Master3Plus acoustic soil and waste pipe systems

SOIL AND WASTE | DESIGN AND SPECIFICATIONS

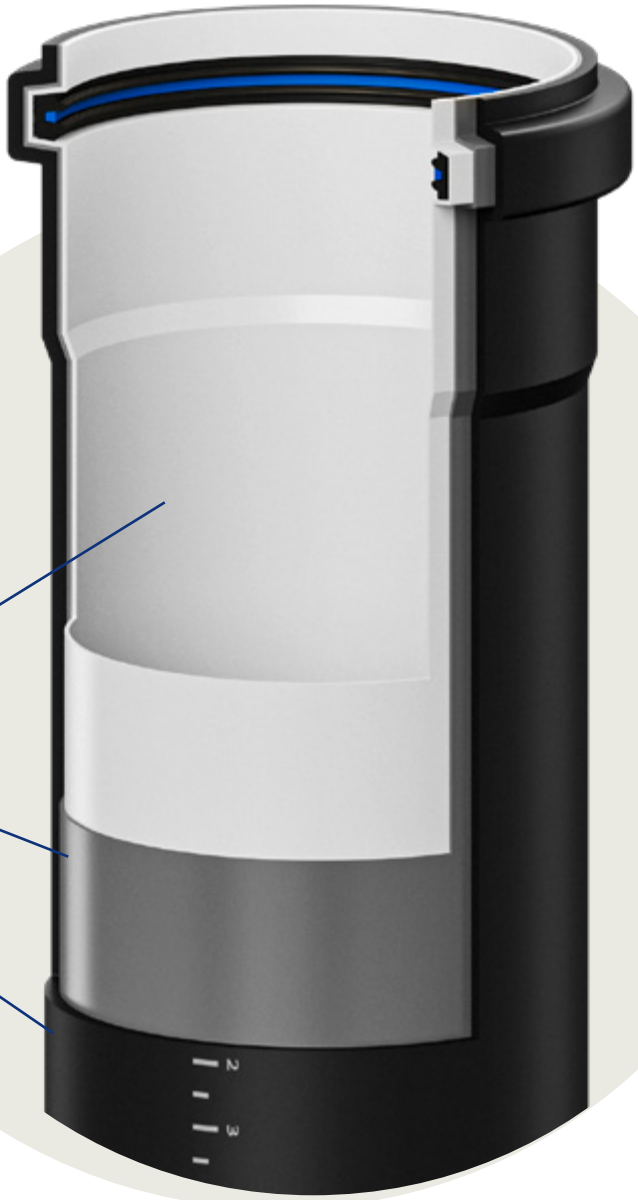
PIPELIFE

wienerberger

Contents

Pipe and fitting design

PIPELIFE Master3Plus acoustic soil and waste pipe systems comprise three carefully matched layers that are engineered to achieve specific properties.



Smooth inner layer

Made of polypropylene copolymer (PP-CO)

Solid middle layer

Made of mineral-reinforced polypropylene (PP-MV)

Impact-resistant outer layer

Made of polypropylene copolymer (PP-CO)

Socket-spigot and all-socket fittings

Molded plug-in sockets, factory-fitted sealing ring. Made of mineral-reinforced polypropylene (PP-MV).

Hydraulically optimized design

Reduced turbulences, higher flow rate. Increased number of connections to downpipe.

Increased product weight and wall thickness

Superior sound insulation.

Technical properties

Application class

Tested and approved for soil and waste discharge for application area code "BD" in accordance with EN 1451-1; with diameters ≥75 mm also permitted for underground discharge systems up to the main sewer junction

Material

Pipe: PP-CO/PP-MV/PP-CO
Fitting: PP-CO-MV, S16 tested to EN 1451-1
Gasket: EPDM
All products are free from halogens, cadmium and heavy metals

Factory standard

Pipes and fittings tested to EN 1451-1

Diameter range

32-160 mm

Pipe lengths

DN/OD 32-50: 0.15, 0.25, 0.50, 1.0, 1.5, 2.0 m

DN/OD 75-160: 0.15, 0.25, 0.50, 1.0, 1.5, 2.0, 2.65 m

Temperature resistance

Short-term exposure: max. 95 °C; continuous load: 60 °C — according to EN1451-1 and elevated temperature cycling test according to EN ISO 13257

Installation at low temperatures

Impact resistance tested to EN 1451 at -10 °C

Chemical resistance

Resistant to acids and alkalis ranging from pH 2 to pH 12

UV resistance

High UV resistance — outdoor storage up to 2 years if stored correctly (please see Master3Plus Installation Guidelines)

Rigidity

Minimum pipe stiffness class SN4 (≥4.0 kN/m^2)
S16 fittings

Color

Outer layer: RAL 9017 traffic black

Inner layer: RAL 9003 signal white

Designation	Unit	Value	Standard
Average density	kg/dm^3	1.2	EN ISO 1183
Modulus of elasticity	MPa	>2400-3100	ISO 178
Linear expansion	mm/(m.K)	0.09	
Vacuum tightness	bar	-0.8	SKZ test report no. 225137

Application areas

Standard application areas

Master3Plus soil and waste pipe systems are mainly utilized for hot-water-resistant drainage pipes for domestic and industrial black-, grey- and rainwater. Within buildings, Master3Plus pipes can be used as:

- Single and group connecting pipes
- Downpipes
- Collecting lines
- Bypass lines
- Ventilation lines
- Internal rainwater pipes with up to 5 meters of backwater height

Special applications

For oil-resistant applications, the EPDM sealing ring must be exchanged for an NBR sealing ring.

- Ventilation systems for commercial and residential buildings
- Central vacuuming systems
- Transport of chemically aggressive wastewater ranging from pH 2 to pH 12

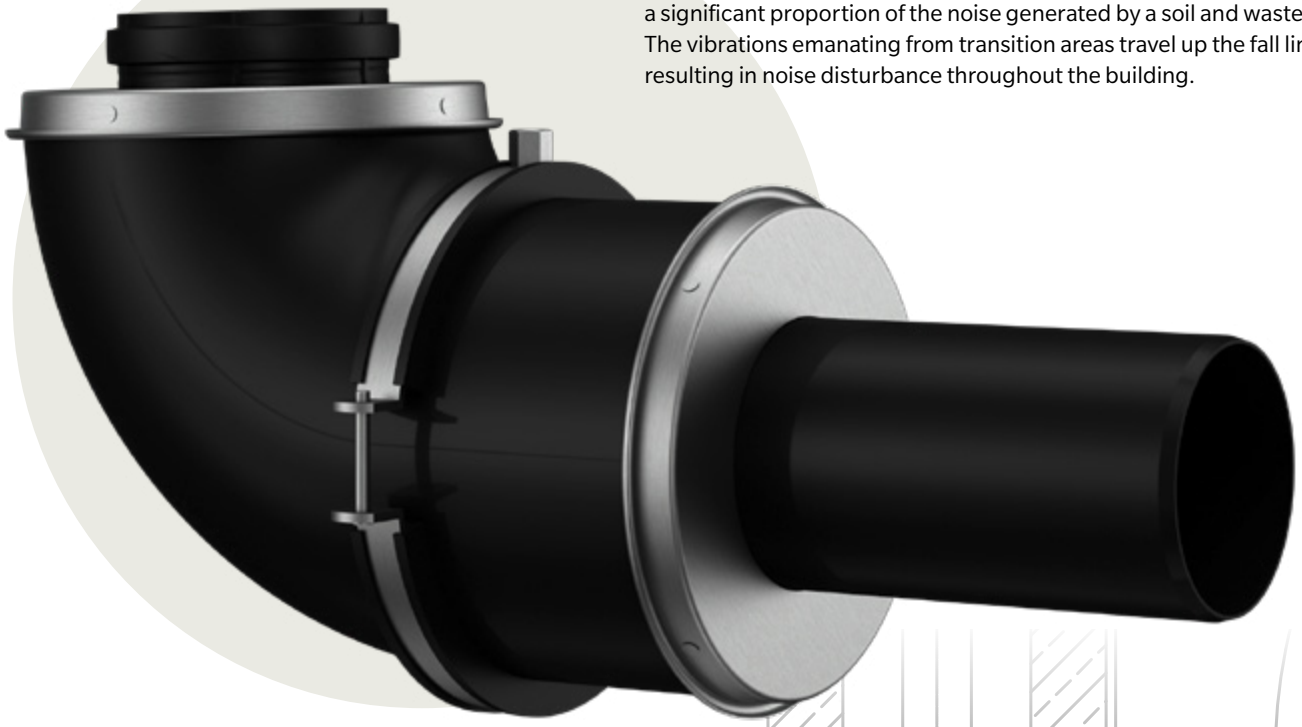
Compatibility

The dimensions of PIPELIFE Master3Plus pipes and fittings comply with EN 1451-1 and can be combined with other products that comply with this standard.

