



Syphonic Cast Iron Rainwater Drainage System

CI/SfB

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OCTOBER 2004



The ideal solution for:

- Factories
- Warehouses
- Shopping Centres
- Airports
- Hotels
- Stadiums



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Introduction



Saint-Gobain Pipelines is a leading supplier of ductile iron pipes, fittings, valves, manhole covers, gullies and grates, as well as being the leading producer of cast iron above and below ground drainage systems. Its markets include water and sewerage, telecommunications, highways, civil engineering, construction and housing.

Saint-Gobain Pipelines, Soil & Drain specialises in the manufacture of cast iron above and below ground drainage systems and rainwater and gutter systems.

Architectural design and roof sizes of certain modern buildings can often make the installation of conventional rainwater drainage a difficult task.

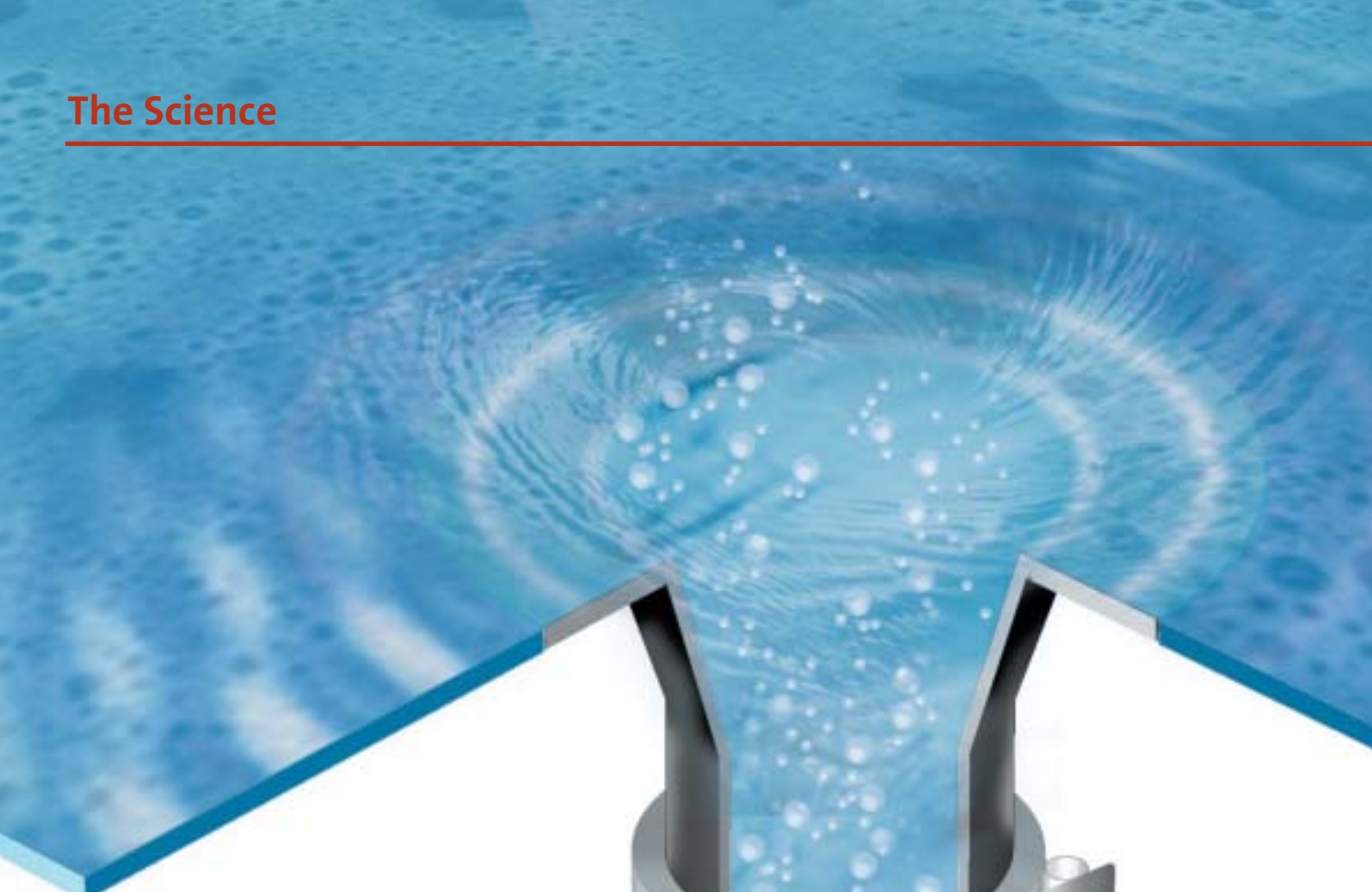
The EPAMS cast iron rainwater system from Saint-Gobain Pipelines provides the perfect syphonic solution, as it requires fewer vertical stacks and reduces installation time; thereby significantly lowers costs.

Applications of the EPAMS system are in the following areas:-

- **Stone/concrete roofs with waterproof membranes**
- **Channelled steel sheet roofs with waterproof membranes**
- **Wooden roofs with waterproof membranes**
- **Roofs covered with different material**



