# Copam building 



# Cast iron solutions that contribute to the comfort, safety and durability of buildings 

## SAFE AND SUSTAINABLE BY NATURE

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## PAM BUILDING, COMMITTED TO SUSTAINABILITY AND PRODUCT EXCELLENCE



For 150 years, we have been designing, manufacturing and supplying high-quality drainage systems for residential and commercial buildings and engineering structures.

We work exclusively with cast iron, a noble and durable material, of which we are a specialist and leader.
$>$ As a leading manufacturer, we claim excellence in our processes, products and services.
> As a responsible manufacturer, we are at the forefront of sustainable performance to ensure we make the world a better home.
$>$ As an innovative manufacturer, we put all our creative audacity into developing new, more specific and more efficient technologies, to deliver better products for your future needs.

PAM Building, a company built on the strength of its people, established in 3 major countries: France, England and Germany, and servicing the world

## over 360 employees

## Sales in more than

50 countries

## 2 manufacturing sites

for our products:
Bayard sur Marne in France
Telford in England

## 1SL business in the

 cast iron industry to have published a third-party validated Environmental Product Declaration (EPD)+38 our indicator «Employee Net Promoter» that reflects the number of staff willing to become Ambassadors of the company (on a scale of -100 to +100 )

## 35\%

female managers

## $1 / 3$

internships and workstudy contracts converted to full employment contracts

As a member of the
Saint-Gobain Group,
a 350-year old world leader
in providing innovative
and sustainable construction products

## 167,000

employees and over 100 nationalities represented

## 10,000

production sites worldwide

An industrial presence in
70 countries
CAST IRON, A MATERIAL WITH AWESOME CARACTERISTICS
FIRE SAFETY
ACOUSTICS
DURABILITY
CHEMICAL RESISTANCE


SOLUTION PRE-ASSEMBLY


ELIXAIR ${ }^{\circledR}$ Earth-to-air heat exchanger

OUR MANAGEMENT SYSTEM FOR QUALITY, ENERGY AND ENVIRONMENT CONTRIBUTES TO THE CONTINUOUS IMPROVEMENT OF OUR ACTIVITY


For PAM Building, being committed to sustainable development actions by ensuring its plants' full compliance with current regulations is just the start.

Plants in the metallurgical industry call for greater vigilance and strict compliance with instructions, as the risks of serious accidents are particularly high.

The comprehensive approach adopted led us to obtain first the ISO 14001 and 50001 certifications for our plants but also recently BES 6001 for Telford site.

## SAFE AND SUSTAINABLE BY NATURE

COMMITTED TO REDUCING OUR IMPACT ON THE ENVIRONMENT
Our 2025 objectives vs 2010


Our commitment to reduce $\mathrm{CO}_{2}$ emissions by 2030:

- $80 \%$ vs 2017

COMMITTED TO THE SAFETY AND DURABILITY OF BUILDINGS


OUR STRENGTH
 IS IN OUR PEOPLE

Our corporate culture attracts and develops the talents of the people in our teams over time.

We forge the technical competence that pushes us to the forefront of everything we do.

PAM Building believes in youth and proves it by integrating young graduates, its practice of apprenticeship and development.

Our commercial approach transforms us into providers of technical solutions to exceed our customers' expectations.

Our team provides excellent service and technical support during the design, implementation of a project.

Our project managers ensure daily follow-up in the field to guarantee the best possible conditions for implementation.

OUR PRODUCTS, PEOPLE, TEAMS ARE HERE TO HELP YOU MAKE THE WORLD A BETTER HOME.

## 01

## BUILDING GOLUTIONS \& R=AFARENCES

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## HOTELS



Hotels are very special buildings since for a short time they act as a second home for the people staying in them. Customers therefore expect hotels to be restful and relaxing places.

The higher the hotel is rated the higher the specifiers' requirements for safety and comfort.

Wastewater and rainwater drainage systems are needed to maintain a peaceful and safe environment, requiring strong and durable materials, with minimal maintenance. Safe, totally watertight and silent in operation, the PAM cast iron drainage solution is the top choice for wastewater drainage systems in hotels.

Combining top-quality products and unrivaled longevity, the PAM cast iron drainage systems help maintain the sustainable and comfortable environment your building projects require.


CHEMICAL RESISTANCE


FIRE SAFETY


ACOUSTICS


DURABILITY

|  |  | FIT | RECOMMENDED |
| :--- | :---: | :---: | :---: |
| (1) | Sanitary blocks (grey and black water) | $\star$ | Plus Range |
| (2) Rainwater stacks | $\star$ |  |  |
| (3) Car parks | $\star$ |  |  |
| (4) Laundry, bleachery (chemicals + hot temp) |  | $\star$ |  |
| (5) Restaurant kitchens (grease + hot temp) | $\star$ |  |  |
| (6) Swimming pools (aggressive environment) | $\star$ |  |  |

Plus Range

Par: SMU Plus nimme 877 C A2

SRange


## HOTELS

## WORLDWIDE REFERENCES

Four Seasons Hotel - Moscow - Russia
Shangri-La Island Hotel - Honk Kong- China Rixos Tersane Hotel - Istanbul - Turkey Club Med La Rosière - Montvalezan - France Hyatt Regency - Algier - Algeria Royal Mansour - Casablanca - Morocco

Peninsula Hotel - London - UK
Raddisson Hotel - Bursa - Turkey
AZALAÏ 5* - Ouagadougou - Burkina Faso
City Of Dreams Mediterranean - Limassol - Cyprus
Movenpick Hotel Diplomatic Quarter - Riyadh - KSA
Sofitel Singapore City Center - Singapore - Singapore


1 | Four Seasons Hotel - Moscow - Russia | S range
2 | Shangri-La Island Hotel - Honk Kong- China | Zn range
3 | Rixos Tersane Hotel - Istanbul - Turkey | S range
ge


## HIGH-RISE BUILDINGS

## WORLDWIDE REFERENCES

Lakhta Tower - Saint-Petersburg - Russia
Ziraat Bank Financial Center - Istanbul - Turkey
CFC Tower - Casablanca - Morocco
Duo Tower Paris - Paris - France
Seef Lusail Residential Development Plots D3\&D4 - Lusail - Qatar Central Bank of Azerbaijan - Baku - Azerbaijan

Studio City Phase 2 - Macau - Macau
Kula Belgrade - Belgrade - Serbia
Downtown One - Tirana - Albania
Air Algeria Tower - Algier - Algeria
Glory - 88 Market Street - Singapore - Singapore
AI Wasl Tower - Dubai - UAE


1 | Lakhta Tower - Saint-Petersburg - Russia | S range

2 | Ziraat Bank Financial Center - Istanbul - Turkey | S range

3 | CFC Tower - Casablanca - Morocco IS range

# HEALTHCARE FACILITIES 

Healthcare facilities have specific requirements that must be considered when designing wastewater drainage. Wastewater drainage systems in these buildings will face demanding operating conditions due to the types of effluents they carry, high operating temperatures and intensive use. In buildings dedicated to providing people with care, the pipe systems must meet more stringent requirements to maintain a safe and comfortable environment. To minimize the risk of ward closures or any disruption to medical care, the pipe system selected should require limited repair and maintenance.

8CHEMICAL RESISTANCE

Effluents drained in healthcare facilities can be aggressive (especially from laboratories, etc.) and/or reach high temperatures (kitchens, laundry, etc.).
These characteristics must be addressed to protect the durability of the wastewater systems and avoid premature and costly repairs, liable to disrupt continuity of service.


The pipework is the building's arteries, passing through structures - walls and slabs designed to contain fire. In case of fire, the main risk for wastewater pipe systems, in addition to early collapse, is that they could fuel and potentially spread the fire. Since a fire in healthcare buildings can have even more harmful effects, careful selection of the pipe material is key to protecting both people and property.


BUILDING SOLUTIONS

## SPECIAL TESTS CARRIED OUT ON PLUS INNER LININGS

The pipe sample (upper) and fitting sample (lower) were immersed for 30 days in different solutions widely used in hospitals in Europe for different purposes. The concentration and temperature were those recommended by the manufacturer. These severe tests aim to simulate accelerated ageing.

| USE | Operating temperature | pH |
| :--- | :--- | :---: |
| Hand soap | $40^{\circ} \mathrm{C}$ | 7.88 |
| High-level disinfectant | $40^{\circ} \mathrm{C}$ | 5.45 |
| High-level disinfectant | $40^{\circ} \mathrm{C}$ | 5.81 |
| Detergent | $50^{\circ} \mathrm{C}$ | 9.37 |
| Pre-disinfectant for medical and surgical instruments | $30^{\circ} \mathrm{C}$ | 7.3 |
| Pre-disinfectant for medical and surgical instruments | $20^{\circ} \mathrm{C}$ | 6.9 |
| Disinfectant for medical and surgical instruments | $20^{\circ} \mathrm{C}$ | 4.71 |
| Disinfectant for medical and surgical instruments | $55^{\circ} \mathrm{C}$ | 11.8 |
| Rinsing product and lubricant | $55^{\circ} \mathrm{C}$ | 6.37 |
| Disinfectant and descaler for hemodialysis | $20^{\circ} \mathrm{C}$ | 3.92 |
| Descaler for dishwasher | $65^{\circ} \mathrm{C}$ | 1.25 |
| Cleaning product with biological action | $60^{\circ} \mathrm{C}$ | 7.52 |

## No damage was observed after the tests either on the PLUS pipe or the PLUS fitting samples.

## > APPLICABLE RANGES

| RECOMMENDATIONS | S Range | Plus Range |
| :---: | :---: | :---: |
| Sterilisation, hemodialysis, OR |  | $\star$ |
| Laboratories |  | $\star$ |
| Departments dealing with aggressive fluids and/or high tempertures |  | $\star$ |
| Wards, offices, treatment rooms | $\star$ |  |
| Laundry, bleachery |  | $\star$ |
| Kitchens |  | $\star$ |
| Car parks |  | * |
| Grey wastewater, black water | $\star$ |  |
| Aggressive and/or high-temperature fluids |  | $\star$ |
| Rainwater | $\star$ |  |
| Crawl spaces |  | $\star$ |
| Grey wastewater, black water | $\star$ |  |
| Aggressive and/or high-temperature fluids |  | $\star$ |
| Rainwater | $\star$ |  |
| Heliport |  | $\star$ |

Plus Range


## HEALTHCARE FACILITIES

## WORLDWIDE REFERENCES

City Clinic Hospital - Kommunarka - Russia
Acıbadem Hospital Atașehir - Istanbul - Turkey
Sidra Hospital - Doha - Qatar
Military Hospital - Tamanrasset - Algeria
CHU ABYME - Guadelouppe - France
Grange University Hospital - Wales - UK

Princesse Grace Hospital - Monaco CHU de Michalon - Grenoble - France Bozüyük State Hospital - Bilecik - Turkey Clínica Universitaria de Navarra - Madrid - Spain Children's Hospital - Helsinki - Finland CHU Tangier - Tangier - Morocco



[^0]
# CULTURAL <br> \& LEISURE FACILITIES 

## 01 <br> BUILDING SOLUTIONS

## WORLDWIDE REFERENCES

Grand Theatre Rabat - Rabat - Morocco
Zaryadie Philharmonic Hall - Moscow - Russia New Atatürk Cultural Center - Istanbul - Turkey Shaw Auditorium - Hong-Kong - China
Berraki Stadium - Algier - Algeria
Arribat Mall Center - Rabat - Morocco


Kai Tak Sports Park - Honk Kong - China
Istanbul Museum of Modern Arts - Istanbul - Turkey
11 Skies Commercial Complex - Honk Kong - China
UAE Pavillion EXPO 2020 - Dubai - UAE
Munch Museum - Oslo - Norway
Oasis Mall - Doha - Qatar


1 | Grand Theatre Rabat - Rabat - Morocco | S range

2 | Ataturk Cultural Center - Istanbul - Turkey | S range = EPAMS ${ }^{\circledR}$
3 | Zaryadie Philharmonic Hall - Moscow - Russia | S range

## AIRPORTS

## WORLDWIDE REFERENCES

Domodedovo Airport - Moscow - Russia
Rize Airport - Rize - Turkey
Geneva Airport-Geneva - Switzerland Hong Kong Airport Terminal 2 Extension - China Muscat International Airport - MC 5 - Muscat - Oman Athens Airport Extension - Athens - Greece

International Airport Terminal 3 - Frankfurt - Germany
Changi Airport Terminal 4 -Singapore-Singapore
Ahmad Yani Airport New Terminal - Semarang - Indonesia
Ahmed Ben Bellah International Airport - Oran - Algeria
Manchester Airport Terminal 2 - Manchester - UK


1 | Domodedovo Airport - Moscow - Russia I S range
2 | Rize Airport - Rize - Turkey | S range
3 | Geneva Airport - Geneva - Switzerland I S range - EPAMS ${ }^{\circledR}$

## INFRASTRUCTURES

## WORLDWIDE REFERENCES

Dumbea Bridge - Noumea - New Caledonia
TGV Train Station - Kenitra - Morocco
Gayrettepe - Istanbul Airport Metro - Istanbul - Turkey Cross Yarra Rail Tunnel - Melbourne - Australia
Tournon Viaduct - Savoie - France

Mont Blanc Tunnel - Haute-Savoie - France
Kula Vodno - Skopje - North Macedonia
Eurasia Tunnel - Istanbul - Turkey
Doha Metro - Doha - Qatar
Step Project - Abu Dhabi - UAE


1 | Dumbea Bridge - Noumea - New Caledonia | Itinero ${ }^{\text {® }}$
2 | TGV Train Station - Kenitra - Morocco | S range = EPAMS ${ }^{\circledR}$
3 | Gayrettepe - Istanbul Airport Metro - Istanbul - Turkey | S range



## OUR SERVCES

CUSTOMER SERVICES DIGITAL
TECHNICAL SUPPORT
BIM SERVICES

## TECHNICAL SUPPORT

## DESIGN STUDIES

To help our customers define the most optimised network for EPAMS ${ }^{\circledR}$, ITINERO ${ }^{\circledR}$ or ELIXAIR ${ }^{\circledR}$ systems, our technical support team designs solutions and provides drawings and bills of quantities.


## EPAMS ${ }^{\circledR}$

You have a project to discharge rainwater on a flat roof and you want to quickly define the details and costs of the EPAMS installation (see also p.172).

## Send us:

> Your drawings in DWG format (roof, levels, section views, etc.).
> The general rainfall intensity of your country (in mm/ hr or $1 / \mathrm{s} . \mathrm{m}^{2}$ ).

You will receive a response within 2 days concerning the feasibility and an initial design study*.
*Full studies are conditional upon the final order of the materials.

## ITINERO ${ }^{\text {® }}$

For our new dedicated range of bridges and tunnels (see p.76), we can support you with the system's complete design.

## Send us:

> The drawing of the bridge
$>$ The drainage location (outlet and collector) in DWG format.

## We will provide you with:

> A design recommendation
> The discharge system's set-up

> A bill of quantities.

## ELIXAIR ${ }^{\circledR}$

With global warming and the growing importance of energy efficiency, our earth-to-air heat exchanger ELIXAIR system (see $p .78$ ) is becoming increasingly specified.

If you are asked to quote ELIXAIR ${ }^{\circledR}$, send us your project and we will be able to help you with the supply of:
> Your earth-to-air heat exchanger
> The bill of quantities
> The heat energy saved in winter
$>$ The cooling energy saved in summer.


## ESTIMATE YOUR PROJECT

You are in a rush or merely have some doubts before finalising your quotation.
PAM Building has set up a service for you.

Send us the drawing of the discharge system's location with details of the pipe diameters in the following formats: DWG (preferred), RVT or PDF.

Based on general plumbing rules, we will provide you with the general bill of quantities including:



## TECHNICAL EXPERTISE \& INSTALLATION RECOMMENDATIONS

Our service portfolio is fully aligned with the new expectations of MEP consultants and contractors working on safe, comfortable and durable building projects.

In addition to our recommendations in this catalog, if you have any questions, you can ask our experts on the following topics:
> Acoustics (p.44)
> Fire protection (p.40)
$>$ Technical and functional advice (see "Design \& Recommendations" section)
> Environmental building certifications (p.63)

## BESPOKE DEVELOPMENT

Upon request, PAM Building can provide special designs of fittings outside the ranges offered in our catalog*. Send us your details and we will provide a response concerning the feasibility within two days.

The latest example is the $125 \times 100 \times 100 \mathrm{~mm}$ Double Branch, which is now available in our product range.
*Sales to order only


OUR SERVICES

## JOB SITE DIAGNOSIS

Drainage pipe systems are often considered utilitarian. As non-visible arteries, they are often poorly maintained and neglected in renovation planning, yet they can ruin the lives of the buildings' occupants by causing major damage.

PAM Building therefore offers a diagnostic service. The company has decades of experience which has resulted in:
> Creation of a database of the disruption and failures experienced on pipework systems.
$>$ Many requests for expertise because cast iron used to be the market's technical reference.
We can either perform the diagnostic ourselves (chargeable service) or train your teams to perform it, to avoid part renovation which brings further disruptions.

To help us provide professional services, we are equipped with:
$>$ Hygrometer
> Temperature sensor
$>$ Toximeter (measurement of hydrogen sulfide)
$>$ Inclinometer
> Fluorescein
> Ultrasonic sensor
> Feedback.

## How does it benefit the owner or maintenance team?

> Get a global picture of the wastewater and rainwater pipe systems
> Perform an audit of pipe discharge drainage
> Map and date the pipework, analyze the interactions and assess the condition.


After diagnosis you will have a list of recommendations, with a view to guiding professional interventions, carried out in compliance with regulations and best practice

For more information, contact us: tcbatiment.sgpam@saint-gobain.com


PAM Building aims to ease the burden on developers, specifiers and contractors in the early stages of construction by providing two levels of BIM library and supporting information.

The new releases include a full-data objects library, a platform that provides supporting information and free individual BIM files for all products and systems.

These include an EN 877 "Generic Cast Iron" content package for use in the early design stages, with parametric model fittings, and standard geometric settings. The files contain only the most vital information, reducing the time and effort required to create early stage plans. These "data-light" designs
can also be overwritten with the full data specification libraries without issue, speeding up later stages of development that require more detailed plans, streamlining the transition from design to as-built work flow.

The PAM BIM Libraries are designed to aid data transmission between the consultants and the Main Contract MEP design engineers, creating a leaner process that reduces design time. As the transmissions usually require more explicit data to be added to the models, PAM Building is also currently creating plugins to quickly add the full data, either automatically by system type, or through floor level and manual area selection.

By providing small file sizes for the generic content, it will facilitate early stage specification in BIM and speed up the whole planning process; this in turn will create measurable cost and time savings for our customers.


Available content


PAM Building has been developing BIM Level 2 libraries in Revit for its domestic use (S), siphonic rainwater (EPAMS ${ }^{\circledR}$ ) and intensive use (Plus) ranges. Contact our technical support team: tcbatiment.sgpam@saint-gobain.com


NEW REGISTRATION REQUIRED
TO KEEP UP TO DATE WITH NEW/ REVISED CONTENT

FULL PARAMETRIC PIPE SYSTEMS GENERIC AND FULL DATA

ACCESS TO GUIDANCE VIDEOS AND 'HOW TO?' FAQs


## EN 877 CAST IRON GENERIC LIBRARY

## - Generic cast iron content

> Full range of cast iron fittings
> All families have 'real geometry'
> Generic coupling with 'fixing zone' visibility
> All fittings have constrained couplings which can be turned on/off
> No 'manufacturer' data
> All files are light at 500 KB max


## PAM CAST IRON LIBRARY

## - Full data content

> Minor modifications to project design stages
> Time saving design for main contract BIM Engineers


## WE SELL PRODUCTS ALL OVER THE WORLD

With 150 years of experience in worldwide export sales, our international organization obtains all our customers' feedback which we need to help us constantly improve our products and services.


## OUR CUSTOMER SERVICE TEAMS WILL BE HAPPY TO HELP!

To optimize its customer service, PAM Building has an integrated network of subsidiaries, agents and distributors which can rely on dynamic and experienced technical sales teams to provide excellent customer support.


For enquiries, our customer service is available from Monday to Friday from 8:30 am to 5:30 pm (French time):

Phone : +33 383807650 / 53 / 54
Fax : +33 383807657
You can also find the contact details of our sales area manager on our website.

## WE PROVIDE LOGISTICS SERVICES

Every day, PAM Building ships a wide range of products to provide its customers with complete, operational solutions wherever they are. Depending on your needs and practices, you can either manage the transport yourself or we can quote you in accordance with the Incoterms you wish to contract with us. To speed up the process, we have signed an agreement with French Customs.

| FAS |
| :--- |
| Free Alongside Ship |
| FOB |
| Free On Board |
| CFR |
| Cost and Freight |
| CIF |

Cost Insurance and Freight


SELLERS COSTS
BUYER'S COSTS
〔 TRANSFER OF RISK
INSURANCE

## DIGITAL



Visit our website ! www.pambuilding.com

Follow the latest news from PAM BUILDING on Linkedin



## Discover our YouTube Channel!

In our YouTube channel, you find installation tutorials of cast iron pipes, fittings and couplings, as well as informations about products, BIM service, production facilities, news and commitments.

Follow us on



## 03

## WHY USE CAST IRONP

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44 ACOUSTIC COMFORT
DURABILITY
54 CHEMICAL \&
CORROSION RESISTANCE
ENVIRONMENT

## WHY USE CAST IRON?

## Cast iron systems, an obvious choice



As a leading manufacturer and the world's top-ranking exporter of cast iron pipe systems for building drainage applications, PAM Building is an essential partner for wastewater and rainwater drainage system designers. PAM Building cast iron products are safe, easy to install and effectively meet project managers' requirements. We provide different ranges to suit all building types and specifications.

## CAST IRON PIPES GIVE OUR WASTE A SECOND LIFE

Cast iron products for building drainage systems are made of an alloy : iron, carbon and silicon. Cast iron is manufactured entirely from recycled raw materials: scrap iron and cast iron which are enhanced by a second melting process.

PAM Building cast iron combines the traditional longevity of iron with outstanding technical and mechanical properties which remain stable over time in all climates. Its robustness limits breakages and damaged supplies, and its nature and density confer thermal and acoustic properties guaranteeing safety and comfort in use.

## MAIN CHARACTERISTICS OF CAST IRON

> Quick standard installation with mechanical couplings assembled with simple tools, without gluing or welding, which can save time and labor costs.
> No expansion joints which facilitates the design and saves on expensive thermal limiters.
$>$ No systematic fire protection or fire collars due to its fire behavior
> Less protection for acoustic insulation due to its acoustic properties, resulting in plasterboard savings while achie ving the same performance.
> Less embedment than other materials in buried applications where ground disturbance or extra loading is likely.


## DURABILITY AND LESS MAINTENANCE

Cast iron has a proven 70-year lifespan due to its outstanding mechanical properties and safety margin in operation.
> Cast iron systems withstand cleaning operations, even at high pressure. They also withstand traditional unblocking chemicals and enzymes without damage: PAM Building is continuously carrying out research on its coatings to maintain such qualities.
> Cast iron in exposed sections of the drainage system, i.e. basement car parks, is more resistant to damage than other drainage materials. It is also less sensitive to cracks and breakage prior to installation.
> Cast iron below ground offers greater resistance to ground movement, and is less likely to fail in unfavorable conditions.

## With our networks, maintenance operations are limited.

> Cast iron drainage requires minimal maintenance during the lifetime of the building under normal conditions, making it the first choice for concealed, built-in or otherwise inaccessible systems, where repair or maintenance would cause major inconvenience to the occupants.
> Where necessary, removable mechanical couplings make repairs easier and cheaper without cutting into the stack. An extensive range of access parts provides ease of maintenance at vital points in the stack to relieve any blockages which may occur.
$>$ In the event of destination changes in the premises or the addition of devices, the PAM systems, whose junctions are not glued or welded, can be modified without having to break or cut them, by simply removing the joints.


## STANDARDS \& CERTIFICATIONS



## PRODUCT PERFORMANCES

PAM Building pipe systems comply with European standard EN 877, applicable to a system (cast iron pipes and fittings, couplings and accessories for building drainage). This standard, specifying the technical requirements for cast iron products, is the most stringent in the market.


## In particular, it specifies requirements regarding:

$>$ Reaction to fire (product range)
> Resistance to internal pressure
> Dimensional tolerances
> Tensile strength, crushing strength
> Joints and their leak tightness
$>$ Inner lining and external coatings and their suitability

It also defines test methods and the quality management system. Except for reaction to fire properties, EN 877 is a self-declared standard; the manufacturer is allowed to self-declare that their product complies with this standard.

Only compliance with EN 877, which is validated by a third party for all criteria and periodically tested, can guarantee the performance of the systems you specify.

The quality of product ranges is guaranteed by quality marks: Marque NF, RAL-GEG, Kitemark, BBA, Sintef, Gost, Q+.

$\frac{\text { European standards }}{\text { EN 877 }} \frac{\text { International standards }}{\text { EN 681-1 }} \frac{\text { ISO 4633 }}{\frac{\text { ISO 9001 }}{\text { ISO 14001 }}}$

| Cast iron pipes and fittings, their joints and accessories for the evacuation of |
| :--- |
| water from buildings - (Requirements, test methods and quality assurance) |
| Elastomer seals - Material requirements |
| Requirements for a quality management system design, product |
| development, production, installation and after-sales support |
| Environmental management system - (Requirements with guidance for use) |
| Energy management system |

## Testing standards

Fire tests
Fire classification of construction products and building elements.

```
EN 13501-1
```

Classification using data from reaction and resistance to fire tests
EN 13501-2
Reaction to fire tests for building products - Part 1 Building products
excluding floorings exposed to thermal attack by a single burning item
EN 13823
Measurement of noise
Laboratory measurement of noise from wastewater installations

WHY USE CAST IRON

## CE MARKING: WHY IS IT REQUIRED?

The European Construction Products Regulation made CE marking mandatory on products for which the manufacturer has drawn up a declaration of performance.
The CE marking indicates that manufacturers take responsibility for the construction product's conformity with the declared performance as well as compliance with all applicable requirements laid down in the European Construction Products Regulation.

> To allow for free circulation of industrial products within the European Union and the European Economic Area
> To guarantee that these products are not dangerous to European consumers and users
> To have the same safety criteria shared throughout Europe.

Fire safety was selected as the only essential requirement for the CE marking on wastewater products, which must be supported by laboratory tests conducted at recognized independent facilities. This led to a "Reaction to fire" classification in the Euroclass system.

Our cast iron drainage systems are manufactured to harmonised European standard EN 877 and have therefore required CE marking by law since July 2013. Although it is not a quality standard, the CE mark is a self-declaration of product performance with the exception of reaction to fire, which requires mandatory certification by independent tests at a recognised fire testing center.

[^1]
## C= marking is not a quality mark or label

It is something very different
The CE mark is NOT a quality mark but a self-declaration of product performance (DoP) in reference to its product standard (with the exception of reaction to fire which requires independent testing at a recognised fire testing center).

The CE marking on a product certifies that it complies with the harmonised part of the reference standards and is a minimum prerequisite for placing the product on the market.

Except for the reaction to fire class, the third-party certification of the performances is not guaranteed by EN 877, but by one of the following marks:
Marque NF, RAL-GEG, Kitemark, BBA, Sintef, Gost, Q+.

| SCOPE | HARMONIZED EN 877 |  |
| :---: | :---: | :---: |
| TEST | CE MARKING | THIID PARTY CERTIFIED |
| Reaction to fire | O | $\bigcirc$ |
| Internal pressure strength | - | $\bigcirc$ |
| Dimension tolerance | , | $\bigcirc$ |
| Mechanical resistance | - | - |
| Tightness | 0 | $\bigcirc$ |
| Durability (internal coating) | O | O |
| Durability (external coating) | ) | - |

Third-party certification not made compulsory by EN 877
O Third-party certified

## STANDARDS \& CERTIFICATIONS

## To comply with the CE mark, PAM Building cast iron drainage systems bear a quality

 mark to demonstrate the product's standard:$>$ Our system complies with all of the standard's clauses.
$>$ We are periodically audited by a third party.
$>$ This gives you the ultimate quality guarantee.

Choosing a complete and consistent range of cast iron products, whose assembly has been performance tested against regulatory requirements, provides you with peace of mind that few other materials can guarantee.

## PRODUCT MARKINGS

Pipes


## Fittings

The identification marking for PAM Building fittings is a label.
Marking also identifies the manufacturing site.


## QUALITY MANAGEMENT SYSTEM

The plants which manufacture our products are certified for their compliance with the ISO 9001 standard which specifies requirements for a quality management system. The scope of this standard covers product design and development and the quality control of procurement, training, and administrative follow-up.



Mabe FRANCE

IS0 9001:2015
BUREAU VERITAS
Certification


[^2]
## FIRE SAFETY

Drainage systems are the arteries of a building. In case of fire, there is a risk that pipes will maintain and spread the fire in the building. Pipe penetrations through a separating element like a wall or a slab are always a source of risk for the spread of fire to the adjacent room, the floor below or the floor above. As regards a building's fire safety, the major responsibility rests with the project manager who must comply with local regulations. Accordingly, and particularly in high-risk buildings like high-rise buildings, materials with reduced flammability should be selected as a precautionary measure.

PAM Building is committed to the development of high-quality and high-safety products. Fire safety is one of the main technical performances of our products. In choosing PAM Building cast iron systems, you are guaranteeing the safety of both people and property.

There are two concepts applied to fire safety: reaction to fire and fire resistance.

## REACTION TO FIRE

This is the instant behavior when a fire breaks out, its propensity to ignite or fuel a fire. This behavior is assessed on the basis of standardised tests and described in a Euroclass classification.

The Euroclasses are based on test methods and establish reaction to fire classifications that are harmonised throughout Europe. This means they can be used to compare materials and product performances.

The Euroclass classification ranges from A1 to $F$, with A1 and A2 being reserved for products that are not, or are only slightly, combustible. The indices $s$ and $d$ respectively refer to smoke emission and the production of flaming droplets.

| EUROCLASSES |  |  |
| :---: | :---: | :---: |
| A1 | - | - |
| A2 | s 1 | dO |
| A2 | s 1 | d 1 |
| A2 | s 2 |  |
|  | s 3 |  |
|  | s 1 | dO |
| B | s 2 | d |
|  | s 3 |  |
|  | s 1 | dO |
|  | s 2 | d 1 |
|  | s 3 |  |
|  | s 1 | dO |
| D | s 2 | d 1 |
|  | s 3 |  |

SMOKE production sub-classification s1: Low smoke production s2: Medium smoke production s3: High smoke production

## FLAMING DROPLETS sub-classification

dO: No flaming droplets
d1: Flaming droplets that persist for less than 10 s
d2: Flaming droplets

## Cast iron remains one of the best materials when it comes to fire safety.

PAM Building cast iron systems are among the safest materials on the market in terms of reaction to fire, and all its drainage systems have been tested independently to the stipulated test criteria.

In tests carried out by the CSTB accredited laboratory, the PAM Building cast iron ranges (pipes, fittings and accessories, including elastomer gaskets and coatings) received the following excellent Euroclass ranking:
A1 for our standard "S" range and A2-s1, d0 for the "Plus" range.

## Scope

The CE marking for cast iron wastewater systems is based on the harmonised standard EN 877, which applies to a system including pipes, fittings, couplings and accessories, and is used to test all of the ranges' components.

The classification obtained by PAM Building covers complete ranges: pipes, fittings, couplings and accessories that are components of a wastewater pipe system.

Check the reaction to fire classification of the products you specify, and ensure the tests were carried out by an accredited testing centre. This compliance is validated by complete quality marks, is periodically tested by accredited third-party laboratories and provides you with a performance guarantee for the systems you specify.


## ADVANTAGES OF OUR SOLUTIONS

A A1 Euroclass Rating for the S Range it is completely non-combustible!

- No smoke and no flaming droplets in the event of a fire.



## FIRE SAFETY

## FIRE RESISTANCE

This is a construction component's ability to withstand fire for a given period of time and to retain its serviceability in the event of fire, avoiding the spread of fire. If a fire breaks out, it is essential to prevent any early collapse of the structure, and then limit the extent of the damage to ensure that occupants can be evacuated and/or belongings will be protected. Many buildings are not sufficiently protected against fire hazards. This means that fire can spread quickly, destroy the building in a short time and, more importantly, endanger the lives of the occupants. When a fire breaks out, the first objective is to slow down its spread both horizontally and vertically.

## The main causes of fire are:

> Faults in electrical systems
> Human error
> Overheating
> Arson

Lightning strikes or explosions play a minor role in the statistics here, but can lead to a chain reaction of fires if they do occur (Source: www.ifs-ev.org).

The fire resistance performance level will be influenced by a number of factors: the pipe diameter, the thickness of the floor or wall, the size of the penetration void, the material used to seal the void and even the stack configuration through the penetration.


## COMPARTMENTAL PRINCIPLE

When they exist, fire safety regulations for buildings are based on a compartmental principle. Within a building, a compartment is a fire rated space designed to stop the fire for a given period of time. The fire stopping requirement for walls (shells and slabs) is generally 2 hours or less - and exceptionally 4 hours.

The requirement depends on the type of building and its level of occupancy, and can be very different from one country to the next.

## Wastewater drainage systems and fire stopping requirements

Drainage systems passing through structures designed to withstand fire should not provide open breaches. For a given time, specified in the applicable regulations, they should not allow the passage of fire, smoke, heat or combustion products from one compartment another.

Cast iron, a non-combustible material, has a melting point of over $1000^{\circ} \mathrm{C}$. In most cases it requires no additional fire protection.

PAM Building has and will continue to periodically test its cast iron drainage systems with standard mortar penetrations and other solutions in order to understand the potential effects of fire on its integrity, resistance and overall performance. We carried out a non-exhaustive series of tests to offer precise guidance for fire resistance.

