

→ Soundproof Pipe System

POLIphon[®]

Technical Guideline Planning and Installation

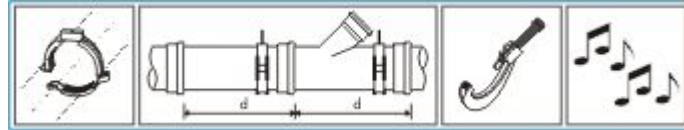
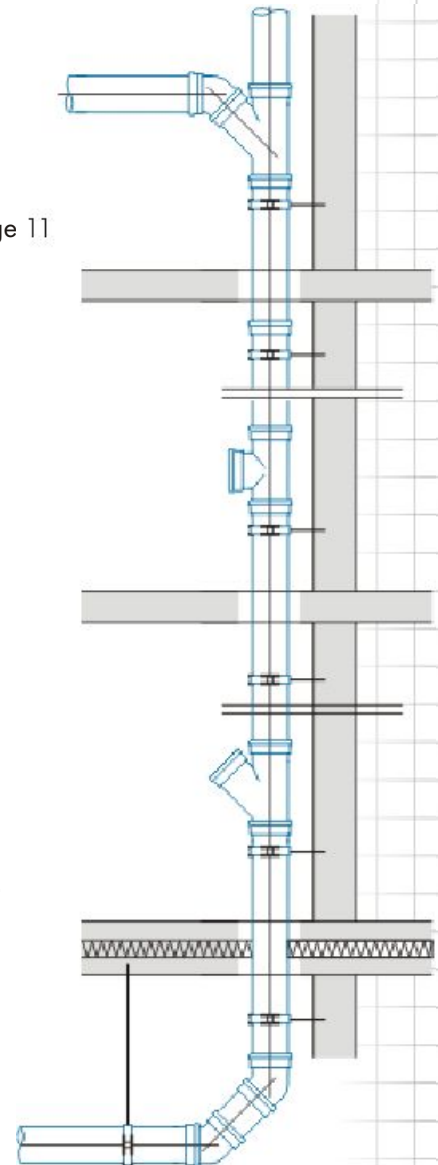
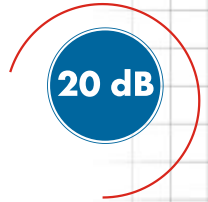
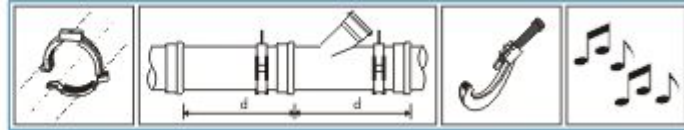


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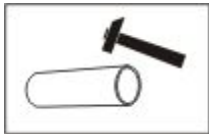
**POLiphon - MODERN, PROFESSIONAL SOUNDPROOF WASTE AND SOIL SYSTEM
ADVANTAGES:**



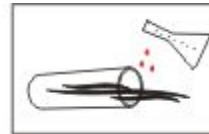
High degree of noise reduction
inside the pipe



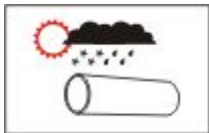
Low weight of elements



Mechanical resistance
to external factors



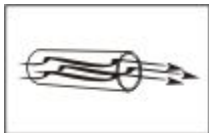
Resistance to chemical
additives in waste water



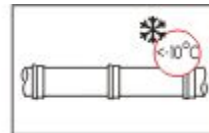
Resistance to temperature
change



Totally recyclable



Low coefficient
of wall roughness



Assembly possible
at temperatures below -10°C



No waste or limestone
incrustation



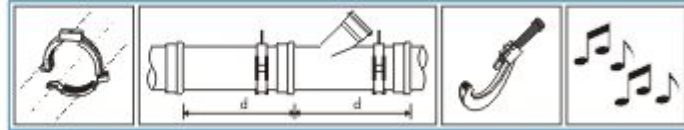
Low degree of vibration transmission
between elements



Resistance to high temperature
of flowing waste water



Full dimensional compliance
with the existing systems



RESEARCH INTO THE SYSTEM

POLlphon - one of the first soundproof waste and soil system was developed and designed in laboratories and research groups as a joint European project of the Poliplast company and Aliaxis R&D Institute. The main objective of this venture was to develop a new generation, soundproof system that could be used not only in buildings with a higher standard but also in multi-family apartment buildings or detached houses, complying at the same time with all the acoustic standards of the European countries.



Photo 1. Aliaxis - Research & Development Institute

MATERIAL FORMULATION

Modified polypropylene - a special material formula was developed for the POLlphon system combining plastic and minerals (mineral fillers), thanks to which was possible to enhance acoustic and mechanical characteristics. Prior to getting right results, detailed chemical tests and a selection of raw materials making up the three-layer POLlphon system material formulation were conducted. Apart from the safe and fast evacuation of sanitary waste water POLlphon reduces noise generated by the flow of waste water in the pipes. In addition, thanks to its additional features it can be used inside and outside the building (in the ground within building outline). The POLlphon system is resistant to hot waste water flow and can also be installed at extremely low temperatures in winter. While developing the system, it was decided that all the layers should be distinguished by colour, depending on the material used for their production.

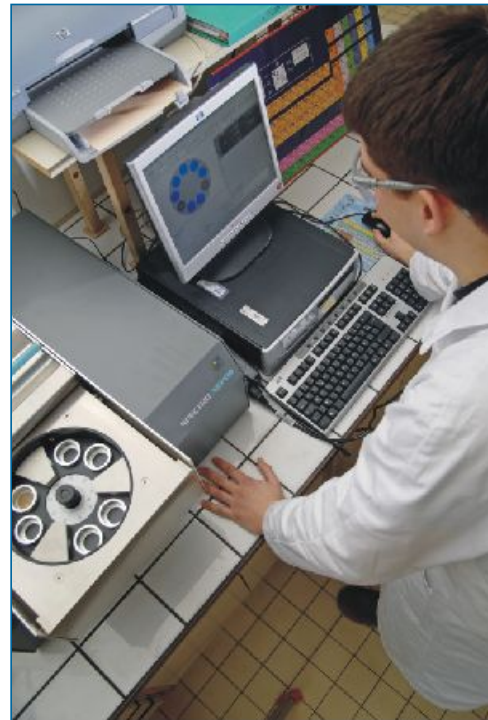
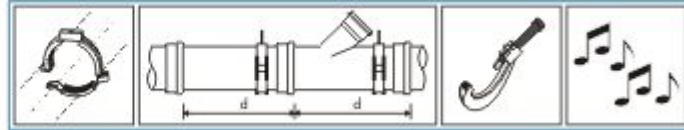


Photo 2. Laboratory tests - material formulation



POLlphon PIPE STRUCTURE - THREE LAYERS

The most modern method of three-layer, PP-MD (modified polypropylene) pipe co-extrusion was used in the production of the POLlphon system. This method means that waste water flowing inside pipes passes through three different layers, i.e. physical media, which severely limits the propagation of noise inside the system and considerably increases resistance to the specific composition and temperature of waste water as well as to external factors.



Photo 3. POLlphon pipe - during production

Each of the three layers that make up POLlphon system is individually responsible for its function.

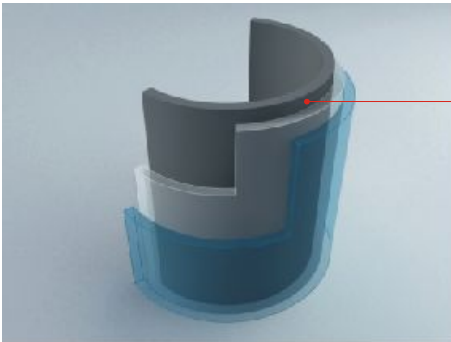


Fig. 1

Internal layer

- material PP-POLlcomp [i]
- colour [light-grey]
- resistance to high temperature +90°C [+95°C]
- resistance to chemical agents
- smooth surface

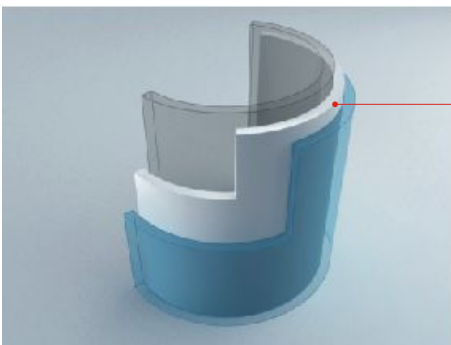


Fig. 2

Middle layer

- material PP-MD POLlcomp [m]
- reinforcement with minerals
- colour [cream-white]
- noise reduction
- high stiffness

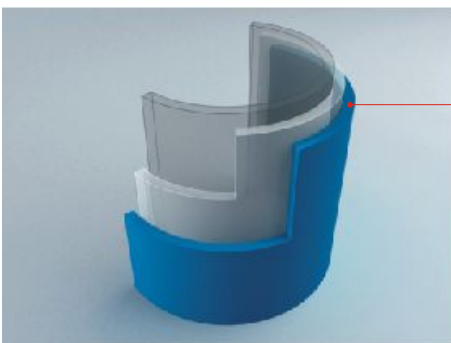
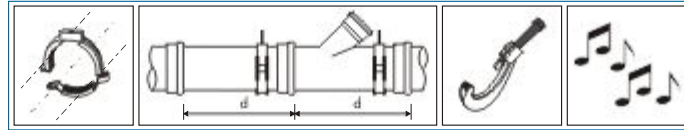


Fig. 3

External layer

- material PP-POLlcomp [e]
- colour [blue]
- high impact resistance [↙]
- resistance to severe weather conditions [✱]
- smooth surface



POLlphon - NOISE REDUCTION IN WASTE AND SOIL SYSTEMS

Every object in motion makes noise transmitting its vibrations -in the form of pressure or negative pressure waves - to the surrounding air. There are two types of noise in waste and soil systems:

Air borne noise - coming from pipelines, generated by waste water flowing inside. In this case, a soundproof waste and soil system should limit the propagation of air noise and close it inside the pipes. This function is performed thanks to a special material formula (using minerals), a three-layer pipe structure, the quality of manufacturing and laying pipelines properly.

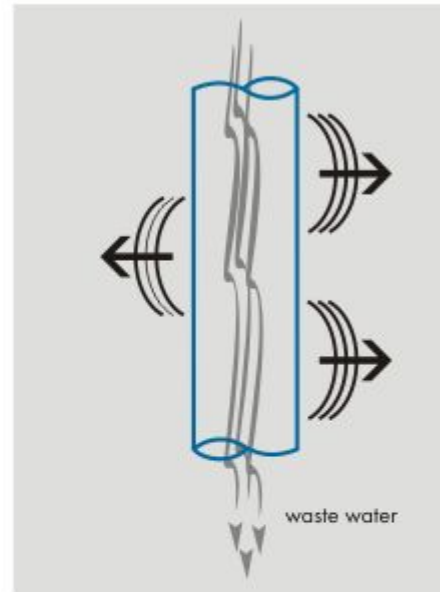


Fig. 4

Structure-borne noise - coming from pipes and fittings as well as the system of fixation to the building's structure. This sound comes from the noise inside the system mentioned before, which being limited by pipes and fittings makes them vibrate (acoustic resonance). The resonance is transmitted through a system of pipeclamps to the building's structure and heard in the neighbouring rooms as an irritating acoustic wave. In this case it is important to design the system of fixing pipes and fittings to the building's structure in such a way that the transmission of the acoustic resonance to its walls is reduced to the minimum.

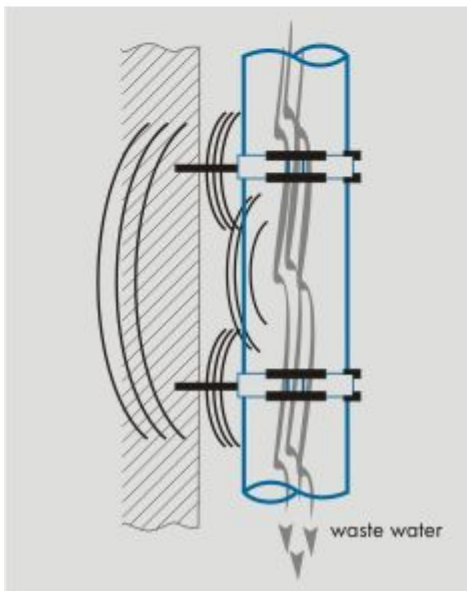


Fig. 5

Vibrations and acoustic bridge

Numerous tests were conducted in Aliaxis R&D laboratories to confirm the abovementioned theories. The tests helped to determine the points where maximum acoustic vibrations are generated on the downpipe (Fig. 6). As shown, the main area of their generation is the downpipe and the junction which further on transmits acoustic vibrations to the downpipe. The test confirmed that the kind and distribution of pipe-clamps as well as the system's design and material formula are the most important factors in the waste and soil system noise reduction. Designing a stand (Photo 4) measuring vibrations transmitted by the pipe-clamp to the building's structure (acoustic bridge) was the next step. Parallel to work on the structure of the POLlphon system, POLlclamps were also being tested (the clamps were designed especially for the soundproof waste and soil system programme). The main objective of the laboratory and prototype work was to develop a system of pipes, fittings and pipe-clamps with the weight and wall thickness lower than in the traditional soundproof systems but with the greatest possible reduction of noise inside the system and its transmission to the surrounding.