The Science

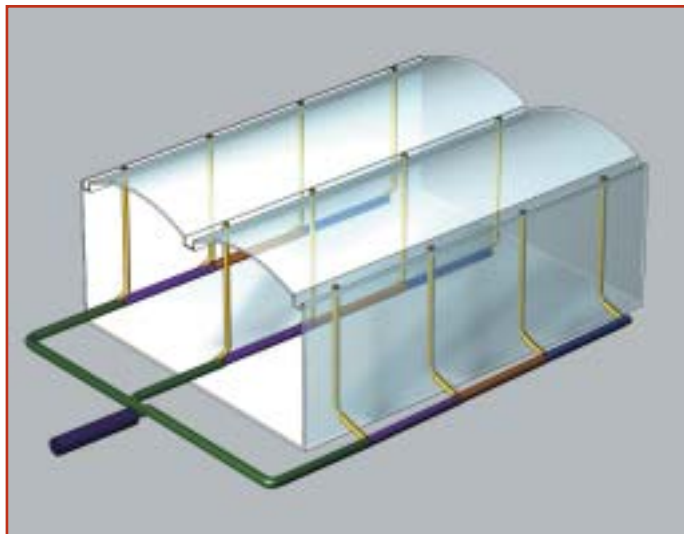


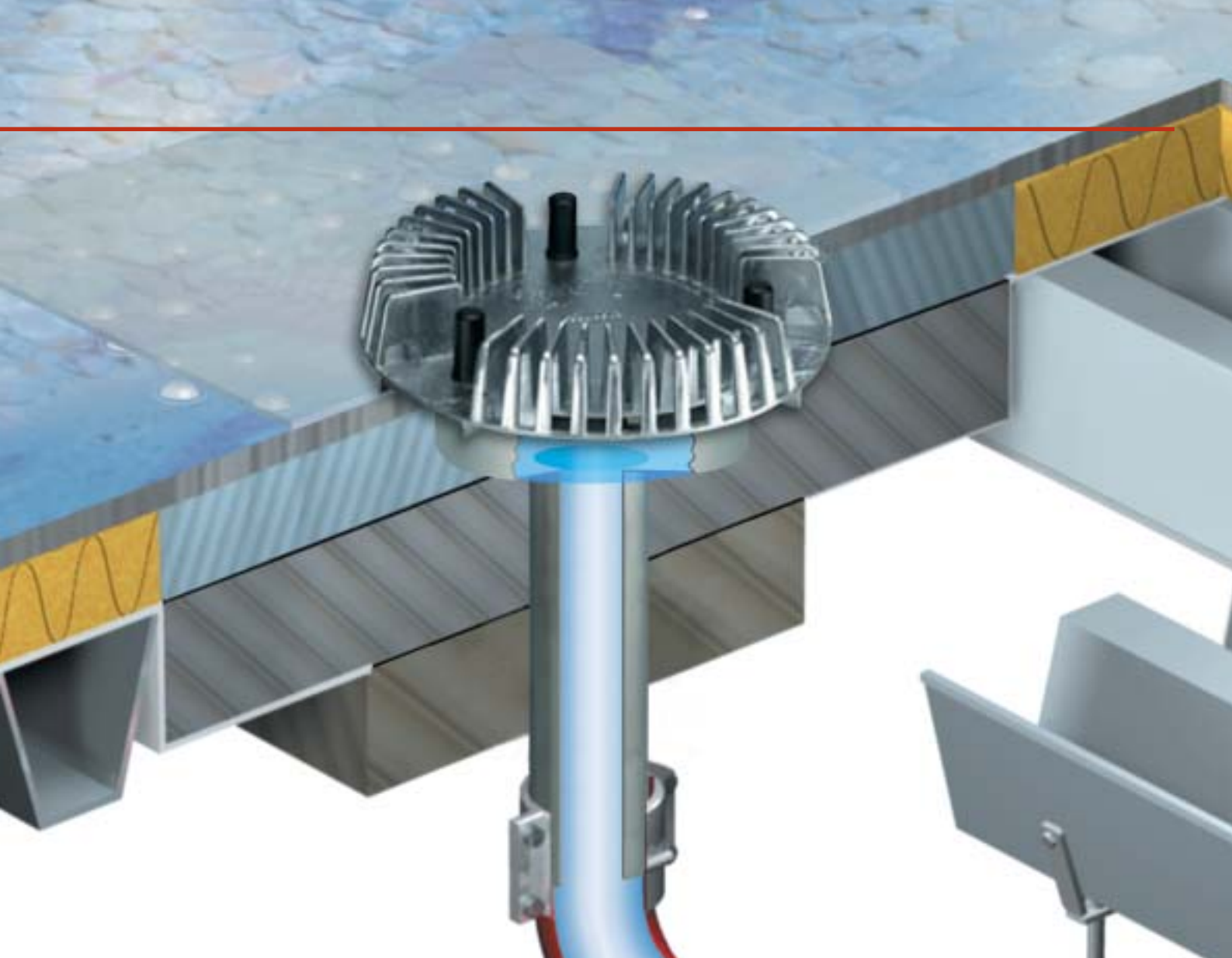
In conventional systems

The presence of air in the pipe (approximately 35 litres of air to 1 litre of water in a 100mm diameter pipe) is the fundamental principle of all gravity drainage.

The inlet of water in the roof outlet produces a vortex of air (ie whirlpool effect).

Due to regulations for installation and flow rate calculations, the above and below ground pipe systems for large roof areas are often numerous and this can impose both technical and economic constraints.





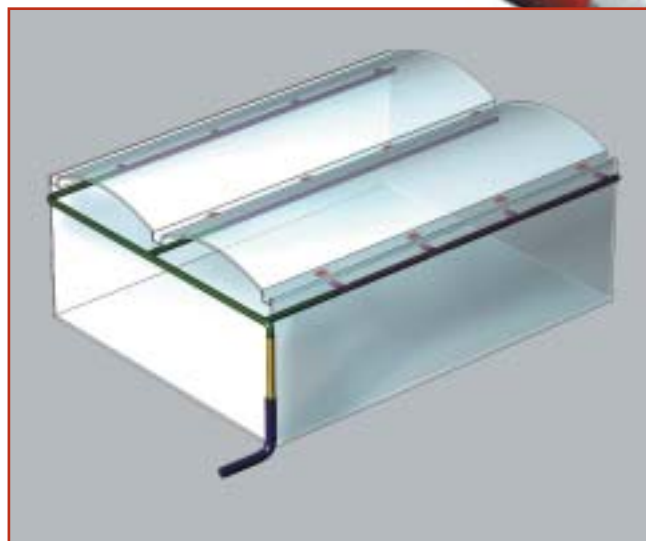
In an EPAMS cast iron syphonic rainwater drainage system

During its design and installation the EPAMS system applies the Bernoulli theory which governs the variations in water pressure during its flow between two points within the system, (high and low).

By virtue of the dynamics of the rainwater flow the mechanical energy produced is absorbed within the system.