Our systems proved to meet integrity and insulation requirements up to 240 minutes
 ( 4 hours)*, and should therefore not collapse causing potential danger to evacuating people or firefighters.

We regularly perform new tests. Therefore, if you have any questions our technical team can provide guidance and help you select the right configuration for optimal performance and provide you with a comprehensive report. You can contact our technical support team on our website: www.pambuilding.com.

## COMPARISON WITH OTHER MATERIALS

For plastics, the fire stopping rule consists in "plugging the hole". This function is achieved by using fire collars recommended by the manufacturers. Plastic materials, which are highly sensitive to heat, will not withstand fire, and will not remain in place, even in the case of a contained fire.
As shown by laboratory tests in Germany, if the fire collars are not activated, particularly when installed under the fire compartment, they significantly increase the risk of the fire spreading downwards in a multi-storey building. When some types of plastic material (e.g. HDPE and Polypropylene) are exposed to fire they generate molten droplets, which could potentially spread a fire down through the building.

Exposed to fire, plastic material releases toxic fumes and gases, which beyond a certain amount may be fatal to the people inhaling them.

Choosing PAM Cast Iron Systems guarantees the safety of both people and property.

[^3]the European leader in fire science, engineering, tests, inspection and certification.

## ACOUSTIC COMFORT

Noise in buildings is considered to be detrimental to health and quality of life. Efforts have been made in the last 30 years to attenuate the sounds coming from the street, worsening the perception of sounds emitted within buildings. Heat insulation policies aimed at reducing energy consumption will also heighten these perceptions. Among the priority criteria in the comparative performances of drainage materials, acoustic performance is considered to be second only to fire safety: cast iron pipe systems have intrinsic acoustic properties. Owing to the development of equipment accessories, they offer outstanding performances.

## WHAT IS NOISE?

## NOISE FROM PIPE SYSTEMS

Noise from wastewater pipe systems is classified in the regulation under "equipment noise". Noise originating from pipe systems is due to the sound energy produced by water/air turbulence, but mostly by the mechanical effect of the water flow on the internal pipe walls. In such circumstances a pipe will radiate noise outward and transfer it to any lightweight ceilings, cupboards and similar areas wherever it makes contact.

Noise is an energy that affects air pressure and is transmitted through vibration.

Sound is measured in decibels (dB) using a nonlinear scale. For equipment noise, the following categories are identified and measured:


## Airborne noise:

Air vibrations that are propagated. In the case of wastewater pipe systems, this noise is mainly heard in the room where the pipe is located. When a material is dense and thick, the pipe walls prevent air transmission, as is the case with cast iron which has intrinsic acoustic properties.

## Structure-borne noise:

The vibration of a building's structure. This noise will be noticed in rooms adjacent to the pipe. When the noise produced in a pipe is not transmitted by the air, the residual noise is transmitted by structural vibrations. Whilst the mass of the cast iron limits the vibratory level, the junctions and fixings to the building will propagate noise. Objective: dampen the vibrations at the connections to the solid structure.

Statutory requirements for "equipment noise" for structure-borne noise differentiate between noisy rooms and quiet rooms with sound attenuation requirements. For noisy rooms, the noise level requirements are generally 35 dB or more. For quiet rooms, which are generally living rooms, resting rooms and work rooms, the noise level requirements are generally around 30 dB , in cases where noise regulations exist.

## COMPARATIVE LABORATORY TESTS

Acoustic comfort is a differentiation criterion that indicates construction quality. The building project manager and specifier may define together specific requirements to improve the final construction.

In 2019, PAM Building commissioned a series of comparative tests on airborne and structure-borne noises in installation conditions described by standard EN 14366*, at the Fraunhofer Institute for Building Physics in Stuttgart.

The measurement results for the PAM Building cast iron pipes listed in the table were determined at the Fraunhofer Institute for Building Physics on an installation wall with a basis weight of $220 \mathrm{~kg} / \mathrm{m}^{2}$.

The prerequisite for this was that the building conditions in the real construction situation be comparable to or more favorable than the test bench of the Fraunhofer Institute for Building Physics in terms of sound technology.

When compared with the requirements, pay attention to the simultaneous operation of plumbing installations and possible interactions among the plumbing components which may produce different results. As a comparison value with the requirements, the measured value should be obtained at a flow rate of $2.0 \mathrm{l} / \mathrm{s}$, because this corresponds to approximately one toilet flush. The sound measurements were taken both on the opposite side of the installation (in the picture on the right) and in the mounting room (on the left of the picture).

Details of the test configuration:
> Standard bracketing: 2 bracket collars per floor. Both mounted with a 1 Nm torque.
> Stack support: Stack supports are fixed to the wall/floor.
> PAM'Acoustic: 2 anti-vibration brackets per floor. Both mounted with a 1 Nm torque.

[^4]

## ACOUSTIC COMFORT

Tests results for the installations, according to EN 14366

| Pipe system | Test report ${ }^{\circ}$ | Installation acc. to EN 14366 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Airborne noise ( $L_{\text {a,A }}$ ) |  | Structural noise ( $\mathrm{L}_{\text {SC, }}$ ) |  |
|  |  | 2.0 (1/5) | 4.0 (1/s) | 2.0 (1/5) | 4.0 (1/s) |
| S range + classical bracketing with rubber and stack support in basement floor | P-BA 223/2019 | 47 dB (A) | 50 dB (A) | 21 dB (A) | 26 dB (A) |
| S range + PAM'Acoustic without stack support in cellar. | P-BA 226/2019 | 47 dB (A) | 50 dB (A) | $<10 \mathrm{~dB}$ (A) | $<10 \mathrm{~dB}$ (A) |

Complete reports are available on request. Sound levels below $10 \mathrm{~dB}(\mathrm{~A})$ are not mentioned in the test report.


## Structure borne noise \& Pam'Acoustic

For the requirements of extreme acoustic comfort (luxury buildings, auditoriums ...), Pam'Acoustic is an acoustic dampener, which, placed between the frame and the support collar of the cast iron pipe, makes it possible to achieve the exceptional structural noise level of $<10 \mathrm{~dB}(\mathrm{~A})$, that is, almost silence.


Tests according to standard NF EN 14366 (IBP laboratory).
For a flow rate of 2 liters/second, wall: 220 kg $/ \mathrm{m}^{2}$.

## NOISE IN REAL CONDITION OF USE

Usually pipe systems are installed in a technical shaft that contributes to reducing the noise emitted by the effluent flowing in a pipe. Nevertheless, the noise level of pipes installed behind a shaft may not be sufficient to comply with the specifications of the owner or set by the national regulation.

In 2018, PAM Building initiated several noise measurement tests with an independent laboratory in real conditions, inspired by standard EN 14366, but using a real WC flush to assess the noise level of the combination of pipe material and shaft acoustic performance ( $\Delta L_{a n}$ ).

Below are some examples of measurements at a flow rate of $2 \mathrm{l} / \mathrm{s}$ with the S range fixed on a 15 cm thick supporting concrete wall:

| Technical Shaft | S range with rubber <br> lined steel brackets | S range with steel brackets <br> and acoustic dampener |
| :---: | :---: | :---: |
| $\Delta \mathrm{L}_{\mathrm{an}}$ Performance | $\mathrm{L}_{\mathrm{A}, \mathrm{S}, \max }[50-5000 \mathrm{~Hz}](\mathrm{dB})$ | $\mathrm{L}_{\mathrm{A}, \mathrm{S}, \max }[50-5000 \mathrm{~Hz}](\mathrm{dB})$ |
| $19 \leq \Delta \mathrm{L}_{\mathrm{an}}<24$ | 33 | 32 |
| $24 \leq \Delta \mathrm{L}_{\mathrm{an}}<29$ | 30 | 25 |
| $29 \leq \Delta \mathrm{L}_{\mathrm{an}}<34$ | 29 | 19 |

Choosing our systems guarantees the best acoustic solution on the market.

Depending on your project specification or national regulation, PAM Building can help you validate your pipework's compliance. Please contact our technical support team
 on our website: www.pambuilding.com.

## Summary of our solutions:

$\rightarrow$ High basis weight
> Low tendency to vibrate
$>$ Effective sound decoupling
$>$ High insulation value
> Suitable for all pressures
> Sewage installations
> Precise installation instructions
> Compliance with project
specifications or regulations

## DURABILITY

## $\Sigma$

## ROBUSTNESS AND MECHANICAL STRENGTH

Pipe system components must withstand hazards before they reach the job site such as accidental impact before and during installation, during storage, handling and transit. In service, outdoor exposed pipes may be damaged by accidental impacts or vandalism. To avoid breakages, which can be expensive, or minor stress cracks which can have serious consequences in operation, the choice of material should be carefully considered.

## DE LAVAUD PROCESS

In this process, a constant flow of molten metal at a perfectly controlled temperature and composition is gradually put into a steel mould rotating at high speed. The mould external wall is cooled by circulating water and the evenly distributed molten metal cools on contact with the wall before extraction.

The process is characterized by quick cooling which gives a finer solidification matrix and thus a more homogeneous metallurgical structure.

## The spun pipes are placed and

 rotated in a heat treatment furnace at $950^{\circ} \mathrm{C}$ and then gradually cooled again. This step is essential to the process as it transforms the cast iron's metallurgical structure.The reduction in iron carbides and the increase in ferrite content considerably improve the mechanical properties of cast iron and reduce its surface hardness. The graphite of the cast iron resulting from the PAM Building process forms clustered graphite, halfway between lamellar and ductile iron.

## Impact strength and crush resistance

Compared with other materials, cast iron provides much better impact resistance and is highly recommended everywhere pipes may be exposed to mechanical shock (car parks, streets, etc.).

Cast iron is well known for its robustness. The quality of PAM Building products is ensured by careful control of both the metal composition and the manufacturing process.

The spinning of pipes in the De Lavaud process, followed by heat treatment, gives these products outstanding mechanical properties.

The advantages of the De Lavaud process: better mechanical characteristics, superior to the requirements of EN 877*
> Very good resistance to crushing.
$>$ Increased impact resistance.
$>$ The pipe is more resistant to mechanical stress such as bending and compression.
> For installers, installation is more comfortable and on-site handling is facilitated. Cutting pipes is easier, the slices are sharp. The set-up is therefore simpler and faster.

| The Pipes | PAM Building process | Others | EN 877 requirements |
| :--- | :---: | :---: | :---: |
| Tensile Strength on samples in MPa <br> (average value) | 300 | 270 | 200 minimum |
| Ring Crush Strength in MPa <br> (average value, DN 100 pipes) | 450 | 360 | 350 minimum |
| Brinnell Surface Hardness in HB de- <br> gree (average value) | 220 | 245 | 260 maximum |

These results indicate greater resistance to impacts and crushing, easier machining and cutting. This also means the products are easier to install on job sites.
*Key mechanical characteristics required by standard EN 877 are checked by three tests, carried out on pipes when coming out of the heat treatment furnace to assess tensile strength, ring crush resistance and hardness. In addition, operators have opted to perform a further test which provides a good indication of the heat treatment quality: impact test.

WHY USE CAST IRON

## RESISTANCE TO THERMAL EXPANSION

Most solids expand when heated and are liable to elongate under temperature increases.
For pipe systems made of materials that are subjected to high levels of thermal expansion, precautions must be taken at the design stage.
Cast iron, which expands very little, does not require specific bracketing or expansion collars. It makes the specifiers' design work easier and avoids extra costs at the installation stage.

## Thermal expansion coefficient of cast iron and other materials

The thermal expansion coefficient for cast iron $-0.01 \mathrm{~mm} / \mathrm{m} .{ }^{\circ} \mathrm{C}$ - is very low and very similar to that of steel and concrete; the building and pipe systems will move and expand together.


For cast iron, the bracketing system is designed to only carry the weight of the pipe and its content, which makes the designers' work easier. Plastic pipes, however, expand considerably with increasing temperature. Their bracketing system must be designed and adapted accordingly, as it can significantly affect the pipework's stability and performance over time.

## Thermal expansion of plastics

To allow expansion without damaging the drainage network, plastic pipe systems require specific accessories - expansion collars or joints, brackets allowing axial movement, in general one of the two.

If these precautions were not taken, expansion could be absorbed by the pipework and cause distortion.

Cast iron does not require these expensive accessories. It makes the design work easier and decreases the risk of mistakes at the installation stage.

These properties of cast iron pipe systems are also valuable for engineering structures such as bridges, where significant expansions have to be carefully addressed to secure the construction project.

## DURABILITY

WATERTIGHTNESS

Sanitary drainage systems, whether exposed or not, must remain watertight over time. Any defects can cause serious damage, leaks, dripping or slow permeation and generate costly repairs, and disruption. PAM Building cast iron mechanical assemblies are designed to easily achieve instant watertightness and are not dependent on process control (gluing or welding, etc.).

Watertightness of cast iron systems
Cast iron is a dense and non-porous material. Cast iron pipe systems are watertight and impervious.

Straight and rigid cast iron components are assembled using metal couplings fitted with elastomer gaskets which ensure the system is completely watertight.

Assemblies benefit from a conventional approach. Put together with only simple tools, they allow installation tolerance with no risk of leaks.


This ease of installation ensures the specified performance is always obtained, even in adverse conditions, unlike with plastics when either gluing or welding can be affected by installation hazards (ambient conditions such as temperature or damp), or when personnel with special skills are required.

## Watertightness over time

Failure of watertightness can occur on drainage systems in operation due to breaks, misalignments, crushes or cracks. Long-lasting watertightness depends on two main factors:
$>$ No deterioration of pipes: Cast iron is highly resistant to ovality. Their specified mechanical properties and stability enable cast iron systems to withstand operating stresses extremely well.
> No deterioration of assemblies: Elastomers are carefully selected for the long-term stability of their physico-chemical characteristics to ensure the lasting watertightness of the rubber gaskets.

## Watertightness and maintenance

Blockages can sometimes occur in drainage networks, therefore the pipework materials must be resistant so that maintenance is easy. The S and Plus systems can withstand
all normal maintenance processes, including high-pressure jetting, without being damaged. They have undergone a high-pressure test according to Swiss standard SN 592012.

## The robustness and dimensional stability of cast iron components along with the careful selection of elastomer ensure pipe installations are high-performance and have a long service life.

## INTERNAL PRESSURE RESISTANCE

Internal overpressure in drainage networks rarely occurs and is always accidental. Thrust efforts in the overloaded sections have to be addressed to guarantee both watertightness and mechanical stability.

As the robust cast iron components can withstand any pressure hazard, the couplings will be subjected to the strain. The quality of the couplings and their careful selection according to their field of use will prevent misalignment or disconnection of the pipework.

## Resistance of the couplings to hydrostatic pressure

## Standard pressure mechanical couplings:

Wastewater drainage systems - which differ from rainwater drainage systems as regards pressure - are connected to sanitary appliances installed on each storey which may serve as outlets in case of accidental overloading (due to blockages, for example). The pressures that occur cannot therefore exceed the pressure corresponding to the height of one storey, i.e. about 0.3 bar. The couplings we describe as" standard" are perfectly suitable for this common type of application.


## High-pressure mechanical couplings:

In some rare cases, a wastewater drainage system may pass through a number of stories without any outlet, and there could be a risk of overloading (blockage due to operation or saturation of the main sewer). The pressure resistance required to ensure these systems remain leaktight and stable in such cases depends on the height of the water column liable to occur, and calls for high-pressure couplings able to withstand the resulting pressure (up to 10 bar).

## SPECIFIC POINTS OF THE PIPEWORK: RESISTANCETO END THRUST EFFORTS

Some specific points on a
pipe system may be subjected to thrust loads due to changes of direction and gradient, branches and plugs. To avoid any risk of disconnection or slippage of the pipe components, these loads must be addressed and the sections at risk must be anchored:
> A section of pipe may be held between two fixed points with ductile iron brackets, for example
> Alternatively, a selfanchoring coupling or an ordinary coupling anchored with a grip collar can be used

If you need help determining the choices for your project, please contact our technical support team on our website: www.pambuilding.com

## DURABILITY



## AGEING BEHAVIOR

As components that are integrated in buildings, wastewater and rainwater drainage systems must remain in a serviceable condition over the long term despite adverse operating conditions.

Ageing refers to any gradual, irreversible change in a material's structure and/or composition, liable to affect its behavior or serviceability.

When a material is selected, the stability of its properties ensures operational reliability over time.


## Stability of cast iron mechanical properties

The ageing of a material may be due to its own instability, environmental or chemical stresses, mechanical strains, or a combination of any of those causes.

It is an established fact that cast iron offers long service, owing in particular to the stability of its mechanical properties over time.

## Cast iron is not sensitive to thermal ageing

> Its mechanical strength remains stable.
> Its thermal expansion is very low compared to plastics.
> Cast iron pipe systems are not liable to creep at operating temperatures.

## Cast iron does not deform under mechanical strain.

$>$ Its ring stiffness (cold measurement) around $700 \mathrm{kN} / \mathrm{m}$ is not affected by temperature and is 87 times that of PVC pipes. It is highly valued for buried pipework.
> Its longitudinal stiffness, which facilitates bracketing and protects the water stream in horizontal sections, remains intact. Its Young's modulus of elasticity is from 80 to 120 GPa vs 2 to 5 GPa for PVC.
> Cast iron's tensile strength is 8 times that of PVC: 200 MPa vs 25 (residual resistance, after 50 years according to the standards). This property is very important in case of network overloading.

The properties of cast iron ensure the stability of the systems and long-lasting operational safety.

WHY USE
CAST IRON

## Resistance to climatic stresses

The properties of materials are extremely important when they are stored in or exposed to adverse conditions (extended exposure to ultraviolet light or wide-ranging temperature variations, etc.). Cast iron undergoes no structural modification under climatic stresses.

## AGEING OF POLYMERS

## Deterioration of mechanical properties under temperature stress

Under the effect of temperature, plastics can suffer two kinds of deterioration, including at operating temperatures:

- Creeping is an irreversible elongation under the combined action of both temperature and a significant mechanical strain. Plastic pipe systems like PVC or HDPE are particularly sensitive; in the horizontal sections, they can bend between two support brackets under their own weight.
> Modification of the elastic limit: most plastic materials will soften when exposed to a temperature increase. With a decrease in temperature, however, they crystallise. PVC, for example, becomes rigid and may crack under mechanical strain - its operating temperature range is generally between $-20^{\circ} \mathrm{C}$ and $80^{\circ} \mathrm{C}$, but depending on its nature, the range can be much narrower.


## Photochemical ageing

Depending on their nature, climatic stresses (such as solar radiation, damp or heat) will cause photochemical ageing to plastic materials of varying severity.

They may merely alter their surface finish, or they may also deeply modify their mechanical properties and thus adversely affect their serviceability.

The same can happen as a result of a slow chemical attack by solvents or even in an aqueous medium.

## CHEMICAL \& CORROSION RESISTANCE

## DOMESTIC USE

Characterlisation of common domestic applications

Building wastewater drainage systems - grey and black water- must be able to withstand the types of domestic effluents specified by standard EN 877. In recent years, however, changes have been observed in the types of these fluids:

- Higher concentration of household detergents,
- Use of more aggressive hygiene products,
- Rise in operating temperatures.

The constraints on sanitary drainage systems are constantly increasing.

To test chemical resistance of cast iron products, according to standard EN 877, the product samples are tested for 30 days at a temperature of $23 \pm 3^{\circ} \mathrm{C}$ with the following liquids ( pH constantly monitored):
> A solution of sulfuric acid with a pH of 2
> A solution of sodium hydroxide with a pH of 12
> A solution of wastewater with a pH of 7

Resistance to hot water ( 24 h at a continuous $95^{\circ} \mathrm{C}$ ) and thermal cycles ( 1,500 cycles of 5 min between $15^{\circ} \mathrm{C}$ and $93^{\circ} \mathrm{C}$ ) are also tested according to standard EN 877.

To provide clearer guidance on the chemical resistance of the $S$ range in domestic applications, PAM Building has carried out 20 further tests in addition to the requirements of standard EN 877 on commonly-used detergent products (floor cleaning products, laundry detergents, etc.) and special products (stain removers, drain cleaners, etc.). The additional tests also aimed to assess the S and Plus range limitations.

The tests were carried out on samples, under the temperature of use recommended by the manufacturers and, where relevant, up to $70^{\circ} \mathrm{C}$ since hot water is normally supplied in houses at around $50-60^{\circ} \mathrm{C}$.

After stopping the test, the pipes and fittings were washed immediately to eliminate any stains, and the coatings were examined for blistering and rusting according to ISO 4628-2 and 3. (Accepted levels according to EN 877).

The duration of the test is considered equivalent to the extrapolation of real chemical stress undergone for 7 or 10 years ( 10 to 15 min of stress per day). This test method, however, simulates severe stress since the samples lie in direct contact with the solution, the temperature is maintained and the test includes no rinsing for its duration.

## 03

WHY USE CAST IRON

|  |  | Dilution* | pH | $23^{\circ}$ | $50^{\circ}$ | $65^{\circ}$ | $70^{\circ}$ | Test duration |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| SALT WATER | Same as sea water | $30 \mathrm{~g} / \mathrm{l}$ |  |  |  |  |  | 28 days |
| DETERGENTS |  |  |  |  |  |  |  |  |
| Laundry detergents | Phosphate-free detergent | $2 \mathrm{ml} / \mathrm{l}$ | 7.7 |  |  |  |  | 28 days |
|  | Softener | $2 \mathrm{ml} / \mathrm{l}$ | 7.6 |  |  |  |  | 28 days |
| Dish washer detergents | Washing tablet | $3 \mathrm{~g} / \mathrm{l}$ | 9.3 |  |  |  |  | 28 days |
|  | Washing gel | $3 \mathrm{~g} / \mathrm{l}$ | 9.8 |  |  |  |  | 28 days |
|  | Washing up liquid | $2 \mathrm{ml} / \mathrm{l}$ | 7.65 |  |  | not applicable |  | 28 days |
| Stain remover | "Ace Gentle" type |  | 7.7 |  |  |  |  | 28 days |
| COMBINATION | Detergent + stain remover | $2 \mathrm{ml} / \mathrm{l}+3 \mathrm{ml} / \mathrm{l}$ | 7.7 |  |  |  |  | 28 days |
|  | Detergent + softener | $2 \mathrm{ml} / \mathrm{l}+3 \mathrm{ml} / \mathrm{l}$ | 7.7 |  |  |  |  | 28 days |
| CLEANING PRODUCTS | Floor cleaning product | $8 \mathrm{ml} / \mathrm{l}$ | 8.2 |  |  |  | not applicable | 28 days |
|  | Bleach | $8 \mathrm{ml} / \mathrm{l}$ | 8.25 |  | not applicable |  |  | 28 days |
| WC CLEANERS | Toilet bowl cleaner (gel) | $20 \mathrm{ml} / \mathrm{l}$ | 5.45 |  | not applicable |  |  | 28 days |
|  | Drain cleaner gel | $0.33 \mathrm{ml} / \mathrm{l}$ | 13 |  |  |  |  | 4 days |
|  | Liquid descaler | $80 \mathrm{ml} / \mathrm{l}$ | 2.07 |  |  |  |  | 28 days |

*according to the manufacturer

## Recommended range for these applications: S range (see p.66)

According to the principle of continuity with no weak points, coatings for fittings and accessories must withstand the same stresses as pipes. There is an anti-corrosion coating process for these parts to ensure they can withstand major stresses, due to the fluids transported or the environment.

## CATAPHORESIS

Fittings and accessories are coated with an epoxy resin deposited by cataphoresis which ensures a uniform deposit and excellent covering of edges. The optimised process by PAM Building is based on careful shotblasting and entails incorporating a chemical surface treatment during the coating cycle, between rinsing after shotblasting and the cataphoresis bath to enhance the coating's covering power.

At the end of the cycle, the parts are oven dried to complete the reticulation of the epoxy film.

## Substantial improvements in:

$>$ The epoxy film's adhesion to the cast iron.
$>$ The corrosion resistance of the coated cast iron.


## CHEMICAL \& CORROSION RESISTANCE

INTENSIVE USE:

## INTERNAL STRESSES DUE TO AGRESSIVE EFFLUENTS

## Characterisation of intense or professional uses

Aggressive effluents are characterized by their content (acids, bases, solvents, hydrocarbons, etc.), their combinations and their temperature.

Above- and below-ground wastewater drainage for aggressive discharge are characterised by:
$>$ Hot water resistance: 24 h at a continuous $95^{\circ} \mathrm{C}$ and thermal cycles $\left(1,500\right.$ cycles of 5 min between $15^{\circ} \mathrm{C}$ and $93^{\circ} \mathrm{C}$ )
> Plus range external coating corrosion resistance test to neutral salt spray according to standard NF-EN ISO 9227_2017: 2500 hours
> Chemical resistance: $1<\mathrm{pH}<13$

## Recommended range for these applications: Plus range (see p.68)

The limitation between the $S$ and Plus ranges is only determined by the type of fluids and the operating temperature. However, the duration of daily exposure also directly determines the appropriate range to select, hence why we called this chapter intensive or professional use. The combination of high pH products (base and alkaline products) and high temperatures systematically calls for the use of the Plus range.

With its anti-corrosion thick linings, the Plus range provides greater chemical resistance and is particularly well-suited to intensive uses.
$>$ To transport effluents containing acids, bases or saline solutions at common operating temperatures, systematic use of the Plus range equipped with couplings with EPDM gaskets is recommended.
> For solvents, hot oil and where hydrocarbon traces may be present, the systematic use of the Plus range equipped with couplings with NBR gaskets is recommended.

| Compulsory use of PLUS range + NBR gasket |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| Solvents at common temperatures of use and hot oils |  |  |  |  |
|  | pH | 20 | 60 | 80 |
| SOLVENTS (except Acetone) |  |  |  |  |
| Ethanol, methanol, glycol |  |  |  |  |
| Xylene |  |  |  |  |
| White Spirit |  |  |  |  |
| Gasoline, diesel, petroleum |  |  |  |  |
| Lubricants, petroleum derivates |  |  |  |  |
| High temperatures OILS |  |  |  |  |

[^5]| Compulsory use of PLUS range + EPDM gasket |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| Acids and bases, saline solutions common temperatures of use |  |  |  |  |
|  | pH | 20 | 60 | 80 |
| WATER |  |  |  |  |
| Salt water $\mathrm{NaCl} 30 \mathrm{~g} / \mathrm{l}$ | 5.6 |  |  |  |
| Dermineralised water | 6.6 |  |  |  |
| Wastewater | 6.9 |  |  |  |
| DETERGENTS |  |  |  |  |
| Cleaning supplies 10\% | 7.4 |  |  |  |
| Phosphate-free washing liquid | 7.7 |  |  |  |
| Dishwasher cleaner 5\% vol | 9 |  |  |  |
| Ammonia solution 10\% | 9.5 |  |  |  |
| Pure ammonia solution | 10 |  |  |  |
| STAIN REMOVER/OXIDANTS |  |  |  |  |
| "Ace Gentle" Type 5\% | 4.2 |  |  |  |
| "Beckmann" Type tablet/5I | 9.3 |  |  |  |
| "Blanco" Type tablet/5I | 10.3 |  |  |  |
| MINERAL ACIDS |  |  |  |  |
| Hydrochloric HCL 5\% | 1 |  |  |  |
| Sulphuric $\mathrm{H}_{2} \mathrm{SO}_{4} 10 \%$ | 1 |  |  |  |
| Sulphuric $\mathrm{H}_{2} \mathrm{SO}_{4} 1 \%$ | 2 |  |  |  |
| Phosphoric $\mathrm{H}_{3} \mathrm{PO}_{4} 10 \%$ | 1.3 |  |  |  |
| Phosphoric $\mathrm{H}_{3} \mathrm{PO}_{4} 5 \%$ | 1.8 |  |  |  |
| Phosphoric $\mathrm{H}_{3} \mathrm{PO}_{4} 2.5 \%$ | 2 |  |  |  |
| Nitric $\mathrm{HNO}_{3} 10 \%$ | 2 |  |  |  |
| ORGANIC ACIDS |  |  |  |  |
| Lactic 10\% | 1.1 |  |  |  |
| Lactic 1-5\% | 2.2 |  |  |  |
| Citic 5\% | 2 |  |  |  |
| Vinegar 30\% | 2.9 |  |  |  |
| Vinegar 10\% | 3.2 |  |  |  |
| BASES |  |  |  |  |
| Soda NaOH | 12 |  |  |  |
| Soda NaOH | 13.6 |  |  |  |
| Ammonia $\mathrm{NH}_{3}$ | 12.1 |  |  |  |
| Potash KOH | 13.6 |  |  |  |
| Bleach 10\% | 12 |  |  |  |
| Bleach 30\% | 12 |  |  |  |
| Bleach 100\% | 12.5 |  |  |  |
| SALTS |  |  |  |  |
| KCL 3\% | 4.2 |  |  |  |
| $\mathrm{NaH}_{2} \mathrm{PO}_{4} 3 \%$ | 4.2 |  |  |  |
| $\left(\mathrm{NH}_{4}\right) 2 \mathrm{SO}_{4} 3 \%$ | 6.7 |  |  |  |



For uses not described or intensive industrial uses, please contact our technical support team: tcbatiment.sgpam@saint-gobain.com

## CHEMICAL \& CORROSION RESISTANCE

INTENSIVE USE: EXTERNAL STRESSES DUE TO AGGRESSIVE GROUND

## Characterisation of external stresses

Below-ground wastewater drainage systems exposed to environmental stresses.

The buried section of a pipe may be laid in non-homogeneous ground or corrosive soil. When protected by galvanic effect, the pipework can be installed without requiring systematic soil studies.


Recommended range for these applications: Plus range (see p.68)

Buried systems are subjected to ground loadings which can cause shearing strain on couplings. For these applications, it is therefore recommended to use wider couplings, and to use the "all stainless steel version" of the steel couplings to avoid corrosion due to the aggressiveness of the ground.

## INTENSIVE USE: EXTERNAL STRESSES DUE TO CLIMATE EXPOSURES

## Outdoor or facade exposures

Depending on the climatic conditions, while in operation outdoor wastewater and rainwater systems can be subjected to ultraviolet radiation, saline mist, condensation, freezing-thawing cycles and pollution.

The drainage systems must be fit for purpose despite exposure to adverse conditions.

Zinc coating improves the pipes' ability to withstand climatic stresses and extends their service life.
Recommended range for these applications: Zn range (see p.70)

## ZINC COATING

The zinc metal coating is an active protection provided by the galvanic action of a zinc-iron cell.

## This action is two-fold:

> Formation of a stable protective layer of insoluble zinc salts
> Self-repairing of any damage.

Zinc metalisation is an excellent corrosion inhibitor and is extremely effective at extending the lifespan of products subject to backfills or climatic stresses.


Zinc spray


Non-zinc coated:
the damage is worsened and the corrosion (red marks) extends beyond the notch


Zinc coated: a white line of zinc salt shows that the damage is completely plugged

## ENVIRONMENT

## Circular economy: recyclability, an exceptional asset of cast iron

PAM BUILDING,
A KEY PLAYER IN THE CIRCULAR ECONOMY

The preservation of natural resources is a major societal challenge, especially for the construction sector, which is a major consumer of raw materials and energy. PAM Building evacuation systems are a responsible and sustainable choice, respectful of natural resources and people.

## A cast iron pipe gives our waste a second life

In order to contribute to the preservation of natural resources, PAM Building's molten iron is produced by recycling cast iron and ferrous products. Unlike plastics, it can be completely and systematically recycled at the end of its life.
PAM Building's drainage solutions can be recycled without any deterioration of their properties.

The product's life cycle is also first-class in terms of environmentally-friendly logistics, long-lasting functionality (up to 70 years without compromising the mechanical properties), low maintenance costs and commercially beneficial recycling.

## 100\% recyclable indefinitely without losing any of its <br> properties and made from 99\% recycled content*



For the standard S range, recycled content is $99 \%$ with $11.5 \%$ pre-consumer** \& 87.5\% post-consumer*** according to ISO 14021: 1999.

## Nothing is wasted: everything is recycled

Cast iron pipe systems are based on the principle of modular ranges of removable components. Their mechanical assemblies are reversible.

You can change your mind today or even tomorrow. When pipe systems are disassembled or modified, these components can be reused, which cuts down on waste dumping.

[^6]

## DID YOU KNOW? <br> In 2021, we have recycled the equivalent


cars.

Organised and numerous actors in the recycling channel

The recycling channel exists: collector network and recovery stream is existing and working!

We work with local supply for scrap ( $<125 \mathrm{~km}$ from the plant) to reduced economic and transport costs.

Following ISO 14021:1999 and LEED V4 criteria we can provide a recycled content declaration for our products.


## ENVIRONMENT

## A transparent approach: Safe products \& Life Cycle Assessment

Life Cycle Assessment: a rigorous tool for assessing the environmental impacts of our products

Understanding the environmental performances of construction products is a growing expectation for professionals in the building chain.

In PAM Building, we strongly believe that Life Cycle Assessment is the most reliable tool available to assess the green credentials of construction products and enables companies to communicate credible, fact-based information about their products to consumers. It is also a powerful tool for enhancing the environmental features of our products.LCA is a methodology based on specific standards ISO 14040 and ISO 14044:
> Multi-criteria tool: consumption of natural resources, air, ground and water emissions, waste generation, warming potential, ...
Multi-step tool: "cradle to gate" or "cradle to grave".