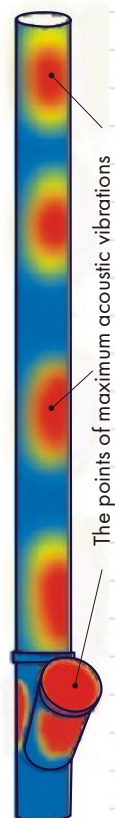


Fig. 6

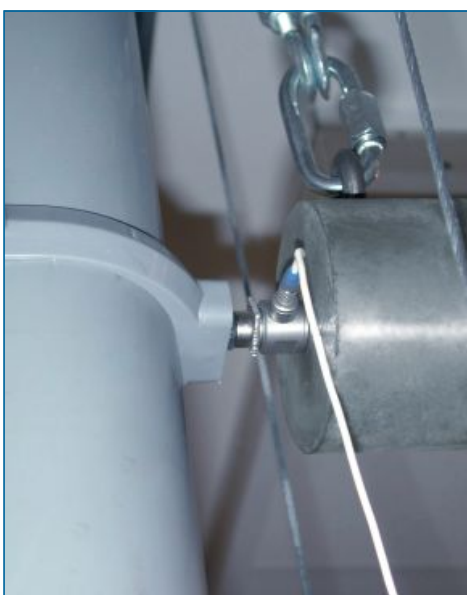
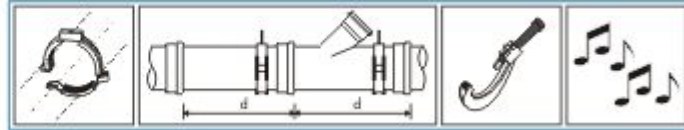


Photo 4



POLlphon - REDUCTION OF NOISE INSIDE THE PIPELINE AND ITS TRANSMISSION TO THE SURROUNDING

The soundproof, three-layer system puts different material media in the way of the propagating noise, which causes partial absorption of sound waves and their partial reflection inwards and significantly reduces transmission to the surrounding. The absorbed and reflected waves cause acoustic resonance of pipes and fittings. The higher inside the building, the more dynamically the resonance (Fig. 7) increases towards the flowing waste water and in transmitted through the fixation system (pipe clamps) onto the building's structure. Construction barriers subject to the acoustic resonance transmission cause its transmission to neighbouring rooms in the form of sound waves. The POLlphon system's structure along with POLlclamps is responsible for the maximum reduction of this acoustic phenomenon (Fig. 8). The acceptable noise level in the abovementioned rooms (a living room, a hospital ward, bedroom or a hotel room) is set forth in the national acoustic safety norms for buildings. Hence these are the places that are particularly protected against noise at the design stage. In contrast, kitchens and bathrooms are the places where down pipes are usually located. But here the noise coming from the waste and soil system is negligible compared with the equipment normally operating in these places (a washing machine, dishwasher or flush) so it is not subject to limitations to the same degree as the abovementioned rooms designed for frequent stay.

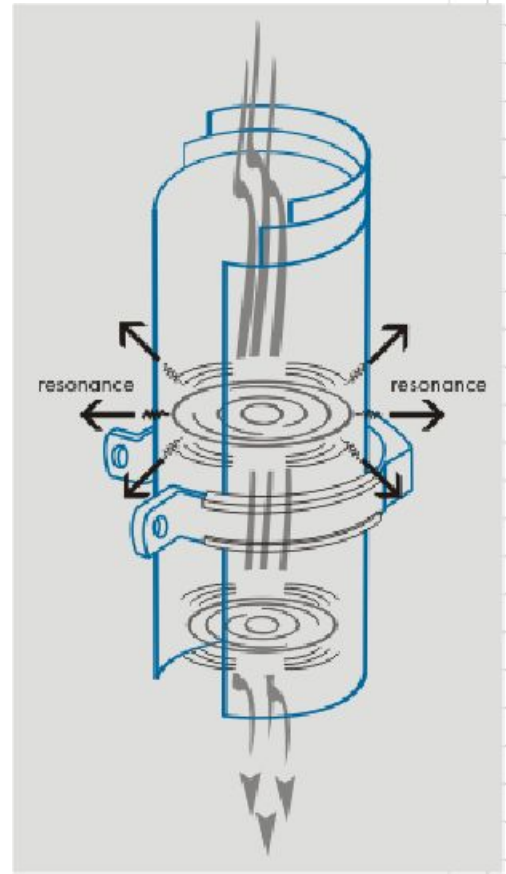
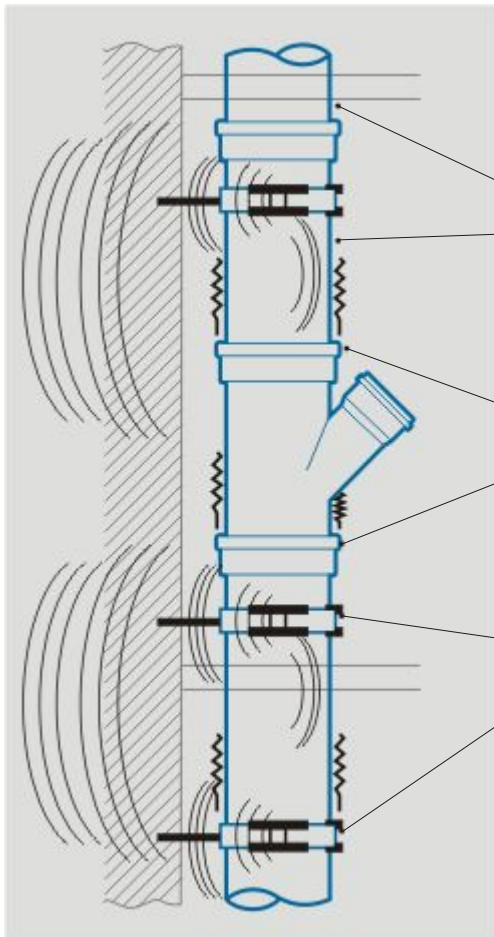


Fig. 7



20dB

Limiting noise propagation

- three-layer wall structure
- special material layout

Preventing transmission of acoustic vibrations

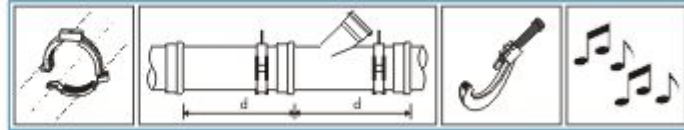
- between pipes and fittings
- tight socket/gasket connection

Elimination of acoustic bridges

- special acoustic clamp programme POLlclamp

Tests on the reduction of noise coming from waste and soil system carried out in the Institute for Building Physics Fraunhofer Germany, POLlphon showed noise transmission at the level of 20 dB under the test conditions.

Fig. 8



POLlclamp - STRUCTURE OF THE ACOUSTIC PIPE CLAMP

In order to provide the described reduction of the acoustic bridge and transmission of vibrations coming from the POLlphon system, a system of acoustic pipe clamps, POLlclamps, was designed. A special body section and the use of elastomer inlays provide a stable grip while maintaining acoustic properties. Cushioning inlays are placed inside the pipe clamp at three points that do not take part in tightening the pipe clamp to the building's structure. The active circumference of the pipe clamp is asymmetric after its opening, which facilitates keeping the pipe vertically before it is mounted inside the pipe clamp.

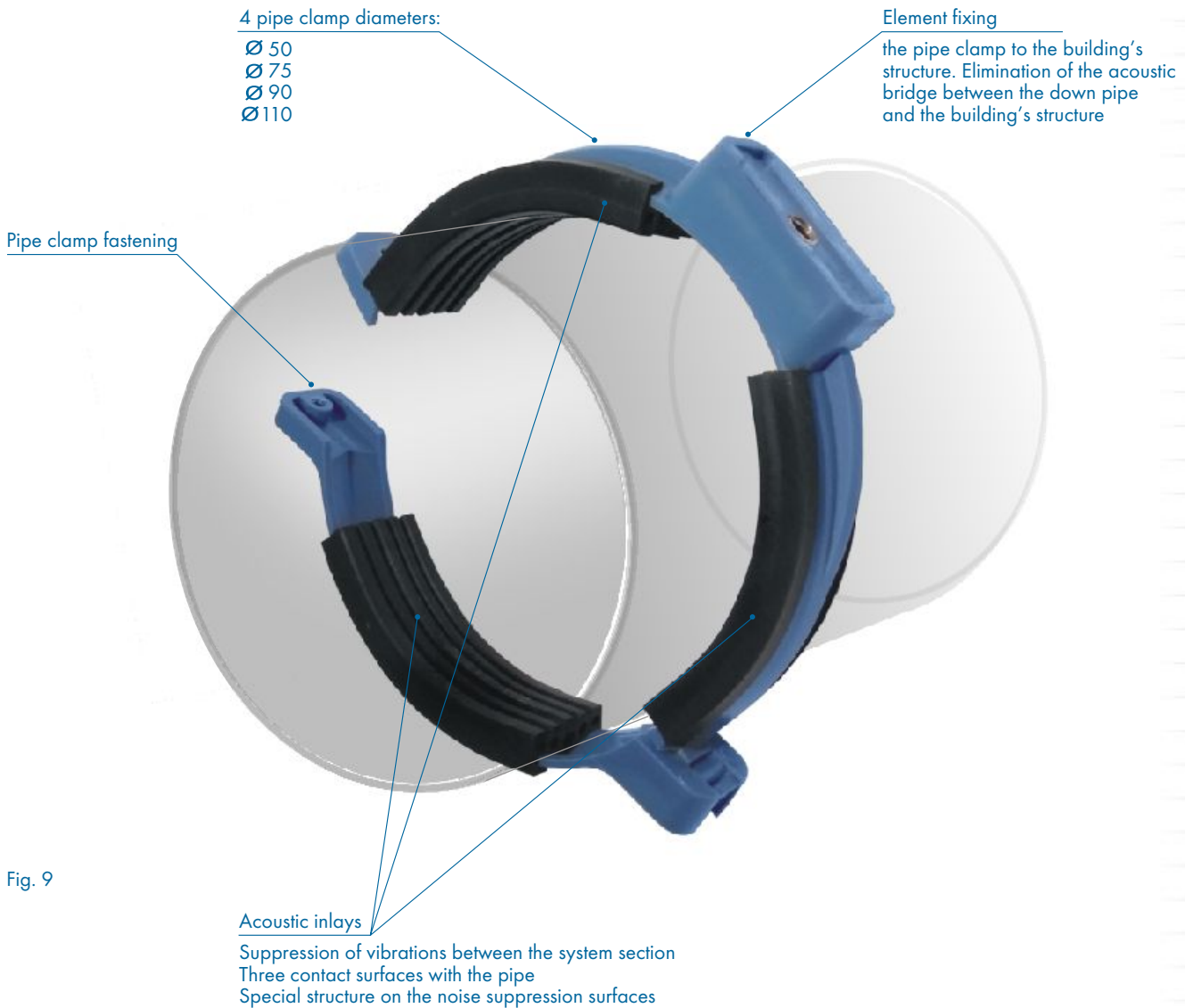
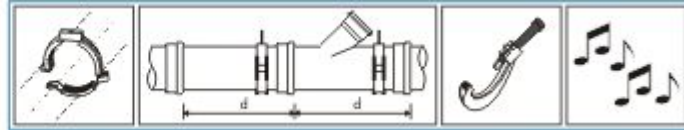


Fig. 9

NOTE: POLlclamp acoustic pipe clamps were used together with POLlphon pipes and fittings during the test procedure of noise reduction inside the pipe line, conducted at the Fraunhofer Institute for Building Physics in Stuttgart, Germany. The use of a different type of pipe clamps for the installation of the POLlphon system will result in change to the certified noise reduction values.



NOISE IN OUR EVERYDAY SURROUNDING

With regard to the previously presented solutions used while developing the POLlphon system, it is worth comparing the POLlphon system's noise reduction and acoustic vibration suppression properties to everyday noise around us. Subject to the test procedure on the level of noise reduction, conducted at Fraunhofer Institute in Germany, according to EN 14366 (the procedure and results are given in Section: Noise level measurement - POLlphon soundproof system, page 11), the POLlphon system showed the emitted noise level of only 20 dB. The diagram below refers the value of 20 dB to the noise present in our everyday surrounding.

Norms the diagram also indicates individual noise levels and their effect on human health.