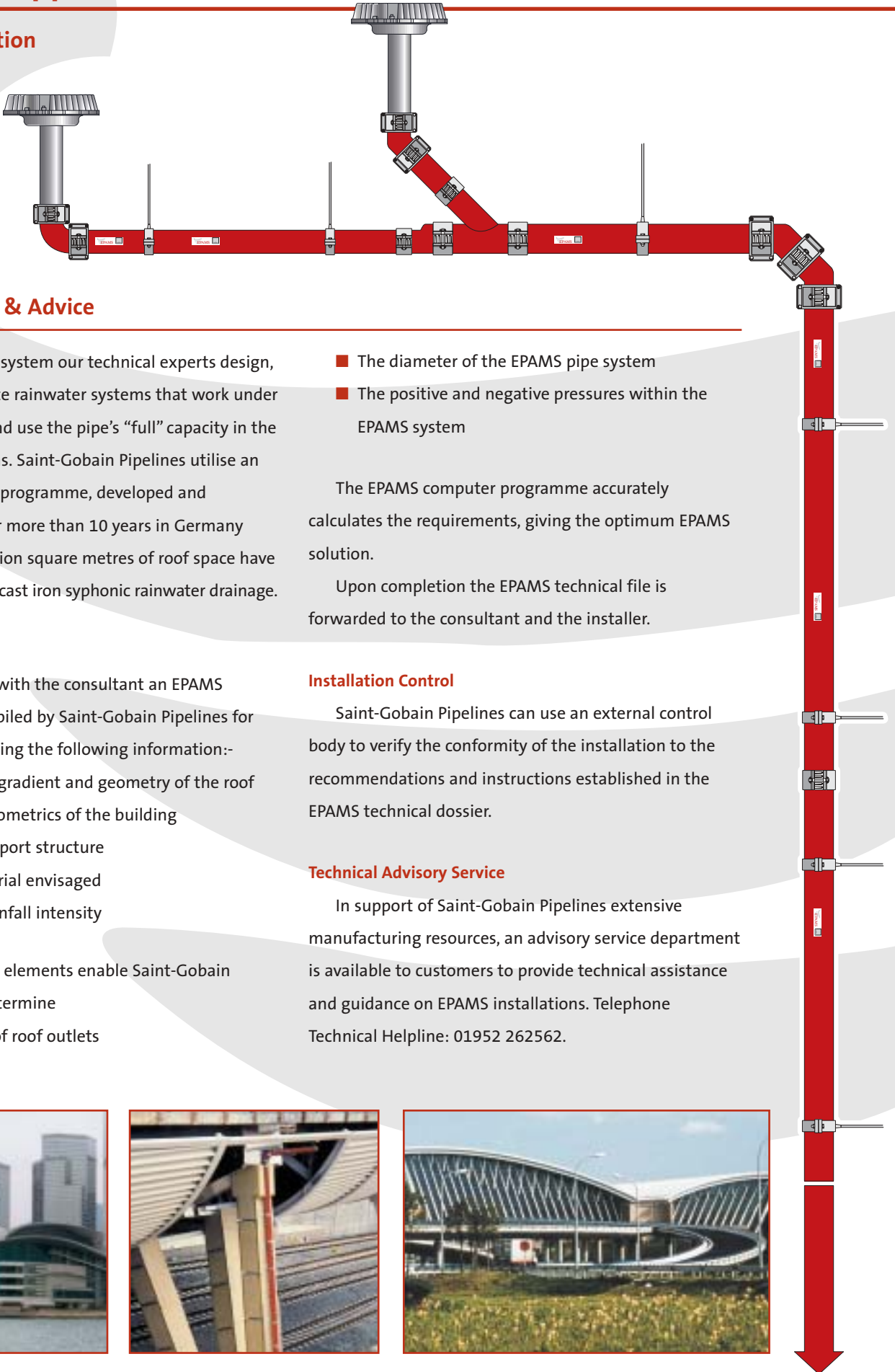
Air is prevented from entering the system by means of a special roof outlet that is equipped with an anti-vortex mechanism thus creating a negative pressure and consequent suction effect allowing the pipes to run completely full.

Therefore at an equivalent flow rate and for an identical roof surface area, the diameters and number of downpipes are reduced and horizontal pipes no longer need to be installed with a gradient to facilitate flow.



Technical Support

Typical installation



Expert Back-up & Advice

With the EPAMS system our technical experts design, dimension and create rainwater systems that work under negative pressure and use the pipe's "full" capacity in the flow rate calculations. Saint-Gobain Pipelines utilise an advanced computer programme, developed and successfully used for more than 10 years in Germany where around 3 million square metres of roof space have been equipped with cast iron syphonic rainwater drainage.

- The diameter of the EPAMS pipe system
- The positive and negative pressures within the EPAMS system

The EPAMS computer programme accurately calculates the requirements, giving the optimum EPAMS solution.

Upon completion the EPAMS technical file is forwarded to the consultant and the installer.

A detailed study

In collaboration with the consultant an EPAMS technical file is compiled by Saint-Gobain Pipelines for each project containing the following information:-

- Surface area, gradient and geometry of the roof
- Height and isometrics of the building
- Nature of support structure
- Roofing material envisaged
- Maximum rainfall intensity

These important elements enable Saint-Gobain Pipelines to then determine

- The number of roof outlets

Installation Control

Saint-Gobain Pipelines can use an external control body to verify the conformity of the installation to the recommendations and instructions established in the EPAMS technical dossier.

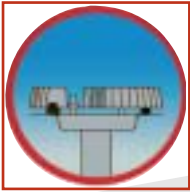
Technical Advisory Service

In support of Saint-Gobain Pipelines extensive manufacturing resources, an advisory service department is available to customers to provide technical assistance and guidance on EPAMS installations. Telephone Technical Helpline: 01952 262562.



Generally the syphon needs to be broken at or before connection to the below ground cast iron system.

Features & Benefits of EPAMS



■ **Steel outlets** allows utilisation of hot materials (including flames) for waterproofing solutions during installation. Anti-Vortex grid bolted to outlet for security in high winds. Large outlet surface to drain the water



■ A **complete product range** of SMU cast iron pipes and fittings, stainless steel couplings, grip collars, sound absorbing brackets, roof outlets and safety collars. 50-300mm diameters.



■ A very **low accumulation of surface water** on the roof.



■ Gradient free installation, which requires **less roof space and depth**.



■ Reduced diameters of pipework - **less cost**.



■ Optimised horizontal runs and **fewer vertical stacks** allowing even greater architectural freedom.



■ **Cost saving** - fewer pipes and fittings.