WHY USE
CAST IRON

## ENVIRONMENTAL PRODUCT DECLARATION

## What is an Environmental Product Declaration?

The results of a LCA are presented in the form of an Environmental Product Declaration, locally administrated by program operators and based on ISO 25930 and EN 15804 standards. When an EPD has been checked by an independent third party, it is said to be verified. This process ensures the quality and reliability of the results: that is why we are committed to have verified EPDs.
We currently have produced and verified EPDs for our S and Plus ranges, both available on the Environdec platform : www.environdec.com

## Overview of the EPD for our S range

This table enables a quick and synthetic overview of environmental footprint of the functional unit ( 1 m of SMU S cast iron pipe system for collection and drainage of waste water, sewage and rainwater in buildings), based on 70 years of lifetime.
The complete EPD is available on the international Environdec platform, registration number S-P-02013.


[^7]

## 04

## OUR SOLUTIONS

76 INFRASTRUCTURE
78 EARTH-TO-AIR HEAT EXCHANGER

# WASTEWATER: DOMESTIC USE 

## S range (details on p.86)



## DESCRIPTION:

Specialised range providing complete drainage solutions for transporting fluid waste and rainwater through buildings. High-quality cast iron pipes and fittings suitable for standard use applications. This range withstands different types of domestic effluents such as grey water, black water and rainwater.

## RECOMMENDED USE:

First choice for commercial, public and residential buildings, particularly medium- to high-rise buildings which require robust and safe solutions for basements and lower levels to vertical risers. Some common applications are:
> Offices
> Shopping centers
> Housing
> Airports
> Hotels
$>$ Public builidings
> Stadiums

## MAJOR BENEFITS:

> Compliant with standard EN 877
> Performance guaranteed with marks delivered by a third party (NF, RAL-GEG, Kitemark, BBA, Sintef, Gost, Q+)
> High level of fire safety with excellent A1 reaction to fire (non-combustible) and fire resistance up to 240 minutes depending on the configuration (generally requires no special fire protection saving time and costs).
> Best acoustic comfort with Lsc, A < $10 \mathrm{~dB}(\mathrm{~A})$ according to EN 14366
> Ease of installation due to the mechanical couplings assembled with simple tools
> Adaptable to all configurations with available accessories connecting cast iron with other materials
> Limited maintenance operations thanks to the technical and mechanical properties of cast iron.

## CHEMICAL AND CORROSION RESISTANCE:

$>$ Hot water resistance: 24 h at $95^{\circ} \mathrm{C}$
$>$ Thermal cycle resistance: 1,500 cycles between $15^{\circ} \mathrm{C}$ and $93^{\circ} \mathrm{C}$
$>$ Chemical resistance for $2 \leq \mathrm{pH} \leq 12$.

OUR
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## DIMENSIONS:

> Diameter: 50 to 400 mm (up to 600 mm on request)
> Length: 3,000 mm.

## ENVIRONMENTAL DATA:

> Recycled content: 99\%
> 100\% Recyclable.

## COATINGS:

## > Pipes:

External coating: Red-brown, acrylic primer paint, average dry film thickness $40 \mu \mathrm{~m}$.Cast-iron made with the De Lavaud processInternal coating: Two-component ochre-coloured epoxy coating, average dry film thickness of $130 \mu \mathrm{~m}$.
## > Fittings:



Externally and internally coated in red epoxy to an average thickness of $70 \mu \mathrm{~m}$.

## PRODUCT MARKING:

> Pipes:

> Fittings:


# WASTEWATER: INTENSIVE USE 

## Plus range (details on p.108)



## DESCRIPTION:

High-performance cast iron pipes and fittings designed to withstand intensive use. Smartly designed to drain wastewater in above- and below-ground applications when exposed to hot and/or aggressive discharge. When installed below ground in aggressive environments it is highly resistant to external stresses.

## RECOMMENDED USE:

The Plus range is the first choice for hospitals, laboratories and collective kitchens.

## MAJOR BENEFITS:

> Compliant with standard EN 877
> Performance guaranteed with marks delivered by a third party (NF, RAL-GEG, Kitemark, BBA, Sintef, Gost, Q+)
> Long-lasting operational safety thanks to the robustness and stiffness (around $700 \mathrm{kN} . \mathrm{m}$ ) of cast iron and the use of flexible mechanical couplings
$>$ High level of fire safety with excellent A2, s1-dO reaction to fire and fire resistance up to 240 minutes depending on the configuration (generally requires no special fire protection, saving time and costs).
$>$ Best acoustic comfort with $\mathrm{L}_{\mathrm{sc}, \mathrm{A}}<10 \mathrm{~dB}(\mathrm{~A})$ according to EN 14366
$>$ Ease of installation due to mechanical couplings assembled with simple tools.

## CHEMICAL AND CORROSION RESISTANCE:

$>$ Hot water resistance: 24 h at $95^{\circ} \mathrm{C}$
$>$ Thermal cycle resistance: 1500 cycles between $15^{\circ} \mathrm{C}$ and $93^{\circ} \mathrm{C}$
$>$ Chemical resistance for $2 \leq \mathrm{pH} \leq 13$, up to $80^{\circ} \mathrm{C}$ (check resistance for more than 30 different effluents in the tables on p. 52 and 53)
> External coating corrosion resistance test to neutral salt spray according to standard NF-EN ISO 9227_2017: 2500 hours.

## DIMENSIONS:

> Diameter: 50 to 400 mm (up to 600 mm on request)
$>$ Length: 3000 mm .

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SOLUTIONS

## ENVIRONMENTAL DATA:

> Recycled content: 99\%
> 100\% Recyclable.

## COATINGS:

## > Pipes:

(1) External coating: Grey, acrylic primer paint, average dry film thickness of $40 \mu \mathrm{~m}$.
(2) Anti-corrosive zinc coating of $130 \mathrm{~g} / \mathrm{m}^{2}$
(3) Cast-iron made with the De Lavaud process
(4) Internal coating: Two-component ochre-coloured epoxy coating applied in two layers, average dry film thickness of $250 \mu \mathrm{~m}$.

## > Fittings:

Externally and internally coated with a grey powder epoxy to an average thickness of $300 \mu \mathrm{~m}$.


## PRODUCT MARKING:

## > Pipes:

CE marking / Reaction to fire classification

> Fittings:


# WASTEWATER: INTENSIVE USE 

## Zn range (details on p.120)



## DESCRIPTION:

High-performance cast iron pipes designed to withstand external stresses due to climate exposures (ultraviolet radiation, saline mist, condensation, freezing-thawing cycles and pollution)

## RECOMMENDED USE:

The Zn range cast iron drainage system is recommended for applications in coastal areas, directly or indirectly exposed to climatic stresses and/or polluted atmospheres, polluted or confined atmospheres such as cellars, crawl spaces or those which may be exposed to external aggressions during manufacturing processes and condensation.

## MAJOR BENEFITS:

> Compliant with standard EN 877
> Performance guaranteed with marks delivered by a third party (NF, Watermark)
> Resistance to climatic stresses thanks to the zinc coating, withstanding extended exposure to ultraviolet light or wide temperature variations
> High level of fire safety with excellent A2, s1-dO reaction to fire and fire resistance up to 240 minutes depending on the configuration (generally requires no special fire protection, saving time and costs).
$>$ Best acoustic comfort with $L_{s c, A}<10 \mathrm{~dB}(\mathrm{~A})$ according to EN 14366
$>$ Ease of installation due to mechanical couplings assembled with simple tools.

## CHEMICAL AND CORROSION RESISTANCE:

$>$ Hot water resistance: 24 h at $95^{\circ} \mathrm{C}$
$>$ Thermal cycle resistance: 1500 cycles between $15^{\circ} \mathrm{C}$ and $93^{\circ} \mathrm{C}$
$>$ Chemical resistance for $2 \leq \mathrm{pH} \leq 12$
> External coating corrosion resistance test to neutral salt spray according to standard NF-EN ISO 9227_2017: 3500 hours.

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## DIMENSIONS:

> Diameter: 50 to 400 mm (up to 600 mm on request)
> Length: 3000 mm .

## ENVIRONMENTAL DATA:

> Recycled content: 99\%
$>100 \%$ Recyclable.

## COATINGS:

## > Pipes:

(1)

External coating: red-brown, acrylic primer paint, average dry film thickness of $40 \mu \mathrm{~m}$.Anti-corrosive layer: flame-applied zinc metal coating of $260 \mathrm{~g} / \mathrm{m}^{2}$ on averageCast-iron made with the De Lavaud processInternal coating: two-component ochre-coloured epoxy coating, average dry film thickness of $130 \mu \mathrm{~m}$.

## > Fittings:

Please contact us for details of the fittings to be used with the Zn range pipes.


## PRODUCT MARKING:

> Pipes:


# RAINWATER: GRAVITY SYSTEMS 

Residential (Type R) (detedils on p.122)


MAJOR BENEFITS:
> Compliant with standard EN 12O56-3
> Additional value to buildings due to the round or fluted aesthetic appearance of the Residential drainage solution
> Low maintenance due to the best in class resistance to shocks and crushing
> Long lifetime with high resistance to climatic stresses due to the zinc coating and the low thermal expansion coefficient of cast iron
> High level of fire safety with excellent A1 reaction to fire (non-combustible)
> Ease of installation due to the push-fit assembly system.
> Shock resistance:

> Crushing resistance:


The test consists of dropping a mass of 2.75 kg on a descent at increasing heights until it breaks or cracks.

The average height of the fall for Residential (Type R) is 2 to 5 times higher than for other products. Up to an average drop height of 2 m , the Residential (Type R) deforms while the other products have cracked.

## DIMENSIONS:

> Diameter: 75-100-125 mm
> Length: 1000 and 2000 mm

## ENVIRONMENTAL DATA:

> Recycled content: 99\%
$>100 \%$ Recyclable.

## COATINGS:

## > Pipes:

(1) External coating: light beige colour (RAL 7032), water-based coating of $40 \mu \mathrm{~m}$.
(2)

Anti-corrosive layer: flame-applied zinc metal coating of $130 \mathrm{~g} / \mathrm{m}^{2}$ in average
(3) Cast-iron made with the De Lavaud process
(4) Internal coating: water-based coating of $40 \mu \mathrm{~m}$.

> Fittings:
Cataphoresis $70 \mu \mathrm{~m}+$ water-based coating $40 \mu \mathrm{~m}$.


## RAINWATER: SIPHONIC SYSTEM

EPAMS ${ }^{\oplus}$ (details on 0.128 )

## HOW IT WORKS?

The EPAMS system is a combination of cast iron pipes, fittings and accessories, jointed with PAM couplings able to withstand a negative pressure of -900 mbar.


## MAJOR BENEFITS:

> System under French Technical Approval EPAMS ${ }^{\circ}$ 5+14.14-2
> Suitable for all ambitious architecture and all roof types*
> Cost-efficiency via savings on purchases and installation costs: fewer downpipes than gravity systems
$>$ Suitable for all areas and rainfall: high volumes of water drained up to $75 \mathrm{I} / \mathrm{s}$
> Low and easy maintenance with a durable system: no claim since its launch (1994)

## TECHNICAL SUPPORT:

$>$ Technical study and network sizing provided by PAM Building through the dedicated EPAMS software
$>2 \mathrm{D}$ and 3D design available
$>$ Job site inspection

## INSTALLATION:

> See p. 172
*For more details please consult French Technical Approval EPAMS* 5+14.14-2 or contact us: tcbatiment.sgpam@saint-gobain.com

## DIMENSIONS:

$>$ Diameters : 50-75-100-125

## PRODUCT RANGE:


$>$ EPAMS outlet to be welded
Application field: This roof outlet is especially designed to be welded (or brazed) in gutters or metal roof valleys.

> EPAMS* outlet with flange
Application field: This roof outlet can be used for roofs containing extra-thick metal gutters or valleys as well as for roofs waterproofed by synthetic or bituminous membranes.


## EPAMS outlet with steel plate

Application field: This roof outlet is used on all the roofs mentioned within the scope of the French Technical Assessment 5+14/14-2386, except those with waterproofing by a synthetic membrane.


## EPAMS* outlet for flexible PVC membrane

Application field: This roof outlet is used on non-accessible roofs and/or with equipment zones, and waterproofed by synthetic PVC-P membranes depending on the manufacturer's technical assessment. Waterproofing is provided by a weld between the various PVC elements to seal them in a traditional way. The membrane may be visible or may be given heavy mineral protection. For the latter case, it is possible to use gravel > 15 mm , but the roof outlet must be fitted with an elevating
 kit for the anti-vortex mechanism.

## INFRASTRUCTURE

Itinero ${ }^{\ominus}$ (detalis on p.130)


## DESCRIPTION:

The Itinero range is a solution that meets the high drainage technical demands of infrastructure projects.
Itinero is a dedicated range which factors in the specificities of a project and guarantees excellent performance to accommodate different stress levels (weather constraints or exposures).

## RECOMMENDED USE:

It is recommended for collecting and draining surface water from bridges, tunnels and viaducts, for new builds or renovation projects.

## MAJOR BENEFITS:

> Compliant with standard EN 877
> Performance guaranteed with marks delivered by a third party (NF)
> Long lifetime with high resistance to climatic stresses due to the zinc coating and low thermal expansion coefficient of cast iron
> Low maintenance due to the best in class resistance to shocks and crushing
$>$ High level of fire safety with excellent A2,s1-dO reaction to fire (non-combustible)
$>$ Suitable for many bridge and tunnel designs and adapted to renovation projects
> Easy to install due to mechanical couplings assembled with simple tools.

## TECHNICAL SUPPORT:

$>$ We provide design recommendations, discharge system set-up and a bill of quantities for your project. Contact us at: tcbatiment.sgpam@saint-gobain.com

## CHEMICAL AND CORROSION RESISTANCE:

$>$ Hot water resistance: 24 h at $95^{\circ} \mathrm{C}$
$>$ Thermal cycle resistance: 1,500 cycles between $15^{\circ} \mathrm{C}$ and $93^{\circ} \mathrm{C}$
$>$ Chemical resistance for $2 \leq \mathrm{pH} \leq 12$
> External coating corrosion resistance test to neutral salt spray according to standard NF-EN ISO 9227_2017: 4500 hours.

OUR
SOLUTIONS

## DIMENSIONS:

> Diameter: 100 to 600 mm
> Length : 3000 mm

## ENVIRONMENTAL DATA:

> Recycled content: 99\%
$>100 \%$ Recyclable.

## COATINGS:

> Pipes:External coating: Grey (approximate RAL 7030), epoxy coating, average dry film thickness of $80 \mu \mathrm{~m}$Anti-corrosive zinc coating of $260 \mathrm{~g} / \mathrm{m}^{2}$ (about $40 \mu \mathrm{~m}$ )Cast-iron made with the De Lavaud process
Internal coating: epoxy coating, average dry film thickness of $130 \mu \mathrm{~m}$.

## > Fittings:

Externally and internally coated with a mat grey powder epoxy (approximate RAL 7030), to an average thickness of $300 \mu \mathrm{~m}$.

## PRODUCT MARKING:


> Pipes:
CE marking / Reaction to fire classification


## > Fittings:



## EARTH-TO-AIR HEAT EXCHANGER

Elixair ${ }^{\circledR}$ Range available on request

## HOW IT WORKS?

An earth-to-air heat exchanger (EAHX) is a surface geothermal solution for buildings, involving a buried pipe system which circulates fresh air.
It aims to warm up fresh air in buildings in winter and cool it down in summer. Based on thermal air-to-ground exchanges, it is a passive solution.
Where installed, the earth-to-air heat exchanger plays an active role in the building's thermal comfort.
ELIXAIR ${ }^{*}$ by PAM is a comprehensive offer, designed to build earth-to-air heat exchangers combining safety and efficiency with ductile iron products.


In winter the Elixair system heats the air

$-5^{\circ} \mathrm{C}$


## RECOMMENDED USE:

> Public buildings
> Commercial and industrial buildings
$>$ Farm buildings

## MAJOR BENEFITS:

> System under French Technical Approval 14/14-2056 CSTB
> Energy savings thanks to the complete system and the high thermal conductivity of ductile iron
> Resistance to ground loading and traffic: ductile iron pipe systems can be buried deep without damage, also under areas which are driven over or car parks
> Withstands rustic laying conditions allowing backfill with the extracted materials
> Excellent air tightness due to Express or Standard couplings working under compression
> Durability: as for all buried systems, strength and longlasting properties are key factors to avoiding premature replacements.


## THERMAL PERFORMANCES:

$>$ In winter: in-out average temperature difference $=7$ to $12^{\circ} \mathrm{C}$
$>$ In summer: in-out average temperature difference $=7$ to $16^{\circ} \mathrm{C}$

## TECHNICAL SUPPORT:

Send us your project and we will be able to help you with the supply of:
> Your earth-to-air heat exchanger
$>$ The bill of quantities
$>$ The heat energy saved in winter
> The cooling energy saved in summer

Contact us: tcbatiment.sgpam@saint-gobain.com

## COUPLINGS

## COUPLINGS MAIN FEATURES

A coupling is made of several components: casing, screws, barrel and gasket as described in the drawing.

(1) Screw and nut
2) Casing
(3) Barrel
(4) Gasket

## SEVERAL GRADES OF STEEL

We follow a global material designation for steel components of the coupling described in the following table.

Material designation*

|  |  | DIN | AISI |
| :--- | :--- | :--- | :--- |
| W2 | Screw and nut | Coated steel class 8.8 |  |
|  | Barrels | 1.4510 | 430 Ti |
|  | Casing or strap | 1.4510 | 430 Ti |
| W4 | Screw | 1.4404 | 316 L |
|  | Barrels | 1.4401 | 316 |
|  | Casing or strap | 1.4301 | 304 |
| W5 | Screw | 1.4404 | 316 L |
|  | Barrels | 1.4401 | 316 |
|  | Casing or strap | 1.4404 | 316 L |

*Please refer to datasheet for specific information as some material may differ depending on the coupling design.

## ELASTOMERIC GASKETS

The choice of the elastomeric gasket is related to the nature of the effluent. EPDM: EPDM rubber is suitable for most types of effluents.
NBR: Nitrile Butadiene Rubber is recommended for wastewater and runoff water liable to contain hot oil, solvents or hydrocarbons. They are recommended for infrastructure applications.

## COUPLING SELECTION GUIDE

|  |  | Type of network |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Type of effluent |  | Aerial network | In concrete | External stresses* | Burried network (A) | Infrastructure B |
|  | Wastewater 1 | S range w2 wa eom |  | Zn range ws eom | Itinero ${ }^{\circledR}$ <br> (ws) |  |
|  | Rainwater 2 |  |  |  |  |
|  | Agressive effluents | Plus range | (12) FPOM |  |  | Plus range ws EDM |  |
|  | Hydrocarbon runoff water | Plus range |  |  |  |  |



## COUPLINGS

We provide a large range of couplings to match all building specifications. Our products are available in different versions to withstand all types of effluents, pressures and external stresses.

## STANDARD COUPLINGS

PAM Rapid (p.134)


The single-bolt PAM Rapid coupling allows fast and reliable installation. It ensures optimized watertightness, pressure and corrosion resistance.

## MAJOR BENEFITS:

> Compliant with standard EN 877
> Ease of installation
> Suitable for projects with effluents containing solvents, hydrocarbons (i.e. car parks), due to the availability of the NBR version (nitrile gasket)

## MATERIAL:

> Main material: W2 or W5 (AISI 316L)
> Gasket: EPDM or NBR

## PRESSURE RESISTANCE:

> Exceeds the EN 877 requirements - DN 50 to 125: 10 bar / DN 150 to 200: 5 bar / DN 250 to 300: 3 bar.

## PAM R (p.135)

## MAJOR BENEFITS:

> Compliant with standard EN 877
$>$ Full opening strap particularly suited to renovation projects

## MATERIAL:

> Main material: W5 (AISI 316L)
> Gasket: EPDM

## SMU PAM (p.135)



Inspired by the PAM Rapid coupling design, the SMU
PAM coupling, available in small diameters, has the same performance but is a larger version. This larger coupling facilitates installation where cuts are not perfectly square.

## MAJOR BENEFITS:

> Compliant with standard EN 877
$>$ Possible compensation of misalignment due to its large dimension

## MATERIAL:

> Main material: W2 or W5 (AISI 316L)
> Gasket: EPDM

## PRESSURE RESISTANCE:

> Exceeds the EN 877 requirements - DN 50 to 125: 10 bar / DN 150 to 200: 5 bar / DN 250 to 300: 3 bar
" $R$ " for Repair: this coupling is particularly suited to repairs and retrofits. It is installed in two separate parts.

PRESSURE RESISTANCE:
> Exceeds the EN 877 requirements - DN 50 to 125: 10 bar / DN 150 to 200: 5 bar.

OUR
SOLUTIONS

## HIGH PRESSURE COUPLINGS



## PAM HP FLEX coupling

(p.136)

PAM HP FLEX couplings withstand up to 10 bar of hydrostatic pressure for most diameters. These couplings are used for straight runs where the pressures can occur.

## MAJOR BENEFITS:

> Compliant with standard EN 877
$>$ The solution for large-diameter networks (>300 mm)

## MATERIAL:

$>$ Main material: W4 (AISI 304) or W5 (AISI 316L)
> Gasket: EPDM or NBR

## PRESSURE RESISTANCE:

> Exceeds the EN 877 requirements DN 100 to 400: 10 bar / DN 500 and DN 600: 6 bar


## PAM HP GRIP coupling

(p.137)

In sections where end thrust efforts have to be addressed, the autogrip couplings are alternative solutions for securing junctions whilst addressing pressure. The PAM HP GRIP couplings are self-anchored couplings with built-in claw rings.

## MAJOR BENEFITS:

> Compliant with standard EN 877
> The 2-in-1 solution: coupling and grip collar with only one product
> Particularly suited to EPAMS* installation

## MATERIAL:

> Main material: W4 (AISI 304) or W5 (AISI 316L)
> Gasket: EPDM or NBR

## PRESSURE RESISTANCE:

> Exceeds the EN 877 requirements DN 100 to 400: 10 bar / DN 500 and DN 600: 4 bar
$00 / 3748$ )N125 45-21 = 눙

## 05

## PRODUCT CATALOG

## 86 WASTEWATER

, Domestic use: SMU S
, Intensive use: SMU Plus, SMU Zn

## RAINWATER

, Gravity systems: Residential (Type R)
, Siphonic systems: EPAMS ${ }^{\circledR}$

## INFRASTRUCTURE

, tinero $^{\circ}$

## COUPLINGS, COLLARS

## 134 \& CONNECTORS

SUPPORTING \& FIXING SYSTEMS
ACCESSORIES

## SMU S - PIPES



| DN | L | H | W | Weight | Product code |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 50 | 3000 | 58 | 58 | 12.9 | 156360 |
| 75 | 3000 | 83 | 83 | 18.8 | 156452 |
| 100 | 3000 | 110 | 110 | 25.1 | 156560 |
| 125 | 3000 | 135 | 135 | 35.3 | 156733 |
| 150 | 3000 | 160 | 160 | 42.1 | 156824 |
| 200 | 3000 | 210 | 210 | 69.1 | 156948 |
| 250 | 3000 | 274 | 274 | 99.5 | 157047 |
| 300 | 3000 | 326 | 326 | 129.4 | 157112 |
| 400 | 3000 | 429 | 429 | 179.5 | 185193 |
|  | 2800 | 429 | 429 | 167.5 | 216735 |

* For dimensions over DN 400 please contact us.



## SMU S - FITTINGS

> BENDS | Short radius bends

$15^{\circ}$ BENDS

| DN | L | H | W | a | q | Weight | Product <br> code |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 50 | 66 | 80 | 58 | 40 | 66 | 0.4 | 155752 |
| 75 | 93 | 99 | 83 | 45 | 78 | 0.68 | 176702 |
| 100 | 121 | 112 | 110 | 50 | 83 | 1 | 155816 |
| 125 | 148 | 134 | 135 | 60 | 99 | 1.7 | 155870 |
| 150 | 173 | 148 | 160 | 65 | 108 | 2.5 | 155903 |
| 200 | 227 | 184 | 210 | 80 | 129 | 4.6 | 155932 |

## > BENDS | Short radius bends

$22^{\circ}$ BENDS

|  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |


|  | $\xrightarrow{L}$ | $0^{\circ} \mathrm{BE}$ |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 4 | 4 | DN | L | H | W | a | 9 | Weight | Product code |
|  | $\square{ }^{\circ}$ | 50 | 76 | 97 | 58 | 45 | 69 | 0.5 | 155753 |
|  | - ${ }^{\text {r }}$ | 75 | 102 | 114 | 83 | 50 | 73 | 0.8 | 176703 |
|  |  | 100 | 132 | 136 | 110 | 60 | 81 | 1.3 | 252058 |
|  |  | 125 | 160 | 164 | 135 | 70 | 96 | 2 | 155871 |
|  |  | 150 | 189 | 188 | 160 | 80 | 108 | 3 | 252060 |
| , | , | 200 | 243 | 229 | 210 | 95 | 124 | 5.4 | 252056 |
|  | 3 | 250 | 309 | 270 | 274 | 110 | 133 | 9.7 | 155948 |
|  | $\cdots$ | 300 | 367 | 322 | 326 | 130 | 159 | 15.5 | 155960 |
|  |  | 400 | 478 | 369 | 429 | 184 | 173 | 26 | 170731 |


|  |  | $45^{\circ}$ BENDS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\stackrel{\pi}{0}$ |  | DN | L | H | W | a | 9 | Weight | Product code |
|  | - VI | 50 | 84 | 106 | 58 | 50 | 65 | 0.6 | 156384 |
|  | - | 75 | 112 | 132 | 83 | 60 | 73 | 0.9 | 156476 |
|  |  | 100 | 142 | 158 | 110 | 70 | 80 | 1.6 | 156593 |
| - |  | 125 | 171 | 184 | 135 | 80 | 89 | 2.1 | 156756 |
|  |  | 150 | 199 | 210 | 160 | 90 | 97 | 3.2 | 156850 |
|  |  | 200 | 256 | 262 | 210 | 110 | 113 | 5.3 | 156970 |
|  | $3$ | 250 | 324 | 319 | 274 | 130 | 125 | 10 | 157069 |
|  | ( ${ }^{(1)}$ | 300 | 387 | 380 | 326 | 155 | 149 | 18.3 | 157134 |
|  | - | 400 | 540 | 573 | 429 | 247 | 270 | 34.4 | 157175 |

*For dimensions over DN 400 please contact us.

## > BENDS | Short radius bends




## $88^{\circ}$ BENDS

| DN | L | H | W | a | q | Weight | Product <br> code |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 50 | 104 | 107 | 58 | 75 | 49 | 0.8 | 156379 |
| 75 | 138 | 140 | 83 | 95 | 57 | 1.4 | 156471 |
| 100 | 166 | 169 | 110 | 110 | 59 | 2.2 | 156588 |
| 125 | 194 | 197 | 135 | 125 | 62 | 2.9 | 156752 |
| 150 | 227 | 230 | 160 | 145 | 70 | 4.3 | 156844 |
| 200 | 288 | 291 | 210 | 180 | 81 | 8.1 | 156966 |
| 250 | 360 | 363 | 274 | 223 | 89 | 13.5 | 157065 |
| 300 | 427 | 431 | 326 | 280 | 105 | 27.7 | 157130 |
| 400 | 644 | 651 | 429 | 466 | 223 | 59 | 245567 |

## > BENDS | Long radius bends


$88^{\circ}$ BENDS

| DN | L | H | W | a | b | Weight | Product <br> code |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 100 | 324 | 324 | 110 | 269 | 230 | 4.2 | 156606 |
| 150 | 349 | 349 | 160 | 274 | 210 | 8 | 156860 |


$135^{\circ}$ BENDS

| DN | L | H | W | $\circ$ | p | Weight | Product <br> code |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 100 | 314 | 272 | 110 | 236 | 100 | 4.5 | 155818 |


$\qquad$

BENDS | Long tail bends


## $45^{\circ}$ BENDS

| DN | L | H | W | a | b | $\circ$ | q | Weight Product |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 100 | 338 | 143 | 110 | 250 | 250 | 180 | 260 | 3.5 | 155824 |



## WASTEWATER

Domestic use - SMU S

## > BENDS | Long taill bends


$88^{\circ}$ BENDS

| DN | L | H | W | a | b | $\circ$ | q | Weight | Product <br> code |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 100 | 305 | 165 | 110 | 110 | 250 | 140 | 195 | 3.7 | 155823 |



BENDS | $88^{\circ}$ Doulble bends


| DN | L | H | W | a | b | c | $\circ$ | Weight | Product <br> code |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 50 | 148 | 148 | 58 | 121 | 50 | 100 | 148 | 1 | 235797 |
| 75 | 183 | 183 | 83 | 145 | 60 | 120 | 183 | 1.5 | 171621 |
| 100 | 228 | 228 | 110 | 170 | 70 | 140 | 228 | 2.8 | 233647 |
| 125 | 265 | 265 | 135 | 195 | 80 | 160 | 265 | 4.4 | 233648 |
| 150 | 303 | 303 | 160 | 219 | 90 | 180 | 303 | 6.3 | 233649 |

> BENDS | $88^{\circ}$ Long tail double bends

"All dimensions are in mm and nominal weights are in kg " - "Hatch patterned area in the drawings shows the max. cutting length".