Do not use

- External applications (e.g., outdoor rainwater downpipes)
- Conveying wastewater containing petrol or benzene
- Environmental temperatures exceeding 100 °C
- Disposal lines in chemical plants
- Indoor rainwater pipes with more than 5 meters of backwater height

Acoustic bottom bend



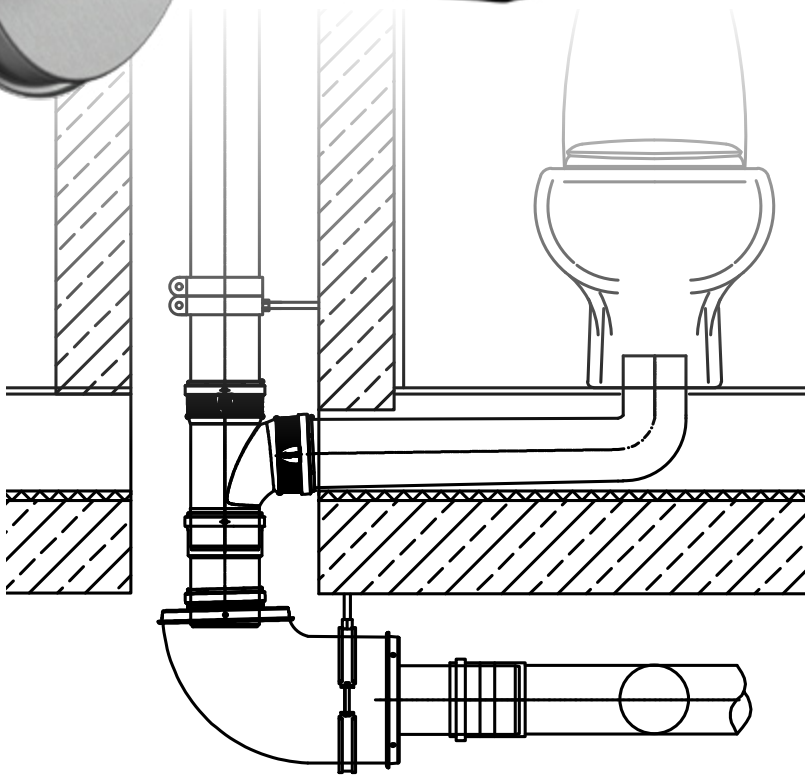
Directional changes in the flow of wastewater, such as the transition from the vertical fall line to the horizontal discharge line, are responsible for a significant proportion of the noise generated by a soil and waste system. The vibrations emanating from transition areas travel up the fall line, resulting in noise disturbance throughout the building.

Operating principle

The acoustic bottom bend has been designed with a longer bend radius to prevent abrupt directional changes. This minimizes vibrations generated as the flow can change direction with less severity.

Its weight is carefully balanced to provide a stabilizing and vibration-reducing anchor point while remaining light enough to handle and install. The bottom bend weighs approximately 10 kg and is suitable for DN/OD 110 Master3Plus pipes.

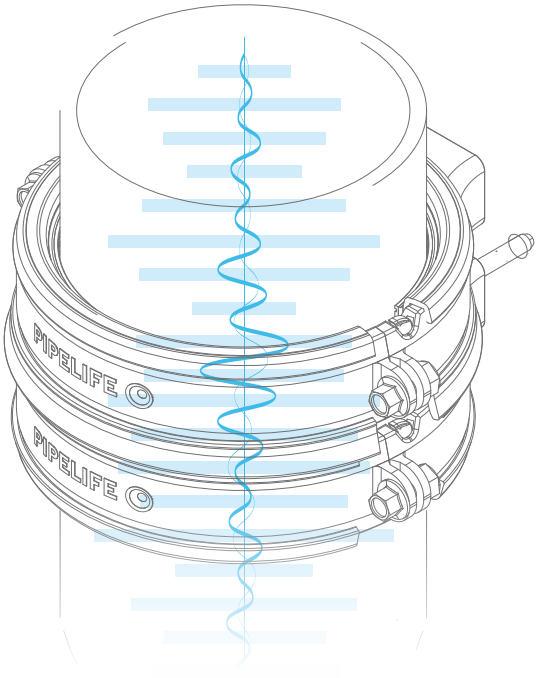
The Fraunhofer Institute in Germany demonstrated that the bottom bend reduces noise in soil and waste systems by up to **7 dB(A)**, depending on the flow speed and clamps used. The Fraunhofer Institute's test results can be found on page 10.



Acoustic clamp

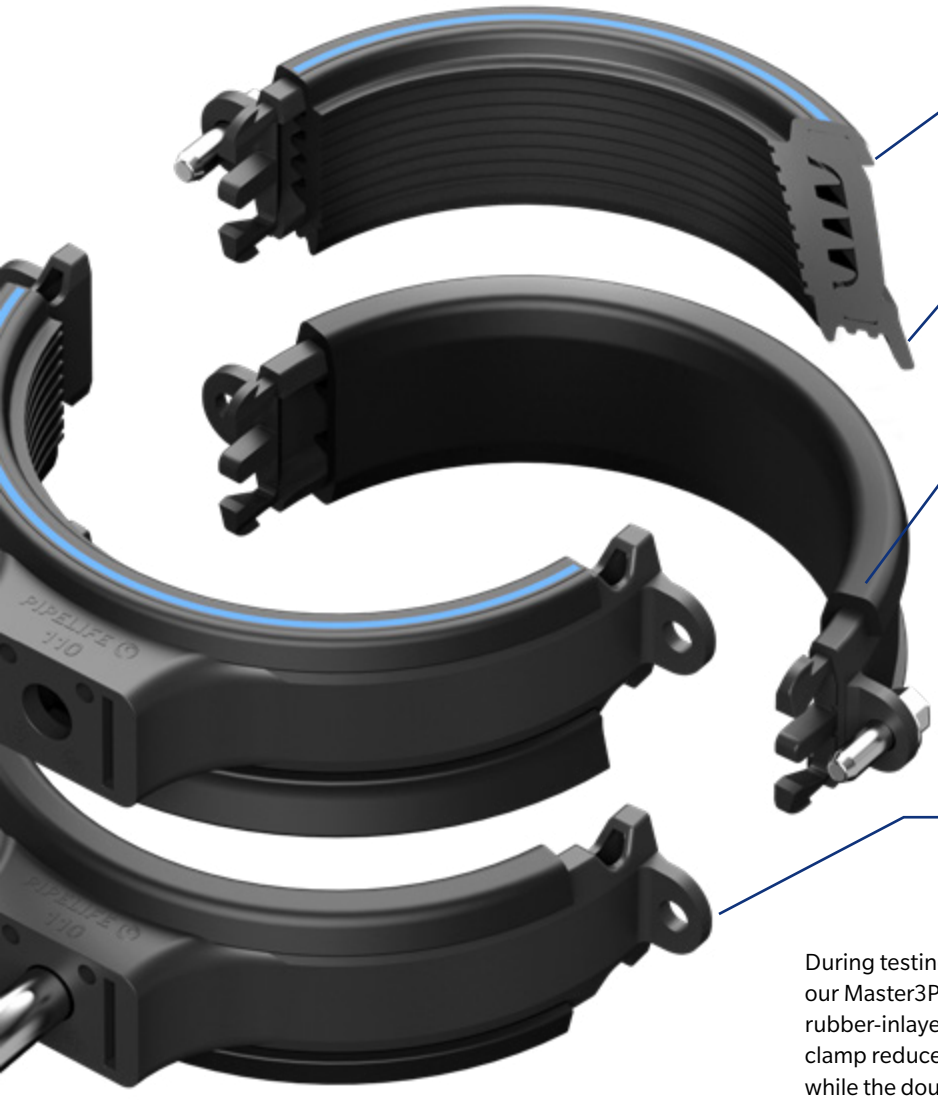
Noise is produced through vibrations that travel as airborne or structure-borne sound. While good pipe and wall insulation will minimize noise transmission within a space, the progression of structure-borne sound is more difficult to contain as it is transferred through building structures to adjacent spaces.

Therefore, the composition and design of the clamps used to attach acoustic pipe systems to building structures are just as important as the make-up and insulation of the pipes themselves.



Operating principle

The Master3Plus acoustic clamp reduces disturbance from soil and waste systems by preventing the transmission of pipe vibrations into walls and adjacent rooms.



The EPDM rubber cushion has a unique geometry that enables significant vibration absorption.

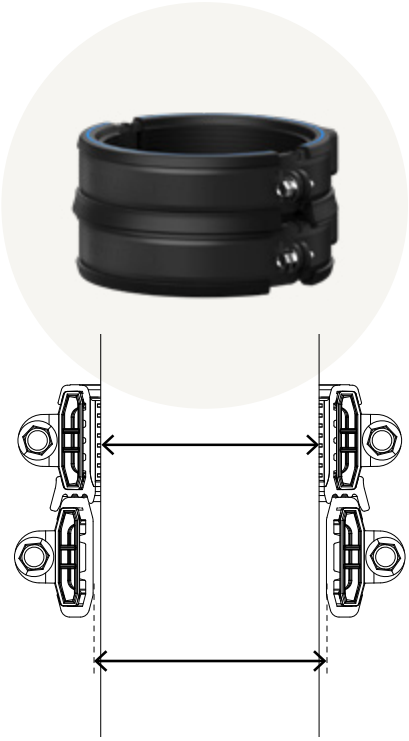
The rubber connection with guiding ribs ensures optimal positioning of the upper and lower clamp.

Easy click-connections speed up installation and ensure perfect clamp alignment and pipe fixation. Colored markings facilitate correct installation.

