HAMZA AS



# TECHNICAL CATALOGUE 2025




HAMZA WATERTIGHTSOLUTIONS SINCE 1949

# TABLE OF CONTENTS


1. OUR HISTORY 0.5

2. INTRODUCTION TO HAMZA AS SYSTEM 08 0.8

2.1 System Description 0.10
2.2 Product Specifications 0.11
2.3 Field of application
2.3.1 Noise pollution affects both health and behavior.
2.3.2 Commercial kitchens and abattoirs
2.3.3 Photographic laboratories 0.12
2.3.4 Dental practices
2.3.5 Food-processing and chemical industries
2.4 Chemical resistance

3. TECHNICAL DATASHEET HAMZA AS 0.13

3.1. Material 0.13
3.2. Physical properties
3.3. Marking 0.13
3.4. Multilayer pipe
3.5. Sealing

4. PRODUCT RANGE 0.15

4.1. Three Layers ended pipe with Push fit socket 0.16
4.2. Three Layers plain ended pipe 0.19
4.3. Socket 0.20
4.4. Repair Socket 0.21
4.5. Compensator Socket 0.22
4.6. Bend 0.23
4.7. Bend 87.5° 0.24
4.8. Elbow 87.5 with access door 0.25
4.9. Single Branch 45°, 67° 0.26
4.10. Single Branch 87.5° 0.27
4.11. Single Branch 87.5o with access door 0.28
4.12. Long Reducer Socket 0.29
4.13. Reducer 0.30
4.14. Plug Socketing 0.31
4.15. P Trap 0.32
4.16. WC Connection Socket 0.33
4.17. WC Connection Socket for height adjustment 0.34
4.18. Drain Elbow for Bath and Shower 0.35
4.19. Floor Drain 0.36
4.20. Floor Drain Extension 0.37
4.21. Floor Drain Led Cover 0.38
4.22. Air Vent 0.38
4.23. Roof Gutter 0.39
4.24. Collecting branch \ Draingage Collector 0.39

5. ACOUSTICS 0.40

5.1. Sound insulation by HAMZA AS 0.40
5.2. Noise calculation software 0.41
5.3. Sound-insulating performance 0.42
5.4. About Sound AS 0.43
5.5. Noise 0.44
5.5.1. Sources of noise in buildings 0.45
5.5.2. How noise is measured 0.46
5.5.3. Acoustic requirements 0.46
5.6. Acoustic design 0.47

5.6.1. Advantageous layouts 0.48
5.6.2. Acoustic plumbing design

**0.49**

## 6. DESIGN OF THE WASTE WATER SYSTEM 0.49
6.1. Installation and layout principles for waste water drainage systems 0.50
6.2. List of definitions according to DIN EN 12056 0.51
6.3. Functional requirements 0.52
6.3.1. Minimum fall 0.53
6.3.2. Basis of calculations 0.54
6.4. Types of pipes and sections 0.55
6.4.1. Single connection pipes 0.56
6.4.2. Collecting connection pipes 0.58
6.4.3. Downpipes 0.63
6.4.4. Collecting pipes 0.65
6.4.5. Ventilation pipes 0.67
6.4.6. Ventilation valves 0.68
6.4.7. Rainwater pipes

**0.71**

## 7. INSTALLATION AND JOINTING 0.71
7.1. Connecting HAMZA AS fittings and pipes 0.71
7.2. Pipe Assembly procedure 0.72
7.3. Horizontal and Vertical piping Fixation 0.74
7.4. Bracket Arrangement 0.74
7.5. Installation in brickwork 0.76
7.6. Installation in concrete 0.76
7.7. Floor crossings 0.76
7.8. Roof drainage pipes in living areas 0.77
7.9. Tensile resistant connection 0.78
7.10. Soundproofing 0.78
7.11. Installation of pipes in existing structures 0.79
7.12 Installation advice 0.79

**0.80**

## 8. FIRE PROTECTION 0.80
8.1. Fire behavior classification 0.80
8.2. Fire resistance classification 0.81
8.3. HAMZA/ WAVIN AS fire protection concept 0.81
8.4. Assembly instructions 0.82
8.5. Installation manual BM-R90

**0.83**

## 9. PACKING, TRANSPORT & STORAGE 0.84
9.1. Packing, transport & storage

**Appendix I:** Chemical Resistance Table 0.85
**Appendix II:** Drainage Sizing Tables 0.90
**Appendix III:** HAMZA AS Certificates 0.92

# OUR HISTORY




**In 1949, Mr. Abdelwahab Hamza established Hamza**, aiming at making a breakthrough in the water solutions industry. He made it a point to make the whole world witness a major change in water supply, drainage and firefighting System. The company is under the name of Hamza Contractors for Electromechanical Works and Hamza Bros. Supplying Co.

**Hamza Industry Co.** is one of Hamza Group's establishments, founded in 2007 and started its work in the Egyptian market back in 2009-2010. It is the extension of Hamza Contractors and Hamza Supplying.

Known as **Hamza AS** and **Hamza TS**, its production for pipes and fittings is unique and advanced, in terms of sanitary, drainage and sewer feeding for water and natural gas applications.
Located in 6th of October City, and spanning over 80,000 sqm., Hamza Industry Co. was built to focus on quality, starting from the product design, raw material, production facilities (machines, tools and moulds), utilities, packing and packaging material, its design and handling equipment and other items needed in the industry.

# THE TRUE ALTERNATIVE TO CAST IRON

**Hamza AS'** pipes and fittings make the special system for professional wastewater installations that are being used in areas of multiple-storey buildings, where noise insulation is required, such as hotels, hospitals, apartments, roofs, bridge drainage, sewage and plumping applications. The noise insulation feature goes back to its special High Molecular structure and easy installation, and it can endure long-term environmental conditions.

Such system has been applied in European countries, especially Germany and Netherlands since a very long time. Hence, being Wavin's sole agent in Egypt, Hamza Bros. Supplying Co. has been incorporating its experience in that too.

Hamza AS also acts as a catalyst for decreasing soil and waste water, because it is the ultimate plastic alternative to cast iron.



*Hamza AS' pipes and fittings make the special system for professional wastewater installations that are being used in areas of multiple-storey buildings*

# FEATURES BENEFITS OF **HAMZA AS**

- **Easy to install** due to the rubber ring push-fit system.
- **Complete low noise system** with noise insulating properties a wide range of low noise pipe and fitting system.
- **Corrosion resistant** for high-flow speeds of the transported liquid.
- **Smooth bore** incrustation free, being the ultimate solution forpolished kitchens.
- **High chemical resistance**
- **Lower installation costs** due to light weight compared to cast iron.

On a closer look, the highly specific weight, and special high molecular structure / weight of the the patent raw material (AstolanR), enables the absorption of airborne sound and structure borne sound. The combinationt of the highly specific weight and high wall thikness.

## Approvals and Testing

*AS pipes and fittings are continually subject to strict quality controls and certification processes as shown below. For More details see* Appendix III

- ISO 9001:2008, 14001:2004, ISO BS OHSAS 18001:2007
- DIN CERTCO, Berlin, Germany Manufacturing license of pipes with/without sockets of mineral filled Polypropylene design for soil and waste discharge ( domestic sewage) Registration No. P1R0310
- DIN CERTCO, Berlin, Germany Manufacturing license of Fittings with/without sliding sockets of mineral filled Polypropylene heavy design for soil and waste discharge ( domestic sewage) Registration No. P1R0311
- Fraunhofer IBP certification of wastewater installation system acoustic performance according to standard EN ISO/IEC 17025
- MPA NRW (Dortmund, Germany) MD- Safe seals resistance to high temperature ( 93 ± 5) oC resistance as per DIN EN 1055 – Application B
- WAVIN overseas production license of low noise mineral reinforced PP domestic drainage
- Plastic Technology center certification of ignobility test according to DIN 4102 – B1
- Plastic Technology center certification of UV stabilization test according to ASTM E 169
- Housing and national research center certification for UV resistance as per G154 and E169
- National Research Center Testing of Density according to DIN 53479, Hydrostatic pressure testing, tensile strength/elongation before and after treatment, UV accelerated weathering testing
- HAMZA collaborated with PWC to implement its corporate governance manual and ensure its proper implementation.
- Hamza is using SAP ERP system in its management and production. HAMZA is also developing automation and integration projects between the production machines and the ERP system.

# 2. Introduction to HAMZA AS system

## 2.1 System Description

With regards to noise, HAMZA is one of the pioneers. More than 15 years ago HAMZA introduced the world's best plastic low noise Soil & Waste system "HAMZA AS". It is the new best in class plastic sound-insulating soil & waste piping system, suitable for drainage of hot and cold waste water and in accordance with all requirements for non-pressurized waste water piping as laid down in DIN EN 12056, DIN 1986-100 and DIN EN 4102.

HAMZA AS reduces the noise level of the Soil & Waste water system better than any other plastic pipe system. Due to the unique material composition for improved islouation, premium reduction of unwanted sound emissions by the drainage system inside the building is assured. Optimal sound reduction is guaranteed due to high density of material and product design.

HAMZA AS is a mineral reinforced polypropylene (PP) low noise soil and waste solution. HAMZA AS is available in sizes ranging from DN50 to DN250. Like all plastics, HAMZA AS is durable, corrosion-resistant and able to resist the chemical attacking all kinds of aggressive waste waters.

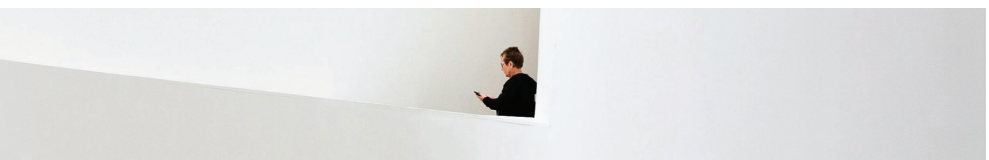
Although the system has been primarily designed as sound-insulating Soil & Waste solution, HAMZA AS is also approved for underground as far as the main sewer connecting point. HAMZA AS has been designed to meet the needs of engineers and installers. On top of 75 years of experience in drainage and cooperation with WAVIN Germany, we spent over a hundred thousand hours on noise level testing, explored new materials and invested heavily in developing a seal with integrated lubricant. This is why we can confidently say that the ultimate noise reduction and super easy installa¬tion delivered by HAMZA AS is no coincidence.

HAMZA AS includes unique product features that are contributing to the ease and safety of an installation:

- EPDM seal with PP reinforcement for in- place securing during assembly
- Sculptured spigot reduces push-in force
- EPDM seal with pp reinforcement shape guarantees leak-free, failure-proof installation
- Unique material composition delivers perfect sound absorption
- Angular rotation guidance to align and rotate fittings in the right direction
- Insertion depth check on fittings to make a secure and safe connection
- Better handling during installation due to the products design and gasket seal technology
- Compact design



*With regards to noise, HAMZA is one of the pioneers. More than 15 years ago HAMZA introduced the world's best plastic low noise Soil & Waste system "HAMZA AS".*



## 2.2 Product Specifications:

Raw Material Astolan®polypropylene, density g/cm3
1.75:1.9 for pipes and fittings (DIN 53479)

| Wall Thickness DN (mm) | Wall Thickness (mm) |
|---|---|
| 50 | 4 |
| 75 | 4.5 |
| 110 | 5.3 |
| 125 | 5.3 |
| 160 | 5.3 |
| 200 | 6.2 |
| 250 | 6.2 |

**Jointing Method**
push- fit; socketed fittings andcompensator sockets for lateral expansion. Hot water

**Chemical Resistance**
PH 2–12 (see Appendex I)

**Hot Water Resistance**
95° ± 3° C short-term exposure
90° C long term exposure
(DIN 1986, DIN 12056)

**Linear Expansion**
~0.09 mm/mk

**Fire Classification**
DIN 4102-B1 (see Appendex III)

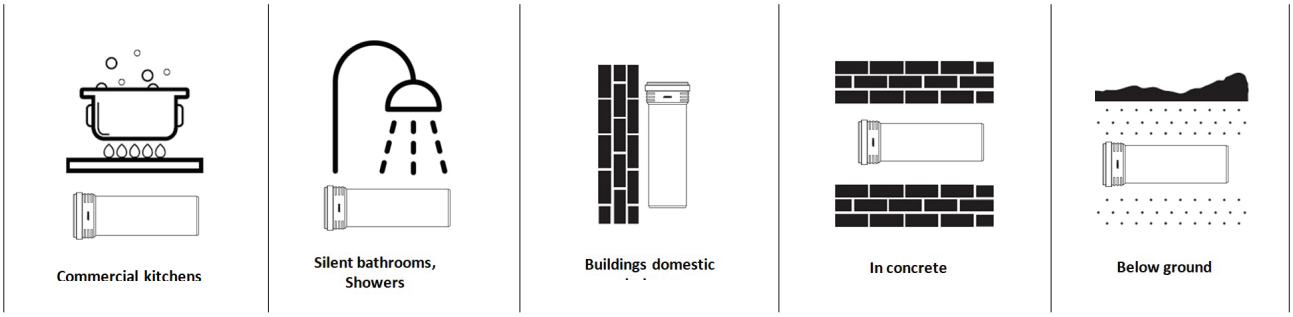
**Quality Marking**
Hamza AS, normal diameter, production date, quality mark, wall thinkness, fire classification



## 2.3 Field of application

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

HAMZA AS is suitable for building, abouve and below ground drainage purposes.
The outstanding acoustic performance of HAMZA AS makes it ideal for wherever DIN 4109-compliant sound insulation might be required, such as in hospitals, hotels, nursing homes, office buildings, or single/multi-occupancy residential properties.




### 2.3.1. Noise pollution affects both health and behavior.

Exposure to noise can affect both health and behavior. Unwanted sound (noise) can damage physiological health. It can cause hypertension, high stress levels, tinnitus, hearing loss, sleep disturbances, and other harmful effects. It is for this reason that modern buildings are equipped with a range of sound-insulation measures designed to favor comfortable living, such as thick exterior walls and soundproofed win¬dows. But we often forget that noise is not just external; it can also be generated from inside the building. HAMZA wants to create better buildings. HAMZA AS is a premium-quality sound-insulating pipe system designed to minimize noise from plumbing systems and maximize living comfort.

### 2.3.2. Commercial kitchens and abattoirs

HAMZA AS is ideal draining fat-containing waste water from e.g. commercial kitchens and abattoirs. Long-term functional reliability and temperature resistance (continuous exposure up to 90°C / short-term up to 95°C in accordance with DIN EN 12056 / DIN 1986-100) are fundamental requirements here. The smooth internal surface of the pipe prevents incru¬stations. When installing HAMZA AS in commercial kitchen and abattoirs with high fat-containing waste water, the use of NBR sealing rings is advised. If fat-containing waste waters need to cover a long distance before reaching the grease-trap facilities, the premises have to be equipped with an auxiliary electric heating system designed to keep the waste water in a liquid state, while maintaining a temperature of no more than 70°C.

### 2.3.3. Photographic laboratories

HAMZA AS pipes and fittings – made of mineral-reinforced PP and supplied with factory-fitted sealing rings – are resistant to the developing and fixing media used in photographic laboratories over long-term exposures at 60°C. They are also approved for short-term temperature loads of up to 95°C. (Please refer to the Chemical Resistance List in the annex for further details). It is recommended that piping is installed with sufficient fall to reduce the contact time between fluid and guiding surface to a minimum.

### 2.3.4. Dental practices

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

### 2.3.5. Food-processing and chemical industries

Usage with waste water containing lactic acid from the food sector and chemical industry, HAMZA AS pipes and fittings are resistant to media containing lactic acid (at concentrati-ons up to 90%) at liquid temperatures up to 60°C. This also applies to the factory-fitted EPDM sealing ring that forms part of the push-fit connecting system, especially as contact is marginal. It is recommended that piping is installed with suf¬ficient fall to reduce contact time to a minimum.

## 2.4. Chemical resistance

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

# 3. TECHNICAL DATASHEET HAMZA AS

HAMZA AS is a mineral reinforced polypropylene (PP) low noise soil and waste water solution. It has a unique material composition for improved noise isolation. Optimal sound reduction is guaranteed due to high density of material and high thicknesses. Optimized three layer pipe structure for low noise levels push fit connections with a pre-lubricated elastomeric seal (EPDM) and PP reinforcement for quick, easy and reliable installation.

## 3.1. Material

Pipes are manufactured from three layers: the outer and inner layers are PP with UV and chemical resistance enhances. The middle layer is a Polypropylene with high density mineral reinforcement. It delivers high density superior to noise insulation and elevated life spans. The three layers are 100 % compatible and co-extruded together through a superior co- extrusion technology under license of german manifuctural and institutes. Fittings are manufactured from polypropylene with high density mineral reinforcement.

## 3.2. Physical properties

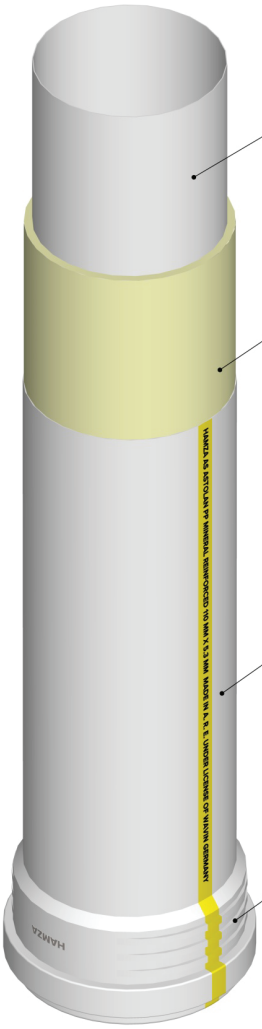
HAMZA AS is primarily made of a high density mineral reinforced Polypropylene and this composite material has the following properties:

| | | |
|---|---|---|
| Density | 1.9 ± 0.5 | g/cm3 (DIN 53479) |
| Elongation at break | 29 | % |
| Tensile Strength | 13 | MPa |
| E- modulus | 3800 | N/mm2 |
| Fire resistance | B1 | DIN 4102 |
| Color | Light grey RAL 7035 | |
| Temperature Long term resistance | 90 ± 3 | °C |
| Temperature short resistance | 95 ± 3 | °C |

## 3.4. Marking

| | | | | |
|---|---|---|---|---|
| HAMZA Logo | HAMZA DMAX ASTOLAN PP Mineral (Pipe Size X Thickness) DIN 4102 – B1 | HAMZA Logo | Production Date & Time | Made in A.R.E. |

## 3.5. Multilayer pipe



**INNER LAYER:**
Chemical resistant and Low Friction Polypropylene (PP)UV and impact resistant Polypropylene (PP) with fire resistant

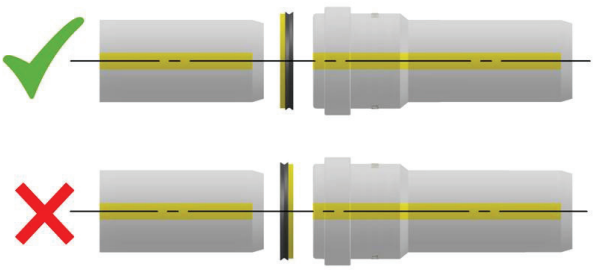
**MIDDLE LAYER:**
High density and stiffness mineral reinforced polypropylene (PP)

**OUTER LAYER:**
UV resistant Polypropylene (PP) with fire resistant

**SOCKET:**
Integrated with EPDM rubber + PP reinforced SEAL
**MADE IN GERMANY**

## 3.6. SEALING

The seal is made from EPDM in black and PP reinforcement in conformity with EN681-1.
CAUTION: Always make sure that the seal is pointing to the pipe end not to the socket as shown below:



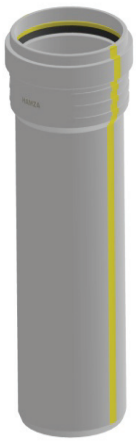
# 4. PRODUCT RANGE

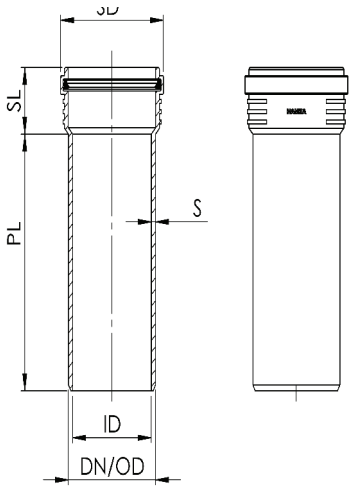
**HAMZA AS** has a wide range of drainage ranging from 50 mm to 250 mm diameter and from 25 cm up to 600 cm length.



## 4.1. Three Layers ended pipe with Push fit socket

Astolan Mineral Reinforced with PP protective inner and outer layers






| ART. NO. | DN | PL | WEIGHT | BOX | S | ID | SL | SD |
|---|---|---|---|---|---|---|---|---|
| | MM | CM | KG | PC | MM | MM | CM | MM |
| AS10110502 | 50 | 25 | 0.3 | 90 | 4 | 42 | 5.8 | 66.0 |
| AS10110505 | | 50 | 0.6 | | | | | |
| AS10110510 | | 100 | 1.1 | | | | | |
| AS10110515 | | 150 | 1.6 | | | | | |
| AS10110520 | | 200 | 2.1 | | | | | |
| AS10110530 | | 300 | 3.1 | | | | | |
| AS10110560 | | 600 | 6.1 | | | | | |
| AS10100502 | | 25 | 0.3 | 90 | 3 | 44 | 5.8 | 66.0 |
| AS10100505 | | 50 | 0.5 | | | | | |
| AS10100510 | | 100 | 0.9 | | | | | |
| AS10100515 | | 150 | 1.3 | | | | | |
| AS10100520 | | 200 | 1.8 | | | | | |
| AS10100530 | | 300 | 2.6 | | | | | |
| AS10100560 | | 600 | 5.2 | | | | | |
| AS10110702 | 75 | 25 | 0.6 | 40 | 4.5 | 66 | 6.0 | 92.0 |
| AS10110705 | | 50 | 1.5 | | | | | |
| AS10110710 | | 100 | 1.9 | | | | | |
| AS10110715 | | 150 | 2.8 | | | | | |
| AS10110720 | | 200 | 3.6 | | | | | |
| AS10110730 | | 300 | 5.4 | | | | | |
| AS10110760 | | 600 | 10.7 | | | | | |
| AS10100702 | | 25 | 0.5 | 40 | 3.5 | 68 | 6.0 | 92.0 |
| AS10100705 | | 50 | 0.9 | | | | | |
| AS10100710 | | 100 | 1.6 | | | | | |
| AS10100715 | | 150 | 2.4 | | | | | |
| AS10100720 | | 200 | 3.2 | | | | | |
| AS10100730 | | 300 | 4.7 | | | | | |
| AS10100760 | | 600 | 9.3 | | | | | |

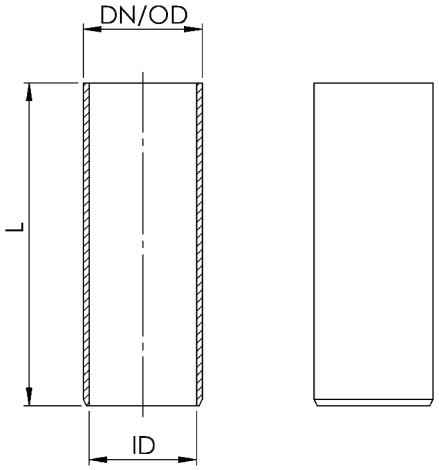
| ART. NO. | DN | PL | WEIGHT | BOX | S | ID | SL | SD |
|---|---|---|---|---|---|---|---|---|
| | MM | CM | KG | PC | MM | MM | CM | MM |
| AS10111102 | 110 | 25 | 1.0 | 24 | 5.3 | 99.4 | 6.5 | 130.0 |
| AS10111105 | | 50 | 1.8 | | | | | |
| AS10111110 | | 100 | 3.3 | | | | | |
| AS1011115 | | 150 | 4.8 | | | | | |
| AS10111120 | | 200 | 6.3 | | | | | |
| AS10111130 | | 300 | 9.4 | | | | | |
| AS10111160 | | 600 | 18.5 | | | | | |
| AS10101102 | | 25 | 0.8 | 24 | 4 | 102 | 6.5 | 130.0 |
| AS10101105 | | 50 | 1.3 | | | | | |
| AS10101110 | | 100 | 2.5 | | | | | |
| AS10101115 | | 150 | 3.6 | | | | | |
| AS10101120 | | 200 | 4.8 | | | | | |
| AS10101130 | | 300 | 7.1 | | | | | |
| AS10101160 | | 600 | 18.5 | | | | | |
| AS10111202 | 125 | 25 | 1.2 | 21 | 5.3 | 114.4 | 8.0 | 145.5 |
| AS10111205 | | 50 | 2.0 | | | | | |
| AS10111210 | | 100 | 3.8 | | | | | |
| AS1011215 | | 150 | 5.5 | | | | | |
| AS10111220 | | 200 | 7.3 | | | | | |
| AS10111230 | | 300 | 10.8 | | | | | |
| AS10111260 | | 600 | 21.2 | | | | | |
| AS10101202 | | 25 | 1.2 | 21 | 4 | 117 | 8.0 | 145.5 |
| AS10101205 | | 50 | 2.0 | | | | | |
| AS10101210 | | 100 | 3.8 | | | | | |
| AS10101215 | | 150 | 5.5 | | | | | |
| AS10101220 | | 200 | 7.3 | | | | | |
| AS10101230 | | 300 | 10.8 | | | | | |
| AS10101260 | | 600 | 21.2 | | | | | |
| AS10111602 | 160 | 25 | 1.6 | 15 | 5.3 | 149.4 | 9.0 | 184.0 |
| AS10111605 | | 50 | 2.7 | | | | | |
| AS10111610 | | 100 | 4.9 | | | | | |
| AS1011615 | | 150 | 7.2 | | | | | |
| AS10111620 | | 200 | 9.4 | | | | | |
| AS10111630 | | 300 | 13.9 | | | | | |
| AS10111660 | | 600 | 27.5 | | | | | |
| AS10101602 | | 25 | 1.6 | 15 | 4.5 | 151 | 9.0 | 184.0 |
| AS10101605 | | 50 | 2.7 | | | | | |
| AS10101610 | | 100 | 4.9 | | | | | |
| AS10101615 | | 150 | 7.2 | | | | | |
| AS10101620 | | 200 | 9.4 | | | | | |
| AS10101630 | | 300 | 13.9 | | | | | |
| AS10101660 | | 600 | 27.5 | | | | | |

| ART. NO. | DN | PL | WEIGHT | BOX | S | ID | SL | SD |
|---|---|---|---|---|---|---|---|---|
| | MM | CM | KG | PC | MM | MM | CM | MM |
| AS10112002 | 200 | 25 | 2.4 | 8 | 6.2 | 187.6 | 11.2 | 2250 |
| AS10112005 | | 50 | 4.6 | | | | | |
| AS10112010 | | 100 | 7.3 | | | | | |
| AS1012015 | | 150 | 10.6 | | | | | |
| AS10112020 | | 200 | 13.9 | | | | | |
| AS10112030 | | 300 | 20.4 | | | | | |
| AS10112060 | | 600 | 40.2 | | | | | |
| AS10102002 | | 25 | 2.4 | 8 | 5 | 190 | 11.2 | 225.0 |
| AS10102005 | | 50 | 4.6 | | | | | |
| AS10102010 | | 100 | 7.3 | | | | | |
| AS10102015 | | 150 | 10.6 | | | | | |
| AS10102020 | | 200 | 13.9 | | | | | |
| AS10102030 | | 300 | 20.4 | | | | | |
| AS10102060 | | 600 | 40.2 | | | | | |
| AS10112502 | 250 | 25 | 3.1 | 6 | 6.2 | 237.6 | 12.9 | 286 |
| AS10112505 | | 50 | 5.2 | | | | | |
| AS10112510 | | 100 | 9.4 | | | | | |
| AS1012515 | | 150 | 13.6 | | | | | |
| AS10112520 | | 200 | 17.8 | | | | | |
| AS10112530 | | 300 | 26.2 | | | | | |
| AS10112560 | | 600 | 51.4 | | | | | |
| AS10102502 | | 25 | 3.1 | 6 | 5.5 | 239 | 12.9 | 286 |
| AS10102505 | | 50 | 5.2 | | | | | |
| AS10102510 | | 100 | 9.4 | | | | | |
| AS10102515 | | 150 | 13.6 | | | | | |
| AS10102520 | | 200 | 17.8 | | | | | |
| AS10102530 | | 300 | 26.2 | | | | | |
| AS10102560 | | 600 | 51.4 | | | | | |

## 4.2. Three Layers plain ended pipe

Astolan Mineral Reinforced with PP protective inner and outer layers



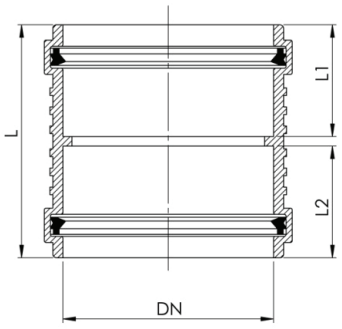


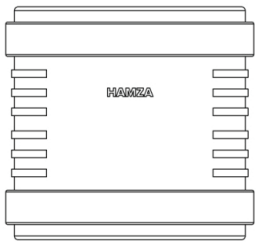

| ART. NO. | DN | PL | WEIGHT | BOX | S | I D | |
|---|---|---|---|---|---|---|---|
| | MM | CM | KG | PC | MM | MM | |
| AS10010530 | 50 | 300 | 3.0 | 90 | 4 | 42 | |
| AS10010560 | | 600 | 6.1 | | | | |
| | | 300 | 2.6 | 90 | 3 | 44 | |
| | | 600 | 5.1 | | | | |
| AS10010730 | 75 | 300 | 5.3 | 40 | 4.5 | 66 | |
| AS10010760 | | 600 | 10.6 | | | | |
| | | 300 | 4.6 | 40 | 3.5 | 68 | |
| | | 600 | 9.2 | | | | |
| AS10011130 | 110 | 300 | 9.2 | 24 | 5.3 | 99.4 | |
| AS10011160 | | 600 | 18.3 | | | | |
| | | 300 | 6.9 | 24 | 4 | 102 | |
| | | 600 | 13.8 | | | | |
| AS10011230 | 125 | 300 | 10.5 | 21 | 5.3 | 114.4 | |
| AS10011260 | | 600 | 20.9 | | | | |
| | | 300 | 7.8 | 21 | 4 | 117 | |
| | | 600 | 15.6 | | | | |
| AS10011630 | 160 | 300 | 13.5 | 15 | 5.3 | 149.4 | |
| AS10011660 | | 600 | 27.1 | | | | |
| | | 300 | 10.8 | 15 | 4.5 | 151 | |
| | | 600 | 21.6 | | | | |
| AS10012030 | 200 | 300 | 19.7 | 8 | 6.2 | 187.6 | |
| AS10012060 | | 600 | 39.4 | | | | |
| | | 300 | 15.8 | 8 | 5 | 190 | |
| | | 600 | 31.5 | | | | |
| AS10012530 | 250 | 300 | 25.2 | 6 | 6.2 | 237.6 | |
| AS10012560 | | 600 | 50.4 | | | | |
| | | 300 | 20.1 | 6 | 5.5 | 239 | |
| | | 600 | 40.3 | | | | |

## 4.3. Socket

Astolan Mineral Reinforced



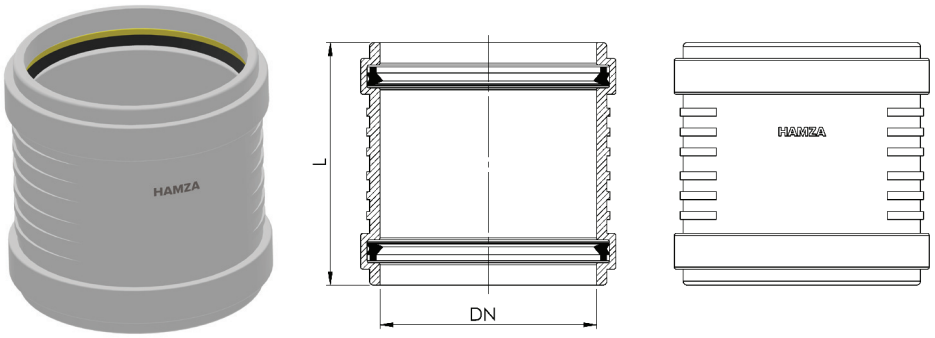




| ART. NO. | DN | WEIGHT | BOX | S | L | L1 | L2 |
|---|---|---|---|---|---|---|---|
| | MM | KG | PC | MM | MM | MM | MM |
| AS10700050 | 50 | 0.178 | 108 | 4 | 104 | 50 | 50 |
| AS10700070 | 75 | 0.286 | 48 | 4.5 | 107 | 53 | 53 |
| AS10700110 | 110 | 0.5 | 24 | 5.3 | 122 | 58 | 58 |
| AS10700120 | 125 | 0.6 | 20 | 5.3 | 128 | 62 | 62 |
| AS10700160 | 160 | 0.8 | 12 | 5.3 | 133 | 64 | 64 |
| ** | 200 | 1.3 | - | 6.2 | - | - | |
| ** | 250 | - | - | - | - | - | |