■ Peace of mind that cast iron is **non-combustible**, meeting all fire regulations (flame and fire proof for at least 4 hours). No expensive fire collars required. No toxic fumes in the event of fire.



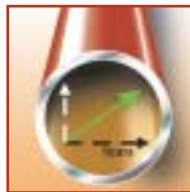
■ The **silent solution** of cast iron whatever the flow rate. No expensive noise insulation required.



■ The **mechanical resistance** of the SMU components to withstand the positive and negative pressures in the EPAMS system.



■ **No expansion joints** or thermal limiters needed, in contrast to HDPE systems.



■ **Long life** - cast iron pipes and fittings will last the life time of the building.



■ **Fewer brackets** compared to HDPE systems. Do not require a costly and complicated rail system of bracketing.



■ **Easy, rapid jointing** can take less than 40 seconds with SMU stainless steel couplings. No special welding required unlike HDPE systems.



■ **Independent Endorsement** - Veritas can be used to verify the final installed network is in accordance with the design. EPAMS has a certificate from GAN (Insurances) that no failure has occurred on an EPAMS design and installation.

Quality Assurance

BS EN ISO 9001:2000 Registered No:FM12908

The EPAMS System is manufactured under the BS EN ISO 9001: 2000 Quality Assurance Scheme. Continual checks made throughout the year by the BSI inspectorate, ensure that the set standards are maintained.

Agrément Certificate - Roof Outlets BBA applied for
Agrément Certificate - SMU Pipe Systems 00/3748
Technical Approval 14+5/01-656 CSTB - Avis
Technique France for Roof Outlets
and 14+5/01-656 *01 Appendum

Standards

European Standard BS EN 877:1999

Scope

This Product Standard applies to cast iron pipework elements used for the construction, normally as gravity pipe systems, of discharge systems for buildings and of drains.



Other Product Ranges

Other products manufactured by Saint-Gobain Pipelines, Soil & Drain include:

Ensign

Ensign, above and below ground system kitemarked to BS EN 877.

Timesaver

Timesaver, British standard kitemarked cast iron drainage systems for above and below ground applications BS416 and BS437.



Classical range of traditional cast iron rainwater and gutter systems, the only cast iron system to be awarded British Board of Agrément (Certificate No. 97/3434) for its standard ranges.



Classical Express, a true half round gutter 125mm, jointed by unique gutter clips.



Classical Plus, a factory applied black semi-gloss top coat for its standard range and Express.

The range of nominal diameters extends from DN 40 to DN 600 inclusive.

This standard specifies the requirements for the materials, dimensions and tolerances, mechanical properties, appearance and standard coatings for cast iron pipes, fittings and accessories. It also indicates performance specifications for all components, including joints.

It covers, above ground soil, waste, rainwater and buried systems and performance requirements in these applications.

Product Standards

ISO 6594

International standard for socketless drainage systems in cast iron.

BS 2494/BS EN 681/ISO 4633/ISO 6447/ISO 6448

Specification for elastomeric seals for joints in pipework and pipelines.

Literature available:

Ensign Specifiers Manual

Timesaver Specifiers Manual

Classical Specifiers Manual including:

- Classical Express

- Classical Plus

CD ROM:

All product ranges, which also includes Ensign CAD.

Website <http://www.saint-gobain-pipelines.com>

The Building Services and Industries section contains all the product literature for the soil and drain brands Ensign, Timesaver and Classical including Ensign CAD drawings available for download.

Other information includes:

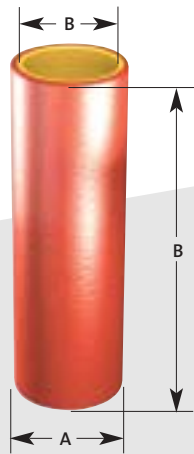
CDM information for health and safety detail.

A Whats New Section - detailing new product developments and project stories updated on a regular basis. Merchants stockists and full list of contacts.



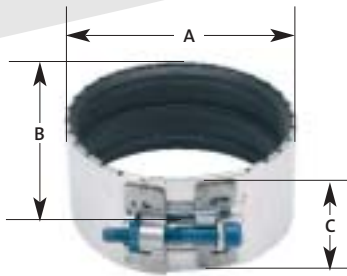
Product Range

Pipe

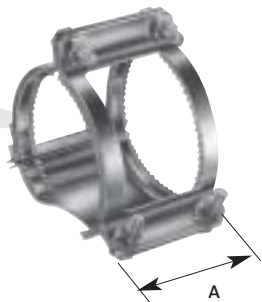


Product Code	Dia	Outside Diameter A (max)	Inside Diameter B (max)	Approximate Mass per full length (3m) kg	Metres C length
Socketless Pipe					
RB001	50	60	47.5	13.0	63
RB002	75	85	79	19.0	43
RB003	100	112	97.5	25.5	33
RB004	125	137	121.87	35.0	22
RB005	150	162	146.25	43.0	18
RB006	200	212	195	69.3	11
RB007	250	276.5	243.75	99.8	8
RB008	300	328.5	292.5	129.7	4

Couplings & Collars



Product Code	Dia	A	B	C	Nominal Wt/kg
SMU Rapid Coupling (EPDM Gasket)					
RB009	50	71	85	51	0.19
RB010	75	96	110	51	0.22
RB011	100	123	137	58	0.29
RB012	125	143	157	58	0.32
RB013	150	173	192	58	0.37
RB014	200	226.5	258.5	83	0.85
RB015	250	290.5	322.5	83	1.00
RB016	300	342.5	378.5	83	1.20



Product Code	Dia	OD	A	Nominal Wt/kg
Grip Collar for Rapid Coupling				
RB335	50	120	73	0.32
RB336	75	146	73	0.39
RB337	100	185	87	1.0
RB399	125	210	98	1.11
RB338	150	230	98	1.23
RB339	200	310	122	2.25
RB340	250	360	122	3.8
RB341	300	420	122	3.9

Product to be used when the system changes direction, or at points in system where internal pressures are at its highest (see example page 4).