The clamp body is made from high-quality polyamide (PA) plastic, which provides a strong and durable structure while remaining lightweight and corrosion-resistant.

During testing at the **Fraunhofer Institute in Germany**, our Master3Plus acoustic clamps outperformed standard rubber-inlayed metal clamps on sound absorption. The single clamp reduced soil and waste disturbance by up to **5 dB(A)**, while the double clamp reduced it by up to **10 dB(A)**.

Souble clamp

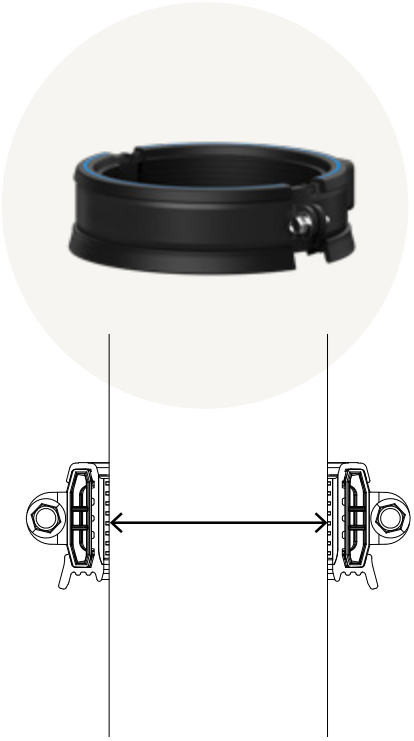


The double clamp is recommended for installations and projects requiring extremely high sound absorption levels. It should be installed near the bottom of the installation on each floor to prevent unwanted movement near horizontal inlets.

The upper clamp forms an even and secure attachment with the pipe thanks to the internal EPDM rubber cushion. The lower clamp is not directly attached to the pipe but is linked to the upper clamp via a rubber connection that perfectly positions the lower clamp so no part of it touches the pipe.

This allows the upper clamp to absorb vibrations from the pipe and guide them into the separated lower clamp, where they disperse into the wall at a lower frequency.

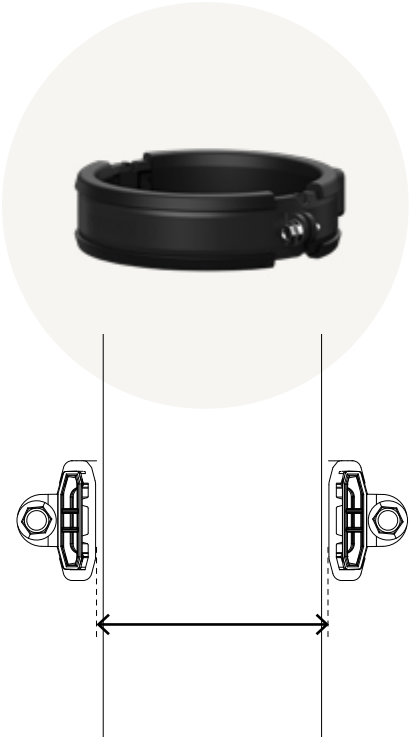
Single clamp



For installations requiring significant noise reduction (but less than the double clamp use case), the single clamp can provide excellent vibration absorption on its own.

Like the double clamp, the single clamp is best placed towards the bottom of the installation on each floor, in the branch area of the incoming horizontal connections. The clamp's secure grip prevents unwanted movement near horizontal inlets.

Loose clamp



The loose clamp should be positioned near the ceiling. This allows pipe elongation while still providing additional safety by preventing the pipe from falling or moving too far from the wall.

Note:
Follow the producers' recommended clamp installation distances.

Acoustic performance

Sound insulation

The requirements for acoustic insulation are regulated via various local norms that differ from market to market. Please ask your local PIPELIFE contact for more details on the respective regulations that apply to you.

Standards and regulations should be taken into consideration during the planning phase. For example, walls with sanitary installations should not be connected to bedrooms.

In general, drainage pipes should not be installed in rooms that need noise protection and must be separated from solid walls with structure-borne sound insulation.

Domestic installations must be arranged and designed in a way that the noise generated from other units in use does not exceed the specified values in the table below. System noise levels may be 5 dB(A) higher in ancillary rooms.

Table 1: Example of sound insulation requirements according to ÖNORM B 8115-2

Type of noise	**Minimum requirement** ($L_{AF, max,nT}$ in dB(A))	**Increased sound insulation** ($L_{AF, max,nT}$ in dB(A))
Short-term, fluctuating noise (e.g., WC flushing)	≤30	≤25

These requirements do not apply to technical equipment in buildings that have been exclusively assigned to the respective unit in use.

Increased sound insulation during the operation of technical equipment in buildings is given if the permissible A-weighted system noise level is lower by at least 5 dB(A), which corresponds to 25 dB(A), and is also maintained within the unit of use.

Increased sound insulation in a building must be specified by the client before the planning work begins and must be recorded in the invitation to tender.

In comparison to apartments in other countries, the German VDI guideline 4100:2012 distinguishes three sound insulation levels. Higher requirements in your own area are marked with the sound insulation levels SSt EB.

The VDI 4100 recommends the following sound insulation values in dB(A) [$L_{AF, max, nT}$] for technical equipment (including both water supply and wastewater installations).

Table 2: Recommended sound insulation values according to VDI 4100

Type of building	SSt I	SSt II	SSt III	SSt EB I	SSt EB II
Multi-family dwellings	≤30	≤27	≤24	≤35	≤30
Single-family semi-detached houses Single-family terraced houses	≤30	≤25	≤22	≤35	≤30

Table 3: Maximum sound levels for rooms requiring external protection according to DIN 4109-1

According to DIN 4109-1:2018, the maximum permissible sound pressure level in rooms requiring external protection must not exceed the values in the following table:

Type of noise	Max. sound level for living and bed-rooms ($L_{AF,max,n}$ in dB(A))	Max. sound level for classrooms and work rooms ($L_{AF,max,n}$ in dB(A))
Short-term, fluctuating noise (e.g., WC flushing)	≤30	≤25

Sound measurement

At the Fraunhofer Institute in Germany, Master3Plus acoustic soil and waste pipe systems have been subject to extensive sound measurement testing according to DIN EN 14366:2005, and with two different fastening clamps in accordance with DIN 4109 and VDI 4100.

The following clamps were used during testing:

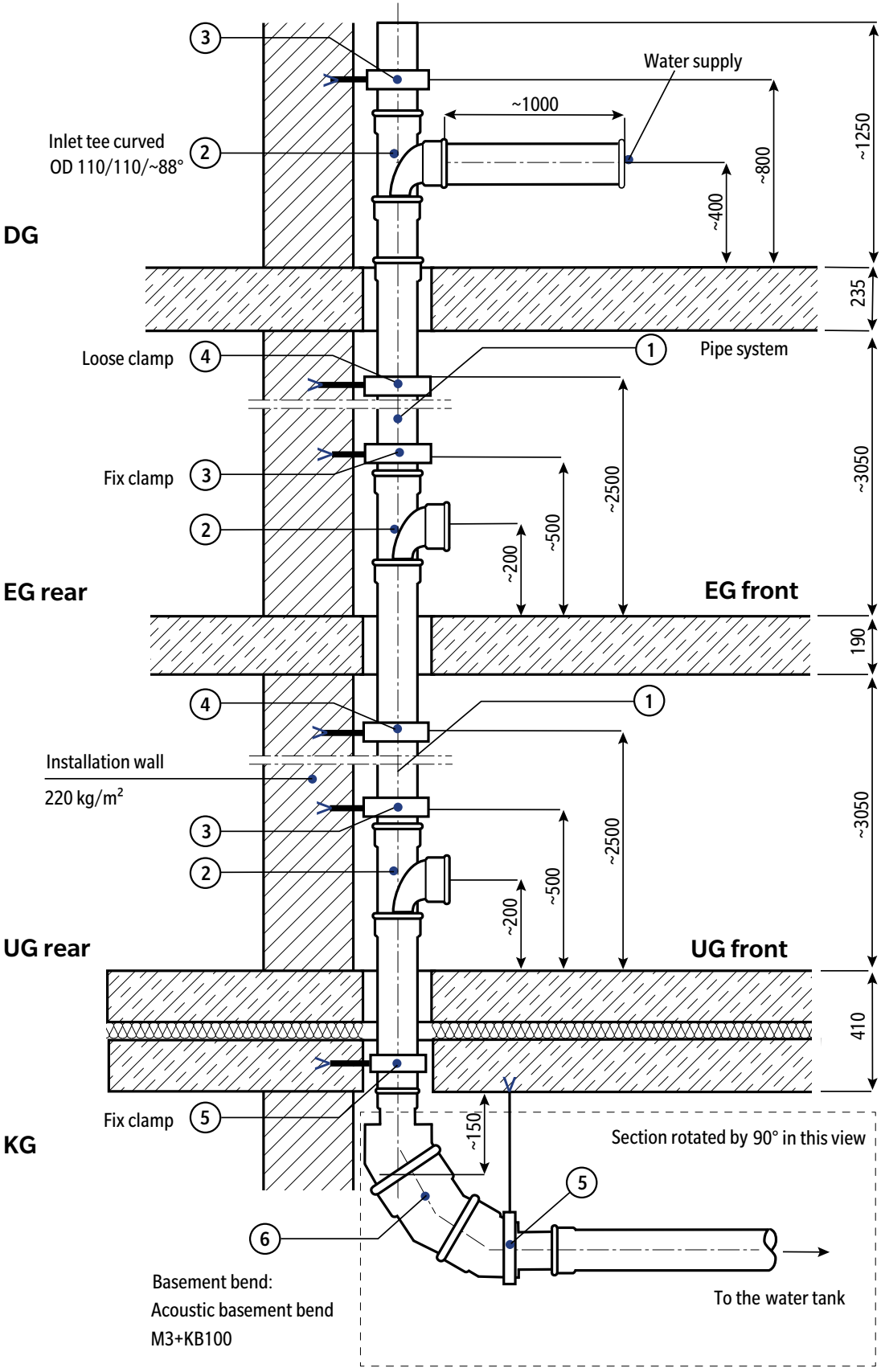
- PIPELIFE double clamp: Acoustic plastic double clamp with rubber insert
- PIPELIFE single clamp: Acoustic plastic single clamp with rubber insert
- BISMAT 1000: Steel double clamp with rubber insert
- BISMAT 2000: Steel standard clamp with rubber insert