*Guranteed by Hamza Group

## 4.4. Repair Socket

Astolan Mineral Reinforced

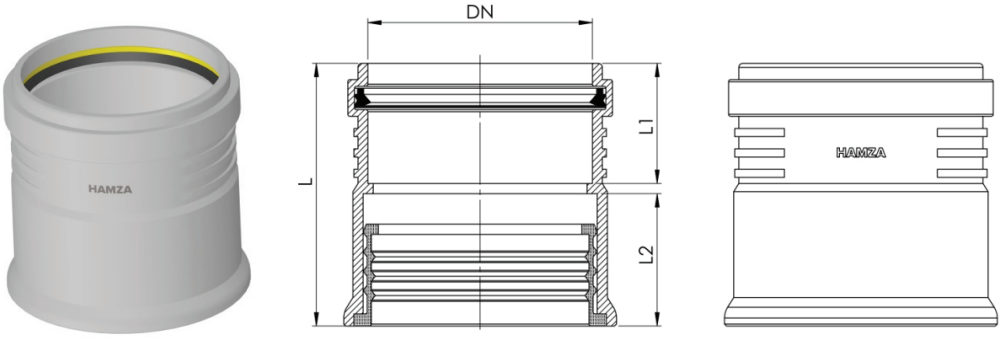



| ART. NO. | DN | WEIGHT | BOX | S | L |
|---|---|---|---|---|---|
| | MM | KG | PC | MM | MM |
| AS10600050 | 50 | 0.128 | 108 | 4 | 104 |
| AS10600070 | 75 | 0.283 | 48 | 4.5 | 107 |
| AS10600110 | 110 | 0.5 | 24 | 5.3 | 122 |
| AS10600120 | 125 | 0.6 | 20 | 5.3 | 128 |
| AS10600160 | 160 | 0.7 | 12 | 5.3 | 133 |

*Guranteed by Hamza Group

## 4.5. Compensator Socket

Astolan Mineral Reinforced

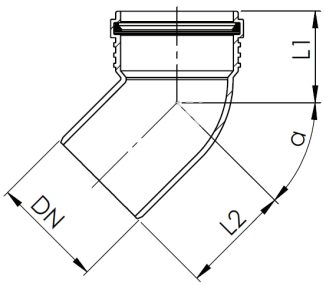


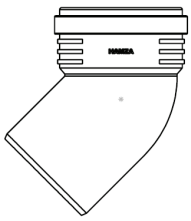

| ART. NO. | DN | WEIGHT | BOX | S | L | L1 | L2 |
|---|---|---|---|---|---|---|---|
| | MM | KG | PC | MM | MM | MM | MM |
| AS10800050 | 50 | 0.199 | 75 | 4 | 118 | 50 | 64 |
| AS10800070 | 75 | 0.322 | 48 | 4.5 | 122 | 53 | 64 |
| AS10800110 | 110 | 0.5 | 24 | 5.3 | 127 | 58 | 64 |
| AS10800120 | 125 | 0.6 | 20 | 5.3 | 146 | 62 | 79 |
| AS10800160 | 160 | 0.8 | 12 | 5.3 | 148 | 64 | 79 |

## 4.6. Bend

Astolan Mineral Reinforced





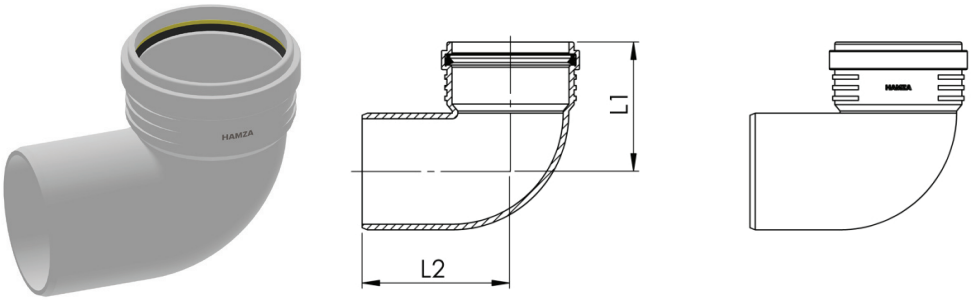



| ART. NO. | DN | ANGLE | WEIGHT | BOX | S | L 1 | L 2 |
|---|---|---|---|---|---|---|---|
| | MM | | KG | PC | MM | MM | MM |
| AS11300054 | 50 | 45° | 0.197 | 80 | 4 | 62 | 83 |
| AS11300074 | 75 | 45° | 0.368 | 36 | 4.5 | 76 | 99.0 |
| * | 110 | 15° | 0.6 | - | - | 73 | 108 |
| * | | 30° | 0.7 | - | - | 77 | 118.0 |
| AS11300114 | | 45° | 0.7 | 16 | 5.3 | 83 | 112.0 |
| * | | 67° | 0.7 | - | - | 102 | 141.0 |
| AS11300124 | 125 | 45° | 0.9 | 10 | 5.3 | 90 | 118.0 |
| * | 160 | 15° | 0.9 | - | - | 77 | 106.0 |
| AS11300164 | | 30° | 1.0 | - | - | 88 | 117.0 |
| * | | 45° | 1.2 | 6 | 5.3 | 100 | 123.0 |
| * | 200 | 45° | | | | | |
| * | 250 | 45° | | | | | |

*Garanteed by Hamza Group

## 4.7. Bend 87.5°

Astolan Mineral Reinforced



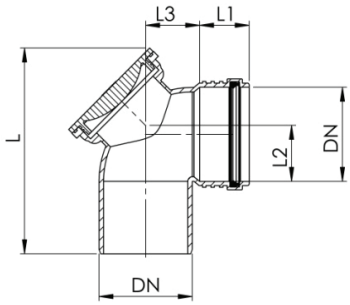

| ART. NO. | DN | WEIGHT | BOX | S | L 1 | L 2 |
|---|---|---|---|---|---|---|
| | MM | KG | PC | MM | MM | MM |
| AS11500058 | 50 | 0.222 | 70 | 4 | 78 | 66 |
| AS11500078 | 75 | 0.443 | 32 | 4.5 | 93 | 76 |
| AS11500118 | 110 | 0.9 | 12 | 5.3 | 115 | 81 |
| AS11500128 | 125 | 1.1 | 10 | 5.3 | 127 | 84 |
| AS11500168 | 160 | 1.6 | 5 | 5.3 | 147 | 87 |
| ** | 200 | 2.5 | 1 | 6.2 | - | - |
| ** | 250 | - | - | - | - | - |

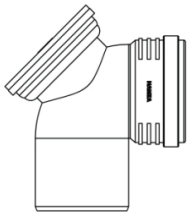
*Guranteed by Hamza Group

## 4.8. Elbow 87.5 with access door

Astolan Mineral Reinforced





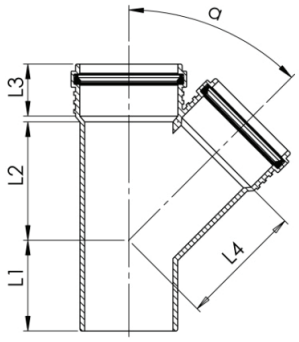



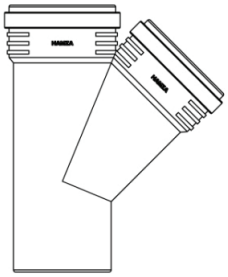
| ART. NO. | DN | WEIGHT | BOX | L | L1 | L2 | L3 |
|---|---|---|---|---|---|---|---|
| | MM | KG | PC | MM | MM | MM | MM |
| AS12307050 | 75/50 | 0.79 | 24 | 222 | 99 | 53 | 53 |
| AS12307070 | 75/75 | 0.85 | 20 | 222 | 99 | 53 | 53 |
| AS12311050 | 110/50 | 1.429 | 10 | 271 | 142 | 58 | 74 |
| AS12311070 | 110/75 | 1.465 | 8 | 271 | 142 | 58 | 74 |
| AS12311110 | 110/110 | 1.643 | 9 | 271 | 142 | 58 | 74 |
| AS12312110 | 125/110 | 1.806 | 8 | 296 | 160 | 62 | 85 |
| AS12312120 | 125/125 | 1.907 | 8 | 296 | 160 | 62 | 85 |
| AS12316110 | 160/110 | 2.434 | 5 | 344 | 203 | 64 | 109 |
| AS12316160 | 160/160 | 2.674 | 5 | 344 | 203 | 64 | 109 |

## 4.10. Single Branch 45°, 67°

Astolan Mineral Reinforced





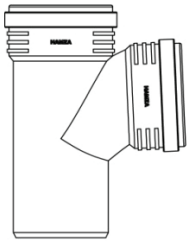
| ART. NO. | DN | ANGLE | WEIGHT | NO. OF BOXES | L | L 2 | L 3 | L 4 |
|---|---|---|---|---|---|---|---|---|
| | MM | | KG | PC | MM | MM | CM | MM |
| AS12005054 | 50/50 | 45° | 0.350 | 40 | 64 | 64 | 50 | 12 |
| AS12007054 | 75/50 | 45° | 0.608 | 20 | 94 | 79 | 53 | 18 |
| AS12007074 | 75/75 | 45° | 0.7 | 18 | 94 | 94 | 53 | 18 |
| | 100/50 | 45° | 1.2 | 8 | 137 | 104 | 58 | 25 |
| AS12011074 | 110/75 | 45° | 1.3 | 8 | 137 | 116 | 58 | 25 |
| AS12011114 | 110/110 | 45° | 1.4 | 8 | 137 | 137 | 58 | 25 |
| AS12012114 | 125/110 | 45° | 1.7 | 4 | 156 | 159 | 62 | 28 |
| AS12012124 | 125/125 | 45o | 1.8 | 4 | 156 | 156 | 62 | 28 |
| AS12016114 | 160/110 | 45° | 2.4 | 3 | 197 | 169 | 64 | 36 |
| AS12016164 | 160/160 | 45° | 2.7 | 4 | 197 | 197 | 64 | 36 |
| ** | 200/110 | 45° | - | - | - | - | - | - |
| ** | 200/160 | 45° | - | - | - | - | - | - |
| ** | 200/200 | 45° | 4.4 | 16 | 42 | 239 | - | 42 |
| ** | 250/110 | 45° | - | - | - | - | - | - |
| ** | 250/160 | 45° | - | - | - | - | - | - |
| ** | 250/200 | 45° | - | - | - | - | - | - |
| ** | 250/250 | 45° | - | - | - | - | - | - |
| ** | 110/110 | 67° | 1.32 | - | 58 | 84 | 58 | 84 |

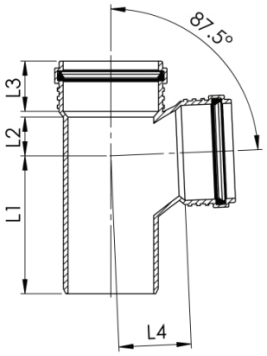
*Guranteed by Hamza Group

## 4.11. Single Branch 87.5°

Astolan Mineral Reinforced







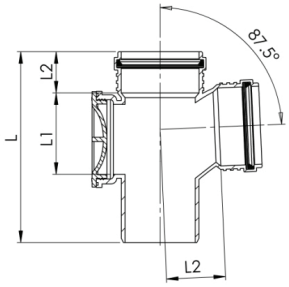

| ART. NO. | DN | ANGLE | WEIGHT | BOX | L1 | L2 | L3 | L4 |
|---|---|---|---|---|---|---|---|---|
| | MM | | KG | PC | MM | MM | CM | MM |
| AS12205058 | 50/50 | 87.5° | 0.33 | 44 | 103 | 26 | 50 | 36 |
| AS12207058 | 75/50 | 87.5° | 0.595 | 24 | 130 | 39 | 53 | 53 |
| AS12207078 | 75/75 | 87.5° | 0.65 | 20 | 130 | 39 | 53 | 53 |
| | 100/50 | 87.5° | 1.085 | 10 | 156 | 57 | 58 | 74 |
| AS12211078 | 110/75 | 87.5° | 1.123 | 8 | 156 | 57 | 58 | 74 |
| AS12211118 | 110/110 | 87.5° | 1.234 | 9 | 156 | 57 | 58 | 74 |
| AS12212118 | 125/110 | 87.5° | 1.48 | 8 | 169 | 65 | 62 | 85 |
| AS12212128 | 125/125 | 87.5° | 1.528 | 8 | 169 | 65 | 62 | 85 |
| AS12216118 | 160/110 | 87.5° | 2.072 | 5 | 196 | 84 | 64 | 109 |
| AS12216168 | 160/160 | 87.5° | 2.313 | 5 | 196 | 84 | 64 | 109 |
| ** | 200/110 | 87.5° | - | - | | | | |
| ** | 200/160 | 87.5° | - | - | | | | |
| ** | 200/200 | 87.5° | - | - | | | | |
| ** | 250/110 | 87.5° | - | - | | | | |
| ** | 250/160 | 87.5° | - | - | | | | |
| ** | 250/200 | 87.5° | - | - | | | | |
| ** | 250/250 | 87.5° | - | - | | | | |

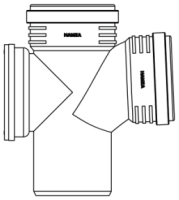
*Guranteed by Hamza Group

## 4.12. Single Branch 87.5° with access door

Astolan Mineral Reinforced





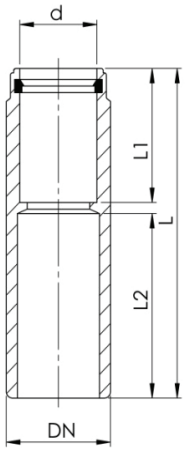
| ART. NO. | DN | WEIGHT | BOX | L | L1 | L2 | L3 |
|---|---|---|---|---|---|---|---|
| | MM | KG | PC | MM | MM | MM | MM |
| AS12307050 | 75/50 | 0.79 | 24 | 222 | 99 | 53 | 53 |
| AS12307070 | 75/75 | 0.85 | 20 | 222 | 99 | 53 | 53 |
| AS12311050 | 110/50 | 1.429 | 10 | 271 | 142 | 58 | 74 |
| AS12311070 | 110/75 | 1.465 | 8 | 271 | 142 | 58 | 74 |
| AS12311110 | 110/110 | 1.643 | 9 | 271 | 142 | 58 | 74 |
| AS12312110 | 125/110 | 1.806 | 8 | 296 | 160 | 62 | 85 |
| AS12312120 | 125/125 | 1.907 | 8 | 296 | 160 | 62 | 85 |
| AS12316110 | 160/110 | 2.434 | 5 | 344 | 203 | 64 | 109 |
| AS12316160 | 160/160 | 2.674 | 5 | 344 | 203 | 64 | 109 |

*Guranteed by Hamza Group

## 4.13. Long Reducer Socket

Astolan Mineral Reinforced





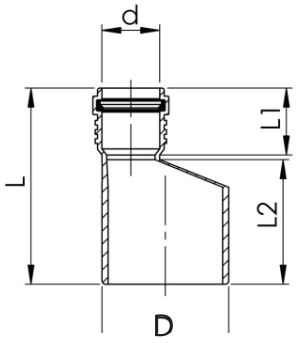


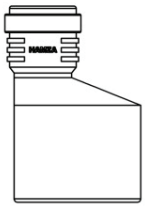
| ART. NO. | DN | WEIGHT | BOX | L | L1 | L2 |
|---|---|---|---|---|---|---|
| | MM | KG | PC | MM | MM | MM |
| AS12905032 | 50/32 | 0.21 | | 150 | 50 | 100 |
| AS12905040 | 50/40 | 0.195 | | 150 | 50 | 100 |

## 4.14. Reducer

Astolan Mineral Reinforced





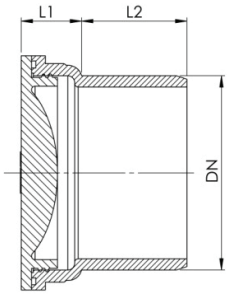



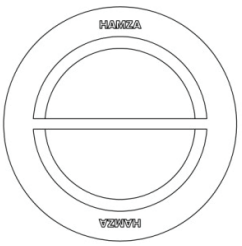
| ART. NO. | DN | WEIGHT | BOX | d | D | L | L1 | L2 |
|---|---|---|---|---|---|---|---|---|
| | MM | KG | PC | MM | MM | MM | MM | MM |
| AS12907050 | 75/50 | 0.296 | - | 50 | 75 | 151 | 50 | 101 |
| AS12911050 | 110/50 | 0.511 | - | 50 | 110 | 175 | 50 | 125 |
| AS12911070 | 110/75 | 0.492 | - | 75 | 110 | 165 | 53 | 112 |
| AS12912070 | 125/75 | 0.608 | - | 75 | 125 | 177 | 53 | 124 |
| AS12912110 | 125/110 | 0.608 | | 110 | 125 | 165 | 58 | 107 |
| AS12916070 | 160/75 | - | - | 75 | 160 | 201 | 53 | 148 |
| AS12916110 | 160/110 | 0.926 | - | 110 | 160 | 188 | 58 | 130 |
| ** | 200/160 | 1.32 | | 160 | 200 | 142 | 64 | 78 |
| ** | 250/200 | - | | 200 | 250 | - | - | - |

## 4.15. Plug Socketing

Astolan Mineral Reinforced



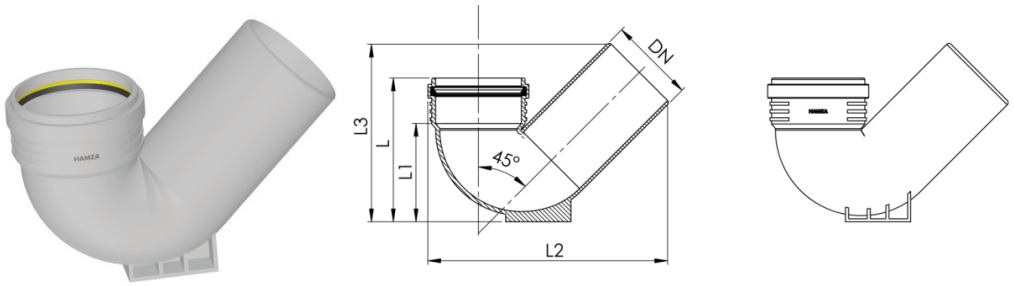




| ART. NO. | DN | WEIGHT | BOX | L1 | L2 |
|---|---|---|---|---|---|
| | MM | pc | pc | Mm | mm |
| AS13100050 | 50 | 0.126 | 120 | 81 | 53 |
| AS13100070 | 75 | 0.21 | 60 | 84 | 56 |
| AS13100110 | 110 | 0.377 | 30 | 90 | 61 |
| AS13100120 | 125 | 0.451 | 40 | 100 | 64 |
| AS13100160 | 160 | 0.618 | 24 | 102 | 67 |
| ** | 200 | - | - | - | - |
| ** | 250 | - | - | - | - |

*Guranteed by Hamza Group

## 4.16. P Trap

Astolan Mineral Reinforced

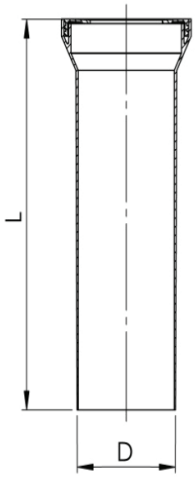


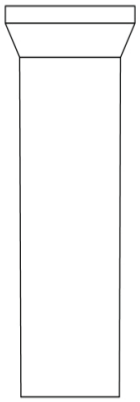

| ART. NO. | DN | WEIGHT | BOX | L | L1 | L2 | L3 |
|---|---|---|---|---|---|---|---|
| | MM | KG | PC | MM | MM | MM | MM |
| AS13500110 | 110 | 1.38 | 8 | 180 | 120 | 300 | 220 |

## 4.17. WC Connection Socket

Astolan Mineral Reinforced



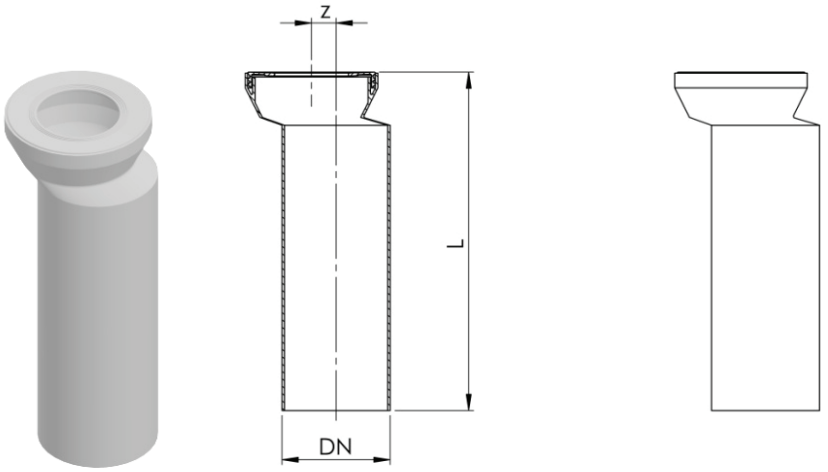


| ART. NO. | WEIGHT | NO. OF BOXES | L | D N |
|---|---|---|---|---|
| | KG | PC | MM | MM |
| AS14000001 | 0.665 | | 350 | 110 |

## 4.18. WC Connection Socket for height adjustment

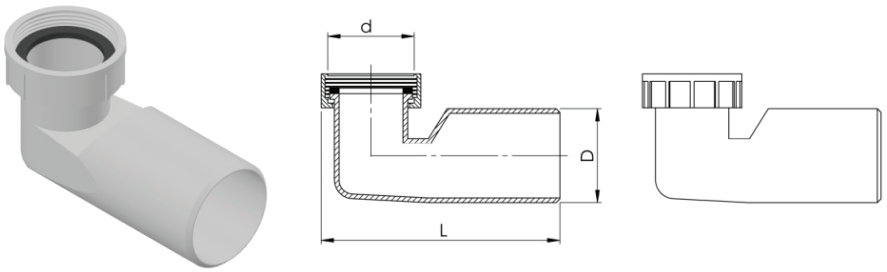
Astolan Mineral Reinforced




| ART. NO. | WEIGHT | BOX | L | D N | Z |
|---|---|---|---|---|---|
| | KG | Pc | MM | MM | MM |
| AS14000002 | 0.685 | | 350 | 110 | 25 |

## 4.19. Drain Elbow for Bath and Shower

Astolan Mineral Reinforced




| ART. NO. | WEIGHT | BOX | L | D | d |
|---|---|---|---|---|---|
| | KG | Pc | MM | MM | MM |
| AS14100050 | 0.045 | | 100 | 50 | 37 |

## 4.20. Floor Drain

Astolan Mineral Reinforced

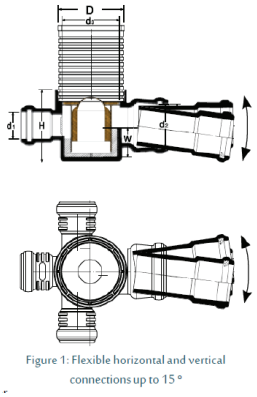
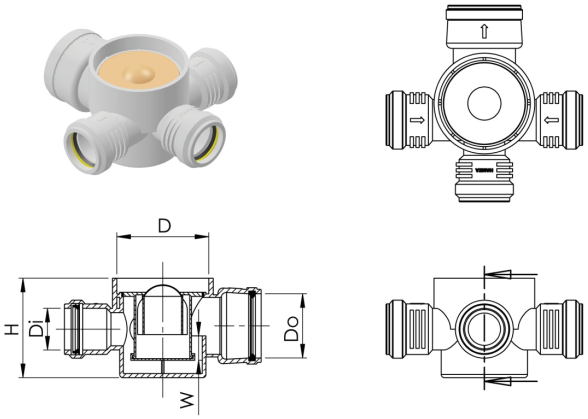


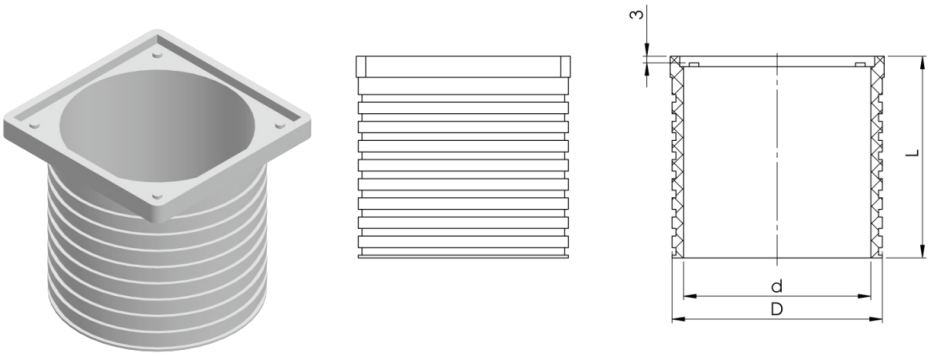

Figure 1: Flexible horizontal and vertical connections up to 15 °




| ART. NO. | WEIGHT | BOX | H | D | DI | DO | W |
|---|---|---|---|---|---|---|---|
| | KG | Pc | MM | MM | MM | MM | MM |
| AS13675550 | | 8 | 120 | 110 | 50 | 75 | 30 |

## 4.21. Floor Drain Extension

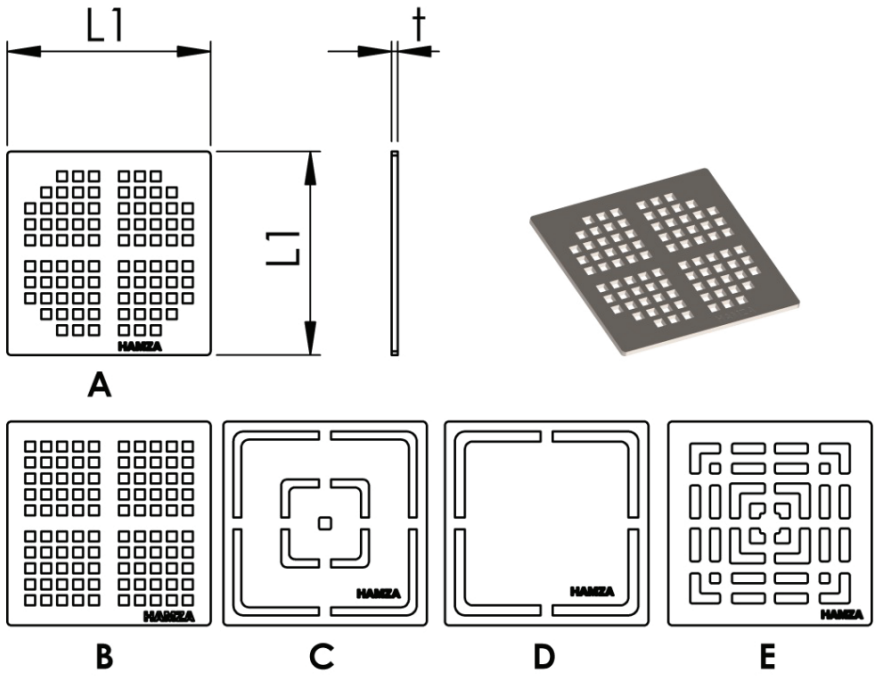
Astolan Mineral Reinforced




| ART. NO. | WEIGHT | UNITS/ PALLET | L | D | d |
|---|---|---|---|---|---|
| | KG | Pc | MM | MM | MM |
| AS13800012 | | | 100 | 110 | 100 |
| AS13800011 | | | 200 | 110 | 100 |

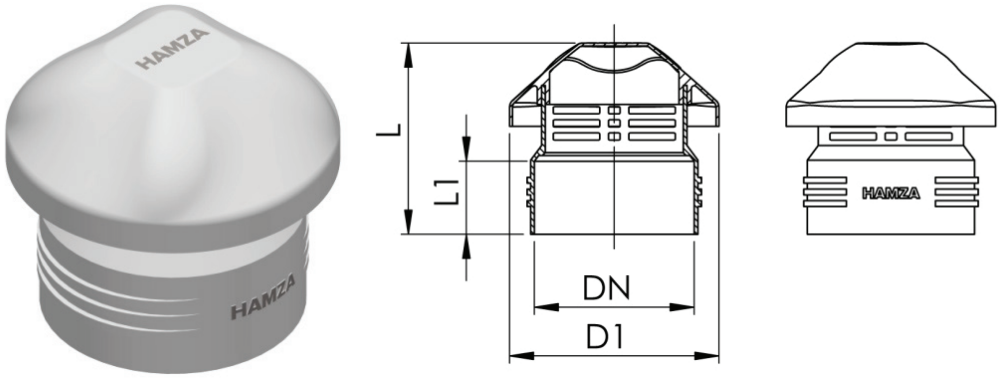
## 4.22. Floor Drain Cover

Stainless Steel 304




## 4.23. Ventilator

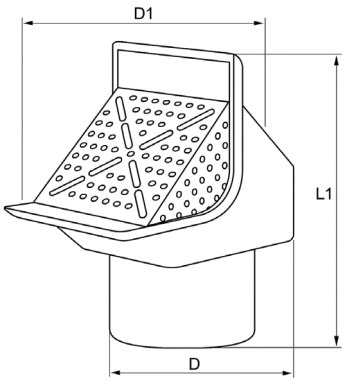
Mineral reinforced
integrated with Polypropylene




| ART. NO. | WEIGHT | BOX | DN | L1 | L | D1 |
|---|---|---|---|---|---|---|
| | KG | Pc | Mm | MM | MM | MM |
| AS14200075 | 0.3 | 22 | 110 | 50 | 130 | 144 |
| AS14200075 | 0.25 | 22 | 75 | 50 | 124 | 144 |

## 4.24. Roof Gutter / Drain

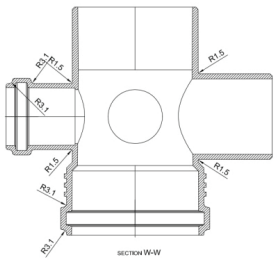


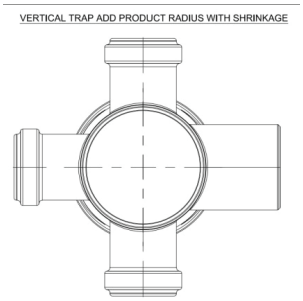



| ART. NO. | WEIGHT | BOX | DN | L1 | L | D1 |
|---|---|---|---|---|---|---|
| | KG | Pc | Mm | MM | MM | MM |
| AS14200000 | 0.3 | | 110 | 50 | 130 | 144 |

## 4.25. Branch Collector








| ART. NO. | DN MM | WEIGHT KG | BOX PC |
|---|---|---|---|
| AS12375550 | 110/75/50/50 | 1 | 5 |

# 5. ACOUSTICS

## 5.1. Sound insulation by HAMZA AS

The excellent sound protection properties of HAMZA AS are primarily attributed to its thick-walled design as well as special molecular weight / structure. and the high density of ~1.9 g/cm3 of the material. This property enables HAMZA AS to absorb airborne sound as well as mechanical vibrations. **A** contribution to sound protection is made by the special product design, system solutions and features.

- Swept branches for minimal flow disturbance in the down pipe.
- With unique system bracket and high structure born sound prevention
- Enhanced sound insulation designs and laminar flow profiles
- Increased socket rips for higher rigidity and better noise insulation





In studies conducted at the Fraunhofer Institut für Bauphysik (Fraunhofer Institute for Building Physics), Stuttgart, HAMZA AS has proven its excellent sound absorption properties.The tests were performed in a laboratory accredited by the German Accreditation System for Testing (DAP, file no.PL-3743.26) according to standard EN ISO/IEC 17025. The measurements in this test were performed following German standard DIN EN14366 and DIN 52219:1993-07; noise excitation by stationary water flow with 0.5 l/s, 1.0 l/s, 2.0 l/s., 3.0 l/s and 4.0 l/s.

## 5.2. Noise calculation software

Determination of the sound level as conducted by Fraunhofer Institut Bauphysik is in general useful to determine the noise level of a pipe system in a static situation. The test method is, however, based on a laboratory set up in which all building parameters are kept the same except for a change in water flow. As a result it is impossible to obtain by this test a realistic figure of the noise levels for the protect chambers of actual projects. To actually determine real noise emission of the pipe system into a room requires a more dynamic test set up in which at least the following parameters can be modified.