Grip Collar: Method of Assembly

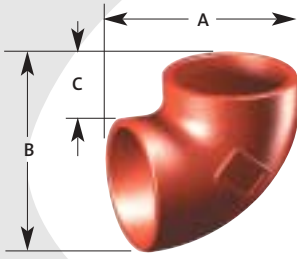
Grip Collar is placed on the SMU® RAPID coupling

- cover the PAM-SMU®RAPID couplings with the grip collar
- position the last segment and insert hexagon bolt
- grip gradually while clamping

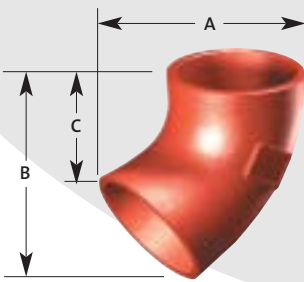


Product Range

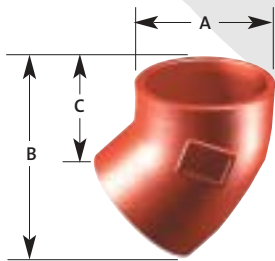
Bends



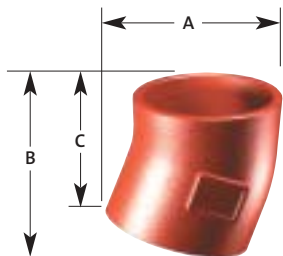
Product Code	Dia	A	B	C	Nominal Wt/kg
87.5° Bend • Short Radius					
RB054	50	104	107	49	0.8
RB055	75	138	140	57	1.2
RB056	100	166	169	59	2.2
RB057	125	194	197	62	2.9
RB058	150	227	230	70	4.3



Product Code	Dia	A	B	C	Nominal Wt/kg
67° Bend • Short Radius					
RB046	50	104	123	70	0.75
RB047	75	131	149	72	1.05
RB048	100	159	176	74	1.80
RB049	125	188	205	80	3.00
RB050	150	219	237	89	4.10
RB051	200	277	295	99	7.78
RB052	250	343	358	104	14.65
RB053	300	406	423	121	20.00

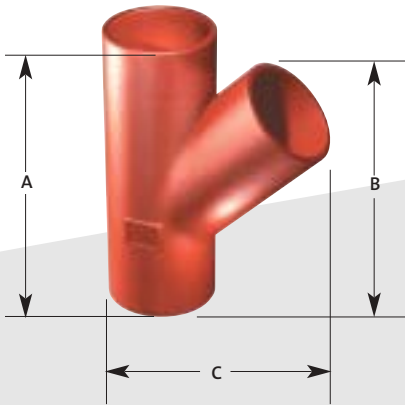


Product Code	Dia	A	B	C	Nominal Wt/kg
45° Bend • Short Radius					
RB038	50	50	106	65	0.5
RB039	75	60	132	73	1.0
RB040	100	70	158	80	1.5
RB041	125	80	184	89	2.2
RB042	150	90	210	97	3.3
RB043	200	100	262	113	5.7
RB044	250	130	319	125	10.0
RB045	300	155	380	149	16.4



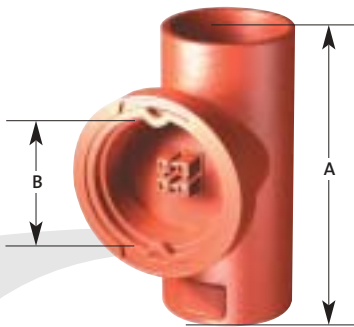
Product Code	Dia	A	B	C	Nominal Wt/kg
22° Bend • Short Radius					
RB033	50	70	88	66	0.45
RB034	75	97	105	74	0.80
RB035	100	126	125	84	1.30
RB036	125	152	143	92	1.85
RB037	150	179	162	102	2.60
RB328	200	233	200	122	4.40
RB351	250	300	240	138	9.50
RB352	300	356	279	157	15.30

Branches



Product Code	Dia	A	B	C	Nominal Wt/kg
45° Single Reducing Branch					
RB063	50 x 50	185	165	144	1.15
RB071	75 x 50	180	161	120	1.8
RB064	75 x 75	215	198	179	2.35
RB072	100 x 50	200	172	191	2.45
RB073	100 x 75	220	199	204	3.05
RBO65	100 x 100	275	253	238	3.95
RB074	125 x 100	280	254	261	5.15
RB066	125 x 125	320	296	284	5.8
RB075	150 x 100	295	262	287	6.1
RB076	150 x 125	325	298	307	7.3
RB067	150 x 150	355	333	323	8.7
RB077	200 x 100	305	266	320	8.8
RB078	200 x 150	375	343	373	11.1
RB068	200 x 200	455	428	418	15.8
RB079	250 x 250	580	530	537	32.8
RB070	300 x 300	660	661	634	50.6

Access Pipes



Product Code	Dia	A	B	Nominal Wt/kg
Short Pipe with Access Door				
RB168	50	160	75	1.9
RB169	75	205	101	3.0
RB170	100	250	128	4.5
RB171	125	280	154	6.5
RB172	150	320	181	10.4
RB173	200	360	181	12.75
RB174	250	380	181	17.6
RB175	300	400	181	26.3

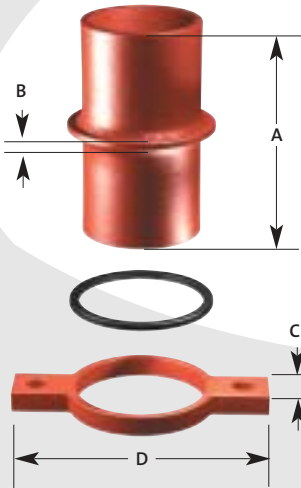
The short pipe with access door combines reliability with simplicity and handling security:

- Allow pressure release of the network before opening (fig 1)
- Gasket shaped to ensure unobstructed flow of the system
- Simplicity for opening and closing the cast iron cover with standard tools



Product Range

Stack Support Pipe & Brackets

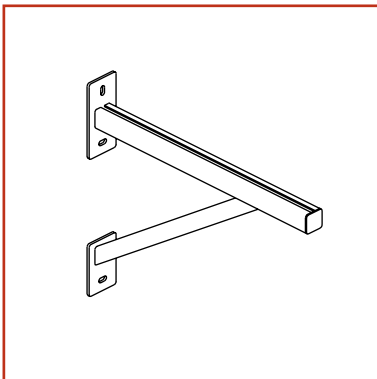
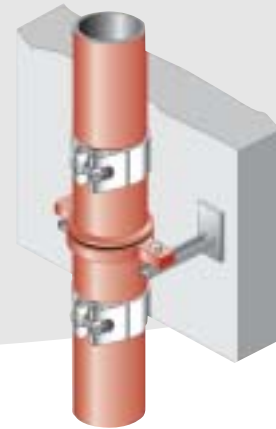