## > BENDS | Offsets



| DN | L | H | W | b | c | Weight | Product <br> code |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 175 | 205 | 110 | 65 | 70 | 2 | 155812 |
| 100 | 240 | 270 | 110 | 130 | 70 | 3.7 | 155821 |
|  | 310 | 340 | 110 | 200 | 70 | 4.2 | 155822 |



BENDS $\mid 88^{\circ}$ Vented bends

| DN | Ventilation | L | $H$ | W | $p$ | $q$ | $r$ | Weight | Product <br> code |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 100 | Radial | 166 | 169 | 150 | 95 | 59 | 110 | 2.15 | 157581 |
| 100 | Axial | 200 | 169 | 110 | 166 | 59 | 110 | 2.15 | 156585 |

Radial



## > BRANCHES | Single branches

## $45^{\circ}$ BRANCHES



| DN | dn | L | H | W | b | $c$ | $\circ$ | $p$ | $q$ | $r$ | Weight Product |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| code |  |  |  |  |  |  |  |  |  |  |  |

[^8]$68^{\circ}$ BRANCHES


| DN | dn | L | H | W | b | $c$ | $\circ$ | $p$ | $q$ | $r$ | WeightProduct <br> code |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 50 | 50 | 118 | 145 | 58 | 80 | 80 | 55 | 117 | 65 | 37 | 1 | 156433 |
| 75 | 50 | 140 | 155 | 83 | 95 | 95 | 60 | 122 | 69 | 42 | 1.4 | 156488 |
|  | 75 | 158 | 180 | 83 | 110 | 110 | 70 | 149 | 72 | 37 | 2 | 156542 |
|  | 50 | 168 | 155 | 110 | 100 | 110 | 55 | 123 | 69 | 43 | 2 | 156616 |
| 100 | 75 | 186 | 185 | 110 | 115 | 125 | 70 | 155 | 79 | 44 | 2.6 | 156623 |
|  | 100 | 195 | 220 | 110 | 130 | 130 | 85 | 189 | 87 | 50 | 2.8 | 156699 |
|  | 50 | 189 | 165 | 135 | 110 | 120 | 55 | 126 | 72 | 50 | 2.6 | on request |
| 125 | 100 | 222 | 225 | 135 | 140 | 145 | 85 | 190 | 88 | 50 | 3.9 | 156773 |
|  | 125 | 235 | 255 | 135 | 155 | 155 | 100 | 220 | 95 | 50 | 4.5 | 156811 |
|  | 100 | 243 | 235 | 160 | 150 | 155 | 85 | 194 | 92 | 55 | 4.8 | 156877 |
| 150 | 125 | 262 | 265 | 160 | 165 | 170 | 100 | 226 | 101 | 56 | 5.7 | 156881 |
|  | 150 | 276 | 295 | 160 | 180 | 180 | 115 | 256 | 108 | 55 | 6.5 | 156929 |
|  | 100 | 296 | 260 | 210 | 175 | 185 | 85 | 205 | 102 | 67 | 7.2 | on request |
| 200 | 150 | 329 | 310 | 210 | 200 | 210 | 110 | 263 | 114 | 62 | 8.5 | 156987 |
|  | 200 | 352 | 365 | 210 | 225 | 225 | 140 | 321 | 126 | 63 | 12 | 157027 |
| 250 | 200 | 420 | 390 | 274 | 255 | 265 | 135 | 428 | 132 | 68 | 18.3 | 157076 |
|  | 250 | 452 | 460 | 274 | 285 | 285 | 170 | 408 | 154 | 77 | 21.1 | 157104 |
| 300 | 300 | 544 | 545 | 326 | 345 | 345 | 170 | 430 | 178 | 80 | 33.4 | 157167 |


$88^{\circ}$ BRANCHES

| DN | dn | L | H | W | b | c | $\circ$ | $p$ | $q$ | $r$ | WeightProduct <br> code |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 50 | 50 | 110 | 145 | 58 | 66 | 80 | 79 | 111 | 53 | 31 | 1 | 156431 |
| 75 | 50 | 132 | 160 | 83 | 75 | 90 | 85 | 117 | 59 | 42 | 1.5 | 156486 |
|  | 75 | 138 | 180 | 83 | 85 | 95 | 95 | 140 | 57 | 37 | 1.6 | 156538 |
|  | 50 | 161 | 170 | 110 | 76 | 105 | 94 | 127 | 69 | 45 | 2 | 156613 |
| 100 | 75 | 166 | 190 | 110 | 90 | 110 | 100 | 145 | 62 | 40 | 2.4 | 156620 |
|  | 100 | 172 | 220 | 110 | 105 | 115 | 115 | 174 | 64 | 41 | 2.8 | 156695 |
|  | 50 | 188 | 180 | 135 | 82 | 120 | 98 | 131 | 73 | 51 | 2.6 | 156768 |
| 125 | 75 | 194 | 205 | 135 | 100 | 125 | 105 | 151 | 68 | 48 | 2.9 | 176722 |
|  | 100 | 199 | 235 | 135 | 110 | 130 | 125 | 184 | 74 | 48 | 4.2 | 155880 |
|  | 125 | 205 | 260 | 135 | 123 | 135 | 137 | 209 | 74 | 48 | 5 | 156809 |
|  | 50 | 221 | 200 | 160 | 100 | 140 | 100 | 134 | 76 | 51 | 3.9 | 156870 |
|  | 75 | 221 | 220 | 160 | 105 | 140 | 115 | 161 | 78 | 55 | 4.4 | 156872 |
| 150 | 100 | 227 | 245 | 160 | 115 | 145 | 130 | 190 | 80 | 52 | 5.6 | 156874 |
|  | 125 | 232 | 275 | 160 | 128 | 150 | 147 | 220 | 85 | 56 | 6.1 | 172289 |
|  | 150 | 237 | 300 | 160 | 142 | 155 | 158 | 243 | 83 | 55 | 6.7 | 156925 |
| 200 | 100 | 282 | 270 | 210 | 125 | 175 | 145 | 206 | 96 | 64 | 8.8 | 156980 |
| 200 | 388 | 365 | 210 | 172 | 183 | 193 | 296 | 86 | 67 | 11 | 157024 |  |
| 250 | 250 | 366 | 455 | 274 | 228 | 243 | 240 | 375 | 101 | 77 | 19.5 | 157102 |
| 300 | 300 | 434 | 530 | 326 | 265 | 265 | 265 | 437 | 111 | 87 | 35 | 157165 |
| 400 | 400 | 616 | 684 | 429 | 314 | 370 | 370 | 595 | 165 | 90 | 67 | 170732 |

## BRANCHES | Long tail single branches



## $45^{\circ}$ BRANCHES

| DN | dn | L | H | W | b | c | d | $e$ | $p$ | $q$ | $r$ | WeightProduct <br> code |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 100 | 100 | 238 | 430 | 110 | 205 | 205 | 225 | 170 | 424 | 346 | 241 | 5.3 | 156723 |
| 150 | 150 | 323 | 705 | 110 | 265 | 265 | 440 | 350 | 684 | 571 | 403 | 18.3 | 156938 |
| 200 | 200 | 423 | 770 | 110 | 340 | 346 | 430 | 320 | 749 | 600 | 383 | 26 | 157036 |



## $68^{\circ}$ BRANCHES

| DN | dn | L | $H$ | $W$ | $b$ | $c$ | $d$ | $e$ | $p$ | q | r | Weight | Product <br> code |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 100 | 100 | 195 | 460 | 110 | 130 | 130 | 330 | 250 | 430 | 328 | 290 | 4.8 | 156721 |



## $88^{\circ}$ BRANCHES

| DN | dn | L | $H$ | $W$ | $b$ | $c$ | $d$ | $e$ | $p$ | $q$ | $r$ | Weight Product |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| code |  |  |  |  |  |  |  |  |  |  |  |  |



[^9]
## > BRANCHES | Double branches

> Short double branches
$45^{\circ}$ BRANCHES


| DN | dn | L | $H$ | $W$ | $b$ | $c$ | $d$ | $p$ | $q$ | $r$ | Weight Product |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| code |  |  |  |  |  |  |  |  |  |  |  |


$68^{\circ}$ BRANCHES

| DN | dn | L | H | W | b | c | d | $p$ | $q$ | $r$ | Weight | Product <br> code |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 50 | 50 | 178 | 145 | 58 | 85 | 85 | 60 | 118 | 64 | 35 | 1.2 | 156437 |
| 75 | 75 | 234 | 180 | 83 | 110 | 110 | 70 | 149 | 72 | 36 | 2.3 | 156546 |
| 100 | 75 | 262 | 185 | 110 | 115 | 125 | 70 | 155 | 79 | 44 | 3 | 156609 |
|  | 100 | 281 | 220 | 110 | 130 | 130 | 85 | 189 | 87 | 50 | 3.4 | 156707 |
| 125 | 100 | 309 | 225 | 135 | 140 | 145 | 85 | 190 | 88 | 50 | 4.4 | 156766 |
|  | 125 | 336 | 255 | 135 | 155 | 155 | 100 | 220 | 95 | 51 | 5.5 | 156815 |
| 150 | 125 | 364 | 265 | 160 | 165 | 170 | 100 | 226 | 101 | 56 | 6.6 | 156867 |
|  | 150 | 392 | 295 | 160 | 180 | 180 | 115 | 256 | 108 | 57 | 8.2 | 156934 |
| 200 | 150 | 448 | 310 | 210 | 200 | 210 | 110 | 259 | 110 | 58 | 10.7 | 156978 |
|  | 200 | 494 | 365 | 210 | 225 | 225 | 140 | 321 | 126 | 67 | 14 | 157032 |


$88^{\circ}$ BRANCHES

| DN | dn | L | $H$ | $W$ | $b$ | $c$ | $d$ | $p$ | $q$ | $r$ | WeightProduct <br> code |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 50 | 212 | 170 | 110 | 76 | 105 | 94 | 127 | 69 | 45 | 2.2 | 155825 |
| 100 | 75 | 220 | 190 | 110 | 90 | 110 | 100 | 145 | 62 | 40 | 2.7 | 179685 |
|  | 100 | 243 | 230 | 110 | 105 | 120 | 115 | 179 | 69 | 49 | 3.7 | 156704 |
| 125 | 100 | 263 | 235 | 135 | 115 | 135 | 130 | 184 | 74 | 48 | 4.5 | 155874 |
| 150 | 100 | 294 | 245 | 160 | 115 | 145 | 130 | 190 | 80 | 52 | 5.9 | 155907 |



## WASTEWATER

## Domestic use - SMU S

## > Long tail double branches



## $68^{\circ}$ BRANCHES

| DN | dn | L | $H$ | $W$ | $b$ | $c$ | $d$ | $p$ | $q$ | $r$ | Weight | Product <br> code |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 100 | 100 | 280 | 414 | 110 | 130 | 130 | 284 | 244 | 281 | 383 | 6.3 | 176896 |



## $88^{\circ}$ BRANCHES

| DN | dn | L | $H$ | W | b | c | d | $p$ | $q$ | r | Weight | Product <br> code |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 100 | 100 | 243 | 405 | 110 | 110 | 120 | 295 | 222 | 244 | 354 | 5.9 | 176883 |



Corner branches - Short corner branches

$45^{\circ}$ BRANCHES

| DN | dn | L | H | W | b | c | d | $p$ | $q$ | $r$ | Weight | Product <br> code |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 100 | 100 | 227 | 260 | 227 | 190 | 190 | 70 | 242 | 166 | 46 | 5.2 | 156716 |



## $68^{\circ}$ BRANCHES

| DN | dn | L | $H$ | $W$ | $b$ | $c$ | $d$ | $p$ | $q$ | $r$ | Weight | Product <br> code |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 75 | 75 | 158 | 180 | 158 | 110 | 110 | 70 | 149 | 72 | 36 | 2.1 | 156548 |
| 100 | 100 | 195 | 220 | 195 | 130 | 130 | 90 | 189 | 87 | 50 | 3.5 | 156714 |




[^10]
$88^{\circ}$ BRANCHES

| DN | dn | L | $H$ | $W$ | $b$ | $c$ | $d$ | $p$ | $q$ | $r$ | WeightProduct <br> code |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 75 | 75 | 137 | 180 | 136 | 85 | 95 | 95 | 140 | 57 | 36 | 2 | 179682 |
| 100 | 75 | 165 | 190 | 165 | 90 | 110 | 100 | 145 | 62 | 40 | 2.8 | 179683 |
|  | 100 | 177 | 230 | 177 | 105 | 120 | 115 | 179 | 69 | 44 | 2.8 | 156712 |
| 125 | 100 | 199 | 235 | 199 | 110 | 130 | 125 | 184 | 74 | 48 | 4.3 | 155889 |
| 150 | 100 | 227 | 245 | 227 | 115 | 145 | 130 | 190 | 80 | 52 | 5.3 | 155919 |


> Corner branches - Long tail corner branches

$68^{\circ}$ BRANCHES

| DN | dn | L | $H$ | $W$ | $b$ | $c$ | $d$ | $p$ | q | r | Weight Product |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| code |  |  |  |  |  |  |  |  |  |  |  |


$88^{\circ}$ BRANCHES

> BRANCHES | Single long arm branches


| DN | dn | L | H | W | a | c | p | Weight Product |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 100 | 100 | 282 | 450 | 110 | 260 | 70 | 340 | 6 | 156726 |

"All dimensions are in mm and nominal weights are in kg " - "Hatch patterned area in the drawings shows the max. cutting length".

## > TAPERED PIPES | Reducers



| DN | dn | L | H | W | b | c | d | Weight Product |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| code |  |  |  |  |  |  |  |  |

* For dimensions over DN 400 please contact us.


## > ACCESS FITTINGS | Access pipes

## ROUND DOOR



| DN | L | H | W | ID | OD | Weight | Number of bolts | Product code |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 50 | 105 | 190 | 93 | 53 | 105 | 2.3 | 2 | 179191 |
| 75 | 134 | 220 | 115 | 78 | 134 | 3.2 | 2 | 179647 |
| 100 | 159 | 260 | 139 | 104 | 159 | 5 | 2 | 179192 |
| 125 | 202 | 280 | 202 | 152 | 202 | 7.0 | 3 | 280010 |
| 150 | 243 | 320 | 226 | 180 | 243 | 9.8 | 4 | 280012 |
| 200 | 243 | 360 | 277 | 180 | 243 | 12.9 | 4 | 280013 |
| 250 | 274 | 380 | 362 | 180 | 243 | 18.7 | 4 | 280014 |
| 300 | 326 | 400 | 413 | 180 | 243 | 25 | 4 | 280015 |



[^11]

RECTANGULAR DOOR

| DN | L | H | W | c | d | e | f | Weight | Product <br> code |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 125 | 190 | 370 | 169 | 255 | 225 | 125 | 101 | 10.3 | 179197 |
| 150 | 215 | 395 | 192 | 280 | 250 | 150 | 112 | 14.3 | 179198 |
| 200 | 262 | 435 | 242 | 330 | 300 | 200 | 137 | 22 | 179199 |
| 250 | 330 | 540 | 307 | 380 | 350 | 260 | 170 | 38.5 | 179200 |
| 300 | 380 | 610 | 358 | 430 | 400 | 310 | 195 | 50 | 179201 |



## ACCESS FITTINGS | Blank ends



| DN | L | H | W | Weight | Product code |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 50 | 58 | 30 | 58 | 0.25 | 156376 |
| 75 | 83 | 35 | 83 | 0.45 | 156466 |
| 100 | 110 | 40 | 110 | 0.8 | 156581 |
| 125 | 135 | 45 | 135 | 1.2 | 156749 |
| 150 | 160 | 50 | 160 | 1.7 | 156841 |
| 200 | 210 | 60 | 210 | 3.2 | 156963 |
| 250 | 274 | 70 | 274 | 5.9 | 157062 |
| 300 | 326 | 80 | 326 | 10 | 157127 |

## > ACCESS FITTINGS | Expansion plugs



| DN | L | H | W | $\circ$ | Weight | Screw | Product code |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 50 | 62 | 47 | 62 | 14 | 0.22 | M8x30 | 156374 |
| 75 | 90 | 71 | 90 | 20 | 0.6 | M8x50 | 156464 |
| 100 | 118 | 77 | 118 | 23 | 1.2 | M8x60 | 156579 |
| 125 | 143 | 77 | 143 | 24 | 1.7 | M8x60 | 156747 |
| 150 | 168 | 73 | 168 | 22 | 2.4 | M10x45 | 156839 |
| 200 | 220 | 87 | 220 | 26 | 5 | M10x60 | 156961 |
| 250 | 284 | 100 | 284 | 44 | 6.2 | M10x70 | 157060 |
| 300 | 336 | 100 | 336 | 44 | 9 | M10x70 | 157125 |

See p. 149 for information on resistance to accidental pressure.
Expansion plugs with bleeding valve are available on request for DN 125/DN 150 and DN 200 (for watertightness tests).

## WASTEWATER

Domestic use - SMU S

## > TRAPS \& VENTILATION | Traps

BRANCH TRAPS DN < 200

| DN | L | H | W | $c$ | $d$ | $e$ | $f$ | $c$ | $\circ$ | $p$ | $q$ | $r$ | $s$ | Access (*) | Weight Product |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| code |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |



(*) Bottom cleaning access: EP by expansion plug / TS by tight sheet
Designed for rainwater networks. The arrows stamped on the cast iron body show the flow direction.

BRANCH TRAPS DN 200

| DN | L | H | W | $c$ | d | $\epsilon$ | $f$ | $c$ | $\circ$ | $\rho$ | $r$ | s | Weight Product code |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 200 | 600 | 590 | 210 | 100 | 420 | 180 | 400 | 200 | 300 | 80 | 415 | 510 | 34.3 | 157018 |



TRAPS DN $\geq 250$ : Installation with $88^{\circ}$ bends

| DN | L | H |
| :---: | :---: | :---: |
| 250 | 900 | 725 |
| 300 | 1070 | 860 |

## > TRAPS \& VENTILATION | Traps



ANTI-SYPHON TRAPS with bottom access door DN 50

| DN | L | H | W | c | d | Weight | Product <br> code |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 50 | 165 | 255 | 58 | 80 | 187 | 2.5 | 229107 |



ANTI-SYPHON TRAPS with bottom access door DN 100-150

| DN | L | H | W | b | c | Weight | Product <br> code |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 100 | 316 | 382 | 110 | 316 | 350 | 9.2 | 179013 |
| 150 | 412 | 531 | 160 | 412 | 470 | 24.8 | 156916 |



ANTI-SYPHON TRAPS with side access door*

| DN | L | H | W | a | $c$ | $\circ$ | $p$ | $q$ | WeightProduct <br> code |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 50 | 165 | 230 | 58 | 136 | 80 | 130 | 213 | 155 | 2.8 | 156422 |
| 75 | 240 | 300 | 83 | 199 | 80 | 131 | 272 | 189 | 4.8 | 156522 |

*With brass closing


Suitable for all wastewater drainage systems, the Anti-Syphon Trap is particularly well-suited to systems without secondary ventilation. It ensures the retention of a water seal within the body of the trap to prevent odors traveling backwards through the system and fouling the atmosphere around sinks, washbasins, baths, rainwater outlets, etc. The Anti-Syphon Trap works by preventing the siphoning effect of a heavy discharge through the system. It does this through the internal partition within the trap allowing the air to bypass the water, thus breaking the vacuum created by the discharge water.


## WASTEWATER

Domestic use - SMU S

## > TRAPS \& VENTILATION | Traps

## VENTED TRAPS

| DN | Outlet | L | H | a | b | $c$ | d | e | f | Weight |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 100 | Vertical | 575 | 371 | 163 | 236 | 229 | 342 | 228 | - | 8.81 |
| 100 | Horizontal | 399 | 371 | 163 | 236 | 108 | 342 | 228 | 283 | 6.55 |



The vertical outlet version consists of $3 \times$ product code: 156588 and $1 \times$ product code 156585


The horizontal outlet consists of $1 \times$ product code: 156585 and $2 \times$ product code: 156588

| DN | Dn | Product code |
| :---: | :---: | :---: |
| 100 | - | 156588 |
| 100 | 50 | 156585 |

## > TRAPS \& VENTILATION I Roof penetrators



| DN | L | H | W | a | b | Weight | Product <br> code |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 75 | 286 | 60 | 286 | 135 | 135 | 6.1 | 205922 |
| 100 | 324 | 60 | 324 | 158 | 246 | 6.6 | 205924 |
| 125 | 349 | 60 | 349 | 188 | 271 | 6.6 | 205925 |



| DN | Product code <br> EPDM gasket | Weight | Product code <br> NBR gasket | Weight |
| :---: | :---: | :---: | :---: | :---: |
| 75 | 179894 | 0.2 | 179895 | 0.2 |
| 100 | 207320 | 0.3 | 207319 | 0.3 |
| 125 | 207335 | 0.3 | 207334 | 0.3 |

## WASTEWATER

Domestic use - SMU S

## > STACK SUPPORT



## > STACK SUPPORT PIPE



| DN | L | H | W | b | Weight | Product <br> code |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 50 | 87 | 220 | 87 | 8 | 1.3 | 156372 |
| 75 | 118 | 220 | 118 | 8 | 1.8 | 156462 |
| 100 | 145 | 220 | 145 | 8 | 2.4 | 156577 |
| 125 | 170 | 220 | 170 | 8 | 3.2 | 156745 |

## > STACK SUPPORT BRACKET



| DN | L | H | W | $\epsilon$ | g | h | Weight Product |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| code |  |  |  |  |  |  |  |



## > SPECIAL FITTINGS | Manifold connector



| DN | L | H | W | a | d | e | Weight | Product code |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 100 | 204 | 125 | 200 | 43 | 142 | 62 | 3.2 | 175626 |
| 150 | 265 | 165 | 290 | 70 | 184 | 81 | 6.1 | 175629 |



The multi-waste manifold simplifies waste plumbing by grouping all associated pipework from various sources such as sinks, basins, bidets, urinals and showers to one internal point above the finished floor level.
See p. 169 for installation details.

## WASTEWATER

## Domestic use - SMU S

## > SPECIAL FITTINGS | Multi-waste manifold



Low level waste connections

| DN | L | H | W | b | d | $f$ | g | $h$ | i | $j$ | $k$ | Weight Product |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| code |  |  |  |  |  |  |  |  |  |  |  |  |



## > SPECIAL FITTINGS | Single Stack Branch



Branches for single downpipe with 2 to 3 inlets - combined networks

| DN | Lateral adjustments | L | H | W | 0 | p | व | Weight | Product code |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 100 | 3 consecutive DN 100 at $90^{\circ}$ | 280 | 490 | 230 | 392 | 140 | 282 | 11 | 177237 |
|  | 2 DN 100 at $90^{\circ}$ | 230 | 490 | 230 | 392 | 140 | 282 | 10.4 | 177236 |
|  | 2 DN 100 at $180^{\circ}$ | 280 | 490 | 180 | 392 | 140 | 282 | 10.8 | 177235 |



## > SPECIAL FITTINGS | Compensators of movement



Every reference is composed of:

- one movement absorber
- two bi-directional stack support pipes

Acceptable pressure for DN 75 to 200:

- negative pressures up to - 0.9 bar
- positive pressures up to 3 bar (accidental and internal hydrostatic pressure)

FOR SHORT RANGES OF MOVEMENTS


| DN | OD | L | H | W | $q$ | $r$ | Socket extension |  |  |  | Weight |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | Product | Pode |
| :---: |
| code |



FOR LONG RANGES OF MOVEMENTS

| DN | OD | L | H | W | 9 | r | Socket extension |  |  | Weight | Product code |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  | K | Y | Z |  |  |
| 75 | 83 | 1794 | 218 | 83 | 81 | 139 | $\pm 60$ | $\pm 130$ | $\pm 130$ | 25.6 | 155051 |
| 100 | 110 | 1796 | 259 | 110 | 80 | 140 | $\pm 60$ | $\pm 130$ | $\pm 130$ | 27.5 | 155063 |
| 125 | 135 | 1796 | 275 | 135 | 80 | 140 | $\pm 60$ | $\pm 130$ | $\pm 130$ | 33 | 155068 |
| 150 | 160 | 1802 | 300 | 160 | 78 | 142 | $\pm 60$ | $\pm 130$ | $\pm 130$ | 39.8 | 155073 |
| 200 | 210 | 1824 | 362 | 210 | 78 | 142 | $\pm 60$ | $\pm 130$ | $\pm 130$ | 55.6 | 155078 |



## SMU Plus - PIPES

|  | DN | L | H | W | Weight | Product code |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 50 | 3000 | 58 | 58 | 12.9 | 155301 |
|  | 75 | 3000 | 83 | 83 | 18.8 | 155320 |
| - 3- Bratere | 100 | 3000 | 110 | 110 | 25.1 | 155347 |
| - ${ }^{13884}$ | 125 | 3000 | 135 | 135 | 35.3 | 155390 |
| - 20, 00,3748 | 150 | 3000 | 160 | 160 | 42.1 | 155412 |
|  | 200 | 3000 | 210 | 210 | 69.1 | 155446 |
|  | 250 | 3000 | 274 | 274 | 99.5 | 155474 |
|  | 300 | 3000 | 326 | 326 | 129.4 | 155491 |
|  |  | 3000 | 429 | 429 | 179.5 | 185196 |
|  | 400 | 2800 | 429 | 429 | 167.5 | 224507 |

* For dimensions over DN 400 please contact us.



## SMU Plus - FITTINGS

> BENDS | Short radius bends

$15^{\circ}$ BENDS


## > BENDS | Short radius bends

$22^{\circ}$ BENDS

|  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | DN | L | H | W | a | 9 | Weight | Product code |
| 0 |  | 50 | 70 | 88 | 58 | 40 | 66 | 0.45 | 155308 |
|  |  | 75 | 97 | 105 | 83 | 47 | 74 | 0.8 | 155327 |
|  |  | 100 | 126 | 125 | 110 | 54 | 84 | 1.3 | 155358 |
| (1) | $\checkmark$ | 125 | 152 | 143 | 135 | 61 | 92 | 1.9 | 155396 |
|  | 5 | 150 | 179 | 162 | 160 | 69 | 102 | 2.6 | 155421 |
|  |  | 200 | 233 | 200 | 210 | 83 | 122 | 4.4 | 155455 |
|  | - 3 | 250 | 300 | 240 | 274 | 100 | 138 | 9.5 | 155482 |
|  | , | 300 | 356 | 279 | 326 | 115 | 157 | 15.3 | 155499 |
|  |  | 400 | 466 | 324 | 429 | 142 | 177 | 23.7 | on request |

## $30^{\circ}$ BENDS

(

## $45^{\circ}$ BENDS



## WASTEWATER

Intensive use - SMU Plus
> BENDS | Short radius bends


$88^{\circ}$ BENDS

| DN | L | H | W | a | q | Weight | Product <br> code |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 50 | 104 | 107 | 58 | 75 | 49 | 0.8 | 155304 |
| 75 | 138 | 140 | 83 | 95 | 57 | 1.4 | 155323 |
| 100 | 166 | 169 | 110 | 110 | 59 | 2.2 | 155353 |
| 125 | 194 | 197 | 135 | 125 | 62 | 2.9 | 155393 |
| 150 | 227 | 230 | 160 | 145 | 70 | 4.3 | 155418 |
| 200 | 288 | 291 | 210 | 180 | 81 | 8.1 | 155451 |
| 250 | 360 | 363 | 274 | 223 | 89 | 13.5 | 155479 |
| 300 | 427 | 431 | 326 | 280 | 105 | 27.7 | 155496 |
| 400 | 644 | 651 | 429 | 466 | 223 | 59 | on request |

## BENDS | $88^{\circ}$ Double bends



| DN | L | H | W | a | b | c | $\circ$ | WeightProduct <br> code |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 50 | 148 | 148 | 58 | 121 | 50 | 100 | 148 | 1 | 235800 |
| 75 | 183 | 183 | 83 | 145 | 60 | 120 | 183 | 1.5 | 235801 |
| 100 | 228 | 228 | 110 | 170 | 70 | 140 | 228 | 2.8 | 155359 |
| 150 | 303 | 303 | 160 | 219 | 90 | 180 | 303 | 6.3 | 155422 |


> BRANCHES | Single branches
$45^{\circ}$ BRANCHES


| DN | dn | L | H | W | b | c | - | p | 9 |  | Weig | Product code |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 50 | 50 | 144 | 185 | 58 | 135 | 135 | 50 | 165 | 124 | 36 | 1.35 | 155316 |
| 75 | 50 | 156 | 180 | 83 | 135 | 135 | 45 | 161 | 120 | 43 | 1.6 | 155331 |
|  | 75 | 179 | 215 | 83 | 155 | 155 | 60 | 198 | 140 | 40 | 2.2 | 155344 |
| 100 | 50 | 191 | 200 | 110 | 165 | 165 | 35 | 172 | 131 | 47 | 2.4 | 155365 |
|  | 75 | 214 | 235 | 110 | 170 | 170 | 50 | 209 | 151 | 46 | 3.2 | 155368 |
|  | 100 | 238 | 275 | 110 | 205 | 205 | 70 | 253 | 175 | 45 | 4 | 155380 |
| 125 | 50 | 218 | 205 | 135 | 185 | 185 | 20 | 170 | 130 | 44 | 3.2 | 155398 |
|  | 75 | 237 | 240 | 135 | 195 | 200 | 45 | 215 | 156 | 51 | 4.2 | 176784 |
|  | 100 | 261 | 280 | 135 | 220 | 220 | 60 | 254 | 177 | 47 | 5 | 155400 |
|  | 125 | 284 | 320 | 135 | 240 | 240 | 80 | 296 | 201 | 49 | 5.2 | 155409 |
| 150 | 75 | 265 | 255 | 160 | 210 | 220 | 35 | 220 | 161 | 54 | 5.1 | 176785 |
|  | 100 | 287 | 295 | 160 | 240 | 240 | 55 | 262 | 185 | 54 | 5.8 | 155430 |
|  | 125 | 307 | 325 | 160 | 255 | 255 | 70 | 298 | 202 | 52 | 7.4 | 155432 |
|  | 150 | 323 | 355 | 160 | 265 | 265 | 90 | 333 | 219 | 53 | 7.9 | 155442 |
| 200 | 100 | 340 | 310 | 210 | 265 | 265 | 40 | 275 | 198 | 67 | 9.3 | 155459 |
|  | 125 | 360 | 340 | 210 | 280 | 280 | 55 | 310 | 215 | 64 | 11.6 | 173812 |
|  | 150 | 383 | 375 | 210 | 300 | 300 | 75 | 353 | 240 | 66 | 12.3 | 155461 |
|  | 200 | 418 | 455 | 210 | 340 | 340 | 115 | 428 | 280 | 68 | 17.1 | 155470 |
| 250 | 150 | 440 | 405 | 274 | 350 | 350 | 55 | 358 | 245 | 75 | 22 | 208730 |
|  | 200 | 486 | 480 | 274 | 390 | 390 | 90 | 440 | 291 | 75 | 22.4 | 155483 |
|  | 250 | 537 | 580 | 274 | 430 | 430 | 130 | 530 | 335 | 70 | 29 | 155490 |
| 300 | 250 | 588 | 580 | 326 | 465 | 465 | 115 | 540 | 347 | 80 | 37.6 | 155500 |
|  | 300 | 634 | 660 | 326 | 505 | 505 | 155 | 661 | 431 | 115 | 46.3 | 155507 |
| 400 | 300 | 728 | 660 | 429 | 555 | 555 | 105 | 620 | 389 | 86 | 56.4 | 155510 |
|  | 400 | 820 | 835 | 429 | 645 | 645 | 190 | 795 | 492 | 101 | 98 | on req |

[^12]
## > BRANCHES | Single branches

$68^{\circ}$ BRANCHES


| DN | dn | L | H | W | b | $c$ | $\circ$ | $p$ | $q$ | $r$ | WeightProduct <br> code |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 50 | 50 | 118 | 145 | 58 | 80 | 80 | 55 | 117 | 65 | 37 | 1 | 155315 |
| 75 | 50 | 140 | 155 | 83 | 95 | 95 | 60 | 122 | 69 | 42 | 1.4 | 155330 |
|  | 75 | 158 | 180 | 83 | 110 | 110 | 70 | 149 | 72 | 37 | 2 | 155343 |
| 100 | 50 | 168 | 155 | 110 | 100 | 110 | 55 | 123 | 69 | 43 | 2 | 155364 |
|  | 75 | 186 | 185 | 110 | 115 | 125 | 70 | 155 | 79 | 44 | 2.6 | 155367 |
|  | 100 | 195 | 220 | 110 | 130 | 130 | 85 | 189 | 87 | 50 | 2.8 | 155379 |
| 125 | 100 | 222 | 225 | 135 | 140 | 145 | 85 | 190 | 88 | 50 | 3.9 | 155399 |
|  | 125 | 235 | 255 | 135 | 155 | 155 | 100 | 220 | 95 | 50 | 4.5 | 155408 |
| 150 | 100 | 243 | 235 | 160 | 150 | 155 | 85 | 194 | 92 | 55 | 4.8 | 155429 |
|  | 125 | 262 | 265 | 160 | 165 | 170 | 100 | 226 | 101 | 56 | 5.7 | 155431 |
|  | 150 | 276 | 295 | 160 | 180 | 180 | 115 | 256 | 108 | 55 | 6.5 | 155441 |
| 200 | 150 | 329 | 310 | 210 | 200 | 210 | 110 | 263 | 114 | 62 | 8.5 | 155460 |
|  | 200 | 352 | 365 | 210 | 225 | 225 | 140 | 321 | 126 | 63 | 12 | 155469 |
| 250 | 250 | 452 | 460 | 274 | 285 | 285 | 170 | 408 | 154 | 77 | 21.1 | 155489 |
| 300 | 300 | 544 | 545 | 326 | 345 | 345 | 170 | 430 | 178 | 80 | 33.4 | 155506 |


$88^{\circ}$ BRANCHES

| DN | dn | L | H | W | b | c | $\circ$ | $p$ | $q$ | $r$ | WeightProduct <br> code |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 50 | 50 | 110 | 145 | 58 | 66 | 80 | 79 | 111 | 53 | 31 | 1 | 155314 |
| 75 | 50 | 132 | 160 | 83 | 75 | 90 | 85 | 117 | 59 | 42 | 1.5 | 155329 |
|  | 75 | 138 | 180 | 83 | 85 | 95 | 95 | 140 | 57 | 37 | 1.6 | 155342 |
| 100 | 50 | 161 | 170 | 110 | 76 | 105 | 94 | 127 | 69 | 45 | 2 | 155363 |
|  | 75 | 166 | 190 | 110 | 90 | 110 | 100 | 145 | 62 | 40 | 2.4 | 176746 |
|  | 100 | 172 | 220 | 110 | 105 | 115 | 115 | 174 | 64 | 41 | 2.8 | 155378 |
| 125 | 100 | 199 | 235 | 135 | 110 | 130 | 125 | 184 | 74 | 48 | 4.2 | 173022 |
|  | 125 | 205 | 260 | 135 | 123 | 135 | 137 | 209 | 74 | 48 | 5 | 155407 |
| 150 | 100 | 227 | 245 | 160 | 115 | 145 | 130 | 190 | 80 | 52 | 5.6 | 155428 |
|  | 150 | 237 | 300 | 160 | 142 | 155 | 158 | 243 | 83 | 55 | 6.7 | 155440 |
| 200 | 200 | 388 | 365 | 210 | 172 | 183 | 193 | 296 | 86 | 67 | 11 | 155468 |
| 250 | 250 | 366 | 455 | 274 | 228 | 243 | 240 | 375 | 101 | 77 | 19.5 | 155488 |
| 300 | 300 | 434 | 530 | 326 | 265 | 265 | 265 | 437 | 111 | 87 | 35 | 155505 |
| 400 | 400 | 616 | 684 | 429 | 314 | 370 | 370 | 595 | 165 | 90 | 67 | on request |

## > BRANCHES | Long tail single branches

$45^{\circ}$ BRANCHES


| DN | dn | L | H | W | b | $c$ | $d$ | $e$ | $p$ | $q$ | $r$ | WeightProduct <br> code |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 100 | 100 | 238 | 430 | 110 | 205 | 205 | 225 | 170 | 424 | 346 | 241 | 5.3 | 155381 |
| 150 | 150 | 323 | 705 | 110 | 265 | 265 | 440 | 350 | 684 | 571 | 403 | 18.3 | 155443 |
| 200 | 200 | 423 | 770 | 110 | 340 | 346 | 430 | 320 | 749 | 600 | 383 | 26 | 155471 |


$68^{\circ}$ BRANCHES


| DN | dn | L | $H$ | H | b | c | d | e | $p$ | q | r | Weight | Product <br> code |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 100 | 100 | 195 | 460 | 110 | 130 | 130 | 330 | 250 | 430 | 328 | 290 | 4.8 | 155388 |



## > BRANCHES | Double branches

## > Short double branches

## $45^{\circ}$ BRANCHES



| DN | dn | L | $H$ | $W$ | $b$ | $c$ | $d$ | $p$ | $q$ | $r$ | Weight Product |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| code |  |  |  |  |  |  |  |  |  |  |  |



## $68^{\circ}$ BRANCHES

| DN | dn | L | H | W | b | $c$ | d | $p$ | $q$ | $r$ | WeightProduct <br> code |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 50 | 50 | 178 | 145 | 58 | 85 | 85 | 60 | 118 | 64 | 35 | 1.2 | 155317 |
| 75 | 75 | 234 | 180 | 83 | 110 | 110 | 70 | 149 | 72 | 36 | 2.3 | 155345 |
| 100 | 75 | 262 | 185 | 110 | 115 | 125 | 70 | 155 | 79 | 44 | 3 | 155362 |
|  | 100 | 281 | 220 | 110 | 130 | 130 | 85 | 189 | 87 | 50 | 3.4 | 155383 |
| 125 | 100 | 309 | 225 | 135 | 140 | 145 | 85 | 190 | 88 | 50 | 4.4 | 155397 |
|  | 125 | 336 | 255 | 135 | 155 | 155 | 100 | 220 | 95 | 51 | 5.5 | 155410 |
| 150 | 125 | 364 | 265 | 160 | 165 | 170 | 100 | 226 | 101 | 56 | 6.6 | 155426 |
|  | 150 | 392 | 295 | 160 | 180 | 180 | 115 | 256 | 108 | 57 | 8.2 | 155444 |
| 200 | 150 | 448 | 310 | 210 | 200 | 210 | 110 | 259 | 110 | 58 | 10.7 | 155456 |
|  | 200 | 494 | 365 | 210 | 225 | 225 | 140 | 321 | 126 | 67 | 14 | 155472 |




## BRANCHES | Double branches

> Corner branches - Short corner branches

$45^{\circ}$ BRANCHES

| DN | dn | L | $H$ | $W$ | $b$ | $c$ | d | $p$ | $q$ | $r$ | Weight Product |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| code |  |  |  |  |  |  |  |  |  |  |  |


$68^{\circ}$ BRANCHES

| DN | dn | L | H | $W$ | b | $c$ | d | $p$ | $q$ | $r$ | Weight Productcode |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 75 | 75 | 158 | 180 | 158 | 110 | 110 | 70 | 149 | 72 | 36 | 2.1 | 155346 |
| 100 | 100 | 195 | 220 | 195 | 130 | 130 | 90 | 189 | 87 | 50 | 3.5 | 155386 |



## > BRANCHES | Single long arm branches



| DN | dn | L | H | W | a | $c$ | p | Weight Product |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| code |  |  |  |  |  |  |  |  |  |
| 100 | 100 | 282 | 450 | 110 | 260 | 70 | 340 | 6 | 155389 |



> TAPERED PIPES | Reducers


| DN | dn | L | H | W | b | c | d | WeightProduct <br> code |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 75 | 50 | 83 | 80 | 83 | 47 | 30 | 13 | 0.65 | 155312 |
| 100 | 50 | 110 | 80 | 110 | 45 | 30 | 26 | 0.9 | 155313 |
|  | 75 | 110 | 90 | 110 | 45 | 35 | 14 | 1 | 155337 |
|  | 50 | 135 | 85 | 135 | 50 | 30 | 39 | 1.5 | 173808 |
| 125 | 75 | 135 | 95 | 135 | 52 | 35 | 26 | 1.3 | 155338 |
|  | 100 | 135 | 95 | 135 | 50 | 40 | 13 | 1.6 | 155374 |
|  | 50 | 160 | 95 | 160 | 55 | 30 | 51 | 1.9 | 173811 |
| 150 | 75 | 160 | 100 | 160 | 57 | 35 | 39 | 1.9 | 155339 |
|  | 100 | 160 | 105 | 160 | 60 | 40 | 25 | 2 | 155375 |
|  | 125 | 160 | 110 | 160 | 60 | 45 | 13 | 2 | 155405 |
|  | 75 | 210 | 115 | 210 | 72 | 43 | 64 | 3.8 | 155340 |
| 200 | 100 | 210 | 115 | 210 | 70 | 40 | 50 | 3.6 | 155376 |
|  | 125 | 210 | 120 | 210 | 70 | 45 | 38 | 3.8 | 155406 |
|  | 150 | 210 | 125 | 210 | 65 | 50 | 25 | 3.4 | 1554399 |
|  | 100 | 274 | 125 | 274 | 82 | 43 | 82 | 6 | 155377 |
| 250 | 150 | 274 | 135 | 274 | 82 | 50 | 57 | 6.3 | 155437 |
|  | 200 | 274 | 145 | 274 | 80 | 60 | 32 | 6.9 | 155465 |
|  | 150 | 326 | 150 | 326 | 97 | 50 | 83 | 11 | 155438 |
| 300 | 200 | 326 | 160 | 326 | 95 | 60 | 58 | 10.2 | 155466 |
|  | 250 | 326 | 170 | 326 | 95 | 70 | 26 | 10.7 | 155487 |
| 400 | 300 | 429 | 200 | 429 | 100 | 100 | 52 | 19.6 | 155504 |

*For dimensions over DN 400 please contact us.