EVERYDAY NOISE

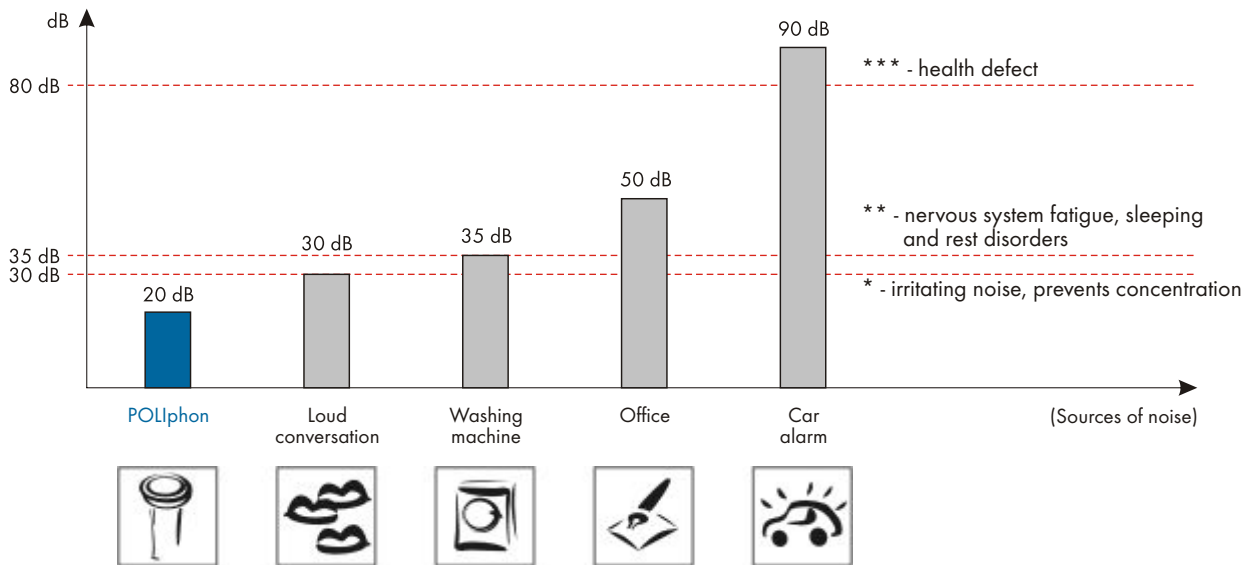
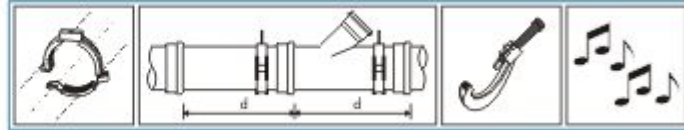


Fig. 10

An organ of hearing like the human ear is made to receive not only very silent noise but also to withstand very loud sounds. As the diagram shows, the difference between the level of noise emitted by the POLlphon system and a loud conversation is 10 dB. The minimum noise level detected by the human ear is 3 dB.

This means that an increase in the noise level by 10 dB makes a significant and noticeable difference for the ear; the difference later turns into irritating noise. While determining acceptable indoor noise norms for the construction industry it is assumed that the minimum noise reduction that can improve room acoustics and human ear perception is 5 dB.

Therefore, the acceptable noise norms for the construction industry described in the next section differ by 5 dB in each room.



**ACOUSTIC SAFETY OF ROOMS
ACCEPTABLE NOISE LEVELS**

The acceptable noise level that a human being can be exposed to while performing everyday activities and relaxing is described as „the threshold noise level value”.

According to the valid regulations, there are two categories of noise tests:

Category I - noise measured outdoors, i.e. in the neighbouring area, surroundings and open space. According to European Directive No. 2002/49/EC, generally speaking, the noise acceptable in a built-up area at daytime is 60 dB and at night (between 6.00 am and 10.00 pm), 50 dB.

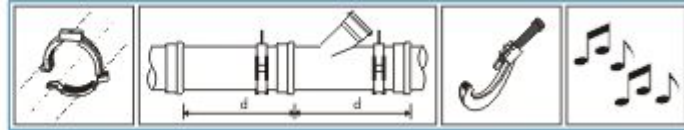
Category II - noise measured indoors. „Building acoustics. Protection of rooms inside buildings against noise. Acceptable indoor sound level values”.

The table below presents several examples of the acceptable sound level in rooms designed for everyday stay.

An acceptable „A” sound level in rooms designed for everyday stay.

Kind of room	Acceptable average level of sound-noise reaching the place from the building’s technical equipment and other equipment inside and outside of the building	
	day	night
Rooms designed for mental activities that require intense concentration	30 dB	-
Rooms in 3-star or below 3-star hotels	40 dB	30 dB
Accommodation in residential buildings, boarding schools, children’s homes, old people’s homes, 4 and more star hotels	35 dB	25 dB
Rooms in Intensive Medical Care Units	25 dB	25 dB
Patient’s rooms in hospitals and sanatoriums except rooms in Intensive Care Units	30 dB	25 dB
Kitchens and sanitary rooms in flats	40 dB	40 dB

The values presented in the table are show in the diagram (Page 10) in reference to the POLlphon system acoustic properties.



Acoustic properties of the POLlphon system versus the regulations

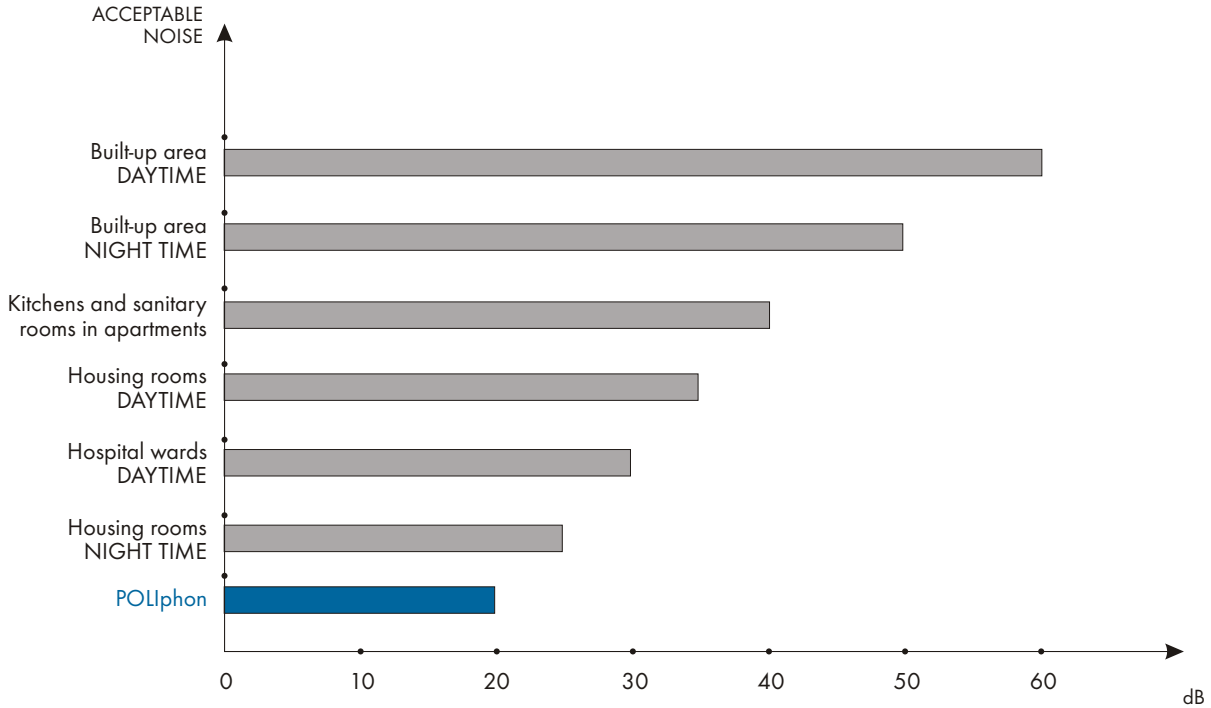
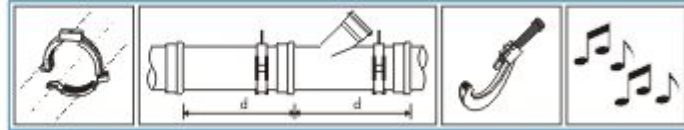


Fig. 11

Acceptable noise	dB
POLlphon	20
Housing rooms - NIGHT TIME	25
Hospital wards - DAYTIME	30
Housing rooms - DAYTIME	35
Kitchens and sanitary rooms in apartments	40
Built-up area - NIGHT TIME	50
Built-up area - DAYTIME	60

Regarding mandatory requirements and the fact that the European Commission is working on tightening the national norms, it is worth considering at the design stage a soundproof system with a high degree of noise reduction inside the pipe line.



NOISE LEVEL MEASUREMENT - POLlphon SOUNDPROOF SYSTEM - FRAUNHOFER TEST

Test and measurements of noise emitted by the soundproof POLlphon system were conducted according to the European norm EN 4366 „Laboratory measurement of noise from waste water installations.

Noise measurement - the diagram below presents noise measurement and its methodology inside the POLlphon system. The test stand, diameters and types of components used are described in the norm and by the measurement stand. Water introduced into the system on the TF(f) floor and received on the C floor was the tested medium.

Acoustic tests are conducted in rooms MR(b) and MR(f) and the least favourable boundary conditions are assumed in the comparative analysis with other waste and soil systems or other sources of noise. The boundary conditions are as follows:

- measured flow in the waste and soil system $Q=4$ l/s (maximum, most frequent flow)
- pipe-line diameter DN=110 mm (maximum, most frequent diameter)
- measurement taken on the lowest floor, in room MR(b) - room marked red in the diagram; safety norms determine and require the lowest noise levels at this point (room neighbouring with the pipelines)
- assembly wall - plastered, silicate brick, weight: 220 kg/m² (the lightest kind of assembly wall onto which waste and soil systems can be fixed indoors)

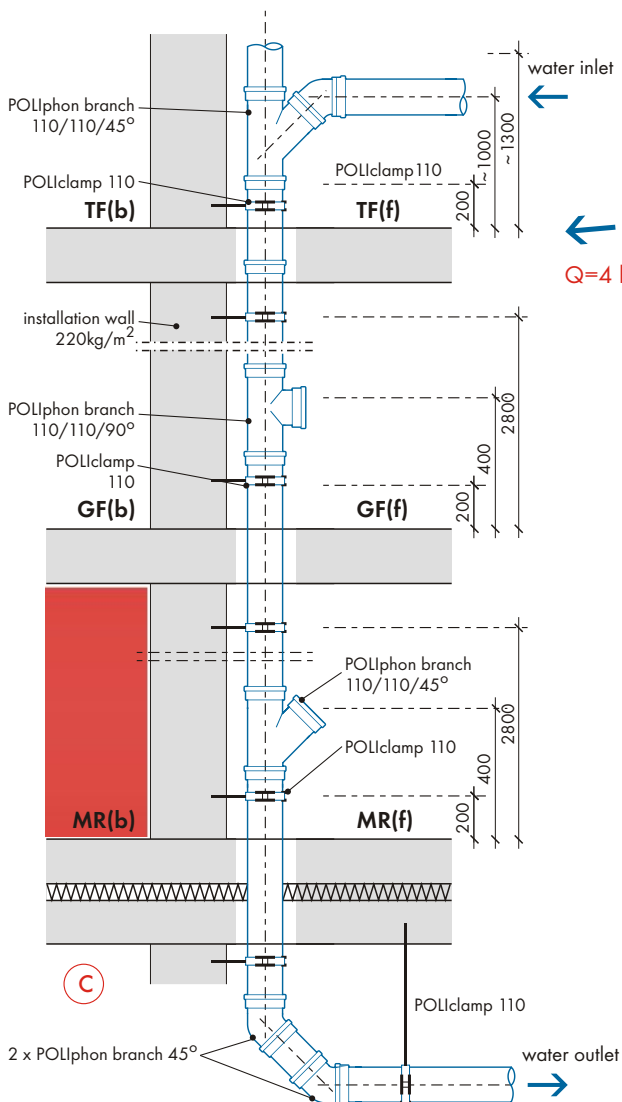


Fig. 12

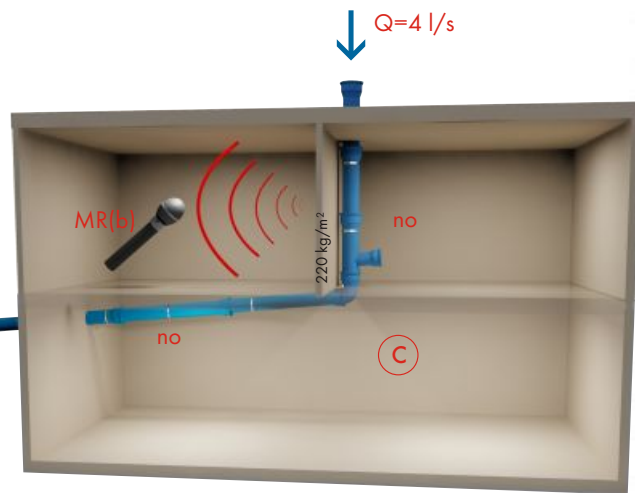
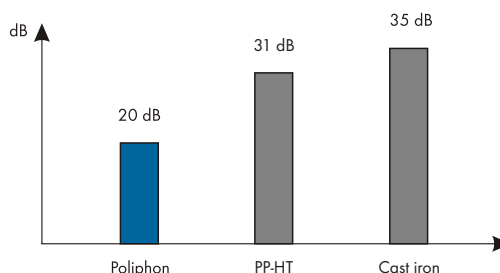


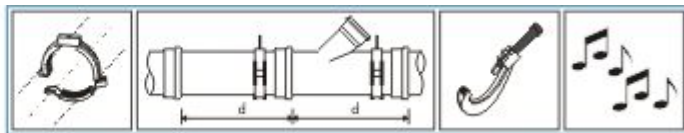
Fig. 13

MARKING:
 TF - top floor
 GF - ground floor
 MR - measurement room
 f - front
 b - back

The diagram below summarises and visualises noise measurement for the POLlphon system conducted under the least favourable boundary conditions.