Table 4: Master3Plus sound measurement results from the Fraunhofer Institute in Germany

Sound levels for Master3Plus installations, including an acoustic bottom bend in the "basement rear," as measured by Fraunhofer Institute. Test report numbers: P-BA 258/2020 and P-BA 25/2021.

PIPELIFE double clamp | BISMAT 1000 clamp						
Flow rate l/s	Structure-borne sound according to DIN EN 14366, Lsc, A [dB(A)]		Installation sound level according to DIN 4109, LAFeg, n [dB(A)]		Installation sound level according to VDI 4100, LAFeg, nT [dB(A)]	
	PIPELIFE	**BISMAT**	**PIPELIFE**	**BISMAT**	**PIPELIFE**	**BISMAT**
0.5	<10	<10	<10	<10	<10	<10
1.0	<10	<10	<10	<10	<10	<10
2.0	<10	<10	<10	<10	<10	<10
4.0	<10	<10	12.7	12.1	<10	<10

PIPELIFE single clamp | BISMAT 2000 clamp						
Flow rate l/s	Structure-borne sound according to DIN EN 14366, Lsc, A [dB(A)]		Installation sound level according to DIN 4109, LAFeg, n [dB(A)]		Installation sound level according to VDI 4100, LAFeg, nT [dB(A)]	
	PIPELIFE	**BISMAT**	**PIPELIFE**	**BISMAT**	**PIPELIFE**	**BISMAT**
0.5	<10	<10	<10	<10	<10	<10
1.0	<10	<10	11.1	12.0	<10	<10
2.0	<10	10.6	13.9	15.0	10.4	11.5
4.0	12.9	14.8	17.4	19.2	13.8	15.7



Master3Plus system sound measurement diagram from the Fraunhofer Institute in Germany (not to scale, dimensions in mm).

Ventilation branch

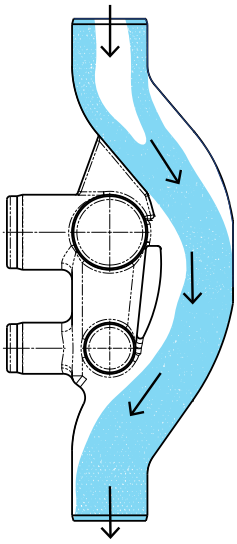
A rapid increase in the quantity of water flowing into conventional fall pipes can cause a vacuum that dries out connected floor lines and empties water traps that prevent discharge odors from escaping.

To avoid this, fall pipes are often over-dimensioned or installed with a separate ventilation line, which requires extra space. Installing smaller-diameter lines due to a lack of space eventually limits the number of horizontal connections that can be made and, accordingly, the overall number of floors in the building.

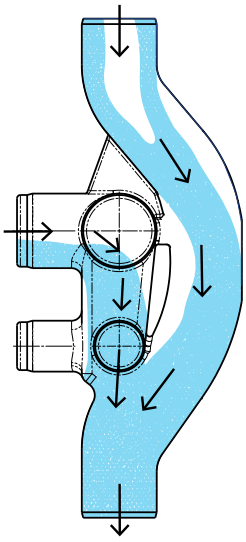
Our flow-optimized ventilation branch solves this dilemma and facilitates the efficient installation of vertical fall pipes in high-rise buildings.

Operating principle

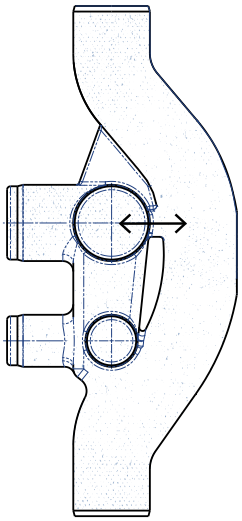
The ventilation branch has a laterally offset design to prevent horizontally inflowing water from disturbing the main flow in the vertical fall lines. The design ensures flows combine in a vertical trajectory, which minimizes turbulence. The venting gap in the flow separator provides the air ventilation required to avoid adverse impacts on pressure.



Due to its laterally offset design, the Master3Plus ventilation branch facilitates a reduced flow. This helps to avoid an increase in negative pressure that could dry out the water traps of connected facilities, such as toilets, wash basins, etc.



With the Master3Plus ventilation branch, inflowing water from horizontal connections can enter the vertical fall pipes without disturbing the main flow. The flows combine in a vertical trajectory, therefore minimizing turbulence.



The venting gap in the flow separator provides the air ventilation required to avoid adverse impacts on pressure.

Flow capacity infomation

The ventilation branch offers six connection possibilities: three for DN 100 (DN/OD 110) and three for DN 70 (DN/OD 75). Connections can be used simultaneously, but the restrictions mentioned in the installation guidelines must be followed.

The DN 100 ventilation branch enables a maximum vertical drainage flow rate of 12 l/s.

The DN 150 ventilation branch enables a minimum vertical drainage flow rate of 18 l/s.

Discharge volumes

The DN 100 inlets allow for a maximum **single** discharge unit (DU) value of 2.5 l/s with a maximum **combined** DU value of 16 l/s. Each sanitary device should have a DU of no more than 2.5 l/s. However, several of these devices can be connected at once, up to a combined DU value of 16 l/s.

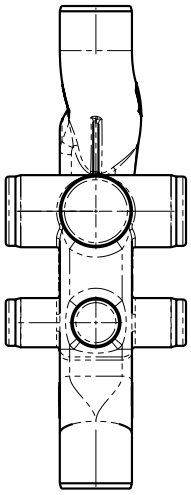
The DN 70 inlets allow for a maximum **single** DU value of 1.5 l/s with a maximum **combined** DU value of 9 l/s. Each sanitary device should have a DU of no more than 1.5 l/s. However, several of these devices can be connected at once, up to a combined DU value of 9 l/s.

The ventilation branch's total discharge volume for its inlets is ∑DU 25 l/s.

DN 100 (DN/OD 110)
DN 150 (DN/OD 160)

DN 100 (DN/OD 110)
∑DU 16 l/s
Single DU 2.5 l/s

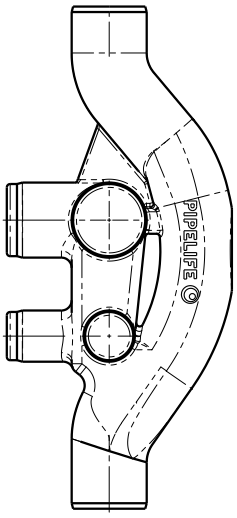
DN 70 (DN/OD 75)
∑DU 9 l/s
Single DU 1.5 l/s



DN 100 (DN/OD 110)
DN 150 (DN/OD 160)

DN 100 (DN/OD 110)
Σ DU 16 l/s
Single DU 2.5 l/s

DN 70 (DN/OD 75)
Σ DU 9 l/s
Single DU 1.5 l/s



System I DUs for sanitary devices according to EN 12056-2 (excerpt). Consult EN 12056-2 for a complete overview of the DUs for various sanitary devices.

Appliance	System I* DU (l/s)
Wash basin, bidet	0.5
Shower without plug	0.6
Shower with plug	0.8
Single urinal with cistern	0.8
Urinal with flushing valve	0.5
Slab urinal (one person)	0.2
Bath	0.8
Kitchen sink	0.8
Dishwasher (household)	0.8
Washing machine up to 6 kg	0.8
Washing machine up to 12 kg	1.5
WC with 6.0 l cistern	2.0
WC with 7.5 l cistern	2.0
WC with 9.0 l cistern	2.5
Floor gully DN 50	0.8
Floor gully DN 70	1.5
Floor gully DN 100	2.0

***A single stack discharge system with partially filled branch discharge pipes**

In type 1 systems, sanitary appliances are connected to partially filled branch discharge pipes. These branch discharge pipes are designed with a filling degree of 0.5 (50%) and are connected to a single discharge stack.

