraffin emulsions	com. avail.	20	–
	com. avail.	40	–
Perchloric acid, aqueous	up to 10	40	r
	up to 10	60	r
	saturated	60	–
Petrol	100	60	nr
Petrol-benzene mixture	80/20	20	cr
Phenol, aqueous	up to 90	45	r
	1	20	-
Phenylhydrazine	100	20	cr
	100	60	–
Phenylhydrazine hydrochloride, aqueous	saturated	20	–
	saturated	60	–
Phosgene, aqueous	100	20	nr
Phosgene, gaseous	100	20	cr
	100	60	cr
Phosphoric acid, aqueous	up to 30	40	r
	40	60	r
	80	20	r
	80	60	r
Phosphorous pentoxide	100	20	r
Phosphorous trichloride	100	20	r
Photographic developers	com. avail.	40	r
Photographic emulsions	any	40	–
Photographic fixers	com. avail.	40	r
Picric acid, aqueous	1	20	r
Potash, aqueous	saturated	40	–
Potassium borate, aqueous	1	40	r
	1	60	r
Potassium bromate, aqueous	up to 10	40	r
	up to 10	60	r
Potassium bromide, aqueous	diluted	40	r
	diluted	60	r
	saturated	60	r
Potassium chlorate, aqueous	1	40	r
	1	60	r
Potassium chloride, aqueous	diluted	40	r
	diluted	60	r
	saturated	60	r
Potassium chromate, aqueous	40	20	r
Potassium cyanide, aqueous	up to 10	40	r
	up to 10	60	r
	saturated	60	r
Potassium dichromate, aqueous	40	20	r
Potassium ferrocyanide	diluted	40	r
Potassium ferrocyanide, aqueous	diluted	60	r
	saturated	60	r
Potassium nitrate, aqueous	diluted	40	r
	diluted	60	r
	saturated	60	r
Potassium permanganate, aqueous	up to 6	20	r
	up to 6	40	r
	up to 6	60	r
	up to 18	40	–
Potassium persulfate, aqueous	diluted	40	r
	diluted	60	r
	saturated	40	r
	saturated	60	r
Propane, gaseous	100	20	–
Propane, liquid	100	20	–
Propargyl alcohol, aqueous	7	60	r
Pure acetic acid	100	20	r
	100	40	r
Ramasite	com. avail.	20	–
	com. avail.	40	–
Roaster gases, dry	any	60	r
Seawater	–	40	r
	–	60	r
Silicic acid, aqueous	any	60	r
Silver nitrate, aqueous	up to 8	40	r
	up to 8	60	r
Soap solution, aqueous	concentrated	20	r
	concentrated	60	r
Soda, aqueous	diluted	40	r
	diluted	60	r
	saturated	60	r
Sodium benzoate, aqueous	up to 10	40	r
	up to 10	60	r
	36	60	r
Sodium chlorate, aqueous	up to 10	40	r
	up to 10	60	r
	saturated	60	r
Sodium chlorite, aqueous	50	20	r
	diluted	60	nr
Sodium hydrosulfate, aqueous	diluted	40	r
	diluted	60	r
	saturated	60	r
Sodium hypochlorite, aqueous	diluted	20	r
Sodium sulfide, aqueous	diluted	40	r

Chemical	Concentr, %	Temp. °C	Silencio PP
	diluted	60	r
	saturated	60	r
Spirits	com. avail.	20	r
Starch syrup	custom. conc	60	r
Starch, aqueous	any	40	r
	any	60	r
Stearic acid	100	60	cr
Sulphur dioxide, aqueous under 8 atmospheric pressures	saturated	20	–
Sulphur dioxide, liquid	100	-10	–
	100	20	r
	100	60	r
Sulphur dioxide,	moist and aqueousany	40	r
	50	50	r
	any	60	r
Sulphur dixode, dry	any	60	r
Sulphuric acid, aqueous	up to 40	40	r
	up to 40	60	r
	70	20	r
	70	60	cr
	80-90	40	cr
	96	20	r
	96	60	nr
Table salt, aqueous	diluted	40	r
	diluted	60	r
	saturated	60	r
Tallow	100	20	r
	100	60	r
Tanigan extra A, aqueous	any	20	–
Tanigan extra B, aqueous	any	20	–
Tanigan extra D, aqueous	saturated	40	–
	saturated	60	–
Tanigan F, aqueous	saturated	60	–
Tanigan U, aqueous	saturated	40	–
	saturated	60	–
Tanning extracts, cellul.	common	20	r
Tanning extracts, natural	common	20	r
Tartaric acid, aqueous	up to 10	40	r
	up to 10	60	r
	saturated	60	r
Thionyl chloride	100	20	nr
Tin (II) chloride, aqueous	diluted	40	r
	diluted	60	r
	saturated	60	r
Toluene	100	20	nr
Trichloroethylene	100	20	nr
Triethanolamine	100	20	r
Trilone	com. avail.	60	–
Trimethylolpropane, aqueous	up to 10	40	–
	up to 10	60	–
	com. avail.	40	r
	com. avail.	60	r
Urea, aqueous	up to 10	40	r
	up to 10	60	r
	33	60	r
Urine	normal	40	r
	normal	60	r
Vinegar (wine vinegar)	com. avail.	40	r
	com. avail.	50	r
	com. avail.	60	r
Vinyl acetate	100	20	r
Water	100		r
	100		r
Wax alcohol	100	60	cr
Wine, red and white	com. avail.	20	r
Xylene	100	20	nr
Yeast wort	custom. con	40	r
	custom. con	60	r
Zinc chloride, aqueous	diluted	40	r
	diluted	60	r
	saturated	60	r
Zinc sulphate, aqueous	diluted	40	r
	diluted	60	r
	saturated	60	r