The diagram compares the maximum noise level measured under identical measurement conditions on three different waste and soil systems, made of different material (but frequently used for the production of waste and soil systems).





POLiPhon SYSTEM - APPLICATION AREA

POLiPhon - safe and silent sanitary waste water collection and transport.

BATHROOMS

- washing accessories
- personal hygiene accessories
- toilets
- public baths

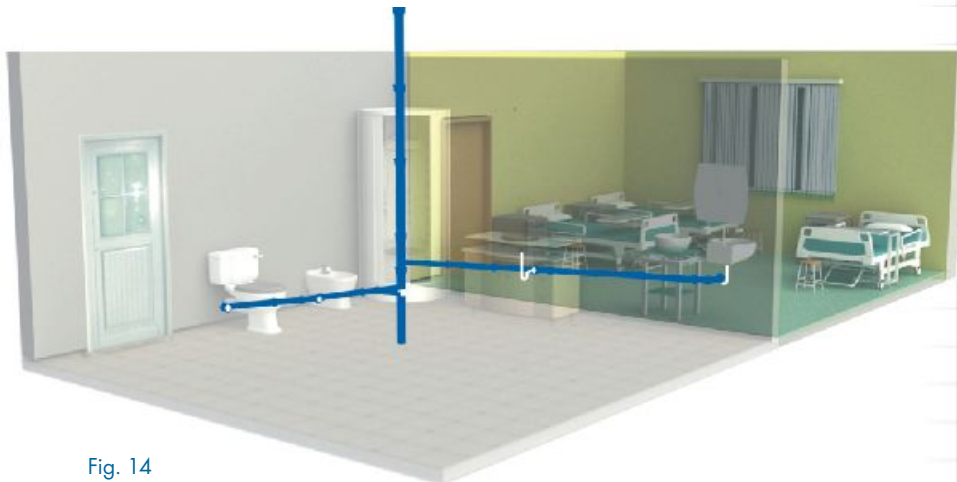


Fig. 14

KITCHENS

- places where food is prepared
- equipment meant for food preparation
- washing-up devices
- high temperature +90°C [+ 95°C]

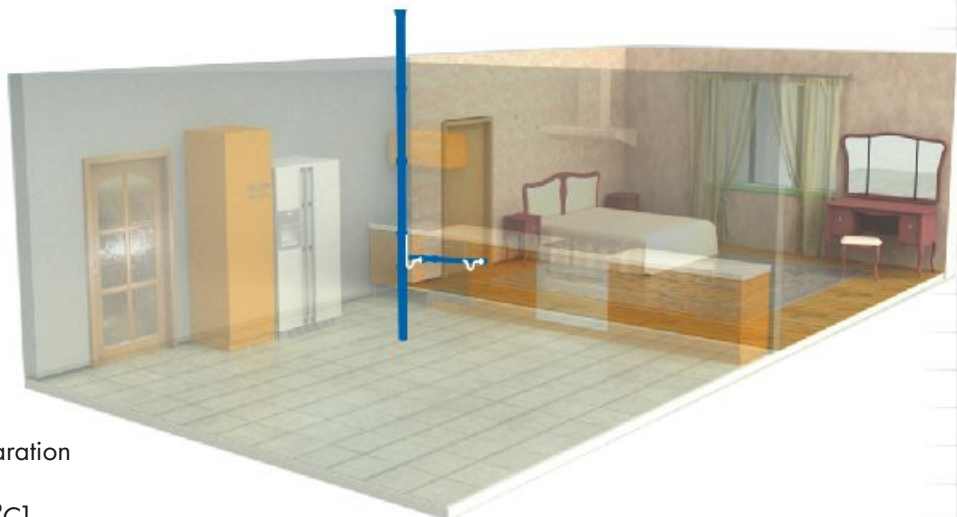


Fig. 15

OTHER

- washing equipment
- cleaning equipment
- rinsing equipment

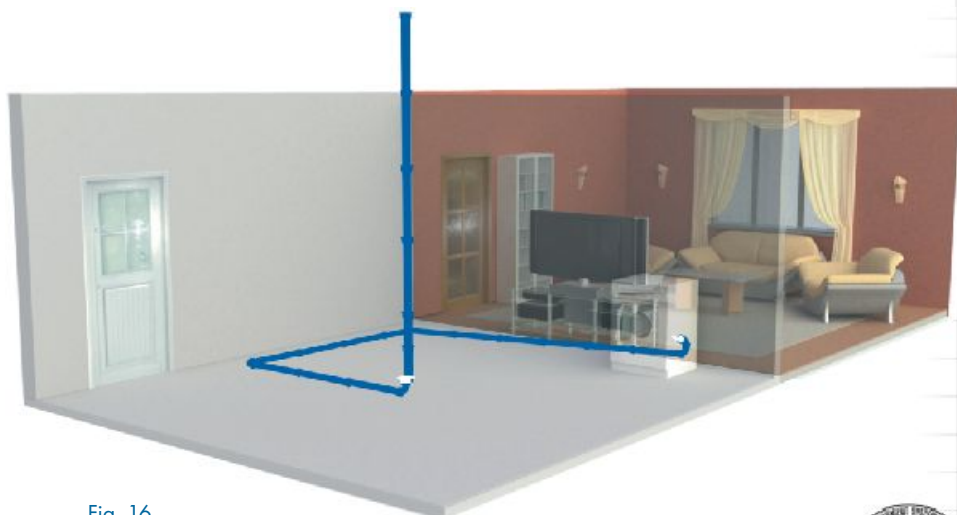
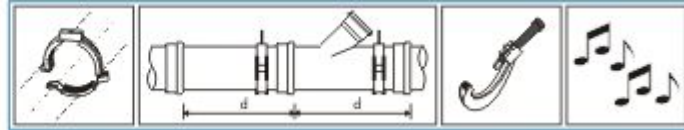


Fig. 16



APPROVALS



SKZ 71858/06

Initial type tests on multilayer pipes made of PP/PP-mineral filled/PP and fittings made of PP-mineral filled for soil and waste discharge, application are „B“ and „BD“ inside buildings and buried in ground within the building structure



P-BA 160/2006e

Determination of the acoustic performance of a waste water installation system consisting of „POLlphon“ plastic pipes mounted with pipe clamps „POLlclamp“ in the laboratory

**DEUTSCHES INSTITUT
FÜR BAUTECHNIK**



Z-42. 1-399

POLlphon - three-layer pipes and fittings made of PP-mineral filled for diameters: from DN 40 to DN 160



AT / 2006-02-1604

POLlphon pipes and fittings made of polypropylene (PP) for soundproof soil and waste system



SCB 0973

POLlphon soundproof soil and waste system for diameters: from 40 mm to 160 mm



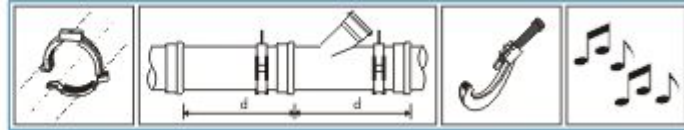
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POLlphon soundproof soil and waste system for diameters: from 40 mm to 160 mm



C 07 0188 V/AO

POLlphon soundproof soil and waste system for diameters: from 40 mm to 160 mm



STANDARDS

Being a safe, fast and high soundproof waste and soil pipe system, POLlphon meets a number of quality and safety standards.

EN 1451

„Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure. Polypropylene (PP). Specifications for pipes, fittings and the system“.

EN 1411

„Plastics piping and ducting systems. Thermoplastics pipes. Determination of resistance to external blows by the staircase method“.

EN 14366

„Laboratory measurement of noise from waste water installations“.

EN 13501

„Fire classification of construction products and building elements“.

DIN 4102

„Fire behaviour of building materials and buiding components“.

EN 1055

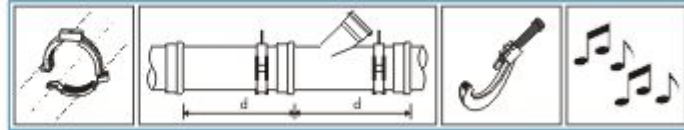
„Plastics piping systems. Thermoplastics piping systems for soil and waste discharge inside buildings. Test method for resistance to elevated temperature cycling“.

EN 1054

„Plastics piping systems. Thermoplastics piping systems for soil and waste discharge. Test method for airtightness of joints“.

EN 681

„Elastomeric seals. Material requirements for pipe joint seals used in water and drainage applications“.



DESIGN GUIDELINES.
SOUNDPROOF POLlphon SYSTEM - PREPARATION AND INSTALLATION

1. Barrier passage and pipe clamp distribution

The distribution of pipe clamps is a crucial factor that has to be taken into consideration while designing and installing the system. The distances are given in the diagram. Additionally, detail „A“ presents the right way of passing a soundproof duct through a construction barrier. Each passage should be secured with a sleeve made of material that prevents moisture and ensures acoustic insulation (preventing acoustic bridges with the building's construction elements - ceilings, walls).

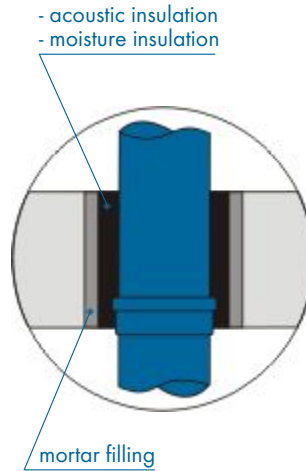


Fig. 18
Detail „A“

2. Clamps

In order to maintain good acoustic properties, the POLlphon system should be installed together with specially designed acoustic pipe clamps. Acoustic pipe clamps for the POLlphon system are produced in two versions, depending on the down pipe diameter.

POLlclamp a special structure of the pipe clamp (section: „POLlclamp - Structure of the acoustic pipe clamp“, page 7). Used for diameters Ø50, Ø75, Ø90 and Ø110, meant for laying connecting points and down pipes to the diameter Ø110.



Fig. 19

POLlphon steel pipe clamp is meant for the diameters of Ø125 and Ø160 due to the high weight of the pipe and fittings, used in down pipes and main connections from buildings to sanitary collectors.

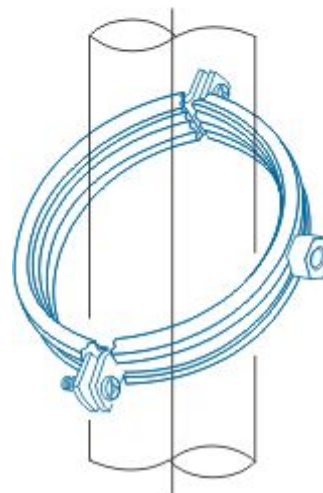


Fig. 20

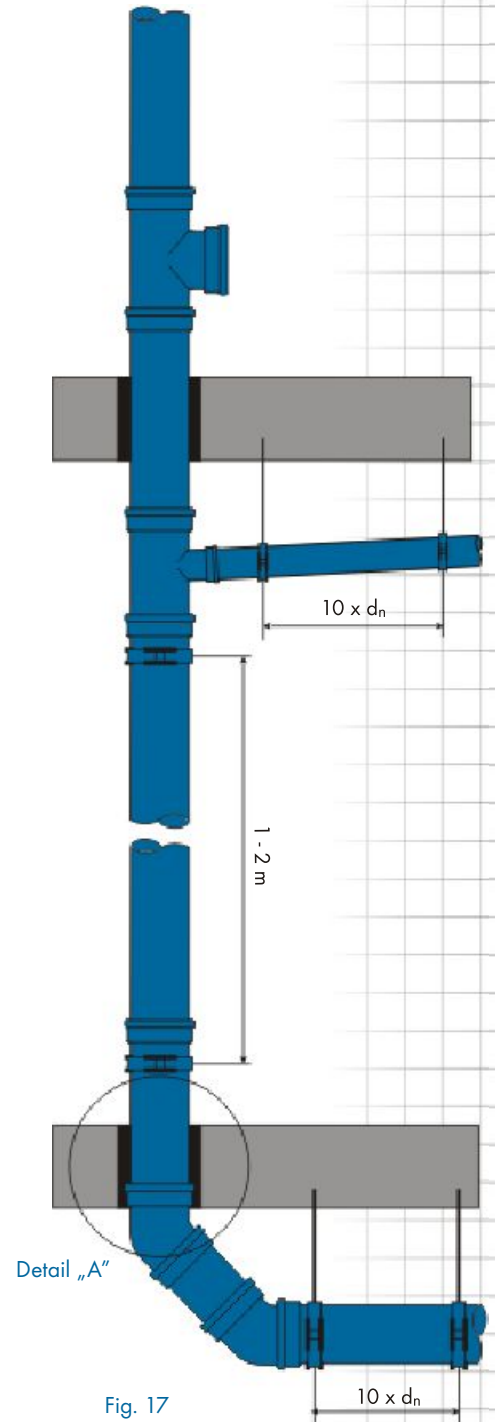
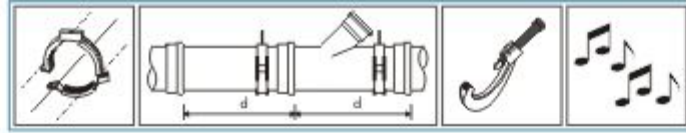


Fig. 17



3. Laying connections inside buildings

Connection sections of outdoor waste water collectors within the diameter range $\varnothing 110$, $\varnothing 125$ and $\varnothing 160$ are fixed to ceilings (most often in a garage or cellar) and should be made with acoustic, steel pipe clamps with a rubber inlay using M-8/M-10 screws. In this case, pipe clamp spacing, as on the other floors of the building, is $10 \times d$.