## > ACCESS FITTINGS | Access pipes

## > Round door



| DN | L | H | W | b | c | d | Weight | Product <br> code |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 50 | 105 | 190 | 93 | 64 | 53 | 105 | 2.3 | 179348 |
| 75 | 134 | 220 | 115 | 73 | 78 | 134 | 3.2 | 179648 |
| 100 | 159 | 260 | 139 | 84 | 104 | 159 | 5 | 179350 |



## > ACCESS FITTINGS | Access pipes

## > Rectangular door



| DN | L | H | W | c | d | e | f | Weight | Product <br> code |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 125 | 190 | 370 | 169 | 255 | 225 | 125 | 101 | 10.3 | 179352 |
| 150 | 215 | 395 | 192 | 280 | 250 | 150 | 112 | 14.5 | 179353 |
| 200 | 262 | 435 | 242 | 330 | 330 | 200 | 137 | 22 | 179354 |



## WASTEWATER

Intensive use - SMU Plus
> ACCESS FITTINGS | Blank ends

> ACCESS FITTINGS | Expansion plugs


See p. 149 for information on resistance to accidental pressure.
Expansion plugs with bleeding valve are available on request for DN 125/DN 150 and DN 200 (for watertightness test).

## > TRAPS | Branch traps

## BRANCH TRAP DN < 200

| DN | L | H | W | $c$ | $d$ | $e$ | $f$ | $c$ | $\circ$ | $\rho$ | $q$ | $r$ | s | Access (*) | Weight Product |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| code |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

(*) with bottom cleaning access: EP by expansion plug / TS by tight sheet Designed for rainwater networks. The arrows stamped on the cast iron body show the flow direction.


BRANCH TRAP DN 200

| DN | L | H | W | c | d | c | f | c | $\circ$ | $p$ | $r$ | s | Weight Product code |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 200 | 600 | 590 | 210 | 100 | 420 | 180 | 400 | 200 | 300 | 80 | 415 | 510 | 34.3 | 155464 |



Designed for rainwater networks when subjected to aggressive environments.

STACK SUPPORT


| DN | L | H | W | b | e | f | g | ø Ext | WeightProduct <br> code |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 50 | 195 | 220 | 108 | 8 | 150 | 17 | 30 | 108 | 2.5 | 212273 |
| 75 | 218 | 220 | 133 | 8 | 175 | 19 | 30 | 133 | 3.1 | 211041 |
| 100 | 259 | 220 | 162 | 8 | 214 | 20 | 32 | 162 | 4.3 | 171912 |
| 125 | 275 | 220 | 187 | 8 | 228 | 20 | 32 | 197 | 5.4 | 211042 |
| 150 | 300 | 220 | 222 | 8 | 255 | 22 | 32 | 222 | 7.2 | 171914 |
| 300 | 498 | 300 | 406 | 8 | 448 | 30 | 40 | 406 | 26.5 | 208264 |
| 400 | 600 | 340 | 508 | 10 | 550 | 30 | 50 | 508 | 43.9 | on request |

"All dimensions are in mm and nominal weights are in kg "

## SMU Zn - PIPES

|  | DN | L | H | W | Weight | Product code |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 50 | 3000 | 58 | 58 | 12.9 | 241706 |
|  | 75/80 | 3000 | 83 | 83 | 18.8 | 241708 |
| $5 \times 10$ | 100 | 3000 | 110 | 110 | 25.1 | 241709 |
| - | 125 | 3000 | 135 | 135 | 35.3 | 253994 |
|  | 150 | 3000 | 160 | 160 | 42.1 | 241710 |
|  | 200 | 3000 | 210 | 210 | 69.1 | 253915 |
|  | 250 | 3000 | 274 | 274 | 99.5 | 253916 |
|  | 300 | 3000 | 326 | 326 | 129.4 | 253917 |
|  |  | 3000 | 429 | 429 | 179.5 | 260554 |
|  | 400 | 2800 | 429 | 429 | 167.5 | 261111 |

* For dimensions over DN 400 please contact us.



## SMU Zn - FITTINGS

For details of the fittings to be used with SMU Zn pipes, please contact us.

## RECENT PROJECTS IN ASIA WITH SMU Zn

1-Shangri-La Island Hotel-Hong Kong
2 - Shaw Auditorium HKUST - Hong Kong
3 - Studio City Phase 2 - Macau
4-11 SKIES Commercial Complex - Hong Kong
5-HKIA Terminal 2 extensions-Hong Kong
6-Kai Tak Sports Ground - Hong Kong
7-Orsted O\&M Taichung Facilities - Taiwan
8-The Avenue Monterey Place - Hong Kong
9 - AMC Tsueng Kwan O-Hong Kong


## GRAVITY SYSTEMS - Residential (Type R)

All our Residential (Type R) downpipes and fittings are delivered with their couplings (see p.126)

## GRAVITY SYSTEMS - PIPES

## > ROUND DOWNPIPES | Straight



| DN | L | H | W | Weight | Product code |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 75 | 1 m | 107 | 107 | 6.9 | 155536 |
|  | 2 m | 107 | 107 | 12.9 | 155539 |
| 100 | 1 m | 134 | 134 | 9.2 | 155595 |
|  | 2 m | 134 | 134 | 17.2 | 155599 |
| 125 | 1 m | 162 | 162 | 12.9 | 155662 |
|  | 2 m | 162 | 162 | 24.2 | 155666 |

## > ROUND DOWNPIPES | Bended



| DN | L | H | W | Weight | Product code |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 75 | 1 m | 154 | 107 | 7.6 | 155572 |
|  | 2 m | 154 | 107 | 13.6 | 155574 |
| 100 | 1 m | 177 | 134 | 10.1 | 155640 |
|  | 2 m | 177 | 134 | 18.1 | 155643 |
| 125 | 1 m | 206 | 162 | 14.2 | 155700 |
|  | 2 m | 206 | 162 | 25.5 | 155702 |

ROUND DOWNPIPES WITH SUPPORT LUG | Straight*


| DN | L | H | W | Weight | Product code |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 75 | 1 m | 119 | 107 | 6.9 | 155535 |
|  | 2 m | 119 | 107 | 12.9 | 155538 |
| 100 | 1 m | 147 | 134 | 9.2 | 155594 |
|  | 2 m | 147 | 134 | 17.2 | 155598 |
| 125 | 1 m | 173 | 162 | 12.9 | 155661 |
|  | 2 m | 173 | 162 | 24.2 | 155665 |

[^13]
## > ROUND DOWNPIPES WITH SUPPORT LUG | Bended*



| DN | L | H | W | Weight | Product code |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 75 | 1 m | 165 | 107 | 6.9 | 155571 |
|  | 2 m | 165 | 107 | 12.9 | 155573 |
| 100 | 1 m | 188 | 134 | 12.9 | 155639 |
|  | 2 m | 188 | 134 | 17.2 | 155642 |
| 125 | 1 m | 216 | 162 | 10.1 | 155699 |
|  | 2 m | 216 | 162 | 24.2 | 155701 |

* Delivered with wall fixing bracket (see p.126)


## > ROUND FLUTED DOWNPIPES | Straight*



| DN | L | H | W | Weight | Product code |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 75 | 1 m | 130 | 121 | 9.8 | 155534 |
|  | 2 m | 130 | 121 | 16.9 | 155537 |
| 100 | 1 m | 158 | 150 | 13.5 | 155592 |
|  | 2 m | 158 | 150 | 23.2 | 155596 |
| 125 | 1 m | 184 | 175 | 16.7 | 155659 |
|  | 2 m | 184 | 175 | 29.1 | 155663 |

* Delivered with wall fixing bracket (see p.126)
> ROUND FLUTED DOWNPIPES | Fishes head shoe*


| DN | L | H | W | Weight | Product code |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 75 | 1 m | 203 | 121 | 14.3 | 155577 |
|  | 2 m | 203 | 121 | 21.4 | 155578 |
| 100 | 1 m | 268 | 150 | 19.5 | 155648 |
|  | 2 m | 268 | 150 | 29.2 | 155649 |
| 125 | 1 m | 325 | 175 | 23.7 | 155705 |
|  | 2 m | 325 | 175 | 36.1 | 155706 |

* Delivered with wall fixing bracket (see p.126)


## GRAVITY SYSTEMS - FITTINGS

## > BENDS Round downpipe bends



## $45^{\circ}$ BEND WITH SOCKET

| DN | L | H | W | Weight | Product code |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 75 | 162 | 210 | 116 | 2.2 | 155557 |
| 100 | 186 | 226 | 145 | 3.2 | 155622 |
| 125 | 215 | 250 | 173 | 4.6 | 155684 |



## $68^{\circ}$ BEND WITH SOCKET

| DN | L | H | W | Weight | Product code |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 75 | 148 | 122 | 115 | 2 | $155555^{*}$ |
| 100 | 210 | 185 | 144 | 3.5 | 155619 |
| 125 | 242 | 198 | 173 | 5.1 | 155681 |

*Availability: Contact us
> BENDS | Round fluted downpipe bends

$45^{\circ}$ BEND WITH SOCKET

| DN | L | H | W | Weight | Product code |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 100 | 164 | 231 | 144 | 3 | 155620 |



## $68^{\circ}$ BEND WITH SOCKET

| DN | L | H | W | Weight | Product code |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 100 | 210 | 236 | 144 | 3.5 | 155617 |

## > OFFSETS | Round offsets



OFFSET WITH SOCKET / E = 75

| DN | L | H | W | Weight | Product code |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 100 | 202 | 311 | 144 | 4.3 | 155630 |
| 125 | 229 | 343 | 173 | 6.4 | 155692 |



OFFSET WITH SOCKET / E = 150

| DN | L | H | W | Weight | Product code |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 75 | 249 | 311 | 115 | 3.1 | $155561^{*}$ |
| 100 | 277 | 317 | 144 | 4.1 | 155626 |
| 125 | 304 | 348 | 173 | 5.7 | 155688 |

*Availability: Contact us
> OFFSETS | Fluted offsets


OFFSET WITH SOCKET / E = 150

| DN | H | W | Weight | Product code |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 100 | 277 | 316 | 144 | 4.8 | 155625 |

## DECORATIVE RAINWATER HEAD



| DN | L | H | W | Weight | Product code |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 75 | 385 | 260 | 260 | 3.3 | 156510 |
| 100 | 385 | 260 | 274 | 4.7 | 156656 |
| 125 | 385 | 260 | 289 | 6.1 | 156792 |

ROUND / FLUTED CONNECTOR


| DN | L | H | W | Weight | Product code |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 75 | 121 | 110 | 121 | 1.25 | $155584^{*}$ |
| 100 | 150 | 115 | 150 | 1.9 | 155654 |
| 125 | 175 | 120 | 175 | 2.4 | 155710 |

* Availability: Contact us
> ACCESSORIES | Wall fixing bracket*


| Weight | Product code |
| :---: | :---: |
| 0.12 | 155531 |

* A wall fixing bracket is delivered with each downpipe with support lug


## > ACCESSORIES Couplings



COUPLINGS FOR DOWNPIPES AND SHOES

| DN | Weight | Product code |
| :---: | :---: | :---: |
| 75 | 0.03 | 155566 |
| 100 | 0.04 | 155632 |
| 125 | 0.05 | 155694 |

## COUPLINGS FOR BENDS AND OFFSETS

| DN | Weight | Product code |
| :---: | :---: | :---: |
| 75 | 0.07 | 156077 |
| 100 | 0.09 | 156133 |
| 125 | 0.11 | 156187 |

## > GARGOYLE $\mid$ For roadsides (Profile A)

(
> GARGOYLE | For pavements (Profile T)
(
> GARGOYLE $\mid$ Shoe to head connector


| Dimension | Entitled | Weight | Product <br> code |
| :---: | :---: | :---: | :---: |
| DN 75 | SMU Plus pipe | 3.7 | 155320 |
| DN 100 | SMU Plus pipe | 7.7 | 155347 |
| $120 \times 40$ | Rectangular pipe | 5.5 | 157385 |



## EPAMS ${ }^{\circledR}$ - OUTLETS

## > OUTLETS TO BE WELDED


> Stainless steel body, including M10 bolts
> Aluminum grating

| DN | DE <br> $(\mathrm{mm})$ | Capacity $\mathrm{I} / \mathrm{s}$ | Surface drainage <br> $\left(\mathrm{m}^{2}\right)$ | Weight <br> $(\mathrm{kg})$ | Product <br> code |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 50 | 58 | 13 | 260 | 5.4 | 171283 |
| 75 | 83 | 23 | 460 | 5.7 | 171284 |
| 100 | 110 | 26 | 520 | 6.4 | 171285 |
| $125^{*}$ | 135 | $26^{*}$ | 520 | 8.3 | 172850 |

*This outlet is the basis for the next three outlets, on which various elements are grafted depending on the application field.
See p. 173 for main dimensions.

## > OUTLETS WITH FLANGE


> Stainless steel body, including M1O bolts
$>$ Aluminum grating
> Aluminum flange

| DN | DE <br> $(\mathrm{mm})$ | Capacity I/s | Surface drainage <br> $\left(\mathrm{m}^{2}\right)$ | Weight <br> $(\mathrm{kg})$ | Product <br> code |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 50 | 58 | 13 | 260 | 6.2 | 171288 |
| 75 | 83 | 23 | 460 | 6.5 | 171289 |
| 100 | 110 | 26 | 520 | 7.2 | 171290 |
| $125^{*}$ | 135 | $26^{*}$ | 520 | 9.1 | 172871 |

## > OUTLETS WITH STEEL PLATE


> Stainless steel body, including M10 bolts
> Aluminum grating
> Stainless steel plate $-500 \times 500 \mathrm{~mm}$

| DN | DE <br> $(\mathrm{mm})$ | Capacity l/s | Surface drainage <br> $\left(m^{2}\right)$ | Weight <br> $(\mathrm{kg})$ | Product <br> code |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 50 | 58 | 13 | 260 | 6.4 | 171081 |
| 75 | 83 | 23 | 460 | 6.7 | 171267 |
| 100 | 110 | 26 | 520 | 7.4 | 171305 |
| $125^{*}$ | 135 | $26^{*}$ | 520 | 9.3 | 172874 |

[^14]
## > OUTLETS FOR FLEXIBLE PVC MEMBRANES


> Stainless steel body, including M10 bolts
> Aluminum grating
> Laminate-steel PVC plate $-500 \times 500 \mathrm{~mm}$

| DN | DE <br> $(\mathrm{mm})$ | Capacity $\mathrm{I} / \mathrm{s}$ | Surface drainage <br> $\left(\mathrm{m}^{2}\right)$ | Weight <br> $(\mathrm{kg})$ | Product <br> code |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 50 | 58 | 13 | 260 | 6.8 | 171286 |
| 75 | 83 | 23 | 460 | 7.1 | 171287 |
| 100 | 110 | 26 | 520 | 7.7 | 171263 |
| $125^{*}$ | 135 | $26^{*}$ | 520 | 9.6 | 172876 |

## EPAMS - ACCESSORIES

## > ELEVATING KITS


> Anti-vortex device fitted to Elevating Kit.
$>$ For roofs with waterproofing protection by fine gravel or by flags on isolating layer by fine gravel.

| Description | Height (mm) | Product code |
| :---: | :---: | :---: |
| Elevating device + anti-vortex | 90 | 171291 |
| Elevating device + anti-vortex | 250 | 171292 |

## ANCHORING STEEL PLATE



| Description | Product code |
| :---: | :---: |
| Anchoring steel plate | 172431 |

## NUTS \& SCREWS

NUTS \& SCREWS

| Description | Weight (kg) | Product code |
| :---: | :---: | :---: |
| Valid for all DN | 0.01 | 171295 |

[^15]
## INFRASTRUCTURE

## ITINERO ${ }^{\circledR}$



| DN | L | H | W | Weight | Product code |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 100 | 3000 | 110 | 110 | 25.1 | 277898 |
| 125 | 3000 | 135 | 135 | 35.3 | 277845 |
| 150 | 3000 | 160 | 160 | 42.1 | 277862 |
| 200 | 3000 | 210 | 210 | 69.1 | 277863 |
| 250 | 3000 | 274 | 274 | 99.5 | 277864 |
| 300 | 3000 | 326 | 326 | 129.4 | 277865 |
| 400 | 3000 | 429 | 429 | 179.5 | 277866 |
| 500 | 3000 | 532 | 532 | 247.6 | 277846 |
| 600 | 3000 | 635 | 635 | 325.5 | 277847 |



## ITINERO ${ }^{\circledR}$ - FITTINGS

> BENDS Short radius bends

$45^{\circ}$ BENDS
(200

$88^{\circ}$ BENDS

| DN | L | H | W | a | q | Weight | Product <br> code |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 100 | 166 | 169 | 110 | 110 | 59 | 2.2 | 277905 |
| 125 | 194 | 197 | 135 | 125 | 62 | 2.9 | 277826 |
| 150 | 227 | 230 | 160 | 145 | 70 | 4.3 | 277879 |
| 200 | 288 | 291 | 210 | 180 | 81 | 8.1 | 277880 |
| 250 | 360 | 363 | 274 | 223 | 89 | 13.5 | 277881 |
| 300 | 427 | 431 | 326 | 280 | 105 | 27.7 | 277882 |
| 400 | 644 | 651 | 429 | 466 | 223 | 59 | 277896 |

[^16]
## BRANCHES | Single branches



[^17]
## INFRASTRUCTURE

## ITINERO®

## > TAPERED PIPES | Reducers



| DN | dn | L | H | W | b | $c$ | d | WeightProduct <br> code |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 125 | 100 | 135 | 95 | 135 | 50 | 40 | 13 | 1.6 | 277822 |  |
| 150 | 100 | 160 | 105 | 160 | 60 | 40 | 25 | 2 | 277900 |  |
|  | 125 | 160 | 110 | 160 | 60 | 45 | 13 | 2 | 277872 |  |
| 200 | 100 | 210 | 115 | 210 | 70 | 40 | 50 | 3.6 | 277823 |  |
|  | 125 | 210 | 120 | 210 | 70 | 45 | 38 | 3.8 | 277831 |  |
|  | 150 | 210 | 125 | 210 | 65 | 50 | 25 | 3.4 | 277873 |  |
|  | 150 | 274 | 135 | 274 | 82 | 50 | 57 | 6.3 | 277874 |  |
| 300 | 150 | 274 | 145 | 274 | 80 | 60 | 32 | 6.9 | 277875 |  |
|  | 150 | 326 | 97 | 50 | 83 | 11 | 277876 |  |  |  |
|  | 326 | 160 | 326 | 95 | 60 | 58 | 10.2 | 277877 |  |  |
| 500 | 300 | 400 | 529 | 532 | 200 | 532 | 100 | 100 | 52 | 28.9 |

## > ACCESS FITTINGS | Access pipes

## > Rectangular door



| DN | L | H | W | $c$ | d | $e$ | f | Weight | Product <br> code |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 100 | 160 | 340 | 138 | 230 | 200 | 100 | 83 | 7.6 | 277857 |
| 125 | 190 | 370 | 169 | 255 | 225 | 125 | 101 | 10.3 | 277858 |
| 150 | 215 | 395 | 192 | 280 | 250 | 150 | 112 | 14.5 | 277859 |
| 200 | 262 | 435 | 242 | 330 | 300 | 200 | 137 | 22 | 277916 |
| 250 | 330 | 540 | 307 | 380 | 350 | 260 | 170 | 38.5 | 277917 |
| 300 | 380 | 610 | 358 | 430 | 400 | 310 | 195 | 50 | 277918 |



## ACCESS FITTINGS | Blank ends



| DN | L | H | W | Weight | Product <br> code |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 100 | 110 | 40 | 110 | 0.8 | 277819 |
| 125 | 135 | 45 | 135 | 1.2 | 277825 |
| 150 | 160 | 50 | 160 | 1.7 | 277901 |
| 200 | 210 | 60 | 210 | 3.2 | 277902 |
| 250 | 274 | 70 | 274 | 5.9 | 277903 |
| 300 | 326 | 80 | 326 | 10 | 277904 |
| 400 | 429 | 98 | 429 | 21 | 277895 |



STACK SUPPORT


| DN | L | H | W | b | e | f | 9 | 6Ext | Weight | Product code |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 100 | 259 | 220 | 162 | 8 | 214 | 20 | 32 | 162 | 4.3 | 277906 |
| 150 | 300 | 220 | 222 | 8 | 255 | 22 | 32 | 222 | 7.2 | 277891 |
| 200 | 362 | 220 | 278 | 8 | 310 | 22 | 36 | 278 | 10.5 | 277892 |
| 250 | 444 | 300 | 354 | 8 | 394 | 25 | 40 | 354 | 19.1 | 277893 |
| 300 | 498 | 300 | 406 | 8 | 448 | 30 | 40 | 406 | 26.5 | 277894 |
| 400 | 600 | 340 | 508 | 10 | 550 | 30 | 50 | 508 | 43.9 | 277897 |



## COUPLINGS, COLLARS \& CONNECTORS

## STANDARD COUPLINGS



PAM RAPID-S / PAM RAPID INOX

| DN | L | H | W | Weight | PAM RAPID-S | PAMRAPID |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  | W2 | W5 |

The PAM Rapid is designed for full tightening with "zero gap", there is no need to check the torque. For DN 250 and 300, apply the following torque: 25 N.m.

PAM RAPID WITH NBR GASKET (Nitrile coupling)

| DN | L | H | W | Weight | PAM RAPID NBR GASKET |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 50 | 70 | 80 | 42 | 0.1 | W5 |
| 75 | 90 | 103 | 42 | 0.12 | 212705 |
| 100 | 125 | 139 | 48 | 0.18 | 212708 |
| 125 | 147 | 161 | 56 | 0.28 | 212710 |
| 150 | 172 | 187 | 56 | 0.32 | 212711 |
| 200 | 223 | 240 | 70 | 0.6 | 212712 |
| 250 | 290 | 315 | 95 | 1.1 | 212713 |
| 300 | 350 | 375 | 95 | 1.25 | 212714 |

For wastewater liable to contain hot oil, solvents or hydrocarbons, it is recommended to use couplings equipped with specific NBR gaskets.

## STANDARD COUPLINGS

## SMU PAM / SMU PAM INOX



| DN | L | H | W | Weight | SMU PAM | SMU PAM <br> INOX |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 50 | 70 | 84 | 47 | 0.13 | 229384 | 229389 |
| 75 | 94 | 114 | 51 | 0.16 | 229386 | 229390 |
| 100 | 124 | 140 | 54 | 0.21 | 229387 | 229391 |
| 125 | 147 | 161 | 56 | 0.28 | 230135 | 230138 |
| 150 | 172 | 187 | 56 | 0.32 | 230136 | 230139 |
| 200 | 223 | 240 | 70 | 0.6 | 230137 | 230140 |



The stainless steel grades are the same as for the W2 and W5 PAM Rapid couplings.

## PAM R ("R" FOR REPAIR)



| DN | L | H | W | Weight | Product code |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 50 | 67 | 86 | 50 | 0.18 | 233899 |
| 75 | 91 | 110 | 50 | 0.2 | 233900 |
| 100 | 118 | 137 | 58 | 0.29 | 233901 |
| 125 | 147 | 166 | 58 | 0.31 | 233902 |
| 150 | 167 | 186 | 58 | 0.36 | 233903 |
| 200 | 223 | 242 | 58 | 0.47 | 233904 |



## All stainless steel

> Strap: austenitic stainless steel - 1.4404/1.4571 (AISI 316L/316Ti)
> Barrels: austenitic stainless steel

> -1.4404/1.4571 (AISI 316/316L/316Ti)
> Screw: stainless steel A4-70, with anti-seizing coating.
(thrust collar: AISI 316/316L)
> Sealing gasket: EPDM

## HIGH PRESSURE COUPLINGS



## PAM HP FLEX-S (W4)

| DN | L | H | W | $c$ | e | Pressure <br> Resistance <br> bar | Torque <br> Nm | Screw | Weight | Product code |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |

Type W4
Casing: 1.4301 / AISI 304
Screws: 1.4404 / AISI 316L
Barrels: 1.4401/ AISI 316
Strengthening plate: 1.4301 / AISI 304
Sealing gasket: EPDM or NBR

## PAM HP FLEX-INOX (W5)

| DN | L | H | W | $c$ | $c$ | Pressure <br> Resistance <br> bar | Torque <br> Nm | Screw | Weight | Product code |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 100 | 89 | 150 | 133 | 42 | 5 | 10 | 25 | M8 | 1.6 | 278478 | 278487 |
| 125 | 114 | 177 | 155 | 67 | 5 | 10 | 25 | M10 | 2.3 | 278479 | 278488 |
| 150 | 114 | 202 | 181 | 67 | 5 | 10 | 25 | M10 | 2.5 | 278480 | 278489 |
| 200 | 114 | 252 | 242 | 67 | 5 | 10 | 25 | M10 | 3.2 | 278481 | 278490 |
| 250 | 114 | 316 | 295 | 67 | 5 | 10 | 25 | M10 | 3.5 | 278482 | 278491 |
| 300 | 144 | 414 | 352 | 81 | 5 | 10 | 40 | M10 | 9.5 | 278483 | 278492 |
| 400 | 144 | 516 | 458 | 81 | 5 | 10 | 80 | M10 | 9 | 278484 | 278493 |
| 500 | 144 | 619 | 561 | 81 | 5 | 6 | 80 | M10 | 11 | 278485 | 278494 |
| 600 | 144 | 721 | 663 | 81 | 5 | 6 | 80 | M10 | 13 | 278486 | 278495 |

Type W5
Casing: 1.4404 / AISI 316L
Screws: 1.4404 / AISI 316L
Barrels: 1.4401/ AISI 316
Strengthening plate: 1.4404 / AISI 316L
Sealing gasket: EPDM or NBR

## GRIPPED HIGH PRESSURE COUPLINGS



## PAM HP GRIP-S (W4)

| DN | L | H | W | c | e | Pressure Resistance bar | Torque Nm | Screw | Weight | Product code |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  |  |  |  | EPDM | NBR |
| 100 | 89 | 156 | 139 | 16 | 8 | 10 | 25 | M10 | 1.4 | 278460 | 278469 |
| 125 | 114 | 192 | 166 | 24 | 8 | 10 | 60 | M12 | 2.6 | 278461 | 278470 |
| 150 | 114 | 218 | 191 | 24 | 8 | 10 | 85 | M16 | 3.2 | 278462 | 278471 |
| 200 | 114 | 269 | 241 | 24 | 8 | 10 | 60 | M16 | 5.0 | 278463 | 278472 |
| 250 | 114 | 357 | 304 | 24 | 8 | 10 | 80 | M16 | 8.6 | 278464 | 278473 |
| 300 | 114 | 410 | 357 | 24 | 8 | 10 | 80 | M16 | 10.0 | 278465 | 278474 |

Type W4
Casing: 1.4301 / AISI 304
Screws: 1.4404 / AISI 316L
Barrels: 1.4401/ AISI 316
Strengthening plate: 1.4301 / AISI 304
Sealing gasket: EPDM or NBR
Grips: 1.4310 / AISI 301

PAM HP GRIP-INOX (W5)

| DN | L | H | W | $c$ | e | Pressure <br> Resistance <br> bar | Torque <br> Nm | Screw | Weight | Product code |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| EPDM |  |  |  |  |  |  |  |  |  |  |

Type W5
Casing: 1.4404 / AISI 316L
Screws: 1.4404 / AISI 316L
Barrels: 1.4401/ AISI 316
Strengthening plate: 1.4404 / AISI 316L
Sealing gasket: EPDM or NBR
Grips: 1.4310 / AISI 301

## GRIP COLLARS

## GRIP COLLARS FOR COUPLINGS

Totally versatile, the PAM grip collar is compatible with all the PAM designed couplings or those of equivalent shape.

| DN | L | H | W | a | b | c | Wrench dimension | Weight | Product code |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 50 | 132 | 76 | 88 | 88 | 22 | 72 | 6 | 0.45 | 221261 |
| 75 | 155 | 78 | 105 | 105 | 25 | 73 | 6 | 0.53 | 221268 |
| 100 | 211 | 93 | 145 | 145 | 33 | 88 | 6 | 0.9 | 220750 |
| 125 | 229 | 93 | 165 | 165 | 32 | 88 | 6 | 1 | 221269 |
| 150 | 260 | 102 | 196 | 196 | 32 | 96 | 6 | 1.2 | 221270 |
| 200 | 316 | 118 | 252 | 252 | 32 | 115 | 8 | 1.7 | 221271 |
| 250 | 394 | 140 | 318 | 318 | 38 | 131 | 8 | 2.3 | 227039 |
| 300 | 447 | 140 | 371 | 371 | 38 | 131 | 8 | 2.5 | 227040 |

Pressure resistance DN 50-125: 10 bar DN 150-200: 5 bar DN 250-300: 3 bar


GRIP COLLARS FOR EXPANSION PLUGS

| DN | L | H | W | a | b | c | Wrench dimension | Weight | Product code |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 50 | 132 | 47 | 88 | 88 | 22 | 43 | 6 | 0.33 | 222092 |
| 75 | 155 | 47 | 105 | 105 | 25 | 41 | 6 | 0.4 | 222127 |
| 100 | 211 | 50 | 145 | 145 | 33 | 45 | 6 | 0.6 | 221563 |
| 125 | 229 | 54 | 165 | 165 | 32 | 49 | 6 | 0.7 | 222129 |
| 150 | 260 | 56 | 196 | 196 | 32 | 51 | 6 | 0.9 | 222131 |
| 200 | 316 | 64 | 252 | 252 | 32 | 60 | 8 | 1.2 | 222133 |

Pressure resistance DN 50-125: 10 bar DN 150-200: 5 bar


## CONNECTORS

For connection to other materials refer to the table on p.166.
STEPPING RINGS


| DN | DE* | Weight | Materials | Product code |
| :---: | :---: | :---: | :---: | :---: |
| 50 | 50 | 0.02 | HDPE and PVC | 156399 |
| 75 | 63 | 0.06 | HDPE | 156495 |
| 75 | 77 | 0.03 | PVC | 156494 |
| 100 | 91 | 0.1 | HDPE | 156555 |
| 100 | 100 | 0.05 | PVC | 156635 |
| 125 | 125 | 0.06 | HDPE and PVC | 156778 |
| 200 | 200 | 0.15 | HDPE and PVC | 157000 |
| 250 | 250 | 0.45 | HDPE and PVC | 157085 |

* External diameters of other materials


## ADAPTING COLLARS



| DN | D min.* | D max.* | L | Weight | Product code |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 75 | 75 | 90 | 100 | 0.4 | 255300 |
| 100 | 100 | 115 | 100 | 0.7 | 155002 |
| 100 | 110 | 121 | 120 | 0.7 | TXB1ONPO1 |
| 125 | 130 | 150 | 120 | 1 | TXB12NLOG |
| 150 | 150 | 175 | 120 | 1 | TXB15NMOJ |
| 200 | 200 | 225 | 150 | 1.5 | TXB2ONLOK |
| 300 | 310 | 335 | 190 | 2.9 | TXB3ONNO2 |

* minimum / maximum external diameter of the pipes to be connected


## ADAPTING COLLAR AND STEPPING RING



| DN | D min.* | D max.* | d min.* | d max.* | L | Weight Product code |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 200 | 200 | 225 | 192 | 201 | 150 | 1.9 | TXB2ONNOK |

d * minimum / maximum external diameter of the pipes to be connected

## COUPLINGS, COLLARS \& CONNECTORS



L

## ADAPTING JOINTS

| DN | D min.* | D max.* | d min.* | d max.* | L | Weight | Product code |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 150 | 155 | 170 | 130 | 145 | 120 | 0.8 | 155003 |
| 200 | 170 | 193 | 210 | 235 | 150 | 1.5 | 155004 |

* minimum / maximum external diameter of the pipes to be connected


DN 75156492


DN 100156629

## EPDM PLUGS

| DN | 1st aperture $\varnothing$ in mm | 2nd aperture $\varnothing$ in mm | 3rd aperture $\varnothing$ in mm | Weight | Product code |
| :---: | :---: | :---: | :---: | :---: | :---: |
| with staintess steel collar |  |  |  |  |  |
| 50 | 32 or 40 or 42 | - | - | 0.1 | 156394 |
| 75 | (32 or 40) or (42 or 50) | - | - | 0.2 | 156492 |
| 100 | 32 or 40 or 42 | 32 | - | 0.3 | 156628 |
| without stainless steel collar |  |  |  |  |  |
| 100 | $\begin{gathered} (32 \text { or } 40) \\ \text { or } 42 \end{gathered}$ | $\begin{aligned} & \text { (32 or } 40 \text { ) } \\ & \text { or ( } 42 \text { or } 50 \text { ) } \end{aligned}$ | (32 or 40) or (42 or 50) or 54 | 0.4 | 156629 |



PAM Konfix

| DN | D1 | D | Ext. $\varnothing$ Connecting pipe mm | L-1 | L | Insert depth mm | Weight | Product code |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 50 | 50 | 72 | 40-56 | 20 | 58 | 35 | 0.1 | 155759 |
| 75 | 82 | 92 | 56-75 | 22 | 72 | 45 | 0.16 | 180852 |
| 100 | 100 | 126 | 102-110 | 28 | 90 | 57 | 0.3 | 155833 |
| 125 | 125 | 151 | 125 | 36 | 106 | 65 | 0.7 | 155883 |

Transitional connectors DN 50-125 are designed for connecting the cast iron S and Plus ranges to other materials, whether steel or plastic. The connections with these flexible connectors are easy and safe: one pre-cut lid and a lip seal inside (see figure). EPDM and hose clamp made of chrome steel no. 1.4016.