- Pipe system characteristics
- Building design
- Shaft characteristics
- Suspended ceiling criteria
- Structural characteristics of the building
- Flow parameters
- Installation requirements

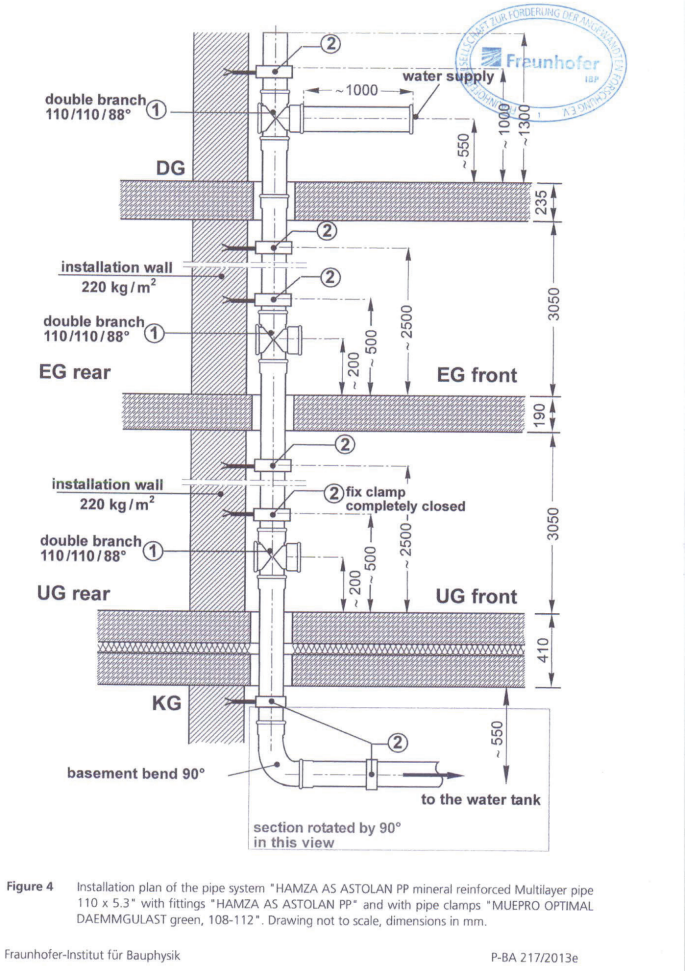



**Figure 4** Installation plan of the pipe system "HAMZA AS ASTOLAN PP mineral reinforced Multilayer pipe 110 x 5.3" with fittings "HAMZA AS ASTOLAN PP" and with pipe clamps "MUEPRO OPTIMAL DAEMMGULAST green, 108-112". Drawing not to scale, dimensions in mm.

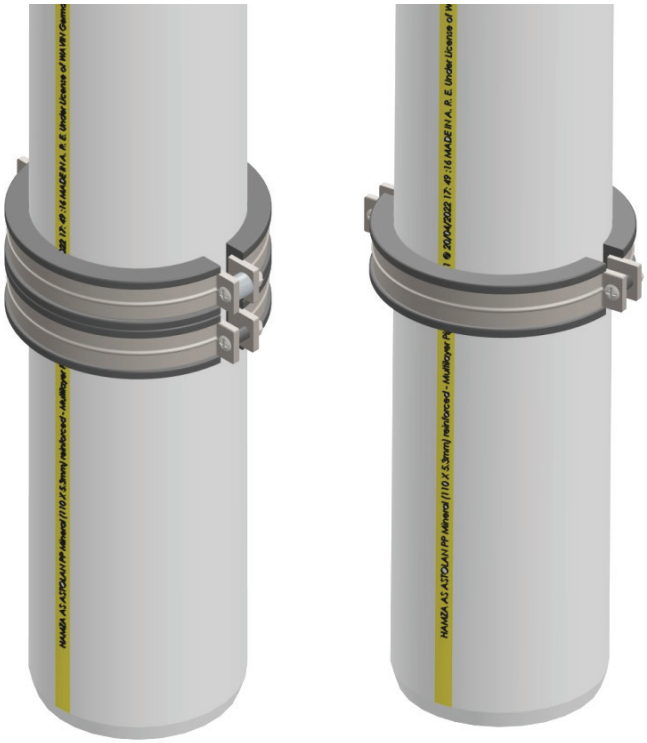
Fraunhofer-Institut für Bauphysik P-BA 217/2013e

*Fig. 3: FRAUNHOFER Test set up for determination of the installation sound level in the laboratory.*

## 5.3. Sound-insulating performance

The excellent sound protection properties of **HAMZA AS** are primarily attributed to its thick-walled design as well as special molecular structure and the high density of ~1.9 g/cm3 of the material used to make the pipes and fittings. This property enables **HAMZA AS** to absorb airborne sound as well as structure borne sound. Studies conducted at the Fraunhofer Institut für Bauphysik (Fraunhofer Institute for Building Physics), Stuttgart, on **HAMZA AS** attest to its excellent sound absorption properties.

| HAMZA AS WITH LOW NOISE BRACKETS | VOLUMETRIC FLOW RATE 2 L/S | 4L/S | Meets Standard |
|---|---|---|---|
| DIN 4109 (PUBLIC MINIMUM LEGAL REQUIREMENT) SPECIFICATION 30 DB(A) | 14 dB(A) | 19 dB(A) | √ |
| VDI 4100 SOUND INSULATION II/III SPECIFICATION 24/27 DB(A) | 11 dB(A) | 16 dB(A) | √ |
| HAMZA AS WITH NO NOISE BRACKETS | | | |
| DIN 4109 (PUBLIC MINIMUM LEGAL REQUIREMENT) SPECIFICATION 30 DB(A) | < 10 dB(A) | 13 dB(A) | √ |
| VDI 4100 SOUND INSULATION II/III SPECIFICATION 24/27 DB(A) | < 10 dB(A) | 10 dB(A) | √ |

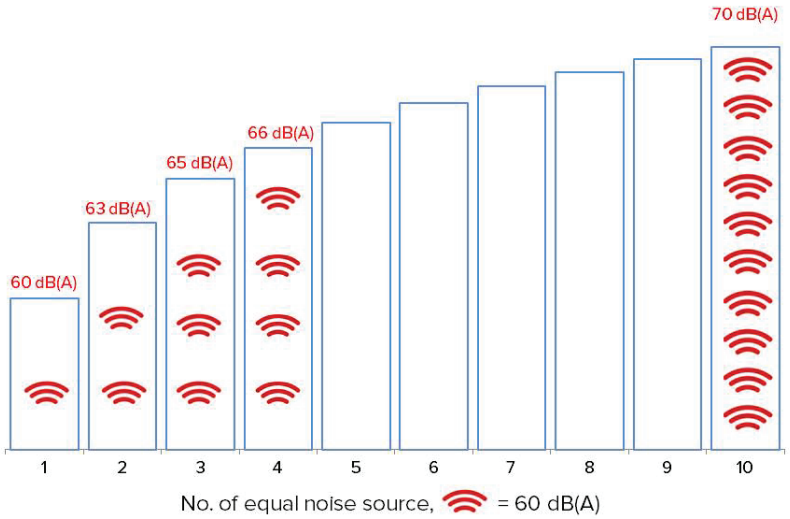


*Left: no noise bracket, Right: low noise bracket*

## 5.4. About Sound

Sound is a sensation felt, a perception of what takes place around us, caused by various compression waves which cross the eardrum and are captured and transformed by the brain; it is composed of different frequencies. The acuteness or intensity of the perception depends on the frequency and range.
Sound is a wave that is: Elastic (it needs a medium to be propagated), and Longitudinal (perturbation takes place parallel to the direction of propagation).
To exist it requires: a source (vibrating body) and an elastic propagation medium (air, water, etc.)
A sound is therefore a method of transmitting mechanical energy. To propagate, a sound needs a medium: any means, whether solid, liquid or gassy, like air, is able to transport sound, influencing its speed according to density.
Sound is propagated through the exchange of air-solid-air or solid-air vibrations (in the second case the solid is the source of the sound). With respect to soundproofing soil and waste systems, we need to think in two different directions: (1) the noise created in the pipes and transmitted by them and (2) noise which is transmitted by the walls or surrounding media.
Sound is measured with a photometer, an instrument which filters noise and measures intensity at its different frequencies. It is expressed in decibels.
The decibel is the logarithm of the ratio between the measured sound pressure and a reference sound pressure, multiplied by ten.
**dB = 10 log (P/Pa)**
We need to remember that sound is an energy (just think of when you stand in front of the stereo speakers and you can “feel” the basses) but what we perceive is a processed sensation. The human ear is sensitive to pressure in a NON LINEAR manner; therefore twice the pressure does not correspond to twice the sensation. The doubling of acoustic power corresponds to an increase of 3 dB. Every 10 dB increase is perceived by the human ear as twice as loud (10 cars are perceived as twice as loud as 1 car).

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




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

## 5.5. Noise

Noise can be described as unwanted sound. In relation to sound, noise is not necessarily random. Acoustic noise can be anything from quiet but annoying to loud and harmful causing permanent irreversible hearing damage. Based on the World Health Organization (WHO) guidelines, European countries have maximized the noise level (in hou¬ses, apartments, hospitals, elderly homes, hotels, etc.) during the night to:

**LA max night = 30 to 35 dB(A).**

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

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

In contrast to many other environmental problems, noise pollution continues to grow and it is accompanied by an increasing number of complaints from people exposed to the noise. The growth in noise pollution is unsustainable because it involves direct, as well as cumulative, adverse health effects. For instance sleep disturbance: measurable effects of noise on sleep begin at sound levels of about 30 dB. However, the more intense the background noise, the more disturbing is its effect on sleep. Sensitive groups mainly include the elderly, shift workers, people with physical or mental disorders and other individuals who have difficulty sleeping. Table 1 presents the WHO guideline values arranged accor¬ding to specific environments and critical health effects. The guideline values consider all identified adverse health effects

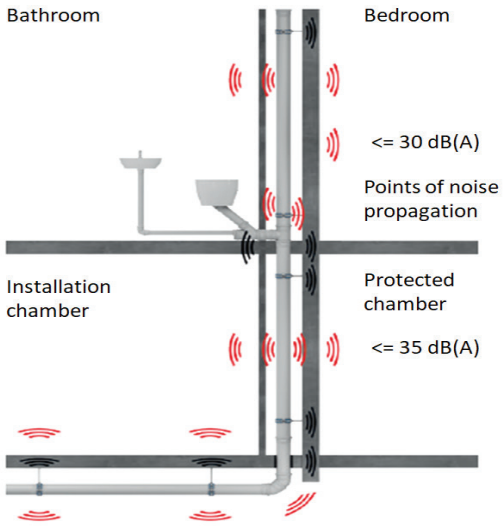
| HAMZA AS WITH LOW NOISE BRACKETS | CRITICAL HEALTH EFFECTS(S) | $L_{Aeq}$ [dB(A)] | Time base [hours] | $L_{Amax}$ fast [dB] |
|---|---|---|---|---|
| OUTDOOR LIVING AREA | SERIOUS ANNOYANCE, DAYTIME AND EVENING | 50 | 16 | |
| DWELLING, INDOORS | SPEECH INTELLIGIBILITY & MODERATE | 35 | 16 | 45 |
| INSIDE BEDROOMS | SLEEP DISTURBANCE , NIGHT-TIME | 30 | 8 | 45 |
| OUTSIDE BEDROOMS | SLEEP DISTURBANCE, WINDOW OPEN | 45 | 8 | 60 |
| SCHOOL CLASS ROOMS & PRE-SCHOOLS, INDOORS | SPEECH INTELLIGIBILITY, DISTURBANCE OF INFORMATION EXTRACTION | 35 | DURING CLASS | |
| PRE-SCHOOL BEDROOMS, INDOOR | SLEEP DISTURBANCE | 30 | SLEEPING TIME | 45 |
| SCHOOL , PLAYGROUND OUTDOOR | ANNOYANCE (EXTERNAL SOURCE) | 55 | DURING PLAY | 40 |
| HOSPITAL, WARD ROOMS, INDOORS | SLEEP DISTURBANCE | 30 | 16 | 110 |
| INDUSTRIAL, COMMERCIAL AREAS | HEARING IMPATIENCE | 70 | 24 | 110 |
| CEREMONIES, FESTIVALS | HEARING IMPATIENCE | 100 | 4 | 110 |
| PUBLIC ADDRESSES | HEARING IMPATIENCE | 85 | 1 | 110 |
| HEADPHONES/EARPHONES | HEARING IMPATIENCE (FREE-FIELD VALUE) | 85 | 1 | 140 |
| IMPULSE SOUNDS FROM TOYS, FIREWORKS AND FIREARMS | HEARING IMPATIENCE | | | |

For the specific environment, an adverse effect of noise refers to any temporary or long-term impairment of physical, psychological or social functioning that is associated with noise exposure. Specific noise limits have been set for each health effect, using the lowest noise level that produces an adverse health effect (i.e. the critical health effect).
It is not enough to characterize the noise environment in terms of noise measures or indices based only on energy summation (e.g., LAeq), because different critical health effects require different descriptions. It is equally important to display the maximum values of the noise fluctuations, preferably combined with a measure of the number of noise events. A separate characterization of night-time noise exposures is also necessary.
For indoor environments, reverberation time is also an important factor for things such as speech intelligibility. If the noise includes a large proportion of low-frequency components, still lower guideline values should be applied.
Supplementary to the guideline values given in Table 2, precautions should be taken for vulnerable groups and for noise of certain character (e.g. low-frequency components, low background noise).

## 5.5.1. Sources of noise in buildings

The noise generated by the building and its utilities may be classified as follows:
- Noise due to filling operations
- Noise generated by control equipment
- Intake noise
- Discharge noise
- Noise due to impact or shock

Noise is generated by moving parts or by flowing media. Waste water discharge pipes are prone to vibration, particularly where water flows through downpipes, or is forced to change direction in joints and elbows (noise due to impact or shock). Experience shows that the greatest problems are typically caused by the transmission of structural noise, particularly in the area of pipe clamps and brackets or where pipe-work is run through walls or ceilings.
The noise created from waste systems obviously depends greatly on the vertical piping. Here the falling water clashes against the wall of the pipes and fittings. The generated noise is transmitted directly to the pipes and indirectly through the ducts and installation walls. Therefore, the thickness and mass of the solid materials are of great importance, just like the fixing brackets and other elements which connect pipes to their supports.



## 5.5.2. How noise is measured

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

## 5.5.3. Acoustic requirements

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

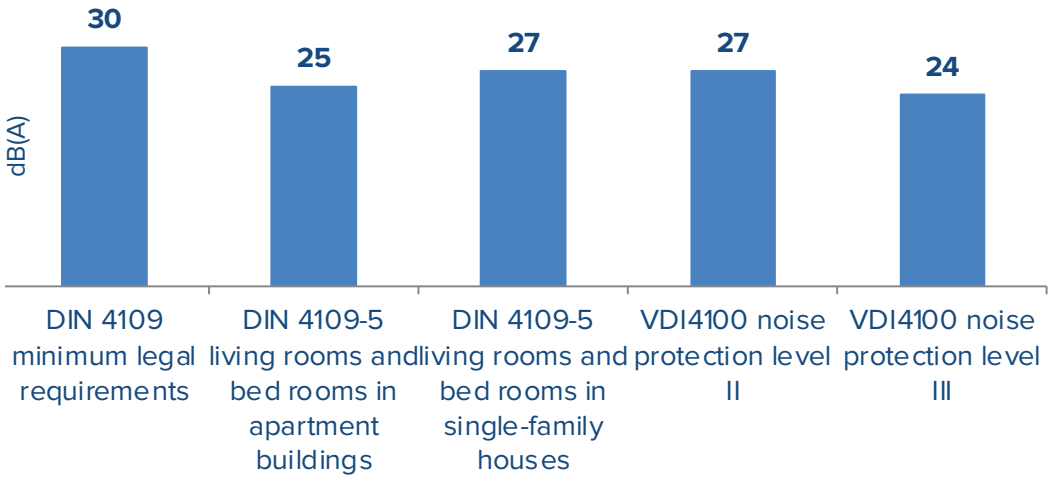
DIN4109-5

This supplement contains instructions relating to noise levels that lie 5 dB (A) below the values given in DIN 4109-1:20/6-07.

In accordance with DIN 4109-5, increased levels of sound insulation can be arranged, by agreement, to a maximum of 25 dB (A) in other areas requiring noise protection.

VDI 4100

In addition to the requirements of DIN 4109, which was adop¬ted as Noise Protection Level I (NPL I), this guideline contains characteristic values for two additional noise protection levels – NPL II and NPL III. These two additional noise protection levels specify the arrangements for increased sound insulation.




*Overview Noise Protection Standards and Guidelines*

## 5.6. Acoustic design

### 5.6.1. Advantageous layouts

An important factor for the assurance of acoustic insulation is the design and implementation of an acoustically advantageous layout. The following measures have proven to be of significant influence to the level of noise generated from the soil system inside the building:

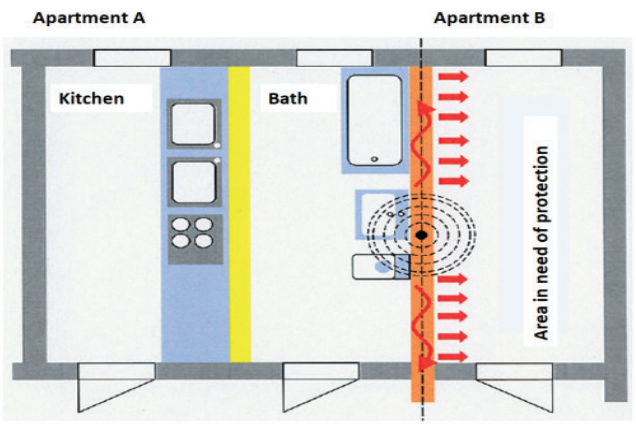
- Noise-sensitive areas should be kept away, as far as possible, from sources of noise
- Non-sensitive areas should, wherever possible, be used as “buffer zones”
- Noise-sensitive areas should not be positioned in the direct vicinity of bathrooms, toilets or stairwells
- Potential sources of noise should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

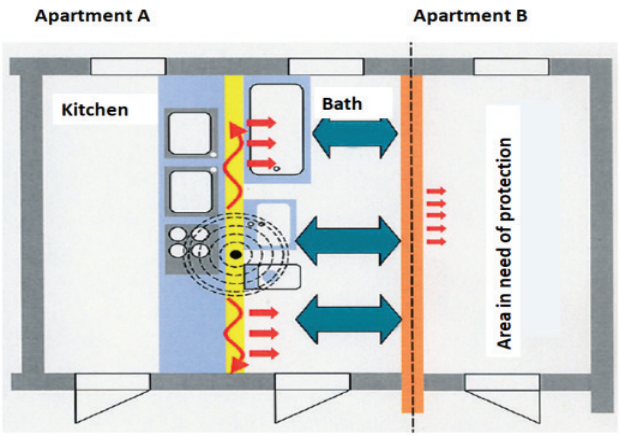
The comparison between the two examples of layout shown above demonstrates how the acoustically advantageous layout in the second example contributes to a clear reduction in the acoustic pressure of the systems in the room which demands acoustic insulation.

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

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

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



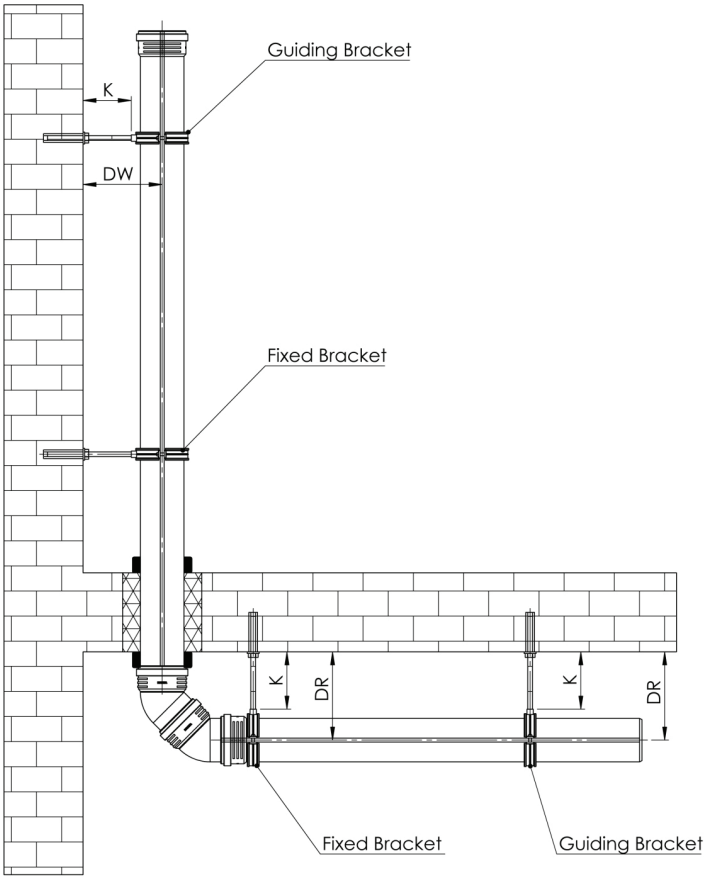



## 5.6.2. Acoustic plumbing design

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

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

**1:** Guiding Bracket with Sound dampening rubber
**2:** Fixed bracket with sound dampening rubber
**3:** Structure borne sound insulation
**4:** Fire collar



# 6. DESIGN OF THE WASTE WATER SYSTEM

## 6.1. Installation and layout principles for waste water drainage systems

The technical aspects of waste water drainage systems have been regulated by an extensive set of standards established in the course of ongoing European/ international harmonization, started in 2001 with DIN EN 12056 (“Gravity drainage systems inside buildings”).
This European drainage system standard consists of five parts:
**Part 1:** General and performance requirements
**Part 2:** Sanitary pipe work, layout and calculation
**Part 3:** Roof drainage, layout and calculation
**Part 4:** Waste water systems, layout and calculation
**Part 5:** Installation and testing, instructions for operation, maintenance and user

For drainage systems, based on the earlier German standard DIN 1986 Parts 1+2 which were not incorporated into the DIN EN 12056 set of European standards The current version of the standard (from 2016) has been reorganized into key points for better readability, including, for example:

• Basic requirements for the design and completion of waste water and rainfall drainage systems
• The installation of pipes inside and outside buildings
• Requirements concerning the quality and quantity of waste water
• Backflow prevention
• Sizing of waste water and rainfall drainage systems
DIN 1986-100 is therefore an extension of European waste water regulations for application in Germany, with uniform technical provisions for the design, construction, operation and maintenance of drainage systems used for the disposal of waste water in buildings and on private property.
For the sake of completeness, we also include other parts of the above-mentioned DIN 1986.

**Part 3:** Specifications for service and maintenance
**Part 4:** Fields of application of sewage pipes
**Part 30:** Maintenance of waste water drainage systems

## 6.2. List of definitions according to DIN EN 12056

| | |
|---|---|
| Waste water drainage system | Structural system for the collection, drainage, disposal and treatment of waste water in buildings and on private property |
| Underground collector pipe | A non-accessible pipe, installed below ground or in the foundations, for the disposal of waste water (normally via the connecting sewer) |
| Collecting pipe | Horizontally installed pipe for the collection of waste water from downpipes and connected lines not buried below ground or installed in foundations |
| Downpipe | Perpendicular pipe for the collection of waste water from individual and collective inlets. It directs the flow of waste water to a collecting pipe or underground and collector pipe |
| Collecting connection pipe | Pipe designed to collect waste water from various single connection pipes and direct it to a downstream pipe |
| Single connection pipe | Pipe from a sink drain or other drainage outlet, designed to direct waste water to a downstream pipe |
| Bypass pipe | Pipeline for connection pipes in the retention area of a downpipe offset or in the transition between a downpipe and a collecting pipe or underground and collector pipe |
| Discharge unit ($D_u$) | The average discharge rate of a sanitary appliance expres¬sed in litres per second (l/s) |
| Frequency factor | Variable to take into account the frequency of use of sanitary appliance (dimensionless) |
| Waste water flow rate ($Q_{ww}$) | Total design flow rate from sanitary appliances in a drainage system or in a part of a drainage system in litres per second (l/s) |
| Continuous flow rate ($Q_c$) | Flow rate of all continuous flows, e.g. cooling water, etc. in liters per second (l/s) |
| Pumped water flow rate ($Q_p$) | Discharge rate of waste water pumps in litres per second (l/s)<br>Total flow rate (Qtot)<br>The total flow rate is the sum of the wate water flow rate (Qww) and continuous flow rate (Qc) and pumped water flow rate (Qp) in liters per second (l/s) |
| Hydraulic capacity ($Q_{max}$) | Maximum flow rate of air through a ventilating pipe or air admittance valve, measured at 250 Pascal (Pa) pressure drop, in liters per second (l/s) |

## 6.3. Functional requirements

The dimensional specifications of waste water standards are based on various requirements:

• The loss of trap water resulting from the flow of water must not reduce the total level of the water seal by more than 25 mm in height.

• The trap water must not be sucked out by a vacuum or expelled by excess pressure.

• The nominal dimensions of waste water and mixed-water systems must not exceed those specified in DIN 1986-100.

• The waste water pipeline must be self-cleaning.

The following sizing method applies to all gravity waste water drainage systems designed to dispose of domestic waste water. The layouts of industrial and commercial waste water drainage systems used in such places as swimming pools or factory buildings must be designed individually. Performance figures are based on the minimum internal diameters specified in the table in DIN EN 12056-2.

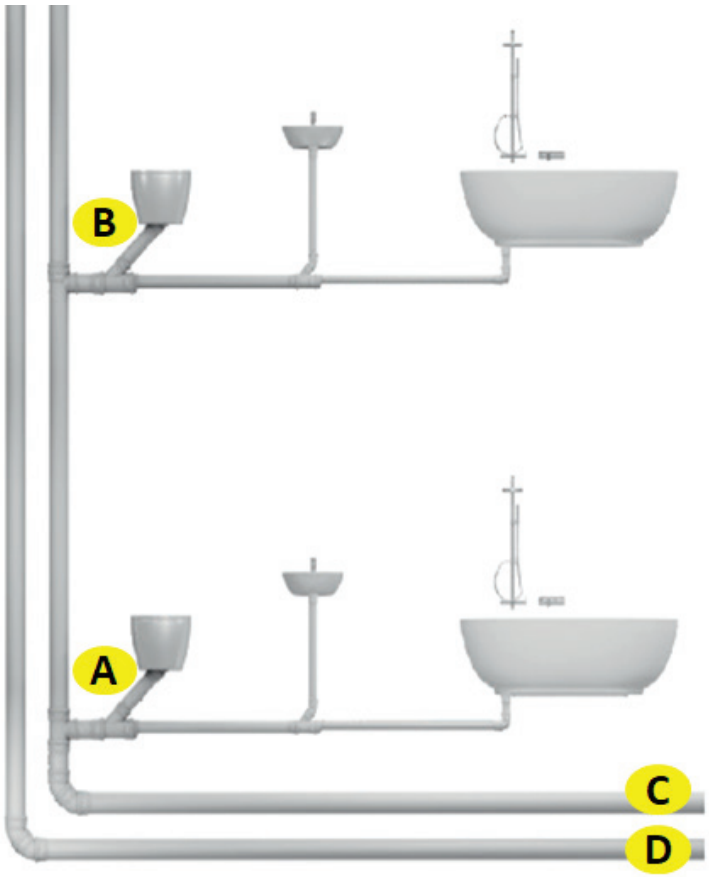
Please note that the product standards applied to pipes and fittings used in Germany are based on outside diameters, which might lead to certain deviations with respect to the tables in DIN EN 12056.

| HAMZA AS SIZE OD | HAMZA AS INTERNAL DIAMETER DI (mm) | Minimum Internal Diameter Di (mm) DIN 2-12056 Table 1 |
|---|---|---|
| 50 | 42 | 42 |
| 75 | 66 | 66 |
| 110 | 99 | 96 |
| 125 | 114 | 113 |
| 160 | 148 | 146 |
| 200 | 188 | 184 |
| 250 | 236 | 232 |

## 6.3.1. Minimum fall

Compliance with the required minimum fall is vital for the proper drainage of waste water. Waste water standards specify different minimum falls, depending on the piping area concerned

| AREA OF PIPING | MINIMUM FALL | Standard | Example |
|---|---|---|---|
| UNVENTILATED CONNECTION PIPES | 1% | DIN 12056-2 DIN 1986-100 | A |
| VENTILATED CONNECTION PIPES | 0.5% | DIN 12056-2 | B |
| UNDERGROUND, COLLECTOR, AND COLLECTING PIPES WASTE WATER INSIDE THE BUILDING | 0.5% | DIN 1986-100 | C |
| WASTE WATER OUTSIDE THE BUILDING | 1: DN | DIN 1986-100 | D |



## 6.3.2. Basis of calculations

The hydraulic calculations for a waste water system begin at the starting point (e.g. a sink, toilet or shower, etc.) and cover the rest of the piping, the layout of which depends on the items included.

- Single connection pipe
- Collecting connection pipe
- Downpipe
- Collecting pipe
- Underground and collector pipe

Please refer to the following pages of the manual for further details of the areas covered by the waste water drainage pipes. The sum total quantities of waste water to be disposed of are normally based on various parameters.

The formula for calculating domestic waste water in accordance with DIN 12056 is as follows:

Basis of calculation DIN EN 12056:

$$Q_{ww} = K.\sqrt{\Sigma^{DU}}$$

$$Q_{tot} = Q_{ww} + Q_c + Q_p$$

| | |
|---|---|
| $D_U$ : design unit | $Q_c$ : continous discharge |
| $Q_{ww}$ : waste water discharge flow rate | $Q_p$ : pump flow rate |
| $Q_{tot}$ : total wastewater discharge | K : discharge coefficient. |

Frequency factor K describes the frequency of use of the sanitary drainage sources concerned, along with its simultaneity. Frequency factor K is not expressed in dimensional terms.

| TYPE OF BUILDING | K |
|---|---|
| NON-REGULAR USAGE (E.G. IN RESIDENTIAL PROPERTIES, BOARDING HOUSES AND OFFICES) | 0.5 |
| REGULAR USAGE (E.G. IN HOSPITALS, SCHOOLS, RESTAURANTS AND HOTELS AND/OR SHOWERS | 0.7 |
| FREQUENT USAGE (E.G. IN PUBLIC TOILETS) | 1.0 |
| SPECIAL USAGE (E.G. LABORATORIES) | 1.2 |

*Typical frequency factor K as per DIN EN 12056 - 2.*

The discharge unit DU is described in terms of the expected amount of waste water for a given drainage source. 1 DU = 1 l/s.