Product Code	Dia	A	B	C	D	Nominal Wt/kg
Stack Support Pipe and Bracket Fitted with Rubber Seal						
RB380	75	220	8	30	218	3.0
RB381	100	220	8	32	259	4.5
RB382	125	220	8	32	275	5.5
RB384	150	220	8	32	300	7.2
RB385	200	220	8	36	362	10.0
RB386	250	300	8	40	444	18.5
RB387	300	300	8	40	498	30.75

Method of assembly

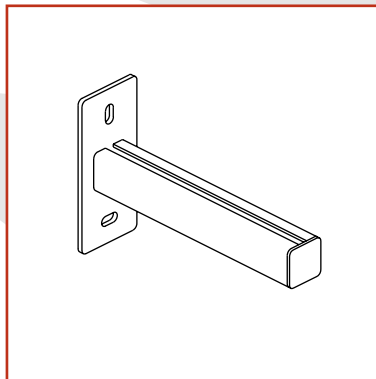
Support: mounting of the stack support pipe on bracket

1. Fix cantilever arms or console (EF052) to the wall
2. Seat rubber gasket in bracket and fit flange pipe onto rubber seal
3. Fix bracket to the cantilever arms or console



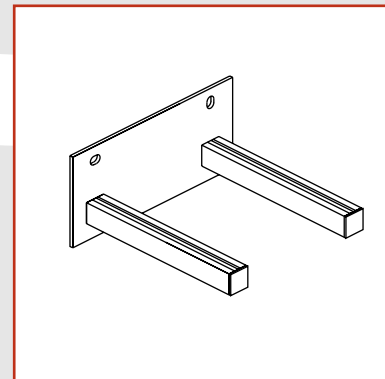
Cantilever Arm with support EF052

Prod.Code 09183



Cantilever Arm EF052

Prod.Code 09184

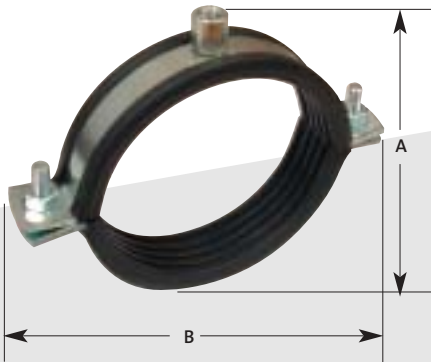


Stack Support Console EF052

Prod.Code 09185

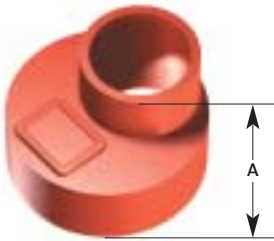
NOTE: Clamp Bracket 09186 required to suit 09183/09185 above.

Brackets



Product Code	Dia	A	B	Fixing Bolt	Nominal. Wt/kg
Syphonic Sound Insulated Support Brackets					
RB420	50	84-88	108	M6 x 25	0.1
RB421	75	113-118	136	M6 x 30	0.2
RB422	100	137-141	158	M6 x 30	0.3
RB423	125	137-141	192	M8 x 35	0.5
RB424	150	193-347	219	M8 x 45	0.6
RB425	200	250-256	292	M10 x 40	1.2
RB426	250	316-347	356	M10 x 40	1.4
RB427	300	362	410	M12 x 40	2.9

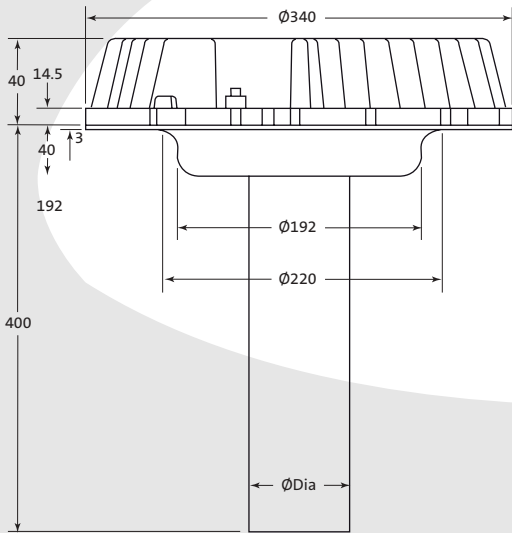
Diminishing Piece



Product Code	Dia	A	Nominal. Wt/kg
Diminishing Piece			
RB129	75 x 50	80	0.7
RB130	100 x 50	80	1.0
RB131	100 x 75	90	1.1
RB132	125 x 75	95	1.3
RB133	125 x 100	95	1.6
RB134	150 x 75	100	1.7
RB135	150 x 100	105	2.3
RB136	150 x 125	110	2.0
RB137	200 x 75	115	3.4
RB138	200 x 100	115	3.7
RB139	200 x 125	120	3.5
RB140	200 x 150	125	3.9
RB142	250 x 100	125	5.7
RB143	250 x 150	135	5.9
RB144	250 x 200	145	6.1
RB146	300 x 100	140	9.1
RB147	300 x 150	150	9.7
RB148	300 x 200	160	9.7
RB149	300 x 250	170	10.1

Product Range

Syphonic roof outlets



Product Code	Dia	O/D	Capacity L/S	Surface Drainage M ²	Nominal Wt/kg
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Roof Outlet to be Welded (or Brazed)

RB472	50	58	13	260	5.4
RB473	75	83	23	460	5.7
RB474	100	110	26	520	6.4
RB475	125	135	26	520	8.3

- Stainless steel body, including M10 bolts
- Aluminium grating

Application field:

This roof outlet is especially designed to be welded (or brazed) in gutters or in metal roof valleys.



6 threaded pins fixed M10 x 40 PCD 240 Ø equally spaced.