Photo 5

4. Stabilising sections

A „short“ stabilising section.

In the case of down pipes up to 10 m high, a change of direction from the down pipe to a horizontal connection should be made with $2 \times 45^\circ$ bend connections and one pipe section $L < 240$ mm of a given diameter.

A „long“ stabilising section.

In the case of down pipes over 10 m high, the length of the section between bend connections should be $L = 240$ mm.

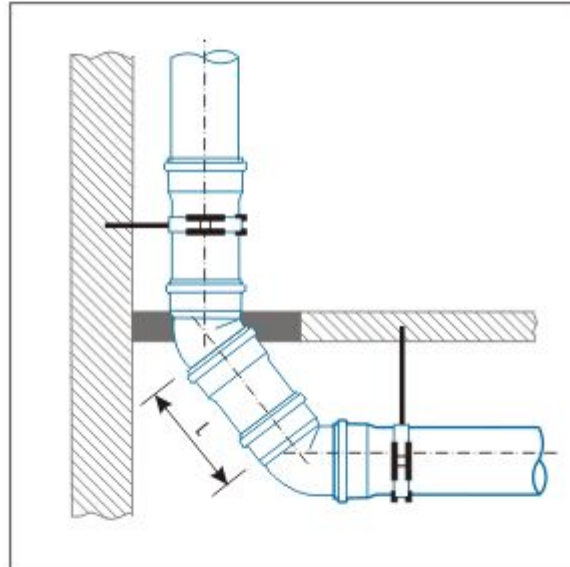


Fig. 21

5. Offset pipe

In buildings over seven floors high (assuming a standard floor height of $h = 2.58$ m, including the ceiling), every 7-8 floors, starting with the highest point of the down pipe, in order to impede the energy of waste water with additives coming down at great speed, offset pipes should be installed. A sample configuration for the given diameter is shown in the adjacent picture.

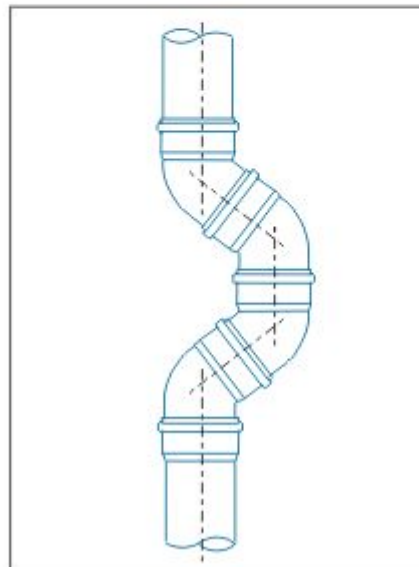
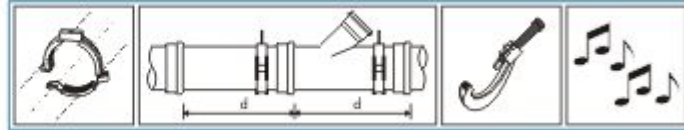


Fig. 22



6. Horizontal change of the flowing waste water direction

Ensure that 45° fittings (instead of 90°) are used for laying the pipeline while changing the direction of waste water flow by 90°. Such a small change in the flow direction causes some loss in the energy of the flowing waste water, making the acoustic properties of the system more efficient.

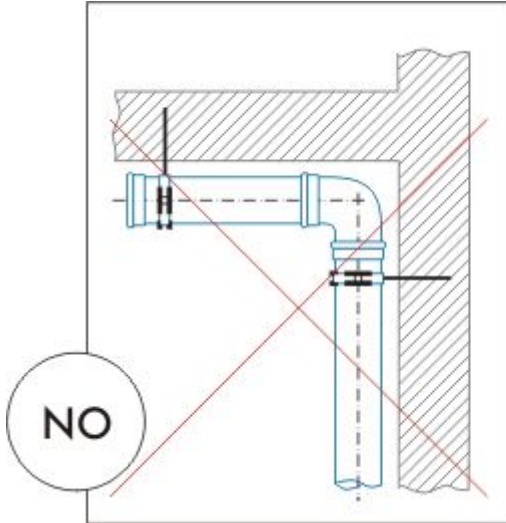


Fig. 23

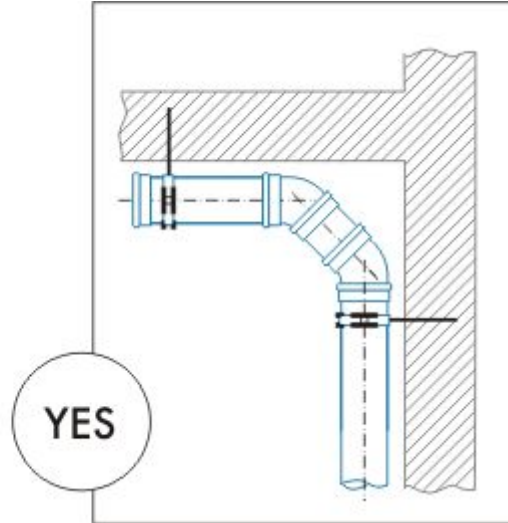


Fig. 24

7. Full dimensional standardisation

With a view to facilitating installation works and connecting the POLlphon system to other waste and soil systems as well as connecting those systems to the POLlphon waste and soil system, full dimensional standardisation of the system was maintained, according to EN 1451. This means that POLlphon connections of all diameters can be made without any need to use adapting connectors for non-standard diameters.

Basic examples of connections are presented below.

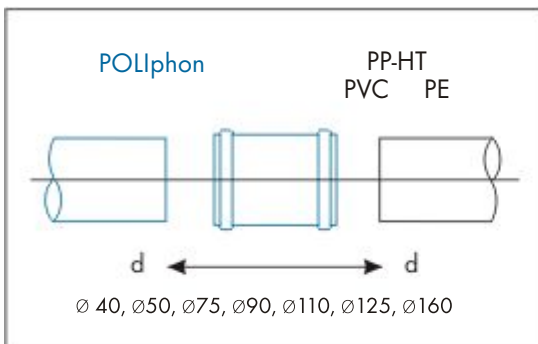


Fig. 25

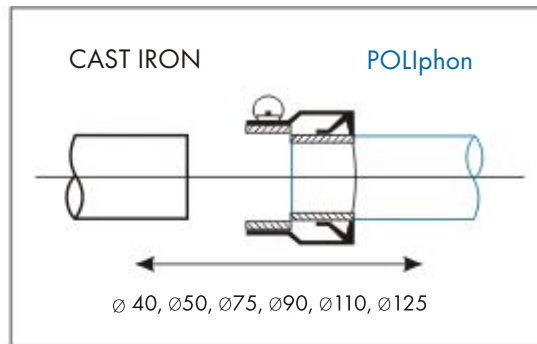


Fig. 26

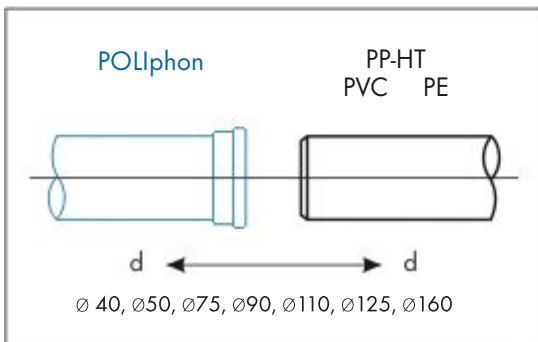


Fig. 27

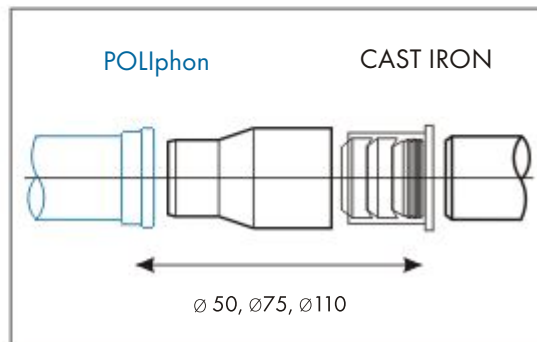
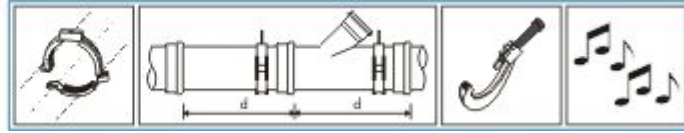


Fig. 28



CUTTING PIPES AND MAKING CONNECTIONS

Prior to cutting the pipe and mounting it to another pipe or fitting, measure the necessary pipe section remembering that the pipe socket is not included in the measurement as it is a connecting element.



Photo 6



Photo 7

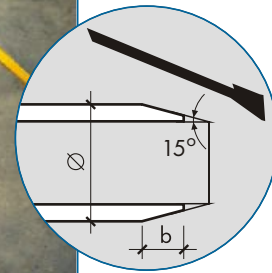
Cut the pipe on a special device using a cutter (Photo 6) or a mitre box and a fine-toothed saw (Photo 7), with particular attention to keeping the angle 90°C.



Photo 8



Photo 9



Another important factor prior to making the connection is to bevel the pipe end properly, using widely available specialist tools (Photo 8 and 9). Beveling length and angle are given in Table.

Ø	40	50	75	90	110	125	160	[mm]
b	3,0	3,5	3,5	4,5	4,5	5,0	6,0	[mm]

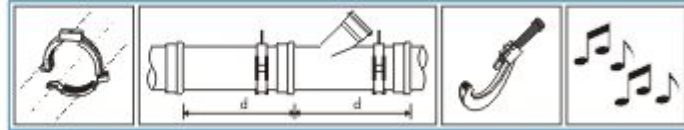


Photo 10



Photo 11

While connecting the pipe with a fitting or the socket of another pipe, press the connected pipe to a stop in the socket or coupling (Photo 10) and mark a line on the edge of the socket and the connected pipe (Photo 11).



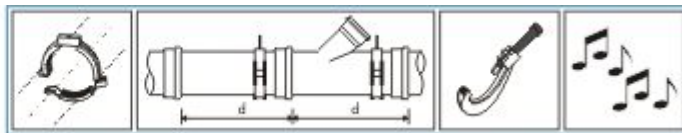
Photo 12



Photo 13

In order to prevent linear lengthening or shrinking of the pipe sections, which result from temperature change, pull 10 mm of the pipe (Photo 12) out of the socket. Install the prepared section or connection to the wall, on the previously mounted pipe clamps.

NOTE! Prior to making socket connections, lubricate the pipe end and the gasket in the socket to facilitate inserting the spigot into the socket.



POLlphon SYSTEM INSTALLATION AND INSTRUCTIONS FOR USE



Photo 14



Photo 15

Using a level (Photo 14), determine the run of the POLlphon down pipe.
On the run line, measure the points (Photo 15) where the pipe clamps will be fixed and horizontal connections to the sanitary fittings made.

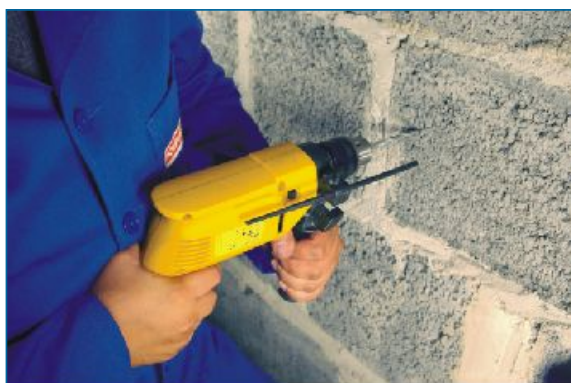


Photo 16



Photo 17

Next, drill holes with a diameter dependent on the diameter (Photo 16) of the pipe line. Fix a rawlbolt into the wall and mount the pipe clamp by screwing it clockwise inside the wall. Tightening the pipe clamp makes the screw lock inside the rawlbolt and simultaneously the pipe clamp is tightened until a stop on the two-thread screw (Photo 17).