## 6.4. Types of pipes and sections

### 6.4.1. Single connection pipes

The term “single connection pipe” refers to a pipe that runs from a drainage source (connection point) to a downpipe, collection pipe or underground and collector pipe. Multiple single connection pipes supply waste water to the collection pipes that run to the downpipe, collection pipe or underground and collector pipe concerned. A distinction is made between unventilated and ventilated single connection pipes. These are subject to allowable waste water discharge with respect to:

- Maximum length of pipe
- Maximum number of changes of direction (bends, etc.)
- Maximum height difference along the length of the pipe
- Minimum fall

Application boundaries for unventilated single connection pipe conforming to DIN 12026-2, System I

| | |
|---|---|
| MAX. LENGTH OF PIPE (l) | 4.0 m |
| MAXIMUM NUMBER OF CHANGES OF DIRECTION | 3 X* |
| MAXIMUM HEIGHT DIFFERENCE | 1.0 m |
| MINIMUM FALL | 1 % |

*Application boundaries for unventilated single connection pipes conforming to DIN EN 12056-2, Table 5*

If the system cannot fulfill the specifications of the above-mentioned table, the connecting pipe must be ventilated. The allowable limitations in the table for ventilated single connection pipes will then apply.Application boundaries for ventilated single connection pipes conforming to DIN 12056-2, System I

| | |
|---|---|
| MAX. LENGTH OF PIPE (l) | 10.0 m |
| MAXIMUM NUMBER OF CHANGES OF DIRECTION | NO LIMIT |
| MAXIMUM HEIGHT DIFFERENCE | 3.0 m |
| MINIMUM FALL | 0.5 % |

*Application boundaries for ventilated single connection pipes conforming to DIN EN 12056-2, Table 5.*

## 6.4.1. Single connection pipes

Once it has been established whether an unventilated or ventilated single connection pipe is required, the dimensions are established in accordance with the following table and depending on the drainage source concerned.

| DRAINAGE SOURCE | Discharge unit (DU) | Dimensions, Single connection pipe (DN) |
|---|---|---|
| WASHBASIN, BIDET | 0.5 | 40 |
| SHOWER WITHOUT PLUG | 0.6 | 50 |
| SHOWER WITH PLUG | 0.8 | 50 |
| INDIVIDUAL URINAL WITH FLUSHING CISTERN | 0.8 | 50 |
| URINAL WITH PRESSURIZED FLUSHING | 0.5 | 50 |
| STAND-TYPE URINAL | 0.2 | 50 |
| NON-FLUSHING URINAL | 0.1 | 50 |
| BATHTUB | 0.8 | 50 |
| KITCHEN SINK AND DISHWASHER* | 0.8 | 50 |
| DISHWASHER | 0.8 | 50 |
| WASHING MACHINE (UP TO 6 KG) | 0.8 | 50 |
| WASHING MACHINE (UP TO 12 KG) | 1.5 | 56/60 |
| WC WITH 4.5/4.0 L FLUSHING CISTERN | 1.8 | 80/90 |
| WC WITH 6.0 L FLUSHING CISTERN | 2.0 | 80/100 |
| WC WITH 7.5 L FLUSHING CISTERN | 2.0 | ** |
| WC WITH 9.0 L FLUSHING CISTERN | 2.5 | 100 |
| FLOOR DRAIN , DN 50 | 0.8 | 50 |
| FLOOR DRAIN , DN 70 | 1.5 | 70 |
| FLOOR DRAIN , DN 100 | 2.0 | 100 |

* With shared sink drain
** Not subject to this standard's scope of application
Discharge units (DU) as per DIN 1986-100, Table 6.

## 6.4.2. Collecting connection pipes

Collecting connection pipes collect waste water from various single connection pipes and carry it to the next pipe section (e.g. a downpipe). Here, too, the load-bearing limitations apply. Ventilated collecting connection pipes therefore deliver considerably better performance than unventilated ones.
The layout dimensions of collecting connection pipes are established by adding together the discharge units (DU) of the corres¬ponding section of collecting connection pipe (ΣDU), using tables 5+6, subject to the corresponding frequency factor K.

The following also applies:
• Minimum fall J= 1cm/m.
• The sum total of discharge units must not exceed ΣDU = 16.
• The limitations for unventilated/ventilated collecting connection pipes must be observed.
• A distinction must likewise be made between unventilated and ventilated collecting connection pipes when carrying out dimensional calculations.
• Dimensional calculations are based on the Prandtl-Colebrook formula.

Application boundaries for unventilated collecting connection pipes

| OUTER DIAMETER | INNER DIAMETER DI (mm) | MAX. LENGTH OF PIPE M DIRECTION (90°) | MAX. NUMBER OF CHANGES OF M | Max. height difference | Minimum fall % |
|---|---|---|---|---|---|
| 50 | 42 | 4.0 | 3 | 1.0 | 1 |
| 75 | 66 | 4.0 | 3 | 1.0 | 1 |
| 110 | 99 | 10.0 | 3 | 1.0 | 1 |

*Application boundaries for unventilated collecting connection pipes conforming to DIN 1986-100*

Application boundaries for ventilated collecting connection pipes

| MAX. LENGTH OF PIPE M | MAX. NUMBER OF CHANGES OF DIRECTION (90°) | MAX. HEIGHT DIFFERENCE M | Minimum fall % |
|---|---|---|---|
| 10.0 | NO LIMIT | 3.0 | 0.5 |

*Application boundaries for ventilated collecting connection pipes conforming to DIN EN 12056-2, Table 8.*

## 6.4.2. Collecting connection pipes

Sizing of unventilated collecting connection pipes

| K=0.5 ΣDU | K=0.7 ΣDU | K=1.0 ΣDU | DN | Di (mm) |
|---|---|---|---|---|
| 1.0 | 1.0 | 0.8 | 50 | 42 |
| 2.0 | 2.9 | 1.0 | 50/60 | 49/56 |
| 9.0 | 4.6 | 2.2 | 70 | 66 |
| 13.0** | 8.0 | 4.0 | 80 | 75 |
| 13.0** | 10.0 | 5.0 | 90 | 79 |
| 16.0 | 12.0 | 6.4 | 100 | 96 |

*Sizing of unventilated collecting connection pipes in accordance with Prandtl-Colebrook.*

Sizing of ventilated collecting connection pipes

| K=0.5 ΣDU | K=0.7 ΣDU | K=1.0 ΣDU | DN | Di (mm) |
|---|---|---|---|---|
| 3.0 | 2.0 | 0.8 | 50 | 42 |
| 5.0 | 4.6 | 1.0 | 50/60 | 49/56 |
| 13.0 | 10.0 | 2.2 | 70 | 66 |
| 16.0 | 13.0 | 4.0 | 80 | 75 |
| 20.0 | 16.0 | 5.0 | 90 | 79 |
| 25.0 | 20.0 | 6.4 | 100 | 96 |

*Sizing of ventilated collecting connection pipes in accordance with Prandtl-Colebrook.*

## 6.4.3. Downpipes

Downpipes are vertical pipes that run down through the floors of a building and are ventilated at roof level. Downpipes should be as perpendicular as possible. Single and collecting connection pipes are connected via branches. The location of the branches should be given special attention during the planning and layout stage, as they have a direct impact on the sizing of the downpipe. Proper matching of such items as branch pipes equipped with internal radius (swept) running into the downpipe can favor the hydraulics of the system, leading to the use of reduced dimensions.

Calculation
The waste water runoff is sized using the following equation:

$$Q_{ww}=K.\sqrt{\Sigma^{DU}}$$

The pipe diameters of ventilated downpipes conforming to DIN 12056-2, Table 10 are determined using waste water discharge calculation Q .
Allowable waste water discharge in primary-ventilated downpipes

| PRIMARY-VENTILATED DOWNPIPE DN | QMAX (L/S) STANDARD BRANCH PIPE | Branch pipe with internal radius (swept) |
|---|---|---|
| 60 | 0.5 | 0.7 |
| 70 | 1.5 | 2.0 |
| 80* | 2.0 | 2.6 |
| 90 | 2.7 | 3.5 |
| 100** | 4.0 | 5.2 |
| 125 | 5.8 | 7.6 |
| 150 | 9.85 | 12.4 |
| 200 | 16.0 | |

** Minimum nominal diameter for toilets with flushing volumes of 4-6 l*
*** Minimum nominal diameter for toilets with flushing volumes of > 6 l*
*Allowable waste water discharge in primary-ventilated downpipes conforming to DIN 12056-2*

## 6.4.3. Downpipes

Downpipes with secondary ventilation conforming to DIN EN 12056-2 must be sized separately. Configurations with secondary ventilation are used, for example, in waste water systems subjected to high loads.

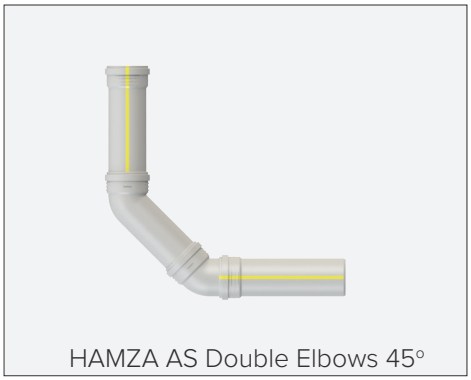
Allowable waste water discharge in secondary ventilated downpipes

| PRIMARY-VENTILATED DOWNPIPE DN | PRIMARY-VENTILATED DOWNPIPE DN | QMAX (L/S) STANDARD BRANCH PIPE | Branch pipe with internal radius (swept) |
|---|---|---|---|
| 60 | 60 | 0.7 | 0.9 |
| 70 | 70 | 2.0 | 2.6 |
| 80* | 80* | 2.6 | 3.4 |
| 90 | 90 | 3.5 | 4.6 |
| 100** | 100** | 5.6 | 7.3 |
| 125 | 125 | 12.4 | 10.0 |
| 150 | 150 | 14.1 | 18.3 |
| 200 | 200 | 21.0 | 27.3 |

** Minimum nominal diameter for toilets with flushing volumes of 4-6 l*
*** Minimum nominal diameter for toilets with flushing volumes of > 6 l*
*Allowable waste water discharge in secondary-ventilated downpipes conforming to DIN 12056-2*

**Kitchen downpipes**
A maximum of four kitchens may be connected to a DN70 downpipe. If more than four kitchens are connected, waste water discharge calculation Qww must be verified and the dimensions of the downpipe increased.

**Layout**
Waste water downpipes must be installed:
• without any change of nominal diameter
• as straight as possible via the individual floors and up to the roof
Connections measuring ≤ DN70 must be used with branches of 87.5°.
Neighboring residential buildings may only be connected to a shared waste water pipe under certain conditions.
1. Conformity with required fire-prevention measures
2. Conformity with noise-protection requirements
Corresponding installation measures are also required for waste water downpipes that change direction, due to the resulting pressure ratios.
Offsets requiring ≤ 1 meter and ≤ 45° may be used. Larger offsets require two 45° bends and a 250 mm coupler.


HAMZA AS Double Elbows 45°

## 6.4.3. Downpipes

Different rules are to be observed, depending on the height of the downpipe, when directing downpipes into a collecting pipe. Failure to observe these rules may lead to build-ups of pressure or undesired vacuums in the upstream/downstream section on either side of the change of direction. This can in turn cause sink traps to be sucked empty, leading to bad smells or to seepage of waste water into the affected area.
DIN 1986-100 therefore makes the following distinctions:

**Downpipes of up to 10 m in height**

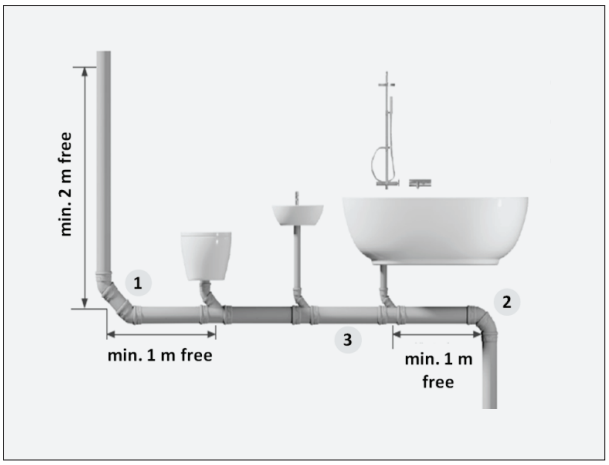
On downpipes of less than 10 m in length, the change of direction in the horizontal pipe may be carried out using an 87.5° bend. However, a technically more ideal solution, from a hydraulic and noise-prevention point of view, is to base the change of direction on two 45° bends.

**A bypass pipe should be used for downpipe offsets < 2 m.**

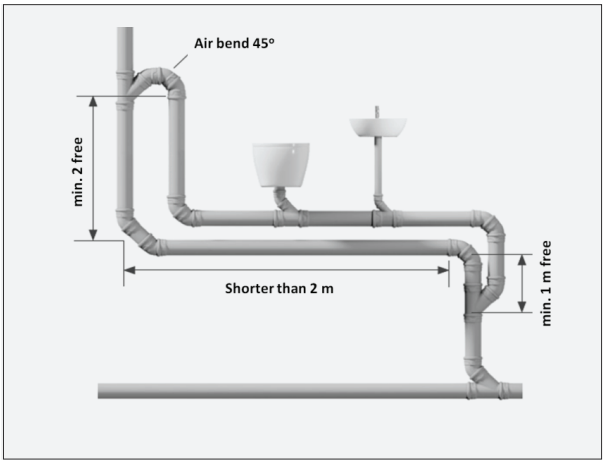
The bypass pipe should be connected at least 2 m above the inlet bend and 1 m below it. The bypass pipe should measure no more than DN100 (prefe¬rably less), in accordance with the dimensions of the downpipe.
The 250 mm coupler can be omitted if a bypass pipe is installed.

**Downpipes of > 10 m to 22 m in height**

In the case of downpipe offsets >2 m, the following areas should be kept free of drainage connection points:
1. Min. 2m above the bend on the inlet side.
2. Min. 1m downstream of the outflow bend and 1 m upstream of the outflow bend of an offset running to a horizontal pipe.
This does not apply to downpipe offsets with a change of direction of up to 45°.
In the case of a downpipe offset, the bends on the inlet and outflow side should be fitted with a 250 mm extended bend.




*1: inflow side bend, 2: discharge unit, 3: case partitioning*
*Downpipe offset > 2 m with pipe sections free of connection points*



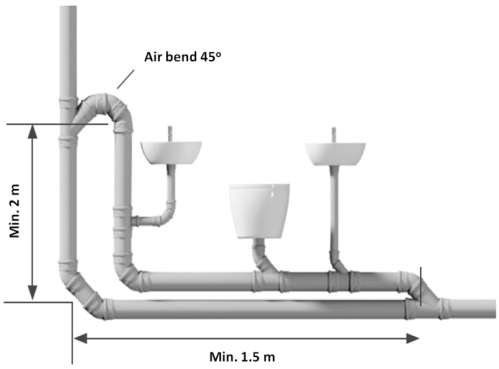

*Downpipe offset < 2 m, with bypass pipe and piping areas without connection points*

## 6.4.3. Downpipes

**Downpipes > 22 m**

In the case of downpipes measuring more than 22 m in length, the downpipe offsets and the downpipe coupler should be connected to the horizontal pipe using bypass pipes.

If the offset is > 2 m, the method of installation shown in Fig.13 must be used. Otherwise the configuration shown below in Fig. 15 is applied. In these cases, either an extended bend or a 250 mm coupler must always be installed.




*Downpipe offset > 2 m with bypass pipe, or bypass pipe for transitioning from a downpipe to a collecting pipe*

**Multiple offset downpipes**

If multiple offset downpipes are required (as in the case of terraced houses, for example), they must be equipped with direct or indirect secondary ventilation. Drainage sources should be connected to horizontal pipes wherever possible.

Please refer to DIN EN 12056, Part 2, for further information on waste water drainage systems with secondary ventilation.

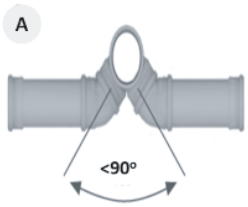
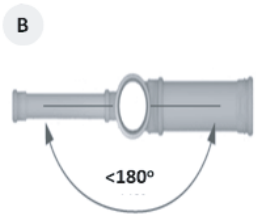
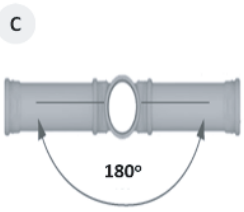
**Connecting collecting pipes to the downpipe**

The rules for the proper hydraulic connection of collecting pipes to downpipes are established in DIN 1986-10. In the worst of cases, failure to observe these rules can lead to so-called inward seepage.

Connection pipes for toilets, bathtubs and showers, and also bathroom inlets, should therefore be connected to the down¬pipe in such a way that dimension h is ≥ the DN of the con¬necting pipe (where h = the difference in height between the water level in the sink trap and the bottom of the connecting pipe at the downpipe branch).

**Backflow**

Connection pipes installed next to or opposite each other must be protected to prevent backflow. DIN 1986-100 contains corresponding suggestions for a hydraulically correct connection to a downpipe, as shown in the following illustrations.

| WC + OTHER DRAINAGE OBJECT | | OPPOSITE WC |
|---|---|---|
| A   | B   | C   |
| MINIMUM DIMENSIONS<br>HEIGHT OFFSET NOT NECESSARY<br>MAX. ANGLE 90° | MINIMUM DIMENSIONS<br>HEIGHT OFFSET MIN. 20 CM<br>MAX. ANGLE 180° | MINIMUM DIMENSIONS<br>HEIGHT OFFSET NOT NECESSARY<br>ANGLE EXACTLY 180° |

## 6.4.4. Collecting pipes

Collecting pipes are defined as any type of installed pipe designed to take up waste water from single or collecting col¬lection pipes and downpipes. Collecting pipes are preferable to underground and collecting pipes for installation inside buildings, as they are easier to inspect, clean and maintain.
Calculation

- Hydraulic specifications
- Filling factor h/di = 0.5
- Minimum fall J = 0.5 cm/m
- Minimum flow rate 0.5 m/s
- Upstream inward volume flow from a waste water pump station, filling factor h/di = 0.7

**Collecting pipes are subject to the equation:**

$$Q_{tot} = Q_{ww} + Q_c + Q_P$$

**$Q_{tot}$ describes the total flow of waste water from the drainage system.**
The total waste water discharge (Qtot) includes both waste water from sanitary drainage points (e.g. showers, toilets and wash basins, etc.) and the amount of water from "con¬tinuous" drainage points (Qc), such as condensate from air conditioning systems or drainage from swimming pools. The total waste water discharge also includes volume flows from pump stations (QP).
Sizing of the collecting pipe should take into account both the calculated total discharge of drainage water and the maximum discharge unit (DU). This is clarified by the example shown below.
**Sanitary drainage points connected to the collecting pipe.**
1 x wash basin (DU = 0.5)
1 x WC with a 4.5-litre cistern (DU = 1.8)

**Waste water discharge Qww is calculated as follows:**

$$Q_{ww} = 0.5 \times \sqrt{(0.5+1.8)} = 0.76\ l/s$$

As the discharge unit for the WC (1.8 l/s) is greater than the calculated waste water discharge of 0.76 l/s, the collecting pipe should be configured on the basis of 1.8 l/s.
**Note**
If total waste water discharge Qtot is less than 2.0 l/s, the collecting pipe can be sized using Table 10 of this manual ("Sizing of secondary-ventilated collecting pipes"). If the total waste water discharge is more than 2.0 l/s, sizing should be based on Table 10.
**Underground and collector pipes**
These are usually directly connected to downpipes or to drainage sources installed in the basement of the building. They are buried under the floor of the building or installed in its foundations. Collecting pipes should be chosen in preference to underground and collector pipes for installation inside buildings. This does not apply to buildings without a basement. In these cases, the underground and collector pipes leading out of the building should be kept as short and as straight as possible.
Underground and collector pipes with a minimum nominal diameter of DN80 (Wavin AS+ = DN90) may be connected to the nearest transfer shaft outside the building if hydraulic calculations permit.
If toilets with water-saving measures (flushing volumes of 4 to 4.5 l/s) are in use, check in each case to ensure that the self-cleaning performance of pipes with nominal diameters of 100 or more is ensured. Examples of corresponding criteria include:

- Nominal diameter of the collecting pipe and underground and collector pipe
- Fall
- Number and type of connected drainage sources
- Simultaneity of waste water drainage

## 6.4.4. Collecting pipes

Bends measuring ≤ 45° must be used for changes of direction in underground and collector pipes or collecting pipes. Branches must be connected to horizontal pipes at an angle of ≤ 45°.
Double branches must not be used with horizontal pipes. Changes of direction in horizontal pipes in open-shaft and enclosed-shaft configuration must likewise be carried out at an angle of ≤ 45°.

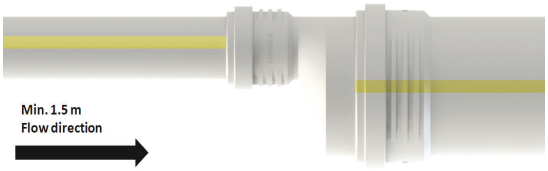
**Note**
Reducers/extensions of underground and collector pipes should be level.

**Underground collector pipes**




*Underground collector pipes*

**For collector pipes**




*For collector pipes*

**Calculation**
Hydraulic criteria for the sizing of underground and collector pipes
- Filling factor h/di = 0.5 inside buildings
- Filling factor h/di = 0.7 outside buildings
- Filling factor h/di = 1.0 upstream of volume flow inlets running from a waste water pump station outside the building upstream of a drain shaft with open flow
- Filling factor h/di = 1.0 in the case of mixed-water pipes measuring at least DN150, upstream of a drain shaft with open flow
- Minimum fall J = 0.5 cm/m inside buildings
- Minimum fall J = 1: DN outside buildings
- Minimum flow rate of 0.5 m/s inside buildings
- Minimum flow rate of 0.7-2.5 m/s outside buildings

If plans and calculations contain no prior definition of pipe material, nominal diameters and usage can be based on the calculation tables in DIN 1986-100 (Annex A, Tables A.3 to A.5).
Calculated drainage performance is based on the smallest possible internal diameter, in accordance with the nominal size given in DIN EN 12056-3, 2001-01, Table 1.
If the material is known (e.g. HAMZA AS), sizing can also be performed based on the actual internal diameter. The tables referred to are reproduced on the following pages of this waste water manual.

**Sizing tables for underground and collector pipes**
The sizing tables are reproduced on the following pages. Please note that a distinction is made between the tables conforming to DIN 1986-100, Annex A, and the tables corres¬ponding to HAMZA AS. The tables are further differentiated by the maximum filling factor h/di of 0.5, 0.7 or 1.0.

## 6.4.4. Collecting pipes

Sizing tables are attached in **Annex II**.

**Installation**

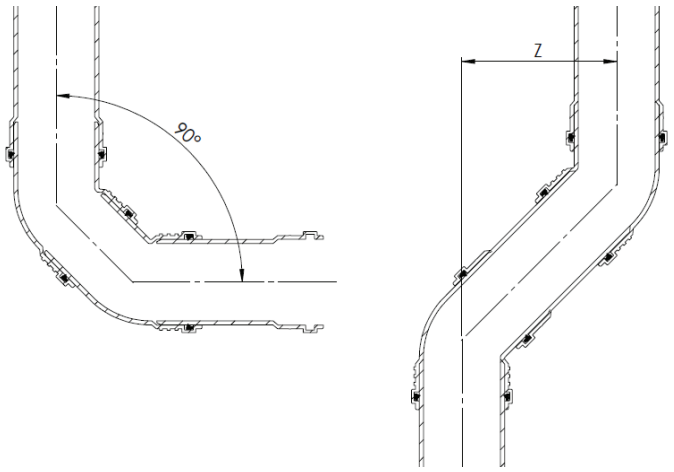
Underground and collector pipes are non-accessible pipes, installed below ground or in foundations, for the disposal of waste water (normally via the connecting sewer). The use of collecting pipes instead of underground and collector pipes is preferred inside buildings, as collecting pipes are easy to inspect, repair and maintain. This does not apply to buildings without a basement. In these cases, the underground and collector pipes leading out of the building area should be kept as short and as straight as possible. Underground and collector pipes should only be used with drainage sources that are beneath the backflow level and connected to a waste water pump or anti-flooding valve if connection to a collecting pipe is not possible (e.g. floor drains showers and bathtubs). See also DIN 1986-30.

Careful planning of the underground and collector pipe system is required, as mistakes at the planning and execution stage are difficult to correct later. The spatial location of the underground and collector pipe system is determined by the arrangement of the downpipes, which should make possible (if the layout of the basement permits) an array of various downpipes under the cellar ceiling with as few connections to underground and collector pipes as possible.

- Buried underground and collector pipes must measure at least DN100.
- All branches used with underground and collector pipes must have an angle of 45°. Double branches are not permitted.
- Changes of direction should be carried out using ≤ 45° bends.
- Changes of direction with 45° bends located outside the building should be in open or enclosed shafts.
- The diameter of an underground and collector pipe must not become smaller along its direction of flow.

## 6.4.5. Ventilation pipes

Proper aerating and venting are vital for ensuring the correct functioning of the drainage system. Correctly functioning ven¬tilation prevents vacuums and build-ups of excess pressure in the system. Sewage fumes are dissipated, and there is no emptying of the sink traps that prevent smells.



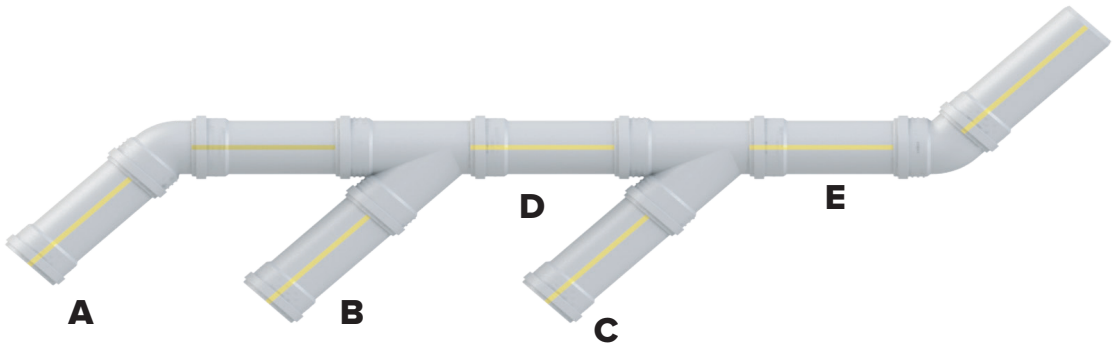

*Changes of direction with 45o bend*

## 6.4.5. Ventilation pipes

**DIN 1986-100 differentiates between waste water drainage systems as follows:**
•Single pipe with primary ventilation
• Collecting pipe with primary ventilation
• Air-circulation conduit
• Bypass pipe

**Single pipe with primary ventilation**
A single pipe with primary ventilation is widely used in small and medium-sized waste water systems.
Downpipes transport both waste water and air at the same time. A pipe with primary ventilation, which is of the same diameter as the downpipe, runs straight up to above roof level. Each downpipe or ventilation pipe should normally run up to above roof level.

**Collecting pipe with primary ventilation**
Pipes with primary ventilation pipes can be designed as col¬lecting pipes with primary ventilation. In these cases, several single pipes with primary ventilation run into one collecting pipe with primary ventilation.




*Example collector pipe with primary ventilation*

**Calculation**
The rule applied here is that the cross-section of the col¬lecting pipe with primary ventilation must total at least half the sum of the individual cross-sections of the single pipes with primary ventilation. Except in single-family homes, the nomi¬nal diameter of the collecting pipe with primary ventilation must, however, be at least one nominal diameter greater than the corresponding single pipe with primary ventilation.

**The following therefore applies:**

$$ASHL \geq \frac{(AEHL1+AEHL2+.....+AEHLn)}{2}$$

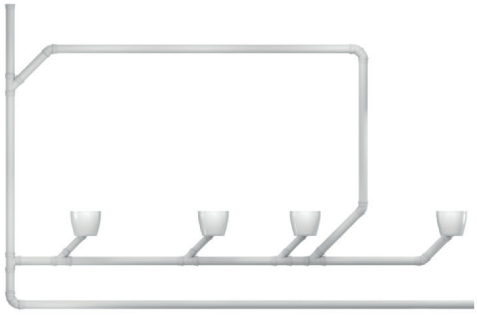
**ASHL cross-section of the collecting pipe with primary ventilation in mm² or cm²**

**AEHL1- AEHLn** cross-section of the collecting pipe with **primary ventilation** in mm² or cm²

## 6.4.5. Ventilation pipes

**Air-circulation pipes**
Air-circulation pipes are used to ventilate collecting connec¬tion pipes which require such ventilation under certain circum¬stances, due to the length, height difference or the number of changes of direction; or for functional reasons.

Air-circulation pipes should have the same nominal diameter as the collecting connection pipes that they ventilate, as measured at the confluence with the downpipe. The cross-section of the pipe up to the start of the ventilation system should likewise be of this nominal diameter.



*Air-circulation pipe*

**Bypass pipes**
Bypass pipes are required under certain circumstances for downpipe offsets or points of confluence between downpipes and underground and collector pipes. Please also refer to the section of this manual that deals with downpipes.

Bypass pipes have the same nominal diameter as the downpipe, but have a maximum diameter of DN100. The size of the ventilation section (the upper part of the bypass pipe without waste water connection) can be calculated using the following table.

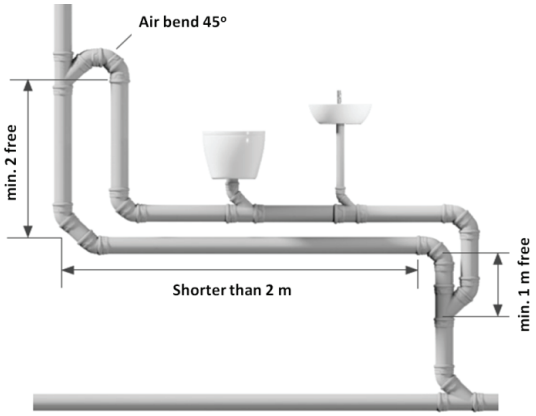
**Please note that this table is only a partial extract from DIN EN 12056, Part 2.**

**Hydraulic capacity (Qmax) and nominal diameter (DN)**

| QMAX (L/S) | CONNECTION PIPE / VENTILATION SECTION (DN) |
|---|---|
| 0.75 | 50/40 |
| 1.5 | 60/40 |
| 2.25 | 70/50 |
| 3.00 | 80/50** |
| 3.40 | 90/60*** |
| 3.75 | 100/60 |

*** Not applicable to toilets*
**** Not more than 1 toilet*
*Extract from Table 7, DIN EN 12056-2*

## 6.4.5. Ventilation pipes




*Bypass pipe conforming to DIN 1986-100*

## 6.4.6. Ventilation valves

Ventilation valves may be installed in drainage systems equipped with primary ventilation systems, as an alternative to air-circulation or indirect secondary ventilation systems designed to reduce vacuums in the piping system. Only ventilation valves conforming to DIN EN 12380 may be used.

Ventilation valves may be used as a substitute for primary-ventilated pipes in single/two-family residential properties or buildings with comparable residential units with a drainage system only for residential waste water provided there is at least one downpipe running up to above roof height. In this case, the downpipe with the largest nominal diameter should be aerated/ ventilated at above roof height. Ventilation valves should be installed in such a way that allows them to be replaced without structural building work in the event of a defect. A sufficient supply of air must be guaranteed.

**This area of application is subject to the operating temperatu¬re and installation position specified in Table 2, in accordance with DIN EN 12380.**

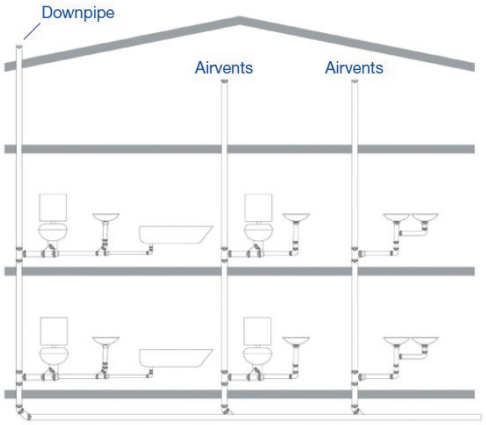
**Operating conditions and designation of ventilation valves**

| Determining factor | Area / Position | Designation |
|---|---|---|
| USABLE BENEATH FLOW LEVEL* OF THE CONNECTION PIPE OF THE CONNECTED DRAINAGE SOURCES | YES | A |
| | NO | B |
| TEMPERATURES | -20° C TO 60° C | I |
| | 0° C TO 60° C | II |
| | 0° C TO 20° C | III |

*Flow level within the meaning of the term "backflow level", as defined in DIN EN 12380*
*NOTE Valves corresponding to Designation I are designed for use in places where the ambient temperature at the point of installation (e.g. unheated attics) may drop to below freezing point over several days.*
*Operating conditions and designations of ventilation valves*

## 6.4.6. Ventilation valves

**Ventilation valves must not be used in areas endangered by backflow or for the ventilation containers (e.g. pump stations).**




*Use of ventilation valves in single/two-family residential properties*

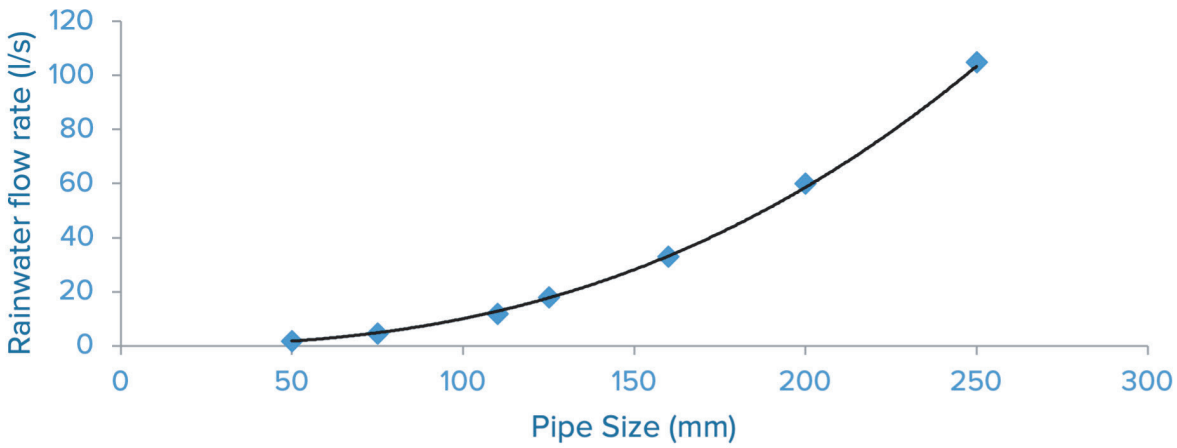
## 6.4.7. Rainwater pipes

Rainwater pipes must be capable of withstanding higher pressures under certain circumstances. Pressures above those foreseen may arise, for example, when overloaded sewers cause build-ups of rainwater. Thrust resistance must be sufficient to guarantee operating safety and reliability in such cases. To ensure this, the sleeves must be fastened using WAVIN LKS clamps, for example.
The installation of rainwater pipes is also affected by the issue of condensation. Under certain operating conditions relating to room temperature, relative humidity in the room concerned and the temperature of the rainwater, the dew point of internal rainwater pipes may drop to below that specified.
Diffusion-resistant insulation should normally be fitted to internal rainwater pipes subject to any latent risk of condensation.