Expected flowrate of wastewater according to EN12056-2

$$Q_{ww} = K\sqrt{\sum DU}$$

Q_{ww} = Wastewater flowrate (l/s)

K = Frequency factor

∑DU = Sum of discharge units

Frequency factors according to EN12056-2

Usage of appliances	K
Intermittent use, e.g., in a dwelling, guesthouse, office, etc.	0.5
Frequent use, e.g., in a hospital, school, restaurant, hotel, etc.	0.7
Congested use, e.g., in public toilets and/or showers	1.0
Special use, e.g., in a laboratory	1.2

According to EN12056-2 specifications, applying a frequency factor of K = 0.5:

- The maximum total discharge volume of DN 100 ventilation branches in a single stack is ∑ DU 576 l/s
- The minumum total discharge volume of DN 150 ventilation branches in a single stack is ∑ DU 1296 l/s

For example, in a standard apartment with appliances in the kitchen (sink, dishwasher), bathroom (shower, wash basin, 6 kg washing machine), and toilet (9 L flush tank, wash basin) — accounting for a load of ∑ DU 6.7 l/s and depending on the design of the building and the discharge installation:

- a DN 100 (DN/OD 110) vertical installation can accommodate approximately 80 apartments connected to a single stack
- a DN 150 (DN/OD 160) vertical installation can accommodate approximately 190 apartments connected to a single stack

In the unlikely scenario that each apartment consumes the maximum capacity of the ventilation branch (∑DU 25 l/s):

- a DN 100 (DN/OD 110) vertical installation can accommodate 23 apartments connected to a single stack
- a DN 150 (DN/OD 160) vertical installation can accommodate 50 apartments connected to a single stack

Note: These calculation examples are for illustration purposes only. The final number of apartments depends on the design of the building, the wastewater discharge system, and the number of apartments per floor that are connected to a single ventilation branch.

If the calculated flow rate in a stack is higher than the permissible ∑DU 576 l/s in DN 100 (DN/OD 110):

- An additional parallel stack of DN 100 (DN/OD 110) should be installed
  or
- The stack dimension should be extended to DN 150 (DN/OD 160)

Fire safety

Fire classification
Master3Plus has been classified as a B2 flammable material, according to DIN 4102.

Fire protection with firestop collars and wraps

Pipe systems and other installations that run through walls and ceilings can compromise fire protection measures. To ensure necessary fire safety precautions are fulfilled, such structures need to, for example, be sealed or encased to provide adequate fire resistance and, therefore, prevent fire and smoke from progressing. The method and scope of these measures are usually defined by national regulations.
In Austria, for example, the specifications for fire protection, as per Guideline 2 of the Institute of Construction (OIB), must be complied with. The "technical guideline for preventive fire protection" (TRVB) sets the requirements for fire resistance and, therefore, the principal implementation possibilities of such measures regarding pipe installations through walls and ceilings.
The installation of soil and waste pipes made from flammable materials in garages, basements and similar spaces is permitted under the following terms:

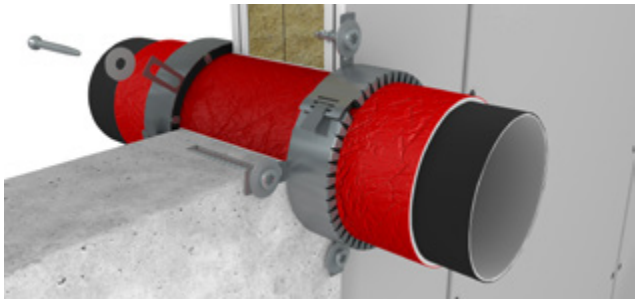
- The pipe system is made from polyethylene (PE) or polypropylene (PP). Note: PVC cleanouts are permissible but must not exceed the minimum number required
- The pipe system only serves apartments and respective operating units
- The necessary encasing can also be implemented as section insulation as long as the measure has been approved in a report by an accredited authority
- Installations outside basements or garages must be made in service ducts and shafts

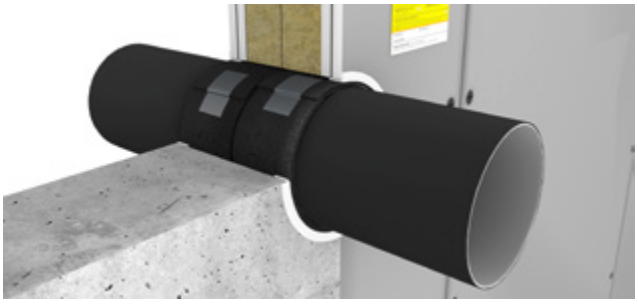
Therefore, and in accordance with this regulation, Master3Plus soil and waste pipe systems may also be used in basements and underground garages.
The openings for installations in partition walls and/or ceilings that form fire partitions must be closed by suitable measures (e.g., bulkheading or cladding) and in such a way that the fire resistance period of the component is not impaired or the transmission of smoke and fire over the time of the required fire resistance period is effectively contained.
If fire safety measures are required for plastic pipelines, fire protection collars or wraps can be used. A multitude of fire collars and wraps have been approved for use with Master3Plus.

For instance, the following:

- Hensotherm® RM30/RM50 and 7KS
- Promat PROMASTOP FC3/FC6
- Hilti CFS
- Air Fire Tech RORCOL V30/V60

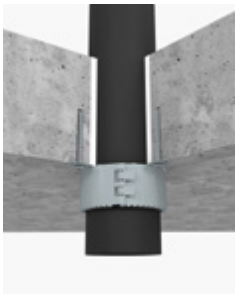
Wall ducts with fire collars or wraps

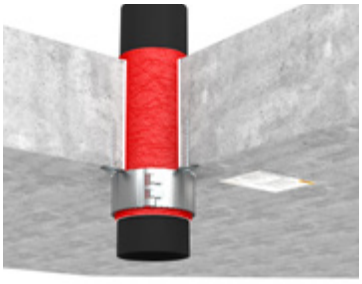




Fire collars or wraps must be installed on both sides of a Master3Plus pipe that leads through a fire compartment wall.

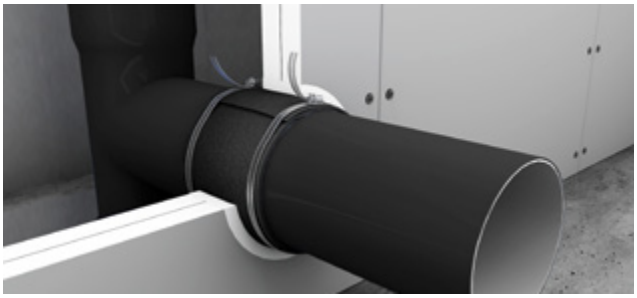
Ceiling ducts with fire collars and wraps





A fire collar or wrap must be applied to a Master3Plus pipe on the ceiling side of a fire compartment.

Shaft ducts with fire wrap 7KS100

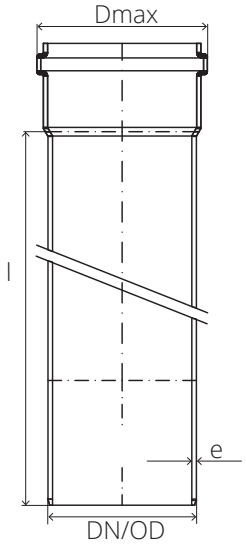


An appropriate number of layers (as specified by Hensotherm) of 100 mm Hensotherm 7KS fire wrap must be applied around Master3Plus soil and waste pipes that run through shaft walls, which are planked on one side.

Please note: For each method and product used, the design, planning and application of fire collars and wraps must comply with the specifications and guidelines of the respective manufacturer.

Product overview

Master3Plus pipe

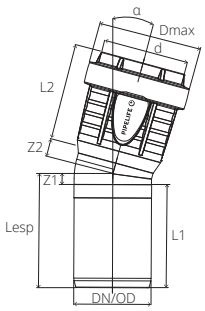


DN/OD	32	40	50	75	90	110	125	160
e	1.8	1.8	2	2.1	2.5	3	3.5	4.4
Dmax	43	54.2	64.2	89.4	105.4	127.8	145.5	183.9

l (mm)	Weight (kg/pc)							
150	0.04	0.06	0.07	0.13	0.2	0.29	0.4	0.69
250	0.06	0.08	0.1	0.19	0.29	0.41	0.57	0.96
500	0.12	0.15	0.19	0.33	0.5	0.72	0.98	1.63
1000	0.22	0.28	0.35	0.63	0.95	1.34	1.81	2.96
1500	0.32	0.41	0.51	0.92	1.39	1.96	2.64	4.3
2000	0.42	0.54	0.68	1.21	1.82	2.57	3.47	5.63
2650	-	-	-	1.59	2.38	3.37	4.54	7.37

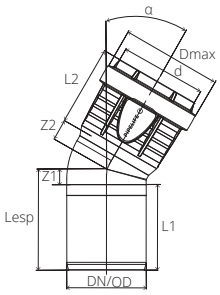
Master3Plus bend

α = 15°



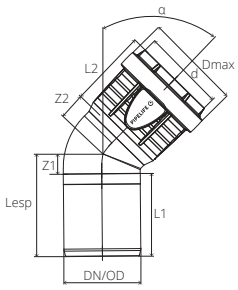
DN/OD	DN	d	Dmax	L1	L2	Lesp	Z1	Z2	Kg/pcs	Code
32	30	33	41.6	37	44.9	46	9	9	0.02	3496102859
40	40	41.1	53.3	53.5	50.6	59	5.5	9	0.04	3496103031
50	50	51	63.3	54	51.2	60	6	10	0.05	3496103033
75	70	76.1	89.1	60	54.8	68	8	12	0.1	3496103035
90	90	91.2	105.4	62	56.5	72	10	14	0.15	3496103037
110	100	111.3	127	66	60.6	76	10	15	0.24	3496103039
125	125	126.3	145.8	72	66.5	88	16	22	0.37	3496103118
160	150	161.5	183.4	81	75.5	95	14	21	0.65	3496103103