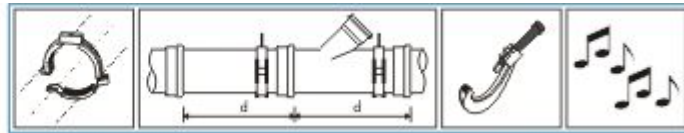


Photo 18



Photo 19

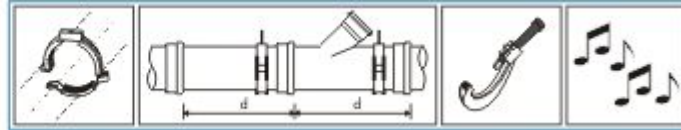
In the final stage, put the pipe or fitting inside the pipe clamp (Photo 19) and connect the two parts of an open the pipe clamp with a drill-driver (Photo 20).



Photo 20



Photo 21



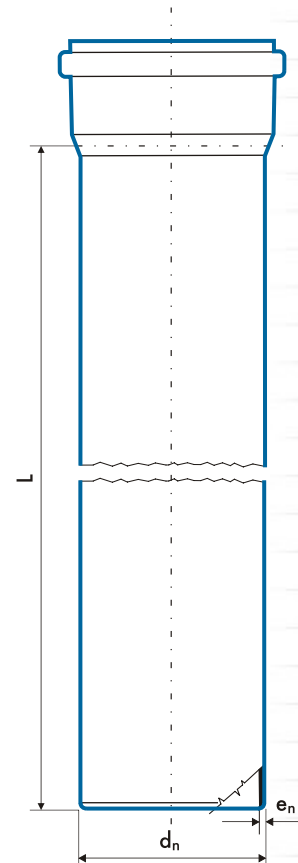
POLiPhon TECHNICAL CATALOGUE

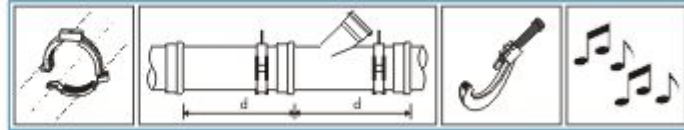
Soundproof Pipe System

POLiPhon pipe with socket

PPA

d_n [mm]	e_n [mm]	L [mm]	Ref.	Pack	Pack type
40	1,8	150	PPA-040-018-015	30	PH5
40	1,8	250	PPA-040-018-025	20	PH5
40	1,8	315	PPA-040-018-031	38	PH4
40	1,8	500	PPA-040-018-050	50	PH3
40	1,8	1000	PPA-040-018-100	10	PLT
40	1,8	1500	PPA-040-018-150	10	PLT
40	1,8	2000	PPA-040-018-200	10	PLT
40	1,8	3000	PPA-040-018-300	10	PLT
50	1,8	150	PPA-050-018-015	20	PH5
50	1,8	250	PPA-050-018-025	30	PH4
50	1,8	315	PPA-050-018-031	25	PH4
50	1,8	500	PPA-050-018-050	35	PH3
50	1,8	1000	PPA-050-018-100	10	PLT
50	1,8	1500	PPA-050-018-150	10	PLT
50	1,8	2000	PPA-050-018-200	10	PLT
50	1,8	3000	PPA-050-018-300	10	PLT
75	2,3	150	PPA-075-023-015	20	PH4
75	2,3	250	PPA-075-023-025	25	PH3
75	2,3	315	PPA-075-023-031	24	PH3
75	2,3	500	PPA-075-023-050	15	PH3
75	2,3	1000	PPA-075-023-100	10	PLT
75	2,3	1500	PPA-075-023-150	10	PLT
75	2,3	2000	PPA-075-023-200	10	PLT
75	2,3	3000	PPA-075-023-300	10	PLT
90	2,8	150	PPA-090-028-015	12	PH4
90	2,8	250	PPA-090-028-025	18	PH3
90	2,8	315	PPA-090-028-031	10	PH4
90	2,8	500	PPA-090-028-050	12	PH3
90	2,8	1000	PPA-090-028-100	10	PLT
90	2,8	1500	PPA-090-028-150	10	PLT
90	2,8	2000	PPA-090-028-200	10	PLT
90	2,8	3000	PPA-090-028-300	10	PLT
110	3,4	150	PPA-110-034-015	15	PH3
110	3,4	250	PPA-110-034-025	10	PH3
110	3,4	315	PPA-110-034-031	10	PH3
110	3,4	500	PPA-110-034-050	6	PH3
110	3,4	1000	PPA-110-034-100	10	PLT
110	3,4	1500	PPA-110-034-150	10	PLT
110	3,4	2000	PPA-110-034-200	10	PLT
110	3,4	3000	PPA-110-034-300	10	PLT
125	3,9	150	PPA-125-039-015	10	PH3
125	3,9	250	PPA-125-039-025	10	PH3
125	3,9	315	PPA-125-039-031	8	PH3
125	3,9	500	PPA-125-039-050	6	PH3
125	3,9	1000	PPA-125-039-100	45	PLT
125	3,9	1500	PPA-125-039-150	45	PLT
125	3,9	2000	PPA-125-039-200	45	PLT
125	3,9	3000	PPA-125-039-300	45	PLT
160	4,9	150	PPA-160-049-015	6	PH3
160	4,9	250	PPA-160-049-025	4	PH3
160	4,9	315	PPA-160-049-031	4	PH3
160	4,9	500	PPA-160-049-050	28	PH3
160	4,9	1000	PPA-160-049-100	28	PLT
160	4,9	1500	PPA-160-049-150	28	PLT
160	4,9	2000	PPA-160-049-200	28	PLT
160	4,9	3000	PPA-160-049-300	28	PLT

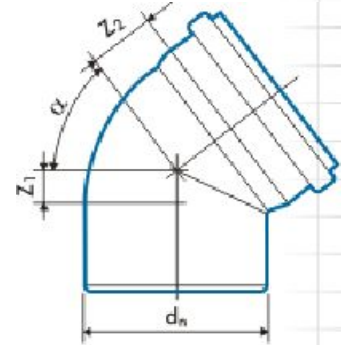




POLlphon TECHNICAL CATALOGUE

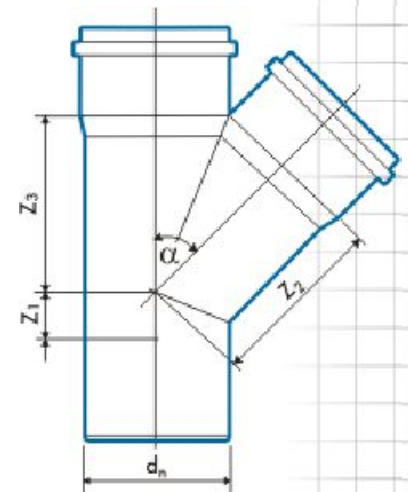
POLlphon bend
PKL

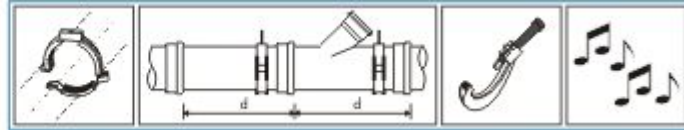
α°	d_n [mm]	Z_1 [mm]	Z_2 [mm]	Ref.	Pack	Pack type
15°	40	4	7	PKL-040-000-015	20	PH7
	50	5	9	PKL-050-000-015	20	PH5
	75	7	10	PKL-075-000-015	20	PH4
	90	7	13	PKL-090-000-015	20	PH4
	110	9	14	PKL-110-000-015	8	PH4
30°	40	7	10	PKL-040-000-030	20	PH7
	50	9	12	PKL-050-000-030	20	PH5
	75	12	15	PKL-075-000-030	20	PH4
	90	14	19	PKL-090-000-030	18	PH4
	110	17	22	PKL-110-000-030	8	PH4
45°	40	10	14	PKL-040-000-045	20	PH7
	50	12	16	PKL-050-000-045	20	PH5
	75	18	21	PKL-075-000-045	20	PH4
	90	21	27	PKL-090-000-045	18	PH4
	110	25	29	PKL-110-000-045	14	PH3
	125	28	33	PKL-125-000-045	14	PH3
67,5°	40	-	-	PKL-040-000-067	20	PH7
	50	20	23	PKL-050-000-067	20	PH5
	75	28	31	PKL-075-000-067	20	PH4
	90	34	40	PKL-090-000-067	15	PH4
	110	40	44	PKL-110-000-067	14	PH3
87,5°	40	23	26	PKL-040-000-090	20	PH7
	50	28	31	PKL-050-000-090	20	PH5
	75	40	43	PKL-075-000-090	20	PH4
	90	48	50	PKL-090-000-090	15	PH4
	110	57	61	PKL-110-000-090	14	PH3
	125	65	70	PKL-125-000-090	10	PH3
160	83	89	PKL-160-000-090	4	PH3	



POLlphon branch
PTR

α°	d_n [mm]	Z_1 [mm]	Z_2 [mm]	Z_3 [mm]	Ref.	Pack	Pack type
45°	40/40	10	49	49	PTR-040-040-045	20	PH5
	50/50	12	61	61	PTR-050-050-045	20	PH4
	75/50	-	79	74	PTR-075-050-045	10	PH4
	75/75	18	91	91	PTR-075-075-045	10	PH4
	90/50	10	94	84	PTR-090-050-045	8	PH4
	90/75	-	-	-	PTR-090-075-045	1*	-
	90/90	18	112	112	PTR-090-090-045	8	PH4
	110/50	-	104	91	PTR-110-050-045	6	PH4
	110/75	1	118	109	PTR-110-075-045	8	PH3
	110/110	25	134	134	PTR-110-110-045	7	PH3
	125/110	12	160	160	PTR-125-110-045	6	PH3
	125/125	28	152	152	PTR-125-125-045	5	PH3
67,5°	160/110	1	179	173	PTR-160-110-045	3	PH3
	160/160	22	210	210	PTR-160-160-045	2	PH3
	40/40	16	33	33	PTR-040-040-067	20	PH5
	50/50	12	61	61	PTR-050-050-067	20	PH4
	75/50	14	54	46	PTR-075-050-067	10	PH4
	90/50	-	-	-	PTR-090-050-067	1*	-
87,5°	90/75	-	-	-	PTR-090-075-067	1*	-
	110/50	8	73	54	PTR-110-050-067	8	PH4
	110/110	40	86	86	PTR-110-110-067	8	PH3
	40/40	23	25	25	PTR-040-040-090	20	PH5
	50/50	28	30	30	PTR-050-050-090	20	PH4
	75/50	27	43	31	PTR-075-050-090	10	PH4
87,5°	75/75	40	43	43	PTR-075-075-090	10	PH4
	90/75	-	-	-	PTR-090-075-090	1*	-
	110/50	28	60	32	PTR-110-050-090	6	PH4
	110/75	40	60	45	PTR-110-075-090	8	PH3
	110/110	57	62	62	PTR-110-110-090	7	PH3
	125/110	58	70	71	PTR-125-110-090	7	PH3
	125/125	65	75	70	PTR-125-125-090	6	PH3
	160/110	58	92	64	PTR-160-110-090	5	PH3
	160/160	83	92	92	PTR-160-160-090	3	PH3



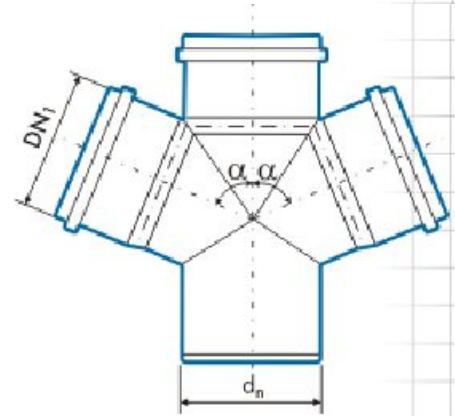


POLlphon TECHNICAL CATALOGUE

POLlphon double branch
PCR

α°	d_n [mm]	DN_1 [mm]	Ref.	Pack	Pack type
45°	90	50	PCR-090-050-045	1*	-
	110	50	PCR-110-050-045	4	PH4
	110	110	PCR-110-110-045	4	PH3
67,5°	50	50	PCR-050-050-067	5	PH5
	110	50	PCR-110-050-067	5	PH4
	110	110	PCR-110-110-067	5	PH3
87,5°	110	75	PCR-110-075-090	1*	-

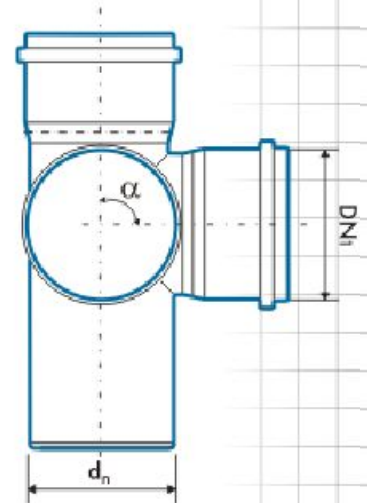
* - upon request



POLlphon double corner branch
PCN

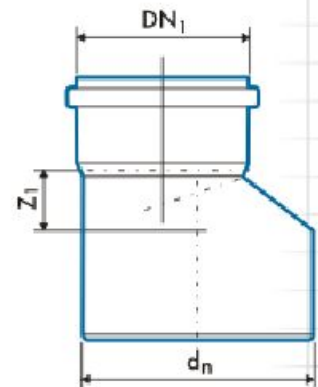
α°	d_n [mm]	DN_1 [mm]	Ref.	Pack	Pack type
67,5°	110	110	PCN-110-110-067	1	-
87,5°	110	75	PCN-110-075-090	1*	-