**Rainwater downpipes/calculation**
The minimum dimensions must not be less than the connection diameter of the roof guttering. Dimensions are calculated subject to rules similar to those governing the layout of collecting pipes described on page 33 of this waste water manual.
The filling factor of r rainwater downpipes totals
f ≤ 0.33

Downpipe deviations ≤ 10° are not taken into account when calculating the dimensions of the rainwater downpipe. If downpipe offsets are ≥ 10°, the sizing should be calculated subject to rules similar to those governing the layout of col-lecting pipes described in Chapter 4 of this waste water manual.

## 6.4.7. Rainwater pipes




*Drainage performance of rainwater downpipes*

**Rainwater collecting pipes/calculation**

Rainwater collecting pipes are subject to a filling factor of h/di = 0,7 and a minimum fall of 0.5%. This sizing is calculated subject to rules similar to those governing the layout of waste water collecting pipes.

**Rainwater underground and collector pipes calculation**

The hydraulic sizing of the rainwater underground and collector pipe should take into account the part of the roof area that provides effective drainage surfaces for the outside of the building, subject at least to the two-year calculation period selected for the surrounding land (duration level “D”), according to the provisions of sections 14.9.2 and 14.9.3 of DIN 1986-100. The larger cross-section at the point of least structural tension resulting from roof drainage is to be taken into account with respect to the direction of flow until the calculation resulting from the two-year calculation period extends the cross-section. The sizing of rainwater underground and collector pipes is calculated subject to rules similar to those governing the layout of underground and collector pipes for sewage.

**The following waste water standards also apply.**

**Inside the building:**

- Minimum diameter DN100
- Filling factor h/di = 0.7
- Minimum fall J = 0.5%

**The following applies outside the building:**

- Minimum diameter DN100
- Filling factor h/di = 0.7
- Minimum fall J = 1: DN

The minimum flow rate is 0.7 m/s

The maximum flow rate is 2.5 m/s

## 6.4.7. Rainwater pipes

Dimensions can include complete filling without excess pressure upstream of a drain shaft with open flow.

Installation

The installation of rainwater pipes is subject to similar criteria to those that apply to the installation of sewage pipes inside and outside buildings. Additional criteria such as dew-point prevention and thrust resistance should also be taken into account. Please refer to the section on rainwater pipes

Mixed-water pipes

Mixed-water systems use a common pipe for waste water and rainwater, running from the building or its surrounding land. As with underground and collector pipes, the minimum diameter of the mixed-water pipe is DN100.

Calculation

The sizing of mixed-water pipes is subject to the relevant mixed-water discharge rate Qm, which is in turn based on the respective proportions of waste water discharge Qww and rainwater outflow Qr, using the equation

$$Q_m = Q_{ww} + Q_r$$

**Qm:**mixed-water discharge rate, in liters per second (l/s);
**Qww:** waste water discharge rate, in litres per second (l/s)
**Qr:** rainwater discharge rate, in litres per second (l/s)

The sizing is calculated subject to rules similar to those governing underground and collector pipes. Mixed-water pipes outside buildings are subject to the following:

- **Filling factor h/di** = 0.7
- **Minimum fall J** = 1: DN
- **Minimum flow rate** = 0.7 m/s
- **Maximum flow rate** = 2.5 m/s

**Installation**

In the case of mixed systems, rainwater and sewage must leave the building via separate downpipes, collecting pipes or underground and collector pipes. Underground and collector pipes or collecting pipes must, for hydraulic reasons, be jointed together as near as possible to the connecting sewer outside the surrounding land. This jointing should be located in a shaft with open flow.

In exceptional cases (e.g. if the surrounding area is built-up), the waste water and rainwater pipes may only be jointed on the property if this occurs in the direct vicinity of the outer wall of the building.

# 7 INSTALLATION AND JOINTING

HAMZA has designed its low-noise systems to reduce noise emissions in concealed and visible installations. However, to ensure the system is leak-tight and to achieve a high level of soundproofing it is strongly recommended to follow the instructions given below.

## 7.1. Connecting HAMZA AS fittings and pipes

HAMZA AS connections are fitted as follows:
• Check position and condition of the seal in the socket. You may have to clean the socket and the seal
• Clean the spigot-end of the pipe and/or fitting.
• In case of pipes: mark the insertion depth (socket length) on the spigot-end.
• Push the spigot-end into the socket according the insertion depth
• The seal is pre-lubricated. For DN150 and DN200, additional lubrication might ease assembly

**For pipes ≥ 2 meters:**
• Pipes & fittings connected to horizontal and vertical pipes ≥ 2 meters to be retracted 10 mm to allow for thermal expansion
• For vertical pipes, directly secure position with brackets to prevent slipping and eliminating the 10 mm dilatation space.

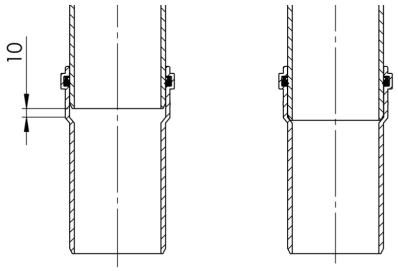
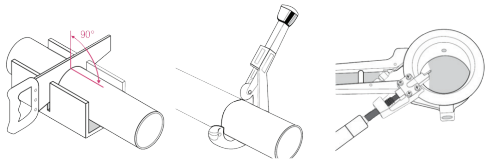
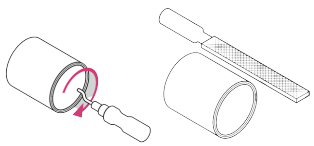
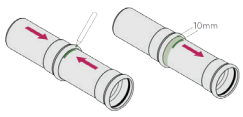
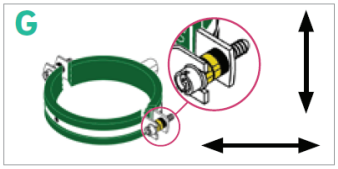
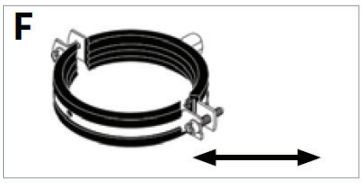



*Figure 1 left: Thermal expansion spacing for pipes > 2m, Right: for fittings and pipes < 2 m*

## 7.2. Pipe Assembly procedure

| | |
|---|---|
| 1. CUTTING PIPE TO SIZE |  |
| 2. CHAMFER THE PIPE END |  |
| 3. LUBRICATE RUBBER SEAL |  |
| 4. MARKING AND FITTING |  |

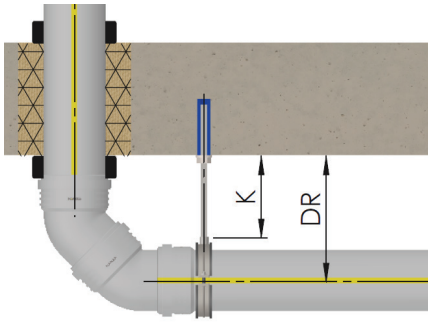
## 7.3. Horizontal and Vertical piping Fixation

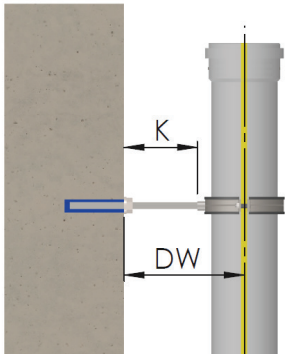
| SOUND-DAMPENING BRACKET | GUIDING BRACKET | FIXING BRACKET |
|---|---|---|
|  Sound-dampening bracket |  Guiding bracket |  |
| - Minimizes transmission of vibrations from pipe through fixing into wall via acoustic de-coupling.<br>- Consists of loose and tight bracket:<br>- lower bracket (loose) attaches to wall<br>- Upper bracket (tight) supports pipe.<br>- attach to vertical stack only<br>- 1 required per floor, per stack | - Allows for thermal expansion of the pipe<br>- Always loose on pipe (has spacer)<br>- Fix to ceiling on horizontal pipes<br>- Fix to wall on vertical stack<br>- Insert 1 yellow spacer per sid | - Always tight on pipe<br>- When used as fixing bracket on horizontal pipes: fix to ceiling<br>- When used as security bracket in vertical stacks: never fix to wall |

| DN | MAX DISTANCE BETWEEN BRACKETS | |
|---|---|---|
| | HORIZONTAL (H) MM | Vertical (V) mm |
| 50 | 750 | 1250 |
| 75 | 1125 | 1875 |
| 110 | 1500 | 2000 |
| 125 | 1625 | 2000 |
| 160 | 2000 | 2000 |
| 200 | 2000 | 2000 |
| 250 | 2000 | 2000 |

*Pipe bracket spacing*

## 7.3. Horizontal and Vertical piping Fixation




**Horizontal**

Maximum (DR) distance to the ceiling and maximum length (K) of threaded rod or threaded pipe

| DN | M8 | | M10 | | M12 | | ½” | | 1” | |
|---|---|---|---|---|---|---|---|---|---|---|
| | DR | K | DR | K | DR | K | DR | K | DR | K |
| 50 | 120 | 85 | 195 | 160 | 315 | 280 | 1530 | 1500 | 1530 | 1500 |
| 75 | 110 | 60 | 170 | 120 | 260 | 210 | 1300 | 1250 | 1550 | 1500 |
| 110 | 105 | 40 | 145 | 80 | 205 | 140 | 920 | 850 | 1560 | 1500 |
| 125 | 100 | 30 | 135 | 60 | 180 | 105 | 730 | 650 | 1570 | 1500 |
| 160 | | | 135 | 45 | 175 | 85 | 590 | 500 | 1590 | 1500 |
| 200 | | | 150 | 40 | 175 | 70 | 510 | 400 | 1360 | 1250 |
| 250 | | | | | | | 510 | 400 | 1300 | 1250 |

**Vertical**

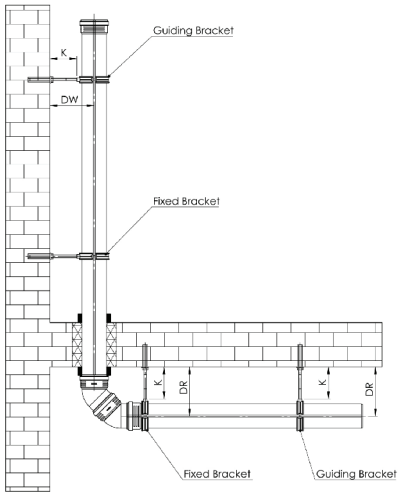
Maximum (DW) distance to the wall and maximum length (K) of threaded rod or threaded pipe

| DN | M8 | | M10 | | M12 | | ½” | | 1” | |
|---|---|---|---|---|---|---|---|---|---|---|
| | DR | K | DR | K | DR | K | DR | K | DR | K |
| 50 | 95 | 60 | 155 | 120 | 245 | 210 | 1290 | 1250 | 1540 | 1500 |
| 75 | 90 | 45 | 130 | 85 | 195 | 150 | 900 | 850 | 1550 | 1500 |
| 110 | | | 115 | 50 | 150 | 85 | 570 | 500 | 1570 | 1500 |
| 125 | | | 105 | 35 | 140 | 70 | 470 | 400 | 1320 | 1250 |
| 160 | | | 120 | 30 | 140 | 50 | 390 | 300 | 1090 | 1000 |
| 200 | | | | | 150 | 40 | 370 | 260 | 960 | 850 |
| 250 | | | | | | | 370 | 250 | 960 | 800 |

*Note: for M12 threaded rods, 1/2” and 1” threaded pipes, adapter pieces are needed to connect to brackets.*
*Fixing distance to the wall - Vertical*

## 7.4. Bracket Arrangement

In this section the arrangements of fixed and guiding brackets, and the maximum distancing between them vertically and horizontally are discussed.




**Vertical pipes:**

• To prevent the vertical stack sliding down, each pipe section between floors must be secured by one fixed bracket at the spigot-end

• All remaining pipe brackets at subject pipe must be sliding brackets

• The table 21 prescribing the maximum distance between brackets is to be respected

**Horizontal pipes:**

• Every horizontally installed pipe length ≥ 2 meters should always be fixed with one fixed bracket at the spigot-end

• All remaining pipe brackets at one pipe must be sliding brackets

• The table 21 prescribing the maximum distance between brackets - is to be respected

**Notes:**

• For all changes of direction - e.g. a bend at the bottom of a down pipe - 1 bracket directly before and after the change of direction

• In case multiple fittings are assembled, additional bracket(s) before/after this assembly might be required to ensure:- A downward slope in flow direction is in place (in case of horizontal pipes). - The center of the assembly cannot be excessively displaced (in case of vertical pipes)

• Ensure the materials are installed tension-free by properly aligning the brackets

• To achieve a high level of sound proofing, generally pipe brackets should not be installed in impact areas (e.g. diameter reductions and changes of directions in the system)

• Pipe brackets to be fixed to building materials with high specific area weight

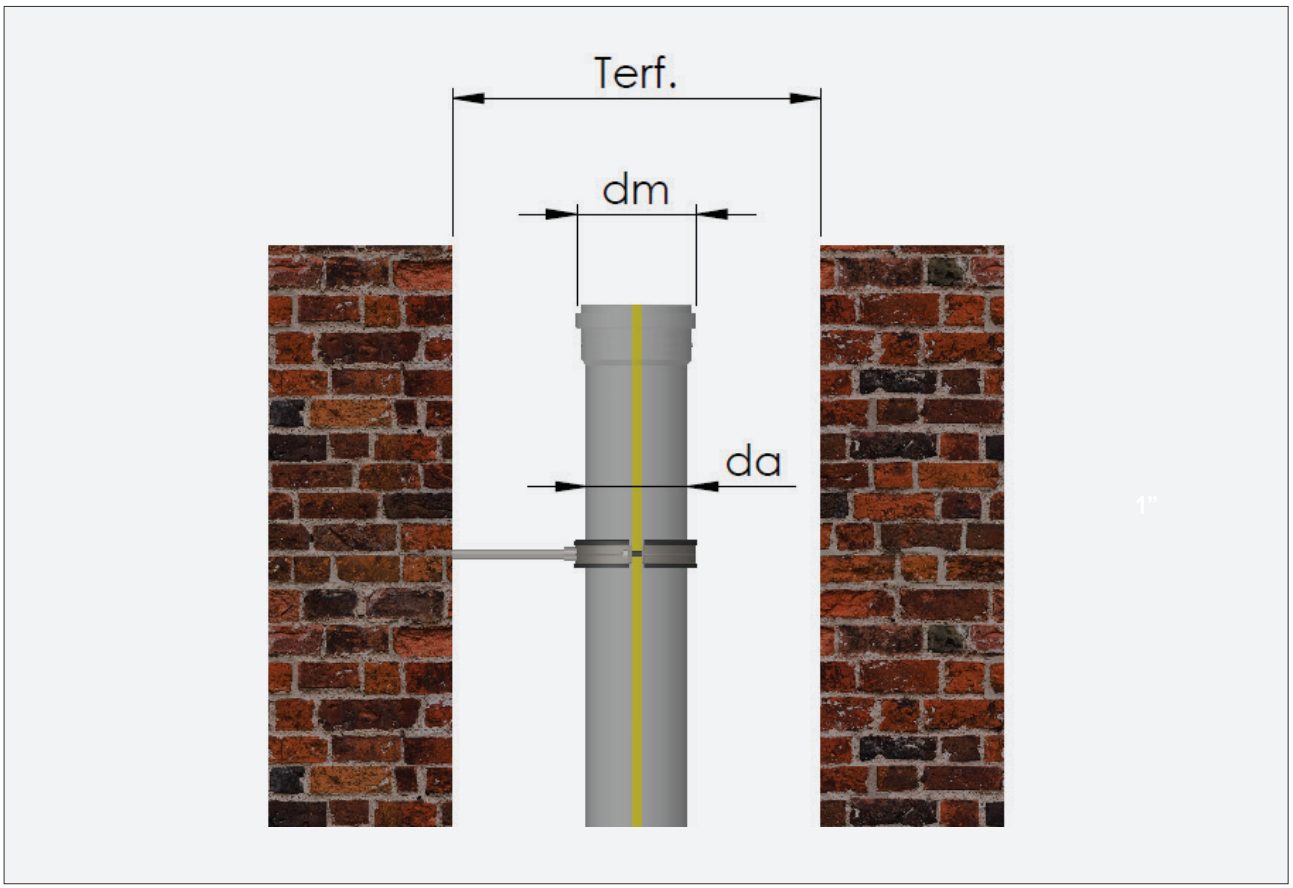
• In multiple storey buildings (from 3 levels and more) the stack pipes of 110mm must be secured by additional fixing (stack pipe support) to prevent sliding. In this case we advise using the HAMZA AS socketed short length with a fixed bracket.

## 7.5. Installation in brickwork

**DIN 1053,** Sheet 1, Section 3.5 specifies that recesses and channels may be made in brickwork, provided they do not affect the stability or load-bearing capacity of the structure. In areas subject to high outside temperatures, thermal insulation measures must be applied (e.g. lagging of heating pipes). The key pipe dimensions to be taken into account when installing HAMZA AS in brickwork recesses can be found in chapter 4 of this manual.

| DN / da | COUPLING DM (mm) | RECESS DEPTH* TERF. (mm) |
|---|---|---|
| 50 | 66 | 125 |
| 75 | 92 | 142 |
| 110 | 130 | 180 |
| 125 | 146 | 195 |
| 160 | 184 | 230 |

*These specified recess depths do not include pipe crossings.*



## 7.6. Installation in concrete

Like all hollow items, pipes are subject to buoyancy load forces when installed in concrete. All materials used in the pipe structure must be able to withstand these buoyancy loads. To this end, we recommend filling the pipe with water before fit-ting suitable fixing clamps to the existing steel reinforcement. Wavin Soil & Waste pipe systems (pipes and fittings) can be set in concrete immediately after installation. There is no need to account for any thermal length-expansion of the pipes once they have been installed in keeping with the installation instructions. The pipe sections should be secured properly so as to prevent any change in length, particularly during the pouring of concrete.

To prevent liquid concrete from seeping into the joins, seal the sleeves with adhesive tape. Exposed pipe ends should also be sealed off. Pour the concrete into the area around the pipe and allow it to flow into the working space. When using a concrete vibrator to compact the concrete, be sure not to come into direct contact with the pipe. If noise-insulating measures are required, insulate the pipe with suitable lagging material before starting work.

## 7.7. Floor crossings

Floor crossings should be made leak-resistant and sound-absorbent. If mastic asphalt is used to cover the floor, the pipe sections located near the floor crossings must be protected using a protection sleeve or heat insulating wrapping material.

## 7.8. Roof drainage pipes in living areas

Roof drainage pipes projected through living areas can be installed as shown in the example opposite. The specific area weight of the casting should be at least equal to the wall.

The use of condensation insulation is also recommended for Wavin **AS**$^{+}$. The installation of rainwater pipes is also affected by the issue of condensation. Under certain operating conditions relating to room temperature, relative humidity in the room concerned and the temperature of the rainwater, the dew point of internal rainwater pipes may drop to below that specified.

## 7.9. Tensile resistant connection

Gravity drainage systems (for rain or waste water) can be subject to both planned and unplanned pressure surges. If Wavin AS+ or Wavin SiTech+ is used as a pressure line for a pump station, for example, the resulting pressure surges are planned. If an overloaded rainwater pipe is subject to hydrostatic pressure, however, this counts as an unplanned pressure surge.

For both types of pressure surge, the joints at changes of flow direction need to be secured to prevent them from detaching. The Wavin LKS clamp guarantees this for internal pressures of up to 2 bar.

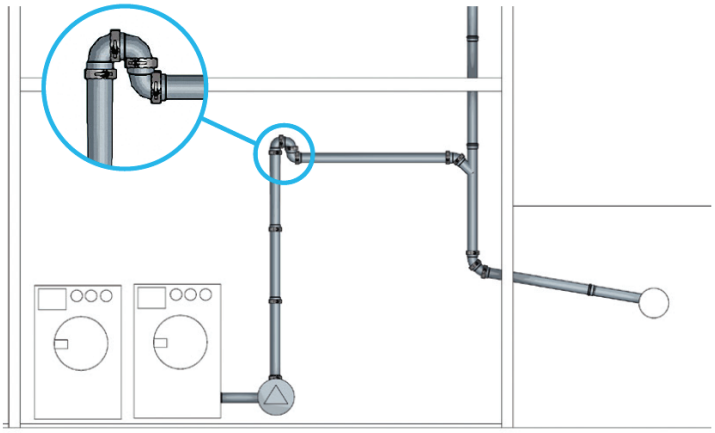


*Fig. 30: Tensile resistant connection.*

Pressure surges may occur in any part of systems located downstream of pumps and pump stations. All fittings should therefore be secured using LKS clamps. Ensure that the fixings used are able to withstand such pressure surges. The system must be able to transfer dynamic loads to the sup¬porting structure.

In the case of rainwater drainage systems, fittings located at changes of direction are critical. These fittings must therefore be equipped with LKS clamps. Vertical pipes (downpipes) do not require separate LKS clamps. Provided that the fixing specifications provided by us in this manual are observed, the joints on these sections will be suitably secured by the LKS clamp fitted where the change of direction occurs.

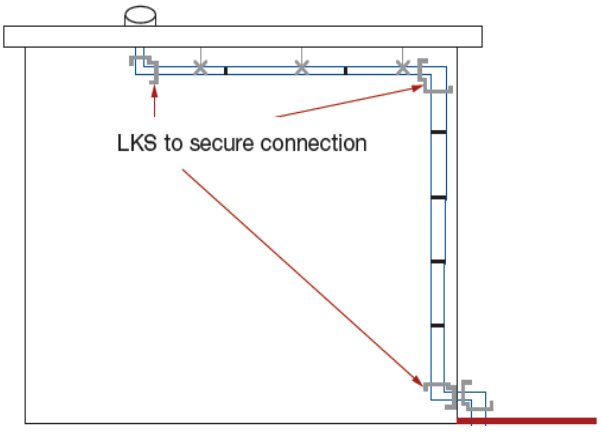



*Fig. 30: Tensile resistant connection.*

## 7.9. Tensile resistant connection

Wavin LKS clamps are available for use with Wavin AS+ and SiTech+ sound-insulating pipe systems in sizes DN50 to DN200.

For details of the required collar sizes and corresponding article numbers, please refer to page 77 of our AS+ range.



Fig. 31.

*HAMZA/ WAVIN LKS clamp*

## 7.10. Soundproofing

If interior spaces are subject to the technical provisions of DIN 4109 (sound insulation in buildings), with pipe-born noise not exceeding 30 dB(A), all work must conform to the technical building regulations applying to in-building systems with respect to the configuration of pipes in the context of the corresponding floor plan. Waste water pipes that run through living areas must not be exposed. If they are to run adjacent to such living areas, they may only be installed inside walls with a minimum specific area weight of 220 kg/m2 (See DIN 4109-5).

The same conditions apply when installing in brickwork reces¬ses conforming to DIN 1053, with pipes running along the other side of an adjacent wall subject to protection measures, where minimum wall dimensions of 220 kg/m2 apply in the area of the recess. Shafts or recesses in brickwork must then be fitted with a supporting structure (matting or metallic mesh) that allows them to be plastered over to a minimum depth 1.5 cm. There must be no sound bridges between the pipe and plaster covering. Preventive measures in this respect include pipe lagging of material classes A1, A2, B1, B2 (e.g. glass fiber, mineral wool or plastic).

As the routing of the pipe has a considerable influence on both the generation and reduction of noise, measures should be taken to minimize its impact. Falling waste water should therefore be directed downwards in stages where possible, i.e. not abruptly, as this would be technically unfavorable. In the case of buildings with more than three storey's (> 10 m), a noise-damping length of 250 mm is fitted between the down¬pipe and the horizontal pipe. This can take the form of two 45° bends and a corresponding length of pipe (see Fig. 34).

Alternatively, the use of one extended 45° bend and one nor¬mal 45° bend is recommended. The waste water pipes should likewise be dimensioned and installed in such a way that allows air to circulate freely around the water being drained. Pipe clamps designed to comply with noise-prevention requi¬rements must be fitted with a suitable rubber insert. In the case of bricked-up pipes, note that these must be secured to the underlying structure and not to the new brickwork. Wall and ceiling penetrations must be flexible.



*Extended 45° bend.*

## 7.11. Installation of pipes in existing structures

If a pipe is to be connected to an existing system, HAMZA AS repair coupler should be used.

Repair coupler: Observe the following procedure when using HAMZA AS repair coupler:

## 7.12. Installation advice

A: To reduce structure-borne noise and improve the acoustic performance of the drainage system, avoid direct contact between pipe and ceiling/wall materials by installing insulation layer within the penetration. When fire collars are used, check with the respective fire collar manufacturer on tested solutions of insulation layers that can be used to prevent sound transmission.

B: Wrap the drainage line with closed cell insulation to avoid condensation, especially for storm-water application condensation may occur on the pipe surface. It is recommended to wrap all pipe work where condensation could occur with closed-cell insulation materials.

C: For commercial kitchen with grease separator located at a distance, install pipe heat trace to prevent premature grease accumulation. Max. heat trace temperature is 65°C

# 8 FIRE PROTECTION

## 8.1. Fire behavior classification

Fire behavior of construction materials, e.g. piping systems and isolation materials, have been defined in fire classification classes as per DIN 4102-1. Construction materials are classified as combustible and non-combustible materials. According to DIN 4102-1 HAMZA AS is listed as B1 (Non- readily ignitable (Low flame spread))

| CRITERIA | DIN 4102-1 |
|---|---|
| NON- COMBUSTIBLE | A1 |
| | A2 |
| NON- READILY IGNITABLE ( LOW FLAME SPREAD) | B1 |
| NORMALLY – IGNITABLE ( NORMAL FIRE BEHAVIOR) | B2 |
| READILY IGNITABLE | B3 |

## 8.2. Fire resistance classification

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

| FIRE RESISTANCE CLASSIFICATION | FIRE RESISTANCE DURATION IN MINUTES |
|---|---|
| F30 | >= 30 FIRE RETARDANT |
| F60 | >= 60 HIGH FIRE RETARDANT |
| F90 | >= 90 FIRE RESISTANT |
| F120 | >= 120 HIGH FIRE RESISTANT |
| F180 | >= 180 EXTREME FIRE RESISTANT |

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

- A made of non-combustible materials
- B made of combustible materials
- AB in principle made of non-combustible materials

## 8.3. HAMZA/ WAVIN AS fire protection concept

**HAMZA / WAVIN** Fire protection collar is in practices the best available solution. The Wavin Fire Protection Collar BM-R90 fully seal the wall or ceiling corridor in case of fire, due to special fire protection material which strongly expands by increased temperature.
The BM-R90 Fire Protection Collar (for HAMZA AS) is especially for sloped piping, suitable up to 45 degrees, and appli¬cable for passages by sleeved pipes or fittings. In practice the collar is suitable to seal off almost any possible configuration.