α = 30°



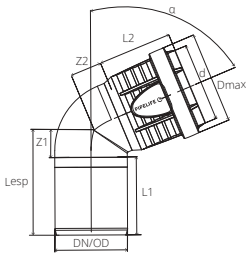
DN/OD	DN	d	Dmax	L1	L2	Lesp	Z1	Z2	Kg/pcs	Code
32	30	33	41.6	37	44.9	47	10	10	0.02	3496102860
40	40	41.1	53.3	53.5	50.6	62	8.5	12	0.04	3496103032
50	50	51	63.3	54	51.2	64	10	13	0.05	3496103034
75	70	76.1	89.1	60	54.8	74	14	18	0.11	3496103036
90	90	91.2	105.4	62	56.5	78	16	20	0.16	3496103038
110	100	111.3	127	66	60.6	84	18	23	0.27	3496102560
125	125	126.3	145.8	72	66.5	96	24	30	0.41	3496103119
160	150	161.5	183.4	81	75.5	106	25	32	0.72	3496103104

α = 45°



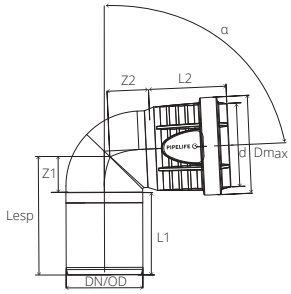
DN/OD	DN	d	Dmax	L1	L2	Lesp	Z1	Z2	Kg/pcs	Code
32	30	33	41.6	37	44.9	48	11	14	0.02	3496102861
40	40	41.1	53.3	53.5	50.6	65	11.5	15	0.04	3496102530
50	50	51	63.3	54	51.2	67	13	17	0.06	3496102493
75	70	76.1	89.1	60	54.8	79	19	23	0.12	3496102543
90	90	91.2	105.4	62	56.5	85	23	27	0.18	3496102552
110	100	111.3	127	66	60.6	92	26	31	0.29	3496102498
125	125	126.3	145.8	72	66.5	105	33	39	0.43	3496102567
160	150	161.5	183.4	81	75.5	114	38	45	0.8	3496102576

α = 67.5°



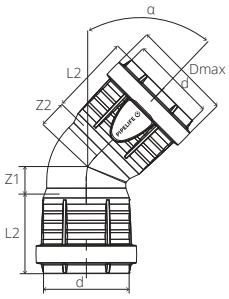
DN/OD	DN	d	Dmax	L1	L2	Lesp	Z1	Z2	Kg/pcs	Code
32	30	33	41.6	37	44.9	55	18	19	0.02	3496102862
40	40	41.1	53.3	53	50.6	70	17	20	0.05	3496103113
50	50	51	63.3	54	51.2	74	20	24	0.06	3496103114
75	70	76.1	89.1	60	54.8	89	29	33	0.13	3496103115
90	90	91.2	105.4	62	56.5	96	34	39	0.2	3496103116
110	100	111.3	127	66	60.6	106	40	45	0.32	3496103117

α = 87.5°



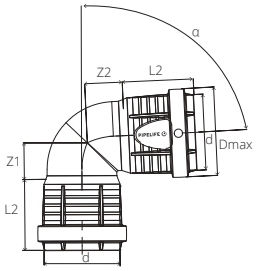
DN/OD	DN	d	Dmax	L1	L2	Lesp	Z1	Z2	Kg/pcs	Code
32	30	33	41.6	37	44.9	62	25	24	0.02	3496102863
40	40	41.1	53.3	53	50.6	76	23	26	0.05	3496102535
50	50	51	63.3	54	51.2	81	27	30	0.06	3496102496
75	70	76.1	89.1	60	54.8	101	41	45	0.14	3496102547
90	90	91.2	105.4	62	56.5	110	48	53	0.22	3496102556
110	100	111.3	127	66	60.6	124	58	63	0.36	3496102563
125	125	126.3	145.8	72	66.5	138	66	72	0.53	3496102570
160	150	161.5	183.4	81	75.5	162	81	88	0.97	3496102578

α = 45° AS



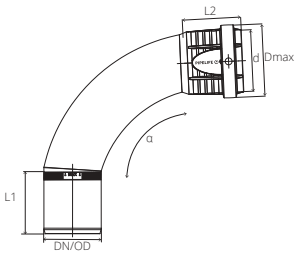
DN/OD	DN	d	Dmax	L2	Z1	Z2	Kg/pcs	Code
40	40	41.1	53.3	50.6	15	15	0.05	3496102532
50	50	51	63.3	51.2	17	17	0.06	3496102537
75	70	76.1	89.1	54.8	23	23	0.13	3496102544
90	90	91.2	105.4	56.5	27	27	0.2	3496102553
110	100	111.3	127	60.6	31	31	0.32	3496102499
125	125	126.3	145.8	66.5	39	39	0.47	3496102569

α = 87.5° AS



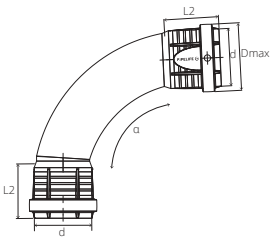
DN/OD	DN	d	Dmax	L2	Z1	Z2	Kg/pcs	Code
40	40	41.1	53.3	50.6	26	26	0.05	3496102536
50	50	51	63.3	51.2	30	30	0.07	3496102539
75	70	76.1	89.1	54.8	45	45	0.15	3496102548
90	90	91.2	105.4	56.5	53	53	0.23	3496102557
110	100	111.3	127	60.6	63	63	0.37	3496102564
125	125	126.3	145.8	66.5	72	72	0.56	3496102572

Long bend α = 87.5°



DN/OD	DN	d	Dmax	L1	L2	Kg/pcs	Code
50	50	51	63.3	54	51.2	0.089	3496103144
75	70	76.1	89.1	61	54.8	0.169	3496103138
110	100	111.3	127	66	60.6	0.464	3496103140

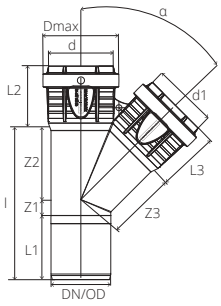
Long bend α = 87.5° AS



DN/OD	DN	d	Dmax	L2	Kg/pcs	Code
50	50	51	63.3	51.2	0.1	3496103145
75	70	76.1	89.1	54.8	0.2	3496103139
110	100	111.3	127	60.6	0.5	3496103141

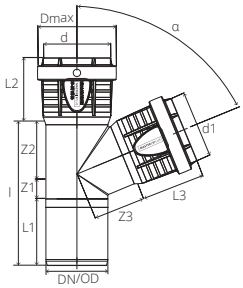
Master3Plus branch

α = 45°



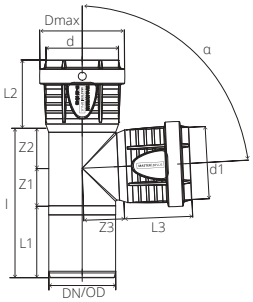
DN/OD	DN	d	d1	Dmax	L1	L2	L3	l	Z1	Z2	Z3	Kg/pcs	Code
32/32	30	33	33	41.6	0	44.9	44.9	47	42	40	42	0.03	3496102866
40/32	40	41.1	33	53.3	53	50.6	44.9	103	6	44	43	0.06	3496103123
40/40	40	41.1	41.1	53.3	53	50.6	50.6	114	12	49	49	0.07	3496102637
50/32	50	51	33	63.3	54	51.2	44.9	103	0	49	53	0.09	3496103125
50/40	50	51	41.1	63.3	54	51.2	50.6	114	6	55	57	0.09	3496103127
50/50	50	51	51	63.3	54	51.2	51.2	128	13	61	61	0.1	3496102647
75/50	70	76.1	51	89.1	61	54.8	51.2	135	-1	75	79	0.19	3496102651
75/75	70	76.1	76.1	89.1	60	54.8	54.8	170	19	91	91	0.23	3496102656
90/50	90	91.2	51	105.4	62	56.5	51.2	136	-7	80	91	0.24	3496102661
90/75	90	91.2	76.1	105.4	63	56.5	54.8	172	11	98	102	0.3	3496102665
90/90	90	91.2	91.2	105.4	63	56.5	56.5	195	23	109	109	0.37	3496102669
110/50	100	111.3	51	127	66	60.6	51.2	142	-16	92	103	0.35	3496102512
110/75	100	111.3	76.1	127	66	60.6	54.8	175	1	108	118	0.43	3496102679
110/90	100	111.3	91.2	127	66	60.6	56.5	197	12	119	123	0.5	3496102684
110/110	100	111.3	111.3	127	66	60.6	60.6	225	26	133	133	0.59	3496102518
125/110	125	126.3	111.3	145.8	71	66.5	60.6	233	20	142	144	0.77	3496102692
125/125	125	126.3	126.3	145.8	71	66.5	66.5	254	31	152	152	0.91	3496102697
160/110	150	161.5	111.3	183.4	81	75.5	60.6	240	1	158	168	1.15	3496102704
160/125	150	161.5	126.3	183.4	81	75.5	66.5	263	13	169	177	1.31	3496102756
160/160	150	161.5	161.5	183.4	81	75.5	75.5	310	37	192	192	1.7	3496102709