PAM Konfix-Multi

| DN | D1 | D | Ext. Ø Connecting | L. | L | Insert <br> depth mm | Weight | Product <br> code |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 100 | 108 | 134 | $32-56$ | 36 | 91 | 40 | 0.3 | 176811 |

For connecting up to three 32-56 mm pipes made out of other materials to a cast iron pipe system DN 100. EPDM and hose clamp made of chrome steel no. 1.4016.


PAM Multiquick

| DN | ¢ D1 | Ø D2 | ø D3 | の D4 | ø d1 | ø d2 | ø d3 | Ø d4 | H | Weight | Product code |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $100 \times 70$ | 117 | 111 | 101 | 81 | 108 | 104 | 94 | 74 | 107 | 0.15 | 176812 |



The Multiquick connector DN 100x70 allows connections between other materials with an outside diameter from 72 to 110 mm , to our cast iron range DN 100 with a maximum outside diameter of 115 mm . There are several pre-cut options. EPDM and hose clamp made of chrome steel no. 1.4016.

## BRACKETS


«802» COLLARS

| DN | Nut | Tightening screw | a | Weight | Product code |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 50 | M8 | Screw M6 (Key of 10) | 11 | 0.08 | 251138 |
| 75 | M8 | Screw M6 (Key of 10) | 11 | 0.1 | 251188 |
| 100 | M8 | Screw M8 (Key of 13) | 11 | 0.19 | 251189 |
| 125 | M8 | Screw M8 (Key of 13) | 11 | 0.23 | 251177 |
| 150 | M8 | Screw M8 (Key of 13) | 11 | 0.25 | 251178 |
| 200 | M10 | Screw M8 (Key of 13) | 14 | 0.46 | 255005 |
| 250 | M10 | Screw M8 (Key of 13) | 14 | 0.68 | 255006 |
| 300 | M10 | Screw M8 (Key of 13) | 14 | 0.79 | 255007 |

In galvanised steel.
Distance between pipe and wall: 1 cm .


SUSPENSION HOOKS «101»

| DN | Weight | Product code |
| :---: | :---: | :---: |
| 50 | 0.04 | 255008 |
| 75 | 0.05 | 255009 |
| 100 | 0.08 | 255010 |
| 125 | 0.11 | 255011 |
| 150 | 0.16 | 255012 |
| 200 | 0.33 | 255013 |
| 250 | 0.45 | 255014 |

## Fixing settings

> Ease of fixation thanks to a 4 cm opening in the upper part of the hook

## Reduced bearing surface

> Recesses to address wall roughness

## Automatic set up

> Level marking on the hook that represents the waterline
> AS13 aluminium / not corrodible


SUSPENSION HOOKS «401»

| DN | Tightening screw | Weight | Product code |
| :---: | :---: | :---: | :---: |
| 50 | M8 | 0.12 | 251179 |
| 75 | M8 | 0.14 | 251180 |
| 100 | M8 | 0.16 | 251191 |
| 125 | M10 | 0.25 | 251192 |
| 150 | M10 | 0.3 | 251193 |
| 200 | M10 | 0.4 | 251194 |
| 250 | M12 | 0.8 | 251195 |
| 300 | M12 | 1 | 251196 |

Quick hooking thanks to the opening


## RUBBER-LINED STEEL BRACKET

| DN | Nut | Tightening screw | a | Weight | Product <br> code |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 50 | M8/10 | Screw M6 (Key of 10) | 24 | 0.1 | 251197 |
| 75 | M8/10 | Screw M6 (Key of 10) | 24 | 0.3 | 251198 |
| 100 | M8/10 | Screw M8 (Key of 13) | 25 | 0.3 | 251199 |
| 125 | M8/10 | Screw M8 (Key of 13) | 25 | 0.4 | 251200 |
| 150 | M10 | Screw M8 (Key of 13) | 18 | 0.6 | 251201 |
| 200 | M10 | Screw M8 (Key of 13) | 19 | 1.6 | 251202 |
| 250 | M12/16 | Screw M12 (Key of 19) | 41 | 1.8 | 251203 |
| 300 | M12/16 | Screw M12 (Key of 19) | 41 | 2.9 | 251204 |

Quick hooking thanks to the opening

## ACOUSTIC DAMPENER



## PAM ACOUSTIC

| DN | Weight | Product code |
| :---: | :---: | :---: |
| 50 to 150 | 0.11 | 205113 |

## CANTILEVER ARMS



CANTILEVER ARM 41/21/2 LG 200 - DN 50 AND 75 GALVANISED STEEL

| DN | F | Weight | Product code |  |
| :---: | :---: | :---: | :---: | :---: |
| 50 | 200 | 150 | 0.5 | 251209 |
| 75 | F: Maximum load for 2 arms, when applied at mid-length of the arm (L/2), in daN |  |  |  |



CANTILEVER ARM 41/ 41/ 2 LG 300 - DN 100 TO 150 GALVANISED STEEL

| DN | L | F* $^{*}$ | Weight | Product code |
| :---: | :---: | :---: | :---: | :---: |
| 100 | 300 | 300 | 0.9 | 251210 |
| 125 |  |  |  |  |
| 150 |  |  |  |  |

* F: Maximum load for 2 arms, when applied at mid-length of the arm (L/2), in daN


## SUPPORTING \& FIXING SYSTEMS



CANTILEVER ARM 41/ 82/ 2 LG 450 - DN 200 TO 300 GALVANISED STEEL

| DN | L | F* | Weight | Product code |
| :---: | :---: | :---: | :---: | :---: |
| 200 | 450 | 500 | 2.4 | 251211 |
| 250 |  |  |  |  |
| 300 |  |  |  |  |

* F: Maximum load for 2 arms, when applied at mid-length of the arm (L/2), in daN


REINFORCEMENT FOR CANTILEVER ARM 41/82/2 LG 450 galvanised steel

| DN | L | F* | Weight | Product code |
| :---: | :---: | :---: | :---: | :---: |
| 200 | 450 | 800 | 2.4 | 251212 |
| 250 |  |  |  |  |
| 300 |  |  |  |  |

* F: Maximum load for 2 arms with reinforcement, when applied at mid-length of the $\operatorname{arm}(L / 2)$, in daN


## FIXATION BOLTS FOR CANTILEVER ARMS

| DN |  | Weight | Product code |
| :---: | :---: | :---: | :---: |
| Cantilever arm 50 to 200 <br> Reinforcement fixation | M12×60 | 0.02 | 251208 |
| Cantilever arm 250 and 300 | M16 x70 | 0.03 | 252587 |

## STACK SUPPORT FIXING KIT

Galvanised zinc in combination with stack support bracket


| DN Description | Kit contents | Plate dimension | Hole spacing / Rail axial dimension | Hole ø | Weight | Product code |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 50 FRK 50 SET | $1 \times$ Stack support console 262 SP45 $1 \times$ Stack support bracket DN 50 or DN 75 $2 \times$ Hexagon bolt M12×35 | $100 \times 205 \times 6$ | 150 | $14 \times 24$ | 3.66 | 235621 |
| 75 FRK 75 SET | $2 \times$ Threaded plate GWP 45/12 Z <br> $2 \times$ Bolt anchor BZ 12-30/125 M 12 | $100 \times 225 \times 6$ | 170 | $14 \times 24$ | 3.94 | 235622 |
| 100 FRK 100 SET | $1 \times$ Stack support console 315 SP45 $1 \times$ Stack support bracket DN 100 or DN 125 $2 \times$ Hexagon bolt M12×35 | $100 \times 269 \times 8$ | 214 | $14 \times 24$ | 5.35 | 235623 |
| 125 FRK 125 SET | $2 \times$ Threaded plate GWP 45/12 Z <br> $2 \times$ Bolt anchor BZ 12-30/125 M 12 | $100 \times 283 \times 8$ | 228 | $14 \times 24$ | 5.53 | 235624 |

[^18]
## TOOLS



## PAINTS AND PROTECTION



TOUCH-UP PAINT
"EXTREM 1" RED

| Quantity | Product code |
| :---: | :---: |
| 250 ml | 226788 |
| 500 ml | 226962 |

After any cutting operation, the pipe ends must be protected by applying EXTREM 1.
EXTREM 1 is a ready-to-use quick drying touch-up paint that air dries in 15 minutes. It is easily applied with a brush (included in the paint bucket)

## TOUCH-UP SPRAY PAINT ( 400 ML )

| Colour | Product code |
| :--- | :---: |
| "S range" red-brown color | 257025 |
| "Plus range" grey color | 257027 |
| "Residential ( Type R)" color | 257028 |
| "ITINERO" grey color | 262704 |




## DESICN \& INSTALLATION

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## RESISTANCE TO PRESSURE

## REQUIREMENTS AND ADMISSIBLE PRESSURE LOAD

## Standard requirements according to EN 12056

Gravity wastewater drainage systems and ventilation systems generally operate without pressure. Although this does not exclude the possibility of pressure arising in the systems under specific operating conditions.

EN 12056-1, Section 5.4.2 Water and Gas Tightness, states that drainage installations must be sufficiently water and gas tight to withstand operating pressure. Furthermore, EN 12056-5, Section 6.3 states, with respect to securing pipe systems: Non-anchored pipes must be secured and/or supported in such a manner that they cannot be disconnected during use. The arising reaction forces must be addressed. For the specific application of rainwater, EN 12056-3, Section 7.6.4. stipulates: Internal rainwater pipes shall be able to withstand the head of water likely to occur in the event of a blockage. The same precautions should be taken as on pipework liable to undergo accidental overloading: securing of bottom bends and joints with adequate grip collars or HP couplings.

## Definitions

Fluid pressure is the force the fluid exerts per surface unit, perpendicular to this surface. Pressure change applied to the surface of an enclosed fluid is transmitted evenly and undiminished in all directions. Robust cast iron components can address any pressure hazard, so the couplings will be subjected to the strain. Couplings designed by PAM building are tested under hydrostatic pressure; only grip collars and autogrip collars are tested under end thrust forces.

## NETWORK REQUIREMENTS AND ADMISSIBLE PRESSURE LOAD

In addition to the above standards, in a drainage network, pressure resistance requirements are dependent on:
> The height of the water column between the considered point of the network and the first outlet located upstream; generally speaking, we differentiate waste and toilet networks from rainwater.
$>$ The accidental risk of loading. The most frequent cases are due to occasional obstruction of downstream pipeline or saturation of the public network.


## WASTEWATER NETWORKS

Risk of pressure build-up with a low water column
Generally, the pressures that occur in wastewater drainage systems cannot exceed the pressure corresponding to the height of one storey, i.e. about 0.3 bar, as sanitary appliances on each floor serve as outlets in case of accidental overloading.
The couplings we describe as "standard" (SMU PAM, PAM Rapid and PAM R) meet these requirements.

Risk of pressure build-up with a high water column
In very rare cases, where domestic wastewater downpipes cross several levels of a building without any outlet, and where there would be a risk of accidental loading, the installation must comply with the recommendations applicable to rainwater networks.

## RAINWATER NETWORKS

Risk of pressure build-up with a low water column
Same as wastewater networks.

Risk of pressure build-up with a high water column
In some rare cases there could be a risk of accidental overloading. The pressure resistance required to ensure these systems remain leak tight and stable depends on the height of the water column liable to occur, and could call for high-pressure couplings able to withstand the resulting pressure (up to 10 bar).
Coupling solutions will be differentiated for building height between 0 to $30 \mathrm{~m}, 30$ to $50 \mathrm{~m}, 50$ to 100 m corresponding to different levels of pressure resistance requirements.

## > Straight runs of the pipework

Straight runs between two fixed points and rigid bracketing do not experience exceptional forces. In case of accidental overloading, the couplings will only have to address hydrostatic pressure. Standard pressure couplings withstand up to 10 bar for DN50-DN125, up to 3 bar for DN250-DN300. High pressure couplings withstand up to 10 bar for DN100-DN4OO and up to 6 bar for DN500 and DN600.

## > Changes of direction and specific elements (plugs, branches, bends)

End thrust forces can be exerted with changes of direction, gradient and specific components like branches and plugs. These forces have to be addressed to avoid any risk of the pipe system disconnecting or slipping using specific couplings.
It is considered that end-thrust effect must be addressed when drainage pipework may be exposed to an internal pressure higher than 0.5 bar.
In such conditions, the installation must be able to stay in place to perform its functions of water tightness, and mechanical stability, preventing any dislocation at the couplings. Grip collars and gripped HP couplings are part of the solutions to secure the network.

## End thrust effect:

The result of the pressure forces exerted by a stationary fluid on the singular points of a pipe (or changes in direction), thus:
$>$ Straight runs (pipes): the forces cancel each other out.
> Singular points (e.g. fittings): the resultant forces tend to dislocate the network.


The forces significantly increase with large pipe diameter as illustrated in the following table.

|  | DN50 | DN75 | DN100 | DN125 | DN150 | DN200 | DN250 | DN300 | DN400 | DN500 | DN600 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Expansion plugs or single long arm branches | 10.5 | 22.5 | 41.5 | 63.5 | 90.5 | 157 | 269.5 | 387 | 666.5 | 1029 | 1475 |
| Two $45^{\circ}$ bends | 14.5 | 32 | 59 | 95 | 127.5 | 225.5 | 382 | 544 | 941 | 1455.5 | 2087.5 |

Thrust effect under 5 m water column (daN), corresponding to a 0.5 bar pressure.
It is considered that end-thrust effect must be addressed for:

1. Pipes laid under the groundwater table
2. Rainwater pipes or wastewater pipes running through several stories without outlets
3. $\mathrm{HP} \geq 5 \mathrm{~m}$
4. EPAMS - gripped collars or gripped couplings are mandatory until positive pressure is reached.

In these areas, the forces have to be addressed to avoid any risk of the pipe system disconnecting or slipping:
> Isolating the section suspected of having thrust forces between two fixed points, like stack support pipes.
> Adapting the joints (selection of couplings solutions) between these fixed points.
To address the thrust forces, other solutions can be used, like anchoring in concrete, or using dedicated bracketing systems.

## RESISTANCE TO PRESSURE

## COUPLING SELECTION ACCORDING TO LOADING RISKS

Couplings + Grip collars: performance
DN600
DN500
DN400
DN300
DN250
DN200
DN150
DN100
DN50

Note: under end thrust forces, where a coupling is secured with a grip collar, the maximum performance of both is limited by the weakest performance of the two products.

Focus on the PAM grip collars installation


Position the two half parts of the PAM grip collar uniformly so it encircles the pipe in parallel. The grip collars must be positioned so that the apertures fit over the coupling's fixing bolts and the teeth are directly located onto the pipe.


Insert the four screws to fix the two parts together loosely.


Tighten the screws crosswise alternately so that the two plates are put in parallel with the same spacing.


The assembly is completed when the external edges of the plates are in contact on both sides.

## > How to select the right coupling?

Before deciding which type of coupling to use it is important to answer the following questions:

- Wastewater or rainwater network?
> Generally, the pressures that occur in wastewater drainage systems cannot exceed the pressure corresponding to the height of one storey, i.e. about 0.3 bar, as sanitary appliances on each floor serve as outlets in case of accidental overloading.
- Diameter of the pipes?
> Thrust forces will be significantly larger for large diameter pipes and will have to be addressed with grip collars and HP couplings. Pressure resistance of couplings are specific for a given diameter. For DN 400 and larger only HP couplings are available.


## - Height of the stack?

> The higher the stack is, the higher the potential pressure build-up.

- Location of the coupling along the system?
$>$ Recommendations will change between $\mathrm{Om}<\mathrm{H} \leq 30 \mathrm{~m}, 30 \mathrm{~m}<\mathrm{H} \leq 50 \mathrm{~m}$, and $50 \mathrm{~m}<\mathrm{H} \leq 100 \mathrm{~m}$ as the height of the water column will correspond to different pressure levels.
- Straight run or change of direction?
> Thrust effort will have to be addressed at change of directions.


## > Wastewater network DN 50 to DN300

Different coupling recommendations should be followed depending on the number of floors and the HP height. In case of several storeys without outlet, the installation must comply with the recommendations applicable to rainwater networks.




PAM Rapid S
(DN250 \& DN300)
PAM HP FLEX
( $\geq$ DN4OO)

PAM Rapid S

+ grip collars
(DN250 \& DN3OO)
PAM HP GRIP
( $\geq$ DN4OO)

PAM HP FLEX

PAM HP FLEX

A drainage pipe is normally at neutral air pressure compared to the surrounding atmosphere. When a column of wastewater flows through a pipe, it compresses air in the pipe, creating a positive pressure that must be released or it will push back on the waste stream and downstream traps' water seals. As the column of water passes, air must flow in behind the waste stream or negative pressure (suction) results. The extent of these pressure fluctuations is determined by the waste discharge fluid volume.

The purpose of a ventilation stack is to control pressure in the pipework to prevent foul air from the wastewater system entering the building. Below are some of the main configuration principles, but combinations and variations are often required (see standard EN 12O56-2). The purpose of a ventilation stack is also to avoid accumulation of dangerous gases.

Black water and grey water can be drained either in separate or in a single discharge stack. The rules for duct sizing are different depending on the option selected.

## Primary ventilated system configurations:

Control of pressure is achieved by air flow in the discharge stacks. The soil stacks extend in main roof vents to above and out of the roof. Alternatively, air admittance valves may be used. They are pressure-activated, one-way mechanical vents, used in a plumbing system to eliminate the need for conventional pipe venting and roof penetrations.


## Secondary ventilated system configurations

In buildings of three or more storeys, if the air pressure within the stack suddenly becomes higher than ambient, this positive transient could cause wastewater to be pushed into the fixture, breaking the trap seal.
Vent stacks are put in parallel to waste stacks to allow proper venting and prevent such disorders. Air admittance valves may also be used in this configuration.
Under many building codes, a vent stack, a pipe leading to the main roof vent, is required to the draining fixtures (sink, toilet, shower stall, etc.).

To allow only one vent stack and therefore one roof penetration, as permitted by local building codes, sub-vents may be tied together and exit a common vent stack.


## SINGLE STACK BRANCH

The single stack branch is a patented device made to allow wastewater drainage without secondary vent pipes.

Provided the maximum number of connected sanitary appliances is respected, the single stack branch properly drains wastewater in a single stack, without vent pipes, whilst limiting the risks of self-siphonage. This device complies with the regulation and with standard EN 12056. The branch for a single downpipe allows wastewater drainage in a combined network without secondary ventilation according to EN 12056.
*Consult local requirements for compliance.

## Field of use:

> Multi-connection of sanitary appliances for adjacent apartments, or sanitary blocks
> Compactness when space is limited
$>$ No secondary vent pipes are required.

Benefits: It simplifies plumbing by grouping pipework from 3 or 4 times more sources than a conventional installation. Maximum connections for each floor level: 2 toilets, 2 bathtubs and all the usual sanitary facilities for two apartments (sinks, basins, showers, etc.). The single stack branch is particularly suitable for narrow service shafts, hotel rooms, student apartments or any other building with adjacent sanitary blocks.


## Operation features

> System under French Technical Approval.
$>$ Prevents excessive pressure variations in the stack system.
> Limits negative pressure by optimal venting and prevents self-siphonage.

The single stack branch DN 100 main body is connected to the stack using standard couplings and a traditional jointing method. Their watertightness is ensured by the rubber gaskets which equip the S and Plus ranges offered by PAM Building.

The overall plumbing works shall be executed in compliance with standard EN 12056: the appliances shall be installed with traps in compliance with the specifications of the same standard.


Owing to the special design of the branch, after a flush, the column of water is directed so that air can pass over the flow and naturally vent the stack.


Inside the branch, at the bottom of the body, a rubber deflector sprays the column of water to prevent draught or self-siphonage.


## Solution

The single stack branch exists as a long tail to allow connection to the main stack under the slab and thus facilitate installation either in new or renovation works.
Three different products, 2 or 3 inlets:
$>$ Corner branch two inlets $88^{\circ}$
$>$ Double branch two inlets $88^{\circ}$
$>$ A consecutive branch, three inlets $88^{\circ}$

Rubber plugs with several pre-cut lids will allow one to three different connections.

## WATER FLOW AND AIR CIRCULATION, ACCORDING TO STANDARDS EN 12056-2 AND EN 12056-3



The internal diameter of pipes cannot be reduced in the direction of the water flow, except in the case of pipework operating at full bore, under negative pressure such as in the EPAMS siphonic roof drainage system. The addition of branch connections, or changes of fall liable to increase the water flow rate, may require an increase in internal pipe diameter. This increase can be applied upstream of the new branch connection, using a tapered pipe (see p.98).

Rainwater horizontal pipelines

In horizontal and near horizontal pipelines, increases in size shall be installed so that the soffit is continuous, to prevent air from being trapped.

## ROOF PENETRATION DEVICE

To secure roof watertightness, which is of crucial importance, the number of roof penetrations should be limited. PAM Building has designed a roof penetration device for its pipe systems that is watertight and quick to install.

The system was developed to facilitate the installation of completely watertight roof penetration for cast iron primary ventilation pipes or vent pipes. The flanged fittings clamp both the vapour barrier and the waterproofing layer.


The roof penetration device is a set of two ductile iron flanged fittings - one of the flanges is fixed, the second is movable - equipped with rubber gaskets. Rubber gaskets are available in EPDM or NBR quality where hydrocarbons may be present.

See product codes on p. 103


The first flange fitting, installed above the roof, clamps the vapour barrier under the roof insulating layer, the second, above the insulating layer, clamps the waterproofing layer, whether it is polymer or bituminous.


## ACCESS TO THE PIPEWORK

Access to the pipework must be ensured so that tests, inspections and maintenance can be performed. Access may be obtained using a short access pipe.

## On downpipes



At the bottom of the stack.


At changes of direction (stack offsets).

## On horizontal collectors

On horizontal runs, the short access pipe will be installed in a slightly sloped position with respect to the pipe crown.


The short access pipe combines reliability, ease of use and operation safety:


## NETWORK SUPPORTING

## BRACKETING: TECHNICAL

Pipe support except for the EPAMS ${ }^{\circledR}$ system
For cast iron, the bracketing system is designed to only carry the weight of the pipe and its content, which makes the specifiers' design work easier.

Pipe weight in kg per metre

|  | 50 | 75 | 100 | 125 | 150 | 200 | 250 | 300 | 400 | 500 | 600 |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Empty pipe | 4.5 | 6 | 8.5 | 12 | 14.5 | 23.5 | 33.5 | 44 | 60 | 82 | 107 |
| Full pipe | 6.5 | 10 | 18 | 25 | 32.5 | 55 | 88 | 121.5 | 185 | 278 | 390 |

Note: The technical specifications for threaded rods and metal brackets shall be established on this basis.

Bracketing recommendations for cast iron pipe system elements

| Number of brackets |  |  | Consult local requirements for compliance |
| :---: | :---: | :---: | :---: |
| Vertical run | Pipes | $1(2) *$ |  |
|  | Fittings** | 1 | * For SMU pipes $L \geq 2.7$ m installed outdoors. <br> ** When the shape of the fitting permits it |
| Horizontal run | Pipe length $\geq 2 \mathrm{~m}$ | 2 |  |
|  | Pipe length<2 m | 1 |  |
|  | Fittings** | 1 |  |

It is also recommended to use one bracket per length or fitting (when the shape allows it, i.e. branches, etc.)

## Support for horizontal pipework

The general recommendation for horizontal pipework is two load bearing brackets per pipe. As an indication, they should be installed 0.75 m from each spigot so that, ideally, the distance between two brackets is 1.5 m . Installation shall respect a slight fall, around 1 or $2 \%$, and $0.5 \%$ as a minimum, ( 0.5 cm per metre).

## Support for vertical pipework

For vertical waste or rainwater stacks, the brackets aim to prevent the pipework from falling over. It is recommended that one bracket be fitted for each floor level.

Ideally, the bracket should be installed on the first third of the upper spigot, and even closer to a socket joint.

At the bottom of the stacks, the forces from the pipe's weight and possible end thrust efforts will preferably be addressed through stack support pipes.

Bracketing installations, openings and sealings are prohibited in pre-stressed girders.

Horizontal collectors


## SPECIFIC BRACKETING FOR ACOUSTIC INSULATION

The evacuation of waste, soil and rainwater generates structure-borne and airborne sound between rooms and usually occurs as a result of a mixed flow, when the pipe is filled with water and air. In such circumstances a pipe will radiate noise outwards and transfer it to any lightweight ceilings, cupboards and similar areas wherever it makes contact.

## PAM Acoustic dampener

All brackets within the PAM Building range meet the requirements of the most demanding standards. For high levels of acoustic performance, the standard steel brackets fitted with a new acoustic dampener should be used. The different assemblies have been tested to EN 14366: Laboratory measurements of noise from wastewater installations. The PAM acoustic dampener has been developed to meet the increasing demand for buildings to have a high level of acoustic performance above regulatory requirements.

> Pipe installation fitted with acoustic dampener* Structure-borne noise according to part 03:
> $2 \mathrm{I} / \mathrm{s}<10 \mathrm{~dB}(\mathrm{~A})$
> $4 \mathrm{I} / \mathrm{s}<10 \mathrm{~dB}(\mathrm{~A})$

* IPB 2019 tests results, installation according to EN 14366.



## Sound insulation in bracketing

## Function

The acoustic dampener is mounted between the wall or ceiling and the pipe bracket and dampens the noise generated in drainage pipe systems. It can be used with M8 and M10 thread rods.


1. Dampener - elastomer EPDM
2. M8-M1O - threaded nut; galvanised stee/
3. Stainless steel housing, A2
4. Thread connection with 17 mm key value ; galvanised steel.

Assembly


2 possibilities for fixing the PAM Acoustic Dampener on a Pipe Bracket:

1. Vertical lines:

Each end of the acoustic dampener can be fixed to the bracket. For each 3 m of length minimum 1 dampener must be used.

The weight of the pipes and the resulting water pressure must be absorbed by other devices: grip collars, stack supports, etc.


## NETWORK SUPPORTING


2. Horizontal lines:

Each end of the acoustic dampener can be fixed to the bracket. At a length of 3 metres, 2 dampeners must be used.

With each type of fixation, the best effect can only be achieved if the components are neither deformed nor compressed.

Maximum horizontal load F per dampener: 100 daN.

## Prohibited assembly

This mounting leads to rotation / torsion of the elastomer, which means the dampener cannot work properly and the elastomer might be cut. Therefore, this type of fixation is not allowed.
ATTENTION: This assembly causes the elastomer to twist


## PIPEWORK STABILITY

## Stack support pipe

Pipework is subject to different forces liable to affect its stability. Stack supports are cast iron components designed to address these efforts.

On straight runs, stack support pipes should be installed to address the pipes' weight. At the bottom of the stack, the first stack support pipe addresses both the pipes' weight and the end thrust effort. For the last case, it is recommended that the support and fixings be adapted accordingly.


We recommend positioning the first stack support pipe at the base of the first floor, and then every subsequent fifth floor, in the case of a standard average 2.5 m between floors, or more generally every 15 m .

In the case of a wall or slab opening closed by mortar, thus constituting a fixed point, no stack support pipe is required.
Stack support pipe and acoustic insulation


Admissible load for stack support console (see products on p.144).

|  | Case 1 | Case 2 |  |
| :---: | :---: | :---: | :---: |
|  |  |  |  |
|  | $F_{A Z}=F 1$ $M_{G}=\frac{F 1 \times L}{2}$ | $F_{\text {AZ }}=\mathrm{F} 2$ $\mathrm{M}_{\mathrm{G}}=\mathrm{F} 2 \times \mathrm{L}$ |  |
| Description | Length (mm) | Case 1 <br> F1 (kN) | $\begin{gathered} \text { Case } 2 \\ \text { F2 } \mathbf{~ ( k N ) ~} \end{gathered}$ |
| Stack support console 262 FRK 50 Set | 262 | 2.3 | 1.15 |
| Stack support console 262 FRK 75 Set | 262 | 2.3 | 1.15 |
| Stack support console 315 FRK 100 Set | 315 | 3.3 | 1.65 |
| Stack support console 315 FRK 125 Set | 315 | 3.3 | 1.65 |

## Stack support pipe installed vertically

Either on cantilever arms or stack support consoles up to DN 125.

## Stack support pipe installed horizontally

A wall bracketing system is available in mild steel, for use with stack support pipes and brackets.


Admissible load for cantilever arms (see products on p.143-144).

|  | Reference | Diameters | Length <br> (L. in mm) | Admissible load <br> (F in daN) |
| :---: | :---: | :---: | :---: | :---: |
| Case 1 | Cantilever arm 41/21/2 LG <br> 200 | $50-75$ | 200 | 150 |
|  | Cantilever arm 41/82/2 LG <br> 300 <br> 450 | $200-250-300$ | 450 | 300 |
| Case 2 | Reinforcement for cantilever <br> arm 41/82/2 LG 450 | $200-250-300$ | 450 | 500 |



Case 2


## JOINTING METHODS

## STAINLESS STEEL COUPLINGS

## ASSEMBLY AS A SLEEVE

PAM Rapid Couplings (S and INOX)
> DN 50 to 200
Couplings are supplied pre-assembled. The PAM Rapid from DN 50 to 200 is designed to be tightened to fully closed, there is no need to check the torque.


Push the supplied assembled coupling onto the pipe spigot so that it abuts on the central register of the elastomer gasket.


Push the next pipe spigot into the other end of the coupling.


Tighten the screw to "zero gap" position, i.e. fully closed, with a ratchet spanner or electric screwdriver.

## > DN 250 to 300

They can be assembled in two different ways, depending on whether an open strap is required.

## Standard assembly:



1 - Open the stainless steel strap.
2 - Slide the stainless steel strap loose around the first pipe component.
3 - Push the sealing gasket onto the component spigot so it abuts on the central register of the gasket.
4 - Push the second component into the sealing gasket, so that it abuts on the central register.
5 - Bring the steel strap over the sealing gasket.
6 - Tighten the bolt with a ratchet spanner or a power tool applying the following tightening torque: DN 250 and DN $300=25$ N.m.

## Open strap assembly:

An open strap is sometimes required to facilitate access: stack installation, etc.


1 - Push the rubber gaskets onto the spigot ends top and bottom, ensuring the central registers are abutted against each spigot edge.
2 - Twist the stainless steel strap to ease the wrapping around the pipe components.
3 - Clip the bolt and loosely assemble the coupling around the gasket.
4 - Check the alignment of the assembly before tightening the bolt with a ratchet spanner or a power tool, applying the following tightening torque: DN 250 and DN $300=25$ N.m.