Product Code	Dia	O/D	Capacity L/S	Surface Drainage M ²	Nominal Wt/kg
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Roof Outlet with Flange

RB468	50	58	13	260	6.2
RB469	75	83	23	460	6.5
RB470	100	110	26	520	7.2
RB471	125	135	26	520	9.1

- Stainless steel body, including M10 bolts
- Aluminium flange
- Aluminium grating

Application field:

This roof outlet is especially designed to be welded (or brazed) in gutters or in metal roof valleys.

Syphonic roof outlets



Product Code	Dia	O/D	Capacity L/S	Surface Drainage M ²	Nominal Wt/kg
Roof Outlets with Steel Plate					
RB460	50	58	13	260	6.4
RB461	75	83	23	460	6.7
RB462	100	110	26	520	7.3
RB463	125	135	26	520	9.2

The plate is fixed to the roof outlet body in the factory by bonding then tightening with 6 nuts on the 6 bolts. This assembly can never be disassembled. The stainless steel plate is tinned on the two faces. Plate size 500 x 500mm with a thickness of 0.4mm.



Product Code	Dia	O/D	Capacity L/S	Surface Drainage M ²	Nominal Wt/kg
Roof Outlets for Flexible PVC Membrane					
RB464	50	58	13	260	6.8
RB465	75	83	23	460	7.1
RB466	100	110	26	520	7.7
RB4671	125	135	26	520	9.6

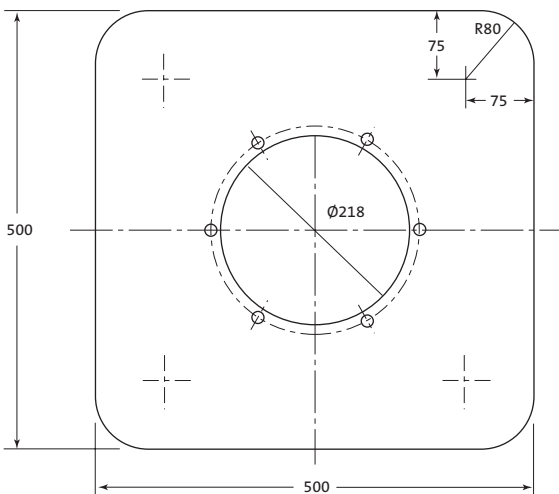
Application field:

This roof outlet is used on non-accessible roofs and/or with equipment zones, and waterproofed by synthetic membranes according to the SARNAFIL Technical Assessment. Waterproofing is provided by a weld between the various PVC elements to seal it in a traditional way. The membrane may be visible or may be given heavy mineral protection. For this latter case, it is possible to use fine gravel but in this case the roof outlet are to be fitted with an elevating kit for the grating.

The plate is fixed to the roof inlet body in the factory by bonding then tightening with 6 nuts on the 6 bolts. This assembly can never be disassembled.

The dimensions of the steel-PVC laminated plate are 500 x 500mm with a total thickness of 1.8mm. It consists of a galvanised steel sheet, thickness 0.62mm, covered in the factory on one face by a layer of epoxy (from SARNAFIL). The steel part contains 4-drilled holes for possible fixing to the roof.

This plate is compatible with the PVC SARNAFIL membranes, Series G 410, of the "G 410" processes, to be applied as described by SARNAFIL.



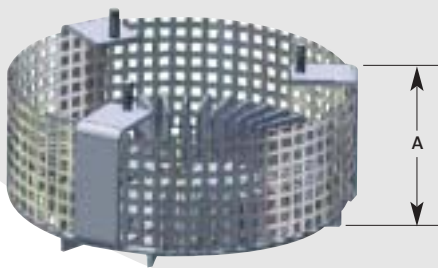
Product Range

Syphonic roof outlets



Product Code	Nominal Wt/kg
Anti-Vortex Device	
RB478	2.24

To suit all outlets 50, 75, 100-125 Dia.



Product Code	A	Nominal Wt/kg
Elivating Kit for Anti-Vortex Device		
RB476	90mm	4.0
RB477	250mm	6.7

For roof with waterproofing protection by fine gravel or by flags on isolating layer by fine gravel.



Anti-Vortex device fitted to Elivating Kit.

Nuts and Bolts Kit - supplied in a bag containing 3 nuts/bolts to suit all outlets.

Order Ref: RB479

Syphonic roof outlets

Operating characteristics:

The conventional calculation and design flows for which the Saint-Gobain Pipelines Company is committed appear in table below.

These figures correspond to the following conditions:

- rainfall: 3l/min.m²
- roof outlet water cover height: 55mm
- fall height (building): 10m

In this table the figures for the flows determined under the conditions of Standard EN 1253, also appear, that is:

- rainfall: 3l/min.m²
- roof outlet water cover height: 55mm
- fall height (building): 4.2mas well as the requirements of the standard.

Flows by type of roof outlet.

DN	50	75	100	125
Conventional calculation and design flow (l/s)	13	23	26	26
Flow according to EN 1253 (l/s)	9	23	23	23
Requirements of the standard	6	14	-	-

The difference between 100 and 125mm outlet is identified when exceed 55mm head of water, (i.e. typically Gutter Installations).

Maintenance Instructions

1. Cleaning the rainwater outlet (RO)

1.1 Twice-yearly inspection of the rainwater heads

The rainwater outlet (RO) must be visited and cleaned at the start of spring and at the start of autumn.

During the construction site period, and during the first 18 months of the building in use, the roofs are to be inspected every three months to prevent the RO becoming blocked by fragments, rubble, leaves, products of the construction. During these visits, the following activities are carried out.

1.1.1. General

Cleaning of gutter or the terrace



1.1.2. On each RO

- Dismantle the Anti-vortex device
- Cleaning of the body of the RO
- Cleaning of the Anti-vortex device with water
- If possible the water used for washing **must not be discharged down the EPAMS network**
- Refitting of the Anti-vortex device

1.1.3. On the welded RO

Visual examination of the welding

1.1.4. On the membrane-mounted RO

Examination of the **connection/bond** with the membrane

1.2 Annual inspection of the overflows

At the same time as the spring inspection to the RO, it must be verified that the warning overflows are not blocked/obstructed. If needed, they have to be cleaned.

2. Dismounting and maintenance of the different elements

2.1 Short access pipe

The short access pipe is the access component of the EPAMS system. If it has to be opened, the maintenance department must take care to verify that the network is **not under load** before the inspection flap is opened. If it is, the column is drained by lodging a screwdriver **in the intended slot in the inspection flap**.