**Fire Protection Collar BM-R90**

- For wall and ceiling crossings
- Suitable for pipes with or without sockets and fittings
- Also suitable for angled passages (up to 45 degrees)
- Approved for ceiling installation
- Applicable for HAMZA AS from DN50 – 200.
- Fire classification F90



## 8.4. Assembly instructions

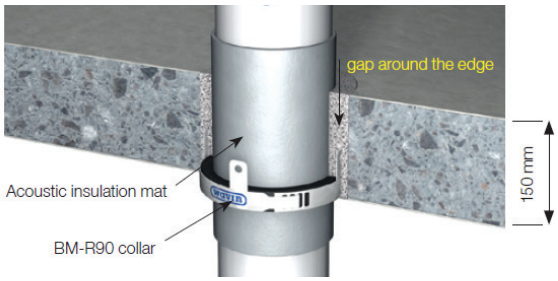
When the system is applied to a fire-resistant vertical (wall) or horizontal installation (floor) which separated a fire-risk area, only one Fire Protection collar is required. If the system is applied to a fire resistant vertical (wall) or horizontal (floor) installation which separated two fire-risk areas, use a Fire Protection collar on both sides.

| | |
|---|---|
| HOLE | DRILL A CIRCULAR HOLE INTO THE WALL OR FLOOR WITH A DIAMETER OF 2 MM GREATER THAN THE EXTERNAL DIAMETER OF THE PLASTIC PIPE TO BE USED. |
| INSTALLING THE PIPE | INSERT THE PVC, PP, PE ETC. PIPE IN THE HOLE AND CLEAN THE PART THE COLLAR IS TO BE APPLIED TO. |
| CLOSING AND SEALING AGAINST FUMES AND GAS | IF THERE ARE ANY GAPS BETWEEN THE PIPE AND THE WALL, SEAL THESE USING PUTTY OR INTUMESCING STRIPS ACCORDING TO THE THICKNESS, TO PREVENT THE PASSAGE OF FUMES IN THE EVENT OF A FIRE. |
| CLEANING THE PIPE | THE EXPANSION OF THE INTUMESCING MATERIAL IN THE COLLAR COM¬PLETELY CLOSES THE PLASTIC PIPES BY A MECHANICAL ACTION. IF THE PIPES ARE VERY DIRTY OR HAVE MORTAR RESIDUES, THIS MAY DELAY THE ACTION. CLEAN THE SURFACE OF THE PLASTIC PIPE IN THE POINT OF INSTALLATION OF THE FIRE PROTECTION COLLARS. |
| INSTALLING THE PIPE | THE EXPANSION OF THE INTUMESCING MATERIAL IN THE COLLAR COM¬PLETELY CLOSES THE PLASTIC PIPES BY A MECHANICAL ACTION. IF THE PIPES ARE VERY DIRTY OR HAVE MORTAR RESIDUES, THIS MAY DELAY THE ACTION. CLEAN THE SURFACE OF THE PLASTIC PIPE IN THE POINT OF INSTALLATION OF THE FIRE PROTECTION COLLARS.<br>NB: THE FIRE PROTECTION COLLAR CAN ONLY PREVENT THE PASSAGE OF FIRE IF IT IS PROPERLY INSTALLED |
| PRECAUTIONS | IN THE CASE OF CONTACT OF THE INTUMESCING MATERIAL WITH THE EYES, WASH DELICATELY WITH SOAP AND WATER. KEEP OUT OF THE REACH OF CHILDREN. |

## 8.5. Installation manual BM-R9

**HAMZA/ Wavin BM-R90** is a new fire protection sleeve designed for use with HAMZA domestic waste water removal piping systems according to DIN 4102-11. It is suitable for use on piping with external diameters of up to 200 mm and is able to provide a secure seal for use in all conceivable installation situations:

- Right-angled wall and ceiling penetration
- Lightly-constructed partition walls
- Angled wall and ceiling penetration to 45°
- For sealing over pipe collars (to 45°)
- For installation under ceilings and in front of walls
- Installation flush with ceiling surface




**Components**

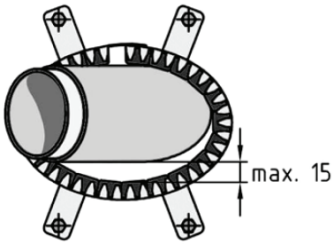
The fire collars are made from powder coated sheet steel with a push-in fastening and tab fixings with an integrated intumescing material for reliable closure in the event of fire. Also included:

- Insulation mat
- Fixing kit
- Identification label

**Selection table**

| HAMZA AS DN (mm) | STRAIGHT INSTALLATION | STRAIGHT INSTALLATION WITH COLLAR | ANGLED INSTALLATION * WITH SLEEVE OR SOCKET < 45° mm |
|---|---|---|---|
| 50 | 63 | 75 | 90 |
| 75 | 75 | 90 | 110 |
| 110 | 110 | 125 | 140 |
| 125 | 140 | 160 | 180 |
| 160 | 160 | 180 | 200 |
| 200 | 200 | - | |

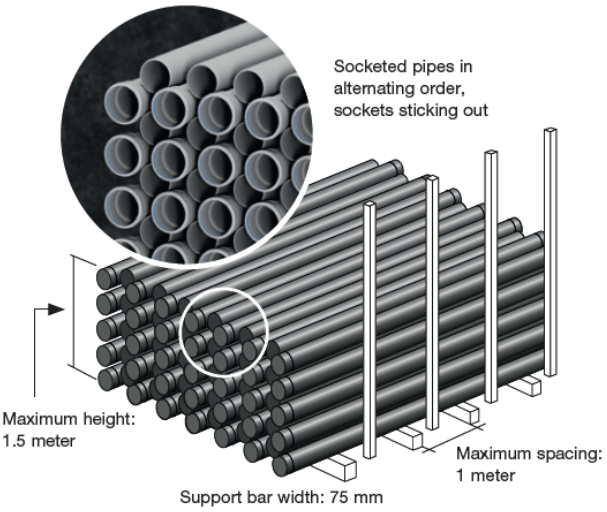
*The shape of the sleeve must be turned oval by pushing on both sides. In that way the shape of the collar can be adapted when leading-through the pipes (see also figure below)

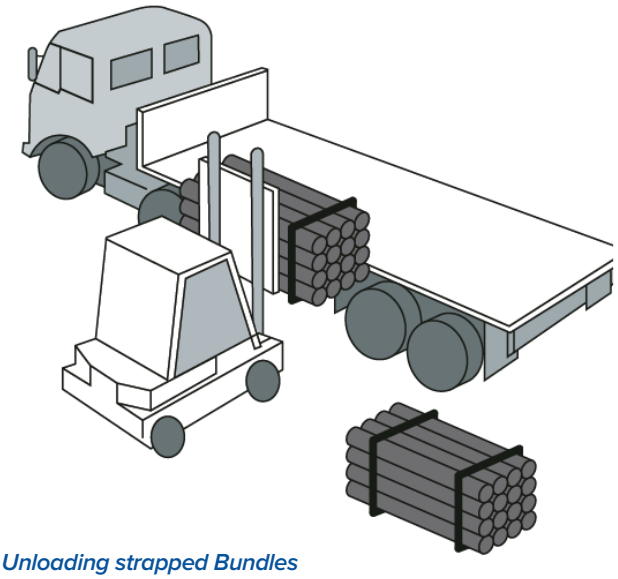



*Maximum allowable gap between pipe and fire protection collar*

# 9 PACKING, TRANSPORT & STORAGE

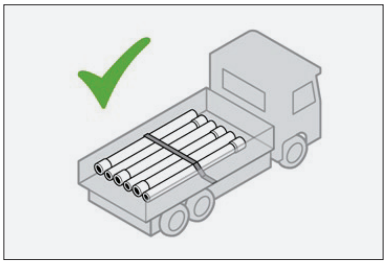
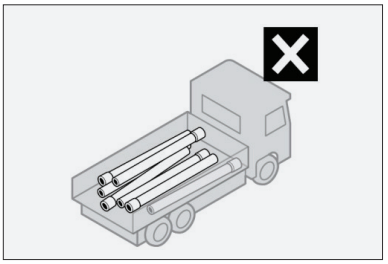
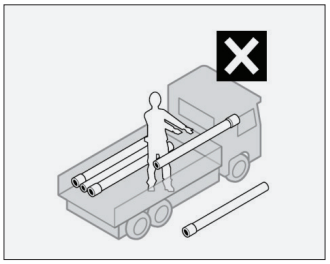
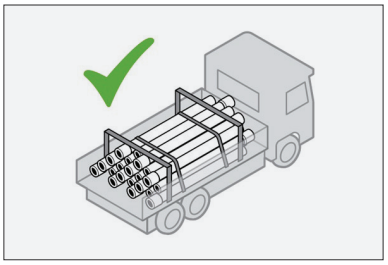
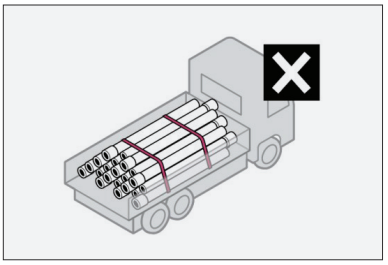
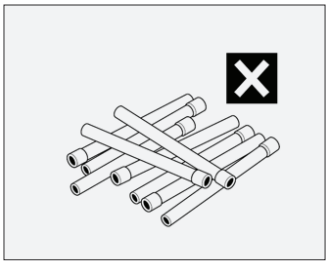
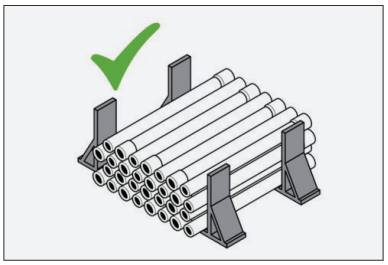
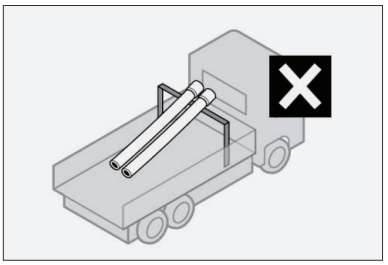
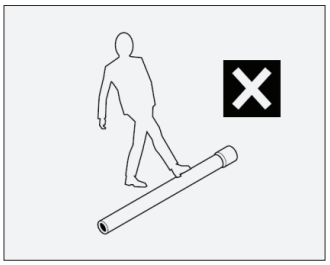
• Handle pipes and fittings with care. Excessive scratching or impact damage on pipes can affect the external structure or impair its sealing performance.
• Loose pipes must be unloaded by hand. If pipes have been inserted into other pipes, always remove the inner pipe first.
• We recommend the use of nylon-covered or plastic forks when unloading bundles of pipes with a forklift truck.
• Do not allow metal forks, hooks or chains to come into contact with the pipes.
• Do not use extended forks. If you intend to load or unload with a crane or excavator arm, attach a sling of sufficient width at the centre of the pipes.
• If HAMZA AS+ pipes are no longer in their original packing, they must be fully supported along their entire length and placed on a clean surface for transport. Avoid any bending of the pipes. Protect the pipe ends and fittings from impact damage.
• HAMZA AS is a generally robust product owing to its three-layer structure and impact-resistant outer layer. Ensure that pipes make firm contact over their entire length.
• Protect boxes from moisture during transport and storage. HAMZA AS and its seals can be stored outdoors for up to 1 year.
• Loose pipes may be stacked up to a maximum height of 1.5 m, preferably supported along their entire length. If this is not possible, place wooden supports with a minimum width of 75 mm under the pipes and spaced no more than 1 m apart.
• Stack pipes of different sizes separately or, if this is not pos¬sible, stack them in such a way that the largest diameter pipes are at the bottom.
• Pipes with sleeves should be stacked alternately so that they are supported along their entire length (see picture).
• Fittings are supplied in boxes and must be stored indoors. Do not subject fittings to heavy loads, as this can deform them.



*Unloading strapped Bundles*

## 9. Packing, transport & storage

| CORRECT TRANSPORTATION PROCEDURE | WHAT NOT TO DO | |
|---|---|---|
|  Where possible use a truck for deliveries. Lay pipe flat on the tray |  Do not throw pipes into the tray |  Do not throw pipes off the ute |
|  Keep pipes strapped down so they don't roll around and remain supported |  Do not over tighten with ratchet |  Take care with O-rings and ensure they are in good condition |
|  Iternate socket and pipe ends when loading |  Do not transport pipes unsupported as they may bend. |  Keep pipes clear of building debris whilst on site |

## Appendix I: Chemical Resistance Table

| | |
|---|---|
| A | EXCELLENT |
| A1 | EXCELLENT UP TO 22° C |
| A2 | EXCELLENT UP TO 48° C |
| B | GOOD |
| B1 | GOOD UP TO 22° C |
| B2 | GOOD UP TO 48° C |
| C | FAIR |
| C1 | FAIR UP TO 22° C |
| C2 | FAIR UP TO 48° C |
| D | SEVERE EFFECT |
| N/A | N/A |



## Appendix I: Chemical Resistance Table

| | | | | | | |
|---|---|---|---|---|---|---|
| ACETALDEHYDE | A1 | ALUMINUM CHLORIDE 20% | A | AMYL ACETOTE | B1 | |
| ACETAMIDE | A1 | ALUMINUM FLUORIDE | A | AMYL AKOHOL | B1 | |
| ACETATE SOLVENT | B1 | ALUMINUM HYDROXIDE | A | AMYL CHLRIDE | D | |
| ACETIC ACID | B | ALUMINUM NITRATE | A2 | ANILINE | A1 | |
| ACETIC ACID %20 | A | ALUMINUM POTASSIUM SULFATE 10% | A | ANILINE HYDROCHLORIDE | D | |
| ACETIC ACID %80 | A | ALUMINUM POTOSSIUM SULFOTE 100% | A | ANTIFREEZE | D | |
| ACETIC ACID, GLACIAL | A1 | ALUMINUM SULFATE | A | ANTIMONY TRICHBRIDE | A | |
| ACETIC ANHYDRIDE | B1 | ALUMS | A | AQUA REGIO (80% HCI, 20% HN03) | B1 | |
| ACETONE | A | AMINES | B2 | AROCHLOR 1248 | D | |
| ACETYL BROMIDE | N/A | AMMONIA 10% | A2 | AROMATIC HYDROCARBONS | D | |
| ACETYL CHLORIDE (DRY) | D | AMMONIA NITROTE | A | ARSENIC ACID | A | |
| ACETYLENE | A1 | AMMONIA, ANHYDROUS | A | ARSENIC SALTS | N/A | |
| ACRYLONITRILE | AT | AMMONIA, LIQUID | A2 | ASPHALT | B1 | |
| ADIPIC ACID | B2 | AMMONIUM ACETATE | A | BARIUM CARBONATE | A | |
| AKOHOLS: AMYL | B1 | AMMONIUM BIFLUORIDE | A | BARIUM CHLORIDE | A | |
| AKOHOLS: BENZYL | A | AMMONIUM CARBONATE | A | BORIUM CYANIDE | D | |
| AKOHOLS: BUTYL | A | AMMONIUM CASEINATE | N/A | BARIUM HYDROXIDE | B | |
| ALKOHOLS: DISCETONE | B2 | AMMONIUM CHLORIDE | A | BARIUM NITRATE | A | |
| AKOHOLS: ETHYL | A | AMMONIUM HYDROXIDE | A | BARIUM SULFATE | B1 | |
| AKOHOLS: HEXYL | N/A | AMMONIUM NITRATE | A | BARIUM SULFIDE | B | |
| AKOHOLS: ISOBUTYL | AT | AMMONIUM OXALATE | A | BEER | AT | |
| AKOHOLS: ISOPROPYL | A2 | AMMONIUM PERSULFATE | A | BEET SUGOR LIQUIDS | A1 | |
| AKOHOLS: METHYL | A2 | AMMONIUM PHOSPHATE, DIBASIC | A | BENZALAHYDE | D | |
| AKOHOLS: OCTYL | N/A | AMMONIUM SULFATE | A | BENZENE | D | |
| AKOHOLS: PROPYL | A | AMMONIUM SULFITE | A2 | BENZENE SULFONIC ACID | D | |
| ALUMINUM CHLRIDE | A | AMMONIUM THIOSULFATE | NIA | BENZOIC ACID | B1 | |

## Appendix I: Chemical Resistance Table

| | | | | | |
|---|---|---|---|---|---|
| BENZOL | B | CHROMIC ACID 30% | D | FERROUS CHLORIDE | A |
| BENZONITRILE | N/A | CHROMIC ACID 5% | D | FERROUS SULFATE | A |
| BENZYL CHLORIDE | C | CHROMIC ACID 50% | D | FLUOBORIC ACID | A |
| BLEACHING LIQUORS | A1 | CHROMIUM SALTS | N/A | FLUORINE | D |
| BORAX(SODIUM BORATE) | B | CIDER | A | FLUOSILICIC ACID | A |
| BORIC ACID | A | CITRIC ACID | A | FORMAKDEHYDE100% | C |
| BREWERY SLOP | N/A | CITRIC OILS | A | FORMAKDEHYDE 40% | A |
| BROMINE | D | CLOROX(BLEACH) | A | FORMIC ACID | A1 |
| BUTADIENE | C | COFFEE | A | FREON 113 | D |
| BUTANE | A1 | COPPER CHLORIDE | A | FREON 12 | A2 |
| BUTANOL(BUTYLAKOHO) | A1 | COPPER CYANIDE | A | FREON 22 | B |
| BUTTER | N/A | COPPER FLUOBORATE | N/A | FREON TF | D |
| BUTTERMILK | A1 | COPPER NITRATE | A | FREON 11 | A |
| BUTYL AMINE | B1 | COPPER SULFATE» 5%6 | A | FRUIT JUICE | B |
| BUTYL ETHER | D | COPPER SULFATE 5% | A | FUEL OILS | A |
| BUTYL PHTHALATE | B2 | CREAM | A | FURAN RESIN | D |
| BUTYLACETATE | B1 | CRESOLS | D | FURFURAL | D |
| BUTYLENE | N/A | CRESYLIC ACID | A1 | GALLIC ACID | A |
| BUTYRIC ACID | B1 | CUPRIC ACID | A2 | GASOLINE (HIGH-AROMATIC) | A |
| CALIUM BISULFATE | NIA | CYANIC ACID | N/A | GASOLINE, LEADED, REF. | B |
| CALIUM BISULFIDE | A | CYCLHEXANE | D | GASOLINE, UNLEADED | C1 |
| CAKIUM BISULFITE | A | CYCLOHEXANONE | D | GELATIN | A |
| CAKIUM CARBONATE | A | DETERGENTS | A | GLUCOSE | A |
| CAKIUM CHLORATE | NIA | DIACETONE AKOHOL | A1 | GLUE, P.V.A. | N/A |
| CAKIUM CHLORIDE | AZ | DICHLROBENZENE | C1 | GLYCERIN | A |
| CALCIUM HYDROXIDE | A2 | DICHBROETHANE | D | GLYCOLIC ACID | A |
| CALIUM HYPOCHLORITE | A1 | DIESEL FUEL | A1 | GOLD MONOCYONIDE | N/A |
| CAKIUM NITRATE | A2 | DIETHVL ETHER | A1 | GRAPE JUICE | N/A |
| CAKIUM OXIDE | A | DIETHYLAMINE | A1 | GREASE | A |
| CAKIUM SULFOTE | A | DIATHYLENE GLYCOL | A2 | HEPTONE | C2 |
| CALGON | A | DIMETHYL ANILINE | D | HEXANE | B1 |
| CANE JUICE | C1 | DIMETHYL FORMAMIDE | A | HONEY | A |
| CARBOLIC ACID (PHENOL) | B | DIPHENYL | D | HYDRAULIC OIL (PETRO) | D |
| CORBON BISULFIDE | D | DIPHENYL OXIDE | D | HYDRAULIC OIL (SYNTHETIC) | D |
| CARBON DIOXIDE (DRY) | A2 | DYES | N/A | HYDRAZINE | C |
| CARBON DIOXIDE (WET) | A2 | EPSOM SALTS (MAGNESIUM SULFATE) | A | HYDROBROMIC ACID 100% | C1 |
| CARBON DISULFIDE | D | ETHONE | D | HYDROBROMIC ACID 20% | A2 |
| CARBON MONOXIDE | A | ETHANOL | A | HYDROCHLORIC ACID 100% | C |
| CARBON TETRACHLORIDE | D | ETHANOLAMINE | D | HYDROCHBRIC ACID 20% | B2 |
| CARBON TETRACHBRIDE (DRY) | D | ETHER | D | HYDROCHLORIC ACID 37% | C |
| CARBON TETRACHLORIDE (WET) | D | ETHYL ACETATE | A1 | HYDROCHLORIC ACID, DRY GAS | B |
| CARBONATED WATER | B | ETHYL BENZOATE | B1 | HYDROCYANIC ACID | A |
| CARBONIC ACID | A | ETHYL CHLORIDE | D | HYDROCYANIC ACID (GAS 10%) | A |
| CATSUP | A | ETHYL ETHER | D | HYDROFLUORIC ACID 100% | C1 |
| CHLORIC ACID | N/A | ETHYL SULFATE | N/A | HYDROFLUORIC ACID 20% | A2 |
| CHLORINATED GLUE | N/A | ETHYLENE BROMIDE | D | HYDROFLUORIC ACID 50% | A2 |
| CHLORINE(DRY) | D | ETHYLENE CHLORIDE | C1 | HYDROFLUORIC ACID 75% | C1 |
| CHLORINE WATER | D | ETHYLENE CHLOROHYDRIN | D | HYDROFLUOSILICIC ACID 100% | A |
| CHLORINE, ANHYDROUS LIQUID | D | ETHYLENE DIOMINE | N/A | HYDROFLUOSILICIC ACID 20% | A |
| CHLOROSCETIC ACID | C1 | ETHYLENE DICHLORIDE | D | HYDROGEN GAS | A |
| CHLOROBENZENE (MONO) | C1 | ETHYLENE GLYCOL | A | HYDROGEN PEROXIDE 10% | A |
| CHLOROBROMOMETHANE | A | ETHYLENE OXIDE | D | HYDROGEN PEROXIDE 100% | B1 |
| CHLOROFORM | C1 | FATTY ACIDS | A | HYDROGEN PEROXIDE 30% | B1 |
| CHLOROSULFONIC ACID | D | FERRIC CHLORIDE | A | HYDROGEN PEROXIDE 50% | B1 |
| CHOCOLATE SYRUP | A2 | FERRIC NITRATE | A | HYDROGEN SULFIDE ( AQUO) | A1 |
| CHROMIC ACID %10 | D | FERRIC SULFATE | A | HYDROGEN SULFIDE (DRY) | A1 |

## Appendix I: Chemical Resistance Table

| | | | | | |
|---|---|---|---|---|---|
| HYDROQUINONE | A | METHYL CELLOSOLVE | B | OILS: LIN SEED | A |
| HYDROXYACETIC ACID 70% | N/A | METHYL CHLORIDE | D | OILS: MINERAL | A |
| TNK | N/A | METHYL DICHLORIDE | D | OILS: OLVE | A |
| LODINE | C | METHYL ETHYL KETONE | B | OILS: ORANGE | D |
| LODINE (IN AKOHOL | N/A | METHYL ETHYL KETONE PEROXIDE | NIA | OILS: PALM | A |
| LODOFORM | N/A | METHYLISOBUTVL KETONE | A | OILS: PEANUT | C |
| ISOOCTANE | A2 | METHYL ISOPROPYL KETONE | NIA | OILS: PEPPERMINT | A |
| ISOPROPYL ACETATE | B1 | METHYL METHACRYLATE | D | OILS: PINE | A1 |
| ISOPROPYL ETHER | B | METHYLAMINE | A2 | OILS: RAPESEED | D |
| ISOTANE | D | METHYLENE CHLORIDE | 81 | OILS: ROSIN | A2 |
| JET FUEL JP3, JP4, JP5) | A1 | MILK | B | OILS: SESAME SEED | B |
| KEROSENE | B | MINERAL SPIRITS | B | OILS: SILICONE | D |
| KETONES | C | MOLASSES | B | OLS: SOYBEAN | A |
| LACQUER THINNERS | D | MONOCHROACETIC ACID | N/A | OILS: SPERM (WHALE) | B |
| LACQUERS | D | MONOETHANOLAMINE | B | OILS: TANNING | A |
| LACTIC ACID | B | MORPHOLINE | B2 | OILS: TRANSFORMER | D |
| LARD | B1 | MOTOR OIL | A1 | OILS: TURBINE | D |
| LATEX | A2 | MUSTARD | A | OLEIE ACID | A |
| LEAD ACETATE | A1 | NAPHTHA | E | OLEUM 100% | A |
| LEAD NITRATE | A2 | NAPHTHALENE | B | OLEUM 25% | B |
| LEND SULFAMATE | A2 | NATURAL GAS | A | OXALIC ACID (COLD) | C1 |
| LIGROIN | A2 | NICKEL CHLORIDE | A | OZONE | A |
| LIME | N/A | NICKEL NITRATE | A2 | PALMITIC ACID | A |
| LINOLEIC ACID | B1 | NICKEL SUFFATE | A | PARAFFIN | N/A |
| LITHIUM CHLORIDE | A2 | NITRATING ACID (<15% HN03) | C | PENTONE | A |
| LITHIUM HYDROXIDE | N/A | NITRATING ACID (>15% H2504) | C | PERCHLORIC ACID | A |
| LUBRICANTS | A1 | NITRATING ACID (51% ACID) | C | PERCHLOROETHYLENE | N/A |
| LVE: CA(OH)2 CALCIUM | A2 | NITRATING ACID (S15% H2504) | C | PETROLATUM | N/A |
| HUDROXIDE | A | NITRIC ACID (20%) | A2 | PETROLEUM | A |
| LYE: KOH POTASSIUM HYDROXIDE | A | NITRIC ACID (50%) | 8 | PHENOL(10%6) | C2 |
| LYE: NOOH SODIUM HYDROXIDE | A2 | NITRIC ACID (5-10% | A | PHENOL(CARBOLIK ACID | B1 |
| MAGNESIUM BISULFATE | A | NITRIC ACID CONCENTRATED) | D | PHOSPHORIC ACID (>40%) | A |
| MAGNESIUM CARBONATE | A2 | NITROBENZENE | B1 | PHOSPHORIC ACID (CRUDE) | D |
| MAGNESIUM CHLORIDA | A | NITROGEN FERTILIZER | N/A | PHOSPHORIC ACID (MOLTEN) | D |
| MAGNESIUM HYDROXIDE | A | NITROMETHANE | B2 | PHOSPHORIC ACID (S40%) | C |
| MAGNESIUM NITRATE | N/A | NITROUS ACIA | A | PHOSPHORIC ACID ANHYDRIDE | C1 |
| MAGNESIUM OXIDE | A | NITROUS OXIDE | D | PHOSPHORUS | A2 |
| MAGNESIUM SULFATE (EPSOM SALTS) | A | OILS: ANILINE | A | PHOSPHORUS TRICHLORIDE | C |
| MALAIRC ACID | D | OILS: ANISE | N/A | PHOTOGRAPHIC DEVELOPER | B2 |
| MALEIC ANHYDRIDE | A1 | OILS: BAY | N/A | PHOTOGRAPHIC SOLUTIONS | C |
| MALE ACID | NA | OILS: BONE | A | PHTHALIC ACID | B |
| MANGANESE SULFATE | N/A | OILS: CASTOR | A | PHTHALIC ANHYDRIDE | A |
| MASH | N/A | OILS: CINNAMON | D | PICRIC ACID | A |
| MAYONNAISE | A | OILS: CITRIC | A | PLATING SOLUTIONS, ANTIMONY PLATING 130°F | C1 |
| MELAMINE | B | OILS: CLOVE | N/A | PLATING SOLUTIONS, ARSENIC PLATING 110°F | A2 |
| MERCURIC CHLORIDE (DILUTE) | B | OILS: COCONUT | A1 | PLATING SOLUTIONS (BRASS): HIGH-SPEED BRASS BATH 110°F | A2 |
| MERCURIC CYANIDE | A | OILS: COD LIVER | A1 | PLATING SOLUTIONS (BRASS): REGULOR BRASS BOTH 100°F | C1 |
| MERCUROUS NITRATE | B | OILS: CORN | A2 | PLATING SOLUTIONS (BRONZE): CU-CD | A |
| MERCURY METHANE | A | OILS: COTTONSEED | A | BRONZE BATH R.T. PLATING SOLUTIONS (BRONZE): CU-SN BRONZE BATH 160° | A |
| METHANOL( METHYL AKOHOL) | A2 | OILS: CREOSOTE | C | PLATING SOLUTIONS (BRONZE): CU-ZN BRONZENBATH 100° | A |
| METHYL ACETATE | D | OILS: DIESEL FUEL OIL (20,30, 40.501) | A1 | PLATING SOLUTIONS (CADMIUM): CYANIDE BOTH 90°F | A |
| METHVL ACETONE | N/A | OILS: FUEL OIL (1. 2. 3, 5A, 5B, 6) | B | PLATING SOLUTIONS (CADMIUM): FLUOBORATE BOTH 100° | B1 |
| METHYL ACRYLATE | D | OILS: GINGER | N/A | PLATING SOLUTIONS, (CHROMIUM): BARREL CHROME BOTH 95°F | B1 |
| METHYL AKOHOL 10% | A2 | OILS: HYDRAULIC OIL (PETRO) | D | PLATING SOLUTIONS, (CHROMIUM): BLACK CHROME BATH 115°E | B1 |
| METHYL BROMIDE | C | OILS: HYDRAULIC OIL (SYNTHETIC) | D | PLATING SOLUTIONS, (CHROMIUM): CHROMIC-SULFURIC BOTH 130°F | A1 |
| METHYL BUTYL KETONE | D | OILS: LEMON | N/A | PLATING SOLUTIONS, (CHROMIUM): FLUORIDE BATH 130°F | A1 |

## Appendix I: Chemical Resistance Table

| | | | | | |
|---|---|---|---|---|---|
| PLATING SOLUTIONS, (CHROMIUM): FLUOSILICATE BOTH 95°F | D | ROSINS | D | STYRENE | N/A |
| PLATING SOLUTIONS (COPPER) (ACID): COPPER FLUOBORATE BATH 120°F | A | RUM | A | SUGAR (LIQUIDS) | A |
| PLATING SOLUTIONS (COPPER) (ACID): COPPER SULFATE BATH R.T. | A | RUST INHIBITORS | A | SULFATE(LIQUORS) | A |
| PLATING SOLUTIONS (COPPER) (CYANIDE): COPPER STRIKE BATH 120°F | A | SALAD DRESSINGS | A | SULFUR CHLORIDE | C1 |
| PLATING SOLUTIONS (COPPER) (CYANIDE): HIGH-SPEED BOTH 180°F | A | SALICYLIC ACID | A | SULFUR DIOXIDE | A1 |
| PLATING SOLUTIONS (COPPER) (CYANIDE): ROCHELLE SALT BATH 150°F | A | SALT BRINE (NACI SATURATED) | A | SULFUR DIOXIDE (DRY) | A1 |
| PLATING SOLUTIONS (COPPER) (MISC): COPPER (ELECTROLESS) | A | SEA WATER | A | SULFUR HEXAFLUORIDE | N/A |
| PLATING SOLUTIONS (COPPER) (MISC): COPPER PYROPHOSPHATE | A | SHELLAC (BLEACHED) | A | SULFUR TRIOXIDE | C |
| PLOTING SOLUTIONS (GOLF): ACID 75°F | A | SHELLAC (ORANGE) | A | SULFUR TRIOXIDE (DRY) | D |
| PLATING SOLUTIONS (GOK): CYANIDE 150°F | A | SILICONE | A | SULFURIC ACID (<10%6) | A2 |
| PLATING SOLUTIONS (GOLD): NEUTRAL75°F | C | SILVER BROMIDE | C | SULFURIC ACID (10-75%6) | A1 |
| PLATING SOLUTIONS, INDIUM SULFAMATE PLATING R. T. | A | SILVER NITRATE | A | SUFFURIC ACID (75-10036) | C1 |
| PLATING SOLUTIONS (IRON): FERROUS AM SULFATE BOTH 150°F | A | SOAP SOLUTIONS | A | SULFURIC ACID (COLD CONCENTRATED) | A2 |
| PLATING SOLUTIONS (IRON): FERROUS CHLORIDE BOTH 190°F | A | SODA ASH (SEE SODIUM CARBONATE) | A | SULFURIC ACID (HOT CONCENTRATED) | D |
| PLATING SOLUTIONS (IRON): FERROUS SULFATE BATH 150°F | A | SODIUM ACETATE | A | SULFUROUS ACID | A |
| PLATING SOLUTIONS (IRON): FLUOBORATE BOTH 145°F | A | SODIUM ALUMINATE | A | SULFURYL CHLORIDE | N/A |
| PLATING SOLUTIONS (IRON): SULFAMATE 140°F | A | SODIUM BENZOATE | A | TALLOW | A2 |
| PLATING SOLUTIONS (IRON): SULFATE-CHLORIDE BOTH 160°F | A | SODIUM BICARBONATE | A | TANNIC ACID | A |
| PLATING SOLUTIONS, LEND FLUOBORATE PLATING | A | SODIUM BISULFATE | A | TANNING LIQUORS | A1 |
| PLATING SOLUTIONS, (NICKEL): ELECTROLESS 200°F | D | SODIUM BISULFITE | D | TARTARIC ACID | A |
| PLATING SOLUTIONS, (NICKEL): FLUOBORATE 100-170°F | A | SODIUM BORATE (BORAX) | A | TETRACHBROETHANE | C |
| PLATING SOLUTIONS, (NICKEL: HIGH-CHLORIDE 130-160°F | A | SODIUM BROMIDE | A | TETRACHBROETHYLENE | D |
| PLATING SOLUTIONS, (NICKEL: SUFFAMATE100-140°F | A | SODIUM CARBONATE | A | TETRAHYDROFURAN | C2 |
| PLOTING SOLUTIONS, (NICKEL: WATTS TYPE 115-160°F | A | SODIUM CHLORATE | A | TIN SALTS | A |
| PLATING SOLUTIONS (RHODIUM) 120°F | A | SODIUM CHLORIDE | A | TOLUENE (TOLUOL) | C1 |
| PLATING SOLUTIONS, (SILVER) 80-120°F | A | SODIUM CHROMATE | A | TOMATO JUICE | A |
| PLATING SOLUTIONS, TIN-FLUOBORATE PLATING 100°F | A | SODIUM CYANIDE | A | TRICHBROACETIC ACID | A |
| PLATING SOLUTIONS, TIN-LEAD PLATING 100°F | A | SODIUM FERROCYANIDE | A | TRICHBROETHANE | C |
| PLATING SOLUTIONS (ZINC): ACID CHLORIDE 140°F | A | SODIUM FLUORIDE | A | TRICHBROETHYLENE | C1 |
| PLATING SOLUTIONS (ZINC): ACID FLUOBORATE BOTH R. T. | A | SODIUM HYDROSULFITE | A | TRICHLOROPROPANE | N/A |
| PLATING SOLUTIONS (ZINC): ACID SULFATE BOTH 150»F | A | SODIUM HYDROXIDE (20%) | A | TRICRESYLPHOSPHATE | A1 |
| PLATING SOLUTIONS (ZINC): ALKALINE CYANIDE BOTH R. T. | A | SODIUM HYDROXIDE (50%) | A | TRIETHYLAMINE | D |
| POTASH (POTASSIUM CARBONATE) | A | SODIUM HYDROXIDE (80%) | A | TRISODIUM PHOSPHATE | A |
| POTASSIUM BICARBONATE | A | SODIUM HYPOCHLORITE (<20%) | A | TURPENTINE | D |
| POTASSIUM BROMIDE | A | SODIUM HYPOCHLORITE (100%) | A | UREA | A |
| POTASSIUM CHLORATE | A | SODIUM HYPOSULFATE | A | URIC ACID | N/A |
| POTASSIUM CHORIDA | A | SODIUM METAPHOSPHATE | A | URINE | A |
| POTASSIUM CHROMATE | A | SODIUM METASILICATE | A | VARNISH | A |
| POTASSIUM CVANIDE SOLUTIONS | A | SODIUM NITRATE | A | VEGETABLE JUICE | NA |
| POTASSIUM DICHROMATE | A | SODIUM PERBORATE | A | VINEGAR | A |
| POTASSIUM FERRICYANIDE | A2 | SODIUM PEROXIDE | A2 | VINYL ACETATE | B1 |
| POTASSIUM FERROCYANIDE | A | SODIUM POLYPHOSPHATE | A | VINYL CHLORIDE | N/A |
| POTASSIUM HUDROXIDE (CAUSTIC POTASH) | A | SODIUM SILICATE | A | WATER. ACID. MINE | A |
| POTASSIUM HYPOCHLORITE | N/A | SODIUM SULFATE | N/A | WATER. DEIONIZED | A2 |
| POTASSIUM LODIDE | A2 | SODIUM SULFIDE | A2 | WATER. DISTILLED | A |
| POTASSIUM NITRATE | A | SODIUM SULFITE | A | WATER. FRESH | A |
| POTASSIUM OXOLATE | N/A | SODIUM TETRABORATE | N/A | WATER. SOLT | A |
| POTASSIUM PERMONGONATE | A1 | SODIUM THIOSULFATE HYPOL | A1 | WEED KILLERS | N/A |
| POTASSIUM SULFATE | A | SORGHUM | A | WHEY | N/A |
| POTASSIUM SULFIDE | A | SOY SAUCE | A | WHISKEY & WINES | A |
| PROPANE LIQUEFIED | A | STANNIC CHLORIDE | A | WHITE LIAUOR /POLO MILLI | A1 |
| PROPYLENE | N/A | STANNIE FLUOBORATE | N/A | WHITE WATER( PAPER MILF | A |
| PROPYLENE GIVEOL | A2 | STANNOUS CHLORIDE | A2 | XVENE | B |
| PURIDINE | A2 | STARCH | A2 | ZINE CHLRIDA | A |
| PYROGALLIC ACID | A | STERIC ACID | A | ZINC HYDROSULFITE | N/A |
| «RESORCINAL | A2 | STODDARD SOLVENT | A2 | ZINE SULFATE | A |