[^19]
## CONNECTION TO OTHER MATERIALS

## BRANCH CONNECTIONS TO SMALL DIAMETER WASTE PIPES

## PAM KONFIX, the easiest solution

The easiest way to connect cast iron systems to other drainage materials is to use rubber connectors or plugs. Flexible couplings and stepping rings are also available to facilitate connections where variances in diameters have to be compensated for.


Rubber transition connectors PAM KONFIX and PAM KONFIX-Multi are used to connect waste pipes made from other materials (steel or plastics) to a PAM cast iron pipe system.

1.Insert the PAM KONFIX rubber connector loosely onto the pipe until the stop point is reached. Then secure to the pipe by tightening the hose clamp screw.

2. Cut the pre-cut rubber to size with a knife and remove the lid. WARNING:
Do not cut too deep as you may damage the lip seal inside.

3. Mark the insert depth on the connecting pipe.
Apply a lubricant and push in. The assembly is complete.

4. The connecting steel pipe illustrated here is only an example.
The PAM KONFIX rubber connectors can be used to connect all waste pipe materials to the PAM cast iron systems.

## EPDM plugs

The plugs can be pierced to the appropriate groove from 32 mm up to 54 mm waste connections and the center disc torn out where required.


## PAM MULTIQUICK, TRANSITION CONNECTOR



To connect PAM cast iron pipes with an outside diameter of 109-112 mm (tolerance range for PAM cast iron pipes DN 100) to other rigid materials with an outside diameter from 72-110 mm. To connect PAM cast iron pipes with an outside diameter of 109-112 mm to waste pipes with an outside diameter up to 115 mm maximum. The connection is made with two hose clamps both suitable to address larger diameter tolerances.


1. Push the open end of the PAM MULTIQUICK connector over the pipe end and place the hose clamp to its tightening position.

2. Then use a knife to cut open the precut lid to the corresponding outside diameter of the connecting waste pipe. Then push the second hose clamp loose over the connecting rubber end.

3. Push the connecting pipe into the PAM MULTIQUICK connector and tighten the hose clamp in the right position. Ensure that the sealing zones (face ends of pipes or fittings) are clean: remove paint flakes and cement residues. The hose clamps should only be tightened manually with a screwdriver to avoid any damage to the PAM MULTIQUICK rubber connector.

## CONNECTION TO OTHER MATERIALS

## CAST IRON TO CAST IRON AND CAST IRON TO OTHER MATERIALS

PAM cast iron connections to other materials may often be required in new construction projects or for renovation. Different solutions can be used with products from our catalog (see figures below).
Depending on the outside diameters, solutions exist for compensation.
If you are unsure of the circumference of the material being connected, you can use a circumference tape.
The range of tolerance of the different joints can help you find the required solution.
The table below lists the solutions for connecting PAM cast iron to the most frequently encountered material.

2. Adapting joint $=A J$


Max. Pressure 0.6 bar/
Stainless steel 304
3. Adapting collar = AC


Max. Pressure 1.5 bar/Stainless steel 304
4. Adapting collar (AC) +

Stepping ring (SR)


Max. Pressure 1.5 bar /Stainless steel 304

| DN* | Existing network material | $\begin{gathered} \underset{(\mathrm{mm})}{\mathrm{OD}} \end{gathered}$ | Circumference (mm) | Admissible tolerance of couplings (mm) |  | Coupling type | Product code | Reference diagram |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | DE | Perimeter |  |  |  |
| 50 | S Range, Plus range | 58 | 182 | 55-60 | 172-188 | SMU PAM | 229384 | 5 |
|  | PVC | 50 | 157 | $\begin{aligned} & 55-60 \\ & 49-52 \end{aligned}$ | $\begin{aligned} & 172-188 \\ & 153-163 \end{aligned}$ | SMU PAM + SR | $\begin{aligned} & 229384 \\ & 156399 \end{aligned}$ | 1 |
|  | HDPE | 50 | 157 | $\begin{aligned} & 55-60 \\ & 49-52 \end{aligned}$ | $\begin{aligned} & 172-188 \\ & 153-163 \end{aligned}$ | SMU PAM + SR | $\begin{aligned} & 229384 \\ & 156399 \end{aligned}$ | 1 |
| 75 | S Range, Plus range | 83 | 260 | 81-86 | 254-270 | SMU PAM | 229386 | 5 |
|  | Old cast iron | 64 | 201 | $\begin{aligned} & 81-86 \\ & 62-65 \\ & 58-79 \end{aligned}$ | $\begin{aligned} & 254-270 \\ & 194-204 \\ & 182-248 \end{aligned}$ | SMU PAM + SR | $\begin{aligned} & 229386 \\ & 156495 \end{aligned}$ | 1 |
|  |  | 77 | 241 | $\begin{aligned} & 81-86 \\ & 75-79 \\ & 58-79 \end{aligned}$ | $\begin{aligned} & 254-270 \\ & 235-248 \\ & 182-248 \end{aligned}$ | SMU PAM + SR | $\begin{aligned} & 229386 \\ & 156494 \end{aligned}$ | 1 |
|  |  | 90 | 282 | 75-90 | 235-282 | SMU "AC" | 255300 | 3 |
|  | PVC | 75 | 235 | $\begin{aligned} & 81-86 \\ & 75-79 \\ & 58-79 \end{aligned}$ | 254-270 235-248 182-248 | SMU PAM + SR | $\begin{aligned} & 229386 \\ & 156494 \end{aligned}$ | 1 |
|  |  | 80 | 251 | 75-79 | 235-282 | SMU "AC" | 255300 | 3 |
|  | HDPE | 63 | 197 | $\begin{aligned} & 81-86 \\ & 62-65 \\ & 58-79 \end{aligned}$ | $\begin{aligned} & 254-270 \\ & 194-204 \\ & 182-248 \end{aligned}$ | SMU PAM + SR | $\begin{aligned} & 229386 \\ & 156495 \end{aligned}$ | 1 |
|  |  | 75 | 235 | $\begin{aligned} & 81-86 \\ & 75-79 \\ & 58-79 \end{aligned}$ | $\begin{aligned} & 254-270 \\ & 235-248 \\ & 182-248 \end{aligned}$ | SMU PAM + SR | $\begin{aligned} & 229386 \\ & 156494 \end{aligned}$ | 1 |


| DN* | Existing network material | $\begin{aligned} & \text { OD } \\ & (\mathrm{mm}) \end{aligned}$ | Circumference (mm) | Admissible tolerance of couplings (mm) |  | Coupling type | Product code | Reference diagram |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | DE | Perimeter |  |  |  |
| 100 | S Range, Plus range | 110 | 345 | 107-112 | 335-351 | SMU PAM | 229387 | 5 |
|  | Old cast iron | 91 | 285 | $\begin{gathered} 107-112 \\ 90-93 \\ 78-106 \end{gathered}$ | $\begin{aligned} & 335-351 \\ & 282-292 \\ & 244-332 \end{aligned}$ | SMU PAM + SR | $\begin{aligned} & 229387 \\ & 156555 \end{aligned}$ | 1 |
|  |  | 104 | 326 | $\begin{aligned} & 100-115 \\ & 78-106 \end{aligned}$ | $\begin{gathered} 314-361 \\ 244-332 \end{gathered}$ | SMU "AC" | 155002 | 3 |
|  |  | 118 | 370 | 110-121 | 345-380 | SMU "AC" | TXB10NP01 | 3 |
|  | Ductile iron | 118 | 370 | 110-121 | 345-380 | SMU "AC" | TXB10NP01 | 3 |
|  | Fibre cement | 115 | 361 | 110-121 | 345-380 | SMU "AC" | TXB10NP01 | 3 |
|  | PVC | 100 | 314 | $\begin{aligned} & 107-112 \\ & 99-102 \\ & 78-106 \end{aligned}$ | $\begin{aligned} & 335-351 \\ & 310-320 \\ & 244-332 \end{aligned}$ | SMU PAM + SR | $\begin{aligned} & 229387 \\ & 156635 \end{aligned}$ | 1 |
|  |  | 110 | 345 | 107-112 | 335-351 | SMU PAM | 229387 | 5 |
|  | HDPE | 90 | 282 | $\begin{gathered} 107-112 \\ 89-92 \\ 78-106 \end{gathered}$ | $\begin{aligned} & 335-351 \\ & 279-288 \\ & 244-332 \end{aligned}$ | SMU PAM + SR | $\begin{aligned} & 229387 \\ & 156555 \end{aligned}$ | 1 |
|  |  | 110 | 345 | 107-112 | 335-351 | SMU PAM | 229387 | 5 |
|  | Steel | 114 | 358 | 100-115 | 314-361 | SMU "AC" | 155002 | 3 |
|  | Sandstone | 132 | 414 | $\begin{gathered} 110-115 \\ 130-145 \end{gathered}$ | $\begin{aligned} & 345-361 \\ & 408-455 \end{aligned}$ | SMU "AJ" | Contact us | 2 |
|  | Concrete | 136 | 427 | $\begin{gathered} 110-115 \\ 130-145 \end{gathered}$ | $\begin{aligned} & 345-361 \\ & 408-455 \end{aligned}$ | SMU "AJ" | Contact us | 2 |
| 125 | S Range, Plus range | 135 | 424 | 133-138 | 417-433 | SMU PAM | 230135 | 5 |
|  | Old cast iron | 118 | 370 | $\begin{aligned} & 110-125 \\ & 121-136 \end{aligned}$ | $\begin{aligned} & 345-387 \\ & 408-427 \end{aligned}$ | SMU "AJ" | Contact us | 2 |
|  |  | 145 | 455 | 130-150 | 408-471 | SMU "AC" | TXB12NLOG | 3 |
|  | Ductile iron | 144 | 452 | 130-150 | 408-471 | SMU "AC" | TXB12NLOG | 3 |
|  | Fibre cement | 141 | 442 | 130-150 | 408-471 | SMU "AC" | TXB12NLOG | 3 |
|  | PVC and HDPE | 125 | 392 | $\begin{aligned} & 133-138 \\ & 123-127 \end{aligned}$ | $\begin{aligned} & 417-433 \\ & 386-398 \end{aligned}$ | SMU PAM + SR | $\begin{aligned} & 230135 \\ & 156778 \end{aligned}$ | 1 |
|  | Steel | 139 | 436 | 130-150 | 408-471 | SMU "AC" | TXB12NLOG | 3 |
|  | Sandstone | 159 | 499 | $\begin{gathered} 121-136 \\ 144-160 \end{gathered}$ | $\begin{aligned} & 379-427 \\ & 452-502 \end{aligned}$ | SMU "AJ" | Contact us | 2 |
| 150 | S Range, Plus range | 160 | 502 | 158-164 | 496-514 | SMU PAM | 230136 | 5 |
|  | Old cast iron | $\begin{aligned} & 145 \\ & 172 \end{aligned}$ | $\begin{aligned} & 455 \\ & 540 \end{aligned}$ | $\begin{aligned} & 130-145 \\ & 155-170 \\ & 150-175 \end{aligned}$ | $\begin{gathered} 408-455 \\ 486-534 \\ 471-549 \end{gathered}$ | SMU "AJ" <br> SMU "AC" | $\begin{gathered} 155003 \\ \text { TXB15NMOJ } \end{gathered}$ | $\begin{aligned} & 2 \\ & 3 \end{aligned}$ |
|  | Ductile iron | 170 | 534 | 150-175 | 471-549 | SMU "AC" | TXB15NMOJ | 3 |
|  | Fibre cement | 166 | 521 | 150-175 | 471-549 | SMU "AC" | TXB15NMOJ | 3 |
|  | PVC | 140 | 439 | $\begin{aligned} & 130-145 \\ & 155-170 \end{aligned}$ | $\begin{aligned} & 408-455 \\ & 486-534 \end{aligned}$ | SMU "AJ" | 155003 | 2 |
|  | PVC and HDPE | 160 | 502 | 158-164 | 496-514 | SMU PAM | 230136 | 5 |
|  | Steel | 168 | 527 | 150-175 | 471-549 | SMU "AC" | TXB15NMOJ | 3 |
|  | Sandstone | 186 | 584 | $\begin{aligned} & 144-160 \\ & 170-193 \end{aligned}$ | $\begin{aligned} & 452-502 \\ & 533-606 \end{aligned}$ | SMU "AJ" | Contact us | 2 |
|  | Concrete | 190 | 596 | $\begin{aligned} & 144-160 \\ & 170-193 \end{aligned}$ | $\begin{aligned} & 452-502 \\ & 533-606 \end{aligned}$ | SMU "AJ" | Contact us | 2 |

## CONNECTION TO OTHER MATERIALS

## CAST IRON TO CAST IRON AND CAST IRON TO OTHER MATERIALS

| DN* | Existing network material | $\begin{aligned} & \text { OD } \\ & (\mathrm{mm}) \end{aligned}$ | Circumference (mm) | Admissible tolerance of couplings (mm) |  | Coupling type | Product code | Reference diagram |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | DE | Perimeter |  |  |  |
| 200 | S Range, Plus range | 210 | 659 | 207-213 | 650-668 | SMU PAM | 230137 | 5 |
|  | Old cast iron | 172 | 540 | $\begin{aligned} & 170-193 \\ & 210-235 \end{aligned}$ | $\begin{aligned} & 534-606 \\ & 659-738 \end{aligned}$ | SMU "AJ" | 155004 | 2 |
|  |  | 197 | 618 | $\begin{gathered} 200-225 \\ 192-201 \end{gathered}$ | $\begin{aligned} & 628-706 \\ & 603-631 \end{aligned}$ | SMU "AC" + SR | TXB2ONNOK | 4 |
|  |  | 218 | 684 | 200-225 | 628-706 | SMU "AC" | TXB2ONLOK | 3 |
|  |  | 225 | 706 |  |  |  |  |  |
|  | Ductile iron | 222 | 697 | 200-225 | 628-706 | SMU "AC" | TXB2ONLOK | 3 |
|  | Fibre cement | 218 | 684 | 200-225 | 628-706 | SMU "AC" | TXB2ONLOK | 3 |
|  | PVC and HDPE | 200 | 628 | $\begin{aligned} & 207-213 \\ & 198-202 \end{aligned}$ | $\begin{gathered} 649-668 \\ 621-634 \end{gathered}$ | SMU PAM + SR | $\begin{aligned} & 230137 \\ & 157000 \end{aligned}$ | 1 |
|  | Steel | 219 | 688 | 200-225 | 628-706 | SMU "AC" | TXB2ONLOK | 3 |
|  | Sandstone | 242 | 760 | $\begin{aligned} & 204-219 \\ & 238-254 \end{aligned}$ | $\begin{aligned} & 640-687 \\ & 747-797 \end{aligned}$ | SMU "AJ" | Contact us | 2 |
|  | Concrete | 244 | 766 | $\begin{aligned} & 204-219 \\ & 238-254 \end{aligned}$ | $\begin{aligned} & 640-687 \\ & 747-797 \end{aligned}$ | SMU "AJ" | Contact us | 2 |
| 250 | S Range, Plus range | 274 | 860 | 271-276 | 850-868 | PAM Rapid S | 228759 | 5 |
|  | Old cast iron | 242 | 760 | $\begin{aligned} & 240-265 \\ & 260-285 \end{aligned}$ | $\begin{aligned} & 753-832 \\ & 816-894 \end{aligned}$ | SMU "AJ" | TXB25NQOK | 2 |
|  |  | 279 | 876 | 260-285 | 816-894 | SMU "AC" | 143192 | 2 |
|  | Ductile iron | 274 | 860 | 271-276 | 850-868 | PAM Rapid S | 228759 | 5 |
|  | Fibre cement | 274 | 860 | 271-276 | 850-868 | PAM Rapid S | 228759 | 5 |
|  | PVC and HDPE | 250 | 785 | $\begin{aligned} & 271-276 \\ & 248-252 \end{aligned}$ | $\begin{gathered} 850-868 \\ 778-791 \end{gathered}$ | PAM Rapid S + SR | $\begin{aligned} & 228759 \\ & 157085 \end{aligned}$ | 1 |
|  | Steel | 273 | 857 | 271-276 | 850-868 | PAM Rapid S | 228759 | 5 |
|  | Sandstone | 296 | 929 | $\begin{aligned} & 285-310 \\ & 270-290 \end{aligned}$ | $\begin{aligned} & 894-973 \\ & 847-910 \end{aligned}$ | SMU "AC" + SR | TXB25NQOL | 4 |
| 300 | S Range, Plus range | 326 | 1024 | 323-328 | 1014-1031 | PAM Rapid S | 228771 | 5 |
|  | Old cast iron | 312 | 980 | 310-335 | 973-1051 | SMU "AC" | TXB3ONNO2 | 3 |
|  |  | 331 | 1039 | 310-335 | 973-1051 | SMU "AC" | TXB30NNO2 | 3 |
|  | Ductile iron | 326 | 1024 | 323-328 | 1014-1031 | PAM Rapid S | 228771 | 5 |
|  | Fibre cement | 329 | 1033 | 310-335 | 973-1051 | SMU "AC" | TXB30NNO2 | 3 |
|  | PVC and HDPE | 315 | 989 | 310-335 | 973-1051 | SMU "AC" | TXB3ONNO2 | 3 |
|  | Steel | 324 | 1017 | 323-328 | 1014-1031 | PAM Rapid S | 228771 | 5 |
|  | Sandstone | 350 | 1099 | $\begin{aligned} & 320-340 \\ & 335-360 \end{aligned}$ | $\begin{gathered} 1005-1068 \\ 1051-1130 \end{gathered}$ | SMU "AC" + SR | TXB30NQOM | 4 |
|  | Concrete | 374 | 1174 | $\begin{aligned} & 310-335 \\ & 350-375 \end{aligned}$ | $\begin{gathered} 973-1051 \\ 1099-1178 \end{gathered}$ | SMU "AJ" | Contact us | 2 |

## MULTI-WASTE MANIFOLD

## Manifold Connector



The multi-waste manifold simplifies waste plumbing by grouping all associated pipework from various sources such as sinks, basins, bidets, urinals and showers to one internal point above the finished floor level. The manifold will permit the connection of three $32 / 38 \mathrm{~mm}$ copper/plastic waste inlets to any new or existing 100 mm diameter pipe stack and three 50 mm copper/plastic waste inlets to a 150 mm diameter pipe stack. The manifold main body is connected to the stack using standard coupling. On the 100 mm manifold, to achieve a 32 mm waste connection, remove the 38 mm inner rubber ring by using the outer ring (for waste pipe maximum lengths see EN 12056-2). Pipework connecting discharge appliances to a manifold should be designed not to cause self-siphonage.

## Fixing instructions



1. Cut the appropriate groove for 32 mm or 38 mm waste connections ( 100 mm manifold only), remove the grommet and tear out the centre disk where required.
2. Apply an appropriate silicone grease (not provided) to the outside of the grommet and re-fit into the manifold ensuring the retaining groove of the grommet is located correctly in the casing.
3. Lubricate the pipe ends and insert into the grommet with a rotational movement. Pipe ends may be chamfered for ease of insertion.
4. Any grommet not fitted with a waste pipe must also follow instruction 2 above.

Typical Manifold Application


## New multi-waste manifold

Developed to meet the requirements of low waste connections such as walk-in showers or when space is limited.


## Benefits:

> Minimum core holes required saving costs
> Long tail spigot that can eliminate the need to have a joint in the slab
$>$ All 6 inlets can be used at the same time.

## Features:

> Available in 100 and 150 mm (see p.106)
> 6 boss pipes
> Supplied with 5 blanking plugs
> Internal baffle to eliminate cross flow
$>$ Long tail spigot to penetrate the floor slab


## BURIED NETWORK

## BURIED PIPE SYSTEMS

The Plus range pipes can be used in below-ground applications. Buried pipes are subject to mechanical strain due to the weight of the ground and possible wheel loading when laid under an area where traffic circulates.

The mechanical performance of buried pipework is to be considered like a pipe/soil system: the interaction of the pipes with the surrounding soils depends on their stiffness or flexibility, and the type of laying condition selected.

The choice of bedding and backfilling depends on the depth at which the pipes have to be laid, and the size and strength of the pipes. Standard EN 1610 "Construction and testing of drains and sewers" applies to drains normally buried in the ground and normally operating under gravity.

The hypothesis for rigid pipes retained for the calculation of admissible depth of cover is set out below.

## DN 100 to DN 300

| Young's modulus: | $110,000 \mathrm{~N} / \mathrm{mm}^{2}$ |
| :--- | :---: |
| Poisson's ratio: | 0.25 |
| Max. stress: | $350 \mathrm{~N} / \mathrm{mm}^{2}$ |
| Strain coefficient: | 1.5 |
| Buckling coefficient: | 2.5 |
| Geometric defect: | $1.2+$ DN $2,000 \mathrm{~mm}$ |

Installation parameters are established according to:
> Soil type (see groups below)
> Quality of compaction of the embedment
> Behavior of the pipe (rigid for cast iron)

> Presence of wheel loads or not
> Particular conditions (groundwater table, etc.)

## Backfilling recommendations from DN 100 to DN 300, with or without traffic loads (according to EN 1610)

Two main solutions have been retained from the EN 1610 recommendations, taking into account both ease of installation and knowledge from experience of rigid pipe systems. For compaction, the most adverse hypothesis was retained.

These solutions maximise the advantage obtained from cast iron's mechanical properties: depth of cover it can withstand, possible backfilling with native soil removed, thereby limiting damage to the environment, etc.


Case no. 2


Dimensions are in mm

* Detrimental materials = stones, tree roots, rubbish, organic material, clay lumps ( $>75 \mathrm{~mm}$ ), snow and ice.

Based on our experience in buried pipe systems and the French origin of our company, we have applied the French Fascicule 70 calculation model (recommendations for sewage pipe systems according to the pipe material).

The table below gives values for depths of cover according to the Fascicule 70 calculation, considering rigid pipes.


|  |  | Depth of cover values (m) |  |
| :--- | :---: | :---: | :---: |
|  |  | Without traffic loads | With traffic loads |
| Solution 1 | Min.** | $0.3(1)$ | 1 |
|  | Max. | 3.2 | 2.4 |
| Solution 2 | Min.** | $0.3(1)$ | 0.3 |
|  | Max. | 6 (or 9) | 6 (or 9) |

** Does not take into account the frost-free arrangements.
(1) The calculation allows shallower depth of cover, but this figure includes a safety margin / ground surface proximity and related hazards.


## Other precautions

> Clearance at each joint between the couplings and the granular bed to allow sufficient space, and to prevent the pipe from resting on the joints. (see EN 1610 §8.5.4)
$>$ Testing for pipe system leak tightness according to EN 1610 §13.
$>$ Identification of the pipework with a netting for example.
> Furthermore, check that these specifications do not contravene other local or national regulations or recommendations for installation.

For any other case, other diameters or buried systems under the bottom slab, please contact our technical support team: tcbatiment.sgpam@saint-gobain.com

Where the pipe system is to be set in concrete, a minimum 2.5 cm width of concrete on every side has to be respected because during and after its curing, the concrete will be subject to shrinkage and carbonation.
To reduce the natural rigidity of the concrete and its strain, a suitable flexible joint can be installed at intervals. This could be made of a compressible material (e.g. expanded polystyrene), be placed next to a pipe joint, and conform to the full cross section of the concrete. (See Fig). Refer to local best practice.


Furthermore, the pipe system should not be in contact with the concrete's metal reinforcements.
Surround should not be carried out until the pipework has been tested and inspected.


The EPAMS ${ }^{\circledR}$ system is a combination of cast iron pipes, fittings and accessories, jointed with PAM couplings able to withstand a negative pressure of -900 mbar.

The system is under French Technical Approval 5+14/14-2386 CSTB.

## EXPLANATIONS OF SIPHONIC SYSTEMS



1. No rain
2. Rainfall starts at low intensity - Drainage is performed by gravity flow
3. Continuous flow is achieved according to the rainfall intensity and roof area drained
4. Rainfall intensity increases to the maximum DRI - Flow continues by gravity until the maximum value is reached
5. No more air entering the system - Kinetic and pressure energies enhance the absorbing capacity quickly to the maximum design flow rate
6. Rainfall intensity stabilises to max. value => absorbing siphonic flow rate is maintained
7. Rainfall intensity decreases - Flow comes back to gravity system
8. Rainfall intensity stabilises to low value => absorbing gravity flow rate is maintained
9. No more rain - the rooftop surface is emptying

## EPAMS ${ }^{\circledR}$ DESIGN SERVICE

A siphonic roof drainage system is truly an "engineered system" which must be designed with careful and expert analysis. The pipework design is the key factor for performance and operational safety.

PAM Building sales staff, trained in the EPAMS ${ }^{\circledR}$ system, first evaluate your roof drainage project. When feasibility is confirmed, a technical team designs both the technical study and network sizing using the dedicated EPAMS ${ }^{\circledR}$ software.

The system must always be properly balanced and the flow velocity controlled. To protect the lifespan of the EPAMS ${ }^{\circledR}$ siphonic systems, the PAM Building design maintains that the dynamic pressure within the system should never exceed 5 bar.


Trained staff specifically in charge of your design will handle your siphonic project until the work's acceptance; each change to the plans results in the need for a new study.

Before the acceptance of the work, PAM Building or a delegated third party checks on site that the installation fully complies with the last study isometric drawings; any modification to an EPAMS ${ }^{\circledR}$ pipework route at the installation stage requires further approval from PAM Building.

This thorough management of the EPAMS ${ }^{\circledR}$ projects - feasibility study, project follow-up and control after installation completion ensures the EPAMS ${ }^{\circledR}$ system's efficiency and provides the project manager with total peace of mind.

## EPAMS ${ }^{\circledR}$ 100\% METAL OUTLETS

## The EPAMS ${ }^{\circledR}$ outlets are made of 3 different parts:

$>$ The Anti-Vortex mechanism, aluminium grating. Bolted on the bowl, it is the same for all the outlets.
> An identical stainless steel bowl for all the outlets, on which different components can be assembled depending on the field of use.
> A stainless steel tail available in four DN: 50-75-100-125.


## INSTALLATION

The EPAMS ${ }^{\circledR}$ outlets are easy to install. The installation has to be done in accordance with best practice and the Technical Approval requirements.

PAM Building EPAMS ${ }^{\circledR} 100 \%$ metal outlets fully guarantee mechanical strength and durability. They fully comply with EN 1253 on each specific point: flow capacity, watertightness, solidity, mechanical strength, heat resistance and climatic stresses (resistance to UV radiation).

The grating and anti-vortex mechanism are made in one piece. This allows quick removal with no risk of mistakes at reassembly, easy intervention and maintenance.


## EPAMS ${ }^{\circledR}$ siphonic roof drainage pipework

An EPAMS ${ }^{\circledR}$ pipework consists of one or several horizontal pipes without fall connected to a downpipe: horizontal runs and stacks are made of $S$ range cast iron components. The joints are generally made with PAM Rapid or equivalent couplings.

## > Connection of the roof outlets to the pipe system:

Depending on the job site constraints, the connection can be made flat or vertical.


## EPAMS ${ }^{\circledR}$

## > Decompression zone:

Before connecting to the sewer main, siphonic systems have to run by gravity again.

At the end of the downpipe, the bottom pipe increases in diameter - generally two extra diameters - causing decompression and reducing the flow velocity.


## > Pipe support

Stack support pipes are installed at the bottom of stacks to address forces due to changes in the stream flow systems.

Every 15 metres is the general requirement.


## > Pipe brackets

Owing to the high discharge rates, rubber-lined steel brackets are compulsory. Two brackets per pipe length shall be installed for horizontal or vertical pipework. It is also recommended to use one bracket per length or fitting (when the shape allows it, i.e. branches, etc.).

For the EPAMS ${ }^{\circledR}$ siphonic system, only round full and rubber-lined brackets shall be used.

| Vertical run | Pipes <br> Fittings* |
| :---: | :---: |
| Horizontal run | Number <br> of brackets |
|  | Pipe length $>2$ |
|  | Pipe length $<2 \mathrm{~m}$ <br> Fittings* |

* When the shape of the fitting permits

For brackets fixed to plain threaded rods, the distance between the bearing structure (concrete slab, steel frame, etc.) and the axis of the pipe shall not exceed 500 mm . If this maximum distance cannot be respected, the rigidity of the fixings should be increased (triangulation, steel knee brace).

Check local requirements for compliance.

## Specific points of the network

> Gripped couplings
On EPAMS pipework, grips collars are specified on couplings where they will withstand dislocation forces.

- Horizontal pipe connected to the outlet when the expected pressure is over 0.5 bar or -0.5 bar.
- The negative pressure will be highest at the head of the stack (down to -0.9 bar); the couplings there will be systematically installed with grip collars.
- Change of direction: at changes of direction on stacks and low collectors, the couplings will be gripped. Where a change of direction will be added or removed, PAM Building will carry out a new study taking the new head loss into account.
- The decompression zone is subject to turbulences, and subsequently, every component at the bottom of the stack, before the return to the gravity flow system, will be gripped.



## EPAMS ${ }^{\circledR}$

## > Reduction of flow sections

Achieving balance of potential energy and head losses on the pipework can require a reduction in the nominal diameters to increase head losses.

The regulations state that reducing the nominal diameter (DN) of discharge pipes is prohibited in the direction of flow except for siphonic systems like EPAMS ${ }^{\circledR}$ (EN 12056-3 \& 7,6,5) where it could be useful to control the pressure level. Increases and reductions of nominal diameters are made with the tapered pipe reducer. On horizontal runs, the pipe reducer will be installed so that the pipe invert is continuous.


## MAINTENANCE GENERAL FEATURES

Keeping the roof outlets clean is key to keeping an EPAMS ${ }^{\circledR}$ siphonic system in good working order.

The Technical Approval recommends they should be cleaned at least twice a year.

Any element like plant matter (leaves, twigs, etc.) or debris from the surroundings can end up on rooftops, and must be regularly cleared away to prevent clogging of the pipework or EPAMS ${ }^{\circledR}$ outlets. Maintenance cleaning frequency will largely depend on the building's environment. For buildings surrounded by trees and gardens, inspections will be done more frequently and the maintenance rate will be higher than the standard twice yearly requirement.

For all types of roof outlets, the cleaning process must be carried out as described opposite.


Ensure the leafguard grid is in place. Clean
the leafguard grid.


Remove the nut caps.


Unscrew
the nuts and lift the leafguard grid to remove it.


Clean the inside of the roof outlet
bowl.

## INSTALLATION FEATURES

## Preparation

Cast iron pipe systems for drainage mainly consist of spigot pipes - generally supplied in 3 m lengths - and fittings of various shapes (bends, branches, etc.). The cast iron pipes can be cut to length. Where pipes are cut on site, ends shall be cut clean and square with burrs removed, and then re-coated with the adequate EXTREM 1 touch-up paints (see p.145), or other repair products recommended by PAM Building.

RECOMMENDED TOOLS


Extrem 1
Touch-up paint


A - T-Box Spanner
B-13 mm Deep Socket
C - Allen Key Socket Adapter
D - Ratchet Spanner

RECOMMENDED TO CUT THE PIPE


Exact saw


Chop saw
For more information contact the technical department by e-mail: tcbatiment.sgpam@saint-gobain.com

## Cutting techniques

Pipes can be cut easily and quickly using either of the following methods. Cutting procedures must comply with the safety guidelines provided in the cutting tool manufacturer's operating manual.

Pipe cutter Exact saw | Powered disc |
| :---: |
| cutter |

S and Plus ranges
DN50
DN75
DN100
DN125
DN150
DN200
DN250
DN300
DN400
DN500
DN600
FLTEDRAINWATIR RANCE
DN75
DN100

## GENERAL INSTALLATION INSTRUCTIONS

## (cutting, coating, painting, testing and repairing)

The Exact saw : the ultimate and fast solution for cutting 50-200 mm cast iron (see p.145)

- Easy, secure and effortless cutting for use on construction sites
- Wide range of applications and dimensions
- No rework necessary - accurate cutting
- Suitable for clamping joints
- Reduction in tool costs
- Reduction in sparks - may not require hot works permit



## Coating cut ends

Pipe ends needed to be re-coated with touch-up paint.
We recommend protecting the cut ends with the same standard as the pipe's internal coating: in this instance, you can use EXTREM 1 (see p.145), a new quick drying touch-up paint that air dries in 15 minutes.


## Overpainting method

The acrylic paint on the pipes is a primer which can be over painted with most top coats. Finishing paint is needed where the pipework is visible, indoor or outdoor. What types of paint can be used? Any alkyd resin or glycerophtalic paint designed for metal care and suitable for the requirements of the local environment.

The system should be gently rubbed down with suitable abrasive paper to provide a good adhesion key for the finishing coating. Where the finishing paint is to be used on zinc-coated pipes to rejuvenate them, rub them down gently to remove possible zinc salts.

Where incipient rust has already appeared on cast iron products, corrosion inhibitors can be used before painting. Some existing metal finishes, including anti-corrosive pigment, can be applied directly to rust.

## MODIFICATIONS TO AN EXISTING INSTALLATION

## Typical example of a spigot system

1. Measure the length of the branch, adding a further 15 mm in total to allow for the coupling's central register top and bottom.
2. Make sure existing pipework is adequately supported from above.
3. Mark the pipe position for cutting.
4. Cut the pipe using a powered disc cutter or wheel cutter and remove sharp edges.
5. Coat the cut ends with the appropriate touch-up product (epoxy coating).
6. Push the rubber gaskets onto the spigot cut ends top and bottom, ensuring the central registers are abutted against each spigot edge.
7. Position the fitting in the stack within each rubber gasket abutting against the central registers.
8. Loosely assemble the coupling around each gasket.
9. Check alignment of assembly before tightening the bolts to the recommended level, depending on the coupling's technical recommendations.
10. Test the new stack for successful joints.