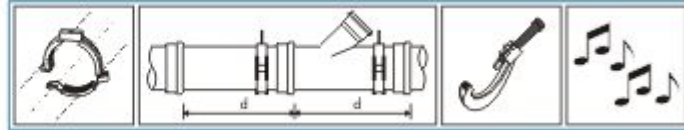
* - upon request



POLlphon asymmetric reducer
PRD

d_n/DN_1 [mm]	Z_1 [mm]	Ref.	Pack	Pack type
50/40	12	PRD-050-040-000	15	PH7
75/50	20	PRD-075-050-000	20	PH5
110/50	40	PRD-110-050-000	17	PH4
110/75	26	PRD-110-075-000	15	PH4
125/110	13	PRD-125-110-000	10	PH4
160/110	14	PRD-160-110-000	15	PH3
160/125	22	PRD-160-125-000	15	PH3

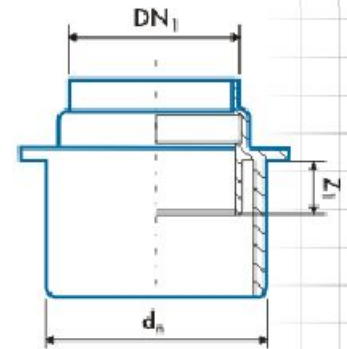




POLlphon TECHNICAL CATALOGUE

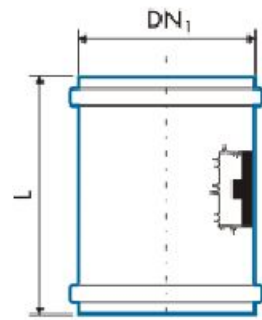
**POLlphon symmetric reducer
PRD**

d_n/DN_1 [mm]	Z_1 [mm]	Ref.	Pack	Pack type
90/50	34	PRD-090-050-000	24	PH5
110/90	30	PRD-110-090-000	14	PH5



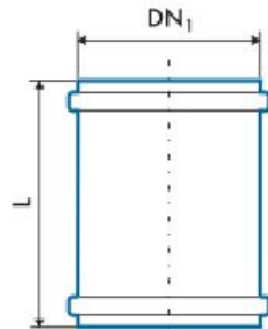
**POLlphon double socket
PMD**

DN_1 [mm]	L [mm]	Ref.	Pack	Pack type
40	125	PMD-040-000-000	20	PH5
50	105	PMD-050-000-000	20	PH5
75	144	PMD-075-000-000	20	PH4
90	120	PMD-090-000-000	20	PH4
110	128	PMD-110-000-000	6	PH5
125	166	PMD-125-000-000	8	PH4
160	179	PMD-160-000-000	6	PH3



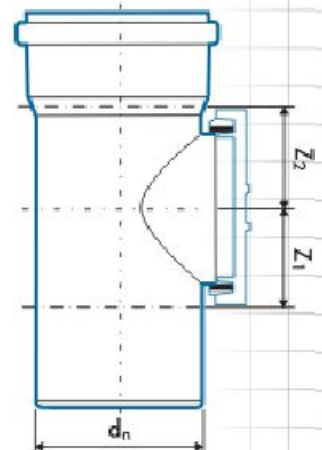
**POLlphon sleeve socket
PMP**

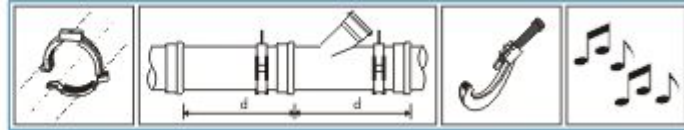
DN_1 [mm]	L [mm]	Ref.	Pack	Pack type
40	137	PMP-040-000-000	20	PH5
50	105	PMP-050-000-000	20	PH5
75	110	PMP-075-000-000	20	PH4
90	120	PMP-090-000-000	20	PH4
110	128	PMP-110-000-000	6	PH5
125	166	PMP-125-000-000	8	PH4
160	179	PMP-160-000-000	6	PH3



**POLlphon inspection pipe
PCZ**

d_n [mm]	Z_1 [mm]	Z_2 [mm]	Ref.	Pack	Pack type
50	28	30	PCZ-050-000-000	10	PH5
75	47	55	PCZ-075-000-000	10	PH4
110	58	62	PCZ-110-000-000	6	PH4
125	50	68	PCZ-125-000-000	8	PH3
160	49	68	PCZ-160-000-000	6	PH3

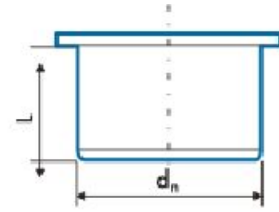




POLiphon TECHNICAL CATALOGUE

**POLiphon socket plug
PKK**

dn [mm]	L [mm]	Ref.	Pack	Pack type
40	39	PKK-040-000-000	20	PH7
50	39	PKK-050-000-000	20	PH7
75	39	PKK-075-000-000	20	PH5
110	46	PKK-110-000-000	20	PH4
125	41	PKK-125-000-000	16	PH5
160	48	PKK-160-000-000	10	PH4



**POLiclamp - pipe clamp
POB**

∅ [mm]	Ref.	Pack	Pack type
40	POB-040-000-000	10	FOL

**POLiclamp - pipe acoustic clamp
POB**

∅ [mm]	Ref.	Pack	Pack type
50	POB-050-000-000	10	FOL
75	POB-075-000-000	10	FOL
90	POB-090-000-000	5	FOL
110	POB-110-0M6-000	5	FOL
110	POB-110-0M8-000	5	FOL

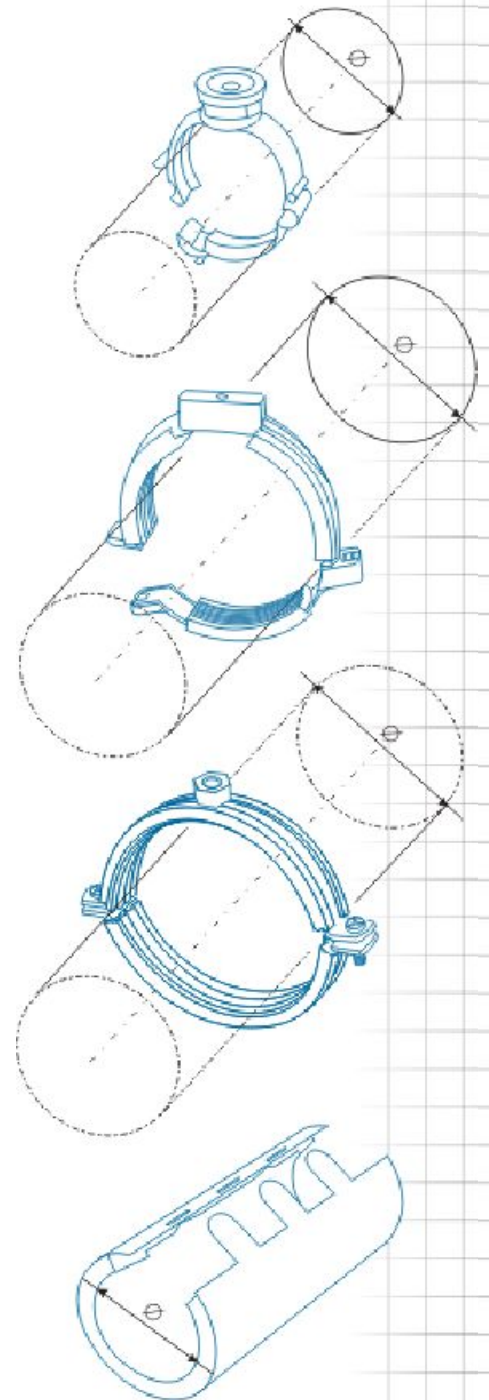
**POLiclamp - pipe acoustic metal clamp
POB**

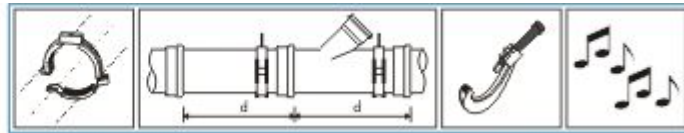
∅ [mm]	Ref.	Pack	Pack type
125	POB-125-000-000	1	-
160	POB-160-000-000	1	-

**PACIFYRE - fire protection collar
POG**

∅ [mm]	Ref.	Pack type
40	POG-040-000-000	1*
50	POG-050-000-000	1*
75	POG-075-000-000	1*
90	POG-090-000-000	1*
110	POG-110-000-000	1*
125	POG-125-000-000	1*
160	POG-160-000-000	1*

* - upon request





POLlphon SYSTEM IDENTIFICATION

POLlphon system marking contains data presented in order to provide a complete:



Photo 22. POLlphon pipe - in the course of marking

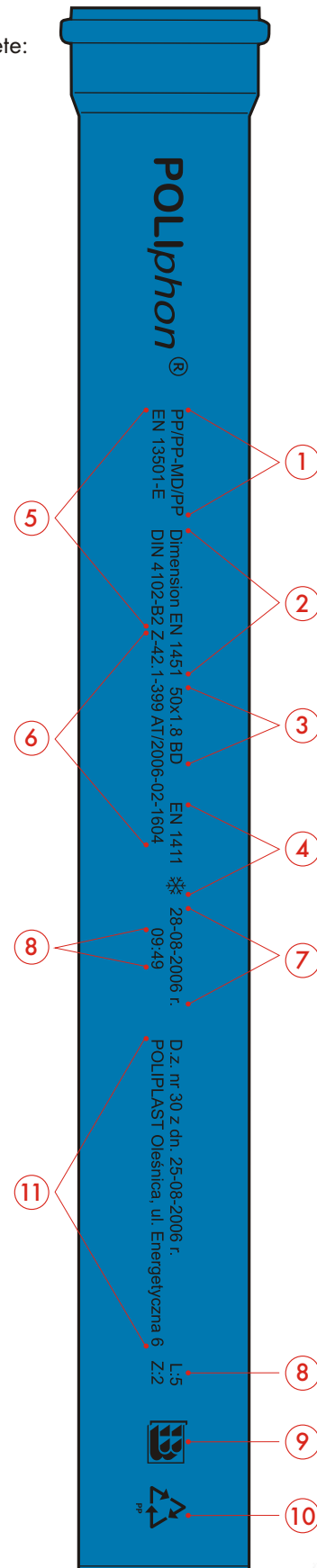
1. TECHNICAL IDENTIFICATION

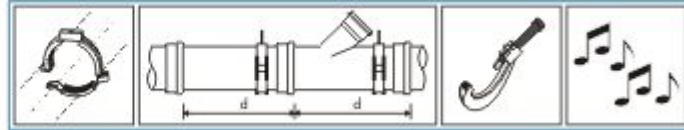
- ① material type
- ② conformity of dimensions
- ③ diameter / wall thickness / area of application
- ④ resistance to low temperatures
- ⑤ fire resistance class
- ⑥ information about the international technical approvals

2. PRODUCTION IDENTIFICATION

- ⑦ day / month / year of production
- ⑧ time / shift no. / production line no.
- ⑨ indication of the degree of safety when used in construction work
- ⑩ information on recycling
- ⑪ manufacturer's data

The identification presented above enables full control over the high quality of the POLlphon system, its storage, logistics and sales distribution.





PACKING, STORING AND TRANSPORTING POLlphon SYSTEM PIPES AND FITTINGS

In order to facilitate transport and storage, all the pipes and fittings (up to 0,5 m long) are packed in cardboard boxes.

Pipes longer than 0,5 m are packed in bundles on pallets. Further details concerning the type and size of cardboard boxes used for packing POLlphon items are given in the catalogue part.

POLlphon pipes and fittings must not be transported unpacked (in bulk) along with other construction materials to prevent their damage during transportation. The pipes must be transported in a horizontal position. During unloading they must be protected against damage, particularly at minus temperatures.

Never throw, drag or bend pipes and fittings when unloading them at stock and construction sites.

Collective packaging is fully adjusted to the use of air hosts and fork lifts.

Pipe sections should be stored horizontally on even surfaces up to 1,5 m high. All products should be protected against sunlight.

Their outdoor storage time should not exceed 12 months. Pipes and fittings should be stored separately, according to their diameter and length.



Photo 23



Fig. 29

Cardboard boxes are placed on a pallet up to 1200 mm high. The pallet is 800 mm wide and 1200 long.