α = 67.5°



DN/OD	DN	d	d1	Dmax	L1	L2	L3	l	Z1	Z2	Z3	Kg/pcs	Code
50/50	50	51	51	63.3	54	51.2	51.2	117	20	43	43	0.1	3496103129
110/50	100	111.3	51	127	66	60.6	51.2	131	8	57	75	0.33	3496103130
110/75	100	111.3	76.1	127	66	60.6	54.8	158	21	71	80	0.39	3496103131
110/110	100	111.3	111.3	127	66	60.6	60.6	191	41	84	84	0.52	3496103132

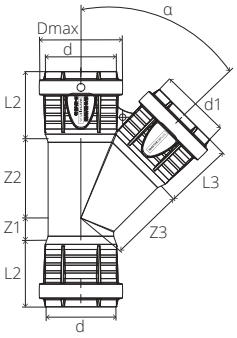
α = 87.5°



DN/OD	DN	d	d1	Dmax	L1	L2	L3	l	Z1	Z2	Z3	Kg/pcs	Code
32/32	30	33	33	41.6	0	44.9	44.9	52	22	30	35	0.04	3496102867
40/32	40	41.1	33	53.3	53	50.6	44.9	93	18	22	26	0.06	3496103124
40/40	40	41.1	41.1	53.3	53	50.6	50.6	101	23	25	25	0.07	3496102640
50/32	50	51	33	63.3	54	51.2	44.9	95	18	23	31	0.07	3496103126
50/40	50	51	41.1	63.3	54	51.2	50.6	102	23	26	30	0.08	3496103128
50/50	50	51	51	63.3	54	51.2	51.2	112	28	30	30	0.09	3496102508
75/50	70	76.1	51	89.1	61	54.8	51.2	121	28	32	43	0.16	3496102654
75/75	70	76.1	76.1	89.1	60	54.8	54.8	147	41	46	46	0.21	3496102659
90/50	90	91.2	51	105.4	63	56.5	51.2	122	26	33	51	0.22	3496102663
90/75	90	91.2	76.1	105.4	62	56.5	54.8	147	39	46	52	0.26	3496102667
90/90*	90	91.2	91.2	105.4	62	56.5	56.5	187	81	44	79	0.36	3496102672
110/50	100	111.3	51	127	66	60.6	51.2	128	27	35	60	0.32	3496102515
110/75	100	111.3	76.1	127	66	60.6	54.8	151	39	46	62	0.38	3496102682
110/90*	100	111.3	91.2	127	66	60.6	56.5	207	81	60	79	0.5	3496102686
110/110*	100	111.3	111.3	127	66	60.6	60.6	207	81	60	79	0.54	3496102689
125/110	125	126.3	111.3	145.8	71.5	66.5	62.2	194	56.8	65.7	62.2	0.62	3496102695
125/125	125	126.3	126.3	145.8	72	66.5	66.5	225	73	80	80	0.77	3496102701
160/110	150	161.5	111.3	183.4	81	75.5	60.6	203	55	67	90	0.99	3496102706
160/160	150	161.5	161.5	183.4	81	75.5	75.5	253	80	92	92	1.34	3496102711

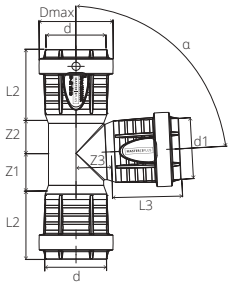
*Swept geometry

α = 45° AS



DN/OD	DN	d	d1	Dmax	L2	L3	Z1	Z2	Z3	Kg/pcs	Code
40/40	40	41.1	41.1	53.3	50.6	50.6	15	49	49	0.08	3496102638
50/50	50	51	51	63.3	51.2	51.2	17	61	61	0.11	3496102648
75/50	70	76.1	51	89.1	54.8	51.2	11	77	80	0.2	3496102652
75/75	70	76.1	76.1	89.1	54.8	54.8	22	91	91	0.24	3496102657
90/90	90	91.2	91.2	105.4	56.5	56.5	27	109	109	0.38	3496102670
110/50	100	111.3	51	127	60.6	51.2	-9	92	103	0.37	3496102513
110/110	100	111.3	111.3	127	60.6	60.6	31	133	133	0.62	3496102519
125/110	125	126.3	111.3	145.8	66.5	60.6	26	142	144	0.8	3496102693
125/125	125	126.3	126.3	145.8	66.5	66.5	37	152	152	0.95	3496102699

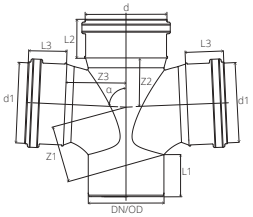
α = 87.5° AS



DN/OD	DN	d	d1	Dmax	L2	L3	Z1	Z2	Z3	Kg/pcs	Code
40/40	40	41.1	41.1	53.3	50.6	50.6	26	25	25	0.07	3496102641
50/50	50	51	51	63.3	51.2	51.2	32	30	30	0.1	3496102510
75/50	70	76.1	51	89.1	54.8	51.2	32	32	43	0.16	3496102655
75/75	70	76.1	76.1	89.1	54.8	54.8	45	46	46	0.21	3496102757
90/90	90	91.2	91.2	105.4	56.5	56.5	50	44	79	0.33	3496102674
110/50	100	111.3	51	127	60.6	51.2	32	35	60	0.34	3496102516
110/110*	100	111.3	111.3	127	60.6	60.6	86	60	79	0.56	3496102690
125/110	125	126.3	111.3	144.9	66.5	60.6	63	66	72	0.66	3496102696
125/125	125	126.3	126.3	144.9	66.5	66.5	79	80	80	0.81	3496102702

*Swept geometry

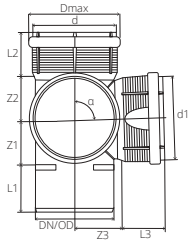
Double branch α = 87.5°



DN/OD	DN	d	d1	L1	L2	L3	Z1	Z2	Z3	Kg/pcs	Code
110/50	100	111.3	51	60	54	44	25	42.5	63	0.39	1533000628
110/110*	100	111.3	111.3	64	59	66	69	58	78	0.81	1533000629

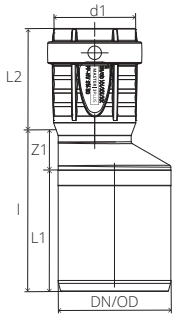
*Swept geometry

Corner branch α = 87.5°



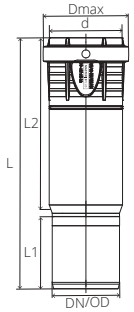
DN/OD	DN	d	d1	Dmax	L1	L2	L3	Z1	Z2	Z3	Kg/pcs	Code
110/110	100	111.3	111.3	127	61	60.6	60.6	59	64	64	0.63	3496103108

Master3Plus reducer



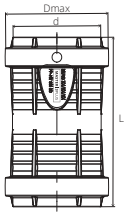
DN/OD	DN	d1	L1	L2	l	Z1	Kg/pcs	Code
40/32	40	33	54	50.6	66	12	0.03	3496102588
50/32	50	33	54	51.2	72	18	0.04	3496103120
50/40	50	41.1	54	51.2	66	12	0.04	3496102590
75/40	70	41.1	60	54.8	87	27	0.08	3496102593
75/50	70	51	61	54.8	81	20	0.08	3496102595
90/50	90	51	62	56.5	91	29	0.11	3496102597
90/75	90	76.1	62	56.5	78	16	0.12	3496102599
110/50	100	51	66	60.6	109	43	0.17	3496102602
110/75	100	76.1	66	60.6	93	27	0.19	3496102604
110/90	100	91.2	66	60.6	85	19	0.19	3496102608
125/110	125	111.3	71	66.5	89	18	0.28	3496102606
160/110	150	111.3	81	75.5	120	39	0.47	3496102610
160/125	150	126.3	81	75.5	111	30	0.51	3496102612

Master3Plus long socket



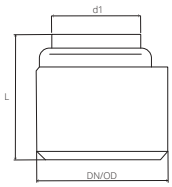
DN/OD	DN	d	Dmax	L1	L	L2	Kg/pcs	Code
40	40	41.1	53.3	53	177	118	0.06	3496102619
50	50	51	63.3	54	187	128	0.08	3496102621
75	70	76.1	89.1	60.5	205	138	0.16	3496102623
90	90	91.2	105.4	62	224	154	0.25	3496102625
110	100	111.3	127	66	244	170	0.37	3496102503

Master3Plus double/push-on socket



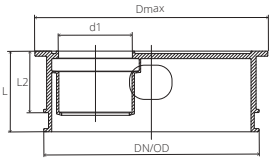
DN/OD	DN	d	Dmax	L	Kg/pcs	Code
32	30	33	41.6	100	0.02	3496102865
40	40	41.1	53.3	102	0.04	3496102613
50	50	51	63.3	103	0.05	3496102500
75	70	76.1	89.1	116	0.1	3496102614
90	90	91.2	105.4	120	0.15	3496102615
110	100	111.3	127	129	0.23	3496102501
125	125	126.3	144.9	140	0.33	3496102616
160	150	161.5	183.4	159	0.6	3496102617