## Appendix II: Drainage Sizing Tables

| | DN 70 | | DN 80 | | DN 90 | | DN 100 | | DN 125 | | DN 150 | | DN 200 | | DN 225 | | DN 250 | | DN 300 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GRADIENT | D,=68 | | D,=75 | | DI=79 | | DI=96 | | DI=113 | | DI=146 | | DI=184 | | DI=207 | | DI=230 | | DI=290 | |
| J | Q | V | Q | V | Q | V | Q | V | Q | V | Q | V | Q | V | Q | V | Q | V | Q | V |
| CM/M | I/S | M/S | I/S | M/S | I/S | M/S | I/S | M/S | I/S | M/S | I/S | M/S | I/S | M/S | I/S | M/S | I/S | M/S | I/S | M/S |
| 0,20 | | | | | | | | | | | | | 6,3 | 0,5 | 8,6 | 0,5 | 11,4 | 0,5 | 21,0 | 0,6 |
| 0,30 | | | | | | | | | | | | 4,2 | 7,7 | 0,6 | 10,5 | 0,6 | 14,0 | 0,7 | 25,8 | 0,8 |
| 0,40 | | | | | | | | | 2,4 | 0,5 | 0,5 | 4,8 | 8,9 | 0,7 | 12,2 | 0,7 | 16,2 | 0,8 | 29,9 | 0,9 |
| 0,50 | | | | | | | 1,8 | 0,5 | 2,7 | 0,5 | 0,5 | 5,4 | 10,0 | 0,8 | 13,7 | 0,8 | 18.1 | 0,9 | 33,4 | 1,0 |
| 0,60 | | | | | 1,1 | 0,5 | 1,9 | 0,5 | 3,0 | 0,6 | 0,6 | 5,9 | 11,0 | 0,8 | 15,0 | 0,9 | 19,8 | 1,0 | 36,7 | 1,1 |
| 0,70 | 0,8 | 0,5 | 1,1 | 0,5 | 1,2 | 0,5 | 2,1 | 0,6 | 3,2 | 0,6 | 0,6 | 6,4 | 11,8 | 0,9 | 16,2 | 1,0 | 21,4 | 1,0 | 39,6 | 1,2 |
| 0,80 | 0,9 | 0,5 | 1,1 | 0,5 | 1,3 | 0,5 | 2,2 | 0,6 | 3,5 | 0,7 | 0,7 | 6,8 | 12,7 | 1,0 | 17,3 | 1,0 | 22,9 | 1,1 | 42,4 | 1,3 |
| 0,90 | 0,9 | 0,5 | 1,2 | 0,6 | 1,4 | 0,6 | 2,4 | 0,7 | 3,7 | 0,7 | 0,7 | 7,3 | 13,4 | 1,0 | 18,4 | 1,1 | 24,3 | 1,2 | 45,0 | 1,4 |
| 1,00 | 1,0 | 0,5 | 1,3 | 0,6 | 1,5 | 0,6 | 2,5 | 0,7 | 3,9 | 0,8 | 0,8 | 7,7 | 14,2 | 1,1 | 19,4 | 1,2 | 25,7 | 1,2 | 47,4 | 1,4 |
| 1,10 | 1,0 | 0,6 | 1,4 | 0,6 | 1,6 | 0,6 | 2,6 | 0,7 | 4,1 | 0,8 | 0,8 | 8,0 | 14,9 | 1,1 | 20,4 | 1,2 | 26,9 | 1,3 | 49,8 | 1,5 |
| 1,20 | 1,1 | 0,6 | 1,4 | 0,6 | 1,6 | 0,7 | 2,7 | 0,8 | 4,2 | 0,8 | 0,8 | 8,4 | 15,5 | 1.2 | 21,3 | 1,3 | 281 | 1,4 | 52,0 | 1,6 |
| 1,30 | 1,1 | 0,6 | 1,5 | 0,7 | 1,7 | 0,7 | 2,9 | 0,8 | 4,4 | 0,9 | 0,9 | 8,7 | 16,2 | 1,2 | 22,1 | 1,3 | 29,3 | 1,4 | 54,1 | 1,6 |
| 1,40 | 1,2 | 0,6 | 1,5 | 0,7 | 1,8 | 0,7 | 3,0 | 0,8 | 4,6 | 0,9 | 0,9 | 9,1 | 16,8 | 1,3 | 23,0 | 1,4 | 30,4 | 1,5 | 56,2 | 1,7 |
| 1,50 | 1,2 | 0,7 | 1.6 | 0,7 | 1,8 | 0,7 | 3,1 | 0,8 | 4,7 | 0,9 | 0,9 | 9,4 | 17,4 | 1,3 | 23,8 | 1,4 | 31,5 | 1,5 | 58,2 | 1,8 |
| 2,00 | 1,4 | 0,8 | 1,8 | 0,8 | 2,1 | 0,9 | 3,5 | 1,0 | 5,5 | 1,1 | 1,1 | 10,9 | 20,1 | 1,5 | 27,5 | 1,6 | 36,4 | 1,8 | 67,2 | 2,0 |
| 2,50 | 1,6 | 0,9 | 2,0 | 0,9 | 2,4 | 1,0 | 4,0 | 1,1 | 6,1 | 1,2 | 1,2 | 12,2 | 22,5 | 1,7 | 30,8 | 1,8 | 40,7 | 2,0 | 75,2 | 2,3 |
| 3,00 | 1,7 | 1,0 | 2,2 | 1,0 | 2,6 | 1,1 | 4,4 | 1,5 | 6,7 | 1,3 | 1,3 | 13,3 | 24,7 | 1,9 | 33,7 | 2,0 | 44,6 | 2,1 | 82,4 | 2,5 |
| 3,50 | 1,9 | 1,0 | 2,4 | 1,1 | 2.8 | 1,1 | 4,7 | 1,3 | 7,3 | 1,5 | 1,5 | 14.4 | 26,6 | 2,0 | 36,4 | 2,2 | 48,2 | 2,3 | | |
| 4,00 | 2,0 | 1,1 | 2,6 | 1,2 | 3.0 | 1,2 | 5,0 | 1,4 | 7,8 | 1,6 | 1,6 | 15,4 | 28,5 | 2,1 | 39,0 | 2,3 | 51,5 | 2,5 | | |
| 4,50 | 2,1 | 1,2 | 2,8 | 1,2 | 3,2 | 1,3 | 5,3 | 1,5 | 8,3 | 1,6 | 1,6 | 16,3 | 30,2 | 2,3 | 41,3 | 2,5 | | | | |
| 5,00 | 2,2 | 1,2 | 2,9 | 1,3 | 3,3 | 1,4 | 5,6 | 1,6 | 8,7 | 1,7 | 1,7 | 17,2 | 31,9 | 2,4 | | | | | | |

SIZING TABLE FOR UNDERGROUND AND COLLECTOR PIPES CONFORMING TO DIN 1986-100, TAB. A.3, FILLING FACTOR 0.5 :

| | DN 70 | | DN 90 | | DN 100 | | DN 125 | | DN 150 | | DN 200 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GRADIENT | DI=68 | | D=80,8 | | DI=99.4 | | DI=114,4 | | DI=148,8 | | DI=184 | |
| J | Q | V | Q | V | Q | V | Q | V | Q | V | Q | V |
| CM/M | I/S | M/S | I/S | M/S | I/S | M/S | I/S | M/S | I/S | M/S | I/S | M/S |
| 0,20 | 0,44 | 0,24 | 0,70 | 0,27 | 1,21 | 0,31 | 1,77 | 0,34 | 3,58 | 0,41 | 6,67 | 0,48 |
| 0,30 | 0,54 | 0,30 | 0,86 | 0,33 | 1,49 | 0,39 | 2,18 | 0,42 | 4,40 | 0,51 | 8,20 | 0,59 |
| 0,40 | 0,62 | 0,34 | 0,99 | 0,39 | 1,73 | 0,45 | 2,52 | 0,49 | 5,09 | 0,58 | 9,48 | 0,68 |
| 0,50 | 0,70 | 0,38 | 1,11 | 0,43 | 1,94 | 0,50 | 2,82 | 0,55 | 5,69 | 0,65 | 10,61 | 0,76 |
| 0,60 | 0,77 | 0,42 | 1,22 | 0,48 | 2,12 | 0,55 | 3,09 | 0,6 | 6,24 | 0,72 | 11,63 | 0,84 |
| 0,70 | 0,83 | 046 | 1,32 | 0,51 | 2,3 | 0,59 | 3,35 | 0,65 | 6,75 | 0,78 | 12,57 | 0,91 |
| 0,80 | 0,89 | 0,49 | 1,41 | 0,55 | 2,46 | 0,63 | 3,58 | 0,70 | 7,22 | 0,83 | 13,45 | 0,97 |
| 0,90 | 0,94 | 0,52 | 1,50 | 0,58 | 2,61 | 0,67 | 3,80 | 0,74 | 7,66 | 0,88 | 14,27 | 1,03 |
| 1,00 | 0,99 | 0,55 | 1,58 | 0,62 | 2,75 | 0,71 | 4,01 | 0,78 | 8,08 | 0,93 | 15,05 | 1,08 |
| 1,10 | 1,04 | 0,57 | 1,66 | 0,65 | 2,89 | 0,74 | 4.20 | 0,82 | 8,48 | 0,97 | 15,79 | 1,14 |
| 1,20 | 1,09 | 0,60 | 1,73 | 0,68 | 3,02 | 0,78 | 4,39 | 0,85 | 8,86 | 1,02 | 16,50 | 1,19 |
| 1,30 | 1,13 | 0,62 | 1,80 | 0,70 | 3,14 | 0,81 | 4,57 | 0,89 | 9,22 | 1,06 | 17,17 | 1,24 |
| 1,40 | 1,18 | 0,65 | 1,87 | 0,73 | 3,26 | 0,84 | 4,75 | 0,92 | 9,57 | 1,10 | 17,83 | 1,28 |
| 1,50 | 1,22 | 0,76 | 1,94 | 0,76 | 3,38 | 0,87 | 4,92 | 0,96 | 9,91 | 1,14 | 18,46 | 1,33 |
| 2,00 | 1,41 | 0,78 | 2,24 | 0,87 | 3,90 | 1,01 | 5,68 | 1,11 | 11,45 | 1,32 | 21,33 | 1,54 |
| 2,50 | 1,58 | 0,87 | 2,51 | 0,98 | 4,37 | 1,13 | 6,36 | 1,24 | 12,81 | 1,47 | 23.86 | 1,72 |
| 3,00 | 1,73 | 0,95 | 2,75 | 1,07 | 4,79 | 1,23 | 6,97 | 1,36 | 14,04 | 1,61 | 26.15 | 1,88 |
| 3,50 | 1,87 | 1,03 | 2,97 | 1,16 | 5,17 | 1,33 | 7,53 | 1,47 | 15,17 | 1,74 | 28,25 | 2,04 |
| 4,00 | 2,00 | 1,10 | 3,18 | 1,24 | 5,53 | 1,43 | 8,05 | 1,57 | 16,22 | 1,87 | 30,21 | 2,18 |
| 4,50 | 2,12 | 1,17 | 3,37 | 1,32 | 5,87 | 1,51 | 8,54 | 1,66 | 17,21 | 1,98 | 32,05 | 2,31 |
| 5,00 | 2,25 | 1,23 | 3,56 | 1,39 | 6,19 | 1,60 | 9,01 | 1,75 | 18,15 | 2,09 | 33,79 | 2,43 |

SIZING TABLE FOR UNDERGROUND AND COLLECTOR PIPES USING WAVIN AS+, FILLING FACTOR 0.5

## Appendix II: Drainage Sizing Tables

| | | DN 70 | | DN 80 | | DN 90 | | DN 100 | | DN 125 | | DN 150 | | DN 200 | | DN 225 | | DN 250 | | DN 300 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GRADIENT | | D,=68 | | D,=75 | | DI=79 | | DI=96 | | DI=113 | | DI=146 | | DI=184 | | DI=207 | | DI=230 | | DI=290 | |
| J | Q | V | Q | V | Q | V | Q | V | Q | V | Q | V | Q | V | Q | V | Q | V | Q | V | |
| CM/M | I/S | M/S | I/S | M/S | I/S | M/S | I/S | M/S | I/S | M/S | I/S | M/S | I/S | M/S | I/S | M/S | I/S | M/S | I/S | M/S | |
| 0,20 | | | | | | | | | | | | | 12,5 | 0,5 | 17,2 | 0,5 | 22,7 | 0,5 | 42,1 | 0,6 | |
| 0,30 | | | | | | | | | | | 8,3 | 0,5 | 15,4 | 0,6 | 21,1 | 0,6 | 27,9 | 0,7 | 51,7 | 0,8 | |
| 0,40 | | | | | | | | | 4,9 | 0,5 | 9,6 | 0,6 | 17,8 | 0,7 | 24,4 | 0,7 | 32,3 | 0,8 | 59,7 | 0,9 | |
| 0,50 | | | | | | | 3,5 | 0,5 | 5,4 | 0,5 | 10,8 | 0,6 | 20,0 | 0,8 | 27,3 | 0,8 | 36,2 | 2,5 | 66,9 | 1,0 | |
| 0,60 | | | | | 2,3 | 0,5 | 3,9 | 0,5 | 6,0 | 0,6 | 11,8 | 0,7 | 21,9 | 0,8 | 30,0 | 0,9 | 39,7 | 0,9 | 73,3 | 1,1 | |
| 0,70 | 1,6 | 0,5 | 2,1 | 0,5 | 2,5 | 0,5 | 4,2 | 0,6 | 6,5 | 0,6 | 12,8 | 0,8 | 23,7 | 0,9 | 32,4 | 1,0 | 42,9 | 1,0 | 79,3 | 1,2 | |
| 0,80 | 1,8 | 0,5 | 2,3 | 0,5 | 2,6 | 0,5 | 4,5 | 0,6 | 6,9 | 0,7 | 13,7 | 0,8 | 25,3 | 1,0 | 34,7 | 1,0 | 45,9 | 1,0 | 84,8 | 1,3 | |
| 0,90 | 1,9 | 0,5 | 2,4 | 0,6 | 2,8 | 0,6 | 4,7 | 0,7 | 7.3 | 0,7 | 14,5 | 0,9 | 26,9 | 1,0 | 36,8 | 1,1 | 48,7 | 1,1 | 90,0 | 1,4 | |
| 1,00 | 2,0 | 0,5 | 2,6 | 0,6 | 3,0 | 0,6 | 5,0 | 0,7 | 7,7 | 0,8 | 15,3 | 0,9 | 28,4 | 1,1 | 38,8 | 1,2 | 51,3 | 1,2 | 94,9 | 1,4 | |
| 1,10 | 2,1 | 0,6 | 2,7 | 0,6 | 3,1 | 0,6 | 5,2 | 0,7 | 8,1 | 0,8 | 16,1 | 1,0 | 29,8 | 1,1 | 40,7 | 1,2 | 53,8 | 1,2 | 99,5 | 1,5 | |
| 1,20 | 2,2 | 0,6 | 2,8 | 0,6 | 3,2 | 0,7 | 5,5 | 0,8 | 8,5 | 0,8 | 16,8 | 1,0 | 31,1 | 1.2 | 42,5 | 1,3 | 56,2 | 1,3 | 104,0 | 1,6 | |
| 1,30 | 2,3 | 0,6 | 2,9 | 0,7 | 3,4 | 0,7 | 5,7 | 0,8 | 8,8 | 0,9 | 17,5 | 1,0 | 32,4 | 1,2 | 44,3 | 1,3 | 58,2 | 1,4 | 108,2 | 1,6 | |
| 1,40 | 2,3 | 0,6 | 3,1 | 0,7 | 3,5 | 0,7 | 5,9 | 0,8 | 9,2 | 0,9 | 18,2 | 1,1 | 33,6 | 1,3 | 46,0 | 1,4 | 60,8 | 1,4 | 112,4 | 1,7 | |
| 1,50 | 2,4 | 0,7 | 3,2 | 0,7 | 3,6 | 0,7 | 6,1 | 0,8 | 9,5 | 0,9 | 18,8 | 1,1 | 34,8 | 1,3 | 47,6 | 1,4 | 62,9 | 1,5 | 116,3 | 1,8 | |
| 2,00 | 2,8 | 0,8 | 3,7 | 0,8 | 4,2 | 0,9 | 7,1 | 1,0 | 11,0 | 1,1 | 21,7 | 1,3 | 40,2 | 1,5 | 55,0 | 1,6 | 72,7 | 1,5 | 134,4 | 2,0 | |
| 2,50 | 3,1 | 0,9 | 4,1 | 0,9 | 4,7 | 1,0 | 7,9 | 1,1 | 12,3 | 1,2 | 24,3 | 1,5 | 45,0 | 1,7 | 61,5 | 1,8 | 81,4 | 1,8 | 150,4 | 2,3 | |
| 3,00 | 3,5 | 1,0 | 4,5 | 1,0 | 5,2 | 1,1 | 8,7 | 1,5 | 13,5 | 1,3 | 26,7 | 1,6 | 49,3 | 1,9 | 67,4 | 2,0 | 89,2 | 2,0 | 164,8 | 2,5 | |
| 3,50 | 3,7 | 1,0 | 4,9 | 1,1 | 5,6 | 1,1 | 9,4 | 1,3 | 14,5 | 1,5 | 28,8 | 1,7 | 53,3 | 2,0 | 72,9 | 2,2 | 96,4 | 2,1 | | | |
| 4,00 | 4,0 | 1,1 | 5,2 | 1,2 | 6,0 | 1,2 | 10,1 | 1,4 | 15,6 | 1,6 | 30,8 | 1,8 | 57,0 | 2,1 | 77,9 | 2,3 | 103,0 | 2,3 | | | |
| 4,50 | 4,2 | 1.2 | 5,5 | 1,2 | 6,3 | 1,3 | 10,7 | 1,5 | 16,5 | 1,6 | 32,7 | 2,0 | 60,5 | 2,3 | 82,7 | 2,5 | | 2,5 | | | |
| 5,00 | 4,5 | 1,2 | 5,8 | 1,3 | 6,7 | 1,4 | 11,3 | 1,6 | 17,4 | 1,7 | 34,5 | 2,1 | 63,8 | 2,4 | | | | | | | |

SIZING TABLE FOR UNDERGROUND AND COLLECTOR PIPES CONFORMING TO DIN 1986-100, TAB. A.3, FILLING FACTOR 0.5

| | | DN 70 | | DN 90 | | DN 100 | | DN 125 | | DN 150 | | DN 200 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GRADIENT | | DI=68 | | D=80,8 | | DI=99.4 | | DI=114,4 | | DI=148,8 | | DI=184 | |
| J | Q | V | Q | V | Q | V | Q | V | Q | V | Q | V | |
| CM/M | I/S | M/S | I/S | M/S | I/S | M/S | I/S | M/S | I/S | M/S | I/S | M/S | |
| 0,20 | 0,87 | 0,24 | 1,39 | 0,27 | 2,43 | 0,31 | 3,54 | 0,34 | 7,15 | 0.41 | 13,35 | 0,48 | |
| 0,30 | 1,08 | 0,30 | 1,71 | 0,33 | 2,99 | 0,39 | 4,35 | 0,42 | 8,79 | 0,51 | 16,39 | 0,59 | |
| 0,40 | 1,25 | 0,34 | 1,98 | 0,39 | 3,46 | 0,45 | 5,04 | 0,49 | 10,17 | 0,58 | 18,96 | 0,68 | |
| 0,50 | 1,40 | 0,38 | 2,22 | 0,43 | 3,87 | 0,50 | 5,64 | 0,55 | 11,39 | 0,65 | 21,22 | 0,76 | |
| 0,60 | 1,53 | 0,42 | 2,44 | 0,48 | 4,25 | 0,55 | 6,19 | 0,6 | 12,49 | 0,72 | 23,27 | 0,84 | |
| 0,70 | 1,66 | 046 | 2,64 | 0,51 | 4,59 | 0,59 | 6,69 | 0,65 | 13,50 | 0,78 | 25,15 | 0,91 | |
| 0,80 | 1,77 | 0,49 | 2,82 | 0,55 | 4,92 | 0,63 | 7,16 | 0,70 | 14,44 | 0,83 | 26,90 | 0,97 | |
| 0,90 | 1,88 | 0,52 | 2,99 | 0,58 | 5,22 | 0,67 | 7,60 | 0,74 | 15,32 | 0,88 | 28,54 | 1,03 | |
| 1,00 | 1,99 | 0,55 | 3,16 | 0,62 | 5,50 | 0,71 | 8,01 | 0,78 | 16,16 | 0,93 | 30,10 | 1,08 | |
| 1,10 | 2,09 | 0,57 | 3,31 | 0,65 | 5,77 | 0,74 | 8,41 | 0,82 | 16,95 | 0,97 | 31,58 | 1,14 | |
| 1,20 | 2,18 | 0,60 | 3,46 | 0,68 | 6,03 | 0,78 | 8,78 | 0,85 | 17,71 | 1,02 | 32,99 | 1,19 | |
| 1,30 | 2,27 | 0,62 | 3,61 | 0,70 | 6,28 | 0,81 | 9,15 | 0,89 | 18,44 | 1,06 | 34,35 | 1,24 | |
| 1,40 | 2,36 | 0,65 | 3,74 | 0,73 | 6,52 | 0,84 | 9,49 | 0,92 | 19,14 | 110 | 35.65 | 1,28 | |
| 1,50 | 2,44 | 0,76 | 3,88 | 0,76 | 6,75 | 0,87 | 9,83 | 0,96 | 19,82 | 1,14 | 36,91 | 1,33 | |
| 2,00 | 2,82 | 0,78 | 4,48 | 0,87 | 7,81 | 1,01 | 11,36 | 1,11 | 22,91 | 1,32 | 42,66 | 1,54 | |
| 2,50 | 3,16 | 0,87 | 5,02 | 0,98 | 8,73 | 1,13 | 12,71 | 1,24 | 25,63 | 1.47 | 47,72 | 1,72 | |
| 3,00 | 3,46 | 0,95 | 5,50 | 1,07 | 9,57 | 1,23 | 13,94 | 1,36 | 28,08 | 1,61 | 52,29 | 1,88 | |
| 3,50 | 3,74 | 1,03 | 5,94 | 1,16 | 10,35 | 1,33 | 15,06 | 1,47 | 30,35 | 1,74 | 56,50 | 2,04 | |
| 4,00 | 4,00 | 1,10 | 6,36 | 1,24 | 11,06 | 1,43 | 16,10 | 1,57 | 32,45 | 1,87 | 60,42 | 2,18 | |
| 4,50 | 4,25 | 1,17 | 6,74 | 1,32 | 11,74 | 1,51 | 17,09 | 1,66 | 34,43 | 1,98 | 64,09 | 2,31 | |
| 5,00 | 4,48 | 1,23 | 7,11 | 1,39 | 12,38 | 1,60 | 18,01 | 1,75 | 36,30 | 2,09 | 67,57 | 2,43 | |

SIZING TABLE FOR UNDERGROUND AND COLLECTOR PIPES USING WAVIN AS+, FILLING FACTOR 0.5.

# Appendix III: HAMZA AS Certificates

TÜV NORD

## CERTIFICATE

Management system as per
**DIN ISO 45001 : 2018**

The Certification Body TÜV NORD CERT GmbH hereby confirms as a result of the audit, assessment and certification decision according to ISO/IEC 17021-1:2015, that the organization

**HAMZA INDUSTRY CO.**
**Industrial Zone - Lot 163,164,166,167**
**6th October City, Giza**
**Egypt**

HAMZA WATER MANAGEMENT

operates a management system in accordance with the requirements of ISO 45001:2018 and will be assessed for conformity within the 3 year term of validity of the certificate.

Scope

**Manufacturing of Complete Plastic Systems for Soil & Waste (Drainage), Sewage, Water Supply, Natural Gas Network and Sanitary Ware Accessories.**

Certificate Registration No. 44 126 18370049
Audit Report No. GR-3469/2021

Valid from 2021-06-10
Valid until 2023-03-13
Initial certification 2017 (BS OHSAS 18001)

Certifcation Body
at TÜV NORD CERT GmbH

Athens, 2021-06-10

TÜV NORD CERT GmbH Langemarckstraße 20 45141 Essen www.tuev-nord-cert.com

IAF DAkkS Deutsche Akkreditierungsstelle D-ZM-12007-01-00

TÜV NORD

## CERTIFICATE

Management system as per
**DIN EN ISO 9001 : 2015**

In accordance with TÜV NORD CERT procedures, it is hereby certified that

**HAMZA INDUSTRY CO.**
**Industrial Zone - Lot 163,164,166,167**
**6th October City, Giza**
**Egypt**

HAMZA WATER MANAGEMENT

applies a management system in line with the above standard for the following scope

**Manufacturing of Complete Plastic Systems for Soil & Waste (Drainage), Sewage, Water Supply, Natural Gas Network and Sanitary Ware Accessories.**

Certificate Registration No. 44 100 17370038
Audit Report No. GR-3469/2020

Valid from 2020-03-14
Valid until 2023-03-13
Initial certification 2017

Certification Body
at TÜV NORD CERT GmbH

Athens, 2020-03-13

This certification was conducted in accordance with the TÜV NORD CERT auditing and certification procedures and is subject to regular surveillance audits.

TÜV NORD CERT GmbH Langemarckstraße 20 45141 Essen www.tuev-nord-cert.com

IAF DAkkS

TÜV NORD

## CERTIFICATE

Management system as per
**DIN EN ISO 14001 : 2015**

In accordance with TÜV NORD CERT procedures, it is hereby certified that

**HAMZA INDUSTRY CO.**
**Industrial Zone - Lot 163,164,166,167**
**6th October City, Giza**
**Egypt**

HAMZA WATER MANAGEMENT

applies a management system in line with the above standard for the following scope

**Manufacturing of Complete Plastic Systems for Soil & Waste (Drainage), Sewage, Water Supply, Natural Gas Network and Sanitary Ware Accessories.**

Certificate Registration No. 44 104 17370038
Audit Report No. GR-3469/2020

Valid from 2020-03-14
Valid until 2023-03-13
Initial certification 2017

Certification Body
at TÜV NORD CERT GmbH

Athens, 2020-03-13

This certification was conducted in accordance with the TÜV NORD CERT auditing and certification procedures and is subject to regular surveillance audits.

TÜV NORD CERT GmbH Langemarckstraße 20 45141 Essen www.tuev-nord-cert.com

IAF DAkkS Deutsche Akkreditierungsstelle D-ZM-12007-01-00

Plastic Technology Center

Ministry of Industry and Foreign Trade
Industry Council for Technology and Innovation

## Analysis Certificate
## Report No. : ( 290-2)

| | |
|---|---|
| Client | : HAMZA INDUSTRY Co. |
| Sample* | : PP Elbow 110 mm /87.5°mm. |
| Sample Data | : Hamza astolan PP Elbow 110/87.5° DIN 4102-B1 under licence of wavin – Germany. |
| Production Date | : 6/11/2018. |
| Color | : Off White. |
| Date | : 22/ 11/2018. |
| Standard | : DIN 4102-B1. |
| Report | : Attached. |

Temperature: 20 ± 2 °C  Humidity :50 ± 5 %

*Sample, its Production Date and data are delivered by the Customer

Labs Manager
(Chemist: Wafaa Moursy)

Expert of Center
(Eng. Nagwa M. EL- Menawy)

Engy

Ministry of Industry and trade
Plastic Technology Center
Approved
Technical Department



**Labs and Training Headquarters:** Gamela Bo Harid St., El Seuof Shamaa- Alexandria. **Tel.-Fax:** 033307233 **Tel.:**033325613
**Administrative Headquarters:** 25 Zaki Attalah St., El Saa'a Square

Plastic Technology Center

Ministry of Trade & Industry
Technological Development Sector

## Analysis certificate

Report No. (1252)

Client : HAMZA INDUSTRY CO.

Sample : PP pipe.

Sample color: White.

Sample Data: (PP mineral reinforced Multi layer Pipe 110 X 5.3 mm - Din 4102 B1).

(Sample and its data is delivered by the customer)

Date : 20/2/2012.

Standard : ASTM E 169.

Instrument used: UV Spectrophotometer - Double beam (Bio lab).

Head of Technical Sector
(Eng. Nagwa M. EL- Menawy)

Managing Director
(Eng. Mahmad Mostafa Kamal)

1 2

20/2/2012

RM

PTC President

**Labs and Training Headquarters:** Gamela Bo Harid St. - El-Seuof Shamaa - Alexandria. **Tel.-Fax:** 033307233 **Tel.:** 033325613
**Administrative headquarters:** Amam 25 Zaki Attallah St., El Saa'a Square.

DIN CERTCO
Gesellschaft für Konformitätsbewertung mbH

DIN

# CERTIFICATE

The company

**Hamza Industry Co.**
Flate 1 second floor
10 Wady El Nile El Mohandessen
KAIRO
EGYPT

with the production site in

**6th of October City**

hereby receives the confirmation that the product/s

**Pipes with and without sliding-socket of mineral-filled Polypropylen (PP) – Heavy design for soil and waste discharge (domestic sewage) DN 50 to DN 200**

**EG 25**

of the Type

**Hamza AS**

conforms to

**Certification scheme ZP 2.11.1-8 (Edition: 2012-03)**

and is granted the licence to use the marks

DIN plus

in conjunction with the Registration No. below.

**Registration No.: P1R0310**

**This certificate remains valid as long as the required surveillance conditions will be passed with a positive result for the assessment.**

See annex for further information.

DIN CERTCO Gesellschaft für Konformitätsbewertung mbH
Alboinstraße 56, D-12103 Berlin
Germany

GESELLSCHAFT FÜR KONFORMITÄTSBEWERTUNG MBH DIN CERTCO

2012-05-18
Dipl.-Ing. Peter Suxdorf
- Managing Director -

DIN CERTCO
Gesellschaft für Konformitätsbewertung mbH

DIN

# CERTIFICATE

The company

**Hamza Industry Co.**
Flate 1 second floor
10 Wady El Nile El Mohandessen
KAIRO
EGYPT

with the production site in

**6th of October City**

hereby receives the confirmation that the product/s

**Fittings with sliding-socket of mineral-filled Polypropylen (PP) – Heavy design for soil and waste discharge (domestic sewage) DN 50 to DN 200**

**EG 25.1**

of the Type

**Hamza AS**

conforms to

**Certification scheme ZP 2.11.1-8 (Edition: 2012-03)**

and is granted the licence to use the marks

DIN plus

in conjunction with the Registration No. below.

**Registration No.: P1R0311**

**This certificate remains valid as long as the required surveillance conditions will be passed with a positive result for the assessment.**

See annex for further information.

DIN CERTCO Gesellschaft für Konformitätsbewertung mbH
Alboinstraße 56, D-12103 Berlin
Germany

GESELLSCHAFT FÜR KONFORMITÄTSBEWERTUNG MBH DIN CERTCO

2012-05-18
Dipl.-Ing. Peter Suxdorf
- Managing Director -

NATIONAL RESEARCH CENTER
TAHRIR St. DOKKI, CAIRO, EGYPT
Central unit for Analysis And
Scientifical services ( CUASS )
MateriaL Test Lab.
Ceramics, Polymers and
Solid matter Department.