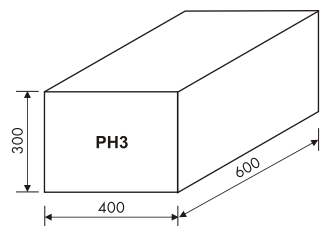
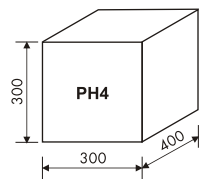
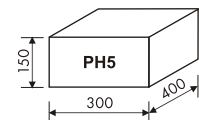
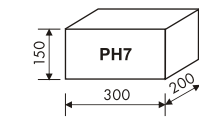
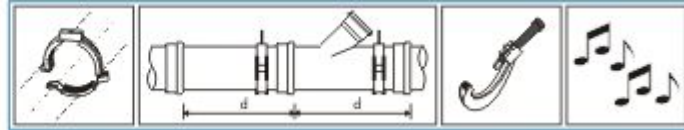


Fig. 30

Types of cardboard boxes used for packing elements of the POLlphon system.



**FIRE SAFETY OF BUILDINGS.
FIRE PROTECTION COLLARS / FIRE STOPS**

Fire safety of buildings.

The protection of buildings and individual rooms against fire is a crucial aspect at the design stage, carefully looked into in each case. When fire breaks out, it spreads very rapidly in each room and uses every possible means to spread to neighbouring rooms, in particular those situated above where the fire has started.

Each unsecured pipe is susceptible to the propagation of fire, gases generated as a result of the fire and burning condensates that can cause fire on lower floors. A proper selection of safe materials for pipes and fittings as well as installing fire protection collars with a suitable fire resistance class guarantees that the fire protection facilities will be accepted and the building will be safe to use.



Photo 24

Fire classification of construction products.

The norm EN 13501 „Fire classification of construction products and building elements“ provides guidelines of classification in reaction to fire for all construction products. Contrary to DIN 4102, the quoted norm, apart from the fire classification, also covers additional parameters such as „d“ and „s“, i.e.:

- „d“ - additional classification with regard to the presence of burning drops,
- „s“ - additional classification with regard to smoke emission.

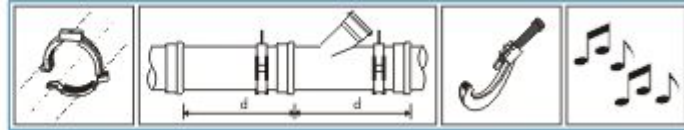
According to the abovementioned norm (EN 13501), the POLLphon system was classified as „E“, and according to DIN 4120 as „B-2“. Both norms describe the material used for the production of the POLLphon system as normally flammable/non-toxic (able to resist fire in a short time without much influence on the spread of fire).

Fire resistance of system passages.

The EN 1366-3:2006 norm describes requirements set for fire passages used to secure system passages through walls and construction barriers. Their main function is to efficiently block fire and smoke propagation through the pipe line.

PACIFYRE Fire Stop MK II P

It is recommended to use Pacifyre Fire Stops MK II P collars with the soundproof POLLphon waste and soil system. Their fire protection class is determined as E I 120 min. A fire resistance class (time in minutes) describes how long a fire barrier and a passage maintain their load capacity, fire tightness and insulation. It is the minimum time necessary to begin the rescue operation, evacuation and for the fire brigade to reach the place. It should also be noted that in the case of Pacifyre fire protection collars, one fire protection collar protects both sides of a barrier while securing a system passage through a wall instead of two fire protection collars or assemblies on both sides of the barrier.



How the PACIFYRE Fire Stop MK II P works

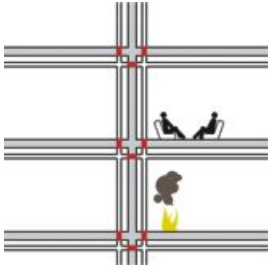


Fig. 31

Distribution of fire protection collars on pipe lines and the moment of fire initiation in a fire separated room.

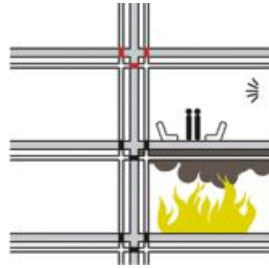


Fig. 32

The fire spreads very quickly and at 140°C makes the fire protection collar on the pipeline closed by expanding its lining. The alarm system is activated at the same moment.

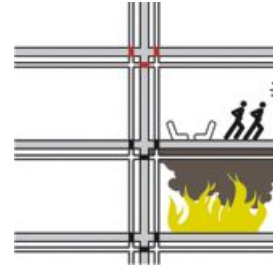


Fig. 33

The collar artificially blocks the spreading fire and smoke from the separated room (120 min.), which enables safe evacuation and gives time for the fire brigade to arrive.

The structure of the fire protection collar.

The Pacifyre fire protection collar consists of a body made of a stainless steel sleeve and counter-pressure element. The steel sleeve has three protective elements on one end and on the other one - three loops into which the catches fastening the ends and tightening the collar on the pipe are inserted. Inside the steel body there is a lining which expands at high temperatures and is responsible for the proper operation of the collar. Additionally, on the expanding layer, there are three elastic straps preventing smoke penetration and providing acoustic insulation.

Mounting PACIFYRE fire protection collars.

Examples of placing the pipe clamps in various installation situations.

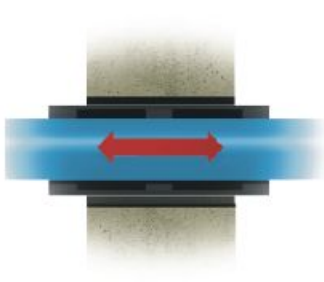


Photo 25



Photo 26



Photo 27

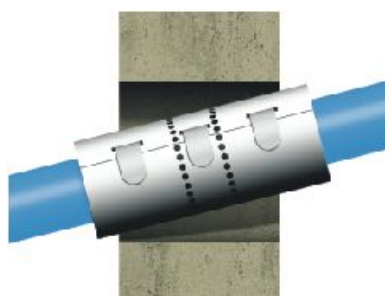
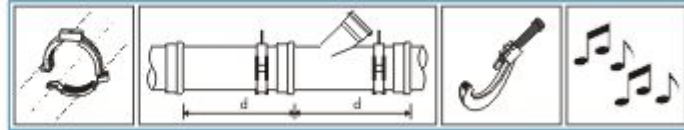


Photo 28



One PACIFYRE fire protection collar - instead of two traditional collars on both sides of a hole.

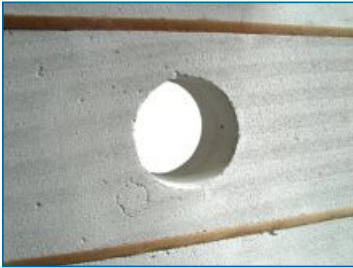


Photo 29



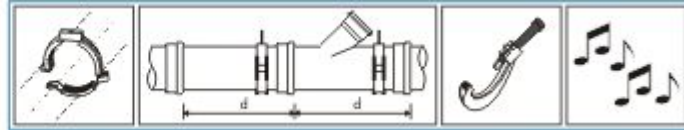
Photo 30



Photo 31

Table - Fire protection collar selection and minimum diameter of the hole in the wall.

No.	Index	Pipe diameter [mm]	Hole diameter [mm]
1.	POG-040-000-000	40	75
2.	POG-050-000-000	50	85
3.	POG-075-000-000	75	110
4.	POG-090-000-000	90	125
5.	POG-110-000-000	110	145
6.	POG-125-000-000	125	174
7.	POG-160-000-000	160	195



POLlphon SYSTEM CHEMICAL RESISTANCE TABLE

The current state of knowledge about chemical resistance of plastics is based on long-lasting laboratory tests and practical experience. The following evaluation can be an initial indicator of the possibilities of POLlphon application for fluid transportation including transport at elevated temperatures. As a matter of fact POLlphon pipes and fittings and rubber gaskets are meant for transporting waste water ranging from acids (pH 2) to alkalis (pH 12) present in households. However in the case of industrial waste water, its chemical composition and concentration should be analysed.

The table covers a set of chemicals and determination of POLlphon chemical resistance. The following evaluation criteria were adopted:

MARKING:

S - satisfactory

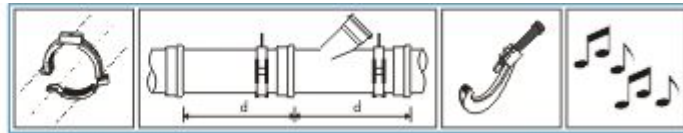
L - limited

NS - not satisfactory

Sat.sol - Saturated aqueous solution, prepared at 20°C

Sol - Aqueous solution at a concentration higher than 10% but not saturated

Chemical or Product	Concentration	Temperature°C		
		20°C	60°C	100°C
Acetic acid	Up to 40%	S	S	-
Acetic acid	50%	S	S	L
Acetic acid, glacial	>96%	S	L	NS
Acetic anhydride	100%	S	-	-
Acetone	100%	S	S	-
Acrylonitrile	100%	S	-	-
Allyl alcohol	100%	S	S	-
Ammonia, aqueous	Sat.sol	S	S	-
Ammonia, dry gas	100%	S	-	-
Ammonia, liquid	100%	S	-	-
Ammonium acetate	Sat.sol	S	S	-
Ammonium chloride	Sat.sol	S	S	-
Ammonium nitrate	Sat.sol	S	S	S
Ammonium sulphate	Sat.sol	S	S	S
Aniline	100%	S	S	-
Beer		S	S	-
Benzene	100%	L	NS	NS
Benzoic acid	Sat.sol	S	S	-
Borax	Sol	S	S	-
Boric acid	Sat.sol	S	-	-
Bromine, liquid	100%	NS	NS	NS
Butane, gas	100%	S	-	-
Butanol	100%	S	L	L
Butyl acetate	100%	L	NS	NS
Calcium carbonate	Sat.sol	S	S	S
Calcium nitrate	Sat.sol	S	S	-
Carbon dioxide, dry gas		S	S	-
Chlorine, dry gas	100%	NS	NS	NS
Chlorine, liquid	100%	NS	NS	NS
Chloroform	100%	L	NS	NS
Chlorosulphonic acid	100%	NS	NS	NS
Chromic acid	Up to 40%	S	L	NS
Citric acid	Sat.sol	S	S	S
Copper (II) chloride	Sat.sol	S	S	-
Cyclohexanone	100%	L	NS	NS



Chemical or Product	Concentration	Temperature °C		
		20°C	60°C	100°C
Dextrin	Sol	S	S	-
Dichloroethylene (A and B)	100%	L	-	-
Dichloromethane	100%	L	NS	-
Ethanolamine	100%	S	-	-
Ethyl alcohol	Up to 95%	S	S	S
Ethyl ether	100%	S	L	-
Ethylene glycol	100%	S	S	S
Formaldehyde	40%	S	-	-
Formic acid	10%	S	S	L
Gasoline, petrol (aliphatic hydrocarbons)		NS	NS	NS
Glycerine	100%	S	S	S
Glycolic acid	30%	S	-	-
Hexane	100%	S	L	-
Hydrochloric acid	Up to 20%	S	S	S
Hydrochloric acid	30%	S	L	L
Hydrogen peroxide	Up to 30%	S	L	-
Hydrogen sulphide, dry gas	100%	S	S	-
Lactic acid	Up to 90%	S	S	-
Magnesium chloride	Sat.sol	S	S	-
Magnesium sulphate	Sat.sol	S	S	-
Milk		S	S	S
Monochloroacetic acid	>85%	S	S	-
Nitric acid	Up to 30%	S	NS	NS
Nitric acid	From 40 to 50%	L	NS	NS
Oleic acid	100%	S	L	-
Oleum (sulphuric acid with 60% of So3)		S	L	-
Oxalic acid	Sat.sol	S	L	NS
Oxygen, gas		S	-	-
Phenol	90%	S	-	-
Potassium bromate	Up to 10%	S	S	-
Potassium chlorate	Sat.sol	S	S	-
Potassium chromate	Sat.sol	S	S	-
Potassium cyanide	Sol	S	-	-
Potassium dichromate	Sat.sol	S	S	S
Potassium ferricyanide	Sat.sol	S	S	-
Potassium hydroxide	Up to 50%	S	S	S
Potassium nitrate	Sat.sol	S	S	-
Potassium permanganate	(2 N) 30%	S	-	-
Propane, gas	100%	S	-	-
Pyridine	100%	L	-	-
Seawater		S	S	S
Sodium chlorate	Sat.sol	S	S	-
Sodium hydroxide	From 10 to 60%	S	S	S
Sodium hypochlorite	10%-15%	S	-	-
Sodium sulphite	40%	S	S	S
Sulphuric acid	Up to 10%	S	S	S
Sulphuric dioxide, dry or wet	100%	S	S	-
Tartaric acid	Sat.sol	S	S	-
Tin (IV) chloride	Sol	S	S	-
Tin (II) chloride	Sat.sol	S	S	-
Toluene	100%	L	NS	NS
Trichloroethylene	100%	NS	NS	NS
Urea	Sat.sol	S	S	-
Vinegar		S	S	-
Wines		S	S	-
Xylene	100%	NS	NS	NS



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