Master3Plus short reducer



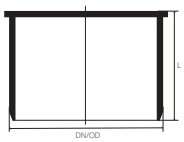
DN/OD	DN	d1	L	Kg/pcs	Code
40/32	40	33	58	0.04	70021408
50/32	50	33	63	0.05	70024364
50/40	50	41.1	63	0.05	70007119
75/50	70	51	71	0.08	70007120
90/50	90	51	83	0.11	1297070081
90/75	90	76.1	78	0.12	2196180587
110/40	100	41.1	84	0.15	70007066
110/50	100	51	84	0.16	70007121
110/75	100	76.1	85	0.16	70007774
110/90	100	91.2	85	0.17	2196180591
160/110	150	111.3	108	0.43	1595006888

Master3Plus internal reducer



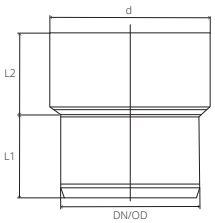
DN/OD	DN	d1	L	L2	Dmax	Kg/pcs	Code
50/40	50	41.1	64.1	53.7	63.3	0.025	1195008828
90/50	90	51	51.8	41.5	105.4	0.055	1195008830
110/40	100	41.1	52.8	41.5	127	0.074	1195008832
110/50	100	51	52.8	41.5	127	0.077	1195008834
110/75	100	76.1	52.8	41.5	127	0.083	1195008836
110/90	100	91.2	62.4	51.1	127	0.071	1195008838
160/50	150	51	66	56	183.4	0.193	1195008847
160/110	150	111.3	56	38.5	183.4	0.186	1195008849

Master3Plus socket plug



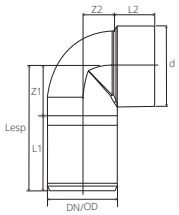
DN/OD	L	Kg/pcs	Code
32	33	0.008	3496102864
40	39	0.01	3496102763
50	39	0.014	3496102764
75	39	0.027	3496102765
90	42	0.041	4195005934
110	46	0.068	3496102584
125	50	0.089	3496102766
160	58	0.174	3496102767

Master3Plus siphon connector straight



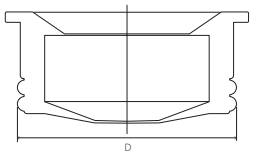
DN/OD	DN	d	L1	L2	Kg/pcs	Code
32	30	53.7	31	32	0.03	3496102758
40	40	53.7	32	30	0.02	3496102759
50	50	53.7	31	31	0.03	3496102760

Master3Plus siphon connector elbow



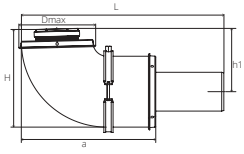
DN/OD	DN	d	Lesp	Z1	Z2	L2	L1	Kg/pcs	Code
32	30	53.7	47	25	23	31	22	0.03	3496103112
40	40	53.7	88	35	29	30	53	0.05	3496102524
50	50	53.7	90	35	24	29	55	0.05	3496102527

Master3Plus combination nipple



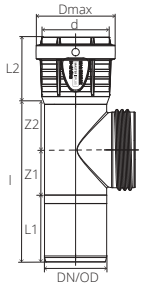
DN/OD	Connection DN/OD	D	Kg/pcs	Code
32/40/50	32/40/50	54	0.03	934130444

Master3Plus acoustic bottom bend



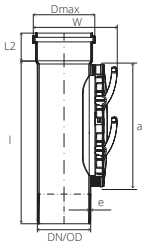
DN/OD	Dmax	H	L	h1	a	Code
110	201	277	569	179	378	1533001198

Master3Plus cleaning pipe



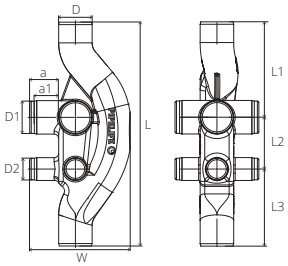
DN/OD	DN	d	Dmax	L1	l	Z1	Z2	L2	Kg/pcs	Code
50	50	51	63.3	54	130	36	40	51.2	0.09	3496103121
75	70	76.1	89.1	61	142	40	41	54.8	0.16	3496103105
90	90	91.2	105.4	62	189	62	65	56.5	0.28	3496102629
110	100	111.3	127	66	194	62	66	60.6	0.41	3496102631
125	125	126.3	144.9	72	225	73	80	66.5	0.63	3496103122
160	150	161.5	183.4	81	253	80	92	75.5	1.08	3496103106

Master3Plus large opening cleaning pipe



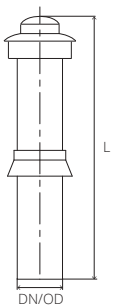
DN/OD	Dmax	a	l	W	e	L2	Kg/pcs	Code
110	129	301	468	196	3.6	65	2.3	1595012497
125	146	301	474	222	4	73	2.5	1595012498
160	185	301	488	251	5.1	84	3.2	1595012499

Master3Plus ventilation branch



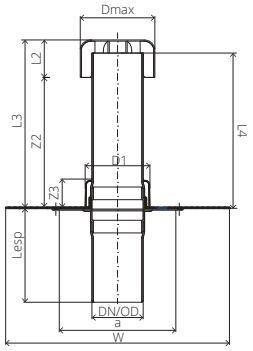
DN/OD	DN	D	D1	D2	W	a	a1	L	L1	L2	L3	Kg/pcs	Code
110	100	110	110	75	330	80	65	736	313	170	253	2.5	1533000626
160	150	160	110	75	378	80	65	793	370	170	253	3.2	1533000627

Master3Plus ventilation pipe

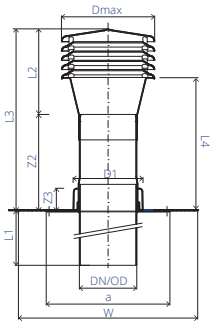


DN/OD	L	Kg/pcs	Code
50	705	0.282	1595005068
75	705	0.398	1595005069
110	705	0.756	1595005065
125	1095	1.322	1595005066
160	1183	2.374	1595005067

Master3Plus UV resistant ventilation pipe



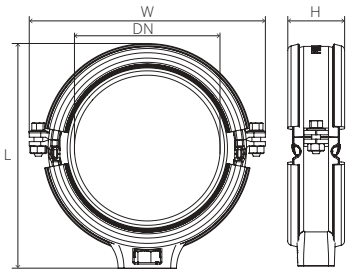
50-125



160

DN/OD	Type	D1	Dmax	Lesp/L1	L3	L2	L4	Z2	Z3	a	W	Code
50	50-125	104	110	200	360	80	332	280	63	250x250	500x500	1533000845
75	50-125	104	110	200	360	80	332	280	63	250x250	500x500	1533000846
110	50-125	139	160	200	360	80	332	280	63	250x250	500x500	1533000847
110	50-125	139	160	200	560	80	532	480	63	250x250	500x500	1533000850
110	50-125	139	160	200	860	80	832	780	63	250x250	500x500	1533000855
110	50-125	139	160	400	860	80	832	780	63	250x250	500x500	1533000858
110	50-125	139	160	400	560	80	532	480	63	250x250	500x500	1533000853
125	50-125	154	160	200	360	80	332	280	63	250x250	500x500	1533000848
125	50-125	154	160	200	560	80	532	480	63	250x250	500x500	1533000851
125	50-125	154	160	200	860	80	832	780	63	250x250	500x500	1533000856
125	50-125	154	160	400	860	80	832	780	63	250x250	500x500	1533000859
125	50-125	154	160	400	560	80	532	480	63	250x250	500x500	1533000854
160	160	195	260	300	510	240	370	270	63	345x345	500x500	1533000849
160	160	195	260	300	710	240	570	470	63	345x345	500x500	1533000852
160	160	195	260	300	1010	240	870	770	63	345x345	500x500	1533000857

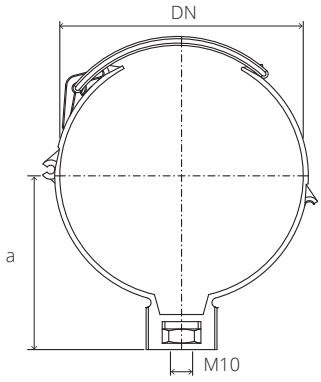
Master3Plus silent clamp M10



DN/OD	W*	L*	H*	Clamp	Code
110	162	152	39	Loose	3496103160
110	162	154	41	Single	3496103159
110	162	154	76	Double	3496103158
125	177	167	39	Loose	3496103163
125	177	169	41	Single	3496103162
125	177	169	76	Double	3496103161
160	212	202	39	Loose	3496103166
160	212	204	41	Single	3496103165
160	212	204	76	Double	3496103164

*Including rubber

Master3Plus pipe clip M10



DN	DN/OD range	a	Code
30-50	DN30-DN50	50	1595012478
70-100	DN70-DN100	79	1595012482
125-150	DN125-DN150	104	1595012484

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