## DISCHARGE CAPACITY

## APPLICATION

For the dimensioning of rainwater and wastewater systems, the nominal sizes can be determined using the dimensioning tables in the appendix of DIN EN 12056. These tables only represent the discharge capacity of the smallest permissible inner diameter of the values specified.

If the pipe material is known at the latest during the execution planning, the specific discharge capacities should be determined for a differentiated calculation on the basis of the actual internal diameter of the respective drainage pipe system should be used for a differentiated calculation.

EXAMPLE OF WASTEWATER PIPE FILLING LEVEL H/D = 1.0 WITH SLOPE 1 CM

| DN | PAM <br> drainage pipes | DIN <br> 1986-100, A3 | DIFFERENCE |
| :---: | :---: | :---: | :---: |
| 100 | $3,0 \mathrm{I} / \mathrm{s}$ | $2,5 \mathrm{I} / \mathrm{s}$ | $+20 \%$ |
| 125 | $5,3 \mathrm{I} / \mathrm{s}$ | $3,9 \mathrm{I} / \mathrm{s}$ | $+36 \%$ |
| 150 | $8,5 \mathrm{I} / \mathrm{s}$ | $7,7 \mathrm{I} / \mathrm{s}$ | $+10 \%$ |



DISCHARGE CAPACITY OF PAM PIPES ACCORDING TO EN 877 AND DIN 19522

|  | $\begin{aligned} & \text { DN } 75 \\ & d_{i}=75 \end{aligned}$ |  | DN 100$d_{i}=103$ |  | DN 125$d_{i}=127$ |  | DN 150$d_{i}=152$ |  | $\begin{aligned} & D_{N} 200 \\ & d_{i}=200 \end{aligned}$ |  | $\begin{aligned} & \text { DN } 250 \\ & d_{i}=263 \end{aligned}$ |  | $\begin{aligned} & \text { DN } 300 \\ & d_{i}=314 \end{aligned}$ |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| J | Q | $v$ | Q | $v$ | Q | v | Q | v | Q | v | Q | v | Q | v |
| $\mathrm{cm} / \mathrm{m}$ | 1/5 | $\mathrm{m} / \mathrm{s}$ | 1/5 | $\mathrm{m} / \mathrm{s}$ | 1/s | $\mathrm{m} / \mathrm{s}$ | 1/s | $\mathrm{m} / \mathrm{s}$ | 1/s | $\mathrm{m} / \mathrm{s}$ | 1/s | $\mathrm{m} / \mathrm{s}$ | 1/s | $\mathrm{m} / \mathrm{s}$ |
| 0.5 | 0.9 | 0.4 | 2.1 | 0.5 | 3.7 | 0.6 | 6.0 | 0.7 | 12.5 | 0.8 | 25.8 | 1.0 | 41.3 | 1.1 |
| 0.6 | 1.0 | 0.4 | 2.3 | 0.6 | 4.1 | 0.6 | 6.6 | 0.7 | 13.7 | 0.9 | 28.3 | 1.0 | 45.3 | 1.2 |
| 0.7 | 1.1 | 0.5 | 2.5 | 0.6 | 4.4 | 0.7 | 7.1 | 0.8 | 14.8 | 0.9 | 30.6 | 1.1 | 48.9 | 1.3 |
| 0.8 | 1.1 | 0.5 | 2.7 | 0.6 | 4.7 | 0.7 | 7.6 | 0.8 | 15.8 | 1.0 | 32.7 | 1.2 | 52.3 | 1.4 |
| 0.9 | 1.2 | 0.6 | 2.9 | 0.7 | 5.0 | 0.8 | 8.1 | 0.9 | 16.8 | 1.1 | 34.7 | 1.3 | 55.5 | 1.4 |
| 1.0 | 1.3 | 0.6 | 3.0 | 0.7 | 5.3 | 0.8 | 8.5 | 0.9 | 17.7 | 1.1 | 36.6 | 1.3 | 58.5 | 1.5 |
| 1.1 | 1.4 | 0.6 | 3.2 | 0.8 | 5.5 | 0.9 | 8.9 | 1.0 | 18.6 | 1.2 | 38.4 | 1.4 | 61.4 | 1.6 |
| 1.2 | 1.4 | 0.6 | 3.3 | 0.8 | 5.8 | 0.9 | 9.4 | 1.0 | 19.4 | 1.2 | 40.1 | 1.5 | 64.2 | 1.7 |
| 1.3 | 1.5 | 0.7 | 3.4 | 0.8 | 6.0 | 1.0 | 9.7 | 1.1 | 20.2 | 1.3 | 41.8 | 1.5 | 66.8 | 1.7 |
| 1.4 | 1.5 | 0.7 | 3.6 | 0.9 | 6.3 | 1.0 | 10.1 | 1.1 | 21.0 | 1.3 | 43.4 | 1.6 | 69.3 | 1.8 |
| 1.5 | 1.6 | 0.7 | 3.7 | 0.9 | 6.5 | 1.0 | 10.5 | 1.2 | 21.7 | 1.4 | 44.9 | 1.7 | 71.8 | 1.9 |
| 1.6 | 1.6 | 0.7 | 3.8 | 0.9 | 6.7 | 1.1 | 10.8 | 1.2 | 22.4 | 1.4 | 46.4 | 1.7 | 74.1 | 1.9 |
| 1.7 | 1.7 | 0.8 | 3.9 | 0.9 | 6.9 | 1.1 | 11.1 | 1.2 | 23.1 | 1.5 | 47.8 | 1.8 | 76.4 | 2.0 |
| 1.8 | 1.7 | 0.8 | 4.1 | 1.0 | 7.1 | 1.1 | 11.5 | 1.3 | 23.8 | 1.5 | 49.2 | 1.8 | 78.7 | 2.0 |
| 1.9 | 1.8 | 0.8 | 4.2 | 1.0 | 7.3 | 1.2 | 11.8 | 1.3 | 24.5 | 1.6 | 50.6 | 1.9 | 80.8 | 2.1 |
| 2.0 | 1.8 | 0.8 | 4.3 | 1.0 | 7.5 | 1.2 | 12.1 | 1.3 | 25.1 | 1.6 | 51.6 | 1.9 | 82.9 | 2.1 |
| 2.5 | 2.0 | 0.9 | 4.8 | 1.2 | 8.4 | 1.3 | 13.5 | 1.5 | 28.1 | 1.8 | 58.0 | 2.1 | 92.8 | 2.4 |
| 3.0 | 2.2 | 1.0 | 5.3 | 1.3 | 9.2 | 1.5 | 14.8 | 1.6 | 30.8 | 2.0 | 63.6 | 2.3 | 101.7 | 2.6 |


|  | $\begin{aligned} & \text { DN } 75 \\ & d_{i}=75 \end{aligned}$ |  | $\frac{\text { DN } 100}{d_{i}=103}$ |  | DN 125$d_{i}=127$ |  | DN 150 di $=152$ |  | $\begin{array}{r} \text { DN } 200 \\ d_{i}=200 \end{array}$ |  | $\frac{\text { DN } 250}{d_{i}=263}$ |  | DN 300$\mathbf{d}_{i}=314$ |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| J | Q | v | Q | v | Q | $\checkmark$ | Q | v | Q | v | Q | v | Q | $v$ |
| $\mathrm{cm} / \mathrm{m}$ | 1/s | $\mathrm{m} / \mathrm{s}$ | 1/s | m/s | 1/s | m/s | 1/s | m/s | 1/s | $\mathrm{m} / \mathrm{s}$ | 1/s | m/s | 1/s | m/s |
| 0.5 | 1.5 | 0.5 | 3.6 | 0.6 | 6.2 | 0.7 | 10.1 | 0.7 | 20.8 | 0.9 | 43.1 | 1.1 | 68.9 | 1.2 |
| 0.6 | 1.7 | 0.5 | 3.9 | 0.6 | 6.8 | 0.7 | 11.0 | 0.8 | 22.9 | 1.0 | 47.2 | 1.2 | 75.5 | 1.3 |
| 0.7 | 1.8 | 0.5 | 4.2 | 0.7 | 7.4 | 0.8 | 11.9 | 0.9 | 24.7 | 1.1 | 51.1 | 1.3 | 81.6 | 1.4 |
| 0.8 | 1.9 | 0.6 | 4.5 | 0.7 | 7.9 | 0.8 | 12.7 | 0.9 | 26.4 | 1.1 | 54.6 | 1.3 | 87.3 | 1.5 |
| 0.9 | 2.1 | 0.6 | 4.8 | 0.8 | 8.4 | 0.9 | 13.5 | 1.0 | 28.0 | 1.2 | 58.0 | 1.4 | 92.6 | 1.6 |
| 1.0 | 2.2 | 0.7 | 5.1 | 0.8 | 8.8 | 0.9 | 14.3 | 1.1 | 29.6 | 1.3 | 61.1 | 1.5 | 97.6 | 1.7 |
| 1.1 | 2.3 | 0.7 | 5.3 | 0.9 | 9.3 | 1.0 | 15.0 | 1.1 | 31.0 | 1.3 | 64.1 | 1.6 | 102.4 | 1.8 |
| 1.2 | 2.4 | 0.7 | 5.5 | 0.9 | 9.7 | 1.0 | 15.6 | 1.2 | 32.4 | 1.4 | 67.0 | 1.6 | 107.0 | 1.8 |
| 1.3 | 2.5 | 0.7 | 5.8 | 0.9 | 10.1 | 1.1 | 16.3 | 1.2 | 33.8 | 1.4 | 69.7 | 1.7 | 111.4 | 1.9 |
| 1.4 | 2.6 | 0.8 | 6.0 | 1.0 | 10.5 | 1.1 | 16.9 | 1.2 | 35.0 | 1.5 | 72.4 | 1.8 | 115.6 | 2.0 |
| 1.5 | 2.7 | 0.8 | 6.2 | 1.0 | 10.9 | 1.1 | 17.5 | 1.3 | 36.3 | 1.5 | 74.9 | 1.8 | 119.7 | 2.1 |
| 1.6 | 2.7 | 0.8 | 6.4 | 1.0 | 11.2 | 1.2 | 18.1 | 1.3 | 37.5 | 1.6 | 77.4 | 1.9 | 123.7 | 2.1 |
| 1.7 | 2.8 | 0.9 | 6.6 | 1.1 | 11.6 | 1.2 | 18.6 | 1.4 | 38.6 | 1.6 | 79.8 | 2.0 | 127.5 | 2.2 |
| 1.8 | 2.9 | 0.9 | 6.8 | 1.1 | 11.9 | 1.3 | 19.2 | 1.4 | 39.8 | 1.7 | 82.1 | 2.0 | 131.2 | 2.3 |
| 1.9 | 3.0 | 0.9 | 7.0 | 1.1 | 12.2 | 1.3 | 19.7 | 1.5 | 40.9 | 1.7 | 84.4 | 2.1 | 134.8 | 2.3 |
| 2.0 | 3.1 | 0.9 | 7.2 | 1.2 | 12.5 | 1.3 | 20.2 | 1.5 | 41.9 | 1.8 | 86.6 | 2.1 | 138.3 | 2.4 |
| 2.5 | 3.4 | 1.0 | 8.0 | 1.3 | 14.0 | 1.5 | 22.6 | 1.7 | 46.9 | 2.0 | 96.9 | 2.4 | 154.7 | 2.7 |
| 3.0 | 3.8 | 1.1 | 8.8 | 1.4 | 15.4 | 1.6 | 24.8 | 1.8 | 51.4 | 2.2 | 106.1 | 2.6 | 169.6 | 2.9 |


|  | $\begin{array}{r} \text { DN } 75 \\ \hline \mathrm{~d}_{\mathrm{i}}=75 \end{array}$ |  | $\begin{aligned} & \hline D_{N} 100 \\ & d_{i}=103 \end{aligned}$ |  | $\begin{aligned} & \hline \text { DN } 125 \\ & d_{i}=127 \end{aligned}$ |  | $\begin{gathered} \hline D_{N} 150 \\ d_{i}=152 \end{gathered}$ |  | $\begin{aligned} & \hline \text { DN } 200 \\ & d_{j}=200 \end{aligned}$ |  | $\frac{\text { DN } 250}{d_{i}=263}$ |  | $\begin{aligned} & \hline \text { DN } 300 \\ & \mathrm{~d}_{\mathrm{i}}=314 \end{aligned}$ |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| J | Q | $v$ | Q | $v$ | Q | $\checkmark$ | Q | $v$ | Q | $v$ | Q | v | Q | $v$ |
| $\mathrm{cm} / \mathrm{m}$ | 1/s | $\mathrm{m} / \mathrm{s}$ | 1/s | $\mathrm{m} / \mathrm{s}$ | 1/s | $\mathrm{m} / \mathrm{s}$ | 1/s | $\mathrm{m} / \mathrm{s}$ | 1/s | $\mathrm{m} / \mathrm{s}$ | 1/s | $\mathrm{m} / \mathrm{s}$ | 1/s | m/s |
| 0.5 | 1.8 | 0.4 | 4.2 | 0.5 | 7.4 | 0.6 | 12.0 | 0.7 | 24.9 | 0.8 | 51.6 | 1.0 | 82.6 | 1.1 |
| 0.6 | 2.0 | 0.4 | 4.7 | 0.6 | 8.2 | 0.6 | 13.2 | 0.7 | 27.4 | 0.9 | 56.6 | 1.0 | 90.5 | 1.2 |
| 0.7 | 2.1 | 0.5 | 5.0 | 0.6 | 8.8 | 0.7 | 14.2 | 0.8 | 29.6 | 0.9 | 61.2 | 1.1 | 97.8 | 1.3 |
| 0.8 | 2.3 | 0.5 | 5.4 | 0.6 | 9.4 | 0.7 | 15.2 | 0.8 | 31.6 | 1.0 | 65.4 | 1.2 | 104.6 | 1.4 |
| 0.9 | 2.4 | 0.6 | 5.7 | 0.7 | 10.0 | 0.8 | 16.2 | 0.9 | 33.6 | 1.1 | 69.4 | 1.3 | 111.0 | 1.4 |
| 1.0 | 2.6 | 0.6 | 6.0 | 0.7 | 10.6 | 0.8 | 17.1 | 0.9 | 35.4 | 1.1 | 73.2 | 1.3 | 117.1 | 1.5 |
| 1.1 | 2.7 | 0.6 | 6.3 | 0.8 | 11.1 | 0.9 | 17.9 | 1.0 | 37.1 | 1.2 | 76.8 | 1.4 | 122.8 | 1.6 |
| 1.2 | 2.8 | 0.6 | 6.6 | 0.8 | 11.6 | 0.9 | 18.7 | 1.0 | 38.8 | 1.2 | 80.3 | 1.5 | 128.3 | 1.7 |
| 1.3 | 2.9 | 0.7 | 6.9 | 0.8 | 12.1 | 1.0 | 19.5 | 1.1 | 40.4 | 1.3 | 83.6 | 1.5 | 133.6 | 1.7 |
| 1.4 | 3.1 | 0.7 | 7.2 | 0.9 | 12.5 | 1.0 | 20.2 | 1.1 | 41.9 | 1.3 | 86.7 | 1.6 | 138.7 | 1.8 |
| 1.5 | 3.2 | 0.7 | 7.4 | 0.9 | 13.0 | 1.0 | 20.9 | 1.2 | 43.4 | 1.4 | 89.8 | 1.7 | 143.6 | 1.9 |
| 1.6 | 3.3 | 0.7 | 7.7 | 0.9 | 13.4 | 1.1 | 21.6 | 1.2 | 44.9 | 1.4 | 92.8 | 1.7 | 148.3 | 1.9 |
| 1.7 | 3.4 | 0.8 | 7.9 | 0.9 | 13.8 | 1.1 | 22.3 | 1.2 | 46.3 | 1.5 | 95.6 | 1.8 | 152.9 | 2.0 |
| 1.8 | 3.5 | 0.8 | 8.1 | 1.0 | 14.2 | 1.1 | 22.9 | 1.3 | 47.6 | 1.5 | 98.4 | 1.8 | 157.3 | 2.0 |
| 1.9 | 3.6 | 0.8 | 8.3 | 1.0 | 14.6 | 1.2 | 23.6 | 1.3 | 48.9 | 1.6 | 101.1 | 1.9 | 161.7 | 2.1 |
| 2.0 | 3.7 | 0.8 | 8.6 | 1.0 | 15.0 | 1.2 | 24.2 | 1.3 | 50.2 | 1.6 | 103.8 | 1.9 | 165.9 | 2.1 |
| 2.5 | 4.1 | 0.9 | 9.6 | 1.2 | 16.8 | 1.3 | 27.1 | 1.5 | 56.2 | 1.8 | 116.1 | 2.1 | 185.6 | 2.4 |
| 3.0 | 4.5 | 1.0 | 10.5 | 1.3 | 18.4 | 1.5 | 29.7 | 1.6 | 61.6 | 2.0 | 127.2 | 2.3 | 203.3 | 2.6 |

$d_{i}=\operatorname{INTERNAL}$ DIAMETER $\quad J=$ GRADIENT $\quad Q=$ VOLUME FLOW RATE $\quad V=F L O W$ VELOCITY

$$
4
$$

## c $=$ NERAL TERMS \& CONDITIONS OF SALE



## Article 1-GENERAL PROVISIONS

These Terms and Conditions of Sale ("T\&Cs") cancel and replace those previously communicated. They apply to any order placed by a client ("Client") to SAINT-GOBAIN PAM BÂTIMENT, a company organized and existing under the laws of the French Republic with a share capital of $6812970,75 €$ with its registered office at 21 avenue Camille Cavallier in Pont-à-Mousson (54700), France registered with the Register of Commerce of Nancy under number 799283882 ("SG PAM BAT"), for the sale of SG PAM BAT's goods and services ("Products").
Any order made by the Client implies its adherence to these terms and conditions of sale. The Client's purchasing conditions shall not take precedence over these terms and conditions of sale unless first agreed in writing by SG PAM BAT.
SG PAM BAT reserves the right to amend its T\&Cs at any time, the applicable T\&Cs being those in force on the date of the order sent by the Buyer.

## Article 2-ORDERS - ACCEPTANCE

2.1 - Each order for Products must be identified as an order and must include the necessary information for its processing, in particular sufficient accurate information on the branding, delivery and listing of the range, in order to allow SG PAM BAT to process this order as best possible. In case of insufficient or inaccurate information, SG PAM BAT may delay the shipping date of Products, without prejudice to any other solution.
2.2 - Orders do not become firm and final until SG PAM BAT has issued an acknowledgement of receipt. No modification or cancellation of an order shall be taken into account after the issue of the acknowledgement of receipt of the order. Unless otherwise provided between the parties, SG PAM BAT's silence does not constitute acceptance of an order.

## Article 3 - PRICING

3.1 Products are sold under the conditions and for the prices currently applicable on the effective delivery date or, where there is an offer, the prices indicated in relation to it, insofar as the order is received by SG PAM BAT within the period of validity of that offer.
3.2 Where SG PAM BAT issues an offer, prices are firm throughout the duration of the offer or for a maximum duration of two (2) months following the issue date of that offer. After this period, price increases may be applied.
3.3 Prices may be modified by SG PAM BAT at any time with a notice period of thirty (30) days.
3.4 Unless specifically agreed, prices are expressed in euros, net, excluding VAT. If applicable according to the Products destination, these prices are billed
after application of value added tax at the rate in force. SG PAM BAT shall be entitled to recover any tax, duty or increase arising from a change to regulations or legislation, from its entry into force.

## Article 4 - DELIVERY

4.1 Our delivery times are mentioned as an indication, and correspond to our best estimate. Delivery times are only firm when they are expressly classified as such in the order acknowledgement. 4.2 Non-respect of the indications relative to the delivery time does not authorise the Client to cancel their order, to delay payment beyond the agreed conditions or to withhold or offset any part of it.
4.3 No late penalty may be claimed from SG PAM BAT if it has not been expressly agreed with regard to its principle and its terms in the order acknowledgement.
4.4 SG PAM BAT is not responsible for breached delivery times where:
the Client has not respected the payment conditions; or
where information to be provided by the Client has not arrived within the required time;
4.5 The transfer of ownership of the Products to the Client is conditional upon payment of the price in full.
4.6 Risk is transferred under the conditions defined by the chosen Incoterm (Incoterms published by Paris International Chamber of Commerce in force on the effective delivery date, the "Incoterms") or where Products are customised and covered by the carrier.
4.7 In the absence of specific conditions agreed beforehand and confirmed in the order acknowledgement by SG PAM BAT, the Products are sold Free Carrier (FCA - Incoterms® 2020) from SG PAM BAT's shipping site.
4.8 For any exit from the European Union territory made by the Client or the forwarding agent designated by the Client, as proof of exit, the Export Control System ("ECS") of exit must be sent to SG PAM BAT. In the event that the ECS cannot be provided, the Client or its forwarding agent may send to SG PAM BAT, the Bill of lading for shipment by sea or the Airway Bill for shipment by air or the CMR Way Bill with receiver's signature and stamp or the Delivery note with receiver's signature and stamp.

## Article 5-INSPECTION

5.1 Products are inspected in the factory according to SG PAM BAT's quality control procedures and the standards in force.
5.2 In cases where a special inspection has been agreed, by the Client or an organisation representing it, the inspectors in charge are advised
of the dates and times in which inspections must normally take place.

## Article 6 - TRANSPORT

6.1 Where the Client organises transport itself, it assumes the restrictions of adapting vehicles to Products and the obligation to make an appointment 48 hours in advance. Otherwise, the delivery cannot be loaded.
6.2 The Client is responsible for unloading operations carried out under its control. In this regard, the Client must ensure respect for safety conditions on site and provide suitable means to allow unloading in the best possible safety conditions. In particular, in case of a delivery by truck crane, the Client shall assist the driver by separating pipes and packages on the ground. The Client must establish a safety protocol with the carrier prior to unloading
6.3 In case of lost, damaged or missing Products observed upon delivery, the Client shall take recourse against the carrier, stating its reservations on the transporter's delivery form. It will confirm these reservations with the carrier, by registered etter with acknowledgement of receipt, addressing its claim with supporting documentation within 3 business days following receipt of the Products.

## Article 7-PAYMENT CONDITIONS

7.1 Unless otherwise indicated, payments are made at the address stated on the invoice, within fortyfive (45) days from end of the month following the invoice issue date, independently from the date of receipt of the Products by the Client.
7.2 Drafts accepted must be returned within 10 days following their issuance. This deadline also applies to means of payment issued by the Client.
7.3 Any payment made after the payment date stated on the invoice shall allow the billing of (i) late penalties at a rate equal to the interest rate applied by the European Central Bank to its refinancing operation plus 10 percentage points and (ii) a fixed charge for recovery costs, of a sum of €40; SG PAM BAT reserves the right to seek additional compensation, upon justification, in the event that its recovery costs exceed this amount.
7.4 In case of non-payment of an outstanding invoice, all of the invoices in arrears shall become immediately payable. In addition, SG PAM BAT reserves the right to suspend orders in progress, without prejudice to damages and interest.
7.5 No claim by the Client may invoke the modification, delay or suspension of payments due, or authorise it to offset or deduct payments against those owed to SG PAM BAT. Any offsetting or deduction not agreed beforehand shall constitute a payment incident justifying the application of the
above measures.
7.6 In the event of a significant change to the Client's legal or financial situation, affecting SG PAM BAT's assessment of its solvency, or in case of an excessive outstanding amount, SG PAM BAT reserves the right even after partial execution of an order to either demand guarantees or cancel the outstanding orders.

## Article 8 - GUARANTEE FOR PRODUCTS

8.1 Without prejudice to the measures to be taken with regard to the carrier, claims in relation to the non-conformity of delivered Products with those listed on the order acknowledgement must be submitted in writing within 3 days from receipt of the Products. After this time, no claims shall be accepted.
8.2 SG PAM BAT guarantees the Client against hidden defects that may affect the sold Products. If the Client detects a manufacturing fault in the Product, in its opinion constituting a hidden defect, it must send a claim to SG PAM BAT immediately. 8.3 The implementation of the guarantee for conformity and hidden defect is conditional upon these faults being jointly observed and acknowledged as effectively attributable to SG PAM BAT. The Client will provide all justifications as to the reality of the faults found. It shall facilitate SG PAM BAT in observing these faults and remedying them. The Client shall abstain from interfering with the Products.
8.4 An observation of the fault will then be conducted, within 1 month -with everything as is, except in case of force majeure - in a report in the presence of SG PAM BAT's representatives.
8.5 If the existence of a fault is jointly found and recognised by SG PAM BAT as being effectively attributable to it, SG PAM BAT shall assume the repair of the Product or supply a replacement of the Product previously delivered, and the corresponding shipping costs.
8.6 The Client is obliged under its exclusive responsibility to respect the indications given by SG PAM BAT as well as the industry standards for the compliant handling and use of the Products as well as all technical instructions.
8.7 The guarantee given is excluded in case of:
apparent defect, or that which a professional would discover;
defect and/or deteriorations caused by natural wear or by an external accident;
modification of the Product not provided for or specified by SG PAM BAT;
defect and/or deteriorations caused by a compatibility fault against Products not provided
by SG PAM BAT;
non-respect by the Client of the indications concerning handling, fitting, use and maintenance of Products as well as industry standards;
> force majeure or similar event.
8.8 The guarantee given by SG PAM BAT is for 12 months from delivery. Interventions conducted in relation to the guarantee shall not result in extending this period.

## ARTICLE 9 - LIABILITY

9.1 SG PAM BAT warrants that its Products comply with their specifications at the date at which they are placed at Client's disposal. Specifications, performances and technical characteristics stated in catalogs, technical brochures and any other commercial documentation and packaging are subject to revision at any time without any prior notice to the Client. Characteristics and colours of SG PAM BAT's Products have an indicative value due to their nature of manufacturing.
9.2 Client recognizes that he is aware of the technical characteristics of the Products as well as their conditions of use and application, defined in particular by the rules of the art and the current technical documentations. For the avoidance of doubt, the Client shall conduct prior and sufficient tests to verify that the Products meet its requirements.
9.3 SG PAM BAT's liability is limited to the supply of the Products complying with SG PAM BAT's specifications to the exclusion of any consequence of an improper, careless or inadequate use which remains under the exclusive responsibility and liability of the Client.
9.4 SG PAM BAT's liability is limited to the replacement or reimbursement of the Products proved to be defective, without indemnification or compensation relating to transport or labour costs to be due to the Client. No responsibility or liability shall be accepted for any statement, representation, warranty or otherwise made by any of SG PAM BAT representative, agent or distributors.

## Article 10-INDUSTRIAL PROPERTY

The plans, models, studies, results of trials, catalogs, notices and all commercial and technical documents disseminated on any support whatsoever, by SG PAM BAT are the exclusive property of SG PAM BAT. As a result, the Client is prohibited from making any copy whatsoever without SG PAM BAT's prior agreement.

Article 11 - MANUFACTURE-RECOMMENDATION 11.1 The weights and dimensions of Products
indicated on SG PAM BAT's documents are theoretical in value. SG PAM BAT reserves the right to make any modification to the information given in its documentation.
11.2 The documents regarding the handling, storage, fitting, use and maintenance of Products are provided by SG PAM BAT free of charge, at the Client's request. The Client remains solely responsible for compliance with the health and safety conditions of these various operations and the implementation of the Products according to industry standards.
SG PAM BAT reserves the right to modify the data given in its documentation at any time. It is the Client's responsibility to verify their validity with SG PAM BAT.

## Article 12 - PACKAGING

12.1 The Products' packaging is designed so as to satisfy the requirements of transportation
12.2 Packaging and dunnage not billed for by SG PAM BAT will be recovered upon delivery.

## Article 13 - CONFORMITY OF EXPORTING

 CONTROLSThe Client undertakes to respect all applicable laws, particularly those concerning export controls. If, at any time, a new law or regulation enters into force rendering the execution of SG PAM BAT's obligations impossible or illegal, SG PAM BAT shall be entitled to cancel the order and terminate the contractual relationship, without any liability with regard to the Client.

## Article 14 - PERSONAL INFORMATION

14.1 SG PAM BAT, as a controller, carries out a computerised processing of its clients personal information to place orders and make deliveries.
14.2 Personal information collected in this context (Client's company name, first and last name of SG PAM BAT's contact at the Client's, email address, business telephone or fax number) is strictly necessary for the T\&Cs execution and enable SG PAM BAT to manage the order, delivery, invoicing and collection.
14.3 Personal information is kept for the entire duration of the commercial relationship and within the limits of the applicable laws.
14.4 SG PAM BAT's customer service, commercial, invoicing and collection departments, as well as its subcontractors responsible for delivery and sending invoices, receive this data.
14.5 In accordance with applicable regulations regarding personal information protection, the Client has a right to access, to correct, to erase and to object to the use of his or her personal information, which the Client may exercise, by sending an email to: privacycontact.sgpambatiment.fr@saint-gobain.com, or by writing to : SAINTGOBAIN PAM BÂTIMENT - Privacy Correspondent - 21 avenue Camille Cavallier, 54700 Pont-à-Mousson, France.
14.6 For more information about the way SG PAM BAT processes personal information, the Client may consult the web page «Your data and your rights» on SG PAM BAT's websites: www.pambatiment.fr (France website) and www.pambuilding.com (Export website).
14.7 If the Client considers, after having contacted SG PAM BAT, that his/her rights are not respected or that the processing of his/her personal information by SG PAM BAT does not comply with the applicable rules, the Client shall be entitled to file a claim with the French personal data protection supervisory authority (CNIL).

## Article 15 - CONFIDENTIALITY

The Client undertakes not to disclose to a third party, in whole or in part, any document, data, or information exchanged, in any form and of any nature whatsoever relating to the order and/or the Products without the prior written consent of SG PAM BAT. This commitment shall apply for the entire duration of the order and for five (5) years from the last delivery of Products under said order.

## Article 16 - FORCE MAJEURE

16.1 SG PAM BAT is not responsible for cases of force majeure. Force majeure is understood to mean any cause independent of the will of SG PAM BAT, which would render the performance of its contractual obligations impossible, and affect the manufacture, shipping and delivery of Products. Cases of force majeure are considered to include disruptions to production and/or delivery resulting from a war (declared or not), strike, lock-out, accident, fire, flooding, natural disaster, epidemics, pandemics, interruption or delay in delivery, shortage of materials and/or raw materials, embargoes, and settlements, of any nature whatsoever.
16.2 In the event of force majeure, SG PAM BAT shall have a reasonable extra period of time in which to execute its obligations.

Article 17 - APPLICABLE LAW - ALLOCATION OF JURISDICTION
In the event of a dispute as to the formation, performance or interpretation of the sales contract, the Nancy courts shall be solely competent even in case of multiple defendants, guarantee claims or proceedings in chambers. These T\&Cs shall be subject to French law to the exclusion of its conflict-of-law rules.


PAM Building
Sales enquiries:
+33 (0) 383807650 / 653 / 654
Technical enquiries: tcbatiment.sgpam@saint-gobain.com

Visit our website: www.pambuilding.com

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[^0]:    1 | City Clinic Hospital - Kommunarka - Russia | S \& Plus range
    2 | Acıbadem Hospital Atassehir - Istanbul - Turkey | S range
    3 | Sidra Hospital - Doha - Qatar I S range

[^1]:    A summary of the Declaration of Performance (DoP) for all our ranges is available on our website:
    www.pambuilding.com

[^2]:    Bayard plant (Haute-Marne): ISO 9001 and ISO 14001 certified by Bureau Veritas.

[^3]:    * Furnace tests carried out in 2017-2018 according to EN 1366-3 at the EFECTIS testing centre,

[^4]:    *As all wastewater pipe systems manufacturers apply the standard test protocol, it allows building project managers to compare their results.

[^5]:    $\rightarrow$ Plus range is compulsory

[^6]:    *Recycled content: proportion, by mass, of recycled material in a product or packaging. Only pre-consumer and post-consumer materials shall be considered recycled content.
    ** Pre-consumer material: material diverted from the waste stream during a manufacturing process. This excludes the reuse of materials such as rework, regrind, or scrap generated in a process and capable of being reclaimed within the same process that generated it.
    ${ }^{* * *}$ Post-consumer material: material generated by households or commercial, industrial and institutional facilities in their role as end users of the product which can no longer be used for its intended purpose.

[^7]:    > Source: https://www.environdec.com/Detail/?Epd=18393

[^8]:    * For dimensions over DN 400 please contact us.

[^9]:    "All dimensions are in mm and nominal weights are in kg" - "Hatch patterned area in the drawings shows the max. cutting length".

[^10]:    "All dimensions are in mm and nominal weights are in kg " - "Hatch patterned area in the drawings shows the max. cutting length".

[^11]:    "All dimensions are in mm and nominal weights are in kg"

[^12]:    "All dimensions are in mm and nominal weights are in kg " - "Hatch patterned area in the drawings shows the max. cutting length".

[^13]:    * Delivered with wall fixing bracket (see p.126)

[^14]:    * The advantage of the DN 125 outlet is in the "gutters" application where the water cover height can exceed 55 mm (see French Technical Approval 14+5/01-656-§ 2.21)

[^15]:    * The advantage of the DN 125 outlet is in the "gutters" application where the water cover height can exceed 55 mm (see French Technical Approval 14+5/01-656-§ 2.21)

[^16]:    "All dimensions are in mm and nominal weights are in kg "

[^17]:    "All dimensions are in mm and nominal weights are in kg"

[^18]:    "All dimensions are in mm and nominal weights are in kg"

[^19]:    ATTENTION:
    Wherever couplings may be subject to end thrust forces, they must be secured with grip collars.
    See p. 150 for installation details.