المركز القومى للبحوث
الدقى . القاهرة . جمهورية مصر العربية
وحدة التحاليل والخدمات العلمية المركزية
معمل إختبار المواد
قسم السيراميك والبلاستيك والمواد الصلبة

## Density Test

*On sample of Multilayer Polypropylene Pipe diameter 110mm*
*according to DIN 53479*

**Produced by HAMZA Industry Co.**

| Sample No. | Weight of Sample in air (g) | Weight of sample suspended in water (g) | Weight of sample + Wire (g) | specific gravity (g/cm3) |
|---|---|---|---|---|
| 1 | 4.8153 | 2.7865 | 0.0532 | 1.9428 |
| 2 | 5.7993 | 3.3141 | 0.0532 | 1.9191 |

** The mean value of Specific Gravity Test = 1.9309 (g/cm3)*
** The technical data Limit = 1.9 (g/cm3)*

## Hydrostatic pressure Test

*After pressing the pipe to double working pressure for 1 hr at 23°C no any effect occur and by increasing pressure to 60 bar , no any effect or faliure occur*

ت:٣٣٣٧١٦١٥_٣٣٣٧١٤٤٩_٣٣٣٧١٣٦٢ داخلى: ١٣٢١ مباشر
ت:٣٣٣٧١٦٣٥_٣٣٣٧١٩٣٣_٣٣٣٧١٧٣٨ ١٠٨٤ وفاكس
٣٣٣٨٧٨٠٢ شارع التحرير ـ الدقى ـ القاهرة

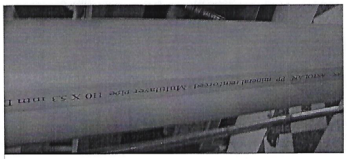
NATIONAL RESEARCH CENTER
TAHRIR St. DOKKI, CAIRO, EGYPT
Central unit for Analysis And
Scientifical services ( CUASS )
MateriaL Test Lab.
Ceramics, Polymers and
Solid matter Department.

المركز القومى للبحوث
الدقى . القاهرة . جمهورية مصر العربية
وحدة التحاليل والخدمات العلمية المركزية
معمل إختبار المواد
قسم السيراميك والبلاستيك والمواد الصلبة

## Visual Inspection

*On sample of Multilayer Polypropylene Pipe diameter 110mm*

**Produced by HAMZA Industry Co.**



** The delivered Multilayer Polypropylene Pipe white color diameter 110mm has external smooth surface without any crack or roughness with smooth internal surface , all delivered pipes have a complete round circular shape without any Defect (elliptic) with a homogenous thickness allover the circumference of the pipes ,the following information are printed on the pipe surface :-*

*Hamza AS Astolan PP mineral reinferced – multilayer – pipe 110 X 3.5mm .*

ت:٣٣٣٧١٦١٥_٣٣٣٧١٤٤٩_٣٣٣٧١٣٦٢ داخلى: ١٣٢١ مباشر
ت:٣٣٣٧١٦٣٥_٣٣٣٧١٩٣٣_٣٣٣٧١٧٣٨ ١٠٨٤ وفاكس
٣٣٣٨٧٨٠٢ شارع التحرير ـ الدقى ـ القاهرة

NATIONAL RESEARCH CENTER
TAHRIR St. DOKKI, CAIRO, EGYPT
Central unit for Analysis And
Scientifical services ( CUASS )
MateriaL Test Lab.
Ceramics, Polymers and
Solid matter Department.

المركز القومى للبحوث
الدقى . القاهرة . جمهورية مصر العربية
وحدة التحاليل والخدمات العلمية المركزية
معمل إختبار المواد
قسم السيراميك والبلاستيك والمواد الصلبة

## To / HAMZA Industry Co.

***Dear Sir;***

*With Correspondence to your request dated 15/12/2010 for testing On sample of Multilayer Polypropylene Pipe diameter 110mm DIN 53479 , 53455 ASTM G23 , We would like to inform you that the test were carried out :-*

*1- Visual inspection .*
*2- Dimension test .*
*3- Density test .*
*4- Hydrostatic pressure Test .*
*5- Tensile Strength Test before and after treatment .*
*6- Elongation Test before and after treatment .*
*7- Modulus of Elasticity Test before and after treatment .*
*8- Accelerated Weathering Results by UV for 150 hrs .*

*The all needed tests were carried out concerning the following points :-*

*1- In all mechanical properties " Instron 5500R Universal Testing Machine was used . This type of instron has a self calibration , zero adjusting and automatic balance , which are done daily before testing or during testing this testing instrument is accompanied by a highly reliable system for evaluating the mechanical properties .*
*2 -On heating type Memmert West Germany.*
*3-Weighing Balance with tolerance ± 0.0001g was used in determining the weights*
*4-Measuring drum of sensitivity ± 0.01mm was used for dimensions evaluation.*
*5- In Accelerated UV Weathering test used fadeometer machine type Philip .*
*6- Accelerated Weathering (U.V + Ozone + Humidity 60% + Temperature 40°C) used in treatment of the testing sample .*
*7-The all used Machinery and the apparatus were calibrated periodically by NIST-America members and ABD-EGYPT.*

***The following tables are give the obtained results representing produced by your company.***

NATIONAL RESEARCH CENTER
TAHRIR St. DOKKI, CAIRO, EGYPT
Central unit for Analysis And
Scientifical services ( CUASS )
MateriaL Test Lab.
Ceramics, Polymers and
Solid matter Department.

المركز القومى للبحوث
الدقى . القاهرة . جمهورية مصر العربية
وحدة التحاليل والخدمات العلمية المركزية
معمل إختبار المواد
قسم السيراميك والبلاستيك والمواد الصلبة

## Results of Dimensions

*On sample of Multilayer Polypropylene Pipe diameter 110mm*

**Produced by HAMZA Industry Co.**

**SAMPLE (1)**

| No. | THICKNESS | DIAMETER | |
|---|---|---|---|
| | | Ext.(mm) | Inter. (mm) |
| 1 | 5.800 | 109.880 | 98.213 |
| 2 | 5.700 | 109.880 | 98.213 |
| 3 | 5.800 | | |
| 4 | 5.900 | | |
| 5 | 5.900 | | |
| 6 | 5.900 | | |
| AVERAGE | 5.833 | 109.880 | 98.213 |

**SAMPLE (2)**

| No. | THICKNESS | DIAMETER | |
|---|---|---|---|
| | | Ext.(mm) | Inter. (mm) |
| 1 | 5.700 | 109.880 | 98.280 |
| 2 | 5.800 | 109.880 | 98.280 |
| 3 | 5.900 | | |
| 4 | 5.900 | | |
| 5 | 5.800 | | |
| 6 | 5.700 | | |
| AVERAGE | 5.800 | 109.880 | 98.280 |

**SAMPLE (3)**

| No. | THICKNESS | DIAMETER | |
|---|---|---|---|
| | | Ext.(mm) | Inter. (mm) |
| 1 | 5.800 | 109.880 | 98.247 |
| 2 | 5.900 | 109.880 | 98.247 |
| 3 | 5.900 | | |
| 4 | 5.800 | | |
| 5 | 5.700 | | |
| 6 | 5.800 | | |
| AVERAGE | 5.817 | 109.880 | 98.247 |

Plastic Technology Center

Ministry of Industry and Foreign Trade
Industry Council for Technology and Innovation

**Report No. 290-2**

Client : HAMZA INDUSTRY Co.
Sample* : PP Elbow 110 mm /87.5°mm.
Sample Data : Hamza astolan PP Elbow 110/87.5° DIN 4102-B1 under licence of wavin – Germany.
Production Date : 6/11/2018.
Color : Off White.
Date : 22/11/2018.
*Sample , its Production and data are delivered by the Customer

| Tests | Result | Reference |
|---|---|---|
| 1- Ignitibility test Apply flame for 15 sec | | -Specimen classed as B1 if they pass ignitibility test. |
| a- Bottom edge ignition Flame is applied to the lower surface of the specimen. | Specimen pass the test without molten dripping | 1- The extent of the combustion shall not reach beyond the primary fire area, and heat released shall be minimal. |
| b- Surface ignition Flame is applied to the center of specimen width at a height of 40 mm from the lower edge. | Specimen pass the test and self extinguished | 2- Shall meet the requirements for class B2 materials. Flame doesn't reach the gauge mark within 20 seconds after flame application either with bottom edge ignition or surface ignition. |

**Conclusion**

From the above tests results:
-The sample passes the ignitibility test according to standard DIN 4102-Class B1.

Note:-
- This report is PTC copyright.

Lab. Specialist
(Engineer: Sherren Mohammed)

Manager of Accurate Lab
(Chemist: Reham Mohamedin)

Ministry of Industry and trade Plastic Technology Center Approved Technical Department



Labs and Training Headquarters: Gamela Bo Harid St., El Seuof Shamaa- Alexandria. Tel.-Fax: 033307233 Tel.:033325613
Administrative Headquarters: 25 Zaki Attaleb St., El Saa'a Square

Plastic Technology Center

Ministry of Industry and Foreign Trade
Industry Council for Technology and Innovation

**Report No. 1649-2**

Client : HAMZA INDUSTRY Co.
Sample* :Astolan pp Branch (110/110/87.5°).
Production Date : 17/1/2018.
Color : Light gray.
Date : 5/2/2018.
*Sample , its Production and data are delivered by the Customer

| Tests | Result | Reference |
|---|---|---|
| 1- Ignitibility test Apply flame for 15 sec | | -Specimen classed as B1 if they pass ignitibility test. |
| a- Bottom edge ignition Flame is applied to the lower surface of the specimen. | Specimen pass the test without molten dripping | 1- The extent of the combustion shall not reach beyond the primary fire area, and heat released shall be minimal. |
| b- Surface ignition Flame is applied to the center of specimen width at a height of 40 mm from the lower edge. | Specimen pass the test and self extinguished | 2- Shall meet the requirements for class B2 materials. Flame doesn't reach the gauge mark within 20 seconds after flame application either with bottom edge ignition or surface ignition. |

**Conclusion**

From the above tests results:
-The sample pass the ignitibility test according to standard DIN 4102-Class B1.

Note:-
- This report is PTC copyright.

Lab. Specialist
(Engineer: El Sayed Mohammed)

Manager of Accurate Lab
(Chemist: Reham Mohamedin)

Ministry of Industry and trade Plastic Technology Center Approved Technical Department

Lab Manager
(Chemist: Wafaa Moursy)



Labs and Training Headquarters: Gamela Bo Harid St., El Seuof Shamaa- Alexandria. Tel.-Fax: 033307233 Tel.:033325613
Administrative Headquarters: 25 Zaki Attaleb St., El Saa'a Square

Plastic Technology Center

Ministry of Industry and Foreign Trade
Industry Council for Technology and Innovation

**Analysis Certificate**
**Report No. : ( 1649-1)**

Client : HAMZA INDUSTRY Co.
Sample* : Astolan pp pipe 110 mm .
Production Date : 17/1/2018.
Color :Light gray.
Date :5/ 2/2018.
Standard : DIN 4102-B1.
Report : Attached.
Temperature: 20 ± 2 °C Humidity :50 ± 5 %
*Sample, its Production Date and data are delivered by the Customer

General Manger of Technical Affairs
(Chemist: Amal Abdel Rahman)

Managing Director
(Eng. Nagwa M. EL- Menawy)

Ministry of industry and trade Plastic Technology Center Approved Technical Department



Labs and Training Headquarters: Gamela Bo Harid St., El Seuof Shamaa- Alexandria. Tel.-Fax: 033307233 Tel.:033325613
Administrative Headquarters: 25 Zaki Attaleb St., El Saa'a Square

Plastic Technology Center

Ministry of Industry and Foreign Trade
Industry Council for Technology and Innovation

**Report No. 1341**

Client : HAMZA INDUSTRY Co.
Sample* : Multi layer pipe 75×4.5 mm .
Color : Light gray.
Date : 17/9/2017.
*Sample and its data are delivered by the Customer

| Test | Result | Reference |
|---|---|---|
| 1- Ignitibility test Apply flame for 15 sec | | -Specimens classed as B1 if they pass ignitibility test. |
| a- Bottom edge ignition Flame is applied to the lower surface of the specimen. | Specimen pass the test without molten dripping | 1- The extent of the combustion shall not reach beyond the primary fire area, and heat released shall be minimal. |
| b- Surface ignition Flame is applied to the center of specimen width at a height of 40 mm from the lower edge. | Specimen pass the test and self extinguished | 2- Shall meet the requirements for class B2 materials. Flame doesn't reach the gauge mark within 20 seconds after flame application either with bottom edge ignition or surface ignition. |

**Conclusion**

From the above tests results:
-The sample pass the ignitibility test according to standard DIN 4102-Class B1.

Note:-
- This report is PTC copyright.



Lab. Specialist
(Engineer: El Sayed Mohammed)

Manager of Accurate Lab
(Chemist: Reham Mohamedin)

Ministry of Industry and trade Plastic Technology Center Approved Technical Department

Lab Manager
(Chemist: Wafaa Moursy)



Labs and Training Headquarters: Gamela Bo Harid St., El Seuof Shamaa- Alexandria. Tel.-Fax: 033307233 Tel.:033325613

Plastic Technology Center

Ministry of Industry and Foreign Trade
Industry Council for Technology and Innovation

**Analysis Certificate**
**Report No. : ( 1341)**

| | |
|---|---|
| Client | : HAMZA INDUSTRY Co. |
| Sample* | :Multi layer pipe 75×4.5 mm . |
| Color | :Light gray. |
| Date | :17/ 9/2017. |
| Standard | : DIN 4102-B1. |
| Report | : Attached. |

Temperature: 20 ± 2 °C Humidity :50 ± 5 %

*Sample and its data are delivered by the Customer

General Manger of Technical Affairs
(Chemist: Amal Abdel Rahman)

Managing Director
(Eng. Nagwa M. EL- Menawy)

Ministry of industry and trade
Plastic Technology Center
Approved
Technical Department



**Labs and Training Headquarters:** Gamela Bo Harid St., El Seuof Shamaa- Alexandria. **Tel.-Fax:** 033307233 **Tel.:**033325613

Plastic Technology Center

Ministry of Industry and Foreign Trade
Industry Council for Technology and Innovation

**Analysis Certificate**
**Report No. : ( 1649-2)**

| | |
|---|---|
| Client | : HAMZA INDUSTRY Co. |
| Sample* | : Astolan pp Branch (110/110/87.5°). |
| Production Date | : 17/1/2018. |
| Color | :Light gray. |
| Date | :5/ 2/2018. |
| Standard | : DIN 4102-B1. |
| Report | : Attached. |

Temperature: 20 ± 2 °C Humidity :50 ± 5 %

*Sample, its Production Date and data are delivered by the Customer

General Manger of Technical Affairs
(Chemist: Amal Abdel Rahman)

Managing Director
(Eng. Nagwa M. EL- Menawy)

Ministry of industry and trade
Plastic Technology Center
Approved
Technical Department



**Labs and Training Headquarters:** Gamela Bo Harid St., El Seuof Shamaa- Alexandria. **Tel.-Fax:** 033307233 **Tel.:**033325613

Plastic Technology Center

Ministry of Industry and Foreign Trade
Industry Council for Technology and Innovation

**Report No. 1649-1**

| | |
|---|---|
| Client | : HAMZA INDUSTRY Co. |
| Sample* | : Astolan pp pipe 110 mm . |
| Production Date | : 17/1/2018. |
| Color | : Light gray. |
| Date | : 5/2/2018. |

*Sample , its Production and data are delivered by the Customer

| Tests | Result | Reference |
|---|---|---|
| 1- Ignitibility test<br>Apply flame for 15 sec | | -Specimen classed as B1 if they pass ignitibility test. |
| a- Bottom edge ignition<br>Flame is applied to the lower surface of the specimen. | Specimen pass the test without molten dripping | 1- The extent of the combustion shall not reach beyond the primary fire area, and heat released shall be minimal. |
| b- Surface ignition<br>Flame is applied to the center of specimen width at a height of 40 mm from the lower edge. | Specimen pass the test and self extinguished | 2- Shall meet the requirements for class B2 materials. Flame doesn't reach the gauge mark within 20 seconds after flame application either with bottom edge ignition or surface ignition. |

**Conclusion**

From the above tests results:
-The sample pass the ignitibility test according to standard DIN 4102-Class B1.

**Note:-**
- This report is PTC copyright.

Lab. Specialist
(Engineer: El Sayed Mohammed)

Manager of Accurate Lab
(Chemist: Reham Mohamedin)

Ministry of industry and trade
Plastic Technology Center
Approved
Technical Department

Lab Manager
(Chemist: Wafaa Moursy)



**Labs and Training Headquarters:** Gamela Bo Harid St., El Seuof Shamaa- Alexandria. **Tel.-Fax:** 033307233 **Tel.:**033325613

Plastic Technology Center

Ministry of Industry and Foreign Trade
Industry Council for Technology and Innovation

**Analysis Certificate**
**Report No. : ( 290-1)**

| | |
|---|---|
| Client | : HAMZA INDUSTRY Co. |
| Sample* | : PP pipe 160 mm /5.3mm. |
| Sample Data | :Hamza astolan PP mineral reinforced multilayer pipe 160*5.3 mm DIN 4102-B1. |
| Production Date | : 6/11/2018. |
| Color | : Off white. |
| Date | :22/ 11/2018. |
| Standard | : DIN 4102-B1. |
| Report | : Attached. |

Temperature: 20 ± 2 °C Humidity :50 ± 5 %

*Sample, its Production Date and data are delivered by the Customer

Labs Manager
(Chemist: Wafaa Moursy)

Expert of Center
(Eng. Nagwa M. EL- Menawy)

Ministry of industry and trade
Plastic Technology Center
Approved
Technical Department



**Labs and Training Headquarters:** Gamela Bo Harid St., El Seuof Shamaa- Alexandria. **Tel.-Fax:** 033307233 **Tel.:**033325613

NATIONAL RESEARCH CENTER
TAHRIR St. DOKKI, CAIRO, EGYPT
Central unit for Analysis And
Scientifical services ( CUASS )
MaterialL Test Lab.
Ceramics, Polymers and
Solid matter Department.

المركز القومى للبحوث
الدقى . القاهرة . جمهورية مصر العربية
وحدة التحاليل والخدمات العلمية المركزية
معمل اختبار المواد
قسم السيراميك والبلاستيك والمواد الصلبة

*This report was given to you representing only On sample of Multilayer Polypropylene Pipe diameter 110mm , Produced by HAMZA Industry Co. , These results and conclusions were given to you without any responsibility on **THE CERAMICS, POLYMERS AND SOLID MATTER DEP.** of **THE MATERIAL TEST LAB** in **THE NATIONAL RESEARCH CENTRE** for pick up the samples to be tested .*

***Head of Director of The Board of Central Depertment***
***for Scientifical Analysis and Tests***
***&***
***SUPERVISOR OF CERAMICS, POLYMER AND SOLID MATTER DEPARTMENT***

***PROF.DR. MOSTAFA ZAKI MOSTAFA***

ت: ٣٣٣٧١٦١٥_٣٣٣٧١٤٤٩_٣٣٣٧١٣٦٢ داخلى: ١٣٢١ مباشر
ت: ٣٣٣٧١٦٢٥_٣٣٣٧١٩٣٣_٣٣٣٧١٧٣٨ ١٠٨٤ وفاكس
٣٣٣٨٧٨٠٣ شارع التحرير - الدقى - القاهرة

***Accelerated Weathering Results by U.V for 150 hrs***
***(U.V + Ozone + Humidity 60% + Temperature 40 ℃)***
*On sample of Multilayer Polypropylene Pipe diameter 110mm*
***Produced by HAMZA Industry Co.***

==========

| Sample | Before Weathering | After Weathering |
|---|---|---|
| L | 69.9 | 70.3 |
| a | 0.6 | 0.8 |
| b | 2.7 | 2.3 |
| Y | 48.7 | 49.3 |
| X | 48.0 | 48.7 |
| Z | 54.4 | 55.4 |
| Δ E | 0.600 | |

** No any effect , cracks or change after weathering for 150 hrs (U.V + Ozone + Humidity 60% + Temperature 40 ℃), There is no change in color ( Δ E less than absolute one) and there is no change in mechanical properties and give warranty to use 3 years in the atmospheric weather*

ت: ٣٣٣٧١٦١٥_٣٣٣٧١٤٤٩_٣٣٣٧١٣٦٢ داخلى: ١٣٢١ مباشر
ت: ٣٣٣٧١٦٢٥_٣٣٣٧١٩٣٣_٣٣٣٧١٧٣٨ ١٠٨٤ وفاكس
٣٣٣٨٧٨٠٣ شارع التحرير - الدقى - القاهرة

NATIONAL RESEARCH CENTER
TAHRIR St. DOKKI, CAIRO, EGYPT
Central unit for Analysis And
Scientifical services ( CUASS )
MaterialL Test Lab.
Ceramics, Polymers and
Solid matter Department.

المركز القومى للبحوث
الدقى . القاهرة . جمهورية مصر العربية
وحدة التحاليل والخدمات العلمية المركزية
معمل اختبار المواد
قسم السيراميك والبلاستيك والمواد الصلبة

***Modulus of Elasticity Test before treatment***
*On sample of Multilayer Polypropylene Pipe diameter 110mm*
***Produced by HAMZA Industry Co.***

==========

| Modulus of Elasticity (N/mm2) | Mean Modulus of Elasticity (N/mm2) |
|---|---|
| 3930<br>3960<br>3971 | 3953.66 |

**The technical data Limit = 3800 ( N/mm2)*

***Modulus of Elasticity Test after treatment***

==========

| Modulus of Elasticity (N/mm2) | Mean Modulus of Elasticity (N/mm2) |
|---|---|
| 3802<br>3801<br>3803 | 3802 |

** The technical data Limit = 3800 ( N/mm2)*

ت: ٣٣٣٧١٦١٥_٣٣٣٧١٤٤٩_٣٣٣٧١٣٦٢ داخلى: ١٣٢١ مباشر
ت: ٣٣٣٧١٦٢٥_٣٣٣٧١٩٣٣_٣٣٣٧١٧٣٨ ١٠٨٤ وفاكس
٣٣٣٨٧٨٠٣ شارع التحرير - الدقى - القاهرة

NATIONAL RESEARCH CENTER
TAHRIR St. DOKKI, CAIRO, EGYPT
Central unit for Analysis And
Scientifical services ( CUASS )
MaterialL Test Lab.
Ceramics, Polymers and
Solid matter Department.

المركز القومى للبحوث
الدقى . القاهرة . جمهورية مصر العربية
وحدة التحاليل والخدمات العلمية المركزية
معمل اختبار المواد
قسم السيراميك والبلاستيك والمواد الصلبة

***Elongation Test before treatment***
*On sample of Multilayer Polypropylene Pipe diameter 110mm*
***Produced by HAMZA Industry Co.***

| Sample No | Lo (cm) | Elongation (cm) | Mean value of Elongation (cm) | Elongation (%) | Elongation Mean value (%) |
|---|---|---|---|---|---|
| 1 | 5.00 | 1.60 | | 32.000 | |
| 2 | 5.00 | 1.50 | 1.600 | 30.000 | 32.000 |
| 3 | 5.00 | 1.70 | | 34.000 | |

** The technical data Limit = 29 ( % )*

***Elongation Test after treatment***

| Sample No | Lo (cm) | Elongation (cm) | Mean value of Elongation (cm) | Elongation (%) | Elongation Mean value (%) |
|---|---|---|---|---|---|
| 1 | 5.00 | 1.50 | | 30.000 | |
| 2 | 5.00 | 1.40 | 1.467 | 28.000 | 29.333 |
| 3 | 5.00 | 1.50 | | 30.000 | |

** The technical data Limit = 29 ( % )*

ت: ٣٣٣٧١٦١٥_٣٣٣٧١٤٤٩_٣٣٣٧١٣٦٢ داخلى: ١٣٢١ مباشر
ت: ٣٣٣٧١٦٢٥_٣٣٣٧١٩٣٣_٣٣٣٧١٧٣٨ ١٠٨٤ وفاكس
٣٣٣٨٧٨٠٣ شارع التحرير - الدقى - القاهرة

مركز تكنولوجيا البلاستيك

وزارة التجارة والصناعة
مجلس الصناعة للتكنولوجيا والابتكار

## تقرير الإختبار
## رقم :٧٧٦

اسم العميـــل : شركة حمزه للصناعة.

تاريـخ الاصدار : ٢٠١٦/١٢/٦ .

العينـــــة : عدد (١) عينة جلبـة PP قطر١١٠مم (ASTOLAN PP DOUBLE SOCKET).

لون العينـــة : رمادى فاتح .

المواصفة : الالمانية DIN 4102-B1.

درجة الحرارة : ٢٣ م° ± ٢ م° نسبة الرطوبة : ٥٠% ± ٥%

▪ في حالة وجود أى شكوى رجاء الاتصال على رقم تليفون ٠٣/٥٠١٤١٩١

مدير عام الإدارة الفنية
(كيميائية / أمل عبد الرحمن)

مديرة المركز
(مهندسة / نجوى المعتاوى)

تحريراً في ٢٠١٦/١٢/٦
إنجي

مقر المعامل والتدريب : ش جميلة بو حريد – السيوف شماعة – الإسكندرية ت – ف / ٠٣٣٣٠٧٢٣٣ ت / ٠٣٣٢١٥٦١٣
مقر الإدارة : أمام ٢٥ ش زكى عطا الله – ميدان الساعة – فيكتوريا – الإسكندرية ت – ف / ٠٣٥٠٢٥٥١٦

Plastic Technology Center

Ministry of Trade & Industry
Technological Development Sector

Report No. (1252)

Client : HAMZA INDUSTRY CO.

Sample : PP pipe.

Sample color: White.

Sample Data: (PP mineral reinforced Multi layer Pipe 110 X 5.3 mm - Din 4102 B1).

(Sample and its data is delivered by the customer)

Date : 20/2/2012.

Instrument used: UV Spectrophotometer – Double beam (Bio lab).

| Test | Reference standard | Result |
|---|---|---|
| -Content of UV stabilizer % (Active material) | ASTM E 169 | 2.8 |

Conclusion

- From the above test, the sample (PP pipe) contains UV stabilizer by 2.8% which makes it endure the out door exposure for 120 months
- This report is concerning only to the sample delivered by the client

Accurate lab manager
( Chemist: Reham Mohamadein )

Lab Manager
(Chemist: wafaa Aly moursy)

General manger of technical affairs
(Chemist: Amal Abd EL – Rahman)

2 2

**Labs and Training Headquarters:** Gamela Bo Harid St. - El-Seuof Shamaa - Alexandria. **Tel.-Fax:** 033307233 **Tel.:** 033325613
**Administrative headquarters:** Amam 25 Zaki Attallah St., El Saa'a Square.

Plastic Technology Center

Ministry of Industry and Foreign Trade
Industry Council for Technology and Innovation

Report No. 290-1

Client : HAMZA INDUSTRY Co.
Sample* : PP pipe 160 mm /5.3mm.
Sample Data :Hamza astolan PP mineral reinforced multilayer pipe 160*5.3 mm DIN 4102-B1.
Production Date : 6/11/2018.
Color : Off white.
Date : 22/11/2018.
*Sample , its Production and data are delivered by the Customer

| Tests | Result | Reference |
|---|---|---|
| 1- Ignitibility test Apply flame for 15 sec | | -Specimen classed as B1 if they pass ignitibility test. |
| a- Bottom edge ignition Flame is applied to the lower surface of the specimen. | Specimen pass the test without molten dripping | 1- The extent of the combustion shall not reach beyond the primary fire area, and heat released shall be minimal. |
| b- Surface ignition Flame is applied to the center of specimen width at a height of 40 mm from the lower edge. | Specimen pass the test and self extinguished | 2- Shall meet the requirements for class B2 materials. Flame doesn't reach the gauge mark within 20 seconds after flame application either with bottom edge ignition or surface ignition. |

Conclusion

From the above tests results:
-The sample passes the ignitibility test according to standard DIN 4102-Class B1.

Note:-
- This report is PTC copyright.

Lab. Specialist
(Engineer: Sherren Mohammed)

Manager of Accurate Lab
(Chemist: Reham Mohamedin)

Page 2 of 3
Engy

**Labs and Training Headquarters:** Gamela Bo Harid St., El Seuof Shamaa- Alexandria. **Tel.-Fax:** 033307233 **Tel.:**033325613

NATIONAL RESEARCH CENTER
TAHRIR St. DOKKI, CAIRO, EGYPT
Central unit for Analysis And
Scientifical services ( CUASS )
MateriaL Test Lab.
Ceramics, Polymers and
Solid matter Department.

المركز القومى للبحوث
الدقى . القاهرة . جمهورية مصر العربية
وحدة التحاليل والخدمات العلمية المركزية
معمل إختبار المواد
قسم السيراميك والبلاستيك والمواد الصلبة

# Test Report

| | |
|---|---|
| **Report No.** | MO1 12037 12 2010 |
| **Client** | **HAMZA Industry Co.** |
| **Authority & date** | Request Orders Date 15/12/2010 |
| **Items Tested Results** | **Multilayer Polypropylene Pipe diameter 110mm**<br>The detailed test results are given on the following pages of this report ( 10 pages) . |
| **Report Typist Test carried by** | * Mis. Hanan Ebrahem – Naglaa Mohamed<br>* Mis . Fatma El – Zahraa Fikry<br>* Mis . Noha Samir - Sara Abd Elrahman<br>* H.Eng. Ahmed Said<br>* Chem. Amr El Shafey<br>* Eng. Abeer Abou El Soad<br>* Dr. Abou El Ftouh Abd El Hakem |
| **Authorized by** | Prof. Dr. Mostafa Zaki Mostafa<br>* The Supervisor of Ceramics, Polymer and Solid Matter Department.<br>* Management Representative and Quality Assurance Manager. |
| **Issue date** | 10/1/2011 |
| **Condition of Test & Issue** | The test speciemen was conditioned at 23 °C with a humidity of 60 % and the needed caliberations as well as balancing of the all used machines were always done . |

ت: ٣٣٣٧١٦١٥_٣٣٣٧١٤٤٩_٣٣٣٧١٣٦٢ داخلى: ١٣٢١ مباشر
ت: ٣٣٣٧١٦٣٥_٣٣٣٧١٩٣٣_٣٣٣٧١٧٢٨ ١٠٨٤ وفاكس
٣٣٣٨٧٨٠٣ شارع التحرير - الدقى - القاهرة

NATIONAL RESEARCH CENTER
TAHRIR St. DOKKI, CAIRO, EGYPT
Central unit for Analysis And
Scientifical services ( CUASS )
MateriaL Test Lab.
Ceramics, Polymers and
Solid matter Department.

المركز القومى للبحوث
الدقى . القاهرة . جمهورية مصر العربية
وحدة التحاليل والخدمات العلمية المركزية
معمل إختبار المواد
قسم السيراميك والبلاستيك والمواد الصلبة

## Tensile Strength Test before treatment

*On sample of Multilayer Polypropylene Pipe diameter 110mm*

**Produced by HAMZA Industry Co.**

| Sample No. | Width (cm) | Thickness (cm) | Load (kg) | Tensile Strength (kg/cm2) | Tensile Strength (N/mm2) |
|---|---|---|---|---|---|
| 1 | 0.62 | 0.550 | 50.30 | 147.507 | 14.466 |
| 2 | 0.63 | 0.570 | 50.20 | 139.794 | 13.709 |
| 3 | 0.62 | 0.550 | 50.40 | 147.801 | 14.494 |

* The mean value of Tensile Strength Test = 145.034 (kg/Cm2)
* The mean value of Tensile Strength Test = 14.223 (N/mm2)
* The technical data Limit = 13 ( N/mm2)

## Tensile Strength Test after treatment

| Sample No. | Width (cm) | Thickness (cm) | Load (kg) | Tensile Strength (kg/cm2) | Tensile Strength (N/mm2) |
|---|---|---|---|---|---|
| 1 | 0.61 | 0.550 | 46.70 | 139.195 | 13.650 |
| 2 | 0.63 | 0.560 | 46.80 | 132.653 | 13.009 |
| 3 | 0.61 | 0.550 | 46.70 | 139.195 | 13.650 |

* The mean value of Tensile Strength Test = 137.015 (kg/Cm2)
* The mean value of Tensile Strength Test = 13.437 (N/mm2)
* The technical data Limit = 13 ( N/mm2)

ت: ٣٣٣٧١٦١٥_٣٣٣٧١٤٤٩_٣٣٣٧١٣٦٢ داخلى: ١٣٢١ مباشر
ت: ٣٣٣٧١٦٣٥_٣٣٣٧١٩٣٣_٣٣٣٧١٧٢٨ ١٠٨٤ وفاكس
٣٣٣٨٧٨٠٣ شارع التحرير - الدقى - القاهرة



# HAMZA AS

Edition: 08 / 25

16865
62 Mohy El-Din Abo El Ezz St.
Dokki, Giza, Egypt

info@hamza.com.eg
www.hamza.com.eg

HAMZA WATERTIGHTSOLUTIONS SINCE 1949