Is it strictly forbidden to open the short access pipe while the EPAMS system is functioning.

2.2 SMU Coupling

The SMU coupling can be dismantled, and allows easy dismantling of any part of the EPAMS network. In case of intervention, care must be taken to refit all the accessories such as the grip collars.

2.3 External appearance of the cast iron pipes and fittings

Our cast iron pipes and fittings are coated in priming paint intending to protect them during transportation and on-site storage prior to installation. If the pipe work is not repainted, the exterior appearance of the pipes and fittings may, with time, show signs of superficial corrosion. This change in the appearance of the pipes and fittings has no effect on the operation of the system and the maintenance department should not be concerned.



3. Intervention on the network

3.1 Modification

The EPAMS system is the result of accurate sizing of diameter and length. Any modification to the network must be indicated in advance, and must receive the written authorisation of Saint-Gobain Pipelines before being carried out.

3.2 Unauthorised connection

The EPAMS system operates under partial vacuum. It is formally forbidden to connect other drainage networks to an EPAMS network.

The EPAMS system has been designed to evacuate/drain rainwater. The evacuation of other effluents poured on the terraces or in the gutters can lead to adverse effects and must be avoided.

4. Extreme weather conditions

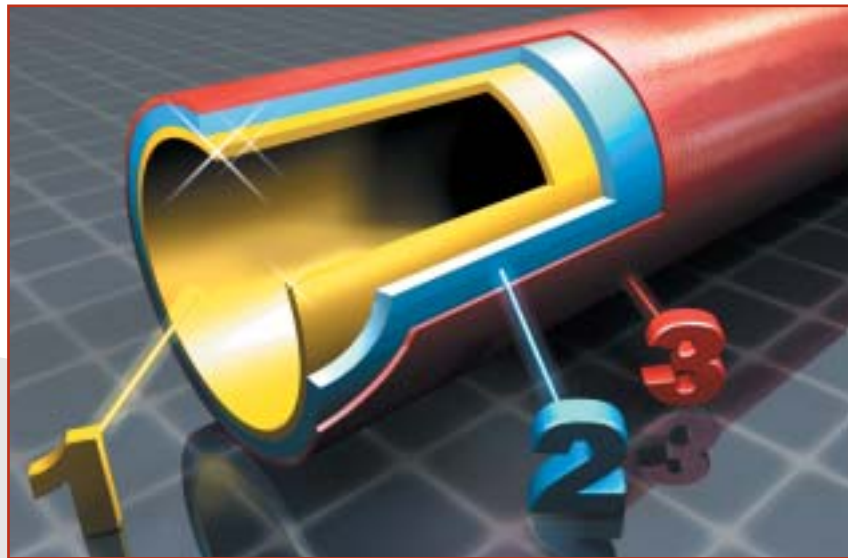
4.1 Violent winds

In the event of exceptionally violent winds, it is advisable to carry out an inspection of the outlets/installation, to check presence and correct positioning of all the elements.

Technical Specification

Coating Specification

- 1** New epoxy-resin inner coat with optimised properties (130 µm)
- 2** Cast iron
- 3** Outer coat (acrylic primer 40 µm)



Interior and Exterior Coating

Details of the coatings for pipes and fittings for SMU Soil are tabled below - used in conjunction with EPAMS Syphonic Roof Outlets.

SMU Soil

Pipes	
Internal	External
Two part epoxy ochre colour with an average thickness of 130 microns	Acrylic, anti corrosive primer coating, red brown colour, average dry thickness 40 microns

SMU Soil

Fittings
Internally and Externally - Red epoxy coated

Technical References

The EPAMS system is supported by:

Technical Assessment 14+5/01-656 and 14+5/01-656*01 addendum

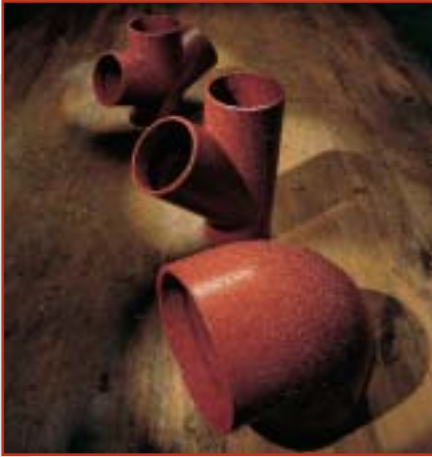
(Published by the Secretariat of the Technical Assessment Commission CSTB in France)

For guidance on siphonic roof drainage systems a draft document is proposed to BSI Technical Committee B/505 for adoption as a British Standard.

Mechanical Properties

Pipes and Fittings Characteristics

All SMU pipes and fittings are manufactured from a grade of Cast Iron which exceeds BS EN 1561 Grade EN-JL 1020 and ISO185 Grade 15 requirements.



Mechanical Properties	(Fittings)	(Pipes)
Tensile Strength	150 MPa	250 MPa
Crushing Strength	4.4	6.5
Modulus of Elasticity	6.0	10.0
Coefficient of Expansion	8.5	17.8

As the coefficient of expansion for concrete ($8-11 \times 10^{-6}$ per °C) is similar to that of iron the requirement for expansion joints is virtually eliminated.

Cutting Techniques

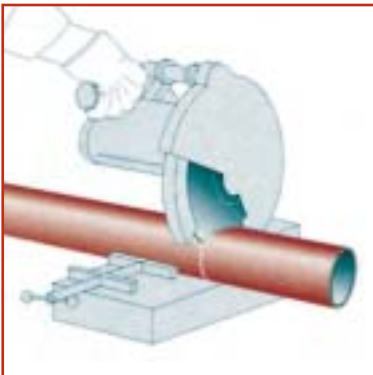
SMU pipes can be easily and quickly cut using either of the following methods. It should be ensured that the cut ends are square and any burrs removed. It should be ensured that cutting procedures comply with all relevant health and safety regulations and also with the safety guidelines from the cutting tool manufacturer's operating manual.

Power Driven Abrasive Wheel Cutter and Saw

This provides a fast method of cutting iron pipes.

Wheel Cutter

An efficient 'non-power' cutter is readily available in the U.K.



WARNING Chain or compression type cutters should not be used.



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